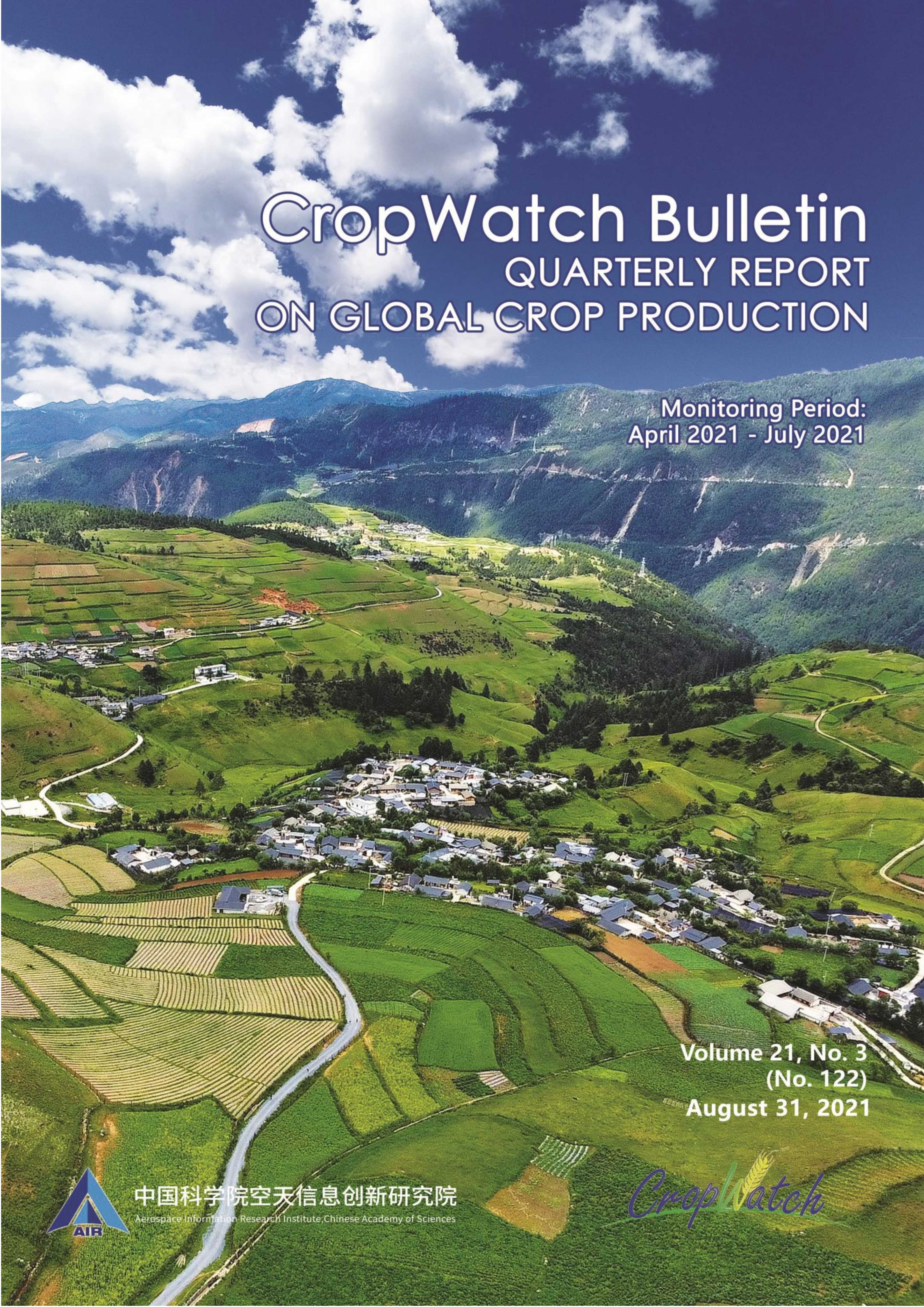

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QUARTERLY REPORT ON GLOBAL CROP PRODUCTION

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CropWatch

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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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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 April to July for 2016-2020; one of the standard reference periods.
15YA	Fifteen-year average, the average for the four-month period from April to July for 2006-2020; 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	Mapping and Reporting Unit
NDVI	Normalized Difference Vegetation Index
OISST	Optimum Interpolation Sea Surface Temperature
PAR	Photosynthetically active radiation
PET	Potential Evapotranspiration
AIR	CAS Aerospace Information Research Institute
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 April and July 2021, a period referred to in this bulletin as the AMJJ (April, May, June and July) period or just the “reporting period.” The bulletin is the 122nd such publication issued by the CropWatch group at the Aerospace Information Research Institute (AIR) 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. 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; and (ii) agronomic indicators—VHIn, CALF, and VCIx and vegetation indices, describing crop condition and development. (iii) 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, 42 major agricultural countries, and 217 Agro-Ecological Zones (AEZs).

This bulletin is organized as follows:

Chapter	Spatial coverage	Key indicators
Chapter 1	World, using Mapping 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	42 key countries (main producers and exporters) and 210 AEZs	As above plus NDVI and GVG survey
Chapter 4	China and regions	As above plus high-resolution images; Pest and crops trade prospects
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 July 2021. It is prepared by an international team coordinated by the Aerospace Information Research Institute, 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 this year's second CropWatch production estimates for selected countries and reviews the first production estimation in chapter 5.

This report for the period from April to July 2021 covers wheat, maize, soybean and rice production in the Northern Hemisphere. Winter wheat reached maturity in June/July and spring wheat will typically reach maturity in August. In the tropical countries, planting of the main rice crop typically starts at the beginning of the monsoon season in May or June. In the Southern Hemisphere, harvest of maize and soybean was concluded by April or May. Sowing of wheat started in May.

In most countries, the COVID-19 pandemic is still not under control. Maize, wheat, and rice prices were about 43%, 12% and 10% above their January 2020 levels, even though the global production outlook for major grains remains good. The Agricultural Commodity Price Index remained near its highest level since 2013, and as of July 16, 2021, was approximately 30% higher than in January 2020. Soaring food prices have worsened the situation of the poor.

Another plague, the outbreak of desert locusts in East Africa and the Middle East is still not under control either. The civil war in Ethiopia poses challenges to implement control measures. The impact of desert locusts on world food supply is limited but is devastating for the farmers in the areas that are hit by a swarm.

Agro-climatic conditions

Global warming continues unchecked. Temperatures set alarming records during this monitoring period according to the National Oceanic and Atmospheric Administration (NOAA) of the USA. June 2021 was the fifth-warmest June, and the warmest for Earth's land area. Temperatures were 0.88ºC above the 20th century average. North America and Africa had their hottest June on record; Europe and Asia had their second hottest June on record. Subsequently, NOAA declared that July 2021 was the Earth's hottest month on record (+0.93ºC). These temperature increases cause prolonged and more intense droughts and heat waves. Intensity of rainfall events also increases, while the number of rainy days' decreases. As a consequence, floods are more likely to occur. These extreme weather events will more and more have a negative impact on the stability and level of crop production around the globe.

Below average rainfall conditions persisted for most of Brazil and the West coast of the USA. In both regions, the drop in rainfall was more than -50% as compared to the 15-year average (15YA). In Mexico, as well as in the south of the USA, above average monsoon rains put an end to the drought conditions of last winter. In southern Africa, rainfall was 23% below the 15YA. A positive departure by 14% was observed for the

Western Cape. This is important for its winter wheat production. The onset of the monsoon rains was delayed in the Gulf of Guinea, causing a decline by 36% in West Africa. Rain in Europe was generally abundant, although the Caucasus, which had experienced a rainfall deficit already during the last monitoring period, continued to stay drier than usual (-17%). Most of the other wheat producing regions such as the Ukraine to the Ural had received slightly above average rainfall (+12%). The south of China, as well as Myanmar and most of the Middle East and parts of Central Asia were affected by below average rainfall. Most of the countries in the Middle East and Central Asia are suffering from prolonged drought conditions that had already started in the previous monitoring period. Especially in Turkey, Lebanon, Syria, Palestine, Iraq, Iran and Afghanistan, the severe drought is causing additional hardships for the local population. Good rainfall in Australia has been creating favorable conditions for its wheat production. In East Asia, Huanghuaihai (China) a strong positive departure by +50% was observed. This was mainly due to an extreme rainfall event that had occurred in late July that caused flooding of urban areas and cropland.

Record setting heat waves hit the west of the USA and Canada. The drier than usual areas in Brazil also experienced above average temperatures. Western Europe experienced cooler than usual temperatures mainly in April and May, whereas the Caucasus and the region from the Ukraine to the Ural Mountains were much warmer than usual. In the other regions, temperatures had stayed close to the 15YA.

2021 Production estimate

Affected by persistent hot and dry weather in Northwestern North America, Brazil, Central Asia, West Africa and Southern Africa, global rice, wheat, and soybean production is expected to be lower than last year's. In 2021, the total global production of four major food crops is expected to be 2.864 billion tonnes, a decrease of 28.16 million tonnes, or 1.0% from the previous year; among them, global maize production is expected to be 1.082 billion tonnes, an increase of 1.1%, or 11.3 million tonnes; global rice production is expected to be 751 million tonnes, a decrease of 1.3%; global wheat production is expected to be 711 million tonnes, a decrease of 3.7% year-on-year, with a decrease of 26.99 million tonnes; global soybean production is estimated to be 321 million tonnes, a decrease of 0.9%.

Maize: The United States, China and Ukraine are forecasted to significantly increase maize production. Estimates are as follows: USA 384.06 million tonnes (+2.6%), China 231.60 million tonnes (+2.4%), Ukraine 34.86 million tonnes (+28.4%). These increases are due to favorable agro-meteorological conditions and larger maize growing areas. In Brazil, the world's third largest maize producer, output declined by 4.8% to 83.34 million tonnes. This country was affected by above average temperatures and drought conditions. Mexico's maize growing area and yield increased simultaneously, resulting in a production increase of 1.95 million tonnes. Romania recovered from the 2020 drought year with an increase of 1.08 million tonnes in maize production to 1.08 million tonnes. Changes in production in each of the remaining major maize producing and exporting countries were less than 1 million tonnes, and therefore will have a relatively small impact on total global maize production.

Rice: Asian rice production accounts for more than 90% of the global production. Agro-meteorological conditions varied widely among the major producing countries. Bangladesh, Myanmar and Iran were affected by drought conditions, and rice production decreased by 1.21 million tones (2.6%), 690,000 tones (2.7%) and 500,000 tones (17.0%), respectively. In Pakistan, production is estimated to decline by 1.08 million tonnes due to a reduction in rice acreage. In China and India, the world's two largest rice producers, the overall rice production situation is good, and production is forecasted to increase by 1.62 million tonnes and 4.76 million tonnes, respectively. Thanks to sufficient precipitation and favorable water supply from the Mekong River, rice production in Thailand is forecasted to increase by 900,000 tonnes and in Vietnam by 760,000 tonnes. In comparison to last year, the total rice production of the remaining major producing countries is forecasted to decrease in 2021 and the global rice production is expected to decline slightly.

Wheat: In some important production regions, production was hampered by below average rainfall, resulting in drought conditions. Production, as compared to 2020, is estimated to decline in the following countries: Iran (-26%), Afghanistan (-25%), Uzbekistan (-22.4%), Canada (-15.2%), Kyrgyzstan (-14.7%), Turkey (-13.1%), Pakistan (-6.1%) and India (-2.5%). In addition, wheat production in most countries of Western Europe also declined slightly due to rainy weather during harvest. Drought conditions in the Pacific Northwest and north of the USA limited spring wheat production. However, winter wheat production benefitted from generally favorable rainfall. The country's total wheat production is estimated to increase by 0.7% year on year. Russia's winter wheat production also benefitted from favorable rainfall, prompting a 3.5% increase in production year on year. Most countries in Eastern Europe also achieved an increase in wheat production. Morocco's wheat production increased significantly by 43.2 % compared to the severe drought year of 2020. For China, the world's top wheat producer, an increase in acreage and yield is estimated to increase production by 0.9%.

Soybean: The widespread drought in South America led to a decline in soybean production in Brazil and Argentina. Affected by persistent hot and dry weather, Brazil's soybean output slumped to 96.3 million tonnes, down 4.74 million tonnes or -4.7% year-on-year, the lowest production in the past three years. In Argentina, soybean production is estimated to decline by 980,000 or -1.9% to 51.61 million tonnes due to below average rainfall which affected the late season crops. Most soybean producing regions of the USA benefitted from favorable weather conditions. Total production is forecasted to increase by 0.7% to 105.24 million tonnes. The increase in soybean acreage in India led to a year-over-year increase in total soybean production by about 6.7%, an increase of 780,000 tonnes. The year-over-year decline in soybean acreage in northeast China, influenced by market factors such as the continued rise in maize prices, led to a year-over-year decrease in soybean production in China by about 1.4%.

China crop prospects

In China, the overall favorable weather conditions benefitted winter crops. During the overwintering to regreening and jointing stages, rainfall (+25%) and temperatures (+0.8°C) were above the 15YA. Benefitting from good agro-climatic conditions and proper crop management, winter crop conditions were overall favorable. CropWatch puts the total crop production in 2021 at 638.87 million tonnes, an increase of 7.44 million tonnes or 1.2% up from last year. Among them, the total output of summer crops (including maize, semi-late rice, late rice, spring wheat, soybeans, tuber crops and other minor crops) is expected to be 472.7 million tonnes, an increase of 6.379 million tonnes or 1.4% over 2020. Rice yields are up, more than compensating for some reductions in planted area of early rice. The area of maize increased by 1.4% over last year, aided by higher market prices for maize. Yields are also forecasted to increase by 0.7%. Area of soybean declined by 1.7%. This was the first time in 5 years that a decline was reported. Yields are expected to increase by 0.3%, resulting in a decline of total production by 1.4%. The total output of winter crops in 2021 is estimated to be 132.48 million tonnes using the latest remote sensing data, an increase of about 0.982 million tonnes or 0.7% year-on-year. Planted area and yield of summer crops increased by 0.5% and 0.3%, respectively.

Chapter 1. Global agroclimatic patterns

Chapter 1 describes the CropWatch Agroclimatic Indicators (CWAIs) rainfall (RAIN), temperature (TEMP), and radiation (RADPAR), along with the agronomic indicator for potential biomass (BIOMSS) in sixty-five global Monitoring and Reporting Units (MRU). RAIN, TEMP, RADPAR and BIOMSS are compared to their average value for the same period over the last fifteen years (called the "average"). Indicator values for all MRUs are included in Annex A table A.1. For more information about the MRUs and indicators, please see Annex B and online CropWatch resources at **www.cropwatch.com.cn**.

1.1 Introduction to CropWatch agroclimatic indicators (CWAIs)

This bulletin describes environmental and crop conditions over the period from April 2021 to July 2021, AMJJ, 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 C and serve the purpose of identifying global climatic patterns. Refer to Annex A for definitions and to table A.1 for 2021 AMJJ 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.

We also stress that the reference period, referred to as "average" in this bulletin covers the 15-year period from 2006 to 2020. Although departures from the 2006-2020 are not anomalies (which, strictly, refer to a "normal period" of 30 years), we nevertheless use that terminology. 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. 2016-2020) but the BIOMSS indicator is nevertheless compared against the longer 15YA (fifteen-year 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.

Correlations between variables (RAIN, TEMP, RADPAR and BIOMSS) at MRU scale derive directly from climatology. For instance, the positive correlation between rainfall and temperature results from high rainfall in equatorial, i.e. in warm areas.

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

Global temperatures set alarming records during this monitoring period according to the National Oceanic and Atmospheric Administration (NOAA) of the USA. June 2021 was the fifth-warmest June, and the warmest for Earth's land area. Temperatures were 0.88 ºC above the 20thcentury average. North America and Africa had their hottest June on record; Europe and Asia had their second hottest June on record. Subsequently, NOAA declared July 2021 as the Earth's hottest month on record (+0.93ºC).

The increase in average temperatures by 1ºC may not sound alarming. However, these temperature increases cause prolonged and more intense droughts and heat waves. Intensity of rainfall events also increases, while the number of rainy days' decreases. As a consequence, floods are more likely to occur. In its newest report on the science of climate change on lands, the Intergovernmental Panel on Climate Change (IPCC) included a chapter on weather extremes for the first time. These extreme weather events will more and more have a negative impact on the stability and level of crop production around the globe.

Figure 1.1 shows unweighted averages of the CropWatch Agroclimatic Indicators (CWAIs), i.e. the arithmetic means of all 65 MRUs, which are relatively close to average. CWAIs are computed only over agricultural areas, and they display a relatively average situation, globally.

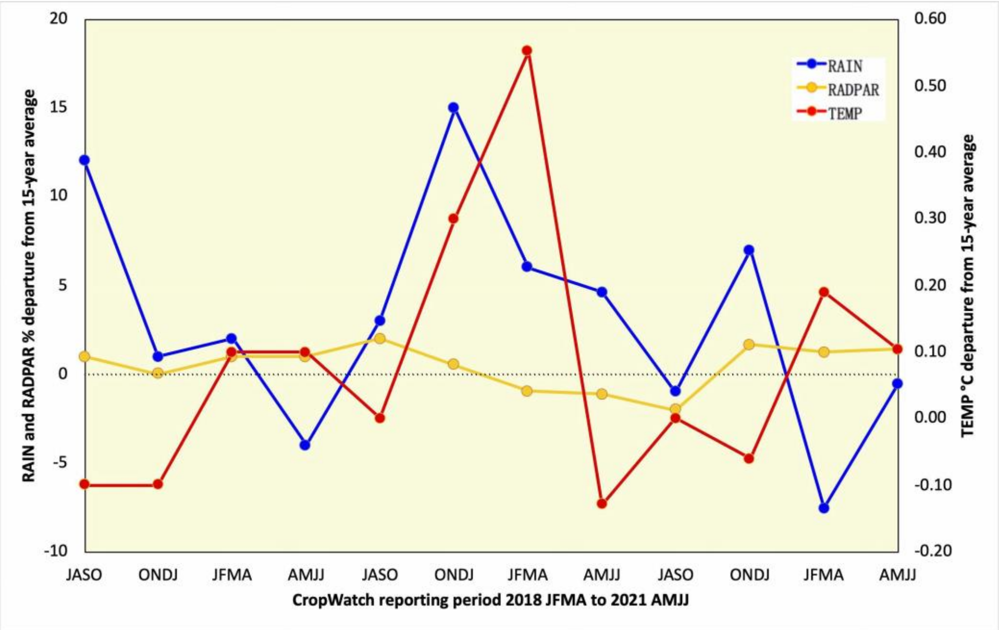


Figure 1.1 Global departure from recent 15 year average of theRAIN, TEMP and RADPAR indicators since 2018 ONDJ period (average of 65 MRUs, unweighted)

1.3 Rainfall (Figure 1.2)

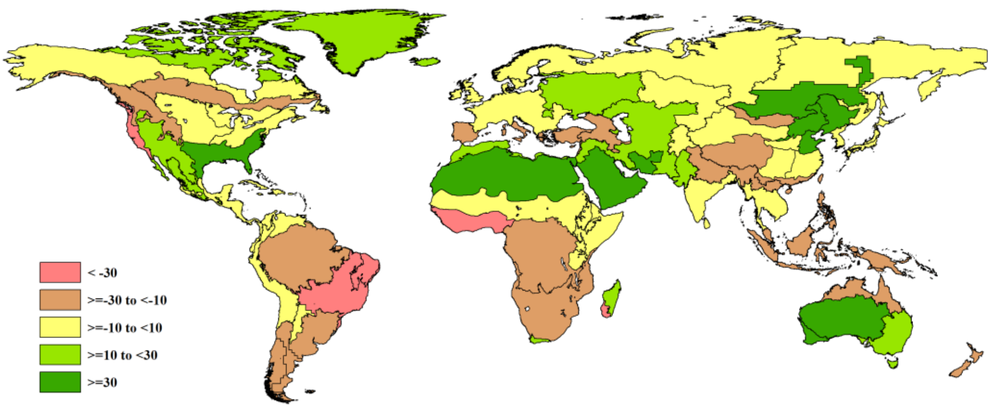


Figure 1.2 Global map of rainfall anomaly (as indicated by the RAIN indicator) by CropWatch Mapping and Reporting Unit: departure of April to July 2021 total from 2006-2020 average (15YA), in percent.

Below average rainfall conditions persisted for most of Brazil and the West coast of the USA. In both regions, the drop in rainfall departure was more than -50%. In Mexico, as well as in the south of the USA, above average monsoon rains put an end to the drought conditions of last winter. In Africa, Southwest Madagascar continued to be affected by the prolonged drought. Rainfall was more than 50% below average, but the other regions of the island received above average rainfall (+18%). In southern Africa, rainfall was 23% below average. A positive departure was observed for the Western Cape, which is important for its winter wheat production. It had received 255 mm of rain, which was 14% above the 15YA. The onset of the monsoon rains was delayed in the Gulf of Guinea, causing a decline by 36%. Rain in Europe was generally abundant, although the Caucasus, which had experienced a rainfall deficit already during the last monitoring period, continued to stay drier than usual (-17%). Most of the other wheat producing regions such as the Ukraine to the Ural had received slightly above average rainfall (+12%). In East Asia, for Huanghuaihai (China) a strong positive departure by +50% was observed. This was mainly due to a catastrophic rainfall event that had occurred in late July. All wheat production regions in Australia received above average rainfall.

1.4 Temperatures (Figure 1.3)

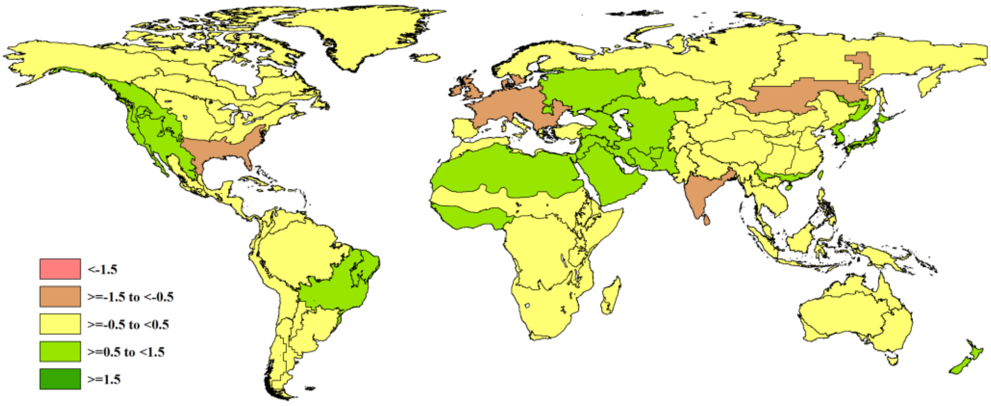


Figure 1.3 Global map of temperature anomaly (as indicated by the TEMP indicator) by CropWatch Mapping and Reporting Unit: departure of April to July 2021 average from 2006-2020 average (15YA), in °C

Temperatures can impact growth in different ways: Cooler than usual temperatures during the spring tend to delay crop growth and development. Above average temperatures, especially when they exceed 30-35ºC, can hasten senescence of the wheat crops and also cause male sterility in maize. Record setting heat waves hit the west of the USA and Canada. Average temperatures were more than 1ºC higher than the 30YA. However, the extremes were much higher. In British Columbia, temperatures reached 49.6ºC, whereas the old record was 45ºC. The drier than usual areas in Brazil also experienced above average temperatures. Western Europe experienced cooler than usual temperatures mainly in April and May, whereas the Caucasus and the region from the Ukraine to the Ural Mountains were much warmer than usual. In South Asia, the largest negative departure was recorded in the region from the Punjab to Gujarat (India). In the other regions, temperatures had stayed near average.

1.5 RADPAR (Figure 1.4)

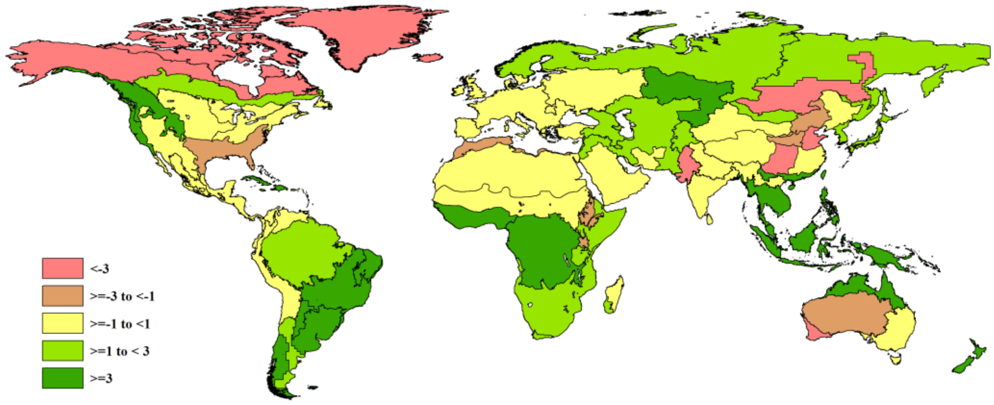


Figure 1.4 Global map of photosynthetically active radiation anomaly (as indicated by the RADPAR indicator) by CropWatch Mapping and Reporting Unit: departure of April to July 2021 total from 2006-2020 average (15YA), in percent.

The largest increase in solar radiation was observed for the Pampas in Argentina (+10%). Solar radiation was above average by more than 5% for most of Brazil and the West Coast of North America (+6%). Southern China experienced an increase by 9%. The strongest negative departures had been observed for Eastern Central Asia (-5.3%) and Huanghuaihai (China) (-4.3%). The AEZ from Nullarbor to Darling in Australia also experienced a sharp decline by -6.3%.

1.6 BIOMSS (Figure 1.5)

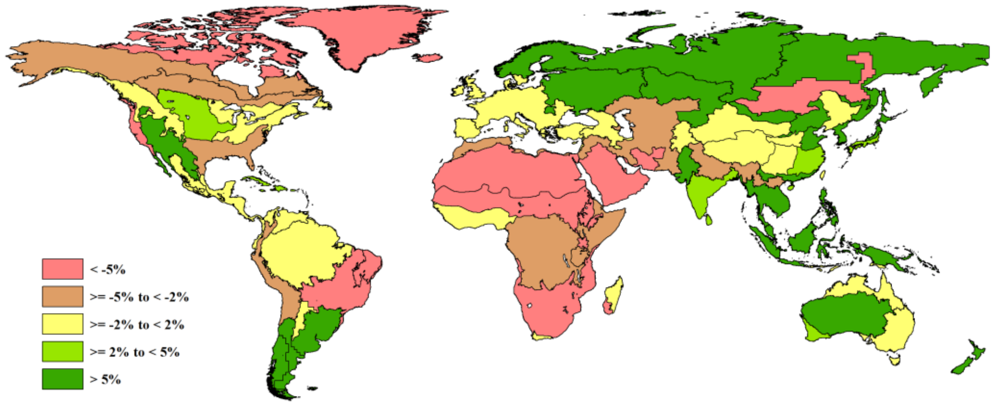


Figure 1.5 Global map of biomass accumulation (as indicated by the BIOMSS indicator) by CropWatch Mapping and Reporting Unit (MRU), departure of April to July 2021 total from 2006-2020 average (15YA), in percent.

The Biomass product is calculated as a function of temperatures, rainfall and solar radiation. In South America, a decline in BIOMSS estimates had been calculated for most of Brazil, affected by drought generated by significantly low precipitation. Similarly, the west coast of the United States was drought-stressed with a 23% lower potential cumulative biomass. Benefiting from favorable rainfall conditions, the Punjab to Gujarat region in South Asia has an 18% higher potential biomass with promising rice yields. Similar increases were seen in the Ukraine to Ural Mountains region, indicating a positive outlook for wheat production in Ukraine and Russia.

Chapter 2. Crop and environmental conditions in major production zones

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

2.1 Overview

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

Table 2.1 Agroclimatic indicators by Major Production Zone, current value and departure from 15YA (April to July 2021)

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

*Note: Departures are expressed in relative terms (percentage) for all variables, except for temperature, for which absolute departure in degrees Celsius is given. Zero means no change from the average value; relative departures are calculated as (C-R)/R*100, with C=current value and R=reference value, which is the fifteen-year average (15YA) for the same period (April-July) for 2006-2020.*

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

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

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

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

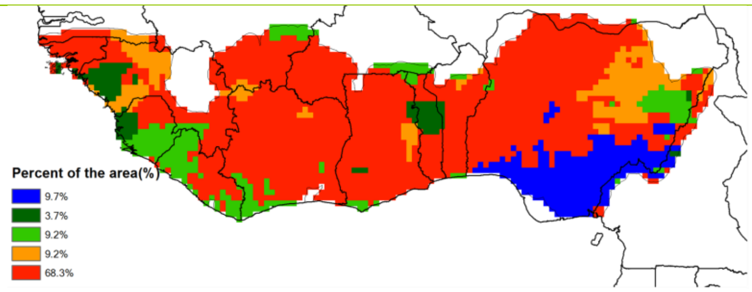
2.2 West Africa

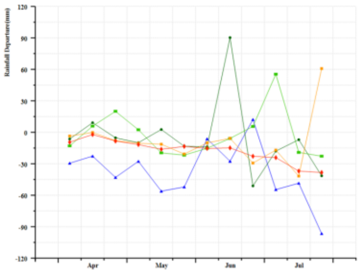
This report covers the onset of the main rainy season in the West Africa Major Production Zone (MPZ). The planting of the crops started in May and June. Dominant crops are the cereal crops, such as maize, sorghum, millet, rice and tuber crops, including cassava and yams crops grown in the coastal areas.

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

The potential biomass (BIOMSS) departure from the 5YA indicated spatial and temporal stratifications similar to the land-sea spatial pattern with coastal areas experiencing positive anomalies (+10 to +20%), whereas the northern areas experienced negative ones (0 to -20%). The VCIx map as an indication of vegetation cover shows that the areas with the highest values (>0.8) were in the coastal and central regions, whereas lower values were observed in the northern parts of the MPZ, which were also drier. This trend is also reflected through the vegetation health index (VHI) map depicting spatial and temporal pattern across the region that were most affected by severe drought conditions. The cropped arable land fraction (CALF) was at 88% with a slight decrease (-3%). The lowest CALF values were observed in Nigeria at 76% (-6%). The low CALF values for Nigeria can be attributed to the conflict in northern Nigeria and dry environments. Generally, crop conditions in the MPZ were below average due to rainfall deficits. More rain will be needed in several important crop production areas to ensure an adequate soil moisture supply for the growth of the main season crops, which is the key to food security in the region.

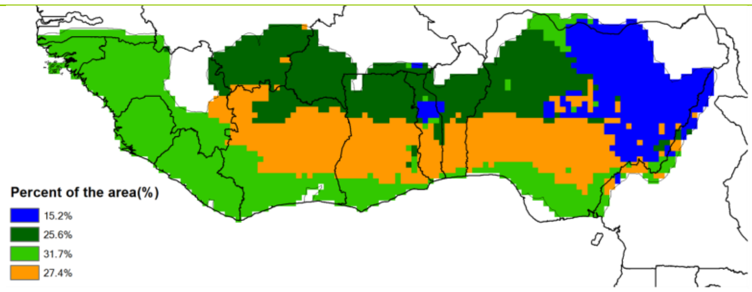
Figure 2.1 West Africa MPZ: Agroclimatic and agronomic indicators, April to July 2021

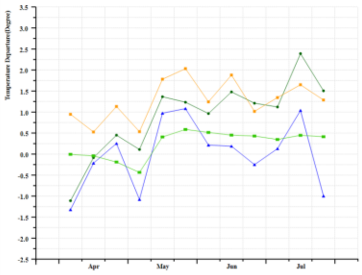




a. Spatial distribution of rainfall profiles

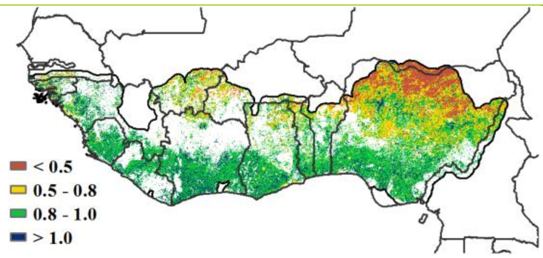
b. Profiles of rainfall departure from average (mm)

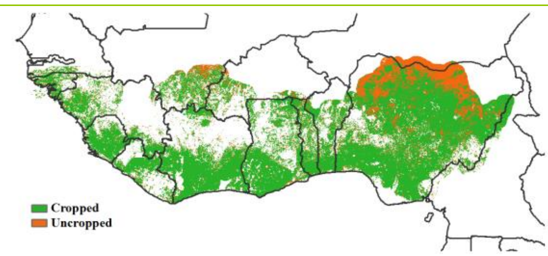




c. Spatial distribution of temperature profiles

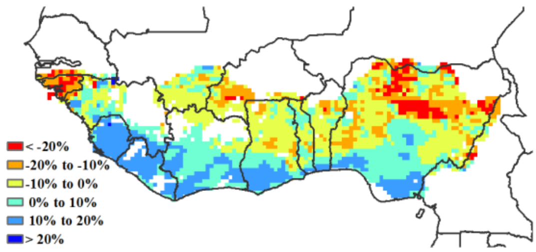
d. Profiles of temperature departure from average(°C)

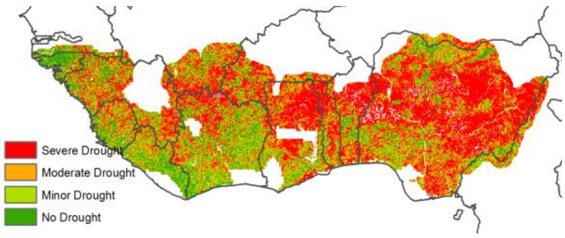




e. Maximum VCI

f. Cropped arable land





g. Biomass accumulation potential departure

h. VHI minimum

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

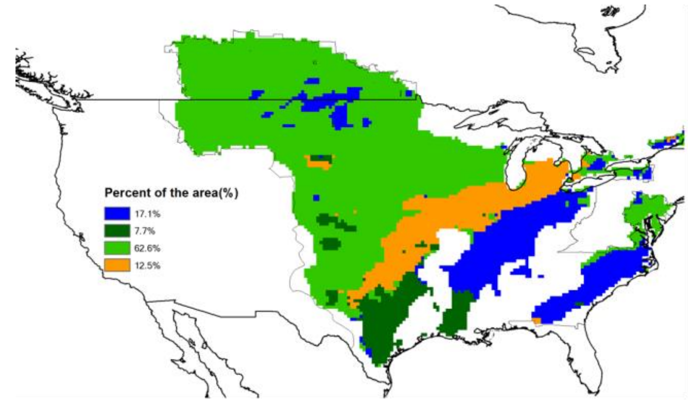
2.3 North America

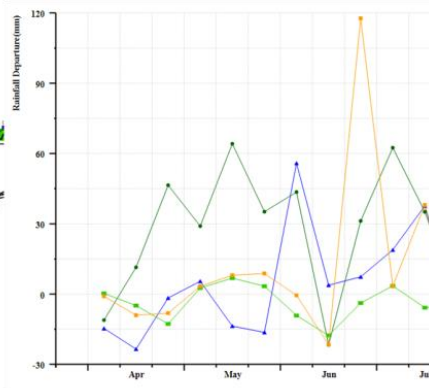
During the current monitoring period from April to July 2021, winter wheat reached maturity and has been harvested. The sowing of maize started in April, followed by soybean in May. Maize reached the silking period and soybean reached seed filling in late July, whereas spring wheat was in its late grain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

For the region as a whole, rainfall was 21% above the 15YA. Rainfall during the reporting period showed significant spatial variation, with areas in the Prairie and Northern Plains to Western Corn Belt being affected by below-average rainfall between late May and late June, and significantly above average rainfall was observed in other areas. Temperature was 0.5°C below the 15YA. Areas with insufficient rainfall between late May and late June also suffered from high temperatures that were 4-5°C above the 15YA, accelerating soil moisture loss and resulting in crop water stress. The RADPAR was at average level. The minimum vegetation health index (VHIn) confirmed severe drought in the Prairie and Northern Plains under a combination of temperature and water stress. During the monitoring period, 94% of the cropland was planted, which is 1% lower than the 5YA. The maximum vegetation condition index shows that crop conditions were generally favorable, except for the Southern Prairie and Northern Plains, which were affected by a severe drought.

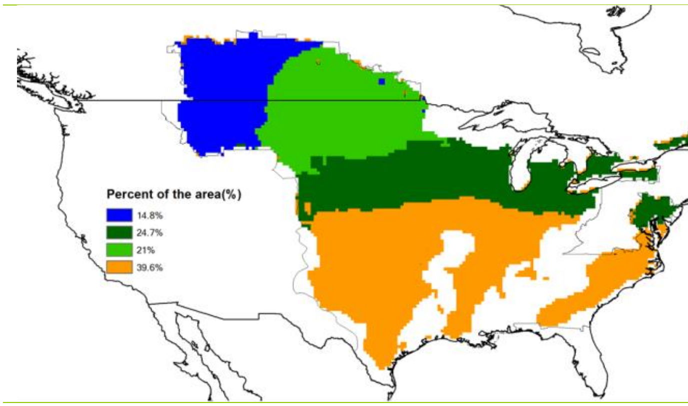
CropWatch assesses the crop condition as below average in the Southern Prairies, Northern Plains and Western Corn Belt and as above average in the other regions.

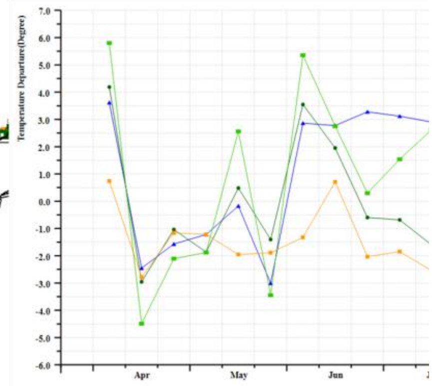
Figure 2.2 North America MPZ: Agroclimatic and agronomic indicators, April to July 2021



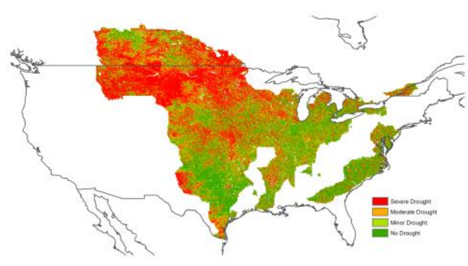


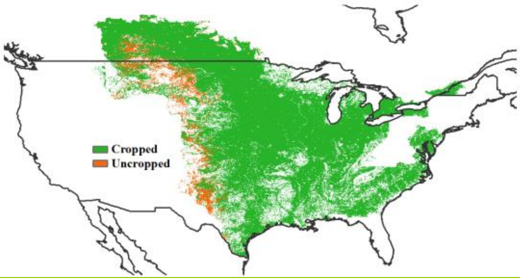
a. Spatial distribution of rainfall profiles b. Profiles of rainfall departure from average (mm)



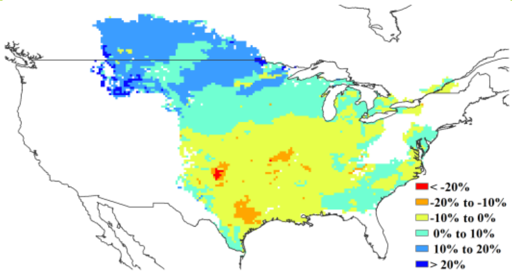


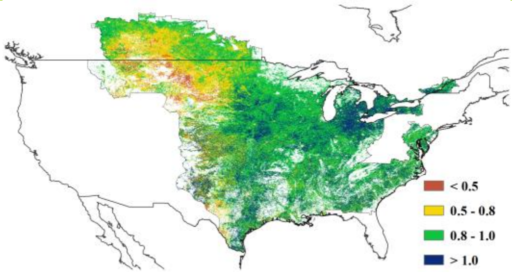
c. Spatial distribution of temperature profiles d. Profiles of temperature departure from average (°C)





e. VHI Minimum f. Cropped and uncropped arable land





g. Biomass accumulation potential departure

h. Maximum VCI

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

2.4 South America

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

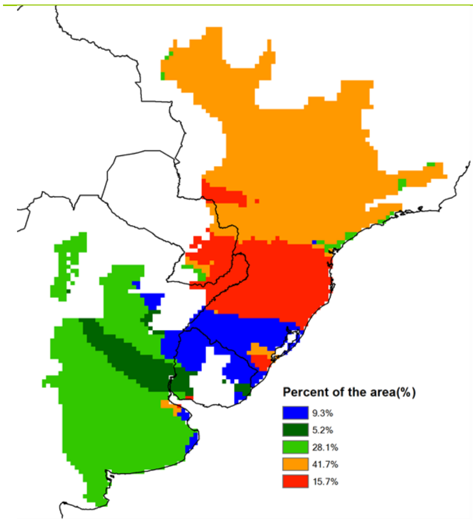
At the MPZ level, rainfall was 45% below average, and temperatures were 0.8 degree cooler and RADPAR 3% above the 15YA. Altogether, the unfavorable condition resulted in BIOMSS estimates that were 14% below the 15YA. The drought conditions in the MPZ were also confirmed by the VHIm map. The spatial distribution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

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

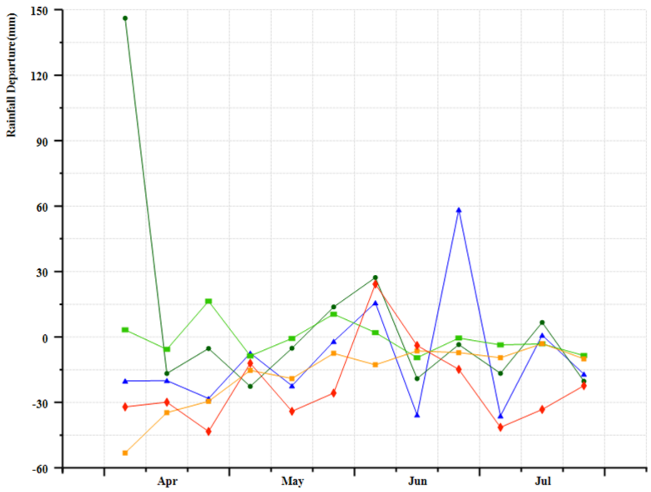
CALF index showed that most areas were cropped in the whole MPZ, except for some sites in the center and south-west Pampas of Argentina. That region was dominated by positive BIOMSS departure values. Poor conditions (lower than -20%) were observed in the northern area of Brazil. The center of the Brazilian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

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

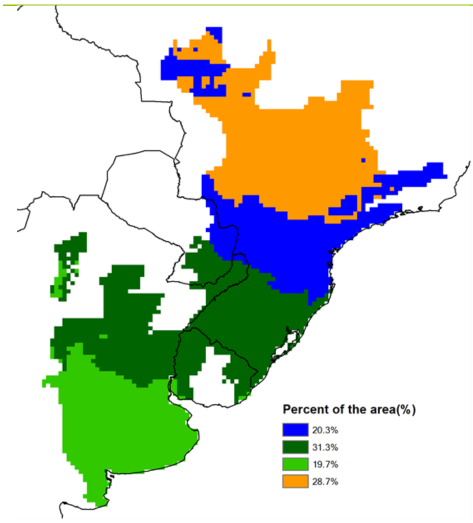
Figure 2.3 South America MPZ: Agroclimatic and agronomic indicators, April to July 2021



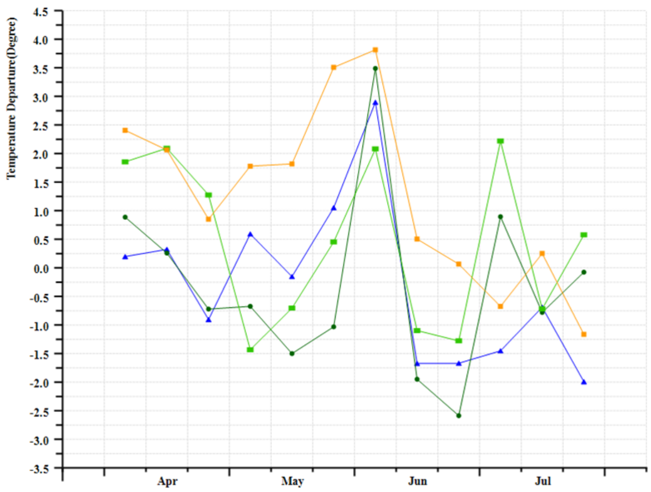
a. Spatial distribution of rainfall profiles



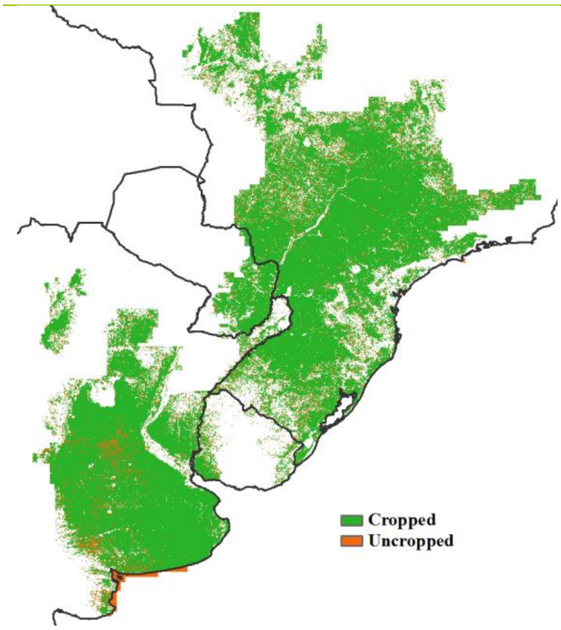
b. Profiles of rainfall departure from average (mm)



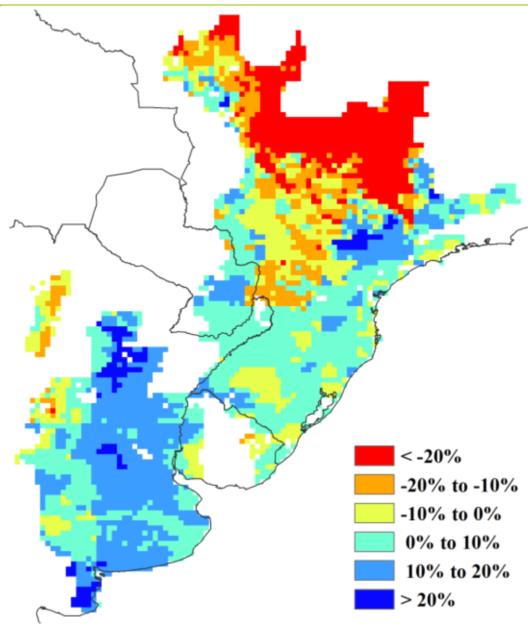
c. Spatial distribution of temperature profiles



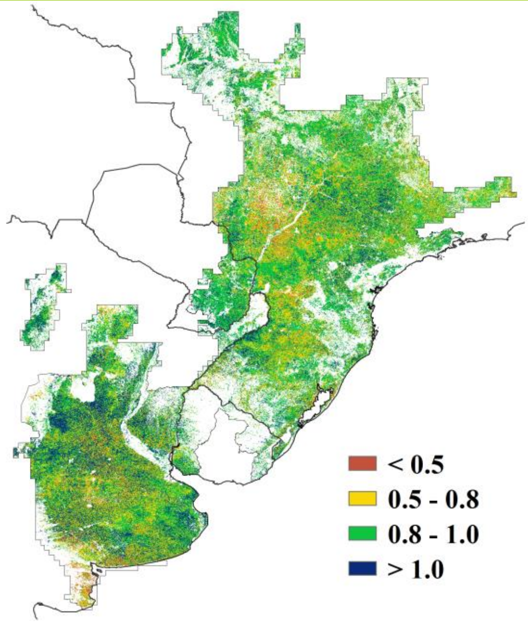
d. Profiles of temperature departure from average (°C)



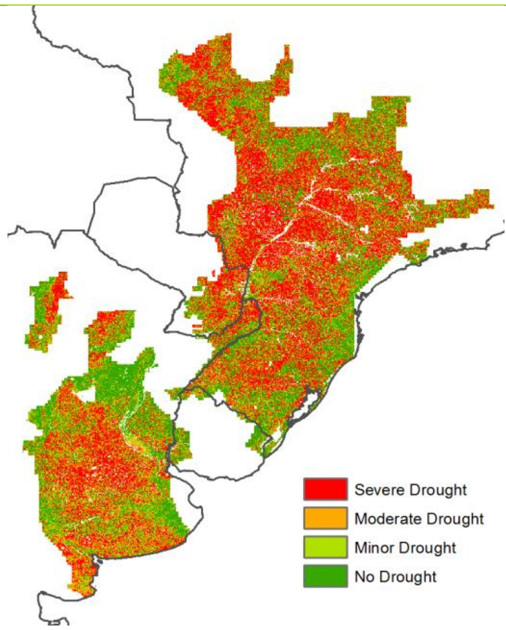
e. Cropped and uncropped arable land



f. Potential biomass departure from 5YA



g. Maximum VCI



h. VHI minimum

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

2.5 South and Southeast Asia

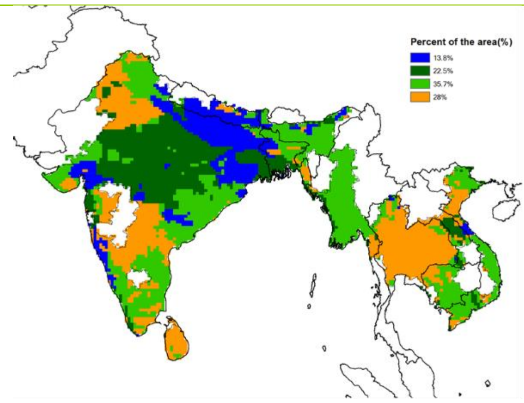
The South and Southeast Asia MPZ includes India, Bangladesh, Cambodia, Myanmar, Nepal, Thailand and Vietnam. This monitoring period covers the harvest of the winter crops, mainly wheat in India and Bangladesh, dry season rice, as well as the planting of the main rice crop in the entire MPZ. For South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

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

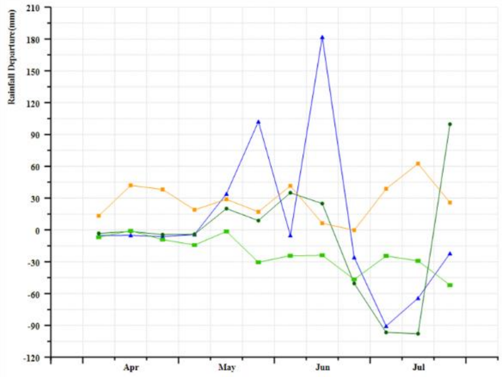
The BIOMSS departure map showed values higher than the average for most of the region, below-average conditions were mainly observed in northern India, eastern India and Nepal. Minimum VHI showed severe drought conditions in northern India, eastern India, central Myanmar and western Cambodia. This may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

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

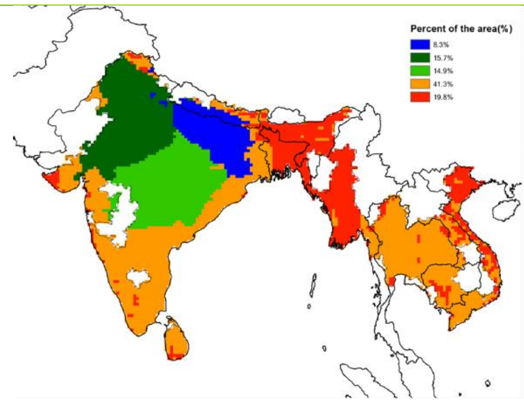
Figure 2.4 South and Southeast Asia MPZ: Agroclimatic and agronomic indicators, April to July2021



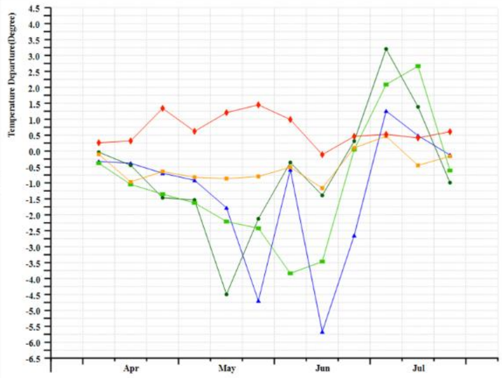
a. Spatial distribution of rainfall profiles



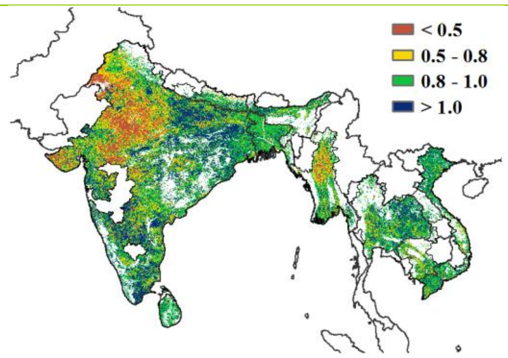
b. Profiles of rainfall departure from average (mm)



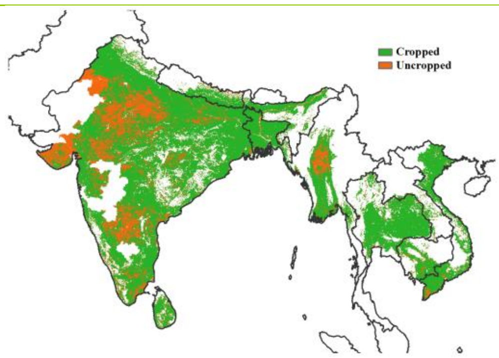
c. Spatial distribution of temperature profiles



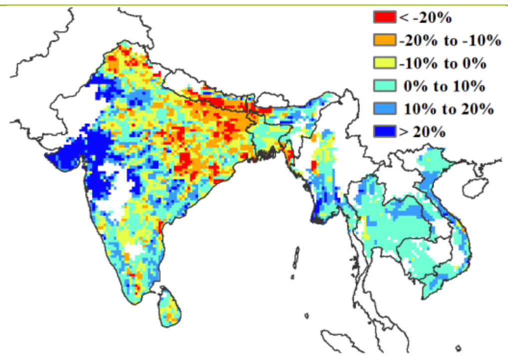
d. Profiles of temperature departure from average (℃)



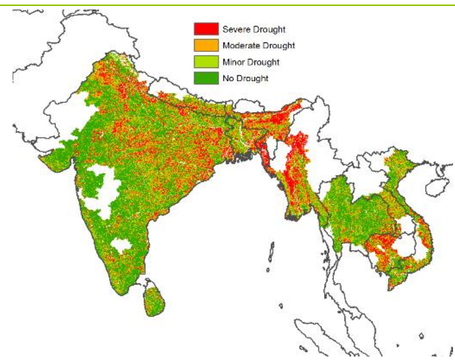
e. Maximum VCI



f. Cropped arable land



g. Biomass accumulation potential departure



h. VHI minimum

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

2.6 Western Europe

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

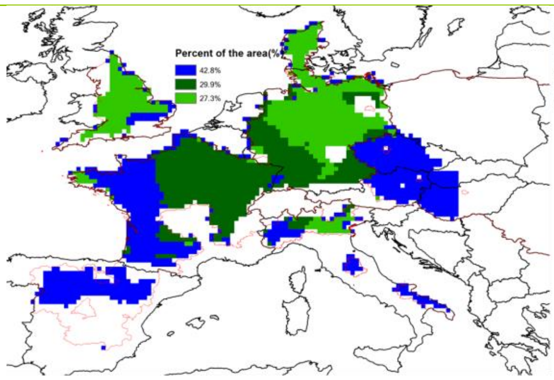
CropWatch agroclimatic indicators show that the whole MPZ showed a significant increase in RAIN (25% above average). Rainfall patterns can be characterized as follows: (1) 42.8 percent of the MPZ areas (Western and south-eastern France (Normandy, Loire, Brittany, Poitou-Charentes, Aquitaine, Sud-Pyrénées),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

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

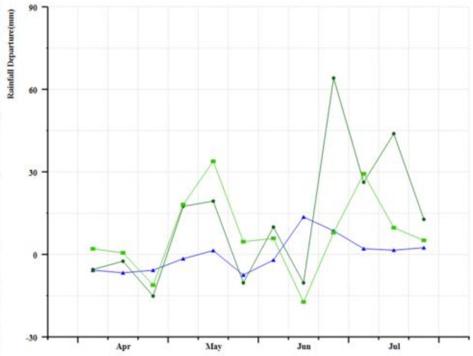
Due to the overall excessive precipitation in the Western European Major Production Zone combined with cooler than usual temperatures, the potential BIOMSS was 6% below average. The lowest BIOMSS values (-10% and below) were mostly concentrated in southern Denmark, western, central and southern Germany,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

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

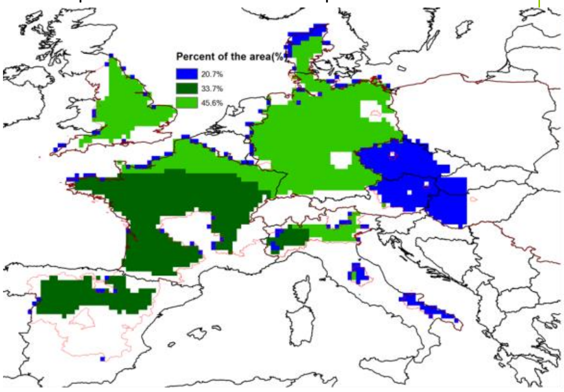
Figure 2.5 Western Europe MPZ: Agroclimatic and agronomic indicators, April to July 2021



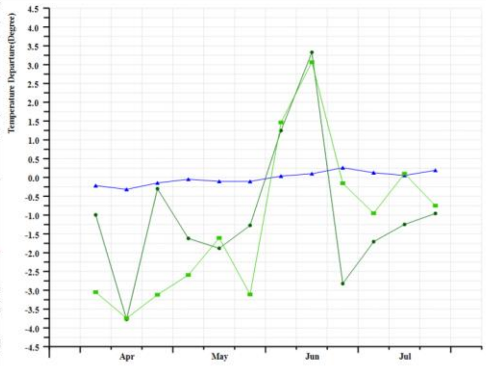
a. Spatial distribution of rainfall profiles



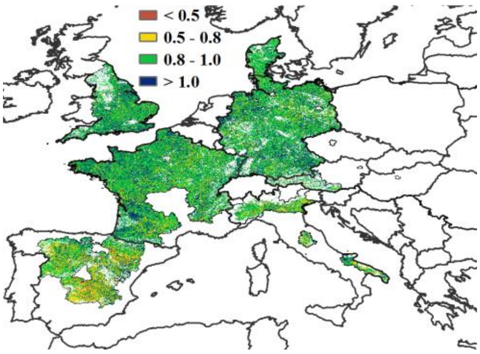
b. Profiles of rainfall departure from average (mm)



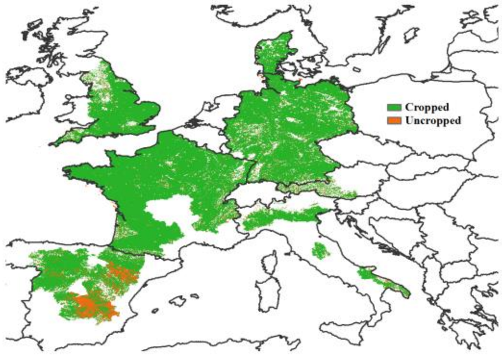
c. Spatial distribution of temperature profiles



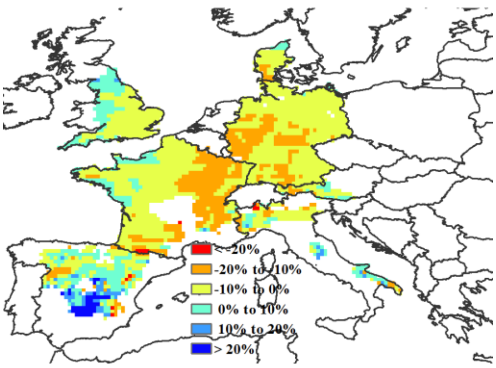
d. Profiles of temperature departure from average (mm)



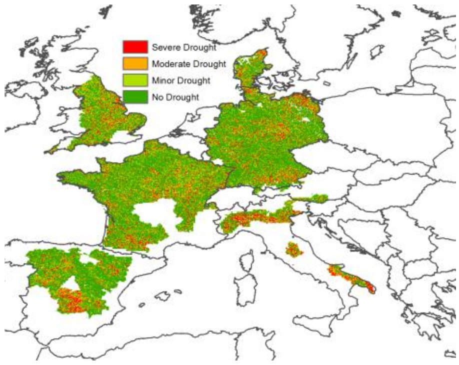
e. Maximum VCI



f. Cropped arable land



g. Biomass accumulation potential departure



h. VHI minimum

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

2.7 Central Europe to Western Russia

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

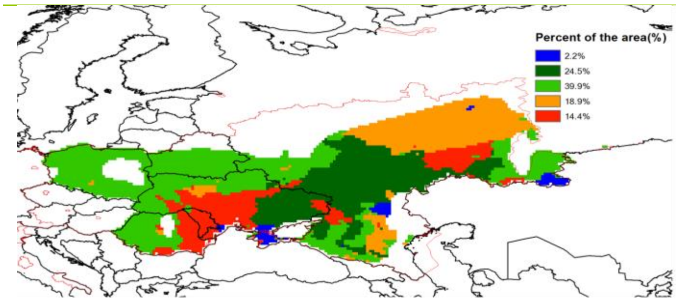
Based on the rainfall departure map, the rainfall varied significantly in the MPZ. The specific spatial and temporal distribution characteristics are as follows: (1) From April to May, the precipitation was slightly above average in Poland, southern Belarus, northern Ukraine, western Romania and parts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

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

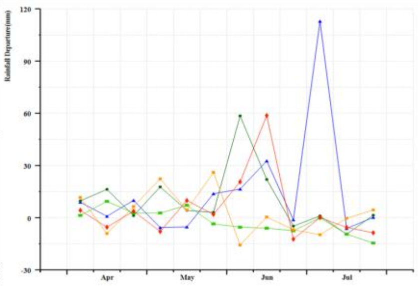
The results of CropWatch monitoring showed that most of the arable land in the MPZ was planted with the exception of a small part of southeastern Russia, where the CALF reached 98%. The BIOMSS in the MPZ increased by 7% compared to the average of the last 15 years. Based on the spatial distribution map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

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

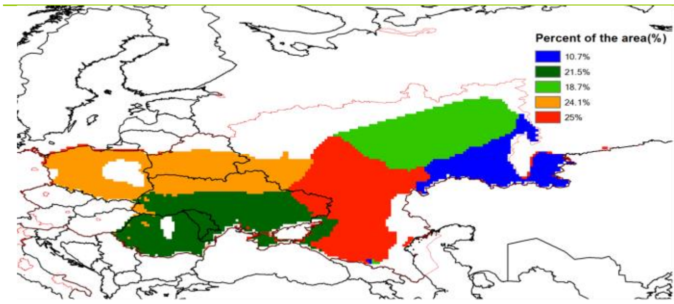
Figure 2.6 Central Europe to Western Russia MPZ: Agroclimatic and agronomic indicators, April to July 2021



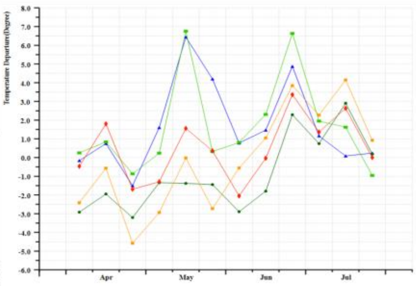
a. Spatial distribution of rainfall profiles



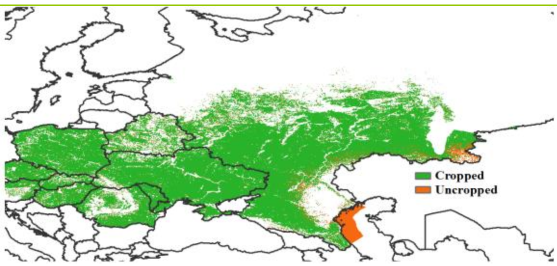
b. Profiles of rainfall departure from average (mm)



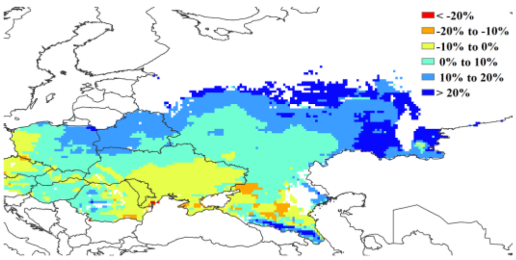
c. Spatial distribution of temperature profiles



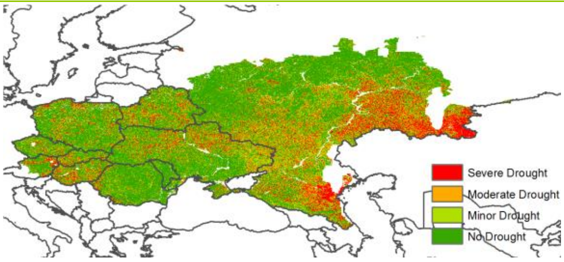
d. Profiles of temperature departure from average (°C)



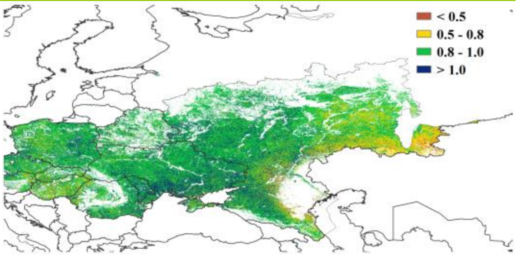
e. Cropped arable land



f. Biomass accumulation potential departure



g. VHI minimum



h. Maximum VCI

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

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 42 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 agroclimatic patterns that emerge at the MRU level (chapter 1) are reflected with greater spatial detail at the national and sub-national administrative levels described in this chapter. The "core countries", 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 agroecological 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 5.2) although extreme events 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 166 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 tons of the covered commodities. There are only 20 countries that rank among the top ten exporters of maize, rice, wheat and soybeans respectively. The United States and Argentina rank among the top ten of all four crops, whereas Brazil, Ukraine and Russia rank among the top ten of three crops.

Maize: Maize exports are dominated by just 4 countries: USA, Brazil, Argentina and the Ukraine. Together, they supply three quarters of maize being traded internationally. In South America, this reporting period covered the grain-filling period of late (2nd crop) maize and its harvest. In Brazil, conditions for maize were unfavorable. The severe drought conditions in all major maize producing states of Brazil persisted throughout this monitoring period and below average production is to be expected. In Argentina, conditions had been favorable, as reported in the May CropWatch bulletin.

In the USA, the western and northern zones of the Corn Belt were affected by drought conditions as well. On the contrary, conditions in the southern and eastern zones were favorable. Hence, the situation for US maize production is mixed. In Europe, conditions so far have been favorable for maize production, although the temperatures in Western Europe, such as in France, were cooler than average, especially in April and May. Rainfall conditions in Romania and the Ukraine have been favorable and high production can be expected from eastern Europe.

In China, maize was off to a good start, helped by the generally above-average precipitation and favorable temperatures. Flooding conditions in late July caused some damage to maize in the Huanghuaihai plain.

Rice: Four out of the 5 top rice exporting countries are located in South and Southeast Asia: India supplies about 1/3 of the rice that is internationally traded, followed by Thailand with 1/5. The USA, number 3, supplies less than 10%. Vietnam contributes about 7% and Pakistan close to 6%.

Conditions for winter (Rabi) season rice production were generally favorable in India, the largest rice exporter. The region of irrigated dry season (Boro) rice production is limited to West Bengal, Telangana, Andhra Pradesh and Assam. However, Boro rice yields are much higher than those obtained in the Kharif (rainy) season. Another region with important dry season rice production is Southeast Asia. Thailand and Vietnam rank in the 2nd and the 3rd position of exporting countries. In these two countries, crop conditions were generally favorable. Conditions for the other important rice producing countries and regions, such as the Philippines and Indonesia, were generally favorable during this monitoring period.

Rainy (monsoon) season rice production has been off to a good start in South and Southeast Asia, aided by average rainfall conditions, although the onset of the monsoon rains was a bit delayed in some states of India. Similarly, conditions in China have been favorable. Rice production in the Sacramento Valley of California is being negatively impacted by the severe drought conditions, whereas the conditions in the other rice producing regions of the USA have been much more favorable, as they received abundant rainfall. All in all, rice production is stable at a global level.

Wheat: This monitoring period covers the sowing of wheat in the Southern Hemisphere. Conditions were favorable in Argentina, Cape Province of South Africa and Australia. In Brazil, the wheat production region has been affected by a prolonged drought, which may cause a reduction in area planted and hamper crop establishment. In the East African Highlands, conditions for wheat sowing from April to June were generally favorable.

Most winter wheat sown in the Northern Hemisphere reached maturity by May, June or July. Spring wheat harvest typically starts in August. Conditions for winter wheat in the Central Plains and the South of the USA were generally favorable. However, the Pacific Northwest was affected by high temperatures and drier than normal conditions. Spring wheat production in the northern states of the USA and the Canadian Prairies has been affected by drought conditions and hot temperatures, which will cause a yield reduction. Winter wheat production in the Maghreb had benefitted from above average rainfall, and production was above average for Morocco, Algeria and Tunisia. In Europe, moisture conditions were generally favorable for wheat production. However, severe storms caused lodging in some areas and the abundant rainfall posed challenges for wheat harvest in some places. Eastern Europe and Russia generally benefitted from above average rainfall as well, and prospects are favorable. Kazakhstan, as most of Central Asia, however, suffered from drought conditions, which will cause a significant yield reduction as compared to last year. In Turkey, Iran, Iraq, Syria and Afghanistan, the crops also suffered from severe drought conditions which reduced yields.

In India and Pakistan, where wheat was harvested in late March and April, the crop had benefitted from generally favorable weather conditions. Winter wheat in the North China Plain reached maturity in late May/early June. Conditions were generally favorable and good yields were obtained. Some of the grains stored on the farms got damaged during the floods in the Huanghuaihai plain in late July. Conditions for spring wheat production in northern China have been favorable so far.

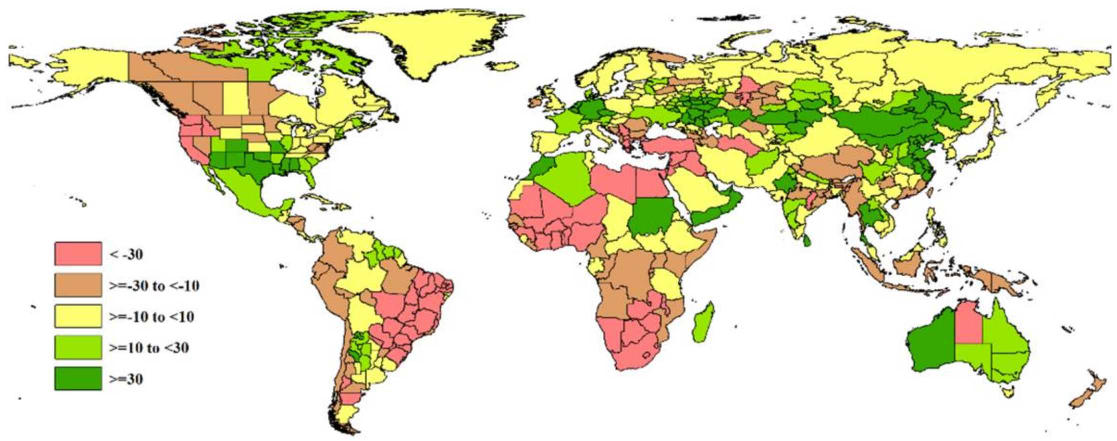
Soybean: In North America, production has benefitted from sufficient rainfall in most production regions, such as the Midwest in the USA and Ontario in Canada. However, the Dakotas had been affected by drought conditions. In the Ukraine, another main exporter of soybean, growing conditions have been favorable during this monitoring period. Conditions for soybean production in China have been favorable so far as well, mainly due to above-average rainfall. In South America, most of the soybeans had been harvested during the previous monitoring period.

3. Weather anomalies and biomass production potential changes

(1) Rainfall (Figure 3.1)

The severe drought conditions in the west of the USA impacted wheat production in the Pacific North West, although most of it is irrigated. However, the lack of rainfall was combined with record setting temperatures, which in turn can shorten the grain-filling period of wheat. Rainfed spring wheat production in the Canadian Prairies and the northern USA was also impacted by below average rainfall. Winter wheat production in Ontario, as well as in Kansas, Colorado, Oklahoma and Texas experienced normal to above average rainfall. Maize and soybean production in the northern USA, including the western and northern regions of the Corn Belt was also affected by drier than usual weather, whereas for the other regions of the Midwest, as well as for the South and East Coast of the USA, favorable rainfall conditions had been observed. Production of summer crops in Mexico benefitted from above average rainfall, putting an end to the prolonged drought. In Central America, as well as the entire west coast of South America, the rainfall deficit ranged from between 10 to 30%, which has a negative impact on maize production in Central America. In Brazil, the severe drought conditions continued, causing challenges for wheat planting in the South. In Argentina, on the other hand, rainfall conditions were more favorable. Wheat production in the Maghreb in North Africa benefitted from above average rainfall. In Morocco, it was 30% above average. Conditions in East Africa, especially in Sudan and Ethiopia were favorable for planting of wheat and maize. In West Africa, a delay of the onset of the rainy season as well as below average rainfall caused generally unfavorable conditions for the sowing of summer crops. In southern Africa, rainfall had been predominantly normal during the previous monitoring period. Most crops reached maturity between April and June. The drier than normal weather created favorable conditions for harvest. Most of the wheat that is grown during the winter months in the southern hemisphere is irrigated. Thus, there is limited impact of the drought conditions (rainfall deficit is greater than -30%) on the establishment of the wheat. Wheat and maize production in Europe, as well as in most of Russia, generally benefitted from normal to above average rainfall. Rainfall was also abundant in the center and north of China, favoring wheat, maize and rice production. The south of China, as well as Myanmar and most of the Middle East and parts of Central Asia were affected by below average rainfall. Most of the countries in the Middle East and Central Asia are suffering from prolonged drought conditions that already started in the previous monitoring period. Especially in Turkey, Lebanon, Syria, Palestine, Iraq and Afghanistan, the severe drought is causing additional hardships for the local population. Good rainfall in Australia has been creating favorable conditions for its wheat production.

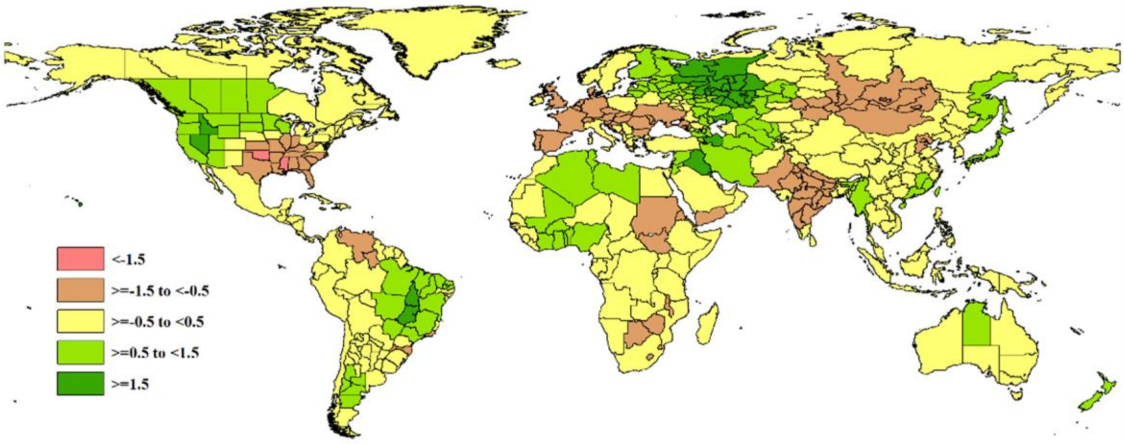
Figure 3.1 National and subnational rainfall anomaly (as indicated by the RAIN indicator) of April to July 2021 total relative to the 2006-2020 average (15YA), in percent



(2) Temperature anomalies (Figure 3.2)

The drought plagued the West of the USA as well as the Canadian Prairies and the northern states of the USA were affected by several heat waves during this monitoring period. The heat, in combination with the drought, will have a negative impact on crop production in those regions. The cooler, below average, temperatures in the Southeast of the USA are not expected to have an impact on crop production in that region. The cooler than usual temperatures in Western and Central Europe slowed the growth of the crops in the spring, but should not have an effect on yield levels. Similarly, the warmer than usual temperatures in Russia will not impact yield levels. Temperature departures from average are expected to have a very limited impact on crop production in the other regions of the world.

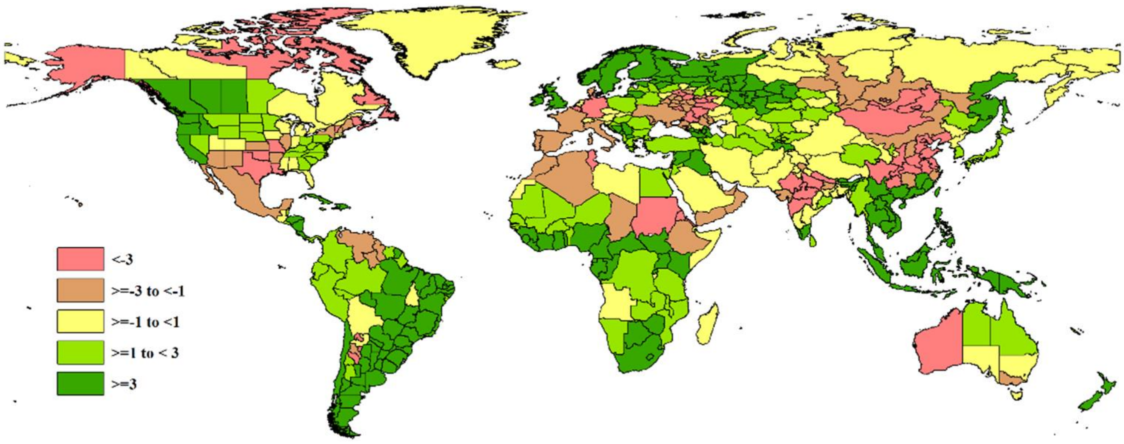
Figure 3.2 National and subnational temperatute anomaly (as indicated by the TEMP indicator) of April to July 2021 average relative to the 2006-2020 average (15YA), in °C



(3) RADPAR anomalies (Figure 3.3)

The higher than normal radiation in the drought affected regions of the USA, Canada and South America, West- Central and Southern Africa increases evapotranspiration and thus exacerbates the drought conditions. The below average radiation in East Asia will have a limited impact on crop production in that region, as radiation levels are generally high during summer.

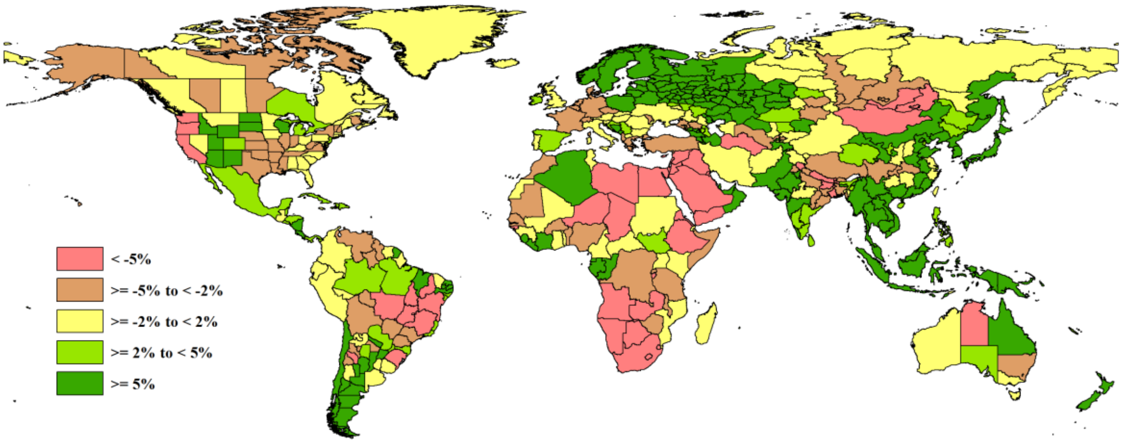
Figure 3.3 National and subnational sunshine anomaly (as indicated by the RADPAR indicator) of April to July 2021 total relative to the 2006-2020 average (15YA), in percent



(4) Biomass accumulation potential BIOMSS (Figure 3.4)

The biomass accumulation map shows favorable prospects for most of the USA, although drought might have reduced the production potential in some regions. Above average biomass estimates had been calculated for the most of Russia, southern India and Southeast Asia.

Figure 3.4 National and subnational bionass production potential anomaly (as indicated by the BIOMSS indicator) of April to July 2021 total relative to the 2006-2020 average (15YA), in percent



3.2 Country analysis

This section presents CropWatch analyses for each of 42 key countries (China is addressed in Chapter 4). The maps and graphs refer to crop growing areas only: (a) Phenology of major crops; (b) Crop condition development based on NDVI over crop areas at national scale, comparing the April-July 2021 period to the previous season and the five-year average (5YA) and maximum; (c) Maximum Vegetation Condition Index over arable land (VCIx) for April-July 2021 by pixel; (d) Spatial NDVI patterns up to April-July 2021 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 agro-ecological zones (AEZ) within a country, again comparing the April-July 2021 period to the previous season and the five-year average (5YA) and maximum.

Refer to Annex A, Table A.1-A.11 for additional information about indicator values by country. For country agricultural profiles please visit the CropWatch Explore module of the cloud.cropwatch.com.cn website for more details.

Figures 3.5 - 3.45; Crop condition for individual countries ([AFG] Afghanistan to [ZMB] Zambia) including agro-ecological zones (AEZ) from April-July 2021.

[AFG] Afghanistan

Wheat, maize and rice are the main cereals that are grown in Afghanistan. The sowing of spring wheat starts in March and April and the harvest is in August and September. Winter wheat is sown in October and November and harvested in May and June. Maize sowing starts in May and harvest is in August. Likewise, rice sowing starts in May/June and harvest is in October / November.

Afghanistan was affected by severe drought conditions during the previous monitoring period. Apart from early May, rainfall was below average for most of the current monitoring period. The cropped arable land is mainly located in Badghis, Faryab, Balkh, Kunduz, Takhar, Badakhshan, and Nuristan. The cropped arable land fraction (CALF) decreased by 34% from the 5YA. This also directly led to the low VCI, which is only 0.4. According to the maximum vegetation condition index (VCIx) map, the vegetation in the east was better than in the west. As to the spatial distribution of NDVI profiles, crop conditions in some areas (about 16.5% of total cropped areas) were above average or close to average from April to July, mainly distributed in Mahajer and Kunduz. The proportion of areas with crop growth slightly lower than the average level was 41.9%, mainly distributed in the east, south and northeast of Afghanistan. In addition, the growth of crops in 41.6% of the cultivated land area was significantly lower than the average level. This was mainly in the northwest, especially in the north of Herat province and Qala-e-naw province. The rainfall increased suddenly in the first ten days of May, reaching 80 mm, which is 2 to 3 times of the precipitation in other periods. According to the meteorological data, the precipitation mainly occurred in Herat, Badghis and Faryab provinces. The flooding caused by the precipitation directly reduced CALF. This bulletin believes that the war also had a great impact on agriculture, causing a decline in CALF. During the monitoring period, most parts of Afghanistan were at war, and the prospect for crop production is far below normal.

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.

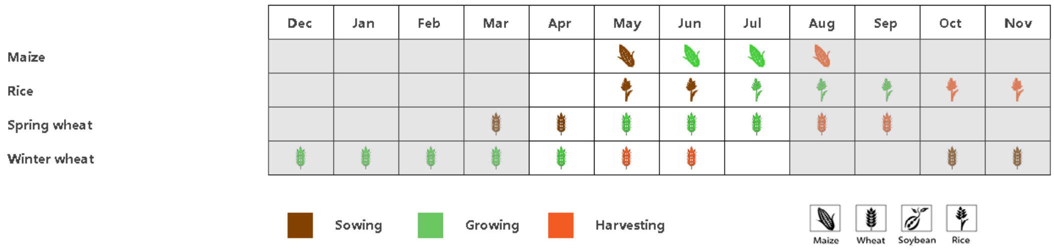
The RAIN in the Central region with sparse vegetation was 183 mm (+23%). The TEMP was 14.4°C (-0.1°C), and the RADPAR was 1630 MJ/m^2, at an average level. According to the NDVI-based crop condition development graph, the NDVI was lower than the average level between April and July. BIOMSS increased by 1%, CALF had increased by 3% and VCIx was 0.56.

The Dry region recorded 95 mm of rainfall (RAIN +27%), TEMP was higher than average at 22.7°C (+0.1°C), and RADPAR was 1651 MJ/m^2 (-1%). According to the NDVI-based development graph, crop conditions were lower than the five-year average in the monitoring period. CALF in this region decreased by 16% and VCIx was 0.24.

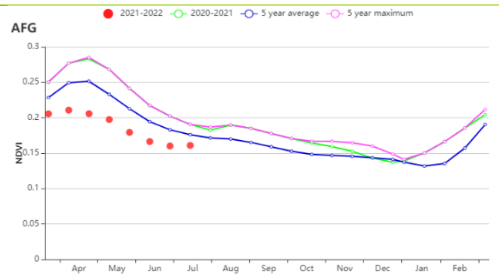
In the Mixed dry farming and irrigated cultivation region, the following indicator values were observed: RAIN 334 mm (+11%); TEMP 17.4°C (+0.1°C); RADPAR 1595 MJ/m^2 (+2%). BIOMSS was 420 g DM/m^2 (-4%) and CALF was 22% below average. According to the NDVI-based crop condition development graph, NDVI was lower than the average level and VCIx was 0.59.

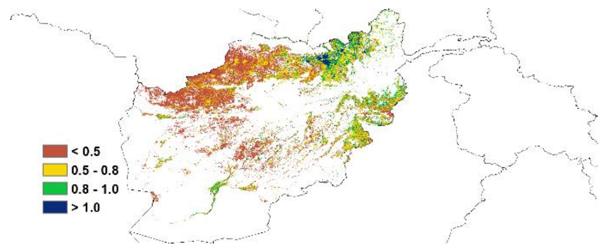
The Mixed dry farming and grazing region recorded 62 mm of rainfall (RAIN -8%). TEMP was 21.5°C (+0.6°C) and the RADPAR was 1647 MJ/m^2, at an average level. CALF was 87% below the 5YA. VCIx was 0.25 and BIOMSS decreased by 1%. According to the crop condition development graph, the NDVI was much lower than the 5YA throughout the monitoring period.

Figure 3.5 Afghanistan's crop condition, April - July 2021

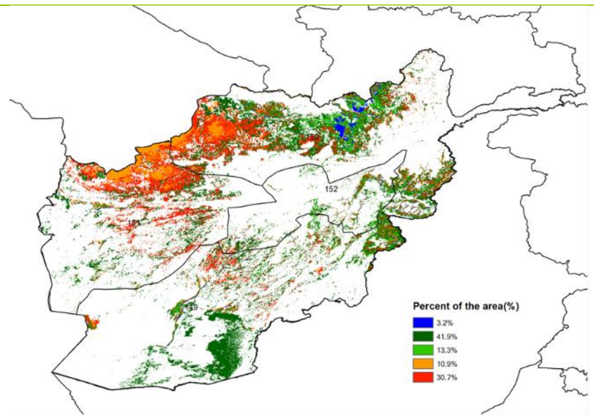


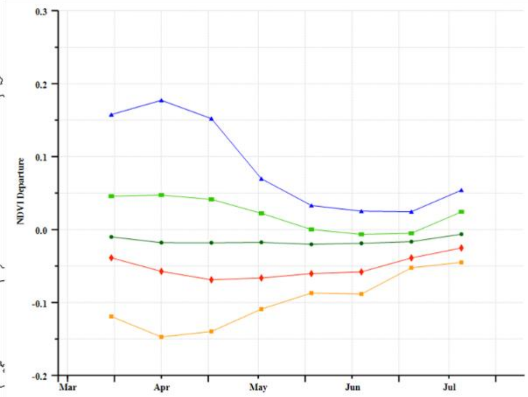
(a). Phenology of major crops



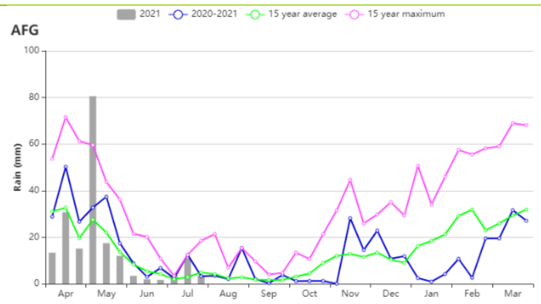


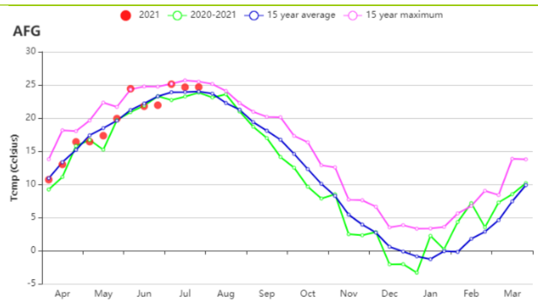
(b) Crop condition development graph based on NDVI (c) Maximum VCI



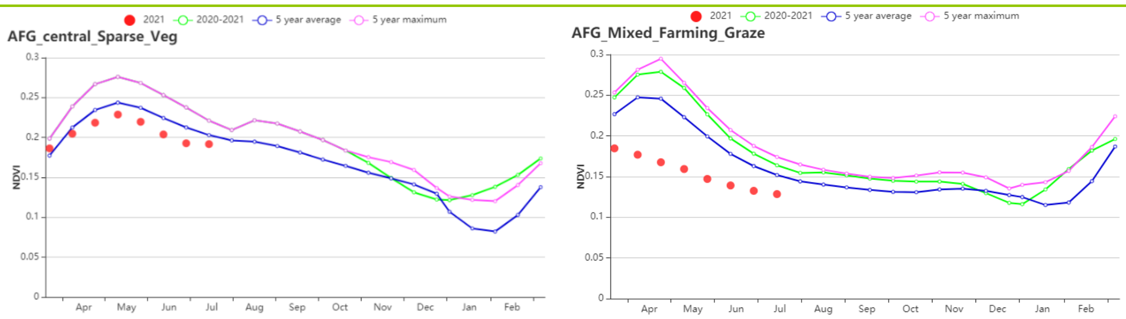


(d) Spatial NDVI patterns compared to 5YA (e) NDVI profiles

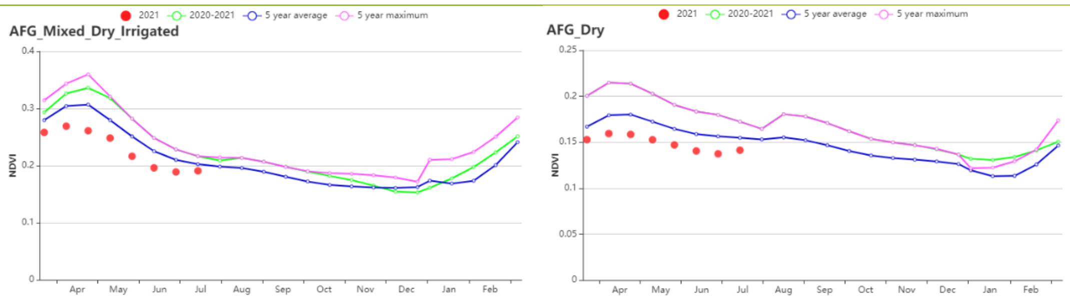




(f) Rainfall profiles (g) Temperature profiles



(h) Crop condition development graph based on NDVI (central_Sparse_Veg Region (left) and Mixed_Farming_Graze Region (right))



(i) Crop condition development graph based on NDVI (Mixed_Dry_Irrigated Region (left) and Dry (right))

Table 3.1 Afghanistan's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, April – July 2021

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Central region with sparse vegetation	183	23	14.4	-0.1	1630	0	378	1
Dry region	95	27	22.7	0.1	1651	-1	397	0
Mixed dry farming and irrigated cultivation region	334	11	17.4	0.1	1595	2	420	-4
Mixed dry farming and grazing region	62	-8	21.5	0.6	1647	0	342	-1

Table 3.2 Afghanistan's agronomic indicators by sub-national regions, current season's values and departure from 5YA, April – July 2021

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure from 5YA (%)	Current
Central region with sparse vegetation	10	3	0.56
Dry region	4	-16	0.24
Mixed dry farming and irrigated cultivation region	18	-22	0.59
Mixed dry farming and grazing region	1	-87	0.25

[AGO] Angola

During this reporting period, the harvest of maize and rice in Angola was concluded by mid-May. Meanwhile, wheat which was sown in May was in its main growth period. Wheat harvest is expected to be in October. Even with no drought recorded for almost 85% of the country, the agroclimatic indicators during this period were characterized by a drop in rainfall (RAIN -16%) and temperature (TEMP -0.1ºC). The radiation recorded for this period was 1228 MJ/m^2, an increase of about 1% compared with the past 15 years' average. According to the rainfall profile graph, the 10-day cumulative rainfall was above the 15YA in late April and early May. Estimated biomass was below the 15YA (BIOMSS -16%).

The crop condition development graph for Angola presented below-average crop conditions in early April, mostly influenced by the below-average precipitation recorded during the period. However, these conditions improved in early May till the end of the reporting period. According to the NDVI departure clustering map and profiles, almost 23% of the cropland presented below-average crop conditions throughout the entire monitoring period. Most of these areas are located in Uíge, Huila and Benguela. However, 17% of the croplands showed above-average crop conditions. Provinces such as Cuando Cubango, Cuanza Sul and Bengo are the regions where the better crop conditions were verified. Despite these conditions as well as the decreases in the cropped arable land fraction (CALF -1%), high VCIx values were recorded across the country (0.87), indicating favorable prospects for the wheat planting regions.

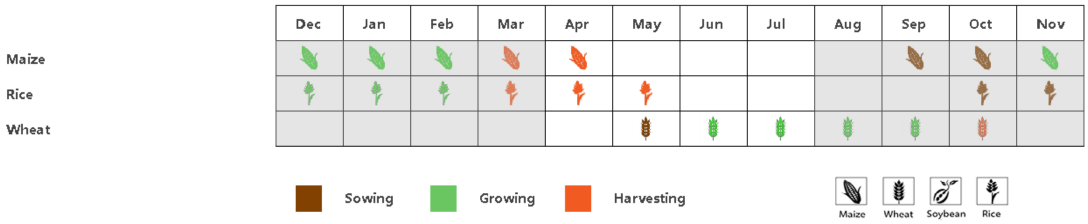
Regional Analysis

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

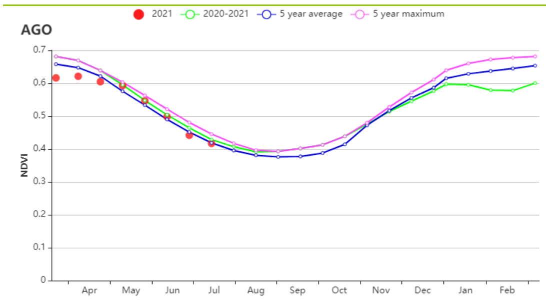
During the reporting period, the agroclimatic indicators reveal that three regions, including the Humid, Semi-arid, and Sub-humid zones, recorded lower rainfalls compared to the past fifteen years' average (about 6%, 23% and 16% lower, respectively). In these regions, the temperature also recorded a drop by 0.1ºC in the Semi-arid and Sub-humid zones and by about 0.3ºC in the Humid zone. Radiation increased by 1% in both Semi-arid and Sub-humid zones while the Humid zone recorded a decrease by 1%. Influenced mostly by the drop in the total precipitation received, the potential biomass in these regions all decreased as expected, by 37%, 23% and 11% in the Humid, Semi-arid, and Sub-humid zones, respectively. Rainfall increased in the Arid zone (RAIN +16%) and Central Plateau (+3%). However, only the Arid zone recorded an increase in temperature by about 0.5ºC while the temperature in the Central Plateau decreased by about 2ºC. Radiation decreased by 2% in the Arid zone and it was near average in the Central Plateau. The potential biomass in both regions was below average, minus 14% in the Arid zone and 13% in the Central Plateau.

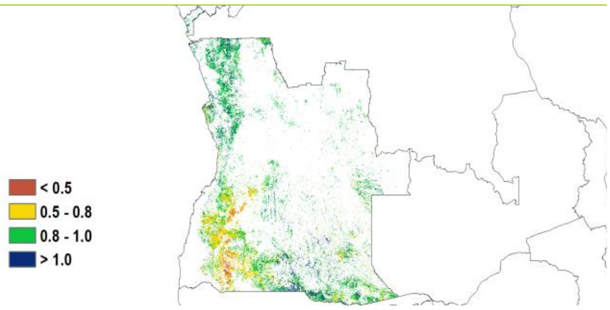
Except for the Humid zone, the crop conditions based on NDVI in the remaining zones indicate favourable crop conditions from early May throughout almost the entire monitoring period. Decreases in the cropped arable land fraction (CALF) were recorded in the Arid zone (-1%), Central Plateau (-10%) and Sub-humid zone (-2%). In the Humid zone, CALF was near average of the past five years, while it increased by 1% in the Semi-arid zone. The lower VCIx of 0.77 was recorded in Central Plateau, a region where a significant drop in CALF was observed.

Figure 3.6 Angola's crop condition, April–July 2021



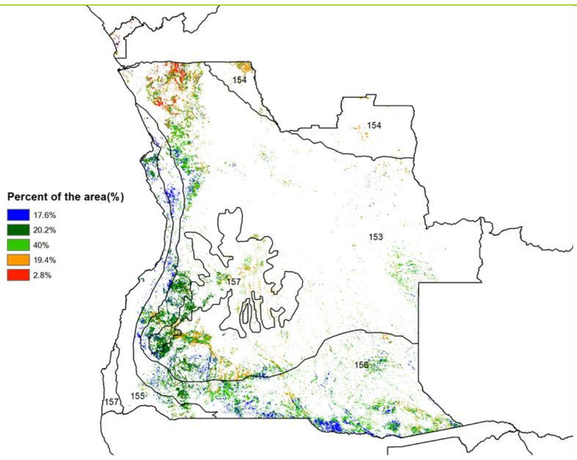
(a) Phenology of major crops

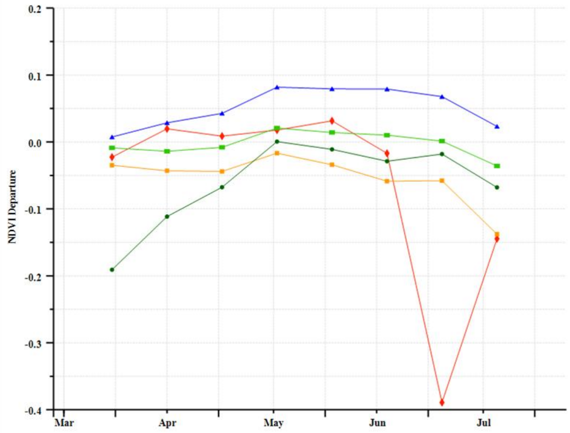




(b) Crop condition development graph based on NDVI

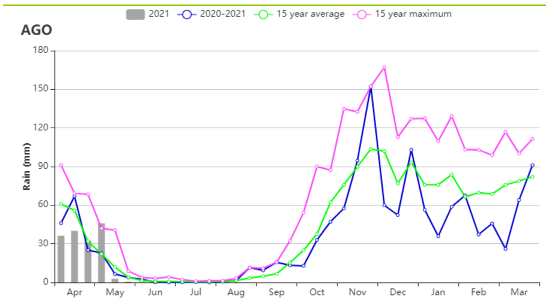
(c) Maximum VCI

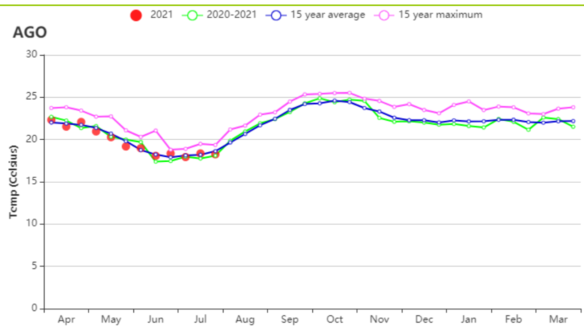




(d) Spatial NDVI patterns compared to 5YA

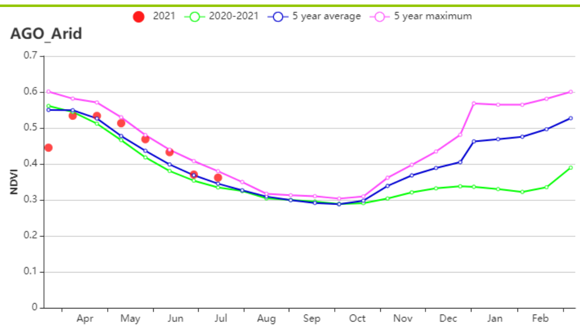
(e) NDVI profiles

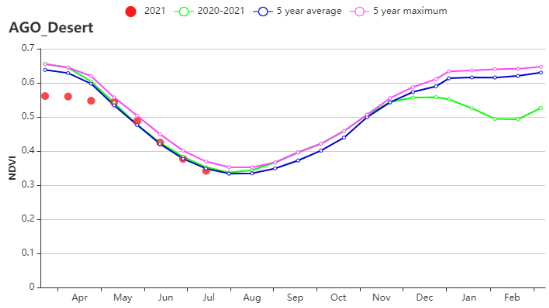




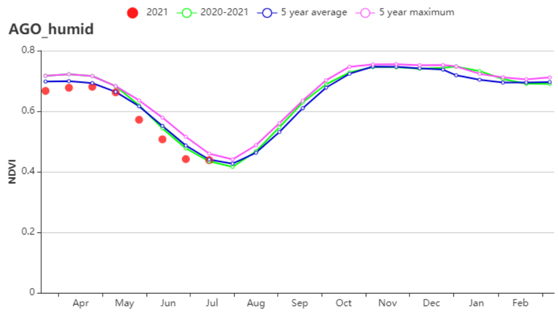
(f) rainfall profiles

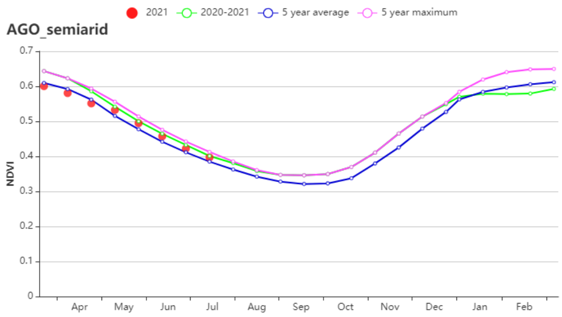
(g) temperature profiles



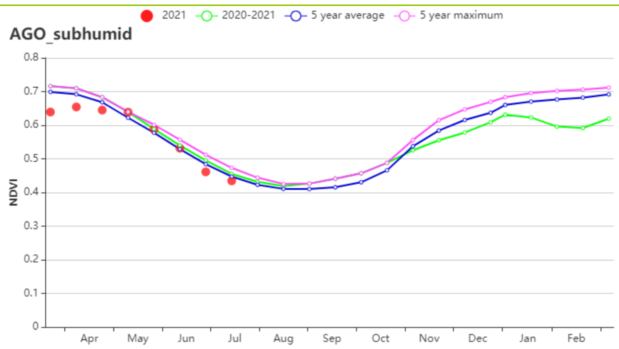


（h）Crop condition development graph based on NDVI - Arid zone (left), and Central Plateau (right)

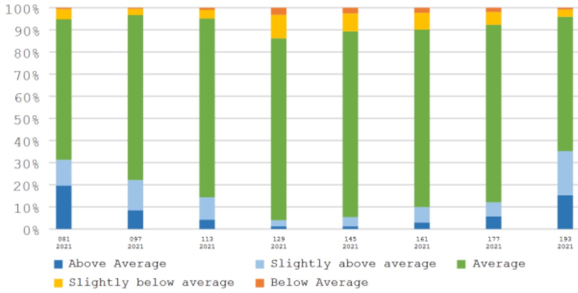


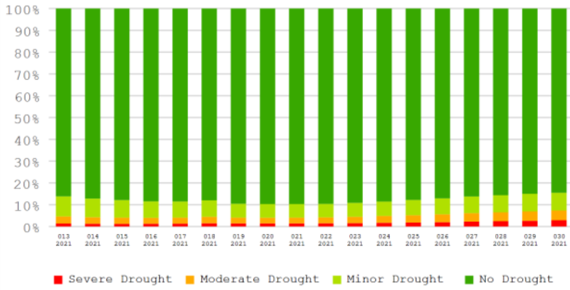


（i）Crop condition development graph based on NDVI - Humid zone (left), and Semi-arid zone (right)



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





(k) Proportion of NDVI anomaly categories compared with 5YA (l) Proportion of VHIm categories compared with 5YA

Table 3.3 Angola's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, April – July 2021

Region	RAIN		TEMP		RADPAR		BIOMASS	
	Current (mm)	Departure (%)	Current (℃)	Departure (℃)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Arid Zone	173	26	22.8	0.5	1177	-2	370	-14
Central Plateau	131	3	16.1	-0.2	1250	0	191	-13
Humid zone	395	-6	22.3	-0.3	1212	-1	338	-37
Semi-Arid Zone	58	-23	18.8	-0.1	1201	1	181	-23
Sub-humid zone	209	-16	20.0	-0.1	1228	1	325	-11

Table 3.4 Angola's agronomic indicators by sub-national regions, current season's values and departure from 5YA, April – July 2021

Region	CALF		Maximum VCI
	Current(%)	Departure from 5YA (%)	Current
Arid Zone	79	-1	0.81
Central Plateau	90	-10	0.77
Humid zone	100	0	0.93
Semi-Arid Zone	96	1	0.99
Sub-humid zone	97	-2	0.86

[ARG] Argentina

This reporting period covers mainly the fallow period following the harvest of the summer crops (late maize, soybean and rice). Wheat planting started in June. For the whole country, rainfall showed a 10% negative anomaly, TEMP was close to average, RADPAR and BIOMSS showed positive anomalies of +7% and +8%, respectively. CALF showed a 2% increment and maximum VCI value was at 0.88. Argentina generally benefitted from favorable conditions for crop production.

For the whole country, rainfall profiles showed some temporal variability around the 15YA. Stronger negative anomalies were observed in June and July. The TEMP profile also showed variability, changing between positive and negative anomalies over the reporting period.

For the whole country, the crop condition development graph based on NDVI showed no anomalies during April and negative anomalies starting in May. The spatial distribution of NDVI profiles showed a mixed pattern. A more homogeneous pattern was observed in Center South Pampas, which showed positive anomalies starting at the end of April. North Pampas was dominated by two similar temporal profiles but with different absolute NDVI departure values, both with a decreasing NDVI departure tendency along the period. The dominating pattern, mainly concentrated in eastern Pampas (dark green) showed almost no anomaly during the monitoring period, while light green areas showed a quite stable pattern with negative anomalies near -0.1. Most areas in Argentina showed VCIx values higher than 0.8. Lower values were observed in South West and Center Pampas and in East Subtropical Highlands.

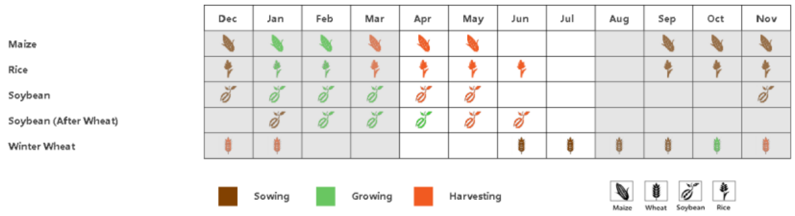
Subregions

CropWatch subdivides Argentina into eight agro-ecological zones (AEZ) based on cropping systems, climatic zones, and topography; they are identified by numbers on the NDVI departure cluster map. During this monitoring period, most crops were grown in the following four agro-ecological zones: Chaco, Mesopotamia, Humid Pampas, and Subtropical Highlands. The other agro-ecological zones were less relevant for this period.

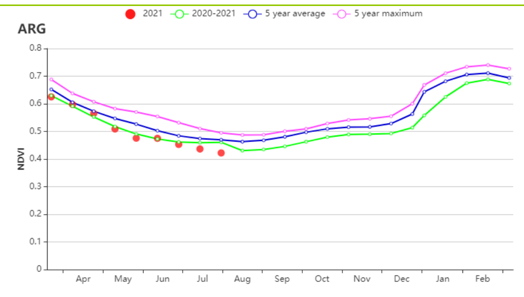
Humid Pampas and Subtropical Highlands showed positive anomalies in RAIN (+2% and +18% respectively); while Chaco and Mesopotamia showed negative anomalies (-9% and -21%, respectively). TEMP showed no anomaly in Subtropical Highlands, positive anomaly in Humid Pampas (+0.2°C), and negative anomalies in Mesopotamia (-0.4°) and Chaco (-0.2°). RADPAR showed positive anomalies in Chaco (+13%), Mesopotamia (+11%) and Humid Pampas (+5%), and negative anomaly in Subtropical Highlands (-1%). BIOMSS showed positive anomalies in Chaco (+11%), Mesopotamia (+8%) and Humid Pampas (+10%), and negative anomaly in Subtropical Highlands (-3%). CALF was almost complete in Chaco (99%), Mesopotamia (100%) and Subtropical Highlands (99%), while the Humid Pampas showed a lower value (95%), but it was 3% higher than the five-year average value. Maximum VCI showed general good conditions, with the highest value observed in Mesopotamia (0.92), followed by Subtropical Highlands (0.91), Chaco (0.90) and Humid Pampas (0.88).

Several differences in NDVI trends were observed among the regions. Pampas and Mesopotamia showed positive anomalies during April and nearly no anomalies during the rest of the reporting period. Chaco showed no anomalies up to June, and negative anomalies during July, while Subtropical Highlands showed negative anomalies since April.

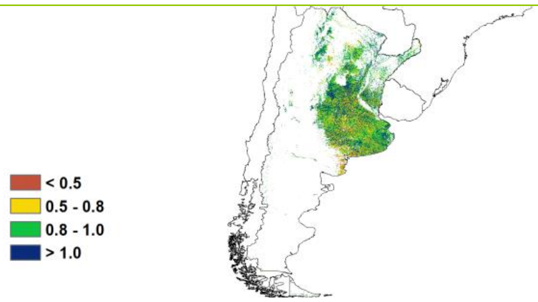
Figure 3.7 Argentina´s crop condition, April-July 2021



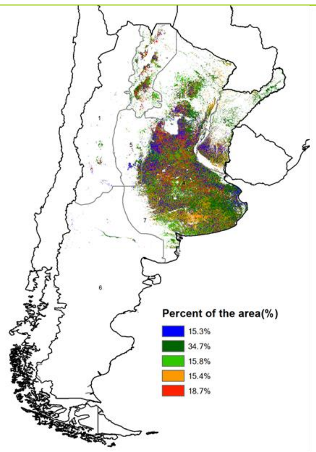
(a). Phenology of major crops

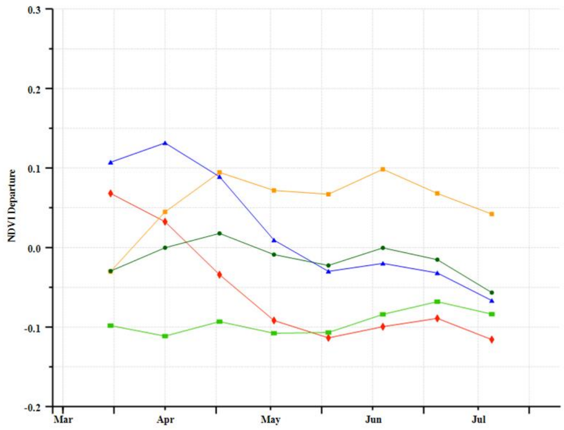


(b) Crop condition development graph based on NDVI



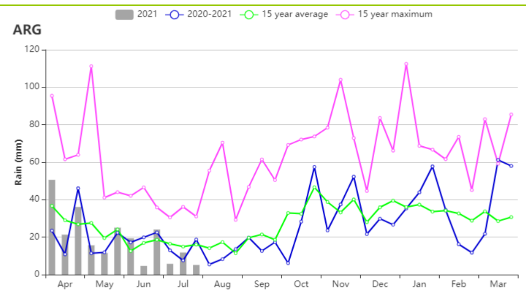
(c) Maximum VCI



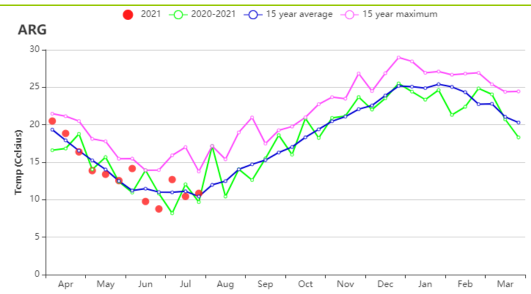


(d) Spatial NDVI patterns compared to 5YA

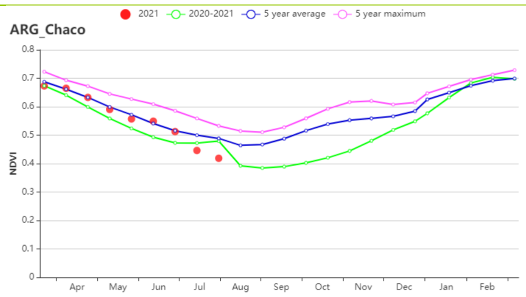
(e) NDVI profiles



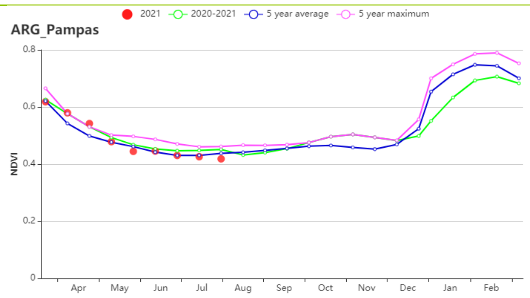
(f) Rainfall time series profile



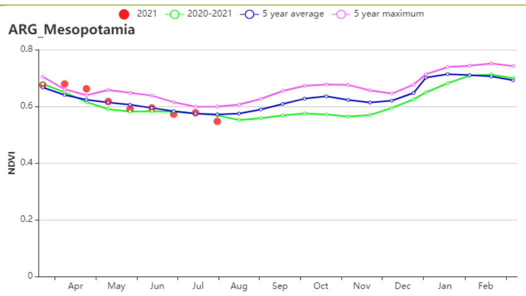
(g) Temperature time series profile



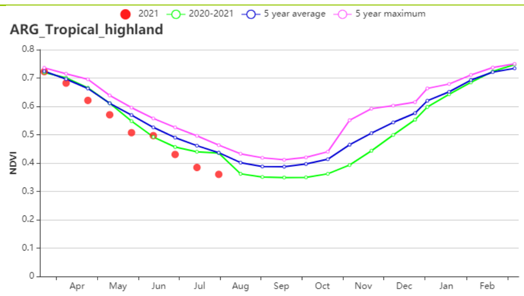
(h) Crop condition development graph based on NDVI (Chaco)



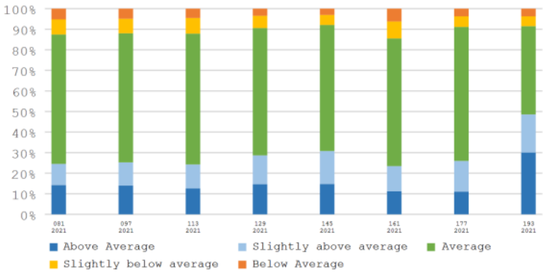
(i) Crop condition development graph based on NDVI (Pampas)



(j) Crop condition development graph based on NDVI (Mesopotamia)



(k) Crop condition development graph based on NDVI (Subtropical Highlands)



(l) Proportion of NDVI anomaly categories compared with 5YA

Table 3.5 Argentina's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, April–July 2021

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m²)	Departure from 15YA (%)	Current (gDM/m²)	Departure from 15YA (%)
Chaco	241	-9	16.2	-0.2	722	13	295	11
Mesopotamia	351	-21	14.8	-0.4	680	11	264	8
Humid Pampas	196	2	12.6	0.2	640	5	218	10
Subtropical highlands	194	18	13.8	0.0	793	-1	265	-3

Table 3.6 Argentina's agronomic indicators by sub-national regions, current season's values and departure from 15YA/5YA, April–July 2021

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure from 5YA (%)	Current
Chaco	99	0	0.90
Mesopotamia	100	1	0.92
Humid Pampas	95	3	0.88
Subtropical highlands	99	-1	0.91

[AUS] Australia

Australia's wheat and barley were sown in May. These crops are grown during the Australian winter season. At the national scale, Australia received sufficient rainfall, which was 22% above average. The other agro-climatic indicators were close to the 15YA, including TEMP (0.0°C), RADPAR (0%), BIOMSS (0%). The agronomic indicators were also positive, with a VCIx of 0.82 and an increased CALF (+6%).

The national NDVI profile shows that overall crop conditions were better than the 5-year average, but lower than the maximum. From the VCI map, the crop condition in Western Australia were better than in the southeast states. The lowest VCIs were found in the west Victoria and New South Wales. The NDVI departure clustering also showed the same spatial pattern. Above-average NDVI was observed on 29% of the cropland, while 24.9% remained below average throughout this monitoring period.

Overall, the agro-climatic indicators in the reporting period are promising. The sufficient rainfall and above-average CALF and NDVI indicate generally favorable crop conditions.

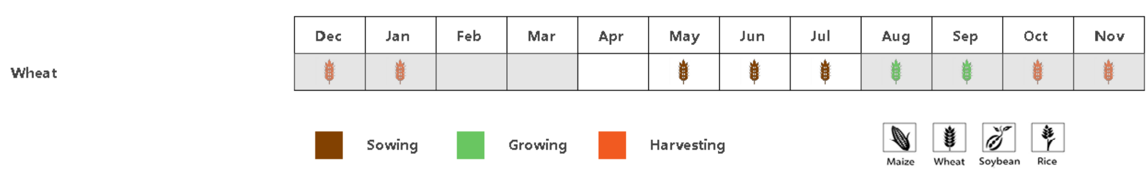
Regional analysis

This analysis adopts five agro-ecological zones (AEZs) for Australia, namely the Arid and Semi-arid Zone (marked as 18 in NDVI clustering map), Southeastern Wheat Zone (19), Subhumid Subtropical Zone (20), Southwestern Wheat Zone (21), Wet Temperate and Subtropical Zone (22). The Arid and Semi-arid Zone, in which hardly any crop production takes place, was not analyzed.

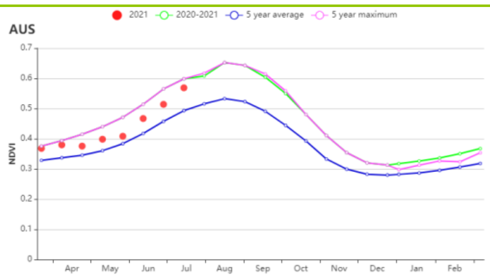
The agro-climatic indicators show that the 4 AEZs could be assigned into two groups. Group 1 includes Southeastern wheat zone, Subhumid subtropical zone, and Wet temperate and subtropical zone, which had the same departure patterns. Group 1 experienced above-average rainfall (+12%, +24%, +14%), slightly below-average temperature (-0.1°C, -0.4°C, -0.1°C), average sunshine (0%, +1%, +2%), and average biomass (0%, 0%, +4%). However, the CALF values in these 3 AEZs were different, in where the Southeastern wheat area and Wet temperate and subtropical zones were average, while the Subhumid subtropical zone was 30% greater than the 5YA. Accordingly, the NDVI profiles also showed the Subhumid subtropical zone had favorable crop conditions, while the other two zones were close to average. The VCIx were 0.68, 0.86 and 0.86, respectively. Only the Southeastern wheat area was not favorable.

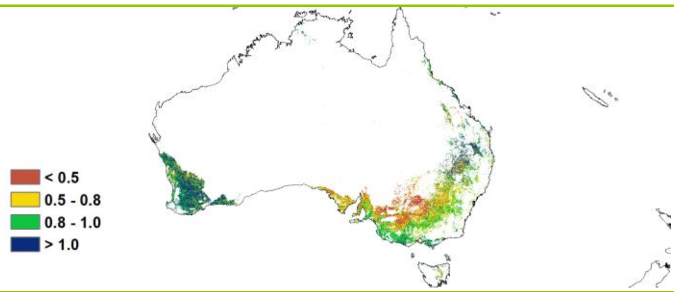
The Southwestern Wheat Zone, representing the 2nd group, had significantly above-average rainfall (+67%), slightly above-average temperature (+0.2°C), below-average sunshine (-6%) and average biomass (+2%). The CALF was 94%, 12% above average. The VCIx was 1.02, which indicated that the crop condition in this AEZ are excellent. This is further confirmed by the NDVI profile showing values that were mostly close to last 5 years' maximum.

Figure 3.8 Australia crop condition, April - July 2021

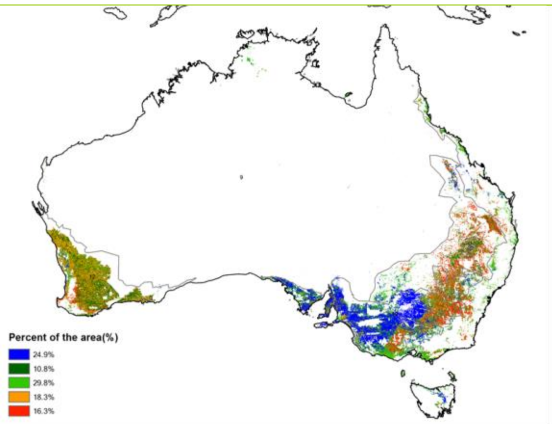


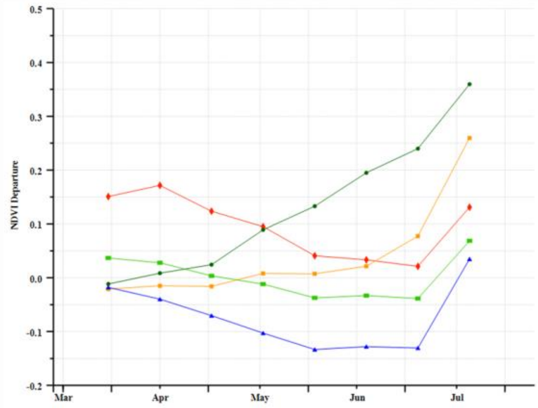
(a). Phenology of major crops



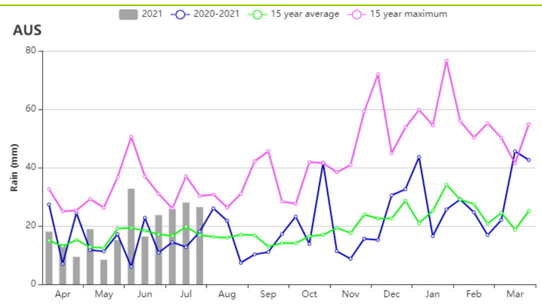


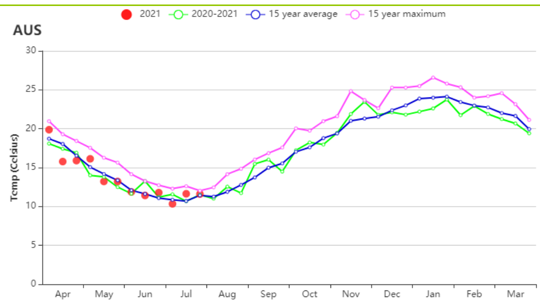
(b) Crop condition development graph based on NDVI (c) Maximum VCI



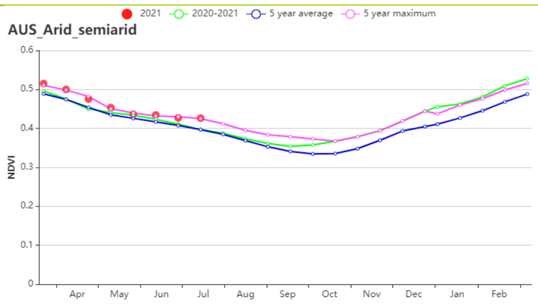


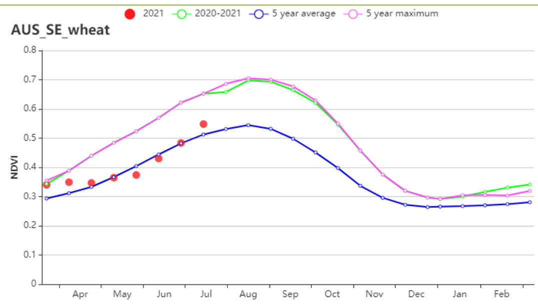
(d) Spatial NDVI patterns compared to 5YA (e) NDVI profiles



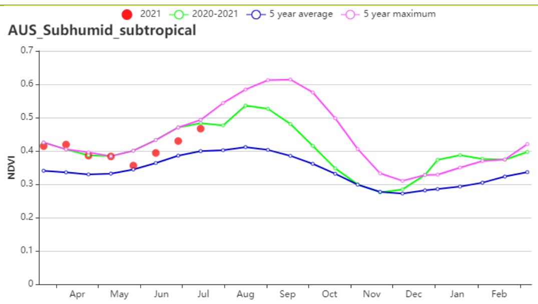


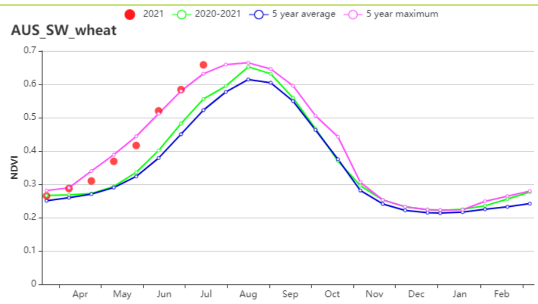
(f) Time series rainfall profile (left) and temperature profile (right))



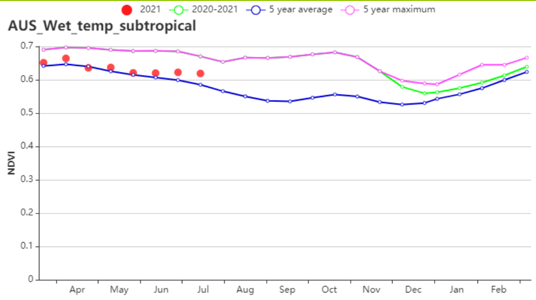


(g) Crop condition development graph based on NDVI (Arid and semiarid zone (left) and Southeastern wheat area (right))





(h) Crop condition development graph based on NDVI (Subhumid subtropical zone (left) and Southwestern wheat area (right))



(i) Crop condition development graph based on NDVI (Wet temperate and subtropical zone)

Table 3.7 Australia agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, April - July 2021

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Arid and semiarid zone	89	-30	22.0	0.6	1032	2	309	-5
Southeastern wheat area	226	12	11.9	-0.1	564	0	194	0
Subhumid subtropical zone	169	24	13.8	-0.4	788	1	267	0
Southwestern wheat area	365	67	14.2	0.2	588	-6	242	2
Wet temperate and subtropical zone	267	14	12.6	-0.1	675	2	244	4

Table 3.8 Australia's agronomic indicators by sub-national regions, current season's values and departure from 5YA, April - July 2021

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Arid and semiarid zone	75	5	0.91
Southeastern wheat area	90	-2	0.68
Subhumid subtropical zone	76	30	0.86
Southwestern wheat area	94	12	1.02
Wet temperate and subtropical zone	99	1	0.86

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

[BGD] Bangladesh

During the reporting period, the sowing of the main rice crop (Aman) started in June. Boro (winter) rice harvest ended in May and Aus rice harvest was mostly completed in July. Wheat harvest was completed in April. Rainfall was below average (-7%), TEMP was higher (+0.4℃) and RADPAR was close to the 15-year average. The potential biomass decreased by 5%. The national NDVI development graph shows that crop conditions across the country were lower than the 5-year average during the whole monitoring period. They started to recover at the end of this period. The spatial NDVI pattern shows that 30.2% of the cultivated area was close to average, mainly distributed in Sylhet basin. 51.1% had a big drop in June and recovered to below-average levels in July in Coastal region and Hills and 18.7% had a big drop in July dispersed over the country. These drops might have been due to cloud cover in the satellite images. The maximum Vegetation Condition Index (VCIx) was 0.90, with most areas higher than 0.8 and CALF was the same as the 5-year average (96%). Conditions for the main rice crop (Aman) which was planted in June and July are favorable, due to sufficient rainfall during those months. Overall, the crop conditions in most parts of Bangladesh were near average.

Regional analysis

Bangladesh can be divided into four agro-ecological zones (AEZ): Coastal region, the Gangetic plain, the Hills, and the Sylhet basin.

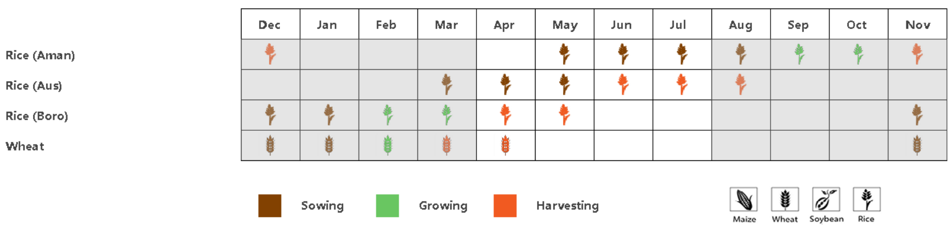
In the Coastal region, both RAIN and TEMP were above average (+12% and +0.2°C, respectively) while RADPAR was below average (-2%). The crop condition development graph based on NDVI shows that crop conditions were below but near the 5-year average from April to July. CALF was at 85% and VCIx at 0.84. BIOMSS was lower than average by 9%. Conditions were below average.

The Gangetic plains received the least precipitation amount of 1188 mm (10% below average). Both TEMP and RADPAR was above average (+0.3°C and +1%). The crop condition development graph based on NDVI shows crop conditions were close to the 5-year average at the end of May and then dropped sharply. During the monitoring period, CALF (97%) was the same as average and VCIx (0.91) indicated average prospects, but the below-average BIOMSS (-3%) indicated slightly unfavorable crop conditions.

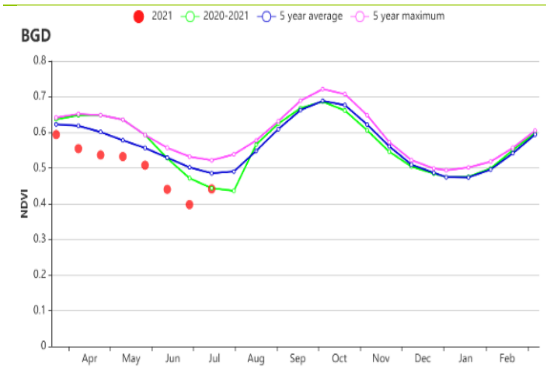
In the Hills, rainfall was 5% below average. TEMP was above average (+0.3°C) and RADPAR was close to average. The crop condition started recovering from June and reached close to average levels at the end of the July, as shown by the NDVI development profiles. But the unfavorable condition before July resulted in a below-average BIOMSS (-9%). CALF (96%) was the same as average and VCIx (0.88) indicate average crop prospects.

The Sylhet Basin experienced the largest drop in rainfall (-14%). TEMP was 0.7°C above average and RADPAR was 1% above. The crop condition development graph based on NDVI shows that crop conditions were below average in the reporting period, and they increased to average levels only at the end of July. The BIOMSS was near average and a high CALF at 99% and VCIx of 0.93 indicated average crop conditions.

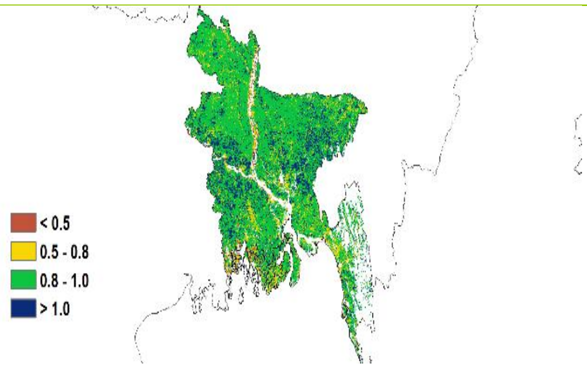
Figure 3.9 Bangladesh's crop condition, April - July 2021



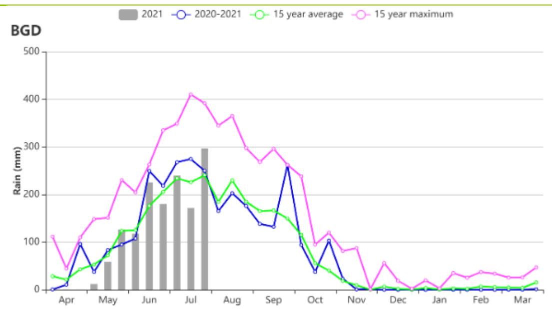
(a). Phenology of major crops



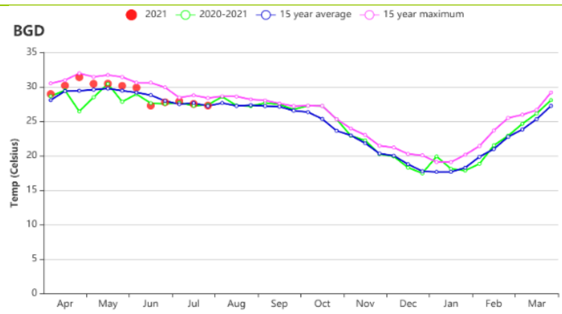
(b) Crop condition development graph based on NDVI



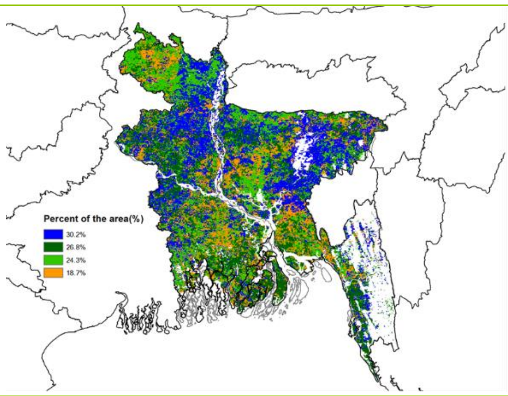
(c) Maximum VCI



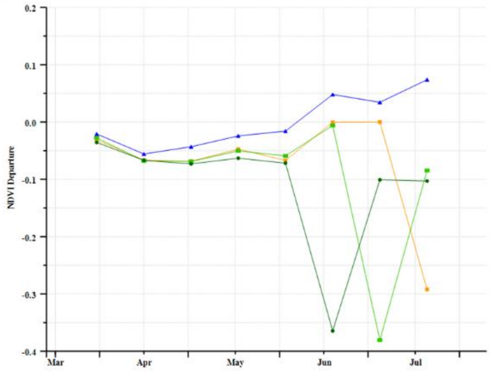
(d) Rainfall Index



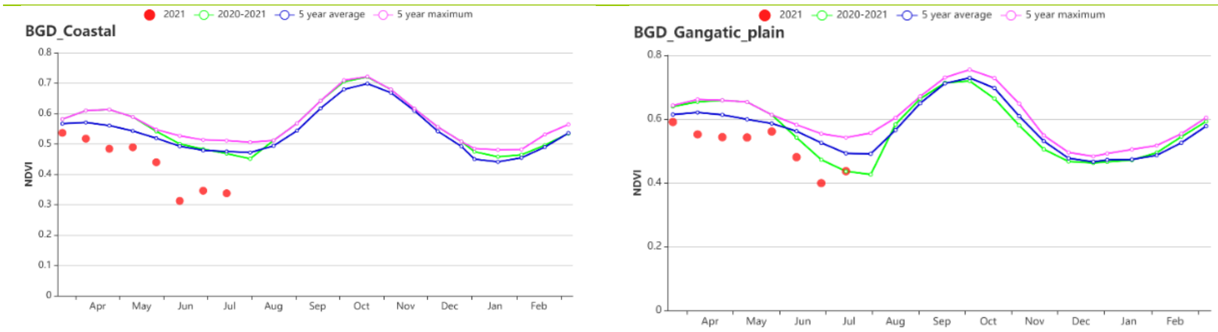
(e) Temperature Index



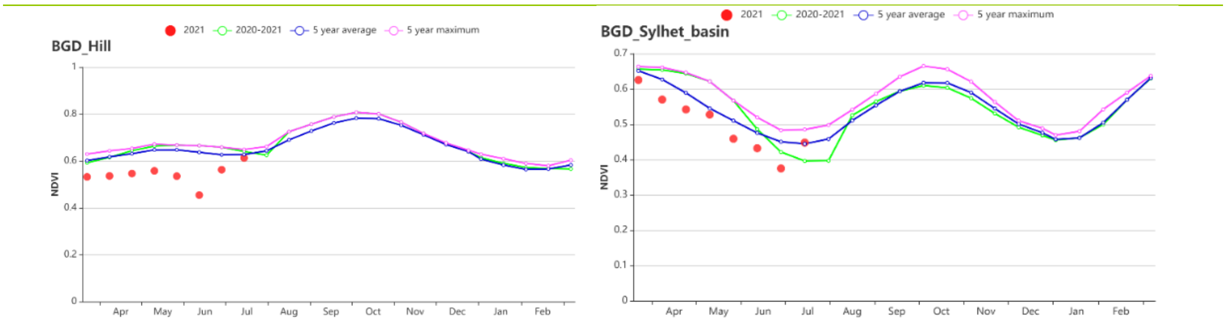
(f) Spatial NDVI patterns compared to 5YA



(g) NDVI profiles



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



(l) 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, April - July 2021

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure from 15YA (%)	Current (gDM/m²)	Departure from 15YA (%)
Coastal region	**1637**	**12**	**29.6**	**0.2**	**1294**	**-2**	**784**	**-9**
Gangetic plain	**1188**	**-10**	**29.8**	**0.3**	**1254**	**1**	**796**	**-3**
Hills	**1875**	**-5**	**27.6**	**0.3**	**1275**	**0**	**765**	**-9**
Sylhet basin	**1344**	**-14**	**29.0**	**0.7**	**1237**	**1**	**827**	**0**

Table 3.10 Bangladesh's agronomic indicators by sub-national regions, current season's values and departure from 5YA, April - July 2021

Region	CALF		Maximum VCI
	Current (%)	Departure from 5YA (%)	Current
Coastal region	**85**	**-1**	**0.84**
Gangetic plain	**97**	**0**	**0.91**
Hills	**96**	**0**	**0.88**
Sylhet basin	**99**	**2**	**0.93**

[BLR] Belarus

In Belarus the reporting period includes the planting of spring wheat and summer crops until June and the harvest of winter wheat from July. The nationwide rainfall amount reached 317 mm, which was about the same as average. Solar radiation (RADPAR 2%) and temperature (0.4°C) were slightly above the 15YA, the potential biomass was increased by 13% and higher than average. Agronomic conditions were shown as favorable: very good values of VCIx (0.94) and cropped arable land fraction (CALF, 100%) were observed.

The NDVI development graph was generally below 5-year average from Apirl to early May and recovered in June. The spatial pattern showed diverse patterns. In about 42.1% of cropped area crop condition was close to or above 5-year average. About 57.9% of cropped areas were 0.1 NDVI units below the average, mostly scattered in the south-east and along the southern-western border. Average national VCIx exceeded 0.94, indicating fair crop prospects in most crop area. Overall, solar radiation deficit due to snow cover in previous months during spring have not constrained crop growth, and agronomic conditions were satisfactory in current monitoring period representing good winter wheat production and summer crop development.

Regional analysis

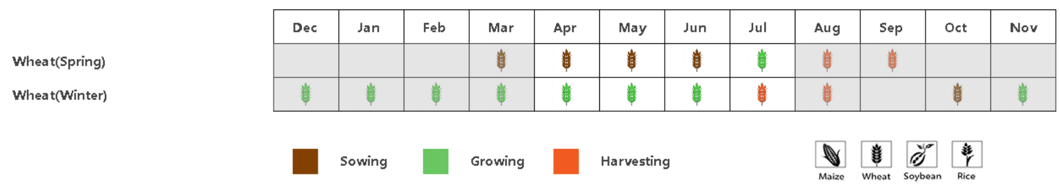
Based on cropping system, climatic zones and topographic conditions, regional analyses are provided for three agro-ecological zones (AEZ), including Northern Belarus (028, Vitebsk, northern area of Grodno, Minsk and Mogilev), Central Belarus (027, Grodno, Minsk and Mogilev and Southern Belarus (029) which includes the southern halves of Brest and Gomel regions.

North Belarus (Vitebsk, northern area of Grodno, Minsk and Mogilev) recorded a minor radiation increase (1%) and temperature (0.6°C) as well as rainfall (1%). BIOMSS increased 15% above average. The VCIx had reached 0.94, and CALF had reached 100%. The NDVI development curve was close to average in April, early May and June. Crop overall condition is normal.

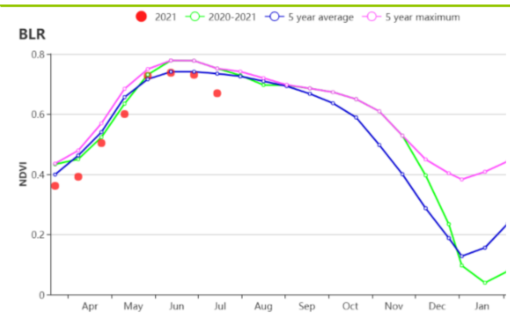
Central Belarus (Grodno, Minsk and Mogilev) also experienced a minor rainfall increase (1%) and temperature (+0.3°C) as well as sunshine (+2%). Potential biomass increased about 12%. High CALF (100%) and VCIx (0.94) were also recorded. Similar to northern Belarus, the NDVI growth curve remained close to the average trend from April to June.

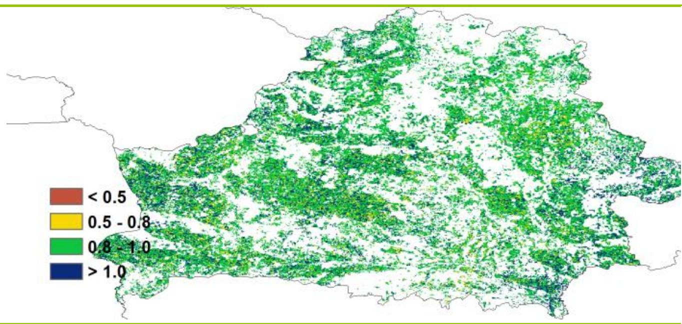
Precipitation in **Southern Belarus** was lower by -7%, while temperature and radiation were slightly higher by 0.1°C and 3%, respectively. Potential biomass was expected to increase by 10%. The CALF and the VCIx were 100% and 0.95 respectively. Agronomic indicators showed that crop growth was generally favorable, the impact of radiation deficit in previous period did not have adverse impact on crops growth. The average NDVI development curve suggests that from April to June, crop condition was general close to average for most of the time.

Figure 3.10 Belarus's crop condition, April – July 2021.



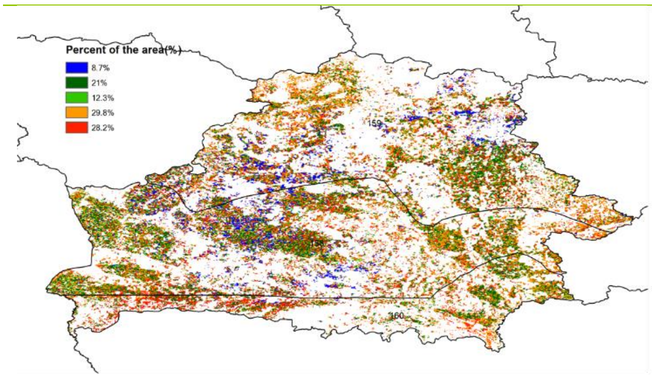
(a). Phenology of major crops

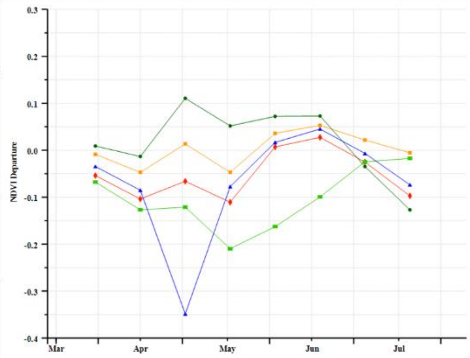




(b) Crop condition development graph based on NDVI

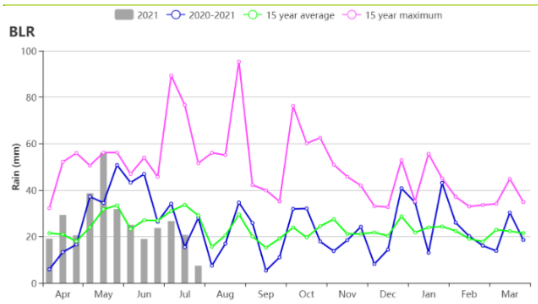
(c) Maximum VCI

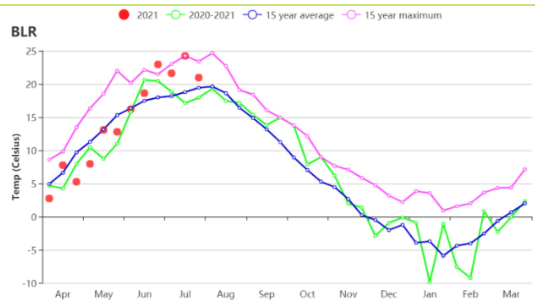




(d) Spatial NDVI patterns compared to 5YA

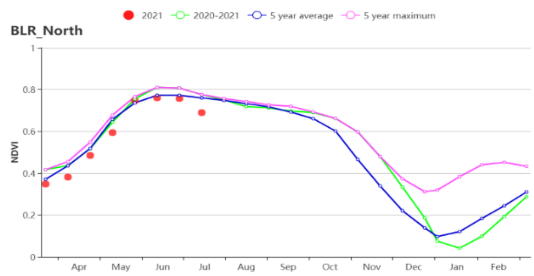
(e) NDVI profiles

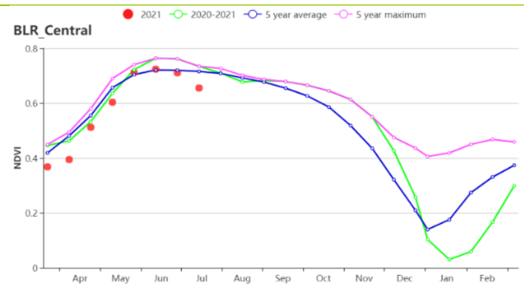




(f)Rainfall time series

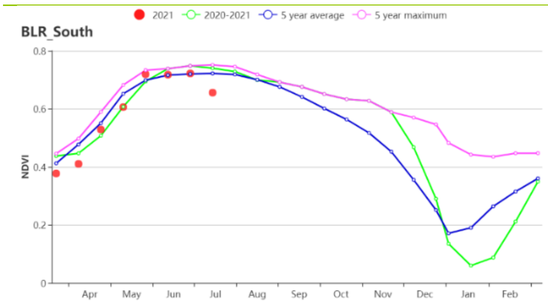
(g) Temperature time series





(h) Crop condition development graph based on NDVI (North Belarus)

(i) Crop condition development graph based on NDVI (Central Belarus)



(j) Crop condition development graph based on NDVI (South-west Belarus)

Table 3.11 Belarus's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, April – July 2021.

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Center	320	1	14.8	0.3	1144	2	511	12
North	331	1	13.9	0.6	1111	1	483	15
South-west	282	-7	15.3	0.1	1180	3	537	10

Table 3.12 Belarus's agronomic indicators by sub-national regions, current season's values and departure from 5YA, April – July 2021

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Center	100	0	0.94
North	100	0	0.94
South-west	100	0	0.95

[BRA] Brazil

During the monitoring period, the harvest of summer crops (maize, soybean, and rice) was almost concluded except for maize in the north-eastern regions which was still at peak growing stage in July. Wheat was sown in April to May and was approaching its peak growth phase by the end of July. Overall crop conditions in Brazil remained below the 5-year average.

The whole growing season of summer crops was dominated by dry and hot weather. Agro-climatic indicators at national scale present generally unfavorable conditions with 40% below average rainfall, 0.6°C higher temperature and 6% above average RADPAR. Shortage of rainfall together with the high temperature and radiation resulted in BIOMSS being 7% below the 15YA. Rainfall profiles illustrated that rainfall stayed below average for each ten-days throughout the four-month monitoring period. The entire country was affected by the hot and dry weather. Almost all states received well below average rainfall except for the northwest. Accordingly, high RADPAR was observed in all states except for Roraima where radiation was 3% below average. Dry and hot weather resulted in a dramatic drop of BIOMSS in some major agricultural producing states, including Goias (-48%), Mato Grosso (-19%), and Minas Gerais (-12%). As presented by the BIOMSS departure map, central Brazil presented larger than 20% negative departures while southern Brazil, Coastal areas, and northern Brazil presented above average BIOMSS. The CWAIs for all major agricultural states are listed in Annex A, table A.5. For detailed information, it is recommended to visit CropWatch Explorer (http://cropwatch.com.cn/newcropwatch/main.htm?language=en).

Due to the prolonged dry weather, NDVI profiles for Brazil presented below-average values throughout the reporting period. NDVI departure clustering map and profiles also show generally below average crop condition, except for the scattered areas (dark green color) in northern Brazil, Southern Brazil and Eastern Coastal areas. Crops in vast agricultural producing areas in Parana Basin remained in unfavorable conditions as a result of drought. The phenology of second maize in Central and Southern Brazil, mainly in Mato Gross and Mato Gross Do Sul was delayed by the dry weather as indicated by NDVI profiles. Irrigation of the second season crop helps reduce the negative impact of dry and hot weather conditions on crop growth. The NDVI was higher than average at peak growing season in June. According to the bar graph depicting drought proportions, the percentages of cropland suffering from moderate to severe drought remained high since May 2021, indicating that the drought situation has not eased. Although VCIx map showed overall high values across the country, the continuously insufficient water supply negatively affected the crops and the national VCIx was at 0.87, which was much lower compared with the previous monitoring period. It seems that the dry weather did not affect the crop cultivation and the CALF was at 99%, comparable with the 5YA.

All in all, crop conditions in Brazil were below average and CropWatch estimates unfavorable outputs for the summer crops.

Regional analysis

Considering the differences of cropping systems, climatic zones and topographic conditions, eight agro-ecological zones (AEZ) are identified for Brazil. These include the Central Savanna, the east coast, Parana River, Amazon zone, Mato Grosso zone, Southern subtropical rangelands, mixed forest, and farmland and the Nordeste.

Similar to the dry and hot weather pattern at the national level, all AEZs received below average rainfall ranging from -8% in Amazonas to -81% in Central Savanna. Above average temperatures were recorded in most AEZs except for Coast (at average level) and Southern subtropical rangelands (-0.3ºC). Central savanna was also the zone with the largest positive departure of temperature (+1.5ºC). Meanwhile, above average RADPAR was also observed in all AEZs with largest departure in Parana Basin at 11% above the 15YA. The prolonged dry, hot and sunny weather conditions in the Central savanna, Mato Grosso zone, Parana Basin and Nordeste hampered crop growth and resulted in lower BIOMSS. The other four AEZs received more than 200 mm rainfall and the BIOMSS was moderately above average from +2% to +7%.

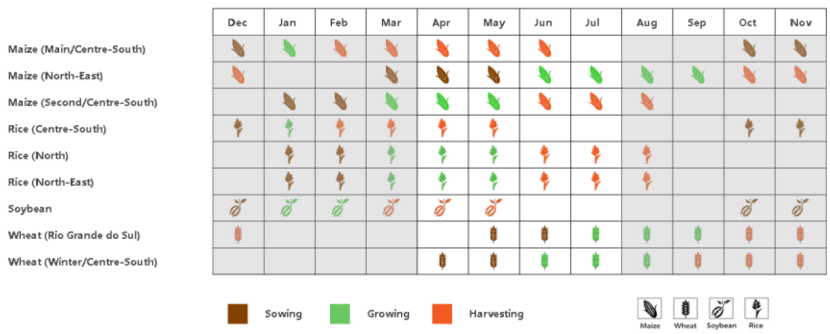
Adverse weather conditions resulted in generally below average crop development in all AEZs but at different levels.

Below average crop conditions were observed in Amazonas, Coast, Parana basin and Southern subtropical rangelands. The CALF remained at average level while VCIx varied across AEZs. Largest VCIx was observed in Amazonas at 0.94 while Parana Basin presented lowest VCIx at 0.83. As the first maize and soybean crops were already harvested by April, and the above mentioned AEZs are not the major producing regions for the second summer crops, the below average NDVI has limited impact on the output of the second summer crops. Growth of wheat in Southern subtropical rangelands was still in its early phase, but it was also affected by the dry weather.

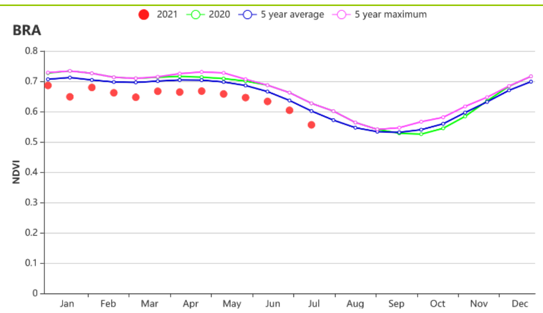
Crop conditions in Central Savanna and Nordeste were in general slightly below average but well below 2020 levels. These two AEZs received the least rainfall among all AEZs at 40 mm and 108 mm respectively. As compared to last year when these two regions were dominated by wet conditions, the shortage of rainfall caused much poorer crop conditions this year. Accordingly, VCIx was also much lower than in 2020.

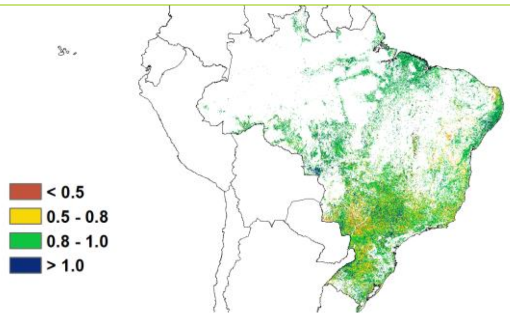
Slightly below average crop condition was observed in Mato Grosso, and Northeastern mixed forest and farmland. The current monitoring period only covers the growing season of the second summer crops which is mainly cultivated in Mato Grosso Zone. Although dry and hot weather dominated the two AEZs, irrigation of the second season crop might reduce the negative impact of adverse weather conditions on crop growth. CALF for the two zones remained average and VCIx values were at 0.92 and 0.95 respectively. In general, second maize output is projected at close to average levels.

Figure 3.11 Brazil's crop condition, April - July 2021

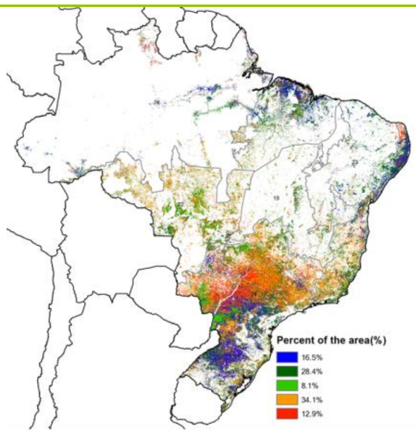


(a) Phenology of major crops

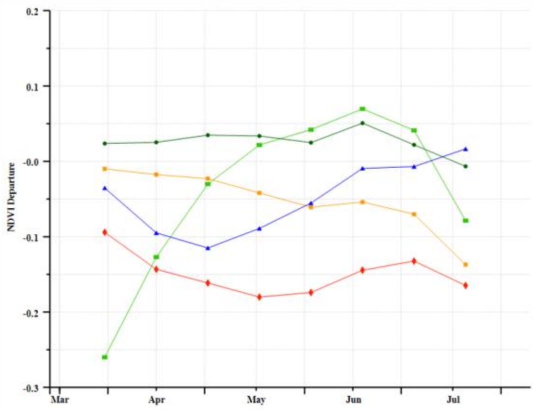




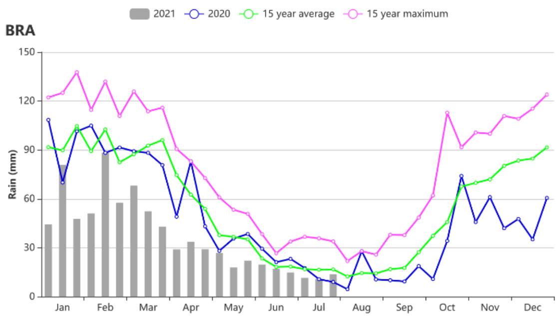
(b) Crop condition development graph based on NDVI of Brazil (c) Maximum VCI



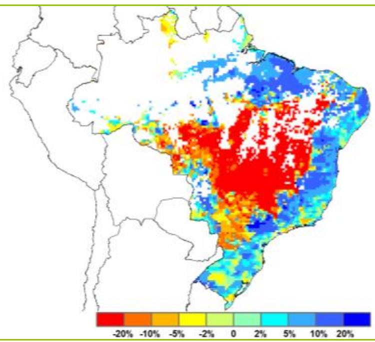
(d) Spatial distribution of NDVI departure from 5YA



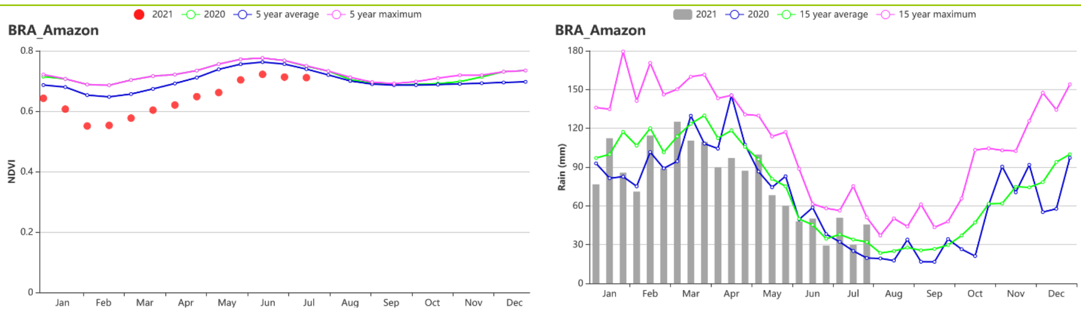
(e) NDVI departure profiles corresponding to the clusters



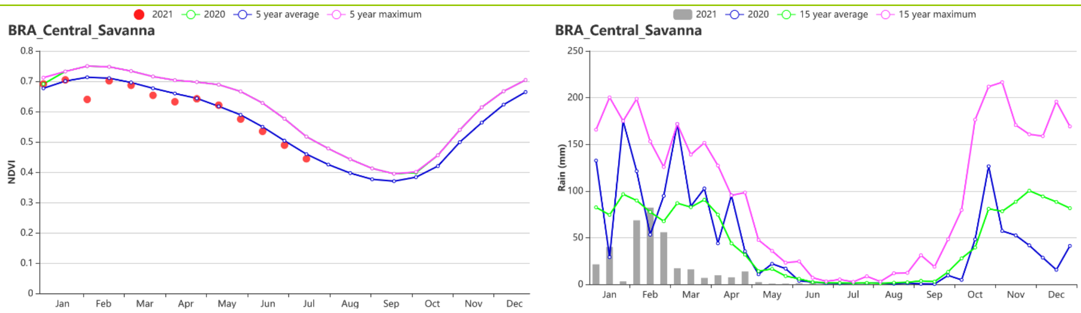
(f) Time series rainfall profile of Brazil



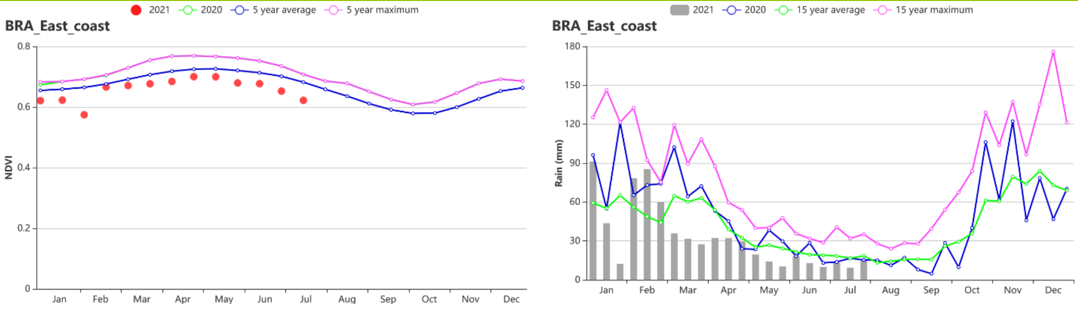
(g) Potential biomass departure from 15YA



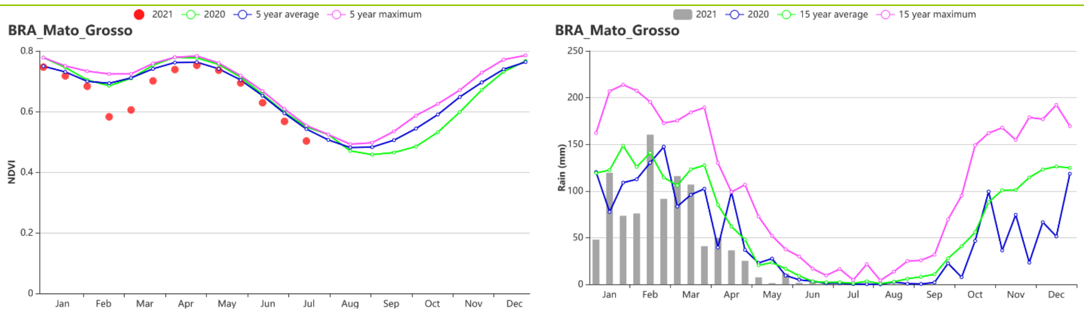
(h) Crop condition development graph based on NDVI (left) and rainfall profile (right) of Amazon



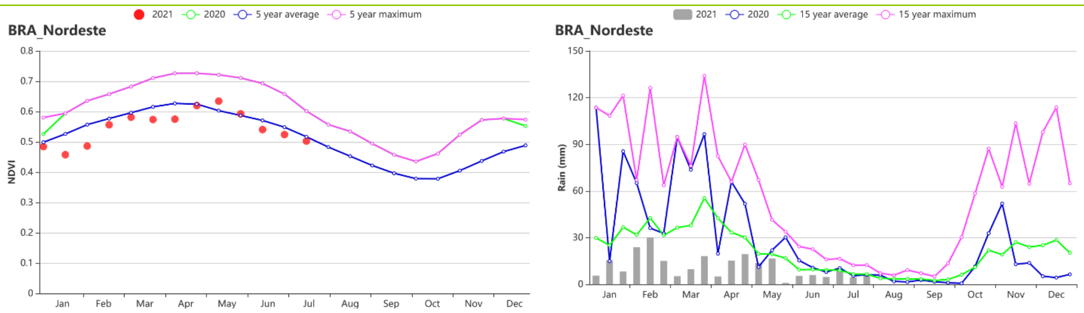
(i) Crop condition development graph based on NDVI (left) and rainfall profile (right) of Central Savanna



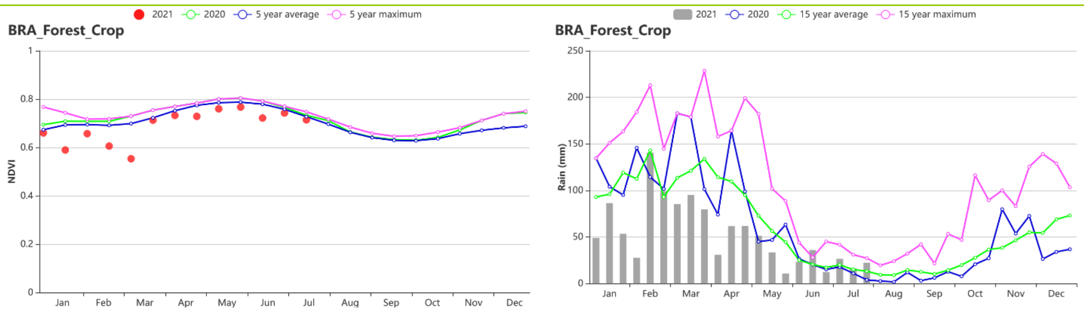
(j) Crop condition development graph based on NDVI (left) and rainfall profile (right) of Coast zone



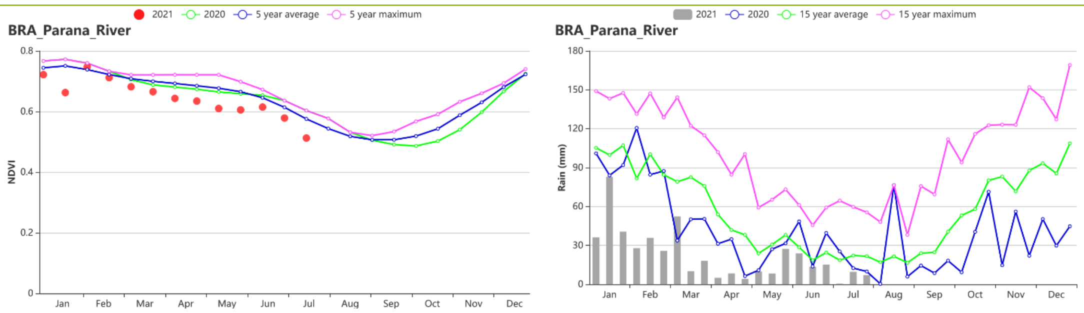
(k) Crop condition development graph based on NDVI (left) and rainfall profile (right) of Mato Grosso



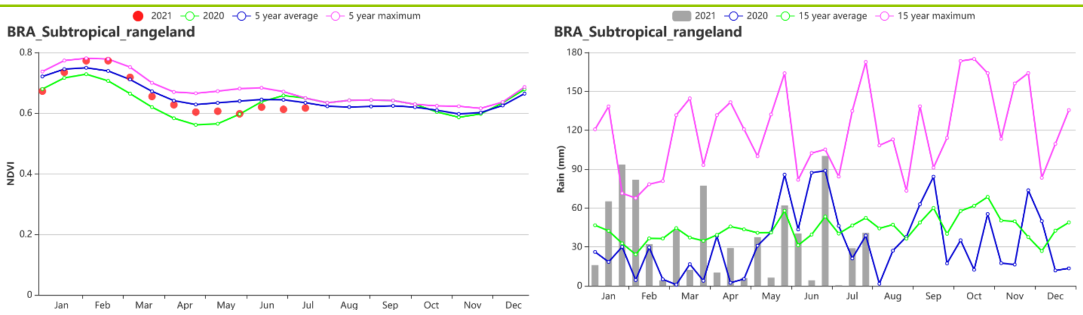
(L) Crop condition development graph based on NDVI (left) and rainfall profile (right) of Nordeste



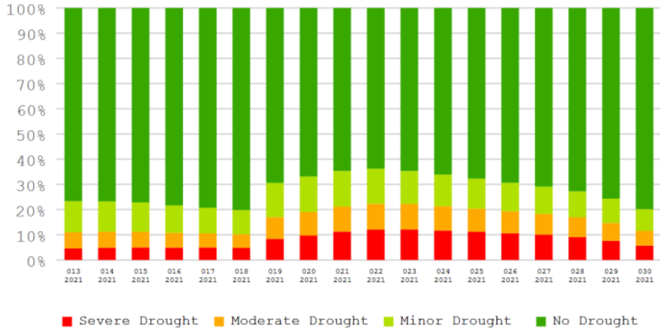
(m) Crop condition development graph based on NDVI (left) and rainfall profile (right) of Northeastern mixed forest and farmland



(n) Crop condition development graph based on NDVI (left) and rainfall profile (right) of Parana basin



(o) Crop condition development graph based on NDVI (left) and rainfall profile (right) of Southern subtropical rangelands



(p) Proportion of drought categories from April - July 2021

Table 3.13 Brazil's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, April - July 2021

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m²)	Departure from 15YA (%)	Current (gDM/m²)	Departure from 15YA (%)
Amazonas	756	-8	24.9	0.1	1122	3	684	2
Central Savanna	40	-81	23.6	1.5	1117	4	348	-30
Coast	217	-31	20.5	0	943	7	530	7
Northeastern mixed forest and farmland	385	-36	25.8	0.7	1198	5	721	6
Mato Grosso	138	-50	24	0.6	1103	4	423	-15
Nordeste	108	-49	24.6	0.7	1109	5	585	-7
Parana basin	133	-63	18.8	0.5	940	11	337	-12
Southern subtropical rangelands	366	-30	14.7	-0.3	673	8	263	3

Table 3.14 Brazil's agronomic indicators by sub-national regions, current season's values and departure from 5YA, April - July 2021

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure from 5YA (%)	Current
Amazonas	100	0	0.94
Central Savanna	98	3	0.86
Coast	100	0	0.87
Northeastern mixed forest and farmland	100	0	0.95
Mato Grosso	100	0	0.92
Nordeste	97	3	0.85
Parana basin	99	0	0.83
Southern subtropical rangelands	99	0	0.86

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

[CAN] Canada

During the monitoring period from April to July 2021, the harvest of winter wheat had started in July. Maize, soybean, and spring wheat had been sown in April and May and were reaching the grainfilling period in the 2nd half of July. According to the CropWatch agroclimatic indicators, Canada experienced hot and dry conditions starting from June. Crop conditions were slightly below average in the Prairies, but good or excellent crop conditions were observed in the Saint Lawrence basin.

The temperature (TEMP +0.5°C) and radiation (RADPAR +2%) were above the 15-year average while the rainfall (RAIN -8%) was below average. The temperature profile depicts those temperatures were above average in June and July. The rainfall profile shows that the precipitation was below average after May. Correspondingly, crop conditions were above average at the beginning of this monitoring period, however, they deteriorated to be significantly below average after May according to the NDVI development graph. As shown in the NDVI cluster map, the crop condition was always above average in 13.6% of the cropped area, concentrated in the Saint Lawrence basin (including the middle of Ontario and patches in the south of Quebec). 33.2% of total cropped land was below average after April. In the remaining parts, crop conditions fluctuated around the average level. The national maximum VCI value was 0.86, and the CALF was slightly below the recent 5-year average (CALF -1%).

The overall conditions of winter wheat, which is predominantly grown in the Saint Lawrence basin is assessed as slightly above average, and the prospects for the summer crops, including spring wheat may have been affected by the dry weather in May and June.

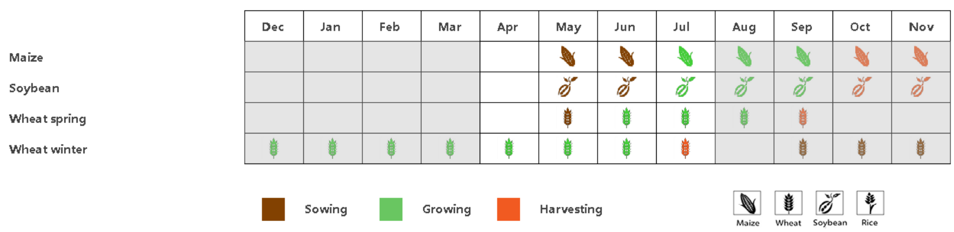
Regional analysis

The **Prairies** (area identified as 53 in the crop condition clusters map) and **Saint Lawrence basin** (49) are the major agricultural regions in Canada.

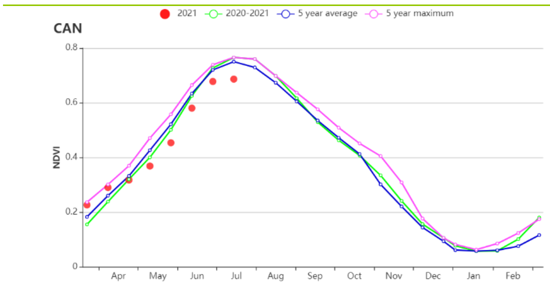
The rainfall in **the Prairies**, the main food production area in Canada, was below average (RAIN 291 mm, -18%), while the temperature (TEMP +0.7°C) and radiation (RADPAR +4%) were above average. The major crops in this region are winter wheat and spring wheat. According to the NDVI development graph and NDVI profile, crop conditions were below average since May. The negative departures were due to the deficit of rainfall. Hence, crop conditions in the Prairies are unfavorable, mostly due to dry weather.

The conditions in **the Saint Lawrence basin** differed from the rest of the country as rainfall (RAIN +4%) and temperature (TEMP +0.3°C) were above average. Radiation was slightly below average (RADPAR -1%). Altogether, these agroclimatic conditions led to average potential biomass (BIOMSS -1%). According to the NDVI development graph, crop conditions reached the maximum level of the recent 5years. Overall, crop conditions were favorable for this region.

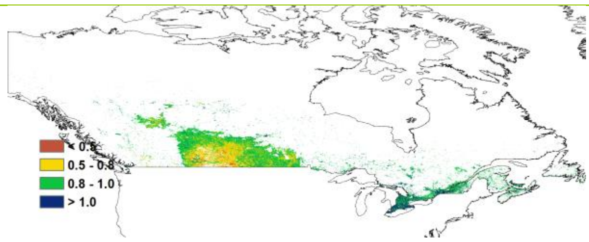
Figure 3.12 Canada's crop condition, April - July 2021



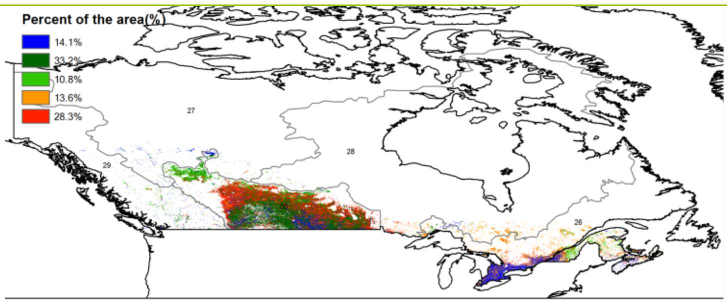
(a). Phenology of major crops



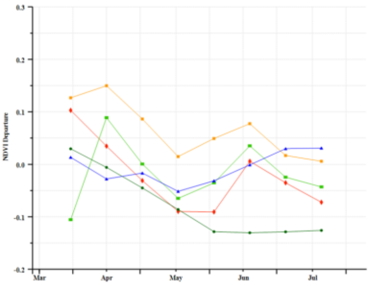
(b) Crop condition development graph based on NDVI



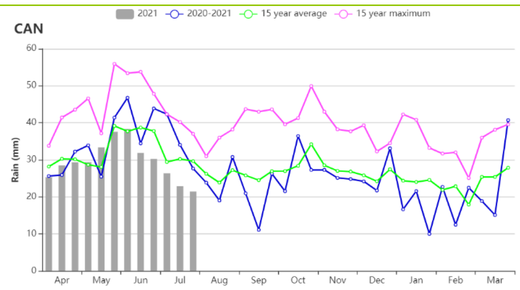
(c) Maximum VCI



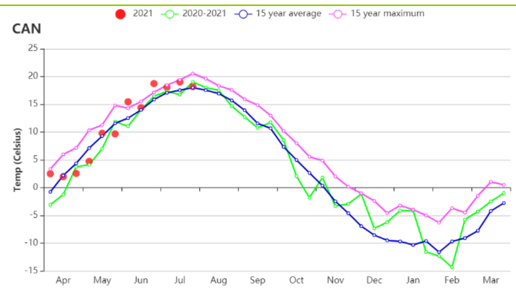
(d) Spatial NDVI patterns compared to 5YA



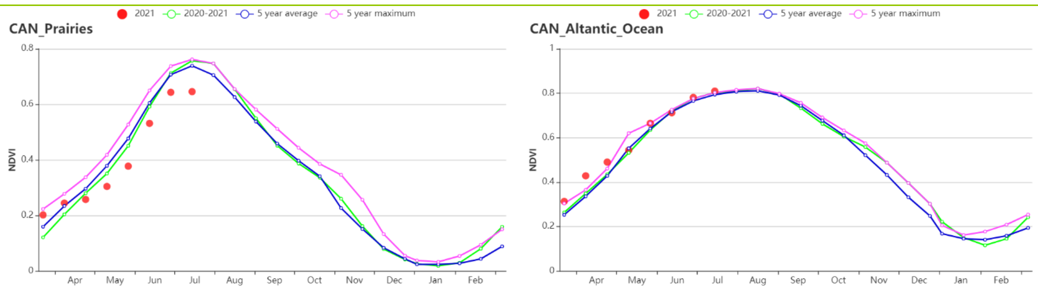
(e) NDVI profiles



f) Rainfall profile



g) Temperature profile



(h) 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, April - July 2021

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m²)	Departure from 15YA (%)	Current (gDM/m²)	Departure from 15YA (%)
Saint Lawrence basin	461	4	11.5	0.3	1100	-1	381	-1
Prairies	291	-18	12.4	0.7	1291	4	501	13

Table 3.16 Canada's agronomic indicators by sub-national regions, current season's values and departure from 5YA, April - July 2021

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure from 5YA (%)	Current
Saint Lawrence basin	100	0	0.99
Prairies	97	-2	0.81

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[DEU] Germany

During this monitoring period, winter wheat reached maturity in July. The planting of summer crops started in April and was completed by mid-May. Based on the agroclimatic and agronomic indicators, the crop conditions in Germany were generally below the 5-year average between April and early June in most regions, and then close to and even above average in July.

At the national level, total precipitation was significantly above average (RAIN +40%), temperature was significantly below average (TEMP -1.3°C) and radiation was also below average (RADPAR -4%). As can be seen from the time series rainfall profile for Germany, Hesse, Thuringia, Lower Saxony, Saxony-Anhalt, Saxony, Brandenburg, Schleswig-Holstein, Mecklenburg-Vorpomerania in Germany experienced above-average precipitation with the exception of late July and mid-June. Precipitation in Baden-Württemberg, southern Bavaria, southeastern North Rhineland-Westphalia, Rhineland-Palatinate in Germany showed a fluctuating trend above and below average until mid-June, with significant below-average departures in late April, late May and mid-June. Starting from late June onwards, those regions experienced heavy precipitation events. Most of the country experienced cooler-than-usual conditions during this reporting period, except for early and mid-June, in which a heatwave event swept across Germany. Due to the overall excessive precipitation combined with cooler-than-usual temperatures, the biomass production potential (BIOMSS) was estimated to decrease by 8% nationwide as compared to the fifteen-year average.

As shown in the crop condition development graph and the NDVI profiles at the national level, NDVI values were below the 5YA and last year's average until mid-June, then close to average and above average from late June to July. These observations are confirmed by the clustered NDVI profiles: 58.8% of regional NDVI values were below average from April to mid-June. Subsequently, 77.9% of regional NDVI values increased to be above average. These observations were also confirmed by lower VCI values in the spatial distribution of maximum VCI map due to the combined effects of precipitation and temperature. Overall VCIx for Germany was 0.94. CALF during the reporting period was the same as for the recent five-year average.

Generally, the agronomic indicators show near and above-average conditions for most winter and summer crops in Germany. The July floods had devastating effects in some areas.

Regional analysis

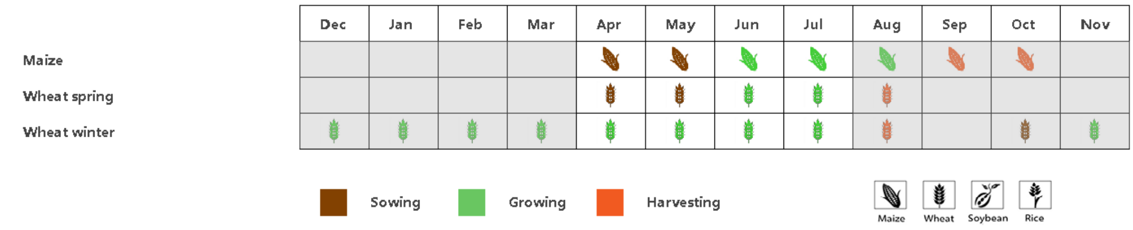
Based on cropping systems, climatic zones, and topographic conditions, six sub-national agro-ecological regions are adopted for Germany. They include: The Wheat Zone of Schleswig-Holstein and the Baltic coast, Mixed Wheat and Sugar beet Zone of the Northwest, Central Wheat Zone of Saxony and Thuringia, Sparse Crop Area of the East-German Lake and Heathland area, Western Sparse Crop Area of the Rhenish Massif and the Bavarian Plateau.

According to the CropWatch agroclimatic indicators, all six sub-national agro-ecological regions experienced the same trend of precipitation, temperature and RADPAR, compared to the average of the past 15 years. RAIN was significantly above average by 47%, 59%, 43%, 40%, 46% and 29%, respectively; Temperature was significantly below average by 0.8°C, 1.2°C, 1.2°C, 1.1°C, 1.4°C and 1.5°C, respectively; RADPAR was below average by 3%, 5%, 5%, 4%, 6% and 2%, respectively. Due to excessive precipitation and cooler-than-usual conditions, the biomass production potential (BIOMSS) in the six sub-national agro-ecological regions was below average by 3%, 8%, 8%, 7%, 10% and 8%, respectively.

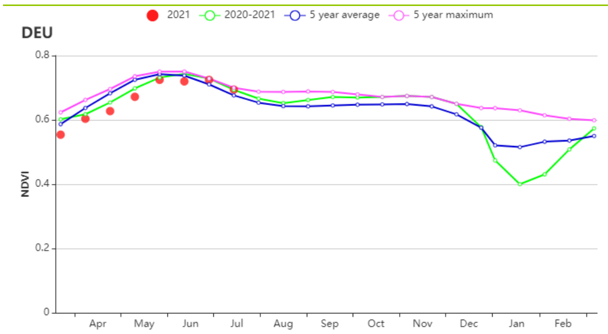
As shown in the crop condition development graph based on NDVI, all six sub-national agro-ecological regions had the same trend of change, that is, NDVI values were below the 5-year average between April and early June, and then close to average and above average during the remainder of this monitoring period.

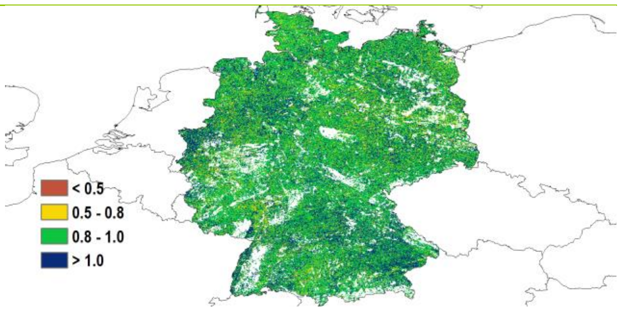
CropWatch agronomic indicators show that CALF of all six regions reached 100%, with a zero departure from their 5YA. As mentioned above, they also recorded a favorable VCIx value at 0.92, 0.94, 0.93, 0.93, 0.93 and 0.96, respectively.

Figure 3.13 Germany's crop condition, April-July 2021

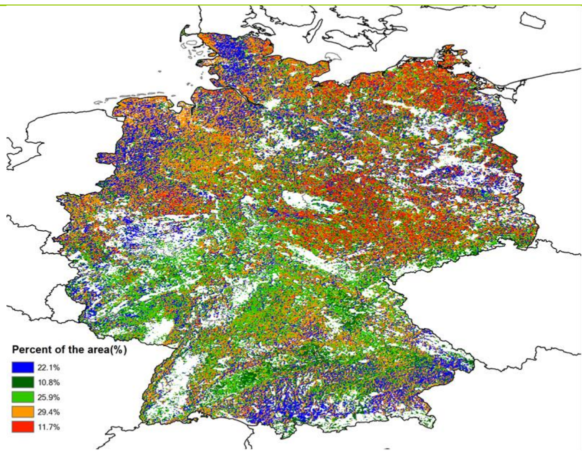


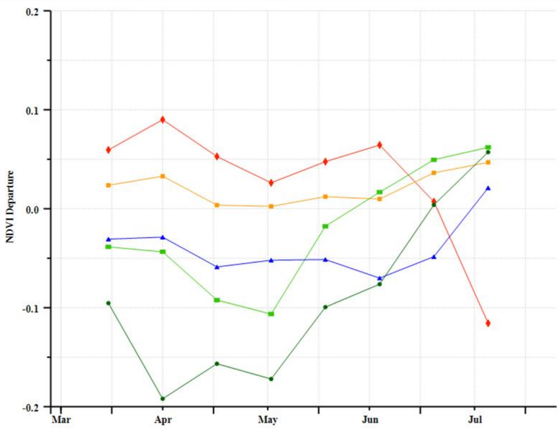
(a) Phenology of major crops



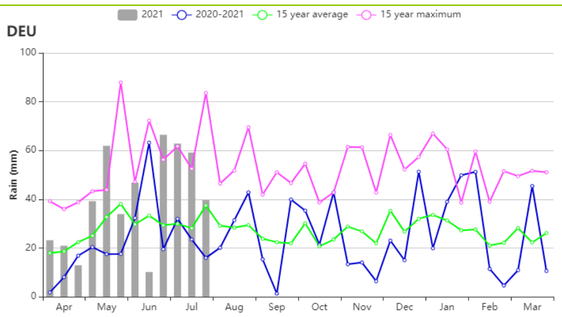


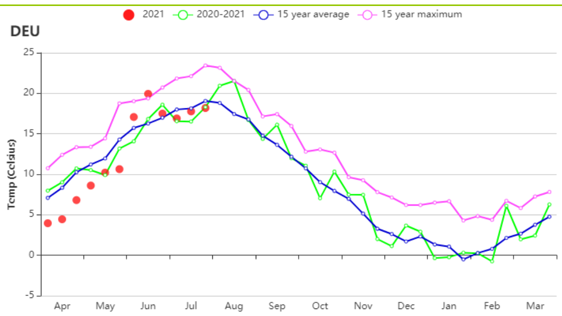
(b) Crop condition development graph based on NDVI (c) Maximum VCI



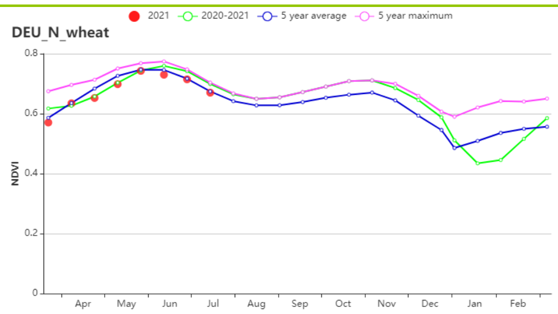


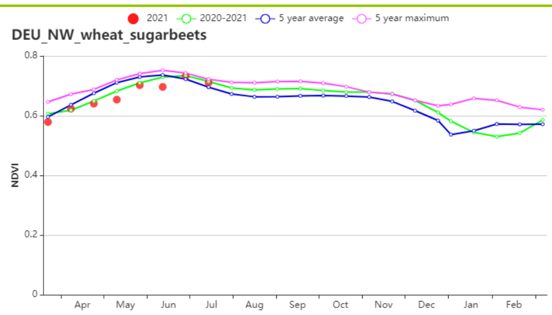
(d) Spatial NDVI patterns compared to 5YA (e) NDVI profiles



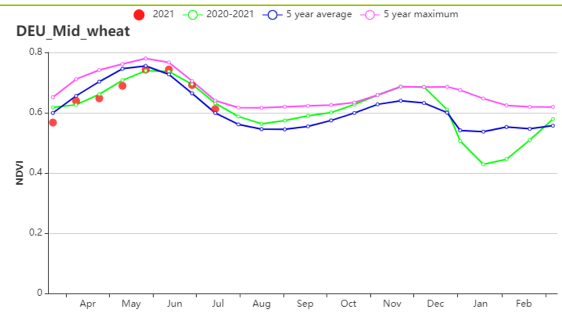


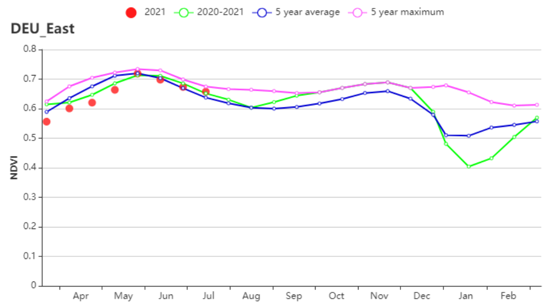
(f) Rainfall profiles (g) Temperature profiles



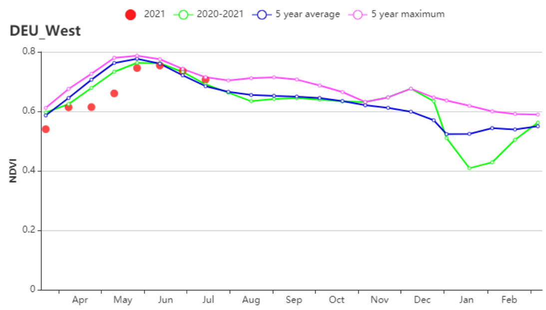


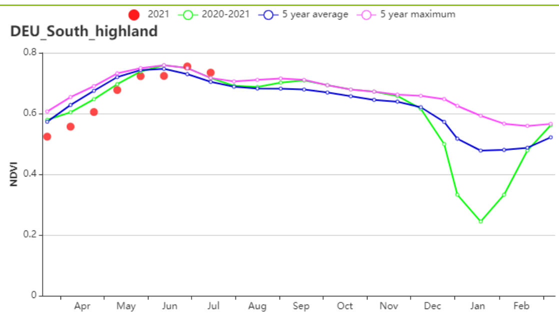
(h) Crop condition development graph based on NDVI (Wheat zone of Schleswig-Holstein and the Baltic coast (left) and Mixed wheat and sugar beets zone of the north-west(right))





(i) 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))





(j) 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, April-July 2021

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m²)	Departure from 15YA (%)	Current (gDM/m²)	Departure from 15YA (%)
Wheat zone of Schleswig-Holstein and the Baltic coast	416	47	13.1	-0.8	1118	-3	429	-3
Mixed wheat and sugarbeets zone of the north-west	449	59	12.8	-1.2	1089	-5	406	-8
Central wheat zone of Saxony and Thuringia	386	43	12.8	-1.2	1142	-5	433	-8
East-German lake and Heathland sparse crop area	409	40	13.4	-1.1	1139	-4	448	-7
Western sparse crop area of the Rhenish massif	420	46	12.4	-1.4	1134	-6	413	-10
Bavarian Plateau	592	29	12.1	-1.5	1214	-2	435	-8

Table 3.18 Germany's agronomic indicators by sub-national regions, current season's value and departure from 5YA, April-July 2021

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure from 5YA (%)	Current
Wheat zone of Schleswig-Holstein and the Baltic coast	100	0	0.92
Mixed wheat and sugarbeets zone of the north-west	100	0	0.94
Central wheat zone of Saxony and Thuringia	100	0	0.93
East-German lake and Heathland sparse crop area	100	0	0.93
Western sparse crop area of the Rhenish massif	100	0	0.93
Bavarian Plateau	100	0	0.96

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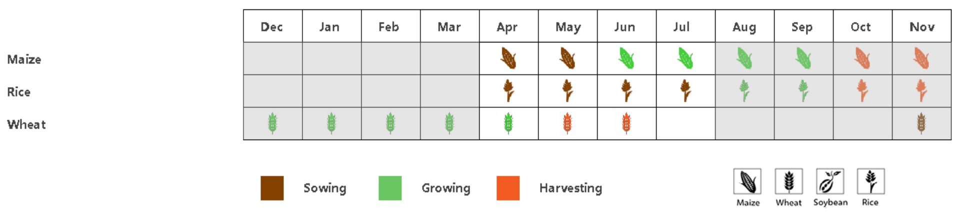
[EGY] Egypt

During the monitoring period (April-July), winter wheat reached maturity in April and was harvested in May and June. Rice and maize were planted in April and May. No rainfall was recorded during this monitoring period. The average temperature reached 23.8°C (+0.3°C). The temperature index graph shows that it fluctuated around the 15YA except for one pulse in early May. The RADPAR was above the 15YA by 1.5%, while BIOMSS was estimated to be below the 15YA by 60%, which can be attributed to the remarkable reduction of rainfall. The CALF was higher than the 5-year average (5YA) by 2%, with the whole country's medium VCIx value was at 0.68. The NDVI spatial pattern shows that only 9.6% of the cultivated area was above the 5YA, 60% fluctuated around the 5YA, and 30.3% was below the 5YA. Overall, the crop conditions were unfavorable.

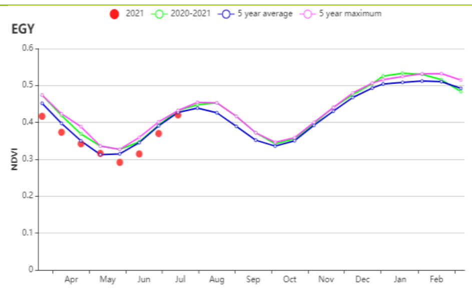
Regional analysis

Based on crop planting systems, climate zones, and topographical conditions, Egypt can be divided into three agro-ecological zones (AEZs), two of which are suitable for crop cultivation, namely **the Nile Delta and the southern coast of the Mediterranean and the Nile Valley.** Rainfall was nearly 0 mm, the temperature was above the 15YA by 0.4°C and 0.5°C, the RADPAR was above the 15YA by 1.5%, and 1.2%, while the BIOMSS was below the 15YA by 57%, and 74% for the Nile Delta and the southern coast of the Mediterranean and the Nile Valley, respectively. Generally, the NDVI development graph shows that crop conditions were below average in both regions, confirming unfavorable crop conditions.

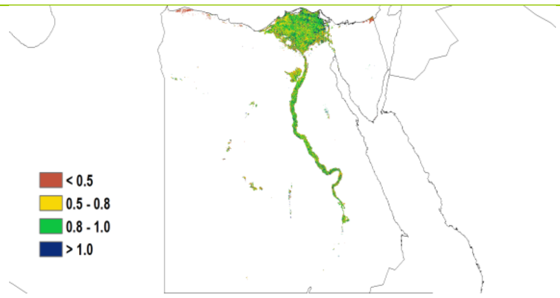
Figure 3.14 Egypt's crop condition, April-July 2021



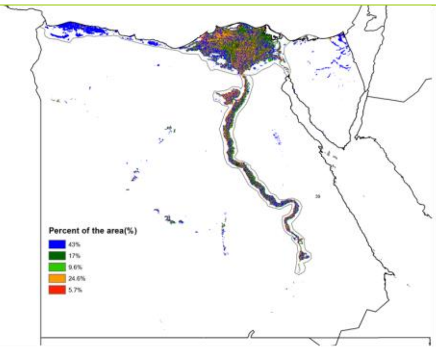
(a). Phenology of major crops



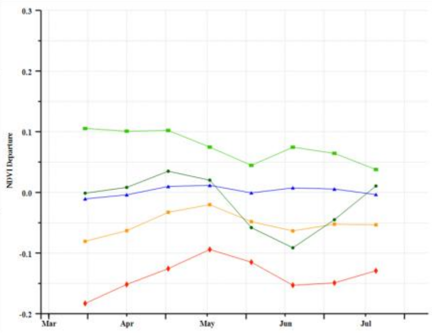
(b) Crop condition development graph based on NDVI



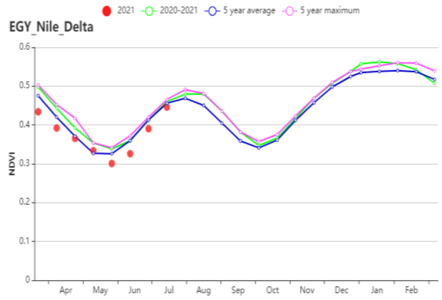
(c) Maxim0um VCI

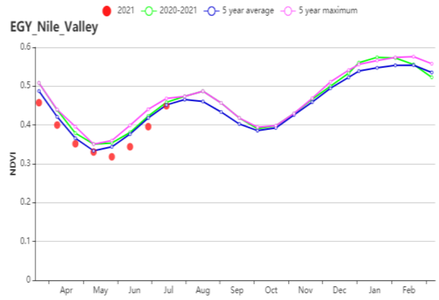


(d) Spatial NDVI patterns compared to 5YA

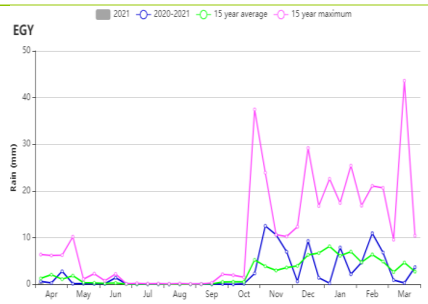


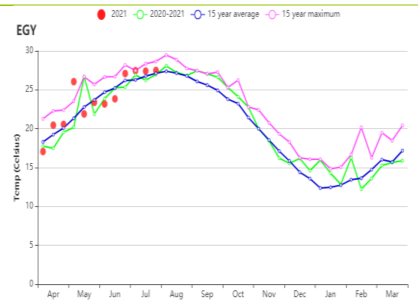
(e) NDVI profiles





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





(g) Time series profile of rainfall

(h) Time series profile of temperature

Table 3.19 Egypt's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, April-July 2021

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m²)	Departure from 15YA (%)	Current (gDM/m²)	Departure from 15YA (%)
Nile Delta and Mediterranean coastal strip	0	-94	23.8	0.4	1613	2	173	-57
Nile Valley	0	-96	27.1	0.5	1654	1	36	-74

Table 3.20 Egypt's agronomic indicators by sub-national regions, current season's values and departure from 5YA, April-July 2021

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure from 5YA (%)	Current
Nile Delta and Mediterranean coastal strip	65	2	0.69
Nile Valley	69	2	0.75

[ETH] Ethiopia

The report monitoring period is from April to July, which almost contains all of the Ethiopia Meher crops' planting seasons. Maize and wheat are the major cereal crops in the country.

In the country level, the cumulative precipitation (RAIN), average temperature (TEMP), solar radiation (RADPAR) decreased slightly by 4%, 0.5°C, and 3%, respectively, compared with the average levels in the past 15 years. Although this seems to be a good agroclimatic condition from the overall numerical value, the uneven distribution of accumulated precipitation over time and the war have reduced the accumulated potential biomass by 11%. The accumulated precipitation almost reached the 15-year maximum in late April and early May, and then there was a drought that lasted for nearly 20 days in late May and early June, which was extremely unfavorable for the sowing of maize and wheat. The crop condition development graph based on NDVI also confirms this fact. It can be seen that the NDVI values have two troughs due to excessive precipitation and drought that delayed crop planting. By the way, the abnormally low NDVI value in July may be caused by the cloud cover of satellite imagery during the rainy season. The Spatial NDVI patterns shows that 37.4% of the regions have NDVI values lower than the 15-year average, mainly in the eastern area.

Another factor is war. Due to the further escalation of the civil war between the government forces and the tigray armed forces in tigray State in northern Ethiopia, the agriculture was hit hard. According to data from the United Nations and the World Health Organization, the civil war has led to the desolation of farmland and economic crises in many areas. In Ethiopia's amhara and afar states, more than 300,000 people have fallen into famine. In the tigray area, the center of the war, at least 5.2 million people have fallen into or are about to fall into famine, and there is a huge food shortage. In the absence of the best planting season in the past three months, Ethiopia's food production in 2021 will also decline due to the war. The maximum VCI map clearly reflects the scope of the war's impact on Ethiopia: the VCIx of the northernmost tigray Region is less than 0.5, the VCIx of the adjacent central and eastern regions is between 0.5-0.8, and the western and southern regions are not affected.

In short, the overall crop condition in Ethiopia is slightly below average. In the east and southeast of the country, the growth and development of crops is negatively affected by the uneven distribution of precipitation over time. The closer to the north, the greater the impact of war on agriculture, in the northernmost tigray state, agriculture has been devastated. Crops in the western region are growing well. A more detailed regional analysis is as follows.

Regional analysis

In **the Semi-arid pastoral areas**, a typical livestock production zone, the accumulated precipitation is above average (+39%). The average temperature and solar radiation are close to average (TEMP -0.3°C, RADPAR -3%), and the cumulative potential biomass has dropped by 16%. At the same time, the NDVI value was lower than average in April and June. The value of VCIx is 0.65. Compared with the 5-year average, CALF has dropped by 34%. Overall, the prospects for livestock production are slightly unfavorable.

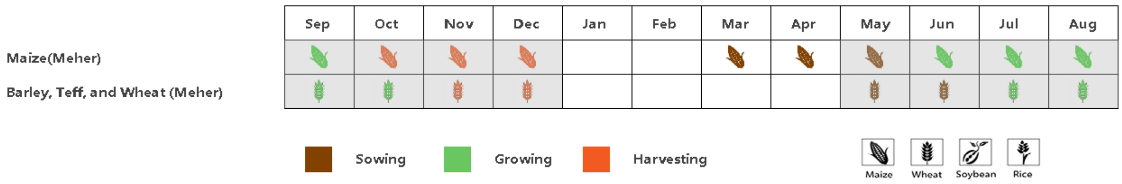
In **the Southeastern Mendebo highlands zone**, the CorpWatch indicators during the monitoring period of this report are as follows: RAIN (-17%), TEMP (-0.5°C), RADPAR (-2%), BIOMASS (-11%), CALF (-1%), VCIx (0.82). The crop condition development graph based on NDVI is slightly lower than the 5-year average. In general, the growth of maize in Southeastern Mendebo highlands zone remained at an average level.

In **South-eastern mixed maize zone**, the accumulated precipitation is close to the 15-year average. The average temperature and light and effective radiation decreased slightly by 0.6°C and 2% respectively. Due to uneven precipitation, the cumulative potential biomass is lower than the average level (-13%). The crop condition development graph based on NDVI is lower than the 5-year average. VCIx is 0.78 and CALF is reduced by 2%. The crops in this area are in general condition.

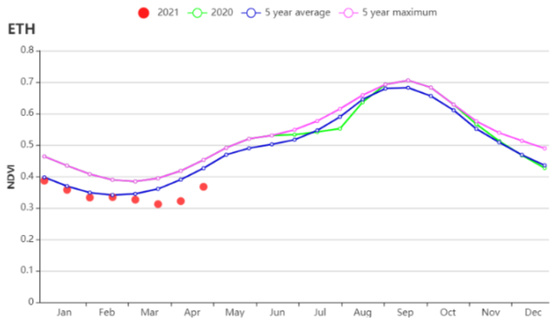
In **the Western mixed maize zone**, maize is the most important crop planted in the Meher season. The accumulated precipitation in the area remained unchanged. Combining the slightly lower average temperature (-0.5°C) and light and effective radiation (RADPAR +1%), the estimated cumulative biomass is close to the 15-year average (-3%). VCIx is 0.95 and CALF remains unchanged. According to CorpWatch indicators, crop conditions are favorable.

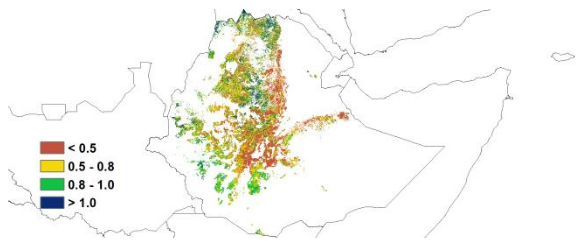
The **northern arid area** is an agricultural area in northern Ethiopia. Due to the war, the cropped arable land fraction was almost zero. In 2021, the crops in this area are facing the risk of no harvest, and the food supply problem of the local people is very worrying.

Figure 3.15 Ethiopia's crop condition, April - July 2021



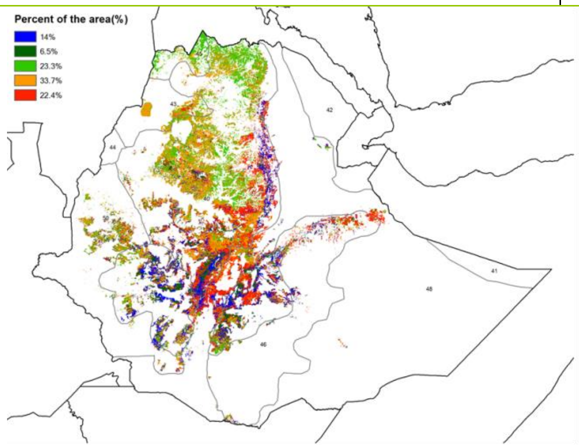
(a) Phenology of major crops

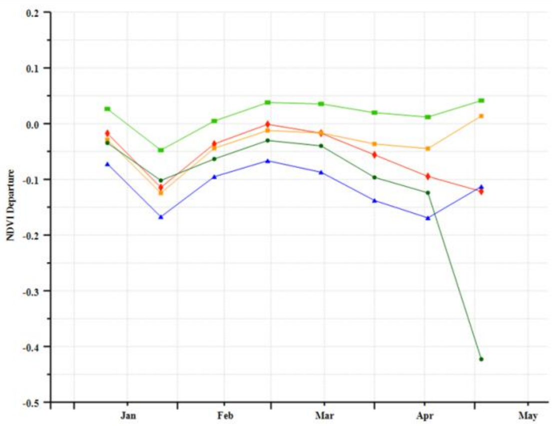




(b) Crop condition development graph based on NDVI

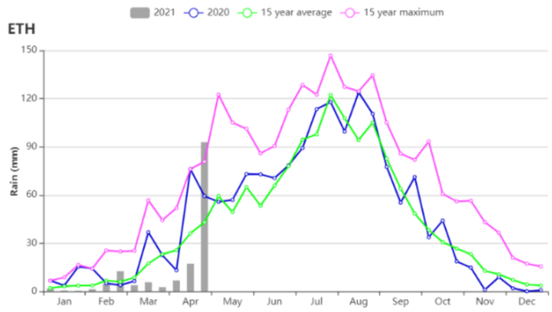
(c) Maximum VCI

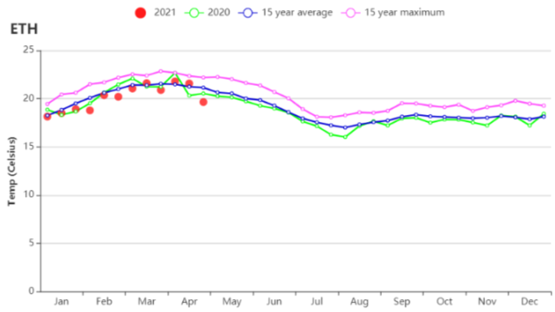




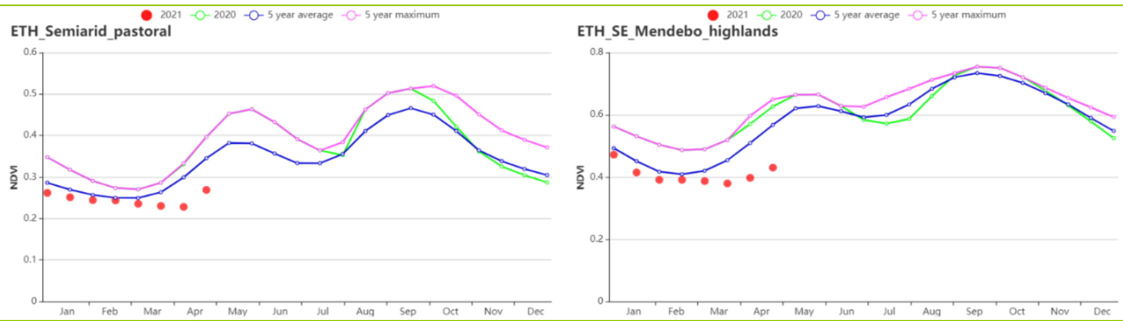
(d) Spatial NDVI patterns compared to 5YA

(e) NDVI profiles

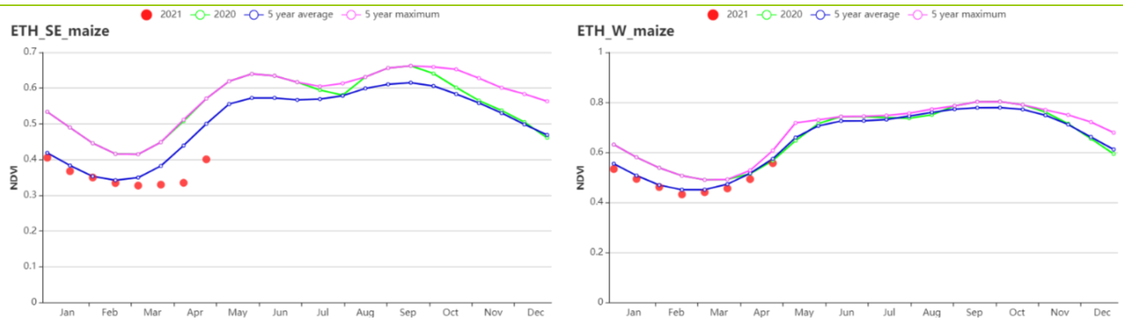




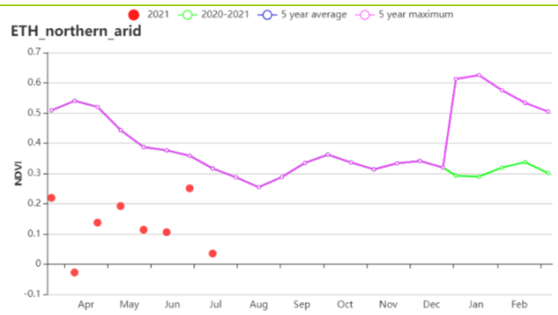
(f) Rainfall profiles (g) Temperature profiles



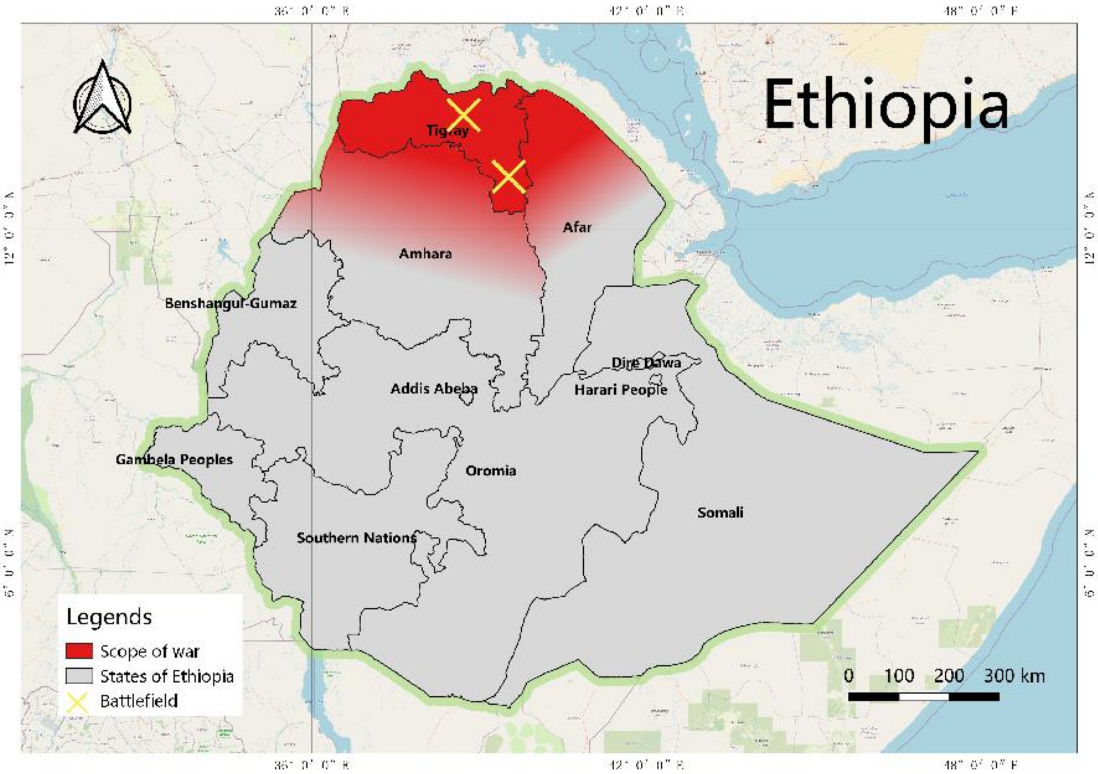
(h) Crop condition development graph based on NDVI (Semi-arid pastoral (left) South-eastern Mendebo highlands (right))



(i) Crop condition development graph based on NDVI (South-eastern mixed maize zone (left) and South-eastern mixed maize zone (right))



(j) Crop condition development graph based on NDVI (Northern arid area)



(k)Tigray war

(l)An aid distribution point in Mekelle in the Tigray region

Table 3.21 Ethiopia's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, April- July 2021

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m2)	Departure (%)	Current (gDM/m2)	Departure (%)
Semi-arid pastoral areas	278	39	23.3	-0.3	1351	-3	544	-16
South-eastern Mendebo highlands	461	-17	15.1	-0.5	1157	-2	418	-11
South-eastern mixed maize zone	488	1	18.2	-0.6	1184	-2	516	-13
Western mixed maize zone	1216	0	21.1	-0.5	1126	1	597	-3
Northern arid area	187	130	29.6	-1.0	1382	-4	534	-22

Table 3.22 Ethiopia's agronomic indicators by sub-national regions, current season's values and departure from 5YA, April- July 2021

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Semi-arid pastoral areas	28	-34	0.65
South-eastern Mendebo highlands	98	-1	0.82
South-eastern mixed maize zone	93	-2	0.78
Western mixed maize zone	100	0	0.95
Northern arid area	0	-100	0.30

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

[FRA] France

The monitoring period covers winter wheat, which had reached maturity by July. The planting of maize and spring wheat was completed in May. The harvest of the summer crops including rice, potatoes and sunflower starts in August and extends into September. CropWatch agro-climatic indicators show below-average temperature (TEMP -1.1°C) over the period except for June. Significantly higher RAIN (+27%) as compared to the 15YA was recorded, which alleviated the drought conditions observed during the last monitoring period. RADPAR was 1% below average. Due to unfavorable temperature and sunshine, the biomass production potential (BIOMSS) is estimated to have decreased by 7% nationwide compared to the 15-year average. The national-scale NDVI development graph shows that the NDVI values were generally lower than in the 2020-2021 season and the 5YA. The crop conditions were above the 5-year average in July only. The spatial distribution of maximum VCI (VCIx) across the country reached an average of 0.92. Overall, below-average temperature and sunshine caused unfavorable growth conditions for most of the monitoring period in France expect for July, which had sufficient precipitation.

Regional analysis

Considering cropping systems, climatic zones and topographic conditions, additional sub-national details are provided for eight agro-ecological zones. They are identified on 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) **Southwestern maize zone, (76) Eastern Alpes region** and (77) the **Mediterranean zone**.

In the **Northern barley region**, RAIN and RADPAR were both above average (+51% and +2% respectively), while TEMP was below average (-1.3°C). The BIOMSS also decreased by 6% when compared to the 15YA. The CALF was average, and VCIx was relatively high at 0.95. Crop condition development based on NDVI for this region was below the 5-year average in April and May, but close to and then above the average in June and July.

In the **Mixed maize/barley and rapeseed zone** from the Center to the Atlantic Ocean, a cooler (TEMP -1.0°C) and humid (RAIN +22%) season was observed, with higher RADPAR (+2%). For the crops, BIOMSS was 4% lower than average, CALF was at the average level and VCIx was 0.93. The regional NDVI profile presented an overall below-average trend, but close to average levels starting in June.

In the **Maize-barley and livestock zone** along the English Channel, RAIN and RADPAR were above average by 29% and 3%. TEMP was lower than average (-0.9°C). BIOMSS decreased by 1%. CALF was average and VCIx was relatively high at 0.95. The regional NDVI profile also presented an overall lower than but close to average trend.

In the **Rapeseed zone** of eastern France, the NDVI profile also indicated below-average conditions but was close to and above average in June and July. Overall, RAIN in this period was 37% higher than the 15-year average, while TEMP decreased by 1.5°C and RADPAR dropped by 3%. BIOMSS was about 11% lower than average while CALF was at the average level, and VCIx was 0.92.

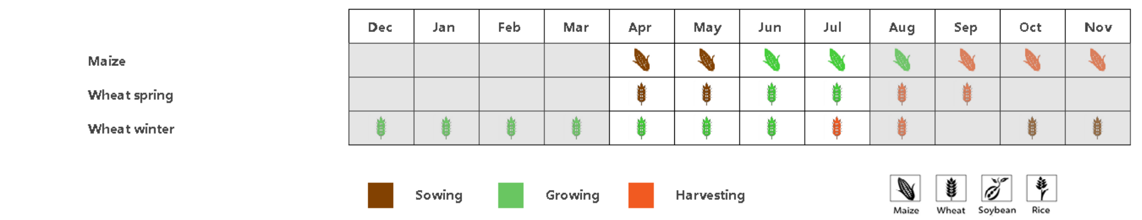
In the **Massif Central dry zone**, TEMP and RADPAR were 1.3°C and 3% lower than the average, respectively, while RAIN increased by 30%. The VCIx was 0.92 and BIOMSS decreased by 11% which indicated a below-average cropping season in the region. Crop conditions based on the NDVI profile were also showing below-average levels in April and May but close to and above average in June and July.

The **Southwestern maize zone** is one of the major irrigated regions in France. The regional NDVI profile presented a below-average trend in the first three month of the monitoring period but was above average in July. RAIN in the period was 7% higher than average, while TEMP was 1.0°C lower. RADPAR slightly decreased by 3%. BIOMSS was 9% lower than average, while CALF showed no significant change. The VCIx was recorded at 0.94, indicating slightly below-average crop conditions.

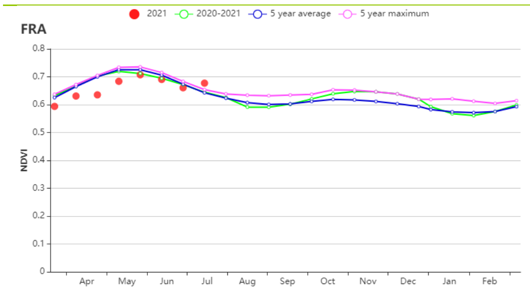
In the **Eastern Alpes region**, the NDVI profile also presented a below-average trend, but was close to average starting in June. RAIN in the region was 32% higher than average, while TEMP was lower than average (-1.3°C) and RADPAR was 4% lower than the 15YA. BIOMSS was 10% lower than the 15-year average. VCIx for the region was recorded at 0.93 and CALF was at the average level, indicating overall below-average crop conditions.

The **Mediterranean zone** aso indicated an overall lower NDVI profile but was close to average in June and July. The region recorded a relatively low VCIx (0.85). RADPAR and TEMP were 4% and 0.9°C lower than average, while RAIN was higher (10%) than average. BIOMSS and CALF decreased by 3% and 1%. This region is showing below-average crop conditions.

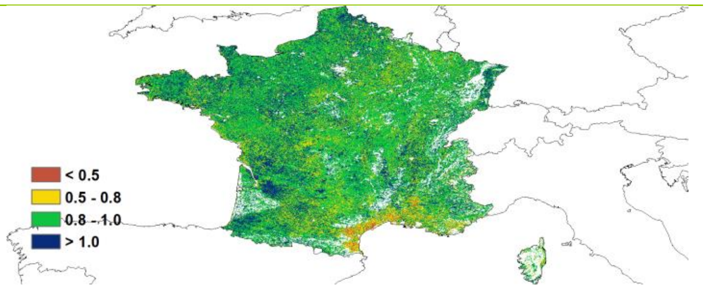
Figure 3.16 France's crop condition, April - July 2021



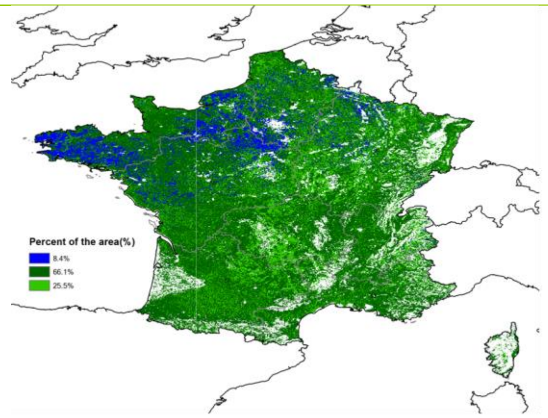
(a). Phenology of major crops



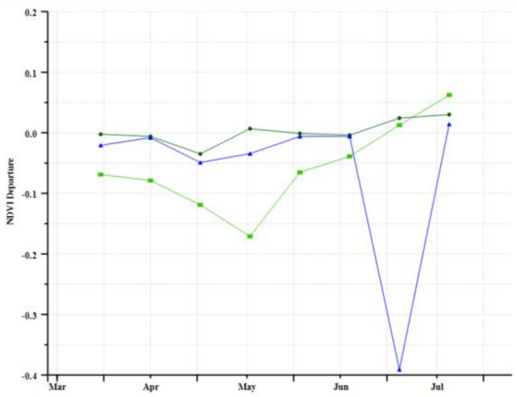
(b) Crop condition development graph based on NDVI



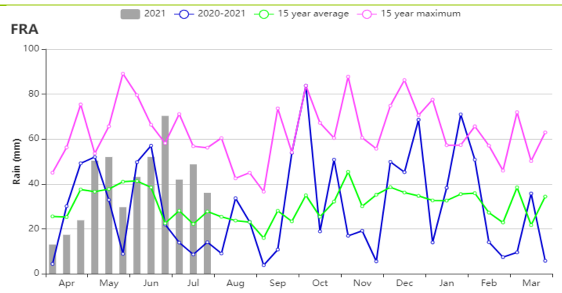
(c) Maximum VCI

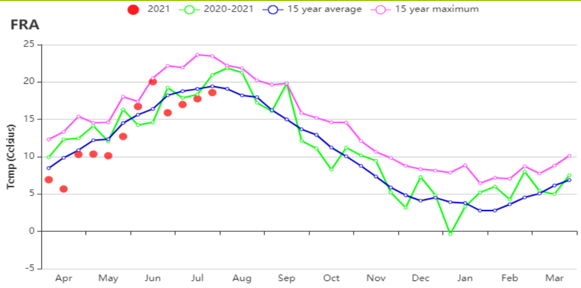


(d) Spatial NDVI patterns compared to 5YA



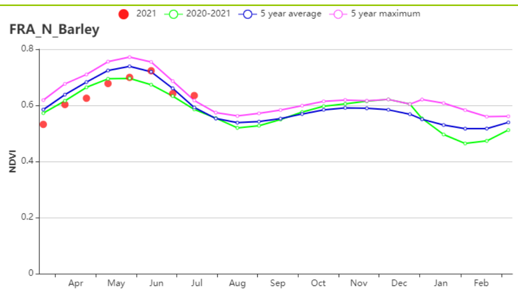
(e) NDVI profiles

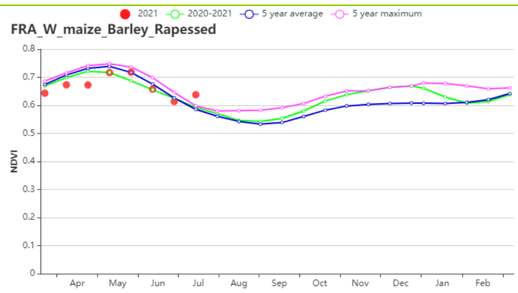




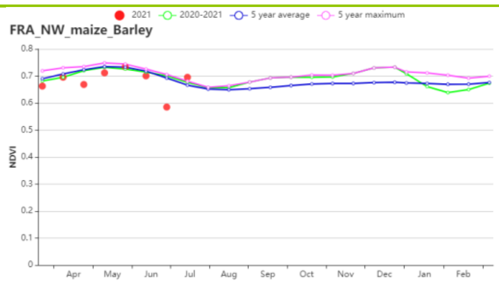
(f) Rainfall profiles

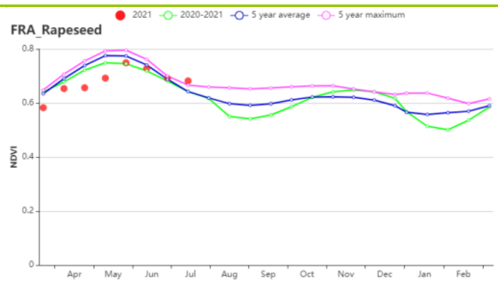
(g) Temperature profiles



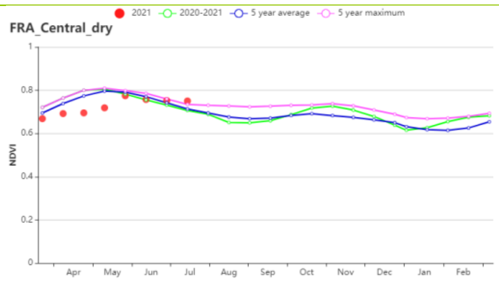


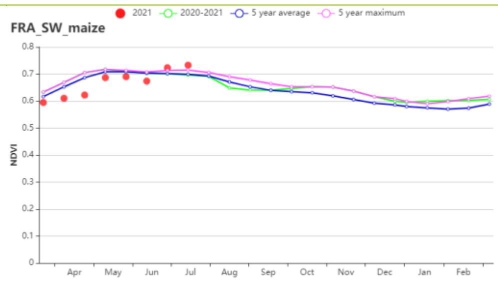
(h) Crop condition development graph based on NDVI (Northern barley region (left) and Mixed maize, Barley and Rapeseed zone (right))



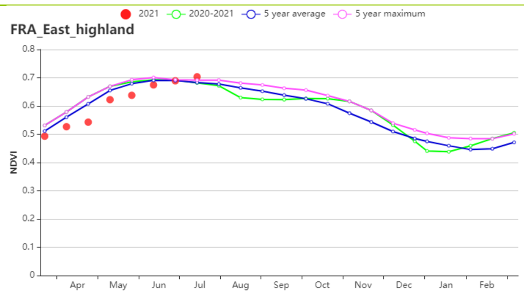


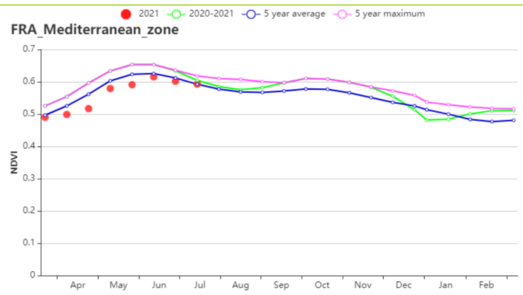
(i) Crop condition development graph based on NDVI (Maize, barley and livestock zone (left) and Rapeseed zone (right))





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





(k) 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, April - July 2021

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Northern Barley zone	462	51	13.0	-1.3	1182	2	429	-6
Mixed maize/barley and rapessed zone from the Centre to the Atlantic Ocean	397	22	14.2	-1.0	1234	2	481	-4
Maize barley and livestock zone along the English Channel	363	29	12.9	-0.9	1201	3	432	-1
Rapeseed zone of eastern France	585	37	13.0	-1.5	1176	-3	430	-11
Massif Central Dry zone	556	30	12.7	-1.3	1209	-3	433	-11
Southwest maize zone	458	7	14.5	-1.0	1233	-3	495	-9
Alpes region	708	32	12.2	-1.3	1263	-4	441	-10
Mediterranean zone	392	10	14.3	-0.9	1336	-4	553	-3

Table 3.24 France's agronomic indicators by sub-national regions, current season's values and departure from 5YA, April - July 2021

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Northern Barley zone	100	0	0.95
Mixed maize/barley and rapessed zone from the Centre to the Atlantic Ocean	100	0	0.93
Maize barley and livestock zone along the English Channel	100	0	0.95
Rapeseed zone of eastern France	100	0	0.92
Massif Central Dry zone	100	0	0.92
Southwest maize zone	100	0	0.94
Alpes region	98	0	0.93
Mediterranean zone	95	-1	0.85

[GBR] Kingdom

During this monitoring period, winter wheat reached the flowering stage in mid May. Subsequent grainfilling was completed by early July. According to the crop condition development graph, crop growth was delayed due to below-average temperatures in April and May. NDVI values were below average during that period and then recovered to average levels in June. Agro-climatic indicators show that rainfall and temperature were below average (RAIN, -6%; TEMP, -0.7°C), radiation was above average (RADPAR, +4%) and BIOMSS was close to average (+1%).

The national average VCIx was 0.95. CALF (100%) was unchanged compared to its five-year average. The NDVI departure cluster profiles indicate that: (1) 22.4% of arable land, scattered in East Midlands, West Midlands and east Scotland, experienced slightly above-average crop conditions. (2) 57.5% of arable land experienced slightly below-average crop conditions before June and then recovered to slightly above-average crop conditions in July, mainly in the east of England. (3) 20.0% of arable land experienced fluctuating crop conditions. The large negative departures were mostly likely due to cloud cover in the satellite images. Altogether, the conditions for wheat in the UK are assessed as average.

Regional analysis

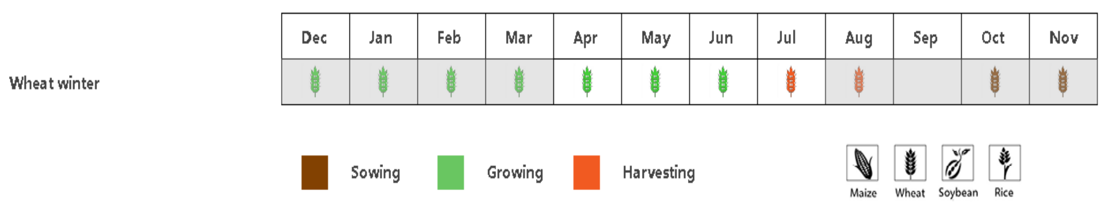
Based on cropping systems, climatic zones, and topographic conditions, three sub-national regions can be distinguished: Central sparse crop region, Northern barley region, and Southern mixed wheat and barley region. All three sub-regions were characterized by unchanged fractions of arable land (CALF) compared to the 5-year average.

The **Central sparse crop region** is one of the country's major agricultural regions for crop production. Crop conditions were below or close to the five-year average according to the NDVI development graph. This region experienced the largest rainfall deficit (RAIN -24%). Temperature was below average (TEMP -0.4°C) and radiation was above average (RADPAR +4%). Biomass was above average (BIOMSS, +3%). The VCIx was at 0.95.

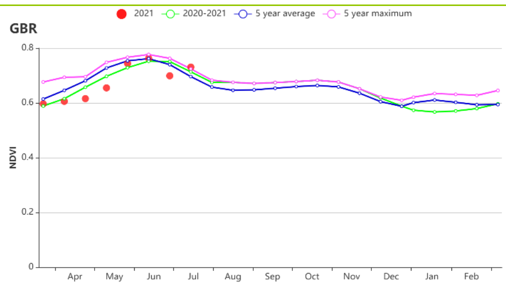
In the **Northern barley region**, NDVI was below average or close to average. Rainfall and temerature were below average (RAIN -10%, TEMP -0.6°C), and radiation was above average (RADPAR +6%). Biomass was above average (BIOMSS, +4%). The VCIx was at 0.94.

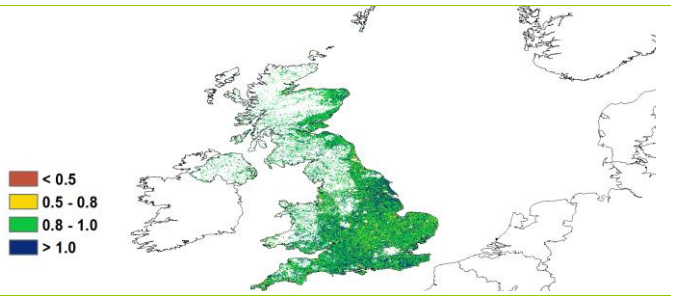
In the **Southern mixed wheat and barley zone**, NDVI was below average or close to average according to the crop condition graph except late July. Rainfall and temperature were significantly below average (RAIN -16%, TEMP -1.0°C), and radiation was above average (RADPAR +4%). Below-average temerature and rainfall resulted in below-average biomass (BIOMSS, -1%). The VCIx was at 0.95.

Figure 3.17 United Kingdom's crop condition, April - July 2021

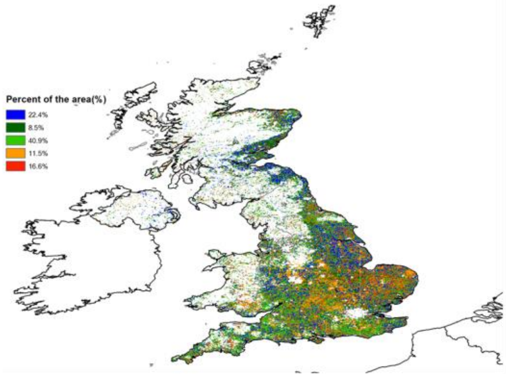


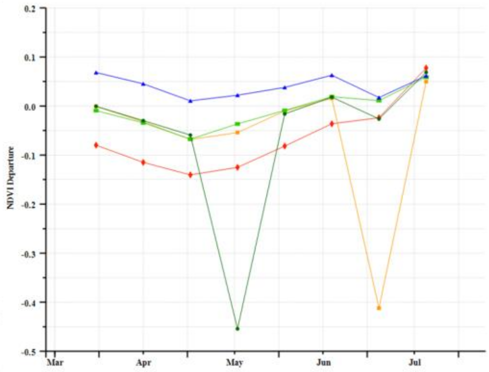
(a). Phenology of major crops



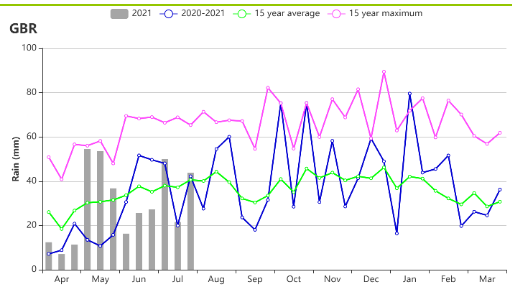


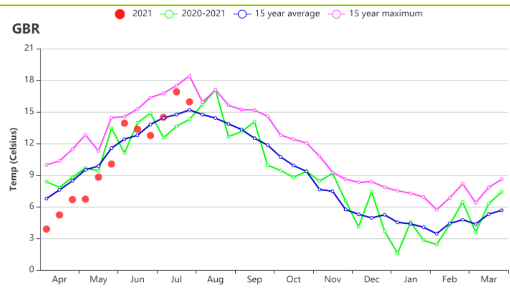
(b) Crop condition development graph based on NDVI (c) Maximum VCI



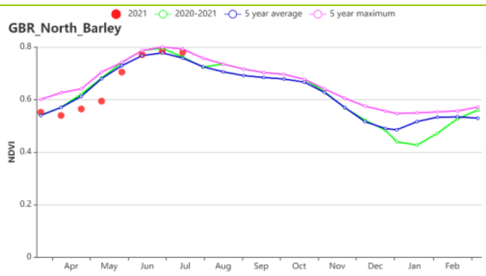


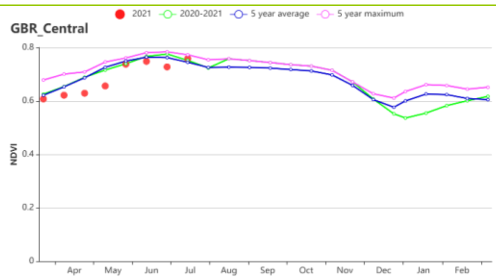
(d) Spatial NDVI patterns compared to 5YA (e) NDVI profiles



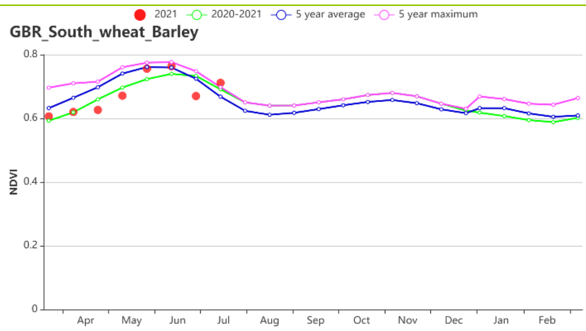


(f) Rainfall profiles (g) Temperature profiles





(h) Crop condition development graph based on NDVI (Northern Barley region (left) and Central sparse crop region (right))



(i) Crop condition development graph based on NDVI (Southern mixed wheat and Barley zone)

Table 3.25 United Kingdom's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, April - July 2021

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m²)	Departure from 15YA (%)	Current (gDM/m²)	Departure from 15YA (%)
Northern Barley region(UK)	364	-10	10.6	-0.6	1013	6	319	4
Central sparse crop region (UK)	340	-24	9.7	-0.4	951	4	282	3
Southern mixed wheat and Barley zone (UK)	371	-16	11.5	-1.0	1083	4	360	-1

Table 3.26 United Kingdom's agronomic indicators by sub-national regions, current season's values and departure from 5YA, April - July 2021

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure from 5YA (%)	Current
Northern Barley region(UK)	100	0	0.94
Central sparse crop region (UK)	100	0	0.95
Southern mixed wheat and Barley zone (UK)	100	0	0.95
Northern Barley region(UK)	100	0	0.94

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

[HUN] Hungary

During this reporting period, winter wheat was harvested in June and July. According to the crop condition development graph, NDVI values were below average for most of the monitoring period, except for late June, when they reached the 15YA. Temperatures were below average (TEMP -0.8°C) and solar radiation was above average (RADPAR +1%) as compared to the 15YA. Conditions had been drier than usual during the previous monitoring period. The overall rainfall was below average (RAIN -5%), mainly due to the fact that the precipitation was much lower than average in June, early July and late July. Biomass was above average compared to the 15YA (BIOMSS +2%). These conditions illustrate that Hungary was much drier than usual, which had affected winter wheat crop growth. The national CALF was 100%. Winter wheat production is expected to be below but close to average.

The national average VCIx was 0.86. The NDVI departure cluster profiles indicate that: (1) 9.4% of arable land experienced above-average crop conditions from April to mid-June, scattered over the whole country. (2) 38% of arable land experienced below-average crop conditions during this reporting period, mainly distributed in Central Hungary. (3) 24.4% of arable land experienced below-average crop conditions from April to early June, mainly distributed in Eastern Hungary. (4) 28.2% of arable land experienced slightly below-average crop conditions from April to mid-May, and above average from late May to mid-June, mainly distributed in Western Hungary and Central Hungary.

Regional analysis

Based on cropping systems, climatic zones, and topographic conditions, four sub-national regions are described below: Central Hungary, the Great Plain (Puszta), Northern Hungary and Transdanubia. During this reporting period, CALF was 100% for all the four subregions.

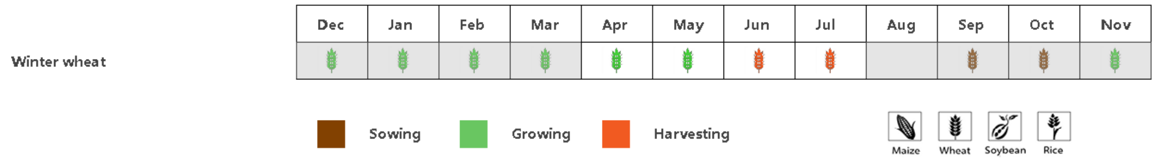
Central Hungary is one of the major agricultural regions in terms of crop production. A sizable share of winter wheat is planted in this region. According to the NDVI development graphs, NDVI values were below average in the entire monitoring period. Temperature and rainfall were below average (TEMP -0.8°C and RAIN -2% respectively). Radiation was above average (RADPAR +2%). Potential biomass was above average compared to the 15YA (BIOMSS +2%). The VCIx was 0.85. The crop conditions in this region are expected to be below but close to average.

The Puszta (The Great Plain) region mainly grows winter wheat, maize and sunflower, especially in the counties of Jaz-Nagykum-Szolnok and Bekes. According to the NDVI development graphs, NDVI values were below average in the entire monitoring period. Agro-climatic conditions include below-average rainfall (RAIN -18%), temperature (TEMP -0.7°C) and radiation (RADPAR -2%). Biomass was above average compared to the 15YA (BIOMSS +2%). The maximum VCI was 0.85. The crop conditions in this region are expected to be below but close to average.

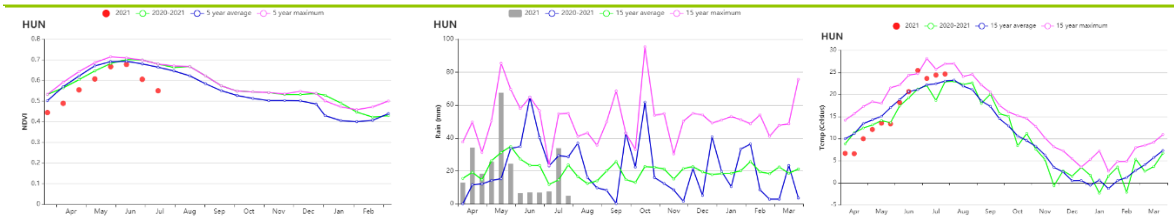
Northern Hungary is another important winter wheat region. According to the NDVI development graphs, NDVI values were below average in this all monitored period. Temperature and rainfall were below average (TEMP -1.0°C, RAIN -4%), and radiation was above average (RADPAR +1%). Estimated biomass was average. The maximum VCI was 0.90. The crop conditions in this region are near average.

Southern Transdanubia cultivates winter wheat, maize, and sunflower, mostly in Somogy and Tolna counties. According to the NDVI development graphs, NDVI values were below average throughout the monitoring period. Agro-climatic conditions include below-average temperature (TEMP -0.9°C) and above-average rainfall (RAIN +10%) and radiation (RADPAR +1%). Biomass was above average compared to the 15YA (BIOMSS +2%). The maximum VCI was favorable at 0.86. The crop conditions in this region are below but close to average.

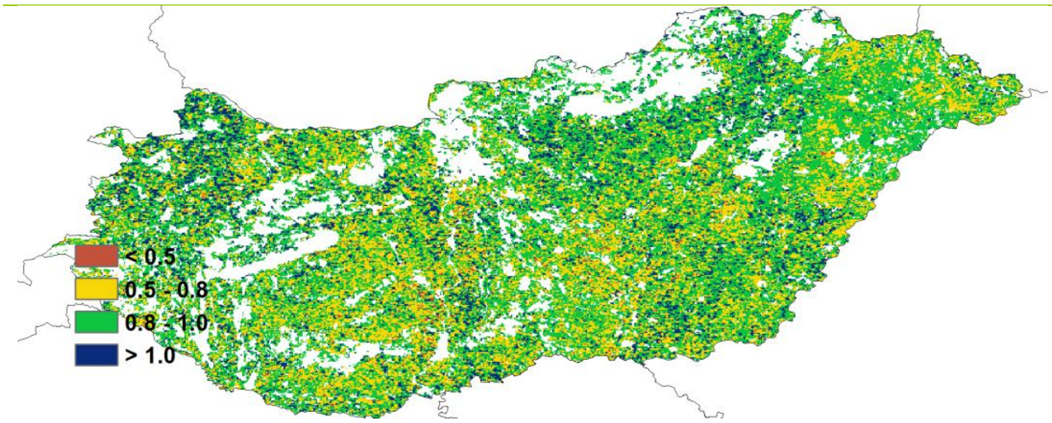
Figure 3.18 Hungary's crop condition, April -July 2021



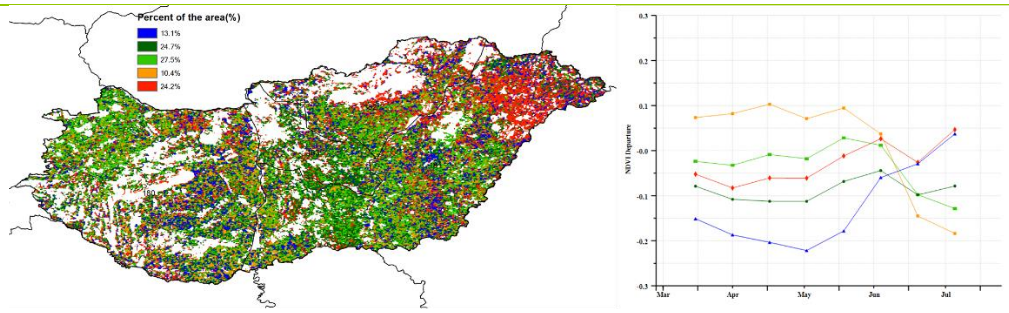
(a). Phenology of major crops



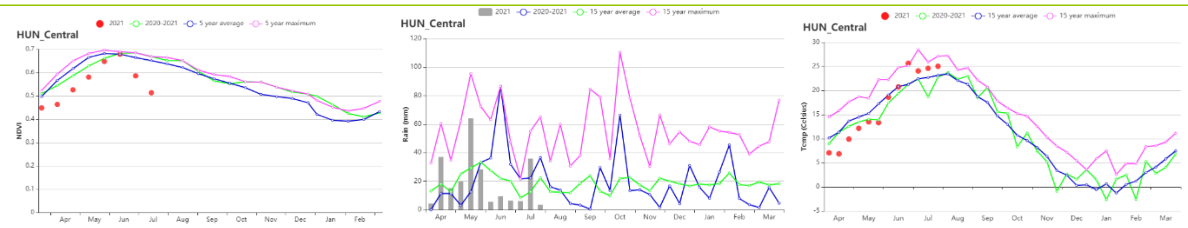
(b) Crop condition development graph based on NDVI, RAIN and TEMP



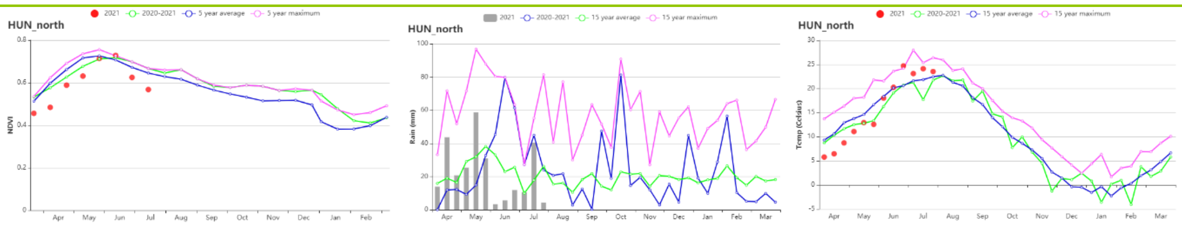
(c) Maximum VCI



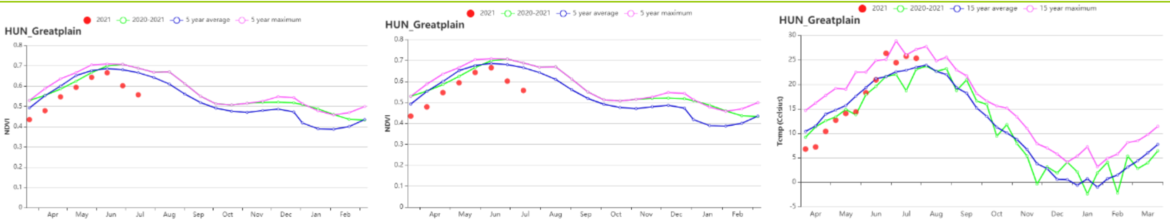
(d) Spatial distribution of NDVI profiles.



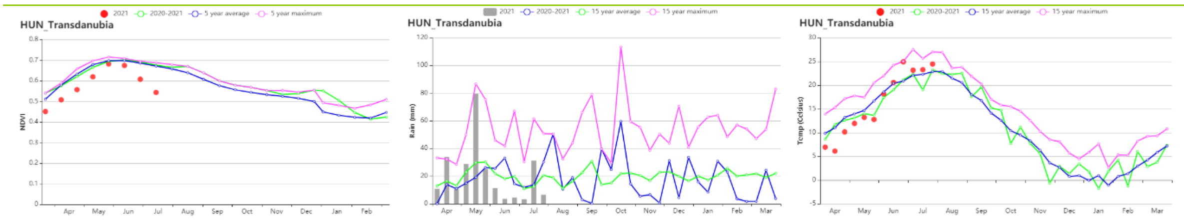
(e) Crop condition development graph based on NDVI, RAIN and TEMP



(f) Crop condition development graph based on NDVI, RAIN and TEMP



(g) Crop condition development graph based on NDVI, RAIN and TEMP



(h) Crop condition development graph based on NDVI, RAIN and TEMP

Table 3.27 Hungary's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, April -July 2021

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Central Hungary	236	-2	16.8	-0.8	1350	2	648	2
The Puszta	239	-18	17.2	-0.7	1329	2	646	2
North Hungary	269	-4	15.9	-1.0	1293	1	595	0
Transdanubia	248	10	16.3	-0.9	1345	1	636	2

Table 3.28 Hungary's agronomic indicators by sub-national regions, current season's values and departure from 5YA, April-July 2021

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current (%)
Central Hungary	100	0	0.85
The Puszta	100	0	0.85
North Hungary	100	0	0.90
Transdanubia	100	0	0.86

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

[IDN] Indonesia

During the monitoring period, the harvest of the main rice and maize were completed, and secondary rice and maize were growing.

In general, conditions were relatively dry at the national scale. Precipitation was below the 15YA (RAIN -11%), but temperature (TEMP +0.3°C) and radiation (RADPAR +6%) were above the 15YA, resulting in a BIOMSS increase by 6% compared with 15YA.

According to the national NDVI development graph, the crop conditions were below the average throughout the reporting period but close to the average in July. According to the NDVI clusters and profiles, 62.4% of the arable land, mostly located in Sumatera, Java and the western of Kalimantan, crop conditions were close to average and even higher than the average in July. 14.4%, 9.8%, 7.5% of cultivated areas, located in the southern of Sumatera and the eastern of Kalimantan were below average in late-March, mid-May and early-July respectively, and then improved to average immediately. On the contrary, NDVI dropped to below average in July on 5.8% of the area, mostly concentrated in West Papua. Considering that CALF reached almost 100% and that the maximum VCI value was 0.95, the crop conditions were normal for Indonesia.

Regional analysis

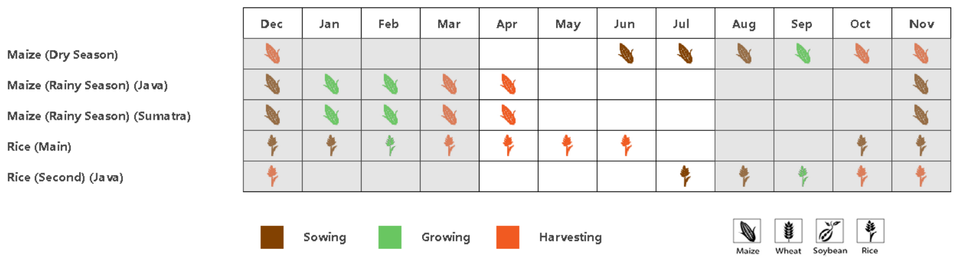
The analysis below focuses on four agro-ecological zones, namely **Sumatra** (92), **Java** (90), the main agricultural region in the country, **Kalimantan and Sulawesi** (91) and **West Papua** (93), among which the first three are relevant for crop production. The numbers correspond to the labels on the VCIx and NDVI profile maps. **Java** is the country's main agricultural region. In all regions, NDVI was below the 5YA in May but recovered to close to normal values by late June, except for Java.

Precipitation was below 15YA (RAIN -19%) in **Java** region, but with slightly higher average TEMP (+0.3°C) and RADPAR (+6%), which may have resulted in a slightly above-average potential biomass (BIOMSS +3%). The NDVI status at the end of the last monitoring period was below the 5YA, but during this period, the NDVI development graph recovered to near the 5YA.

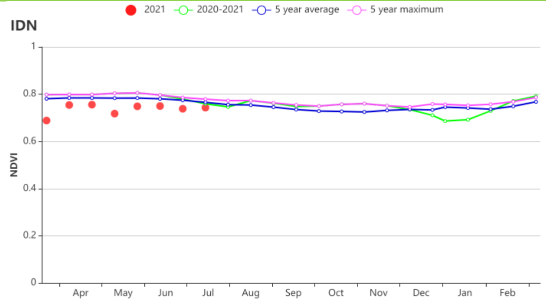
In **Kalimantan and Sulawesi**, precipitation was significantly below average (RAIN -12%) while temperature and radiation were both above the 15YA (TEMP +0.3℃, RADPAR +6%). BIOMASS (+6%) was higher than the average. According to the NDVI development graph, crop conditions were generally close to the 5YA in May. Overall, the crop conditions were close to average at the end of this monitoring period.

In **Sumatra**, precipitation was significantly lower than the 15YA (RAIN -19%) while temperature and radiation were above average (TEMP +0.2℃, RADPAR +5%). BIOMASS (+5%) was higher than average. According to NDVI development graph, despite the low rainfall, the crop conditions were close to the average in July. Overall, the crop conditions were normal for this monitoring period.

Figure 3.19 Indonesia's crop condition, April – July 2021

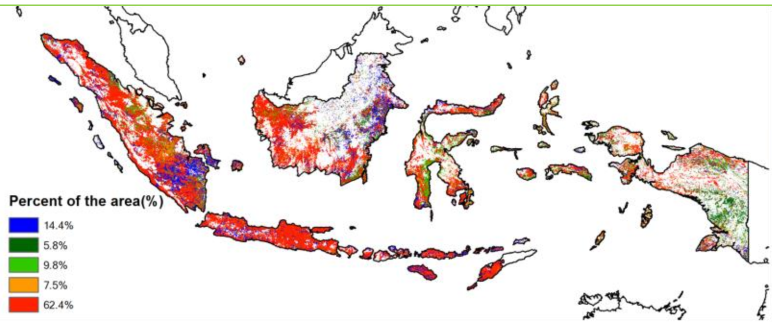


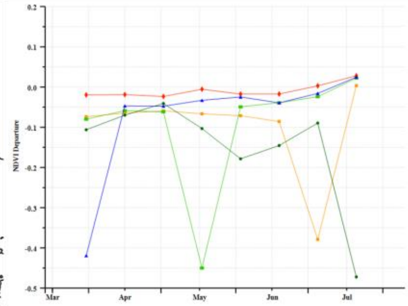
(a). Phenology of major crops



(b) Crop condition development graph based on NDVI

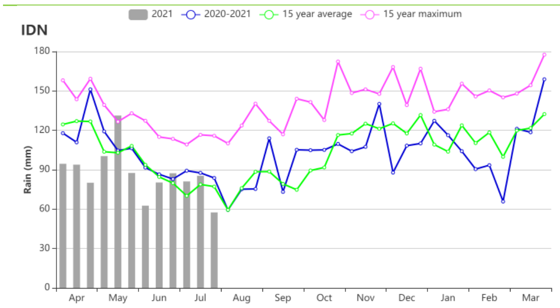
(c) Maximum VCI

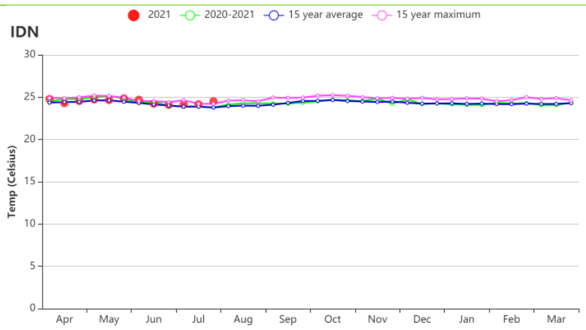




(d) Spatial NDVI patterns compared to 5YA

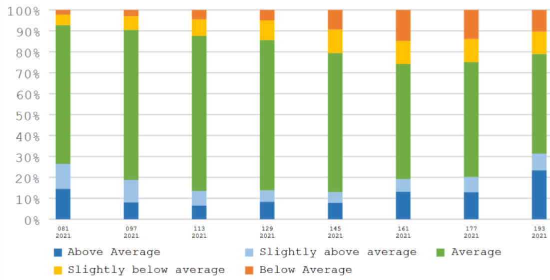
(e) NDVI profiles

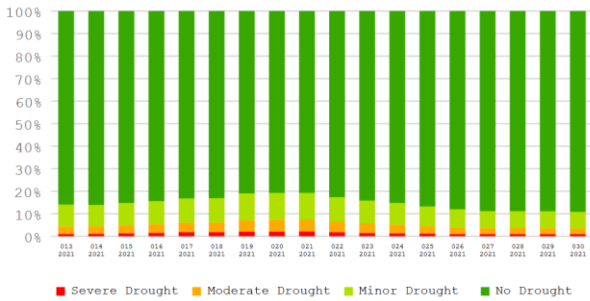




(f)Rainfall profiles

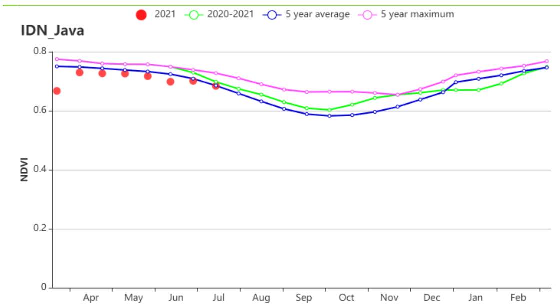
(g)Temperature profiles

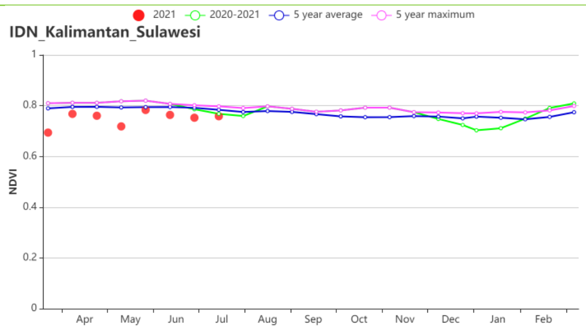




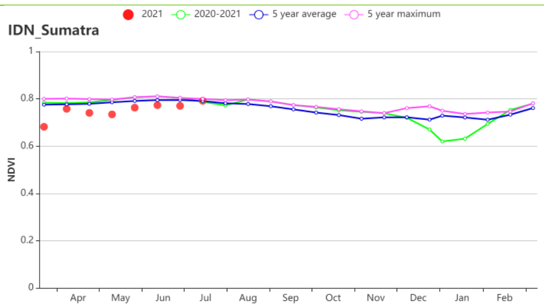
(h) Proportion of NDVI anomaly categories compared with 5YA

(i) Proportion of VHIn categories compared with 5YA





(j) Crop condition development graph based on NDVI (Java (left) and Kalimantan-Sulawesi (right))



(k) Crop condition development graph based on NDVI (Sumatra)

Table 3.29 Indonesia's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, April – July 2021

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Java	518	-19	25.1	0.3	1213	6	739	3
Kalimantan and Sulawesi	1038	-12	24.7	0.3	1179	6	773	7
Sumatra	806	-19	24.9	0.2	1195	5	786	5
West Papua	1573	-3	23.4	0.3	970	9	625	10

Table 3.30 Indonesia's agronomic indicators by sub-national regions, current season's values and departure from 5YA, April – July 2021

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Java	99	0	0.90
Kalimantan and Sulawesi	100	0	0.96
Sumatra	100	0	0.95
West Papua	100	0	0.97

[IND] India

The current monitoring period covers the harvest of rabi rice and wheat in April and May, as well as the sowing of maize, kharif rice and soybean. The graph of NDVI development shows that the crop conditions were close to or above the average in general, except in July, indicating that the crop conditions for rabi rice and wheat were favorable at the national level.

The CropWatch agroclimatic indicators show that nationwide TEMP (-0.6°C) and RADPAR was close to average, whereas RAIN was slightly below the 15YA (-7%). The average TEMP and RADPAR made up for the low rainfall, resulting in a BIOMSS increase by 4% compared with the 15YA. The overall VCIx was high, with a value of 0.86. As can be seen from the spatial distribution, only the Northwestern region recorded values below 0.80. Most of India had high VCIx values. These spatial patterns of VCIx were thus generally consistent with those of NDVI. The southwestern and northeastern regions showed above-average crop conditions while the conditions were slightly below average in the northwestern regions. The spatial distribution of NDVI profiles shows that after June, 61.2% of the areas showed above-average crop conditions in the eastern and southern regions. CALF increased by 9% compared to the 5YA. With the exception of a few areas, the crop conditions in all parts of India were favorable.

Regional analysis

India is divided into eight agro-ecological zones: The Deccan Plateau (94), the Eastern coastal region (95), the Gangetic plain (96), Assam and north-eastern regions (97), Agriculture areas in Rajasthan and Gujarat (98), the Western coastal region (99), the North-western dry region (100) and the Western Himalayan region (101).

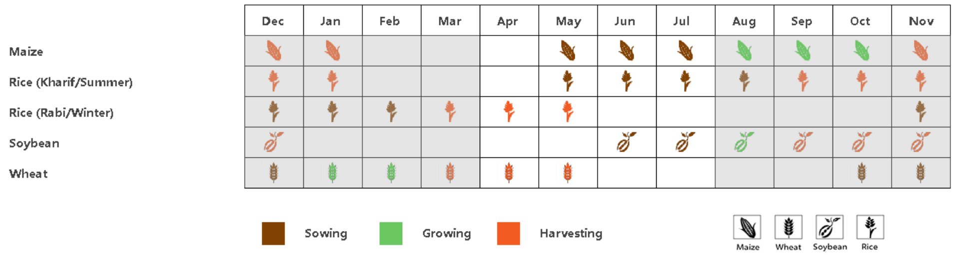
The four agro-ecological zones of the Gangetic plain, the Agriculture areas in Rajastan and Gujarat, the Western coastal region and the North-western dry region showed similar trends in agricultural indices. Compared to the same period of previous years, RAIN had increased significantly, especially in the North-western dry region (+50%). The TEMP was slightly below average and RADPAR was lower, and the abundant rainfall caused BIOMSS to be much higher than the 15-year average. CALF showed different trends. The highest increases had been observed in Western coastal region (+28%), and the highest decreases in North-western dry region (-50%). The graph of NDVI development shows that the crop growth of these three agro-ecological regions during this monitoring period exceeded the 5-year average in most months. Generally, the crop production is expected to be above average.

The **Eastern coastal region** and the **Western Himalayan region** recorded similar trends of agricultural indices in this monitoring period. Compared to the same period of the previous years, RAIN had decreased by 11% in the Eastern coastal region and by 20% for the Western Himalayan region. TEMP was slightly above average (+0.6°C). The RADPAR was above average for both regions but did not compensate for the rainfall effect and caused a decrease in BIOMSS. Both regions recorded increases of CALF. VCIx was above 0.87. The graph of NDVI development shows that the crop growth for both regions was generally above the 5-year average. The crop production is expected to be above average.

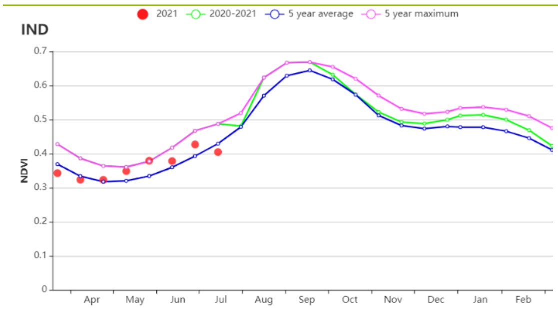
The **Assam and north-eastern regions** recorded 1534 mm of RAIN, which was 26% below average. TEMP was at 25.0°C (+0.6°C), and RADPAR was slightly above the 15YA at 1172 MJ/m² (+5%). BIOMSS was slightly above the 15YA (+1%). CALF reached 96% which was a slight decrease over the 5-year average, and VCIx was 0.91. The graph of NDVI development shows that the crop growth of this region during the monitoring period was below the 5-year average in most months. Generally, the crop production is expected to be below average.

The **Deccan Plateau** recorded 561 mm of RAIN, which was slightly below average (-8%). TEMP was at 30.3°C (-0.9°C) and RADPAR was at 1221 MJ/m² (-3%). BIOMSS was above the 15YA (+3%). CALF reached 79% which was significantly above average (+15%), and VCIx was 0.84. The graph of NDVI development shows that the crop growth of the region during the monitoring period exceeded the 5-year average in most months. The outlook of crop production in this region is favorable.

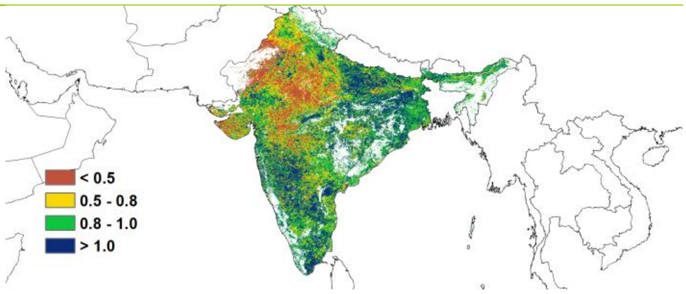
Figure 3.20 India's crop condition, April - July 2021



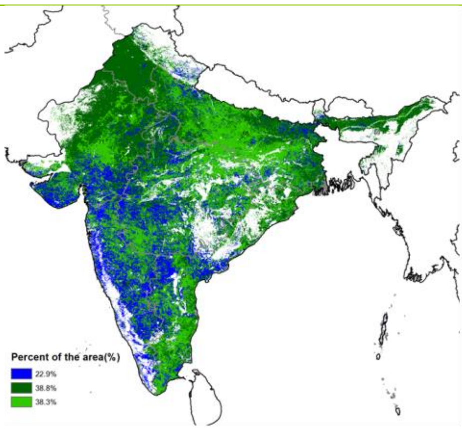
(a). Phenology of major crops



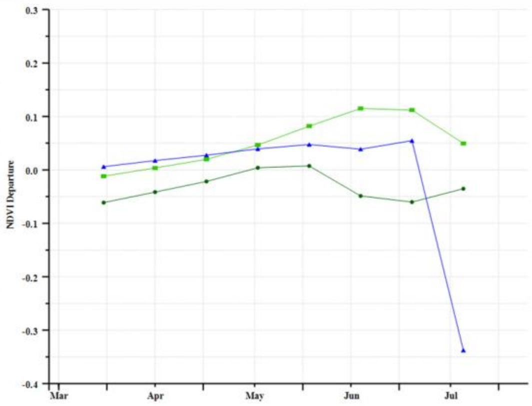
(b) Crop condition development graph based on NDVI



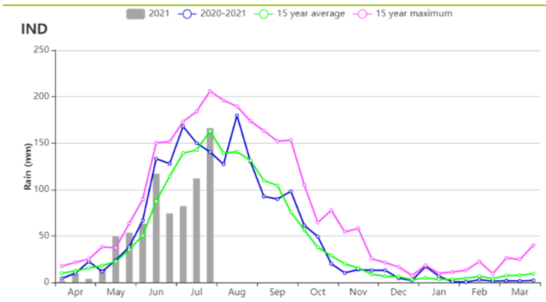
(c) Maximum VCI



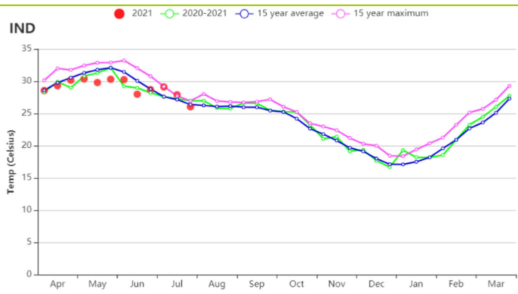
(d) Spatial NDVI patterns compared to 5YA



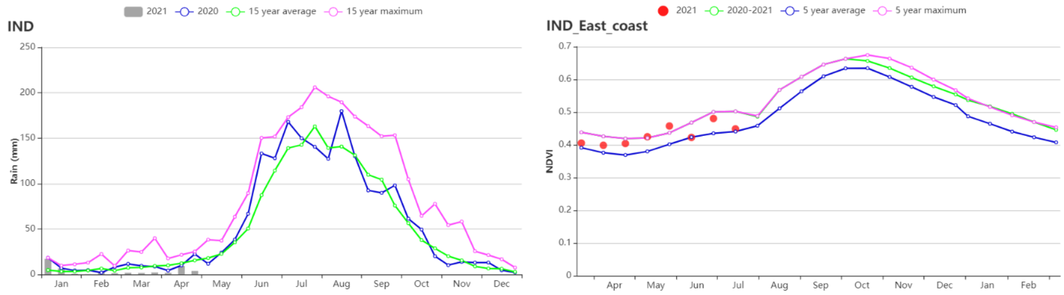
(e) NDVI profiles



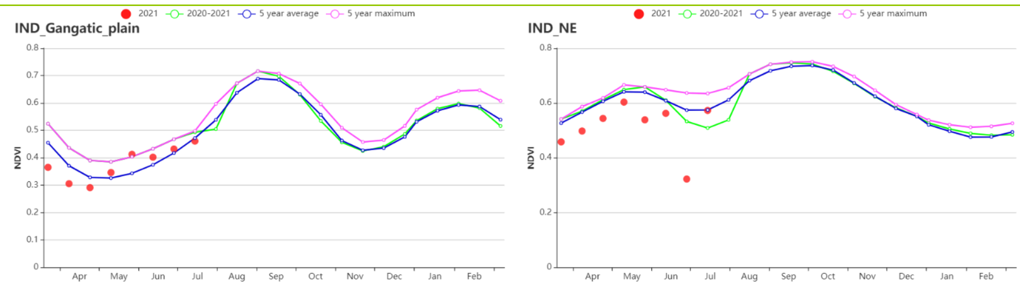
(f) Rainfall profiles



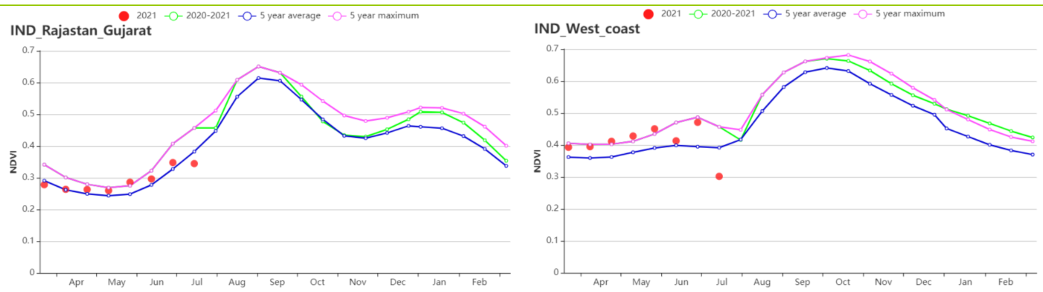
(g) Temperature profiles



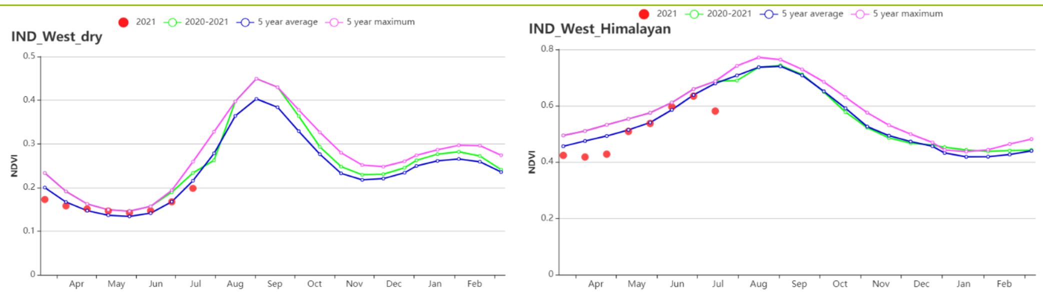
(h) Crop condition development graph based on NDVI (Deccan Plateau (left) and Eastern Coastal Region (right))



(i) Crop condition development graph based on NDVI (Gangetic Plains (left) and Assam and north-eastern regions (right))



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



(k) 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, April - July 2021

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m²)	Departure from 15YA (%)	Current (gDM/m²)	Departure from 15YA (%)
Deccan Plateau	561	-8	30.3	-0.9	1221	-3	644	3
Eastern coastal region	498	-11	29.4	-0.6	1245	1	727	0
Gangatic plain	615	1	31.1	-0.9	1318	-2	714	-6
Assam and north-eastern regions	1534	-26	25.0	0.6	1172	5	692	1
Agriculture areas in Rajastan and Gujarat	572	11	31.6	-0.4	1280	-6	654	22
Western coastal region	1129	17	26.5	-0.5	1168	-1	704	8
North-western dry region	235	57	33.0	-0.5	1440	-3	737	27
Western Himalayan region	456	-20	19.3	-1.0	1449	0	532	-9

Table 3.32 India's agronomic indicators by sub-national regions, current season's values and departure from 5YA, April - July 2021

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure from 5YA (%)	Current
Deccan Plateau	79	15	0.84
Eastern coastal region	81	20	0.97
Gangatic plain	86	4	0.90
Assam and north-eastern regions	96	0	0.91
Agriculture areas in Rajastan and Gujarat	47	-11	0.71
Western coastal region	76	28	1.00
North-western dry region	5	-50	0.43
Western Himalayan region	98	0	0.88

[IRN] Iran

This monitoring period covers the grain filling period and harvest of winter wheat, as well as the planting and early establishment of the rice crop. According to the NDVI based crop condition development graph, the conditions in Iran during this whole monitoring period were below the 5-year average. The cumulative rainfall was 91 mm, which was 1% below average. The average temperature was 22.8°C (1.4°C above average), whereas the photosynthetically active radiation was 1628 MJ/m2 (at average). The potential biomass was 1% lower than the 15-year average. The national maximum vegetation condition index (VCIx) was 0.58, while the cropped arable land fraction (CALF) was 31% lower than the average of the past 5-years.

The NDVI spatial patterns show that from April to July, crop conditions on 8.8% of the cropped areas were above the 5-year average (marked in blue). 29.4% of the cropped areas (marked in dark green) and 21.4% of the cropped areas (marked in red), mainly located in the provinces of West Azaibaijan, East Azarbaijan, Gilan, Mazandaran and Khuzestan, experienced close to average crop conditions almost throughout the monitoring period. The two remaining clustered regions, accounting for 40.4% of the cropped areas, both suffered from significantly below average crop conditions (negative NDVI anomaly more than -0.1) from early to middle June (light green marked regions) and from middle April to middle June (orange marked regions), mainly located in the provinces of Kordestan, Zanjan, Kermanshah, Hamadan, Ilam, lorestan, Golestan, North Khorasan and Razavi Khorasan. The severe lack of rainfall in April caused very unfavorable conditions for rice and wheat, as confirmed by the NDVI profiles. The spatial pattern of maximum Vegetation Condition Index (VCIx) was in accord with the spatial distribution of the NDVI profiles.

The proportion of NDVI anomaly categories, as compared with the 5-year average, shows that in the first and third 16-day phases, almost 10% of the cropped area had slightly below or below average crop conditions. From the 3rd to the 6th 16-day phases, about 20% of the cultivated areas experienced above average crop conditions. The proportion of VHIm categories shows that more than 20% of the cultivated regions suffered from severe droughts from the 6th to the 16th weekly phases. Overall, lack of rainfall caused unfavorable crop conditions for Iran.

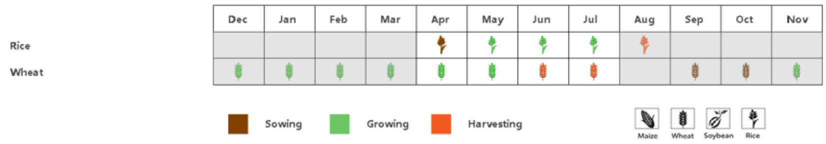
Regional Analysis

Based on farming system, climate, and topographic conditions, Iran can be subdivided into three regions, two of which are the main production areas for crops, namely the **Semi-arid to the subtropical hilly region in the west and the north** and the **Coastal lowland and plain areas of the arid Red Sea**.

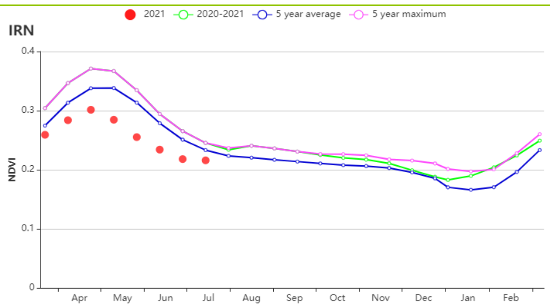
In the **Western and northern semi-arid subtropical hilly areas**, the cumulative precipitation during the monitoring period was 99 mm, 8% below the average, the temperature was 21.0°C (+1.5°C), and photosynthetically active radiation was at average. The potential biomass was 2% lower than the average. Crop conditions were below the 5-year average throughout the monitoring period. The proportion of cultivated land was 25%, which is 31% lower than the 5YA average. The average VCIx for this region was 0.61, indicating unfavorable crop conditions.

In the **Coastal lowland and plain areas of the arid Red Sea**, the temperature was 1.2°C above average, the accumulated precipitation was 36% above average and the photosynthetically active radiation was also slightly above average (+1%). The potential biomass was at the 15-year average. Crop conditions were below to near the 5YA average. During the monitoring period, CALF was 20% below the average of the last 5-years, and the VCIx was 0.51, also indicating poor crop prospects.

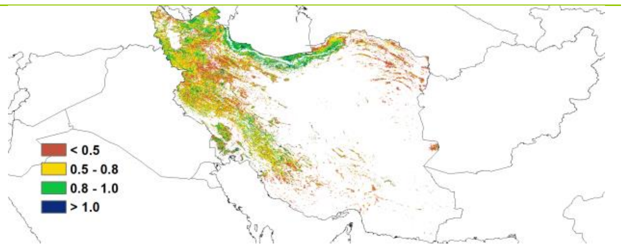
Figure 3.21 Iran's crop condition, April-July 2021



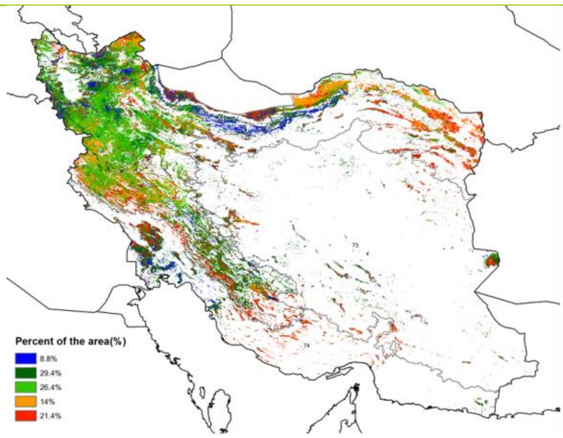
(a). Phenology of major crops



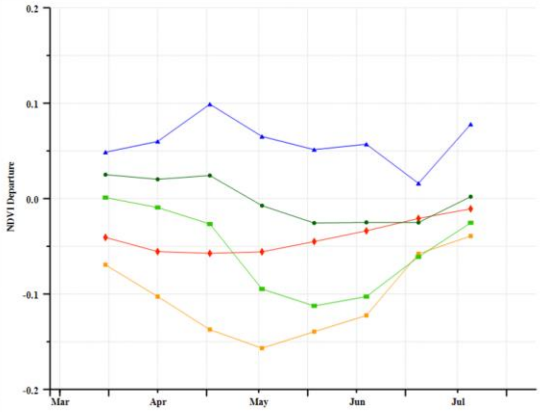
(b) Crop condition development graph based on NDVI



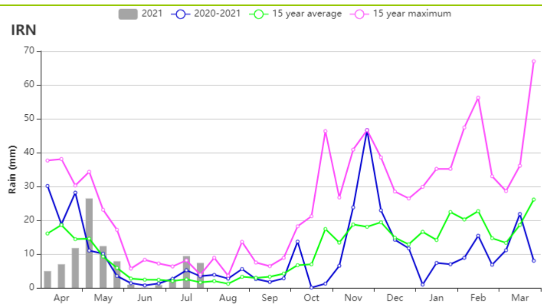
(c) Maximum VCI



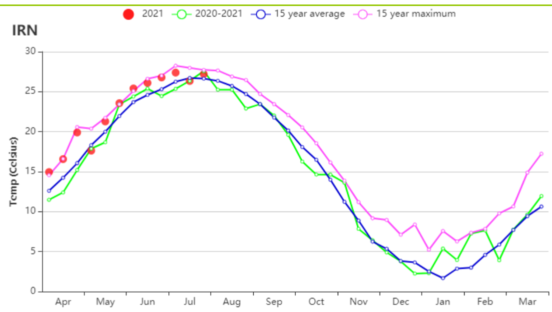
(d) Spatial NDVI patterns compared to 5YA



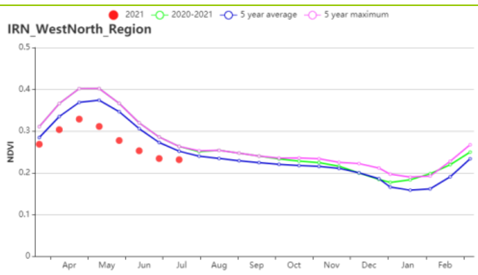
(e) NDVI profiles

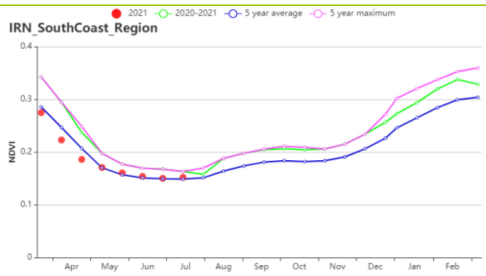


(f) Rainfall time series profile

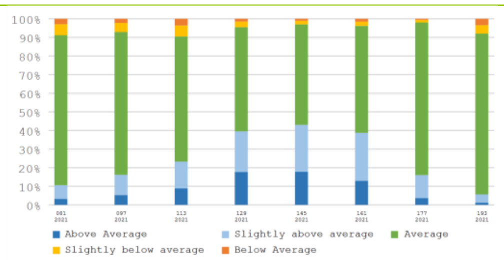


(g) Temperature time series profile

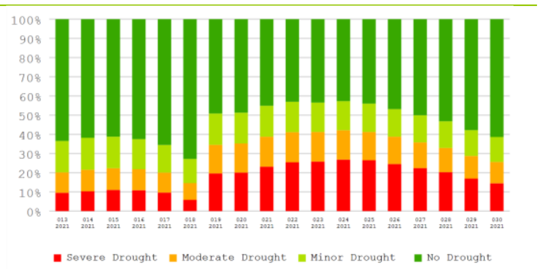




(h) Crop condition development graph based on NDVI (Semi-arid to sub-tropical hills of the west and north region (left) and Coastal lowland and plain areas of the arid Red Sea (right))



(i) Proportion of NDVI anomaly categories compared with 5YA



(j) Proportion of VHIm categories compared with 5YA

Table 3.33 Iran's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, April-July 2021

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m²)	Departure from 15YA (%)	Current (gDM/m²)	Departure from 15YA (%)
Semi-arid to sub-tropical hills of the west and north	99	-8	21.0	1.5	1617	0	452	-2
Coastal lowland and plain areas of the arid Red Sea	39	36	32.8	1.2	1662	1	327	0

Table 3.34 Iran's agronomic indicators by sub-national regions, current season's value and departure from 5YA, April-July 2021

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure from 5YA (%)	Current
Semi-arid to sub-tropical hills of the west and north	25	-31	0.61
Coastal lowland and plain areas of the arid Red Sea	10	-20	0.51

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

[ITA] Italy

During this reporting period, winter wheat was harvested in June and July. Summer crops, especially maize, rice, sunflower and soybeans were planted in April and early May. According to the NDVI development graph, crop conditions were below average in all reporting periods.

At the national level, rainfall (-7%), temperature (-0.5 ºC) and solar radiation (RADPAR -2%) were all below the 15YA. Precipitation in April and May was near average, which was favorable for wheat growth. Potential biomass production was 1% above average.

CALF was 99%, and VCIx was 0.88. Except for a few areas in the north and central part of the country (Piemonte, Lombardia, Veneto and Lazio), the VCIx was above 0.80 for most of the cultivated land. The crop condition development graph indicates that NDVI was below average in this reporting period. In summary, the overall crop conditions during this period were near average.

About 12.5% of the crops, mainly located in the Po Valley and Eastern Italy (Puglia and Emilia-Romagna), showed a positive departure from the 5YA in April and May, but were below average in June and July. 12.4% of arable land experienced below-average crop conditions, scattered in Umbria, Puglia and Sicilia. About 19.4% of arable land (mainly in Piemonte, Lombardia and Veneto) experienced below-average crop conditions between April and early June, above-average conditions in mid-June, and then below-average between late June and July. On about 32.5% of arable land, NDVI was near average in April and early May, and then below average until late July. For the remaining 23.2% of arable land, NDVI hovered above or below average, which was scattered in Toscana, Lazio and Campania.

Regional analysis

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

East coast (mainly in Puglia, Marche and Abruzzi) experienced below-average rainfall (RAIN -37%), above-average temperature (TEMP +0.2°C) and slightly above average solar radiation (RADPAR +2%). Although the precipitation was below average, it was sufficient for the growth of winter wheat in April and May. The potential production showed a slightly increase (BIOMSS +2%). VCIx was 0.88. The crop condition development graph indicates that NDVI was close to the average of the past five years from April to mid-May and below the average from late May to July. Close-to-average wheat crop production can be expected.

Crop production in the **Po Valley** (mainly in Piemonte, Lombardia and Veneto) was affected by slightly higher rainfall (RAIN +3%) and below-average temperature (TEMP -1.0°C) and solar radiation (RADPAR -2%). BIOMSS was below the 15YA by 5% and VCIx reached 0.87. The crop condition development graph indicates that the crop condition was near average during the entire reporting period. According to the agro-climatic indicators, a near-average output can be expected.

The Islands recorded a below-average precipitation (RAIN -12%) with above-average temperature (TEMP +0.3°C). RADPAR was slightly below average (-2%). BIOMSS increased by 7% compared with the 15YA. VCIx was 0.91. NDVI was close to average throughout the monitoring period. The crop production in this region is expected to be close to average.

In **Western Italy**, RAIN (-20%), RADPAR (-1%) and TEMP (TEMP -0.4°C) were all below average. Although the precipitation was below average, it was sufficient for the growth of winter wheat in April and May, and the biomass production potential increased in this region (BIOMSS +2%). The NDVI was below average from April to early May. It reached average levels from mid-May to mid-June, and was below average from late June to July. VCIx reached 0.87. CropWatch expects an average production.

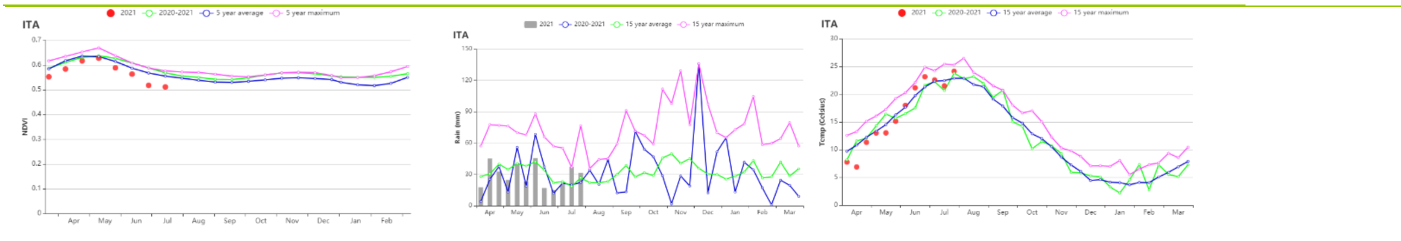
Figure 3.22 Italy's crop condition, April 2021-July 2021

	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
Winter wheat												

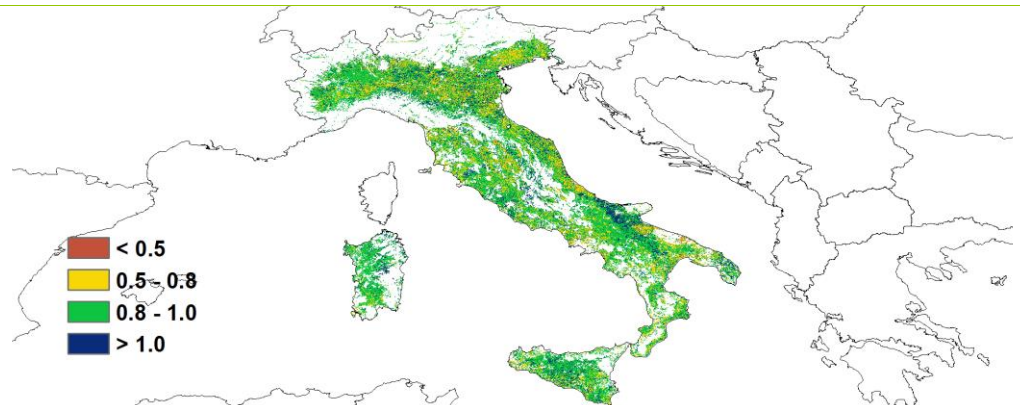
Sowing Growing Harvesting

Maize Wheat Soybean Rice

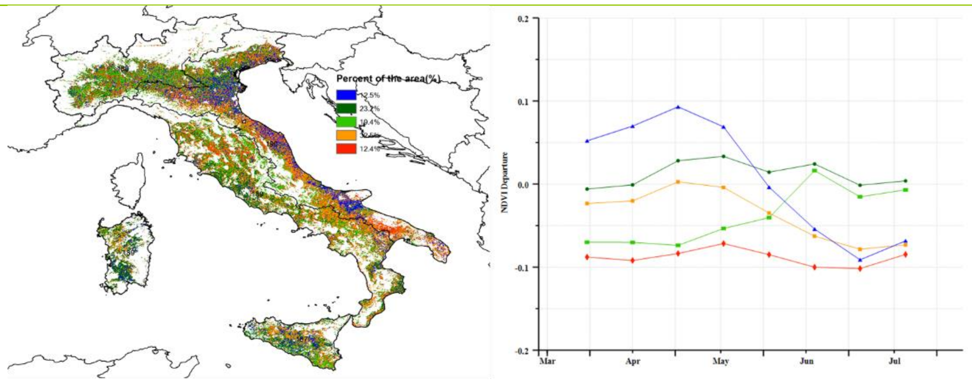
(a). Phenology of major crops



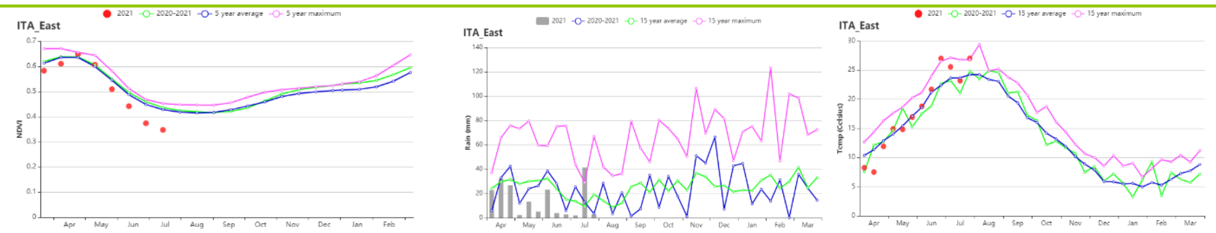
(b) Crop condition development graph based on NDVI, RAIN and TEMP (Italy).



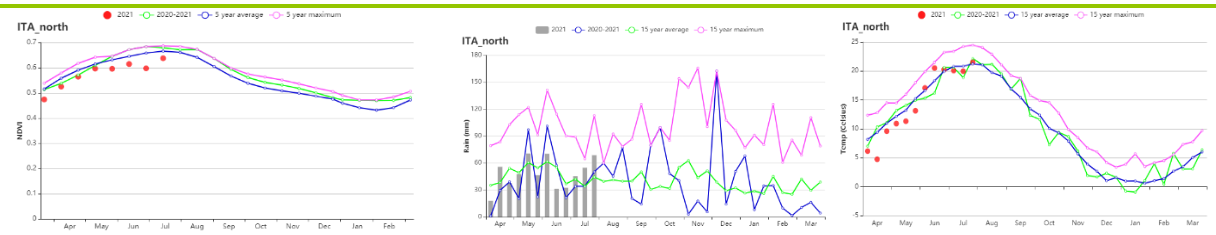
(c) Maximum VCI



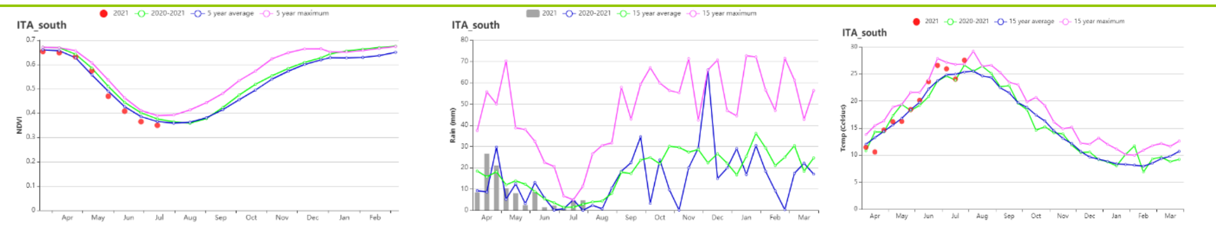
(d)Spatial distribution of NDVI profiles



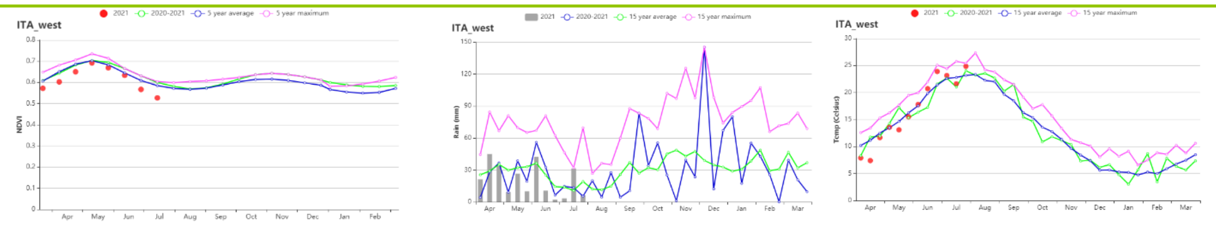
(e) Crop condition development graph based on NDVI, RAIN and TEMP (East Italy).



(f) Crop condition development graph based on NDVI, RAIN and TEMP (Po Valley).



(g) Crop condition development graph based on NDVI, RAIN and TEMP (Ialands).



(h) Crop condition development graph based on NDVI, RAIN and TEMP (West Italy).

Table 3.35 Italy's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, April 2021-July 2021

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
East Coast	178	-37	18.1	0.2	1439	1	685	2
Po Valley	579	3	14.6	-1.0	1305	-2	536	-5
Islands	100	-12	19.6	0.3	1508	-2	665	7
Western Italy	241	-20	16.8	-0.4	1410	-1	641	2

Table 3.36 Italy's agronomic indicators by sub-national regions, current season's values and departure from 5YA, April 2021-July 2021

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current (%)
East Coast	98	-1	0.88
Po Valley	100	0	0.87
Islands	98	0	0.91
Western Italy	100	0	0.87

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

[KAZ] Kazakhstan

This report covers the sowing and growing period of spring wheat in Kazakhstan. The crop conditions were generally below average from April to July. Compared to the 15-year average, accumulated rainfall, temperature and radiation were above average (RAIN +23%, TEMP +0.1°C, RADPAR +2%). The dekadal precipitation was above the 15-year maximum in early and mid July. The dekadal temperature reached the 15-year maximum in May and early July. The favorable agro-climatic conditions resulted in an increase in the BIOMSS index by 7%.

However, the national average maximum VCI index was 0.69 and the Cropped Arable Land Fraction (CALF) went down by 13% over the recent five-year average. The spatial VCIx map matched well with the national crop condition development graphs. Due to the impact of continual rainfall deficits from April to June and the high temperature in May, about 84.7% of croplands experienced unfavorable crop conditions from April to July. About 16.3% of croplands, which were distributed in some areas of the Kostanay, Soltustik kazakstan, and Akmola states in central northern region, and some parts of Batysdy kazakstan state in the northwest region, experienced favorable crop conditions in May and June.

Overall, due to the drought during the planting and main growth period of spring wheat, the crop output in this season is estimated to be below average.

Regional analysis

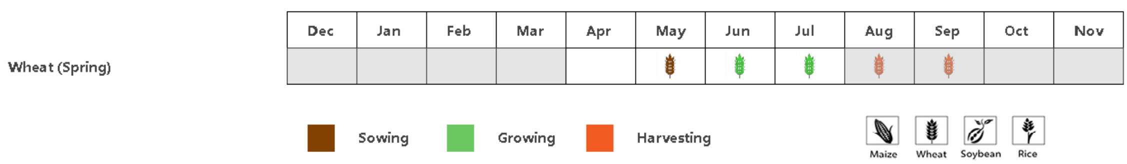
Based on cropping systems, climatic zones and topographic conditions, four sub-national agro-ecological regions can be distinguished for Kazakhstan, among which three are relevant for crop cultivation: The Northern region (112), the Eastern plateau and southeastern region (111) and the South region (110).

The **Northern region** is the main spring wheat production area. Although the accumulated rainfall was above average by 16%, the dekadal rainfalls from April to June were mostly below average. According to NDVI profiles, crop conditions were below average during the monitoring period. The average VCIx for this region was 0.67, and the proportion of cultivated land was 15% lower than the average. The spring wheat production is estimated to be below average.

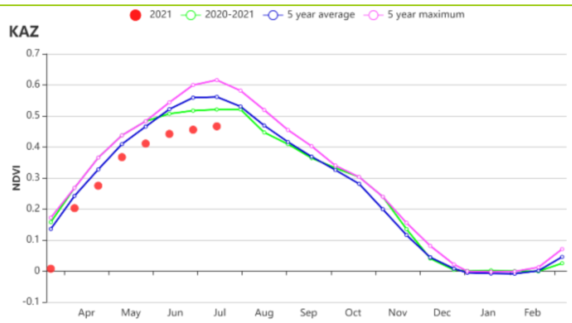
The **Eastern plateau and Southeastern region** had the largest precipitation departure (RAIN +32%) among three regions, while temperature was below average (TEMP -0.6°C). Crop conditions in this region were below average during this reporting period. The average VCIx for this region was 0.83, and CALF was below average by 9%. Outputs for spring wheat are unfavorable.

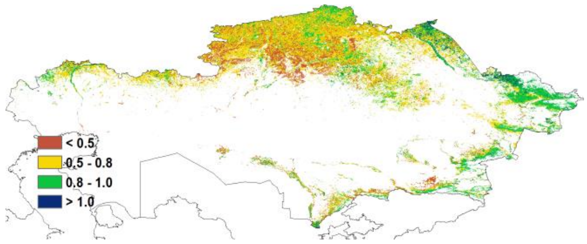
The **South region** received 100 mm of rainfall, which was lowest among the three regions. Temperature and radiation were above average. The average VCIx for this region was 0.67 and CALF was below average by 14%. The NDVI profiles show poor crop condition from April to July.

Figure 3.23 Kazakhstan's crop condition, April -July 2021

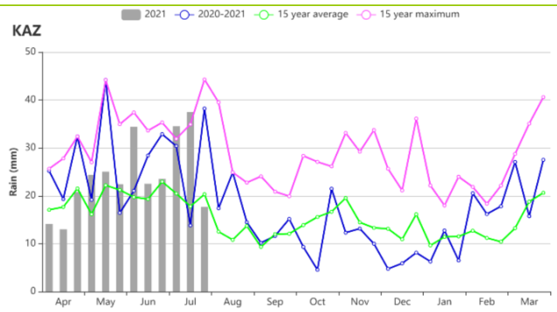


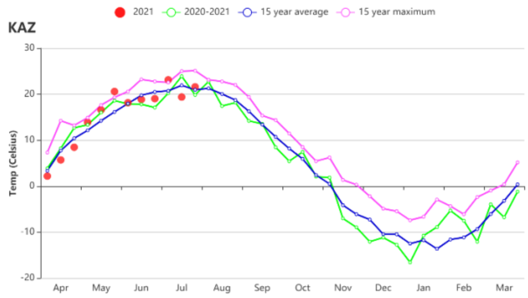
(a). Phenology of major crops



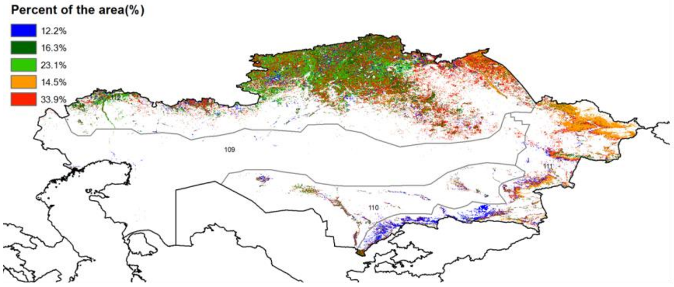


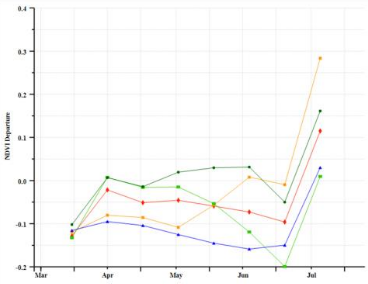
(b) Crop condition development graph based on NDVI (c) Maximum VCI



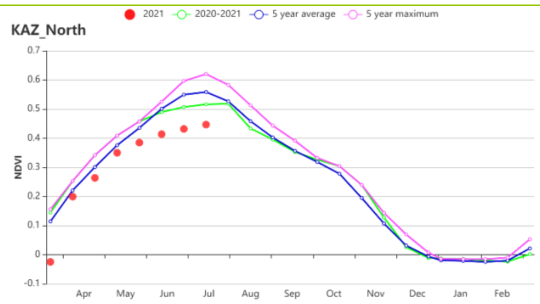


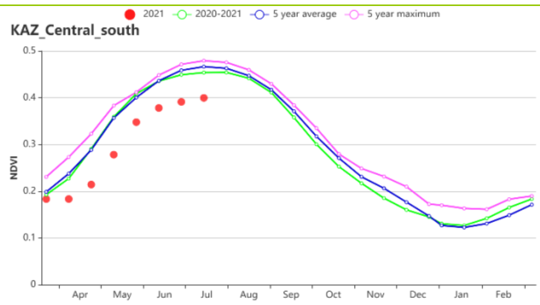
(d) Rainfall Index (e) Temperature Index





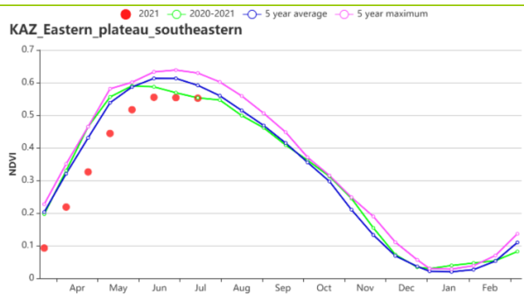
(f) Spatial NDVI patterns compared to 5YA (g) NDVI profiles





(h) Crop condition development graph based on NDVI (North region)

(i) Crop condition development graph based on NDVI (South region)



(j) Crop condition development graph based on NDVI (Eastern plateau and southeastern region)

Table 3.37 Kazakhstan agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, April - July 2021

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m^2)	Departure from 15YA (%)	Current (gDM/m^2)	Departure from 15YA (%)
Northern region	244	16	15.6	0.4	1297	3	595	10
Eastern plateau and southeastern region	431	32	14.4	-0.6	1439	1	562	1
South region	100	6	22.8	0.4	1540	2	730	4

Table 3.38 Kazakhstan, agronomic indicators by sub-national regions, current season's values and departure from 5YA, April - July 2021

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Northern region	4	-47	0.63
Eastern plateau and southeastern region	14	-69	0.51
South region	2	-76	0.54

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

[KEN] Kenya

Kenya has two rainy seasons. The long rainy season lasts from March to May and the short rainy season lasts from October to December. Maize can be grown during the long and short rains, whereas wheat is grown during the long rains only. During the monitoring period from April to July 2021, the short rain maize has been harvested, the sowing of long rain maize has started and wheat sowing starts in May.

At the national scale, precipitation was 546 mm, 12% below average. The weather was slightly cooler (TEMP -0.2°C) and RADPAR was slightly above the 15YA (+3%). The BIOMSS was 1% lower than average. According to the national rainfall profiles, the 10-day accumulations of rainfall presented conditions that were close to the 15YA in April and May but significantly below average in June and July. At the sub-national level, almost all regions received less rainfall and the eastern coastal region had the largest negative departure in rainfall compared with the 15YA (RAIN -26%).

The NDVI development graph at the national level shows lower-than-average NDVI values from April to July. Crop growth condition was significantly below average since June, mainly due to delayed maize planting caused by drought conditions. Significantly lower-than-average precipitation in May and June may have also affected the sowing of wheat in the north. According to the NDVI clusters map and the NDVI departure profiles, western Kenya accounting for 54% of national cropland (areas in red color) had near-average NDVI values, while other areas showed significant deviations in crop growth. This was in agreement with the maximum VCI graph which shows relatively low VCI between 0.5 and 0.8 in the central and southeastern regions. The national average VCI value reached 0.82, and the cropped arable land fraction remains virtually unchanged as compared to the 5YA. In general, crops in Kenya were severely affected by the drought, with the exception of the north-western region.

Regional analysis

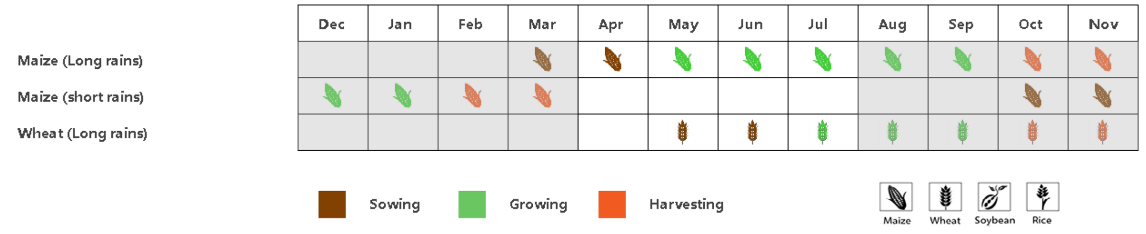
The largest negative departure in RAIN was observed in the Eastern coastal region, with average TEMP and 5% above average RADPAR. The shortage of rainfall resulted in a significant drop of NDVI compared with the 5YA throughout the monitoring period. The drought conditions also hampered the sowing of crops as indicated by a 10% drop in CALF compared to the 5YA. The maximum VCI was only 0.68, the lowest among the four AEZs in Kenya. In general, the crop condition was unfavorable in the coastal area with poor perspectives for livestock and crop production.

The Highland agriculture zone recorded 582 mm of rain, which was below the 15YA (-11%). In combination with lower temperatures (TEMP -0.2°C) and higher RADPAR (+3%), a lower estimate for biomass resulted (-2%). The NDVI remained below the 5YA from April to July. The maximum VCI value recorded was 0.82. The CALF increased by 2% to 97%. Overall, crop growth has been severely affected by drought conditions in the upland agricultural areas where rainfall was below average.

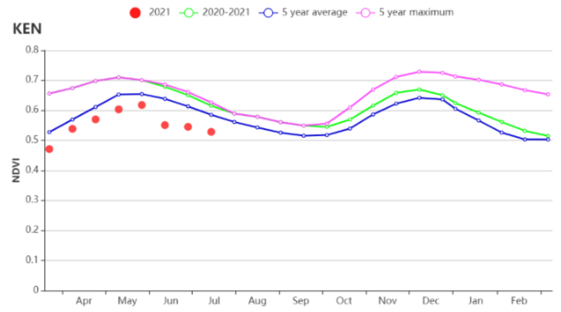
Agro-climatic indicators in the Northern rangelands region with sparse vegetation were similar to those in the Eastern coastal region. Precipitation was significantly below average at 368 mm, decreasing by 17%. Temperature was close to the 15YA, whereas RADPAR was above average (+1%). BIOMSS was below average (-2%). The below-average trend of its crop condition development graph indicates that the region is affected by drought. The maximum VCI was normal at 0.73. CALF was unchanged.

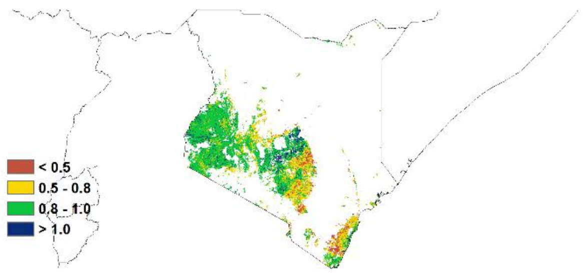
The Southwest region includes the districts Narok, Kajiado, Kisumu, Nakuru, and Embu. The following indicator values were observed: RAIN 851 mm (-16%); TEMP 18.3°C (-0.5°C); RADPAR and BIOMSS both slightly improved. CALF was unchanged and VCIx was 0.90. The crop conditions were normal. NDVI values generally closely followed the five-year average. Despite the large variation in precipitation, its biomass, CALF and RADPAR all increased and the VCIx value remained at a level of 0.9. This indicates normal crop growth in this region.

Figure 3.24 Kenya's crop condition, April- July 2021

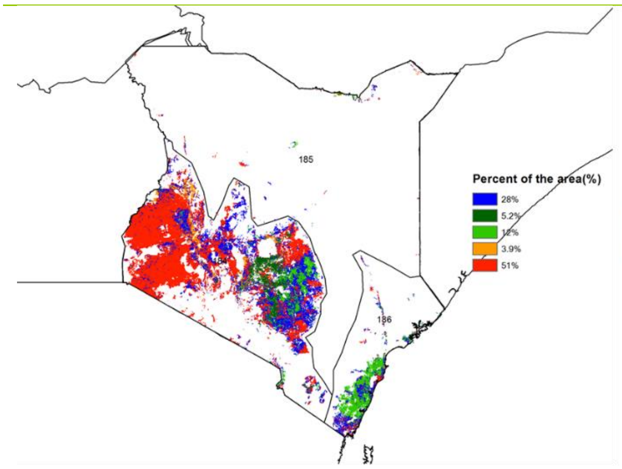


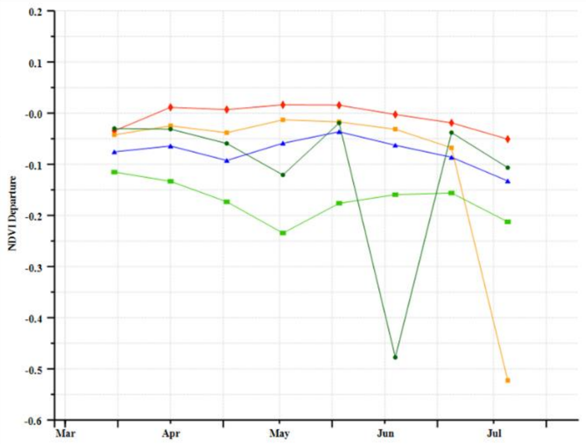
(a) Phenology of major crops



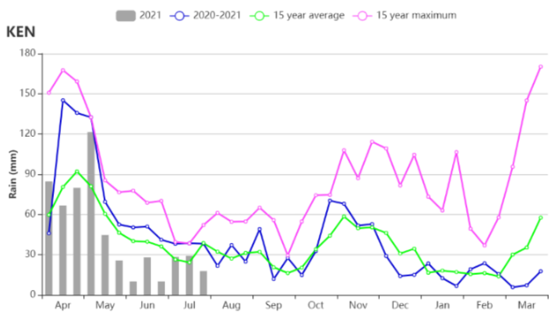


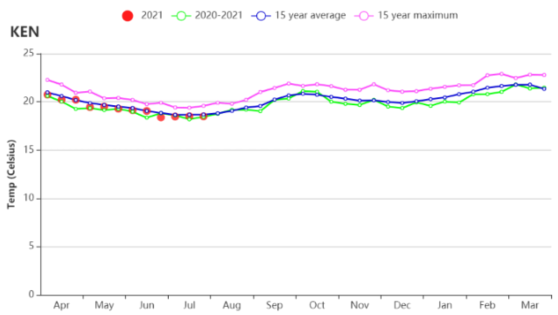
(b) Crop condition development graph based on NDVI (c) Maximum VCI



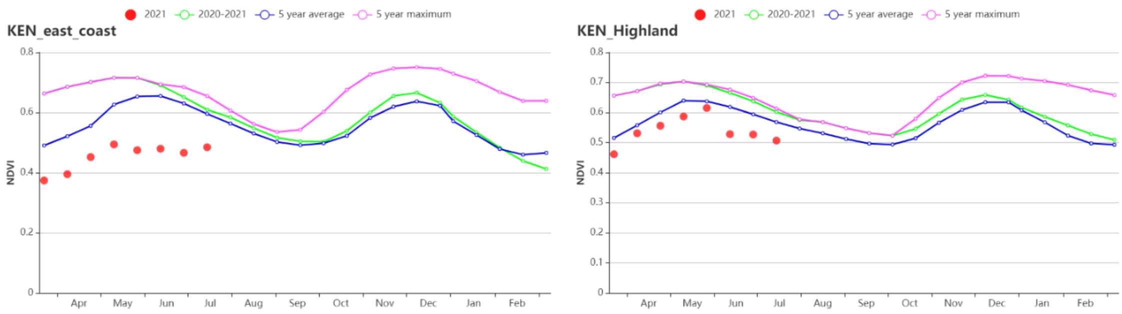


(d) Spatial NDVI patterns compared to 5YA (e) NDVI profiles

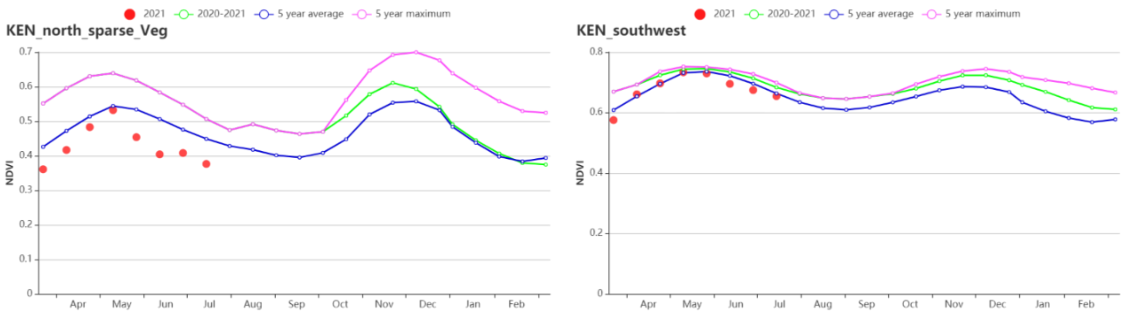




(f) Rainfall profiles (g) Temperature profiles



(h) Crop condition development graph based on NDVI, The eastern coastal region (left), The Highland agriculture zone (right)



(i) Crop condition development graph based on NDVI, the northern region with sparse vegetation (left), South-west (right)

Table 3.39 Kenya's agro-climatic indicators by sub-national regions, current season's values and departure from 15YA, April-July 2021

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m2)	Departure (%)	Current (gDM/m2)	Departure (%)
Coast	243	-26	24.9	0.0	1198	5	765	3
Highland agriculture zone	582	-11	18.0	-0.2	1114	3	507	-2
nothern rangelands	368	-17	22.5	-0.1	1205	1	673	-2
South-west	851	-16	18.3	-0.5	1220	5	587	2

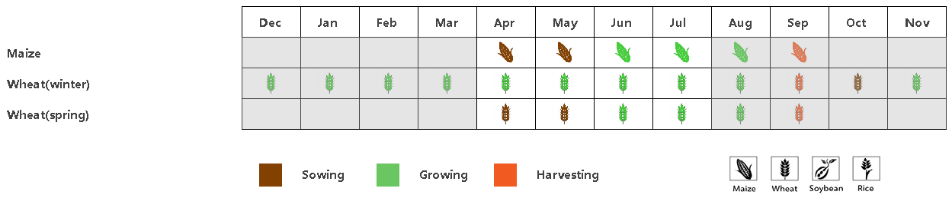
Table 3.40 Kenya's agronomic indicators by sub-national regions, current season's values and departure, April-July 2021

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Coast	88	-10	0.68
Highland agriculture zone	97	2	0.82
nothern rangelands	80	0	0.73
South-west	100	0	0.90

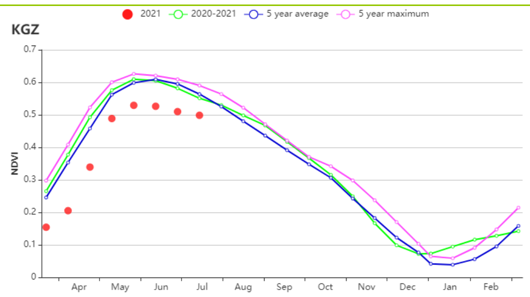
[KGZ] Kyrgyzstan

The reporting period covers the sowing and growing stages of maize, and the growth and harvest of wheat. Among the CropWatch agro-climatic indicators, RAIN (+12%) and RADPAR (+2%) were above average, while TEMP (-0.2°C) was slightly below average. The combination of the factors resulted in an above-average BIOMSS (+2%) compared to the 15YA. As we can see from the time series rainfall profile, the precipitation was above the 15-year average in early May, late May, middle June and early July. From the time series temperature profile, the temperature was lower than the 15YA in April, middle May, middle to late June and middle July. The lower temperature was favorable for pastures, but due to the lack of heat, the glaciers were melting more slowly resulting in a hydrological drought caused by low water levels in the rivers, which influences irrigation. Slightly unfavorable agro-climatic conditions in the early part of the monitoring period affected the growth of wheat and maize to some extent. Therefore, the nationwide crop conditions were below average throughout the whole monitoring period. The spatial NDVI clustering profile shows that all of the cultivated regions suffered from below-average crop conditions from the beginning of the monitoring period to early June. Then, 21.7% of the cropped areas (marked in red) firstly recovered to above-average crop conditions in middle June, mainly located in the southwestern part of Jalal-Abad region and in the northwestern part of Osh region. By the end of the monitoring period, there was only 21.7% of the cropped areas (marked in red) remaining near-average crop conditions. All the other clustered regions had below-average crop conditions throughout the country. The spatial pattern of maximum Vegetation Condition Index (VCIx) was in accord with the spatial distribution of the NDVI profiles. CALF decreased by 3% and the nationwide VCIx average was 0.81. Crop conditions in Kyrgyzstan can be assessed as fair. Close-to-average wheat yields can be expected. Maize harvest will start in September.

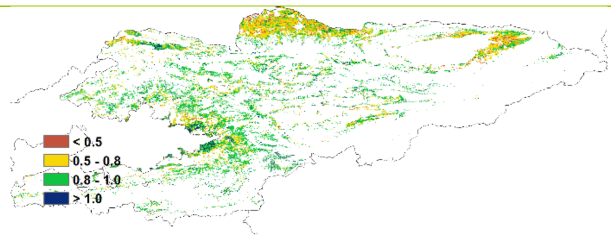
Figure 3.25 Kyrgyzstan's crop condition, April - July 2021



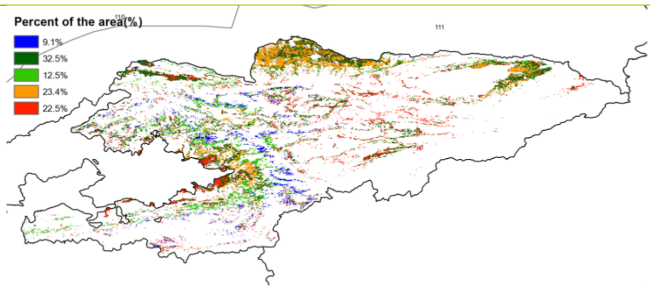
(a). Phenology of major crops



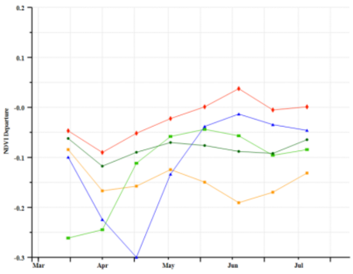
(b) Crop condition development graph based on NDVI



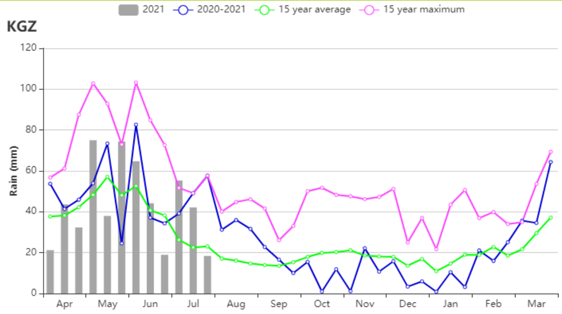
(c) Maximum VCI



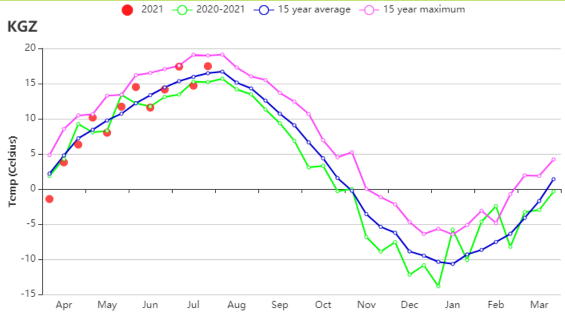
(d) Spatial NDVI patterns compared to 5YA



(e) NDVI profiles



(f) Time series rainfall profile



(g) Time series temperature profile

Table 3.41 Kyrgyzstan agro-climatic indicators, current season's values and departure from 15YA, April - July 2021

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m²)	Departure from 15YA (%)	Current (gDM/m²)	Departure from 15YA (%)
Kyrgyzstan	528	12	10.7	-0.2	1508	2	467	2

Table 3.42 Kyrgyzstan agronomic indicators, current season's values and departure from 5YA, April - July 2021

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure from 5YA (%)	Current
Kyrgyzstan	94	-3	0.81

[KHM] Cambodia

The wet season in Cambodia usually lasts from May to October, which is the primary production period for the main crops. Within this monitoring period, the harvest of early rice (dry season) and dry season maize was completed in April and the maturation of soybean started in July. Early rice (wet season) and wet season maize started to be planted in May, followed by the floating rice and medium rice.

Cambodia generally experienced normal agro-climatic conditions compared to the past 15 years. As the agro-climate indicators show, the rainfall for the country was slightly higher than average (RAIN, +3%) and the temperature (TEMP) was about average. Moreover, the radiation was above average as well (RADPAR, +5%), which contributed to an above-average predicted biomass (BIOMSS, +6%). Cambodia had experienced several natural disasters during the monitoring period, including strong winds and heavy downpours in early May and heavy rain mixed with strong winds brought by the typhoon Cempaka in late July. The cropped arable land fractionwas slightly higher than average (CALF, +2%), and the maximum VCI value was at 0.88, which indicates the crop conditions were close to average.

According to the NDVI profile for the country, the initial NDVI values were lower than the average of the previous 15 years, which is inferred to be the consequence of the below-average precipitation in March and early April, and then they recovered to the average level in the early May with an increasing rainfall. However, the NDVI values began to decline in early July and remained below the average level, which may have been due to the impact of Cempaka. The spatial patterns of the NDVI profiles show that about 14.3% of crop land (shown by the dark green, mainly located in southwest of the Kampong Cham) had an NDVI that was around 0.1 below average during the whole reporting period. For about 17.7% of crop land (shown by the red color), the NDVI values were higher than average by more than 0.1 in May and June. This indicates that the soybean condition was favorable in Prey Veng.

Regional analysis

Based on cropping systems, climatic zones and topographic conditions, four sub-national regions are described below: The **Tonle Sap Lake area** where the seasonally inundated freshwater lake and especially temperature are influenced by the lake itself, **the Mekong valley between Tonle Sap and Vietnam border**, **Northern plain and northeast**, and **the Southwest Hilly region** along the Gulf of Thailand coast.

For the **Tonle Sap Lake area**, compared to the average condition, the rainfall was higher (RAIN, +4%) and the temperature was close to the average (TEMP, +0.1℃). In the meanwhile, the radiation increased above the average level (RADPAR, +4%). The agro-climatic conditions mentioned above were beneficial to the growth of the crops and thus the predicted biomass increased by 5% above the 15YA. According to the NDVI profile, NDVI values were close to the average of the past 5 years before mid-June, when they started to drop slightly below the average.

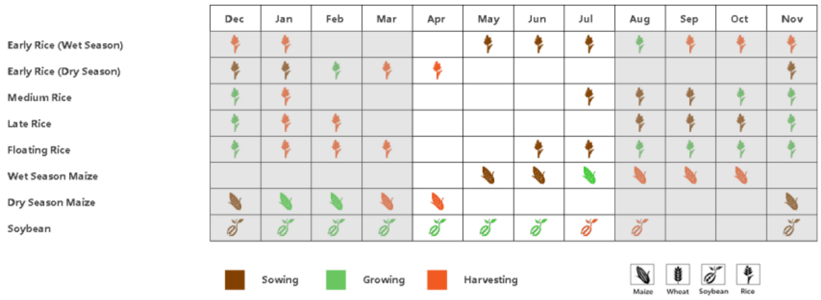
As the main rice growing area of Cambodia, the **Mekong valley between Tonle Sap and Vietnam border** recorded a decreased precipitation (RAIN, -7%), near-average temperature (TEMP) and above-average radiation (RADPAR, +5%). As a result, the predicted biomass was higher than average by 6%. However, as shown by the NDVI profile, the NDVI values were lower than average after the mid-June, which was inferred to be caused by the delay of sowing of early wet-season rice.

The **Northern plain and northeast** experienced a wetter (RAIN, +9%) and slightly cooler (TEMP, -0.1℃) weather compared to the 15YA. The radiation for the region increased (RADPAR, +7%), and the resulted biomass was predicted 8% higher than average (BIOMSS, +8%). The recorded NDVI values for the region was below average for the whole reporting period, especially in mid-May and late July, which is considered as the consequence of the strong winds and heavy downpours in May and the typhoon Cempaka in July.

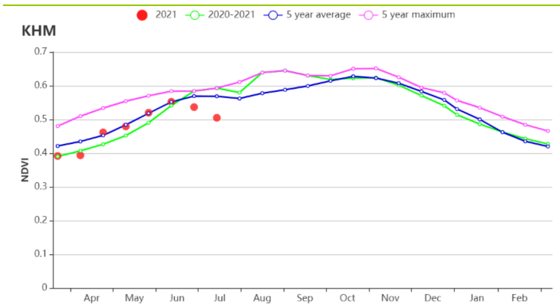
For the **region of Southwest Hilly**, the precipitation was 2% higher than average (RAIN, +2%) , accompanied by near-average temperature (TEMP, +0.2℃) and above-average radiation (RADPAR, +3%), which resulted in an increase for biomass (BIOMSS, +4%). The cropped arable land fraction remained close to the average

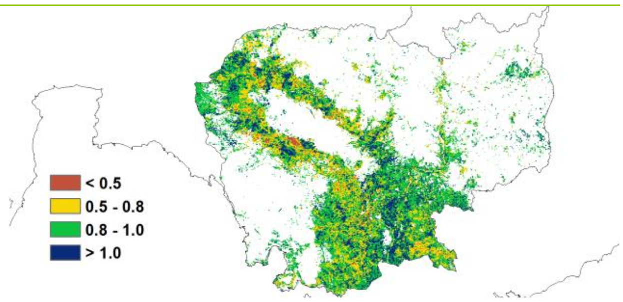
(CALF, 99%), and the maximum VCI for the region was at 0.91. However, the NDVI values for the region were slightly lower than average, which means the crop conditions for the region were near average.

Figure 3.26 Cambodia's crop condition, April - July 2021

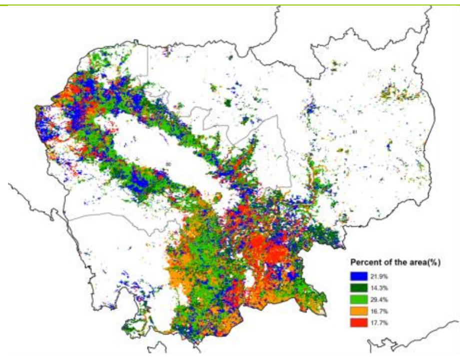


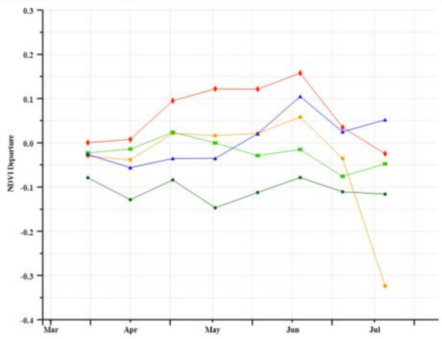
(a) Phenology of major crops



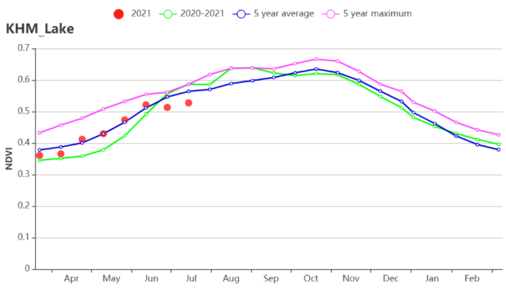


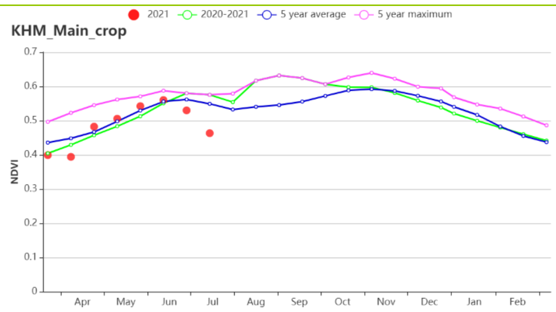
(b) Crop condition development graph based on NDVI (c) Maximum VCI



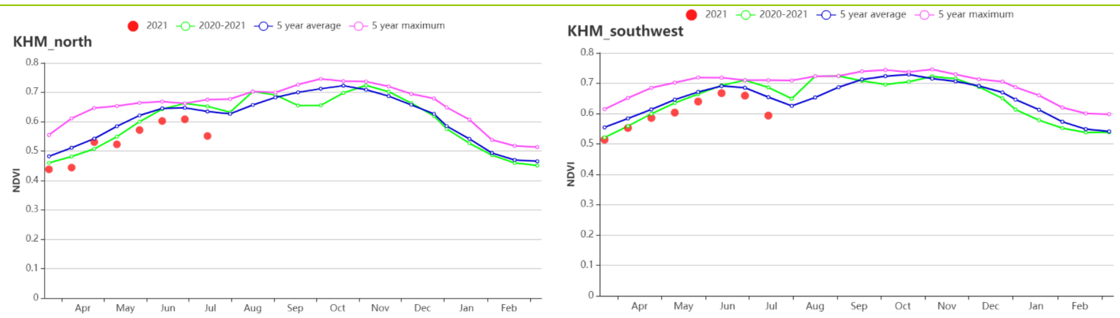


(d) Spatial NDVI patterns compared to 5YA (e) NDVI profiles





(f) Crop condition development graph based on NDVI_Tonle-sap (left) and NDVI_Mekong valley (right)



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

Table 3.43 Cambodia's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, April - July 2021

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m²)	Departure from 15YA (%)	Current (gDM/m²)	Departure from 15YA (%)
Tonle-sap	890	4	27.3	0.1	1221	4	831	5
Mekong valley	906	-7	27.3	0.0	1235	5	844	6
Northern plain and northeast	1320	9	26.7	-0.1	1220	7	826	8
Southwest Hilly region	1047	2	25.7	0.2	1228	3	846	4

Table 3.44 Cambodia's agronomic indicators by sub-national regions, current season's values and departure from 5YA, April - July 2021

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure from 5YA (%)	Current
Tonle-sap	95	2	0.87
Mekong valley	93	**2**	0.89
Northern plain and northeast	98	0	0.87
Southwest Hilly region	99	0	0.91

[LKA] Sri Lanka

This report covers the second season (Yala) sowing of rice and maize in June and July. According to the CropWatch indicators, crop conditions were normal for the period from April to July.

This period is dominated by the south-western monsoon, which is active between May and September. At the national level, precipitation significantly increased (RAIN +40%) and radiation also increased (RADPAR +1%), while temperature (TEMP -0.3℃) experienced a slight decrease as compared to the 15-year average (15YA). The increase in rainfall mainly happened in May. As shown on the NDVI development graph, NDVI values were always near average from April to May and slightly above average in early June and below average in July compared to the 5-year average (5YA). The fraction of cropped arable land (CALF) was 1% above the recent five-year average. Potential biomass was 2% above the 15YA. The maximum VCI (VCIx) for the whole country was 0.95.

As shown by the NDVI clusters map at the national level, 40.8% of cropland showed above-average condition from April to July. 7.8% of cropland showed a large decline of NDVI values in late May and early July, as well as 7.2% in late July, which may have been an outlier due to cloud cover. Overall, prospects for crop production are normal.

Regional analysis

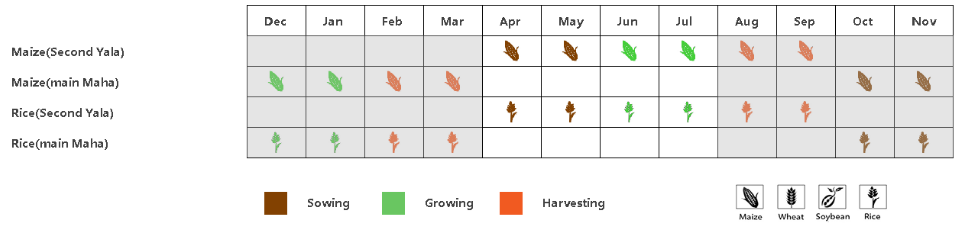
Based on the cropping system, climatic zones and topographic conditions, three sub-national agroecological regions can be distinguished for Sri Lanka. They are the **Dry zone**, the **Intermediate zone**, and the **Wet zone**.

In the **Dry zone**, the recorded rainfall (RAIN 629 mm) was 50% above average, which could meet the water demand of maize growing in this region. The temperature was below average (TEMP -0.4℃) with increased radiation (RADPAR +2%) and above-average potential biomass (BIOMSS +3%) compared with the 15-year average. CALF was 2% up compared to the 5YA level and cropland was near fully utilized. NDVI followed a similar trend as the whole country. The VCIx for the zone was 0.94. Overall, crop conditions were close to the average for this zone.

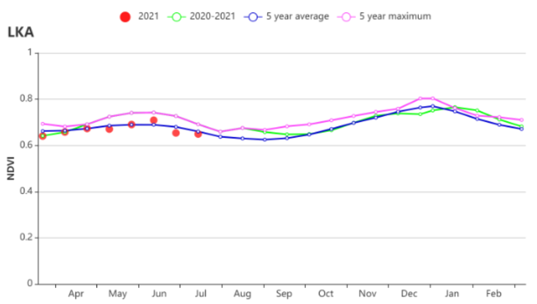
The **Intermediate zone** went through the rainy season during this monitoring period. Rainfall (RAIN 1358 mm) was up by 46% when compared to the 15YA. Temperature, radiation and potential biomass were below average (TEMP -0.4℃, RADPAR -1% and BIOMSS -1%). NDVI followed a similar trend as the whole country. The VCIx value for the zone was 0.96. Overall, crop conditions were average for this zone.

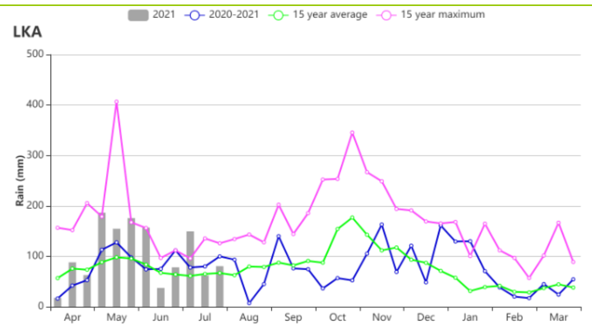
The **Wet zone** also experienced an abundant precipitation (RAIN 2534 mm), 34% above the 15YA. This is more than sufficient for rice and maize. The temperature was down by 0.1°C compared to the 15YA with radiation close to the 15YA. With full use of cropland, potential biomass was close to the average for this zone. NDVI values were below average except for near average in early May and above average in late June. The VCIx value for the zone was 0.96. Crop conditions were assessed as close to the average for this zone.

Figure 3.27 Sri Lanka's crop condition, April-July 2021

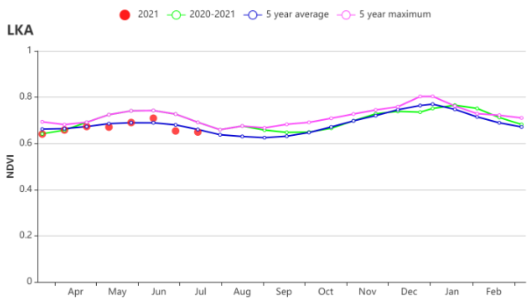


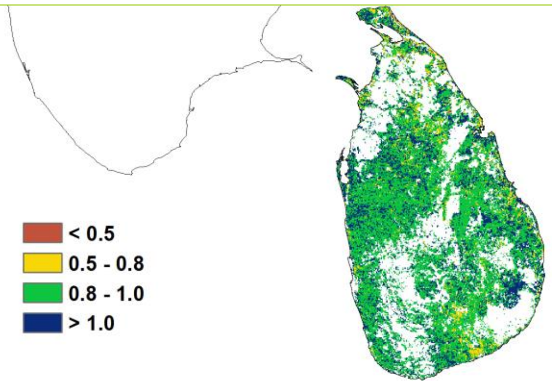
(a) Phenology of major crops



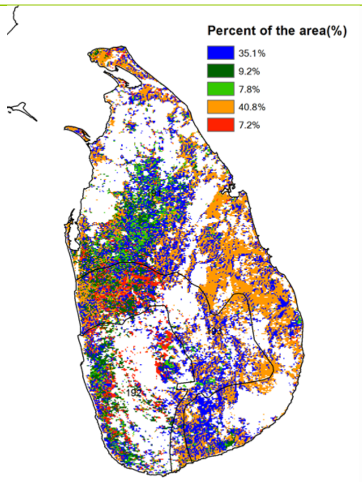


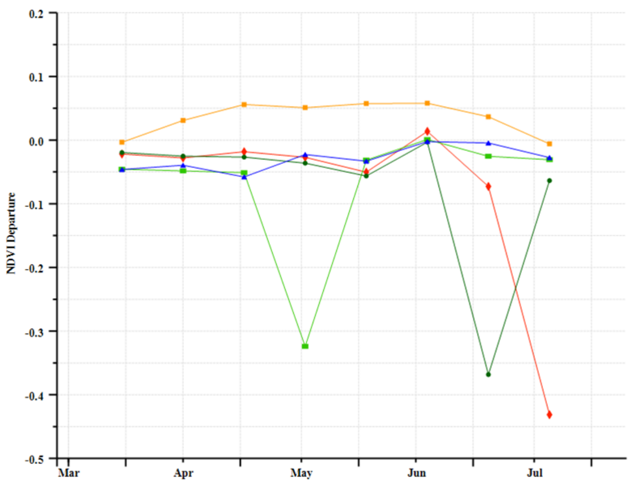
(b) Crop condition development graph based on NDVI (c) Rainfall profile





(d) Temperature profile (e) Maximum VCI

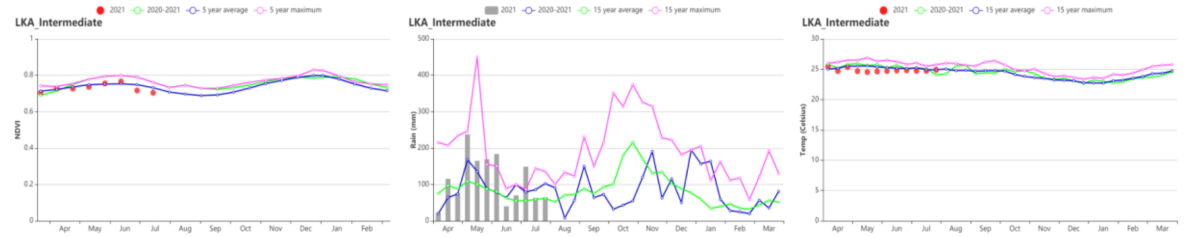




(f) Spatial NDVI patterns compared to 5YA (g) NDVI profiles

(h) Dry zone crop condition development graph based on NDVI (left), time series rainfall profiles (middle) and temperature (right)

(i) Wet zone crop condition development graph based on NDVI (left), time series rainfall profiles (middle) and temperature (right)



(j) Intermediate zone crop condition development graph based on NDVI (left), time series rainfall profiles (middle) and temperature (right)

Table 3.45 Sri Lanka's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, April-July 2021

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Dry zone	629	50	27.4	-0.4	1340	2	872	3
Intermediate zone	1358	46	24.8	-0.4	1186	-1	764	-1
Wet zone	2534	34	24.7	-0.1	1177	0	793	0

Table 3.46 Sri Lanka's agronomic indicators by sub-national regions, current season's values and departure from 5YA, April-July 2021

Region	Cropped arable land fraction		Maximum VCI
	Current	Departure (%)	Current
Dry zone	98	2	0.94
Intermediate zone	100	0	0.96
Wet zone	100	0	0.96

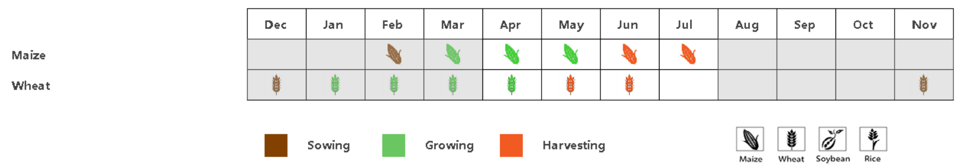
[MAR] Morocco

During this monitoring period (April-July), wheat reached maturity by the end of April. It was harvested in May and June. Maize matured by the end of May and was harvested in June and July. The cumulative rainfall was 36% above the 15-year average (15YA). The average temperature was 20.2℃, close to the 15YA. Both RADPAR and BIOMSS were slightly below the 15YA by 2% and 2%, respectively. The nationwide NDVI development graph indicates that the crop conditions were above the 5-year average (5YA) until the end of April and slightly below the 5YA during the remaining period. The NDVI spatial pattern shows that 19.1% of the cultivated area was above the 5YA crop conditions, 18.8% were below, and 62% fluctuated around the 5YA; the latter was 19% higher than the 5YA to the end of April. CALF was above the 5-year average (5YA) by 23%, with the VCIx value reaching 0.85, confirming favorable crop conditions.

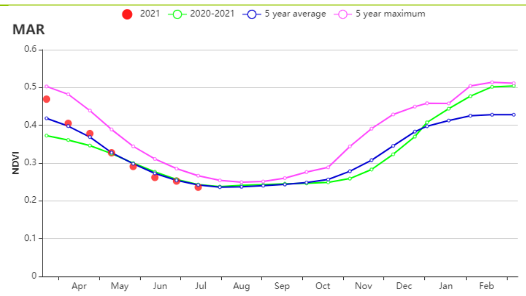
Regional analysis

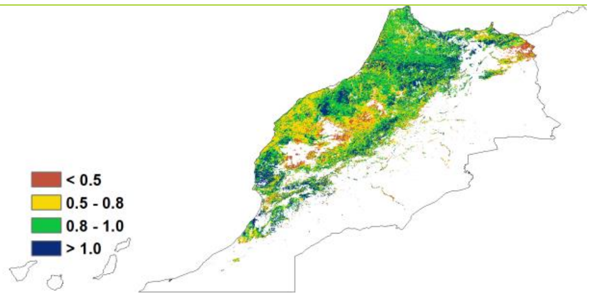
CropWatch demarcates three agro −ecological zones (AEZs) relevant for crop production in Morocco: **the Sub-humid northern highlands**, **the Warm semiarid zone**, and **the Warm subhumid zone**. In **the Sub-humid northern highlands**, rainfall and temperature were above the 15YA by 66% and 0℃, respectively. Both RADPAR and BIOMSS were below the 15YA by 3% and 1%, respectively. In **the Warm semiarid zone**, rainfall was above the 15YA by 1%. Both RADPAR and BIOMSS were below the 15YA by 2%. In **the Warm sub-humid zone**, rainfall was above the 15YA by 50%. Both RADPAR and BIOMSS were below the 15YA by 3% and 1%, respectively. The NDVI profile confirms generally good crop conditions in the three zones, as it was slightly above the 5YA in April and early May. The CALF was 23%, 28%, and 21% above the 5YA, and the VCIx was 0.89, 0.82, and 0.87, for the three zones, respectively, confirming favorable crop conditions.

Figure 3.28 Morocco's crop condition, April - July 2021



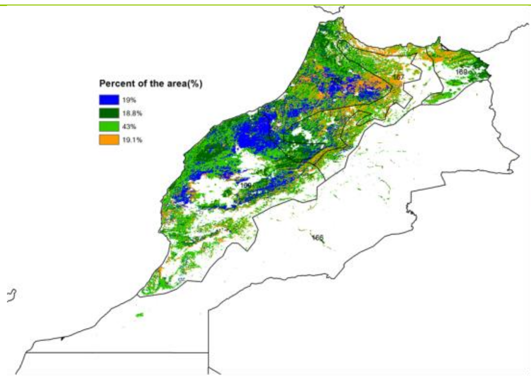
(a). Phenology of major crops



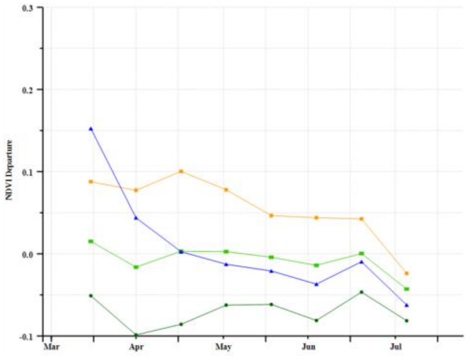


(b) Crop condition development graph based on NDVI

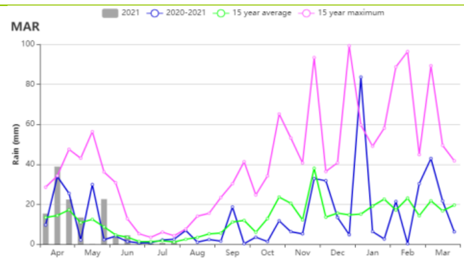
(c) Maximum VCI



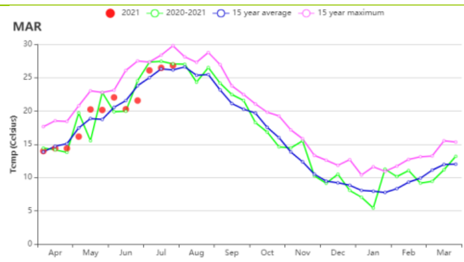
(d) Spatial NDVI patterns compared to 5YA



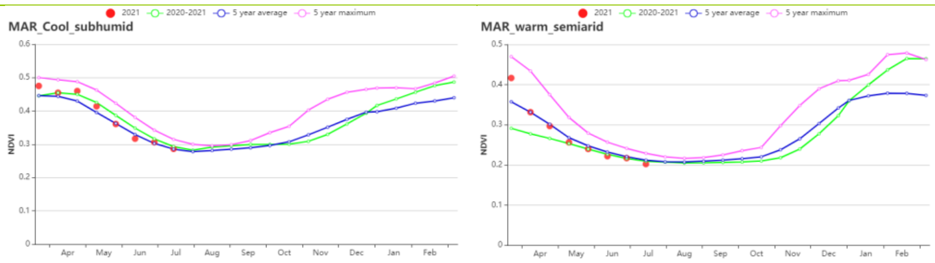
(e) NDVI profiles



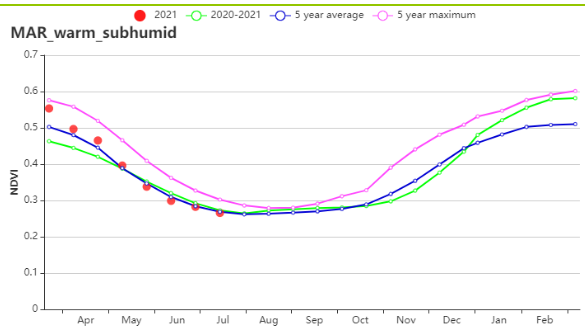
(f) Rainfall profiles



(g) Temperature profiles



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



(i) Crop condition development graph based on NDVI, Warm subhumid zones

Table 3.47 Morocco's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, April - July 2021

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m²)	Departure from 15YA (%)	Current (gDM/m²)	Departure from 15YA (%)
Sub-humid northern highlands	211	66	19.7	0.0	1523	-3	624	-1
Warm semiarid zones	63	1	20.6	0.0	1591	-2	616	-2
Warm sub-humid zones	169	50	19.8	0.0	1534	-3	657	-1

Table 3.48 Morocco's agronomic indicators by sub-national regions, current season's values and departure from 5YA, April - July 2021

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure from 5YA (%)	Current
Sub-humid northern highlands	68	23	0.89
Warm semiarid zones	26	28	0.82
Warm sub-humid zones	76	21	0.87

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

[MEX] Mexico

This report covers the production of irrigated wheat, typically sown in November and December, as well as of irrigated winter maize, sown roughly one month earlier. Maize and wheat were at the harvesting stage in March and April, respectively. Rice and soybean sowing began in April.

The CropWatch agroclimatic indicators show that TEMP and RADPAR were close to average and RAIN was above average (+17%). Accordingly, BIOMSS increased by 2% as compared to the 15YA. CALF was close to average and reached 85%. Favorable weather conditions and relatively high CALF made the VCI reach 0.93.

Some parts of Mexico had suffered the worst drought in 30 years during the 2020/21 winter season. Crop growth reported in this monitoring period was initially also affected by the drought. At the national scale, the NDVI graph was not above average until mid-July. The conditions varied greatly across the country. According to its spatial pattern, the VCIx in the south was higher than in the north. Very high values (greater than 1.0) occurred mainly in the east of the Tamaulipas and the northeast of Veracruz province. Other areas with high VCIx were scattered in the eastern coastal areas, whereas extremely low values (less than 0.5) occurred in the west and north of the country.

In April, most parts of central and northern Mexico suffered from drought. The water storage levels of the reservoirs were low and farmers had to limit irrigation. This bulletin believes that this has led to reduced planting and crop growth in northern Mexico. After April, with the gradual recovery from the drought crop growth started to reach average levels. The VCIx in other regions of Mexico was moderate, with values between 0.5 and 1.0.

As shown in the spatial NDVI profiles and distribution map, only 21.7% of the total cropped areas were positive during the entire monitoring period, mainly distributed in the south of Veracruz and Tabasco. About 59% of total cropped areas were below average, mainly in the north of Mexico.

Overall, the crop conditions in the north were below average, but reached average or above average levels in the center and south of the country.

Regional analysis

Based on cropping systems, climatic zones and topographic conditions, Mexico is divided into four agro-ecological regions. They include the **Arid and semi-arid region** (128), **Humid tropics with summer rainfall** (129), **Sub-humid temperate region with summer rains** (130) and **Sub-humid hot tropics with summer rains** (131). Regional analyses of crop conditions provide more details for the production situation in Mexico.

The **Arid and semi-arid region**, located in northern and central Mexico, accounts for about half of planted areas in the country. According to the NDVI development graph, crop condition in this region was below average before mid-July. VCIx was relatively low with a value of 0.89 and CALF increased by 4% compared with the 5YA. RAIN increased by 17% and TEMP and RADPAR were close to average. The Arid and semi-arid region was the most drought affected region and the VCIx was 0.89.

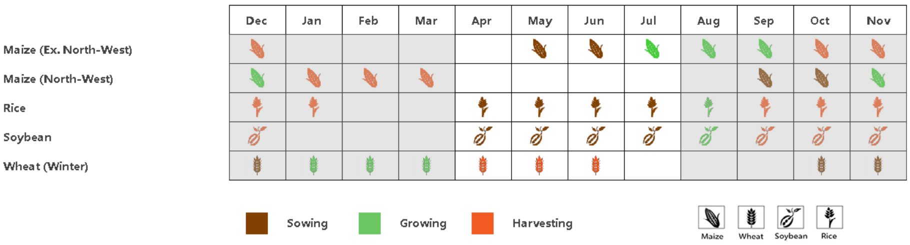
The region of **Humid tropics with summer rainfall** is located in southeastern Mexico. RAIN was significantly above average (+21%), TEMP was 0.1℃ warmer and RADPAR was near the 15YA, which resulted in an increase of BIOMSS (3%). As shown in the NDVI development graph, crop conditions were closed to average from April and July. The VCIx (0.95) confirmed favorable crop conditions in this region.

The **Sub-humid temperate region with summer rains** is situated in central Mexico. According to the NDVI development graph, crop conditions were below average in this region at the beginning of this monitoring period, but then recovered to average levels. The agro-climatic condition showed that RAIN increased by

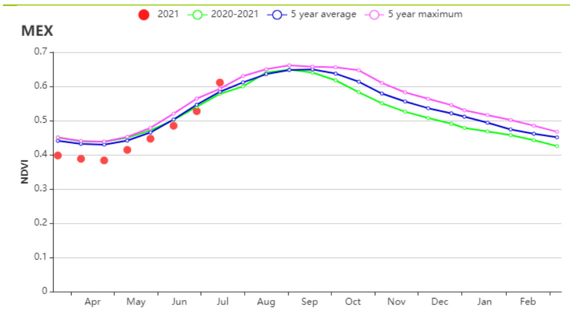
16%, TEMP decreased by 0.3, and RADPAR decreased by 2% compared to the 15YA. BIOMSS also decreased by 1% and CALF was 98%. Favorable meteorological conditions and high CALF made VCIx reach 0.96.

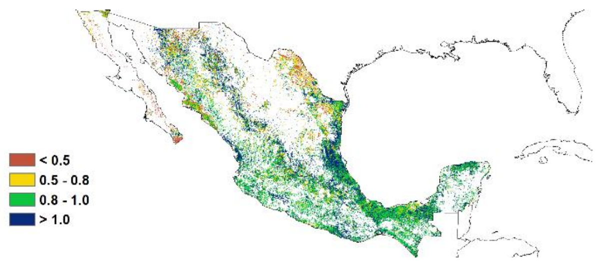
The region called **Sub-humid hot tropics with summer rains** is located in southern Mexico. During the monitoring period, crop conditions were below average between April and June, as shown by the NDVI time profiles. Agro-climatic conditions showed that RAIN was above average (+17%) while TEMP and RADPAR were near average (-0.1°C and -2% respectively). The VCIx for the region was 0.95 and BIOMSS was below average.

Figure 3.29 Mexico's crop condition, April - July 2021

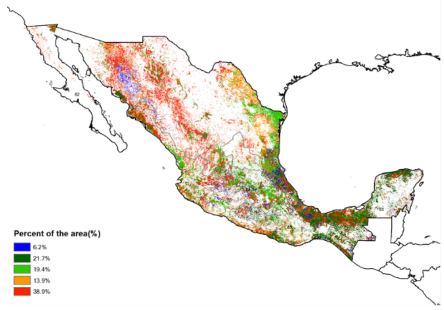


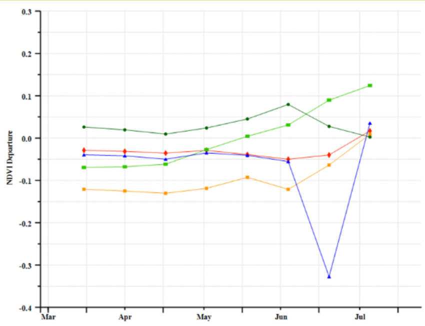
(a) Phenology of major crops



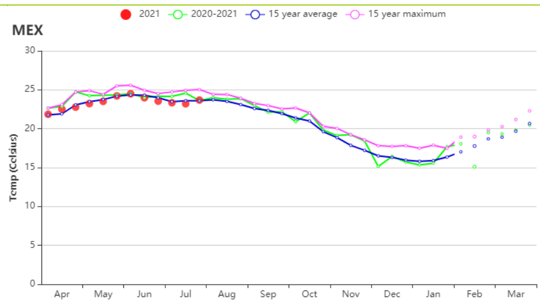


(b) Crop condition development graph based on NDVI (c) Maximum VCI

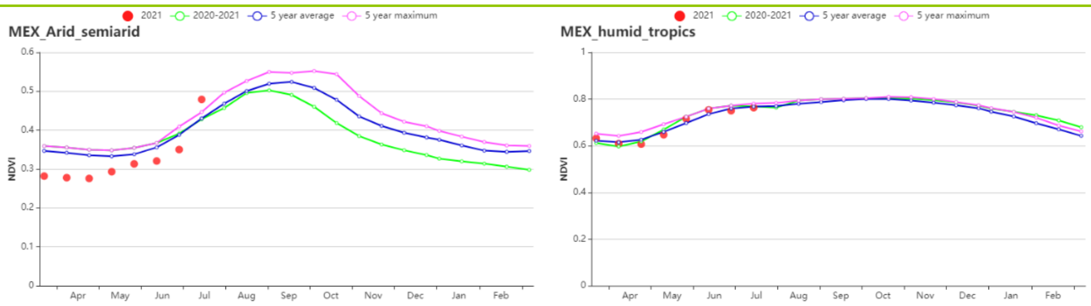




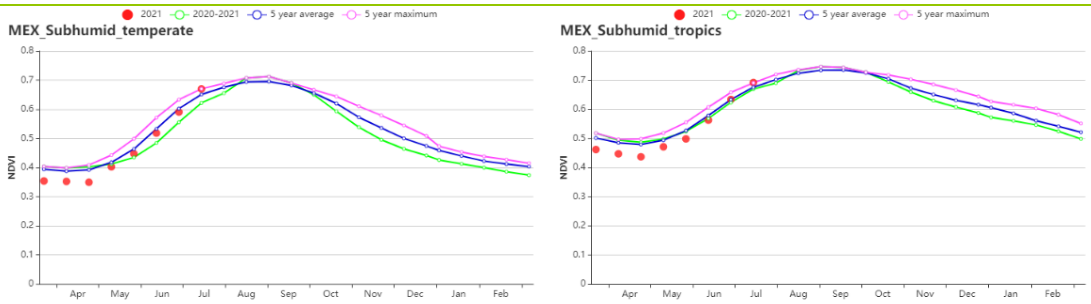
(d) Spatial NDVI patterns compared to 5YA (e) NDVI profiles



(f) Rainfall profiles (g) Temperature profiles



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



(i) 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 3.49 Mexico's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, April – July 2021

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m^2)	Departure (%)	Current (gDM/m^2)	Departure (%)
Arid and semi-arid regions	435	17	22.9	-0.1	1540	-2	712	4
Humid tropics with summer rainfall	1029	21	26.1	0.1	1386	1	902	3
Sub-humid temperate region with summer rains	839	16	20.4	-0.3	1418	-2	666	-1
Sub-humid hot tropics with summer rains	790	17	23.4	-0.1	1432	-2	714	-2

Table 3.50 Mexico's agronomic indicators by sub-national regions, current season's values and departure from 5YA, April – July 2021

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Arid and semi-arid regions	67	4	0.89
Humid tropics with summer rainfall	100	0	0.95
Sub-humid temperate region with summer rains	98	3	0.96
Sub-humid hot tropics with summer rains	97	1	0.95

[MMR] Myanmar

Myanmar produces maize, rice (two seasons) and wheat as its main crops. They are predominantly grown across the eastern mountains, central plains and the western coastal areas. The harvesting of maize was completed in April, while the second rice (summer rice) was harvested between April and June. The planting of main rice (monsoon rice) started in May and June. However, the planting period varies according to region and weather conditions. The crop condition development graph based on NDVI shows that the crop conditions during the monitoring period were lower than average in June and July.

Compared with the 15YA, TEMP was slightly higher (+0.5℃), but RAIN showed a large drop (-18%). According to its profile, the precipitation in Myanmar continued to be below average from late April to late June. At the end of the monitoring period, the precipitation had recovered and exceeded the average level. It created favorable conditions for the planting of new crops. RADPAR showed a small change (+2%), while the biomass (+6%) was slightly higher than average and the CALF was 6% below average. During the monitoring period, the maximum VCI value for the whole country was 0.85.

The spatial distribution of crop condition can be divided into two periods according to the NDVI cluster and profile maps: Before mid-May, the crop conditions trended near average. In the second period, the crop situation was more complicated: 34.4% of the cultivated area had good crop conditions, even slightly higher than the average level, mainly distributed in the western part of Mandalay, Shan State, Yangon and Magway. In the southern region of Mandalay and the central region of Magway, 20.5% of the total cultivated area had poor crop conditions in mid-June but recovered to near average by the end of July. 13.7% of the areas, mainly in the north-central Irrawaddy, had bad crop condition in early June and returned to above average by early July. The large negative departures of NDVI were presumably due to cloud cover in the satellite images. The VCIx map shows low values in the central part of the country. Overall crop conditions were below average.

Regional analysis

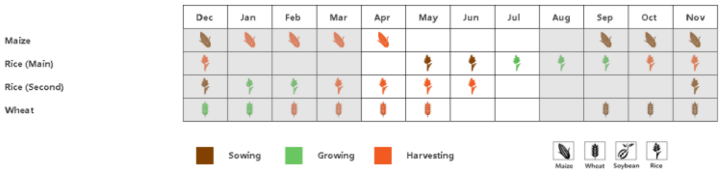
Based on the cropping system, climatic zones and topographic conditions, three sub-national agro-ecological regions (AEZ) can be distinguished for Myanmar. They are the **Coastal region, the Central plain, and the Hills region**.

The cumulative precipitation in the **Central plain** decreased significantly (RAIN -41%), TEMP was higher (+0.9℃) and RADPAR was close to average (+0%). The biomass was 4% higher than the average. The CALF was 77%. It showed that the cultivated land in this area was not fully utilized. It was 6% lower than the 5YA. NDVI was slightly below average during most of the monitoring period, and the maximum VCI value was 0.79 for this region.

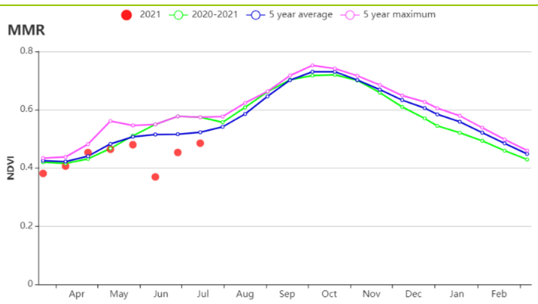
The cumulative precipitation in the **Hills region** decreased by 14% compared with the average level of the past 15 years, and the temperature was 0.4℃ higher. The CALF reached 95%, which is the highest among the agricultural areas in Myanmar. The cultivated land in this region has been fully utilized. This was the only region in which RADPAR was above average (+3%), and the biomass was slightly above average (+5%). The maximum VCI value was 0.91 for this region. The crop condition in this region was slightly below the average level.

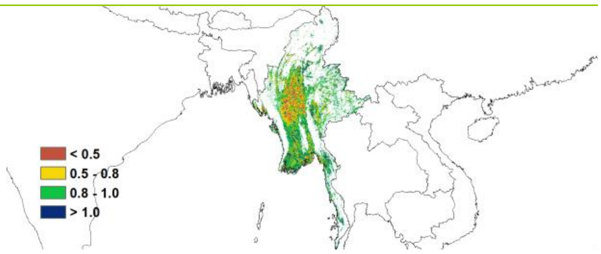
In the **Delta and Southern Coastal region**, the cumulative precipitation was below average (-13%), whereas the temperature was only 0.2℃ higher than average, and the RADPAR was close to average (-1%). CALF increased by 11% compared with the 5YA to 87%, as more cultivated land was put into use. NDVI was slightly higher than average, and the maximum VCI value reached 0.90, indicating that the crop growth in this area was relatively normal.

Figure 3.30 Myanmar 's crop condition, April-July 2021

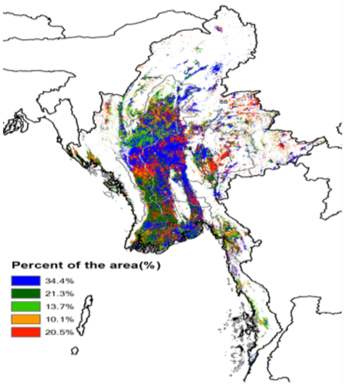


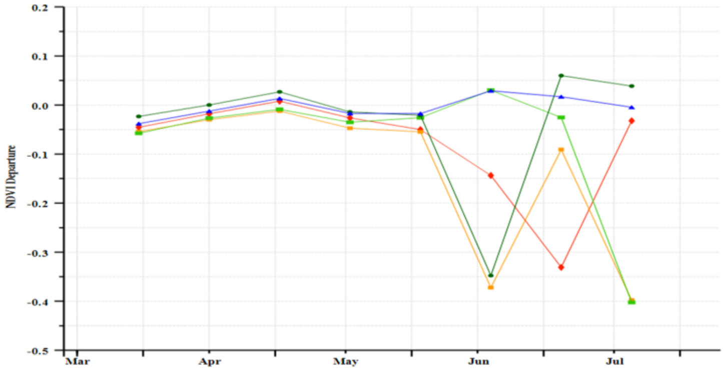
(a). Phenology of major crops





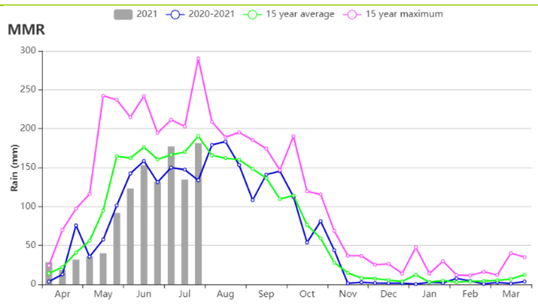
(b) Crop condition development graph based on NDVI

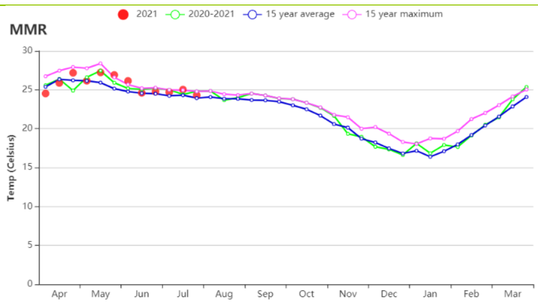




(d) Spatial NDVI patterns compared to 5YA

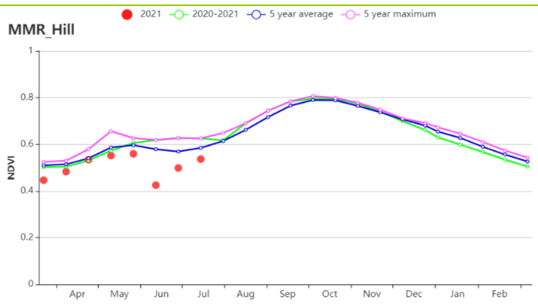
(e) NDVI profiles

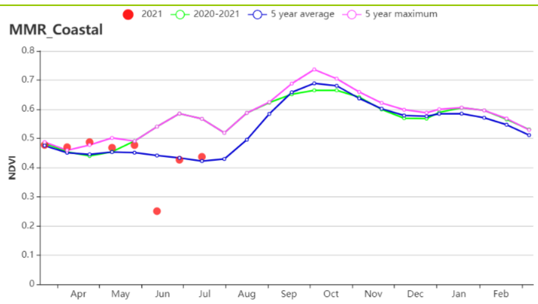




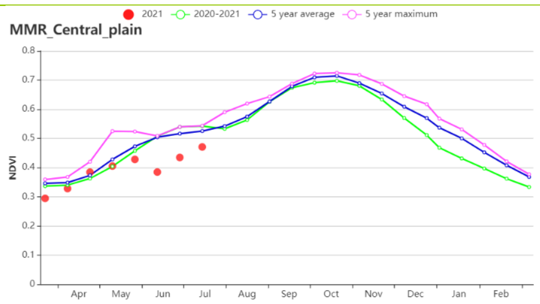
(f) Rainfall time series profile

(g) Temperature time series profile





(h) Crop condition development graph based on NDVI (Hills region (left) and Delta and Southern Coastal region (right))



（i）Crop condition development graph based on NDVI （**Central plain**）

Table 3.51 Myanmar 's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, April-July 2021

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m²)	Departure from 15YA (%)	Current (gDM/m²)	Departure from 15YA (%)
Delta and southern-coast	1512	-13	27.5	0.2	1214	-1	829	10
Central plain	546	-41	27.1	0.9	1186	0	766	4
Hill region	1334	-14	24.1	0.4	1173	3	713	5

Table 3.52 Myanmar 's agronomic indicators by sub-national regions, current season's value and departure from 5YA, April-July 2021

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure from 5YA (%)	Current
Delta and southern-coast	87	11	0.90
Central plain	77	-6	0.79
Hill region	95	0	0.91

[MNG] Mongolia

During the monitoring period, the temperature has been higher than 0℃ since April and reached the highest in July, which corresponds to the sowing and growing stage of wheat. Among the CropWatch agroclimatic indicators, RAIN was above the fifteen-year average (+45%), while TEMP and RADPAR were below average (-1.2°C and -5%). The combination of these factors resulted in a decreased BIOMSS (-10%) compared to the fifteen-year average. The national VCIx was 1.05, and the cropped arable land fraction increased by 3%. Overall, since the rainfall is abundant, the conditions for crop production are expected to be favorable.

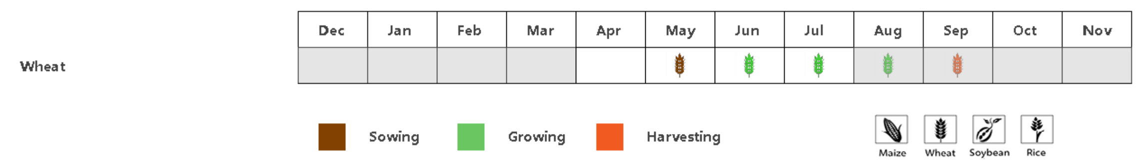
Regional analysis

Hangai Khuvsgul Region: NDVI was above the five-year average from late June to July, RAIN was above average (+43%), while TEMP and RADPAR were below average (-1.0℃ and -4%). The BIOMSS index decreased by 8% compared to the fifteen-year average, the maximum VCI index was 0.96. Overall crop prospects are normal.

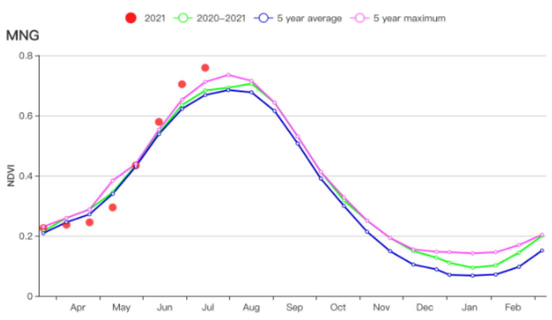
Selenge-Onon Region: Crop conditions were above the five-year average from late June to July, RAIN was above average (+51%), while TEMP and RADPAR were below average (-1.5℃ and -6%). The BIOMSS index decreased by 14% compared to the fifteen-year average. The maximum VCI index was 1.08, and the cropped arable land fraction increased by 4%. Overall, crop conditions are expected to be normal.

Central and Eastern Steppe Region: According to the NDVI development graph, crop condition in this region was below the five-year average in April, May, and late June, and above the five-year average in July. RAIN was above average (+41%), while TEMP, RADPAR, and BIOMSS were below average (-0.6℃, -4% and -5% respectively). The maximum VCI index was 1.1, and the cropped arable land fraction increased by 5%. Overall crop prospects are favorable.

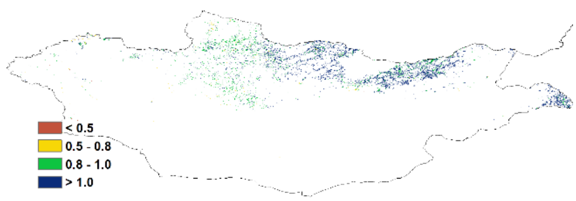
Figure 3.31 Mongolia's crop condition, April - July 2021



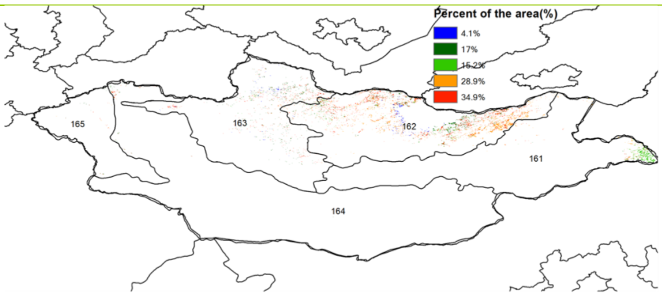
(a) Phenology of major crops

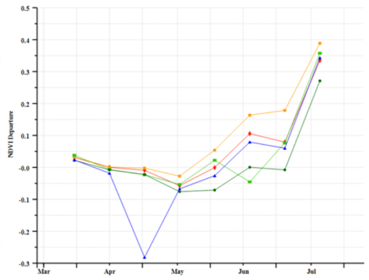


(b) Crop condition development graph based on NDVI

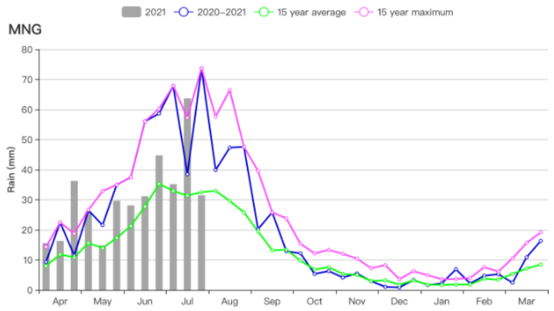


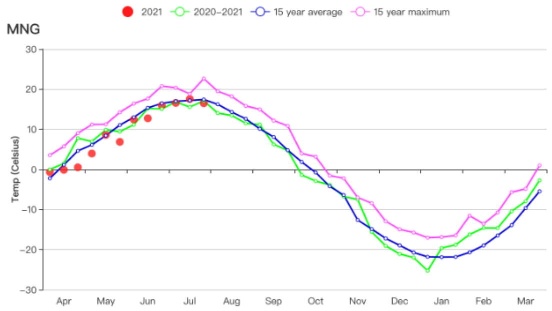
(c) Maximum VCI



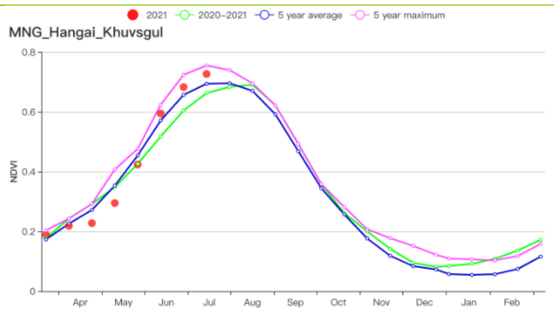


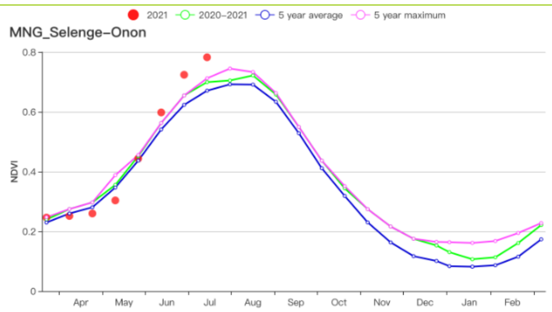
(d) Spatial NDVI patterns compared to 5YA (e) NDVI profiles



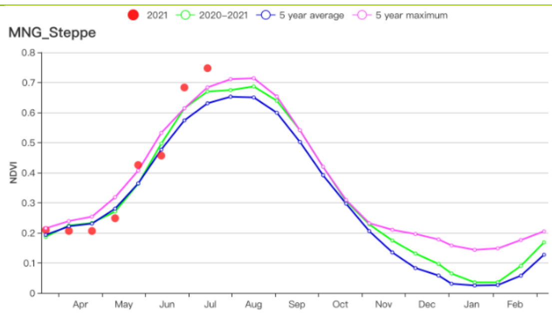


(f) Rainfall profiles (g) Temperature profiles

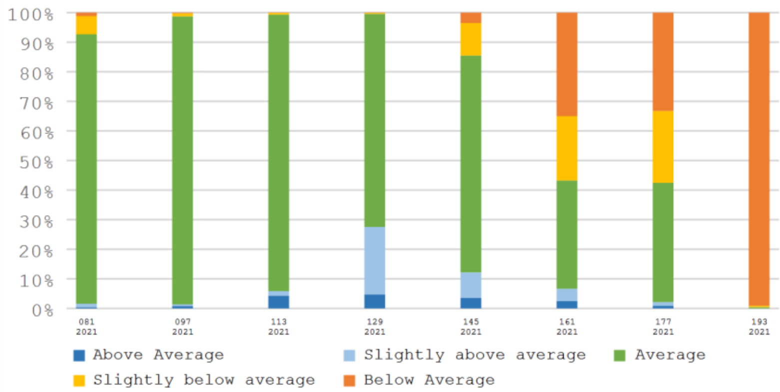




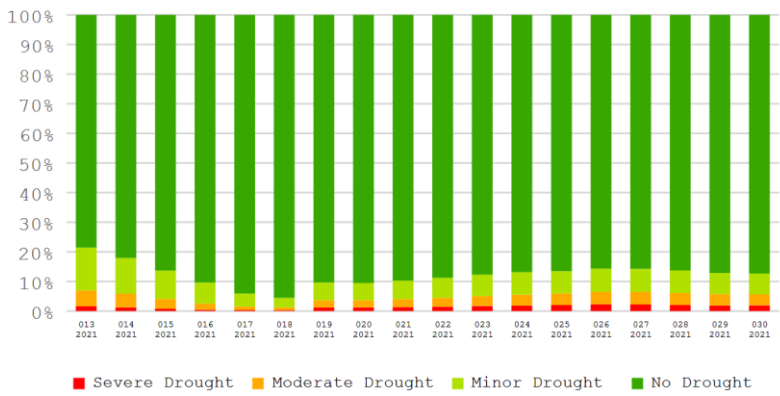
(h) Crop condition development graph based on NDVI (Hangai Khuvsgul Region (left) and Selenge-Onon Region (right))



(i) Crop condition development graph based on NDVI (Central and Eastern Steppe)



(j) Proportion of NDVI anomaly categories compared with 5YA in Mongolia



(k) Proportion of VHIm categories compared with 5YA in Mongolia

Table 3.53 Mongolia's agroclimatic indicators by sub-national regions, current season's values, and departure from 15YA, April- July 2021

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Hangai Khuvsgul Region	409	43	7.0	-1.0	1335	-4	345	-8
Selenge-Onon Region	387	51	9.6	-1.5	1282	-6	393	-14
Central and Eastern Steppe Region	296	41	13.0	-0.6	1296	-4	499	-5
Altai Region	420	-1	7.3	-0.6	1355	1	383	-2
Gobi Desert Region	185	-5	10.9	-0.5	1431	-1	493	2

Table 3.54 Mongolia's agronomic indicators by sub-national regions, current season's values, and departure from 5YA, April- July 2021

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Hangai Khuvsgul Region	100	1	0.96
Selenge-Onon Region	100	4	1.08
Central and Eastern Steppe Region	100	5	1.10
Altai Region	83	8	0.88
Gobi Desert Region	76	8	0.90

[MOZ] Mozambique

During the April-July 2021 reporting period, the summer crops including maize, rice and wheat were completely harvested in Mozambique. The agroclimatic indicators show that rainfall was 15% below the average of the past fifteen years, the temperature decreased by about 0.5℃ and radiation increased by 1%. The potential biomass decreased by 2%. The country's seasonal rainfall profile indicates overall above-average rainfall in late April and May.

The crop conditions development graph based on NDVI indicates that NDVI fluctuated near the average of the past five years throughout the entire reporting period. In general, the maximum VCIx across the country (0.89) was favourable. High values of the VCIx were recorded in the northern Tete, Zambezia and Nampula provinces. However, low values of VCIx were observed in the coastal regions of Maputo, Gaza and Inhambane, influenced mostly by the tropical storms in late March. The spatial distribution of NDVI profiles indicates that on nearly 17.6% of the cropland, crop conditions were above and 54.9% were near average. Despite the climate adversity recorded in late March, the country recorded favourable crop conditions.

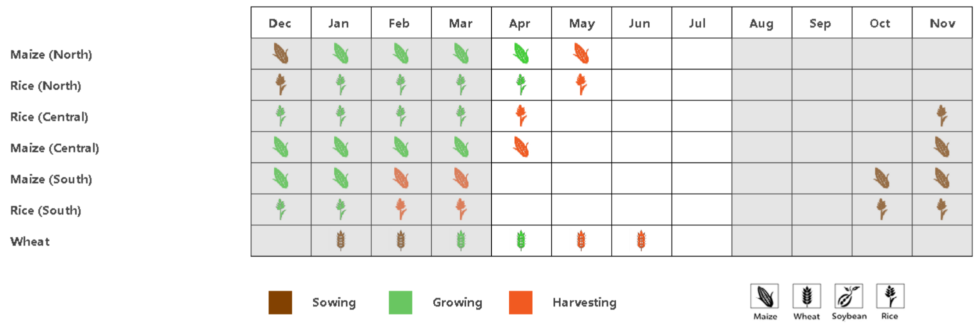
Regional analysis

CropWatch subdivided Mozambique into five agroecological zones including **the Buzi Basin**, **Northern High-altitude Areas**, **Low Zambezi River Basin**, **Northern Coast**, and **Southern Region**. This subdivision was based on the cropping system, topography and climate.

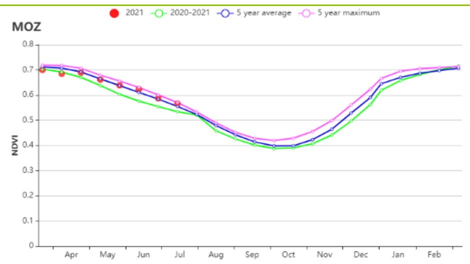
During the reporting period, four zones received below-average rainfall, including Buzi basin (-51%), Northern high-altitude areas (-18%), Low Zambezia River basin (-26%) and Southern region (-38%). Above-average rainfall was only observed on the Northern coast (+4%). In all regions, the temperature was below average varying from -0.3℃ to -0.7℃, with the largest decreases recorded in the Buzi basin (-0.7℃), Northern high-altitude areas (-0.6℃) and the Low Zambezia River basin (-0.6℃). Except for the Northeast cost (radiation about the average), the remaining regions recorded an increase in radiation with the highest increase verified in the Buzi Basin (RADPAR +4%). The potential biomass in the Buzi basin was near average while in the Southern region it increased by 1%. In the remaining zones, including the Northern high-altitude areas, Low Zambezia River basin, and the Northern coast, the potential biomass production decreased by about 3%, 3% and 1%, respectively.

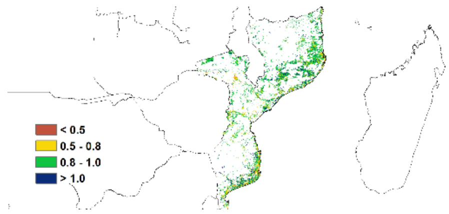
With the exception of the Southern region (CALF +1%), CALF in the remaining regions was near the average of the past five years. With the maximum VCIx values varying from 0.84 to 0.93, the crop conditions based on the NDVI graph reveal favourable crop conditions through the entire monitoring period, with the exception of the Buzi basin. in this region, the crop conditions were below the average for the past 5 years and the same monitoring period in 2020.

Figure 3.32 Mozambique's crop condition, April–July 2021

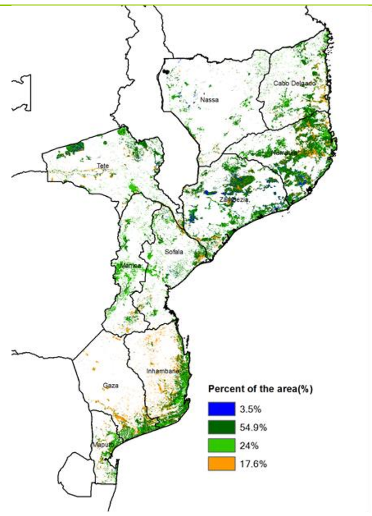


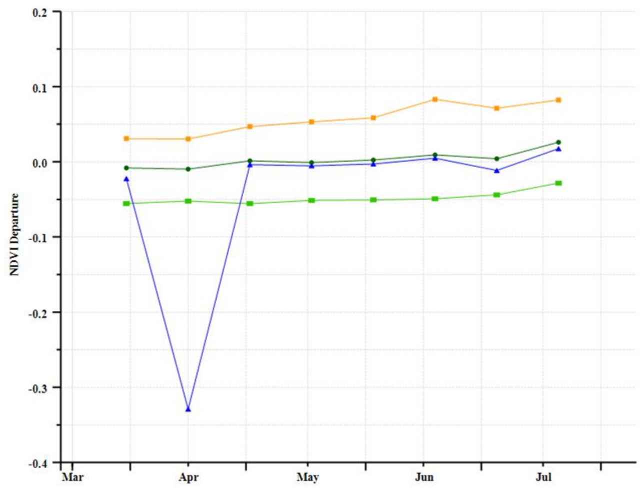
(a). Phenology of major crops



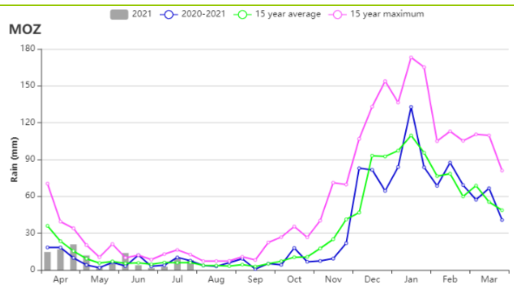


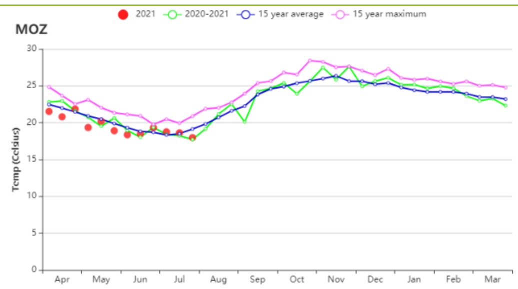
(b) Crop condition development graph based on NDVI (c) Maximum VCI



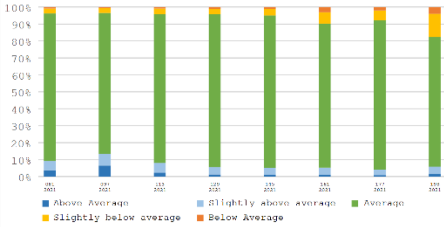


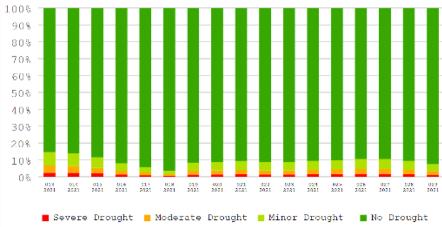
(d) Spatial NDVI patterns compared to 5YA (e) NDVI profiles



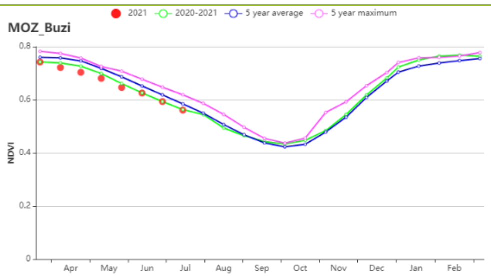


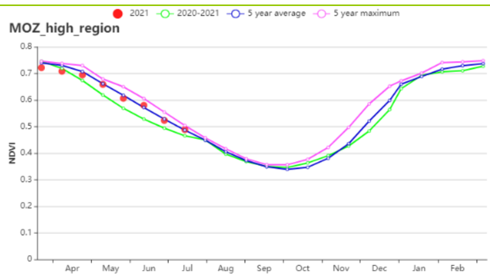
(f) National time-series rainfall profiles (g) National time-series temperature profiles



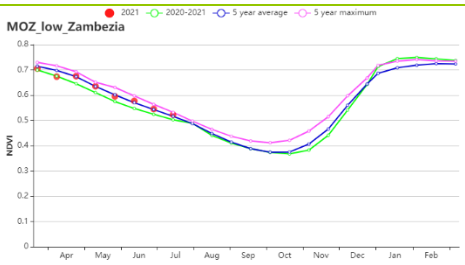


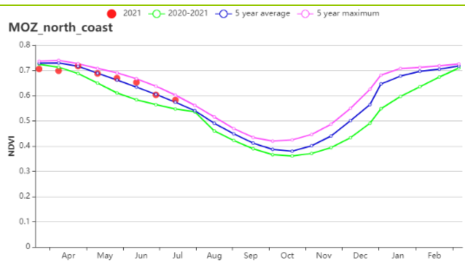
(h) Proportion of NDVI anomaly categories compared with 5YA (i) Proportion of VHIm categories compared with 5YA



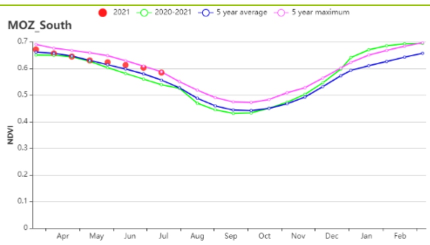


(j) Crop condition development graph based on NDVI-Buzi basin (left), and Northern high-altitude areas (right)





(k) Crop condition development graph based on NDVI-Lower Zambezi River basin (left), and Northern coast region (right)



(l) Crop condition development graph based on NDVI-Southern region

Table 3.55 Mozambique's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, April – July 2021

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m^2)	Departure (%)	Current (gDM/m^2)	Departure (%)
Buzi basin	52	-51	16.7	-0.7	1039	4	427	0
Northern high-altitude areas	94	-18	18.6	-0.6	1000	1	485	-3
Low Zambezia River basin	92	-26	19.0	-0.6	968	1	457	-3
Northern coast	175	4	20.6	-0.3	985	0	551	-1
Southern region	64	-38	20.1	-0.4	920	3	465	1

Table 3.56 Mozambique's agronomic indicators by sub-national regions, current season's values and departure from 5YA, April – July 2021

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure from 5YA (%)	Current
Buzi basin	100	0	0.84
Northern high-altitude areas	100	0	0.93
Low Zambezia River basin	98	0	0.88
Northern coast	100	0	0.91
Southern region	99	1	0.87

[NGA] Nigeria

This report covers crop conditions for maize and rice in Nigeria during the reporting period. In the northern region, maize sowing started in May, while in the south, it had begun in March and the crop was reaching maturity in July. The planting of rainfed rice started in April, followed by that of irrigated rice one month later.

The CropWatch agroclimatic indicators show that the rainfall was below the 15YA (-42%) and the average temperature was above the 15YA (+0.5°C). Rainfall had stayed below the 15YA during the entire monitoring period. The recorded radiation increased by 4%. Due to the decline of rainfall, the BIOMSS was below the 15YA (-5%). The observed maximum vegetation condition index (VCIx) was 0.71 and the CALF was lower than the 5YA (- 6%).

According to the crop condition development graph based on NDVI, the NDVI of the country was below the 15YA from April to July. The maximum VCI graph showed values that were lower in the north and higher in the south. As shown in the spatial NDVI profiles and distribution map, 45.7% of the total cropped areas were near the 15YA from April to the middle of May and below average from June to July in the north of the country. About 19.7% of the total cropped areas were near the 15YA from April to mid-May and above average in June and July. Overall, the crop conditions in most of the cropped areas were below average due to lack of rainfall.

Regional analysis

The analysis focuses on four major agroecological zones in the country, i.e., **Sudan-Sahel savanna** region across the northern region, **Guinea savanna and Derived savanna** within the central region and **Humid Forest** situated towards the southern region.

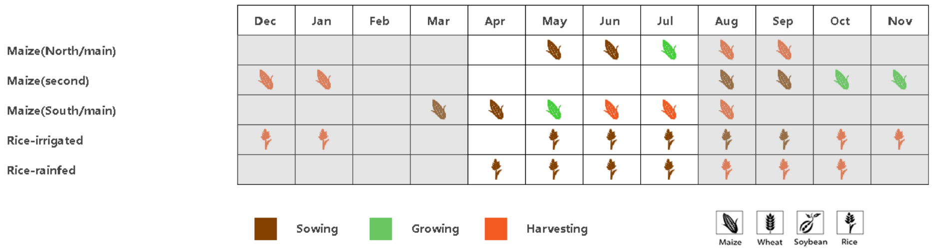
The **Sudan-Sahel savanna** zone is located in northern Nigeria. The agro-climatic condition showed that rainfall decreased by 43% and the overall temperature was near the 15YA. The radiation increased by 2%. The BIOMSS decreased by 13% compared to the 15YA because of the decline of RAIN and associated cloud cover. The CALF was 47% and the maximum VCI was 0.51. According to the NDVI development graph, crop conditions in the zone were near average from April to May and below average from May to July.

The **Guinea savanna** region is predominantly located in the central region of the country. Compared to the 15YA, TEMP increased by 0.5°C, RAIN decreased by 40%, RADPAR was 2% lower, and BIOMSS was down by 10% because of the decline of rainfall. The CALF was 87% and the maximum VCI was 0.74. According to the NDVI development graph, crop conditions in the region were below average throughout the monitoring period.

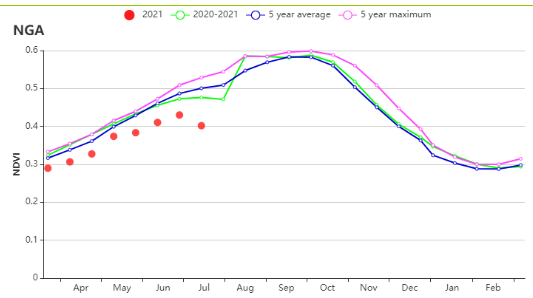
The **Derived savanna** region is a transition zone between the Guinea savanna and Humid Forest zones. The rainfall decreased by 45% and the temperature increased 0.9°C. The radiation increased by 4% compared to the 15YA and the BIOMSS was near the 15YA (+1%). The CALF was 98% and the maximum VCI was 0.88. According to the NDVI development graph, crop conditions in the region were below average throughout the monitoring period.

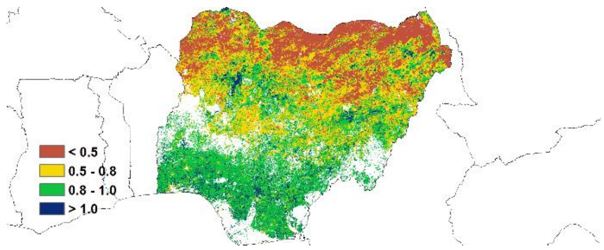
In the **Humid Forest** zone, the precipitation is quite high as compared to other regions. However, it decreased by 41% whereas the average temperature increased about 0.5°C. The radiation increased by 9% and the BIOMSS increased by 10%. The CALF was near the 5YA at 99% and the maximum VCI was 0.94. According to the NDVI development graph, crop conditions in the zone were below average throughout the monitoring period.

Figure 3.33 Nigeria 's crop condition, April-July 2021

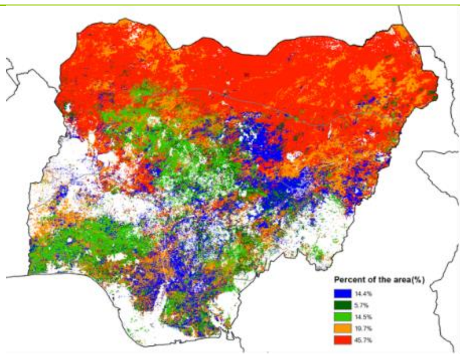


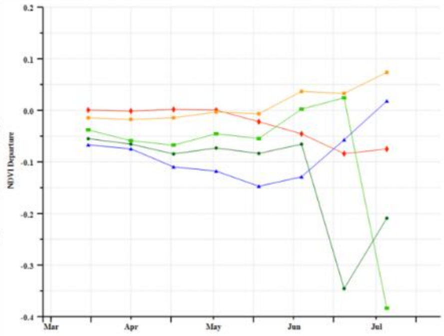
(a). Phenology of major crops



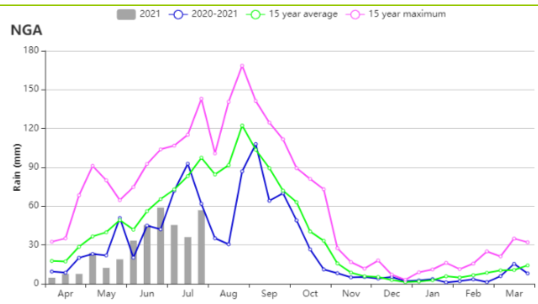


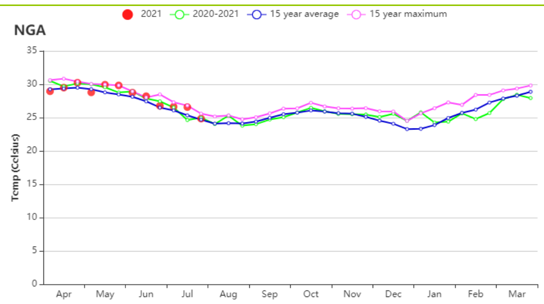
(b) Crop condition development graph based on NDVI (c) Maximum VCI



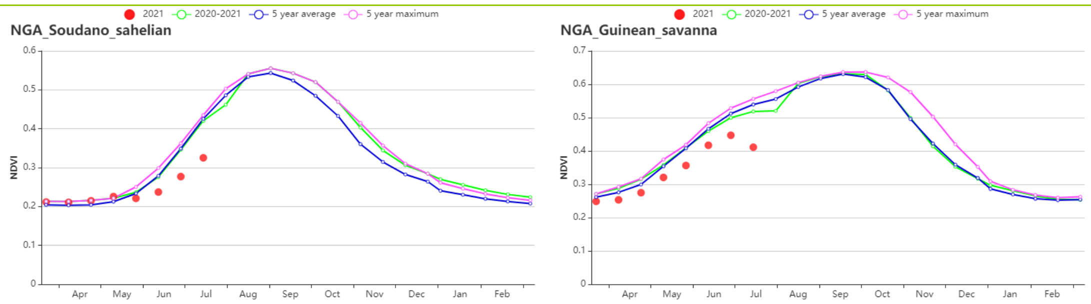


(d) Spatial NDVI patterns compared to 5YA (e) NDVI profiles

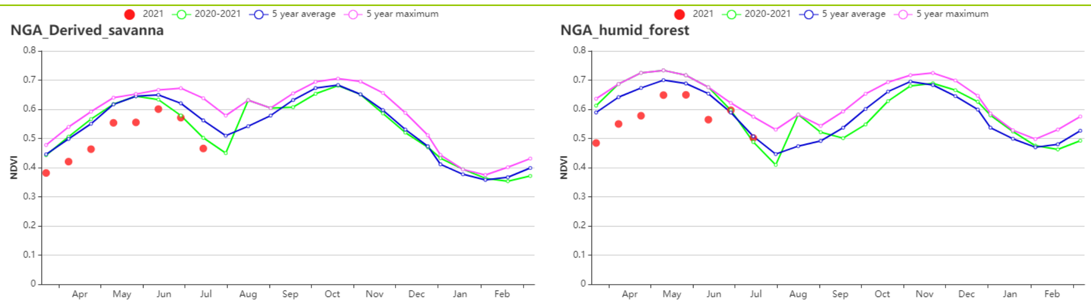




(f) Time series rainfall profile (g) Time series temperature profile



(h) Crop condition development graph based on NDVI for Sudan-Sahel savanna (left) and Guinean savanna (right)



(i) Crop condition development graph based on NDVI for Derived savanna (left) and Humid forest (right)

Table 3.57 Nigeria's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, April-July 2021

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Sudan-Sahel savanna	103	-43	31.1	-0.0	1361	2	567	-13
Guinea savanna	255	-40	28.5	0.5	1280	2	683	-10
Derived savanna	386	-45	27.4	0.9	1215	4	778	1
Humid forest	694	-41	26.1	0.5	1172	9	795	10

Table 3.58 Nigeria's agronomic indicators by sub-national regions, current season's values and departure from 5YA, April-July 2021

Region	Cropped arable land fraction		Maximum VCI
	Current	Departure (%)	Current
Sudan-Sahel savanna	47	-18	0.51
Guinea savanna	87	-4	0.74
Derived savanna	98	-1	0.88
Humid forest	99	0	0.94

[PAK] Pakistan

During this reporting period, winter wheat harvest was completed in June. The planting of maize and rice, together with cotton the main summer crops, started in May. Crop conditions were below average in April, but by July, they had reached average levels. The only exception was the northern highlands, where the conditions remained below average throughout this monitoring period.

RAIN was 4% below average at the country level. TEMP and RADPAR were also below the 15YA (-0.7℃ and -1% respectively). The combination of all the agro-climatic indicators resulted in BIOMSS exceeding the 15YA by 6%. Precipitation varied greatly in time and space. The dekad rainfall was continuously below average for most dekads, except for one dekad in July, when it reached maximum levels. The drier than usual conditions in May and June caused unfavorable conditions for the planting of summer crops, although most of them are irrigated. About 40% of the crop areas experienced drought in April, as shown in the VHIn graph. After early July, summer maize and rice had benefited from the generally favorable weather conditions, but the fraction of cropped arable land (CALF) decreased by 9% compared with 5YA, which may have a negative effect on the summer crop production.

At the national level, the NDVI development graph indicated below-average conditions for most of this monitoring period. The spatial NDVI patterns and profiles show that 80% of the cropped areas were below average in April, while 39% were above average in July. About 46% of the cropped area was continuously below average, mainly located in the north highland and Punjab and some regions along the Indus river basin. The sowing of maize was hampered by unfavorable conditions in Punjab, which resulted in a lower CALF. It was also below the average of the last 5 years in the other regions. The Indus river basin, the main rice producing area, had reached average NDVI after transplanting in June. Though below-average crop conditions were observed in the three main agricultural areas in June, above-average rainfall in the Northern Highland (+37%) and the Lower Indus river basin in south Punjab and Sind (+47%) regions, together with irrigation in the lower Indus river basin, might help sustain favorable crop conditions for the remainder of the growing season. The below-average CALF will reduce crop production, but high yield levels of the summer crops might still be achievable, as NDVI had improved to average levels in all 3 major production regions.

Regional analysis

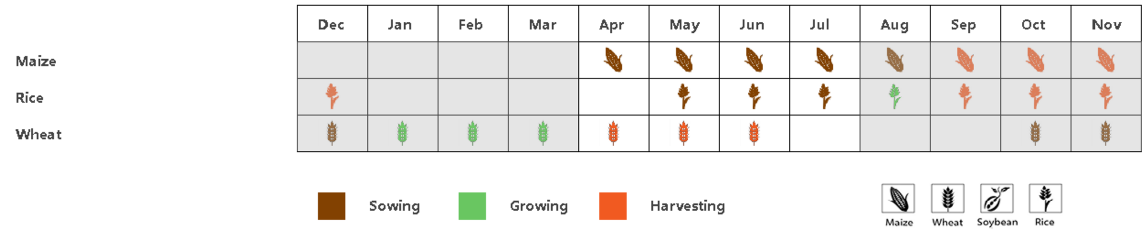
For a more detailed spatial analysis, CropWatch subdivides Pakistan into three agro-ecological regions based essentially on geography and agro-climatic conditions: **The Northern highlands**, **Northern Punjab region** and **the Lower Indus river basin** in South Punjab and Sind.

The NDVI development graph of **Northern highlands** shows below-average crop conditions from April to early July. It was caused by drier-than-usual conditions (RAIN -12%). RADPAR was near average (+1%) and temperatures sightly cooler (-0.8℃). The resulting BIOMSS fell short of the fifteen-year average by 5%. Wheat conditions were unsatisfactory due to drought; weather was generally favorable for the establishment of maize. The region achieved a rather low CALF of 50%, which is a decrease by 10% over the 5YA and VCIx is 0.68. Production is expected to be below average.

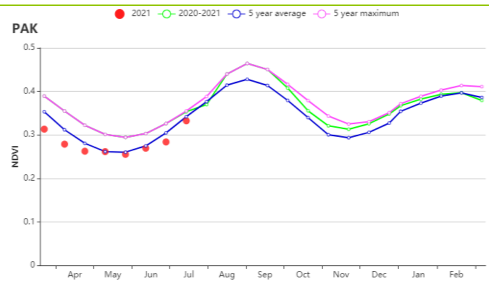
The **Northern Punjab**, the main agricultural region in Pakistan recorded abundant RAIN (37% above average). The TEMP was below average by 0.7℃, and the RADPAR departure was -3%. The estimated BIOMSS departure by +5%, as compared to the fifteen-year average, is probably not relevant, since this period covers the harvest of wheat and the establishment of maize and rice crops. Wheat had below-average NDVI values during the entire growth period, which resulted in below-average yields. Together with the relatively small VCIx (0.68) and low CALF (61% with a decrease by 14%), crop productions of summer crops are forecasted to be below average.

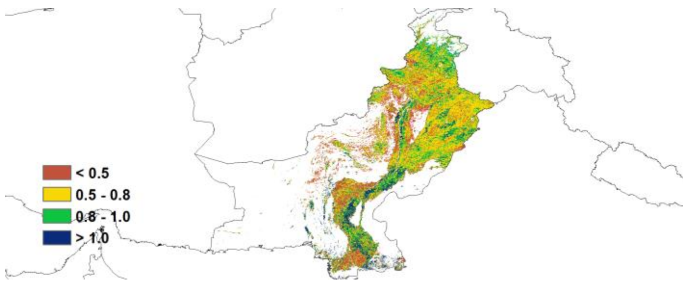
In the **Lower Indus river basin** in south Punjab and Sind, RAIN was above average by 47%, while RADPAR and TEMP were below average by 2% and 0.5℃ respectively. Estimated BIOMSS was 15% higher than the last fifteen-year average. The VCIx was at 0.69, which is normal for this period between the harvest of wheat and the establishment of the summer crops. Considering that the vast majority of land in this region is irrigated, prospects for the newly established crops are promising. But CALF was rather low (38%), 7% lower than the five-year average. Thanks to favorable weather, slightly below-average summer crop production can be expected despite a smaller planted area.

Figure 3.34 Pakistan crop condition, April-July 2021

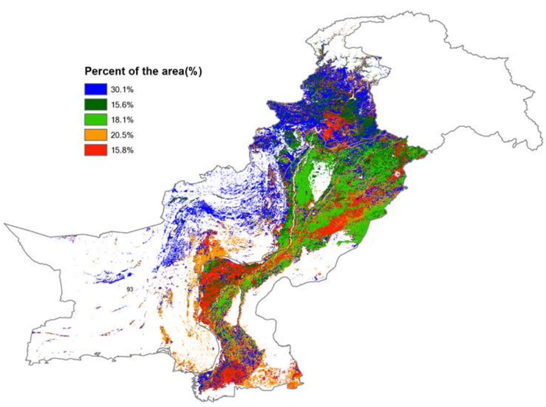


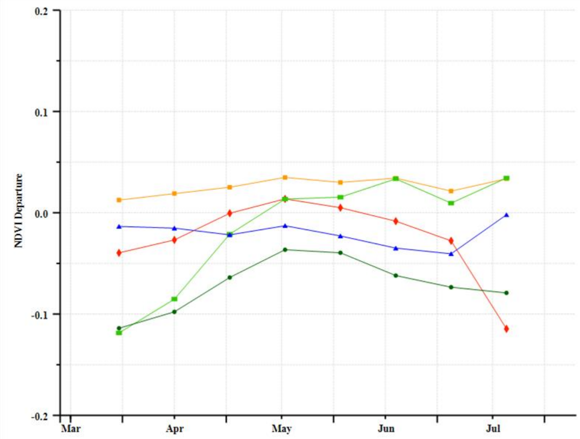
(a). Phenology of major crops



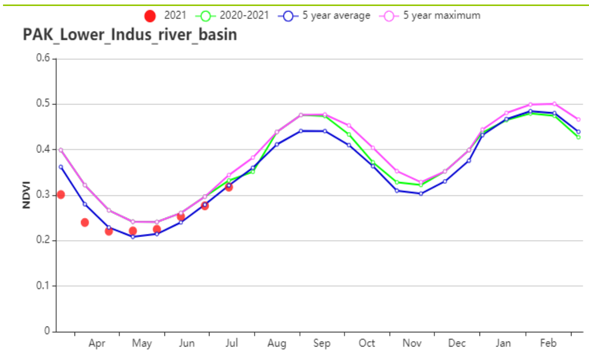


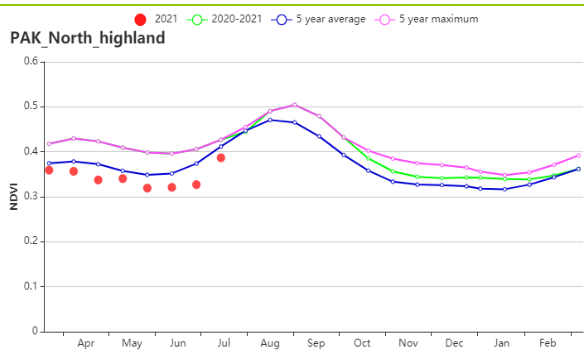
(b) Crop condition development graph based on NDVI (c) Maximum VCI



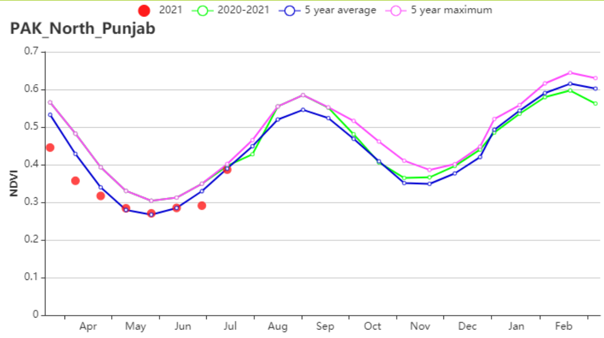


(d) Spatial NDVI patterns compared to 5YA (e) NDVI profiles

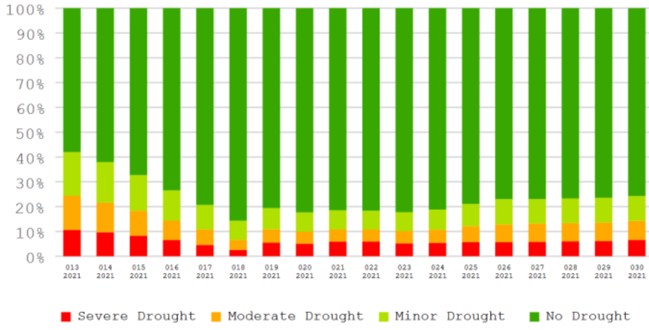




(f) Crop condition development graph based on NDVI in Lower Indus river basin in south Punjab and Sind (left) and Northern Highlands (right)



(g) Crop condition development graph based on NDVI in Northern Punjab



(h) Proporation of VHIn categories compared with 5YA

Table 3.59 Pakistan's agroclimatic indicators by agro-ecological region, current season's value and departure, April-July 2021

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m^2)	Departure (%)	Current (gDM/m^2)	Departure (%)
Lower Indus river basin in south Punjab and Sind	105	47	34.4	-0.5	1526	-2	741	15
Northern highland	317	-12	20.5	-0.8	1568	1	651	-5
Northern Punjab	276	37	32.2	-0.7	1470	-3	947	5

Table 3.60 Pakistan's agronomic indicators by agro-ecological region, current season's value and departure, April-July 2021

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Lower Indus river basin in south Punjab and Sind	38	-7	0.69
Northern highland	50	-10	0.68
Northern Punjab	61	-14	0.68

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

[PHL] Philippines

The rainy season in the Philippines lasts from May to early October. The harvest of the second rice crop was completed in April, followed by the second maize crop one month later.

The country experienced a drier (RAIN -7%) and slightly warmer (TEMP +0.2℃) period. Compared to the average of the past 15 years, the radiation (RADPAR) for the country increased by 4% and the resulting biomass (BIOMSS) increased by 3%. The country experienced several natural disasters, including the strong typhoon Surigae in mid-April and the tropical storm Dante in late May. The cropped arable land fraction was near average and reached 100%, and the maximum VCI for the country was at 0.95.

According to the NDVI profile of the country, the NDVI values kept trending slightly below average starting in late April. In particular, the values in mid-July were significantly below average, which might have been due to cloud cover in parts of the satellite images. Considering the spatial pattern of the NDVI profiles, the NDVI values for most of the crop land were stable fluctuating around the average level during the whole reporting period. About 9.1% of the crop land (mainly in the northern part of Mindanao) experienced a significant drop in NDVI in mid-April, which seems to have been caused by Typhoon Surigae or cloud cover in the satellite images. The storm Dante caused negative NDVI departures for the east of Luzon that was visible until mid-July. Approximately 9.2% of the crop land, mainly in central Misamis, had a decrease in NDVI of about 0.5 in mid-July, presumably due to cloud cover. In general, the crop conditions were normal for those regions that were not affected by Dante.

Regional analysis

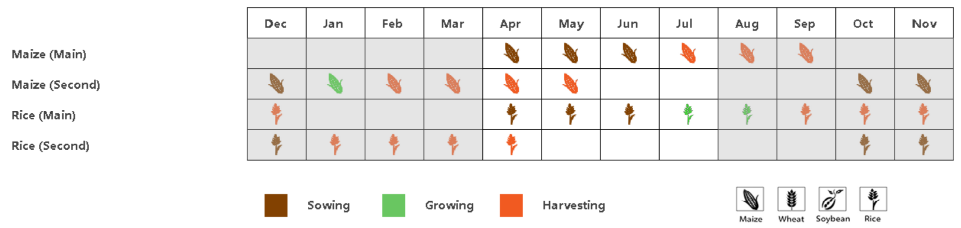
Based on the cropping systems, climatic zones and topographic conditions, three main agro-ecological regions can be distinguished for the Philippines. They are **the Lowlands region** (northern islands), **the Hilly region** (Island of Bohol, Sebu and Negros), and **the Forest region** (mostly southern and western islands). All the regions are characterised by a stable cropped arable land fraction (CALF almost 100%) and a high maximum VCI value (VCIx ⩾0.93).

The Lowland region experienced a decrease in precipitation (RAIN -17%) and a slight rise in temperature (TEMP +0.2℃). The radiation (RADPAR) for the region increased by 5% compared to the 15YA, which resulted in a 3% increase in estimated biomass (BIOMSS).

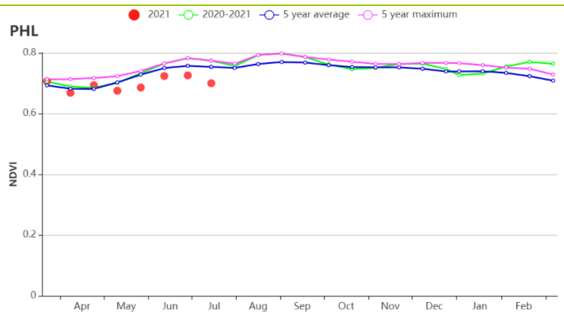
Compared to previous 15 years, **the Hilly region** underwent a drier (RAIN, -6%) and slightly warmer (TEMP +0.1℃) period, accompanied by above-average radiation (RADPAR +4%). As a result, the estimated biomass (BIOMSS) increased by 4%. The NDVI for the region was close to average during most of the time except in late May and late June.

For the **Forest region**, the rainfall (RAIN) increased by 4% and the temperature was close to average (TEMP +0.1℃). The radiation (RADPAR) rose by 3% and the resulted biomass (BIOMSS) increased by 3% compared to the average level. As the NDVI profile shows, the regional NDVI remained close to average during the whole reporting period, which indicates the crop conditions for the region were normal.

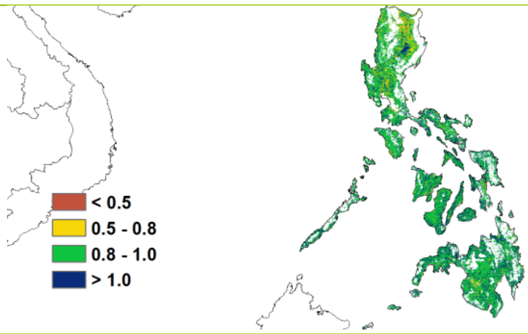
Figure 3.35 Philippines' crop condition, April - July 2021



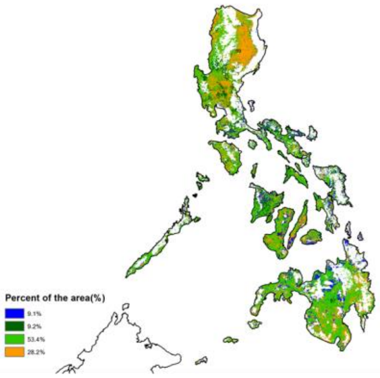
(a). Phenology of major crops



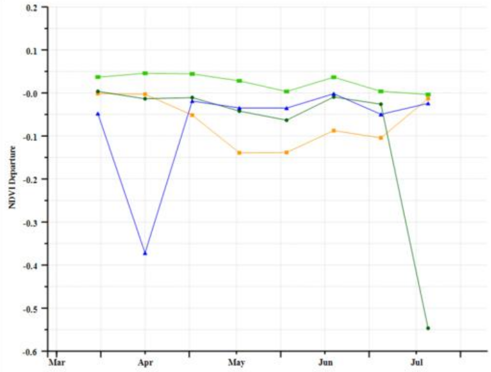
(b) Crop condition development graph based on NDVI



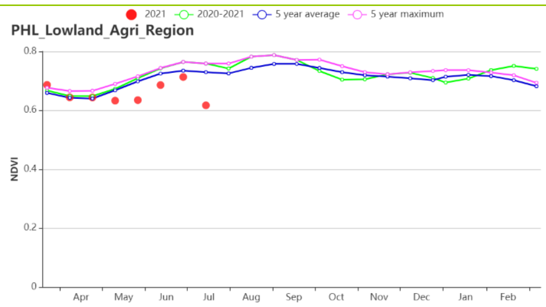
(c) Maximum VCI

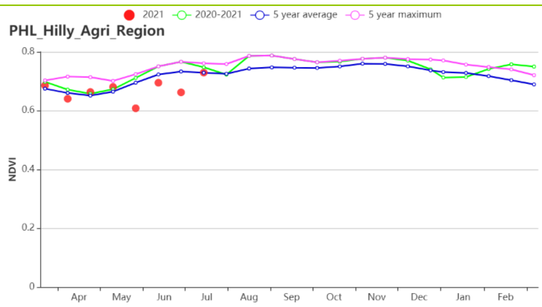


(d) Spatial NDVI patterns compared to 5YA

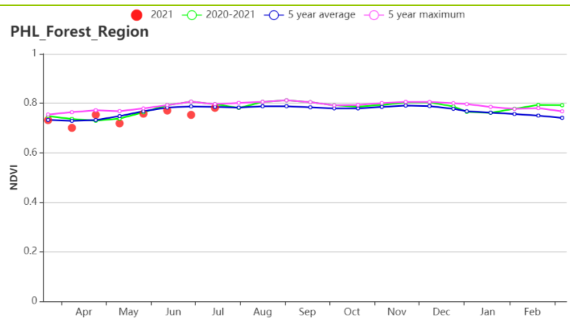


(e) NDVI profiles





(f) Crop condition development graph based on NDVI (Lowlands region (left) and Hills region (right))



(g) Crop condition development graph based on NDVI (Forest Region)

Table 3.61 Philippines' agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, April - July 2021

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m²)	Departure from 15YA (%)	Current (gDM/m²)	Departure from 15YA (%)
Forest region	1350	4	25.5	0.1	1303	3	873	3
Hilly region	1208	-6	27.4	0.1	1385	4	941	4
Lowlands region	**1154**	-17	26.4	0.2	1374	5	911	5

Table 3.62 Philippines' agronomic indicators by sub-national regions, current season's values and departure from 5YA, April - July 2021

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure from 5YA (%)	Current
Forest region	100	0	0.97
Hilly region	100	0	0.97
Lowlands region	100	0	0.93

[POL] Poland

During this monitoring period, the sowing of maize and spring wheat started in late April. However, the continuously cool and wet weather in the spring caused some delays in the sowing. Winter wheat harvest started in late July.

Compared to the average of the last 15 years, rainfall and RADPAR were both 1% higher and temperature was 0.4°C lower, which led to a 6% higher BIOMSS. Below-average temperatures in April and May were accompanied by above-average rainfall. Temperatures increased to above-average levels in June. As shown by the development graph of NDVI, the conditions in the spring were not conducive to planting and early crop development. NDVI was lower than the average of the last 5 years until early June. Subsequently, the conditions became more favorable, especially during the grain filling period of winter wheat, which started in mid-June. NDVI approached the average of the last 5 years in June and July.

NDVI on about 24.1% of the country's arable land area, was continuously below average during the entire period scattered over the cultivated area. For another 14.7% of the crops, located mainly in the north and west region, NDVI was above average until the end of July. In addition, NDVI on 28.1% of the crops mainly in the eastern region was below average from late April to May and above average from June to July. For the rest 33.2% crops, located mainly in the southeast region, NDVI was significant below average from April to May, recover after June until near average.

CALF reached 100% and VCIx was 0.93. VCIx was above 0.8 in almost the entire country.

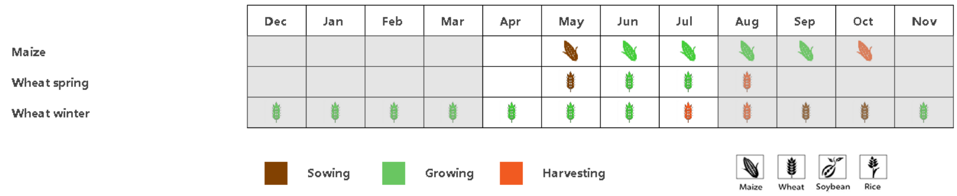
Overall, it appears that winter wheat yield can be expected to be near average. Conditions for spring wheat were less favorable. Maize seems to have benefitted from the warm and humid conditions that started in mid-June.

Regional analysis

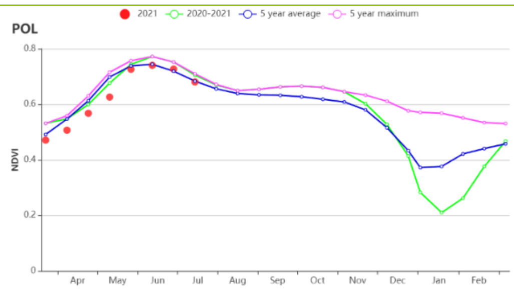
The country is divided into four zones according to agro-ecological characteristics, including: (a) the **Northern oats and potatoes areas** covering the northern half of West Pomerania, eastern Pomerania and Warmia-Masuria, (b) the **Northern-central wheat and sugar-beet area** (Kuyavia-Pomerania to 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 Sub-Carpathian along the Czech and Slovak borders).

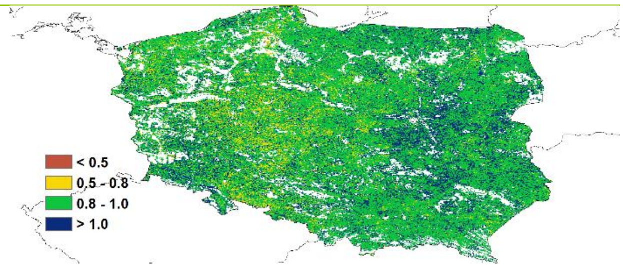
Although the TEMP, RAIN, RADPAR and BIOMSS differed in their departures from the average level among the four subregions (TEMP: +0.1°C, -0.2°C, -0.4°C, -0.7°C; RAIN: 0, +1%, 0, +1%; RADPAR: +2%, +1%, +1%, +2%; BIOMSS: +10%, +7%, +6%, +4%), the temporal distribution of temperature and rainfall in all four regional zones was consistent with the national characteristics, with wet and cold weather from April to May, dry and hot in June, and wet and hot in July. As shown by the crop development graphs, NDVI in the Northern oats and potatoes areas and the Northern-central wheat and sugar-beet area was below average only in May, and close to average in the other three months. In the Central rye and potatoes area and Southern wheat and sugar-beet area, NDVI was below average from April to May, and close to or even slightly above average from June to July.

Figure 3.36 Poland's crop condition, April-July 2021

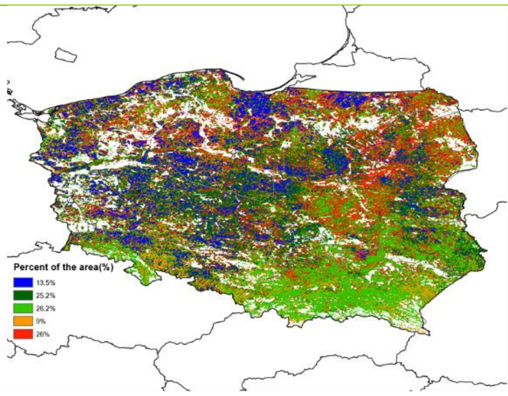


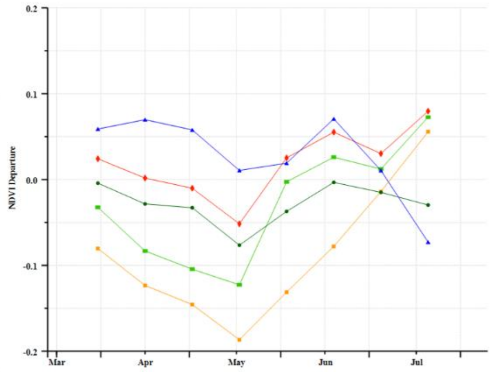
(a). Phenology of major crops



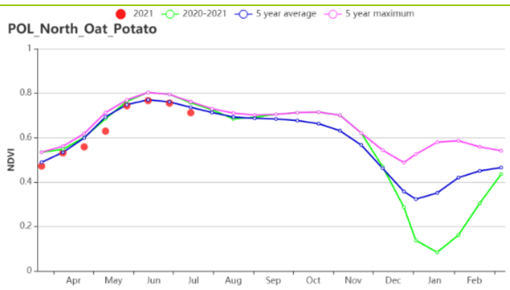


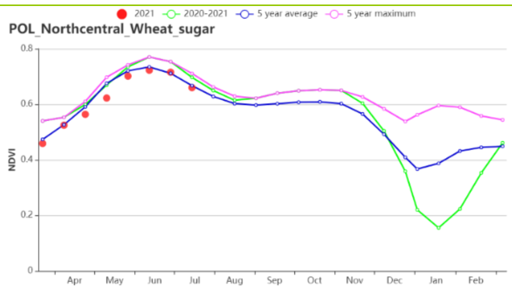
(b) Crop condition development graph based on NDVI (c) Maximum VCI



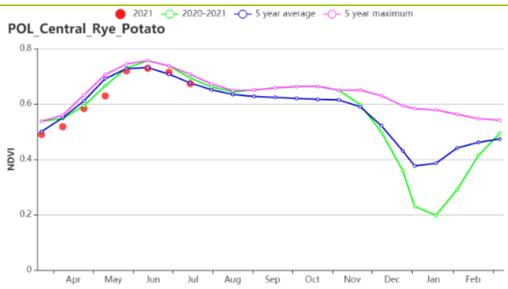


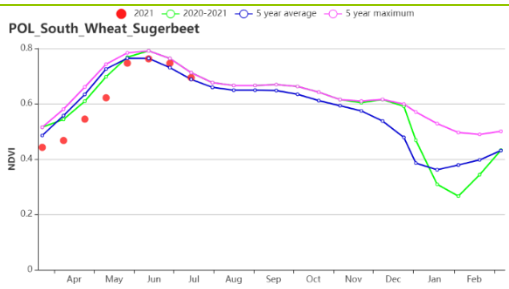
(d) Spatial NDVI patterns compared to 5YA (e) NDVI profiles



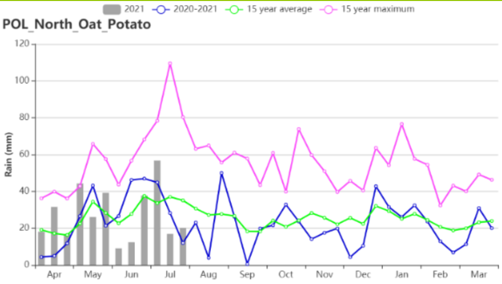


(f) Crop condition development graph based on NDVI, Northern oats and potatoes area (left) and Northern-central wheat and sugar beet area (right).

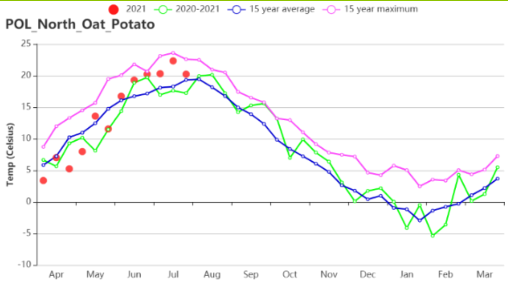




(g) Crop condition development graph based on NDVI, Central rye and potatoes area (left) and Southern wheat and sugar beet area (right)



(h) Rainfall index



(i) Temperature Index

Table 3.63 Poland's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, April-July 2021

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Northern oats and potatoes areas	329	0	14.0	0.1	1163	2	485	10
Northern-central wheat and sugarbeet area	302	1	14.1	-0.2	1164	1	489	7
Central rye and potatoes area	310	0	14.6	-0.4	1171	1	505	6
Southern wheat and sugarbeet area	360	1	13.7	-0.7	1203	2	494	4

Table 3.64 Poland's agronomic indicators by sub-national regions, current season's values and departure from 5YA, April-July 2021

Region	Cropped arable land fraction		Maximum VCI
	Current	Departure (%)	Current
Northern oats and potatoes areas	100	0	0.94
Northern-central wheat and sugarbeet area	100	0	0.91
Central rye and potatoes area	100	0	0.94
Southern wheat and sugarbeet area	100	0	0.95

[ROU] Romania

During this reporting period, maize and spring wheat were sown, while winter wheat was harvested in July. At the national level, rainfall was 16% below average, average temperature was 0.8°C lower and radiation was slightly above average (+1%). Higher radiation compensated for the negative impact of lower temperature and rainfall, resulting in an average biomass production. The CALF of Romania remained unchanged (100%) and the maximum VCI was at 0.94, which was fair for production. The rainfall time series shows that it was around average in April, far below average in May, early June and July, impacting the growth of maize and wheat. The temperature was below average in April and above average in July. The VHI map shows that drought conditions were not serious during the reporting period. According to the NDVI development curve, crop conditions were below average from April to June and reached close-to-average levels in July. Crop conditions are assessed as generally favorable.

Regional analysis

More details are provided below for three main agro-ecological zones: The Central mixed farming and pasture Carpathian hills (160), the Eastern and southern maize, wheat and sugar beet plains (161) and the Western and central maize, wheat and sugar beet plateau (162).

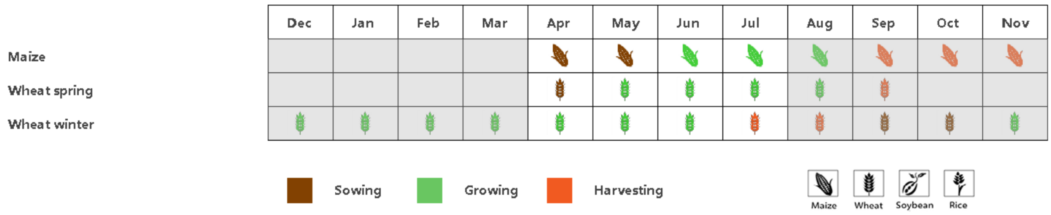
For **the Central mixed farming and pasture Carpathian hills**, compared to the 15YA, rainfall decreased by 20%, temperature was down by 0.7°C, radiation was above average (RADPAR +1%) and BIOMSS increased by 2%. According to the NDVI development, crop conditions were below average during the reporting period. The regional average VCI maximum was 0.92. This region occupies only a small part of cropland in Romania, thus the below-average vegetation conditions have little impact on Romania's crop production.

For **the Eastern and Southern maize, wheat and sugar beet plains**, rainfall decreased by 12%, temperature was 0.9 °C lower than average and radiation remained average. This resulted in a reduced estimate of biomass (-2%). The NDVI development graph shows that crop conditions dropped to below average in April and then improved. The VCI max value of this region was 0.95. According to the distribution map, the blue NDVI profile line region in the southeast (counties of Tulcea and Constanta) dropped largely in June and July, meanwhile the VCI maximum values in this area were between 0.8 and 1.0. All indicators show that the crop condition in this region was fair.

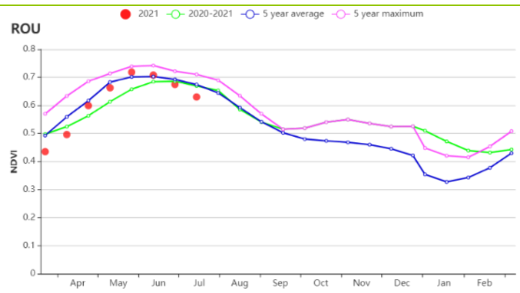
For **the Western and central maize, wheat and sugar beet plateau**, rainfall was lower than average by 19%. Temperature was also lower than average by 0.6°C, radiation was a bit higher (RADPAR +3%) and biomass increased by 4%. Maximum VCI of this region was 0.89 and the spatial distribution was between 0.5 and 1.0. Spatial NDVI pattern shows that NDVI increased in the central region from May to July (red line) and NDVI of the western region was constant (green line), which indicates that crop conditions were fair for this region.

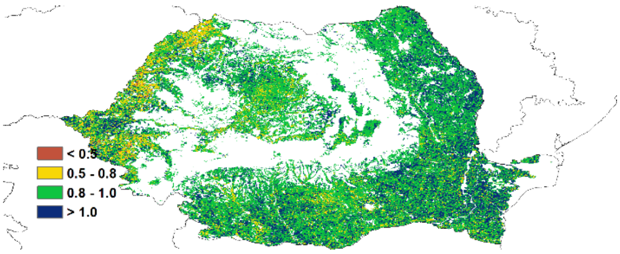
Overall, crop conditions were fair and close to average in Romania during this reporting period. Currently, the outlook is favorable for wheat and maize.

Figure 3.37 Romania's crop condition, April - July 2021



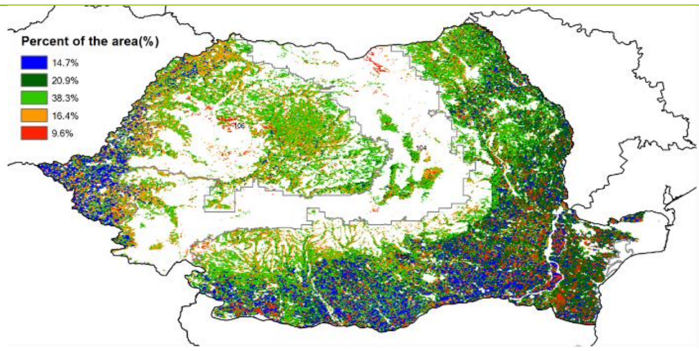
(a). Phenology of major crops

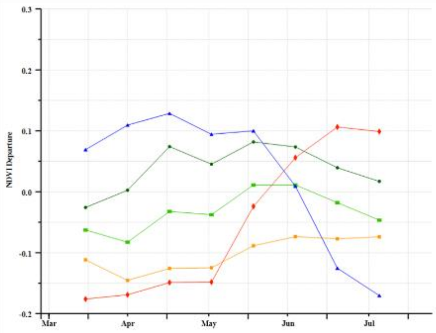




(b) Crop condition development graph based on NDVI

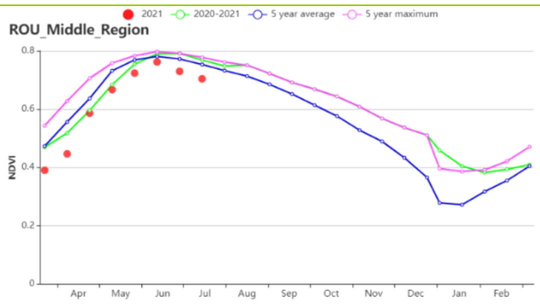
(c) Maximum VCI

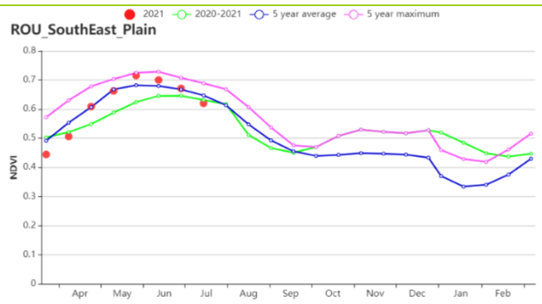




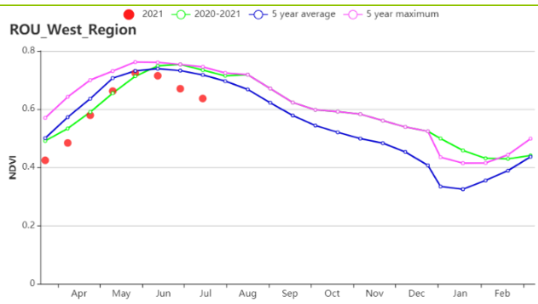
(d) Spatial NDVI patterns compared to 5YA

(e) NDVI profiles

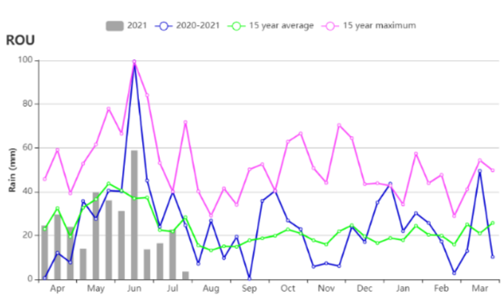




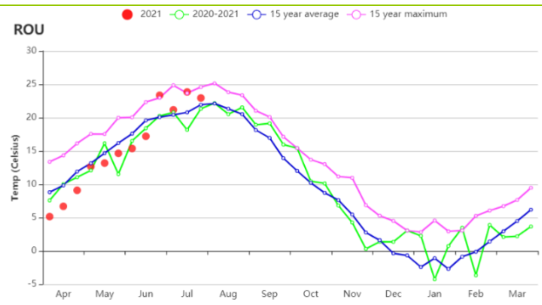
(f) Crop condition development graph based on NDVI (Central mixed farming and pasture Carpathian hills (left) and Eastern and southern maize, wheat and sugar beet plains (right))



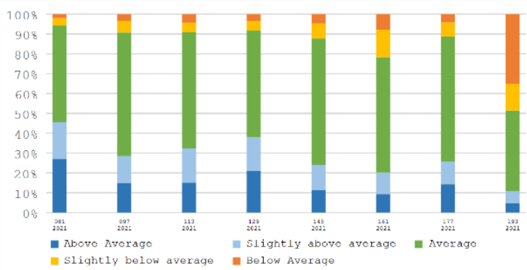
(g) Crop condition development graph based on NDVI (Western and central maize, wheat and sugar beet plateau)

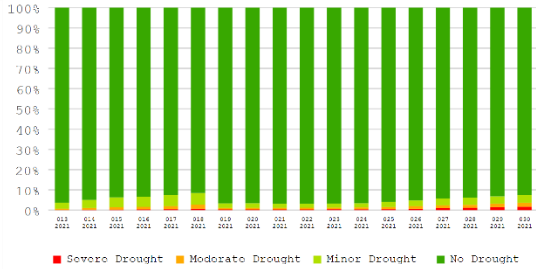


(h) Time series rainfall profile



(i) Time series temperature profile





(j) Proportion of NDVI anomaly categories compared with 5YA (k) Proportion of VHIn categories compared with 5YA

Table 3.65 Romania's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, April - July 2021

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Central mixed farming and pasture Carpathian hills	355	-20	13.4	-0.7	1305	1	512	2
Eastern and southern maize wheat and sugar beet plains	299	-12	16.3	-0.9	1319	0	606	-2
Western and central maize wheat and sugar beet plateau	305	-19	15.2	-0.6	1352	3	592	4

Table 3.66 Romania's agronomic indicators by sub-national regions, current season's values and departure from 5YA, April - July 2021

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure from 5YA (%)	Current
Central mixed farming and pasture Carpathian hills	100	0	0.92
Eastern and southern maize wheat and sugar beet plains	100	0	0.95
Western and central maize wheat and sugar beet plateau	100	0	0.89

[RUS] Russia

In Russia, the period from April to July is a time of active crop growth. At the end of July, winter crop harvest started in many regions, and the grainfilling period of spring crops started.

According to the national data, during the analyzed period, the NDVI stayed mainly below the 5-year average, although in June, its peak values reached the 5YA in most regions. Atmospheric precipitation from April to June was above the 15-year average and in early May it reached the 15-year maximum. Starting in late June, rainfall was below last year's level and the 15-year average. The temperature was mainly close to the 15-year average and the level of the previous year, except mid-May and the period from mid-June to mid-July when it reached the 15-year maximum. In general, the NDVI Index in Russia is lower than last year and lower than the long-term average. Most regions showed negative NDVI departure during the report period except for June. Only South Caucasus and North Caucasus regions showed positive NDVI departure from late April to June. In almost all regions, the index was below the average during the growth and maturation of winter crops.

In the main regions of winter crop production, such as Central Russia, Central black soils region, North and South Caucasus, the Middle Volga, VCI values ranged from 0.8 to 1 and higher. VCI in the Urals and western Volga regions varied mainly from 0.5 up to 1. The situation was worse for the crops in Western Siberia and in the Volga region. It was better in Central Siberia. In the rest of the territory, it was close to normal. Thus, we can expect a lower-than-normal harvest of spring wheat in Western Siberia and in the Volga region. The situation is better in Central Siberia, but that region's crop production is not large.

The winter crop production is forecasted to be slightly below the long-term average. Summer crop conditions were generally close to, but below average.

Regional analysis

South Caucasus

Rainfall was 7% below the 15-year average. Temperature and RADPAR were above the 15-year average by 0.9°C and 4% correspondingly. CALF was 1% lower than the 5-year average. The VCI was 0.86. NDVI from late April to early June was close to the 5-year average. Even though the situation was worse at the beginning of the growing season, according to the NDVI profile, the winter wheat harvest is expected to be higher than last year and close to the average. The maize harvest is expected to be at the level of last year or slightly higher.

North Caucasus

Rainfall exceeded the 15-year average by 27% and temperature was higher by 0.2°C. RADPAR was down by 3% compared to the 15-year average. CALF was 1% higher than the 5-year average. The VCI was 0.90. NDVI stayed below the 5-year average and the level of the previous year until May, when it started to increase and reached the 5-year maximum in late June and then dropped back to the level of the previous year in July. Despite the fact that the situation was unfavorable at the beginning of the growing season, it improved starting in May. In accordance with the NDVI index, the winter wheat harvest is expected to be higher than last year and above average. The maize harvest is expected to be at the level of the last year or slightly higher.

Central Russia

Rainfall was 5% below average. The air temperature was 0.9°C above the average. BIOMSS was above average by 14%. The CALF was equal to the 5-year average. The VCI was 0.97. The NDVI was mostly below the 5-year average, but it reached the average level in late May and early June. The yield of winter wheat is likely to be at the level of last year, and spring wheat is slightly lower than last year and the average. As to maize, the result will depend on the weather conditions in August.

Central black soil area

Rainfall was 28% higher than the 15-year average, which is the maximum deviation from the 15-year average in Russia. The air temperature was 0.4°C above the 15-year average. RADPAR was 3% below the 15-year average. BIOMSS was by 5% above average. The CALF was equal to the 5-year average. The VCI was 0.96. The NDVI was mostly below the 5-year average reaching the level of the previous year only in June. The yield of winter and spring wheat is expected to be below the level of last year and close to the long-term average. The maize yield will be below the level of last year and slightly below the average level.

Middle Volga

The atmospheric precipitation, temperature and RADPAR were higher than the 15-year average by 14%, 1.6°C and 2% respectively. BIOMSS was 17% above average. CALF was 2% below the 5-year average. The VCI was 0.85. The NDVI was mostly below the 5-year average and the level of the previous year. According to the NDVI profile, the yield of winter, spring wheat and maize is likely to be lower than last year and the 5-year average.

Ural and western Volga

Rainfall was 29% below the 15-year average. The air temperature and RADPAR were above the 15-year average by 1.6°C and 10% correspondingly. BIOMSS was by 23% higher than the average, which is the maximum excess in Russia. CALF was 1% below the 5-year average. The VCI was 0.79. The NDVI was equal to the 5-year average until early May, when it dropped below the average level. The yield of winter and spring wheat, as well as maize is likely to be lower than last year and below average. If the conditions in August are favorable, the maize yield may reach the level of last year.

Western Siberia

Rainfall increased by 18%, while the temperature decreased by 0.3°C compared to the 15-year average. CALF was equal to the 5-year average. VCI was 0.92. NDVI in the period from April to early June was less than the 5-year average, but from early June to late July it was equal to the 5-year average. The yield of spring wheat is expected to be close to the average and similar to last year.

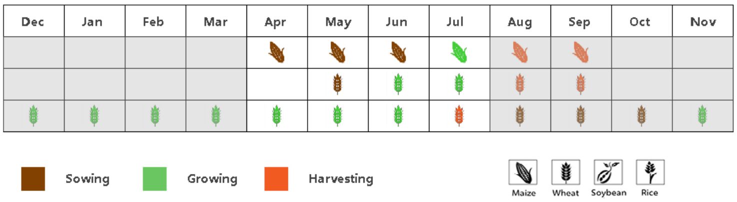
Middle Siberia

Rainfall increased by 18% compared to the 15-year average. Lower temperature and less sunshine resulted in a decrease of BIOMSS by 8%. CALF was 4% higher. VCI was 1.02. The NDVI in the period from April to late May was less than the 5-year average, but from early June to July it exceeded the 5-year maximum. According to the NDVI graph, the yield of spring wheat is expected to be higher than the average, above last year and close to the maximum.

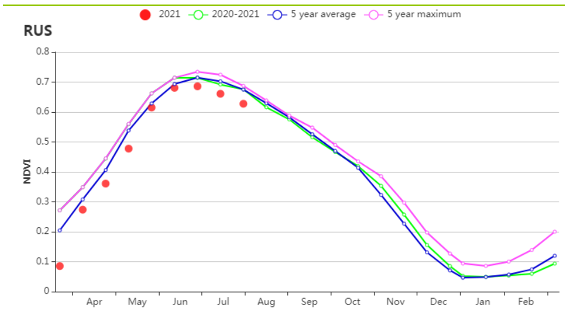
Eastern Siberia

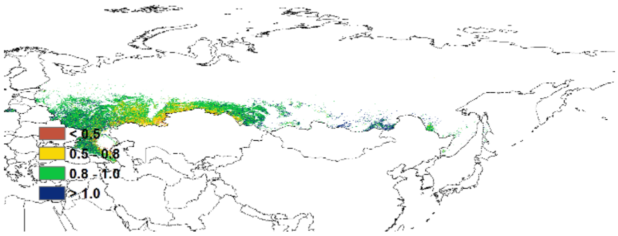
Favorable agroclimatic conditions (TEMP +1.0°C, RADPAR +4%) brought an increase of BIOMSS by 14%. CALF was equal to the 5-year average. VCI was 0.96. The NDVI in the period from April to early June in the region was less than the 5-year average, but from early June to late July it was equal to the 5-year average. According to the graphs, the yield of spring wheat is expected to be slightly lower than the average and last year.

Figure 3.38 Russia's crop condition, April - July 2021

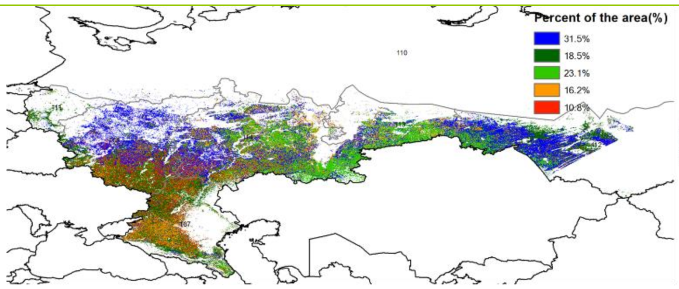


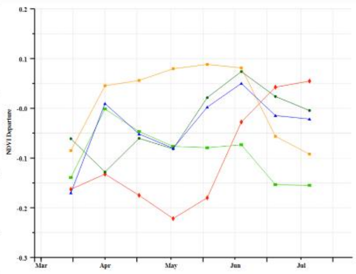
(a) Phenology of major crops



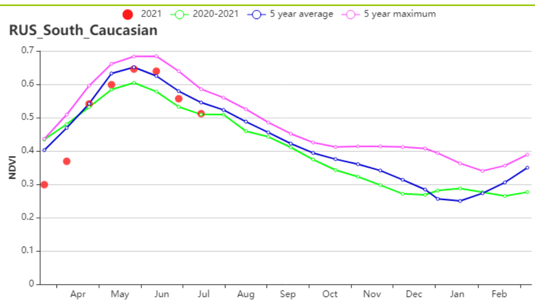


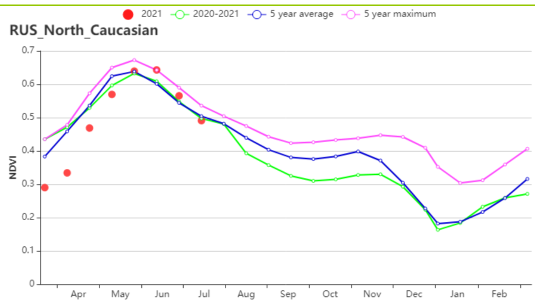
(b) Crop condition development graph based on NDVI (c) Maximum VCI



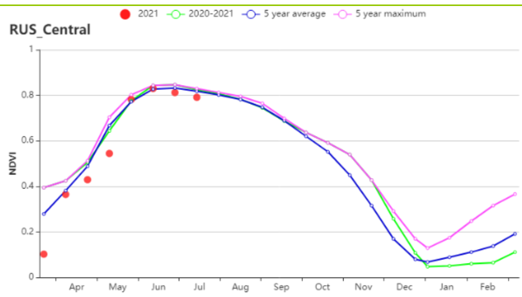


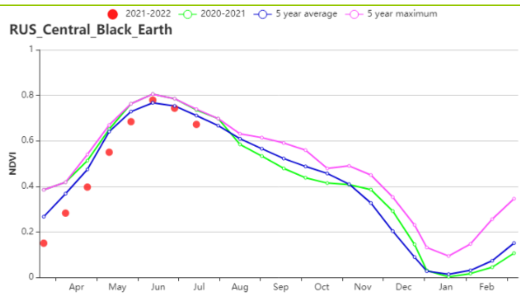
(d) Spatial NDVI patterns compared to 5YA (e) NDVI profiles



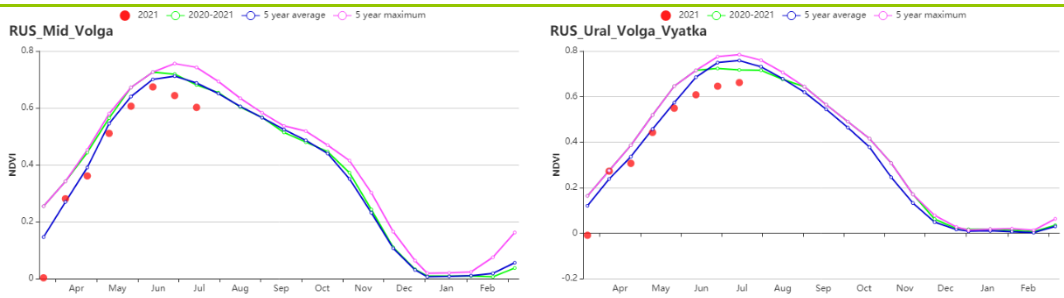


(f) Crop condition development graph based on NDVI, Southern Caucasus (left) and Northen Caucasus (right).

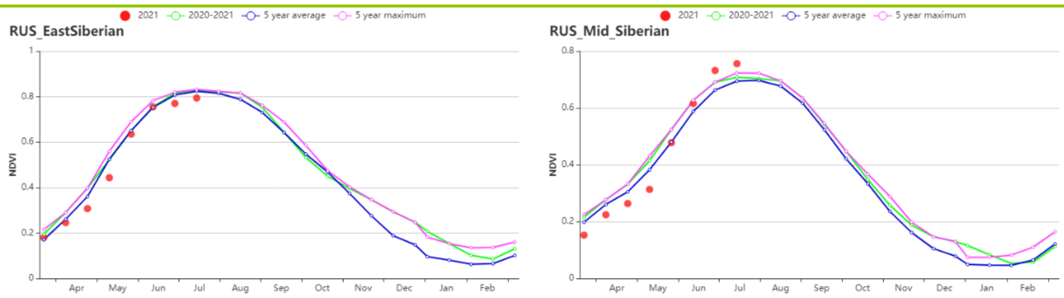




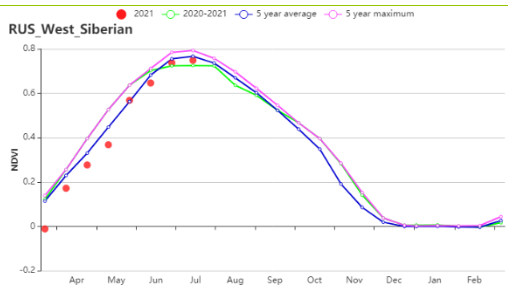
(g) Crop condition development graph based on NDVI, Central Russia (left) and Central black soils area (right).



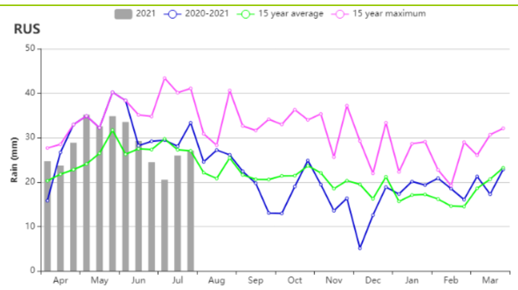
(h) Crop condition development graph based on NDVI, Middle Volga (left) and Ural and western Volga region (right).

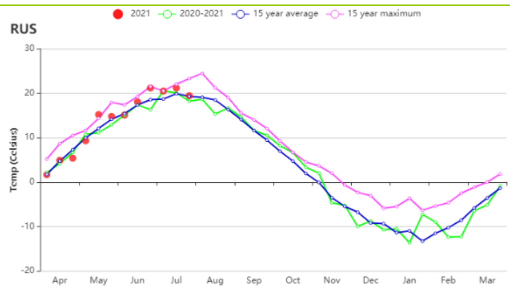


(i) Crop condition development graph based on NDVI, Eastern Siberia (left) and Middle Siberia (right).



(j) Crop condition development graph based on NDVI, Western Siberia.





(k) Rainfall index

(l) Temperature Index

Table 3.67 Russia's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, April - July 2021

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m^2)	Departure (%)	Current (gDM/m^2)	Departure (%)
Central Russia	315	-5	13.7	0.9	1085	0	470	14
Central black soils area	380	28	15.1	0.4	1146	-3	522	5
Eastern Siberia	414	-6	12.5	1.0	1182	4	459	14
Middle Siberia	332	18	9.4	-1.1	1210	-4	378	-8
Middle Volga	341	14	15.0	1.6	1174	2	544	17
Northern Caucasus	369	27	17.9	0.2	1279	-3	639	1
Southern Caucasus	477	-7	16.0	0.9	1346	4	551	0
Ural and western Volga region	205	-29	14.1	1.6	1203	10	512	23
Western Siberia	341	18	12.3	-0.3	1153	1	441	2

Table 3.68 Russia's agronomic indicators by sub-national regions, current season's values and departure from 5YA, April - July 2021

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Central Russia	100	0	0.97
Central black soils area	100	0	0.96
Eastern Siberia	100	0	0.96
Middle Siberia	99	4	1.02
Middle Volga	96	-2	0.85
Northern Caucasus	96	1	0.90
Southern Caucasus	95	-1	0.86
Ural and western Volga region	98	-1	0.79
Western Siberia	100	0	0.92

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[THA] Thailand

From April to July, the main rice and maize crops were sown, and the harvest of the second rice was completed in June. According to the agroclimatic indicators, Thailand suffered rainy and cooler than usual weather in this monitoring period with above-average rainfall (RAIN, +36%) and sunshine (RADPAR, +5%), as well as decreased temperature (TEMP, -0.4°C). Sufficient rainfall mitigates water stress for crops, while enough sunshine ensures photosynthesis and benefits the accumulation of biomass. All of these indicators led to a favorable potential biomass (BIOMSS, +6%). As shown by its profile, rainfall was above average during the whole monitoring period.

The NDVI development graph shows that crop conditions were above average in April and May. According to the NDVI departure clustering map, 29.9% of cropland was always slightly above average from April to July, mostly located in central and eastern areas. Crop conditions for 28.2% of the cropped area were slightly below average, except for the end of April, when they were slightly above average. Those areas were located in patches around most of Thailand, but predominantly in the south, including Surat Thani, Nakhon Si Thammarat, Krabi, Trang and northern areas including Chiang Rai, Phayao, Chiang Mai and Lampang. 30.4% of the cropped area, mostly located in central and eastern regions, fluctuated near the average level at beginning of the monitoring period and significantly improved to be above average after May. For the remaining 11.5% of the cropped area conditions were above average until June. The sharp negative departure at the end of this monitoring period was mostly likely due to cloud cover in the satellite image.

At the national level, all arable land was cropped during the season (CALF +1%) and had favorable VCIx values of around 0.94. CropWatch estimates that the crop condition was favorable and above average.

Regional analysis

The regional analysis below focuses on some of the already mentioned agro-ecological zones of Thailand, which 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).

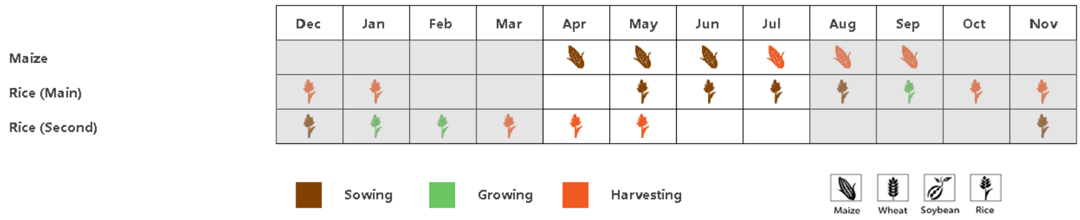
The situation in the **Central double and triple-cropped rice lowlands** followed the same pattern as for the whole country: accumulated rainfall and radiation were above average (RAIN +91%, RADPAR +4%), and temperature was below average (TEMP -1.0°C), which resulted in above-average biomass production potential (BIOMSS +6%). According to the NDVI development graph, crop conditions were slightly above the 5-year average. At the end of April, the crop conditions even reached the 5-year maximum level. Considering the favorable VCIx value of 0.91, the situation is assessed as slightly above average.

According to agro-climatic indicators for the **South-eastern horticulture area**, temperature was below average (TEMP -0.1°C), while accumulated rainfall and solar radiation were above average (RAIN +24%, RADPAR +4%), resulting in a slightly above-average biomass production potential (BIOMSS +5%). Crop conditions were slightly above average for most of the monitoring period, except for late June and July. Considering the favorable VCIx value of 0.96, the crop conditions in this area were slightly above average.

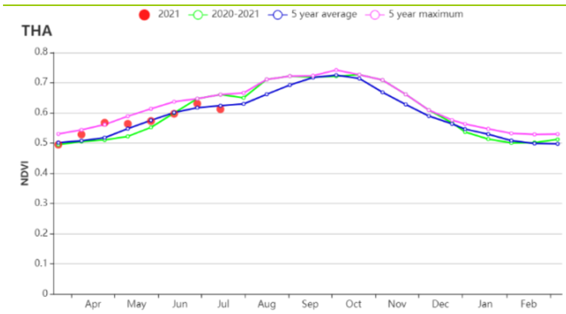
Agro-climatic indicators show that the conditions in the **Western and southern hills** were slightly above average: accumulated rainfall and radiation were above average (RAIN +22%, RADPAR +3%), and temperature was below average (TEMP -0.3°C), resulting in a biomass production potential increase (BIOMSS +5%). As shown in NDVI development graph, the crop conditions were slightly above average before May but dropped to below-average levels in June and July. According to the favorable VCIx value of 0.94, crop conditions are assessed as fair.

Indicators in the **Single-cropped rice north-eastern region** follow the same patterns as those for the country as a whole: accumulated rainfall and radiation were above average (RAIN +41%, RADPAR +7%), and temperature was below average (TEMP -0.3°C), resulting in an increased biomass production potential (BIOMSS +8%). The crop condition was slightly above average as depicted in the NDVI development graph. According to the satisfactory VCIx value of 0.96, the crop conditions were above average.

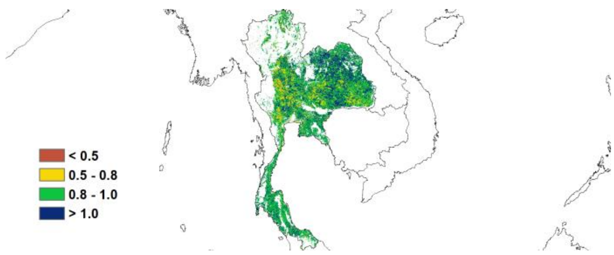
Figure 3.39 Thailand's crop condition, April - July 2021



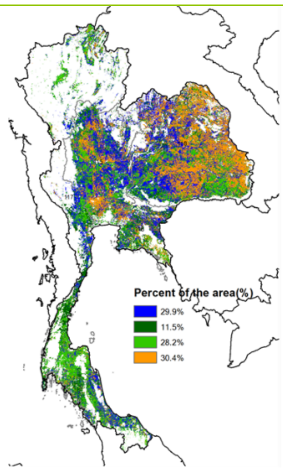
(a). Phenology of major crops



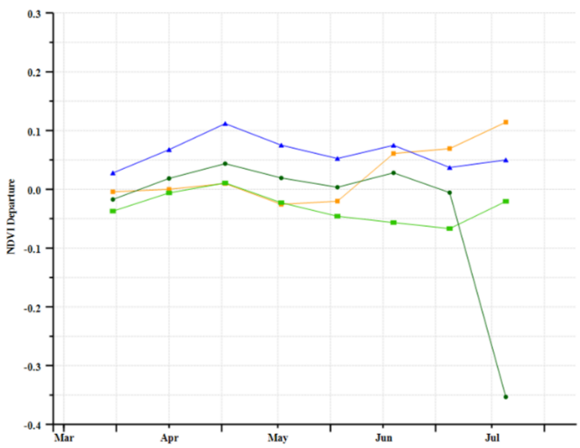
(b) Crop condition development graph based on NDVI



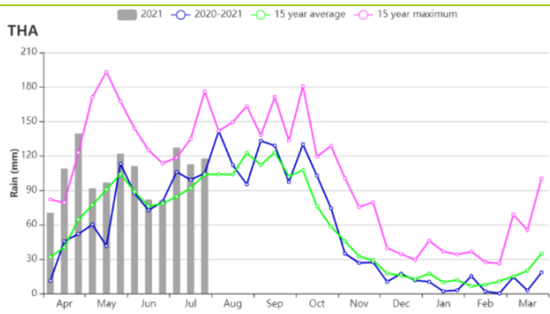
(c) Maximum VCI



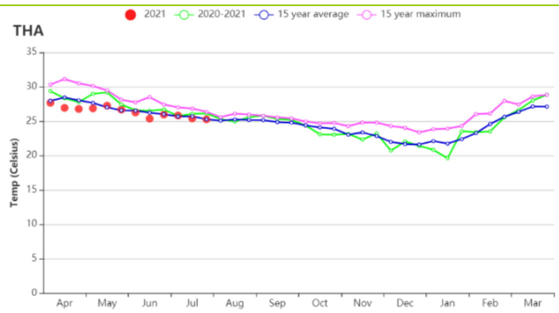
(d) Spatial NDVI patterns compared to 5YA



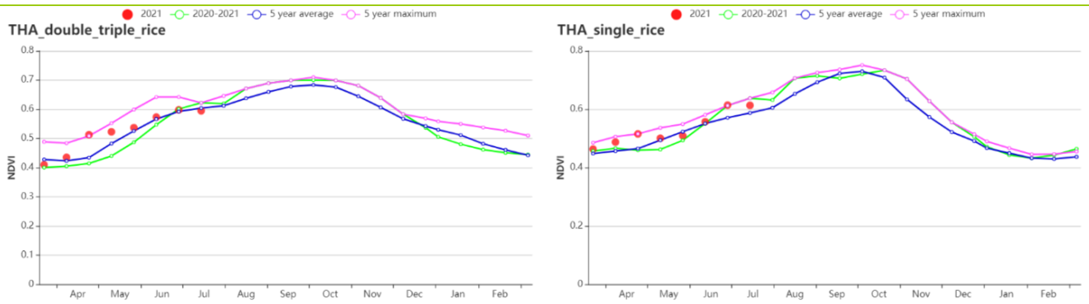
(e) NDVI profiles



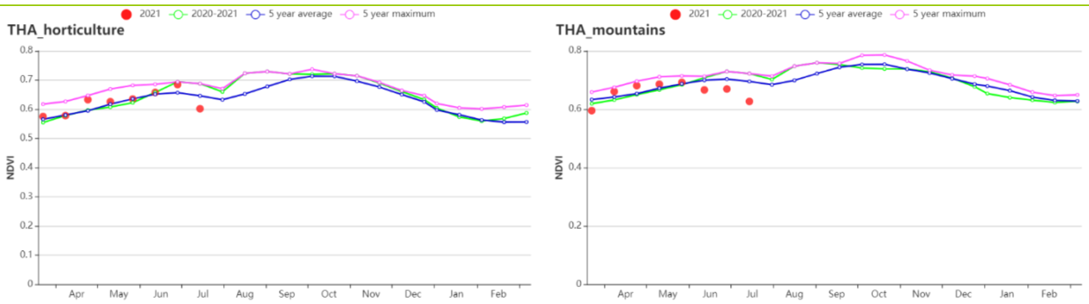
f) Rainfall profile



g) Temperature profile



(h) Crop condition development graph based on NDVI in the double and triple-cropped rice lowlands (left) and single-cropped rice North-eastern region (right)



(i) Crop condition development graph based on NDVI in the South-eastern horticulture area (left) and Western and southern hill areas (right)

Table 3.69 Thailand's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, April - July 2021

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Central double and triple-cropped rice lowlands	1389	91	26.8	-1.0	1215	4	823	6
South-eastern horticulture area	1314	24	27.0	-0.1	1290	4	884	5
Western and southern hill areas	1111	22	25.4	-0.3	1239	3	828	5
Single-cropped rice north-eastern region	1402	41	27.3	-0.3	1229	7	835	8

Table 3.70 Thailand's agronomic indicators by sub-national regions, current season's values and departure from 5YA, April - July 2021

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure from 5YA (%)	Current
Central double and triple-cropped rice lowlands	99	1	0.91
South-eastern horticulture area	99	1	0.96
Western and southern hill areas	100	0	0.94
Single-cropped rice north-eastern region	100	1	0.96

[TUR] Turkey

This monitoring period covers the sowing and main growing period of maize and rice, while the harvest of wheat was almost concluded by the end of July. Nationwide, RAIN was far below average (-35%), and both TEMP (+0.4°C) and RADPAR (+2%) were slightly above the 15YA. BIOMSS was 7% below average. During the last reporting period, rainfall was 7% less than average and the impact of rainfall deficiency was not yet obvious from crop condition and indicators. However, in this monitoring period, especially in April and mid-May, lack of rainfall has caused negative impact on the growth of winter crops and severe drought was observed for around 10% of the country.

The NDVI-based crop condition development graph indicates below-average crop conditions during the whole monitoring period. The national average VCIx was 0.76. The southeastern, southern, and western provinces, such as Sanliurfa, Mardin, and Adana, experienced low VCIx values ranging from 0.5 to 0.8, indicating that crops in those regions were not satisfactory. Low VCIx (< 0.5), which indicates below-average crop conditions, was mainly observed for the central provinces such as Ankara, Yozgat and Kayseri.

In terms of the NDVI spatial departure clustering map, the results confirmed the spatial pattern described above. Due to the impact of low rainfall in April and May, strong negative departures of NDVI were observed. As shown by the VHIn graph, some areas went through dry conditions in the reporting period starting in April. Due to the severe drought, crop conditions were below average for Turkey.

Regional analysis

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

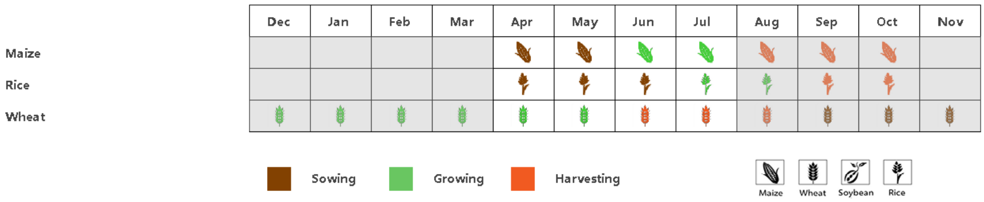
In **the Black Sea zone**, crop conditions were close to average. The rainfall was slightly below average (RAIN -6%), while the temperature (TEMP) increased by 0.1°C and radiation remained average. The cropped arable land fraction was 92%, 6% below average. The average value of VCIx was high at 0.88, the highest among all four AEZs of Turkey. The crop conditions are assessed to be close to normal.

In **the Central Anatolian plateau**, rainfall was far below average (RAIN -40%) during this monitoring period. TEMP (+0.4°C) and RADPAR (+2%) were both above the 15YA, resulting in a decrease of the BIOMSS index (-5%). The average VCIx for this region was 0.73. The cropped land area was only 55%, a decrease by 14%. Crop conditions are assessed as below average.

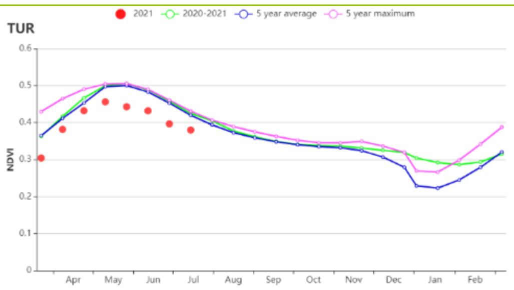
In **Eastern Anatolia**, rainfall was 48% below average, which is the largest decrease among the four AEZs. TEMP and RADPAR were 1.1°C and 5% above average, respectively. The lack of rainfall led to a decrease of biomass by 2%. The CALF decreased 16% compared to the average. With VCIx at 0.72, crop output is assessed to be below average.

As indicated by the NDVI profile, in **the Marmara Aegean Mediterranean lowland zone**, the crop conditions were below average during the reporting period. RAIN was 38% below average. The temperature was slightly above average (TEMP +0.1°C). VCIx was 0.79, and CALF was down 3% and biomass decreased 10%. Production in this region is expected to be below average.

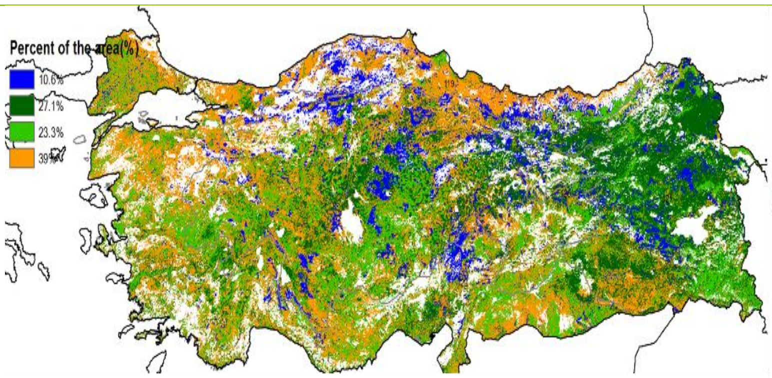
Figure 3.40 Turkey's crop condition, April - July 2021

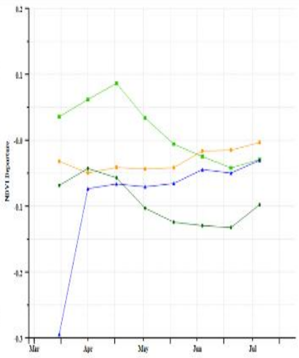


(a). Phenology of major crops

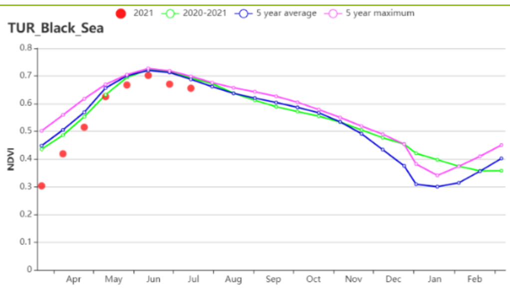


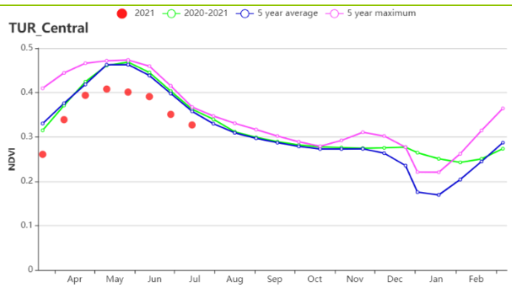
(b) Crop condition development graph based on NDVI (c) Maximum VCI



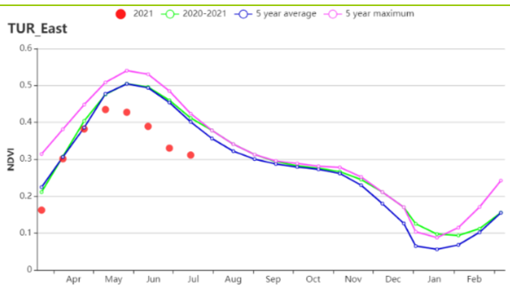


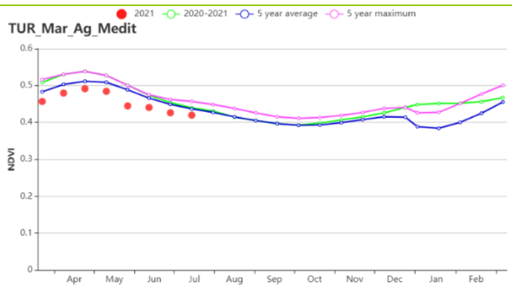
(d) Spatial NDVI patterns compared to 5YA (e) NDVI profiles



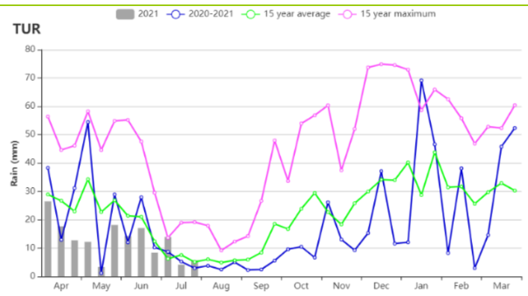


(f) Crop condition development graph based on NDVI (Black Sea region) (g) Crop condition development graph based on NDVI (Central Anatolia region)

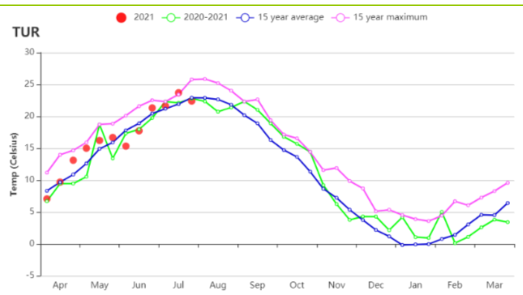




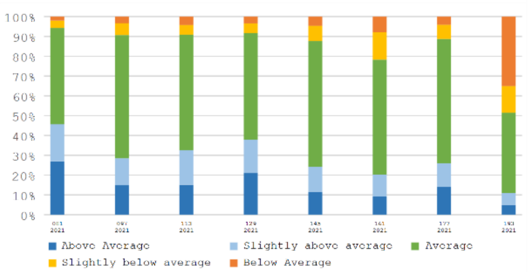
(h) Crop condition development graph based on NDVI (Eastern Anatolia region) (i) Crop condition development graph based on NDVI (Marmara_Agean_Mediterranean lowland region)



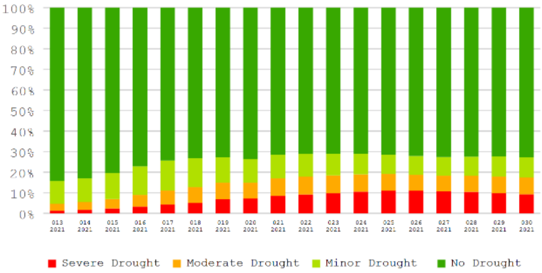
(h) Time series rainfall profi



(i) Time series temperature profile



(j) Proportion of NDVI anomaly categories compared with 5YA



(k) Proportion of VHIn categories compared with 5YA

Table 3.71 Turkey's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, April - July 2021

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m²)	Departure from 15YA (%)	Current (gDM/m²)	Departure from 15YA (%)
Black Sea region	353	-6	13	0.1	1325	0	478	-3
Central Anatolia region	129	-40	15.8	0.4	1503	2	535	-5
Eastern Anatolia region	162	-48	15.4	1.1	1598	5	462	-2
Marmara Agean Mediterranean lowland region	110	-38	19	0.1	1567	2	523	-10

Table 3.72 Turkey's agronomic indicators by sub-national regions, current season's values and departure from 5YA, April - July 2021

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure from 5YA (%)	Current
Black Sea region	92	-6	0.88
Central Anatolia region	55	-14	0.73
Eastern Anatolia region	69	-16	0.72
Marmara Agean Mediterranean lowland region	77	-3	0.79

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[UKR] Ukraine

In the Ukraine, maize, winter wheat and canola were the major crops in the field between April and July. Maize was planted in May and winter wheat was harvested in July.

At the national level, rainfall was abundant (RAIN 374 mm, +24%) during this monitoring period, while temperatures were cooler (TEMP 15.4°C, -0.7°C) with close-to-average RADPAR (-2%). Agroclimatic conditions results in close to average potential biomass is normal (-1%) as compared to the 15YA. Almost all cropland was cultivated (CALF 100%) and the maximum vegetation condition index (VCIx) reached 0.97. NDVI at the national level recovered from below-average levels in April to normal levels in late May and subsequently exceeded the 5YA maximum in July. NDVI on 84.6% of the cropland was at or higher than the 5YA at the end of July, which indicated most of the crops were in good conditions. However, the remaining 15.4% of cropland, mainly concentrated in southern areas, especially in Odessa and Crimea experienced a depression in July. According to its spatial pattern, the VCIx of most cropland in this period was between 0.8 and 1, confirming the favorable crop conditions.

In summary, weather conditions were positive for crop growth, resulting in favorable conditions for winter wheat and maize.

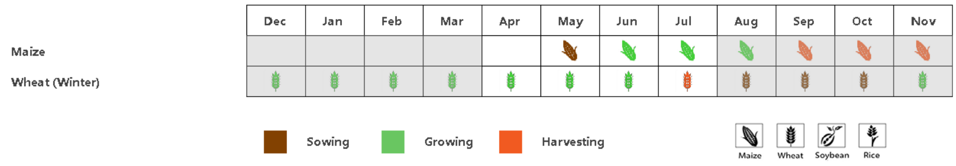
Regional analysis

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** with the Poltava, Cherkasy, Dnipropetrovsk and Kirovohrad Oblasts; **Northern wheat area** with Rivne; **Eastern Carpathian hills** with Lviv, Zakarpattia and Ivano-Frankivsk Oblasts and **Southern wheat and maize area** with Mykolaiv, Kherson and Zaporizhia Oblasts.

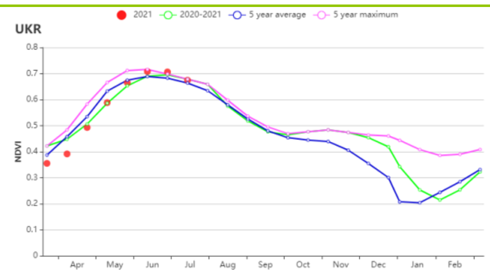
The **Central wheat area** and **Southern wheat and maize area** experienced similar conditions in this period. They recorded abundant rainfall (384 mm, +34% and 381 mm, +55%, respectively). Both had cooler temperature (-0.8°C) and less sunshine (-4%) as compared to the 15YA. Potential biomass for both regions was estimated 4% lower than the 15YA average. CALF reached 100% for both areas with a favorable VCIx (0.96 and 0.99 respectively). Crop development based on NDVI also showed near or above average levels starting in June. Based on the above information, above average production of wheat and maize in these two zones can be expected.

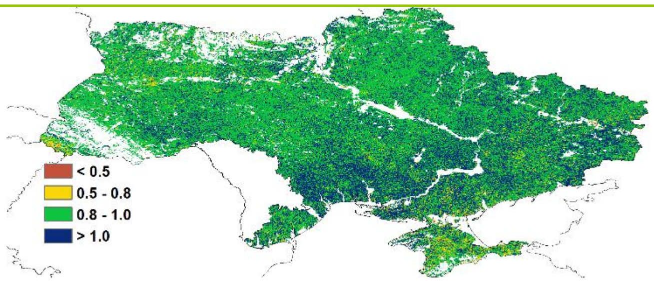
The other two AEZs, **Eastern Carpathian hills** and **Northern wheat area**, generally showed normal conditions during this season, near average rainfall (-7 and+8%, respectively) and normal sunshine (0 and +1%, respectively) with cooler temperatures (-0.7 and -0.4°C). The BIOMSS indicator reached 493 and 531 gDM/m2 respectively, which were very close to the 15YA average (+1% and +4%) as compared to the 15YA. The agronomic indicators show a very good CALF (100%) and VCIx (0.94 and 0.95). The NDVI development profile also confirmed favorable conditions starting in mid-June, when they started to surpass the 5YA. Conditions for the crops were favorable.

Figure 3.41 Ukraine's crop condition, April - July 2021

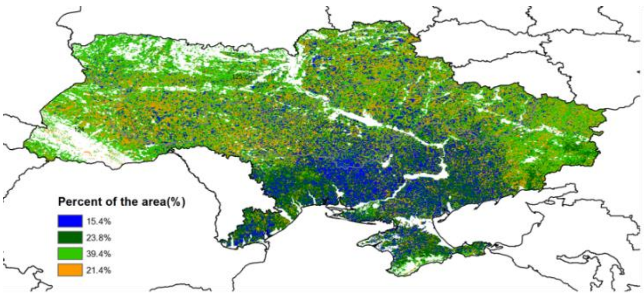


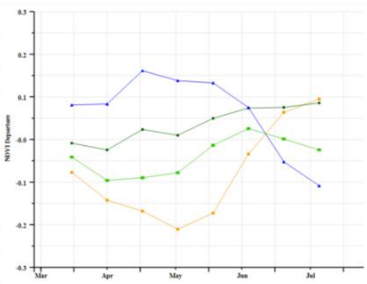
(a). Phenology of major crops



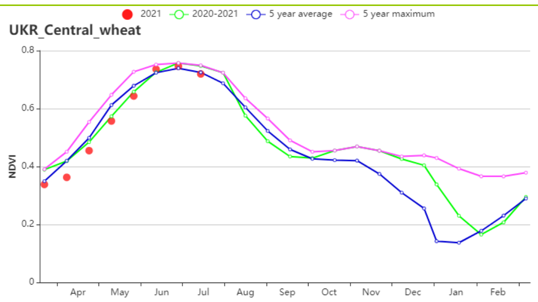


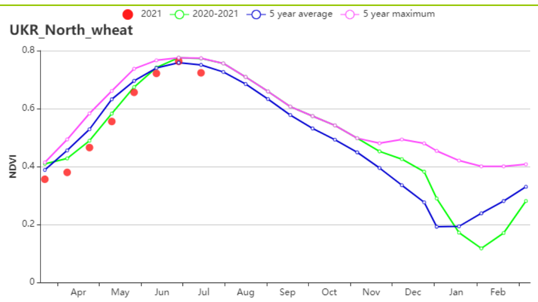
(b) Crop condition development graph based on NDVI (c) Maximum VCI



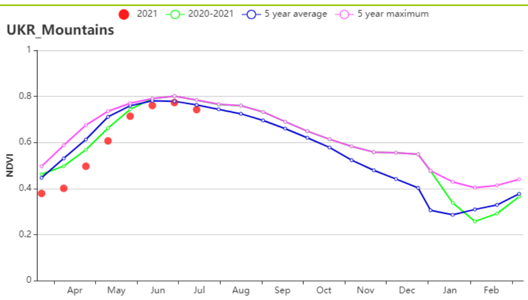


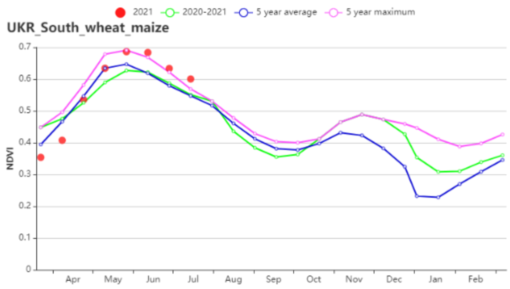
(d) Spatial NDVI patterns compared to 5YA (e) NDVI profiles



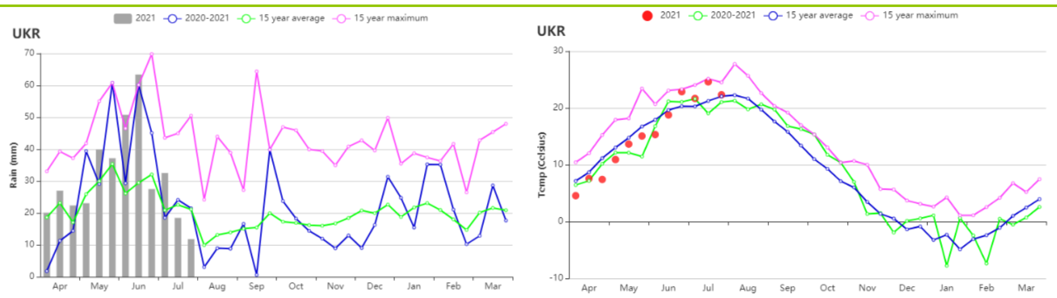


(e) Crop condition development graph based on NDVI (Central wheat area(left) Northern wheat area(right))

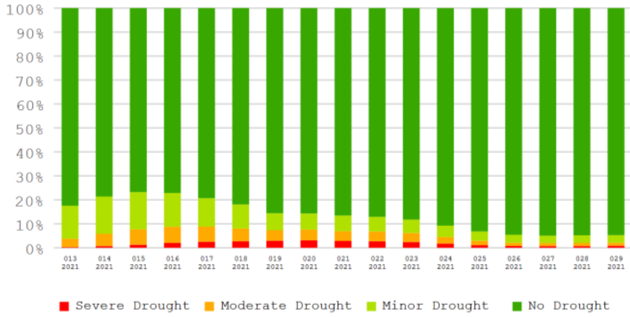




(f) Crop condition development graph based on NDVI (Eastern Carpathian hills(left) Southern wheat and maize area(right))



(g) Rainfall profile (left) and temperature profile (right)



(h) Proportion of drought categories from January-July 2021

Table 3.73 Ukraine's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, April - July 2021

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Central wheat area	386	34	15.3	-0.8	1195	-4	543	-4
Eastern Carpathian hills	401	-7	13.7	-0.7	1222	0	493	1
Northern wheat area	349	8	14.8	-0.4	1202	1	531	4
Southern wheat and maize area	381	55	16.6	-0.8	1241	-4	595	-4

Table 3.74 Ukraine's agronomic indicators by sub-national regions, current season's values and departure from 5YA, April – July 2021

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Central wheat area	100	0	0.96
Eastern Carpathian hills	100	0	0.94
Northern wheat area	100	0	0.95
Southern wheat and maize area	100	1	0.99

[USA] United States

This report covers the period from April to July 2021. Winter wheat had reached maturity in June and July. Maize and soybean planting started in April and finished in May. Corn reached the silking stage in late July and soybeans the flowering and podding stage. Spring wheat sowing was completed in May and it will reach harvest stage in August. Overall, NDVI showed below-average crop conditions until July and near-average conditions in July.

For the country as a whole, rainfall was 20% higher and temperatures 0.4°C lower than the 15 years' average. Time-series rainfall profile indicated above-average rainfall in all time windows except mid-June. Hot weather was observed in early to mid-June 2021, with temperatures reaching the maxima of the last 15 years. Rainfall in California (-70%), Oregon (-50%), Washington (-50%), Idaho (-47%), Nebraska (-21%), Montana (-13%), North Dakota (-13%) and Minnesota (-11%) was below the 15YA, and temperatures in these states were 0.8°C to 1.7°C warmer than the 15YA. Other states, particularly those along the Mississippi River, received abundant rainfall during the reporting period.

Poor crop condition due to water and temperature stress is confirmed by the VCIx in the Northern Plains and Northwest, which is important spring wheat and maize production area where poor unfavorable weather conditions had a negative impact on crop production. NDVI departure clustering also identified the poor crop condition in the Northern Plains. Elsewhere, VCIx reflected good or excellent crop conditions, particularly in major parts of the Corn Belt and the lower Mississippi River area. The latter is an important maize, soybean and rice producing area and good crop conditions indicate that above-average crop production can be expected. At the country level, CALF was 3% below average due to drought conditions that reduced crop emergence.

In short, favorable crop conditions were assessed by CropWatch with the exception of the Northern Plains, northwest area and western regions.

Regional analysis

Southern Plains

The Corn Belt, as indicated by its name, is the most important maize and soybean producing zone. Normal agro-climatic conditions were observed during period with slightly above average precipitation, and average temperature and RADPAR. On average, the crop conditions were close to the 15-year peak at the end of July. Rainfall was 28% in Illinois above average, effectively replenishing the soil moisture needed for crop growth. Although the rainfall in Iowa was above 15YA (+7%), the northern half of Iowa was affected by severe and extreme drought. The cropped arable land fraction reached 100%, and the maximum vegetation index reached to 0.95, identifying favorable crop growing conditions. Soybeans and maize harvest will start in September and above-average crop production could be expected if the good agro-climatic conditions continue.

Northern Plains

The Northern Plains is the largest spring wheat producing region and an important corn producing region in the United States. During the reporting period, the region experienced severe water shortages, and the weather was dominated by hot and dry conditions with rainfall 5% below average and temperatures 0.9°C above average. During the early and middle stages of crop growth, this region suffered from severe drought, which had a significant negative impact on crop emergence. Some crops were almost destroyed by drought. CALF was only 73% which was 17% below the average. As a result of the drought, the crop conditions in the Northern Plains, as indicated by the NDVI development profile, were significantly below the average. The maximum vegetation index dropped to 0.69, also indicating the poor crop conditions. In short, CropWatch assessed that below average crop production can be expected for this the region.

Lower Mississippi

The Lower Mississippi region is the most important rice producing region and an important producer of soybean and maize. During the reporting period, abundant rainfall occurred, with rainfall 53% above average. Rice has a high water demand and the significantly above-average rainfall facilitated the recharge of soil moisture in favor of rice growth. The NDVI development profile indicated good crop conditions by the end of July. Compared to the last 5 years, cropped arable land fraction reached 100%, and the maximum vegetation index reached to 0.93, indicating good growth conditions. In short, CropWatch assessed that above-average crop production can be expected in the region given that rice is about to reach harvest stage soon.

Southern Plains

The Southern Plains is the most important area for winter wheat, sorghum and cotton production. During this period, winter wheat harvest was completed. Sorghum and cotton finished sowing and entered their peak growth periods. The Southern Plains received abundant rainfall, 58% above average. The NDVI development profile indicates the good crop condition after June. CALF reached 90%, which is 4% higher than the average, and the maximum vegetation index reached 0.93, indicating favorable growing conditions for the crop. In short, CropWatch assessed that above average production can be expected for the crops growing in the region.

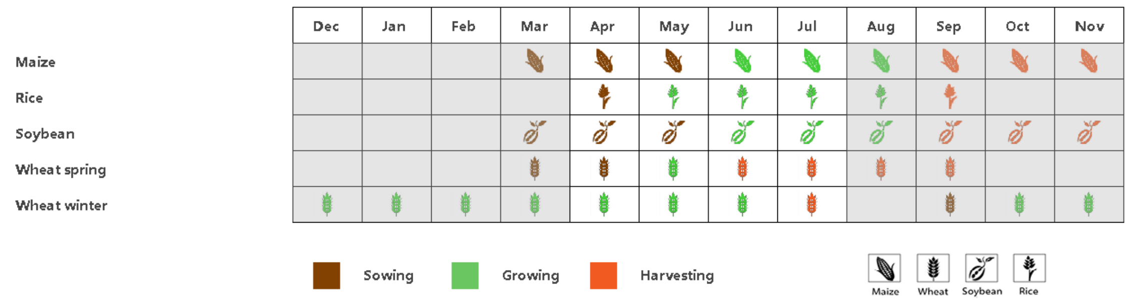
Southeast region

Southeast region is an important cotton and maize producing area. This region received abundant rainfall, 33% above average. The NDVI development profile indicated that the good crop conditions were observed after June. CALF reached 100%, and the maximum vegetation index reached 0.95, indicating good growing conditions. In short, CropWatch assessed that average production can be expected for the crops growing in the region.

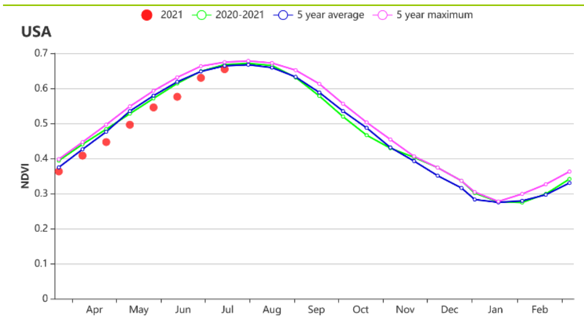
Northwest

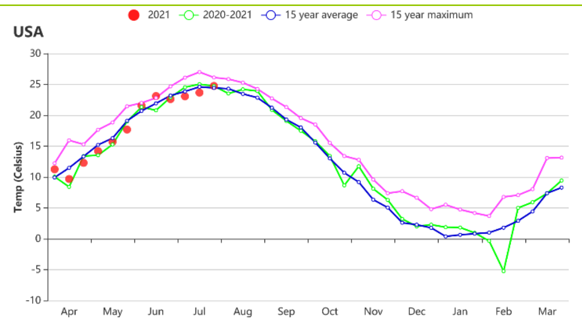
The Northwest is the second most important winter wheat producing areas, and an important spring wheat producing area. During the monitoring period, this region experienced hot and dry weather conditions with rainfall 45% below average and temperatures 1.5°C above average. The continued hot and dry weather accelerated soil moisture loss and greatly limited crop growth. The NDVI development profile indicated very poor crop conditions during this reporting period. CALF was only 71%, which was 16% below the average. The maximum vegetation index was 0.70. This also indicated the unfavorable crop conditions. In short, CropWatch assessed below average crop production can be expected in the region.

Figure 3.42 United States crop condition, April to July 2021

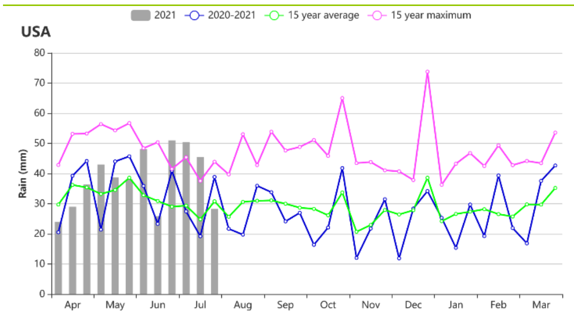


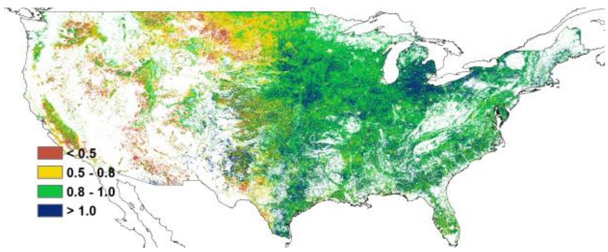
(a). Phenology of United States from April to July 2021



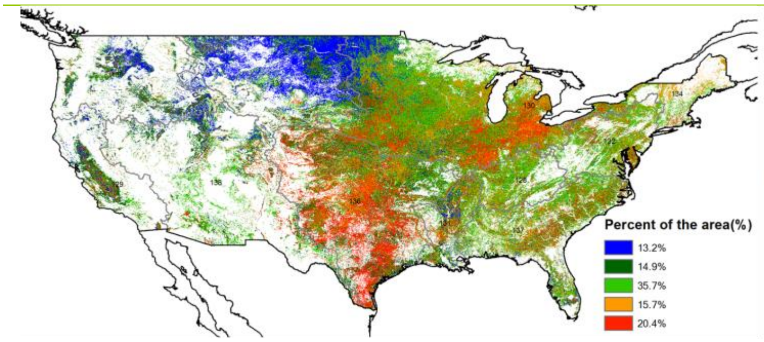


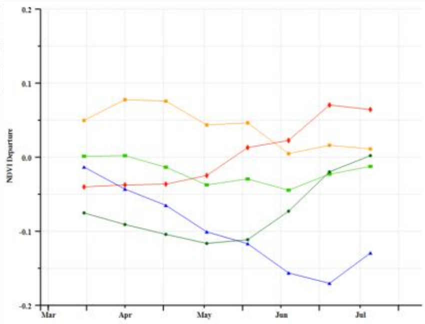
(b). Crop condition development graph based on NDVI (c) Time series temperature profile



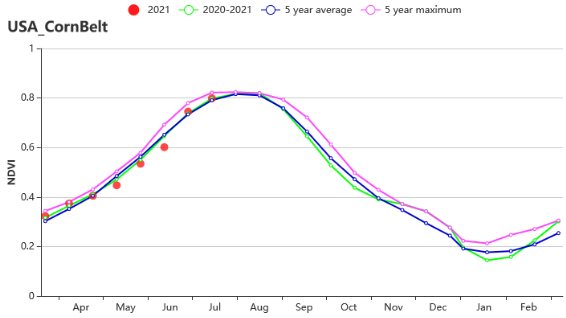


(d). Time series rainfall profile (e). Maximum VCI

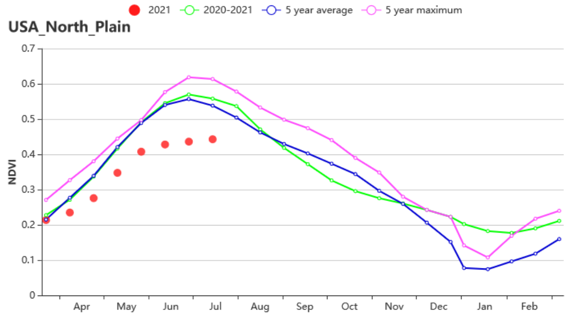




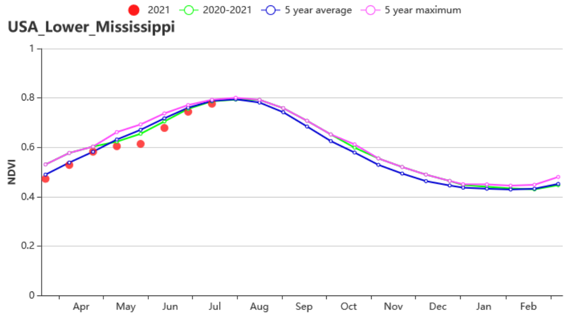
(f). Spatial distribution of NDVI profiles



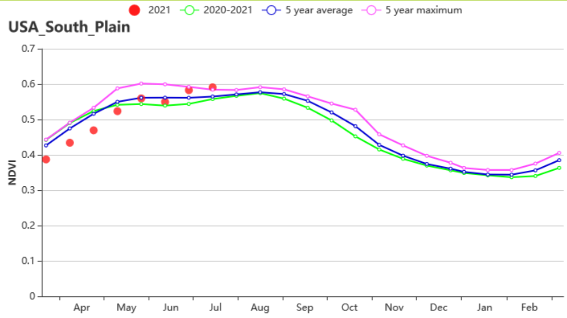
(g) Crop condition development graph in Corn Belt



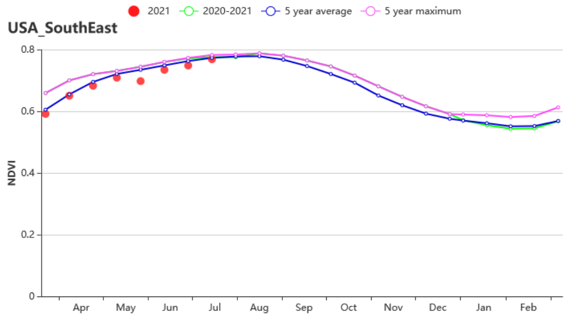
(h) Crop condition development graph in North Plain



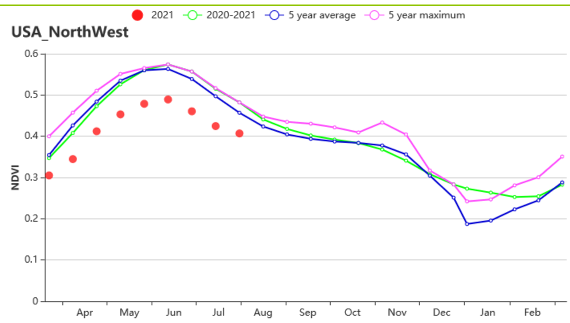
(i) Crop condition development graph in Lower Mississippi



(j) Crop condition development graph in South Plain



(i) Crop condition development graph in Southeast



(j) Crop condition development graph in Northwest

Table 3.75 United States' agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, April - July 2021

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure(°C)	Current (MJ/㎡)	Departure (%)	Current (gDM/m²)	Departure (%)
Corn Belt	428	4	16.9	0.0	1293	0	621	2
Northern Plains	321	-5	15.2	0.9	1416	2	632	10
Lower Mississippi	738	53	22.1	-1.4	1360	-2	797	-4
Southeast	660	33	22.1	-1.1	1413	1	828	0
Southern Plains	559	58	21.4	-1.4	1355	-5	766	-5
North-eastern areas	435	0	15.9	-0.2	1252	0	550	-1
Northwest	139	-45	13.7	1.5	1495	7	557	15
Southwest	253	33	18.5	0.6	1572	-1	674	12
Blue Grass region	428	-3	18.9	-1.2	1377	1	709	-2
California	33	-70	18.4	1.3	1694	4	491	2

Table 3.76 United States' agronomic indicators by sub-national regions, current season's values and departure from 5YA, April - July 2021

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure from 5YA (%)	Current
Corn Belt	100	0	0.95
Northern Plains	73	-17	0.69
Lower Mississippi	100	0	0.93
Southeast	100	0	0.95
Southern Plains	90	4	0.93
North-eastern areas	100	0	0.97
Northwest	72	-16	0.70
Southwest	37	-12	0.68
Blue Grass region	100	0	0.96
California	66	-16	0.63

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

[UZB] Uzbekistan

This monitoring period from April to July covers the sowing and main growth phase of maize. Wheat had reached maturity in June. Among the CropWatch agroclimatic indicators, RAIN was below average (-7%), while TEMP and RADPAR were above average (+0.9°C and +2%). The combination of these factors resulted in a decreased BIOMSS (-7%) compared to the fifteen-year average. The NDVI development graph shows that crop conditions were below the five-year average during the monitoring period. As shown in the NDVI cluster graph and profiles, only about 11% of the agriculture areas had above-average conditions in April and May. These areas are located mainly in the northern part of Kashkadarya province, the western part of Fergana province and Surkhandarya province. And in June and early July, 26% of the agriculture areas had above-average conditions, which are mainly distributed in Khorezm province and Bukhara province. By late July, in addition to the above two provinces, parts of the agriculture areas in Samarkand province and Jizzakh province also had above-average conditions. The national average VCIx was 0.73, and the cropped arable land fraction decreased by 13%.

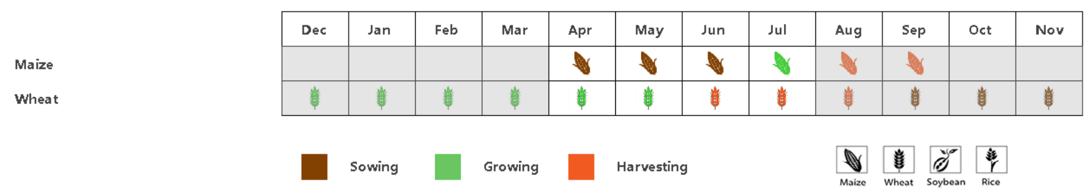
Overall, the conditions for crop production in Uzbekistan are unfavorable.

Regional analysis

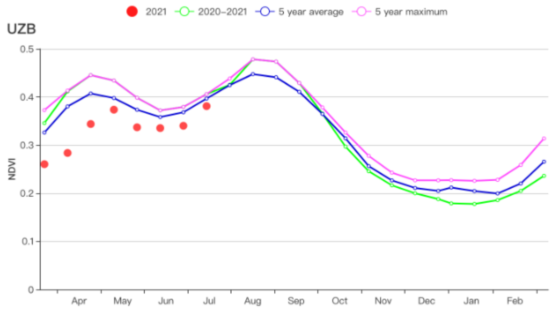
In **the Eastern hilly cereals zone**, NDVI was below the five-year average from April to July. The RAIN was below average (-6%), while TEMP and RADPAR were above the fifteen-year average (+0.7°C and +2%). The combination of these factors resulted in a decreased BIOMSS (-5%). The maximum VCI index was 0.71 and Cropped Arable Land Fraction decreased by 14%. Overall, crop conditions are expected to be below average.

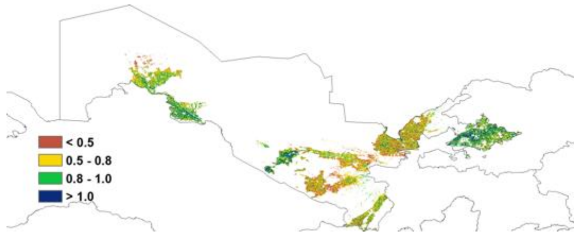
In **the Aral Sea cotton zone**, crop condition was below the five-year average according to the NDVI development graph. The TEMP was much higher than average (+2.1°C), while RAIN was below average (-57%). RADPAR was slightly above average (+4%). Affected by these factors, BIOMSS decreased by 16% compared to the fifteen-year average. The maximum VCI index was 0.77 and Cropped Arable Land Fraction decreased by 7%. Overall crop prospects are unfavorable.

Figure 3.43 Uzbekistan crop condition, April - July 2021



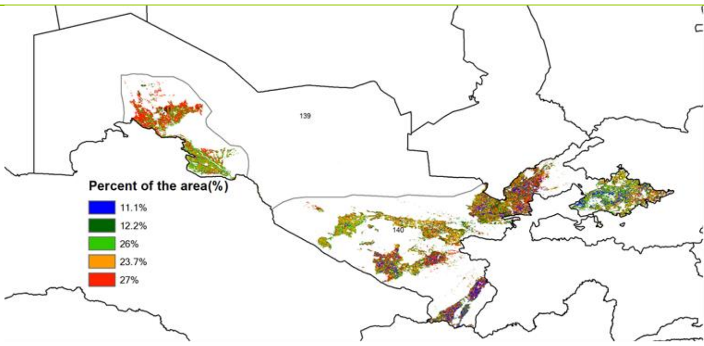
(a) Phenology of major crops

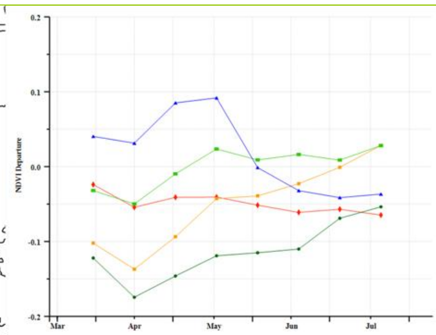




(b) Crop condition development graph based on NDVI

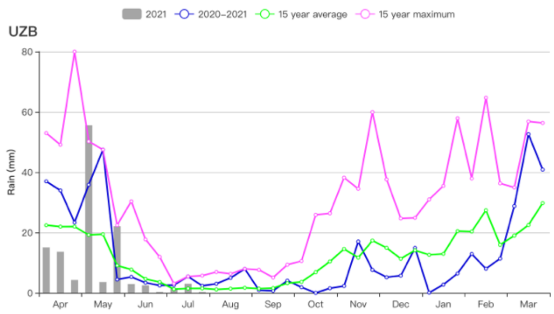
(c) Maximum VCI

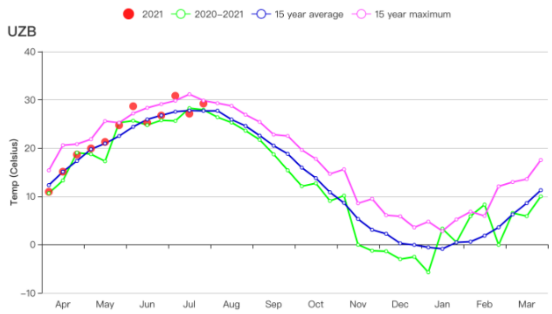




(d) Spatial NDVI patterns compared to 5YA

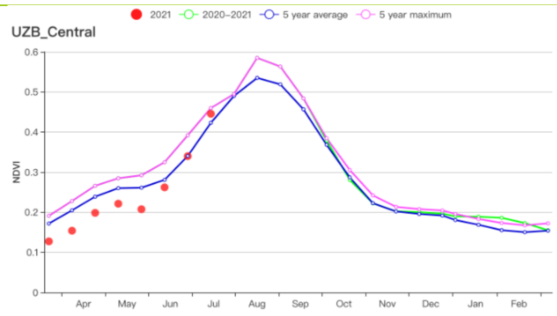
(e) NDVI profiles

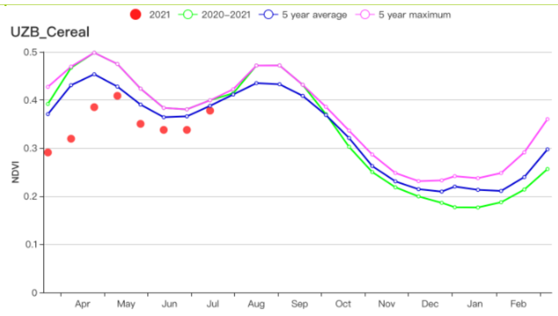




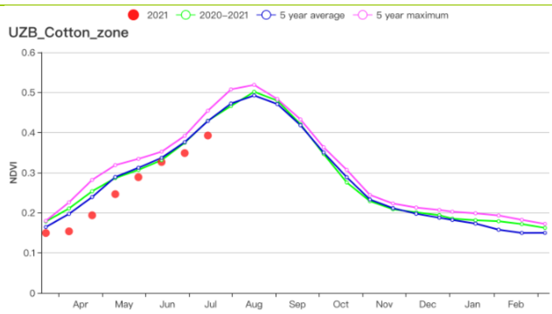
(f) Rainfall profiles

(g) Temperature profiles

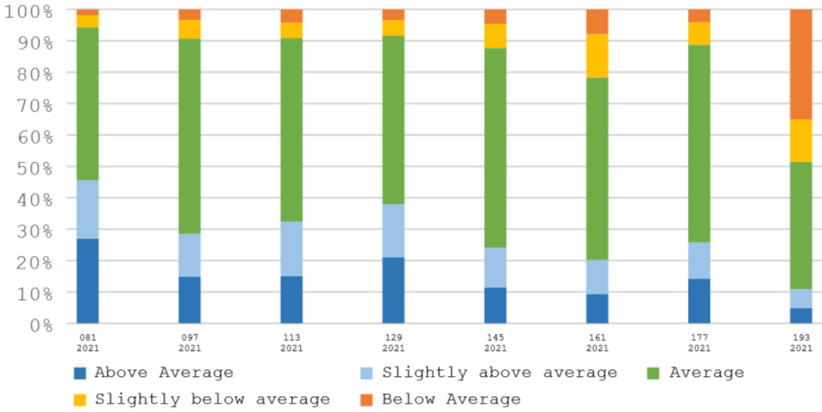




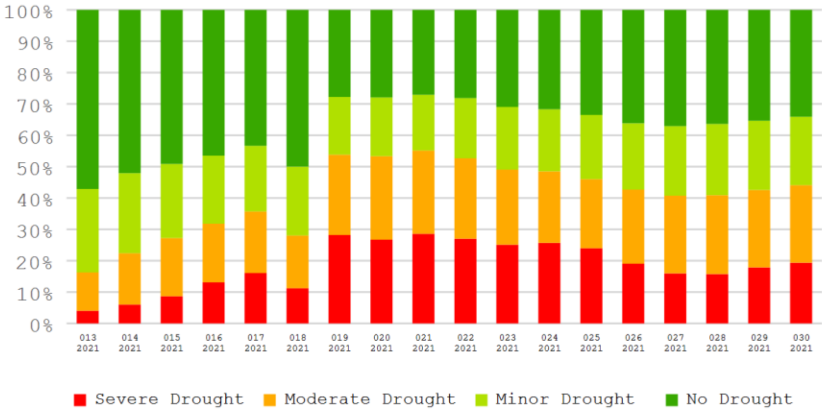
(h) Crop condition development graph based on NDVI Central region with sparse crops (left) Eastern hilly cereals region (right)



(i) Crop condition development graph based on NDVI Aral Sea cotton region



(j) Proportion of NDVI anomaly categories compared with 5YA in Uzbekistan



(k) Proportion of VHIn categories compared with 5YA in Uzbekistan

Table 3.77 Uzbekistan's agroclimatic indicators by sub-national regions, current season's values, and departure from 15YA, April- July 2021

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m^2)	Departure (%)	Current (gDM/m^2)	Departure (%)
Aral Sea cotton zone	11	-57%	27.0	2.1	1592	4	519	-16
Eastern hilly cereals zone	137	-6	22.8	-0.7	1601	2	538	-5
Central region with sparse crops	29	-34	27.0	1.7	1596	3	**464**	-20

Table 3.78 Uzbekistan's agronomic indicators by sub-national regions, current season's values, and departure from 5YA, April- July 2021

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Aral Sea cotton zone	61	-7	0.77
Eastern hilly cereals zone	64	-14	0.71
Central region with sparse crops	72	8	0.84

[VNM] Viet Nam

This monitoring period covers the entire period from the sowing to harvesting of summer rice in the Central part. In May, winter-spring rice in the north and summer-autumn rice in the Mekong Delta and the south-east had reached maturity. In July, the production of spring-winter rice started in the Mekong Delta and South-east region. The planting of rainy season rice in the north started as well. CropWatch agro-climatic indicators show average precipitation (1137 mm, +1%) and TEMP (25.1°C, +0.2°C), but with higher RADPAR (+7%), the BIOMSS (+8%) showed a marked increase compared to the 15YA. Both, VCIx (0.94) and CALF (96%) were high. Based on the NDVI development graph, the crop conditions were below the 5YA and the average of the same period last year, especially at the beginning of this monitoring period. The precipitation during this monitoring period showed an average level compared with the 15YA, while the temperature fluctuated near the 15YA. According to distribution of the VCIx, crop conditions in the North were favorable, while in the South Central Coast they showed an area with low values. As to the spatial distribution of NDVI profiles, crop conditions in about 40.1% were above average mainly in the central of Nghe An Province, Ninh Thuan Province and the South Central Coast region. About 18.3% were below average at the beginning of this monitoring period, mainly distributed in the Northeast of the country. Overall, crop conditions were favorable.

Regional analysis

Based on cropping systems, climatic zones, and topographic conditions, several agro-ecological zones (AEZ) can be distinguished for Vietnam: Central Highlands, Mekong River Delta, North Central Coast, North East, North West, Red River Delta, South Central Coast, and South East.

In the **Central Highlands**, RAIN was below average (1080 mm, -9%) and TEMP was near average (23.8°C). While RADPAR increased significantly (1234 MJ/m^2, +8%), BIOMSS was also higher by 9%. CALF was 99% and VCIx was 0.91. The crop condition development graph based on NDVI indicated that the conditions had fallen from favorable levels to below the 5YA and last year's levels starting in May. Crop production is expected to be average at best.

In the **Mekong River Delta**, RAIN (1059 mm, 0%) and TEMP (27.9°C, -0.1°C) were close to the 15YA. The favorable radiation (RADPAR +6%) caused an increase of BIOMSS by 7%. CALF was also higher (86%, +3%) and VCIx was 0.93. According to the NDVI-based development graph, crop conditions were near the 5YA, except for early April and late July. Crop production is expected to be favorable.

In the **North Central Coast**, with average TEMP (25.1°C, +0.3°C), above average RAIN (1080 mm, +19%) and RADPAR (1300 MJ/m^2, +9%) were observed, resulting in an above-average BIOMSS (+11%). VCIx was 0.95 and CALF was 98%. According to the NDVI-based development graph, crop conditions were low in April but close to average from May to June, and finally surpassed the 5-year-maximum in July. Crop production in this area is expected to be above the average.

In the **North East**, TEMP (24.3°C, +0.5°C) and RAIN (1421 mm, 0%) were near the 15YA. RADPAR was above the 15YA (1211 MJ/m^2, +5%), which resulted in an increased BIOMASS (779 gDM/m^2, +7%). CALF was 100% and VCIx was 0.97. Overall, the crop output is expected to be favorable.

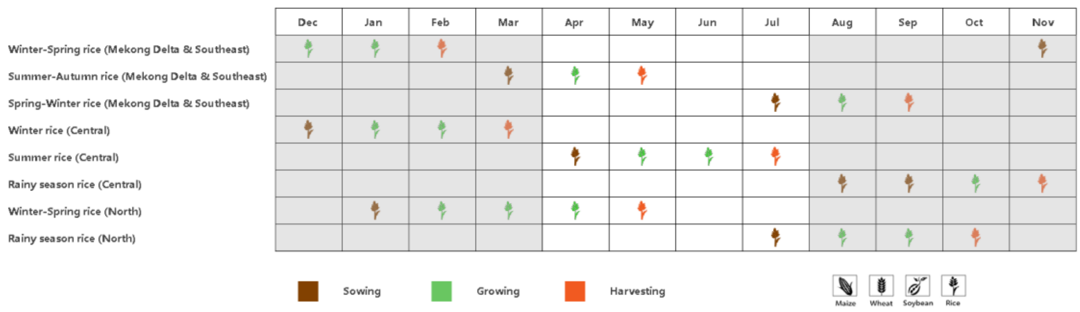
In the **North West**, with significantly increased RAIN (1322 mm, +18%) and RADPAR (1255 MJ/m^2, +6%) and normal TEMP (23.1°C, 0.2°C), BIOMSS increased by 8%. CALF was 100% and VCIx was 0.96. According to the NDVI-based development graph, crop conditions improved and exceeded the 5-year-maximum before May and then decreased below the 5YA. Crop conditions in this region were close to or above the average.

The situations of agro-climatic indicators in the **Red River Delta** were the same as in the **North West**. Increased RAIN (1186 mm, +12%) and RADPAR (1262 MJ/m^2, +6%) and average TEMP (27.2°C, 0.4°C) resulted in an increased BIOMSS (864 gDM/m^2, +8%). CALF was 96% and VCIx was 0.92. According to the crop condition development graph, the NDVI was below the 5YA during the whole monitoring period. Crop output is estimated to be below average.

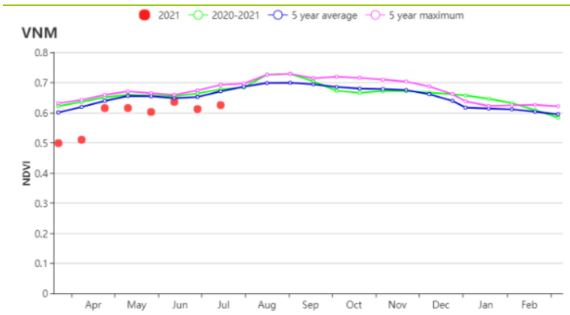
In the **South Central Coast**, RAIN greatly decreased (606 mm, -36%), together with average TEMP (24.6°C, +0.3°C) and increased RADPAR (1318 MJ/m^2, +10%) an increased BIOMSS (807 gDM/m^2, +6%) resulted. CALF was 96% and VCIx was 0.86. According to the crop condition development graph, the NDVI was below the 5YA during the whole monitoring period. Crop conditions were slightly unfavorable.

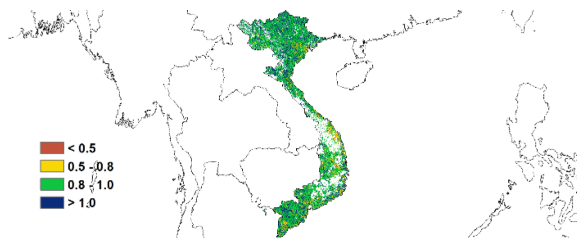
The situations of agro-climatic indicators in the **South East** were the same as those in the **South Central Coast**. Average TEMP (26.5°C, +0%), slightly decreased RAIN (1113 mm, -5%) and increased RADPAR (1301 MJ/m^2, +7%) resulted in an increased BIOMSS (870 gDM/m^2, +7%). CALF was 95% and VCIx was 0.92. According to the crop condition development graph, the NDVI was close to the 5YA in April but decreased below the 5YA after May. Crop conditions in this region were slightly unfavorable.

Figure 3.44 Vietnam's crop condition, April-July 2021



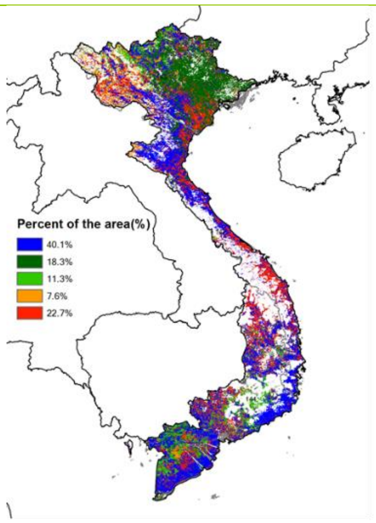
(a). Phenology of major crops

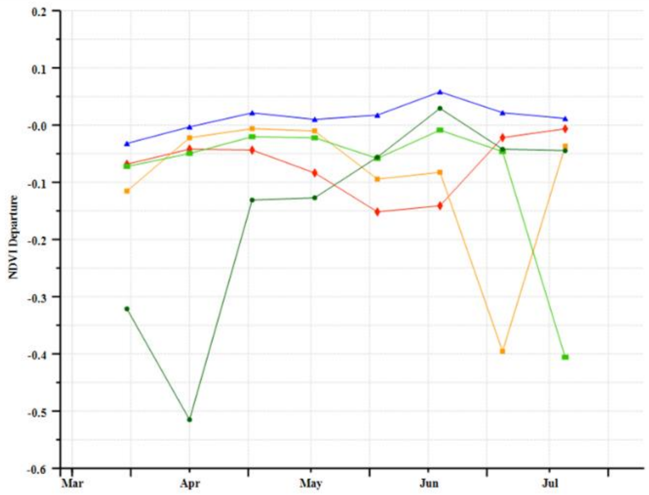




(b) Crop condition development graph based on NDVI

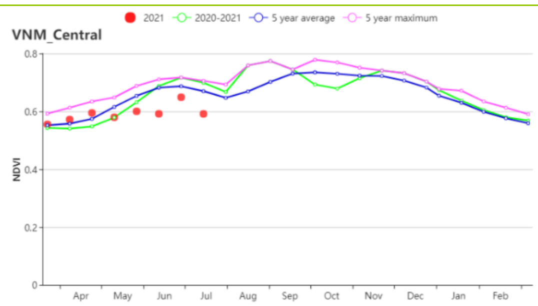
(c) Maximum VCI

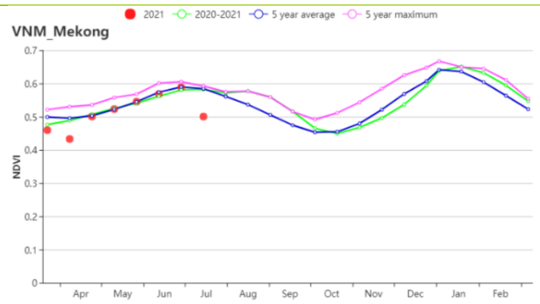




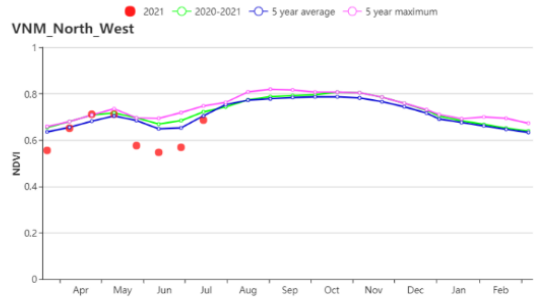
(d) Spatial NDVI patterns compared to 5YA

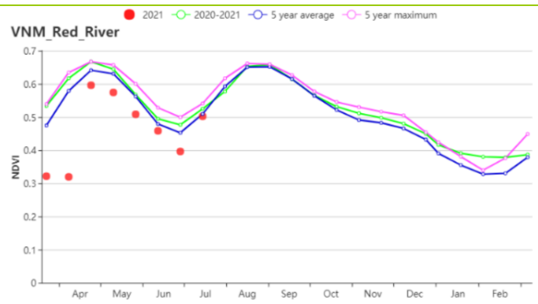
(e) NDVI profiles



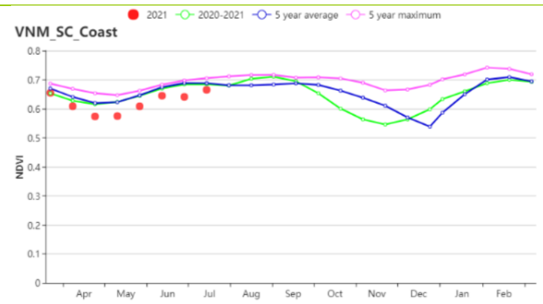


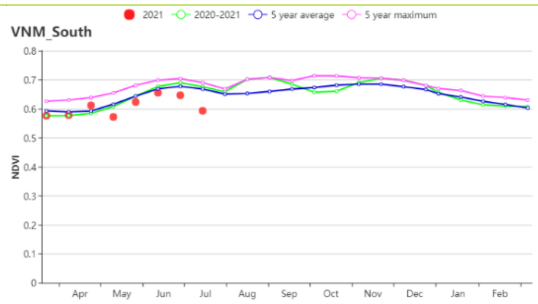
(f) Crop condition development graph based on NDVI Central Highlands Vietnam(left), and Mekong River Delta(right)



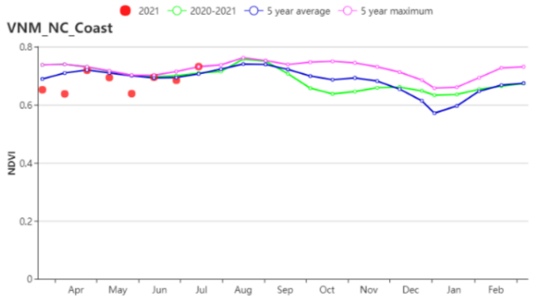


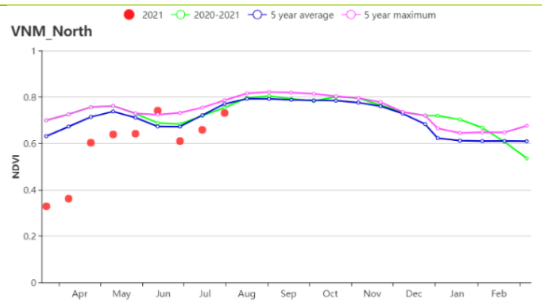
(g) Crop condition development graph based on NDVI North West Vietnam(left), and Red River Delta(right)



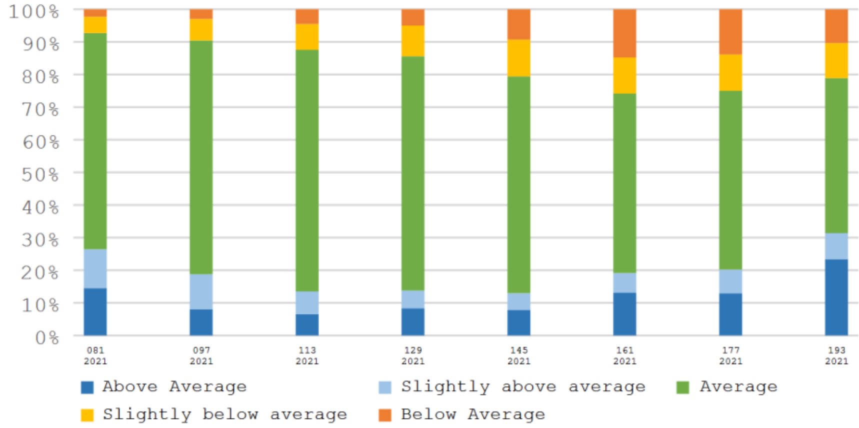


(h) Crop condition development graph based on NDVI South Central Coast Vietnam(left), and South East Vietnam(right)

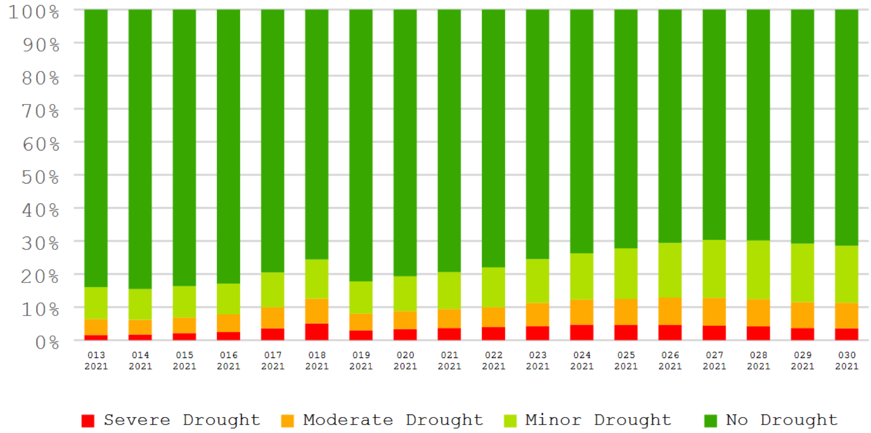




(i) Crop condition development graph based on NDVI North Central Coast Vietnam(left), and North East Vietnam(right)



(j) Proportion of NDVI anomaly categories compared with 5YA



(k) Proportion of VHIm categories compared with 5YA

Table 3.79 Vietnam's agronomic indicators by sub-national regions, current season's values and departure from 15YA, April–July 2021

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m2)	Departure from 15YA (%)	Current (gDM/m2)	Departure from 15YA (%)
Central Highlands	1080	-9	23.8	0.0	1234	8	780	9
Mekong River Delta	1059	0	27.9	-0.1	1333	6	917	7
North Central Coast	1080	19	25.1	0.3	1300	9	856	11
North East	1421	0	24.3	0.5	1211	5	779	7
North West	1322	18	23.1	0.2	1255	6	779	8
Red River Delta	1186	12	27.2	0.4	1262	6	864	8
South Central Coast	606	-36	24.6	0.3	1318	10	807	6
South East	1113	-5	26.5	0.0	1301	7	870	7

Table 3.80 Vietnam's agronomic indicators by sub-national regions, current season's values and departure from 5YA, April–July 2021

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure from 5YA (%)	Current
Central Highlands	99	0	0.91
Mekong River Delta	86	3	0.93
North Central Coast	98	0	0.95
North East	100	0	0.97
North West	100	0	0.96
Red River Delta	96	-1	0.92
South Central Coast	96	0	0.86
South East	95	1	0.92

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

[ZAF] South Africa

In South Africa, soybean and maize are the main crops being produced during this monitoring period. In the east, maize harvest started in May, whereas in the west, it started one month later. Soybean harvest began in April and wheat planting in May.

Based on the NDVI development graph, the crop conditions were below the 5-year average in April and May and improved in June and July. It subsequently started to improve over the 5YA levels in June. At the national level, the CropWatch agroclimatic indicators showed that radiation was slightly above the 15-year average (RADPAR, +5%). With a significantly lower rainfall (RAIN, -36%) and a slightly lower temperature (TEMP, -0.3°C), the potential biomass decreased by 15% compared to the 15-year average. The maximum vegetation condition index (VCIx) was 0.84, and the cropped arable land fraction (CALF) increased by 1% compared with the last 5 years. According to the VCIx, conditions in the western region (such as Western Cape) were better than in the eastern region (like Gauteng, Mpumalanga). As to the spatial distribution of NDVI profiles, crop conditions on about 43.5% of the cropland were above average and about 56.5% of the area was below average during the whole monitoring period. The areas with negative departures were mainly in the center of the eastern region (like Gauteng, Mpumalanga province). Overall, crop conditions were slightly below average.

Regional analysis

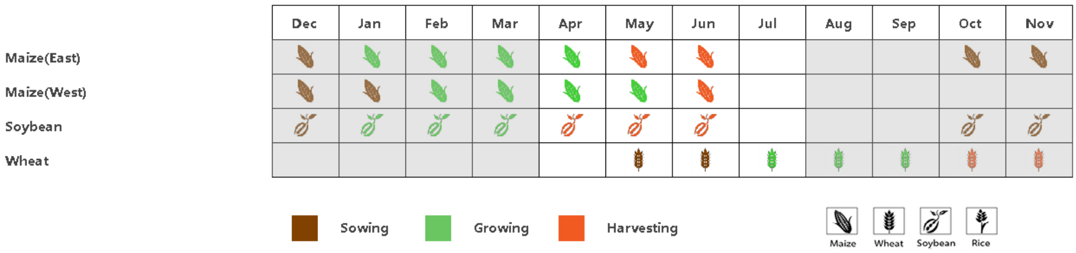
Rainfall in the Arid and desert zones was significantly below average (58 mm, -31%). whereas the average temperature (12.6°C, +0.2°C) and radiation (853 MJ/m2, +4%) were slightly above the average, potential biomass was reduced by 17% due to the insufficient precipitation. Cropped arable land fraction (CALF) decreased substantially (-14%) and VCIx was 0.78. The crop condition development graph based on NDVI indicates that the crop conditions were generally below the 5-year average, and only in June they started to become better than the average. Crop production is expected to be unfavorable.

In the Humid Cape Fold mountains, the temperature was near average (14.5°C, -0.1°C)， and radiation (826 MJ/m2, +5%) was slightly above average. With significant below-average rainfall (93mm, -32%), potential biomass was below the 15-year average (-4%). CALF was 96% and VCIx was 0.85. The crop condition development graph based on NDVI also indicates normal conditions.

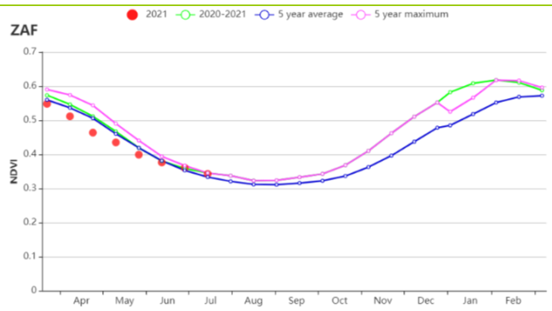
In the Mediterranean zone, the temperature was near average (13.3 °C, 0 °C), while rainfall witnessed a significant increase (316mm, +25%) and radiation was near average (689 MJ/m2, +1%). The estimated potential biomass was reduced by 5%. CALF increased substantially (87%, +6%) and VCIx was 0.93. According to the crop condition development graph, the NDVI was above the 5-year maximum for most of the period. Crop conditions were favorable.

In the Dry Highveld and Bushveld maize areas, most agroclimatic indicators were below the 15-year average: rainfall (31 mm, -54%), temperature (11.9 °C, -0.4°C) and radiation (196 MJ/m2, +5%). Potential biomass was reduced by 20%. CALF was above the 5YA (84%, +1%) and VCIx was 0.83. The crop condition development graph based on NDVI indicated similar conditions as in the Arid and desert zones, which became better than the average only at the end of June. Crop conditions were unfavorable.

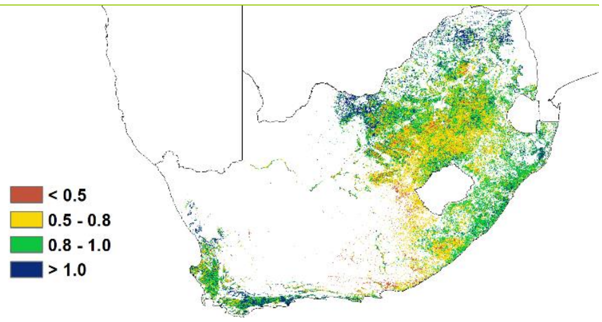
Figure 3.45 South Africa's crop condition, April - July 2021



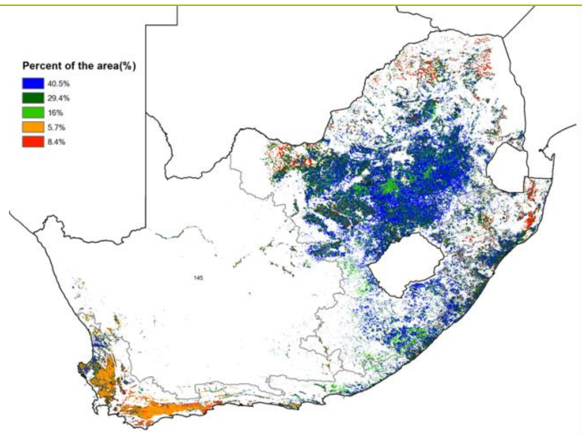
(a). Phenology of major crops



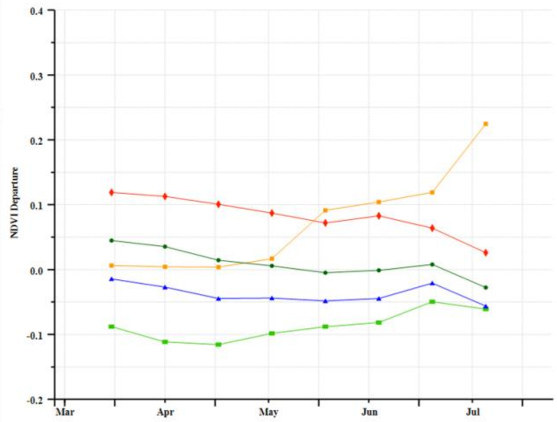
(b) Crop condition development graph based on NDVI



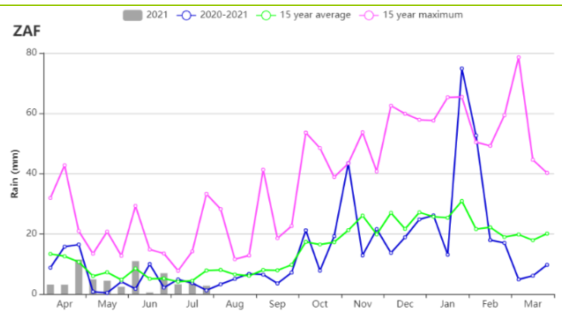
(c) Maximum VCI



(d) Spatial NDVI patterns compared to 5YA

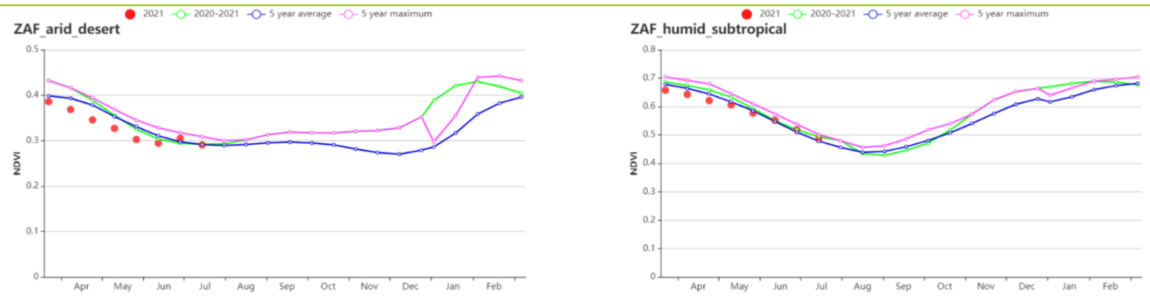


(e) NDVI profiles

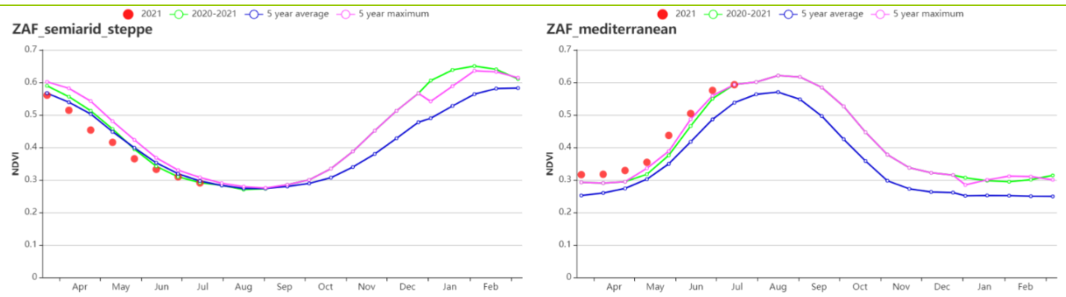


(f) Rainfall profiles

(g) Temperature profiles



(h) Crop condition development graph based on NDVI Arid desert (left) and Humid sub-tropical (right)



(i) Crop condition development graph based on NDVI semiarid steppe (left) and Mediterranean (right)

Table 3.81 South Africa's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, April - July 2021

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Arid and desert zones	58	-31	12.6	0.2	853	4	196	-17
Humid Cape Fold mountains	93	-32	14.5	-0.1	826	5	283	-4
Mediterranean zone	316	25	13.3	0.0	689	1	238	-5
Dry Highveld and Bushveld maize areas	31	-54	11.9	-0.4	967	5	196	-20

Table 3.82 South Africa's agronomic indicators by sub-national regions, current season's values and departure from 5YA, April - July 2021

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure from 5YA (%)	Current
Arid and desert zones	37	-14	0.78
Humid Cape Fold mountains	96	1	0.85
Mediterranean zone	87	6	0.93
Dry Highveld and Bushveld maize areas	84	1	0.83

[ZMB] Zambia

The report covers the harvest period for the rainfed crops and the sowing of irrigated winter wheat and horticultural crops. The 2021 rainfed cereal harvest was completed in July. Harvest of the minor winter wheat crop will take place in November. The total cereal production in the country is expected to be around 4 million tonnes for the 2020/2021 season. This includes the winter wheat crop, which is expected to be above average. The conducive rainfall throughout the season, favourable weather conditions in general and on-time provision of production inputs provided a favorable environment for the attainment of high crop yields. Minor and localized crop losses in parts of Southern and Western provinces occurred due to infestations of African Migratory Locust (AML). Regular control operations minimized the impact on agricultural output.

Rainfall showed a 54% negative departure from the 15YA. Temperature (TEMP) was also lower than the 15YA by 0.5°C, whereas radiation (RADPAR) showed a positive anomaly by 3% and potential biomass production (BIOMSS) showed a negative departure by 14%. The cropped arable land fraction (CALF) showed a 2% increase and maximum VCI value was 0.88. Based on the NDVI profiles, 12.2% of the cultivated area was above normal, 33.3% was close to normal, and 54.4% of the cultivated area had a negative departure attributed to the early ending of the rainy season. The observed rainfall deficit indicates drier conditions, which facilitated harvest. It had limited impact on the crops. Overall, crop conditions were fair.

Regional Analysis

CropWatch considers four main crop production zones in Zambia, namely the **Northern high rainfall zone**, **Central-eastern and southern plateau**, **Western semi-arid plain** and **Luangwa Zambezi rift valley**.

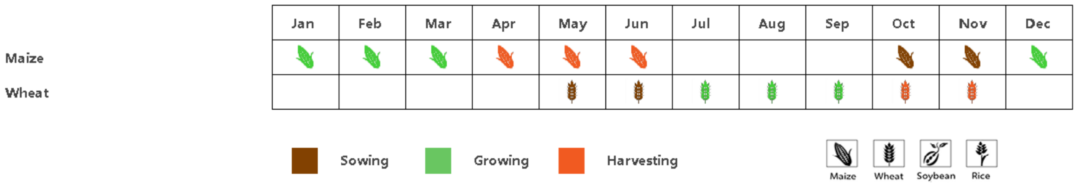
In the **Northern high rainfall zone**, precipitation decreased by 41%, temperature was near average (-0.4°C), while the radiation increased by 4%. In this zone the reduction in rainfall affected the estimated potential biomass by a 7% decrease over the 15YA, however the cropped arable land fraction (CALF) remained at 100% with no departure from the 5YA and VCIx was at 0.90.

In the **Central-eastern and southern plateau**, the precipitation decreased by 64% and temperatures by -0.5°C, while the radiation increased by 2%. VCIx was at 0.90. This region forms the main agriculture production of Zambia.

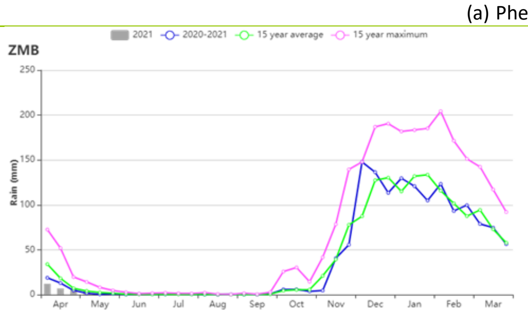
In the **Western semi-arid plain** the rainfall departed by -94% and temperatures by -0.3°C while radiation increased by 2%. These conditions affected biomass production with a reduction by 27% as a result of rainfall reduction and low water holding capacity of the predominant sandy soils in this region.

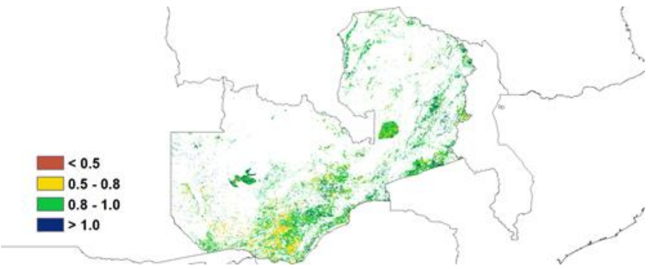
In the **Luangwa Zambezi rift valley**, the rainfall departed by -81%, temperatures were also below average (-0.5°C) and radiation increased by 2%. Estimated biomass was reduced by 17%. This region is associated with low rainfall and normally affected by drought and dry spells.

Figure 3.46 Zambia 's crop condition, April-July 2021

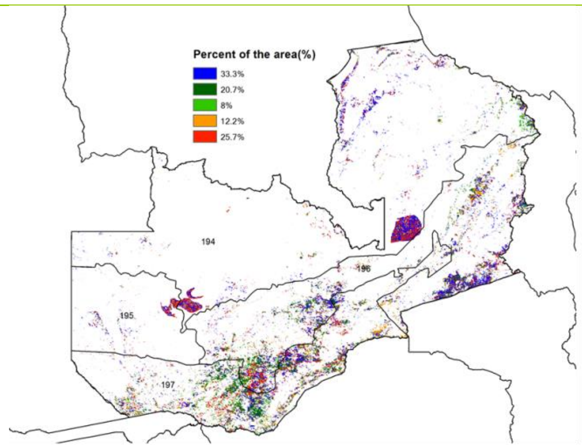


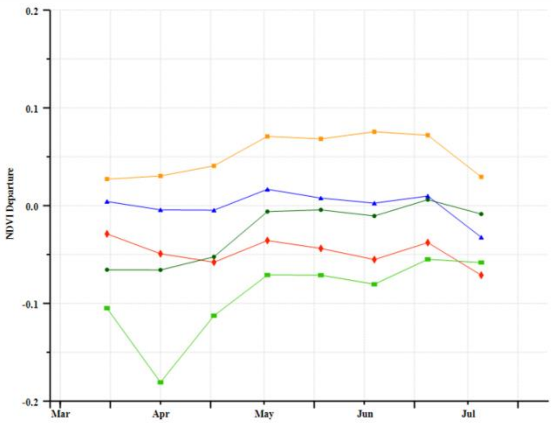
(a) Phenology of major crops



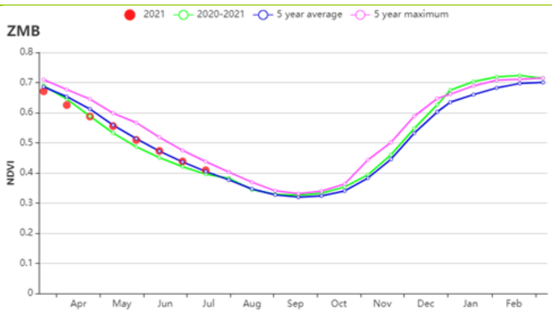


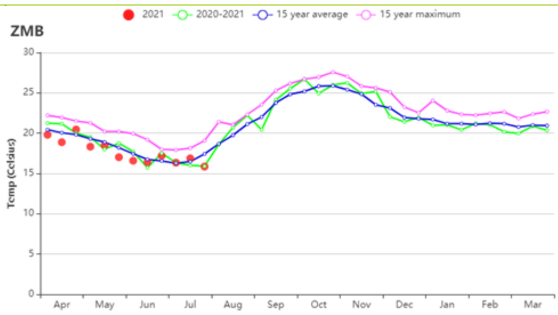
(b) Crop condition development graph based on NDVI (c) Maximum VCI



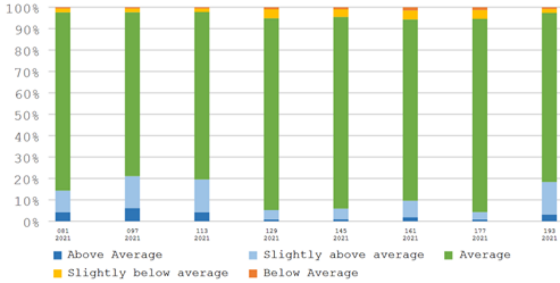


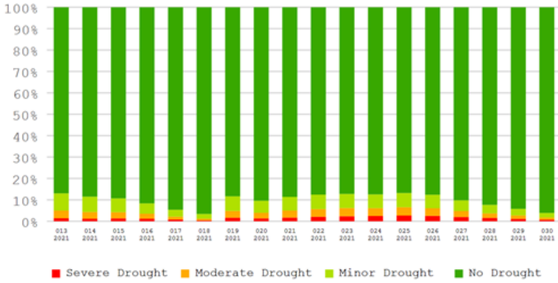
(d) Spatial NDVI patterns compared to 5YA (e) NDVI profiles





(f) Rainfall time series profile (g) Time series temperature profile





(h) Proportion of NDVI anomaly categories compared with 5YA (i) Proportion of VHIm categories compared with 5YA

Table 3.83 Zambia 's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, April-July 2021

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m²)	Departure from 15YA (%)	Current (gDM/m²)	Departure from 15YA (%)
Northen high rainfall zone	62	-41	17.6	-0.4	1214	4	363	-7
Central-eastern and southern plateau	21	-64	17.5	-0.5	1116	2	361	-9
Western semi-arid plain	2	-94	18.3	-0.3	1194	1	150	-27
Luangwa Zambezi rift valley	7	-81	17.6	-0.5	1135	2	271	-17

Table 3.84 Zambia 's agronomic indicators by sub-national regions, current season's value and departure from 5YA, April-July 2021

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure from 5YA (%)	Current
Northen high rainfall zone	100	0	0.90
Central-eastern and southern plateau	100	2	0.89
Western semi-arid plain	99	0	0.85
Luangwa Zambezi rift valley	99	4	0.86

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 then presents China's crop prospects (section 4.2), 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 (section 4.3). Section 4.4 describes trade prospects of major cereals and soybean. Additional information on the agro-climatic indicators for agriculturally important Chinese provinces is listed in table A.11 in Annex A.

4.1 Overview

Most of the summer crops, such as semi-late rice, maize and soybean, were in the field during the reporting period. This period also covers the harvest of early rice and winter wheat. The sowing of late rice was completed in July. The agro-climatic conditions were quite favorable, with temperature slightly above average (+0.1°C), rainfall and RADPAR near average. This was beneficial for crop growth and VCIx reached a high value of 0.94 at the national scale.

According to the time series rainfall profile, above-average rainfall was observed nationwide in mid-May and late July. Nearly all of the main agricultural regions of China recorded above-average rainfall, with the largest positive departure occurring in Huanghuaihai (+50%). The only exception was Southern China (-12%). Excessive rainfall (positive departures by more than 20%) occured mainly in the provinces in Huanghuaihai (Hebei, Henan and Shandong), Lower Yangtze region (Jiangsu, Anhui and Zhejiang), Inner Mongolia (Inner Mongolia) and Northeast China (Heilongjiang and Liaoning). The largest positive departure was observed in Hebei province (+62%). In late July, typhoon In-Fa in connection with monsoon rains, exacerbated by climate change, affected large areas in Henan, Hebei, Shanxi and Beijing. The record-setting precipitation caused regional floods which affected both urban and rural areas. The floods damaged maize and peanuts, the two dominant crops grown in the region. At the country level, rainfall anomalies fluctuated largely over time and space. As can be seen from the spatial distribution of rainfall profiles, 64.1% of the cropped areas recorded slightly below-average precipitation, with the rainfall departure within -25mm/dekad. 25.6% of the cropped areas, mainly located in Huanghuaihai and some parts in Northeast China (western Heilongjiang) and Southwest China (eastern Sichuan), received significantly above-average rainfall (more than +90mm/dekad) during middle July. 10.4% of crop areas experienced the largest positive departure of rainfall (more than +120mm/dekad) during middle May and the largest negative rainfall departure (more than -60mm/dekad) during middle July, occurred mainly in some parts of Anhui, Jiangsu, Zhejiang, Fujian, Jiangxi, Hunan and Guangdong provinces.

Three of the main agricultural regions in China recorded above-average temperature (Northeast China, +0.1℃; Lower Yangtze region, +0.3℃; Southern China, +0.7℃), Southwest China recorded average temperature, and the other regions all recorded below-average temperatures with departures ranging from -0.1°C to -0.3°C. Temperatures fluctuated during the monitoring period as follows: 50.1% of the cultivated regions in Loess region, southern Huanghuaihai, northern Lower Yangtze region and northern Southwest China had negative temperature anomalies by more than -1.5℃ in early April. 25.8% of the cropped areas in northern Huanghuaihai, Inner Mongolia and Northeast China had negative temperature anomalies by more than -1.5℃ in early May, late May and early June, and had positive temperature anomalies exceeding +1.5℃ in middle July. The remaining 24.1% of the cultivated regions in Southern China and southern parts of Lower Yangtze region and Southwest China had almost all positive temperature anomalies throughout the monitoring period. RADPAR had the largest negative anomalies in Huanghuaihai and Southwest China (-4%), and the biggest positive anomalies in Southern China (+9%).

As for BIOMSS, the situation was quite different among all the main producing regions, with the departures between -3% (Huanghuaihai, Inner Mongolia) and +12% (Southern China). CALF increased in the Loess region (+2%) and Inner Mongolia (+1%) as compared to the 5YA, indicating that the cultivated areas in these two regions are quite promising. The remaining regions all showed average CALF. The VCIx values were higher than 0.9 in almost all the main producing regions of China, with values between 0.92 and 0.98, except for the Loess region (0.88).

In terms of the proportion of NDVI anomaly categories compared with the 5-year average, the 16-day phases from April to Mid-June shared almost the same pattern, while the last three phases had slightly below to below average anomalies in around 20% of the cropped areas. According to the proportion of different drought categories compared with the 5-year average, less than 10% of the cropped areas had moderate to severe drought conditions throughout the monitoring period.

Table 4.1 CropWatch agroclimatic and agronomic indicators for China, April to July 2021, departure from 5YA and 15YA

Region	Agroclimatic indicators				Agronomic indicators	
	Departure from 15YA (2006-2020)				Departure from 5YA (2016-2020)	Current
	RAIN (%)	TEMP (°C)	RADPAR (%)	BIOMSS (%)	CALF(%)	Maximum VCI
Huanghuaihai	50	-0.3	-4	-3	0	0.93
Inner Mongolia	32	-0.3	-3	-3	1	0.96
Loess region	7	-0.1	-1	2	2	0.88
Lower Yangtze	0	0.3	0	3	0	0.94
North-east China	30	0.1	1	2	0	0.98
Southern China	-12	0.7	9	12	0	0.92
Soutwest China	1	0.0	-4	-1	0	0.96

Figure 4.1 China crop calendar

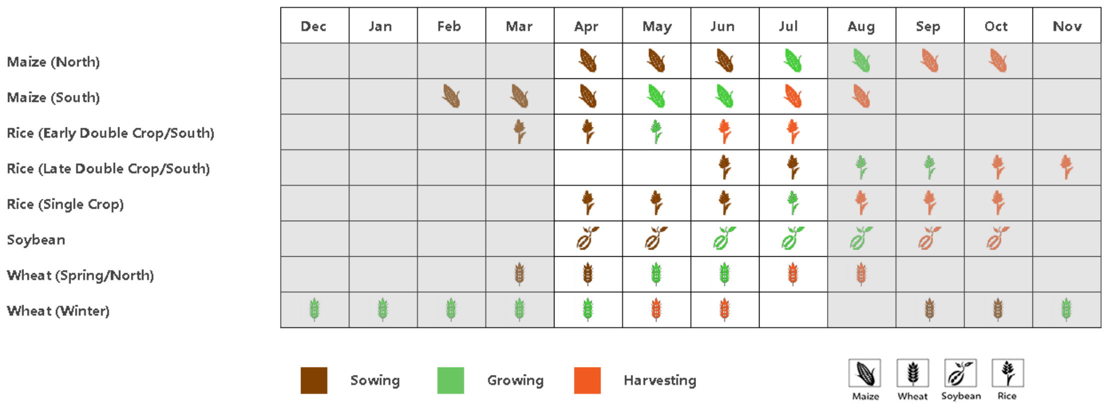


Figure 4.2 China spatial distribution of rainfall profiles, April - July 2021

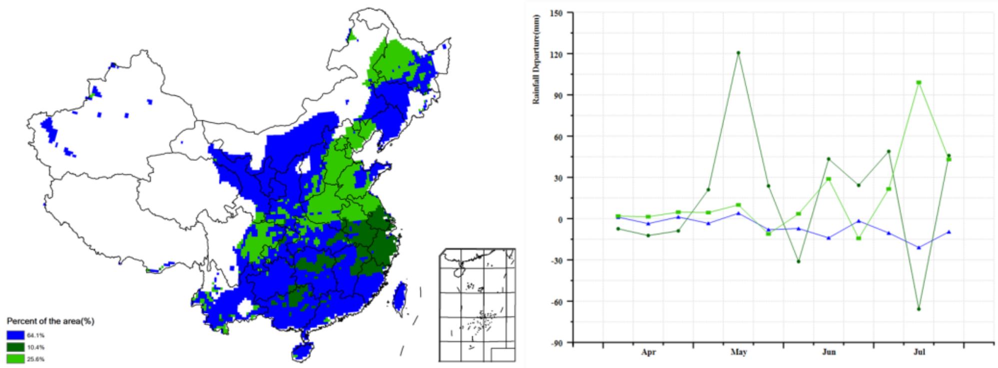


Figure 4.3 China spatial distribution of temperature profiles, April - July 2021

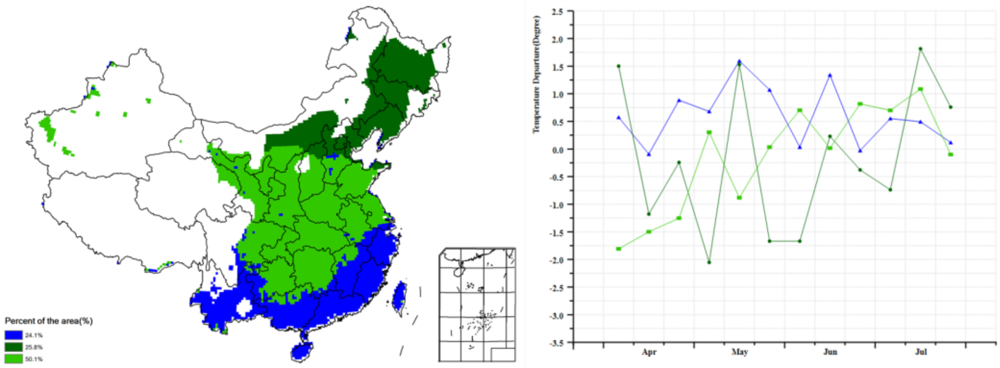


Figure 4.4 China spatial distribution of NDVI profiles, April-July 2021

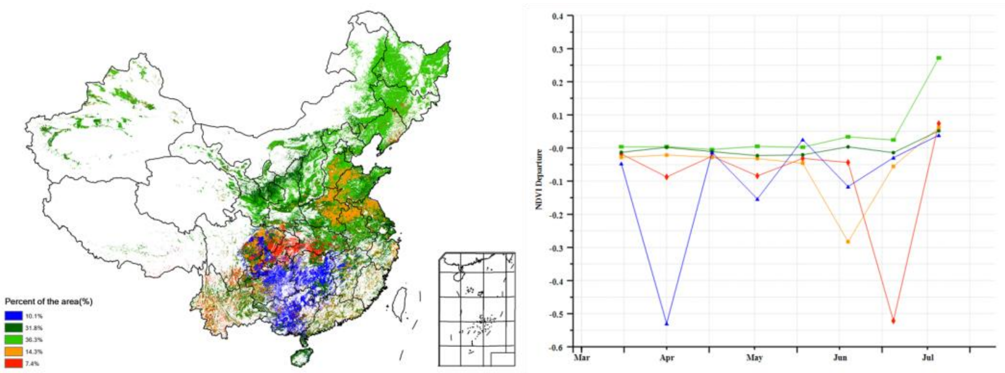


Figure 4.5 Cropped and uncropped arable land by pixel, April - July 2021

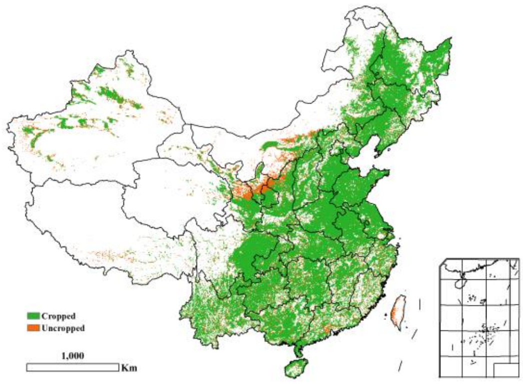


Figure 4.6 China maximum Vegetation Condition Index (VCIx), by pixel, April - July 2021

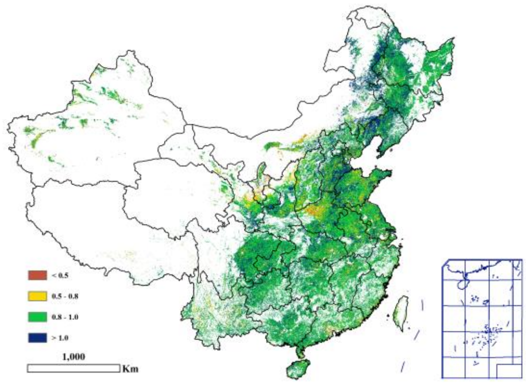


Figure 4.7 China biomass departure map from 15YA, by pixel, April-July 2021

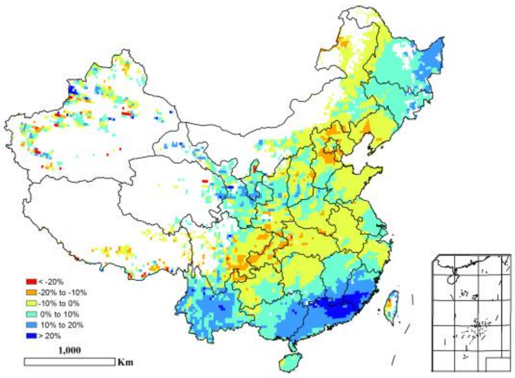


Figure 4.8 Time series rainfall profile for China

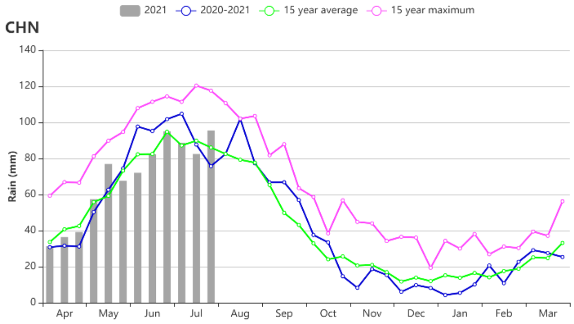


Figure 4.9 Proportion of NDVI anomaly categories from April to July 2021

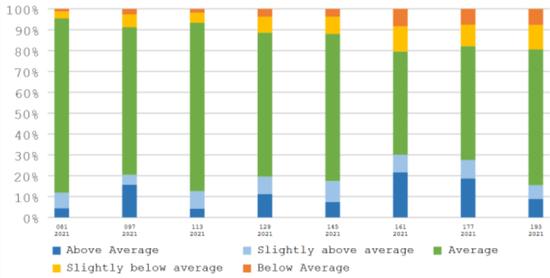
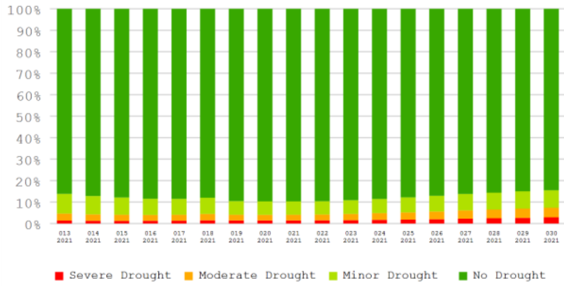


Figure 4.10 Proportion of different drought categories from April to July 2021



4.2 China's winter crops production

The multi-source remote sensing data such as Sentinel 1/2, Landsat 8 and Chinese satellite data such as Gaofen-1 were combined with the latest meteorological information, the yield of China's staple grain and oil crops (mainly including maize, rice, wheat and soybean) in 2021 was quantitatively predicted by integration of remote sensing index model, agro-meteorological yield estimation model. Based on GVG APP, 142,379 ground-based actual measurement samples covering 145 counties (or districts) in Northeast, North China Plain, Northwest, Southwest and other major agricultural production areas were collected. Combined with the latest national 10 m resolution cropland data, crop area was estimated using Big Data analysis method.

Total crop production in 2021 is expected to be 638.87 million tonnes, an increase of 7.44 million tonnes or 1.2% up from last year. Among them, the total output of summer crops (including maize, semi-late rice, late rice, spring wheat, soybeans, tuber crops and other minor crops) is expected to be 472.7 million tonnes, an increase of 6.379 million tonnes or 1.4% over 2020; the total output of winter crops in 2021 is estimated to be 132.48 million tonnes using the latest remote sensing data, an increase of about 982 thousand tonnes or 0.7% year-on-year. Planted area and yield of summer cropsincreased by 0.5% and 0.3%, respectively (Table 4.2).

Table 4.2 Review results of winter wheat production in China's major summer grain-producing provinces and cities in 2021

	2020	2021			
	Production (thousand tonnes)	Area variation(%)	Yield variation(%)	Production variation(%)	Production (thousand tonnes)
Hebei	12336	1.7	0.9	2.6	12653
Shanxi	2352	-2.3	-1.3	-3.5	2270
Jiangsu	10216	-1.1	-0.2	-1.2	10089
Anhui	12042	0.3	0.8	1.1	12179
Shandong	25638	2.8	1.7	4.5	26793
Henan	28081	-0.4	-0.5	-0.9	27824
Hubei	5492	-1.4	0.4	-1.1	5432
Chongqing	2318	-0.8	1.3	0.5	2329
Sichuan	5785	-1.2	1.8	0.6	5820
Shaanxi	4223	-3.5	1.5	-2.1	4135
Gansu	3605	-4.3	1.9	-2.4	3517
Subtotal	112087			0.9	113041
Other provinces	19415			0.1	19443
National*	131502	0.5	0.3	0.7	132484

Maize

Due to market factors such as the continued rise in maize prices, China's maize planted area increases by 1.8% to 41,463 thousand ha in 2021, an increase of 724 thousand ha. Although floods and other disasters occurred in some areas during the maize reproductive period, sufficient precipitation was generally favorable to maize yield formation, and national maize yields are expected to increase by 0.7%. Total maize production will reach 231.62 million tonnes, an increase of 5.52 million tonnes (Table 4.3). As the largest maize-producing region in China, the Northeastreceived abundant rainfall, creating good agro-meteorological conditions for maize production. Together with the year-on-year increase in maize planted area in Heilongjiang, Jilin, Liaoning and Inner Mongolia, maize production is expected to increase by 5.1%, 3.1%, 3.8% and 4.6%, respectively; Shandong, Hebei and Shanxi have good agro-meteorological conditions during the maize reproductive period, and maize yields are expected to increase by 3.9%, 4.8% and 1.0% from last year, respectively. In Gansu and Shaanxi, the temporary low precipitation during the fertility period of maize, resulted in poor growth condition, and maize production is expected to decrease by 5.2% and 2.2%, respectively;

Table 4.3 China's maize, rice, wheat and soybean production (thousand tonnes) and variation (%), 2021

Province	Maize		Rice		Wheat		Soybeans	
	2021	variation	2021	variation	2021	variation	2021	variation
Anhui	3571	-0.9	17396	0.2	11679	1.3	1081	1.4
Chongqing	2119	-0.4	4771	1.6	1146	0.3		
Fujian			2803	-0.7				

Gansu	5430	-5.2			3077	-1.7		
Guangdong			11329	-1				
Guangxi			10636	-0.3				
Guizhou	5185	0.2	5542	5.3				
Hebei	19635	4.8			12341	2.6	200	6.5
Heilongjiang	43057	5.1	22337	2.9	451	3.4	4849	-5.3
Henan	15713	-1.1	3776	-1.6	27694	-1	824	0.6
Hubei			16304	4.9	3904	-1		
Hunan			25070	-0.8				
Inner Mongolia	24139	4.6			1938	2.1	1200	1.3
Jiangsu	2193	0.4	16252	1.1	9867	-1.2	769	2.9
Jiangxi			16349	-0.5				
Jilin	30677	3.1	5794	0.7			814	2.2
Liaoning	18817	3.8	4592	4.3			439	4.9
Ningxia	1786	3.2	449	1.8	752	-0.8		
Shaanxi	3886	-2.2	1012	-3.1	4053	-2.1		
Shandong	19746	3.9			26554	4.5	737	5.5
Shanxi	9355	1			2197	-3.5	161	2.1
Sichuan	7057	-1.4	15196	2.8	5004	1.3		
Xinjiang	7013	4.8			5052	-1.6		
Yunnan	6547	3.1	5890	2.8				
Zhejiang			6489	-0.5				
Subtotal	225924	2.9	191986	1.1	115711	0.9	11074	-1.1
China*	231602	2.4	202798	0.8	127981	0.7	14371	-1.4

Affected by the flooding in July, the production of maize in Henan Province in 2021, was 15.713 million tonnes, a decrease of 182 thousand tonnes, or 1.1%. Nearly 1/4 of the maize in Hebi, and 15.1 thousand hectares and 14.5 thousand hectares of maize in Xinxiang and Anyang was damaged by floods, with maize production in Hebi, Xinxiang, and Anyang decreasing by 24.7%, 3.5%, and 2.2%, respectively; Zhoukou, the largest maize-producing city in Henan, was observed with a 1.3% decrease in maize production; Pingdingshan, Xuchang, and Kaifeng also had a small reduction in maize production. Strong precipitation at the same time brought sufficient water for maize in Nanyang and Zhumadian in southern Henan, Shangqiu in the east, Puyang in the northeast which is favorable for maize, production increased by 1.1%, 1.1%, 0.8% and 3.2% respectively, which narrowed the maize production drop caused by flooding.

Rice

The total national rice production is expected to be 202.80 million tonnes, an increase of 0.8% and 1.62 million tonnes; of which early rice production is 33.52 million tonnes, an increase of 0.2%, semi-late rice/single rice production is expected to be 134.14 million tonnes, an increase of 1.3%, and late rice production is expected to be 35.14 million tonnes, a decrease of 0.4%.

The national early rice planting area was 5,029.9 thousand hectares, a decrease of 1.4%, and the area shrank by 71.5 thousand hectares, but still higher than in 2019. Except for Fujian Province, where early rice yields declined, early rice yields increased in the remaining major producing provinces. Early rice yields in Hubei Province recovered by 4.7%, the largest increase in early rice producing provinces. The increase in national early rice yields offset the impact of shrinking planted area, with a slight increase of 0.2% production. Early rice production in four provinces including Anhui, Guangxi, Hunan and Hubei increased from 2020.

Since the sowing of the semi-late/single rice, the agro-meteorological conditions in the main rice producing areas are generally normal, and the average yield increased by 0.9% and the total output increased by 1.69

million tonnes from 2020. Semi-late/single rice production in Guizhou, Hubei, Liaoning, Sichuan, and Yunnan is expected to increase by 5.3%, 4.9%, 4.3%, 2.8% and 2.8%, respectively. Weather are more favorable compared with 2020 in Heilongjiang and Jilin, resulting in 2.9% and 0.7% increase of single rice production. The risk of flooding in the middle and lower reaches of the Yangtze River, and the rivers in the northeast still exists, and the local farmers should be prepared if disasters ocurr.

Soybeans

The national soybean area in 2021 is 7807.5 thousand hectares, a decrease of 132.3 thousand ha compared with 7939.8 thousand hectares in 2020. The national average soybean yield is expected to increase slightly by 0.3%, and the total output will reach 14.37 million tonnes, down 1.4%. In terms of the provinces, Heilongjiang and Inner Mongolia, the two major producing provinces, was observed with largest reduce ofsoybean planted area by 8.0% and 3.0%, mainly due to the agricultural policy and the high maize price. Farmers prefer maize rather than soybeans. More than average rainfall was observed in Heilongjiang and Inner Mongolia which provide sufficient water for soybean, although causing local Flooding. Favorable conditions benefitted soybean growth and yield formation, resulting in an increase of soybean yields. Soybean production in Heilongjiang Province is predicted to be 5.3% lower than 2020. Soybean yields in Inner Mongolia increased which compensate the impact of decreased planted areas, and soybean production is expected to increase by 1.3%. The remaining soybean-producing provinces and regions are all expected to close to 2020.

Wheat

The total winter wheat production in 2021 is estimated at 122.28 million tonnes, an increase of 1.13 million tonnes or 0.9%. The total planted area is 23,952.6 thousand hectares, up by 0.5%, and the average yield of winter wheat was 5,105.1 kg/ha, 0.5% higher than 2020 (Table 4.4). National wheat production is estimated at 127.98 million tonnes, an increase of 929 thousand tonnes compared with 2020; total spring wheat production is 5.7 million tonnes, a decrease of 0.20 million tonnes.

As for the provincial level, both planted area and yield of winter wheat in Hebei, Anhui and Shandong increased from 2020, and the output of winter wheat increased by 0.31 million tonnes, 0.15 million tonnes and 1.14 million tonnes respectively. Water deficit affected Shanxi's winter wheat, and both the yield and planted area decreased by 1.3% and 2.3%, resulting in a 3.5% decrease in winter wheat output. The winter wheat planted area in Jiangsu and Henan decreased slightly. The two provinces were also affected by strong winds and heavy rains in May which resulted in wheat lodging locally, leading to a slight decrease of wheat yield by 0.2% and 0.5%, respectively. As a result, winter wheat output dropped by 0.12 million tonnes and 0.27 million tonnes in Jiangsu and Henan, respectively. The area of winter wheat in Hubei, Chongqing, Sichuan, Shaanxi, and Gansu decreased, while the average winter wheat yield increased. The departure of winter wheat production from 2020 in those five provinces is less than 100 thousand tonnes.

Table 4.4 Winter wheat production in the main producing provinces in China,2021

	Planting area		Yield		Production	
	2021 (thousand hectares)	Variation (%)	2021(kg/ha)	Variation (%)	2021 (thousand tonnes)	Variation (%)
Hebei	1998	1.7	6176.5	0.9	12341	2.6
Shanxi	504.9	-2.3	4351	-1.3	2197	-3.5
Jiangsu	1956.4	-1.1	5043.2	-0.2	9867	-1.2
Anhui	2442.3	0.5	4782.1	0.8	11679	1.3
Shandong	4398.8	2.8	6036.5	1.7	26554	4.5

Henan	5349.9	-0.4	5176.6	-0.5	27694	-1
Hubei	971.4	-1.3	4019.2	0.3	3904	-1
Chongqing	340	-0.9	3372.3	1.2	1146	0.3
Sichuan	1283.7	-0.4	3898.6	1.7	5004	1.3
Shaanxi	1034.4	-3.5	3918.4	1.5	4053	-2.1
Gansu	433.1	-4.3	4057	1.9	1757	-2.4
Subtotal	20712.9	0.1	5127.1	0.8	106197	1
Other	3239.6	2.7	4964.7	-2	16084	0.6
National*	23952.6	0.5	5105.1	0.5	122281	0.9

4.3 Regional analysis

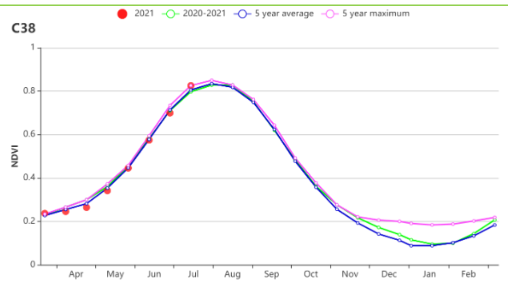
Figures 4.11 through 4.17 present crop condition information for each of China's seven agricultural regions. The provided information is as follows: (a) Phenology of major crops; (b) Crop condition development graph based on NDVI, comparing the current season up to July 2021 to the previous season, to the five-year average (5YA), and to the five-year maximum; (c) Spatial NDVI patterns for April to July 2021 (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 April to July 2021. Additional information about agro-climatic indicators and BIOMSS for China is provided in Annex A.

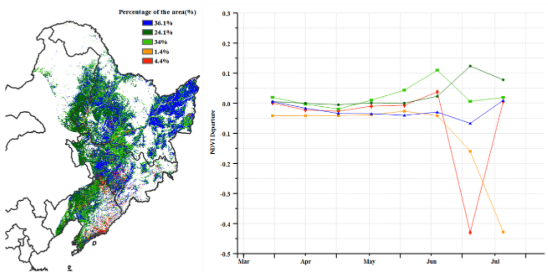
Northeast region

This current monitoring period covers the sowing and the first half of the growing season of main crops in the northeast of China (April to July 2021). CropWatch Agroclimatic Indicators (CWAIs) show that the precipitation greatly deviated from the average level. The total precipitation increased by 30%. It was above average level from late May to late July. The photosynthetically active radiation and the temperature were close to average. This resulted in a potential biomass estimate that was 2% above the fifteen-year average level.

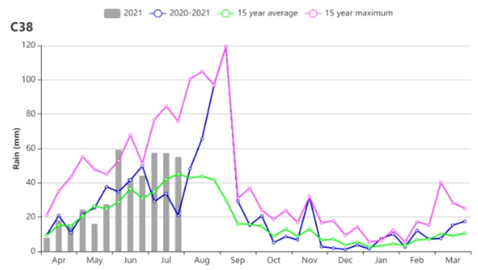
The crop conditions during the monitoring period were in general slightly above average but spatial variations existed. The maximum VCI shows that all provinces of the Northeast of China were above 0.8, except for a small part of western Heilongjiang province near the riverside area. This was mainly due to the flooding caused by significant above average rainfall. The sowing dates in some low-lying areas in the eastern part of Heilongjiang province were delayed due to waterlogging in spring, this in return caused a delayed development of NDVI. In the eastern part of Heilongjiang province, soybean suffered from drought at the flowering stage, which negatively affected podding.

Figure 4.11 Crop condition China Northeast region, April - July 2021

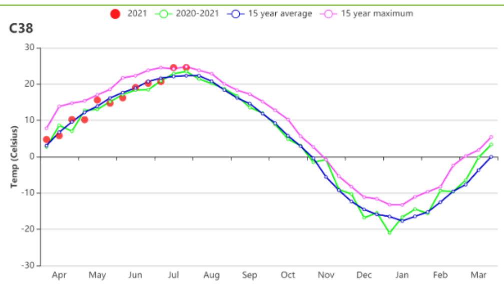




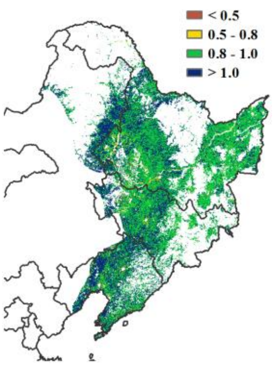
(a) Crop condition development graph based on NDVI (b) Spatial NDVI patterns compared to 5YA (c) NDVI profiles



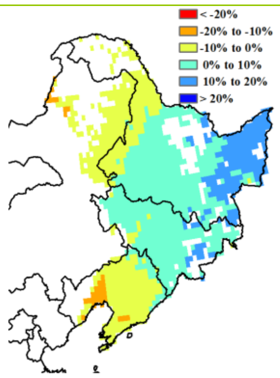
(d)Time series rainfall profile



(e)Time series temperature profile



(f) Maximum VCI



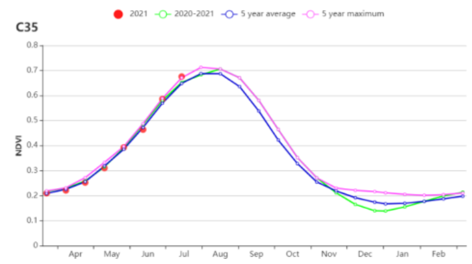
(g) Biomass departure

Inner Mongolia

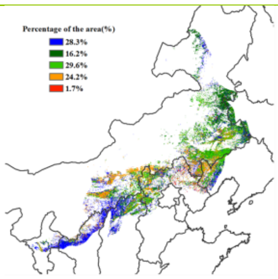
During the reporting period, the summer crops (maize, spring wheat and soybean) were grown in Inner Mongolia. Overall, the crop conditions were normal. Rainfall was greatly above average (+32%). TEMP (-0.3°C) and RADPAR (-3%) were both slightly below average, resulting in a below-average estimate for BIOMSS (-3%). The spatial and temporal distribution for these indicators was very uneven. Low temperatures dominated the early growing season from April to June, meanwhile a large increase in rainfall in July caused a below-average RADPAR in some region in Northern Hebei, where the biomass accumulation potential (BIOMSS) was significantly below average. Almost all cropped areas displayed consistently average NDVI during the reporting period.

The fraction of cropped arable land (CALF) reached 93%; VCIx was 0.96. According to the NDVI development graph, crop conditions were close to average during the reporting period. The final outcome of the season will depend on weather conditions in August and September.

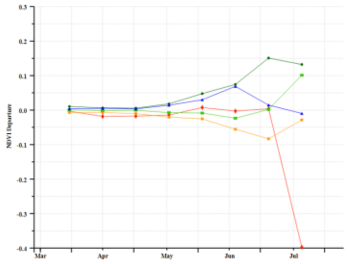
Figure 4.12 Crop condition China Inner Mongolia, April - July 2021



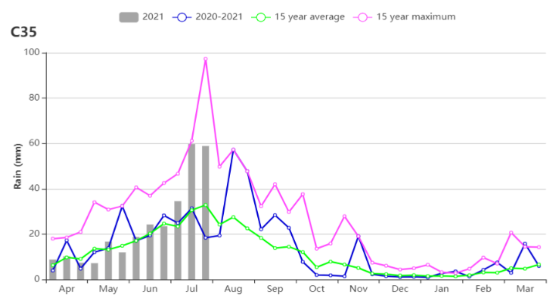
(a) Crop condition development graph based on NDVI



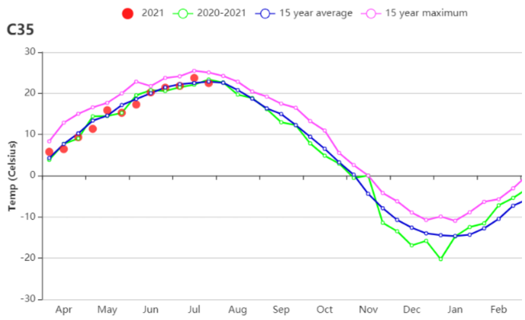
(b) Spatial NDVI patterns compared to 5YA



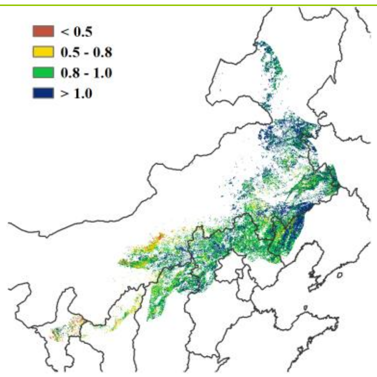
(c) NDVI profiles



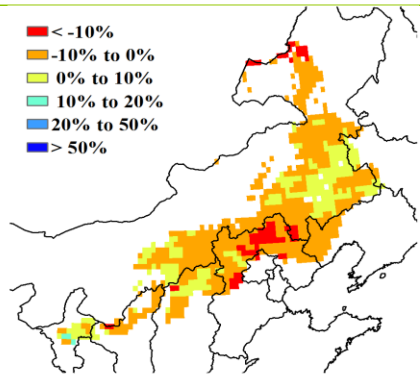
(d) Rainfall Index



(e) Temperature Index



(f) Maximum VCI



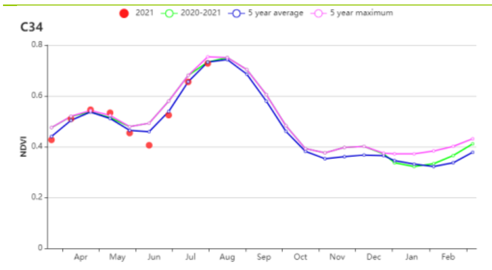
(g) Biomass departure

Huanghuaihai

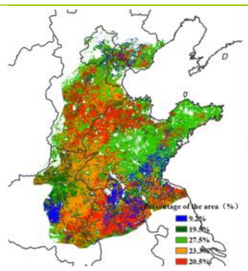
During the monitoring period, the main crops were winter wheat and summer maize in Huanghuaihai region. Winter wheat was sown in October last year and harvested in June this year. Summer maize was planted after the winter wheat had been harvested. Agroclimatic indicators show that precipitation increased by 50%, temperature and radiation decreased by 0.3 degree and 4% compared to the 15YA. Altogether, it led to a 3% decrease in BIOMSS compared to the 15YA. The potential biomass departure map shows that biomass in the most part of the region was higher than the average level except for Central Hebei. The VCIx value was 0.93.

The NDVI-based crop growth profile shows that the peak growing period of winter wheat in April and early May was higher than or equal to the 5-year maximum, and was at the 5YA in July. As shown by NDVI clusters and profiles, 27.5% of cropland over central and Eastern Shandong and a small part of Hebei presented positive NDVI departures. 20.5% of cropland in Northern Anhui and Shandong and Southern Hebei were above average before June, but fell to below average level in June, and began to turn better than average in early July. 9.2% of cropland in central Henan and some scattered area in Shandong and Anhui were negative NDVI departures in July because of the floods. The map of maximum VCI shows that except for the poor growth of crop in a small part of the area, the crop conditions in Southern Hebei and Eastern Henan were even better than the optimal condition in the past five years. Overall, the crop condition was favorable during the monitoring period.

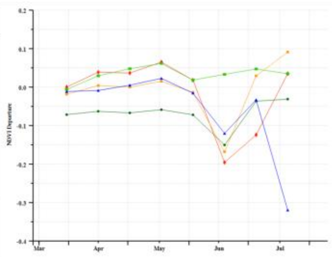
Figure 4.13 Crop condition China Huanghuaihai, April - July 2021



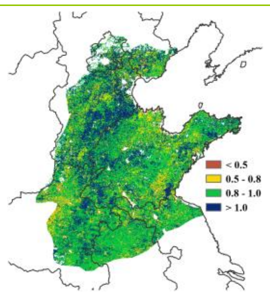
(a) Crop condition development graph based on NDVI



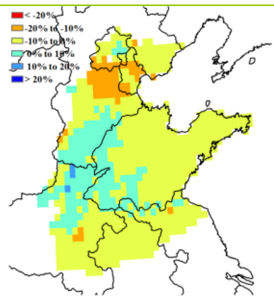
(b) Spatial NDVI patterns compared to 5YA



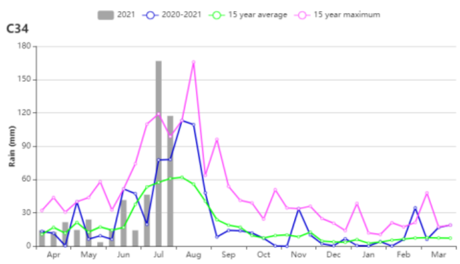
(c) NDVI profiles



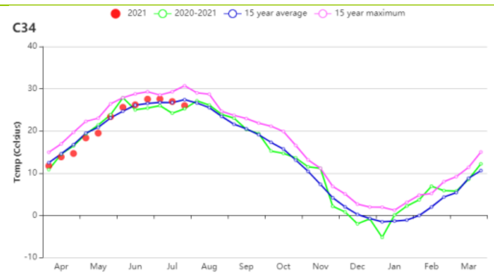
(d) Maximum VCI



(e) Biomass departure



(f) Time series rainfall profile

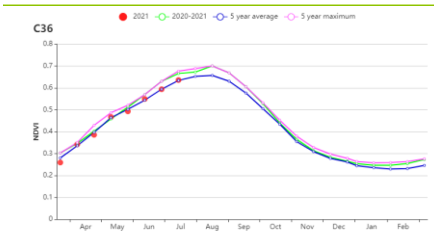


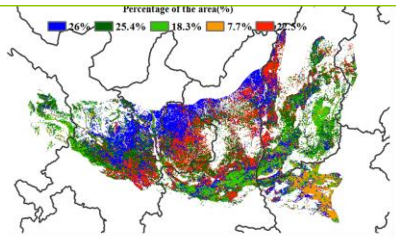
(g) Time series temperature profile

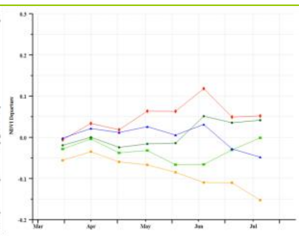
Loess region

During the reporting period, winter wheat was harvested from early to mid-June, while summer maize was planted in late June. Crop conditions in the Loess Region were close to average compared to the previous five years. The CropWatch Agroclimatic Indicators (CWAIs) in Loess Region show that the weather conditions were generally normal: Rainfall (RAIN) exceeded the average by 7%, temperature (TEMP) was below average by 0.1°C and radiation (RADPAR) dropped by 1%. The potential biomass (BIOMSS) was 2% above average. Temperatures were slightly below the 15-year average in April and then reverted to average in May and June, and were slightly above average in July. This may accelerate the loss of soil water, which is detrimental to the subsequent growth of autumn crops. As can be seen from the regional NDVI development graph, the crop conditions were generally close to the 5-year average in this reporting period. Precipitation was also generally close to average, and in late April, mid-May, and mid-July it was close to or above the 15-year maximum. NDVI clusters and profiles show that crop conditions were close to average in most parts of the region; about 7.7% was below the 5-year average from June to July, mainly in the northwest part of Henan Province. The Maximum VCI map shows high VCIx values in most cropped areas of the region, with an average value of 0.88. CALF was at 96% which is 2% above the 5YA.In conclusion, the current agroclimatic and agronomic conditions show normal crop production situation in this region.

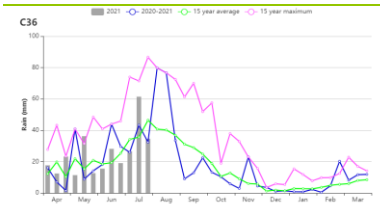
Figure 4.14 Crop condition China Loess region, April - July 2021

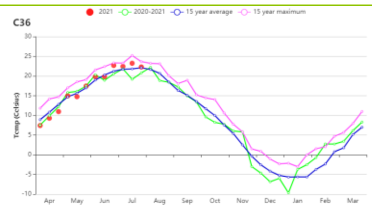






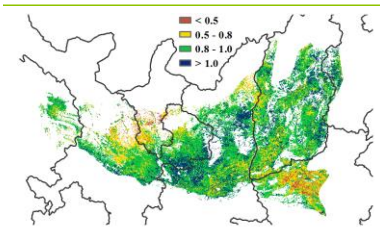
(a) Crop condition development graph based on NDVI (b) Spatial NDVI patterns compared to 5YA (c) NDVI profiles

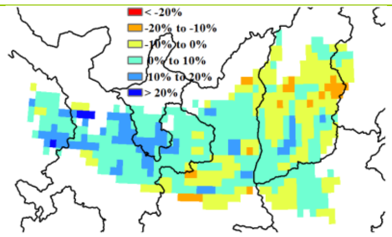




(d) Maximum VCI

(e) Biomass departure





(f) Maximum VCI

(g) Biomass departure

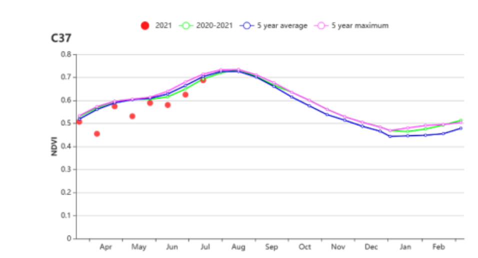
Lower Yangtze region

During this monitoring period, winter wheat and rapeseed had reached maturity and been harvested by June in Hubei, Henan, Anhui and Jiangsu provinces. The semi-late and late rice crops are still growing in the south and the center of the region including Jiangsu, Fujian, Jiangxi, Hunan, and Hubei provinces, while early rice has been harvested.

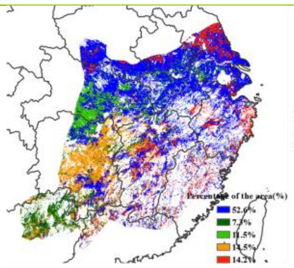
According to the CropWatch agro-climatic indicators, the accumulated precipitation and photosynthetically active radiation from April to July was close to the long-term average in this region. However, the precipitation changed greatly during the monitoring period. The rainfall profiles also indicate that the precipitation in mid-May exceeded the 15-year maximum, while the precipitation in mid-July was less. The temperature was slightly above average by 0.3℃. The overall normal agro-climatic conditions resulted in a 3% positive departure of the biomass production potential. The potential biomass departure map shows that in most places in this region, it varied between -10% and 20%. The potential biomass levels in Jiangsu, Fujian, Jiangxi and southern Hunan were up to 20% higher than 15YA. As shown in the NDVI development graph, crop conditions were slightly below the 5-year average. The crop growth in Jiangsu, Anhui, Henan and Hubei (accounting for 52.6% of the cropland in the region) was close to previous years from April to May. In June, the NDVI was below the 5YA, but improved to average levels in July. The average VCIx of this region is 0.94, and most of the area had VCIx values ranging from 0.8 to 1.

Overall, the crop conditions in the lower Yangtze region are normal.

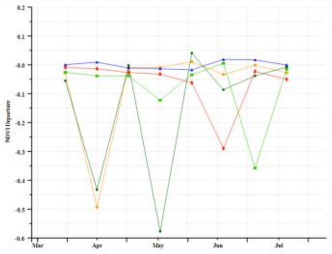
Figure 4.15 Crop condition China Lower Yangtze region, April - July 2021



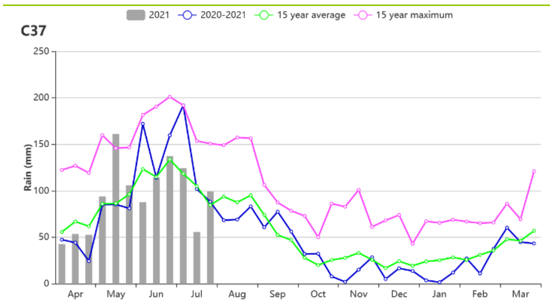
(a) Crop condition development graph based on NDVI



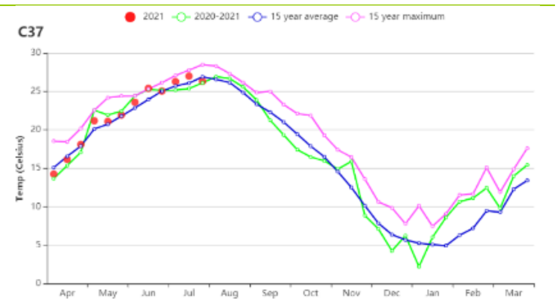
(b) Spatial NDVI patterns compared to 5YA



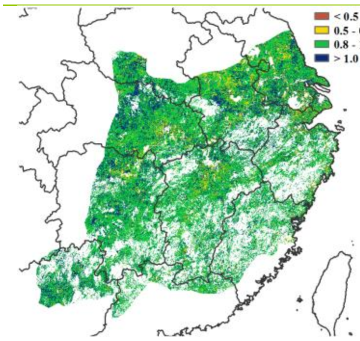
(c) NDVI profiles



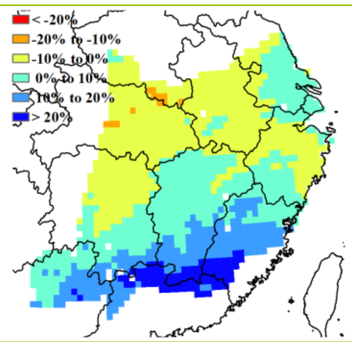
(d) Maximum VCI



(e) Biomass departure



(f) Maximum VCI



(g) Biomass departure

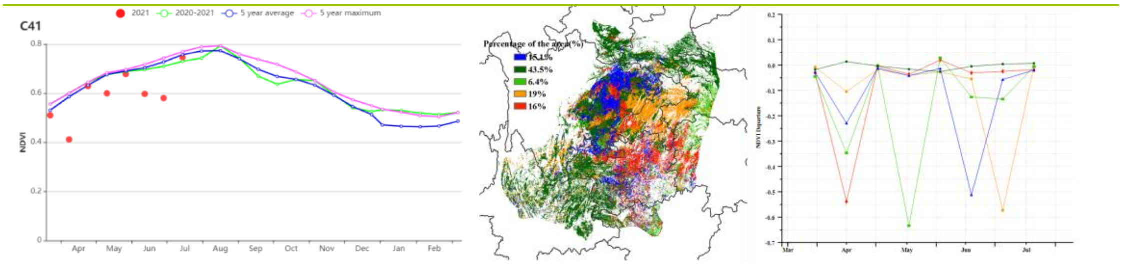
Southwest region

The reporting period covers the harvest of winter wheat in southwestern China, whose harvest was concluded by late April. Summer crops (including semi-late rice, late rice and maize) are still growing. Overall, crop conditions were slightly below the 5-year average.

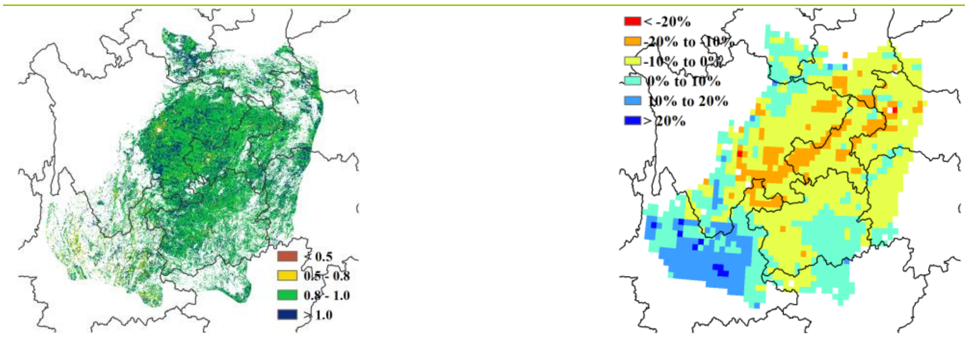
On average, rainfall was slightly above the 15-year average (RAIN +1%), whereas solar radiation was below average (RADPAR -4%). Temperature was close to average (TEMP +0.0°C). The resulting BIOMSS was 1% below average mainly due to lower radiation. The cropped arable land fraction remained at the same level as in the last five years, which indicated the crop planting conditions were generally normal for this period.

According to the NDVI departure clustering map and the profiles, crop condition was slightly below average in most areas of the whole region. Notably, rainfall and RADPAR were below average for Guizhou (-15% and -4% respectively), which hampered the crop photosynthesis and crop growth condition was unfavorable. However, average and higher NDVI throughout the monitoring period was observed in Yunnan, where radiation and precipitation were both above average (See Annex A.11). The maximum VCI reached 0.96, indicating that peak conditions were comparable to the last five years. The rainy and cloudy weather conditions persisted in this reporting period, and conditions were mixed but slightly below average.

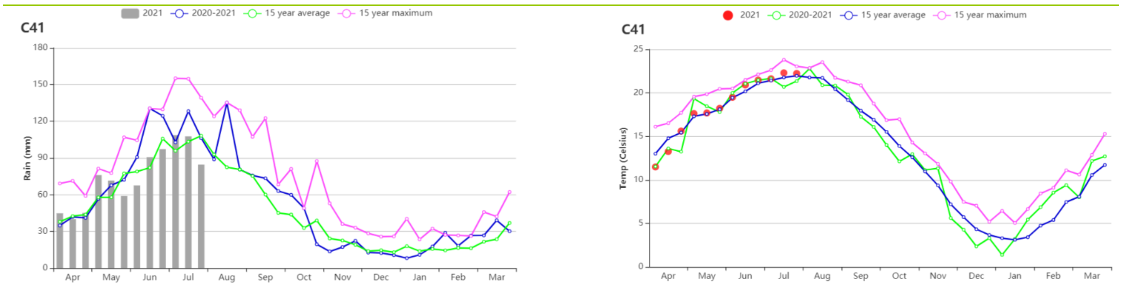
Figure 4.16 Crop condition China Southwest region, April - July 2021



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



(d) Maximum VCI (e) Biomass departure



(f) Time series rainfall profile (g) Time series temperature profile

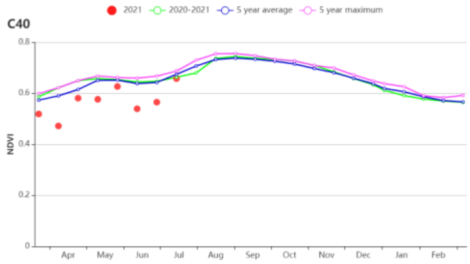
Southern China

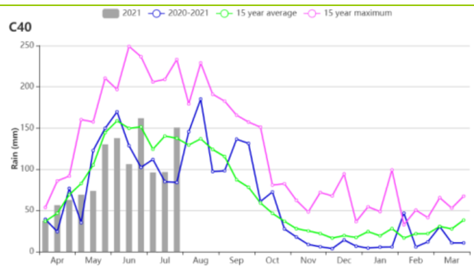
During the monitoring period, the harvest of wheat and early rice was concluded. Spring maize reached maturity. In July, semi-late rice was in booting stage, and late rice was partially transplanted. According to the crop condition development graph based on NDVI, crop conditions were below the 5-year average in the early stage, but close to the average level at the end of the monitoring period.

For the whole region, although rainfall was below the 15YA (-12%), it still reached 1178mm, which is enough to meet the water requirement of crops. Radiation (+9%), temperature (+0.7°C), and BIOMSS (12%) were above average. As shown by the NDVI departure clustering map and the profiles, crop condition was below the 5-year average during most of the reporting period, especially in Guangxi and Guangdong due to the persistent drought. From April to early June, crop conditions were significantly lower than average. But at the end of the monitoring period, the overall NDVI in the region was close to the average level, probably due to the increased precipitation in late July after the harvest of early rice. Less rain and sufficient sunshine during the filling period were beneficial to the increase of rice yield, which led to an increase in BIOMSS. The average VCIx of the Southern China region was 0.92, and most of the area had VCIx values ranging from 0.80 to 1.00. Low VCIx values were mostly scattered in Yunnan and in central and southern parts of Guangdong. The cropped arable land fraction remained at the same level as in the last five years.

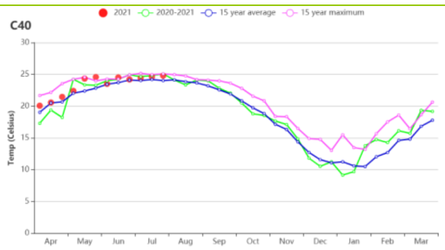
Overall, the crop conditions during the monitoring period tended to be normal.

Figure 4. 17 Crop condition Southern China region, April - July 2021

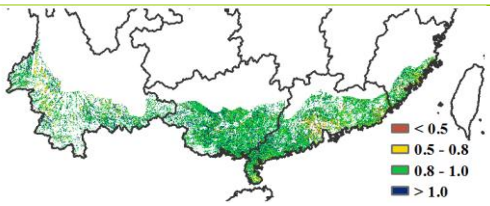


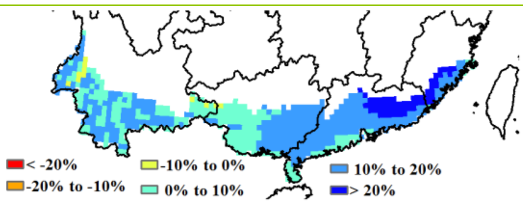


(a) Crop condition development graph based on NDVI(b) Rainfall profiles

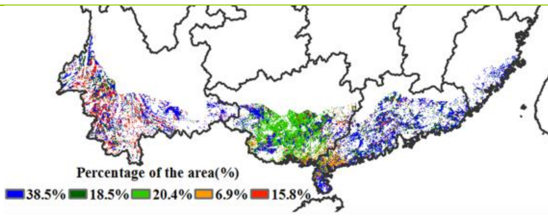


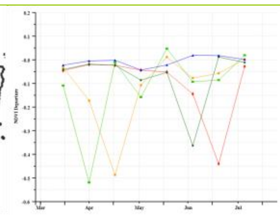
(c) Time series temperature profile





(d) Maximum VCI (e) Biomass departure





(f) Crop condition development graph based on NDVI (g) NDVI profiles

4.4 Major crops trade prospects

This section analyzes the import and export situation of the maize, rice, wheat, and soybean in China for 2021.

Maize

In the first half of the year, China imported 15.3037 million tonnes of maize, an increase of 3.2 times over the first half of last year. The main import sources were the United States and Ukraine, accounting for 57.8% and 41.7% of the total import respectively, with an import volume of US $4.048 billion. The export of maize was 3.9 thousand tonnes, an increase of 129% over the first half of last year, and the export volume was US $1.884 million.

Rice

In the first half of the year, China imported 2,554.9 thousand tonnes of rice, more than double the first half of last year. The main import sources were Pakistan, Vietnam, Myanmar, India and Thailand, accounting for 23.2%, 22.0%, 20.9%, 18.4% and 7.5% of the total import respectively, with an import volume of US $1.196 billion. The export of rice was 1,317.8 thousand tonnes, a decrease of 3.2% over the first half of last year. It was mainly exported to South Korea, Sierra Leone and Papua New Guinea, accounting for 10.5%, 9.5% and 7.0% of the total export respectively, with an export volume of US $556 million.

Wheat

In the first half of the year, China imported 5.3678 million tonnes of wheat, an increase of 60.1% over the first half of last year. The main import sources were Canada, the United States, Australia and France, accounting for 31.5%, 27.4%, 24.4% and 12.2% of the total import respectively, with an import volume of US $1.624 billion. The export of wheat was 35.7 thousand tonnes, a significant decrease over the first half of last year. It was mainly exported to Afghanistan and Ethiopia, accounting for 62.8% and 38.9% of the total export respectively, with an export volume of US $18.4128 million.

Soybean

In the first half of the year, China imported 48.9562 million tonnes of soybeans, an increase of 8.7% over the first half of last year. The main import sources were Brazil and the United States, accounting for 53.4% and 44.1% of the total import respectively, with an import volume of US $25.435 billion. Soybean exports were 40.1 thousand tonnes, a decrease of 20.8% over the first half of last year.

Trade prospects for major cereals and oil crop in China for 2021

On the basis of remote sensing-based production prediction in major agricultural producing countries in 2021 and the Major Agricultural Shocks and Policy Simulation Model, it is predicted that the import of major grain crop varieties will increase slightly in 2021. The details are as follows:

Maize

At present, the supply and demand of domestic maize is in a tight balance. China's demand for maize in the international market remains strong. Combined with the impact of the implementation of the Sino US economic and trade agreement, it is expected that China's maize import will increase significantly by 70.5% and export will decrease by 12.4% in 2021.

Rice

Novel coronavirus pneumonia is the main cause of the global rice market supply and demand. The price gap between China and abroad is persisting. The import of rice will keep growing in the light of the Covid-19 pandemic. The import of rice is expected to grow by 75.3% and export by 2.5% in 2021.

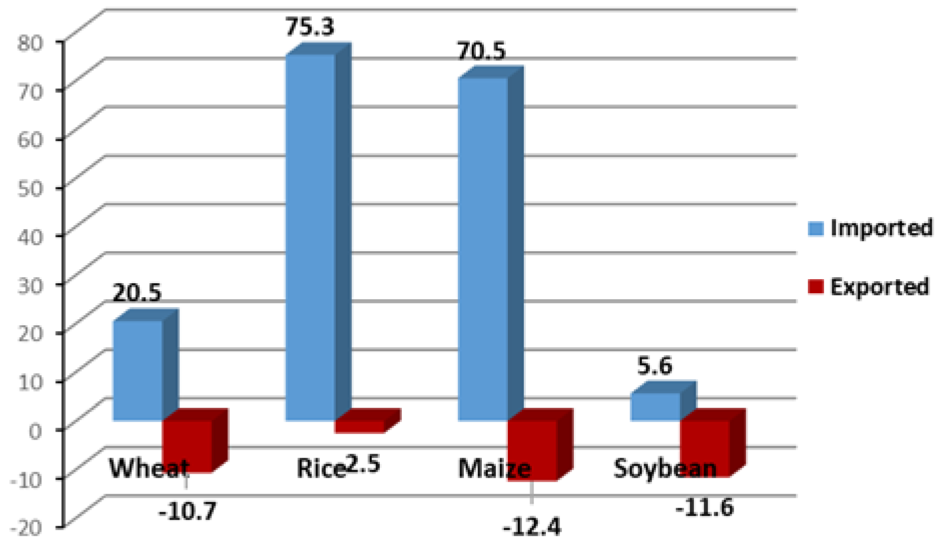
Wheat

Affected by drought and other natural disasters, the global wheat output has declined and the price difference at home and abroad has narrowed. It is expected that China's wheat import will increase by 20.5% and export will decrease by 10.7% in 2021.

Soybean

As the domestic soybean consumption demand remains stable and the domestic soybean output is limited, China's soybean import will maintain a steady growth. It is expected that China's soybean import will increase by 5.6% and export will decrease by 11.6% in 2021.

Figure 4.18 Rate of change of imports and exports for rice, wheat, maize, and soybean in China in 2021 compared to those for 2020(%).



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 2021 (section 5.1), as well as sections on recent disaster events (section 5.2), and an update on El Niño (section 5.3).

5.1 CropWatch food production estimates

The production outlook for the current bulletin includes only the major producers in the Equatorial region, the Southern Hemisphere, and some isolated Northern Hemisphere countries where crop development is sufficiently advanced to ensure that estimates are reliable.

CropWatch production estimates differ from most other global estimates by the use of geophysical data in addition to statistical and other reference information such as detailed crop distribution maps. Recent sub-national statistics are used for the calibration of remote-sensing-based models. It is also stressed that the assessments and underlying data are crop-specific, i.e. based on different crop masks for each crop and that, for each crop listed in Table 5.1, both yield variation and cultivated area variation are taken into account when deriving the production estimates.

Table 5.1 Preliminary 2021 production estimates in thousands tonnes for selected countries in Equatorial region, and Southern Hemisphere as well as early crops in the Northern Hemisphere. Δ% stands for the change in % compared with the corresponding season in 2020.

	Maize		Rice		Wheat		Soybean	
	2021	**Δ%**	**2021**	**Δ%**	**2021**	**Δ%**	**2021**	**Δ%**
Afghanistan					3905	-25		
Angola	2623	-11.4	45	-1.9				
Argentina	53440	-1.1	1901	-1.9	16313	3.7	51608	-1.9
Australia					30606	1.3		
Bangladesh	3476	-10.9	44800	-2.6				
Belarus					3267	5.7		
Brazil	83345	-4.8	11851	2.4	6121	-1.8	96300	-4.7
Cambodia			9850	-2.7				
Canada	12096	1.3			28777	-15.2	7872	2.6
China	231602	2.4	202798	0.8	127981	0.7	14371	-1.4
Egypt	5915	-3.4	6574	-3.3	11466	-4.9		
Ethiopia	6074	-12.4			3374	-8.6		
France	14647	1.5			33813	-2.9		
Germany	4850	0.4			26075	-2.1		
Hungary	6023	-5			4942	-5.2		
India	18856	1.4	185038	2.6	93439	-2.5	12434	6.7
Indonesia	16652	0	65004	0.1				
Iran			2439	-17	12157	-26		

	Maize		Rice		Wheat		Soybean	
	2021	Δ%	2021	Δ%	2021	Δ%	2021	Δ%
Italy	6315	-2			7750	-0.9	1571	-2.8
Kazakhstan					11055	-14.1		
Kenya	2451	-15.2			274	-13.7		
Kyrgyzstan	672	-4.9			534	-14.7		
Mexico	25710	8.2			3436	-20.3	955	10.4
Mongolia					316	13.2		
Morocco					9024	43.2		
Mozambique	2102	4.1	399	4.5	20	1.9		
Myanmar	1897	1.1	24900	-2.7				
Nigeria	10108	0.2	4012	-4.3				
Pakistan	5329	-5.1	10404	-9.4	25822	-6.1		
Philippines	7211	0.9	21010	1.3				
Poland					10656	-0.9		
Romania	13885	8.5			8002	8		
Russia	13583	-1.7			57601	3.5	3624	-3.5
South Africa	11459	-2.6			1647	-3.9		
Sri Lanka			2461	-2.1				
Thailand	4216	0.4	41525	2.2				
Turkey	6432	-1.6			16809	-13.1		
Ukraine	34860	24.8			24122	9		
United Kingdom					12875	1.2		
United States	384063	2.6	11424	-2.2	53722	0.7	105239	0.7
Uzbekistan					7073	-22.4		
Vietnam	5394	-0.2	47593	1.6				
Zambia	3586	4			88	1.6		
Total	998870	1.4	694028	0.6	653063	-2.3	294213	-1.4
Others	82693	-2.7	56761	-19.6	58065	-16.6	26378	5.1
Global	1081563	1.1	750789	-1.3	711128	-3.7	320591	-0.9

Affected by persistent hot and dry weather in Northwestern North America, Brazil, Central Asia, West Africa, and Southern Africa, global rice, wheat, and soybean production is expected to reduce. Global maize production in 2021 is expected to be 1.082 billion tones, an increase of 1.1%, 11.3 million tones. Global rice production is expected to be 751 million tones, a decrease of 1.3%. Global wheat production is expected to be 711 million tones, a 3.7% decrease of 26.99 million tones; global soybean production is expected to be 321 million tones, a 0.9% decrease.

Maize

In 2021, the United States, China and Ukraine ranked the top 3 in maize production, with maize production of 384.06 million tones, 231.60 million tones and 34.86 million tones, an increase of 9.8 million tones (2.6%), 5.52 million tones (2.4%) and 6.93 million tones (24.8%) respectively, mainly due to more favorable agro-meteorological conditions during the maize reproductive period and larger maize growing area. Brazil, the world's third largest maize producer, reduced 4.8% at 83.34 million tones. Brazil's high temperature and dry weather since the maize planting period continued to lead to a 4.5% decline in maize yield. Mexico's maize growing area and yield increased simultaneously, prompting the country's production of 1.95 million tones. Romania recovered from the 2020 drought year with an increase in maize production of 1.08 million tones. Changes in maize production in the remaining major maize producing and exporting countries were less than 1 million tones, with a relatively small impact on total global maize production.

Rice

Asian rice production accounted for more than 90% of the total global production. Agro-meteorological conditions vary widely among the major producing countries. Bangladesh, Myanmar and Iran were affected by drought conditions, and rice production decreased by 1.21 million tones (2.6%), 690,000 tones (2.7%) and 500,000 tones (17.0%), respectively. Pakistan was affected by the reduction of rice acreage; rice production fell by 1.08 million tones. China and India, as the world's two largest rice producers, the overall rice production situation is good, production increased by 1.62 million tones and 4.76 million tones, respectively. Under sufficient precipitation and other favorable weather, Thailand and Vietnam rice production increased by 900,000 tones and 760,000 tones respectively. The total rice production of the remaining major producing countries decreased compared with 2020, offsetting the increase in rice production in China and India, and the total global rice production is expected to decline slightly.

Wheat

Due to the continued dry weather, some wheat-producing countries in the northern hemisphere shrink planted area, most wheat-producing countries affected by drought yields fell, global wheat production is lower than 2020. China's total winter wheat production will increase by 0.9%.Since sowing period, precipitation in the Northern Hemisphere has been generally lower than the average of the past 15 years, with poor winter wheat growth and impaired yields in several countries, including Iran, Afghanistan, Uzbekistan, Canada, Kyrgyzstan, Turkey, Pakistan and India, combined with the reduction in wheat growing area in some countries, and wheat yields reduced by 26.0%, 25.0%, 22.4%, 15.2%, 14.7%, 13.1%, 6.1% and 2.5% respectively. In addition, wheat production in most countries in Western Europe also declined slightly. The severe drought in the northwest of United States only affected the production of spring wheat in the region, the country's total wheat production still increased by 0.7%. The good agricultural weather of Russia's winter wheat production areas prompted a 3.5% increase in production. Most countries in Eastern Europe also achieved an increase in wheat production. Morocco's wheat yields increased significantly compared to the severe drought year of 2020, with a recovery increase in wheat production of 43.2%.

Soybean

The widespread drought in South America led to a decline in soybean production in Brazil and Argentina. Affected by persistent hot and dry weather, Brazil's soybean slumped to 96.3 million tones, down 4.74 million tones (4.7%), the lowest production in the past three years. The agro-meteorological conditions of early growing stags in Argentina's main soybean production areas were normal while since April, the continued reduction in precipitation on late sowybean growing season led to a 980,000 tones fall (1.9%) at 51.61 million tones. As the world's largest soybean producer, the United States soybean production areas are not affected by high temperature and dry weather, soybean yields increased slightly, total soybean production increased by 0.7% to 105.24 million tones. The increase in soybean growing area in India led to an increase in total soybean production of about 6.7%, an increase of 780,000 tones. The decline in soybean growing area in northeast China, influenced by market factors such as the continued rise in corn prices, led to a decrease in soybean production in China of about 1.4%.

5.2 Disaster events

Introduction

Extreme weather events from severe drought to massive floods negatively influence key agricultural regions worldwide, driven by human-induced climate changes. According to the 2021 Intergovernmental Panel on Climate Change (IPCC) report, these extreme weather events are projected to increase since climate change intensifies the water cycle leading to more intense rainfall and associated flooding and more intense drought in many regions. Hence, this report discusses several disasters related to climate change threatening human lives and food production worldwide.

Floods

Record-breaking floods occurred in Henan province, China, during July 2021, caused by intensive rainfall. As of Aug. 2, 2021, provincial authorities have reported the death of 302 people, with 50 more that went missing and 815,000 people were evacuated, 1.1 million were relocated, and 9.3 million people were affected. It not only caused great losses in human lives and property but also has a high potential impact on the national food supplies, as the province is one of China's leading grain producers. According to a report released by the provincial government, the record floods affected 712,000 hectares of crops in Henan, accounting for 9 % of the fall crop area, and damaged about 23,000 hectares. Besides, the disaster may still cause serious damage to the processing, storage, and transportation of summer grain. CropWatch shows that about 116,000 ha of autumn crops in Henan Province were damaged, with 36,000 ha of maize and 31,000 ha of other autumn crops going out of production, which is greater than the government's published data. The heavy precipitation also brought sufficient water for maize growth in other parts of Henan Province, and the increased yields in other areas somewhat compensated for the reduced maize yields caused by the floods, making Henan Province's maize production only 1.1% lower than in 2020.

Figure 5.1 A complete village in Hebei, Henan province, was inundated on July 23, 2021, due to the dam breach caused by floods (https://www.chinadaily.com.cn/a/202107/26/WS60feb99da310efa1bd664784.html).

Several European countries have been affected by massive floods during July 2021, causing the death of 270 people, including 184 in Germany, in addition to the severe damage to infrastructure, mainly in Belgium and Germany. During the flooding event, many farms and livestock in Belgium had to be evacuated, and many fields were damaged and crops destroyed by inundation. The two regions severely affected in Germany were Rhineland-Palatinate and southern North Rhine-Westphalia. Families are currently providing their labor, tractors, and equipment for cleanup, and many fields were submerged and could not be be replanted immediately. In Turkey, the intensive floods in August were also responsible for the death of 70 persons, and 329 people went missing. Kastamonu province is the worst-hit area where several buildings in the town of Bozkurt were destroyed when the Ezine River burst its banks.

Figure 5.2 Protected crops in greenhouses were inundated by intensive floods in Limburg, in the South of Netherlands(https://www.hortidaily.com/article/9340224/heavy-rain-causes-severe-damage-to-open-field-fruit-and-vegetable-crops-in-western-europe/)

In western Japan, more than a million people have been urged to seek shelter due to the unprecedented levels of rain that lead to intensive floods and landslides during July 2021. As reported by the local government, at least 18 people had died, and 14 were missing in the prefectures of Kumamoto and Kagoshima, where the strength of the floodwaters completely destroyed houses.

Wildfires

Last month was the worst July for wildfires on record worldwide, as described by many scientists. Wildfires were severe, particularly in North America, Siberia, Africa, and southern Europe. The high temperature and prolonged drought ignited the forests and grasslands to release 343 mega tonnes of carbon, about a fifth higher than the global peak in July 2014, where more than 50% of the carbon came from two regions – North America and Siberia.

In Siberia, the total carbon emissions from wildfires during June and July reached 188 mega tonnes, equivalent to 505 mega tonnes of carbon dioxide. This amount of carbon dioxide is more than half of the emissions from Germany, Europe's biggest polluter, in the entire year 2018. Consequently, the region has lost almost 500,000 square kilometers of vegetation to the fires, according to end of July estimates.

In the USA, National Interagency Fire Center's situation report listed a total of 39,267 wildfires across the country that had burned over 1.4 million hectares until Aug. 8. In Canada, the number of wildfires was reported by the Canadian Interagency Forest Fire Centre (CIFFC) as 5,619 wildfires until Aug. 7, which had burned more than 3.7 million hectares.

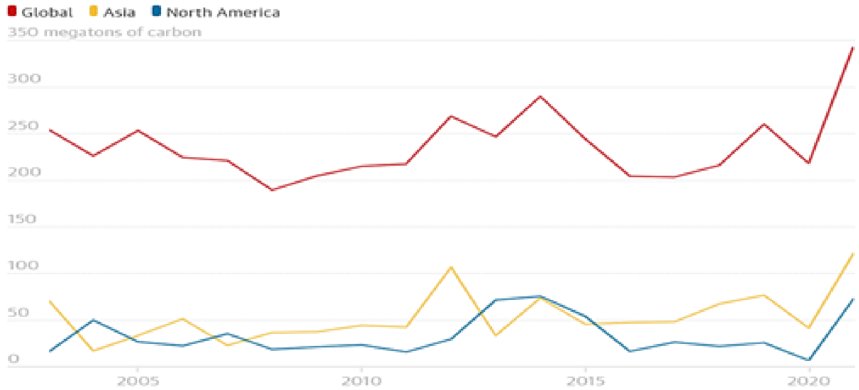


Figure 5.3 The amount of carbon emissions during 2005 -2020 from Asia and North America compared to global emissions. (https://www.theguardian.com/world/2021/aug/06/last-month-worst-july-wildfires-since-2003)

Another hotspot of wildfires was the Mediterranean region, particularly in Turkey, Italy, Greece, Spain, Algeria, and Tunisia. According to the European Forest Fire Information System, about 128,000 hectares of vegetation were burned in Turkey by the end of July, which is eight times higher than the average. Most of the fires in turkey were mainly in southern provinces such as Antalya, Adana, and Mersin. Overall, three people were killed in the fire, and the Disaster and Emergency Management Authority (AFAD) announced on July 29 that 122 people were affected by the fire while 58 were still hospitalized.

Italy had also suffered from intensive wildfires during July 2021 when 80,000 hectares of vegetation were burnt, four times higher than the 2008-20 average. According to local experts, much of the damage has been in national parks, including ancient UNESCO-protected beech forest in the Aspromonte national park in Calabria, which will need at least 15 years to recover. Scientists attributed most wildfires to global warming that makes heat waves more frequent and intense. However, the minister for the Green Transition, Roberto Cingolani, attributed about 70 percent of fires to humans, particularly those who benefit financially from the fires (e.g., private companies of firefighting workers, plane and helicopter fleets) and those who want to convert land for development or pasture.

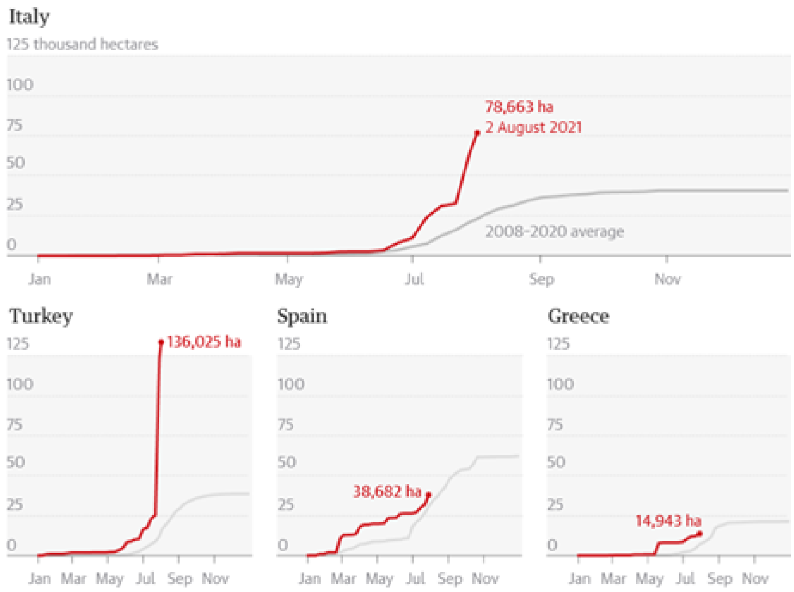


Figure 5.4 The burnt area by wildfires during last four months in four Mediterranean countries; Italy, Turkey, Spain, and Greece. (https://www.theguardian.com/world/2021/aug/06/last-month-worst-july-wildfires-since-2003).

Figure 5.5 A residential area was devastated by wildfires in Manavgat district in Antalya, southern Turkey, on July 29, 2021, as seen from an aerial photo. (https://www.dailysabah.com/turkey/suspicious-forest-fires-rage-in-turkeys-south-for-a-second-day/news?gallery_image=undefined#big)

In Algeria, at least 69 persons lost their lives during their fight against wildfires until Aug. 12. Meteorologists attributed the wildfires to the heatwave that hit North Africa during July and August, with temperatures in Algeria reaching 46 degrees Celsius. According to the Algerian Minister of Agriculture and Rural Development, about 8,000 hectares have been damaged by wildfires since the beginning of July.

In Tunisia, the temperature in the capital Tunis hit a record of 49 degrees Celsius (120 degrees Fahrenheit) on Aug. 10, 2021. In addition, wildfires were reported in the border regions between Tunisia and Algeria during the last week of August, and more than 2500 hectares of land were damaged.

Despite its vital role in curbing climate change by absorbing greenhouse gases, wildfires that intensively hit the Amazon rainforest in Brazil during June and July were responsible for the high deforestation rate, which has increased by 1.8% in June 2021 compared to last year, to 1.062 million hectares, according to national space research agency (Inpe).

Drought

Drought hits several regions around the globe during the last three months. The areas with severe drought were Canada and the north USA, South America, Eastern Europe, and Central Africa. During June and July of 2021, about 36% of the USA regions were under severe to extreme drought, threatening recently planted corn, soybean, and spring wheat crops in Iowa, Minnesota, and the Dakotas. California farmers were prompted to leave fields fallow in the western part of the USA and triggered water and energy rationing in several states due to severe drought. Spring wheat was also under drought stress, as estimated by local experts. Moreover, about 41% of Iowa, the nation's top corn producer and No. 2 soybean state, was under severe drought during the last two months, according to the weekly U.S. drought monitor report. In the western Corn Belt, drought in July and August, critical months for corn, has already trimmed the U.S. corn yield average by 2 to 4 bushels per acre.

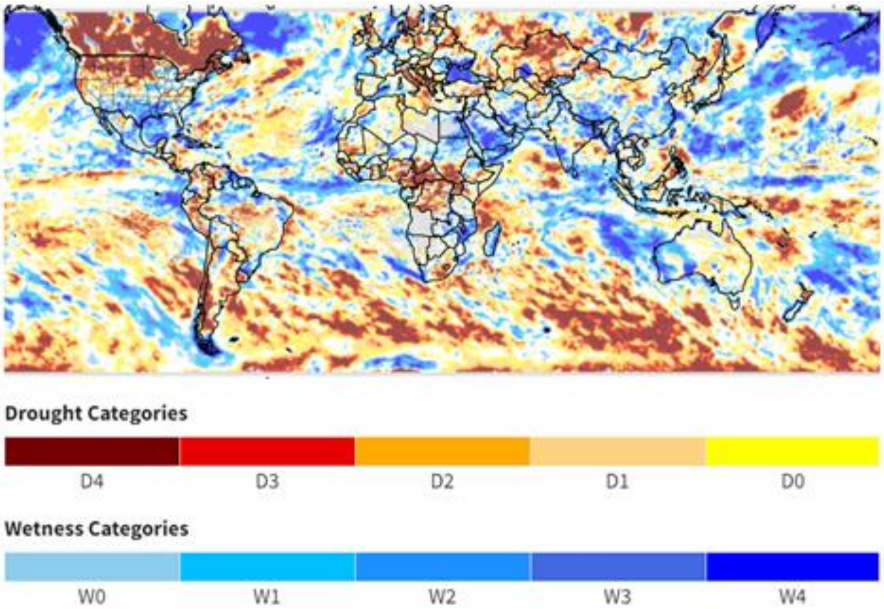


Figure 5.6 The 3-month Standardized Precipitation Index (SPI) indicates the global scale's drought/wet conditions(https://www.drought.gov/international).

In South America, drought continues to hit the Paraná River, one of the leading commercial waterways which go through Brazil, Paraguay, and Argentina, threatening vast ecosystems. The river has reached its lowest level in nearly 80 years due to a prolonged drought in Brazil that scientists attribute to climate change. According to the national water institute of Argentina, the low water level of the Paraná River is the worst since 1944. The Paraná waterway is of paramount importance since its aquifers supply fresh water to some 40 million persons in Brazil and Argentina. As a main waterway in South America, almost 3.9 million tonnes of goods, including soybeans and corn, were moved on the Parana system last year. The low water level in the river caused the down of import goods from an average of 5.6 million tonnes between 2017 and 2019.

Figure 5.7 A photo was taken on July 29, 2021, showed the shallow water level in the Paraná River due to the severe drought and scares rainfall over South America. (https://www.register-herald.com/region/drought-hits-south-america-river-threatening-vast-ecosystem/article_cd52843d-f489-576b-81ee-c6aedb7ee5f6.html)

Desert locust

A limited to moderate swarm breading is now taking place over eastern Africa. Due to the unstable security and political situation in northern Ethiopia, the control operations were hampered, despite the good rainfall over the region during June and July, which could help more swarms to bread and laying eggs. It is expected that the mature swarms in northeast Ethiopia will finish laying eggs in areas of recent rain, including adjacent areas of southern Djibouti. Hatching and band formation is expected to take place this month in Afar, causing locust numbers to increase and leading to the formation of new immature swarms from late September onwards. If the necessary survey and control operations cannot be carried out safely in Afar, then a greater number of swarms are likely to form than originally anticipated that would migrate east and threaten eastern Ethiopia and northern Somalia in October. In Yemen, small-scale breeding is underway in the interior. Elsewhere, the situation remains calm, and no significant developments are likely.

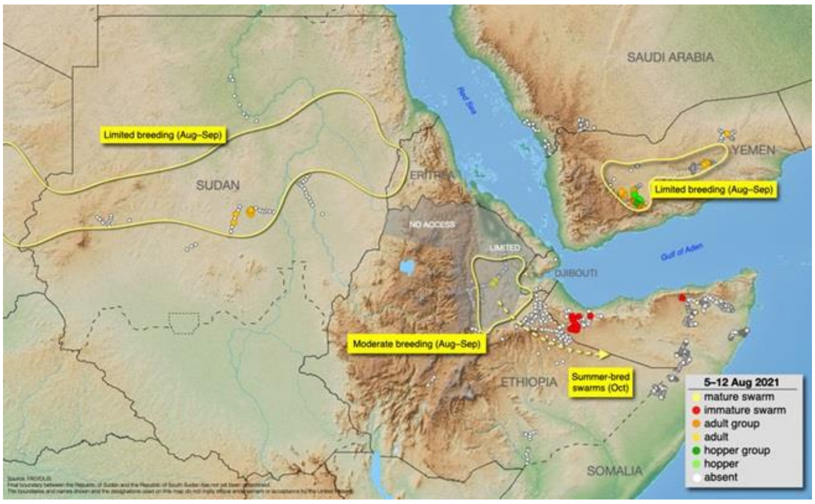


Figure 5.8 The current distribution and movement of different desert locust groups over African horn and Yemen(http://www.fao.org/ag/locusts/en/info/info/index.html).

COVID-19

Nearly 2.37 billion people (or 30% of the global population) lacked access to adequate food in 2020. As estimated by WFP, about 272 million people are already or are at risk of becoming acutely food-insecure in 2020-2021 due to COVID-19. Moreover, the prices of crops such as maize, wheat, and rice were about 43%, 12%, and 10% above their January 2020 levels, as estimated by FAO. Although the hunger trend was increasing even before COVID-19, the pandemic was a setback to all UN efforts to reduce poverty and hunger worldwide.

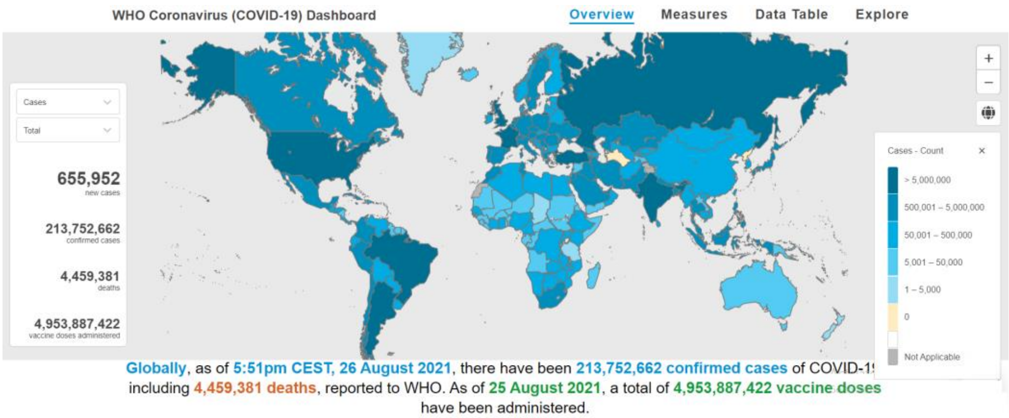


Figure 5.9 The WHO COVID-19 Dashboard (source:https://covid19.who.int/).

5.3 Update on El Niño

The El Niño –Southern Oscillation (ENSO) remains neutral with most oceanic and atmospheric indicators within the neutral range. While pressure patterns show some La Niña-like characteristics, as indicated by the latest Southern Oscillation Index (SOI) 30-day value of +15.1, it is likely that some of this shift in pressure is driven from warm conditions in the eastern Indian Ocean. Most climate model outlooks indicate the central tropical Pacific is likely to cool over the coming months, with three of seven models surveyed by the Bureau indicating this cooling will be enough to reach La Niña thresholds in spring, with the remaining four models staying neutral. Along with the negative Indian Ocean Dipole (IOD), this may be contributing to the wetter than median climate outlooks in Australia.

Figure 5.10 illustrates the behavior of the standard Southern Oscillation Index (SOI) published by the Australian Bureau of Meteorology (BOM) for the period from July 2020 to July 2021. 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 this monitoring period, SOI increased from 2.0 in April to 3.6 in March, then decreased to 2.6 in June, then increased to 15.9 in July.

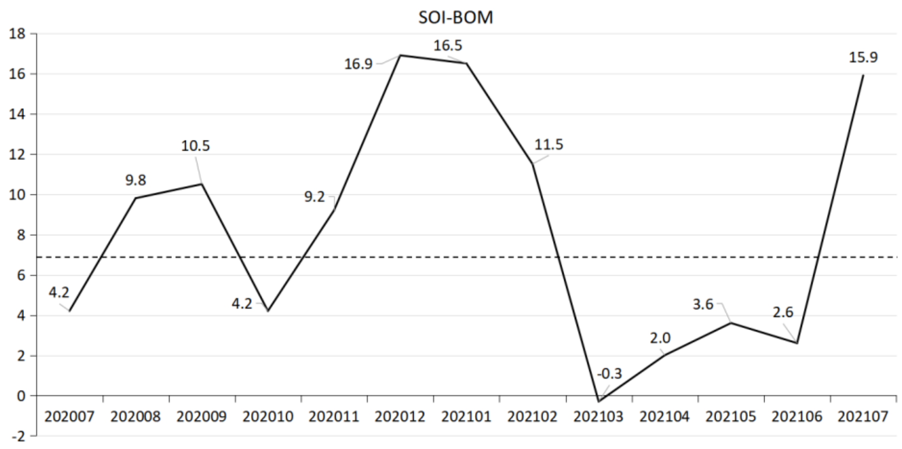


Figure 5.10 Monthly SOI-BOM time series from July 2020 to July 2021

(http://www.bom.gov.au/climate/current/soi2.shtml)

The SST map (Figure 5.11) for July 2021 shows SSTs were close to average across most of the equatorial Pacific Ocean, although warmer than average SSTs continued in the eastern Pacific Ocean close to South America. SSTs were warmer than average in waters around the north and southeast of Australia. Values of the three key NINO indices for July 2021 were: NINO3 +0.1 ℃, NINO3.4 +0.0 ℃, and NINO4 +0.1℃.

The sea surface temperature anomalies in January values of the three key NINO indices were: NINO3 -0.4℃, NINO3.4 -0.8℃, and NINO4 -0.9℃, respectively, somewhat colder than the 1961-1990 average according to BOM (see Figure 5.10 and Figure 5.11). La Niña has developed and is expected to last into next year, affecting temperatures, precipitation and storm patterns in many parts of the world, according to the World Meteorological Organization (WMO).

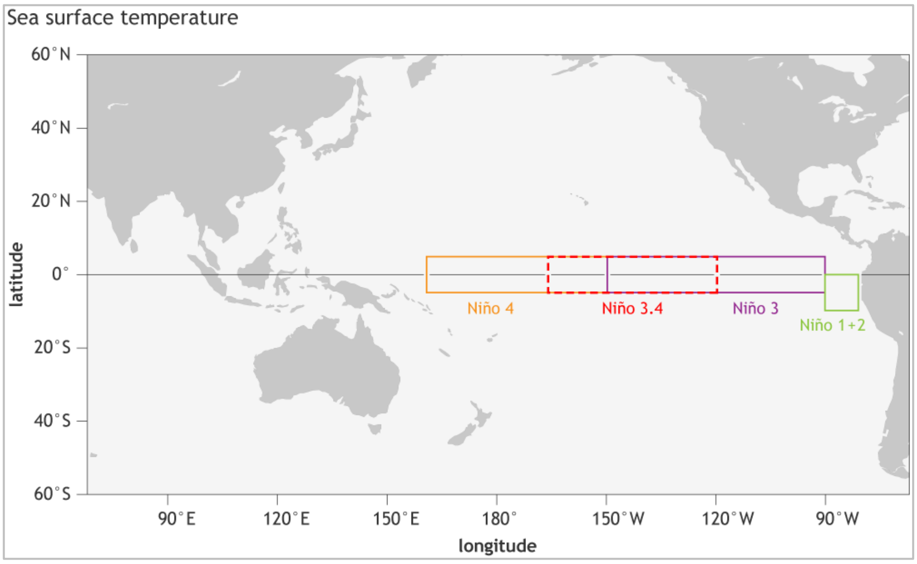


Figure 5.11 Map of NINO Region

(https://www.climate.gov/sites/default/files/Fig3_ENSOindices_SST_large.png)

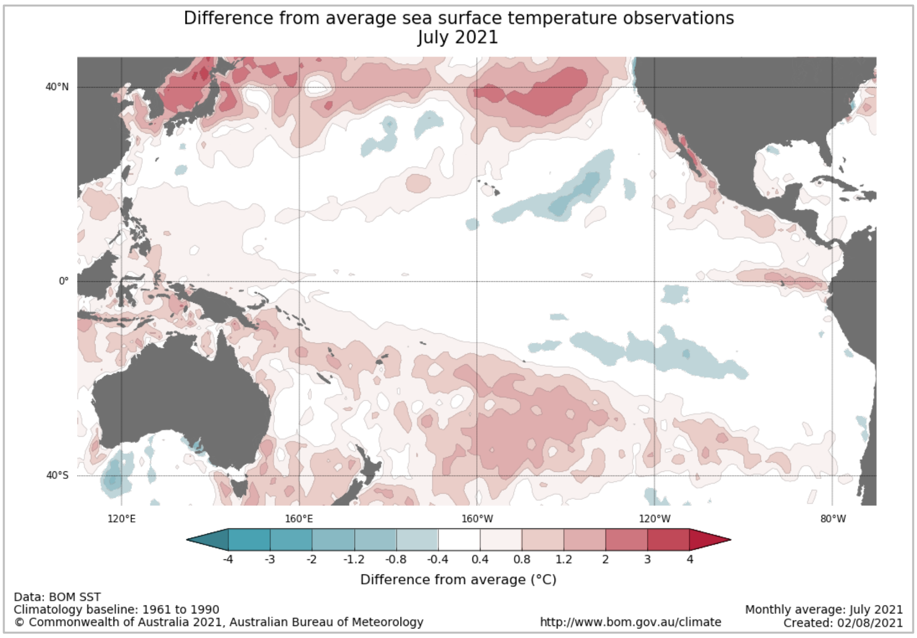


Figure 5.12 July 2021 sea surface temperature departure from the 1961-1990 average

(http://www.bom.gov.au/climate/enso/wrap-up/archive/20210511.ssta_pacific_monthly.png?popup)

Annex A. Agroclimatic indicators

Table A.1 Apr 2021 - Jul 2021 agroclimatic indicators and biomass by global Monitoring and Reporting Unit (MRU)

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 15YA dep. (%)
C01	Equatorial central Africa	496	-20	22.3	-0.1	1183	3	559	-4
C02	East African highlands	727	-5	18.5	-0.4	1177	-1	504	-9
C03	Gulf of Guinea	392	-36	27.7	0.7	1250	5	759	0
C04	Horn of Africa	314	1	20.2	-0.3	1179	1	547	-5
C05	Madagascar (main)	290	18	19.4	-0.2	942	0	456	0
C06	Southwest Madagascar	34	-51	21.2	0.1	995	2	404	-6
C07	North Africa-Mediterranean	123	26	21.3	0.5	1532	-2	610	-3
C08	Sahel	307	3	29.9	-0.2	1312	0	618	-7
C09	Southern Africa	87	-24	17.1	-0.4	1034	3	318	-9
C10	Western Cape (South Africa)	256	14	13.2	0.0	696	2	243	-2
C11	British Columbia to Colorado	286	-12	11.1	1.1	1442	4	491	0
C12	Northern Great Plains	375	3	16.9	0.1	1353	1	644	5
C13	Corn Belt	452	3	15.6	-0.2	1243	0	534	0
C14	Cotton Belt to Mexican Nordeste	618	44	22.0	-1.2	1373	-2	801	-2
C15	Sub-boreal America	304	-16	10.8	0.5	1191	2	418	-3
C16	West Coast (North America)	85	-55	16.4	1.2	1574	6	503	-23
C17	Sierra Madre	807	12	20.5	-0.2	1452	-1	632	0
C18	SW U.S. and N. Mexican highlands	214	17	20.6	0.6	1583	0	688	10
C19	Northern South and Central America	1105	2	24.1	-0.3	1241	0	757	1
C20	Caribbean	550	-5	25.7	-0.1	1453	3	966	4
C21	Central-northern Andes	529	-8	13.7	-0.2	1057	1	318	-3
C22	Nordeste (Brazil)	130	-44	24.4	0.7	1102	5	593	-6
C23	Central eastern Brazil	133	-55	21.9	0.8	1023	6	418	-12
C24	Amazon	561	-14	24.0	0.2	1091	3	585	-2
C25	Central-north Argentina	170	-5	15.7	0.1	758	4	288	2

C26	**Pampas**	282	-29	14.5	-0.2	701	10	258	6
C27	**Western Patagonia**	556	-29	7.7	0.4	497	6	118	7
C28	**Semi-arid Southern Cone**	93	-20	10.5	0.4	725	2	177	5
C29	**Caucasus**	254	-17	17.2	1.0	1497	2	526	-1
C30	**Pamir area**	337	-1	16.8	-0.3	1583	2	538	1
C31	**Western Asia**	117	14	23.5	0.9	1568	1	487	-3
C32	**Gansu-Xinjiang (China)**	266	7	16.0	-0.3	1440	0	646	1
C33	**Hainan (China)**	746	-17	27.2	0.7	1385	6	924	5
C34	**Huanghuaihai (China)**	493	50	21.8	-0.3	1269	-4	708	8
C35	**Inner Mongolia (China)**	282	32	15.9	-0.3	1344	-3	580	10
C36	**Loess region (China)**	299	7	17.1	-0.1	1345	-1	618	2
C37	**Lower Yangtze (China)**	1128	0	22.2	0.3	1086	0	653	3
C38	**Northeast China**	425	30	15.6	0.1	1274	1	551	2
C39	**Qinghai-Tibet (China)**	957	-14	10.2	-0.1	1178	0	333	-1
C40	**Southern China**	1178	-12	23.3	0.7	1217	9	742	12
C41	**Southwest China**	893	1	18.5	0.0	1033	-4	524	-1
C42	**Taiwan (China)**	793	-18	26.3	1.0	1320	5	785	-1
C43	**East Asia**	552	3	14.8	0.5	1227	3	507	8
C44	**Southern Himalayas**	904	-13	26.2	-0.2	1247	0	664	-2
C45	**Southern Asia**	812	3	28.9	-0.6	1224	-1	712	3
C46	**Southern Japan and the southern fringe of the Korea peninsula**	872	2	18.3	0.6	1201	2	578	4
C47	**Southern Mongolia**	180	-11	7.7	-0.3	1510	2	446	6
C48	**Punjab to Gujarat**	443	18	31.9	-0.5	1372	-4	756	19
C49	**Maritime Southeast Asia**	1107	-10	24.6	0.2	1170	6	767	6
C50	**Mainland Southeast Asia**	1223	6	26.7	0.0	1245	4	828	6
C51	**Eastern Siberia**	326	1	9.9	0.0	1145	2	399	8
C52	**Eastern Central Asia**	369	40	9.8	-1.0	1229	-5	391	-9
C53	**Northern Australia**	344	-11	23.9	0.5	1114	5	587	1
C54	**Queensland to Victoria**	226	16	12.3	-0.2	650	1	219	0
C55	**Nullarbor to Darling**	366	67	14.2	0.2	588	-6	242	2
C56	**New Zealand**	337	-11	9.5	0.6	453	4	132	8
C57	**Boreal Eurasia**	344	3	10.0	0.2	1109	3	369	9
C58	**Ukraine to Ural mountains**	345	12	14.7	0.7	1163	0	525	10

C59	**Mediterranean Europe and Turkey**	175	-18	16.9	-0.2	1464	0	579	-2
C60	**W. Europe (non Mediterranean)**	389	8	13.7	-0.8	1222	0	486	-2
C61	**Boreal America**	362	4	5.8	-0.3	969	-3	241	-3
C62	**Ural to Altai mountains**	296	6	13.7	0.3	1258	4	521	8
C63	**Australian desert**	185	33	15.5	0.3	676	-1	271	6
C64	**Sahara to Afghan deserts**	42	38	28.4	0.5	1618	-1	323	-16
C65	**Sub-arctic America**	157	24	-3.7	0.1	1150	-6	159	-5

Table A.2 Apr 2021 - Jul 2021 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 15YA Departure (%)
ARG	Argentina	231	-10	13.5	0.0	677	7	236	8
AUS	Australia	237	22	13.6	-0.1	677	0	235	1
BGD	Bangladesh	1432	-7	29.1	0.4	1259	0	793	-5
BRA	Brazil	247	-40	22.2	0.6	1042	6	472	-7
KHM	Cambodia	1088	3	26.9	0.0	1227	5	836	6
CAN	Canada	355	-8	11.3	0.5	1198	2	411	8
CHN	China	825	0	19.6	0.1	1175	0	603	1
EGY	Egypt	0	-94	23.8	0.3	1619	2	118	-60
ETH	Ethiopia	755	-4	19.1	-0.5	1203	-3	512	-11
FRA	France	478	25	13.5	-1.1	1227	-1	467	-7
DEU	Germany	477	40	12.7	-1.3	1148	-4	427	-8
IND	India	746	-7	29.0	-0.6	1249	-1	686	4
IDN	Indonesia	1042	-11	24.5	0.3	1141	6	740	6
IRN	Iran	91	-1	22.8	1.4	1628	0	434	-1
KAZ	Kazakhstan	290	23	15.6	0.1	1351	2	598	7
MEX	Mexico	712	17	23.4	-0.1	1459	-1	730	2
MMR	Myanmar	1147	-18	25.6	0.5	1186	1	747	6
NGA	Nigeria	351	-42	28.3	0.5	1256	4	684	-5
PAK	Pakistan	245	-4	25.1	-0.7	1547	-1	671	6
PHL	Philippines	1253	-7	26.0	0.2	1341	4	895	3
POL	Poland	330	1	14.2	-0.4	1179	1	496	6
ROU	Romania	314	-16	15.4	-0.8	1325	1	585	0
RUS	Russia	340	10	13.9	0.6	1178	1	490	7
ZAF	South Africa	57	-36	12.4	-0.3	925	5	213	-15
THA	Thailand	1260	36	26.4	-0.4	1238	5	836	6
TUR	Turkey	154	-35	16.7	0.4	1525	2	511	-7
GBR	United Kingdom	360	-6	10.7	-0.7	1024	4	326	1
UKR	Ukraine	374	24	15.4	-0.7	1219	-2	555	-1
USA	United States	459	20	18.3	-0.4	1363	0	645	2
UZB	Uzbekistan	125	-7	23.2	0.9	1600	2	533	-7
VNM	Vietnam	1137	1	25.1	0.2	1272	7	827	8
AFG	Afghanistan	195	12	19.7	0.2	1625	1	390	-1
AGO	Angola	160	-16	19.7	-0.1	1217	1	270	-16

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 15YA Departure (%)
BLR	Belarus	317	0	14.5	0.4	1136	2	504	13
HUN	Hungary	249	-5	16.6	-0.8	1329	1	632	2
ITA	Italy	350	-7	16.5	-0.5	1388	-2	616	1
KEN	Kenya	546	-12	19.3	-0.2	1146	3	570	-1
LKA	Sri_Lanka	1250	40	26.5	-0.3	1288	1	851	2
MAR	Morocco	123	36	20.2	0.0	1561	-2	623	-2
MNG	Mongolia	373	45	9.3	-1.2	1304	-5	391	-10
MOZ	Mozambique	111	-15	19.5	-0.5	976	1	492	-2
ZMB	Zambia	32	-54	17.7	-0.5	1162	3	315	-12
KGZ	Kyrgyzstan	528	12	10.7	-0.2	1508	2	467	2

*Note: Departures are expressed in relative terms (percentage) forall 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 between Jan - Apr.*

Table A.3 Argentina, Apr 2021 - Jul 2021 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 15YA Departure (%)
Buenos Aires	196	-8	12.0	0.4	596	4	201	0
Chaco	277	-10	16.3	-0.3	714	15	297	-6
Cordoba	145	25	13.1	0.1	714	4	234	6
Corrientes	370	-20	15.3	-0.5	676	12	273	8
Entre Rios	349	4	13.6	-0.3	640	7	243	1
La Pampa	125	-4	12.1	0.5	629	5	192	6
Misiones	325	-46	15.8	-0.6	763	16	296	2
Santiago Del Estero	194	15	15.6	0.0	728	6	273	4
San Luis	84	0	12.0	0.4	718	3	213	6
Salta	219	11	13.8	-0.1	809	1	280	-1
Santa Fe	263	8	14.4	-0.3	691	11	270	16
Tucuman	138	21	12.3	0.1	812	-3	246	-5

Table A.4 Australia, Apr 2021 - Jul 2021 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 15YA Departure (%)
New South Wales	196	12	11.6	-0.4	682	1	211	-3
South Australia	255	24	13.7	0.2	547	0	217	5
Victoria	294	13	10.8	-0.1	467	-2	159	1
W. Australia	329	61	15.4	0.2	649	-5	245	1

Table A.5 Brazil, Apr 2021 - Jul 2021 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 15YA Departure (%)
Ceara	173	-57	26.1	1.0	1227	6	768	2
Goias	17	-92	23.3	1.9	1124	5	238	-48
Mato Grosso Do Sul	93	-66	21.5	0.9	942	10	408	-6
Mato Grosso	95	-62	24.0	0.7	1118	4	391	-19
Minas Gerais	52	-77	19.8	0.7	1016	10	389	-12
Parana	263	-48	16.2	-0.4	852	14	316	-3
Rio Grande Do Sul	348	-39	14.4	-0.4	702	10	266	-18
Santa Catarina	328	-44	13.6	-0.8	767	12	278	4
Sao Paulo	79	-75	19.1	0.6	947	13	381	-3

Table A.6 Canada, Apr 2021 - Jul 2021 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 15YA Departure (%)
Alberta	270	-23	11.6	0.7	1306	4	476	-6
Manitoba	304	-16	12.8	0.7	1225	2	500	-3
Saskatchewan	302	-9	12.6	0.5	1278	3	504	-2

Table A.7 India, Apr 2021 - Jul 2021 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 15YA Departure (%)
Andhra Pradesh	500	5	29.7	-1.0	1203	-1	713	3
Assam	1812	-24	25.6	0.8	1145	7	721	4
Bihar	862	5	30.7	-1.0	1287	-3	657	-15
Chhattisgarh	456	-34	29.5	-0.9	1241	1	646	-4
Daman and Diu	925	-15	29.4	0.2	1443	0	559	16
Delhi	301	15	32.2	-1.2	1428	-2	803	1
Gujarat	657	2	31.0	-0.2	1358	-2	611	36
Goa	2431	16	26.5	-0.2	1167	-6	630	-1
Himachal Pradesh	494	-17	20.2	-0.9	1427	-2	544	-12
Haryana	288	20	32.3	-0.9	1440	0	829	7
Jharkhand	603	-14	29.9	-0.7	1265	0	640	-9
Kerala	1656	0	25.2	-0.3	1254	7	827	6
Karnataka	886	28	26.2	-0.6	1117	-1	699	3
Meghalaya	1471	-31	25.9	1.1	1198	9	745	6
Maharashtra	1000	26	28.6	-1.0	1196	-4	702	16
Manipur	998	-45	22.5	0.6	1187	7	669	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 15YA Departure (%)
Madhya Pradesh	478	-23	30.8	-0.6	1209	-6	583	1
Mizoram	1334	-17	24.7	0.2	1220	0	759	-1
Nagaland	1427	-29	22.0	0.4	1180	8	650	6
Orissa	536	-29	29.4	-0.6	1249	3	683	-5
Puducherry	893	-17	29.3	-0.5	1351	6	894	12
Punjab	334	17	31.9	-0.7	1439	-1	783	-7
Rajasthan	415	36	32.6	-0.6	1306	-7	726	20
Sikkim	488	-24	17.2	0.0	1398	4	471	-10
Tamil Nadu	503	6	28.0	-0.4	1240	3	778	4
Tripura	1366	-22	27.9	0.6	1240	2	816	0
Uttarakhand	413	-27	22.3	-1.1	1430	1	586	-7
Uttar Pradesh	549	7	31.7	-1.1	1306	-5	704	-3
West Bengal	1002	-11	29.9	-0.1	1280	0	703	-12

Table A.8 Kazakhstan, Apr 2021 - Jul 2021 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 15YA Departure (%)
Akmolinskaya	236	16	14.7	-0.1	1275	1	555	6
Karagandinskaya	249	33	14.2	-0.3	1365	2	552	4
Kustanayskaya	180	-19	16.0	1.0	1313	6	631	17
Pavlodarskaya	259	21	14.5	-0.5	1276	2	539	1
Severo kazachstanskaya	230	-10	14.4	0.7	1224	5	528	14
Vostochno kazachstanskaya	368	33	12.6	-1.2	1414	2	523	-3
Zapadno kazachstanskaya	367	107	19.2	1.3	1333	1	731	15

Table A.9 Russia, Apr 2021 - Jul 2021 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 15YA Departure (%)
Bashkortostan Rep.	234	-30	14.5	1.8	1236	7	538	21
Chelyabinskaya Oblast	179	-39	14.5	1.6	1259	9	549	22
Gorodovikovsk	416	48	18.7	0.2	1288	-4	681	2
Krasnodarskiy Kray	381	4	14.0	-0.6	1225	-2	491	-3
Kurganskaya Oblast	198	-27	14.3	1.4	1222	10	530	23
Kirovskaya Oblast	331	4	13.5	1.8	1104	6	474	23
Kurskaya Oblast	378	28	14.6	-0.1	1145	-3	509	3
Lipetskaya Oblast	359	25	14.9	0.4	1151	-2	517	5
Mordoviya Rep.	429	37	14.8	1.3	1119	-2	514	12

	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 15YA Departure (%)
Novosibirskaya Oblast	309	10	12.3	-0.2	1140	3	438	4
Nizhegorodskaya O.	343	11	14.5	1.5	1125	2	517	20
Orenburgskaya Oblast	258	2	16.6	1.5	1307	4	650	19
Omskaya Oblast	288	4	13.2	0.7	1134	4	461	12
Permskaya Oblast	332	2	13.4	1.9	1101	6	456	20
Penzenskaya Oblast	467	57	15.1	1.1	1121	-4	514	8
Rostovskaya Oblast	377	41	17.8	0.1	1265	-4	627	-2
Ryazanskaya Oblast	404	33	14.9	0.9	1101	-3	503	8
Stavropolskiy Kray	468	10	17.9	0.4	1326	0	601	-6
Sverdlovskaya Oblast	217	-31	13.7	2.1	1184	13	488	27
Samarskaya Oblast	386	30	16.2	1.7	1189	-1	577	14
Saratovskaya Oblast	432	72	16.8	1.0	1209	-4	604	7
Tambovskaya Oblast	420	47	15.5	0.8	1171	-2	539	7
Tyumenskaya Oblast	226	-18	13.6	1.5	1139	8	474	20
Tatarstan Rep.	361	17	14.8	1.7	1146	2	522	18
Ulyanovskaya Oblast	404	33	15.3	1.4	1125	-3	527	11
Udmurtiya Rep.	338	11	13.9	1.8	1105	4	476	19
Volgogradskaya O.	348	56	17.7	0.5	1236	-4	632	4
Voronezhskaya Oblast	368	28	15.9	0.4	1205	-2	564	4

Table A.10 United States, Apr 2021 - Jul 2021 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 15YA Departure (%)
Arkansas	533	22	21.1	-1.5	1356	-2	763	-5
California	31	-70	18.5	1.2	1696	4	487	-24
Idaho	129	-47	13.7	1.7	1546	5	571	13
Indiana	491	6	17.8	-0.7	1317	0	654	-2
Illinois	582	28	18.2	-0.8	1299	-2	659	-4
Iowa	456	7	17.5	-0.2	1288	-1	648	0
Kansas	383	9	20.2	-1.2	1387	-2	758	-4
Michigan	412	6	14.3	0.4	1236	0	513	2
Minnesota	359	-11	15.5	0.8	1265	3	579	-1
Missouri	548	33	19.3	-1.3	1319	-3	697	-7
Montana	288	-13	13.8	1.2	1423	3	598	2
Nebraska	276	-21	18.3	-0.1	1421	2	733	-6

	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 15YA Departure (%)
North Dakota	317	-11	16.0	1.4	1326	3	626	13
Ohio	412	-5	17.1	-0.5	1307	1	630	-1
Oklahoma	507	40	21.4	-1.9	1348	-5	766	-7
Oregon	116	-50	14.3	1.5	1498	8	598	-15
South Dakota	342	-5	17.4	0.7	1373	2	686	7
Texas	626	93	23.6	-1.5	1339	-7	827	-4
Washington	130	-50	14.5	1.4	1443	8	543	-23
Wisconsin	401	-4	15.2	0.6	1248	1	560	6

Table A.11 China, Apr 2021 - Jul 2021 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 15YA Departure (%)
Anhui	1013	34	22.1	0.0	1092	-6	646	8
Chongqing	922	6	19.7	-0.4	967	-9	536	-8
Fujian	1081	-20	22.3	0.9	1140	9	695	14
Gansu	318	-10	14.1	0.1	1315	0	554	6
Guangdong	1168	-26	25.2	1.0	1261	13	833	16
Guangxi	1346	-5	23.6	0.5	1138	6	725	8
Guizhou	920	-15	18.9	0.0	924	-4	492	-1
Hebei	375	63	18.8	-0.6	1335	-4	637	8
Heilongjiang	423	35	15.4	0.3	1277	3	553	5
Henan	533	38	21.9	-0.4	1225	-5	703	10
Hubei	788	-1	20.5	-0.3	1056	-8	596	-6
Hunan	1042	-9	21.5	0.0	1029	-2	618	1
Jiangsu	847	33	22.0	0.3	1157	-3	673	0
Jiangxi	1209	-7	22.7	0.5	1087	3	669	7
Jilin	380	8	16.0	0.2	1300	1	581	3
Liaoning	426	31	17.0	-0.3	1262	-3	584	13
Inner Mongolia	312	46	15.3	-0.3	1325	-2	561	15
Ningxia	144	-17	17.0	0.2	1450	3	677	5
Shaanxi	491	11	17.9	-0.1	1245	-3	624	-1
Shandong	419	33	21.5	-0.3	1283	-5	716	9
Shanxi	268	14	17.2	-0.2	1360	-2	619	-1
Sichuan	943	13	17.1	-0.1	1076	-5	490	-4
Yunnan	1007	4	18.5	0.4	1134	5	546	8
Zhejiang	1477	40	21.2	0.5	1029	-2	588	1

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**.**

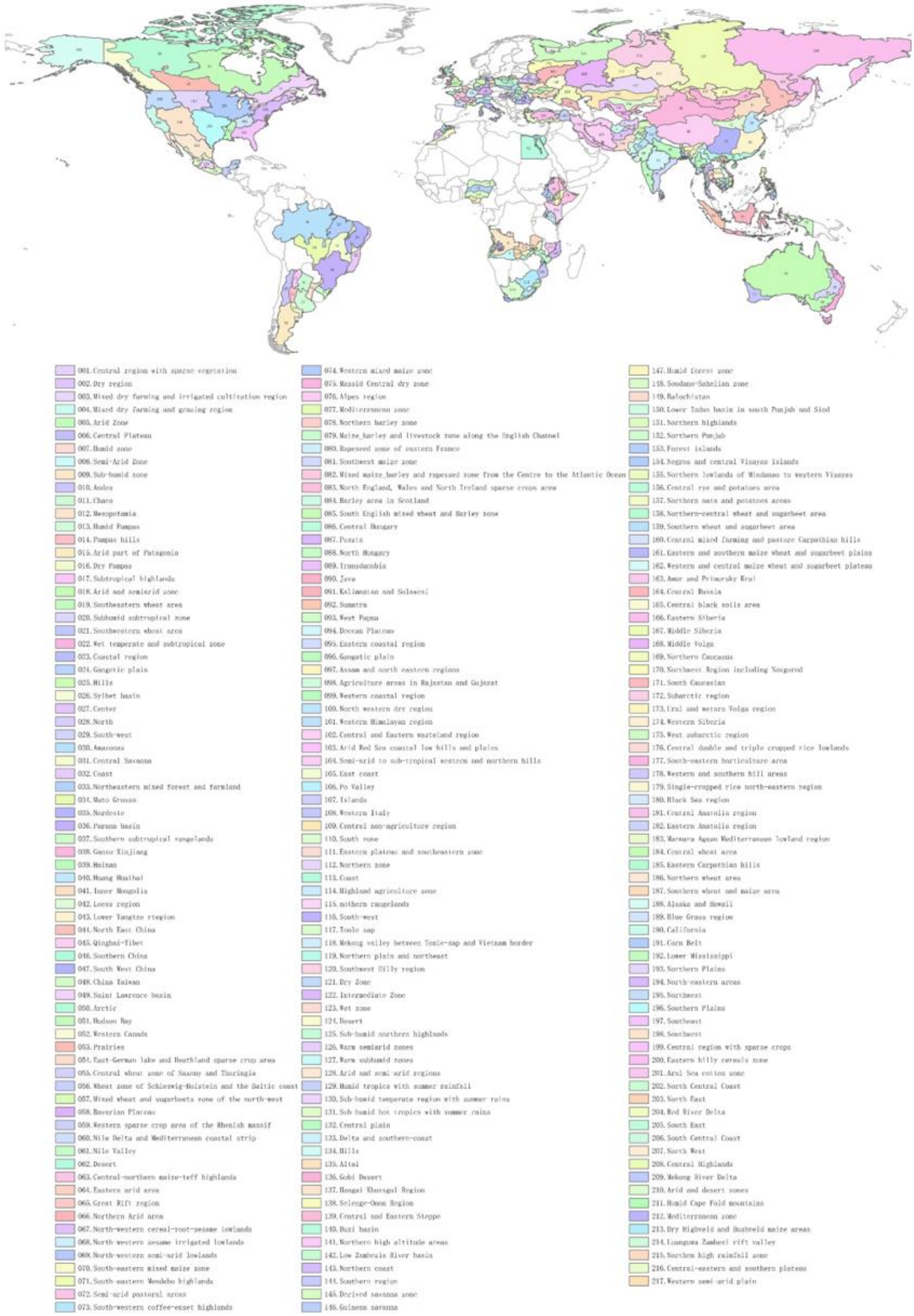
Agroecological zones for 43 key countries

Overview

217 agroecological zones for the 43 key countries across the globe

Description

43 key agricultural countries are divided into 217 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 43 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 (2015-2019), 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 (2015-2019), 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 (2015-2019), 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 (2005-2019), 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 (2005-19), 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 (2005-19), 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 4km/week for MPZs and 1km/dekad for China.

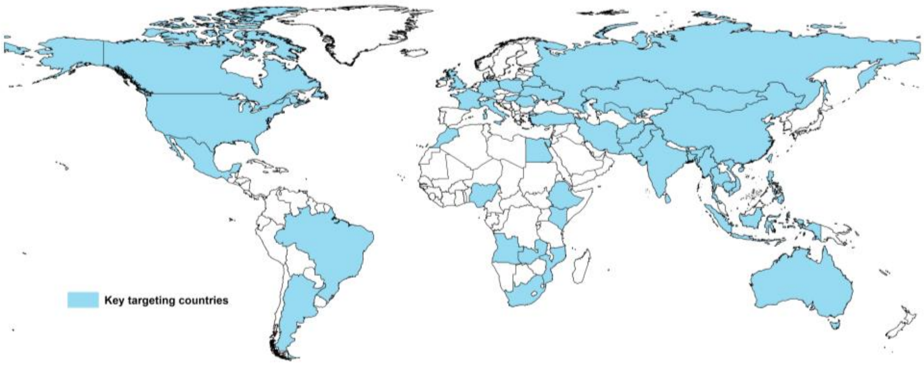
Note: Type is either "Weather" or "Crop"; source specifies if the indicator is obtained from ground data, satellite readings, or a combination; units: in the case of ratios, no unit is used; scale is either pixels or large scale CropWatch spatial units (CWSU). Many indicators are computed for pixels but represented in the CropWatch bulletin at the CWSU scale.

CropWatch spatial units (CWSU)

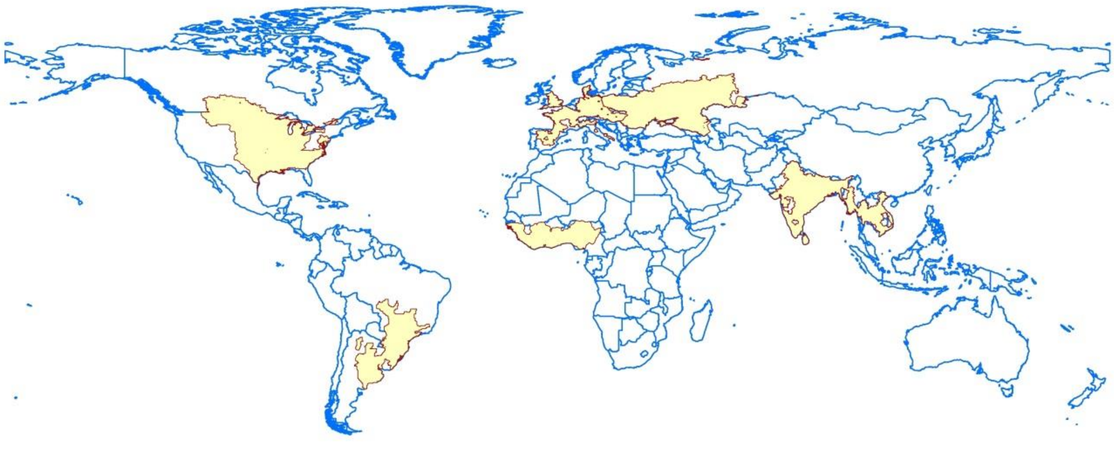
CropWatch analyses are applied to four kinds of CropWatch spatial units (CWSU): Countries, China, Major Production Zones (MPZ), and global crop Mapping and Reporting Units (MRU). The tables below summarize the key aspects of each spatial unit and show their relation to each other. For more details about 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.

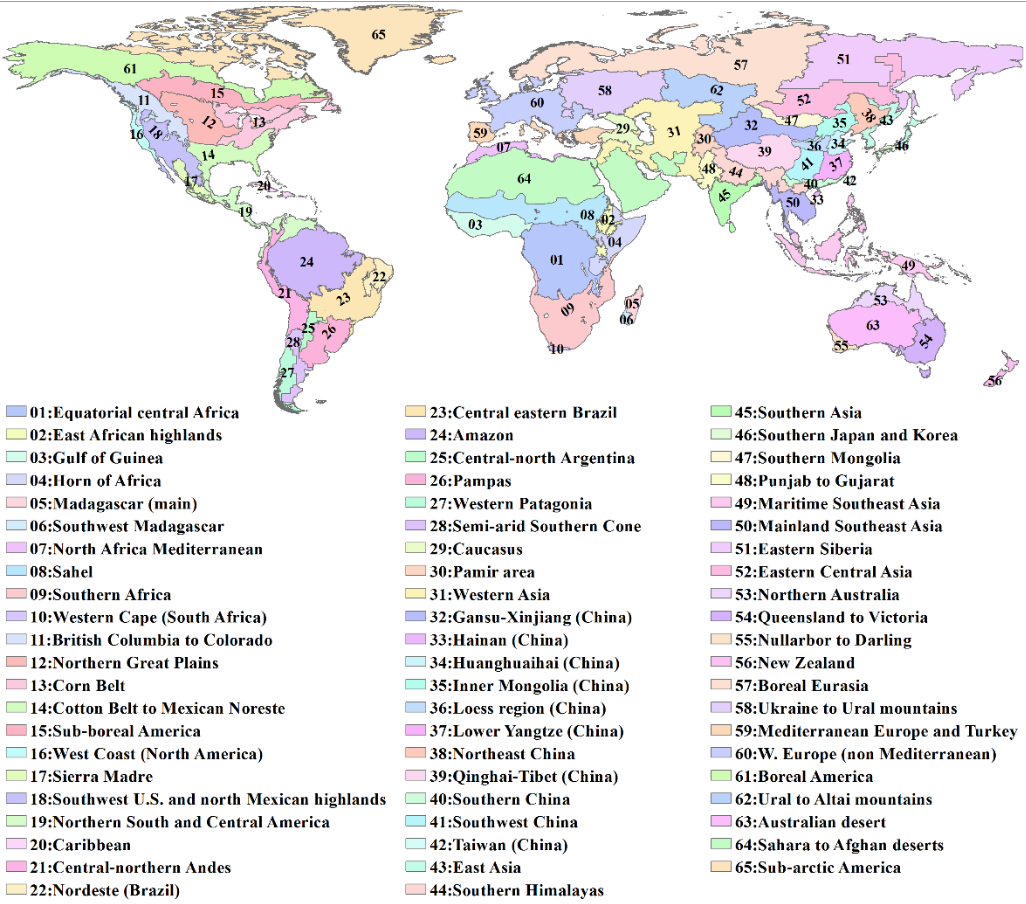
Countries (and first-level administrative districts, e.g., states and provinces)	
Overview	*Description*
"42 + 1" countries to represent main producers/exporters and other key countries.	CropWatch monitored countries together represent more than 80% of the production of maize, rice, wheat and soybean, 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 "42 + 1," referring to 42 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 Mapping 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 42 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 2017 of aggregated FAOSTAT data (using aggregated world production minus the sum of production by the 31 CropWatch monitored countries).

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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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