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

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Abbreviations

5YA	Five-year average, the average for the four-month period from April to July of for 2017-2021; one of the standard reference periods.
15YA	Fifteen-year average, the average for the four-month period from April to July for 2007-2021; 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
CPI	Crop Production Index
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
Tonne	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 2022, a period referred to in this bulletin as the JFMA (April, May, June and July) period or just the "reporting period.", while the information on disaster events was updated until mid-August The bulletin is the 126th 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.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, 43 major agricultural countries, and 223 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	43 key countries (main producers and exporters) and 223 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.cn**, **http://cloud.cropwatch.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 2022. It is prepared by an international team coordinated by the Aerospace Information Research Institute, Chinese Academy of Sciences.

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 agroclimatic 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 (the "core countries") while chapter 4 zooms into China. Special attention is paid to the production outlook of main crop producing and exporting countries where major cereal and oil crops (maize, rice, wheat and soybean) are harvested this year or currently still in the field. Subsequent sections of Chapter 5 describe the global disasters that occurred from April to July 2022.

Agroclimatic conditions and global warming

As a consequence, weather conditions for crop production are getting more extreme, exacerbated by a third year of La Niña conditions. The period from January to July ranks as the 6th hottest on record. The five warmest Julys on record have all occurred since 2016. Unusually high temperatures were recorded in the North China Plain, as well as in Europe. Apart from the high temperatures, Europe, as well as parts of China, were hit by severe drought conditions, causing not only damage to crops, but also limiting hydropower generation and shipping operations on the Rhine, Loire and Yangtze rivers. Thus, global warming is not only impacting agriculture, but the economy and well-being of people as well.

In many regions of the world, water is the most important factor controlling crop production. The regional rainfall patterns continue to be influenced by La Niña, as well as by climate change: The largest rainfall deficits, exceeding more than -30%, as compared to the 15 year average (15YA), were observed for most of Europe and the Horn of Africa, Central-Eastern Brazil, and the Central-northern Andes. In most other regions in South America, as well as in the Southern USA and Northern Mexico, the Maghreb, Central and Western Africa and the Indian subcontinent, rainfall deficits ranged between -10 to -30%. The strongest positive departures were observed for Pakistan, Ural to Altai mountains, northeast of China and Eastern Australia. Only few regions, such as the northern half of the USA, Russia west of the Ural, South-East China and South-East Asia experienced normal rainfall, with a departure range of -10 to +10%.

Impact of weather conditions on crops

Maize: The main maize producing countries in the northern hemisphere have been affected by high temperature and dry weather, causing a decline in area and yield. The southern hemisphere countries had expanded their maize acreage and production increased. 2022 global maize production is expected to be 1.037 billion tonnes, a decrease of 40.68 million tonnes (-3.8%). In the 2022 northern hemisphere summer, extreme heat and dry weather had a serious adverse impact on agricultural production in Europe, resulting in reduced maize yields, among others, in France, Germany, Hungary, Italy, Romania, and the Ukraine. Hungary, Italy, and Romania were the most severely affected countries. Their maize yields declined by more than 10%; the war in the Ukraine limited the country's agricultural production. Both area and yield fell sharply, resulting in a large decline by 34% or 12.22 million tonnes, resulting in production of 23.72 million tonnes. The U.S. is the world's top maize producer. It experienced drought conditions in its main maize-producing regions in June, resulting in a decrease in maize production to 363.59 million tonnes, down by 17.51 million tonnes or 4.6 %. China's maize acreage shrank, and the high temperature and drought in the Yangtze River basin and flooding in some northern areas led to a reduction in maize production to 222.76 million tonnes, down by 11.08 million tonnes or 4.7%. The continued drought in Ethiopia and Kenya in the Horn of Africa led to a 20.1% and 7.8% reduction in production, respectively. Production in Canada, Nigeria, Vietnam and other countries was slightly reduced. In Brazil, the second season maize acreage increased by 9.2%. Combined with higher yields (+6,7%) due to favorable weather during the grain filling period in April, second season total maize production increased by 16.5%, prompting

Brazil's total 2021-22 maize production to reach 91.3 million tonnes, an increase of 9.6%. Argentina’s and South Africa’s maize production is estimated to be 54.97 million tonnes (+2.9%) and 11.86 million tonnes (+3.5%), respectively.

Rice: Rice production is forecasted to increase slightly by 3.54 to 768 million tonnes (+0.5%). In China, the world's largest rice producer, production is expected to increase slightly by 0.3% to 197.01 million tonnes, although local areas were affected by high temperatures, drought or flooding. In the important rice production countries of South- and South-East Asia, such as Thailand, Vietnam, Indonesia, the Philippines, Myanmar and Bangladesh, precipitation has generally been normal and production levels are similar to last year. Pakistan has received significantly more precipitation, causing local flooding. But overall conditions are still conducive to the growth of rice. Production is estimated to increase by 6.8%. In central and north-central India, precipitation is significantly below average, but the main rice producing areas have well-developed irrigation systems, and the dry and hot weather has less of an impact on rice production. The country's rice production is expected to decline slightly by 1.7%. Rice production in the U.S. and Nigeria also declined due to below average rainfall. Overall, the global rice production and supply situation is stable and an increase by 3.54 million tonnes in global rice production is forecasted.

Wheat: Total wheat production is expected to be 708 million tonnes, a reduction of 12.68 million tonnes (-1.8%). In most of Europe, wheat reached maturity before the drought had intensified and production levels in France, the UK and Germany dropped by less than 10%. Romania was the country that was most severely affected and its wheat production decreased by 13.2%. In India and Pakistan, a heat wave led to a shorter grain filling period, resulting in a yield decline by 2.8% and 4.9%, respectively. Total wheat production is estimated at 93.24 million tonnes and 25.57 million tonnes, respectively. Due to droughts, Morocco (-33%), Ethiopia (-20.7%), Kenya (-16,6%) and Afghanistan (-7,4%) saw sharp declines in their wheat production. In Iran, wheat acreage and yields fell simultaneously, resulting in a decline of the country's wheat production by 13.4%. Conditions in the USA have been mixed. Winter wheat production in the Plains was impacted by drought conditions, whereas spring wheat production in the North is benefitting from favorable moisture conditions, resulting in decline of production by 1% at the national level. Among the major wheat-producing countries, only Australia, Brazil, Canada, Mexico and Kazakhstan and Kyrgyzstan in Central Asia have increased wheat production. Total global wheat production has fallen to the lowest level in the past five years, and the tight situation of global wheat supply is expected to continue.

Soybean: Global soybean production is forecasted at 320 million tonnes, with a slight decrease by 0.2%. Production in major soybean exporting countries declined, while in China, the largest importer, it increased significantly. The United States and Brazil are the world's two largest soybean exporters. Production is estimated at 102.36 million tonnes and 95.14 million tonnes, respectively, a decrease of 2.35 million tonnes and 1.16 million tonnes or 2.2% and 3.3%. The main reason for the reduction in soybean production in the United States is the low precipitation and high temperatures in its main soybean producing areas in June and July, affecting soybean flowering and podding, while Brazil is mainly affected by persistent drought conditions, which reduced yields. In contrast, China, the largest soybean importer, increased its soybean acreage significantly this year, prompting Chinese soybean production to reach 18.15 million tonnes, the highest production in nearly 10 years, an increase of 3.81 million tonnes or 26.5%. This increase offsets reductions in U.S. and Brazilian production. Soybean production in Canada and India decreased by 260,000 tonnes and 440,000 tonnes, respectively, while production in Russia and Argentina increased by 230,000 tonnes and 170,000 tonnes, respectively. Overall, the global soybean supply situation is normal.

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 growth conditions over the period from April to July 2022, 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 B and serve the purpose of identifying global climatic patterns. Refer to Annex A for definitions and to table A.1 for 2022 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 2007 to 2021. Although departures from the 2007-2021 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., 2017-2021). This makes provision for the fast response of markets to changes in supply.

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. It is important to note that we have adopted an improved calculation procedure of the biomass production potential in the bulletin based on previous evaluation.

1.2 Global overview

2022 is well on track to rank among the 10-warmest years on record, according to the National Oceanic and Atmospheric Administration (NOAA) of the USA. The period from January to July ranks as the 6th hottest on record. The five warmest Julys on record have all occurred since 2016. Unusually high temperatures were recorded in the North China Plain, as well as in Europe. Apart from the high temperatures, Europe, as well as parts of China, were hit by severe drought conditions, causing not only damage to crops, but also limiting hydropower generation and shipping operations on the Rhine, Loire and Yangtze rivers. Thus, global warming is not only impacting agriculture, but the economy and well-being of people as well.

The analysis of the CropWatch Agroclimatic Indicators (CWAIs) at the global level showed that temperatures were 0.14ºC warmer, solar radiation was 0.7% above average, but rainfall was reduced by 2.6% when compared to the 15YA (Fig 1.1).

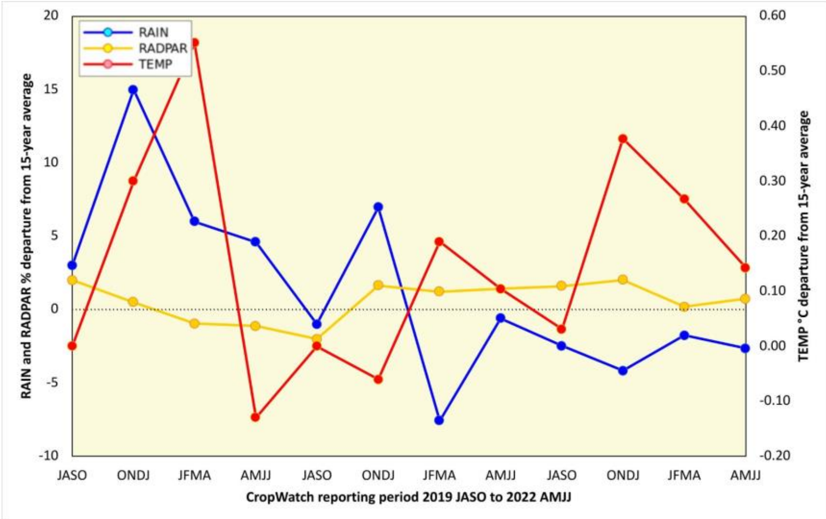


Figure 1.1 Global departure from recent 15-year average of the RAIN, TEMP and RADPAR indicators. The last period covers April to July (AMJJ) 2022 (average of 65 MRUs, unweighted).

1.3 Rainfall

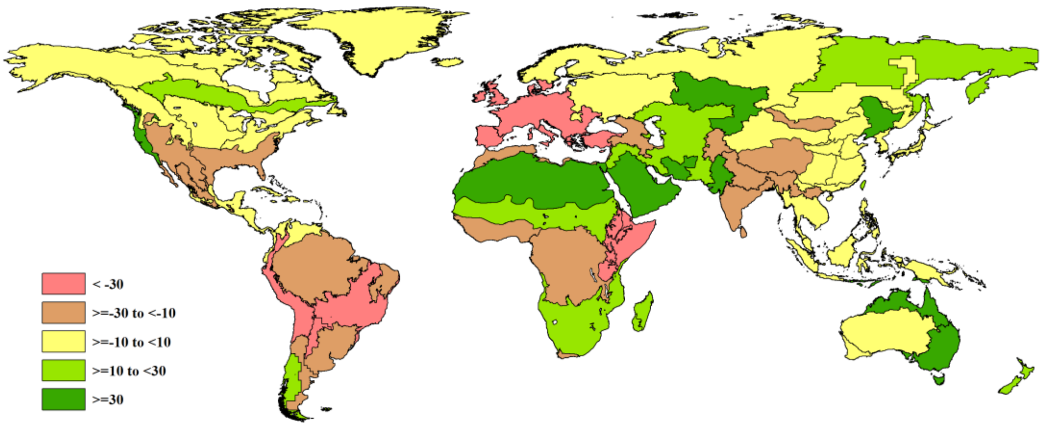


Figure 1.2 Global map of rainfall anomaly (as indicated by the RAIN indicator) by CropWatch Mapping and Reporting Unit: Departure of April to July 2022 total from 2007-2021 average (15YA), in percent.

The rainfall departure map continues to reflect the current La Niña conditions. The largest rainfall deficits, exceeding more than -30%, as compared to the 15YA, were observed for Central-Eastern Brazil, the Central-northern Andes, most of Europe and the Horn of Africa. In addition, most of South America, as well as the Southern USA and Northern Mexico, the Maghreb, Central and Western Africa and the Indian subcontinent and SouthWestern of China also experienced rainfall deficits between -10% to -30%. The strongest positive departures were observed for Pakistan, Ural to Altai mountains, northeast of China and Eastern Australia. Only few regions, such as the northern half of the USA, Russia west of the Ural, South-East China and South-East Asia experienced normal rainfall, with a departure range of -10% to +10%.

1.4 Temperatures

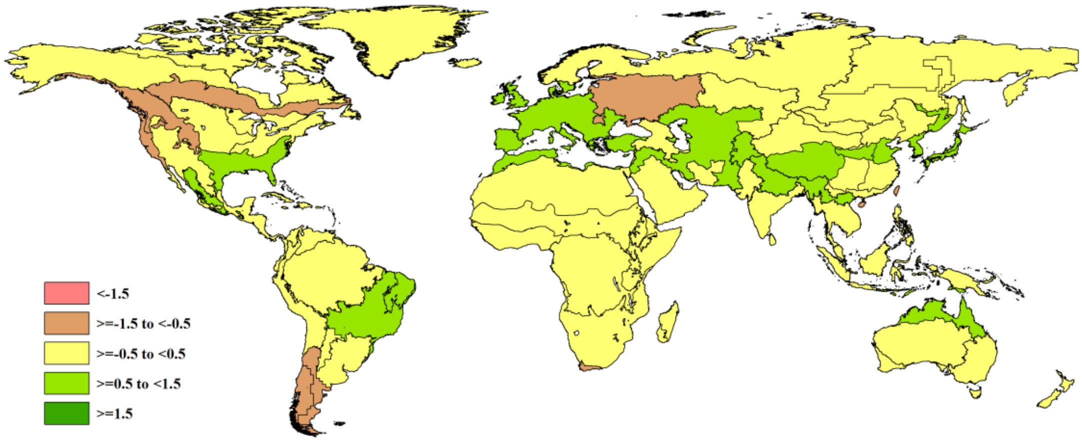


Figure 1.3 Global map of temperature anomaly (as indicated by the TEMP indicator) by CropWatch Mapping and Reporting Unit: departure of April to July 2022 average from 2007-2021 average (15YA), in °C.

Cooler temperatures, in the range of -1.5ºC to -0.5ºC as compared to the 15YA, were observed in the southern tip of South America, California and Pacific Northwest, the Canadian Prairies and Russia west of the Ural. Warmer temperatures (+0.5ºC to 1.5ºC) were observed for most the crop production region of Brazil, the South and East of the USA, most of Europe, the Maghreb, Central Asia and Himalayas, as well as the North China Plain. For all other regions, the average departures were minimal, in the range of +0.5ºC to -0.5ºC.

1.5 RADPAR

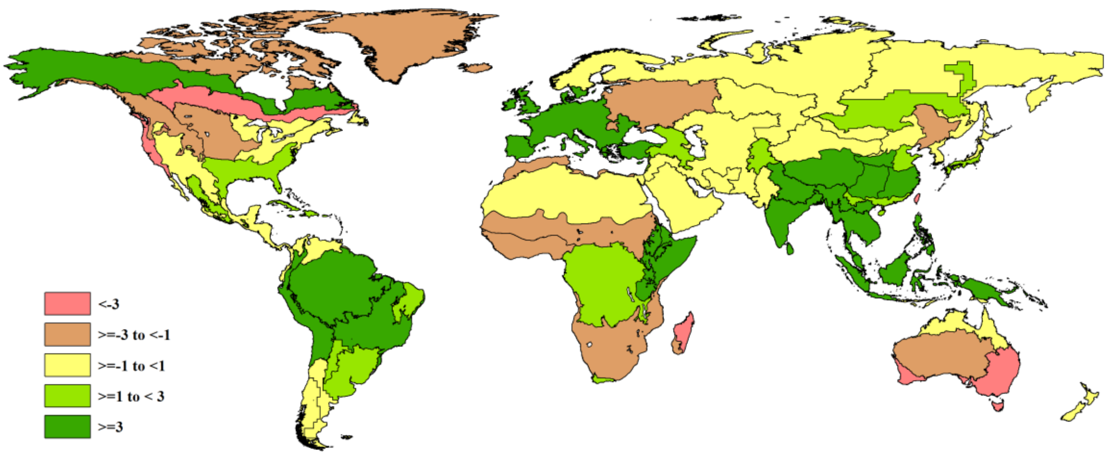


Figure 1.4 Global map of photosynthetically active radiation anomaly (as indicated by the RADPAR indicator) by CropWatch Mapping and Reporting Unit: departure of April to July 2022 total from 2007-2021 average (15YA), in percent.

The strongest negative departures (<-3%) in solar radiation were observed for California, the Canadian Prairies and the wheat production regions of Australia. The Northern Great Plains in the USA, Russia west of the Ural, north-east of China, Africa north of the equator as well as southern Africa had below average solar radiation, in the range of -1% to -3% below average. Solar radiation was normal to above-average for most of the Americas. Most of Europe, apart from Russia west of the Ural, the Horn of Africa, South and South-East Asia and Southern China experienced radiation levels that were more than 3% above average. Higher solar radiation, in combination with warm temperatures, increases potential evapotranspiration, and thus crop water demand. This in turn exacerbates drought conditions.

1.6 BIOMSS

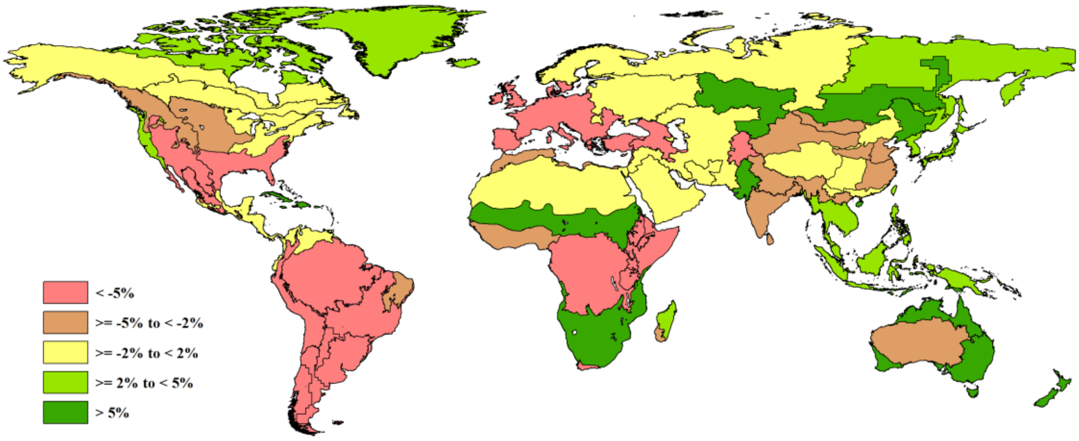


Figure 1.5 Global map of biomass accumulation (as indicated by the BIOMSS indicator) by CropWatch Mapping and Reporting Unit: departure of April to July 2022 total from 2007-2021 average (15YA), in percent.

Potential biomass production, which is calculated by taking rainfall, temperature and solar radiation into account, was more than 5% below the 15YA for most of South Africa, southern USA, as well as central and northern Mexico. Central Africa and the Horn of Africa, most of Western and Central Europe, as well as drought plagued Afghanistan also experienced strong negative departures (<-5%). Negative departures (-5% to -2%) were observed for the north-west of the USA, the Maghreb , South Asia with the exception of Pakistan, as well as Eastern China, including the North China Plain. Northeastern United States, Eastern Canada, Central America and most of Russia generally experienced average biomass production. Siberia and the north-east of China had generally favorable conditions for biomass production, with a positive departure that was greater than +5%.

Chapter 2. Crop and environmental conditions in major production zones

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

2.1 Overview

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

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

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

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

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

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

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

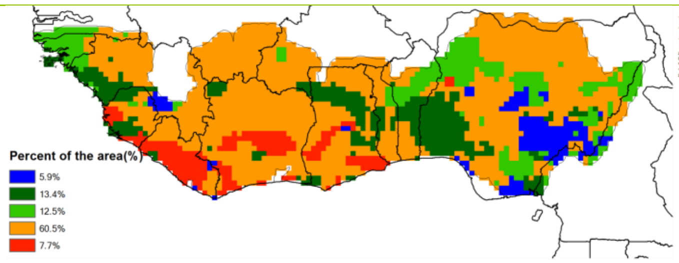
2.2 West Africa

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

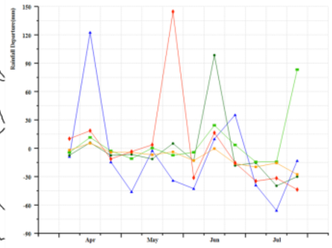
The VCIx map as an indication of vegetation cover shows that the areas with the highest values (>0.8) were in the coastal and central regions, whereas lower values were observed in the northern parts of the MPZ, which were generally drier. The vegetation health index (VHI) map also depicts a spatial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

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

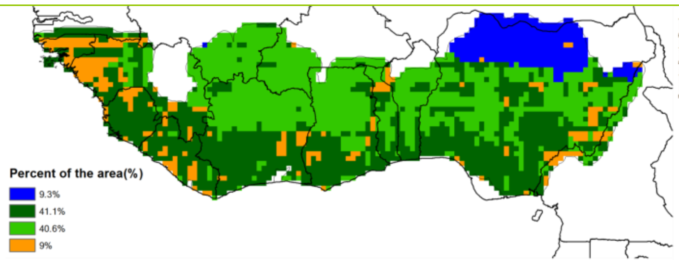
Figure 2. 1 West Africa MPZ: Agroclimatic and agronomic indicators, April - July 2022.



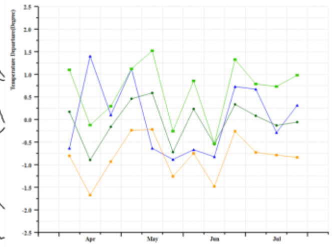
a. Spatial distribution of rainfall profiles



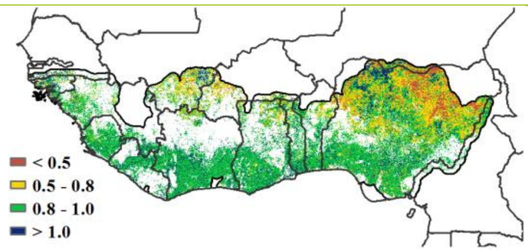
b. Profiles of rainfall departure from average (mm)



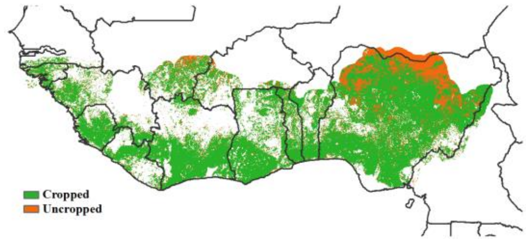
c. Spatial distribution of temperature profiles



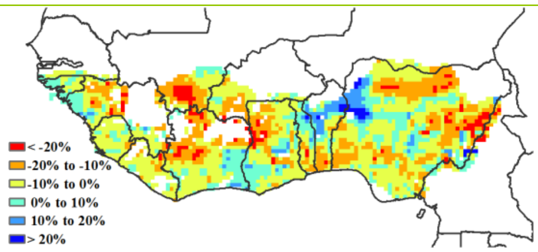
d. Profiles of temperature departure from average (mm)



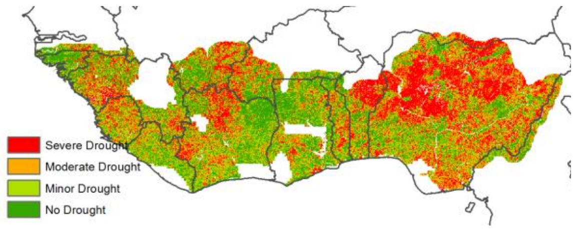
e. Maximum VCI



f. Cropped arable land



g. Biomass accumulation potential departure



h. VHI minimum

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

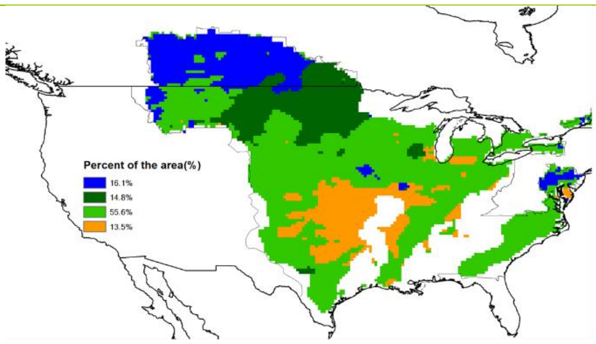
2.3 North America

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

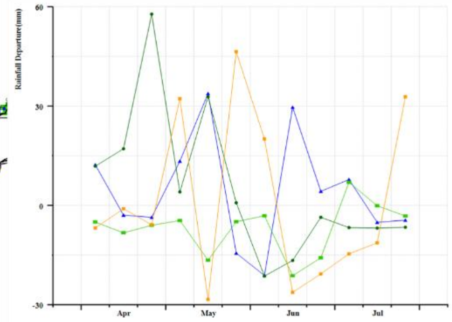
For the region as a whole, North America experienced a dry and hot season. Rainfall was 8% below the 15YA and temperature was 0.5°C above average. The rainfall departure profile indicated that the Canadian Prairies received significantly above average rainfall in mid-May and mid-June, while most of the U.S. experienced a rainfall deficit. In May, much warmer than usual temperatures were observed for the central regions of the USA and Canada. Temperature departure profiles showed that temperature was 1-4°C above average in the Southern Plains and Lower Mississippi River, and 1-2°C above average in the Northern Plains and Corn Belt from mid-June to July. Precipitation deficits and above average solar radiation accelerated soil moisture loss leading to localized drought and spatial variation in crop conditions. Potential biomass was 4% below average and crop growth was near average, but below 5-year mamximum, in North America during the monitoring period with VCIx of 0.83. The minimum vegetation health index (VHIn) indicated a severe drought in the Southern Plains, where potential biomass was generally 10-20% lower. VCIx indicated good crop conditions in the Canadian prairies (VCIx is above 1.0) and poor crop conditions in the Southern Plains (VCIx is below 0.5). The drought resulted in an increase in the fraction of uncropped land, with CALF showing that 92% of cropland was planted during the monitoring period, 3% lower than the 5YA.

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

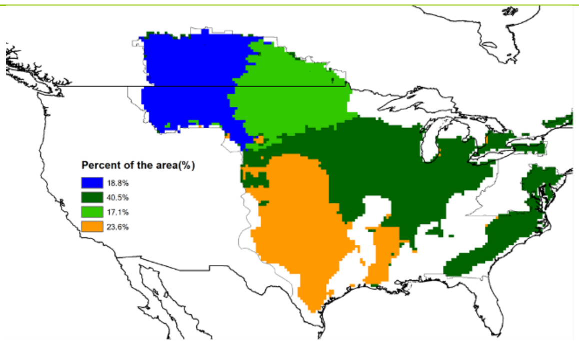
Figure 2. 2 North America MPZ: Agroclimatic and agronomic indicators, April to July 2022.



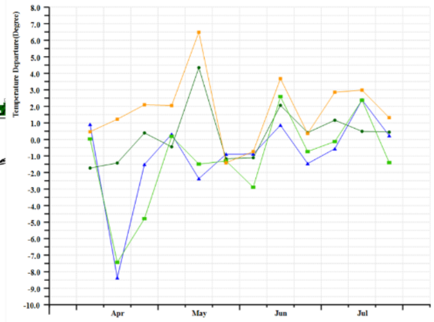
a. Spatial distribution of rainfall profiles



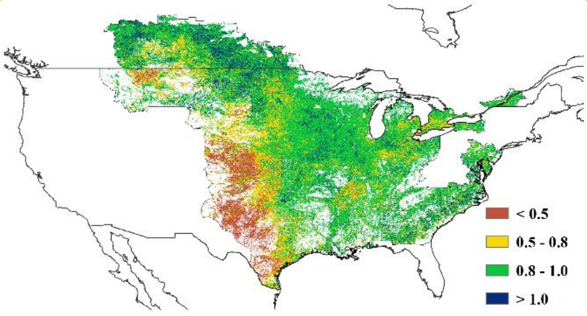
b. Profiles of rainfall departure from average (mm)



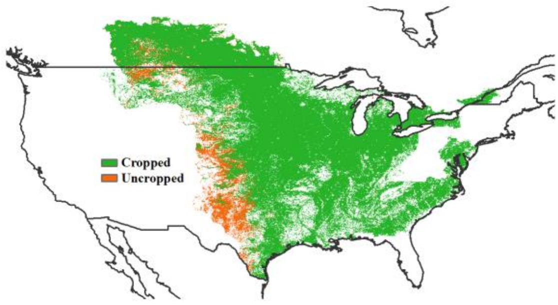
c. Spatial distribution of temperature profiles



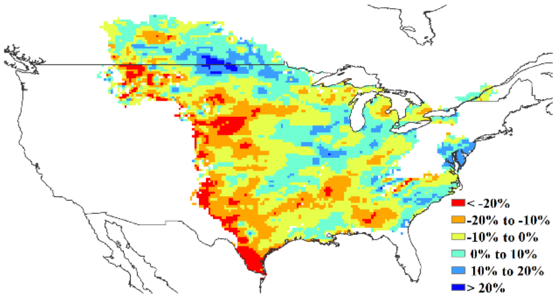
d. Profiles of temperature departure from average (mm)



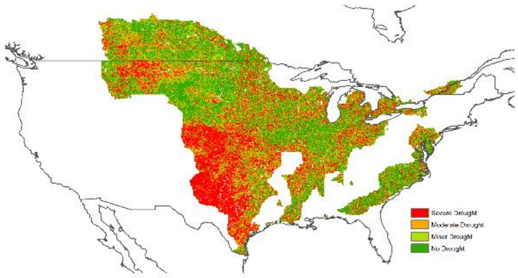
e. Maximum VCI



f. Cropped arable land



g. Biomass accumulation potential departure



h. VHI minimum

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

2.4 South America

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

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

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

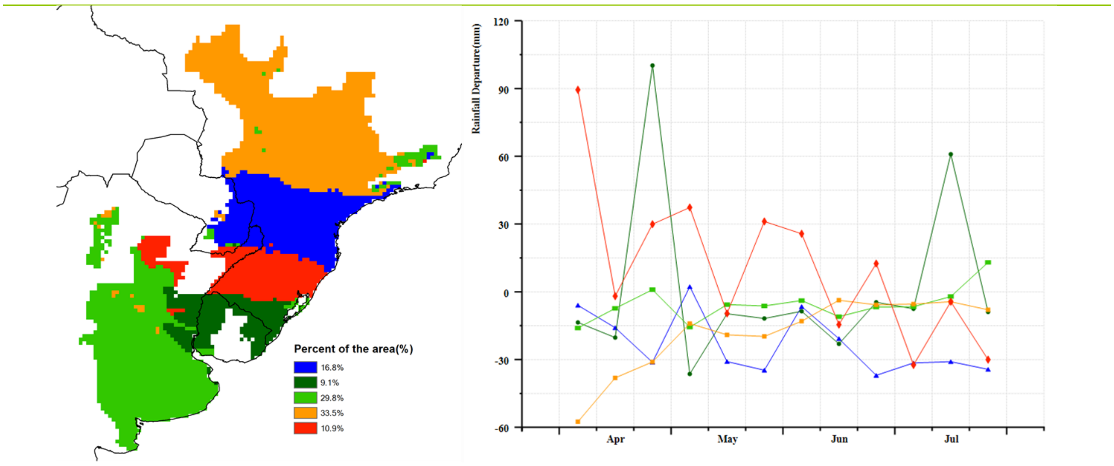
The temperature profiles showed 5 patterns. All of them showed showed similar trends, but different magnitudes of the anomalies. Most of the profiles showed reductions in April, mid-May and mid-June; and increments at the end of April, May and June. The red profile was located in the north of the MPZ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

The BIOMSS departure map showed poor conditions with values lower than -20 % in the north and south of the MPZ. This pattern covered most of the MPZ and included Mato Grosso, Mato Grosso do Sul, Goias, Minas Gerais and Sao Paulo in Brazil, West Paraguay and most of the Pampas and the east of Subtropical Highlands in Argentina. Good conditions were observed in most of Mesopotamia and Chaco in Argentina, East Uruguay and Rio Grande do Sul and Santa Catarina in Brazil.

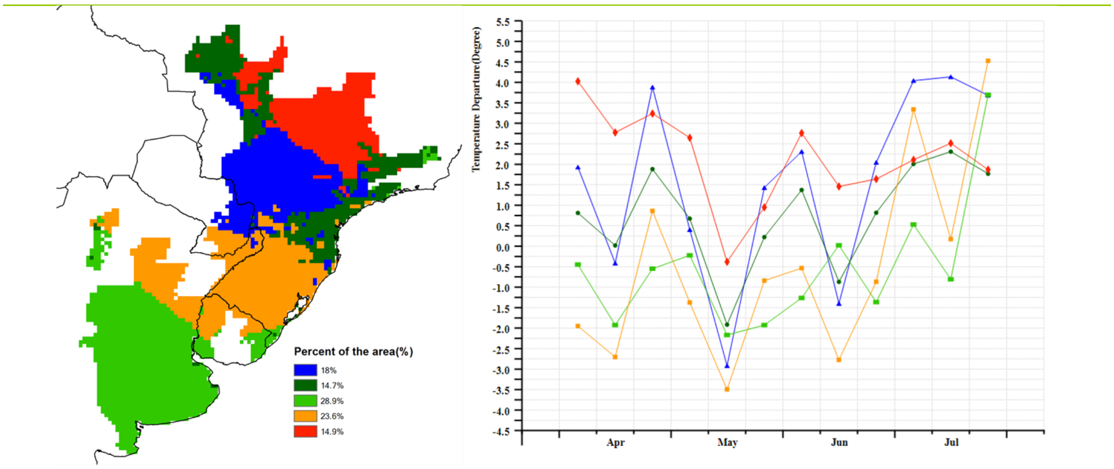
Maximum VCI showed good conditions with values higher than 0.8 in the north of the MPZ and showed poor conditions in most of the Pampas in Argentina. Although the dry and hot weather in southern Brazil was unfavorable for crops, as presented by the significantly below average BIOMSS, vegetation conditions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

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

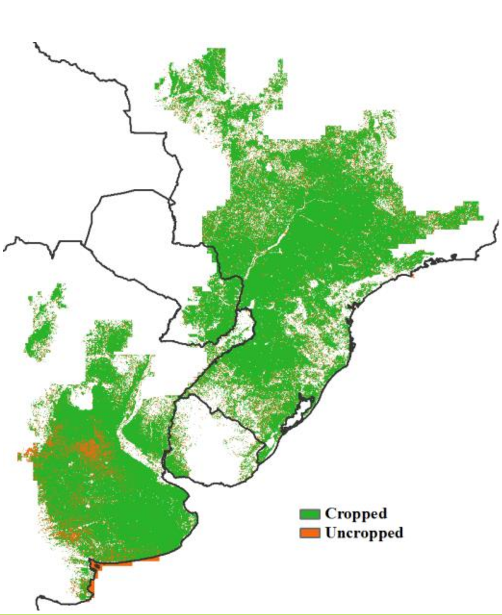
Figure 2. 3 South America MPZ: Agroclimatic and agronomic indicators, April- July 2022



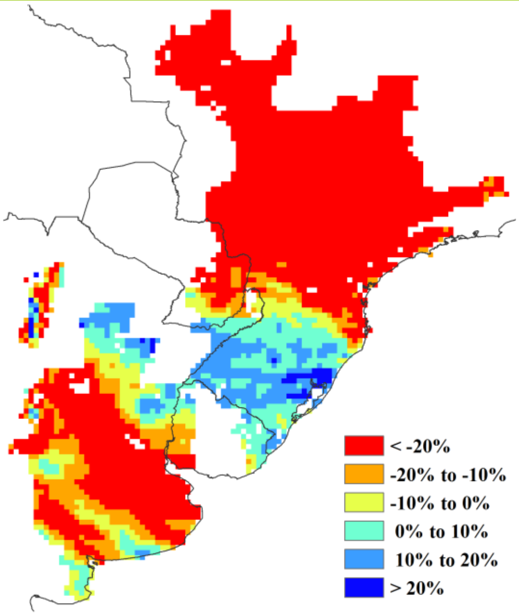
a. Spatial distribution of rainfall profiles b. Profiles of rainfall departure from average (mm)



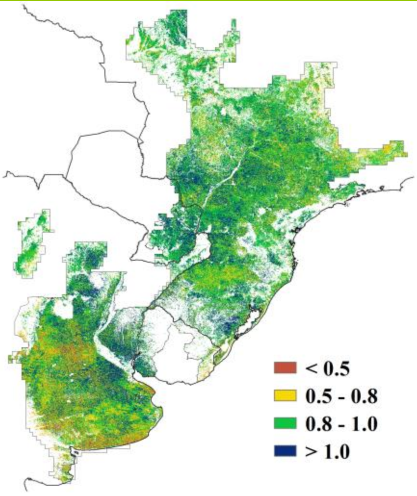
c. Spatial distribution of temperature profiles d. Profiles of temperature departure from average (°C)



e. Cropped and uncropped arable land



f. Potential biomass departure from 15YA



g. Maximum VCI

2.5 South and Southeast Asia

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

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

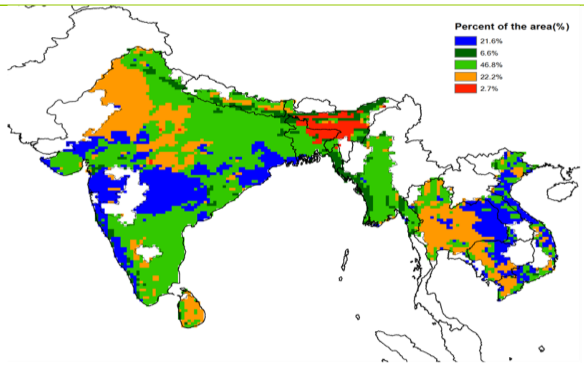
According to the spatial distribution of rainfall profiles, the precipitation for 22.2% of the MPZ showed higher positive departures in July, mainly located in western India, Sri Lanka, central Nepal, southern, eastern and central Thailand, southern and eastern Cambodia and southern Vietnam. The precipitation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

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

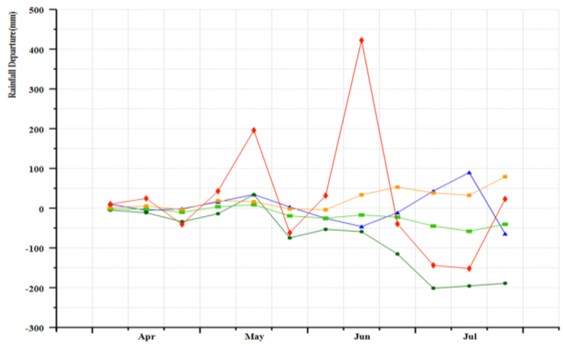
The BIOMSS departure map reveals that the potential biomass in western India and central Thailand was 20% higher than the average level, while the potential biomass in northern, southern, eastern and central India and central Myanmar was estimated to be below average. The Maximum VCI map shows that the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

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

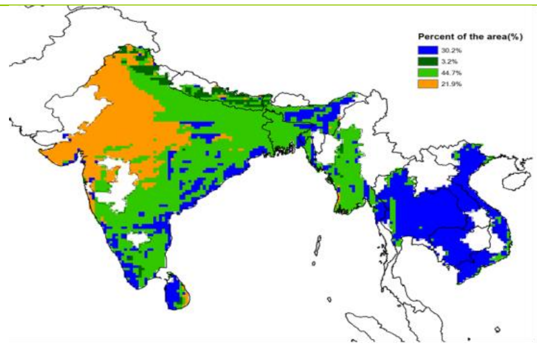
Figure 2. 4 South and Southeast Asia: Agroclimatic and agronomic indicators, April - July 2022.



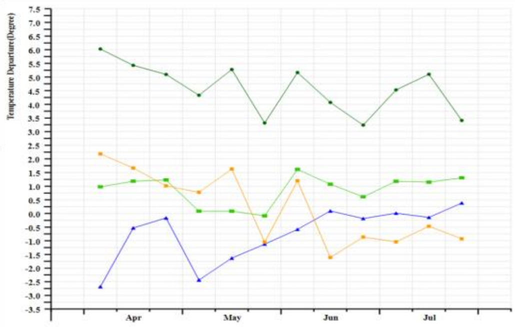
a. Spatial distribution of rainfall profiles



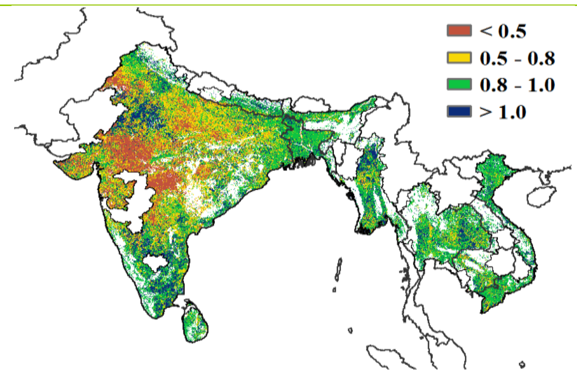
b. Profiles of rainfall departure from average (mm)



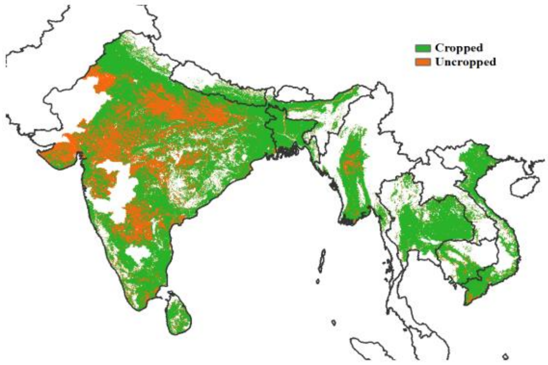
c. Spatial distribution of temperature profiles



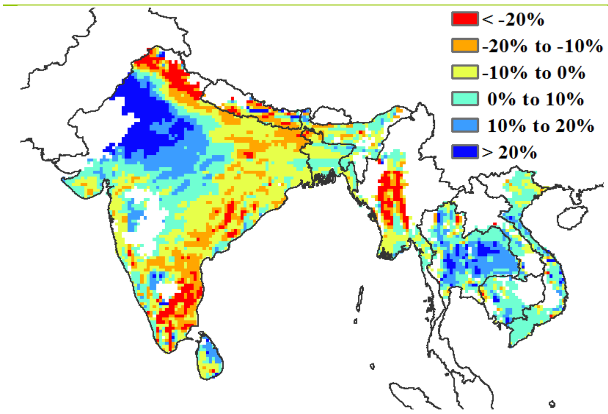
d. Profiles of temperature departure from average (mm)



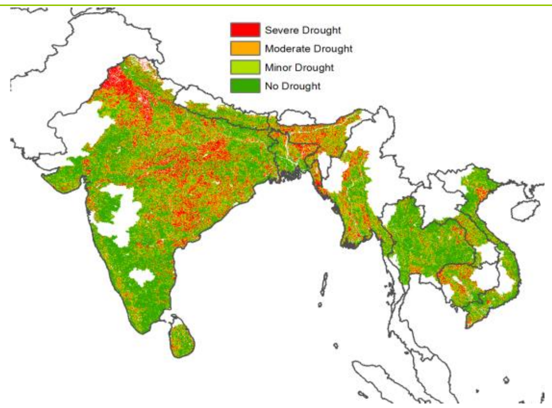
e. Maximum VCI



f. Cropped arable land



g. Biomass accumulation potential departure



h. VHI minimum

2.6 Western Europe

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

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

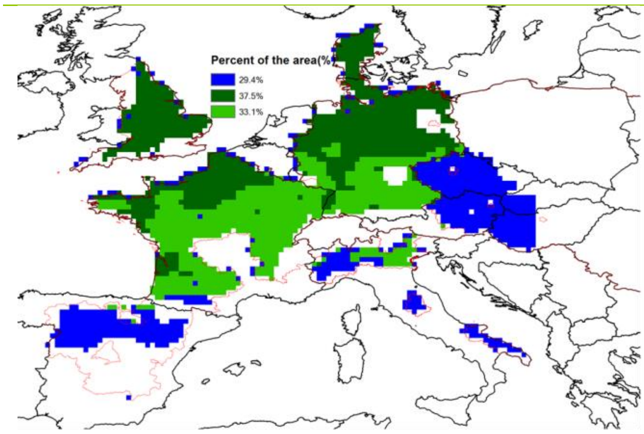
Temperature for the MPZ as a whole was significantly above average (TEMP +1.1%) and radiation was above average with RADPAR up by 7%. As shown in the spatial distribution of temperature profiles, the regions in Denmark, Southeastern Italy, most of the Czech Republic, southwestern Slovakia, northeastern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

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

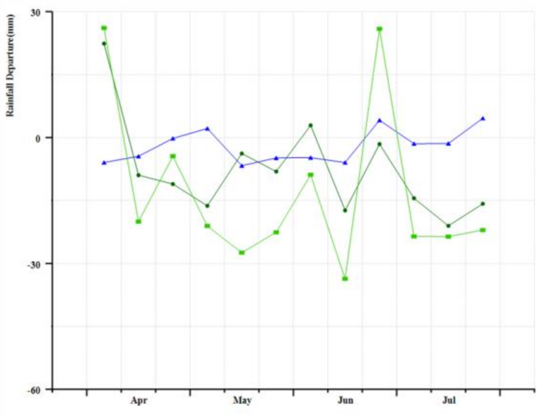
The average maximum VCI for the MPZ reached a value of 0.86 during this reporting period. About 97% of arable land was cropped, which is the same as the recent five-year average in the whole MPZ. The uncropped areas of arable land were mainly concentrated in eastern and southeastern Spain, and a few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

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

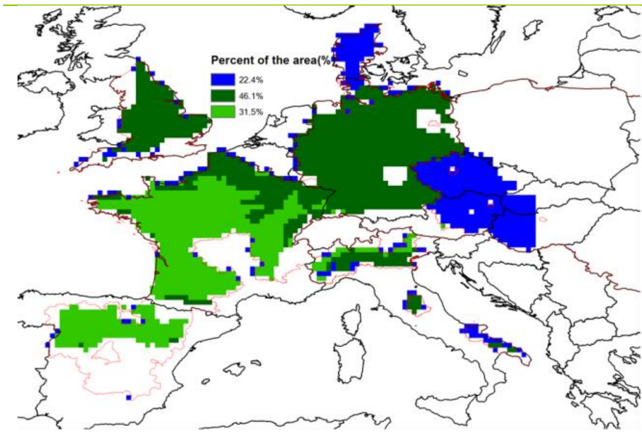
Figure 2. 5 Western Europe MPZ: Agroclimatic and agronomic indicators, April to July 2022.



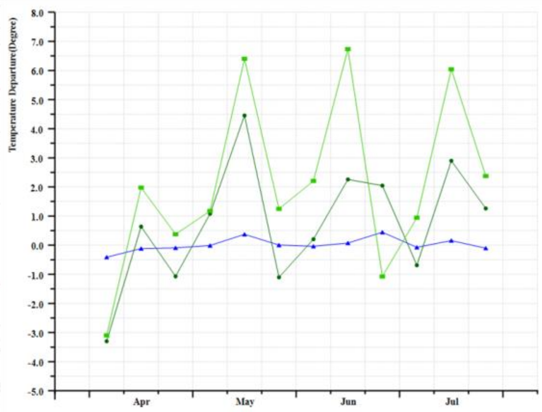
a. Spatial distribution of rainfall profiles



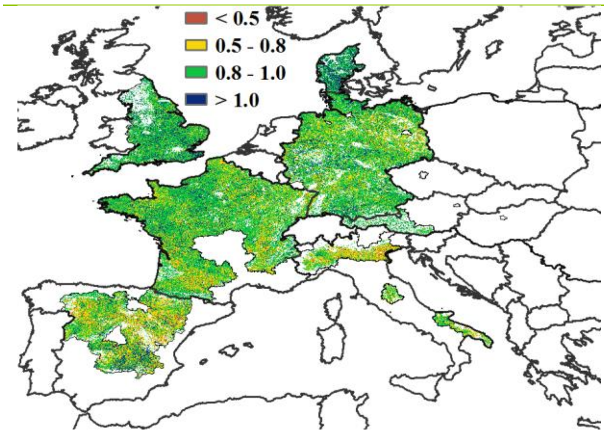
b. Profiles of rainfall departure from average (mm)



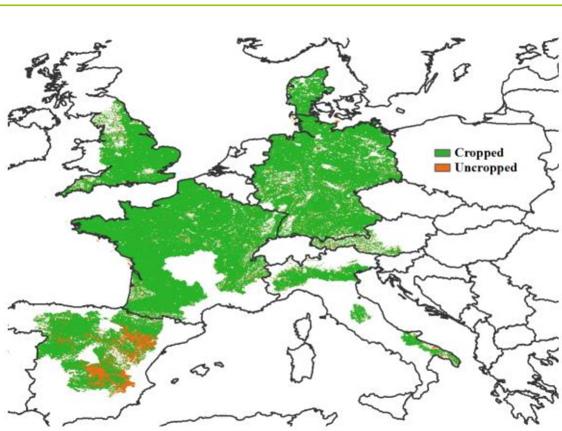
c. Spatial distribution of temperature profiles



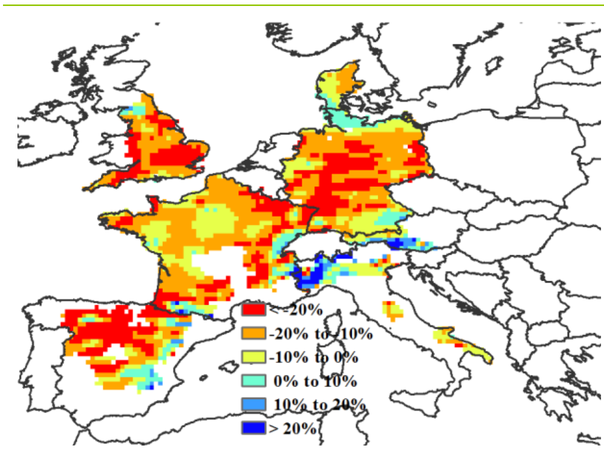
d. Profiles of temperature departure from average (mm)



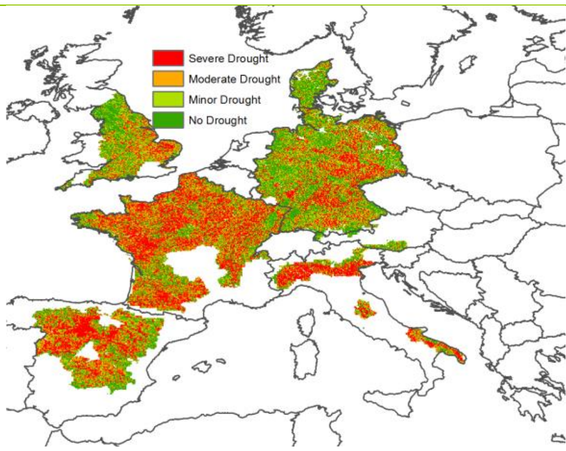
e. Maximum VCI



f. Cropped arable land



g. Biomass accumulation potential departure



h. VHI minimum

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

2.7 Central Europe to Western Russia

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

According to the spatial distribution map of rainfall departure, the precipitation in most areas of the MPZ fluctuated around the mean during the monitoring period. The spatial and temporal distribution characteristics were as follows: (1) In early and mid-April, above-average precipitation occurred in northern Russia, northeastern Ukraine, Belarus, and parts of Poland (62.2% of the MPZ). (2) In early and mid-May, early and mid-June, 78.4% of the MPZ received below-average precipitation, whereas eastern Russia received above-average rainfall. (3) In early July, precipitation within the MPZ was below average; in mid-July, 79.2% of the MPZ received above-average precipitation (+120 mm).

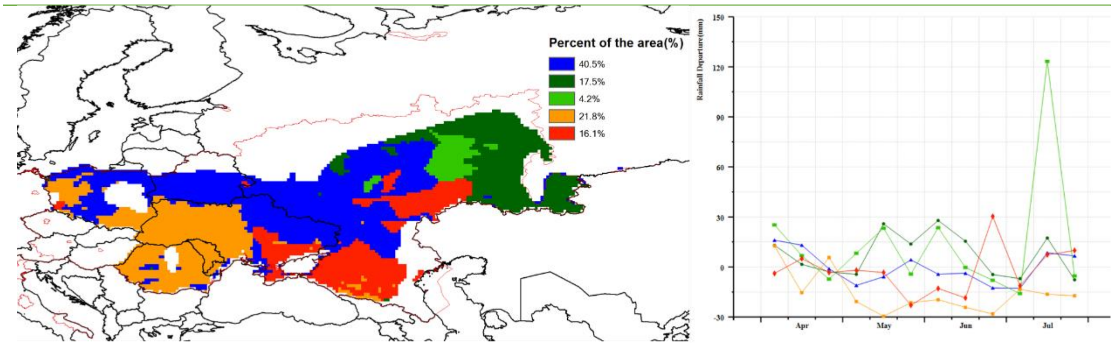
According to the average temperature departure map, temperatures in the MPZ varied significantly during this monitoring period, and the specific spatial and temporal characteristics were shown as follows: (1) In April, temperatures were above average in eastern Ukraine and southern Urals (42.7% of the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

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

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

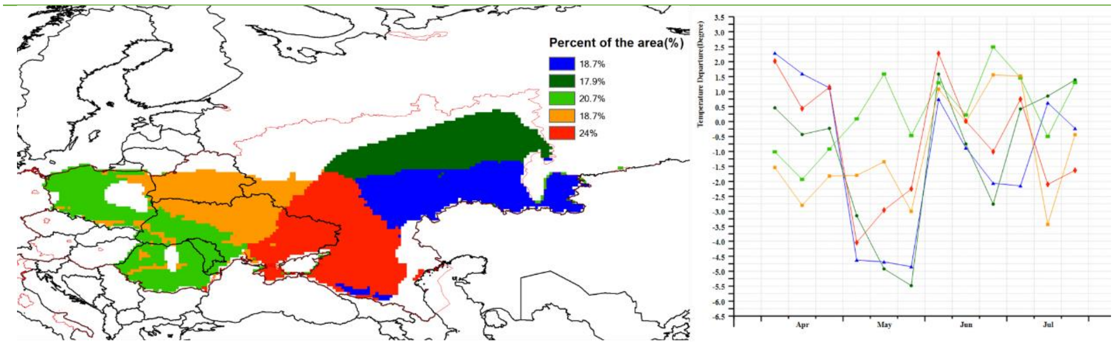
Overall, due to precipitation deficits, crop conditions in Central Europe and south-eastern Russia were below average in this monitoring period.

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



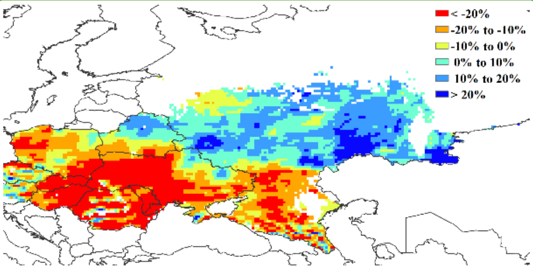
a. Spatial distribution of rainfall profiles

b. Profiles of rainfall departure from average (mm)

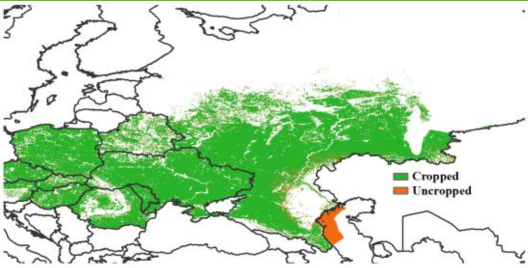


c. Spatial distribution of temperature profiles

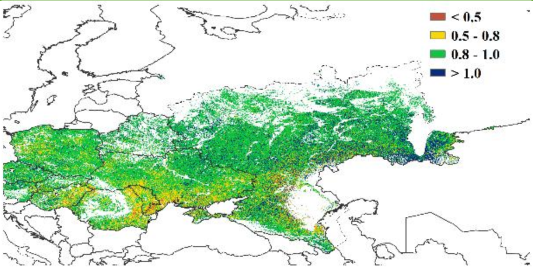
d. Profiles of temperature departure from average (℃)



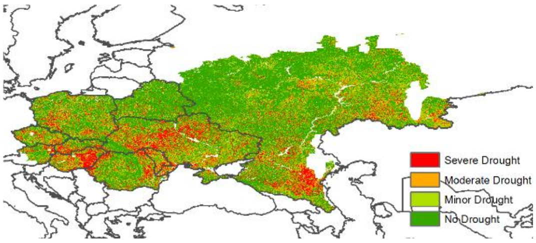
e. Biomass accumulation potential departure



f. Cropped arable land



g. Maximum VCI



h. VHI minimum

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

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.

The global agro-climatic 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 agro-ecological zones receive due attention in this chapter as well.

In many cases, the situations listed below are also mentioned in the section on disasters (chapter 5.2) 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.

1. 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 have been dominated by just 4 countries: USA, Brazil, Argentina, and the Ukraine. Together, they have supplied three quarters of maize being traded internationally. In South America, this reporting period covered the grain-filling period of late (2nd crop or safrinha) maize and its harvest. In Brazil, conditions for maize were mixed. Mato Grosso is the most important maize producer within Brazil, accounting for almost half of its safrinha production. It is followed by Parana. In both states, soil moisture supply was generally sufficient to support crop growth and average yields can be expected. Goias, on the other hand, had received very little rainfall in this monitoring period and much lower than usual yields are to be expected. In the USA, the maize crop was off to a slow start, due to relatively cold and wet conditions in April. However, rainfall distribution was generally regular and high yields can be expected. Maize production in the traditionally 3rd largest exporter, the Ukraine, has been plagued by the ongoing Ukrain's crisis well as sub-optimal moisture supply, mainly in its western regions. Similarly, conditions were too dry in Romania, another important exporter of maize. In India and China, conditions for maize production have been generally favorable, although temperatures in the North China Plain have been much warmer than usual. This report covers the harvesting period of maize in Southern Africa, where most of the production is rainfed. Irregular rainfall, with intermittent drought spells, during the rainy season caused variable conditions. In almost all of Europe, where maize is grown between May and September, the drought is most likely to cause considerable yield losses.

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, as well as in Bangladesh. Most of the dry season rice, which is usually planted between December and February, got harvested in April and May. Although the area of irrigated rice is much smaller than of rainfed rice, which is grown during the summer months, its production levels are much higher. In Bangladesh, boro rice production makes up for more than 50% of the total production. Production of boro rice was favorable in both countries and planting of the rainy (Kharif) season rice was well under way and mostly completed by the end of July. 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 favorable. Conditions for the other important rice producing countries and regions, such as the Philippines and Indonesia, were generally favorable during this monitoring period. In China, conditions were generally favorable until the end of July, although a rainfall deficit that had started in July, may hamper rice production. In the USA, the South as well as the West have been affected by drier than usual conditions, prompting farmers to reduce the acreage.

Wheat: Spring wheat sowing in Australia, Canada, Northern USA, Russia, and Kazakhstan ended in May or early June. So far, soil moisture conditions have been rather favorable in these countries. There were some delays in sowing due to excessive soil moisture conditions in the Northern Prairies of the USA and Canada, but conditions for spring wheat production have been generally favorable. This is in contrast to the winter wheat production in the Southern Plains, where wheat was harvested in May and June. The prolonged drought had caused yield reductions in that region. In Europe, wheat mostly escaped the severe drought conditions, because it had reached maturity before the soils dried up. However, in Hungary, Romania, and the Ukraine, lower than average yields are to be expected. This is in contrast to Russia and Kazakhstan, where temperature and rainfall conditions were favorable and above average yield levels can be expected. In China, yields of winter wheat, which got harvested in May and June were close to record levels. Wheat harvest in the Maghreb, Levant, Iran, and Afghanistan was far below average, due to the drought conditions that have persisted in this region since last fall. In Turkey, conditions were mixed. In Argentina, low rainfall is dampening the forecasts for this year's wheat production. Prospects for wheat production in Australia and Brazil, where wheat sowing had started in May, are favorable.

Soybean: In North America, production has benefitted from sufficient rainfall in most production regions, such as the Midwest in the USA, Ontario in Canada and the Northern Plains. Conditions for soybean production in China have been favorable so far as well, especially in the Northeast, due to above-average rainfall. In parts of Europe, the drought is negatively affecting soybean production. In South America, most of the soybeans had been harvested during the previous monitoring period.

2. Weather anomalies and biomass production potential changes

2.1 Rainfall

Rainfall for most of Brazil was 30% and more below average during this monitoring period. Especially Goias, located in the Cerrados, was badly affected, where total rainfall was 1 mm during the April to July period. In the important maize production region of Mato Grosso, rains were below average, but the soil carried over sufficient moisture levels from the previous monitoring period. In the South-East of Brazil, where the two important wheat production states of Parana and Rio Grande do Sul are located, rainfall conditions were slightly better than in the more northern states. Most of Argentina, especially the important wheat production regions in the Pampas, experienced a precipitation deficit of close to 40%. Apart from the south, all of Mexico experienced a rainfall deficit that varied between 10 and 30%. This will have a negative impact on its rainfed maize production. In the USA, the most severe precipitation deficits were observed for Texas, Nevada, and Nebraska, whereas the deficit was slightly less severe in the neighboring states as well as in the other states in the South, apart from Florida, where conditions were average. Rainfall was more abundant than usual in the Pacific Northwest (>+30%) as compared to the 15YA. Apart from Alberta, where rainfall was average, the Canadian Prairies as well as North Dakota experienced above average rainfall. In the south-east of Africa, as well as in the Sahel from Senegal to Sudan, rainfall was more abundant than usual. However, rainfall in the south-east of Africa had been irregular during the peak of the rainy season. As this was the harvest period, the above average rains did not have a large positive impact on crop production in that region. In East Africa, the multi-year drought continued, as well as in the Maghreb. A rainfall deficit was observed for the countries bordering the Gulf of Guinea as well. In Europe, the drought was most severe In the Southwest and Southeast. Conditions were more favorable for Belarus and most of Russia, apart from its Caucasus region. The multiyear drought continued in the Middle East, Iran, and Afghanistan as well. The northern countries of Central Asia, Pakistan, Siberia, and the North-east of China, together with Eastern Australia, experienced above average rainfall. The eastern half of India, Tibet and Myanmar experienced a rainfall deficit of 10 to 30%. In the important rice production region of South-East Asia, rainfall was mostly near average.

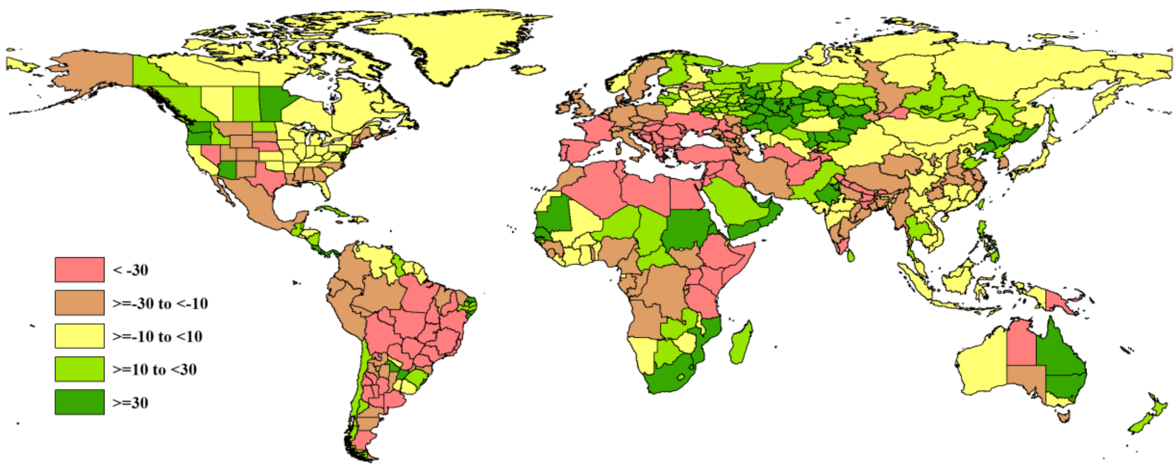


Figure 3.1 National and subnational rainfall anomaly (as indicated by the RAIN indicator) of April to July 2022 total relative to the 2007-2021 average (15YA), in percent

2.2 Temperatures

Drought and above normal temperatures often go hand-in-hand. This can be seen when comparing the regions affected by a rainfall deficit (Fig 3.1) to the map depicting the temperature departures from the 15YA. Almost all regions that show positive temperature departure had been affected by drier than usual conditions. This can be seen in the case of Europe, northern Africa, middle East, the Southern Plains in the USA and Brazil. Cooler conditions than usual were observed for most of Argentina, the Pacific Northwest and all of Western Canada. Russia west and east of the Ural, as well as Kazakhstan also experienced cooler than usual temperatures. Temperatures in Thailand, Cambodia and Laos were also 0.5 to 1.5°C cooler than usual. However, this did not impact rice production. For most of Africa south of the Sahara, temperatures were normal. In China, the North China Plain experienced a very hot summer.

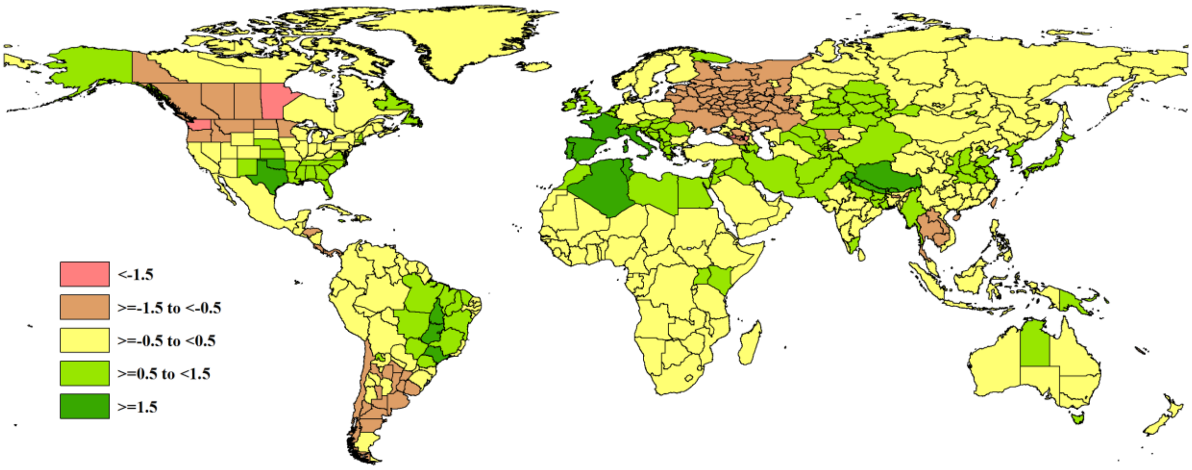


Figure 3.2 National and subnational temperature anomaly (as indicated by the TEMP indicator) of April to July 2022 average relative to the 2007-2021 average (15YA), in °C

2.3 RADPAR

The map depicting departures from average solar radiation is more variable than the temperature departure map. In South America, the regions suffering from a rainfall deficit generally received more than average solar radiation than the 15YA. The only region with a deficit was in the south of Brazil and the north of Argentina. However, these departures had little effect on crop production levels, since most crops were reaching maturity in April or May. Mexico, as well as the Southern and Central Plains in the USA, also received above average solar radiation. California, the Pacific Northwest, the North-east of the USA as well as most of Canada had below average solar radiation. Almost all of Europe was sunnier than usual. However, due to the drought conditions, this did not necessarily translate into higher crop yields. Lower radiation levels were recorded for Russia west of the Ural, as well as West and Southern Africa. Radiation levels were higher in East Africa, South- and South-East Asia and all of China. A radiation deficit was observed for the wheat production regions of Australia.

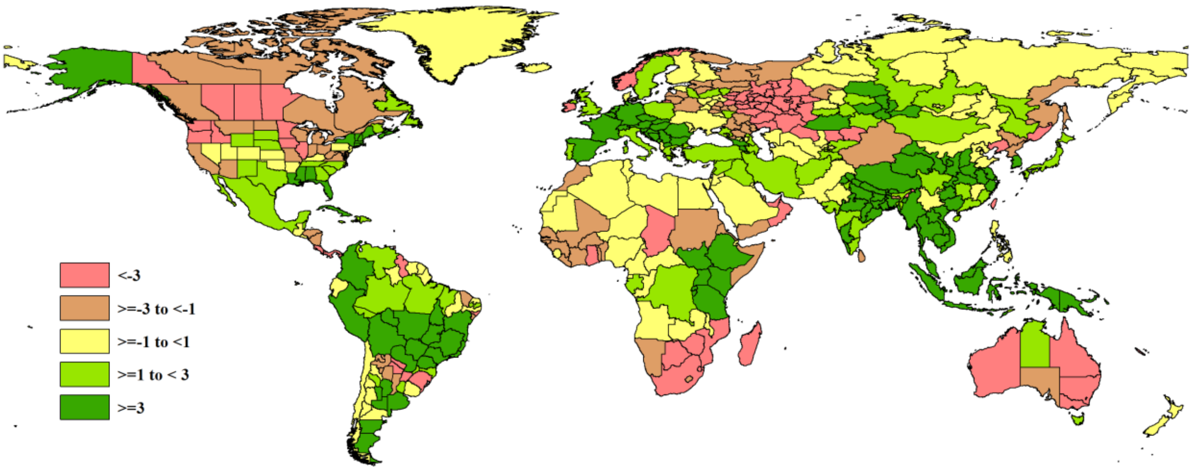


Figure 3.3 National and subnational sunshine anomaly (as indicated by the RADPAR indicator) of April to July 2022 total relative to the 2007-2021 average (15YA), in percent

2.4 Biomass production

The BIOMSS indicator is controlled by temperature, rainfall, and solar radiation. In some regions, rainfall is more limiting, whereas in other ones, mainly the tropical ones, solar radiation tends to be the limiting factor. For high latitude regions, temperature may also become the most critical limiting factor. Most of South America had a strong negative departure from the 15YA, as well as Mexico and the High Plains in the

USA. Drought stricken Europe and Eastern Africa, the Middle East, and to a lesser extent, Eastern India, Myanmar, and some regions in China, such as the North China Plain had a negative departure in estimated biomass. For the South-east of Africa, Eastern Australia, Pakistan, Siberia, Kazakhstan and the North-East of China, a strong positive departure by more than 10% for biomass production was estimated.

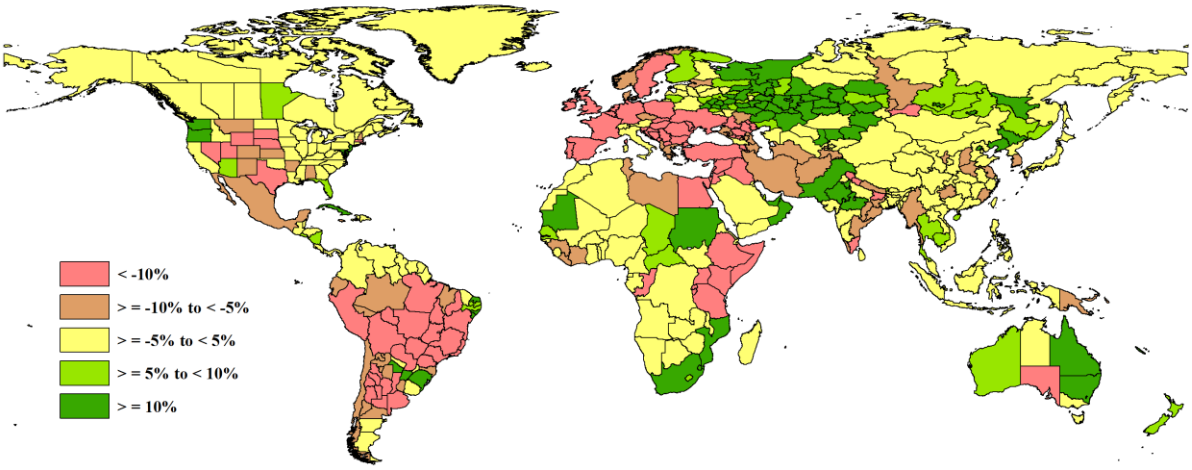


Figure 3.4 National and subnational biomass production potential anomaly (as indicated by the BIOMSS indicator) of April - July 2022 total relative to the 2007-2021 average (15YA), in percent

Table 3.1 April - July 2022 agro-climatic and Agronomic indicators by country, current value, and departure from average.

Code	Country	Agro-climatic indicators				Agronomic indicators	
		Departure from 15YA (2005-2020)				Departure from 5YA (2015-2020)	Current
		RAIN (%)	TEMP(°C)	PAR(%)	BIOMSS (%)	CALF (%)	VCIx
AFG	Afghanistan	-52	1.3	2	-8	-33	0.45
AGO	Angola	-10	-0.3	0	-4	1	0.89
ARG	Argentina	-8	-0.5	0	-10	-2	0.87
AUS	Australia	39	0.0	-7	15	12	0.89
BGD	Bangladesh	-17	0.2	5	-1	0	0.92
BLR	Belarus	6	-1.0	-1	-1	0	0.93
BRA	Brazil	-39	0.9	6	-22	0	0.89
KHM	Cambodia	9	-0.6	6	5	3	0.89
CAN	Canada	9	-0.7	-3	1	1	0.93
CHN	China	-4	0.2	3	-1	0	0.92
EGY	Egypt	-75	0.6	-1	-21	2	0.80
ETH	Ethiopia	-34	0.4	4	-16	-8	0.78
FRA	France	-37	1.8	10	-14	0	0.85
DEU	Germany	-28	0.5	4	-14	0	0.87
HUN	Hungary	-55	0.9	3	-27	0	0.83
IND	India	-14	0.5	4	1	-8	0.76
IDN	Indonesia	-2	0.2	4	4	0	0.95
IRN	Iran	-27	0.5	1	-6	-20	0.58
ITA	Italy	-21	1.6	3	-4	0	0.81
KAZ	Kazakhstan	38	0.3	-1	14	-6	0.77
KEN	Kenya	-57	0.6	3	-22	-6	0.76
KGZ	Kyrgyzstan	14	-0.3	2	3	1	0.91
MEX	Mexico	-18	0.5	2	-8	-6	0.75

MNG	Mongolia	-5	0.2	2	0	1	0.92
MAR	Morocco	-22	0.9	-2	-1	-11	0.59
MOZ	Mozambique	32	-0.1	-4	11	0	0.94
MMR	Myanmar	-22	0.5	3	-6	7	0.95
NGA	Nigeria	-14	0.2	0	-5	-4	0.79
PAK	Pakistan	18	1.5	0	11	-6	0.67
PHL	Philippines	18	-0.2	0	5	0	0.95
POL	Poland	-26	-0.3	2	-14	0	0.89
ROU	Romania	-52	0.6	3	-24	0	0.82
RUS	Russia	14	-0.5	-2	7	1	0.92
ZAF	South Africa	36	-0.3	-3	12	9	0.89
LKA	Sri_Lanka	15	-0.2	-3	4	1	0.92
THA	Thailand	14	-0.5	5	7	1	0.92
TUR	Turkey	-36	0.1	2	-14	-10	0.74
UKR	Ukraine	-35	-0.6	0	-19	0	0.86
GBR	United Kingdom	-27	0.8	1	-12	0	0.93
USA	United States	-7	0.5	0	-3	-3	0.81
UZB	Uzbekistan	-3	0.8	0	-2	2	0.80
VNM	Vietnam	0	-0.4	5	3	1	0.94
ZMB	Zambia	24	0.0	-1	3	2	0.96

3.2 Country analysis

This section presents CropWatch analyses for each of 43 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 2022- July 2022 period to the previous season and the five-year average (5YA) and maximum; (c) Maximum Vegetation Condition Index over arable land (VCIx) for April 2022- July 2022 by pixel; (d) Spatial NDVI patterns up to April 2022- July 2022 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 2022- July 2022 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 - 3.47; Crop condition for individual countries ([AFG] Afghanistan to [ZMB] Zambia) including agro-ecological zones (AEZ) from April 2022- July 2022.

[AFG] Afghanistan

As shown on the phenology map, the main cereals in Afghanistan during the monitoring period of this bulletin include spring wheat, winter wheat, maize, and rice. With the exception of winter wheat, the other three crop types have been sown and have entered the growing season, and the harvesting is expected to start from August.

The agro-climatic conditions showed that RAIN decreased by 52%, TEMP increased by 1.3°C and RADPAR increased by 2%. Affected by the decrease of RAIN, BIOMSS decreased by 8%. The CALF decreased by 33%, and VCIx was 0.45.

According to the crop condition development graph based on NDVI, the growth of crops is worse than that of last year and lower than the average level. This is due to the continuous drought from March to May. The spatial distribution of NDVI profiles showed that 11.7% of the total cropped areas were close to the average level in April and far below the average level in May. The NDVI departure in 13.3% of the total cropped areas changed from positive to negative. According to meteorological data, heavy rains and floods occurred in Takhar, Baghlan, Badghis and Kunduz provinces in May, with an average rainfall of 20 to 60 mm, of which Baghlan, Takhar and Badghis provinces were the most severely affected. As the irrigation facilities were damaged by the war, the crop conditions in some areas of eastern Afghanistan were also lower than the 5YA. Additionally, about 49.4% of total cropped areas were near average levels, mainly distributed in southern Afghanistan. Maximum VCI shows similar results.

Fig. f revealed that the precipitation reached the highest level in 15 years in July. Some areas in the South have suffered from floods. Due to the small area of crop land, floods have not had a great impact on agricultural production. The crop growth of most crop land returned to the average level in July.

The proportion of irrigated cropland in Afghanistan is 54%. However, due to the damage of irrigation facilities, agro-climatic conditions play an important role in the growth of most crop lands. In addition, the CPI of Afghanistan was 0.89, which indicates a poor overall agricultural production situation. Overall, as in the previous bulletin monitoring period, the situation of agricultural production in this quarter is not optimistic. In addition, climate change may make the situation worse. Low crop yields raise fears of severe food shortages.

Regional analysis

CropWatch subdivides Afghanistan into four zones based on cropping systems, climatic zones, and topography. They are described below as Central region with sparse vegetation (1), Dry region (2), Mixed dry farming and irrigated cultivation region (3), and Mixed dry farming and grazing region (4).

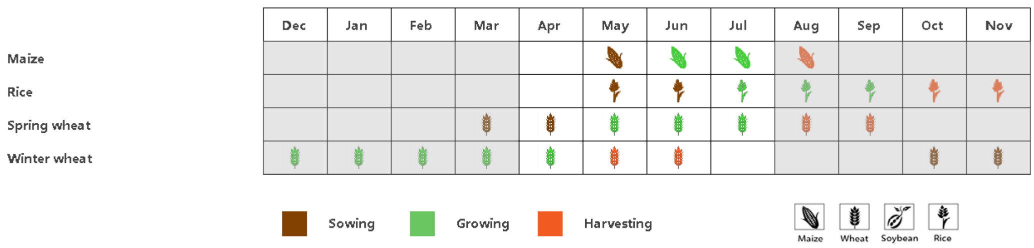
The RAIN in the Central region with sparse vegetation was 61 mm (-62%). The TEMP was 17.2°C (+2.8°C), and the RADPAR was 1650 MJ/m^2 (+2%). BIOMSS decreased by 10% due to the drought. According to the NDVI-based crop condition development graph, the NDVI was lower than the 5-year average level during the entire monitoring period. CALF had decreased by 7% and VCIx was 0.43. CPI was 0.97, which indicates a slightly lower production situation in this zone.

The Dry region recorded 78 mm of rainfall (RAIN -3%), TEMP was higher than average at 24.1°C, RADPAR was 1645 MJ/m^2, and BIOMSS increased by 2%. According to the NDVI-based development graph, crop conditions were lower than the 5YA during the monitoring period. CALF in this region was only 4% and VCIx was 0.23.

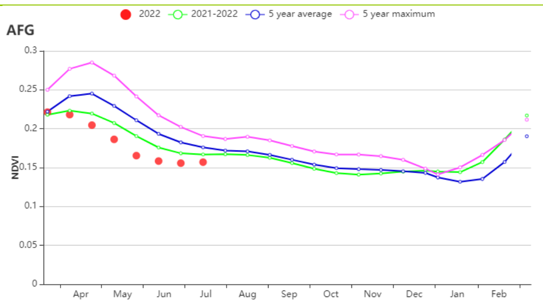
In the Mixed dry farming and irrigated cultivation region, the following indicator values were observed: RAIN 129 mm (-59%); TEMP 18.4°C (+1.2°C); RADPAR 1624 MJ/m^2 (+4%); BIOMSS decreased by 18%. CALF was 33% below average. According to the NDVI-based crop condition development graph, NDVI was below the average level between April and July, and VCIx was 0.60.

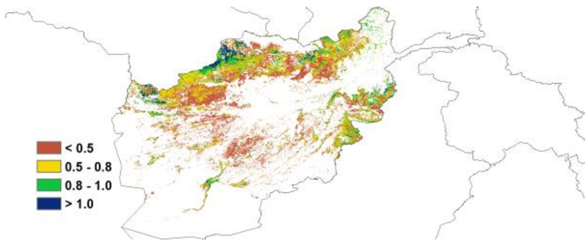
The Mixed dry farming and grazing region recorded 21 mm of rainfall (RAIN -70%). TEMP was 21.9°C (+1.1°C) and RADPAR was 1674 MJ/m^2 (+2%). CALF was 5%, decreased by 44% compared to the 5YA. According to the crop condition development graph, the NDVI was lower than the 5YA throughout the monitoring period, but above last year. Crop conditions in this region were below average, and VCIx was 0.45.

Figure 3.5 Afghanistan's crop condition, April- July 2022



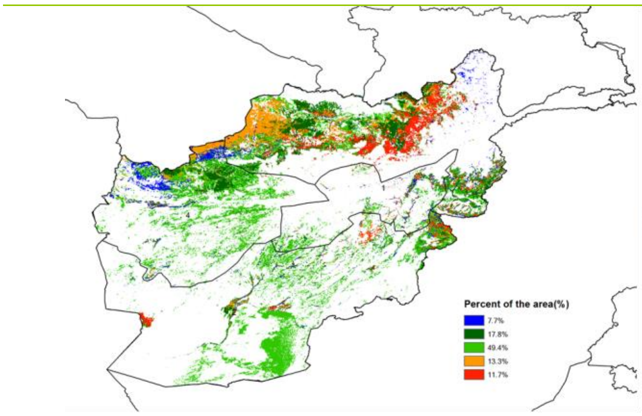
(a). Phenology of major crops

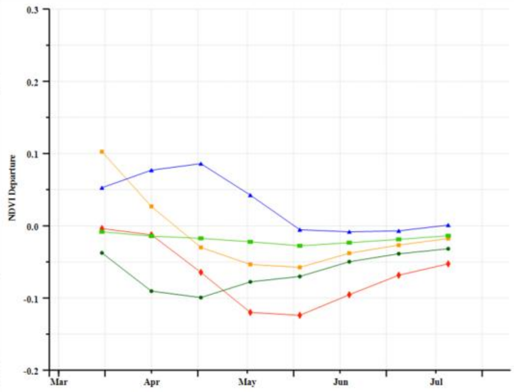




(b) Crop condition development graph based on NDVI

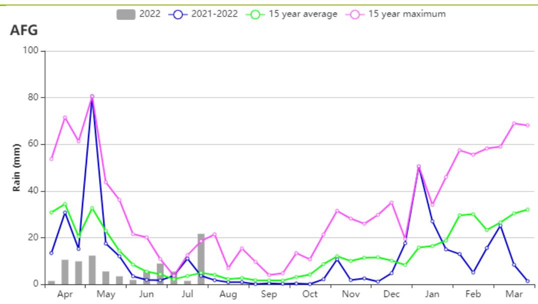
(c) Maximum VCI

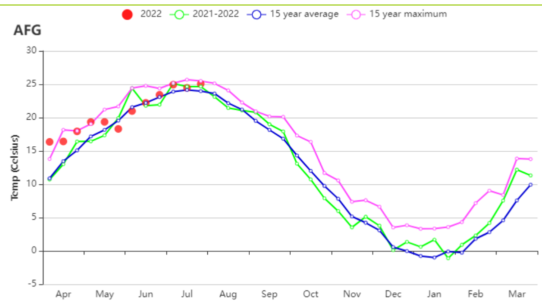




(d) Spatial NDVI patterns compared to 5YA

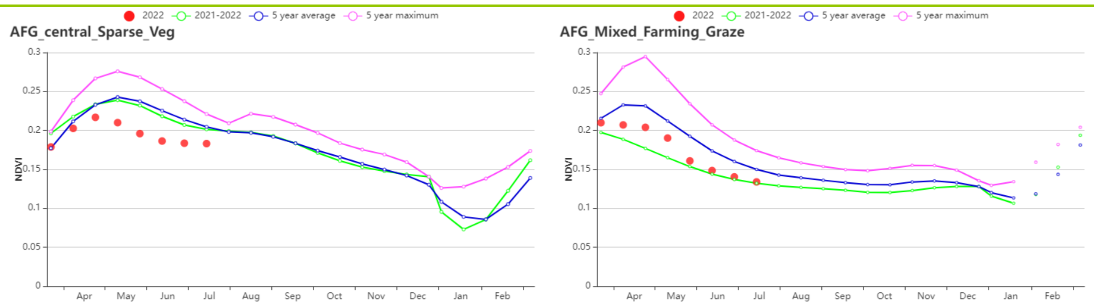
(e) NDVI profiles



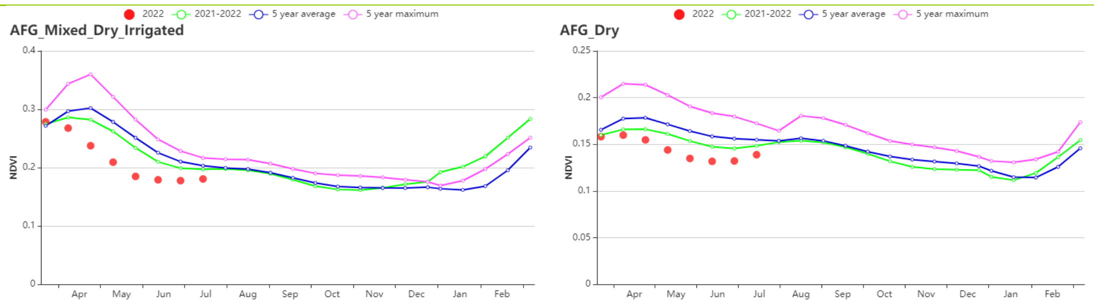


(f) Rainfall profiles

(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 3.2 Afghanistan's agroclimatic indicators by sub-national regions, current season's values, and departure from 15YA, April - July 2022

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	61	-62	17.2	2.8	1650	2	509	-10
Dry region	78	-3	24.1	1.5	1645	-1	636	2
Mixed dry farming and irrigated cultivation region	129	-59	18.4	1.2	1624	4	583	-18
Mixed dry farming and grazing region	21	-70	21.9	1.1	1674	2	529	-11

Table 3.3 Afghanistan's agronomic indicators by sub-national regions, current season's values, and departure from 5YA, April-July 2022

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Central region with sparse vegetation	10	-7	0.43
Dry region	4	-24	0.23
Mixed dry farming and irrigated cultivation region	14	-33	0.60
Mixed dry farming and grazing region	5	-44	0.45

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

[AGO] Angola

During the April-July monitoring period, maize and rice harvest were concluded. The sowing of wheat took place in May. In Angola, the proportion of irrigated cropland area is 1.9%, and therefore, crop production mainly depends on rainfall. Compared to the past fifteen years' average, both rainfall and temperature were low (RAIN -10% and TEMP -0.3%). Photosynthetic active radiation was near average. Together, these agroclimatic conditions led to a decrease in the total biomass production (BIOMSS -4%).

The crop conditions development graph based on NDVI indicates below-average crop conditions during the entire monitoring period, influenced by the low amount of rains registered nationwide (RAIN = 171 mm). This situation is also confirmed by the spatial NDVI patterns compared to the 5YA and the NDVI profiles, in which on only 34.7% of arable land, crop conditions were above the average, mostly distributed in the provinces of Cuando Cubango, Cunene and Huila. Below-average crop conditions were observed for the provinces of Namibe, Benguela, Cuanza Sul, Bengo, Luanda and Zaire. The cropped arable land fraction increased by 1% compared to the recent 5YA while the maximum VCI was 0.89. Even with the Crop Production Index (CPI) slightly higher than 1 (improving situation), in general, the crop conditions development in Angola was unfavorable.

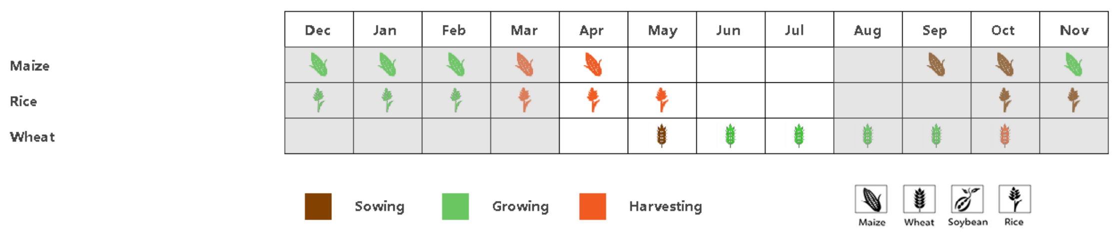
Regional Analysis

Considering the cropping systems, climate zones and topographic conditions, CropWatch has divided Angola into five agroecological zones (AEZs): Arid zone (5), Central Plateau (6), Humid zone (7), Semi-arid zone (8) and Sub-humid zone (9).

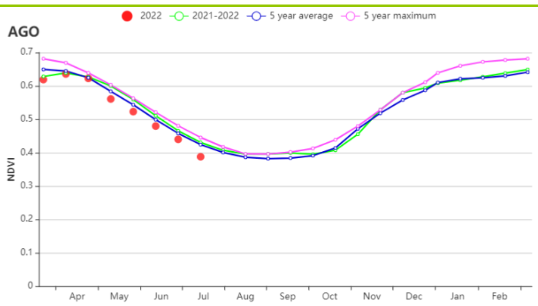
Regionally, the crop conditions development graphs based on NDVI indicate below-average crop conditions compared to the past fifteen years' average in all agro-ecological zones. Also, all the agro-ecological zones registered drops in rainfall, with the highest drop (RAIN -16%) recorded in the Semi-arid zone. A considerable decrease in temperature was observed for the Arid zone (TEMP -0.6ºC). The photosynthetic active radiation increased by about 3%, 4% and 8% in the Central Plateau, Sub-humid zone and Humid zone, respectively.

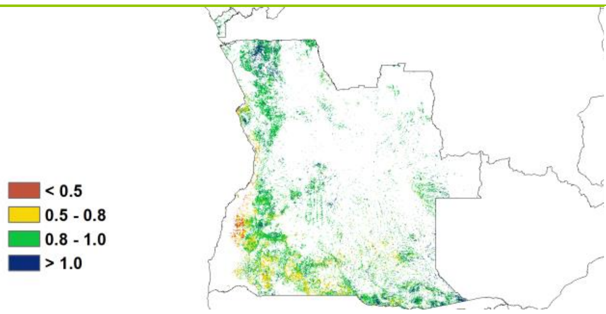
Except for the Central Plateau (BIOMSS +2%), the total biomass production in the remaining regions recorded decreases varying from 1% to 2% compared to the past 15YA. The CALF in the Arid zone decreased by 1%. In the Central plateau it increased by 1% while in the remaining zones it was near the average of the past five years. The Arid zone recorded a relatively low VCIx (0.79) while the highest VCIx (0.92) for this period was recorded in the Semi-arid zone. The CPI was low (0.7) in the Arid zone, while in the remaining regions it was at a normal level.

Figure 3.6 Angola's crop condition, April–July 2022



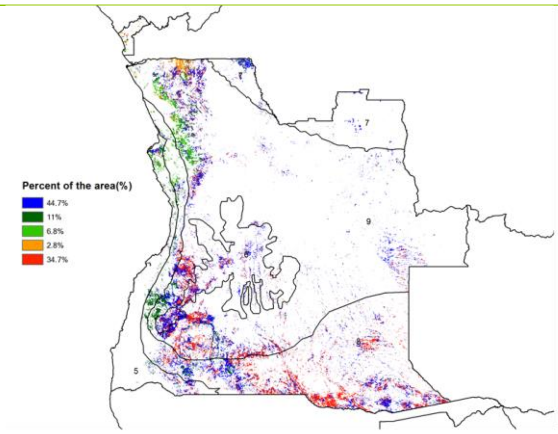
(a) Phenology of major crops

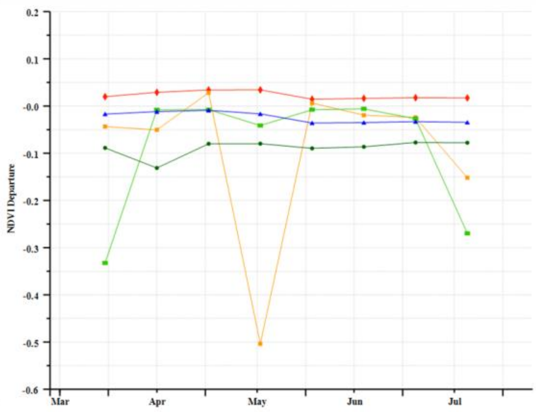




(b) Crop condition development graph based on NDVI

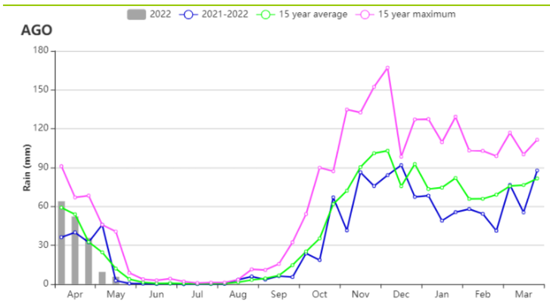
(c) Maximum VCI

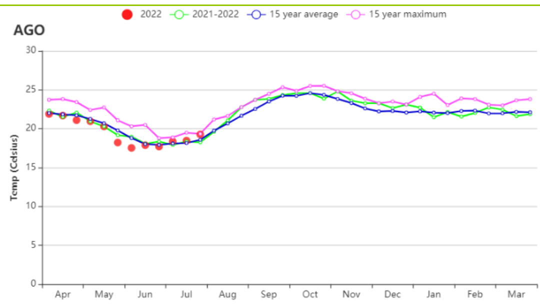




(d) Spatial NDVI patterns compared to 5YA

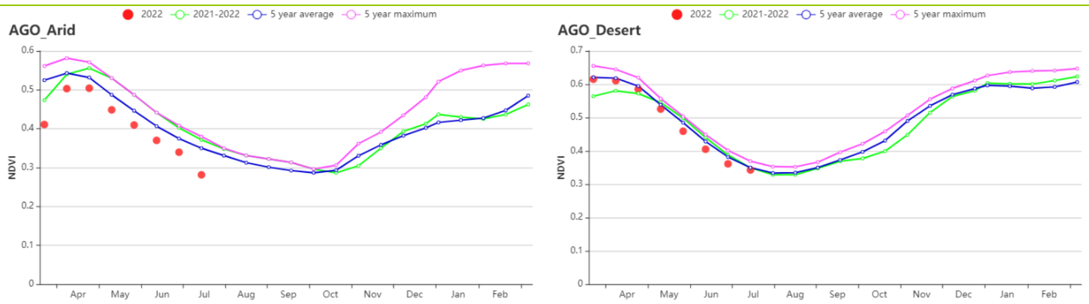
(e) NDVI profiles



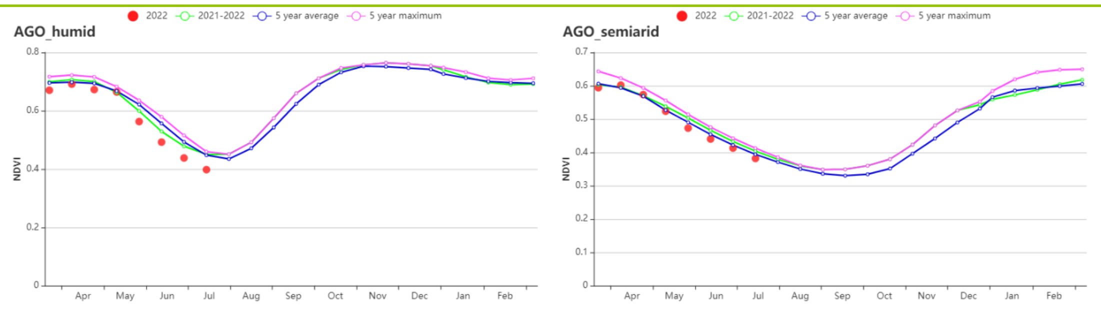


(f) rainfall profiles

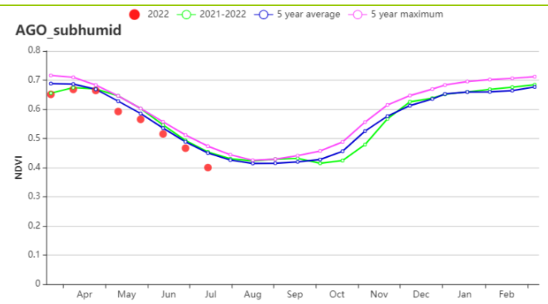
(g) temperature profiles



(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

Table 3. 4 Angola's agroclimatic indicators by sub-national regions, current season's values, and departure from 15YA, April – July 2022

Region	RAIN		TEMP		RADPAR		BIOMASS	
	Current (mm)	Departure from 15YA (%)	Current (℃)	Departure from 15YA (℃)	Current (MJ/m²)	Departure from 15YA (%)	Current (gDM/m²)	Departure from 15YA (%)
Arid Zone	447	-9	24.4	-0.6	1246	0	1048	-1
Central Plateau	823	-12	17.9	-0.3	1154	3	1231	2
Humid zone	906	-13	22.4	0.1	1248	8	1458	-1
Semi-Arid Zone	530	-16	22.6	0.0	1186	-1	1117	-2
Sub-humid zone	796	-13	21.4	-0.2	1201	4	1282	-1

Table 3. 5 Angola's agronomic indicators by sub-national regions, current season's values, and departure from 5YA, April – July 2022

Region	CALF		Maximum VCI
	Current (%)	Departure from 5YA (%)	Current
Arid Zone	83	-1	0.79
Central Plateau	99	1	0.88
Humid zone	100	0	0.92
Semi-Arid Zone	98	0	0.85
Sub-humid zone	100	0	0.91

[ARG] Argentina

This reporting period covers mainly the fallow period of summer crops. The harvesting of late maize, soybean and rice concluded during this period, and the sowing of wheat is still on-going. Some regions, such as the Humid Pampas and Subtropical Highlands showed particularly poor crop conditions.

At the country level, rainfall was 8% below the 15YA, TEMP showed a 0.5°C anomaly, and RADPAR remained at average. The shortage of rain resulted in 10% negative departure of BIOMSS. Particularly in the Humid Pampas, negative anomalies in rainfall were much more frequent than in the other major production zones. TEMP profile showed quite some variability with periods with negative anomalies (since mid-May to end June) and times of positive anomalies (beginning and end of July). Maximum VCI showed good conditions in Mesopotamia, Chaco and Subtropical Highlands, and regular to poor conditions in most of the Pampas. Worst conditions were observed in the agricultural belt in Center Pampas, where late maize, late soybean and winter crops like wheat and barley are present, and in South West Pampas where wheat and barley are the dominant crops.

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.

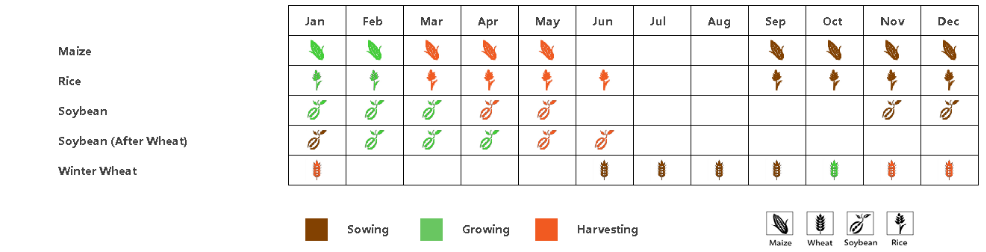
RAIN showed positive anomalies in Mesopotamia (+12%) and Chaco (+9%), and negative anomalies in Humid Pampas (-40%) and Subtropical Highlands (-31%). TEMP showed negative anomalies in all the AEZs: Chaco (-0.8℃), Mesopotamia (-0.6℃), Humid Pampas (-0.5℃) and Subtropical Highlands (-0.4℃). RADPAR showed negative anomalies in Chaco (-6%), Mesopotamia (-4%) and Subtropical Highlands (-1%), and positive anomaly in Humid Pampas (+5%). BIOMSS showed slight positive anomalies in Mesopotamia (+4%) and Chaco (+2%), and strong negative anomalies in Humid Pampas (-24%) and Subtropical Highlands (-11%). CALF was complete in Chaco and Mesopotamia (100 %), almost complete in Subtropical highlands (99%) and reduced in Humid Pampas (91%) showing a -2% negative anomaly. Maximum VCI showed good conditions in Mesopotamia (0.97) and Chaco (0.95) and regular conditions in Subtropical Highlands (0.87) and Humid Pampas (0.85).

For the whole country, the crop condition development graph based on NDVI showed negative anomalies since the end of April. Pampas showed a similar pattern, but negative anomalies were observed since end of May. Chaco showed negative anomalies since June. Mesopotamia showed positive anomalies during April and beginning May and negative anomalies at the end of June and beginning of July. Subtropical Highlands showed near no anomaly during most of the period, except during June, when negative anomalies were observed.

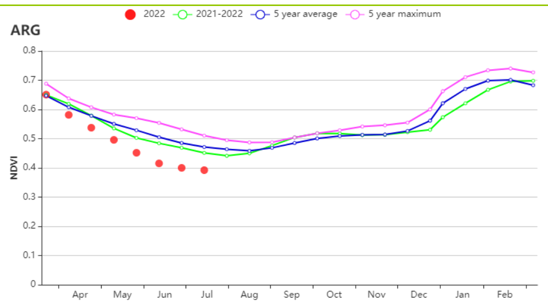
Spatial distribution of NDVI profiles determined five homogeneous spatial patterns. Best conditions were observed in North Chaco and North Mesopotamia (orange profile) with positive or no anomalies during the reporting period. South Mesopotamia, South Chaco and North Pampas were dominated by the dark green pattern which showed positive anomalies up to May and negative anomalies since June. The blue profile was located in South Subtropical Highlands, North West Pampas and over small areas in the rest of the Pampas. It showed slight negative anomalies since the end of April. The red profile was located in Center, West and South Pampas and showed negative anomalies during the entire reporting period. They were stronger at the beginning of the reporting period. The light green profile was mainly located in East Pampas and showed near no anomalies in April and strong negative anomalies during June and July.

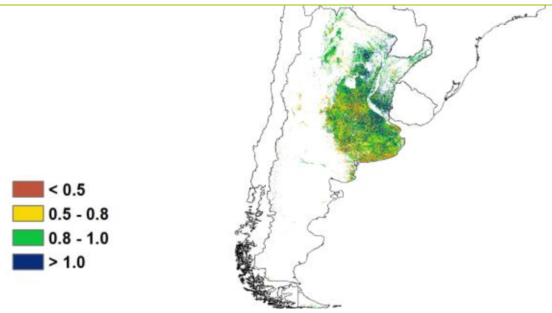
In summary, variable conditions were observed in Argentina according to the different major production zones. Humid Pampas showed negative anomalies in RAIN, poor conditions in BIOMSS, and a considerable uncropped area. Subtropical Highlands showed also negative anomalies in RAIN and low BIOMSS values. Chaco and Mesopotamia showed regular to good conditions.

Figure 3.7 Argentina's crop condition, April- July 2022



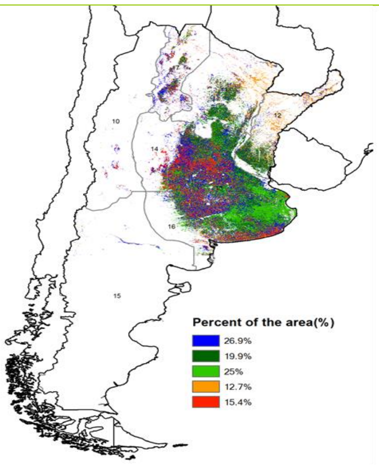
(a). Phenology of major crops

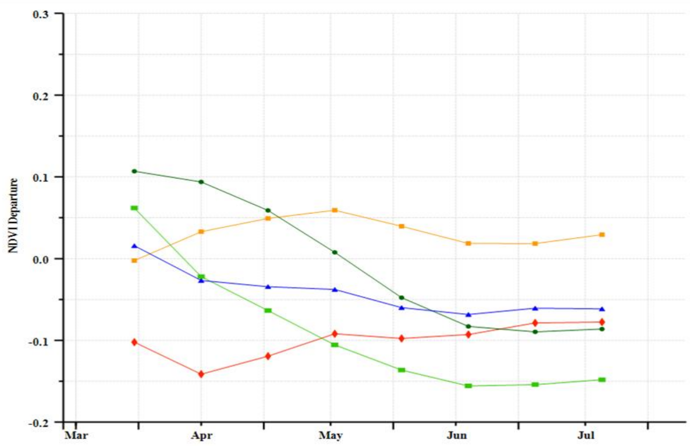




(b) Crop condition development graph based on NDVI

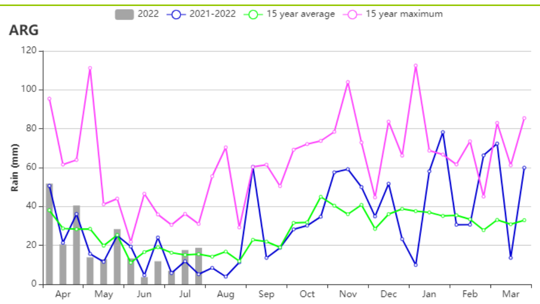
(c) Maximum VCI

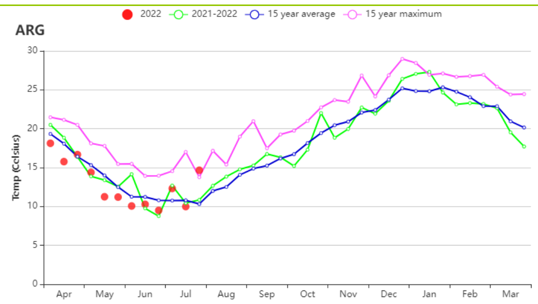




(d) Spatial NDVI patterns compared to 5YA

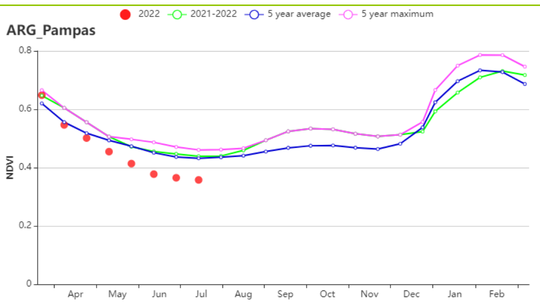
(e) NDVI profiles

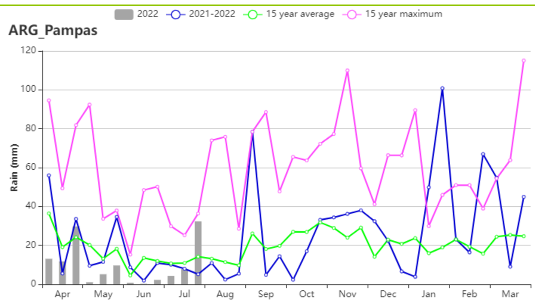




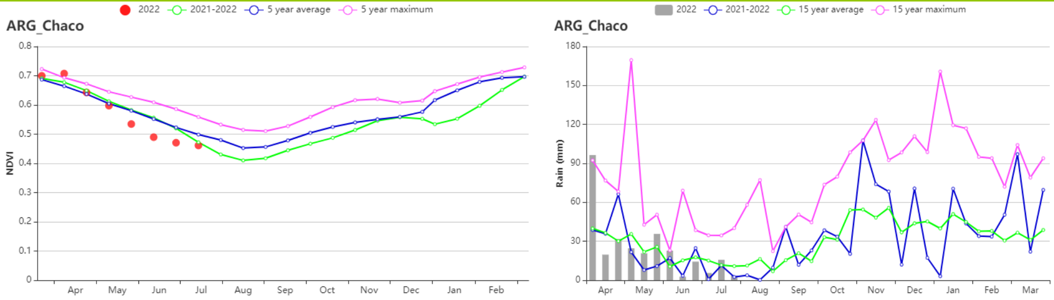
(f) rainfall profiles

(g) temperature profiles

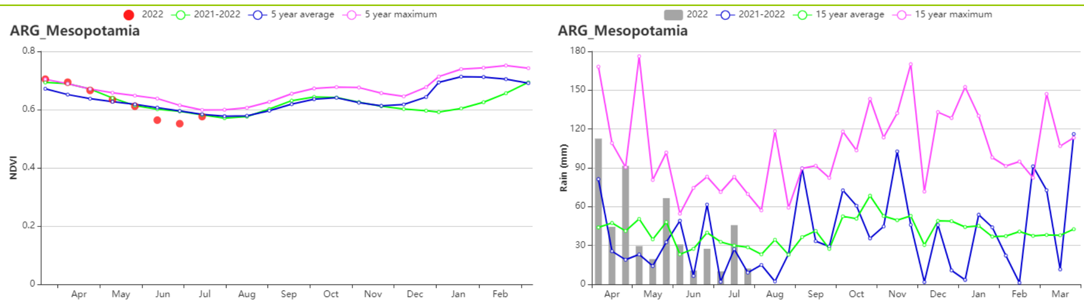




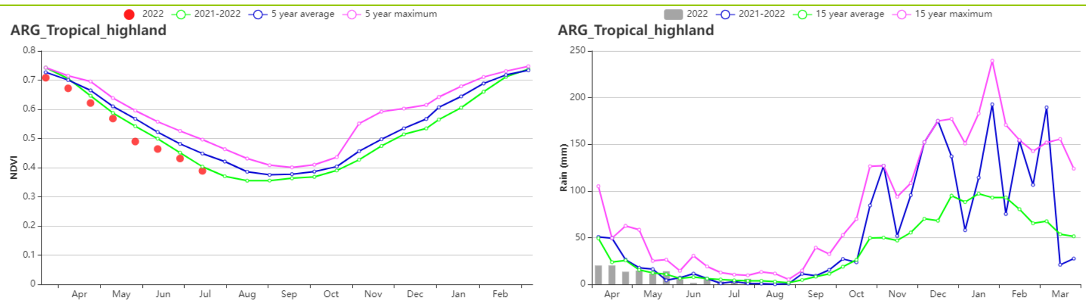
(h) Crop condition development graph based on NDVI (left) and rainfall profile (right) of Pampas



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



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



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

Table 3. 6 Argentina's agroclimatic indicators by sub-national regions, current season's values, and departure from 15YA, April - July 2022

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Chaco	293	9	15.4	-0.8	601	-6	601	2
Mesopotamia	501	12	14.5	-0.6	590	-4	781	4
Humid Pampas	118	-40	11.8	-0.5	638	5	349	-24
Subtropical highlands	117	-31	13.4	-0.4	788	-1	394	-11

Table 3. 7 Argentina's agronomic indicators by sub-national regions, current season's values, and departure from 5YA, April-July 2022

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Chaco	100	0	0.95
Mesopotamia	100	0	0.97
Humid Pampas	91	-2	0.85

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Subtropical highlands	99	-1	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

[AUS] Australia

Australia's wheat and barley were sown in May. They will be ready for harvest starting in October. Above-average rainfall was received at the national scale (+39%). The temperature was average, while the radiation was below average (-7%). Sufficient rainfall resulted in an above-average estimate for biomass (+15%). The agronomic indicators were also positive, with a VCIx of 0.89 and an increased CALF (+12%), which were both better than in the same period of last year.

The national NDVI profile also shows good conditions, which were even above the maximum from late May to early July. The VCI map also indicates that the crop conditions were overall favorable. Low values (< 0.5) were mainly found in New South Wales. The NDVI departure clustering shows that only 19.4% of the cropland remained below average throughout this monitoring period, and the others were mostly above average.

Overall, the agro-climatic indicators in the reporting period are promising. The sufficient rainfall has caused favorable conditions for wheat and barley. The above-average CALF and NDVI, and CPI of 1.19 also indicate favorable crop conditions.

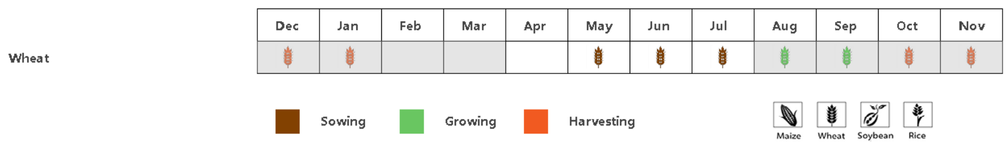
Regional analysis

Australia has five agro-ecological zones (AEZs), namely the Arid and Semi-arid Zone (marked as 18 on the 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.

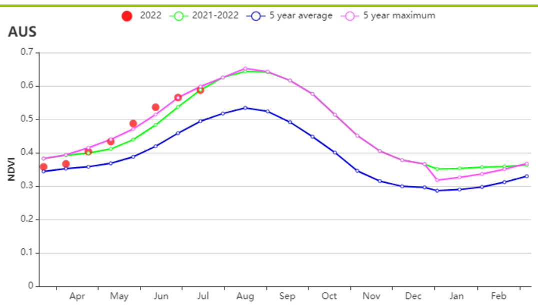
The Southeastern Wheat Zone and the Southwestern Wheat Zone both had above-average rainfall (+12%, +4%), slightly below average temperature (-0.1°C, -0.3°C), and below-average radiation (-6%, -5%), which led to above-average biomass (+6%, +6%). The CALF in the two zones were 97% (+9%) and 92% (+10%), respectively, and the VCIx were 0.91 and 0.89. The NDVI profiles further confirmed that the crop conditions in these zones were promising.

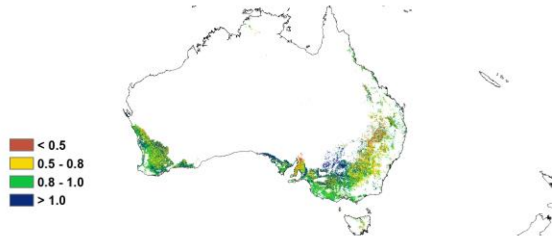
Largely above average rainfall was observed in the Subhumid Subtropical Zone (+77%) and Wet Temperate and Subtropical Zone (+64%), along with below-average radiation (-10%, -8%), while the temperature departures were opposite (-0.3°C, +0.4°C). As a result, the biomass was also above average (+31%, +26%). The CALF in Subhumid Subtropical Zone was 82%, 40% above average, and VCIx was 0.86. Meanwhile, the CALF in the Wet Temperate and Subtropical Zone was 100%, which means that the cropland in this AEZs was almost fully cultivated. The NDVI profiles were also above average starting from May in these two AEZs.

Figure 3.8 Australia's crop condition, April- July 2022



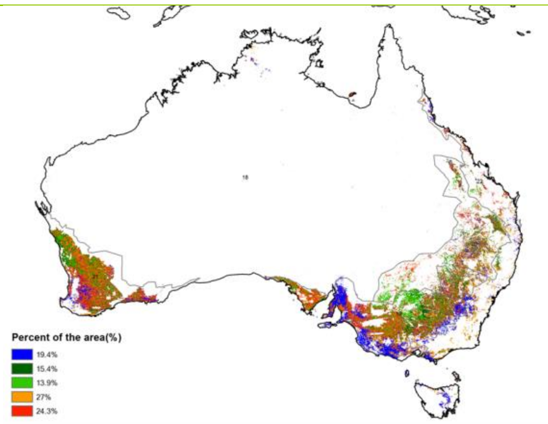
(a). Phenology of major crops

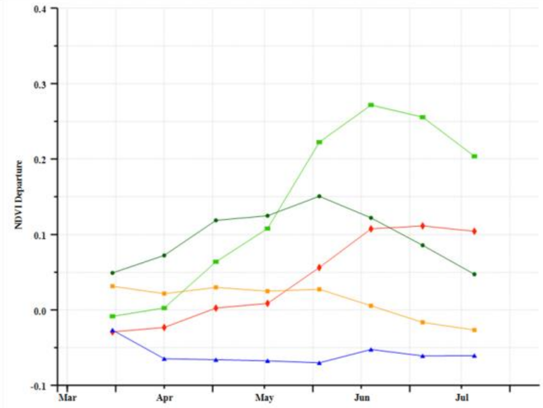




(b) Crop condition development graph based on NDVI

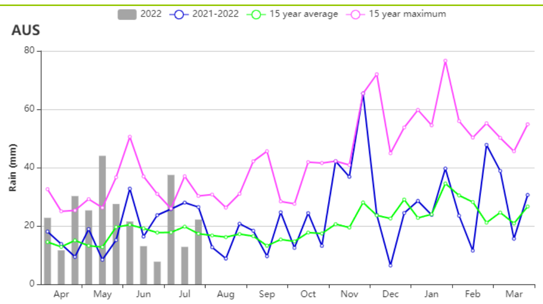
(c) Maximum VCI

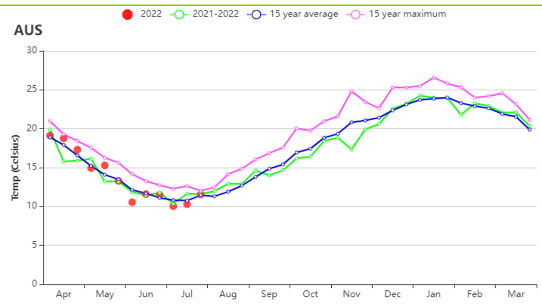




(d) Spatial NDVI patterns compared to 5YA

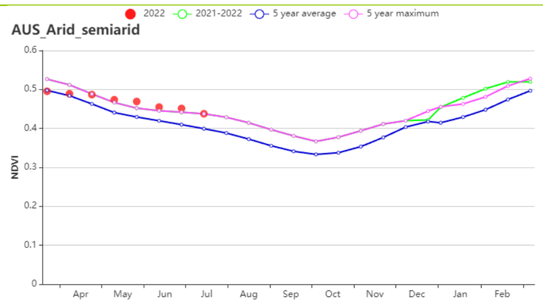
(e) NDVI profiles

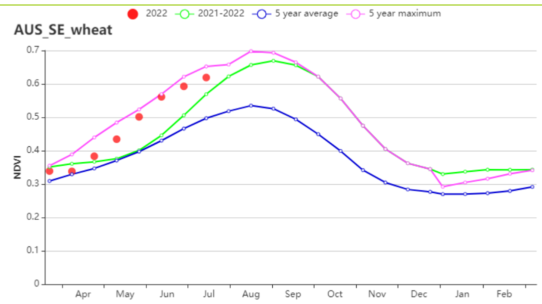




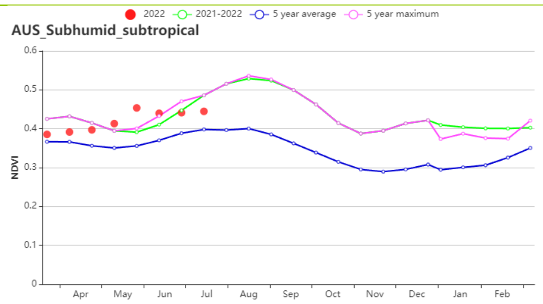
(f) Rainfall profiles

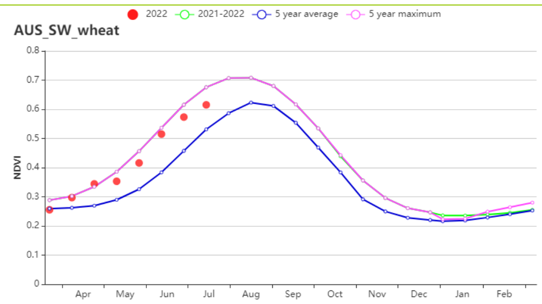
(g) Temperature profiles



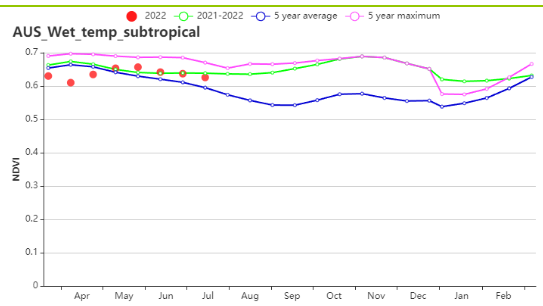


(h) Crop condition development graph based on NDVI (Arid and semiarid zone (left) and Southeastern wheat area (right))





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



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

Table 3.8 Australia agroclimatic indicators by sub-national regions, current season's values, and departure from 15YA, April - July 2022

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m^2)	Departure (%)	Current (gDM/m^2)	Departure (%)
Arid and semiarid zone	181	55	22.0	0.4	1012	0	549	12
Southeastern wheat area	230	12	12.0	-0.1	531	-6	533	6
Subhumid subtropical zone	248	77	13.9	-0.3	700	-10	562	31
Southwestern wheat area	244	4	13.8	-0.3	596	-5	584	6
Wet temperate and subtropical zone	389	64	13.0	0.4	611	-8	700	26

Table 3.9 Australia's agronomic indicators by sub-national regions, current season's values, and departure from 5YA, April - July 2022

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Arid and semiarid zone	79	9	0.88
Southeastern wheat area	97	9	0.91
Subhumid subtropical zone	82	40	0.86
Southwestern wheat area	92	10	0.89
Wet temperate and subtropical zone	100	1	0.86

[BGD] Bangladesh

During the reporting period, the sowing of the main rice crop (Aman) started in May. Boro (winter) rice and wheat harvest ended in April. Aus rice harvest was mostly completed in July. Rainfall was greatly below average (-17%), both TEMP (+0.2℃) and RADPAR (+5%) were higher than the 15YA. The proportion of irrigated cropland is 53% and regular rainfall is important for crop production. The potential biomass decreased by 1%. The national NDVI development graph shows that crop conditions across the country were lower than the 5-year average from April to June and then returned to the average and maximum levels in July. These drops in June might have been caused by cloud cover in the satellite images and flooding. The spatial NDVI pattern shows that 12.8% of the cultivated area in the Sylhet basin was below to average and had big drops in May and June due to the floods and returned to above-average levels in July. 14.4%, mainly located along the Coastal region, was slightly below average during this period. There was a sharp drop in July, but the conditions rapidly recovered to above-average by the end of this monitoring period. The remaining crop areas were close to average except for 37.9% that showed a sharp decrease in June. The maximum Vegetation Condition Index (VCIx) was 0.92, with most areas higher than 0.8 and CALF was the same as the 5-year average (96%). The Crop Production Index (CPI) was 1.17. Overall, the crop conditions in most parts of Bangladesh were close to average.

Regional analysis

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

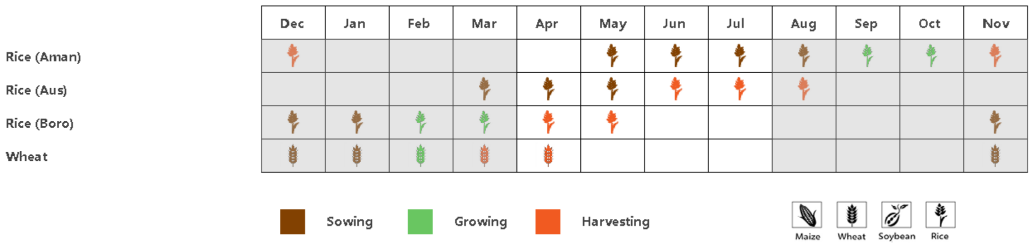
In the **Coastal region**, rainfall was 27% below average. TEMP and RADPAR were above average (+0.1°C and +6%). The crop condition development graph based on NDVI shows that crop conditions were below the 5-year average from April to June and returned to above the 5YA in July. CALF was at 87% and VCIx at 0.89. BIOMSS was close to average. Conditions were near average and CPI was 1.20, confirming favorable agricultural production.

The **Gangetic plains** received the least precipitation amount of 914 mm (32% below average). Both TEMP and RADPAR was above average (+0.6°C and +7%). BIOMASS was slightly below average (-4%). The crop condition development graph based on NDVI shows crop conditions were below the 5-year average during the period except the end of July. CALF (97%) was the same as average. VCIx (0.92) and CPI (1.16) indicated average prospects. They indicated average conditions in this region.

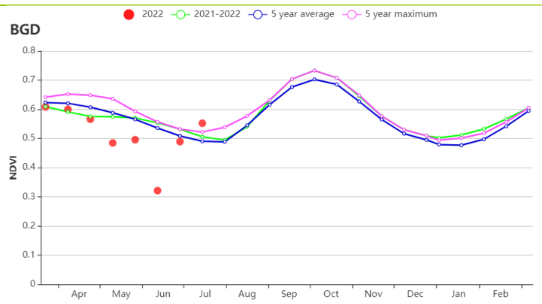
In the **Hills**, both RAIN and TEMP were below average (-33% and -0.1°C, respectively) while RADPAR was above average (+5%). The crop condition started recovering from June and reached above-average levels at the end of the July, as shown by the NDVI development profiles. Estimated biomass production was average. CALF (96%) was 1% higher than average. VCIx (0.96) and CPI (1.21) indicated above-average crop prospects.

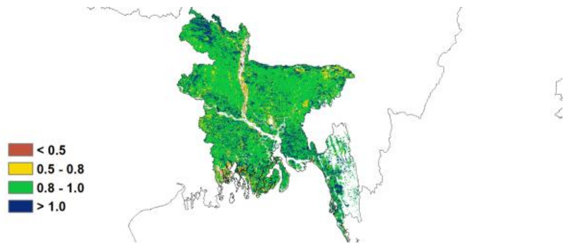
The **Sylhet Basin** experienced an increase in rainfall (+11%). TEMP was 0.1°C above average and RADPAR was 2% above. The crop condition development graph based on NDVI shows that crop conditions were below average for most of the reporting period and they increased to above average levels only at the end of July. The BIOMSS was slightly above average (1%). A high CALF at 98% and VCIx of 0.92 and CPI of 1.17 indicated favorable crop conditions.

Figure 3.9 Bangladesh's crop condition, April - July 2022



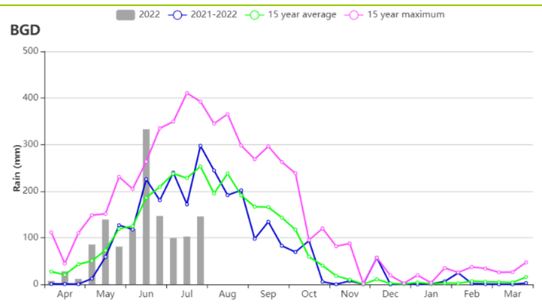
(a). Phenology of major crops

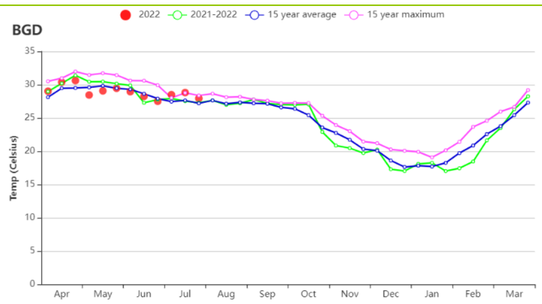




(b) Crop condition development graph based on NDVI

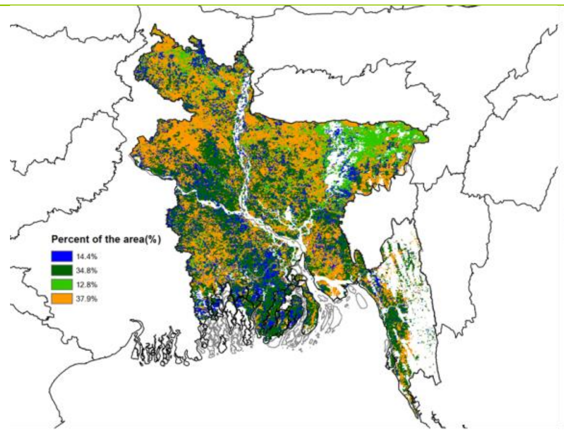
(c) Maximum VCI

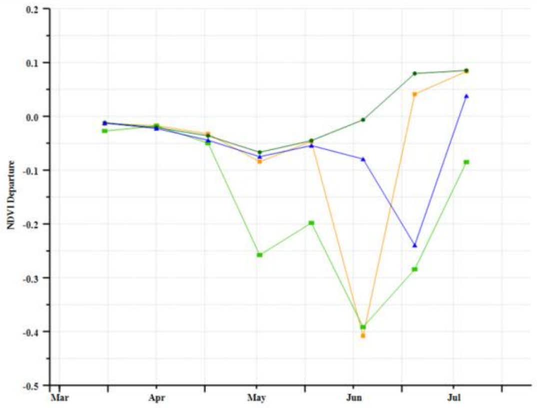




(d) Time series rainfall profile

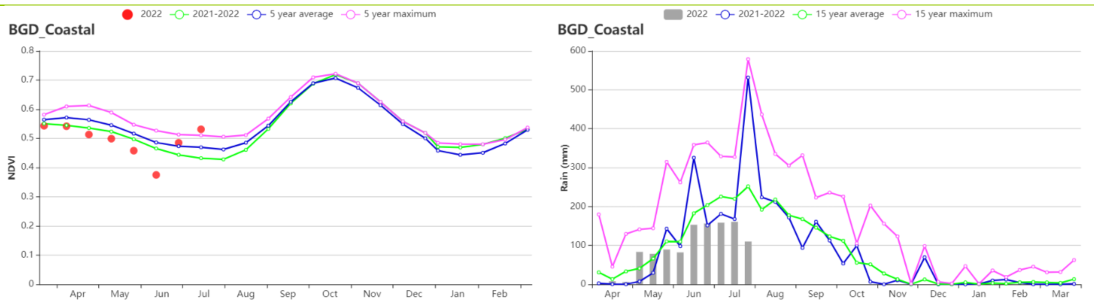
(e) Time series temperature profile



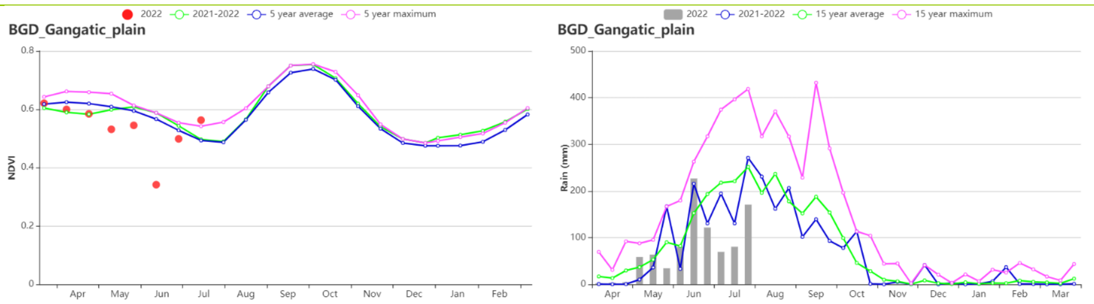


(f) Spatial NDVI patterns compared to 5YA

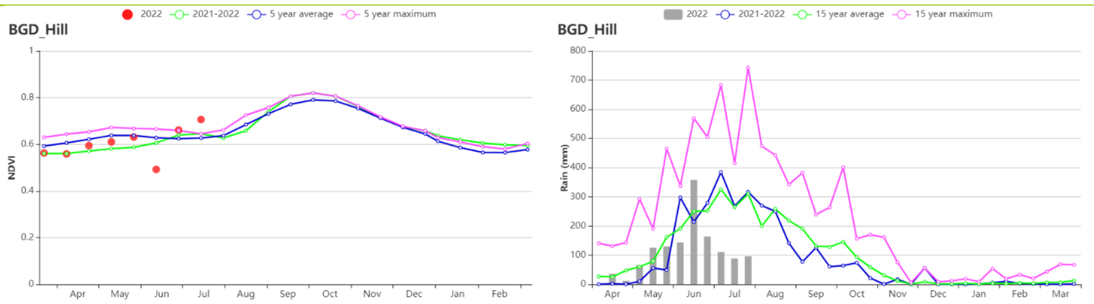
(g) NDVI profiles



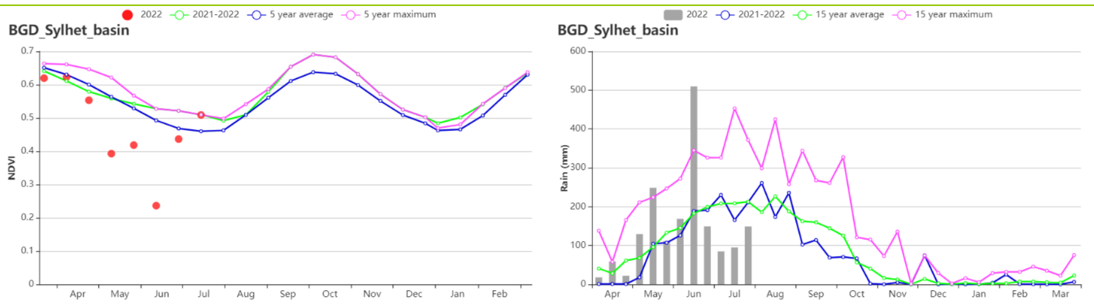
(h) Crop condition development graph based on NDVI (left) and rainfall profile (right) of Coastal region



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



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



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

Table 3.10 Bangladesh's agroclimatic indicators by sub-national regions, current season's values, and departure from 15YA, April - July 2022

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	1084	-27	29.5	0.1	1393	6	1462	0
Gangetic plain	914	-32	30.0	0.6	1331	7	1336	-4
Hills	1327	-33	27.2	-0.1	1340	5	1534	0
Sylhet basin	1744	11	28.3	0.1	1250	2	1554	1

Table 3.11 Bangladesh's agronomic indicators by sub-national regions, current season's values, and departure from 5YA, April - July 2022

Region	CALF		Maximum VCI
	Current (%)	Departure from 5YA (%)	Current
Coastal region	87	2	0.89
Gangetic plain	97	0	0.92

Region	CALF		Maximum VCI
	Current (%)	Departure from 5YA (%)	Current
Hills	97	1	0.96
Sylhet basin	98	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

[BLR] Belarus

The reporting period covers the planting of spring wheat and summer, which ended in late May. Winter wheat harvest started in July. The nationwide rainfall reached 338 mm, which was 6% above 15YA average. Solar radiation (RADPAR -1%) and temperature (-1.0°C) were slightly below the 15YA, the potential biomass slightly decreased by -1%. Only about 0.4% of the crop land is irrigated and rainfall is a key factor controlling crop growth. Agronomic conditions were shown as favorable: very good values for VCIx (0.93) and cropped arable land fraction (CALF 100%) were observed.

The NDVI development graph was generally below the 5-year average from April to early May, but recovered to average levels in June. The spatial pattern showed large variability. On about 63.4% of the cropped area, crop conditions were close to or above the 5-year average. About 36.6% of cropped areas were 0.1 NDVI units below the average, mostly scattered in the north-east and along the northern-western border. Average national VCIx exceeded 0.93, indicating fair crop prospects in most crop areas. The agricultural production situation index was above 1.0 (CPI, 1.15), indicating a good prospect.

Overall, solar radiation deficit due to snow cover and rainy weather in the previous season have not constrained crop growth, and agronomic conditions were satisfactory during the current monitoring period, which indicate 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.

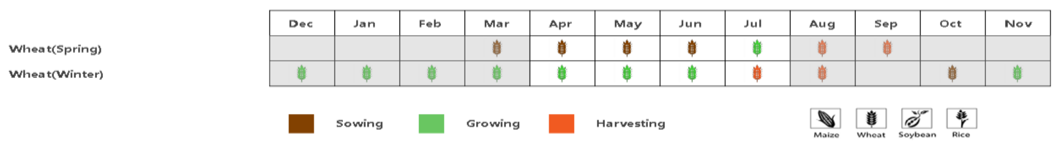
Northern Belarus recorded a minor decrease of radiation (-1%) and temperature (-1.0°C) but significant increase of rainfall (+22%). Therefore, BIOMSS was expected to increase by 9%. The VCIx had reached 0.95, CALF had reached 100%, with an CPI of 1.18. The NDVI development curve was close to average in April, early May and June. Overall conditions were generally favorable.

Central Belarus experienced a minor decrease in solar radiation (-1%) and temperature (-0.9°C) as well as rainfall (-2%). Potential biomass slightly decreased by about 4%. High CALF (100%), VCIx (0.92) and CPI (1.14) were also recorded. Similar to Northern Belarus, the NDVI growth curve remained close to the long-term average trend from April to June.

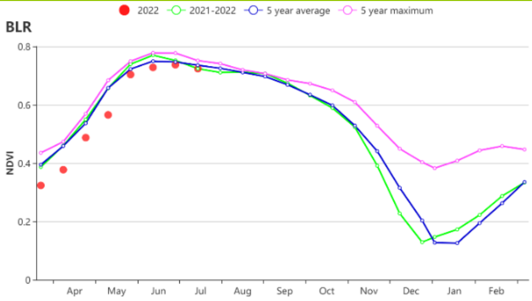
Precipitation in **Southern Belarus** had dropped by 21%, while temperature and radiation were slightly lower by 1.0°C and 2%, respectively. Potential biomass was estimated to have a large decrease (-16%). The CALF and the VCIx were 100% and 0.92 respectively, with an CPI of 1.13. The average NDVI development curve suggests that from April to June, crop conditions were generally close to average for most of the time, but the impact of water deficit might have depressed NDVI development in July.

In summary, although Northern and Central Belarus experienced different agroclimatic conditions in the current season, agronomic situation for both regions were generally favorable. But for Southern Belarus, the rainfall deficit may have caused a water shortage and adversely impacted crop production.

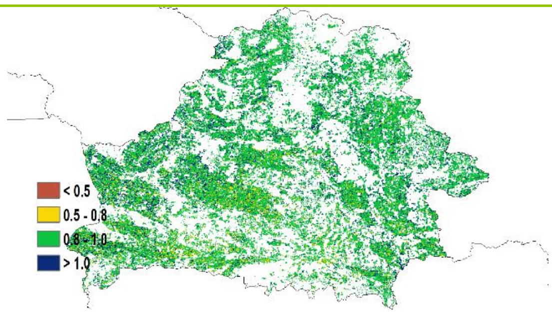
Figure 3.10 Belarus's crop condition, April – July 2022.



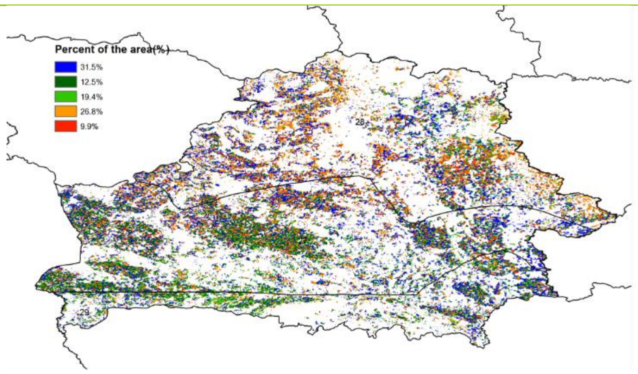
(a). Phenology of major crops



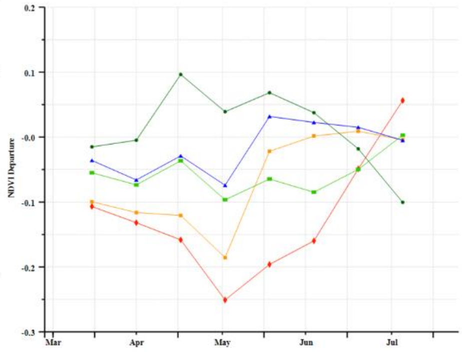
(b) Crop condition development graph based on NDVI



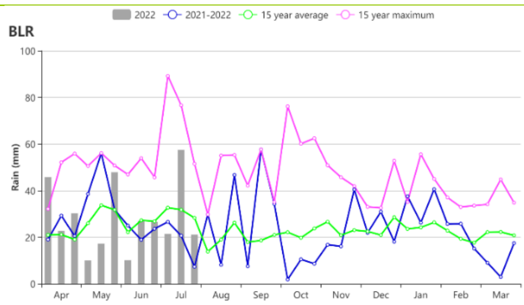
(c) Maximum VCI



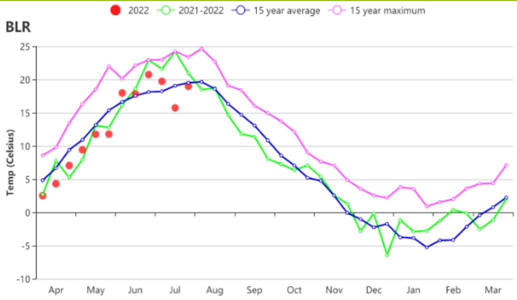
(d) Spatial NDVI patterns compared to 5YA



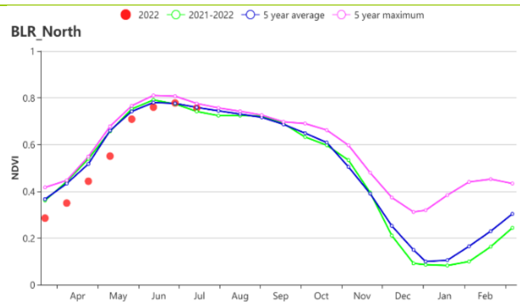
(e) NDVI profiles



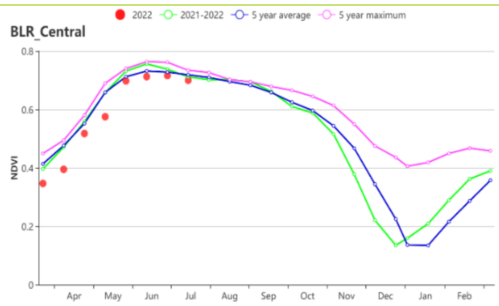
(f)Rainfall time series



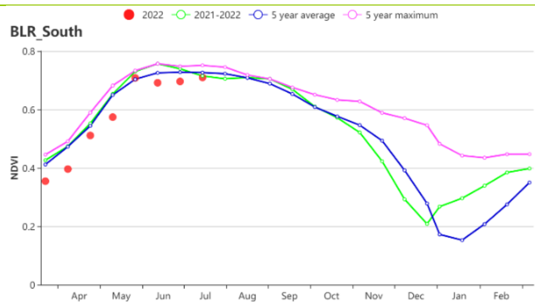
(g) Temperature time series



(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. 12 Belarus's agroclimatic indicators by sub-national regions, current season's values, and departure from 15YA, April – July 2022.

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m^2)	Departure (%)	Current (gDM/m^2)	Departure (%)
Center	312	-2	13.6	-0.9	1109	-1	807	-4
North	403	22	12.3	-1.0	1090	-1	919	9
South-west	237	-21	14.3	-1.0	1126	-2	693	-16

Table 3. 13 Belarus's agronomic indicators by sub-national regions, current season's values, and departure from 5YA, April – July 2022

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Center	100	0	0.92
North	100	0	0.95
South-west	100	0	0.92

[BRA] Brazil

This bulletin covers the period from April to July during which the summer crops had reached maturity and got harvested. The only exception is maize in the northeast, which will be harvested starting in October. The sowing of wheat concluded in June and its harvest will start in late September.

Brazil experienced another dry and hot period which has continued for two years since August 2020. During the monitoring period, Brazil received 244 mm rainfall on average, 39% below average. The rainfall profile for this year is similar to last year's. Both were below average. We also observed that the average temperature was 0.9 °C higher than 15YA and RADPAR was 6% above average. The adverse weather conditions were unfavorable for crops, resulting in a 22% drop of BIOMSS compared with 15YA. The prolonged dry and warm weather affected almost the entire country, except for Rio Grande Do Sul (+32% RAIN, with close to average TEMP and RADPAR) and some states less relevant for agriculture in the Northeast and Northern Brazil. Most of the major agricultural states in central and southern Brazil suffered from severe drought with significant below average rainfall and well above average temperature (+0.9 °C in Parana to +2.2 °C in Goias). Goias just received 1 mm rainfall during the four months while the average value is 125 mm. Suffering from the dry conditions, the potential biomass in most states was estimated to be below average levels except for Rio Grande Do Sul which was 10% above 15YA. The potential biomass departure map presents the same spatial pattern with above average BIOMSS only observed in southern, northern, and northeastern states.

The continuous dry weather negatively affected the second summer crops with overall crop growth conditions below average levels as shown in crop development profile based on NDVI. Distribution of NDVI departure from the 5YA and the corresponding profiles further illustrated the spatial variations of crop growth conditions. Above average rainfall in Rio Grande Do Sul benefitted the wheat in the region resulting in slightly above average crop conditions. Similarly, scattered areas in the northeastern Brazil also presented above average condition thanks to favorable precipitation. Most crops in Mato Grosso Do Sul, western Parana, and western Sao Paulo (in blue color on NDVI departure cluster map) presented well above average crop conditions although the regions experienced a significant rainfall shortage. The major reason is the irrigation systems along the Parana River which provides sufficient water for second crops in the region mitigating the meteorological drought. However, only 12% of the cropland in Brazil is irrigated, while most areas in central, eastern, and northern Brazil are rainfed. In contrast to the irrigated fields, crop growth condition presented below average conditions in those rainfed regions as dry weather conditions play a decisive role. The VCIx map shows similar spatial pattern with relatively high VCIx values in the regions along the Parana River and Rio Grande Do Sul while other regions especially in Central and Eastern Brazil present low VCIx. At the national level, VCIx was 0.89 and 99% of the cropland was cultivated at 5YA.

In general, the prolonged dry weather was less favorable for summer crops while wheat crops in Rio Grande Do Sul received above average rainfall resulting in slightly above average growth conditions.

Regional Analysis

Considering the differences in cropping systems, climatic zones, and topographic conditions, eight agro-ecological zones (AEZ) are identified for Brazil. These include the Amazon zone (30), Central Savanna (31), the East coast (32), Northeastern mixed forest and farmland (33), Mato Grosso zone (34), the Nordeste (35), Parana River (36), and Southern subtropical rangelands (37). During this monitoring period, dry and hot weather dominated in most AEZs except for Southern Subtropical rangelands where rainfall was 28% above average.

Similar as during the previous monitoring period, Central Savanna (31) and Mato Grosso (34) were still the two AEZs with largest negative rainfall departures in percentage. Both AEZs received less than 100 mm rainfall during the four months. They were 92% and 76% below average, respectively. Central Savanna experienced the largest positive temperature departure (+1.9°C) and lowest CALF (97%) and VCIx (0.81) values among all AEZs, indicating the significant impact of the drought. Rainfall was 17% below average in the Coast zone. The shortage of rainfall resulted in well below average NDVI as presented in the crop development profiles. Drought lowered the yield of second maize in those zones but the increased maize planted area partially compensated for the drought effects.

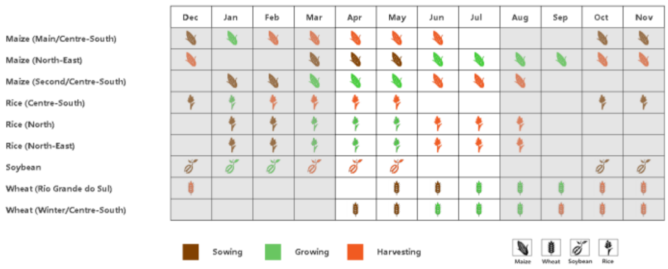
Rainfall in Nordeste (35) and Northeastern mixed forest and farmland (33) was generally below average with above average temperature during the monitoring period. It is noteworthy that the rainfall in late May to early June was above average which mitigated the drought effects and helped the crops recover, resulting in above or close to 5YA NDVI since June. As crops in those zones benefitted from the periodical above average rainfall, Northeastern mixed forest and farmland had the second highest VCIx value among the AEZs. Meanwhile, CALF in Nordeste was 3% above 5YA which is also the largest positive departure among the AEZs.

Parana Basin (36), the second major agricultural producing zone, received 55% less rainfall than 15YA during the monitoring period. Low rainfall together with the 1.3°C higher than 15YA temperature and 11% above average RADPAR resulted in 36% below average BIOMSS, confirming the adverse weather since April 2022. However, the negative impact of the adverse weather was limited. Peak crop growth conditions were above the 5YA and last year's values of the same period. This can be attributed to the irrigation during the second maize growing season. Second maize yield is estimated to be higher than in 2021 for this region.

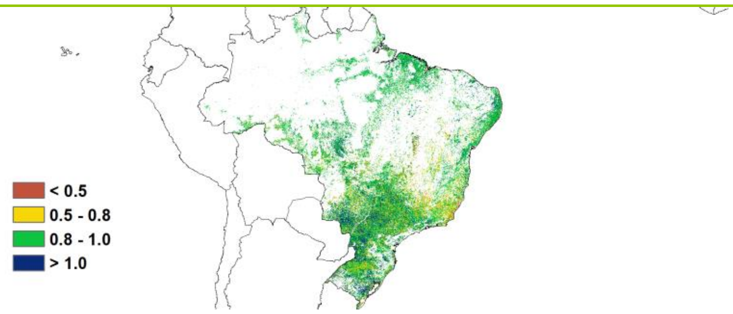
Southern subtropical rangeland (37) is the only AEZ experiencing above average rainfall but with an irregular distribution. The rainfall in the zone is 28% above 15YA and temperature and RADPAR is below average. Favorable rainfall has provided sufficient water for the wheat crops since sowing. Compared to the first and second bulletin in 2022, the weather conditions are more favorable, leading to above or close to average crop growth condition and highest VCIx (0.95) among all AEZs. Wheat yield is projected to be above average level. Considering that CALF is 1% above average, wheat production in the zone will be higher than 5YA.

For more indicators and detailed information, it is recommended to visit CropWatch Explore (**http://cropwatch.com.cn/newcropwatch/main.htm**).

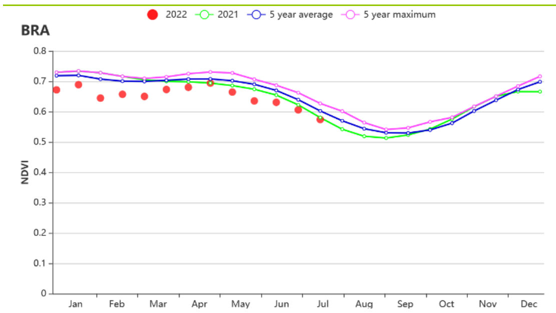
Figure 3. 11 Brazil's crop condition, April–July 2022

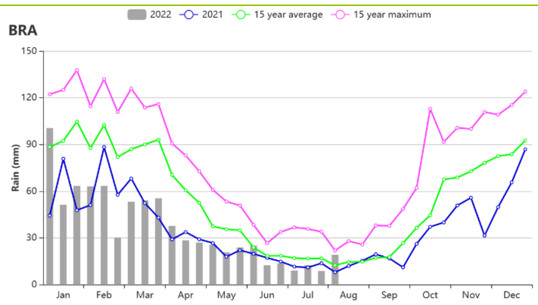


(a) Phenology of major crops

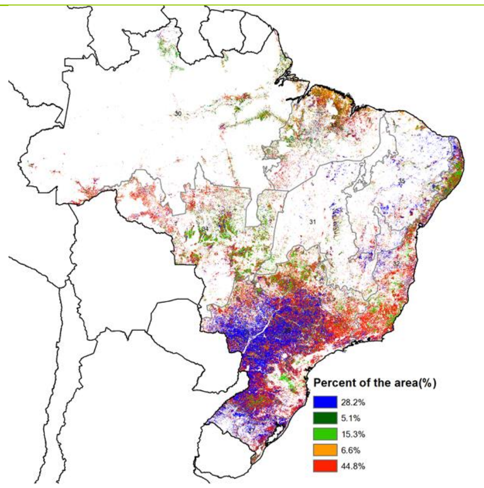


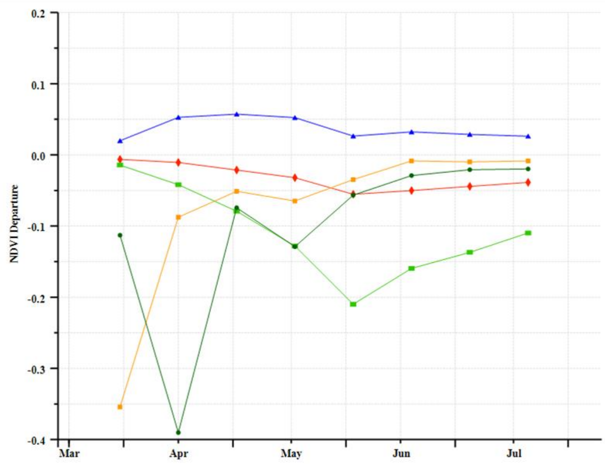
(b) Maximum VCI



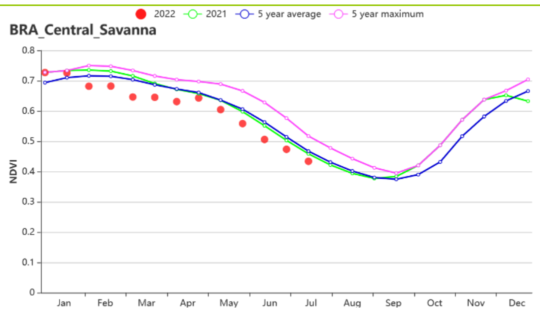


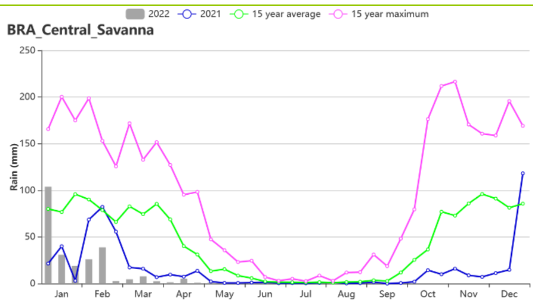
(c) Crop condition development graph based on NDVI (left) and rainfall profile (right) of Brazil



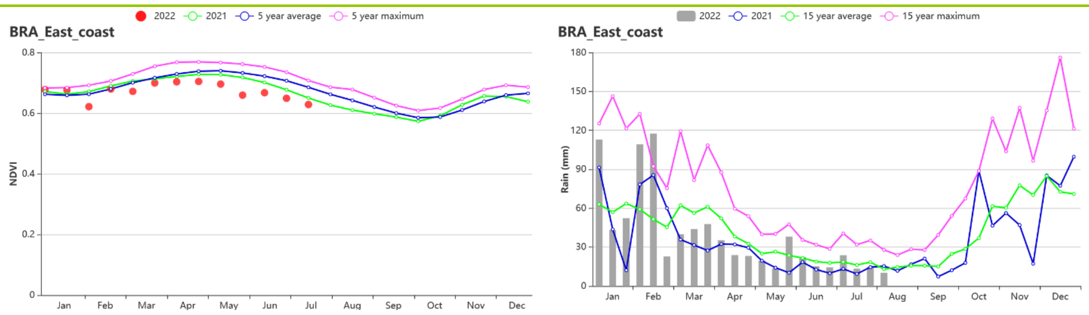


(d) Spatial distribution of NDVI departure clusters (e) NDVI departure profiles corresponding to the clusters in figure d

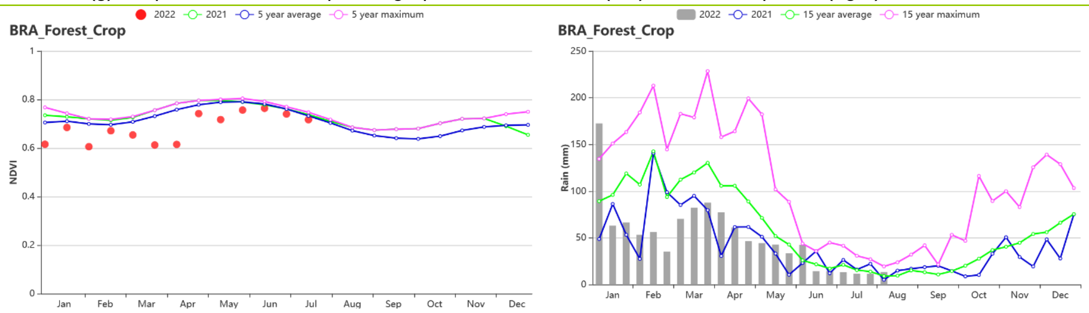




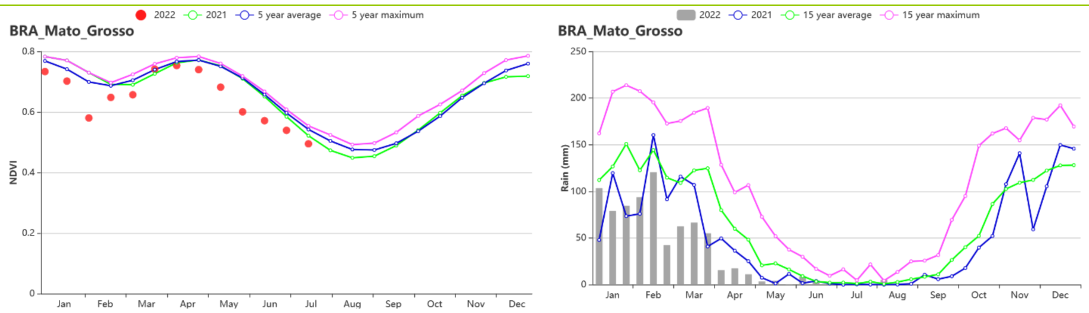
(f) Crop condition development graph based on NDVI (left) and rainfall profile (right) of Central Savanna



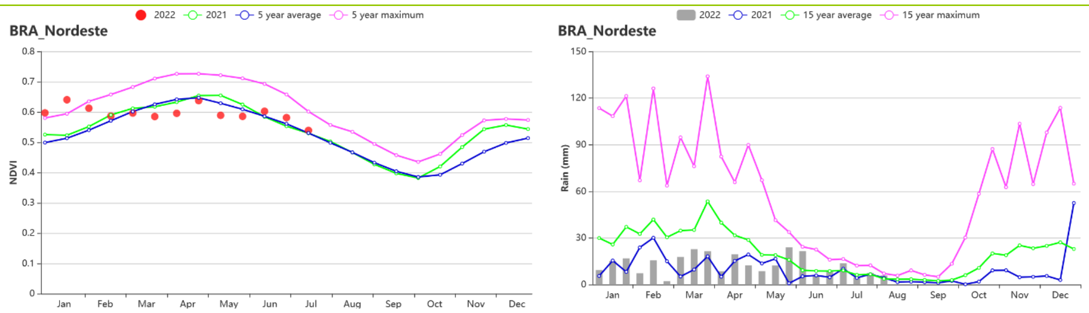
(g) Crop condition development graph based on NDVI (left) and rainfall profile (right) of Coast zone



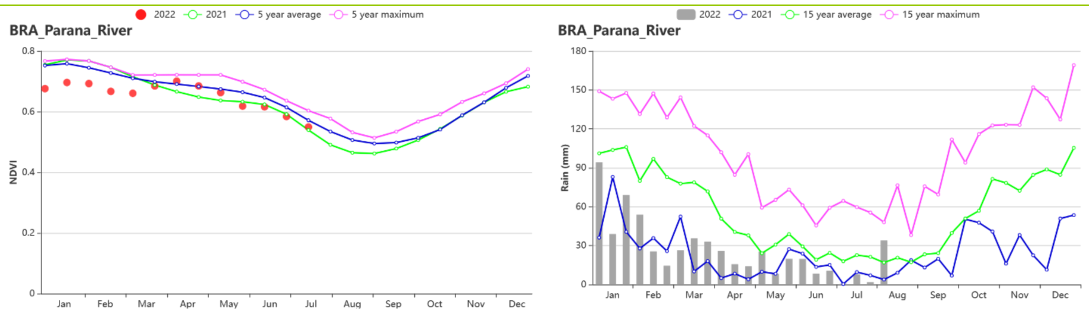
(h) Crop condition development graph based on NDVI (left) and rainfall profile (right) of Northeastern mixed forest and farmland



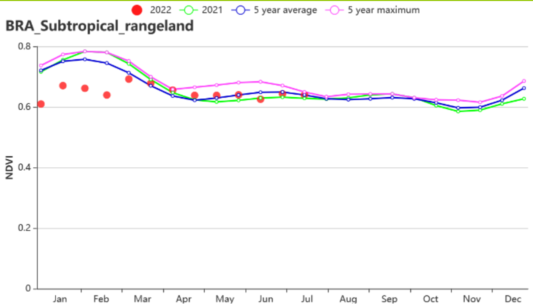
(i) Crop condition development graph based on NDVI (left) and rainfall profile (right) of Mato Grosso

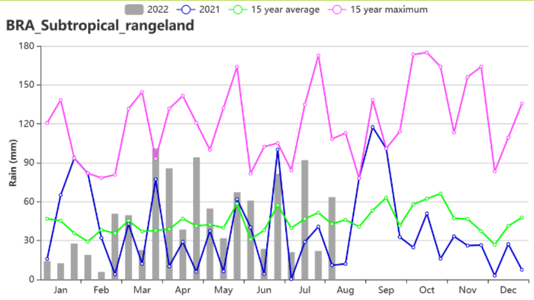


(j) Crop condition development graph based on NDVI (left) and rainfall profile (right) of Nordeste



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





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

Table 3. 14 Brazil's agroclimatic indicators by sub-national regions, current season's values, and departure from 15YA, April – July 2022

Region	RAIN		TEMP		RADPAR		BIOMASS	
	Current (mm)	Departure from 15YA (%)	Current (℃)	Departure from 15YA (℃)	Current (MJ/m²)	Departure from 15YA (%)	Current (gDM/m²)	Departure from 15YA (%)
Amazonas	626	-23	25.2	0.3	1124	2	1131	-9
Central Savanna	16	-92	24.1	1.9	1162	7	345	-44
Coast	258	-17	21	0.4	965	9	706	-11
Northeastern mixed forest and farmland	414	-29	25.9	0.8	1167	1	975	-12
Mato Grosso	65	-76	24.3	0.9	1147	8	478	-35
Nordeste	148	-27	24.6	0.7	1097	3	639	-7
Parana basin	159	-55	19.5	1.3	940	11	470	-36
Southern subtropical rangelands	674	28	14.6	-0.4	580	-7	963	12

Table 3. 15 Brazil's agronomic indicators by sub-national regions, current season's values, and departure from 5YA, April – July 2022

Region	CALF		Maximum VCI
	Current (%)	Departure from 5YA (%)	Current
Amazonas	100	0	0.92
Central Savanna	97	0	0.81
Coast	100	0	0.86
Northeastern mixed forest and farmland	100	0	0.94
Mato Grosso	100	0	0.90
Nordeste	98	3	0.88
Parana basin	100	0	0.89
Southern subtropical rangelands	99	1	0.95

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 SYR THA TUR UKR USA UZB VNM ZAF ZMB

[CAN] Canada

Maize, soybean, and spring wheat had been sown in April and May and were reaching the grain-filling period in the 2nd half of July. Harvest of winter wheat started in July. Overall, crop conditions were above average.

According to the CropWatch agroclimatic indicators, Canada experienced cooler and cloudier conditions. Due to the low temperatures in May, the sowing of summer crops was delayed. Therefore, the NDVI development curve shows a slight lag in April and May, but improved to average levels in June. The proportion of irrigated cropland in Canada is only 5% and rainfall is an important factor controlling crop production. The temperature (TEMP -0.7°C) and radiation (RADPAR -3%) were below the 15-year average while the rainfall (RAIN +9%) was above average, which led to average potential biomass (BIOMSS +1%). The temperature profile depicts that those low temperatures occurred mostly in May. The temperatures surpassed the 15-year maximum after June. The rainfall profile shows that the precipitation was above average in late June, when reached the 15-year maximum value.

As shown in the NDVI cluster map, the crop conditions were below average at the beginning and recovered to average after May on 26.5% of the cropped area, concentrated in the Northern Prairies (including the north of Saskatchewan and the middle of Manitoba). Crop conditions on 9.6% of total cropped land were predominantly below average and 20% were below average after April. On 26.7% of total cropped land, crop conditions fluctuated around the average level. In the remaining parts, crop conditions were below average at the beginning and subsequently fluctuated around average levels. The national maximum VCI value was 0.93, and the CALF was slightly above the recent 5-year average (CALF +1%).

The overall conditions of winter wheat, which is predominantly grown in the Saint Lawrence basin are assessed as average and above, and the prospects for the summer crops, including spring wheat, maize, and soybean are favorable.

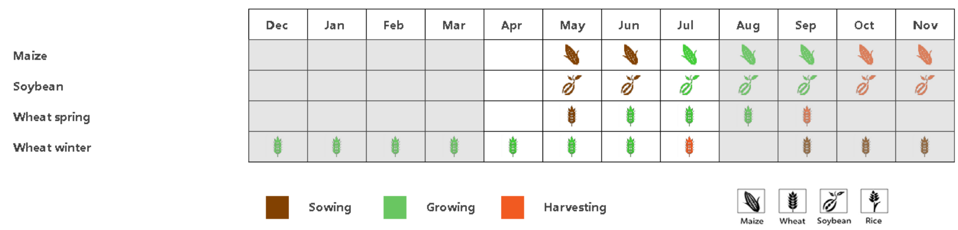
Regional analysis

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

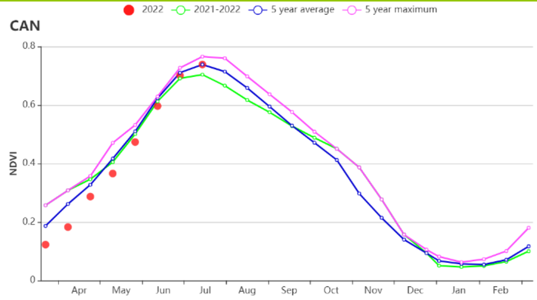
The rainfall in the Prairies, the main food production area in Canada, was significantly above average (RAIN 421 mm +19%), while the temperature and radiation were below average (TEMP –1.2°C; RADPAR -5%). The major crops in this region are winter wheat and spring wheat. According to the NDVI development graph and NDVI profile, crop conditions were below average before June. The negative departures were due to the lower temperature and wet soil conditions during the planting period of the summer crops. Crop conditions in the Prairies were favorable.

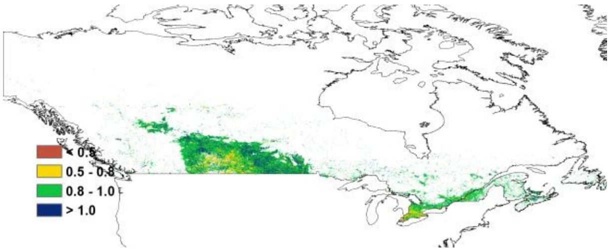
The conditions in the Saint Lawrence basin differed from the Prairies as rainfall was below average (RAIN-5%) and the temperature and radiation were close to average (TEMP +0.0°C; RADPAR +1%). Altogether, these agroclimatic conditions led to average potential biomass (BIOMSS +1%). According to the NDVI development graph, crop conditions were close to the average level in the recent 5 years. Overall, crop conditions were close to the average for this region.

Figure 3.12 Canada's crop condition, April- July 2022

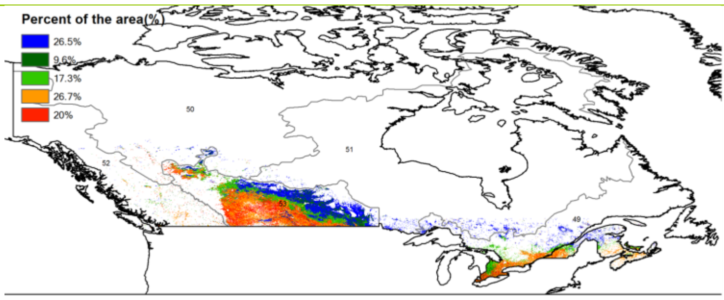


(a). Phenology of major crops

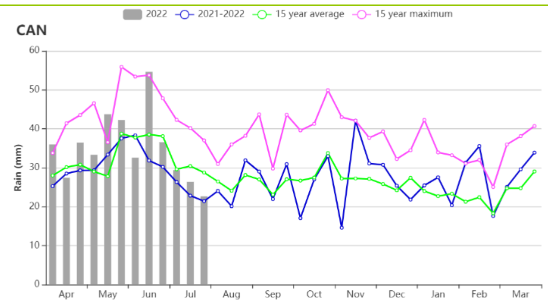


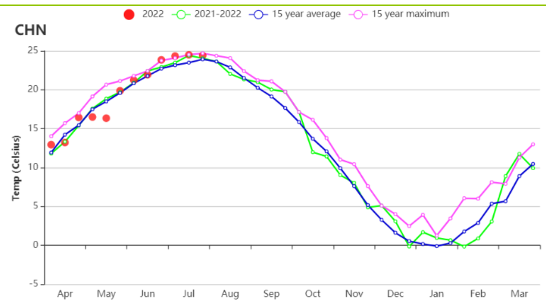


(b) Crop condition development graph based on NDVI (c) Maximum VCI

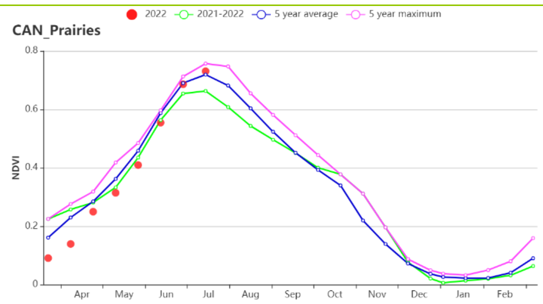


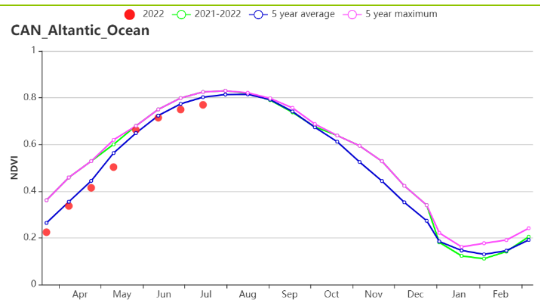
(d) Spatial NDVI patterns compared to 5YA (e) NDVI profiles





(f) Rainfall profiles (g) Temperature profiles





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

Table 3.16 Canada's agroclimatic indicators by sub-national regions, current season's values, and departure from 15YA, April - July 2022

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Saint Lawrence basin	423	-5	11.2	0.0	1123	1	874	1
Prairies	421	19	10.4	-1.2	1185	-5	831	2

Table 3.17 Canada's agronomic indicators by sub-national regions, current season's values, and departure from 5YA, April-July 2022

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Saint Lawrence basin	100	0	0.92
Prairies	98	1	0.93

[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.

According to the CropWatch agroclimatic indicators, total precipitation at the national level was significantly below average (RAIN -28%), temperature was above average (TEMP +0.5°C) and radiation was also above average (RADPAR +4%). As shown in the time series rainfall profile for Germany, precipitation was below-average with the exception of early April when it was significantly above average and of mid-June, when it was close to average. Most of the country experienced warmer-than-usual conditions during this reporting period, except for April and early July, in which heatwaves swept across Germany. Due to the persistent precipitation deficits combined with warmer-than-usual temperatures, the biomass production potential (BIOMSS) was estimated to decrease by 14% 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, except during the period from May to early June, when it was close to average. These observations are confirmed by the clustered NDVI profiles: 55.3% of regional NDVI values were below average from April to early June. These observations are confirmed by lower VCI values shown in the maximum VCI map. These negative departures were due to below-average rainfall. Overall VCIx for Germany was 0.87. CALF during the reporting period was close to the recent five-year average.

Generally, the agronomic indicators show near to or below-average conditions for most winter and summer crops in Germany. The crops are mainly rainfed crops in Germany, and irrigation rates are relatively low (7.2%). But average rainfall during the previous monitoring period had helped build up soil moisture content, thus limiting the negative impact of the rainfall deficit during this period on the winter crops. Nevertheless, production of the winter crops is estimated to be slightly below average. The effects of the rainfall deficit on the summer crops will be more severe.

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.

Schleswig-Holstein and the Baltic Coast are among the major winter wheat zones of Germany. Temperature was same as average in this region, but total precipitation was below average (RAIN -7%) and radiation was below average (RADPAR -2%). As a result, BIOMSS is expected to decrease by 3% as compared to the average. As shown in the crop condition development graph (NDVI), the values were below average and last year's records until early June when they recovered to the average level. However, they dropped to below-average levels again after that. The area has a high CALF (100%) as well as a favorable VCIx (0.9), indicating a large cropping area.

Wheat and sugar beets are the major crops in the Mixed Wheat and Sugar beet Zone of the Northwest. According to the CropWatch agroclimatic indicators, temperatures and radiation were both higher than average (TEMP +0.5°C; RADPAR +5%), but rainfall was significantly below average (RAIN -30%), which led to a decrease in BIOMSS by 16%. As shown in the crop condition development graph based on NDVI, the values were below average until early June when they recovered to the average level. However, they dropped to below-average levels again after that. The area has a high CALF (100%) and crop conditions for the region are favorable according to the high VCIx (0.87).

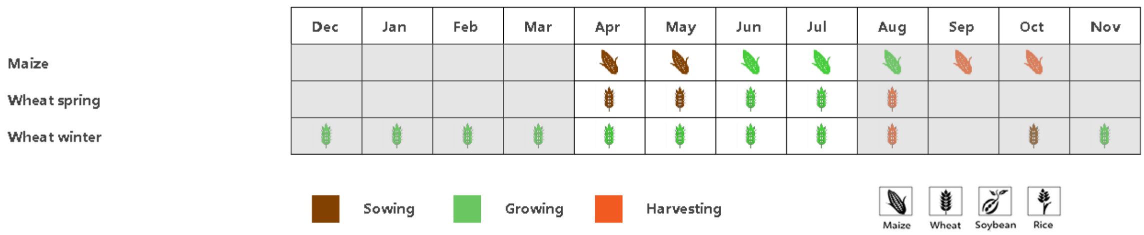
Central Wheat Zone of Saxony and Thuringia is another major winter wheat zone. Temperatures and radiation were both higher than average (TEMP +0.5°C; RADPAR +3%), but rainfall was significantly below average (RAIN -40%), which led to a decrease in BIOMSS by 20%. As shown in the crop condition development graph based on NDVI, the values were below average until early June when they recovered to the average level. However, they dropped to below-average levels again after that. The area has a high CALF (100%) and the VCIx was 0.86 for this region.

Significantly below-average precipitation was recorded in **the East-German Lake and Heathland Sparse Crop Area** (RAIN -38%). Temperatures and radiation were both higher than average (TEMP +0.3°C; RADPAR +3%). As a result, BIOMSS is expected to decrease by 18% as compared to the average. As shown in the crop condition development graph based on NDVI, the values were below average throughout the monitoring period except early June when they were close to average. The area has a high CALF (100%) and the VCIx was 0.83 for this region.

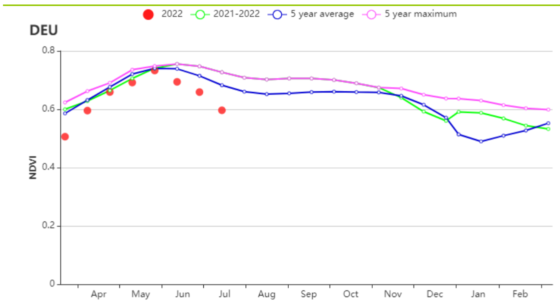
Significantly below-average precipitation was also recorded in **the Western Sparse Crop Area of the Rhenish Massif** (RAIN -41%) with above-average temperature and solar radiation (TEMP +1.0°C; RADPAR +8%). The biomass potential (BIOMSS) decreased by 22% compared to the 15YA. As shown in the crop condition development graph based on NDVI, the values were below average in April and from late-June to late-July, and close to average from early May to early June. The CALF was 100% for the regions. The VCIx value was 0.89 for the western areas.

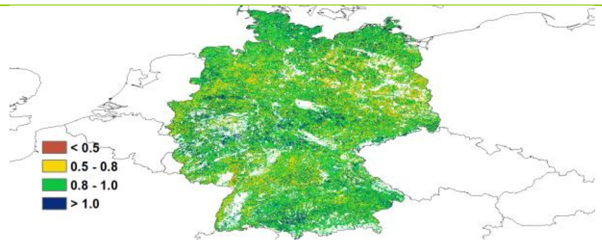
On average, a significant reduction in rainfall was recorded for **the Bavarian Plateau** (RAIN -26%), with above-average temperature (+0.5°C) and above-average radiation (RADPAR +6%). Compared to the five-year average, BIOMSS decreased by 13%. As shown in the crop condition development graph based on NDVI, the values were below average in April and from late-June to late-July, and close to average from early May to early June. The area had a high CALF (100%) as well as a favorable VCIx (0.88).

Figure 3.13 Germany's crop condition, April-July 2022



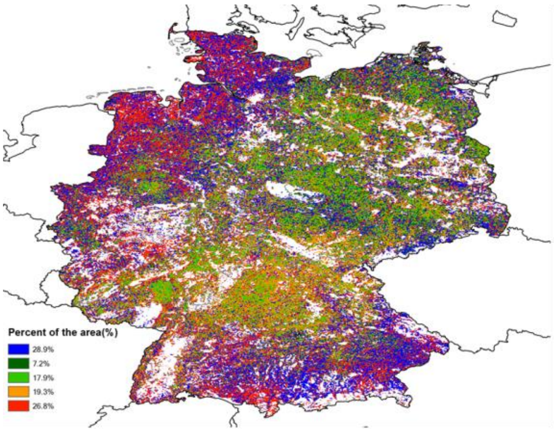
(a). Phenology of major crops

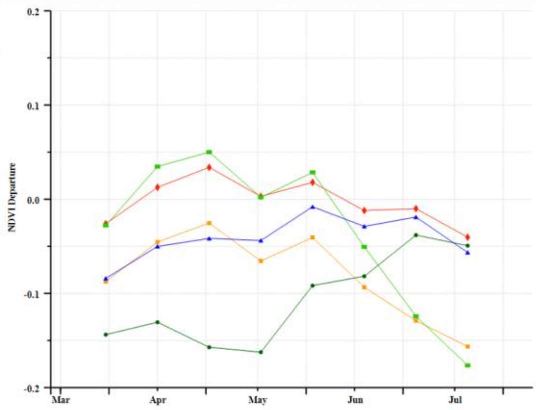




(b) Crop condition development graph based on NDVI

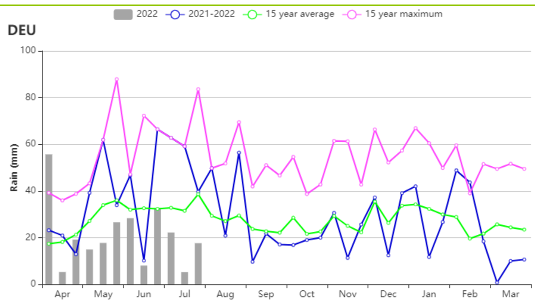
(c) Maximum VCI

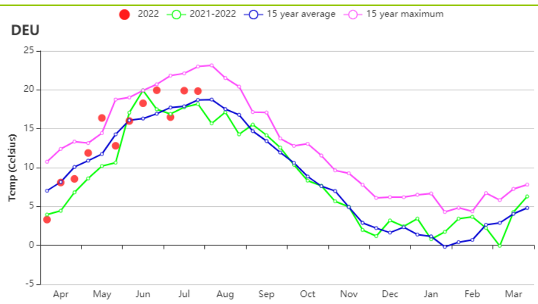




(d) Spatial NDVI patterns compared to 5YA

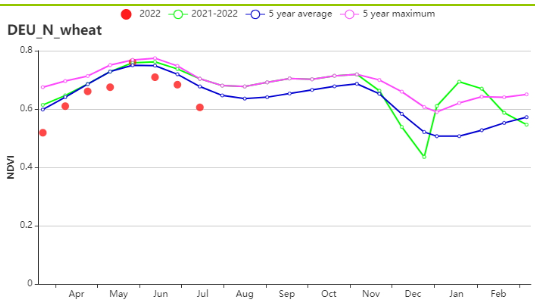
(e) NDVI profiles

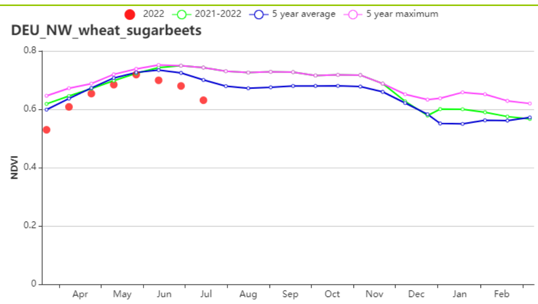




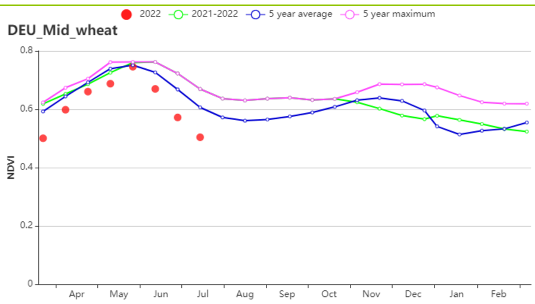
(f) Rainfall profiles

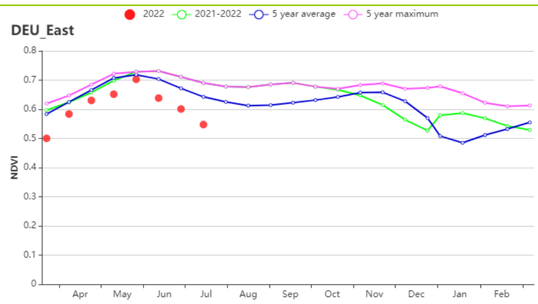
(g) Temperature profiles



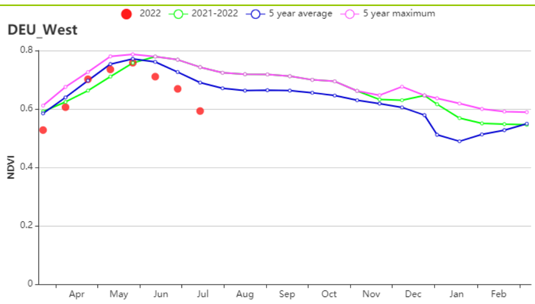


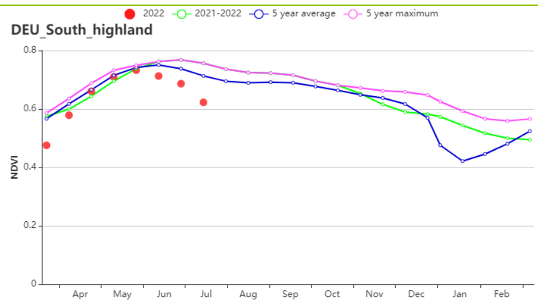
(h) Crop condition development graph based on NDVI (Wheat zone of Schleswig-Holstein and the Baltic coast (left) and Mixed wheat and sugar beets zone of the north-west(right))





(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. 18 Germany's agroclimatic indicators by sub-national regions, current season's values, and departure from 15YA, April-July 2022

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Wheat zone of Schleswig-Holstein and the Baltic coast	276	-7	13.8	0.0	1129	-2	757	-3
Mixed wheat and sugarbeets zone of the north-west	206	-30	14.3	0.5	1196	5	666	-16
Central wheat zone of Saxony and Thuringia	168	-40	14.4	0.5	1226	3	614	-20
East-German Lake and Heathland sparse crop area	188	-38	14.7	0.3	1215	3	662	-18
Western sparse crop area of the Rhenish massif	174	-41	14.7	1.0	1290	8	621	-22
Bavarian Plateau	346	-26	14.0	0.5	1319	6	814	-13

Table 3. 19 Germany's agronomic indicators by sub-national regions, current season's values, and departure from 5YA, April-July 2022

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Wheat zone of Schleswig-Holstein and the Baltic coast	100	0	0.90
Mixed wheat and sugarbeets zone of the north-west	100	0	0.87
Central wheat zone of Saxony and Thuringia	100	0	0.86
East-German Lake and Heathland sparse crop area	100	0	0.83
Western sparse crop area of the Rhenish massif	100	0	0.89
Bavarian Plateau	100	0	0.88

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 SYR THA TUR UKR USA UZB VNM ZAF ZMB

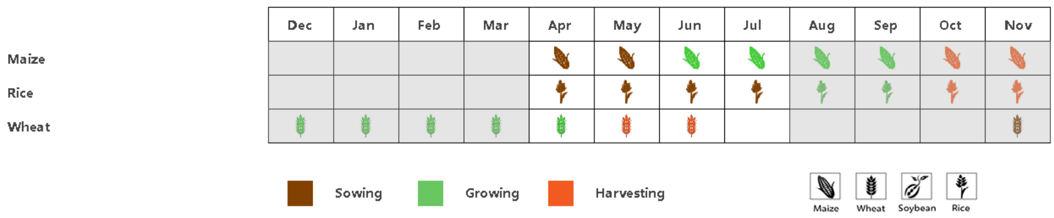
[EGY] Egypt

During the monitoring period, winter wheat reached maturity in April and was harvested in May. Rice and maize planting started in April. Total rainfall was at 2 mm, which was 75 mm less than the 15YA. The average temperature was higher than the 15YA by 0.6 ℃. The temperature index graph shows that it fluctuated around the 15YA during the monitoring period. RADPAR and BIOMSS were below the 15YA by 0.7% and 21%. The reduction in BIOMSS can be attributed to the remarkable rainfall reduction. The CALF was higher than the 5-year average (5YA) by 2% and VCIx was at 0.80. The nationwide NDVI development graph indicates that the crop conditions followed the 5YA trend until mid-May and subsequently remained below average, but reached close to average levels by the end of July. The NDVI spatial pattern shows that only 11.1% of the cultivated area was above the 5YA, 59.9% fluctuated around the 5YA, and 29% were below the 5YA. Overall, the crop conditions for winter wheat were favorable. Conditions for summer crops reached average levels by the end of this monitoring period.

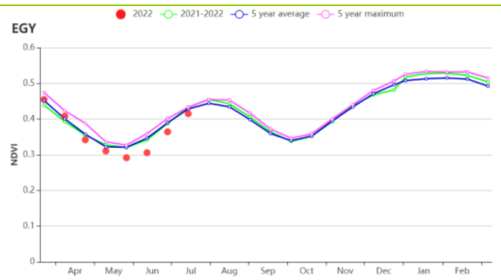
Regional analysis

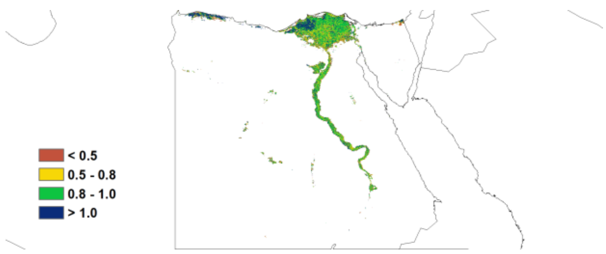
Based on crop planting systems, climate zones, and topographical conditions, Egypt can be divided into three agro-ecological zones (AEZs), two of which are suitable for crop cultivation, namely the Nile Delta and the southern coast of the Mediterranean and the Nile Valley. Rainfall was below the 15YA by 71 mm and 80 mm, the temperature was above the 15YA only by 0.6 ℃ and 0.2 ℃, the RADPAR was below the 15YA only by 0.9%, and 1.5% for the Nile Delta and the southern coast of the Mediterranean and the Nile Valley respectively. The BIOMSS was at the 15YA in the first zone while it was below the 15YA by 64% in the second zone. The CALF was only 2% below the 5YA for the two zones, and the VCIx was 0.86, and 0.79 for the first and second zones, respectively. The NDVI-based crop condition development graphs show similar conditions for both zones following the national crop development NDVI graph, which was discussed above.

Figure 3.14 Egypt's crop condition, April- July 2022



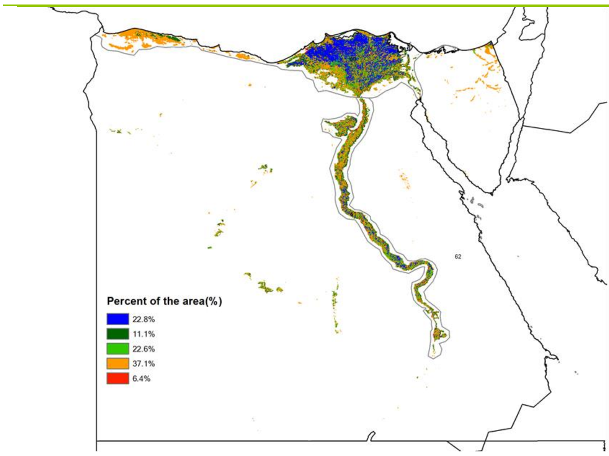
(a). Phenology of major crops



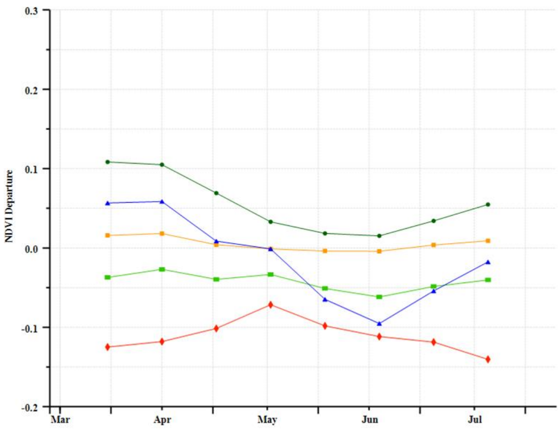


(b) Crop condition development graph based on NDVI

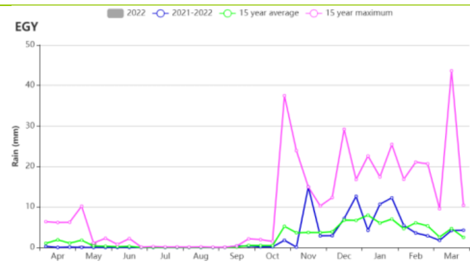
(c) Maximum VCI



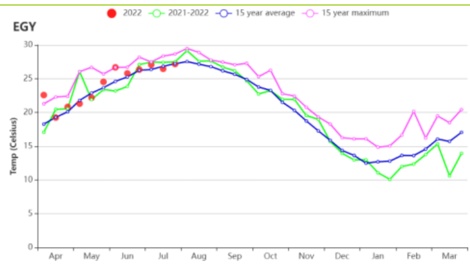
(d) Spatial NDVI patterns compared to 5YA



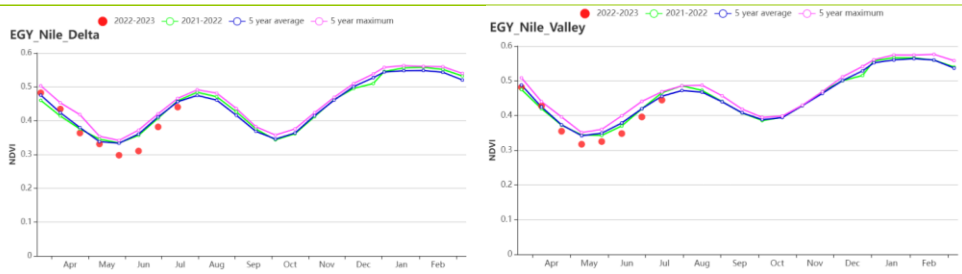
(e) NDVI profiles



(f) Rainfall profiles



(g) Temperature profiles



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

Table 3. 20 Egypt's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, April - July 2022

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Nile Delta and Mediterranean coastal strip	2	-71	24.1	0.6	1576	-0.9	523	0
Nile Valley	0	-80	26.8	0.2	1611	-1.5	145	-64

Table 3. 21 Egypt's agronomic indicators by sub-national regions, current season's values and departure from 5YA, April-July 2022

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Nile Delta and Mediterranean coastal strip	66	2	0.86
Nile Valley	70	2	0.79

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[ETH] Ethiopia

This monitoring period from April to July covers the Meher crops planting season. At the national level, the drought that had already been observed during the previous monitoring period, adversely affected the planting of maize, wheat, and barley. The cumulative precipitation had dropped by 34% from the 15YA, average temperature (+0.4°C) and photosynthetic effective radiation (+4%) were slightly higher than the 15YA. The largest precipitation deficit had been recorded for May, which is a critical month for planting. The drought resulted in a 16% reduction in biomass, compared to the 15YA. The crop condition development graph based on NDVI for Ethiopia presents below-average values after May, mainly due to delayed planting and poor crop development caused by dry weather in eastern Ethiopia. The NDVI departure clustering map shows a negative departure in the east. The average Maximum VCI for Ethiopia was 0.78. The Maximum VCI graph shows the same pattern as the NDVI departure clustering map. The cropped arable land fraction decreased by 8% compared to the 5YA. In Ethiopia, only 4.9% of the land is irrigated. In short, crop planting and development were negatively affected by below-average precipitation. The east and the north were the regions that were most adversely affected by the drought conditions.

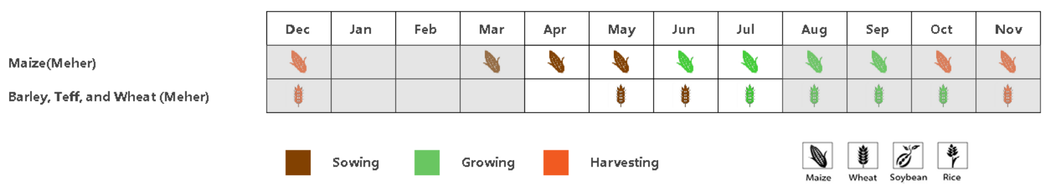
Regional analysis

The agroclimatic conditions in **semi-arid pastoral areas**, **southeastern mendebo highlands zone**, and **south-eastern mixed maize zone** were similar: low precipitation, but average temperature and adequate photosynthetically active radiation. As a result, the estimated cumulative biomass was reduced by 13%, 28%, and 29% in the three regions compared to the 15YA. The NDVI was also below the average level after May, which means that the forage growth and maize sowing were affected by the drought. In addition, the cropped arable land fraction in the **semi-arid pastoral areas** dropped by 64% and the maximum VCI was 0.41, which implies a significant decrease in forage production in the area. It also negatively affected maize production.

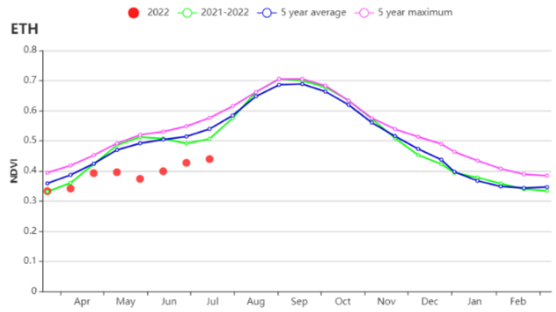
The agroclimatic conditions in the **western mixed maize zone** were different. There was a slight decrease in rainfall (-20%), and the effect on cumulative biomass (-9%) was minimal. The cropped arable land fraction did not change (0%) either. The NDVI was near the 15YA and the maximum VCI at 0.93. Conditions for maize cultivation in this region can be assessed as close to normal.

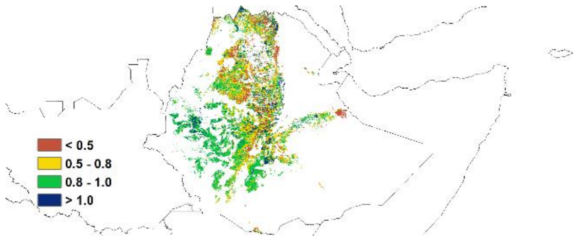
The **northern arid area** is important for local crop production. Due to the war, the cropped arable land fraction was almost zero and the local food shortage, which had started a year ago, is continuing.

Figure 3.15 Ethiopia's crop condition, April-July 2022



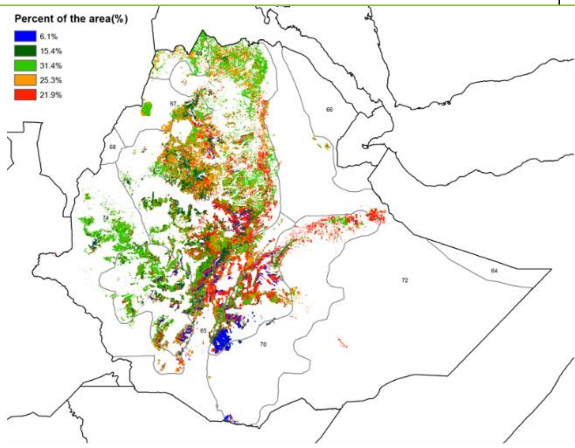
(a) Phenology of major crops

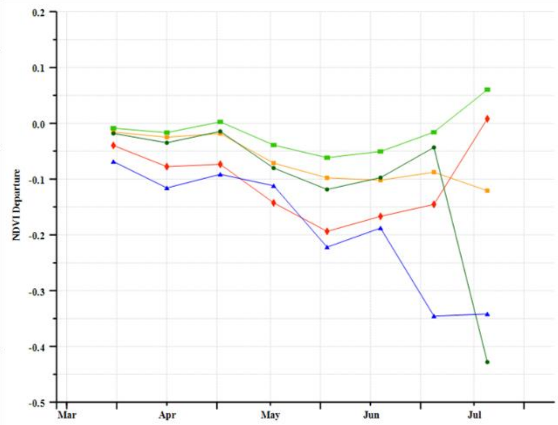




(b) Crop condition development graph based on NDVI

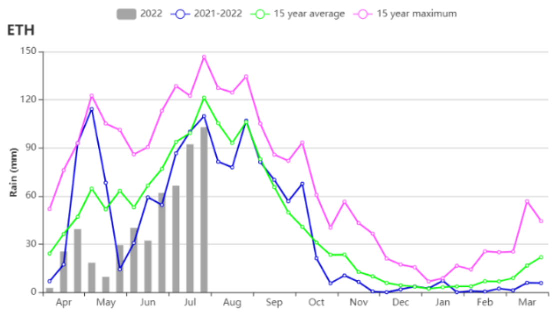
(c) Maximum VCI

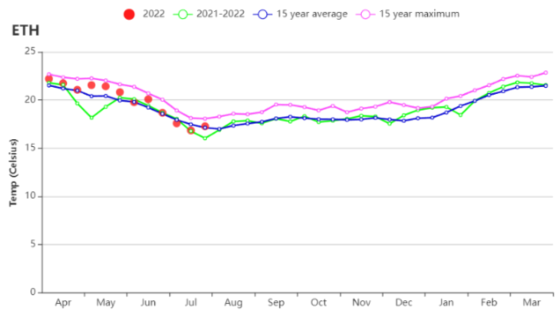




(d) Spatial NDVI patterns compared to 5YA

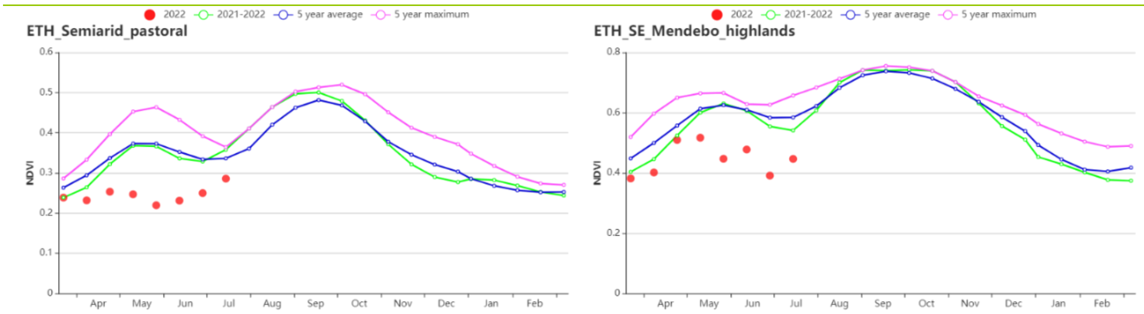
(e) NDVI profiles



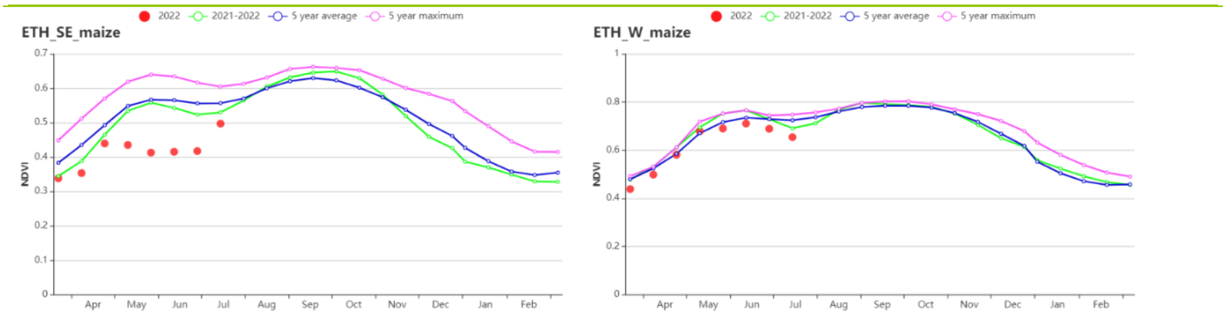


(f) Rainfall profiles

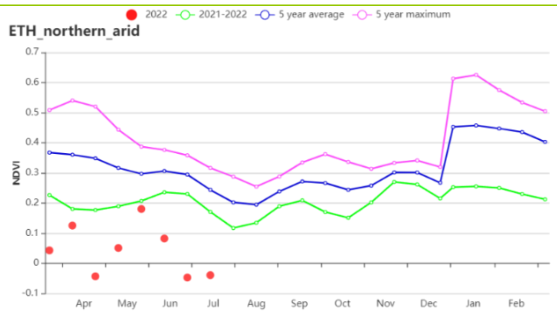
(g) Temperature profiles



(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 Western mixed maize zone (right))



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

Table 3.22 Ethiopia's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, April-July 2022

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m2)	Departure (%)	Current (gDM/m2)	Departure (%)
Semi-arid pastoral areas	114	-45	25.2	1.6	1394	0	645	-13
South-eastern Mendebo highlands	236	-58	15.8	0.2	1227	4	625	-28
South-eastern mixed maize zone	183	-63	19.3	0.6	1225	1	650	-29
Western mixed maize zone	984	-20	21.5	0.1	1189	7	1160	-9
Northern arid area	156	75	30.0	-0.5	1430	0	755	14

Table 3.23 Ethiopia's agronomic indicators by sub-national regions, current season's values and departure from 5YA, April -July 2022

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Semi-arid pastoral areas	15	-64	0.41
South-eastern Mendebo highlands	97	-2	0.83
South-eastern mixed maize zone	89	-5	0.78

Western mixed maize zone	100	0	0.93
Northern arid area	0	-100	0.31

[FRA] France

This monitoring period covers winter wheat, which had reached maturity by July. The planting of maize and spring wheat was mostly completed in early May. The harvest of the summer crops including rice, potatoes and sunflower starts in August and extends into September. As the proportion of irrigated cropland in France is only 9.1% of the total cropland, rainfall conditions play a decisive role in the growth of most crops. CropWatch agro-climatic indicators show above-average temperature (TEMP +1.8°C) over the period. Temperatures had surpassed the 15-year maximum during several periods between May and July. RADPAR was 10% above average. However significantly lower RAIN (-37%) as compared to the 15YA was recorded, which aggravated the drought conditions observed during the last monitoring period. Due to extremely unfavorable rainfall and the relatively warm temperature conditions, the biomass production potential (BIOMSS) is estimated to have decreased by 14% 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 especially after May. The spatial distribution of maximum VCI (VCIx) across the country reached an average of 0.85 only. Overall, significant drought conditions caused unfavorable growth conditions for the whole monitoring period in France.

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**, TEMP and RADPAR were both above average (+1.3°C and +10% respectively), while RAIN was below average (-29%). The BIOMSS also decreased by 13% when compared to the 15YA. The CALF was average, and VCIx was at 0.86. Crop condition development based on NDVI for this region was close to the 5-year average in April and mid-May, but then below the average in June and July.

In the **Mixed maize/barley and rapeseed zone from the Center to the Atlantic Ocean**, a warmer (TEMP +1.9°C) and sunnier (RADPAR +12%) season was observed, with lower RAIN (-26%). For the crops, BIOMSS was 10% lower than average, CALF was at the average level and VCIx was relatively high at 0.88. The regional NDVI profile presented an overall below-average trend, only close to average levels in April.

In the **Maize-barley and livestock zone along the English Channel**, TEMP and RADPAR were above average by 1.7°C and 10%. TEMP was lower than average (-31%). BIOMSS decreased by 14%. CALF was average and VCIx was relatively high at 0.88. The regional NDVI profile also presented an overall lower than average trend but close to average in April and May.

In the **Rapeseed zone of eastern France**, the NDVI profile also indicated below-average conditions but was close to average from mid-April to mid-May. Overall, RAIN in this period was 36% lower than the 15-year average, while TEMP and RADPAR increased by 1.3°C and 12%. BIOMSS was about 15% lower than average while CALF was at the average level, and VCIx was 0.86.

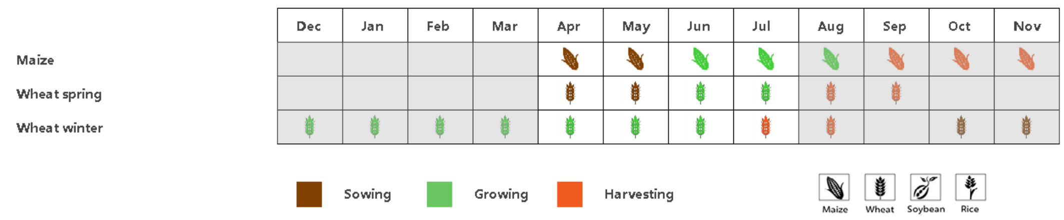
In the **Massif Central dry zone**, TEMP and RADPAR were 1.8°C and 13% higher than the average, respectively, while RAIN decreased by 38%. The VCIx was 0.88 and BIOMSS decreased by 17% which indicated a below-average cropping season in the region. Crop conditions based on the NDVI profile were also showing below-average levels but only close to average in early May.

The **Southwestern maize zone** is one of the major irrigated regions in France. The regional NDVI profile presented a below-average trend during the whole monitoring period. RAIN in the period was 44% lower than average, while TEMP and RADPAR was 1.8°C and 10% higher than the average levels. BIOMSS was 16% lower than average, while CALF showed no significant change. The VCIx was recorded at 0.84, confirming the below-average crop conditions.

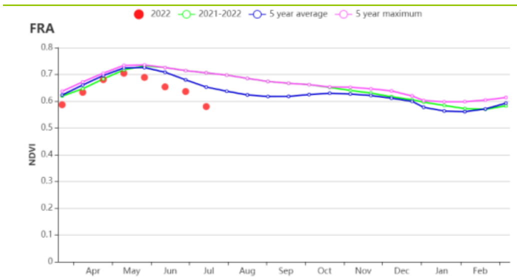
In the **Eastern Alpes region**, the NDVI profile also presented a below-average trend, but was close to average in late April and early May. RAIN in the region was 44% lower than average, while TEMP was higher than average (+1.9°C) and RADPAR was increased by 10%. BIOMSS was 15% lower than the 15-year average. VCIx for the region was recorded at 0.83 and CALF was at the average level, indicating overall below-average crop conditions.

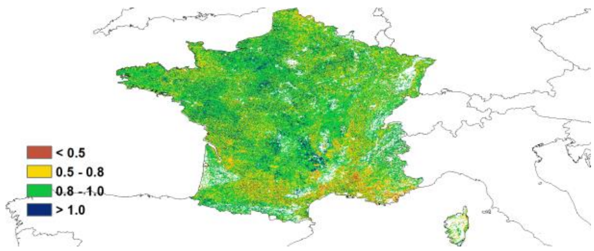
The **Mediterranean zone** also indicated an overall lower NDVI profile but was close to average in late April and late May. The region recorded a relatively low VCIx (0.78). RADPAR and TEMP were 6% and 2.8°C higher than average, while RAIN was lower (-44%) than average. BIOMSS and CALF decreased by 13% and 1%. This region is showing below-average crop conditions and agricultural production situation.

Figure 3.16 France's crop condition, April- July 2022

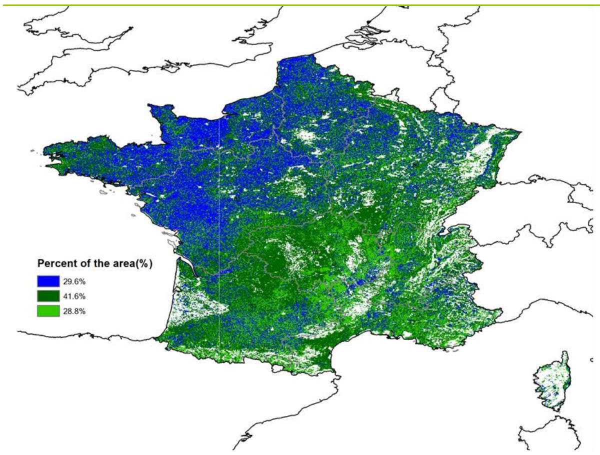


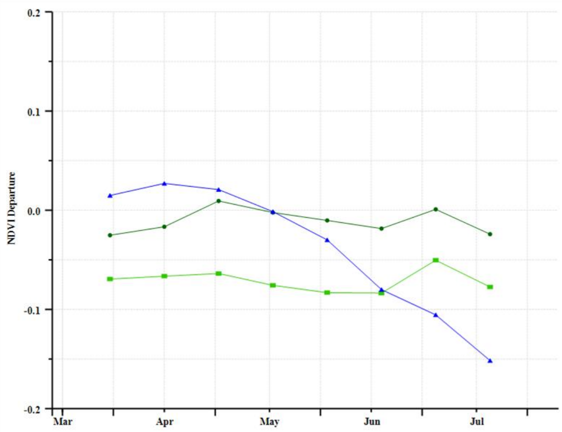
(a). Phenology of major crops



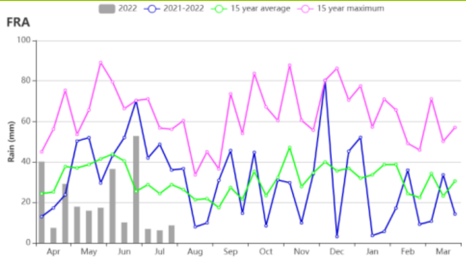


(b) Crop condition development graph based on NDVI (c) Maximum VCI

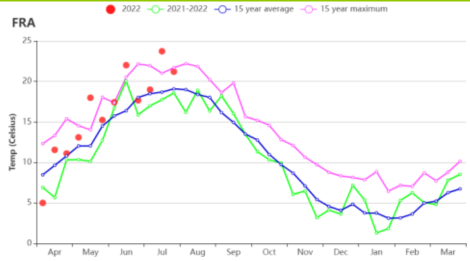




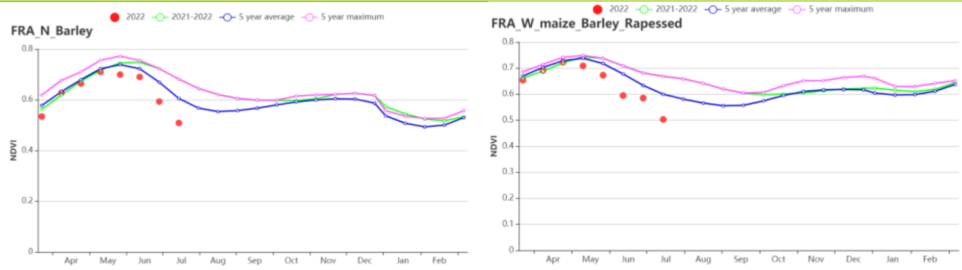
(d) Spatial NDVI patterns compared to 5YA (e) NDVI profiles



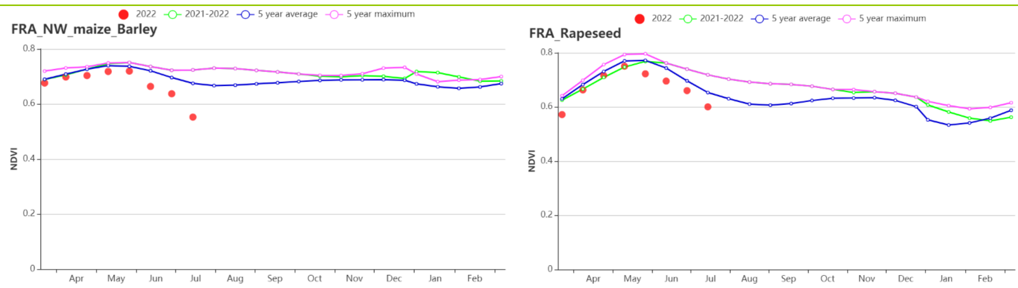
(f) Rainfall profiles



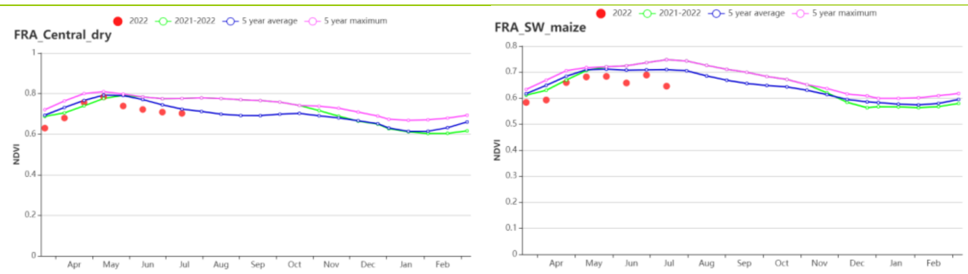
(g) Temperature profiles



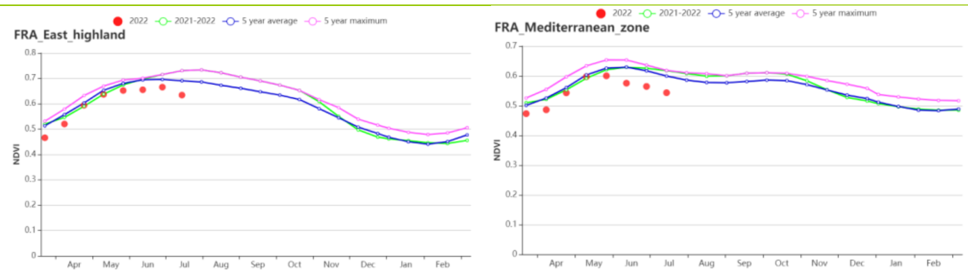
(h) Crop condition development graph based on NDVI (Northern barley region (left) and Mixed maize, Barley and Rapeseed zone (right))



(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 3.24 France's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, April - July 2022

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Northern Barley zone	225	-29	15.4	1.3	1279	10	717	-13

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Mixed maize/barley and rapessed zone from the Centre to the Atlantic Ocean	248	-26	17.0	1.9	1347	12	776	-10
Maize barley and livestock zone along the English Channel	200	-31	15.4	1.7	1279	10	676	-14
Rapeseed zone of eastern France	280	-36	15.6	1.3	1362	12	775	-15
Massif Central Dry zone	271	-38	15.6	1.8	1403	13	788	-17
Southwest maize zone	248	-44	17.1	1.8	1397	10	791	-16
Alpes region	315	-44	15.3	1.9	1445	10	794	-15
Mediterranean zone	207	-44	17.8	2.8	1478	6	704	-13

Table 3.25 France's agronomic indicators by sub-national regions, current season's values and departure from 5YA, April-July 2022

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Northern Barley zone	100	0	0.86
Mixed maize/barley and rapessed zone from the Centre to the Atlantic Ocean	100	0	0.88
Maize barley and livestock zone along the English Channel	100	0	0.88
Rapeseed zone of eastern France	100	0	0.86
Massif Central Dry zone	100	0	0.88
Southwest maize zone	100	0	0.84
Alpes region	98	0	0.83
Mediterranean zone	95	-1	0.78

[GBR] Kingdom

During this monitoring period, winter wheat reached the flowering stage in mid to late May. Subsequent grainfilling was completed by early July. According to the crop condition development graph, crops experienced average conditions from April to June and unfavorable conditions in July due to below-average rainfall and high temperatures. Agro-climatic indicators show that rainfall was below average (RAIN -27%), temperature was above average (TEMP +0.8°C) and radiation was slightly above average (RADPAR +1%). BIOMSS was estimated below average (BIOMSS -12%) because of rain deficit and high temperatures. The seasonal RAIN and TEMP profiles presents below-average rainfall in May and July, and large positive temperature departure in mid-July.

The national average VCIx was 0.93. CALF (100%) was unchanged compared to its five-year average. The crops are mainly rainfed crops in United Kingdom, irrigation rate is low (2.0%). The NDVI departure cluster profiles indicate that: (1) 17% of arable land, mainly in East Midlands and East of England, experienced slightly above-average crop conditions from April to early June, after then below-average crop conditions in late June and July. (2) 62.9% of arable land experienced average crop conditions before June and then decreased to below-average crop conditions in July. (3) 15.9% of arable land experienced slightly below-average crop conditions in this monitoring period, scattered in South of England and Scotland. (4) crop conditions in 4.2% of arable land, mainly in East of England, were average in April and May, and decreased to below average in June, then recovered to slightly below average in July.

Although rainfall was generally below average, it was quite evenly distributed. NDVI started to decline in mid-June, when wheat was at the mid-grainfilling stage. Thus, the drier-than-usual conditions in late June and early July may have had a limited negative impact on wheat yields and conditions can be assessed as average for wheat.

Regional analysis

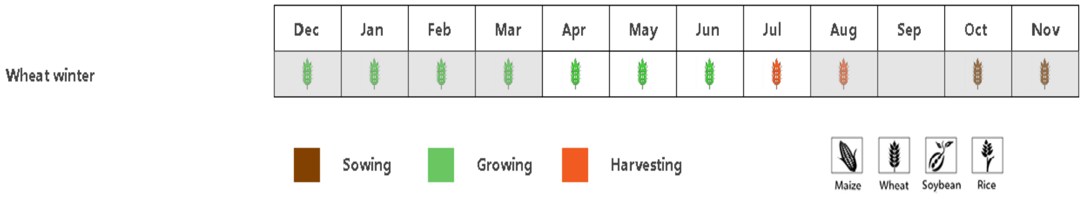
Based on cropping systems, climatic zones, and topographic conditions, three sub-national regions can be distinguished: Central sparse crop region, Northern barley region, and Southern mixed wheat and barley region. All three sub-regions were characterized by unchanged fractions of arable land (CALF) 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 close to the five-year average from April to June, and below the five-year average in July according to the NDVI development graph. This region experienced the large rainfall deficit (RAIN -31%). Temperature was above average (TEMP +0.7°C) and radiation was slight below average (RADPAR -4%). Biomass was below average (BIOMSS, -13%). The VCIx was at 0.94.

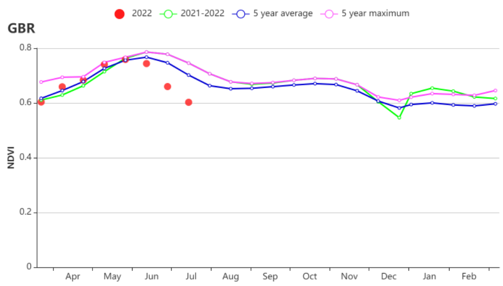
In the **Northern barley region**, NDVI was similar to the Central sparse crop region. Rainfall and radiation were below average (RAIN -13%, RADPAR -4%) , and temperature was above average (TEMP +0.5°C). Biomass was below average (BIOMSS, -4%). The VCIx was at 0.96.

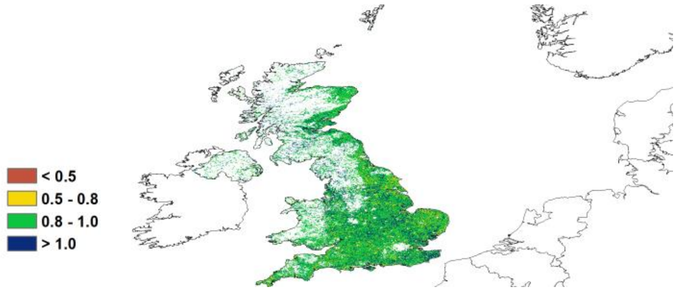
In the **Southern mixed wheat and barley zone**, NDVI was also similar to the other sub-national regions. This region experienced the largest rainfall deficit (RAIN -40%). Temperature and radiation were significantly above average (TEMP +1.0°C, RADPAR +6%). Biomass was significantly below average due to severe rainfall deficit and high temperature (BIOMSS -19%). The VCIx was at 0.93.

Figure 3.17 United Kingdom's crop condition, April- July 2022



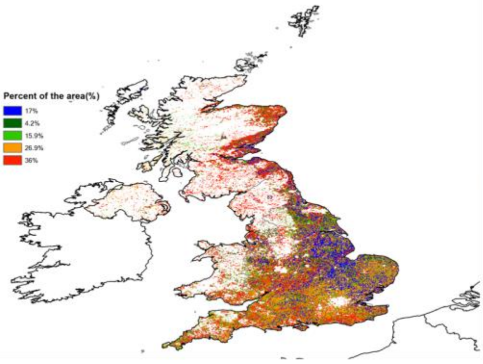
(a). Phenology of major crops

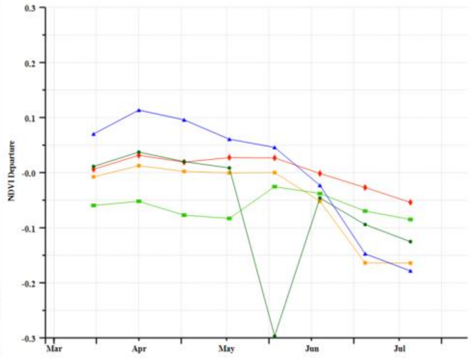




(b) Crop condition development graph based on NDVI

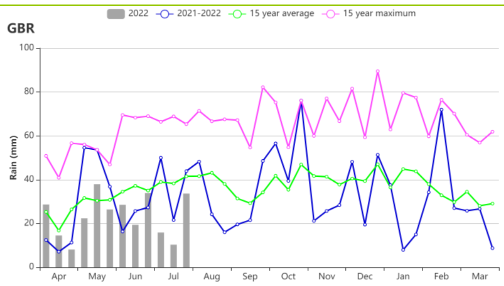
(c) Maximum VCI

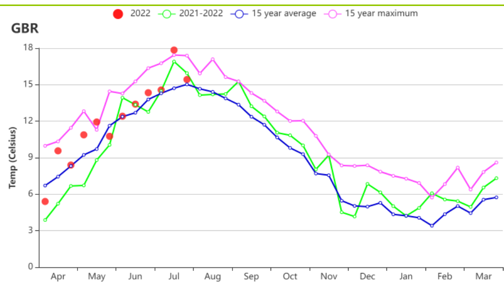




(d) Spatial NDVI patterns compared to 5YA

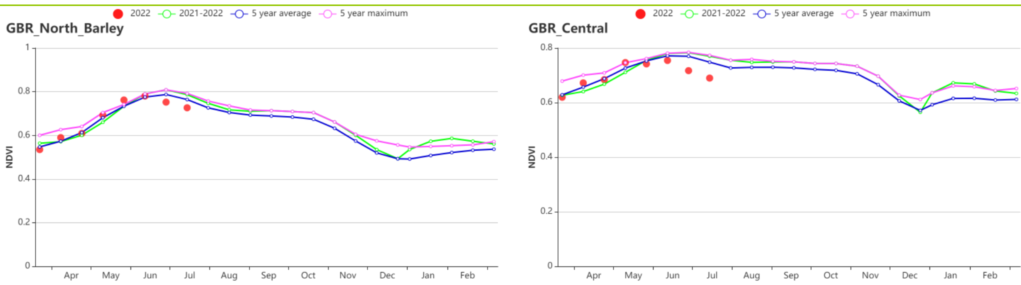
(e) NDVI profiles



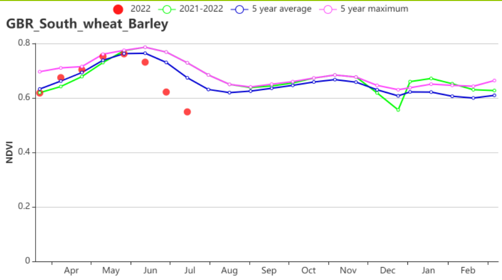


(f) Rainfall profiles

(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 3.26 United Kingdom's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, April - July 2022

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Central region	385	-13	10.5	0.5	872	-4	758	-4
Dry region	279	-31	11.9	0.7	952	-1	717	-13
Dry and irrigated cultivation region	194	-40	13.3	1.0	1108	6	630	-19

Table 3.27 United Kingdom's agronomic indicators by sub-national regions, current season's values and departure from 5YA, April-July 2022

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Central region	100	0	0.96
Dry region	100	0	0.94
Dry and irrigated cultivation region	100	0	0.93

[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 during the monitoring period, and much lower than the 5YA in April and July. Temperature was above average (TEMP +0.9°C) and solar radiation was above average (RADPAR +3%) as compared to the 15YA. Conditions had already been drier than usual during the previous monitoring period. The overall rainfall was below average (RAIN -55%), mainly due to the fact that the precipitation was much lower than average in mid-April, May, June and July. Biomass was below average compared to the 15YA (BIOMSS -27%). These conditions illustrate that Hungary was much drier than usual. This limited growth and yield of winter wheat. Meanwhile, according to the Hungarian National Water Authority's report, Hungary experienced the driest 7 months since 1901. The proportion of irrigated cropland in Hungary is only 4.3% and rainfall is the predominant factor limiting crop growth. The national CALF was 100%. Winter wheat production is expected to be below average.

The national average VCIx was 0.83. The NDVI departure cluster profiles indicate that: (1) 14.2% of arable land experienced above-average crop conditions from mid-April to mid-June, scattered over the whole country. (2) 28.4% of arable land experienced below-average crop conditions during this reporting period, mainly distributed in Central Hungary and Eastern Hungary. (3) 11.5% of arable land experienced below-average crop conditions from April to mid-June, mainly distributed in Western Hungary. (4) 31.2% of arable land experienced slightly below-average crop conditions from April to May, above average from early June to mid-June, and below average from late June to July, mainly distributed in Western Hungary and Central Hungary. (5) 14.7% of arable land experienced below-average crop conditions in early April, above average from mid-April to early May, and below average from mid-May to July, mainly distributed in Eastern 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.

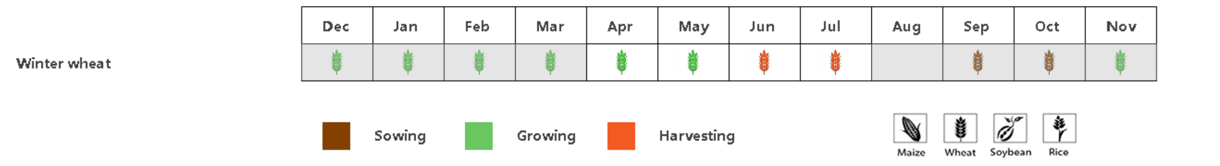
Central Hungary is one of the major agricultural regions in terms of crop production. A sizable share of winter wheat is planted in this region. According to the NDVI development graphs, NDVI values were below average in the entire monitoring period. Temperature and radiation were above average (TEMP +1.1°C and RADPAR +3% respectively). Potential biomass was below average compared to the 15YA (BIOMSS -29%) mainly due to below-average (RAIN -62%) rainfall. The VCIx was 0.81. The crop conditions in this region were below 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 early April and mid-April, close to average in late April, and below average from May to July. Temperature and radiation were above average (TEMP +0.7°C and RADPAR +4% respectively). Potential biomass was below average compared to the 15YA (BIOMSS -32%) mainly due to below-average (RAIN -61%) rainfall. The VCIx was 0.78. The crop conditions in this region were unfavorable.

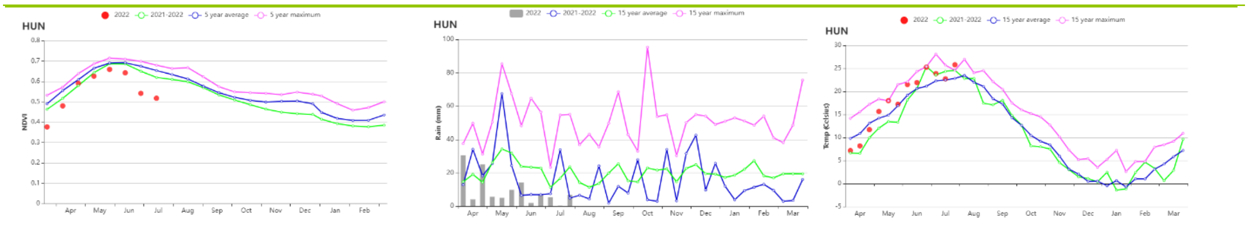
Northern Hungary is another important winter wheat region. According to the NDVI development graphs, NDVI values were below average during the entire monitoring period. Temperature and radiation were above average (TEMP +1.1°C and RADPAR +1% respectively). Potential biomass was below average compared to the 15YA (BIOMSS -35%) mainly due to below-average rainfall (RAIN -65%). The VCIx was 0.83. The crop conditions in this region were below average, but better than in the other regions.

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 from April to early June, above average in mid-June, and below average from late June to July. Agro-climatic conditions include above-average temperature (TEMP +1.0°C) and radiation (RADPAR +4%), below-average rainfall (RAIN -44%) . Biomass was below average compared to the 15YA (BIOMSS -18%). The maximum VCI was favorable at 0.89. The crop conditions in this region were unfavorable.

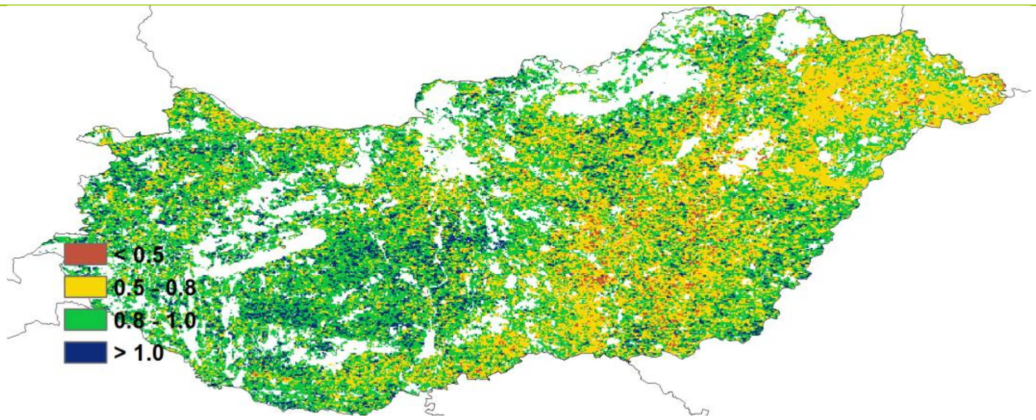
Figure 3.18 Hungary's crop condition, April -July 2022



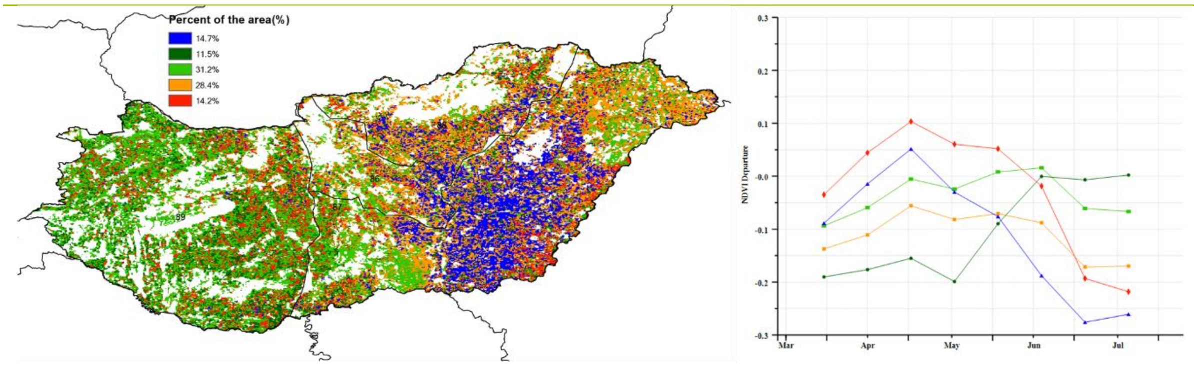
(a). Phenology of major crops



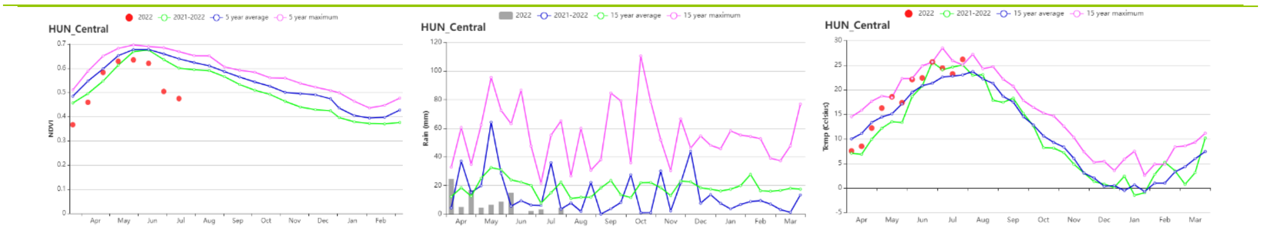
(b) Crop condition development graph based on NDVI, RAIN and TEMP



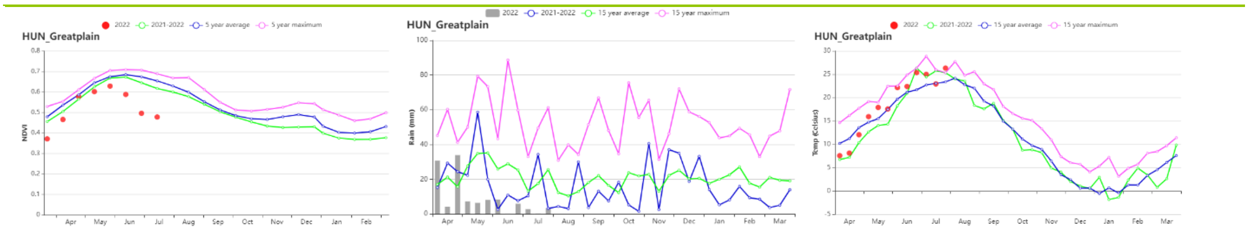
(c) Maximum VCI



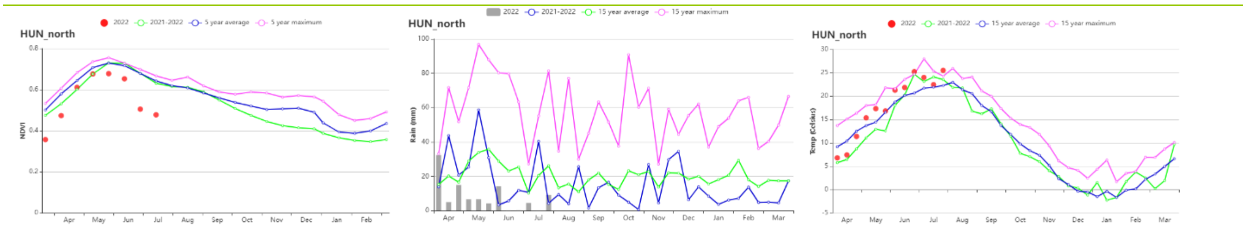
(d) Spatial distribution of NDVI profiles.



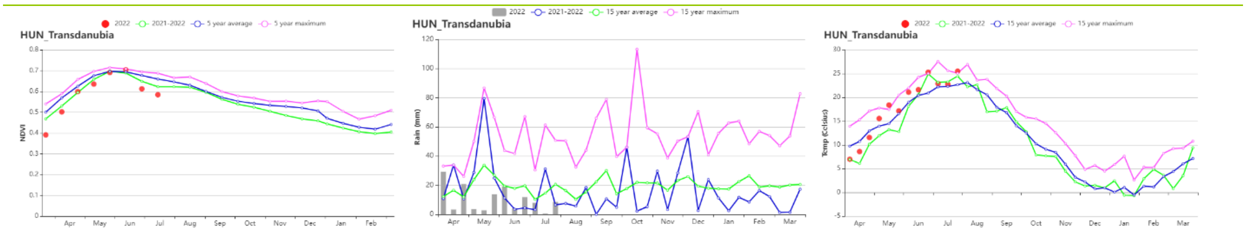
(e) Crop condition development graph based on NDVI, RAIN and TEMP



(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 3.28 Hungary's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, April -July 2022

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Central Hungary	91	-62	18.7	1.1	1361	3	560	-29
North Hungary	98	-65	17.9	1.1	1299	1	538	-35
The Puszta	111	-61	18.6	0.7	1362	4	583	-32
Transdanubia	126	-44	18.1	1.0	1388	4	623	-18

Table 3.29 Hungary's agronomic indicators by sub-national regions, current season's values and departure from 5YA, April-July 2022

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current (%)
Central Hungary	100	0	0.81
North Hungary	100	0	0.83
The Puszta	100	0	0.78
Transdanubia	100	0	0.89

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 rainy season maize in Java and Sumatra, and of the main rice was completed. It was followed by planting of the secondary rice and dry season maize.

The proportion of irrigated cropland in Indonesia is only 14.3% and rainfall conditions play a decisive role for most crops. CropWatch agroclimatic indicators show that the precipitation (RAIN -2%) was below average, while temperature (TEMP +0.2°C) and radiation (RADPAR +4%) were slightly above the 15YA, resulting in an increase of the BIOMSS by 4% compared with the 15YA.

NDVI clusters and profiles show that for 58.2% of the cropland, which was located in Palembang, Java and Semarang, the southeast of Sumatra, the western and southern of **Kalimantan**, the southern of Sulawesi, and Ambon, crop conditions were close to average and even higher than the 5YA in July. The crop conditions on 41.8% of arable land were below average in late-April and early-June respectively, but returned to normal in July.

Considering that all the arable land in Indonesia was cropped (CALF 100%), and the VCIx value was 0.95, the crop conditions are anticipated to be above average. The CPI index of all regions in Indonesia is greater than 1, and the agricultural production situation is good.

Regional analysis

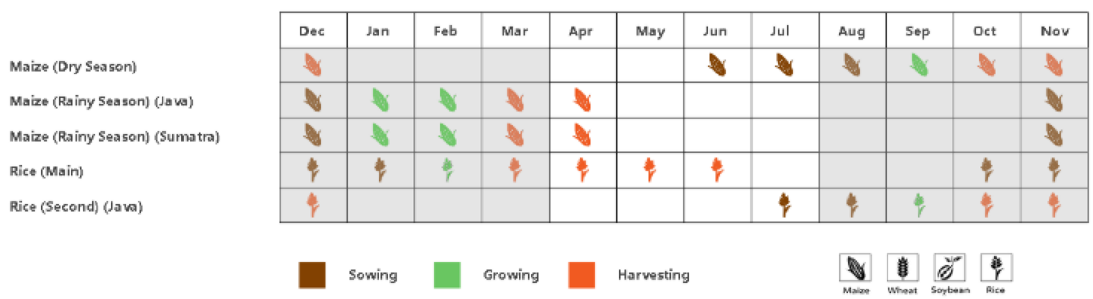
The analysis below focuses on four agro-ecological zones, namely **Sumatra** (92), **Java** (90, the main agricultural region in Indonesia), **Kalimantan and Sulawesi** (91) and **West Papua** (93), among which the former three are the most relevant for crop cultivation. The numbers correspond to the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

In **Java,** precipitation (RAIN +17%), temperature (TEMP +0.2°C) and radiation (RADPAR +2%) were all above the 15YA, resulting in an increase of BIOMSS (BIOMSS +11%). The NDVI development graphs show that crop conditions were close to average. Crop conditions in this region are anticipated to be above the average.

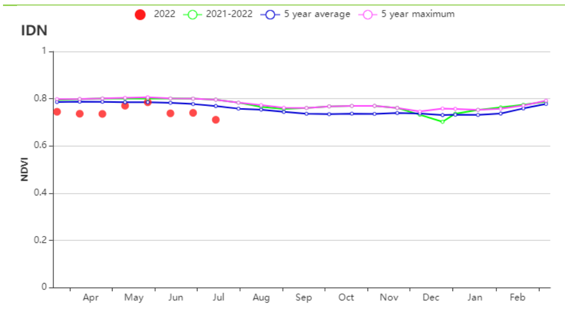
According to the agroclimatic conditions of **Kalimantan and Sulawesi,** precipitation (RAIN -1%) was below the 15YA, but temperature (TEMP +0.3°C) and radiation (RADPAR +4%) were above the average, which caused an increase in the potential biomass production (BIOMSS +4%). The NDVI development graphs show that crop conditions were below average. Overall, crop conditions in this region are expected to be slightly above the average.

In the **Sumatra** region, precipitation (RAIN +2%), temperature (TEMP +0.2°C) and radiation (RADPAR +1%) were all above the 15YA, which led to an increase in the potential biomass production by 4% compared to the 15YA (BIOMSS +4%). The NDVI development graphs show that crop conditions were below average in April, but close to average at other times. Crop conditions in **Sumatra** are assessed as to be above average.

Figure 3.19 Indonesia's crop condition, April – July 2022

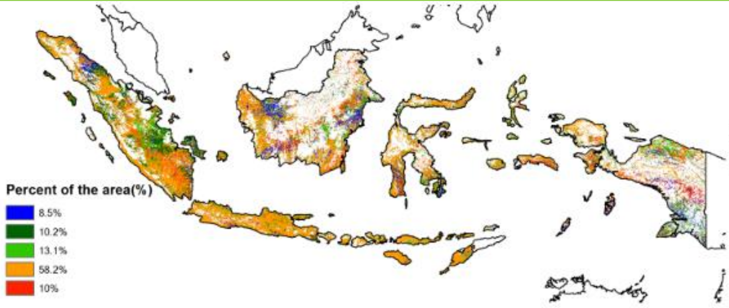


(a). Phenology of major crops

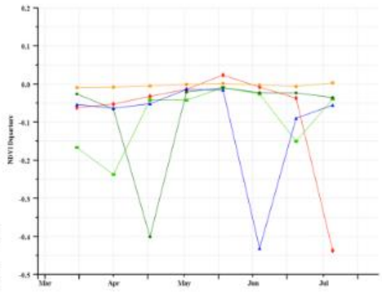


(b) Crop condition development graph based on NDVI

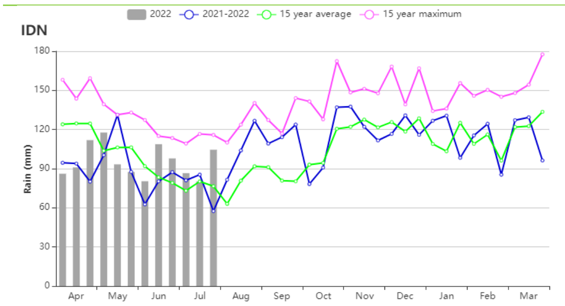
(c) Maximum VCI



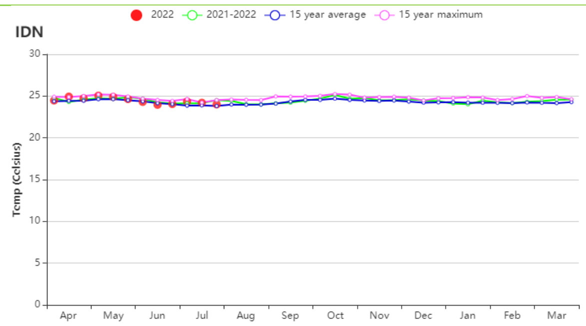
(d) Spatial NDVI patterns compared to 5YA



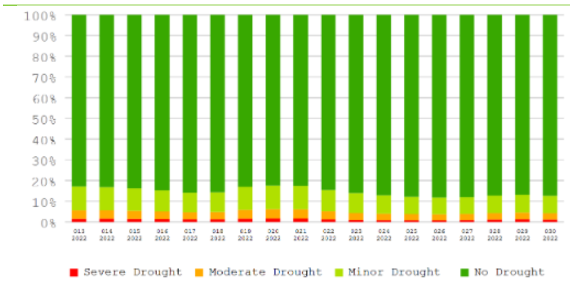
(e) NDVI profiles



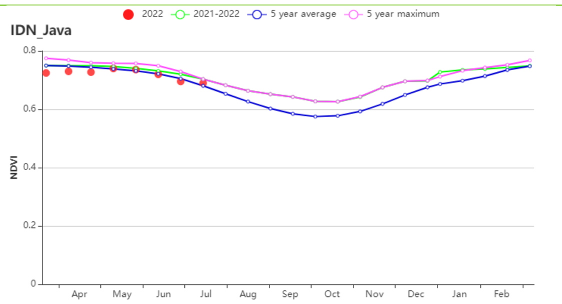
(f)Rainfall profiles



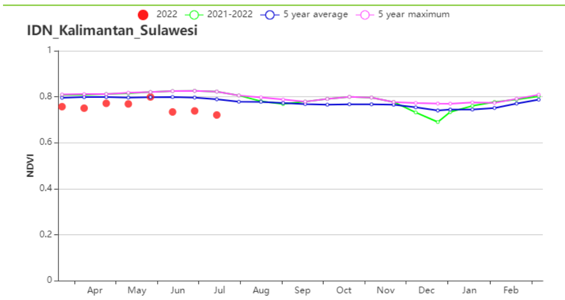
(g)Temperature profiles

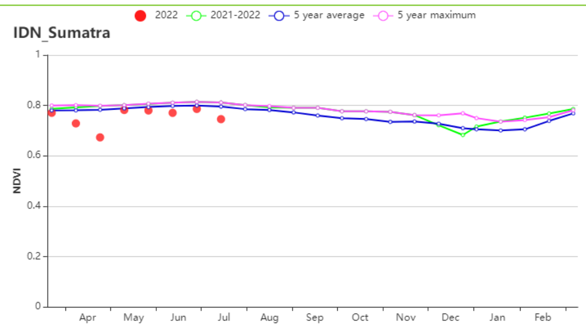


(h) Dynamic change of area proportion of different drought grades from April to July 2022



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





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

Table 3.30 Indonesia's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, April – July 2022

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m^2)	Departure (%)	Current (gDM/m^2)	Departure (%)
Java	735	17	25.0	0.2	1181	2	1149	11
Kalimantan and Sulawesi	1154	-1	24.8	0.3	1163	4	1476	4
Sumatra	1003	2	24.9	0.2	1156	1	1430	4
West Papua	1486	-9	23.4	0.3	989	10	1357	2

Table 3.31 Indonesia's agronomic indicators by sub-national regions, current season's values and departure from 5YA, April – July 2022

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Java	99	0	0.92
Kalimantan and Sulawesi	100	0	0.95
Sumatra	100	0	0.94
West Papua	100	0	0.96

[IND] India

The current monitoring period covers the harvest of rabi rice and wheat in April, as well as the subsequent sowing of maize, kharif rice and soybean. The graph of NDVI development shows that the crop conditions were close to or above the 5-year average before June. Presumably due to cloud cover in the satellite images, the NDVI shows a negative departure from the average trend starting in June.

The proportion of irrigated cropland in India is 50% and agro-meteorological conditions play an important role in the growth of almost half of the crops. The CropWatch agroclimatic indicators show that nationwide, TEMP and RADPAR were slightly above average, whereas RAIN was below the 15YA (-14%). The BIOMSS increased by 1% compared with the 15YA due to the abundant sunshine. The overall VCIx was low, with a value of 0.76. As can be seen from the spatial distribution, only parts of the southern and northern regions recorded high values. Most of India had low VCIx values. These spatial patterns of VCIx were thus generally consistent with those of NDVI. The southern and northern regions showed above-average crop conditions while the conditions were slightly below average in the central regions. The spatial distribution of NDVI profiles shows that before May, 45.1% of the areas had above-average crop conditions in the central and southern regions. CALF decreased by 8% compared to the 5YA. At the country level, conditions for crop production were close to normal.

Regional analysis

India is divided into eight agro-ecological zones: the Deccan Plateau (94), the Eastern coastal region (95), the Gangetic plain (96), the 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 Eastern coastal region, the Gangetic plain, Assam and north-eastern regions and Western coastal region showed similar trends in agricultural indices. Compared to the same period of previous years, RAIN had decreased significantly, especially in the Gangetic plain (-31%). The TEMP and RADPAR were slightly above average and BIOMSS was below the 15-year average. CALF differed among the four regions: It increased for the Eastern coastal region (+14%) and dropped for the Gangetic plain (-13%). The graph of NDVI development shows that the crop growth of the four regions was close to or above the 5-year average in most of the period. It is worth noting that the sharp drop in June in the Western coastal region was caused by cloud cover in the satellite images. Generally, the crop production is expected to be near average.

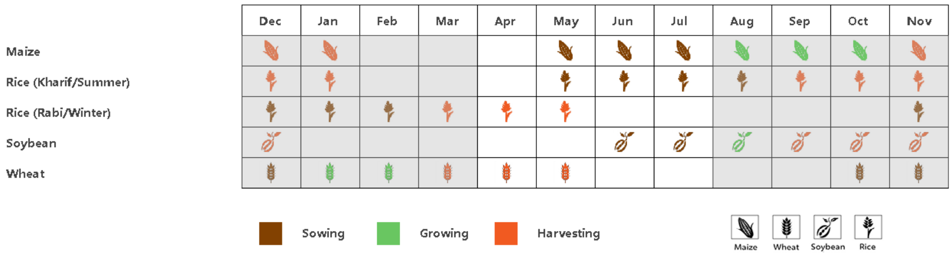
The Western Himalayan region recorded 224 mm of RAIN, which was significantly below average (-61%), whereas TEMP and RADPAR wer above average (+2.8°C, +7%). BIOMSS was significantly below the 15YA (-20%) due to the low rainfall. CALF was 90% which was the same as the 5-year average, and VCIx was 0.94. The graph of NDVI development shows that the crop growth of this region during the monitoring period was close to the 5-year average. Cloud cover in the satellite images caused the sharp drop in June. Generally, the crop production is expected to be close to average.

The Deccan Plateau recorded 623 mm of RAIN, which was close to average. TEMP was at 31.5°C (+0.4°C), and RADPAR was above the 15YA at 1321 MJ/m² (+5%). BIOMSS was slightly above the 15YA (+4%). CALF was 60% which was a decrease over the 5-year average, and VCIx was 0.64. The graph of NDVI development shows that the crop growth of this region during the monitoring period was close to the 5-year average before June, then below average. Generally, the crop production is expected to be close to but below average.

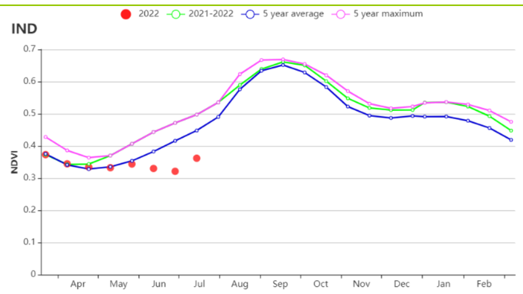
The North-western dry region recorded 481 mm of RAIN, which was significantly above the average (+201%). TEMP was near average, and RADPAR was slightly below the 15YA (-1%). BIOMSS was significantly above the 15YA benefitting from abundant rainfall (+34%). CALF was only 7% which was a significant decrease over the 5-year average, and VCIx was 0.58. The graph of NDVI development shows that the crop growth of this region during the monitoring period was close to the 5-year average in most months. Generally, the crop production is expected to be near average.

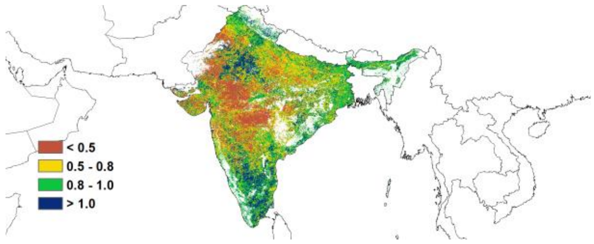
The agriculture areas in Rajastan and Gujarat recorded a significantly increased trend of RAIN. TEMP was near average, and RADPAR was slightly above the 15YA (+2%). BIOMSS was slightly above the 15YA (+14%). CALF was 46% which was a decrease over the 5-year average, and VCIx was 0.70. The graph of NDVI development shows that the crop growth of this region during the monitoring period was below the 5-year average in most months, but slightly below average after June. Generally, the crop production is expected to be below average.

Figure 3.20 India's crop condition, April- July 2022



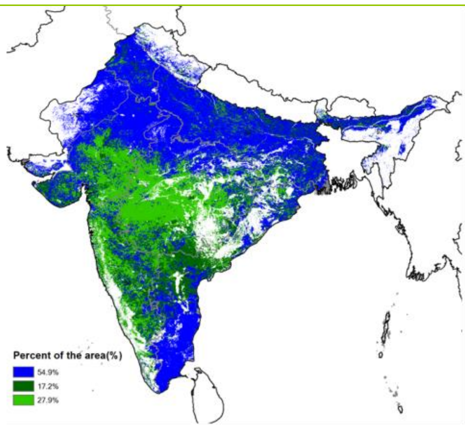
(a). Phenology of major crops

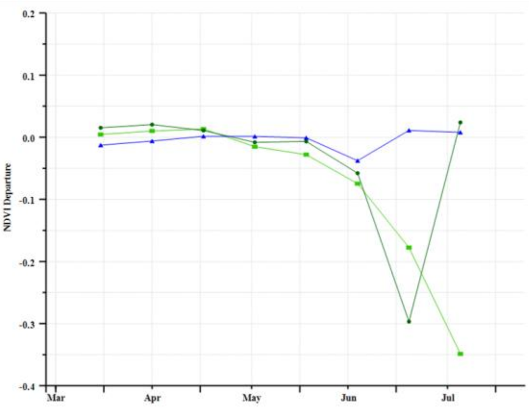




(b) Crop condition development graph based on NDVI

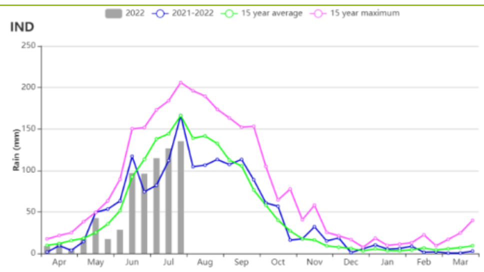
(c) Maximum VCI

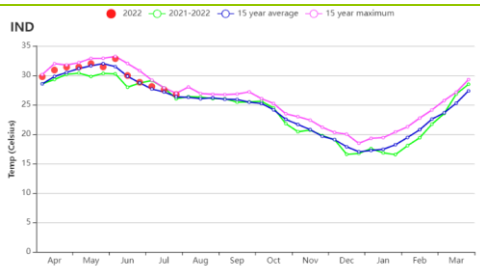




(d) Spatial NDVI patterns compared to 5YA

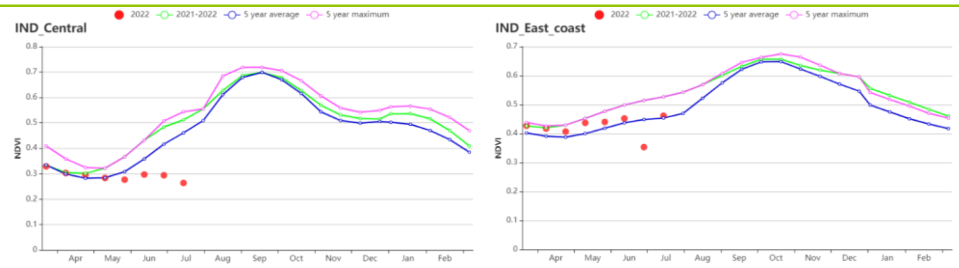
(e) NDVI profiles



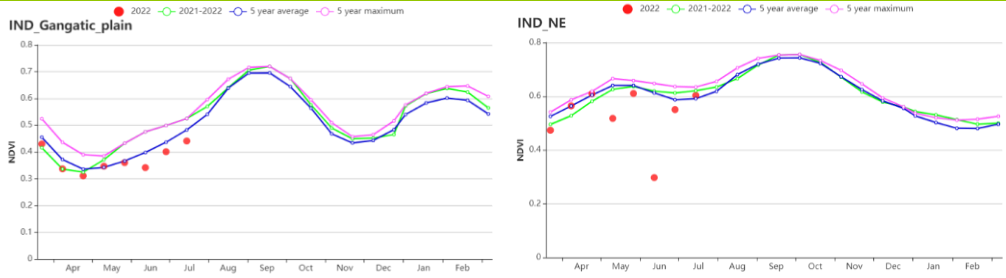


(f) Rainfall profiles

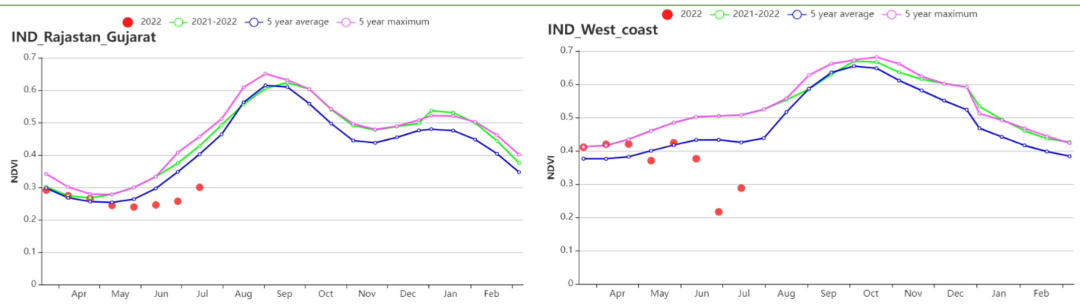
(g) Temperature profiles



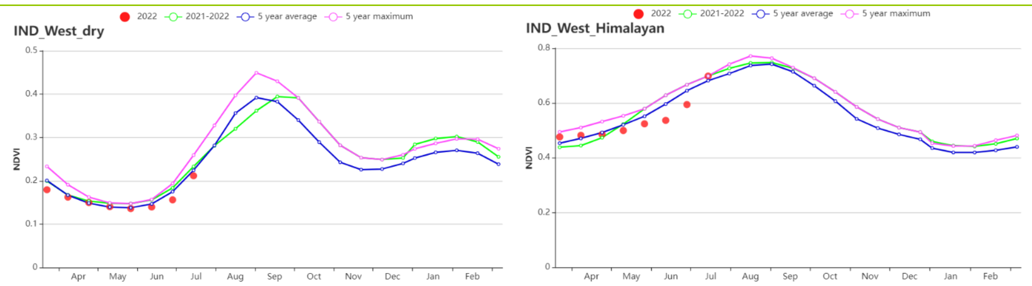
(h) Crop condition development graph based on NDVI (Deccan Plateau (left) and Eastern Coastal Region (right))



(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 3.32 India's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, April - July 2022

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Deccan Plateau	623	0	31.5	0.4	1321	5	985	4
Eastern coastal region	408	-27	30.3	0.4	1274	3	878	-9
Gangatic plain	431	-31	32.9	1.1	1418	5	938	-3
Assam and north-eastern regions	1855	-12	24.5	0.1	1135	3	1422	-1
Agriculture areas in	672	26	31.9	-0.1	1387	2	1012	14

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m^2)	Departure (%)	Current (gDM/m^2)	Departure (%)
Rajastan and Gujarat								
Western coastal region	801	-17	27.2	0.3	1218	3	1020	-2
North-western dry region	481	202	33.1	-0.4	1472	-1	928	34
Western Himalayan region	224	-61	23.0	2.8	1540	7	656	-20

Table 3.33 India's agronomic indicators by sub-national regions, current season's values and departure from 5YA, April-July 2022

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Deccan Plateau	60	-18	0.64
Eastern coastal region	80	14	0.90
Gangatic plain	73	-13	0.77
Assam and north-eastern regions	96	0	0.91
Agriculture areas in Rajastan and Gujarat	46	-19	0.70
Western coastal region	67	1	0.82
North-western dry region	7	-30	0.58
Western Himalayan region	98	0	0.94

[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 70 mm, which was 27% below average. However, excessive precipitation in late July had caused regional flooding. The average temperature was 21.9°C (0.5°C above average), whereas the photosynthetically active radiation was 1644 MJ/m^2 (1% above average). The potential biomass was 6% lower than the 15-year average. The national maximum vegetation condition index (VCIx) was 0.58, while the cropped arable land fraction (CALF) was 20% lower than the average of the past 5-year. The national Crop Production Index (CPI) was 0.9, indicating an unfavorable agricultural production situation.

The NDVI spatial patterns show that from April to July, crop conditions on 10.5% of the cropped areas were above the 5-year average (marked in blue). 22.1% of the cropped areas (marked in red) and 34% of the cropped areas (marked in light green), experienced close to average crop conditions almost throughout the monitoring period. The orange marked regions (23.2% of the cropped areas) experienced slightly below-average crop conditions from middle May to middle June, mainly located in Kordestan, Hamadan, Zanjan, Qazvin, Gilan and Mazandaran. The dark green marked regions (10.2% of the cropped areas), mainly located in Ardebil, Golestan, Ilam, and Fars, suffered from below-average crop conditions (negative NDVI departure bigger than 0.1) from the beginning of the monitoring period and then gradually recovered to near-average in early July. The spatial pattern of maximum Vegetation Condition Index (VCIx) was in accord with the spatial distribution of the NDVI profiles.

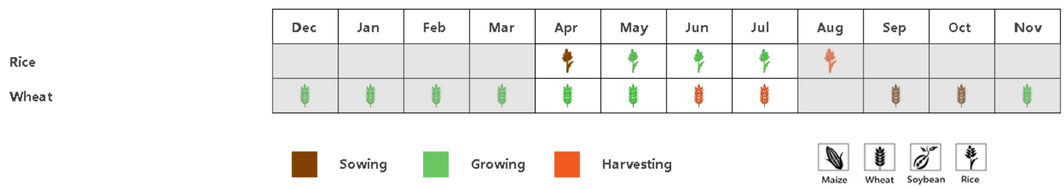
Regional Analysis

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**.

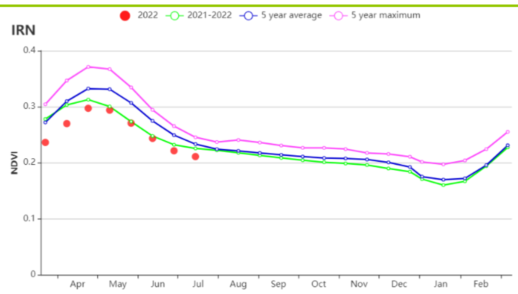
In the **Western and northern semi-arid subtropical hilly areas**, the cumulative precipitation during the monitoring period was 75 mm, 32% below average, the temperature was 20.0°C (+0.5°C), and photosynthetically active radiation was 2% above average. The potential biomass was 9% lower than the average. Crop conditions were below the 5-year average throughout the monitoring period. The proportion of cultivated land was 28%, which is 20% lower than the 5YA average. The average VCIx for this region was 0.62, indicating unfavorable crop conditions.

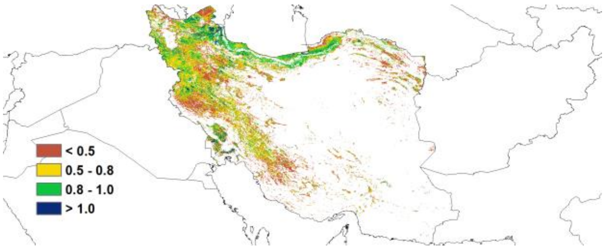
In the **Coastal lowland and plain areas of the arid Red Sea**, the temperature was 0.5°C above average, the accumulated precipitation was 102% above average and the photosynthetically active radiation was slightly below average (-1%). The potential biomass was 2% above the 15-year average. Crop conditions were below but near the 5YA average. During the monitoring period, CALF was 10% below the average of the last 5-years, and the VCIx was 0.49, also indicating poor crop prospects.

Figure 3.21 Iran's crop condition, April- July 2022



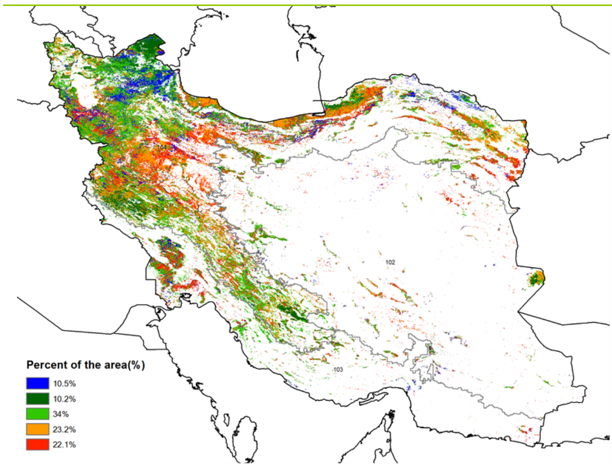
(a). Phenology of major crops

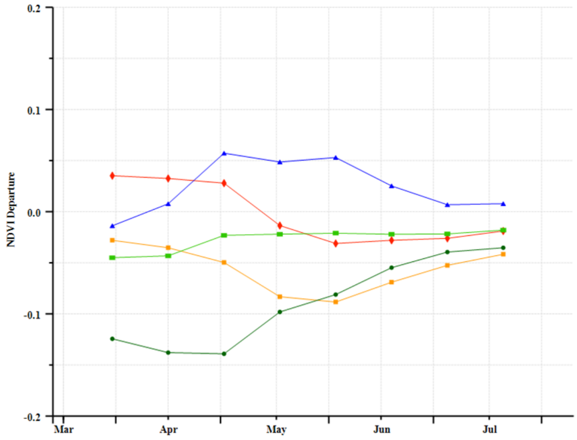




(b) Crop condition development graph based on NDVI

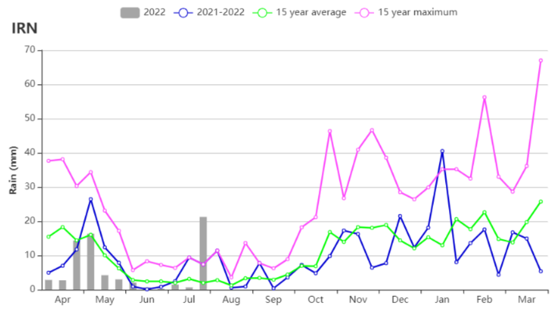
(c) Maximum VCI

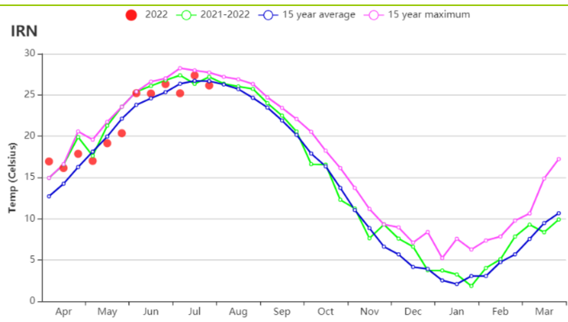




(d) Spatial NDVI patterns compared to 5YA

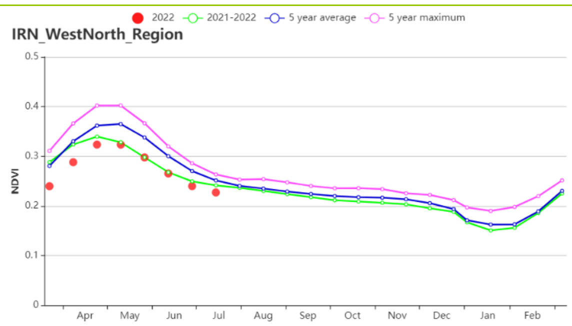
(e) NDVI profiles

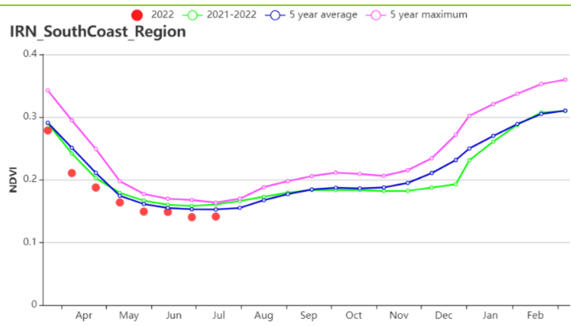




(f) Rainfall profiles

(g) Temperature profiles





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

Table 3.34 Iran's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, April - July 2022

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Semi-arid to sub-tropical hills of the west and north	75	-32	20.0	0.5	1637	2	563	-9
Arid Red Sea coastal low hills and plains	60	102	32.3	0.5	1638	-1	629	2

Table 3.35 Iran's agronomic indicators by sub-national regions, current season's values and departure from 5YA, April-July 2022

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Semi-arid to sub-tropical hills of the west and north	28	-20	0.62
Arid Red Sea coastal low hills and plains	11	-10	0.49

[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, NDVI values were below average in the entire monitoring period. At the national level, temperature (TEMP +1.6 ºC) was above average starting from mid-May. The solar radiation (RADPAR 3%) was above the 15YA. Rainfall was below average (RAIN -21%), although the levels during the wheat growing season (April and May) were near average, which resulted in a below-average biomass (BIOMSS -4%). CALF was 99%, and VCIx was 0.81. 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. Crop Production Index (CPI) was 1.00, which means agricultural production situation is average. The proportion of irrigated cropland in Italy is 39.7%. In summary, the overall crop conditions during this period were slightly below average, as indicated by below average NDVI trends.

About 12.4% of the crops, mainly located in the Po Valley (mainly in Piemonte, Lombardia and Veneto), showed a positive departure from the 5YA in April and May, but were below average in June and July. 64.5% of arable land experienced below-average crop conditions, scattered in Puglia, Umbria, Puglia and Abruzzi. About 23.1% of arable land (mainly in Piemonte, Lombardia and Veneto) experienced below-average crop conditions from early April to mid-April, above-average conditions from late April to late May, and below-average conditions in June and July.

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.

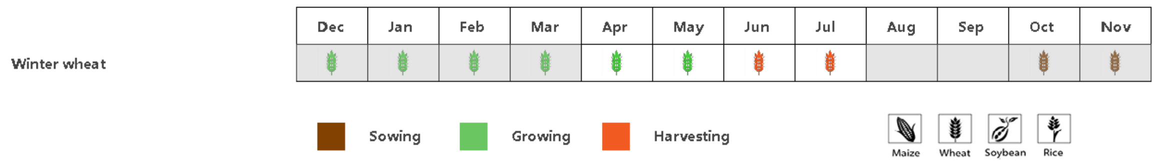
East coast (mainly in Puglia, Marche and Abruzzi) experienced below-average rainfall (RAIN -33%), above-average temperature (TEMP +1.1°C) and solar radiation (RADPAR +2%). Temperature was above average mainly due to the higher values during the harvesting period, which had little effect on yield formation. The potential production showed a decrease (BIOMSS -11%) mainly due to the lower rainfall. VCIx was 0.80. The CPI was 1.04. The crop condition development graph indicates that NDVI was below average in the entire monitoring period. 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 lower rainfall (RAIN -13%) and above-average temperature (TEMP +1.7°C) and solar radiation (RADPAR +3%). BIOMSS was above the 15YA by 4% and VCIx reached 0.77. The CPI was 0.95, which meant the agricultural production situation was slightly below average. The crop condition development graph indicates below-average conditions during the entire reporting period. According to the agro-climatic indicators, a near-average output can be expected.

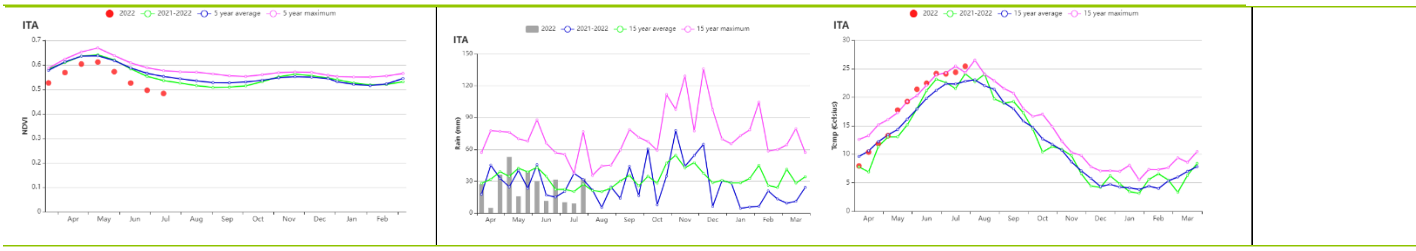
The **Islands** recorded a below-average precipitation (RAIN -24%) with above-average temperature (TEMP +1.4°C). RADPAR was average. BIOMSS decreased by 4% compared with the 15YA. VCIx was 0.86. The CPI was 1.07. NDVI was below average in April, above average in May, and below average in June and July. The crop production in this region is expected to be close to average.

In **Western Italy**, RAIN (RAIN -35%) was below average. The solar radiation (RADPAR +4%) and TEMP (TEMP +1.7°C) were above average. Biomass decreased in this region (BIOMSS -12%) mainly due to the lower rainfall in mid-April and mid-May of growing season. The NDVI was below average in the entire monitoring period. VCIx reached 0.82. The CPI was 1.03. Close-to-average wheat crop production can be expected.

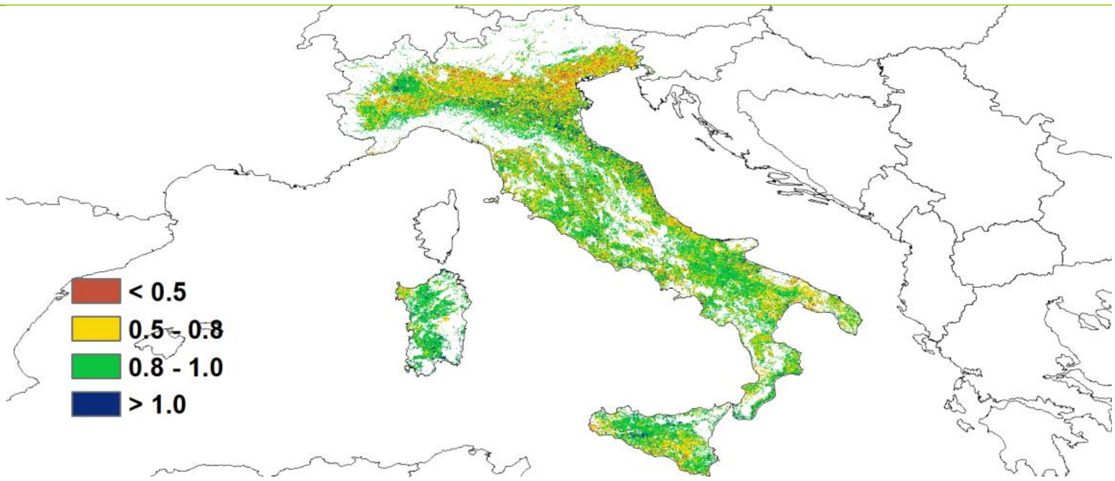
Figure 3.22 Italy's crop condition, April 2022-July 2022



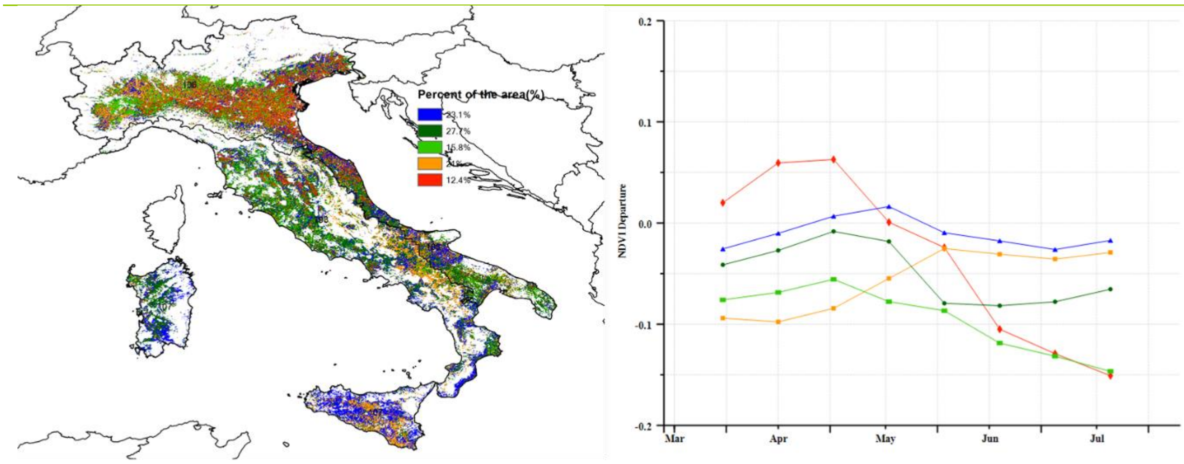
(a). Phenology of major crops



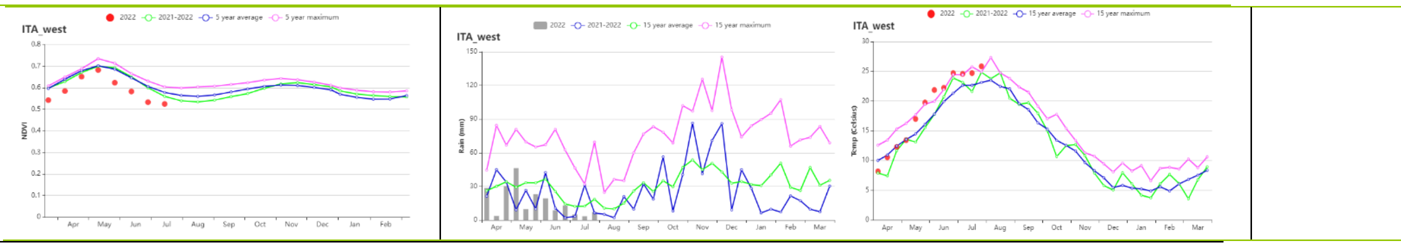
(b) Crop condition development graph based on NDVI, RAIN and TEMP (Italy).



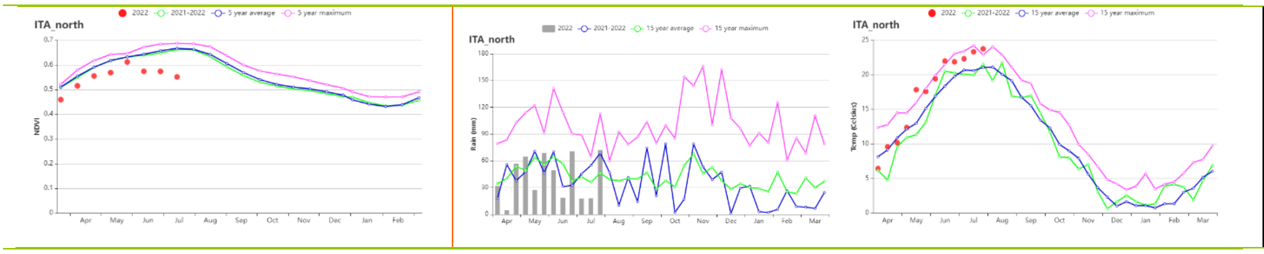
(c) Maximum VCI



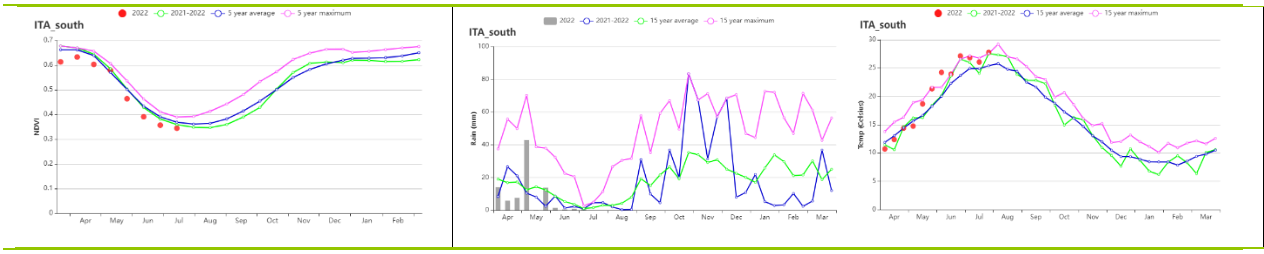
(d)Spatial distribution of NDVI profiles.



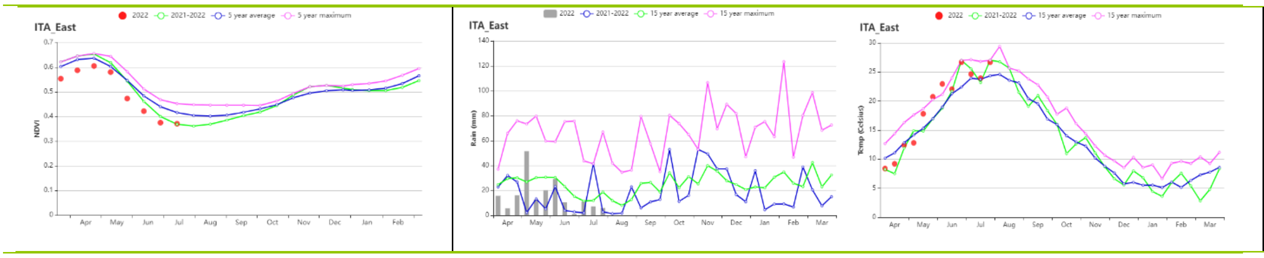
(e) Crop condition development graph based on NDVI, RAIN and TEMP (East Italy).



(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 3.36 Italy's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, April -July 2022

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
East coast	187	-33	19.0	1.1	1464	2	725	-11
Po Valley	500	-13	17.2	1.7	1379	3	968	4
Islands	88	-24	20.7	1.4	1540	0	598	-4
Western Italy	197	-35	18.8	1.7	1478	4	723	-12

Table 3.37 Italy's agronomic indicators by sub-national regions, current season's values and departure from 5YA, April - July 2022

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current (%)
East coast	97	-1	0.80
Po Valley	100	0	0.77
Islands	96	-2	0.86
Western Italy	100	0	0,82

[KAZ] Kazakhstan

Spring wheat was cultivated in most of the country during this monitoring period in Kazakhstan. Sowing took place in May and harvest will start in mid-August. Crop production in Kazakhstan is mostly rainfed, as only 3% of the cropland is under irrigation.

Compared to the 15-year average, accumulated rainfall and temperature was above average (RAIN +38%, TEMP +0.3°C), while the radiation was close to average. The dekadal precipitation was above average from May to July and exceeded the 15-year maximum in late May and mid-June. The abundant rainfall and warm temperature resulted in an increase in the BIOMSS index by 14%.

However, the national average maximum VCI index was 0.77 and the Cropped Arable Land Fraction (CALF) was below average by 6%. The spatial VCIx map mostly matched well with the national crop condition development graphs. About 71.9% of croplands experienced slightly below average crop conditions from late April to July. About 15.6% of croplands, which were distributed in most areas of the Batysdy Kazakstan and Aktube states in northwest region, and some areas of Almaty state in east region, experienced favorable crop conditions throughout the entire monitoring period. The crop conditions in the 12.5% croplands, distributed in some areas of Kostanay, Akmola and Soltustik Kazakhstan states, were below average from April to early June and returned to above average from late June to July.

According to the agro-climate and agronomic indicators of CropWatch, the output of spring wheat in this season is estimated to be favorable, yet the acreage might have been reduced as compared to last year.

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. The accumulated precipitation and temperature were above average (RAIN +33%, TEMP +0.2°C), while RADPAR was below average (-2%). The rainy weather resulted in an increase of BIOMSS by 14%. According to NDVI profiles, crop conditions trended below the 5YA, but surpassed last year's level by the end of this monitoring period. The average VCIx for this region was 0.76, and the proportion of cultivated land was 7% lower than the average. The spring wheat production is estimated to be lower than the five-year average, but is higher than last year.

In the **Eastern plateau and southeastern region**, the average rainfall and temperature were above average (RAIN +43%, TEMP +0.1°C). The abundant rainfall led to an increase of potential biomass by 12%. Crop development, as indicated by the NDVI closed to the 5YA in late May and then dropped to below last year's levels. The average VCIx for this region was 0.84, and CALF was below average by 3%. Output for spring wheat is estimated to be below average.

The **South region** had the largest precipitation departure (RAIN +99%) among the three regions. The temperature was above average (TEMP +1.3°C), while the solar radiation was below average (RADPAR -3%). The combination of agro-climatic indicators resulted in an increase of the BIOMSS index by 21%. The average VCIx for this region was 0.68 and CALF was below average by 11%. The NDVI profiles show below-average conditions from April to July. The heavy rainfall in this region might have had a negative impact on crop growth.

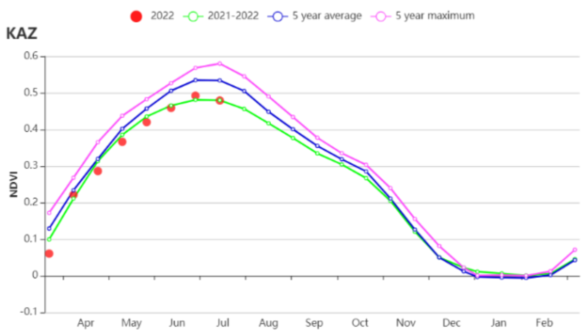
Figure 3.23 Kazakhstan's crop condition, April – July 2022

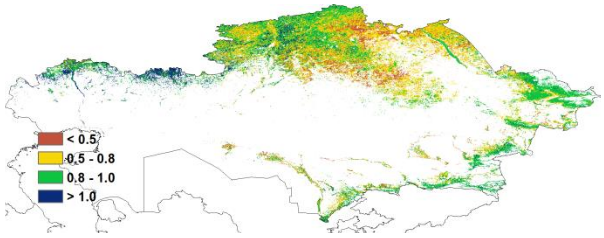
	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
Wheat (Spring)												

Sowing Growing Harvesting

Maize Wheat Soybean Rice

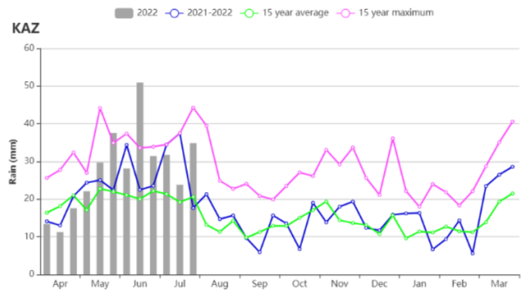
(a). Phenology of major crops

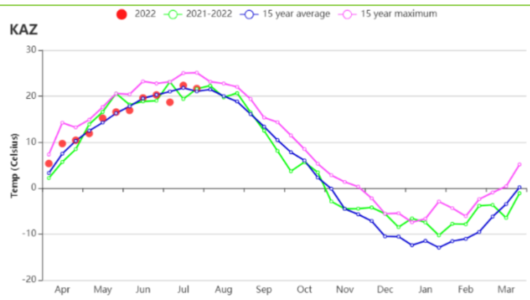




(b) Crop condition development graph based on NDVI

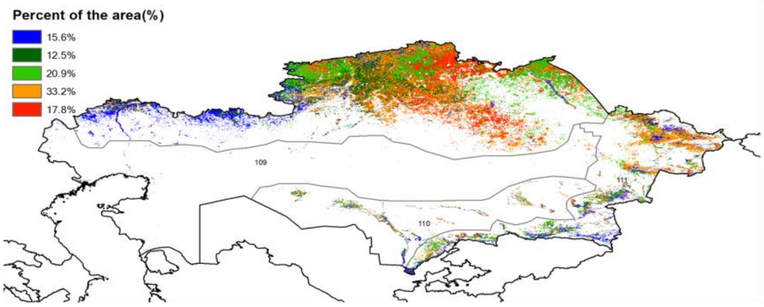
(c) Maximum VCI

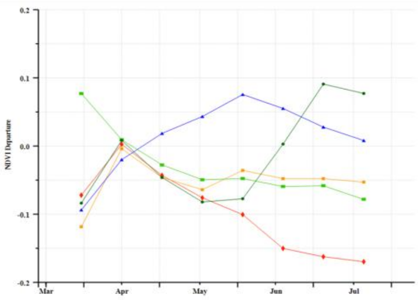




(d) Rainfall profiles

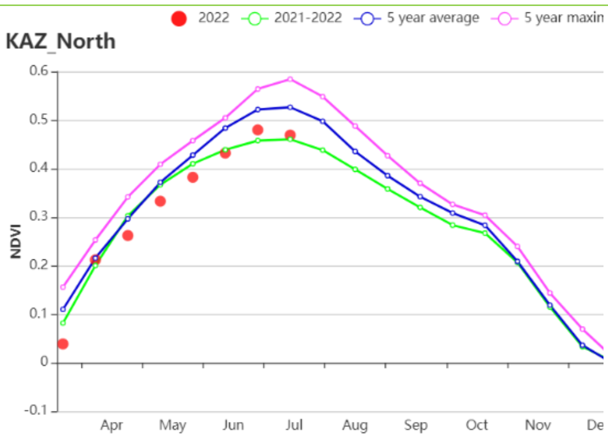
(e) Temperature profiles

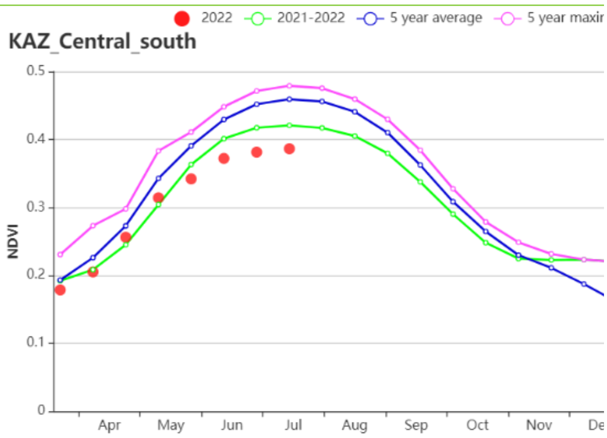




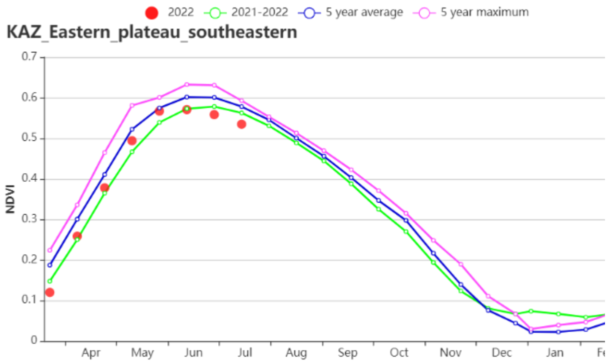
(f) Spatial NDVI patterns compared to 5YA

(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 3.38 Kazakhstan agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, April - July2022

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Northern region	280	33	15.4	0.2	1244	-2	788	14
Eastern plateau and southeastern region	490	43	15.0	0.1	1416	0	828	12
South region	198	99	23.7	1.3	1464	-3	783	21

Table 3.39 Kazakhstan, agronomic indicators by sub-national regions, current season's values and departure from 5YA, April - July 2022

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Northern region	76	-7	0.76
Eastern plateau and southeastern region	89	-3	0.84
South region	54	-11	0.68

[KEN] Kenya

Kenya experiences two rainy seasons. The long rains last from March to late May and the short rains from late October to December. Maize can be grown during long and short rains, while wheat is grown only during long rains. This report for the monitoring period from April to July 2022 covers the sowing and early growing stage of long rain maize and wheat.

At the national scale, precipitation was 272 mm, 57% below average. The weather was slightly warmer and RADPAR was close to the 15YA (TEMP +0.6°C, RADPAR +3%). The BIOMSS was 22% lower than average due to insufficient rainfall. According to the national rainfall profiles, Kenya has low overall precipitation and severe drought, with the 10-day cumulative rainfall in early April and mid-May showing significantly lower conditions than the 15YA. At the sub-national level, all regions received less rainfall, and the Southwest region had the largest negative departure in rainfall compared with the 15YA (RAIN -71%).

The NDVI development graph at the national level shows that the NDVI values from April to July were below average. Crop growth conditions were significantly below average, mainly due to the drought conditions. Based on the NDVI clusters and the corresponding NDVI departure profiles, only the western part of Kenya (red area), which accounts for 45.5% of the country's cultivated land, has near-average NDVI values. And eastern Kenya accounting for 12.9% of national cropland (areas in light green color) had significantly below-average values, with up to 0.2 negative NDVI departures. This agreed with the maximum VCI graph which shows relatively low VCI between 0.5 and 0.8 in the eastern regions. The national average VCI value reached 0.76, and the cropped arable land fraction was reduced by 6% compared to the 5YA. The proportion of irrigated cropland in Kenya is only 11% and agro-meteorological conditions play a decisive role in the growth of most crops. In general, crops in Kenya were severely affected by the drought, with the exception of the eastern coastal region.

Regional analysis

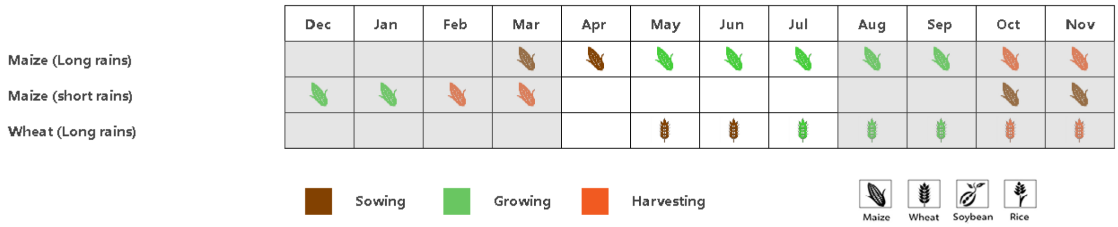
Based on cropping systems, climatic zones, and topographic conditions, four sub-national agro-ecological regions can be distinguished for kenya: the Eastern coastal region (113), the Highland agriculture zone (114) and Northern region (115) and the Southwest region (116).

The **Eastern coastal region** had the minimum negative deviation in rainfall (-9%), 0.5°C above average temperature and unchanged RADPAR. The shortage of rainfall resulted in a significant drop of NDVI compared with the 5YA in April but the BIOMSS was unchanged. The drought conditions also hampered the sowing of crops as indicated by a 16% drop in CALF compared to the 5YA. The maximum VCI was normal at 0.68. Overall, the situation in the coastal areas was unfavorable.

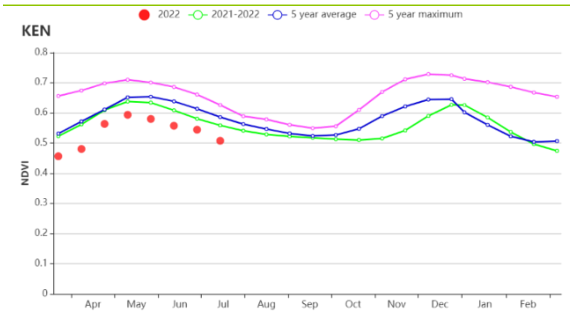
In the **Northern region**, precipitation was significantly below average at 183 mm, decreasing by 59%. The temperature was close to the 15YA (+0.8°C), while RADPAR was above average (+2%). BIOMSS was below average (-24%). The maximum VCIx value was low (0.59). The below-average trend of its crop condition development graph indicates that the area was affected by drought between April and July. The sowing of long rain maize and wheat was delayed. In addition, CALF decreased (-23%) to 62%. In general, the region experienced a substantial reduction in rainfall, biomass, and CALF. This indicates that the region was severely affected by the drought.

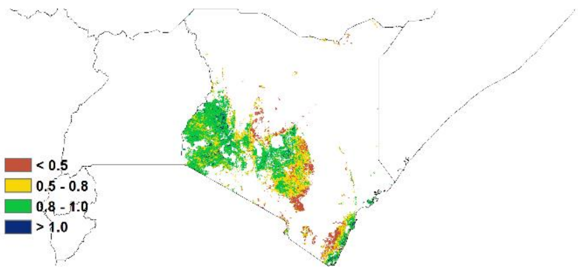
The largest negative departure in RAIN (-71%) was observed in the **Southwest region**, where the BIOMSS decreased by 34%. The TEMP was 0.7°C above average with unchanged RADPAR and CALF. And the NDVI curve was close to the 5YA with a VCIx value of 0.86. These indicators point to below, yet close to average conditions for this region.

Figure 3.24 Kenya's crop condition, April- July 2022

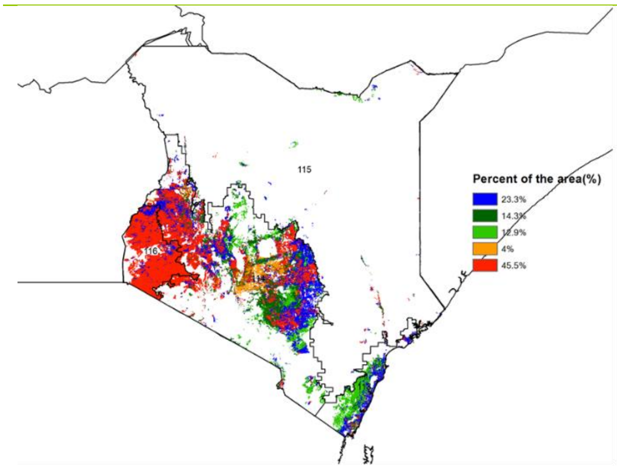


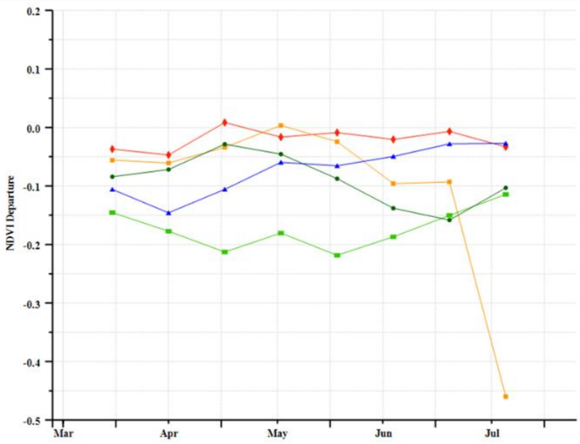
(a) Phenology of major crops



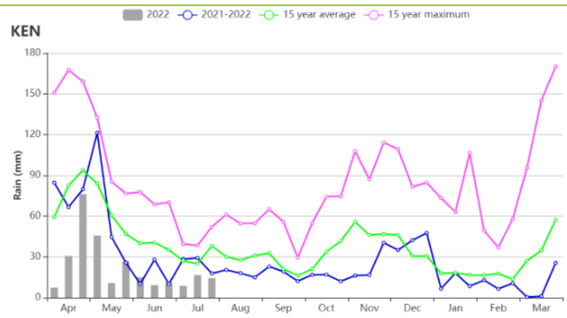


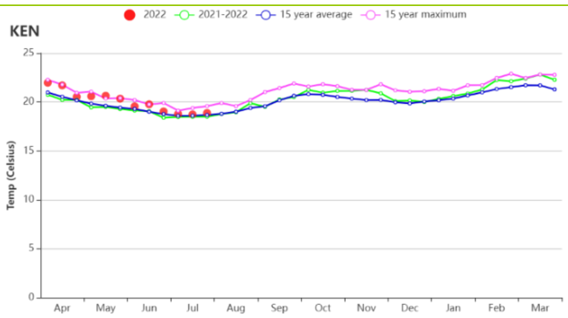
(b) Crop condition development graph based on NDVI (c) Maximum VCI



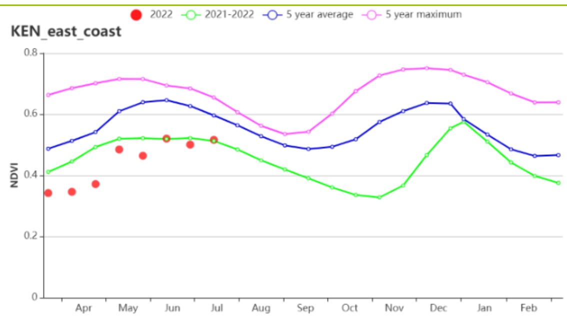


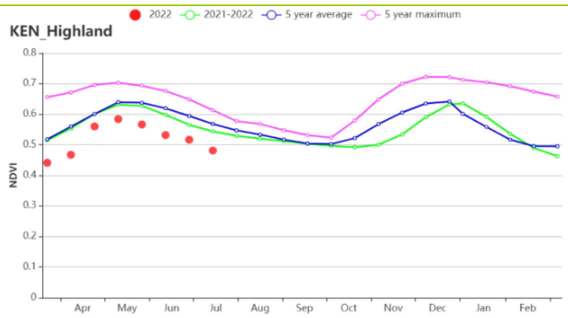
(d) Spatial NDVI patterns compared to 5YA (e) NDVI profiles



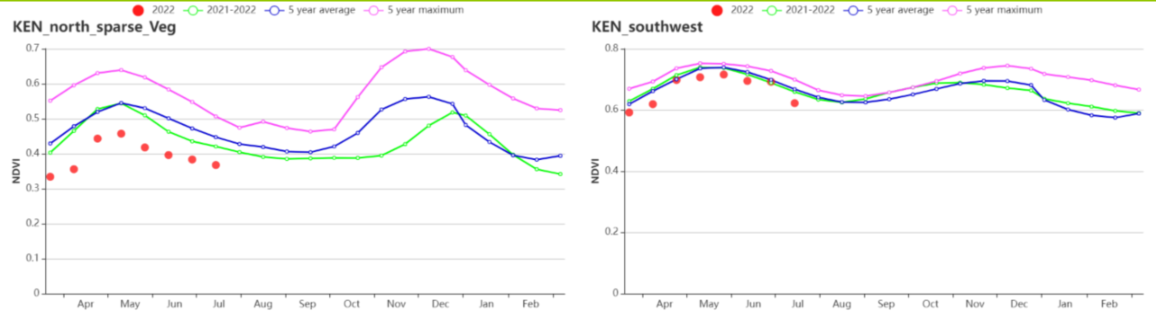


(f) Rainfall profiles (g) Temperature profiles

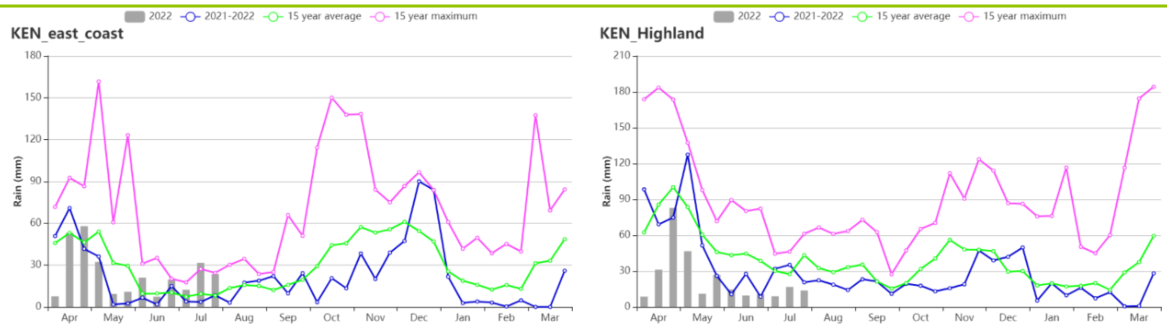




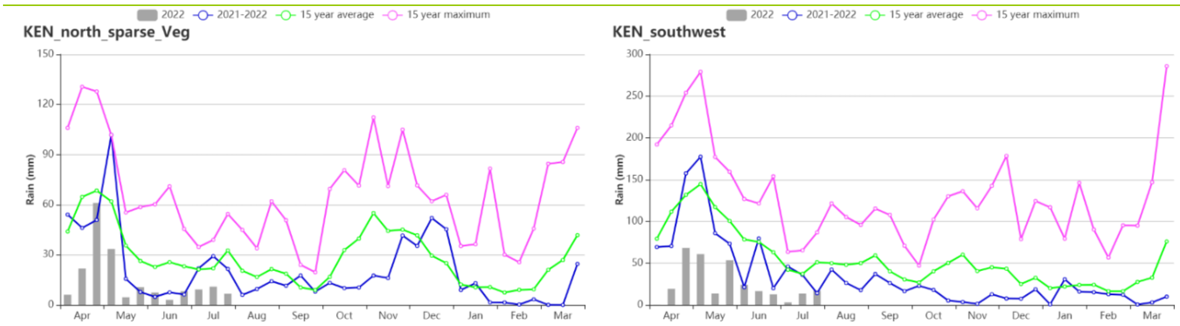
(h) Crop condition development graph based on NDVI, The eastern coastal region (left), The Highland agriculture zone (right)



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



(j) Time series rainfall pofile, The eastern coastal region (left), the Highland agriculture zone (right)



(k) Time series rainfall pofile, the northern region with sparse vegetation (left), South-west (right)

Table 3.40 Kenya's agro-climatic indicators by sub-national regions, current season's values and departure from 15YA, April-July 2022

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m2)	Departure (%)	Current (gDM/m2)	Departure (%)
Coast	286	-9	25.4	0.5	1150	0	929	0
Highland agriculture zone	281	-57	18.7	0.6	1138	4	669	-24
nothern rangelands	183	-59	23.4	0.8	1220	2	679	-24
South-west	303	-71	19.4	0.7	1172	0	787	-34

Table 3.41 Kenya's agronomic indicators by sub-national regions, current season's values and departure, April-July 2022

Region	Cropped arable land fraction		Maximum VCI	Crop Production Index (CPI)
	Current (%)	Departure (%)	Current	

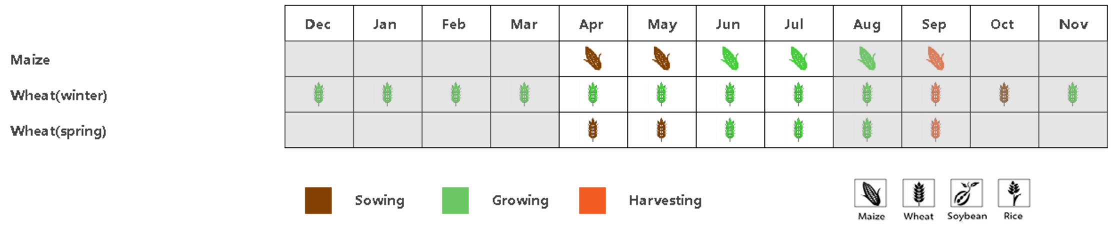
Coast	81	-16	0.68	1.04
Highland agriculture zone	90	-5	0.76	1.06
nothern rangelands	62	-23	0.59	1.02
South-west	100	0	0.86	0.94

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 SYR THA TUR UKR USA UZB VNM ZAF ZMB

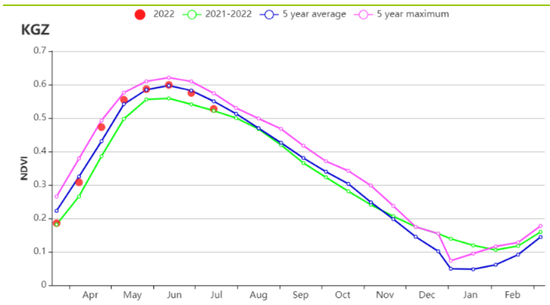
[KGZ] Kyrgyzstan

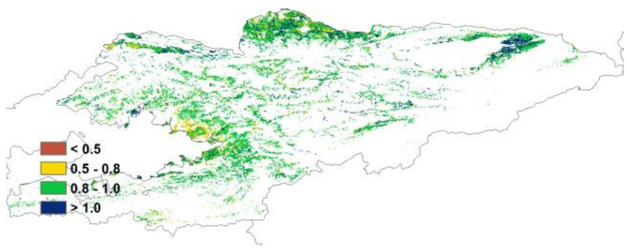
This reporting period covers the sowing and growing stages of maize, and the growth and harvest of wheat. Among the CropWatch agro-climatic indicators, RAIN (+14%) and RADPAR (+2%) were above average, while TEMP (-0.3℃) was slightly below average. The combination of the factors resulted in an above-average BIOMSS (+3%) compared to the 15YA. As we can see from the time series of rainfall profile, the precipitation was above the 15-year average from early May to late June. From the time series temperature profile, the temperature was only higher than the 15YA in early and middle April, early May, and late July. The lower temperature was favorable for pastures. The nationwide crop conditions were around average throughout the whole monitoring period. The spatial NDVI clustering profile shows that 13.4% of the cropped areas (marked in dark green) enjoyed near to substantially above-average crop conditions during the whole monitoring period (especially the positive NDVI departure by almost 0.2 in early May). Light green marked regions (17.1% of the cropped areas) had slightly below-average crop conditions throughout the whole monitoring period, mainly distributed in some parts of Jala-Abad, Naryn and Osh. Orange marked regions (15.7% of the cropped areas) had below-average crop conditions at the beginning of the monitoring period and recovered to near average from middle April on, mainly distributed in southern Jala-Abad and northern Osh. The remaining regions had approximately near average crop conditions during the whole monitoring period. The spatial pattern of maximum Vegetation Condition Index (VCIx) was in accord with the spatial distribution of the NDVI profiles. CALF increased by 1% and the nationwide VCIx average was 0.91. Crop conditions in Kyrgyzstan can be assessed as favorable. Above-average wheat yields should be expected. Maize harvest will start in September.

Figure 3.25 Kyrgyzstan's crop condition, April- July 2022

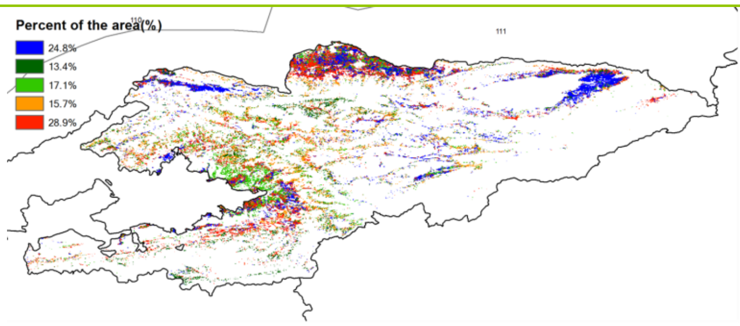


(a). Phenology of major crops

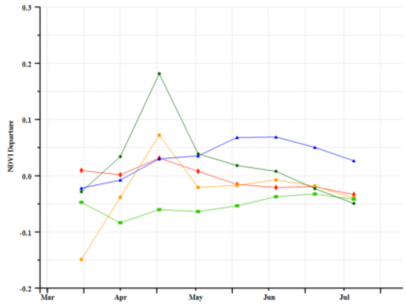




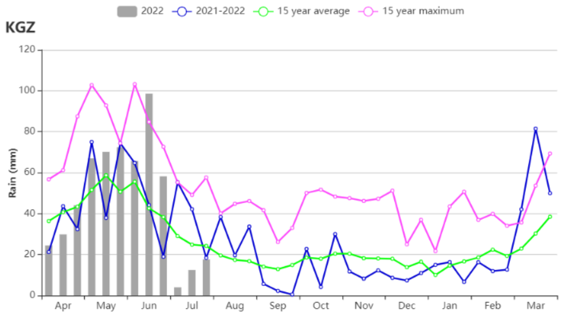
(b) Crop condition development graph based on NDVI (c) Maximum VCI



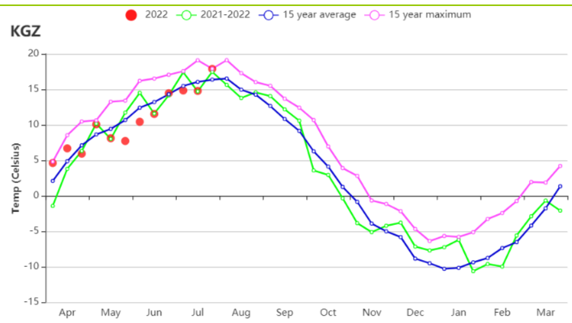
(d) Spatial NDVI patterns compared to 5YA



(e) NDVI profiles



(f) Rainfall profiles



(g) Temperature profiles

Table 3.42 Kyrgyzstan's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, April - July 2022

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (℃)	Departure (℃)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Kyrgyzstan	564	14	10.6	-0.3	1495	2	709	3

Table 3.43 Kyrgyzstan's agronomic indicators by sub-national regions, current season's values and departure from 5YA, April-July 2022

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Kyrgyzstan	97	1	0.91

[KHM] Cambodia

Cambodia has gradually entered its wetter season since April, when the harvest of dry-season early rice and dry-season maize were finished. Both the sowing of wet-season early rice and wet-season maize began in May, which was followed by the sowing of floating rice and medium rice starting in June. Soybean had reached maturity at the end of this period.

During this monitoring period, Cambodia experienced wetter and relatively cooler weather conditions. Compared to the 15YA, the precipitation in Cambodia was higher (RAIN +9%) , while the average temperature was slightly cooler (TEMP + 0.6℃). Abundant precipitation and more sunshine (RADPAR, +6%) with average temperature are generally beneficial to the crop growth and biomass accumulation, which resulted in a higher potential biomass (BIOMSS +5%). As the NDVI profile shows, NDVI kept staying at a 5-year maximum level before mid-April, indicating favorable growth conditions for dry-season rice and dry-season maize. However, the crop NDVI was lower than average in mid-June, which could partly be a consequence of the rainy and cloudy weather, as well as of cloud cover in the satellite images. The spatial assessment of NDVI dynamics revealed four patterns: 1) about 35.8% cropland (in light green color) showed favorable crop conditions during this monitoring period. These regions were mainly located on western Pursat, Kampong Chhnang, and Kampong Speu. 2) Around 27.7% of cropland (in blue and red color) had an above-average NDVI before mid-May, followed by a below-average NDVI, indicating relatively poor conditions for rain-season rice and maize. The sudden decline over the blue-color regions in early July was the result of clouds in the satellite images. 3) Around 26.7% of cropland experienced near average NDVI during the monitoring period, indicating normal crop conditions. These regions were mainly located in the lower Mekong River basin, which is the major crop planting area in Cambodia. 4) About 9.9% of cropland (in dark green color) experienced poor crop conditions, which were mainly located in Banteay Meanchey and southern Takéo.

In conclusion, at the national scale, the agro-climatical indicators imply generally favorable weather conditions and water supply from the Mekong River. Negative departures in the NDVI maps can be attributed to cloud cover in the satellite images. The VCI value was as high as 0.89 and the CALF index slightly increased by 3%, also indicating favorable conditions. All in all, conditions in Cambodia can be assessed as normal.

Regional analysis

Based on cropping systems, climatic zones, and topographic conditions, four sub-national regions are described below: **The Tonle Sap Lake area** (agro-ecological zone number 117), a seasonally inundated freshwater lake which is influenced by the inflow and outflow from the Mekong River; **the Mekong valley** between Tonle Sap and Vietnam border (number 118); **Northern plain and northeast** (number 119); and the **Southwest Hilly region** (number 120) along the Gulf of Thailand coast.

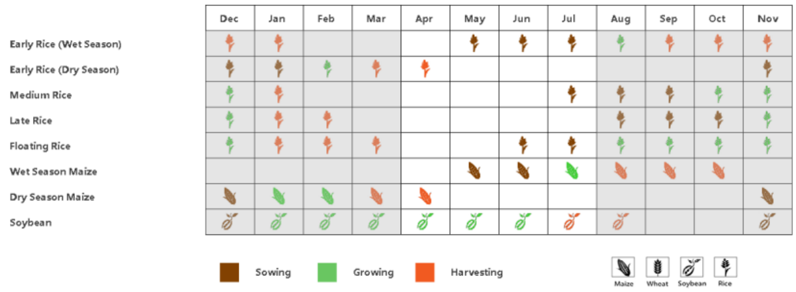
For **Tonle Sap Lake region**, the region experienced 11% higher cumulative precipitation, 0.7℃ lower average temperature, and about 4% higher radiation, resulting in a 3% higher potential biomass. However, the crop NDVI in this region had stayed below average since late-April, which could be the result of increased rainfall. Abundant precipitation may have delayed the sowing of rice and maize, leading to a lower NDVI. As NDVI departure cluster graph shows, the poor crop growth was mainly located in the eastern bank of Tonle Sap Lake (in red color), which only accounts for a small part. In addition, the CALF index is at 96% and the VCIx value is 0.88. The crop growth condition was normal.

For **Mekong Valley region**, the precipitation was significantly higher by 17%, the average temperature was about 0.4℃ lower, radiation was 7% higher, and abundant precipitation resulted in a higher potential biomass (+7%). NDVI in this region was higher than average before early May, indicating a favorable production for dry-season crops. However, the NDVI declined in mid-June and stayed below average, indicating a relatively poor growth for rainy season crops. The poor condition mainly appeared in the eastern part (in blue and red color) of this region. The CALF index for this region was at 96% and the VCIx value was as high as 0.90. Crop conditions were close to normal.

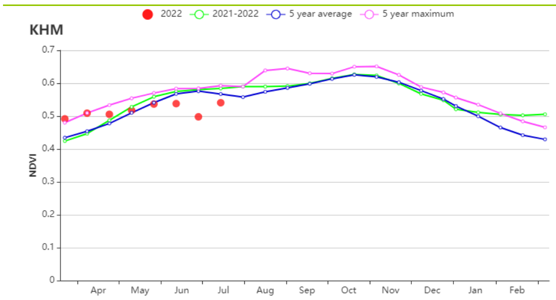
For **Northern plains and Northwest region**, the zone had an 2% higher cumulative precipitation, about 0.6℃ lower average temperature, and about 8% higher radiation, resulting in a potential biomass increase by about 5%. Similar to Mekong Valley region, the crop NDVI was above average before mid-May and below average since mid-June. The sowing of rain-season crop may have been delayed by the increased precipitation as well. Furthermore, the NDVI development showed some anomalies, presumably due to cloud cover in the satellite images. The CALF index in this region is 99% and the VCIx value was as high as 0.93.

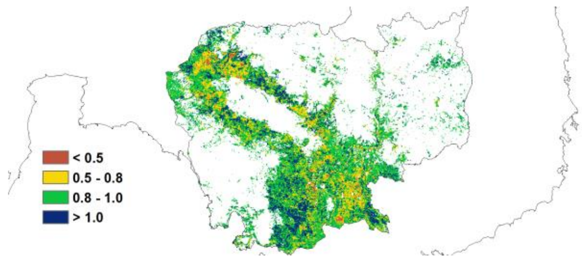
For **Southwestern Hilly region**, the precipitation was 22% above average, the average temperature was about 0.7℃ lower, and the radiation was about 2% higher, resulting in a potential biomass increase in this region that was also about 2% higher. The NDVI pattern was similar to Mekong Valley region and ended in above-average conditions by the end of this monitoring period. The CALF index in this area is as high as 100% and the VCIx index is close to 0.93.

Figure 3.26 Cambodia's crop condition, April- July 2022



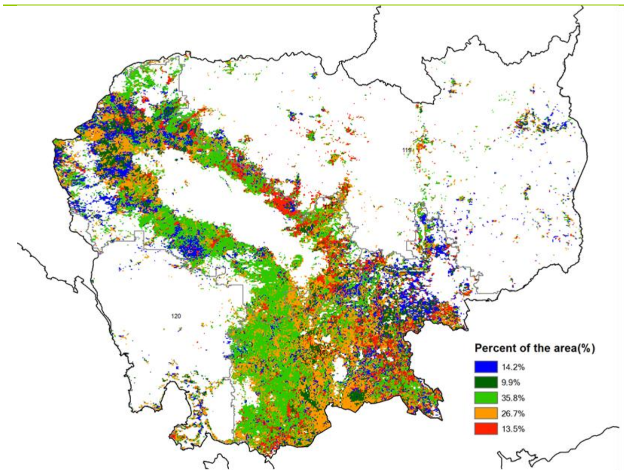
(a). Phenology of major crops

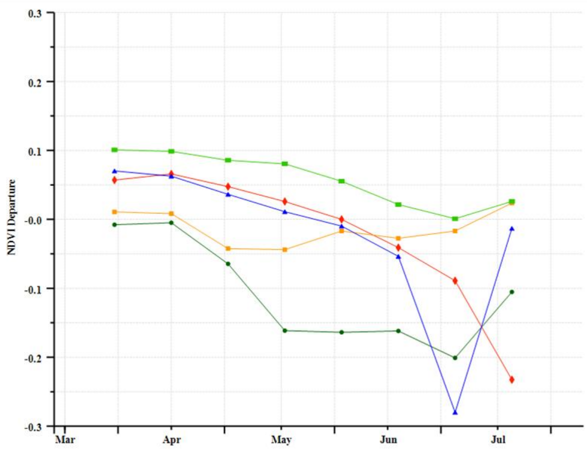




(b) Crop condition development graph based on NDVI

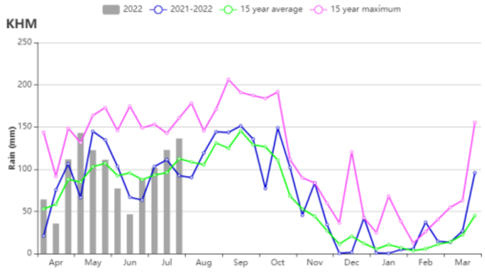
(c) Maximum VCI





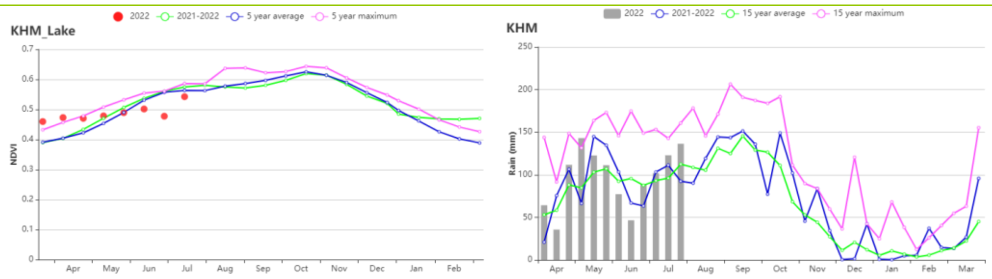
(d) Spatial NDVI patterns compared to 5YA

(e) NDVI profiles

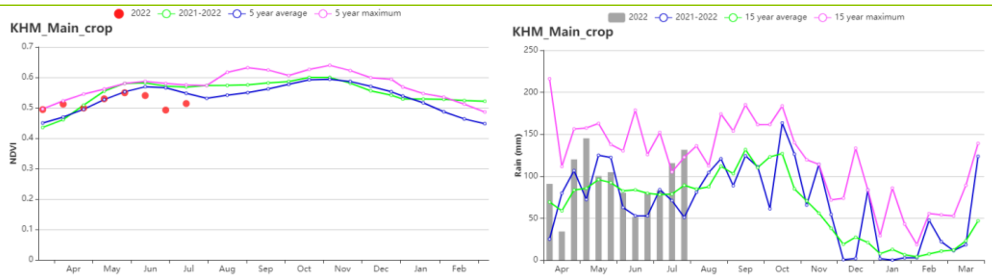


(f) Rainfall profiles

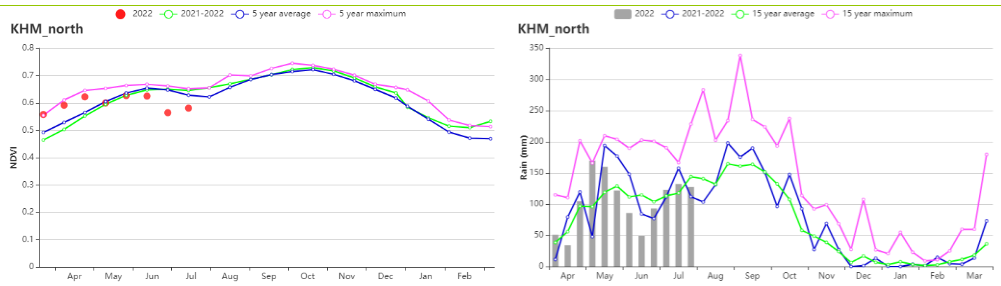
(g) Temperature profiles



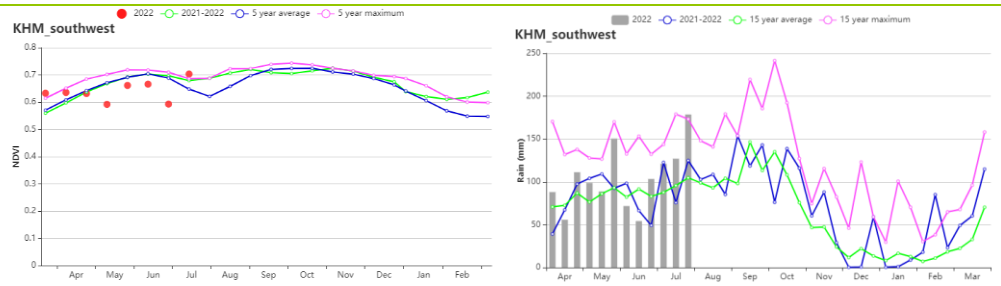
(h) Crop condition development graph based on NDVI (left) and time series rainfall profile (right) in Tonle Sap Lake region



(i) Crop condition development graph based on NDVI (left) and time series rainfall profile (right) in Mekong valley region



(j) Crop condition development graph based on NDVI (left) and time series rainfall profile (right) in Northern plain and northeast region



(k) Crop condition development graph based on NDVI (left) and time series rainfall profile (right) in Southwest hilly region

Table 3.44 Cambodia's agroclimatic indicators by sub-national regions, current season's values, and departure from 15YA, April - July 2022

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (℃)	Departure (℃)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Tonle-sap	971	11	26.5	-0.7	1224	4	1516	3

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (℃)	Departure (℃)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Mekong valley	1138	17	26.8	-0.4	1276	7	1661	7
Northern plain and northeast	1252	2	26.2	-0.6	1237	8	1617	5
Southwest Hilly region	1249	22	24.8	-0.7	1224	2	1561	2

Table 3.45 Cambodia's agronomic indicators by sub-national regions, current season's values, and departure from 5YA, April-July 2022

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Tonle-sap	96	4	0.88
Mekong valley	96	3	0.90
Northern plain and northeast	99	1	0.93
Southwest Hilly region	100	1	0.93

[LKA] Sri Lanka

This report covers the second cropping season (Yala) of Sri Lanka. The sowing of second season crops (maize and wheat) took place between April and May. During the monitoring period, the country's political and economic situation gradually fell into turmoil and economic crisis. According to the CropWatch monitoring results, crop conditions were assessed as below average for the monitoring period.

The proportion of irrigated cropland in Sri Lanka is 41% and agro-meteorological conditions play an important role in the growth of more than half of the crops.

During this period, the country experienced the Southwest-Monsoon Season, during which the island typically experiences rainy and cold weather. At the national level, precipitation was markedly above the 15YA (RAIN +15%), while temperature (TEMP -0.2℃) and radiation (RADPAR -3%) were slightly below the average. The increase of rainfall in early April ensured sufficient water supply for the sowing of crops. The fraction of cropped arable land (CALF) increased by 1% and BIOMSS was up by 4% compared to the 15YA. As shown in the NDVI development graph, NDVI was average in April and turned to below average after that. The maximum VCI for the whole country was 0.92.

As shown by the NDVI clustering map and profiles, more than half of country's cropland showed close to average crop conditions. These croplands were mainly located in the east, but there were also some clustered areas in the west. The ban on the use of chemical fertilizer in Sri Lanka continued to negatively influence the crop conditions. The abnormal NDVI departure values during May to July were mainly caused by cloud cover in the satellite images. The maximum VCI showed high values almost all over the country.

Regional analysis

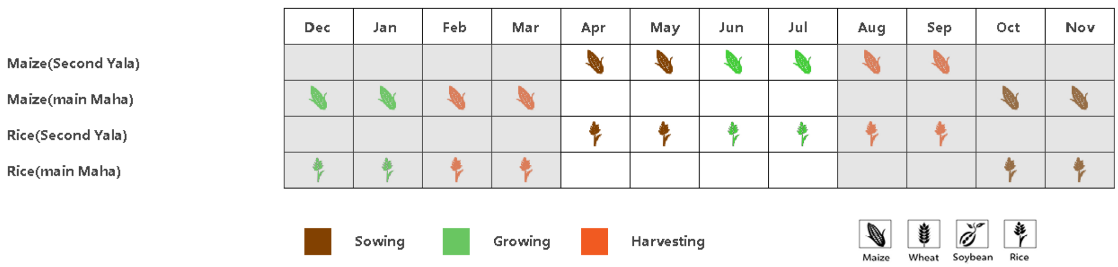
Based on the cropping system, climatic zones and topographic conditions, three sub-national agroecological regions can be distinguished for Sri Lanka. They are the **Dry zone**, the **Wet zone**, and the **Intermediate zone**.

In the **Dry zone**, the recorded RAIN (465 mm) was 7% above average. TEMP was 0.1℃ above average and RADPAR was near average. BIOMSS increased by 8% as compared to the 15YA. CALF was up by 2% as compared to the 5YA level with 99% of cropland utilized. NDVI was similar to that of the whole country. The VCIx for the zone was 0.95. Overall, crop conditions were below average for this zone.

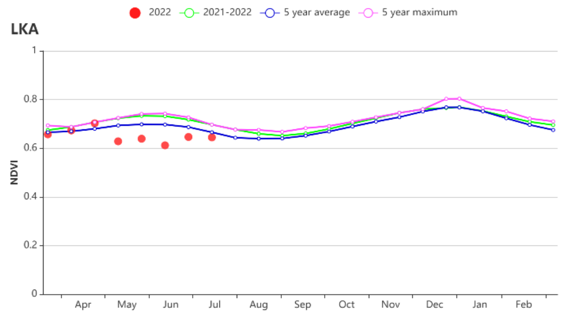
For the **Wet zone**, RAIN (2372 mm) was 21% above average as compared to the 15YA. TEMP and RADPAR decreased by 0.7℃ and 5% respectively. BIOMSS was 2% below the 15YA and cropland was fully utilized. NDVI values showed apparent deviation from average in May and June. The VCIx value for the zone was 0.95. Crop conditions were below average for this zone.

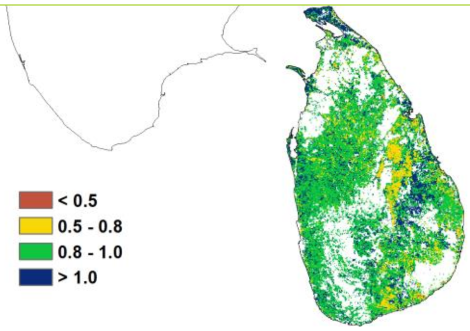
The **Intermediate zone** also experienced sufficient rain (1023 mm) with a 5% increase from the 15YA. TEMP was 0.2℃ above average and RADPAR was 2% below average compared to the 15YA. With full use of cropland, BIOMSS was comparable to the average. The NDVI values were similar to the Dry zone and the VCIx value for this zone was 0.94. Conditions of the crops were below average.

Figure 3.27 Sri Lanka's crop condition, April- July 2022



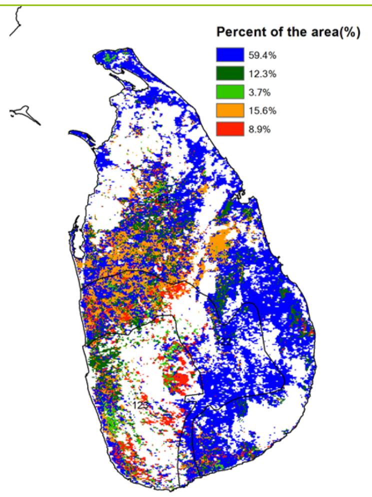
(a). Phenology of major crops

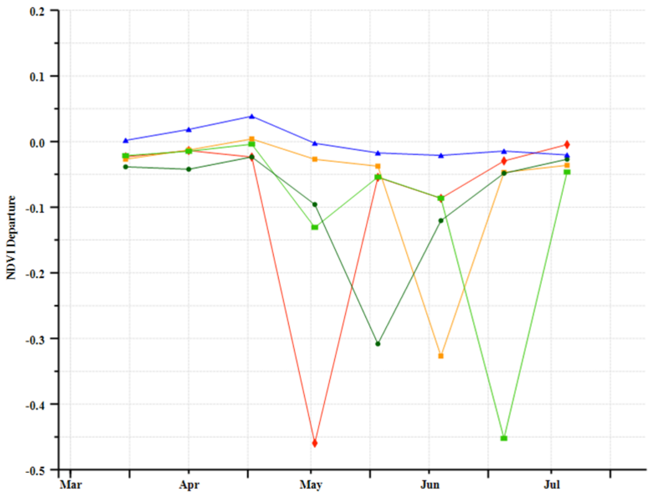




(b) Crop condition development graph based on NDVI

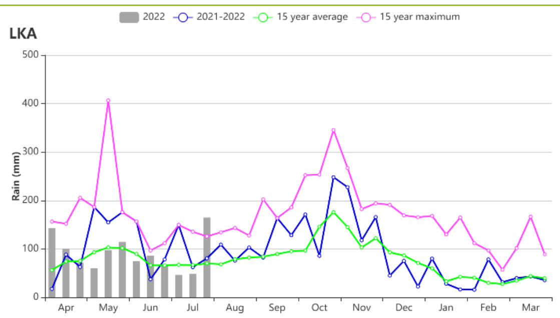
(c) Maximum VCI

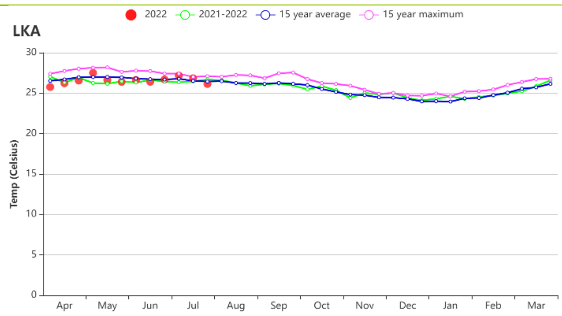




(d) Spatial NDVI patterns compared to 5YA

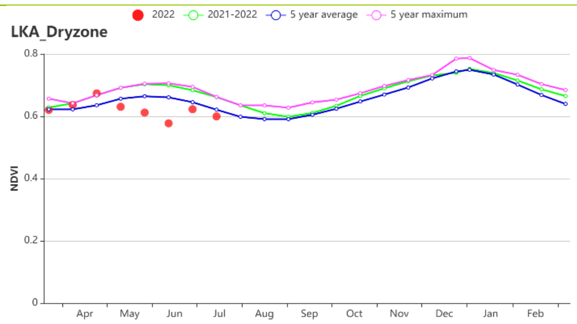
(e) NDVI profiles

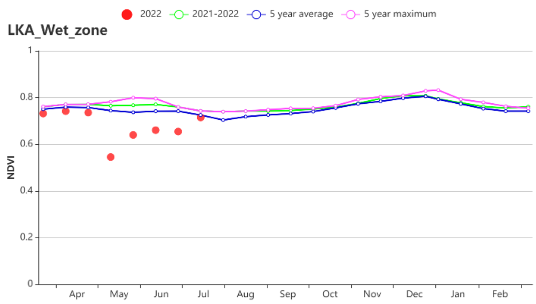




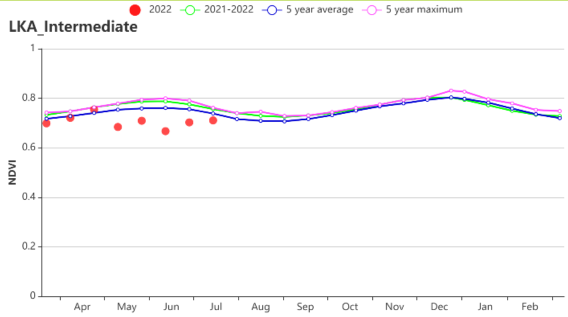
(f) Rainfall profiles

(g) Temperature profiles





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



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

Table 3.46 Sri Lanka's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, April - July 2022

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (℃)	Departure (℃)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Dry zone	465	7	27.9	0.1	1309	-1	1121	8
Wet zone	2372	21	24	-0.7	1115	-5	1535	-2
Intermediate zone	1023	5	25.4	0.2	1173	-2	1253	0

Table 3.47 Sri Lanka's agronomic indicators by sub-national regions, current season's values and departure from 5YA, April-July 2022

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Dry zone	99	2	0.9
Wet zone	100	0	0.95
Intermediate zone	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

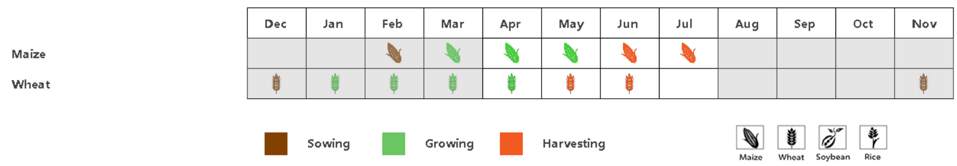
[MAR] Morocco

During this monitoring period, wheat reached maturity by the end of April and was harvested in May and June, while maize matured by the end of May and was harvested from June to July. The cumulative rainfall was 22% below the 15-year average (15YA). The rainfall index graph shows that the rain was higher than the 15YA during first dekad in April, second and third dekads in June and first dekad in July. The average temperature was higher than the 15YA by 0.9 ℃. The temperature index graph fluctuated around the 15YA during the monitoring period. RADPAR and BIOMSS were below the 15YA by 2.4% and 1%, respectively. The nationwide NDVI development graph indicates that the crop conditions were below the 5-year average (5YA) during the monitoring period. NDVI was far below average at the start of this monitoring period. Morocco had experienced a rainfall deficit during the entire winter cereal production period which started in November. The NDVI spatial pattern shows that only 19.2% of the cultivated area fluctuated around the 5YA; the rest (80.8%) were below the 5YA. The CALF was below the 5YA by 11%, and the VCIx value reached 0.59, confirming unfavorable crop conditions.

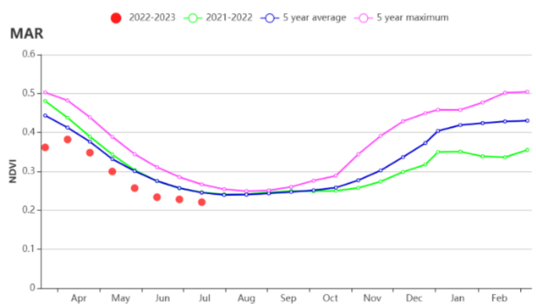
Regional analysis

CropWatch delineates three agro-ecological zones (AEZs) relevant for crop production in Morocco: the **Sub-humid northern highlands**, the **Warm semiarid zone**, and the **Warm sub-humid zone**. In the three zones, rainfall was below the 15YA by 20%, 35%, and 12%, while the temperature was above the 15YA by 0.7℃, 1.0℃, and 0.7℃, respectively. RADPAR was below the 15YA by 3%, 2%, and 3%, in the three zones respectively. BIOMSS was below the 15YA in the first and second zones by 3% and 2% respectively while it was at the 15YA in the third zone. The NDVI-based crop condition development graphs show similar conditions for the three zones following the national crop development NDVI graph. The CALF was 13%, 19%, and 7% below the 5YA, and the VCIx was 0.72, 0.47, and 0.70 for the three zones, respectively, confirming unfavorable crop conditions.

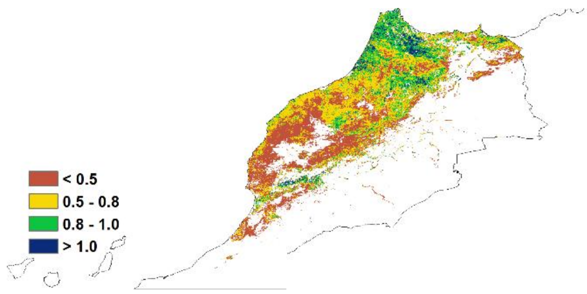
Figure 3.28 Morocco's crop condition, April- July 2022



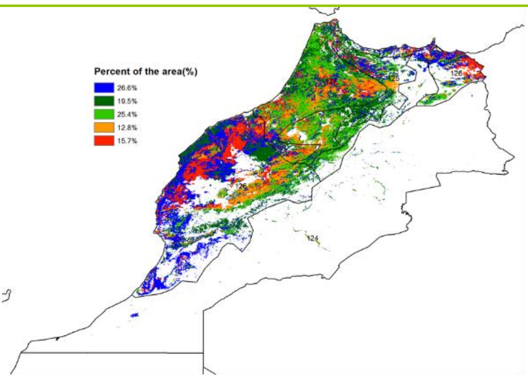
(a). Phenology of major crops

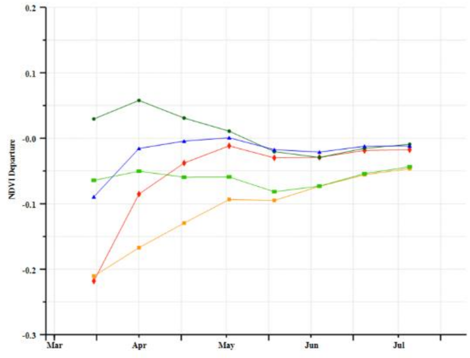


(b) Crop condition development graph based on NDVI

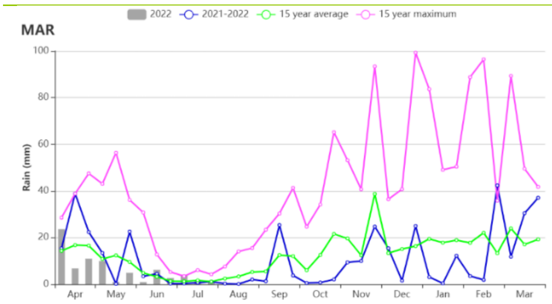


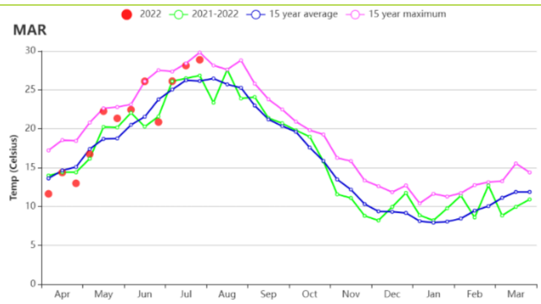
(c) Maximum VCI



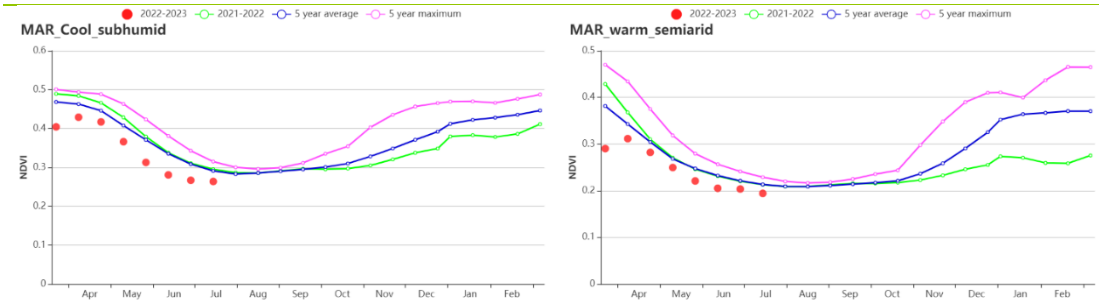


(d) Spatial NDVI patterns compared to 5YA (e) NDVI profiles

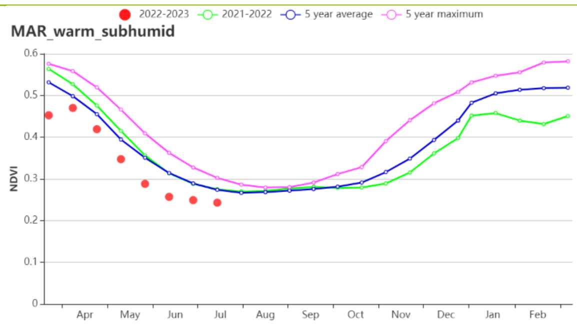




(f) Rainfall profiles (g) Temperature profiles



(h) Crop condition development graph based on NDVI-Sub-humid northern highlands (left), and Warm semiarid zones (right)



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

Table 3.48 Morocco's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, April - July 2022

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (℃)	Departure (℃)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Sub-humid northern highlands	108	-20	20	0.7	1529	-3	638	-3
Warm semiarid zones	40	-35	21	1.0	1590	-2	554	-2

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (℃)	Departure (℃)	Current (MJ/m^2)	Departure (%)	Current (gDM/m^2)	Departure (%)
Warm sub-humid zones	104	-12	20	0.7	1527	-3	636	0

Table 3.49 Morocco's agronomic indicators by sub-national regions, current season's values and departure from 5YA, April-July 2022

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Sub-humid northern highlands	53	-13	0.72
Warm semiarid zones	18	-19	0.47
Warm sub-humid zones	63	-7	0.70

[MEX] Mexico

This report covers the harvest 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 RAIN had decreased by 18%, TEMP increased by 0.5℃ and RADPAR was above average (+2%) when compared to the 15YA. Accordingly, BIOMSS decreased by 8%. CALF was 79%. It had decreased by 6%. The VCIx was 0.75.

Compared to the 15YA average, precipitation decreased by 18%, and it was not evenly distributed. The rainfall deficit was more pronounced in the north, where the drought conditions persisted. According to the VCIx spatial patterns, very high values (greater than 1.0) occurred mainly in the coastal areas of Jalisco and Colima, east of Sonora, Veracruz, Tabasco. Extremely low values (less than 0.5) occurred in the northern border area, mainly in Coahuila de Zaragoza and northern part of Nuevo León.

As shown in the spatial NDVI profiles and distribution map, 10.6% of the total cropped areas were above average during the entire monitoring period, mainly distributed in Southeast region, including Campeche and Tabasco. This may have been due to the precipitation brought by the Tropical storm "Celia" in June. 54.3% of the cropped areas were below average, and 11.8% of the areas were significantly below average. One of the main causes of severe drought is the La Niña phenomenon, which has caused a significant rise in temperatures, less rainfall and drier soils in the areas affected by it. After June, more than half of Mexico has been suffering from drought. The northern state of Nuevo León, which is experiencing a severe water shortage, is the most seriously affected state.

The proportion of irrigated cropland in Mexico is 34.9%. Thus, rainfall plays a decisive role in the growth of most crops. Crop conditions were generally below average due to the drought.

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.

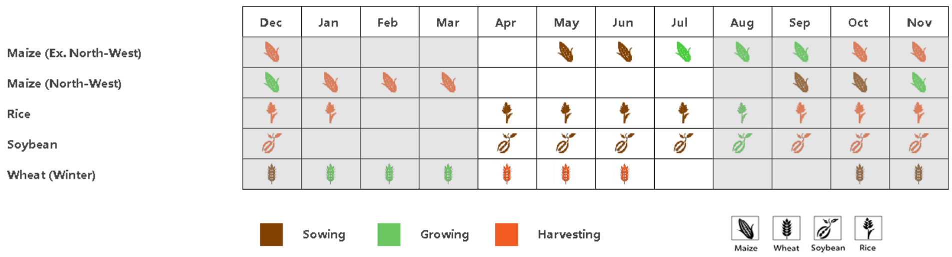
The **Arid and semi-arid regio**n, located in northern and central Mexico, accounts for about half of the planted area in the country. The agro-climatic condition showed that RAIN decreased by 35%, TEMP increased by 0.9℃ and RADPAR increased by 1%. According to the NDVI development graph, crop condition in this zone was worse than last year. CALF decreased by 15% compared with the 5YA. This region was most severely affected by the drought in Mexico. VCIx was only 0.61.

The **region of Humid tropics with summer rainfall** is located in southeastern Mexico. RAIN was significantly above average (+10%), TEMP decreased by 0.3℃, RADPAR increased by 1% and BIOMSS increased by 5%. As shown in the NDVI development graph, crop conditions were close to average from May to June, and later recovered to average levels. CALF was 100%. The increased precipitation brought some relief from the drought. The VCIx (0.93) confirms that crops grew better in this region than in other regions.

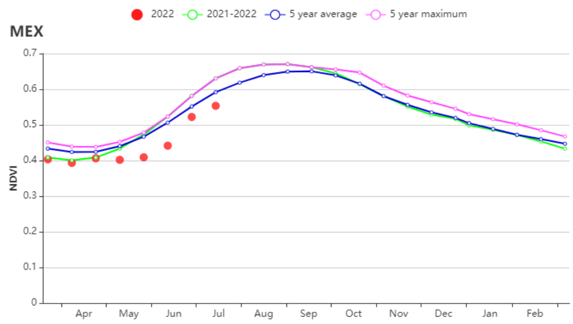
The **Sub-humid temperate region with summer rains** is situated in central Mexico. According to the NDVI development graph, the crop condition has been below the average level since May. The agro-climatic conditions were close to the average level. RAIN decreased by 52%, TEMP increased by 0.2℃, RADPAR increased by 5%, and BIOMSS decreased by 21% compared to the 15YA. CALF was 93%, and VCIx for this zone was 0.74.

The **region called Sub-humid hot tropics with summer rains** is located in southern Mexico. During the monitoring period, crop conditions were below average as shown by the NDVI time profiles. Agro-climatic conditions were close to average levels, including RAIN (-17%), RADPAR (+3%) and BIOMSS (-8%). CALF was 95%. The VCIx for the region was 0.86.

Figure 3.29 Mexico's crop condition, April- July 2022

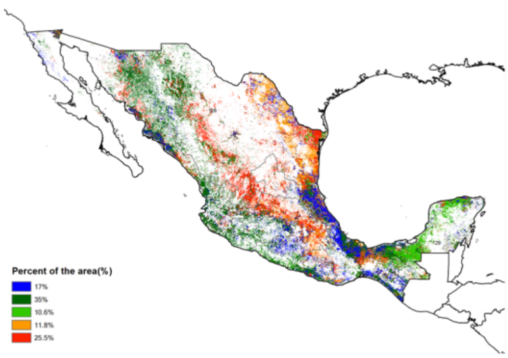


(a). Phenology of major crops

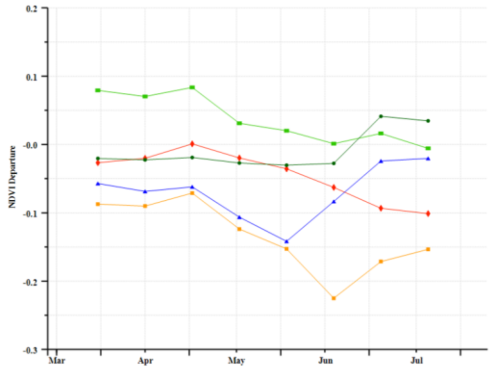


(b) Crop condition development graph based on NDVI

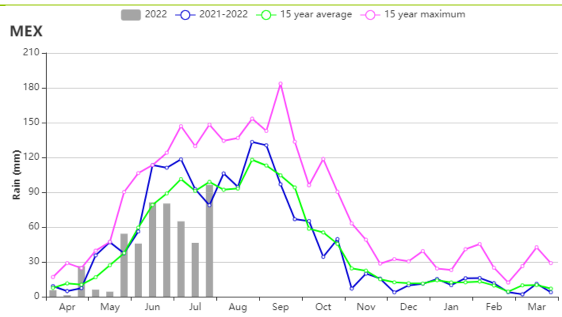
(c) Maximum VCI



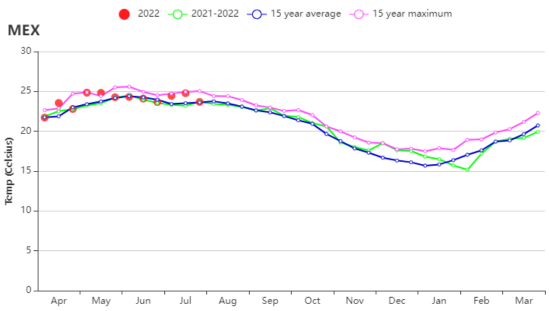
(d) Spatial NDVI patterns compared to 5YA



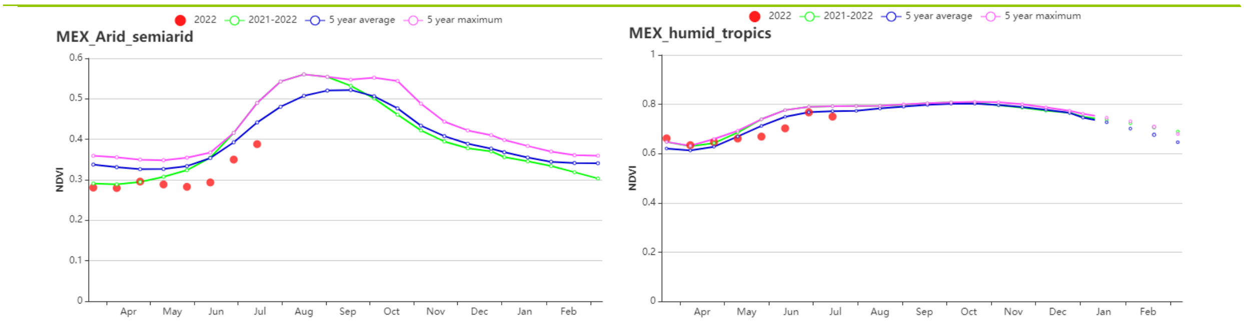
(e) NDVI profiles



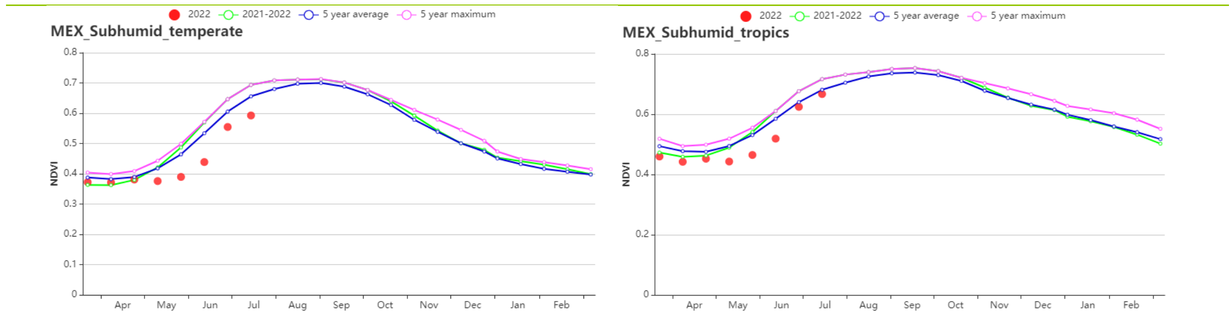
(f) Rainfall profiles



(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 3.50 Mexico's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, April - July 2022

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (℃)	Departure (℃)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Arid and semi-arid regions	254	-35	23.9	0.9	1574	1	765	-11
Humid tropics with summer rainfall	952	10	25.7	-0.3	1391	1	1324	5
Sub-humid temperate region with summer rains	362	-52	21.3	0.7	1516	5	834	-21
Sub-humid hot tropics with summer rains	575	-17	23.9	0.4	1492	3	986	-8

Table 3.51 Mexico's agronomic indicators by sub-national regions, current season's values and departure from 5YA, April-July 2022

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Arid and semi-arid regions	56	-15	0.61
Humid tropics with summer rainfall	100	0	0.93
Sub-humid temperate region with summer rains	93	-3	0.74
Sub-humid hot tropics with summer rains	95	-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 SYR THA TUR UKR USA UZB VNM ZAF ZMB

[MMR] Myanmar

During this reporting period, the harvest of maize was finished in April, whereas that of the second rice and wheat were underway before June and May respectively. The main rice crop was planted in May and June. According to the CropWatch monitoring results, crop conditions were below average for the monitoring period. The military coup in February of 2021 has caused a sharp increase in cost of farm inputs, such as fertilizer, seeds and pesticides, which in turn negatively impacts crop production.

The weather in Myanmar was warmer and drier than usual in general. Compared to the 15YA, RAIN was lower (-22%) while TEMP was higher (+0.5ºC) and RADPAR was up by 3%. As a result of insufficient of rainfall, BIOMSS was below the average (-6%). Compared to the 5YA, the utilization of cropland had increased by 7%. NDVI values were average before June, while the values declined after that and recovered to above average in July. The maximum VCI during this period was 0.95.

As shown by the NDVI clusters map and profiles, the crop conditions across the country were quite different. A majority of the country’s cropland showed average and above-average crop conditions before June. It was distributed throughout the country except for the southern region. The cropland in Central Plain and Hills region showed below-average crop condition since June, which accounts for more than half of the whole cropland. However, the condition recovered to average levels in July. The lowest VCI values were observed for parts of the Central Plain and southern region.

Regional analysis

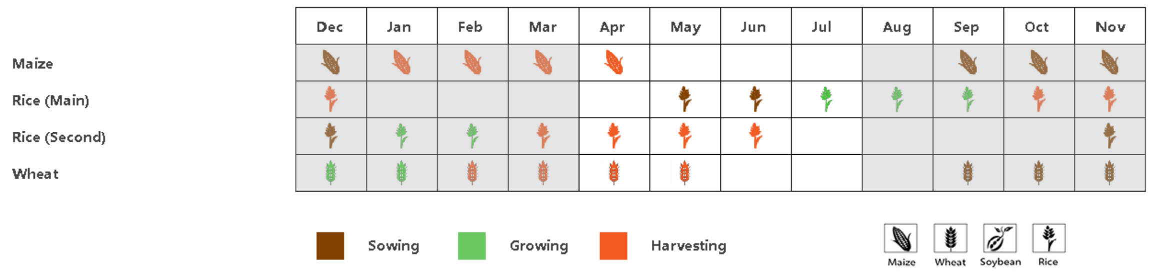
Three sub-national agro-ecological zones (AEZ) can be distinguished for Myanmar based on the cropping system, climatic zones and topographic conditions. They are the **Central plain**, **the Hills and the Delta** and **Southern Coast regions**.

The **Central Plain** had a marked rainfall deficit (RAIN -39%), and RADPAR and TEMP were up by 5% and 1.1ºC compared to the 15YA. BIOMSS was 13% lower than the 15YA. CALF (8%) showed that 89% of the cropland was fully utilized. NDVI was above the level of the 5YA for most of the period except for June. The VCIx was 0.95. Crop conditions for this region were slightly below average.

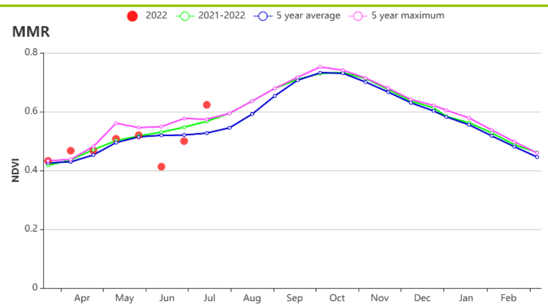
The **Hills region** also had below-average rainfall (RAIN -21%). RADPAR and TEMP increased by 3% and 0.4ºC. BIOMSS dropped by 4% compared to the 15YA. The cropland was almost fully utilized (CALF 96%). The NDVI values were close to the 5YA during the period except for June with values below average. The VCIx was 0.95. Crop conditions are assessed as below the 5YA level.

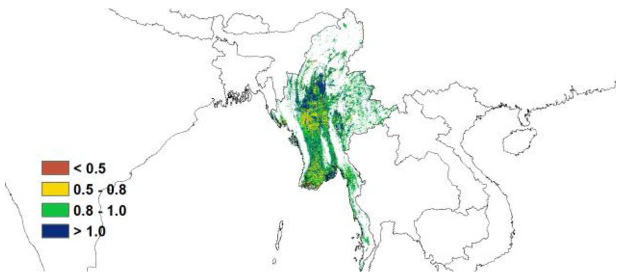
The **Delta and Southern Coast region** had the highest RAIN compared with the other two sub-national regions, though it was also below the 15YA (-18%). RADPAR and TEMP were 0.1ºC and 2% above average. BIOMSS was comparable to the 15YA. The cropland was not fully utilized (CALF 90%). VCIx was 0.94. The NDVI values were below the 5YA in May and June. Crop conditions in this region were below average.

Figure 3.30 Myanmar’s crop condition, April- July 2022



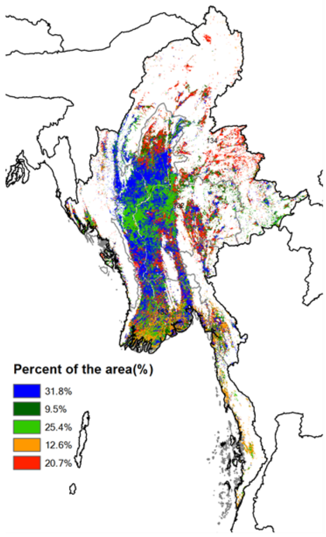
(a). Phenology of major crops

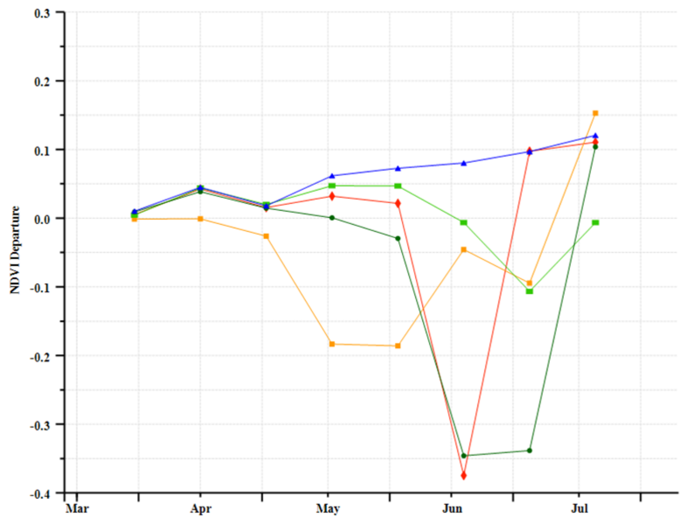




(b) Crop condition development graph based on NDVI

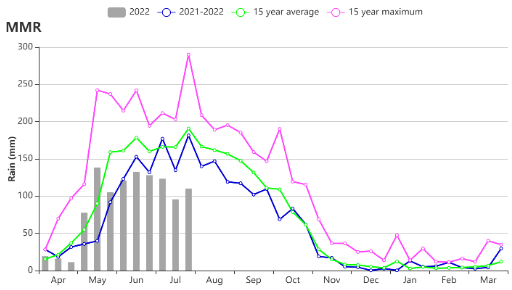
(c) Maximum VCI

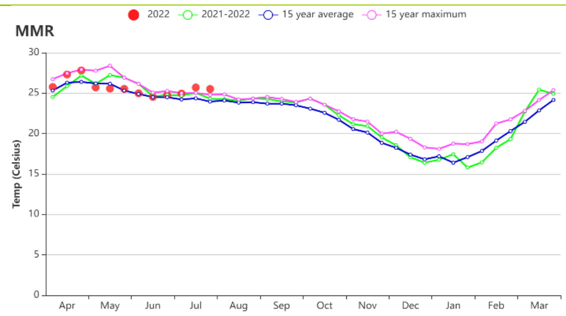




(d) Spatial NDVI patterns compared to 5YA

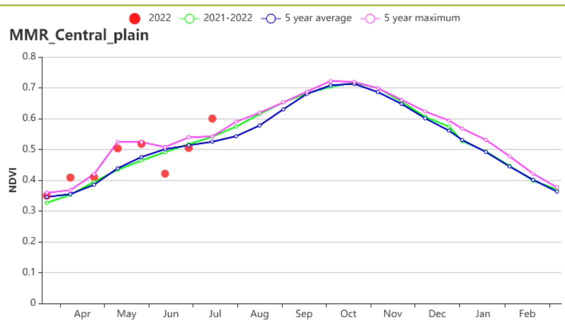
(e) NDVI profiles

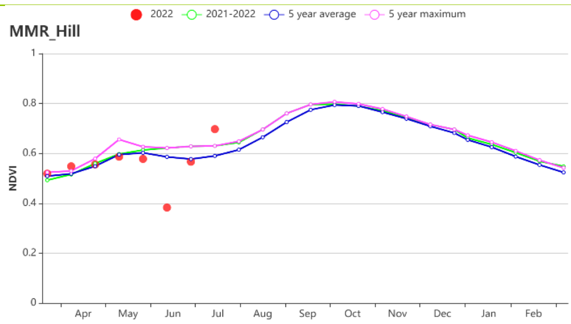




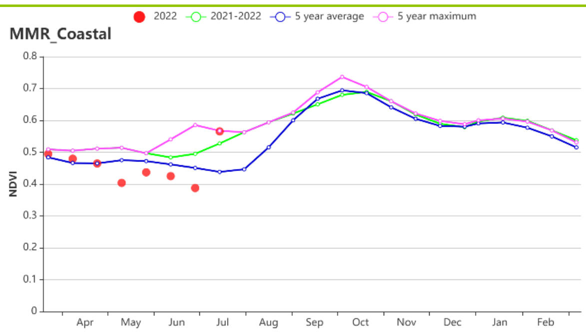
(f) Rainfall profiles

(g) Temperature profiles





(h) Crop condition development graph based on NDVI (Central plain region (left) and Hills region (right))



(i) Crop condition development graph based on NDVI (Delta and Southern coast region)

Table 3.52 Myanmar's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, April - July 2022

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (℃)	Departure (℃)	Current (MJ/m^2)	Departure (%)	Current (gDM/m^2)	Departure (%)
Central plain	543	-39	27.5	1.1	1249	5	1085	-13
Hills region	1226	-21	24.1	0.4	1175	3	1313	-4
Delta and southern-coast	1404	-18	27.4	0.1	1255	2	1476	0

Table 3.53 Myanmar's agronomic indicators by sub-national regions, current season's values and departure from 5YA, April-July 2022

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Central plain	89	8	0.95
Hills region	96	2	0.95
Delta and southern-coast	90	12	0.94

[MNG] Mongolia

This monitoring period covers the spring and wet summer season in Mongolia from April to July. Wheat, the main cereal crop, was sown in early May. It will reach maturity in September. The proportion of irrigated cropland in Mongolia is only 2.9% and crop growth is mainly limited by rainfall. The NDVI development graph shows that crop conditions were close to the five-year maximum. As compared to the fifteen-year average, RAIN decreased by 5% during the whole monitoring period but was sufficient from June to July. TEMP and RADPAR were slightly above 15YA (+0.2℃ and +2%), and BIOMSS was equal to the 15YA.

According to the spatial distribution of NDVI profiles, only 19.2% of the area of Mongolia had above-average conditions during the sowing stage. However, subsequently, 71.7% of the area had above-average conditions. The below-average areas were mainly in the east of Hangai Khuvsgul region and the west of Selenge-Onon region, where the VCIx graph also shows poor crop conditions (VCIx is between 0.5 and 0.8). The national VCIx was 0.92.

Overall, crop prospects in Mongolia are favorable. In addition, The Crop Production Index (CPI) was 1.20 for Mongolia, which also indicates favorable crop prospects.

Regional analysis

Hangai Khuvsgul region:

The NDVI development graph and the spatial distribution of NDVI profiles show that the crop conditions in this region were near average during the monitoring period. As for the agro-climate indicators, RAIN decreased by 9%, while TEMP and RADPAR increased by 0.2℃ and 2%. BIOMSS decreased by 2%. The regional average VCIx was 0.87. Crop prospects for this region were normal.

Selenge-Onon region:

Crop conditions in this region were significantly above average since late June, and close to the five-year maximum. All the agro-climate indicators of RAIN, TEMP, RADPAR, and BIOMSS were slightly above average. And most of this region had VCIx values of 0.8 to 1.0. The regional average VCIx was 0.93. Overall crop prospects for this region are favorable.

Central and Eastern Steppe Region:

Although the agro-climate indicators in this region seem to be slightly unfavorable (RAIN, RADPAR, and BIOMSS decreased by 13%, 1%, and 4%, while TEMP increased by 0.2℃), the spatial distribution of NDVI profiles shows that most areas have above-average conditions during this period. And the NDVI development graph shows that crop conditions in this region were better than the five-year maximum in June and July, which is the key growing stage for wheat. Therefore, the crop conditions for this region are expected to be favorable. The CPI was 1.29 for this region, which also indicates very favorable crop prospects.

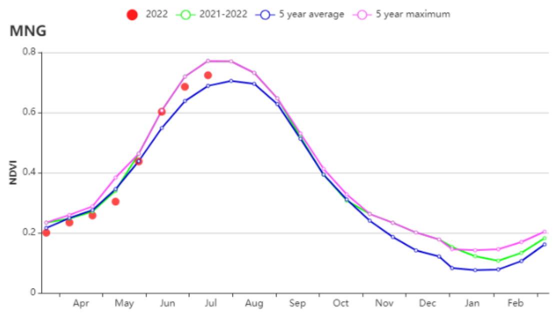
Figure 3.31 Mongolia's crop condition, April - July 2022

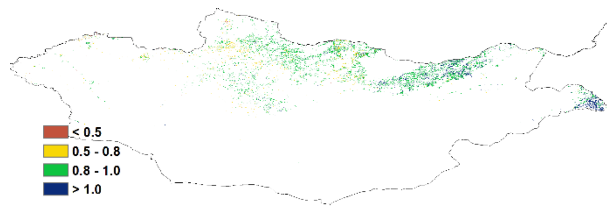
	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
Wheat												

Sowing Growing Harvesting

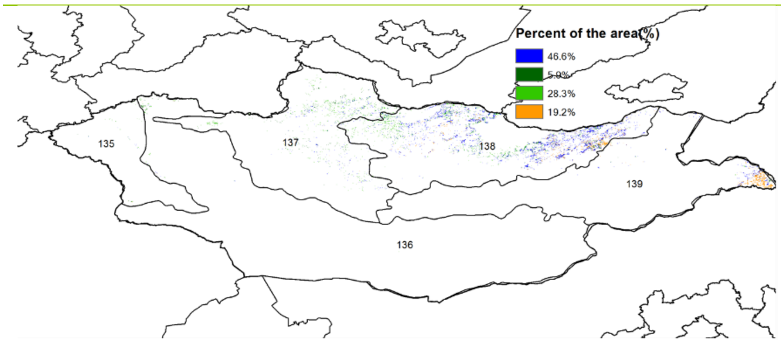
Maize Wheat Soybean Rice

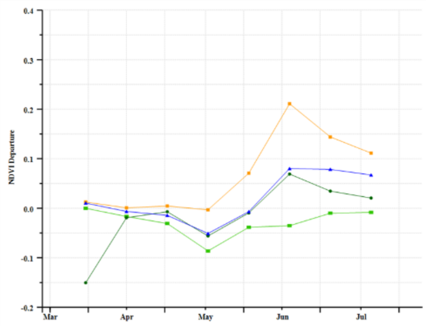
(a) Phenology of major crops



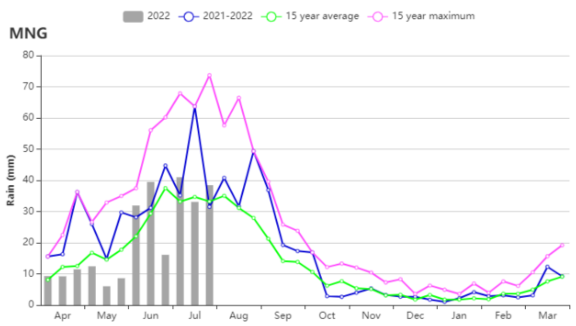


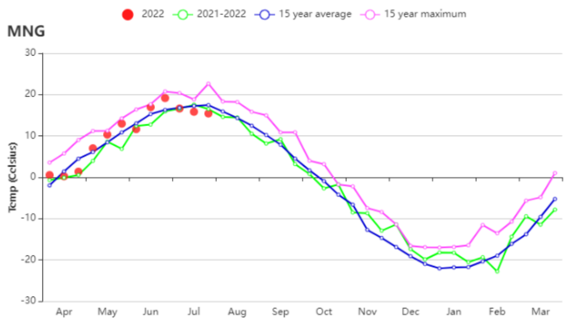
(b) Crop condition development graph based on NDVI (c) Maximum VCI



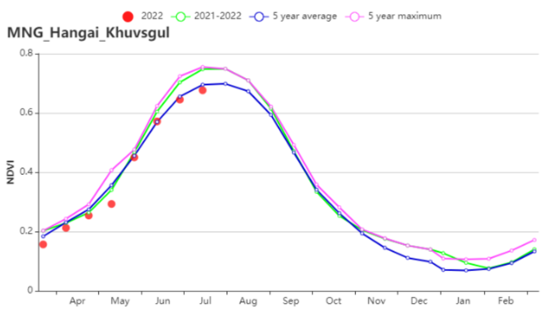


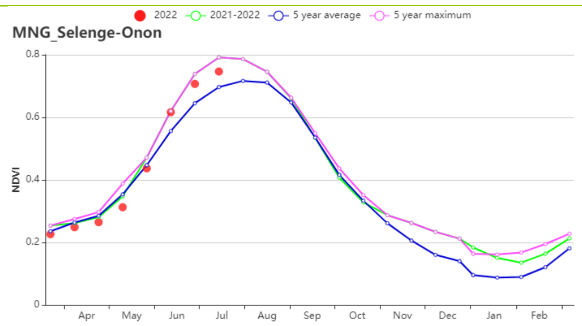
(d) Spatial NDVI patterns compared to 5YA (e) NDVI profiles



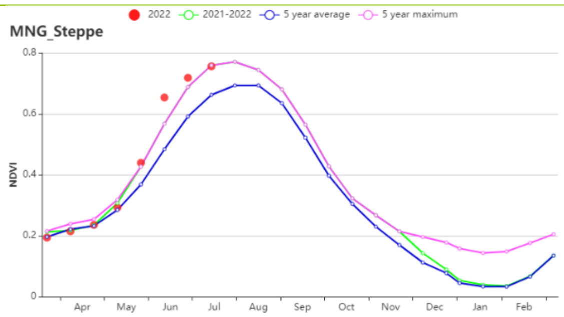


(f) Rainfall profiles (g) Temperature profiles





(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)

Table 3.54 Mongolia's agroclimatic indicators by sub-national regions, current season's values, and departure from 15YA, April - July 2022

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (℃)	Departure (℃)	Current (MJ/m2)	Departure (%)	Current (gDM/m2)	Departure (%)
Hangai Khuvsgul Region	272	-9	8.2	0.2	1425	2	655	-2
Selenge-Onon Region	282	4	11.3	0.2	1385	2	743	4
Central and Eastern Steppe Region	189	-13	13.9	0.2	1344	-1	659	-4
Altai Region	142	-67	10.0	2.0	1455	8	479	-24
Gobi Desert Region	71	-64	11.7	0.3	1523	6	384	-33

Table 3.55 Mongolia's agronomic indicators by sub-national regions, current season's values, and departure from 5YA, April - July 2022

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Hangai Khuvsgul Region	99	1	0.87
Selenge-Onon Region	100	1	0.93
Central and Eastern Steppe Region	100	2	1.02
Altai Region	75	-4	0.77
Gobi Desert Region	72	0	0.80

[MOZ] Mozambique

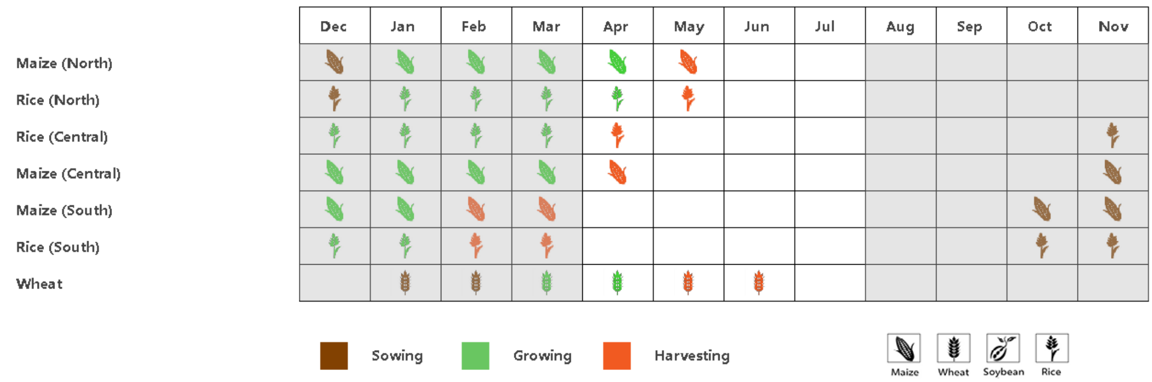
In Mozambique, the harvest season of maize, rice and wheat was concluded in June. More than 90% of cropland is rainfed. During the April-July 2022 monitoring period, Mozambique had relatively wet weather. Rainfall had increased by 32% and both temperature and radiation dropped by about 0.1℃ and 4%, respectively. The total biomass production was 583 gDM/m^2, an increase of 11% compared to the 15YA. The favourable crop development performance is also shown by the crop development graph based on NDVI, in which crop conditions were above maximum conditions when compared to the past five years. Compared to the recent five years average, the Cropped Arable Land Fraction (CALF) was near average while the maximum VCI was 0.94. The spatial NDVI patterns and the NDVI profiles reveal that except for 21% of the cropped arable land (mostly in the provinces of Zambézia, Nampula and Cabo Delgado), crop conditions were favourable in all the regions throughout the monitoring period. The country's CPI registered for this period was 1.16. In sum, during the monitoring period between April to July, crop conditions in Mozambique were generally favourable.

Regional analysis

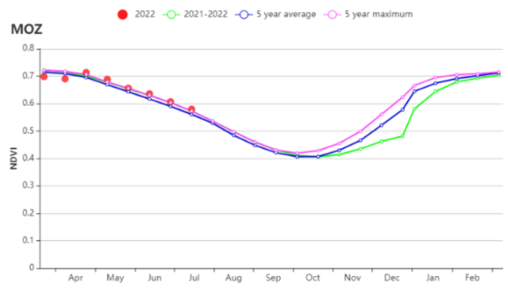
Based on the national cropping system, topography and climate, CropWatch has subdivided Mozambique into five agroecological zones (AEZs) including the **Buzi basin** (140), **Northern High-altitude areas** (141), **Low Zambezi River basin** (142), **Northern coast** (143), and the **Southern region** (144).

The crop conditions development graphs based on NDVI indicate favourable crop conditions in all agroecological zones when compared to the average of the past five years. Nevertheless, rainfall is above average for all the sub-regions. The rainfall increased by 8% on the Northern coast and 108% in the Southern region. A slight decrease in temperature was observed on the Northern high-altitude areas (TEMP -0.4℃), Low Zambezia River basin (TEMP -0.2℃), and Northern coast (TEMP -0.3℃). an increase (TEMP +0.6℃, +0.3℃) was recorded in the Buzi basin and Southern region. During this period, decreases in radiation were observed in Northern high-altitude areas (RADPAR -2%), Low Zambezi river basin (RADPAR -6%) and Northern coast (RADPAR -1%). While in the Buzi basin, Low Zambezi river basin, and Southern region, the total biomass production increased by 10%, 8% and 32%, respectively. In the Northern high-altitude areas and the Northern coast, both of them had increased by 4%. The cropped arable land fraction in all agroecological zones was near the average of the past 5YA, while the maximum VCIx varied from 0.92 to 0.97. CPI was verified to be above 1 in all agroecological regions.

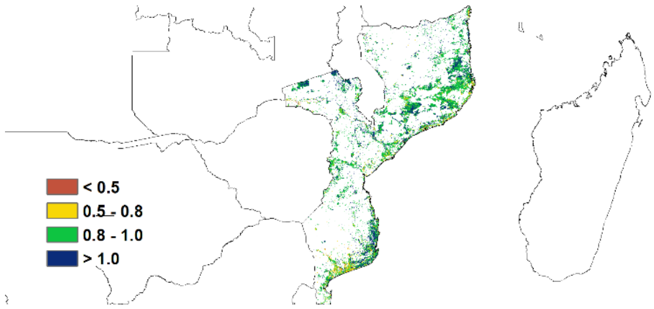
Figure 3.32 Mozambique's crop condition, April- July 2022



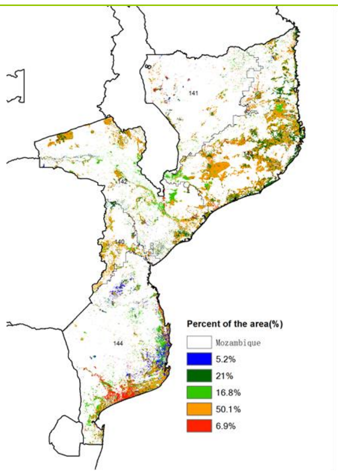
(a). Phenology of major crops

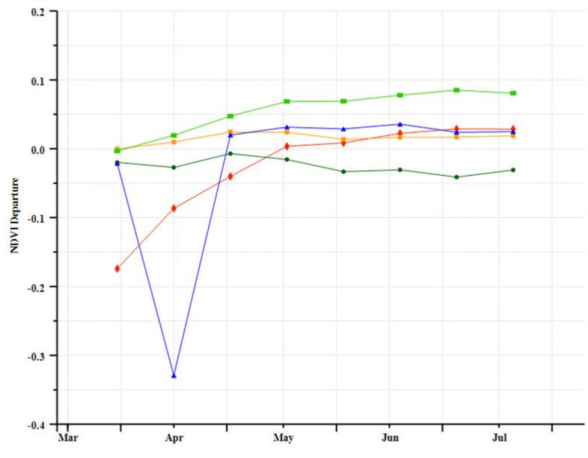


(b) Crop condition development graph based on NDVI



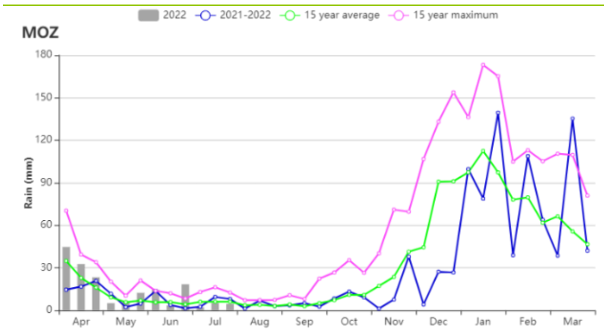
(c) Maximum VCI

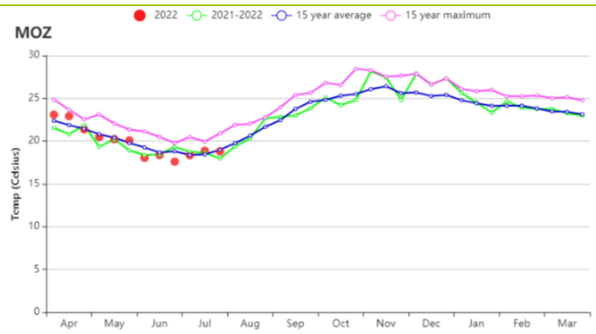




(d) Spatial NDVI patterns compared to 5YA

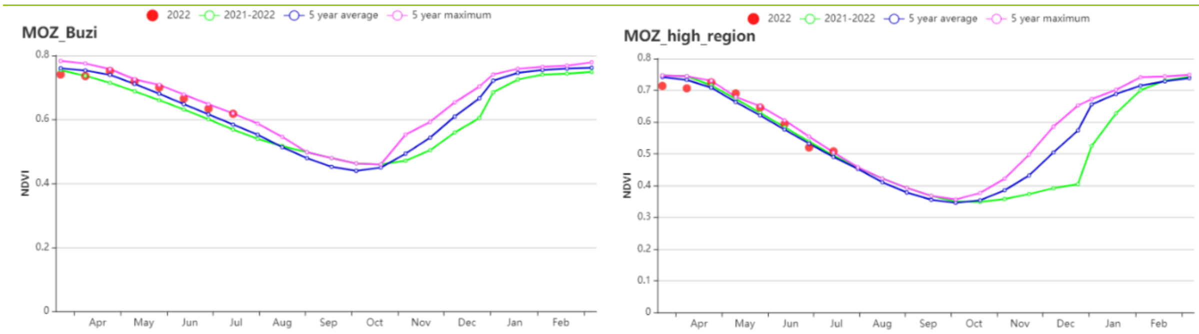
(e) NDVI profiles



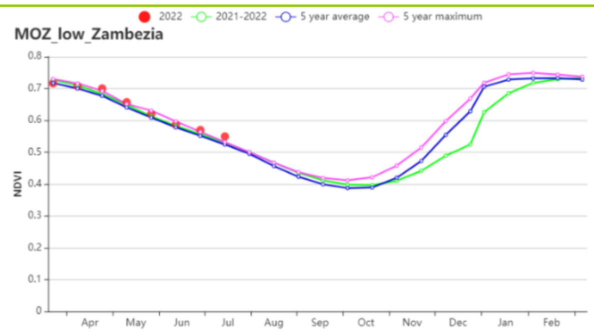


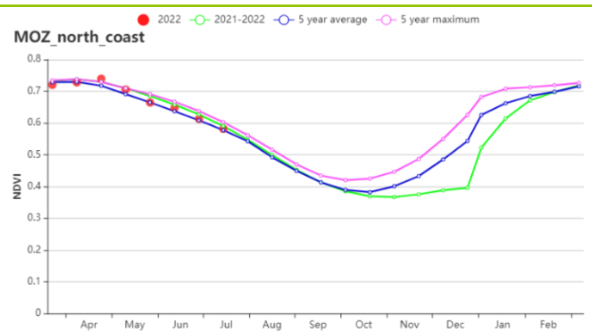
(f) Rainfall profiles

(g) Temperature profiles

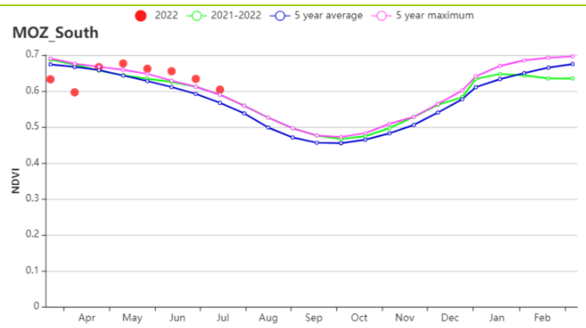


(h) Crop condition development graph based on NDVI-Buzi basin (left), and Northern high-altitude areas (right)





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



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

Table 3.56 Mozambique's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, April - July 2022

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (℃)	Departure (℃)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Buzi basin	135	25	17.8	0.6	944	-6	488	10
Northern high-altitude areas	136	19	18.7	-0.4	977	-2	505	4
Low Zambezia River basin	169	36	19.4	-0.2	906	-6	534	8
Northern coast	183	8	20.6	-0.3	979	-1	649	4
Southern region	202	103	20.7	0.3	841	-6	618	32

Table 3.57 Mozambique's agronomic indicators by sub-national regions, current season's values and departure from 5YA, April-July 2022

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Buzi basin	100	0	0.92
Northern high-altitude areas	100	0	0.97
Low Zambezia River basin	99	1	0.95
Northern coast	100	0	0.94
Southern region	99	1	0.93

[NGA] Nigeria

This report covers crop conditions for maize and rice in Nigeria from April to July. In the northern area, main maize was sown in May and June. It will reach maturity in August and September. In the southern area, maize was sown in April and started to reach maturity in June/July. The rainfed rice was sown in April, whereas irrigated rice was predominantly sown in May.

The CropWatch agroclimatic indicators showed that the rainfall was below the 15YA (-14%), with a few exceptions: Only in the middle of April and the middle and late July, rainfall was above 15YA. The average temperature was higher than the 15YA (+0.2℃) while the RADPAR was below the 15YA (-0.4). Due to the decline of rainfall, the BIOMSS was below the 15YA (-5%).

The proportion of irrigated cropland in Nigeria is only 0.4%, almost all the crops are rainfed. The below-average rainfall evidently limited crop production.

According to the crop condition development graph based on NDVI, the NDVI of the country was below the 5YA during all of this period, especially in June and July. The maximum VCI graph showed that the northwest was generally doing better than the northeast. In the south, conditions were average. As shown in the spatial NDVI profiles and distribution map, 33.3% of the total cropped areas were near the 5YA during the whole period mainly in the northern, 40% of the total cropped areas were below the 5YA from March to the end of June but reached above the 5YA in the southern area in July. Overall, the crop conditions in most areas were below the average during this monitoring period. Especially the northeast seems to have been affected by drought conditions.

Regional Analysis

The analysis focuses on four major agroecological zones in the country, i.e., **Sudan-Sahel savanna**(148) region across the northern region, **Guinea savanna**(146) and **Derived savanna**(145) within the central region and **Humid forest**(147) situated towards the southern region.

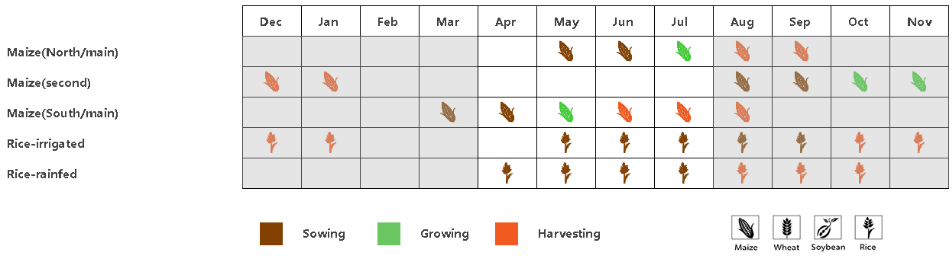
The **Sudan-Sahel savanna** zone is located in northern Nigeria. The agro-climatic condition showed that rainfall decreased by 1% and the overall temperature was near the 15YA (+0.03℃). RADPAR decreased by 2%. The BIOMSS was below the 15YA (-3%). The CALF was 51% and the maximum VCI was 0.71. According to the NDVI development graph, crop conditions in the zone were near the 5YA from April to May and below the 5YA from June to July.

The **Guinea savanna** region is predominantly located in the central region of the country. Compared to the 15YA, TEMP increased by 0.4℃, RAIN decreased by 12%, RADPAR decreased by 1%, and BIOMSS was below the 15YA (-6%). The CALF was 86% and the maximum VCI was 0.76. According to the NDVI development graph, crop conditions in the region were near average from April to May and below average from June to July.

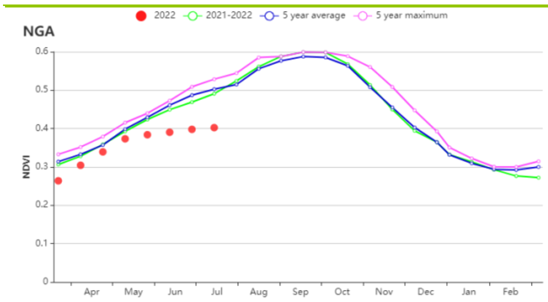
The **Derived savanna** region is a transition zone between the **Guinea savanna** and **Humid forest** zones. Rainfall increased by 10% and the temperature increased by 0.2 ℃. Compared to the 15YA, RADPAR increased by 1% and BIOMSS decreased by 5%. The CALF was 98% and the maximum VCI was 0.90. According to the NDVI development graph, crop conditions in the region were below the average in most of the monitoring period.

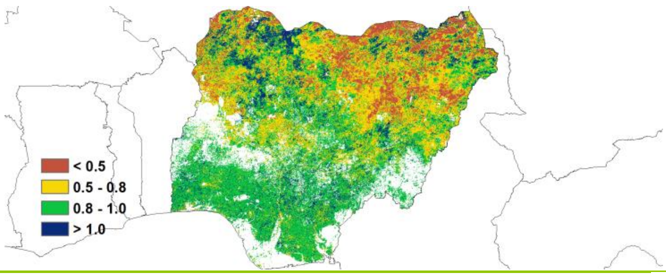
The **Humid forest** zone is in the southern area of the country. The rainfall decreased by 20% and the average temperature was near the 15YA (-0.02℃). The RADPAR increased by 1% and the BIOMSS decreased by 5%. The CALF was 98% and the maximum VCI was 0.91. According to the NDVI development graph, crop conditions in the zone were below average.

Figures 3.33 Nigeria's crop condition, April-July 2022

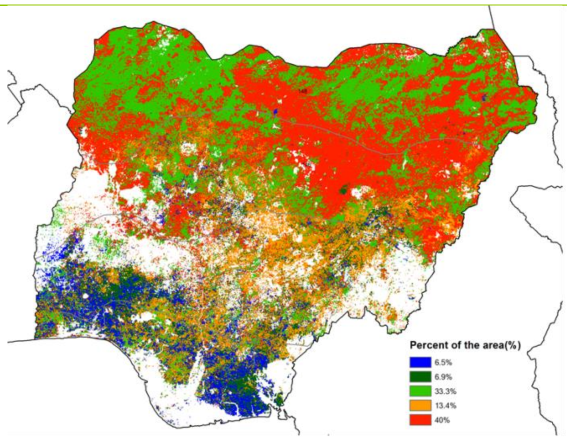


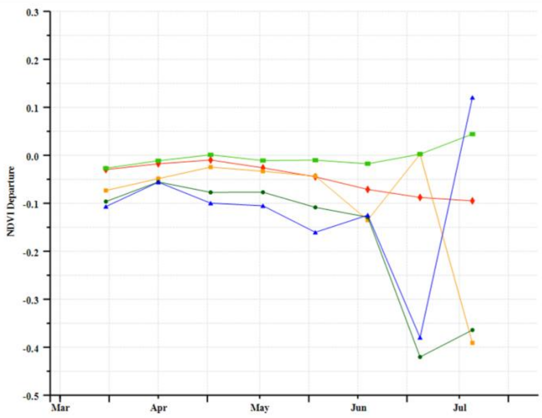
(a) Phenology of major crops



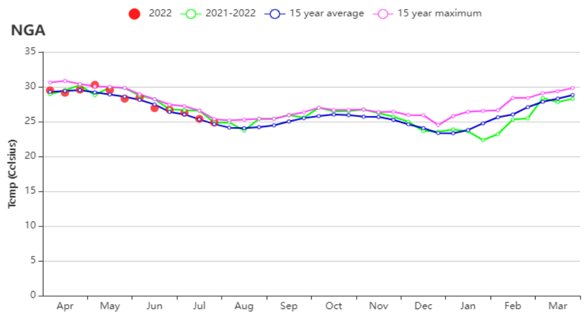


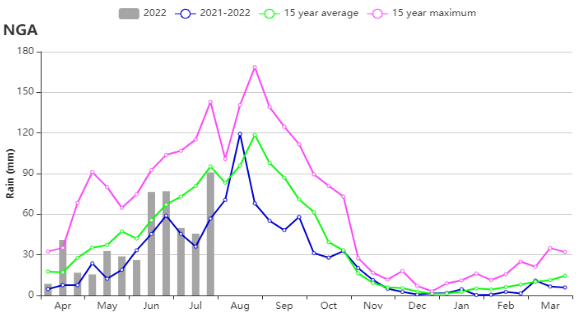
(b) Crop condition development graph based on NDVI (c)Maximum VCI



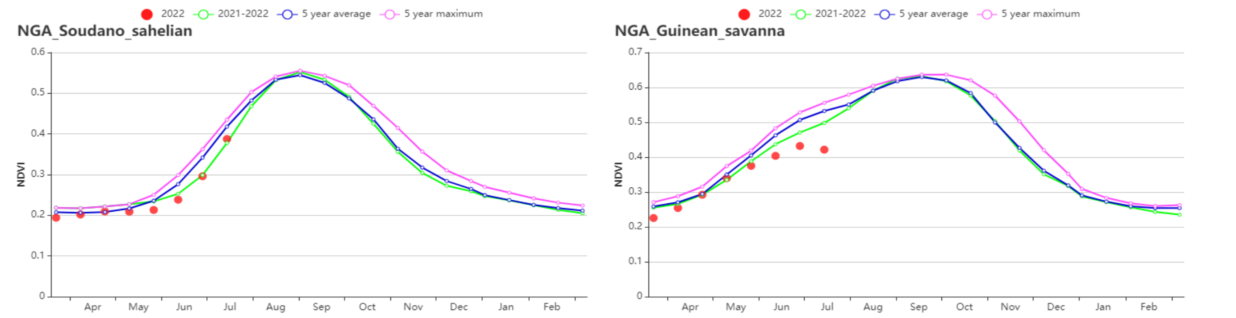


(d) Spatial NDVI pattern compared to 5YA and NDVI profiles (e)NDVI profiles

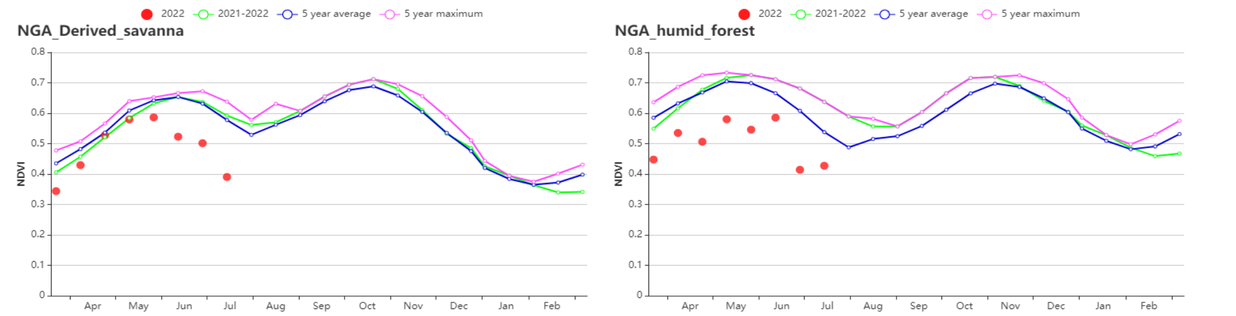




(f) Time series temperature profile (g) Time series rainfall profile



(h) Crop condition development graph based on NDVI (Left:Sudan-Sahel savanna, Right: Guinean savanna)



(i) Crop condition development graph based on NDVI(Left:Derived savanna, Right:Humid forest)

Table 3.58 Nigeria's agro-climatic indicators by sub-national regions, current season's values and departure from 15YA. April-July 2022

region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (℃)	Departure (℃)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Derived savanna zone	612	-10	26.7	0.2	1177	1	1152	-5
Guinean savanna	365	-12	28.4	0.4	1238	-1	928	-6
Humid forest zone	929	-20	25.6	-0.02	1091	1	1413	-5
Soudano-Sahelian zone	179	-1	31.1	0.03	1308	-2	703	-3

Table 3.59 Nigeria's agro-climatic indicators by sub-national regions, current season's values and departure from 5YA. April-July 2022

region	CALF		VCI
	Current (%)	Departure from 5YA (%)	Current
Derived savanna zone	**98**	**0**	**0.90**
Guinean savanna	**86**	**-5**	**0.76**
Humid forest zone	**98**	**0**	**0.91**
Soudano-Sahelian zone	**51**	**-7**	**0.71**

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 SYR THA TUR UKR USA UZB VNM ZAF ZMB

[PAK] Pakistan

This bulletin covers the period from April to July. Winter wheat harvest was completed in June. The planting of maize and rice started in May. Crop conditions were below average from April to early July and subsequently reached average levels.

At the country level, RAIN was 18% above average, TEMP was also above the 15YA by 1.5℃, and RADPAR was equal to the average. The combination of all the agro-climatic indicators resulted in BIOMSS exceeding the 15YA by 11%. Precipitation varied greatly in time and space. The dekad rainfall was continuously below average from April to the third dekad of June, later it reached or exceeded the maximum levels in July. The drier than usual conditions from April to June caused unfavorable conditions for the planting of summer crops, although most of them are irrigated. About 60% of the crop areas experienced drought in April, as shown in the VHIn graph. After late June, summer maize and rice had benefited from the generally favorable weather conditions, but the fraction of cropped arable land (CALF) decreased by 6% 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 66% of the cropped areas were below average in April, while 86% were below average in July. About 30% of the cropped area was continuously below average, mainly located in the 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 approached 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 late June and July for these regions, together with irrigation in the Lower Indus River basin (the proportion of irrigated cropland in Pakistan is over 80%.) helped improve the crop conditions. However, heavy rainfall and floods affected some areas of Punjab and Sindh in July. It is too early to assess the full damage that had been created by these floods. The below-average CALF will reduce crop production. The Crop Production Index (CPI) in Pakistan is 1.0, indicating close to normal conditions.

Regional analysis

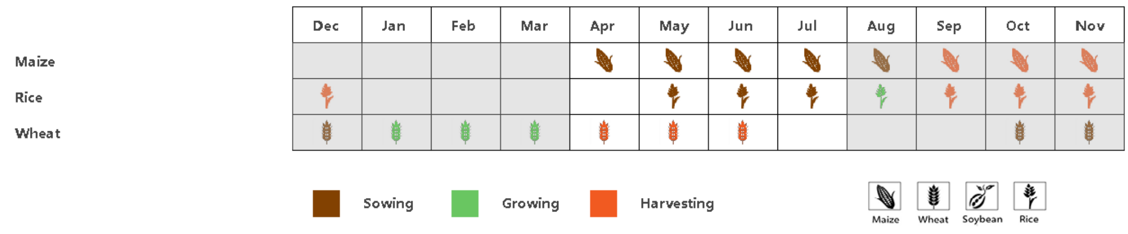
For a more detailed spatial analysis, CropWatch subdivides Pakistan into three agro-ecological regions based on geography and agro-climatic conditions: the **Northern highlands**, **Northern Punjab region** and the **Lower Indus River basin in South Punjab and Sind**.

The NDVI development graph of **Northern highlands** shows below-average crop conditions from late April to early July. It was caused by drier-than-usual conditions (RAIN -50%). RADPAR was above average (+2%) and temperatures were warmer (+2.6℃). The estimated BIOMSS was 18% lower than the 15YA. Wheat conditions were unsatisfactory due to drought; weather was generally unfavorable for the establishment of maize. The region achieved a rather low CALF of 52%, which is a decrease by 6% over the 5YA and VCIx is 0.77. Crop production is expected to be below average.

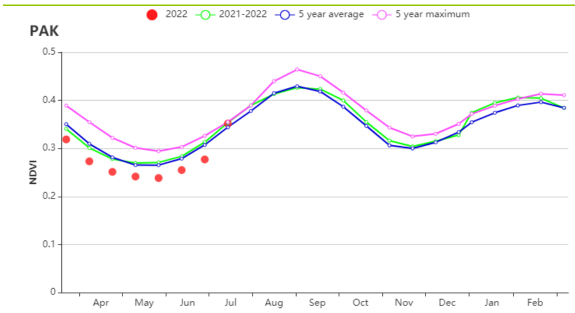
The **Northern Punjab**, the main agricultural region in Pakistan recorded abundant RAIN (29% above average). The TEMP was above average by 1.5℃, and the RADPAR was normal. The estimated BIOMSS departure was -2%, as compared to the fifteen-year average. Wheat had below-average NDVI values during the late growth period, which resulted in below-average yields. For summer crops, crop conditions in July were above average, but the CALF was low (64%) with a decrease by 10%. Production of summer crops is uncertain.

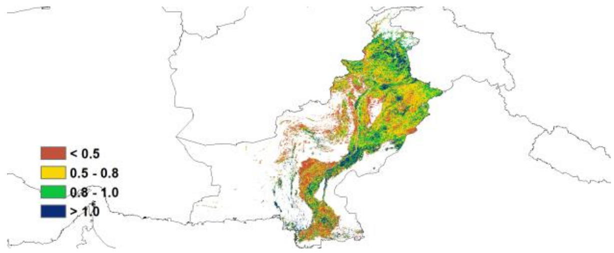
In the **Lower Indus River basin in south Punjab and Sind**, RAIN was greatly above average by 529%, while RADPAR and TEMP were below average by 3% and 0.3℃ respectively. Estimated BIOMSS was 34% higher than the last fifteen-year average. The VCIx was at 0.66, which is normal for this period between 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 crops were submerged by floods in some areas of Punjab and Sindh in July, and CALF was rather low (38%), 4% lower than the five-year average. The excessive rains, together with the ensuing floods, may hamper crop production in this region.

Figure 3.34 Pakistan' s crop condition, April- July 2022



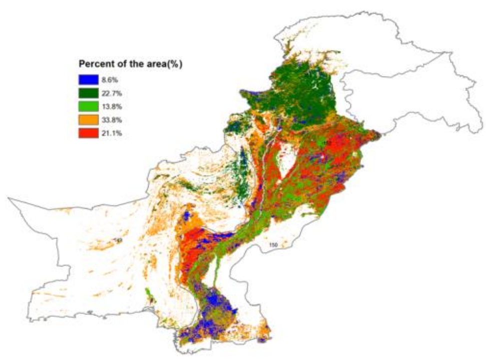
(a) Phenology of major crops

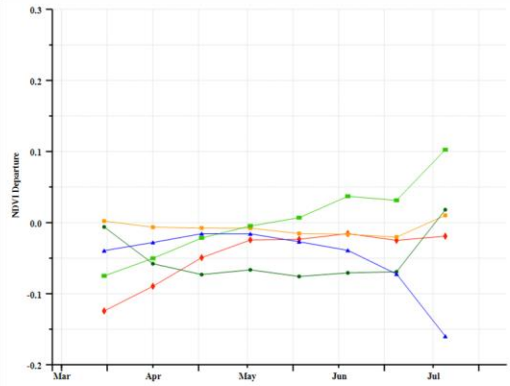




(b) Crop condition development graph based on NDVI

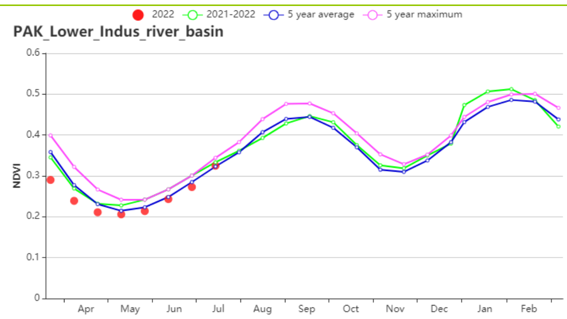
(c) Maximum VCI



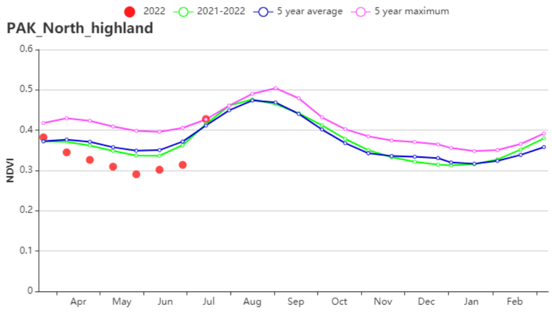


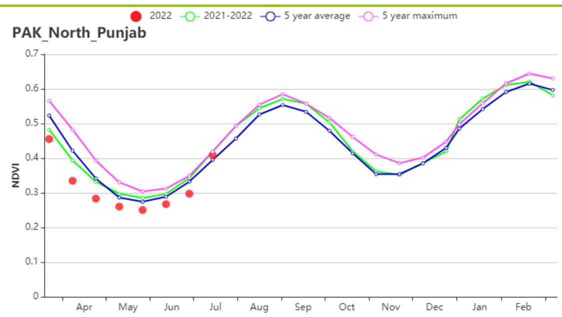
(d) Spatial NDVI patterns compared to 5YA

(e) NDVI profiles

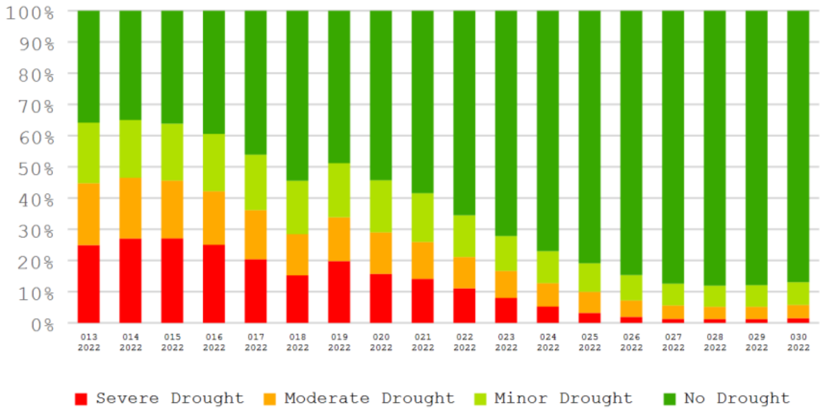


(f) Crop condition development graph based on NDVI for Lower Indus river basin (Pakistan)





(g) Northern Highland (Pakistan)(right) and Northern Punjab crop condition development graph based on NDVI(left)



(h) Proportion of VHIm categories compared with 5YA

Table 3.60 Pakistan's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, April - July 2022

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (℃)	Departure (℃)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Lower Indus river basin in south Punjab and Sind	487	529	34.4	-0.3	1516	-3	884	34
Northern highlands	185	-50	23.9	2.6	1581	2	667	-18
Northern Punjab	277	29	34.3	1.5	1509	0	819	-2

Table 3.61 Pakistan's agronomic indicators by sub-national regions, current season's values and departure from 5YA, April-July 2022

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Lower Indus river basin in south Punjab and Sind	38	-4	0.66
Northern highlands	52	-6	0.77
Northern Punjab	64	-10	0.73

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 SYR THA TUR UKR USA UZB VNM ZAF ZMB

[PHL] Phlippines

During this monitoring period, the harvest of second rice and second maize was concluded in April and May respectively. It was followed by the planting period for both main maize and main rice. The Philippines experienced generally wetter and relatively cooler weather conditions than normal. Compared to the average of the same period of the past 15 years, precipitation was 18% higher, average temperature was 0.2℃ lower, while the radiation was basically at the average level. Abundant precipitation comboined with average temperature and average radiation is generally beneficial to the crop growth and biomass accumulation, which resulted in a higher potential biomass (BIOMASS, +5%). This is consistent with the result shown by the NDVI time series graph. NDVI kept close to the average except for late June. That drop was presumeably due to cloud cover in the satellite images. According to the NDVI departure cluster graph, there are generally four patterns: 1) about 67.1% cropland (in dark green color) experienced a near-average NDVI during the monitoring period, indicating a normal crop growth in these regions, which was distributed all around the country. 2) around 17.1% of the cropland (in orange color) underwent a sudden NDVI drop in late June and kept a near-average NDVI in other times. These regions were mainly located in southern Luzon Island and Mindoro. 3) around 15.8% cropland (in blue color and light green) experienced a sudden NDVI drop in April and May and kept a slightly below-average NDVI at other times. These regions were mainly distributed in Mindanao Island. As mentioned above, these NDVI drops were artifacts in the satellite images. Considering the high CALF index (100%) and high VCIx index (0.95), the crop growth was normal during this monitoring period.

Regional analysis

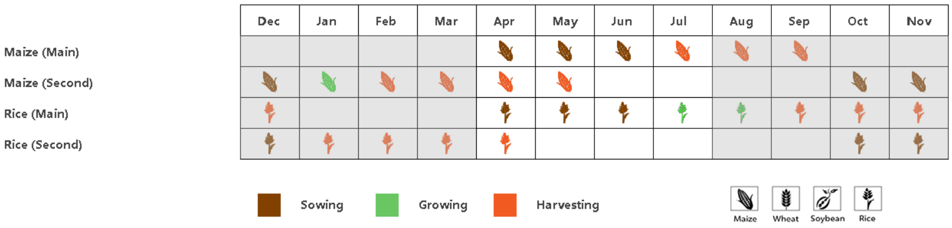
Based on the cropping systems, climatic zones, and topographic conditions, three main agro-ecological regions can be distinguished for the Philippines. They are **the Lowlands region** (northern islands), **the Hilly region** (Island of Bohol, Sebu, and Negros), and **the Forest region** (mostly southern and western islands). All the regions are characterized by a stable cropped arable land fraction (CALF almost 100%) and a high maximum VCI value (VCIx ⩾0.95).

The **lowland region** had about 5% higher cumulative precipitation, 0.3℃ lower average temperature, and 2% higher radiation. Higher precipitation and more sunshine with near average temperature are beneficial to crop growth and biomass accumulation, resulting a higher potential biomass (BIOMSS +5%). As for NDVI time series graph, the NDVI was above and close to average before mid-June. Although a sudden drop occurred in late June, this drop was most likely caused by cloud cover in the satellite images. Therefore, the crop growth in this region was generally normal.

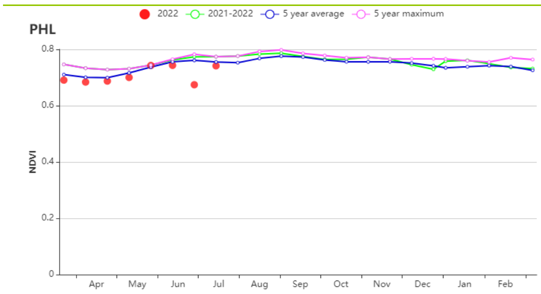
For the **hilly region**, cumulative precipitation was significantly higher by about 48%, temperature was about 0.7℃ lower, and radiation was about 3% lower than average. Abundant precipitation resulted in a higher biomass (BIOMSS +6%) in this region as well. As shown by NDVI time series graph, crop NDVI recovered to average levels in early April and kept close to average until mid-June. The subsequent NDVI drop was the result of a sudden NDVI drop over orange regions in early July, which is likely to have been caused by cloud cover as well. Crop growth in this zone was slightly below the average.

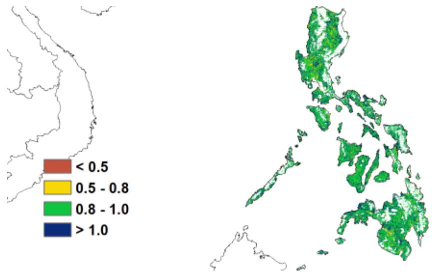
For the **Forest region**, the precipitation was higher by about 29%, average temperature was lower by about 0.3℃, radiation was higher by about 2%, which resulted in a higher biomass (BIOMSS +4%). According to the NDVI time series graph, the crop NDVI was below average before May and recovered to average in May. However, it declined again and kept below and close to average until the end of this monitoring period. Although the NDVI drop can partly be attributed to cloudy weather as well, the continuous below-average NDVI indicates slightly lower than normal crop growth conditions for this region.

Figure 3.35 Philippines' crop condition, April- July 2022



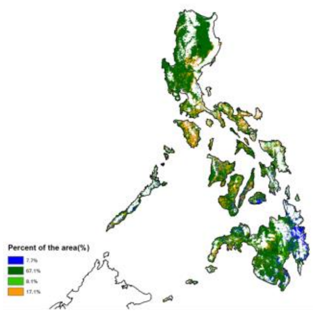
(a). Phenology of major crops

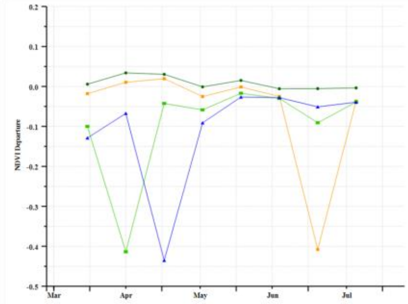




(b) Crop condition development graph based on NDVI

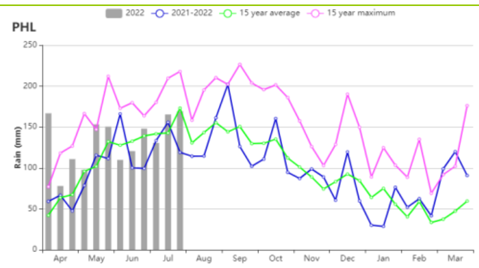
(c) Maximum VCI

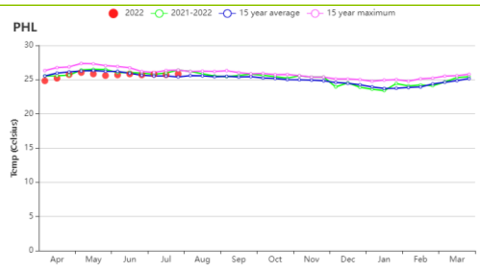




(d) Spatial NDVI patterns compared to 5YA

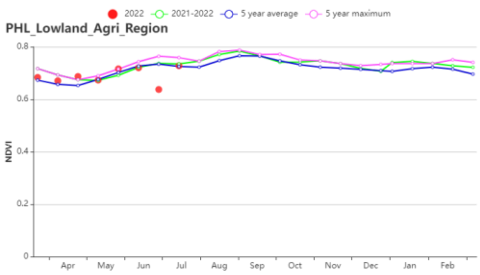
(e) NDVI profiles

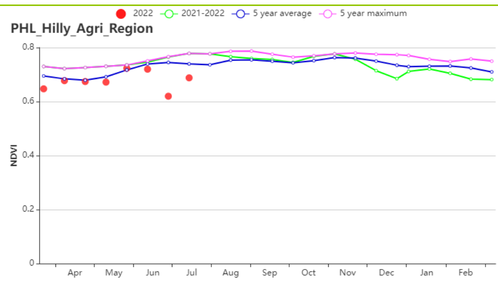




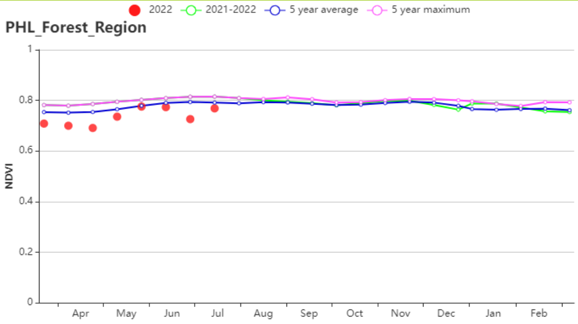
(f) Rainfall profiles

(g) Temperature profiles





(h) Crop condition development graph based on NDVI in Lowland region (left) and in the Hilly region (right)



(i) Crop condition development graph based on NDVI in Forest region

Table 3.62 Philippines' agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, April - July 2022

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (℃)	Departure (℃)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Forest region	1703	29	25.3	-0.1	1245	-2	1556	4
Hilly region	1911	48	26.5	-0.7	1304	-3	1666	6
Lowlands region	1446	5	25.9	-0.3	1350	2	1547	5

Table 3.63 Philippines' agronomic indicators by sub-national regions, current season's values and departure from 5YA, April-July 2022

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Forest region	100	0	0.96
Hilly region	100	0	0.95
Lowlands region	100	0	0.95

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

[POL] Poland

During this monitoring period, the sowing of maize and spring wheat was slightly delayed due to the cooler-than-usual temperatures in April. The winter wheat harvest started in July.

Rainfall and temperatures in Poland were 26% and 0.3℃ lower, respectively, compared to the average for the same period in the past 15 years. Despite of RADPAR being 2% above average, drier and cooler weather resulted in 14% lower potential biomass. The rainfall time series showed a precipitation deficit between mid-April and mid-May. The rainfall levels generally improved to close to average starting in late May. Considering that the irrigation rate in Poland is only about 1%, both winter and spring crops are likely to be impacted by the general rainfall deficit, which will reduce crop yields. The sub-optimal precipitation levels are also reflected in the NDVI development, which was below the recent 5-year average throughout the monitoring period. Average precipitation in late July improved the conditions for the summer crops.

The NDVI departure clustering map shows that NDVI for about 62.9% of crops (marked as "red", "dark green" and "light green") were below the average of the last five years throughout the monitoring period. However, 38.3% of these crops (marked as "dark green" and "light green") recovered to near average by the end of July. A further 26.7% of the arable crops (marked "blue") were near average during the monitoring period, mainly in the central region. The remaining 10.4% of the arable crops (marked "orange") was above average in April-May, but dropped to below average in June-July, mainly in the western region. CALF in the country reached 100%, and VCIx was 0.89. VCIx below 0.8 was mainly located at the western and southeastern regions.

In general, yields of winter crops may be slightly lower than average due to the rainfall deficits. Average precipitation in late July may help summer crops recover to average levels.

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).

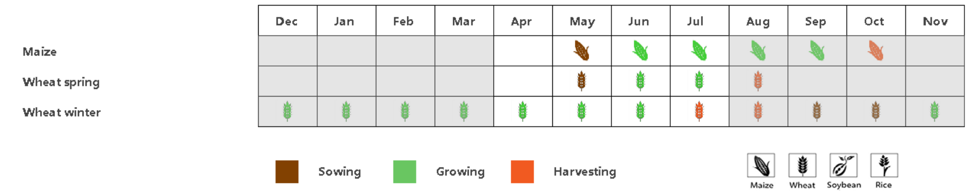
Compared to the average of the same period of the last 15 years, all the agro-ecological indicators in the **Northern oats and potatoes areas** were lower, including 18% lower RAIN, 0.4℃ lower TEMP, 3% lower RADPAR and 9% lower BIOMSS (the smallest departure among the four subregions). CALF in this region reached 100%, and VCIx was 0.91. NDVI was significantly lower than the average of the same period of the last five years in April and May, but slowly increased to near average from June to July. Yields are expected to be close to the average.

Rainfall in the **Northern-central wheat and sugar-beet area** was 25% below the average of the last 15 years, TEMP was 0.2℃ lower, while RADPAR was close to average, and BIOMSS was 14% lower due to drought stress. CALF was close to 100% and VCIx was 0.88. NDVI in this subregion was lower than the average of the same period in the last 5 years, while it reached above average levels in early July and dropped back to slightly below average in late July. Rainfall in this subregion exceeded 40 mm in late July, which effectively replenished soil moisture. Crop yields are expected to be close to the average.

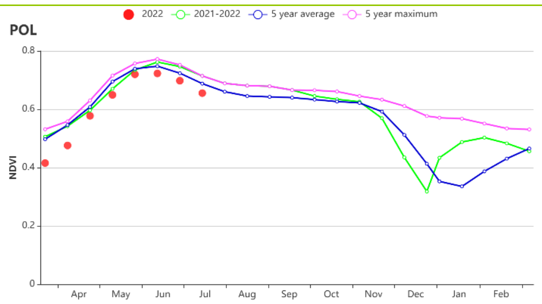
Compared to the average for the same period of the last 15 years, the **Central rye and potatoes area** had 21% lower RAIN, 0.2℃ lower TEMP, and 1% higher RADPAR, while drought caused 12% lower BIOMSS. CALF in the region was 100% and VCIx was 0.88. Crop growth in the region was below average throughout the monitoring period. Crop production is expected to be slightly below average.

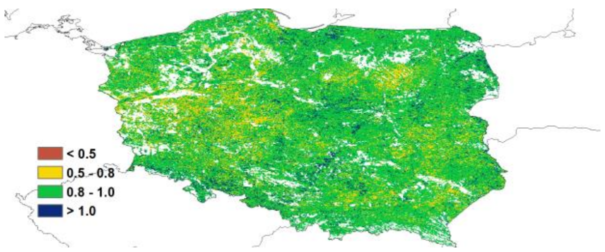
In the **Southern wheat and sugar-beet area**, the largest rainfall deficit (-34%) was observed. TEMP was also 0.4℃ lower than the 15YA. BIOMSS was still 17% lower, although RADPAR was 4% higher. CALF in this zone was 100% and VCIx was 0.90. The crop growth in this zone was below the average of the last 5 years throughout the monitoring period. Especially in July, the NDVI was still significantly lower. Crop yield in this subregion is expected to be lower than average due to drought stress.

Figure 3.36 Poland's crop condition, April – Jully 2022



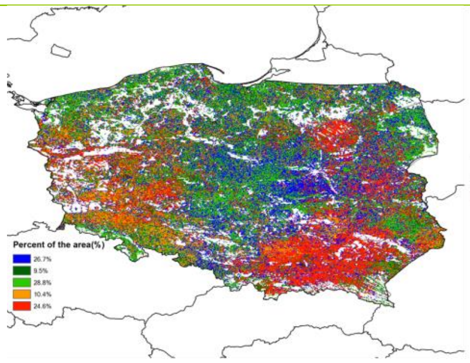
(a). Phenology of major crops

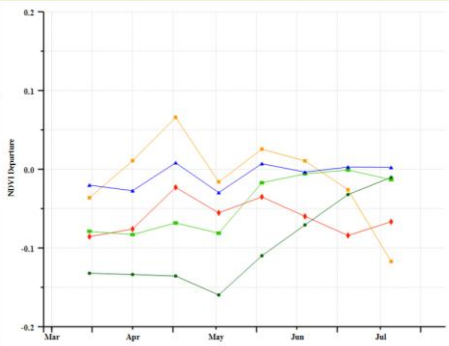




(b) Crop condition development graph based on NDVI

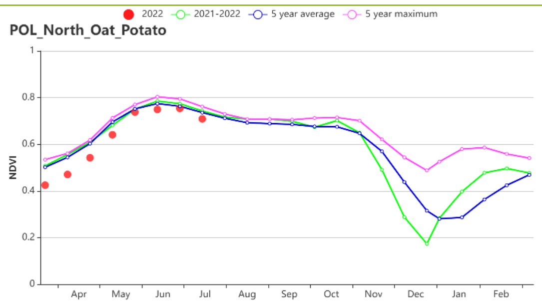
(c) Maximum VCI

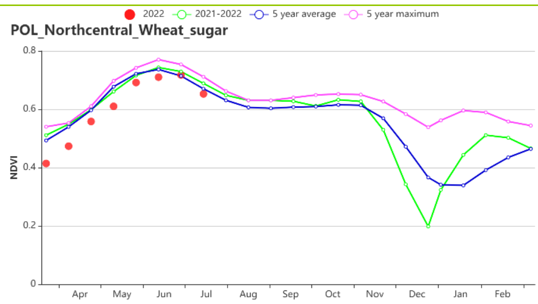




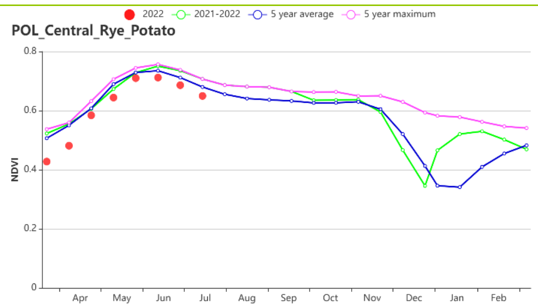
(d) Spatial NDVI patterns compared to 5YA

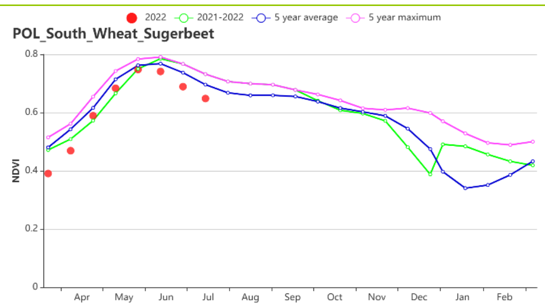
(e) NDVI profiles



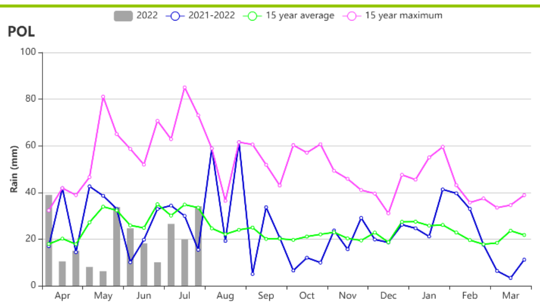


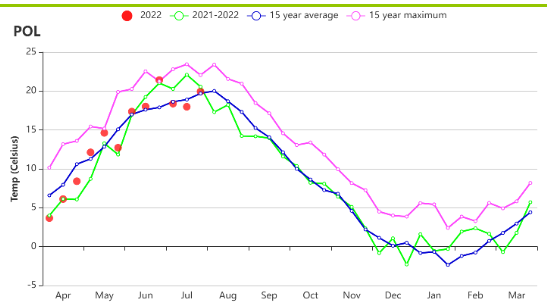
(f) Crop condition development graph based on NDVI, Northern oats and potatoes area (left) and Northern-central wheat and sugar beet area (right)





(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 3.64 Poland's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, April – July 2022

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (℃)	Departure (℃)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Northern oats and potatoes areas	274	-18	13.5	-0.4	1109	-3	773	-9
Northern-central wheat and sugarbeet area	227	-25	14.1	-0.2	1155	0	708	-14
Central rye and potatoes area	248	-21	14.7	-0.2	1168	1	738	-12
Southern wheat and sugarbeet area	239	-34	14.0	-0.4	1227	4	718	-17

Table 3.65 Poland's agronomic indicators by sub-national regions, current season's values and departure from 5YA, April – July 2022

Region	Cropped arable land fraction		Maximum VCI
	Current	Departure (%)	Current
Northern oats and potatoes areas	100	0	0.91
Northern-central wheat and sugarbeet area	100	0	0.88
Central rye and potatoes area	100	0	0.88
Southern wheat and sugarbeet area	100	0	0.90

[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 52% below average, average temperature was 0.6℃ higher and radiation was slightly above average (+3%). The significant decrease in rainfall and the rise of temperature caused a large biomass decrease (-24%). The CALF of Romania remained unchanged (100%) and the maximum VCI was only 0.82. The rainfall time series shows that precipitation was far below average in May, early June and July, below 20 mm, impacting the growth of maize and wheat. In contrast to the lower rainfall, the temperature was above average for most of the reporting period and even reached the 15 years maximum in late July. The VHI map shows that drought conditions were serious in the eastern region. According to the NDVI development curve, crop conditions were below average from April to June. Only 6% (green line) of Romain cropland experienced a change from a negative to a positive departure from the average NDVI trend during the reporting period. The proportion of irrigated cropland in Romania is only 4%. Crop conditions are assessed as unfavorable, especially for the summer crops.

Regional analysis

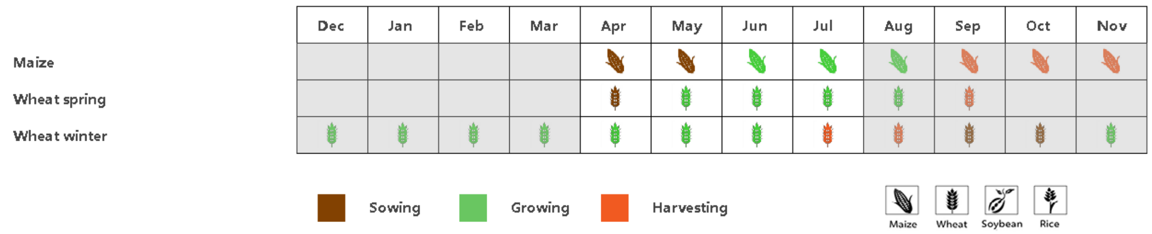
More details are provided below for three main agro –ecological zones: the Central mixed farming and pasture Carpathian hills (160), the Eastern and southern maize, wheat and sugar beet plains (161) and the Western and central maize, wheat and sugar beet plateau (162).

For the Central mixed farming and pasture Carpathian hills, compared to the 15YA, rainfall decreased by 53%, temperature was up by 0.8℃, radiation was above average (RADPAR +5%) and BIOMSS decreased by 23%. According to the NDVI development, crop conditions were below average during the reporting period. The regional average VCI maximum was 0.90. CPI was 1.03. 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.

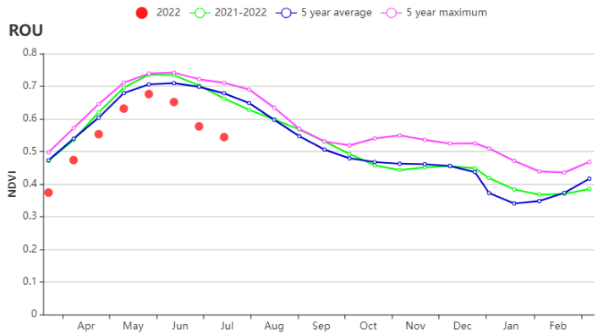
For the Eastern and Southern maize, wheat and sugar beet plains, rainfall decreased by 53%, the temperature was 1.0ºC higher than average and radiation remained average. This resulted in a reduced estimate of biomass (-24%). The NDVI development graph shows that crop conditions dropped to below average during the reporting period. The VCIx value of this region was only 0.80. According to the distribution map, the yellow and blue NDVI profile line region in the southeast (counties of Tulcea and Constanta) dropped largely in June and July, meanwhile, the maximum VCI values in this area were below 0.5. CPI was 0.99. All indicators show that the crop condition in this region was unfavorable.

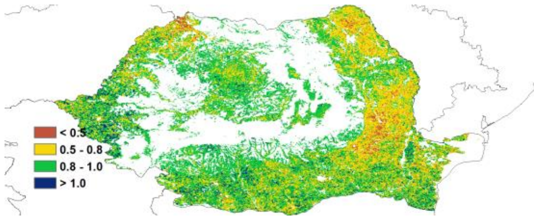
For the Western and central maize, wheat and sugar beet plateau, rainfall was lower than average by 51%. Temperature was also higher than average by 0.1℃, radiation was also higher (RADPAR +5%) and biomass decreased by 26%. Maximum VCI of this region was 0.85. It ranged considerably in this region (0.5 to 1.0). CPI was 1.04. The spatial NDVI pattern shows that NDVI was also decreasing in the central region (blue line), which indicates that crop conditions were unfavorable.

Figure 3.37 Romaina's crop condition, April- July 2022

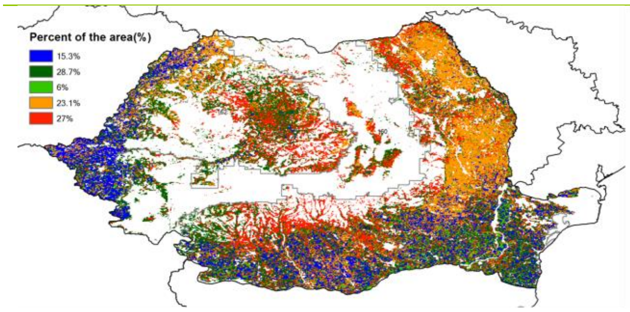


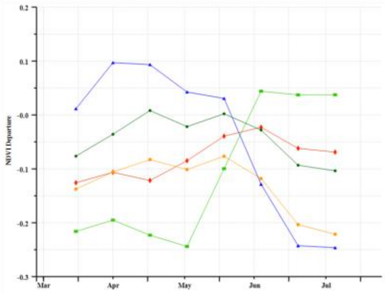
(a). Phenology of major crops



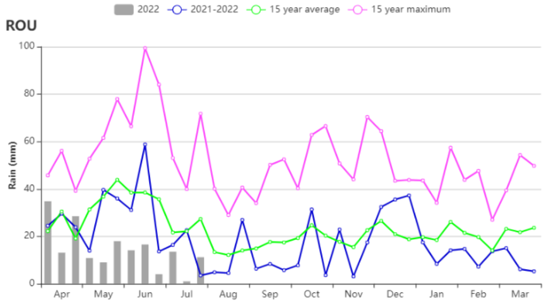


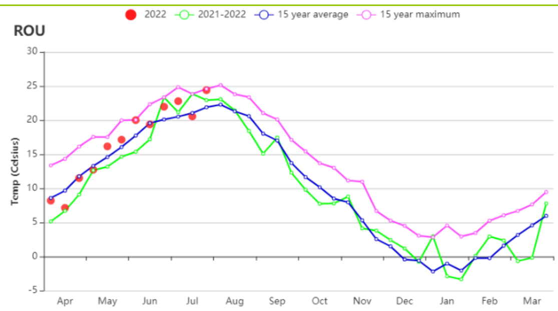
(b) Crop condition development graph based on NDVI (c) Maximum VCI



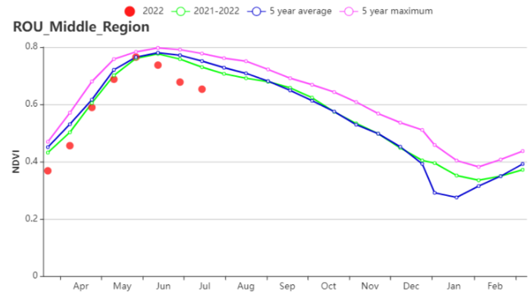


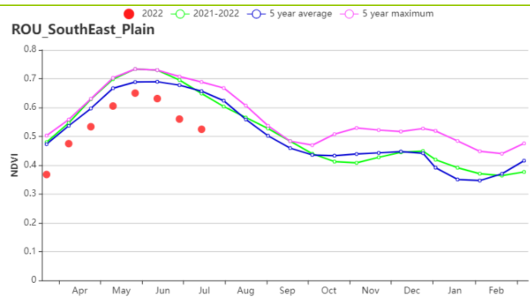
(d) Spatial NDVI patterns compared to 5YA (e) NDVI profiles



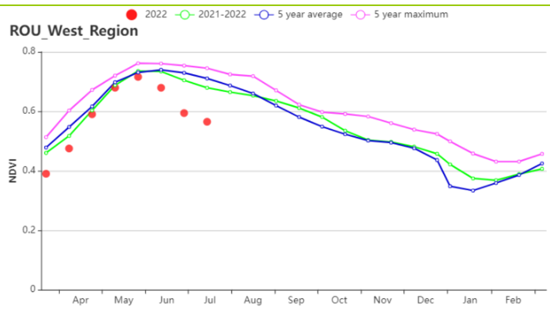


(f) Rainfall profiles (g) Temperature profiles





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



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

Table 3.66 Romania's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, April - July 2022

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	203	-53	14.9	0.8	1361	5	685	-23
Eastern and southern maize wheat and sugarbeet plains	157	-53	18.2	1	1345	2	665	-24
Western and central maize wheat and sugarbeet plateau	179	-51	15.9	0.1	1395	5	649	-26

Table 3.67 Romania's agronomic indicators by sub-national regions, current season's values and departure from 5YA, April-July 2022

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Central mixed farming and pasture Carpathian hills	100	0	0.90
Eastern and southern maize wheat and sugarbeet plains	100	0	0.80
Western and central maize wheat and sugarbeet plateau	100	0	0.85

[RUS] Russia

In Russia, the period from April to July is a time of active crop growth. At the end of July, winter crops are harvested in many regions, and spring crops reach their peak.

According to national data, NDVI during the analyzed period remained close to or slightly below the 5YA. Atmospheric precipitation from late April to early May was below the 15YA. During June and July rainfall was mostly above the 15YA. Temperatures were mostly close to the 15YA and last year's levels, except in May when they were below average. Overall, the NDVI in Russia is close to last year and to the 5YA.

Most regions showed negative NDVI departure from April to June. Among the main regions of crop production, South Caucasus and North Caucasus regions showed mainly positive NDVI departures from April to July (6.7% of croplands marked with blue color). In Central Russia and the Central Black Soil Region the situation was mixed: south-eastern part of the territory followed the same pattern as Northern and South Caucasus; the other part (12% of croplands marked with light green color) demonstrated negative NDVI departures till the end of June, then returned to above average – likely due to the development of spring crops. The rest of the regions (32.8 % of the croplands indicated with red color on the map) demonstrated mainly negative NDVI departures except for the beginning and middle of June and middle of July.

In major winter crop production regions, such as Central Russia, the Central Black Soil Region, the North and South Caucasus, and the Middle Volga, VCIx values ranged mainly from 0.8 to 1 or higher. The winter wheat outputs are estimated to be comparable to the average. As to the major spring wheat production regions, VCIx in the Central and East Siberia regions ranged mostly from 0.8 to 0.9. The yield of spring wheat there is expected to be close to the average. The crop status is worse in Ural and Western Siberia regions. Thus, we can expect a lower-than-normal yield for spring wheat in Western Siberia and the Ural region.

Regional analysis

South Caucasus

Rainfall and temperature were 25% and 0.8°C below the 15YA, respectively. BIOMASS was 14% below the 15YA. CALF was 1% below the 5YA. VCIx was 0.86. NDVI was below the 5YA in April, rising to the 5YA at the end of April. Then in July it dropped below the 5YA and below the previous year's level.

The winter wheat yield is expected to be lower than last year and lower than the average. There is small spring wheat acreage in the region, but its yield is expected to be below the average as well as the maize yield.

North Caucasus

Rainfall was 26% less than the 15YA. Temperatures and RADPAR were 0.6°C and 1% below the 15YA. BIOMSS was 13% below the 15YA. CALF was 1% above the 5YA. The VCIx was 0.9.

NDVI was equal to the 5YA till early July. In July NDVI declined sharply relative to the previous year's level and the 5YA.

The winter wheat yield is expected to be close to the 5YA. Spring wheat is scarce in the region, but its yield is also expected to be at the 5YA. The maize yield is expected to be below the average level.

Central Russia

Rainfall was 11% higher than the 15YA. Temperatures were 1.2°C less than the 15YA. Biomass was 6% higher than the 15YA. CALF was equal to the 5YA. VCIx was 0.97. NDVI was close to but mostly below the 5YA.

Based on the NDVI, the yield of winter wheat is likely to be at the level of last year, and those of spring wheat and maize are slightly lower than last year and normal.

Central Black Soil

Precipitation was 14% higher than the 15YA. Temperature was 1.1°C below the 15YA. RADPAR was 2% below the 15YA. BIOMSS was 8% above the 15YA. CALF was equal to the 5YA. The VCIx was 0.96. NDVI was mostly equal to the 5YA.

Winter, spring wheat and maize yields are expected to be equal to last year's level and close to the average.

Middle Volga

Atmospheric precipitation was 33% above the 15YA, temperatures were and RADPAR were 1.1°C and 7% below the 15YA, respectively. BIOMSS was 13% above the 15YA. CALF was 2% above the 5YA. The VCIx index was 0.85. NDVI was almost close to the 5YA from April to June and slightly above average in July.

Winter, spring wheat and maize yields are likely to be higher than last year and slightly above the average.

Ural and Western Volga

Rainfall was 35% above the 15YA. Temperature and RADPAR were by 0.2°C and 5% below the 15YA, respectively. Biomass was 16% above the 15YA. CALF was 1% above the 5YA. The VCIx was 0.79. The NDVI was below the 5YA until late May, after which it rose above this level and last year's level.

Winter and spring wheat and maize yield are likely to be higher than last year and close to average.

Western Siberia

Rainfall increased by 32% and temperature increased by 0.7°C above the 15YA. RADPAR was 4% higher than the 15YA. BIOMSS was 14% above the 15YA. CALF was 1% less than the 5YA. The VCIx was 0.92. NDVI was below the 5YA and last year's value.

There are very few winter crops and maize in this region. According to the graphs, the yield of spring wheat is expected to be below the average and last year's.

Middle Siberia

Precipitation was down by 1% compared to the 15YA. Temperature increased by 0.5°C. RADPAR was 3% higher than the 15YA. BIOMSS was 3% lower the 15YA. CALF was 1% higher than the 5YA. VCIx was 1.02. NDVI from April to early June was below the 5YA, but from early June to late July was equal to it.

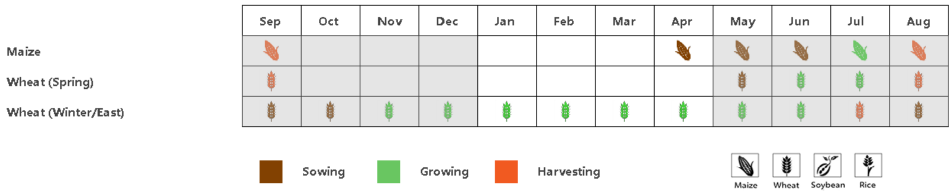
There are no winter crops or maize in this region. Spring wheat yield is expected to be close to the average and to last year's level.

Eastern Siberia

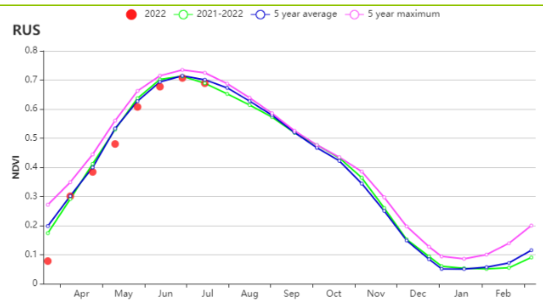
RADPAR and temperature decreased by 3% and by 0.4°C compared to the 15YA, respectively. Precipitation was higher than the 15YA by 3%. BIOMSS was 3% above the 15YA. CALF was equal to the 5YA. VCIx was 0.96. NDVI for the region was below the 5YA in the period from April to early June, but from early June to late July it was equal to the 5YA.

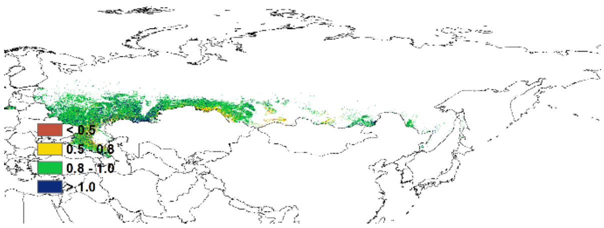
There are very few winter crops and maize in this region. The yield of spring wheat is expected to be close to the average.

Figure 3.38 Russia’s crop condition, April – July 2022

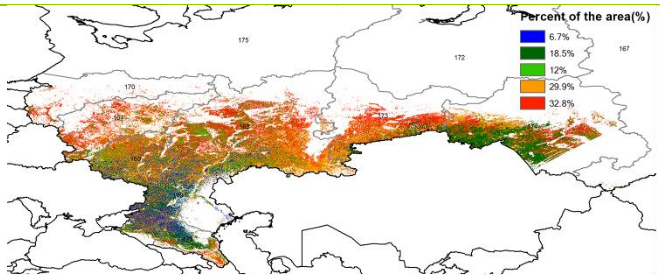


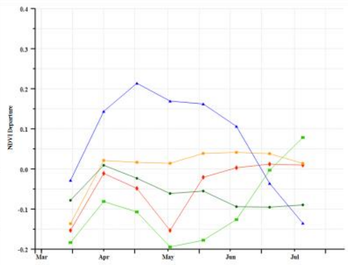
(a) Phenology of major crops



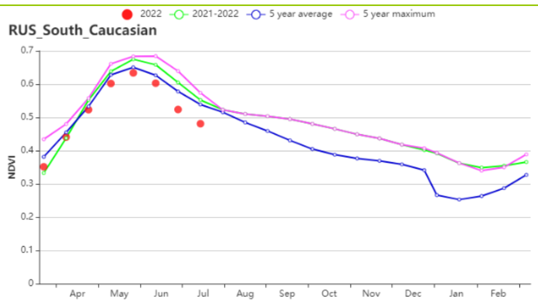


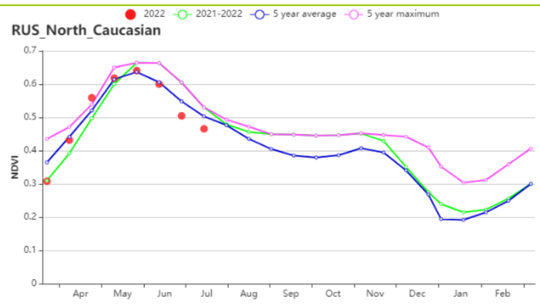
(b) Crop condition development graph based on NDVI (c) Maximum VCI



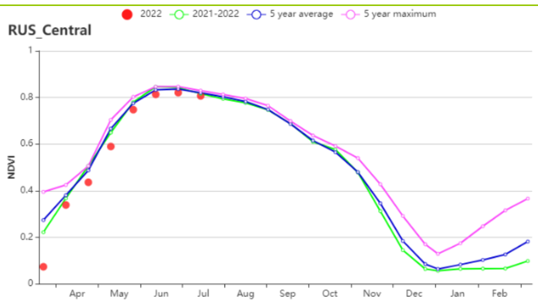


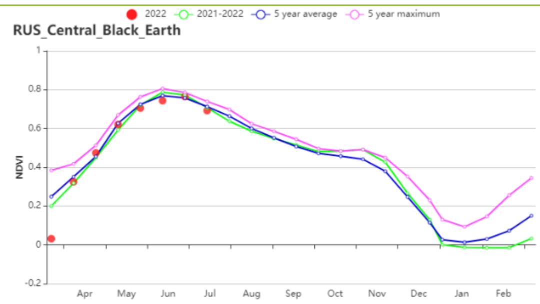
(d) Spatial NDVI patterns compared to 5YA (e) NDVI profiles



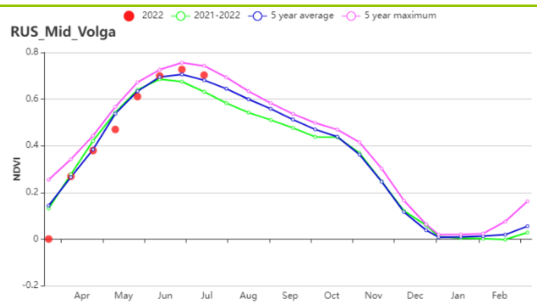


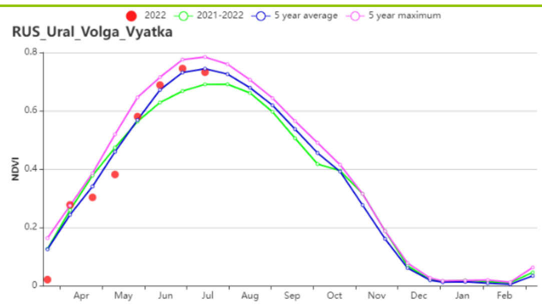
(f) Crop condition development graph based on NDVI, Southern Caucasus (left) and Northen Caucasus (right).



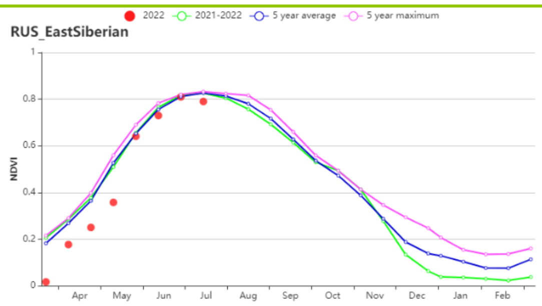


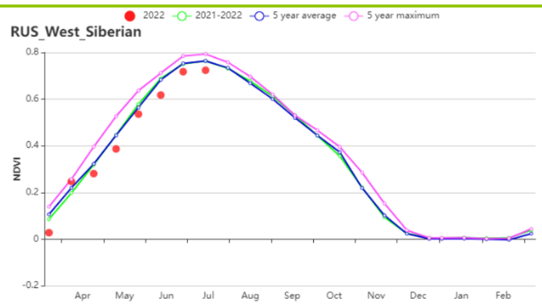
(g) Crop condition development graph based on NDVI, Central Russia (left) and Central black soils area (right).



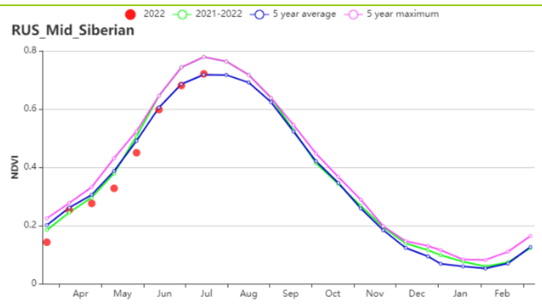


(h) Crop condition development graph based on NDVI, Middle Volga (left) and Ural and western Volga region (right).

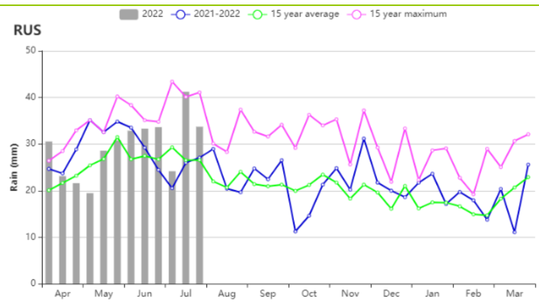


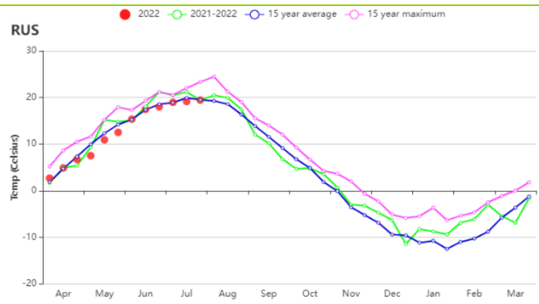


(i) Crop condition development graph based on NDVI, Eastern Siberia (left) and Middle Siberia (right).



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





(k) Rainfall index

(l) Temperature Index

Table 3.68 Russia's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, April – July 2022

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m^2)	Departure (%)	Current (gDM/m^2)	Departure (%)
Central Russia	363	11	11.6	-1.2	1087	0	882	6
Central black soils area	342	14	13.7	-1.1	1157	-2	885	8
Eastern Siberia	443	3	11.3	-0.4	1117	-3	901	3
Middle Siberia	281	-1	10.9	0.5	1290	3	716	3
Middle Volga	392	33	12.5	-1.1	1069	-7	892	13
Northern Caucasus	220	-26	17.2	-0.6	1303	-1	710	-13
Southern Caucasus	385	-25	14.4	-0.8	1295	-1	745	-14
Ural and western Volga region	372	35	12.3	-0.2	1053	-5	865	16
Western Siberia	388	32	13.3	0.7	1182	4	878	14

Table 3.69 Russia's agronomic indicators by sub-national regions, current season's values and departure from 5YA, April – July 2022

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	97	1	1.02
Middle Volga	99	2	0.85
Northern Caucasus	96	1	0.90
Southern Caucasus	95	-1	0.86
Ural and western Volga region	100	1	0.79
Western Siberia	100	-1	0.92

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[SYR] Syria

The main crops in Syria include barley, rice and wheat. During the current reporting period from April to July, both barley and wheat were in their respective grain-filling stages and reached maturity in May and June, while rice was in sowing and growth stages. The proportion of irrigated cropland in Syria is about 44% and regular rainfall is crucial to the crop growth.

Compared to the 15-year average, accumulated rainfall was less than average (RAIN, -86%)， while radiation was above average (RADPAR, +2%). The temperature was above average (TEMP, +1℃), the average temperature value for the reporting period was 24.9℃. The precipitation was generally below average except in late July. The temperature was generally above average except in May and late July. It is noticeable that the temperatures warmed up to above 19°C in early April and stayed above average in April. The drier and higher temperature conditions resulted in a decrease of BIOMSS by 13%. According to the NDVI profiles, the national average NDVI values were far below the 5YA during the grain-filling periods of barley and wheat in April and May. The national average VCIx was 0.40 and CALF was below average by 36%. Conditions for cereal production in Syria were poor due to the ongoing, multiyear drought as well as the civil war.

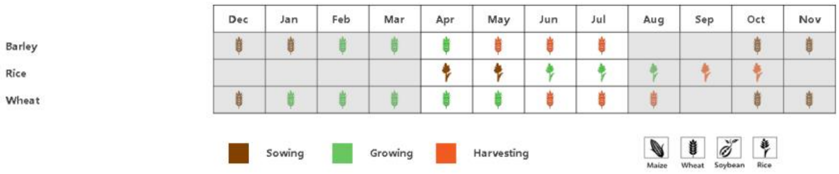
Regional analysis

Based on cropping systems, climatic zones and topographic conditions, five sub-national agro-ecological regions can be distinguished for Syria, among which three are relevant for crop cultivation: The first (a) (220) and first (b) region (221), the second region (222), the third (223) and the fourth region (219).

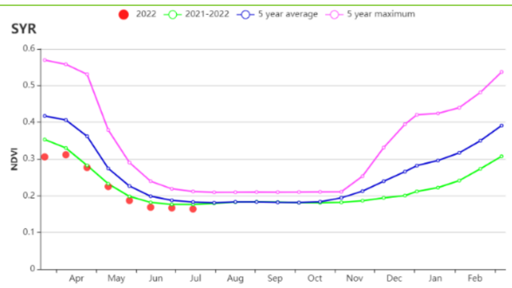
In the first two regions (a and b), the accumulated precipitation was below average, and temperature was above average, while RADPAR was close to average. The hot and dry weather resulted in a decrease of BIOMSS by 13% to 16%. The national average VCIx values were not higher than 0.75 for the two regions. Compared to the other regions, the higher CALF values indicated more agricultural activities in this region, but they were below their 5YA by 2% and 11%, respectively. According to NDVI profiles of two regions, crop conditions were mostly below the 5YA, but surpassed last year's level by the end of this monitoring period. The severe drought limited crop growth. The conditions for barley and wheat production were not favorable.

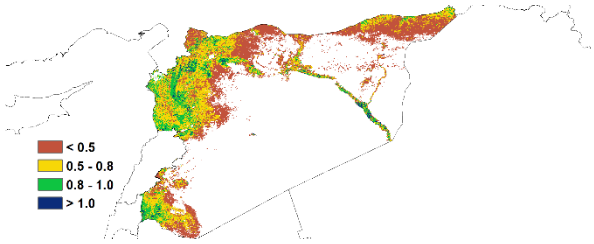
Agro-climatic conditions in the second, third and fourth region were unfavorable. The average rainfall was below average by more than 90%, the temperature and RADPAR were above average. The unfavorable weather conditions led to decrease of potential biomass by at least 12%. The CALF values in three regions decreased significantly by more than 53%. The average VCIx value in the second region, the third region and the fourth region was 0.4, 0.28 and 0.16. According to NDVI profiles of three regions, crop conditions were below the 5YA, particularly from April to May. Due to the serious rainfall deficit and high temperature in the main growth period, the outputs of wheat and barley in the second region are estimated to be below average, and the barley outputs in the third and fourth region are also not favorable.

Figure 3.39. Syria's crop condition, April 2022 – July 2022



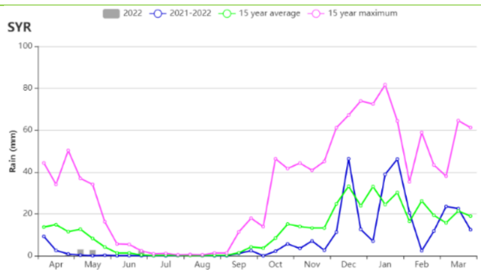
(a). Phenology of major crops

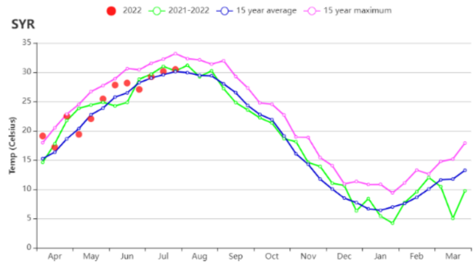




(b) Crop condition development graph based on NDVI

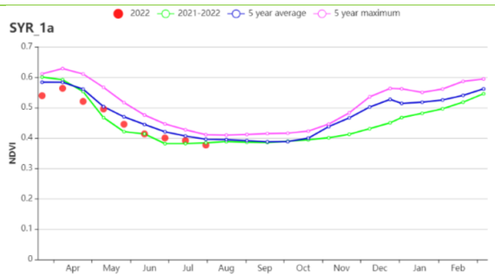
(c) Maximum VCI

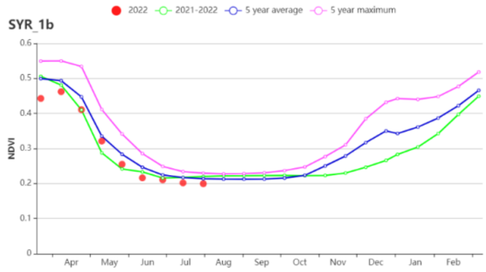




(d) Rainfall profiles

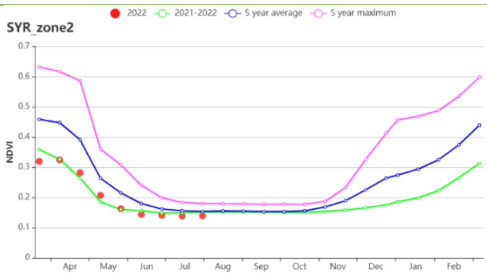
(e) Temperature profiles

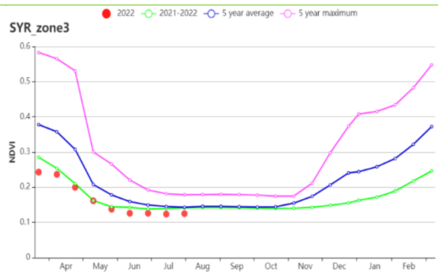




(f) Crop condition development graph based on NDVI (The first(a) region)

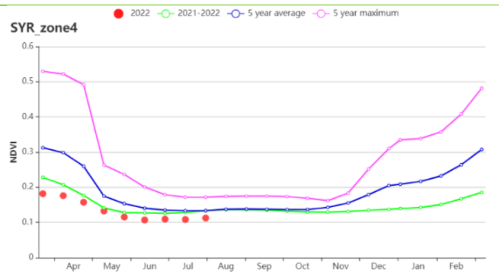
(g) Crop condition development graph based on NDVI (The first (b) region)





(h) Crop condition development graph based on NDVI (The second region)

(i) Crop condition development graph based on NDVI (The third region)



(j) Crop condition development graph based on NDVI (The fourth region)

Table 3.70. Syria agro climatic indicators by sub-national regions, current season's values and departure from April - July 2022

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
First (a) region	19	-76	22.1	0.3	1657	1	547	-16
First (b) region	19	-78	22.4	1.0	1655	1	550	-13
Second region	7	-90	25.1	1.3	1640	2	554	-15
Third region	6	-90	24.5	1.1	1660	2	549	-12
Forth region	4	-92	25.5	1.2	1665	2	559	-12
Badia	3	-92	26.1	1.0	1667	2	563	-9

Table 3.71. Syria, agronomic indicators by sub-national regions, current season's values and departure from 5YA, - April - July 2022

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
First (a) region	92	-2	0.75
First (b) region	55	-11	0.69
Second region	23	-53	0.40
Third region	8	-72	0.28
Forth region	6	-72	0.16
Badia	12	-42	0.22

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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 experienced rainy and cooler than usual weather in this monitoring period with above-average rainfall (RAIN +14%) and sunshine (RADPAR +5%), as well as decreased temperature (TEMP -0.5°C). All these indicators led to a favorable potential biomass (BIOMSS, +7%). The proportion of irrigated cropland in Thailand is 22.5%, and therefore, regular rainfall is important to sustain crop growth.

The NDVI development graph shows that crop conditions were above average before mid-May mainly due to high temperatures and sufficient rainfall. Subsequently, the rainfall and temperature were generally below average from late-May to mid-to-late June, which led to a decrease in crop conditions. Then, the crop conditions gradually improved close to the 5-year average at the end of monitoring period. According to the NDVI departure clustering map, 57.7% of cropland was always slightly above average from April to July, widely located in central, eastern and southern areas. 18.1% of the cropped area, mostly located in northeast and southwest parts, showed a sharp drop in May, presumably due to cloud cover in the satellite images, and then reached average levels by the end of this monitoring period. A similar sharp drop in early July was observed for 13.8% of the cropped area. Those areas were located in pockets over most of Thailand, but predominantly in the south. For the remaining 10.4%, a sharp negative departure was observed at the end of this monitoring period.

At the national level, all arable land was cropped during the season (CALF +100%) and had favorable VCIx values of around 0.92. The Crop Production Index (CPI) in Thailand is 1.15. CropWatch estimates that the crop conditions were 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).

For the **Central double and triple-cropped rice lowlands**, the agroclimatic indicators show that the accumulated rainfall and radiation were above average (RAIN +34%, RADPAR +6%), and temperature was below average (TEMP -0.6ºC), which resulted in above-average biomass production potential (BIOMSS +11%). According to the NDVI development graph, crop conditions were favorable and above the 5-year average for most of the monitoring period, except for July. The crop conditions even reached the 5-year maximum level before late April. Considering the favorable VCIx value of 0.91, the situation is assessed as slightly above average.

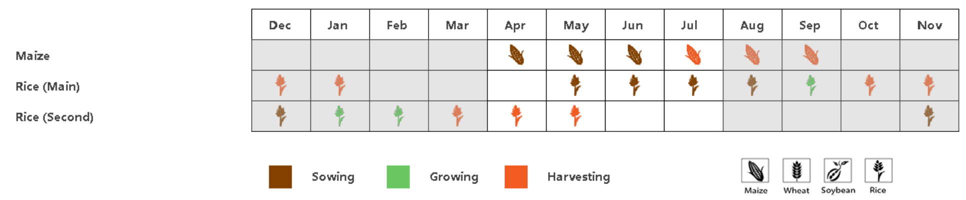
According to agro-climatic indicators for the **South-eastern horticulture area**, temperature was below average (TEMP -0.5 ºC), while accumulated rainfall and solar radiation were slightly above average (RAIN +3%, RADPAR +2%), the resulting biomass production potential stayed unchanged (BIOMSS 0%). The NDVI curve as well as a VCIx of 0.92 indicate average conditions.

Agroclimatic indicators show that the conditions in the **Western and southern hills** were slightly above average: accumulated rainfall and radiation were above average (RAIN +4%, RADPAR +4%), and temperature was below average (TEMP -0.1ºC), resulting in an increase of biomass production potential (BIOMSS +4%). As shown in NDVI development graph, the crop conditions were markedly above average and even at the 5-year maximum level in early-to-mid April, but dropped to below-average levels after mid-May. VCIx was at 0.94. Overall, crop conditions were close to normal.

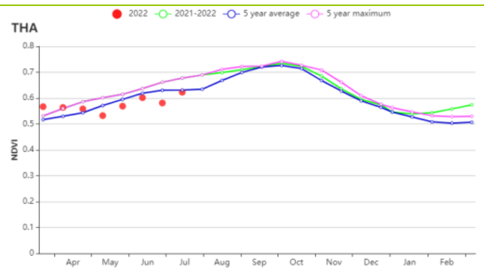
Indicators for the **Single-cropped rice north-eastern region** follow the same patterns as those for the country as a whole: accumulated rainfall and radiation were above average (RAIN +24%, RADPAR +7%), and temperature was below average (TEMP –1.0ºC), resulting in an increased biomass production potential (BIOMSS +11%). As depicted in the NDVI development graph, the crop conditions were above average before early May, when a sharp drop was observed. Subsequently, conditions gradually improved to average levels.

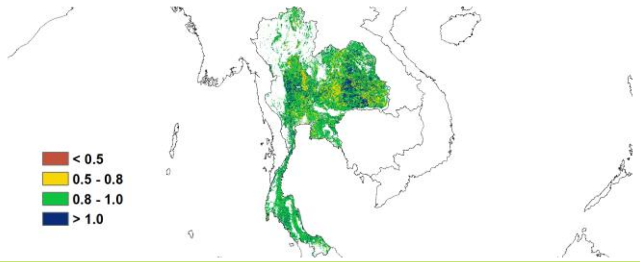
According to the satisfactory VCIx value of 0.91, and the NDVI curve, the crop conditions were close to average.

Figure 3.40 Thailand's crop condition, crop calendar from April-July 2022



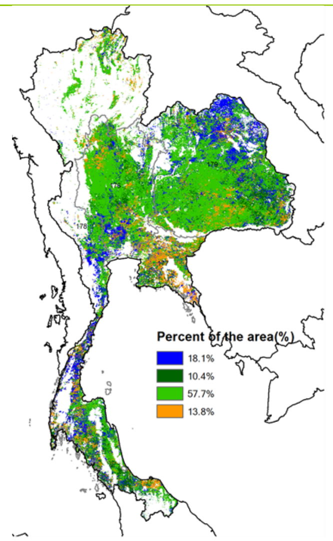
(a) Crop phenology map of major crops

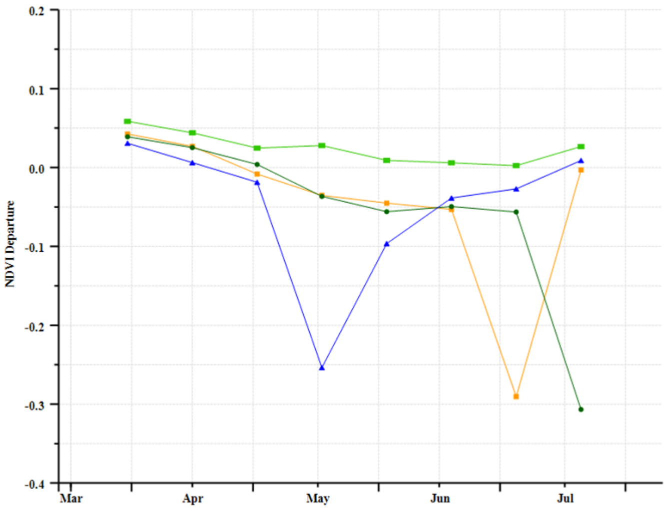




(b) Crop condition development graph based on NDVI

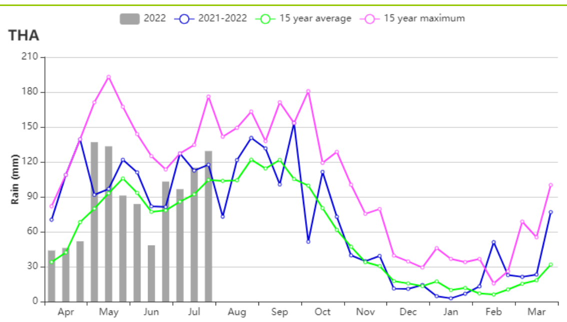
(c) Maximum VCI

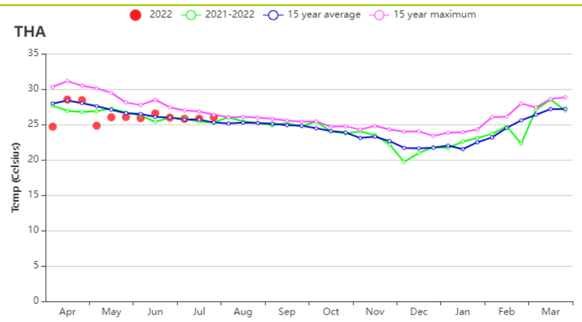




(d) Spatial distribution of NDVI profiles

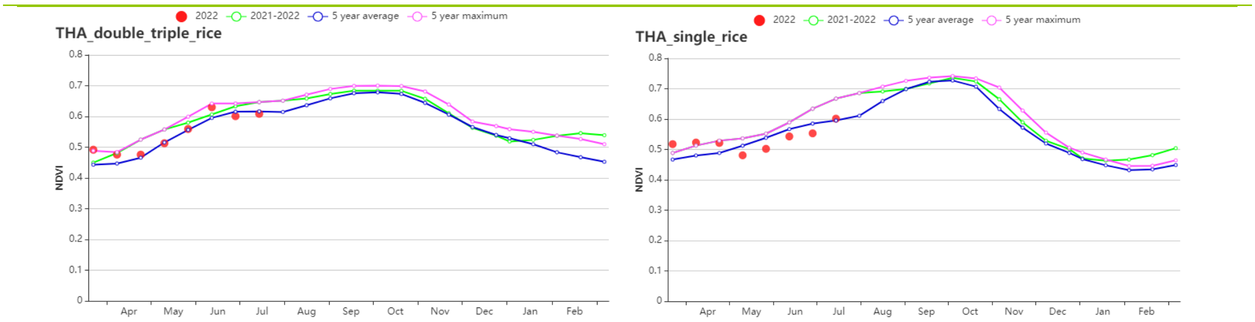
(e) NDVI profiles



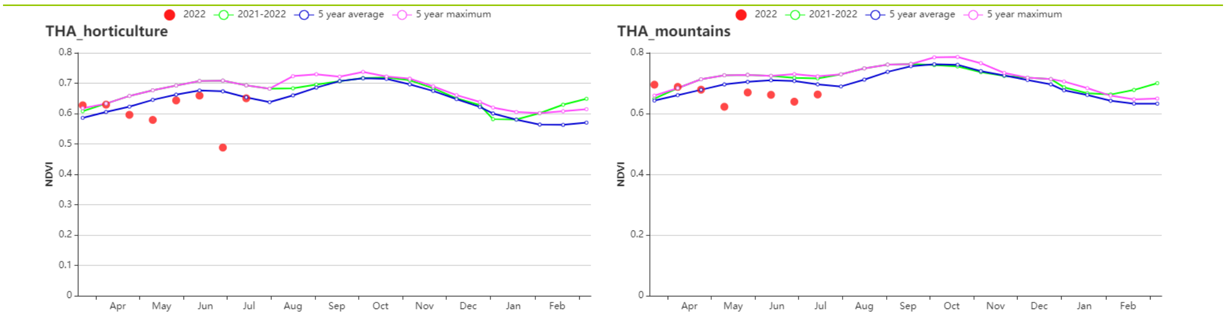


(f) Rainfall profiles

(g) Temperature profiles



(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 3.72 Thailand's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, April - July 2022

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	1029	34	27.2	-0.6	1245	6	1454	11
South-eastern horticulture area	1115	3	26.6	-0.5	1266	2	1529	0
Western and southern hill areas	943	4	25.6	-0.1	1262	4	1423	4
Single-cropped rice north-eastern region	1282	24	26.5	-1	1241	7	1575	11

Table 3.73 Thailand's agronomic indicators by sub-national regions, current season's values and departure from 5YA, April - July 2022

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Central double and triple-cropped rice lowlands	99	0	0.91
South-eastern horticulture area	99	1	0.92
Western and southern hill areas	100	0	0.94

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Single-cropped rice north-eastern region	100	1	0.91

[TUR] Turkey

The present monitoring period covers the sowing and growing period of rice and maize, and part of the growing and harvesting period of wheat. The percentage of irrigated cropland in Turkey is 19.8%, and agrometeorological conditions play an important role in the growth of most crops. Nationwide, RAIN in Turkey is 36% lower than the last 15-year average comparison, while both average temperature (TEMP)(+0.1°C) and RADPAR (+1.6%) are slightly higher than the last 15-year average. BIOMASS was 14% below average. The low RAIN in the cropland, which in turn led to a decrease in BIOMASS.

The Crop condition development graph based on NDVI indicated that crop growth conditions were slightly below average throughout the monitoring period. The best vegetation condition index (VCIx) for the whole country was 0.74. The mean VCIx value for the Black Sea region was 0.91 and some areas had VCIx values higher than 1.0, indicating that crop growth in this region was close to the average. The VCIx values in other regions are lower than 0.8, indicating that the crop growth is inferior to the average.

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.

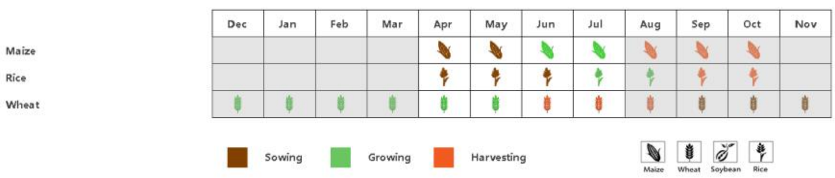
In the Black Sea area, overall crop growing conditions were slightly below average. The rainfall was below average (-16%) and the temperature (TEMP) decreased by 1.0°C. The cropped arable land fraction (CALF) was 97%, which is comparable to the average. VCIx had a high mean value of 0.91, the highest of all four agroecological zones in Turkey. The crop harvest was estimated to be close to normal.

Crop growth in the Central Anatolia region was below average during the current monitoring period. Cumulative precipitation in this agroecological zone was 31% lower than average during the present monitoring period. the temperature (TEMP) (-0.1°C) and RADPAR (+1%) were close to the 15-year average. The BIOMSS decreased by 12% due to the decrease in precipitation. The VCIx in the region averaged 0.71 and CALF was 16% below average. Crop yields are expected to be below average.

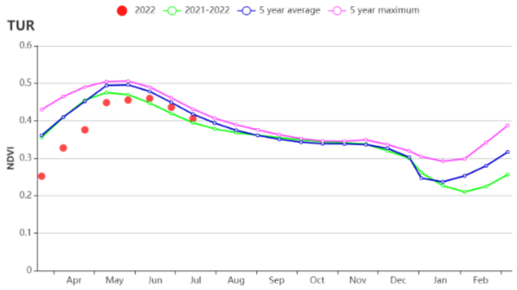
In the Eastern Anatolia region, crop growth was generally below average through mid-July. Rainfall was 48% below average and was the most severe of the four agroecological zones. the temperature (TEMP) and RADPAR were 0.5°C and 3% above average, respectively. The reduction in precipitation compromised crop growth and resulted in an 18% reduction in BIOMSS. CALF was reduced (-7%) compared to the average of the last 5 years. The average VCIx for the region is 0.79 and crop yields are predicted to be below average.

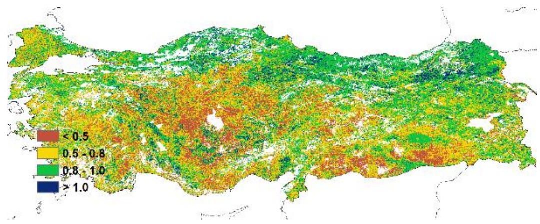
NDVI-based crop growth process lines show slightly below-average crops in the Marmara Aegean Mediterranean lowland zone regions. Rainfall is 44% below average, and the temperature (TEMP) and RADPAR are 0.5°C and 1% above average, respectively. the VCIx value is 0.71 and CALF is slightly lower (-8%). Yields in the region are expected to be below average.

Figure 3.41 Turkey’s crop condition, April-July 2022



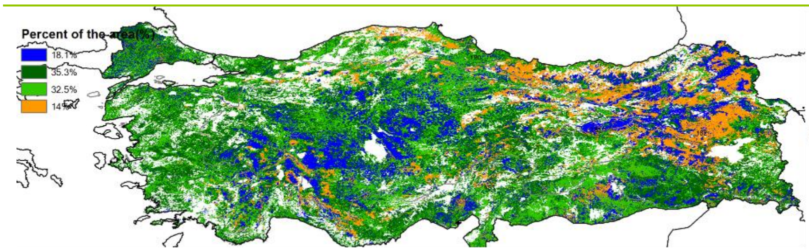
(a). Phenology of major crops

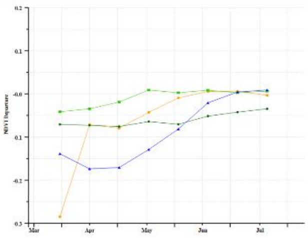




(b) Crop condition development graph based on NDVI

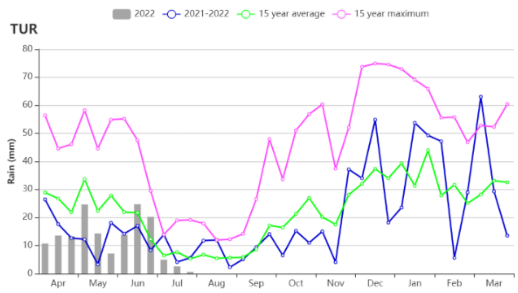
(c) Maximum VCI

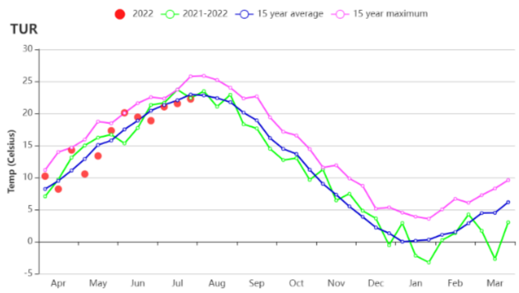




(d) Spatial NDVI patterns compared to 5YA

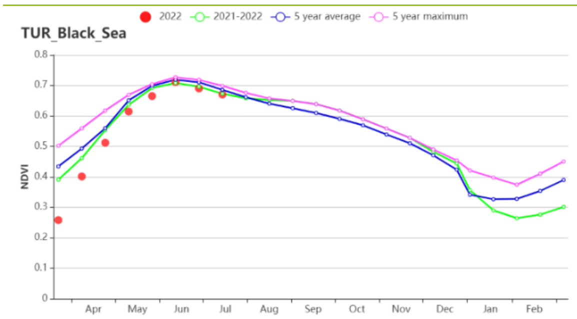
(e) NDVI profiles

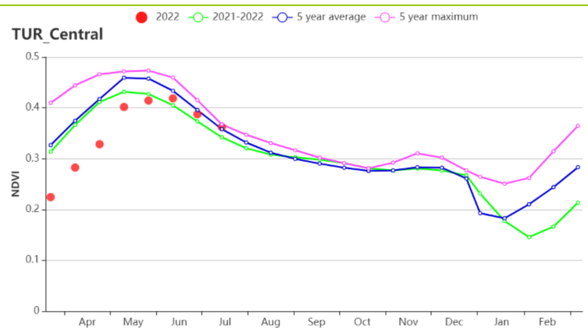




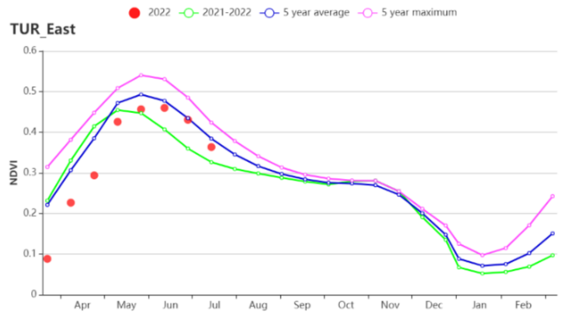
(f) Time series rainfall profile

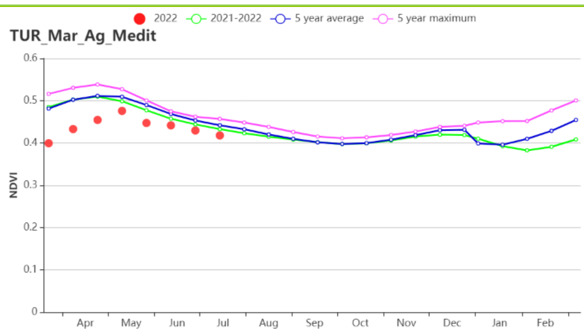
(g) Time series temperature profile



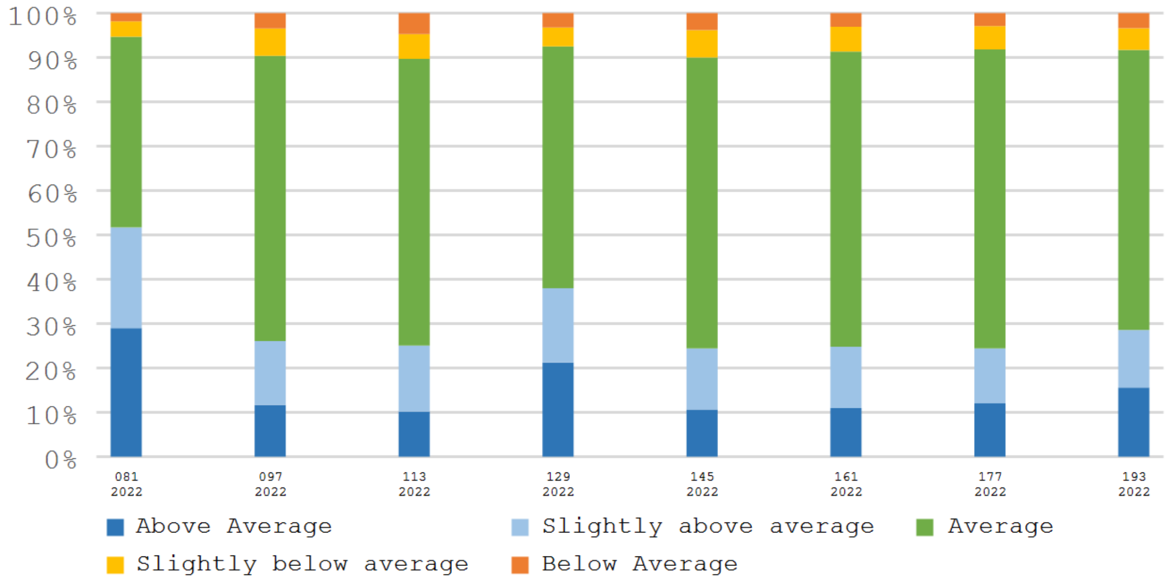


(h) Crop condition development graph based on NDVI (Black Sea region (left) and Central Anatolia region (right))

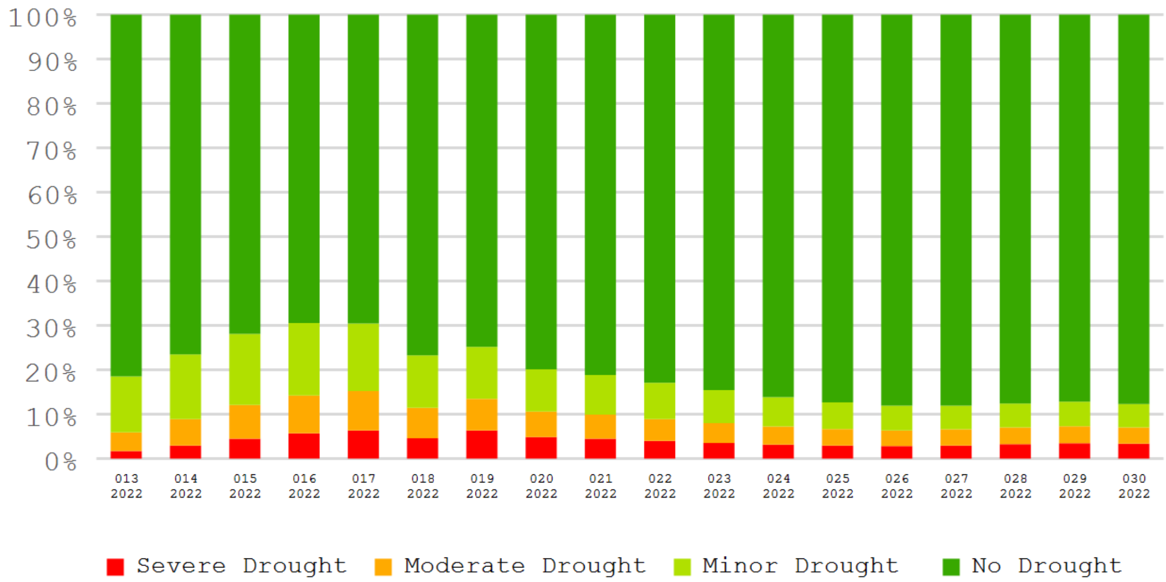




(i) Crop condition development graph based on NDVI (Eastern Anatolia region (left) and Marmara_Agean_Mediterranean lowland region (right))



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



(k) Proportion of VHIm categories compared with 5YA

Table 3.74 Turkey's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, April-July 2022

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure from 15YA (%)	Current (℃)	Departure from 15YA (℃)	Current (MJ/m2)	Departure from 15YA (%)	Current (gDM/m2)	Departure from 15YA (%)
Black Sea region	323	-16	12.0	-1.0	1338	0	722	-10
Central Anatolia region	149	-31	15.3	-0.1	1502	1	608	-12
Eastern Anatolia region	160	-48	14.8	0.5	1572	3	611	-18
Marmara Agean Mediterranean lowland region	100	-44	19.4	0.5	1559	1	608	-15

Table 3.75 Turkey's agronomic indicators by sub-national regions, current season's values and departure from 5YA, April-July 2022

Region	CALF		Maximum VCI
	Current (%)	Departure from 5YA (%)	Current
Black Sea region	97	0	0.91
Central Anatolia region	53	-16	0.71
Eastern Anatolia region	73	-7	0.79
Marmara Agean Mediterranean lowland region	73	-8	0.71

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 SYR THA TUR **UKR** USA UZB VNM ZAF ZMB

[UKR] Ukraine

In Ukraine, this monitoring period (April to July) covers the sowing and major growing stages of maize, as well as the harvesting of winter wheat which started in July.

At the national level, a severe deficiency of rainfall was observed since May, which led to a 35% reduction of precipitation in this period as compared to the 15YA. Other agroclimatic indicators were close to normal. Temperature (15.5 ℃) was 0.6 ℃ lower while radiation (1238 MJ/m2,+0%) was normal. Due to the lack of rainfall, CropWatch predicts that the potential biomass is 19% below the 15YA. Agronomic indicators showed nearly all cropland was cultivated (CALF 100%) and the maximum vegetation condition index (VCIx) reached 0.85, which was favorable.

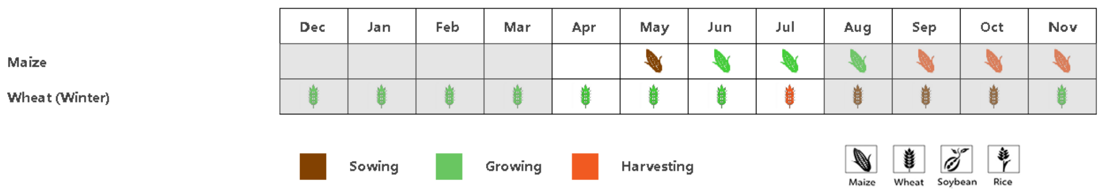
The remote sensing-based national crop condition development curve showed that the NDVI was consistently lower than the 5YA throughout the whole period. NDVI of only 14.7% of cropland was higher than the 5YA before July. In line with the severe condition of drought, VCIx in eastern (i.e. Transcarpatia Oblasts) and southern (i.e. Odessa Oblasts) was low (below 0.5), indicating crop development in these areas was unfavorable. In addition to the drought, the ongoing Ukraine crisis continues to negatively impact crop production. Considering that the cirsis has reached a stalemate in the southern Ukraine, including Kherson, Odessa, Mykolaiv and Zaporizhia Oblasts, which are the major maize areas, the prospects for maize production are unfavorable. Wheat production had also suffered due to the crisis.

Regional analysis

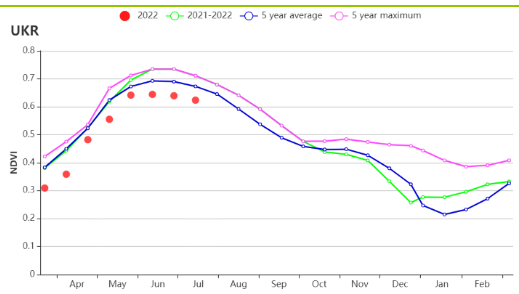
Regional analyses are provided for four agro-ecological zones (AEZ) defined by their cropping systems, climatic zones and topographic conditions. They are referred to as **Central wheat area** with the Poltava, Cherkasy, Dnipropetrovsk and Kirovohrad Oblasts; **Northern wheat area** with Rivne; **Eastern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

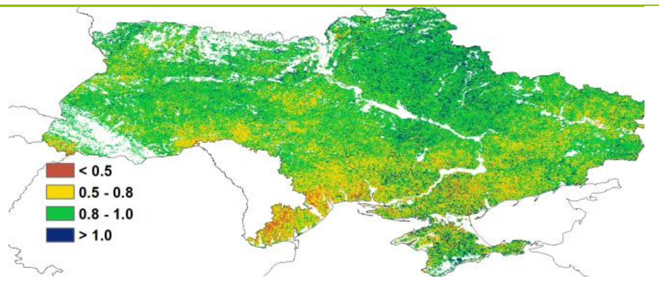
All four AEZs experienced similar agroclimatic and agronomic conditions in this period, a significant decrease in rainfall was recorded (from -28% to -53%), and all had cooler temperatures (-0.4℃ to -0.8℃) except **Eastern Carpathian hills** (no change) and normal solar radiation (-1% to 4%) as compared to the 15YA. Potential biomass for all AEZs was estimated 16% to 28% lower than the 15YA. All cropland was cultivated (CALF, 99% to 100%) with normal to favorable VCIx (0.80 to 0.90). Because of the rainfall deficiency, crop development based on NDVI showed below-average levels throughout this period. Based on the above information, below-average production of maize is to be expected, especially in the **Southern wheat and maize area**.

Figure 3.42 Ukraine's crop condition, April - July 2022

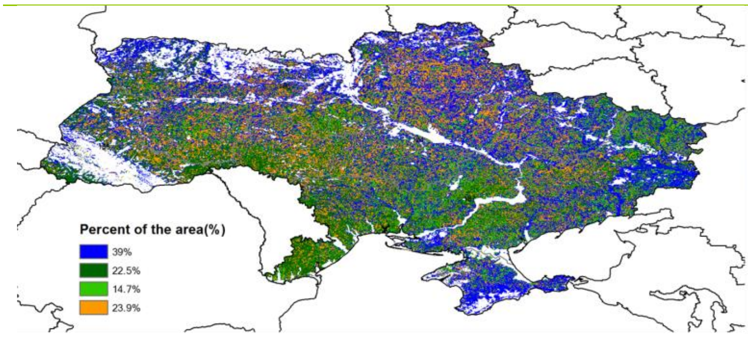


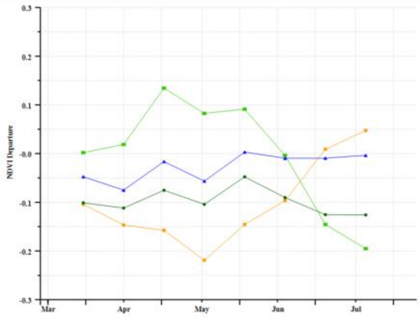
(a). Phenology of major crops



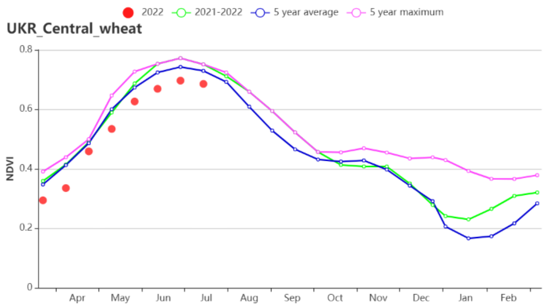


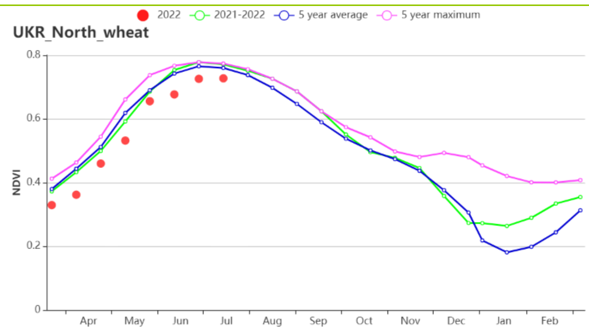
(b) Crop condition development graph based on NDVI (c) Maximum VCI



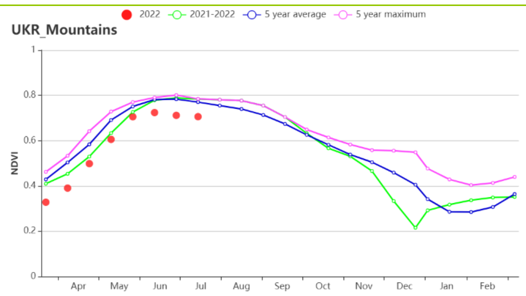


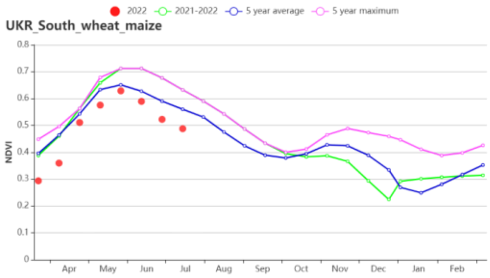
(d) Spatial NDVI patterns compared to 5YA (e) NDVI profiles



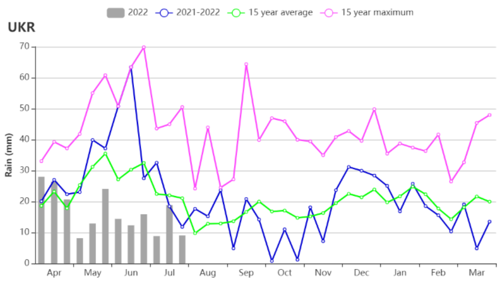


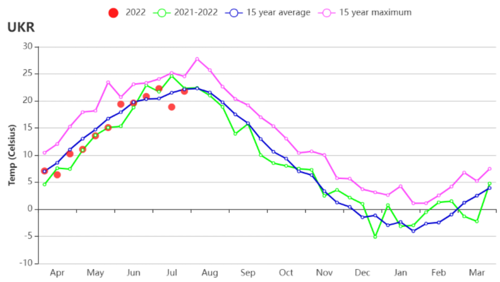
(e) Crop condition development graph based on NDVI (Central wheat area(left) Northern wheat area(right))





(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)

Table 3.76 Ukraine's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, April - July 2022

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m^2)	Departure (%)	Current (gDM/m^2)	Departure (%)
Central wheat area	215	-28	15.5	-0.7	1225	-2	703	-16
Eastern Carpathian hills	200	-53	14.4	0.0	1271	4	665	-28
Northern wheat area	220	-32	14.5	-0.8	1177	-1	693	-19
Southern wheat and maize area	161	-37	17.0	-0.4	1294	0	637	-20

Table 3.77 Ukraine's agronomic indicators by sub-national regions, current season's values and departure from 5YA, April - July 2022

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Central wheat area	100	0	0.88
Eastern Carpathian hills	100	0	0.86
Northern wheat area	100	0	0.90
Southern wheat and maize area	99	0	0.80

[USA] United States

This report covers the period from April to July 2022. Winter wheat had reached maturity in June and July. The sowing of maize, soybean, and spring wheat concluded in May. By late July, maize had reached the silking stage and soybeans were at the flowering and podding stage. Spring wheat will be harvested in August. Overall, NDVI showed below-average crop conditions until the end of July.

At the country level, rainfall was 7% below average, the temperatures were 0.5°C above and RADPAR was near the 15YA. The time series of rainfall and temperature indicates that the United States experienced a dry and hot period with below-average rainfall in June, accompanied by above-average temperatures starting in mid-June. A rainfall deficit occurred in the Great Plains from South Dakota to Texas, including Texas (-37%), Nebraska (-32%), South Dakota (-22%), Montana (-12%), and Kansas (-9%). The northwest experienced a wet season, including Washington (+68%) and Idaho (+15%). Near-average rainfall occurred in the other regions.

The strong heterogeneity of agro-climatic conditions led to diverse crop conditions. The VCIx map indicated poor crop conditions in the Southern Plains (VCIx < 0.5) and acceptable crop conditions in other regions (VCIx > 0.8). The drought in the Southwest and Southern Plain resulted in a decrease in the cropped arable land fraction. At the national level, CALF was 3% below average. The NDVI departure profile indicated large spatial variability of crop growth conditions. Good crop conditions were prevalent in the Northwest, where above-average rainfall provided sufficient water for the crops. Poor crop conditions were observed in the Southern Plain and Southwest region from April to July, mostly due to dry and hot weather. The crop conditions in the Northern Plain improved from April to July. The crop conditions in the Corn Belt, Northern Plain, and Northeast region improved from May to July. The national-scale agricultural production situation index (CPI=1.04) indicates that the agricultural production situation is close to the average.

In short, CropWatch assessed the mixed crop conditions, and crop conditions in the Corn Belt should be closely monitored.

Regional Analysis

1. Corn Belt

The Corn Belt is the most important maize and soybean producing zone. It includes Illinois, Iowa, Minnesota, Wisconsin, Ohio, and Michigan. During this period, agro-climatic conditions were normal, rainfall was 4% below the 15-year average, the temperature was average, and RADPAR was 2% below the 15YA. A wet and cooler than usual spring delayed the planting of crops in April, which in turn caused the NDVI development curve to lag behind other years. But the NDVI profile indicated that crop conditions were close to average by the end of July. In June, the region experienced a rainfall deficit resulting in below-average crop conditions, which recovered to normal as rainfall returned to above-average levels. The CALF reached 100% and VCIx reached 0.89, identifying average crop growing conditions.

2. Northern Plains

The Northern Plains is the largest spring wheat producing region and an important maize producing region in the United States. It includes North Dakota, South Dakota, and some parts of Nebraska. Wet and cool weather in April created unfavorable conditions for the sowing of summer crops, but conditions improved in May. Rainfall and temperature were 17% and 0.5℃ below the 15YA. The crop growth condition is close to average and better than the same period in 2021. CALF was observed at 86%, the same as the average level. VCIx of the region reached 0.82. A rainfall deficit started in June. Nevertheless, NDVI levels reached the 5YA in July. The conditions were close to average, but more rainfall is needed in August to secure high yields for soybean and maize.

3. Lower Mississippi

This is the most important rice-producing area and an important soybean producing area in the United States. It includes Arkansas, Louisiana, Mississippi, and Missouri. Rice reached the heading stage in July. Dry and hot weather swept across this region. Agro-climatic indicators indicated that the rainfall was 17% below, the average temperature was above (+1.2°C) and the RADPAR (+2.1%) was also above the 15YA.

This region experienced a significant rainfall deficit in June. Rainfall returned to normal in July. Although a high proportion of cropland in the region is irrigated, the dry and hot weather still negatively affected the crops with overall crop growth conditions slightly below average. CALF and VCIx reached 100% and 0.85, respectively.

4.Southern Plains

The Southern Plains is the most important area for winter wheat, sorghum, and cotton production. It includes Kansas, Oklahoma, Texas, and eastern Colorado. During this period, the winter wheat harvest was completed. Sorghum and cotton entered their peak growth periods in July. During this monitoring period, poor crop conditions were prevalent in this region due to a severe moisture deficit and high temperatures. CropWatch agro-climatic indicators suggest that the rainfall was 16% below the 15YA, temperature and radiation were 1.5ºC and 1% above average. The significant rainfall deficit and abnormal above-average temperature caused severe drought, and led to a significant drop in the cropped arable land fraction. CALF was only 74%, which was 14% below the 5YA. The VCIx was only 0.63. That is far below the national average, indicating poor crop conditions. In short, CropWatch assessed that below-average crop production could be expected for this region.

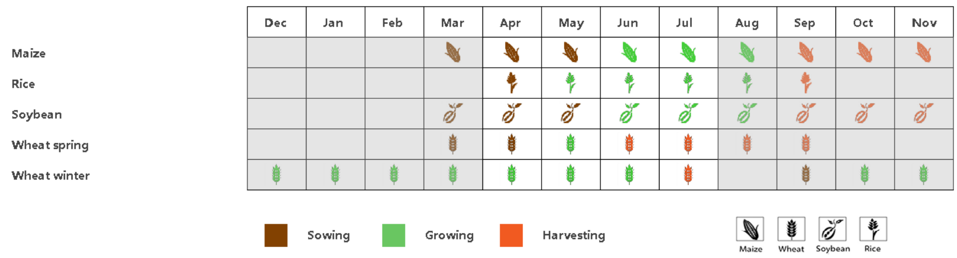
5.Southeast region

The Southeast region is an important cotton and maize producing area. It includes Georgia, Alabama, and North Carolina. Dry and hot weather was observed in the Southeast region. Close to average crop condition was indicated by the NDVI profile. In the reporting period, the rainfall was 9% below average, temperature and RADPAR were 1.5ºC and 1% above average. Strong rainfall in mid-May reduced the impact of high temperatures, and above-average temperatures from mid-June to late July led to below-average growth in June, but high rainfall in mid-to early July largely offset the impact of high temperatures. CALF and VCIx indicated acceptable crop growth conditions in the Southeast region. Compared to the last 5 years' average, CALF and VCIx reached 100% and 0.90, respectively. In short, CropWatch assessed that average production can be expected for the crop production in the region.

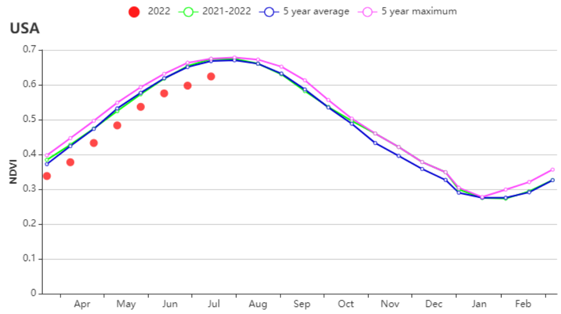
6. Northwest

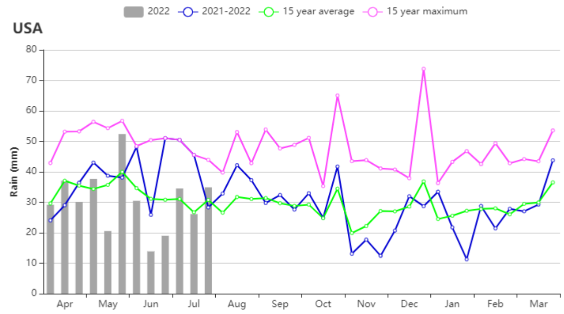
The Northwest is the second most important winter wheat producing area, but also an important spring wheat producing area. Winter wheat reached maturity and was mostly harvested by the end of July. Favorable crop conditions were indicated by the NDVI profile. Wet agro-climatic conditions were prevalent in this region. Compared to the 15 YA, rainfall was 38% above, temperature was 1.2℃ was below and PAR was 5% below. CALF reached 90% compared to the last 5 years, which is 8% above the average. VCIx reached 0.91, indicating good crop conditions during the monitoring period. In short, CropWatch assessed that above-average crop production could be expected in the region.

Figure 3.43 United States crop condition, April to July 2022



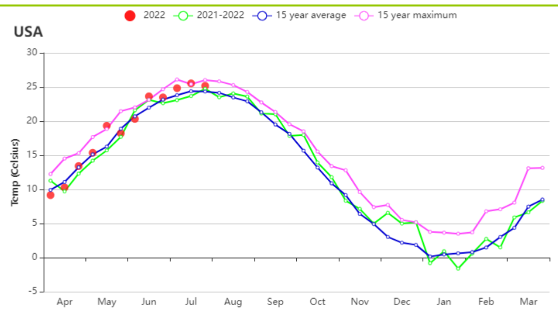
(a). Phenology of United States from April to July 2022

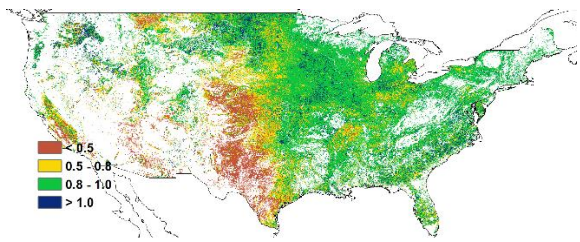




(b). Crop condition development graph based on NDVI

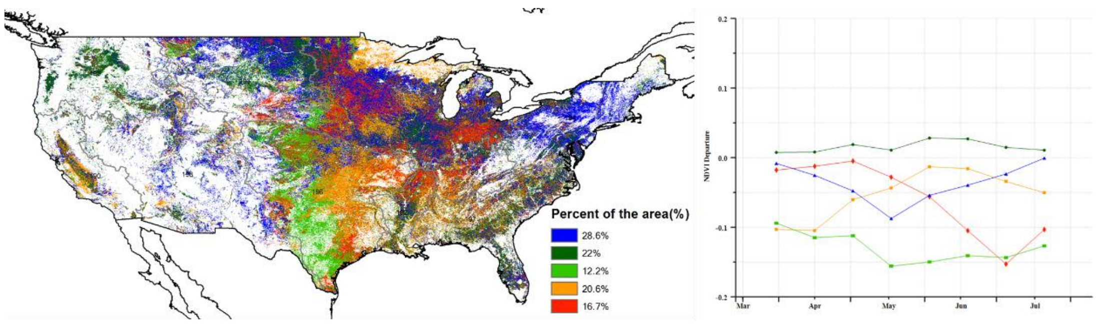
(c). Time series rainfall profile



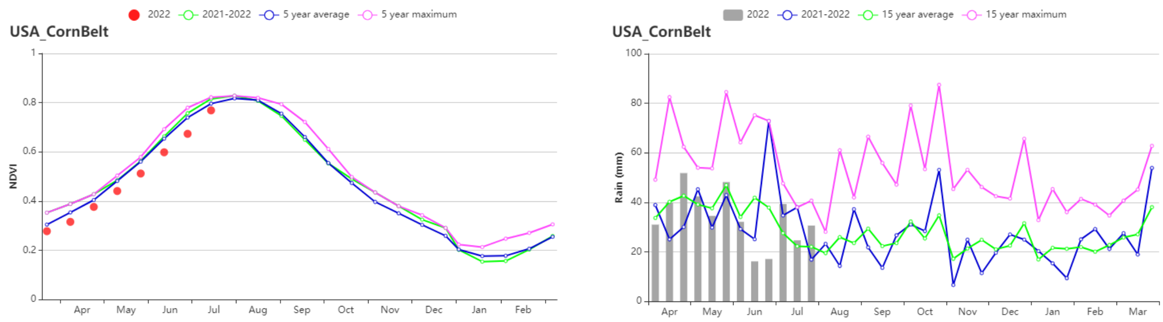


(d). Time series temperature profile

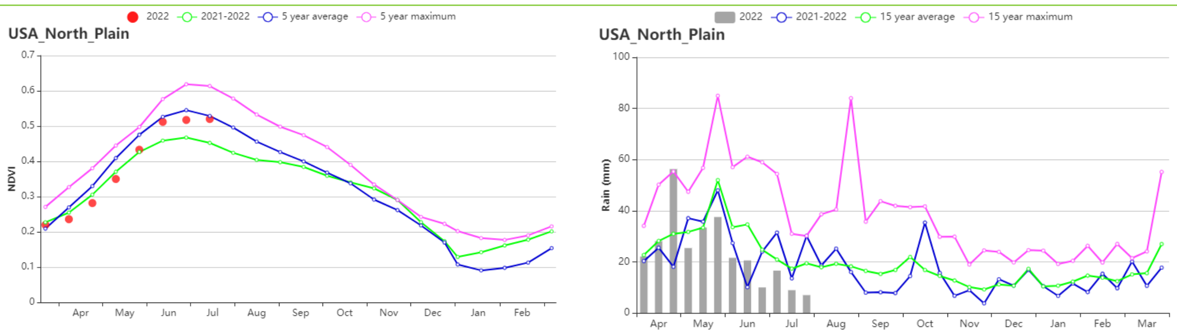
(e). Maximum VCI



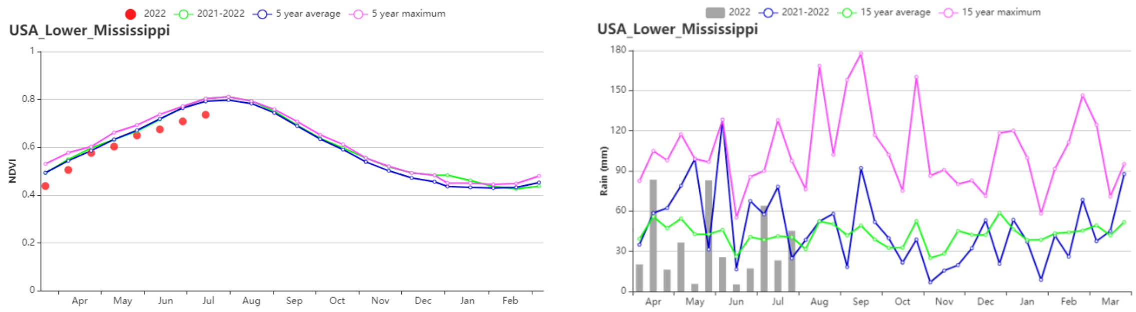
(f). Spatial distribution of NDVI profiles



(g). Crop condition development graph based on NDVI and time series rainfall profile in Corn Belt

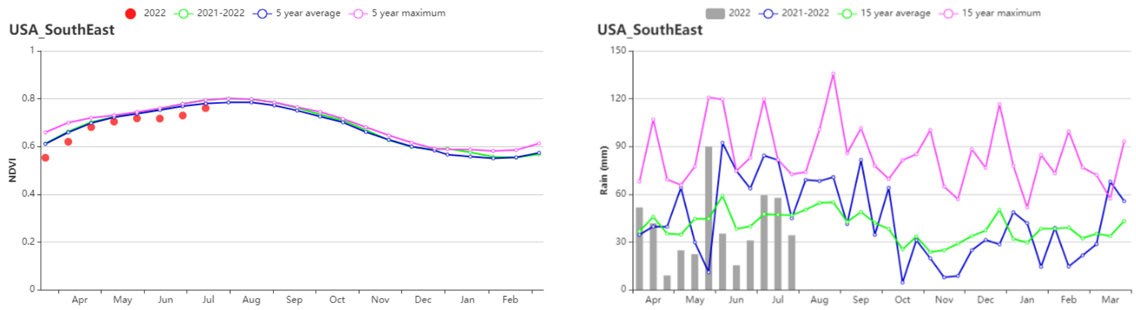


(h).Crop condition development graph based on NDVI and time series rainfall profile in Northern Plains

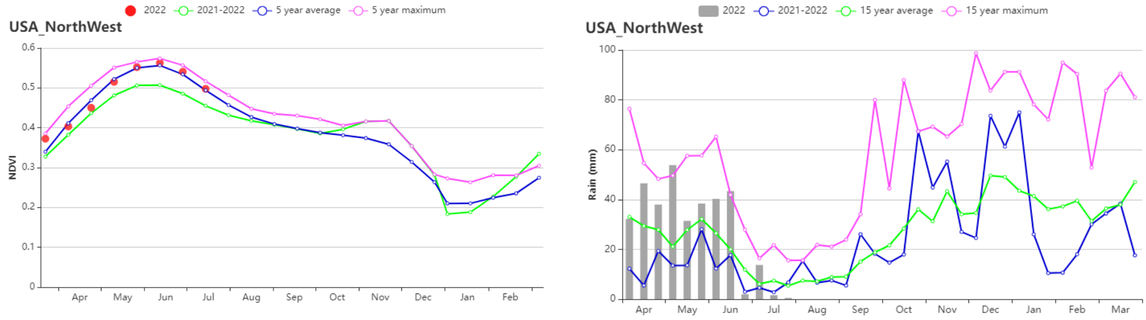


(i).Crop condition development graph based on NDVI and time series rainfall profile in Lower Mississippi

(j).Crop condition development graph based on NDVI and time series rainfall profile in Southern Plains



(k).Crop condition development graph based on NDVI and time series rainfall profile in Southeast region



(l).Crop condition development graph based on NDVI and time series rainfall profile in Northwest

Table 3.78.United States' agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, April - July 2022

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 (%)
Corn Belt	407	-4	16.8	0.0	1261	-2	986	-1
Northern Plains	287	-17	13.6	-0.5	1389	0	778	-8
Lower Mississippi	425	-17	24.6	1.2	1413	2	1102	-7
Southeast	472	-9	23.9	0.9	1444	3	1194	-1
Southern Plains	314	-16	24.2	1.5	1428	1	889	-9
North-eastern areas	414	-4	16.4	0.3	1265	1	1010	0
Northwest	341	38	10.9	-1.3	1328	-5	696	5
Southwest	186	-6	18.5	0.6	1601	0	674	-7
Blue Grass region	422	-6	20.4	0.5	1371	1	1072	-3
California	100	1	17.1	-0.0	1606	-1	544	-3

Table 3.79. United States'agronomic indicators by sub-national regions, current season's values and departure, April - July 2022

Region	CALF		Maximum VCI
	Current(%)	Departure from 5YA (%)	Current
Corn Belt	100	0	0.89
Northern Plains	86	0	0.82
Lower Mississippi	100	0	0.85
Southeast	100	0	0.90
Southern Plains	74	-14	0.63
North-eastern areas	100	0	0.93
Northwest	90	8	0.91
Southwest	37	-12	0.62
Blue Grass region	100	0	0.89
California	64	-16	0.63

[UZB] Uzbekistan

This monitoring period from April to July 2022 covers the late growing period and harvest stage of winter wheat in Uzbekistan, as well as the sowing stage and early growth period of maize. The proportion of irrigated cropland in Uzbekistan is 30% and regular rainfall is crucial to sustain the growth of most crops. During this monitoring period, except for the TEMP (+0.8°C), the other agro-climate indicators were generally normal (RAIN -3%, RADPAR +0%). The NDVI development graph shows that crop conditions were near average for most of the growing period. The national VCIx was 0.80, whereas the areas with low VCIx values were mainly in the southwest of the Eastern hilly cereals zone and the northwest of the Aral Sea cotton zone. The NDVI development graph also shows slightly below average trends for these regions. Overall, crop conditions were close to normal.

Regional analysis

Central region with sparse crops

RAIN and RADPAR were below the 15YA, while TEMP was significantly above average (+1.3°C), and BIOMSS decreased by 1%. The regional VCIx was 0.68. The NDVI development graph shows that the crop conditions in this region were slightly below average, especially in late May and early June. This was presumably due to cloud cover in the satellite images. Crop conditions by the end of this monitoring period were slightly below average.

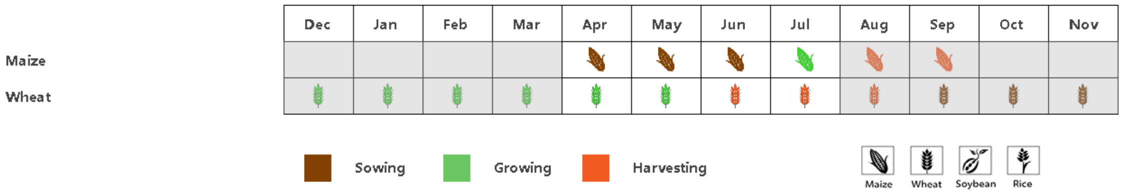
Eastern hilly cereals zone

RAIN was below average, while TEMP was above average (+0.8°C), and RADPAR was normal. According to the VCIx graph and the spatial distribution of NDVI profiles, the below-average crop conditions in June were caused by the poor crop conditions in Bukhoro and Kashkadarya province. The regional VCIx was 0.82, which was the highest among these three subregions. Overall crop prospects in this region are normal.

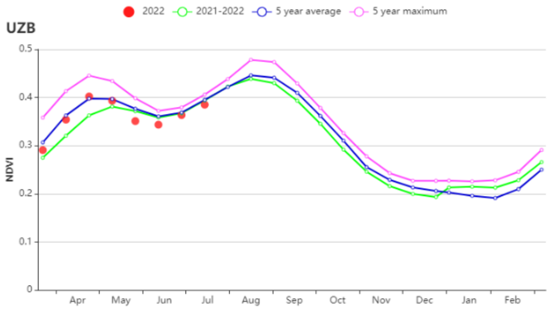
Aral Sea cotton zone

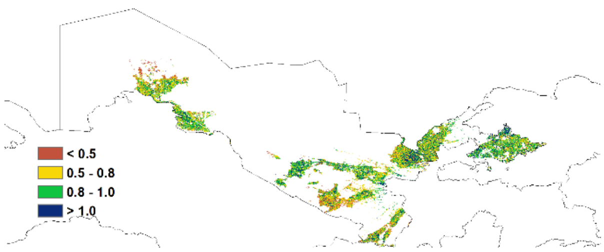
Although the farmland in this region can potentially be irrigated, lack of high quality irrigation water can limit production. High temperature is another adverse factor. Apart from the high temperature (TEMP +1.3°C), the other agro-climate indicators were basically normal (RAIN +3%, RADPAR -2%). The regional VCIx was 0.76 and CALF decreased by 10%. Crop prospects are unfavorable in this region.

Figure 3.44 Uzbekistan crop condition, April - July 2022



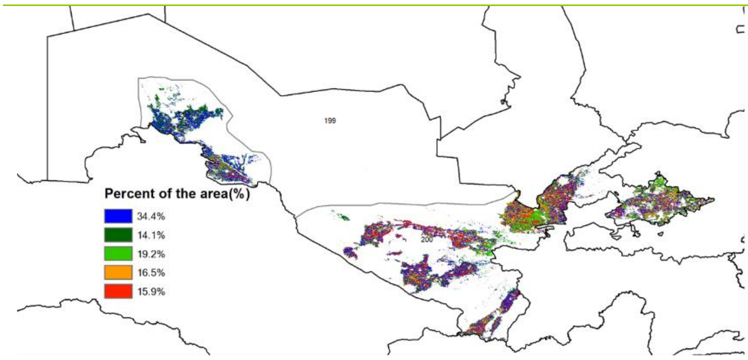
(a) Phenology of major crops

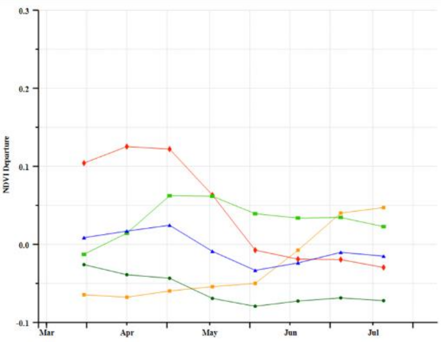




(b) Crop condition development graph based on NDVI

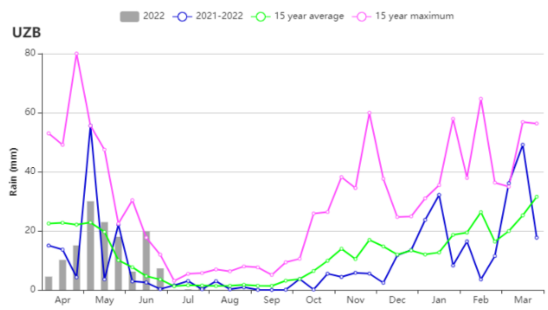
(c) Maximum VCI

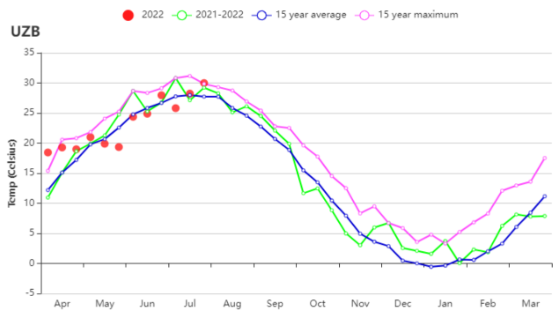




(d) Spatial NDVI patterns compared to 5YA

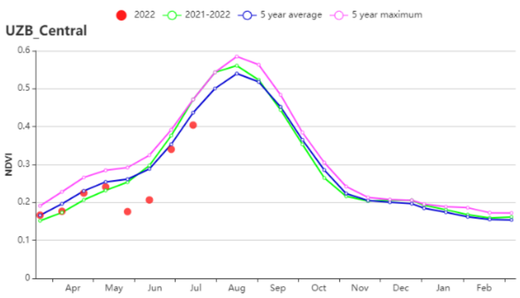
(e) NDVI profiles

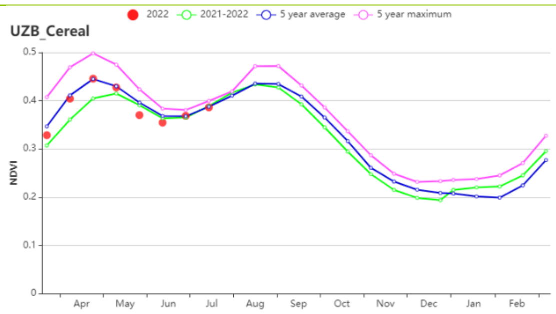




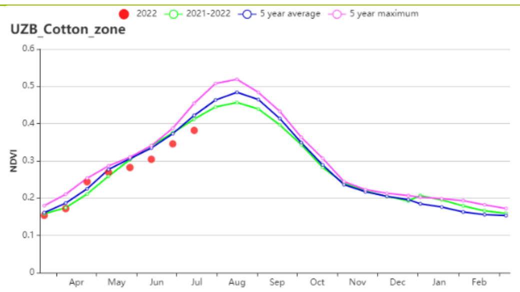
(f) Rainfall profiles

(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

Table 3.80 Uzbekistan's agroclimatic indicators by sub-national regions, current season's values, and departure from 15YA, April - July 2022

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m2)	Departure (%)	Current (gDM/m2)	Departure (%)
Central region with sparse crops	44	-2	26.4	1.3	1530	-2	600	-1
Eastern hilly cereals zone	147	-3	22.8	0.8	1565	0	689	-2
Aral Sea cotton zone	27	3	26.4	1.3	1507	-2	581	0

Table 3.81 Uzbekistan's agronomic indicators by sub-national regions, current season's values, and departure from 5YA, April - July 2022

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Central region with sparse crops	70	3	0.68
Eastern hilly cereals zone	75	5	0.82
Aral Sea cotton zone	56	-10	0.76

[VNM] Viet Nam

This report covers the entire period from the sowing to harvesting of summer-rice in the central part. Spring-winter rice was harvested in May. The planting of summer-autumn rice and rainy season rice in the North had started in July, and they will be harvested in September and October.

The proportion of irrigated cropland in Vietnam is 32%. Therefore, precipitation is an important factor controlling crop production. CropWatch agro-climatic indicators showed average precipitation (1128 mm) and TEMP (24.5°C, -0.4°C). Because of higher RADPAR (1262 MJ/m2, 5%), an increase in estimated biomass resulted (BIOMSS +3%), as compared to the 15YA. The CALF was close to the 5YA (at 97%, +1%) while the VCIx (0.94) was at a high level.

Based on the NDVI development graph, the crop conditions were generally close to the 5YA. In April, the crop conditions were above the 5YA and almost reached the maximum of 5 years. Due to the presence of clouds in the satellite images, the NDVI suffered a serious drop in May, and in subsequent months, but it reached the 5YA in late July. From April to July, the precipitation was generally near the 15YA and even surpassed the average in early April and May. The temperature was below the 15YA in the early monitoring period except for late April but it was near the 15YA in June and July. As to the spatial distribution of NDVI profiles, crop conditions on 47.3% were near average, mainly located in Thanh Hoa Province, Nghe An Province, Ha Tinh Province, Quang Binh Province and the South Central Coast of Vietnam. Overall, the crop conditions were favorable.

Regional analysis

Based on cropping systems, climatic zones, and topographic conditions, Vietnam can be divided into several agro-ecological zones (AEZ): **Central Highlands (208), Mekong River Delta (209), North Central Coas (202), North East (203), North West (207), Red River Delta (204), South Central Coast (206) and South East (205)**.

In the **Central Highlands**, RAIN was above the 15YA (1274 mm, +5%) and TEMP was below the 15YA (23.2°C,-0.5°C). Due to an 8% RADPAR increase, BIOMSS also increased slightly (1476 gDM/m2, +5%). CALF was 100% and VCIx was 0.96. The crop condition development graph based on the NDVI indicated that the crop conditions were near the average in May and early June, and surpassed the 5-year-maximum in April. Because of the influence of the clouds in the satellite images the NDVI suddenly dropped below the 5YA in early July, and then returned to the 5YA by the end of this monitoring period. Crop conditions were expected to be above average.

In the **Mekong River Delta**, with decreased TEMP (27.5° C, -0.5° C), significantly increased RAIN (1171 mm, +12%) and RADPAR (1341 MJ/m2, +5%), BIOMSS increased by 6%. VCIx was 0.90 and CALF was 87%. According to the NDVI −based development graph, crop conditions were below the 5YA during the whole monitoring period. The crop conditions were expected to be slightly below average.

The situations of agro-climatic indicators in the **North Central Coast** were the same as in the Mekong River Delta. Increased RAIN (1030 mm, 11%) and RADPAR (1267 MJ/m2, +6%) and decreased TEMP (24.1°C, -0.8°C) all resulted in the increased BIOMASS (1414 gDM/m2, +6%). CALF was 99% and VCIx was 0.96. According to the NDVI-based development graph, crop conditions were below the 5YA, except in April and late July. Crop production was expected to be below average.

In the **North East**, TEMP was near the 15YA (23.8°C, -0.1°C) and RADAR was above the average (1199 MJ/m2, +3%). Although RAIN (1267 mm) decreased by 11%, BIOMSS (1484 gDM/m2) was still the same as the average (+0%). CALF was 100% and VCIx was 0.94. According to the NDVI −based development graph, due to the influence of cloud, the NDVI greatly dropped below the 5YA in May and June. It was at average levels in April and July. Overall, the crop conditions were estimated to be average.

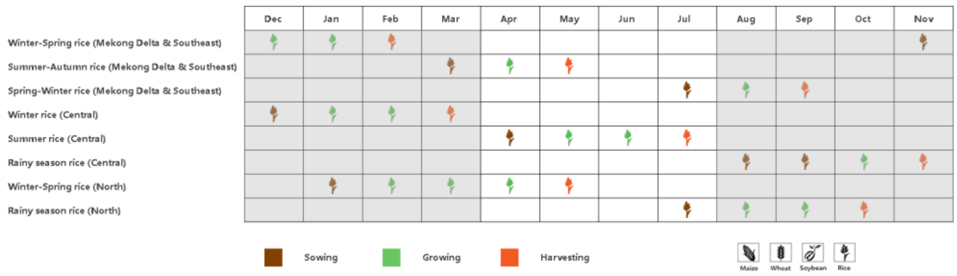
In the **North West**, RADPAR was above the 15YA (1241 MJ/m2, +4%). While TEMP and RAIN were both below the 15YA (22.8°C, -0.2%; 1078 mm, -5%), BIOMSS decreased slightly (1397 gDM/m2, -1%). CALF was 100% and VCIx was 0.86. According to the agroclimatic indicators, crop conditions in this region had a big fluctuation: In the middle of the monitoring period, the NDVI sharply dropped below the 5YA, which may have been caused by cloud cover in the satellite images. In April and July, the conditions were average. Overall, crop conditions in this region were slightly below the average.

In the **Red River Delta**, RAIN and RADPAR increased significantly (1153 mm, +8%; 1244 MJ/m2, +4%). TEMP was slightly below the average (26.0°C, -0.8°C) and BIOMSS was near the 15YA (1495 gDM/m2, +1%). CALF was 96% and VCIx was 0.88. According to the crop condition development graph, the NDVI was below the 5YA during the whole monitoring period except late April and early June. Based on the agroclimatic indicators, the crop conditions in this region were below the average.

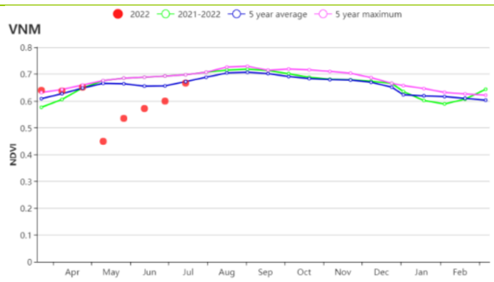
In the **South Central Coast**, TEMP (24.0°C, -0.2°C) was on average. Because of the increased RAIN (1112 mm, +8%) and RADPAR (1293 MJ/m2, +5%), the BIOMSS increased by 7%. CALF was 96% and VCIx was 0.88. According to the crop condition development graph, the NDVI was above the 5YA during the whole monitoring period. Crop conditions were expected to be favorable.

In **South East**, average TEMP (26.2°C, -0.2%), slightly decreased RAIN (1112 mm, -6%), increased RADPAR (1293 MJ/m2, +5%) all resulted in increased BIOMSS (1517 gDM/m2, +3%). CALF was 95% and VCIx was 0.91. According to the crop condition development graph, the NDVI was closed to the 5YA in April and May, but it dropped at the end of this monitoring period. Crop production in this region was close to the 5YA.

Figure 3.45 Viet Nam's crop condition, April- July 2022

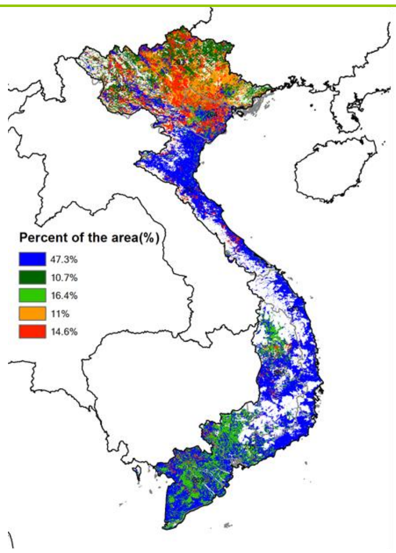


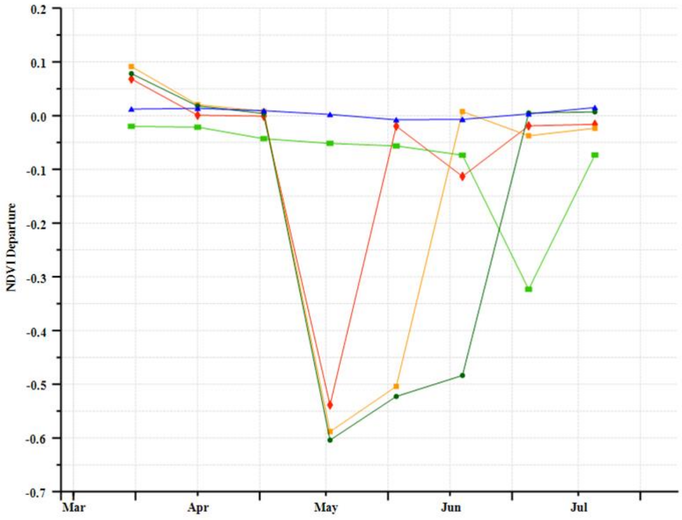
(a). Phenology of major crops



(b) Crop condition development graph based on NDVI

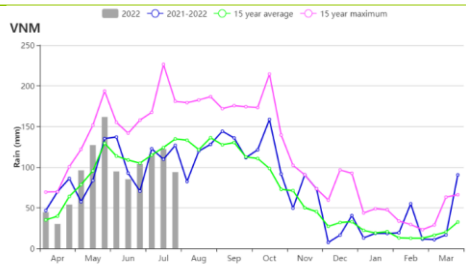
(c) Maximum VCI

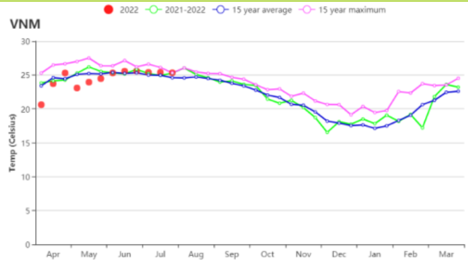




(d) Spatial NDVI patterns compared to 5YA

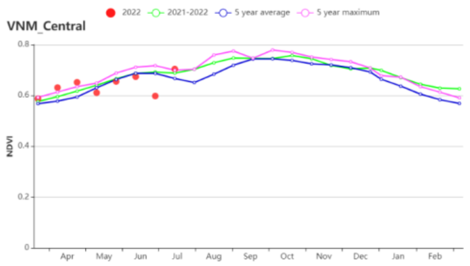
(e) NDVI profiles

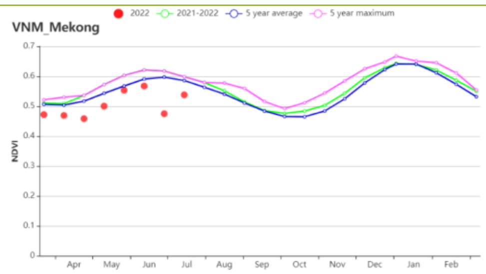




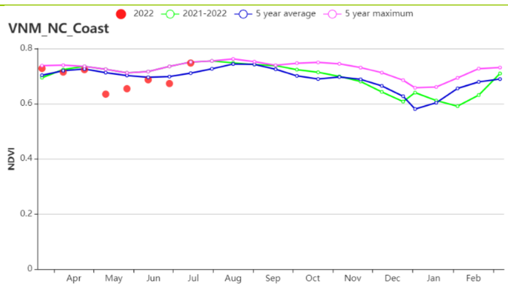
(f) Rainfall profiles

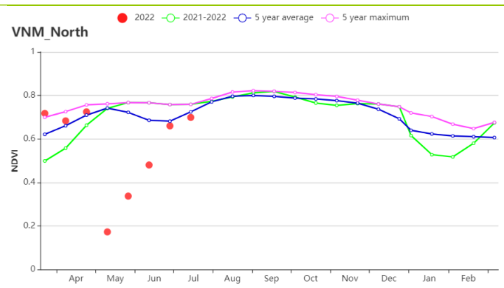
(g) Temperature profiles



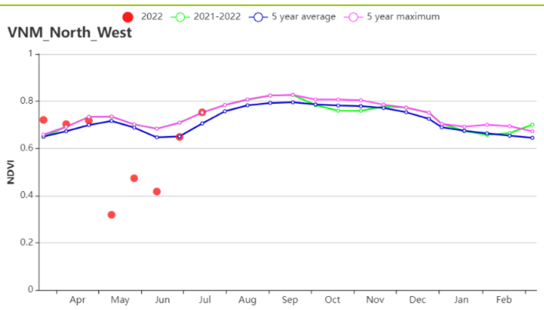


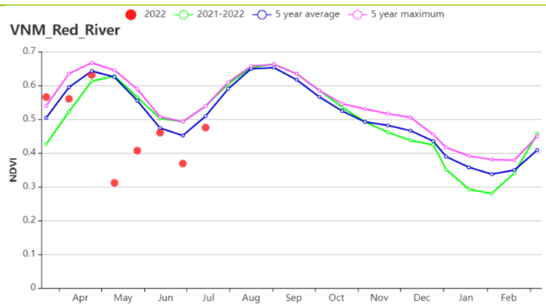
(h) Crop condition development graph based on NDVI Central Highlands Vietnam (left), and Mekong River Delta (right).



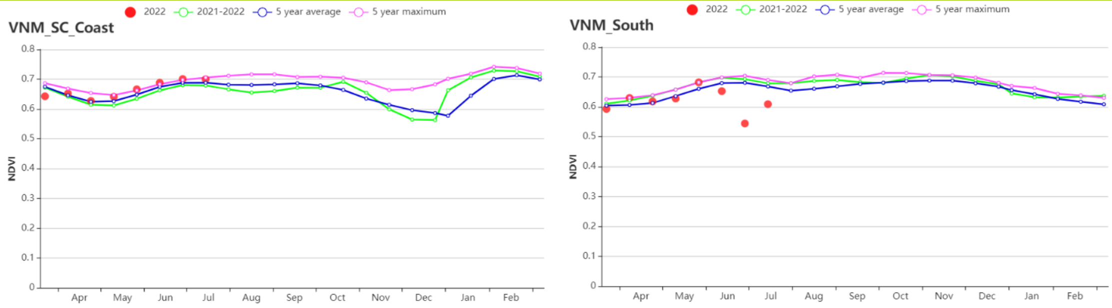


(i) Crop condition development graph based on NDVI North Central Coast Vietnam (left), and North East Vietnam (right).





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



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

Table 3.82 Vietnam's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, April - July 2022

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Central Highlands	1274	5	23.2	-0.5	1246	8	1476	5
Mekong River Delta	1171	12	27.5	-0.5	1341	5	1696	6
North Central Coast	1030	11	24.1	-0.8	1267	6	1414	6
North East	1267	-11	23.8	-0.1	1199	3	1484	0
North West	1078	-5	22.8	-0.2	1241	4	1397	-1
Red River Delta	1153	8	26.0	-0.8	1244	4	1495	1
South Central Coast	1020	8	24.0	-0.2	1307	8	1349	7
South East	1112	-6	26.2	-0.2	1293	5	1517	3

Table 3.83 Vietnam's agronomic indicators by sub-national regions, current season's values and departure from 5YA, April-July 2022

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Central Highlands	100	0	0.96
Mekong River Delta	87	3	0.90
North Central Coast	99	0	0.96
North East	100	0	0.94
North West	100	0	0.96
Red River Delta	96	0	0.88
South Central Coast	97	1	0.93
South East	95	1	0.91

[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 above the 5-year average during the entire monitoring period. At the national level, the CropWatch agroclimatic indicators show that radiation was slightly below the 15-year average (RADPAR -3%). With a significantly increased rainfall (RAIN +36%) and average temperature (TEMP -0.3℃), the potential biomass increased by 12% compared to the 15-year average mainly due to the abundant rainfall. The maximum vegetation condition index (VCIx) was 0.89, and the cropped arable land fraction (CALF) increased by 9% compared with the last 5 years. According to the VCIx, conditions in the Mediterranean zone, where wheat is an important crop, were better than in the western region (Gauteng, Mpumalanga). As to the spatial distribution of NDVI profiles, crop conditions on about 68.5% of the cropland were close and above average mainly in the central and northern parts, and on about 31.5% were below average mainly in the southwestern regions during the whole monitoring period, respectively. The areas with negative departures were mainly in the center of the western region, most located in Gauteng, Mpumalanga, North West and Orange Free State Province. Water is generally limiting crop production in South Africa. Its government has developed several large water facilities, which have increased the irrigated area of the country by 40%, and the yield of crops has generally increased in recent years. Overall, crop conditions were favorable.

Regional analysis

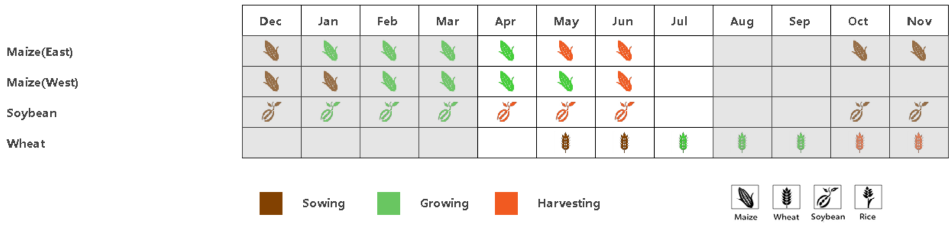
Rainfall in the Arid and desert zones was significantly above average (95mm, +18%) and the temperature was near average (11.8°C, -0.6°C), whereas radiation was slightly below average (-1%), and potential biomass increased by 3% due to the abundant rainfall. Cropped arable land fraction (CALF) increased significantly (+35%) and VCIx was 0.91. The crop condition development graph based on NDVI indicates that the crop conditions were generally above the 5-year average and even above the 5-year maximum in April. Crop production is expected to be favorable.

In the Humid Cape Fold mountains, the temperature was near average (-0.4°C), and radiation was slightly below average (-4%). With abundant rainfall (+35%), potential biomass was significantly above the 15-year average (+15%). CALF was 97% and VCIx was 0.90. The crop condition development graph based on NDVI also indicates favorable crop conditions.

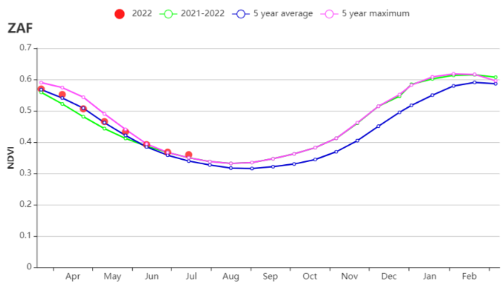
In the Mediterranean zone, the temperature was below average (-1.2°C), while rainfall witnessed a significant decrease (-33%) and radiation was slightly above average (+4%). The estimated potential biomass was significantly decreased by 23% due to the insufficient rainfall. CALF decreased slightly (82%, -1%) and VCIx was 0.72. According to the crop condition development graph, the NDVI was close to or below the 5-year average for most of the period. Crop conditions initially were unfavorable but recovered to close to average for this important wheat production region by the end of this monitoring period.

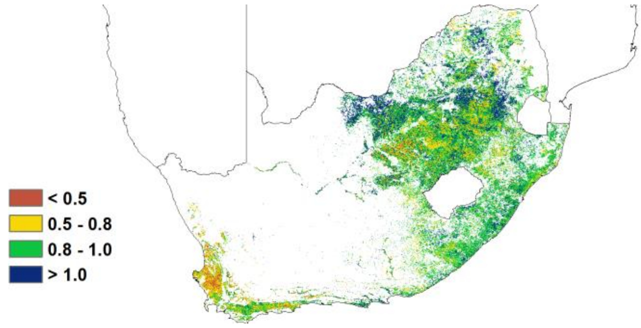
In the Dry Highveld and Bushveld maize areas, rainfall (RAIN +59%) was significantly above the 15-year average and temperature was near average (-0.2°C). Radiation was slightly below average (-4%). Potential biomass increased by 20%. CALF above the 5YA (95%, +11%) and VCIx was 0.91. Notably, during this monitoring period, the area was in the rainy season. The crop condition development graph based on NDVI shows that the NDVI was above the 5-year average for most of the period. In all, the crop conditions were favorable.

Figure 3.46 South Africa’s crop condition, April- July 2022



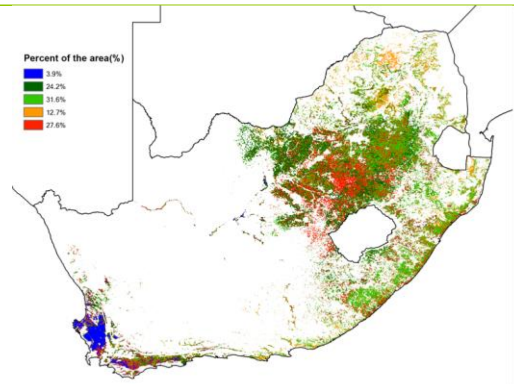
(a). Phenology of major crops

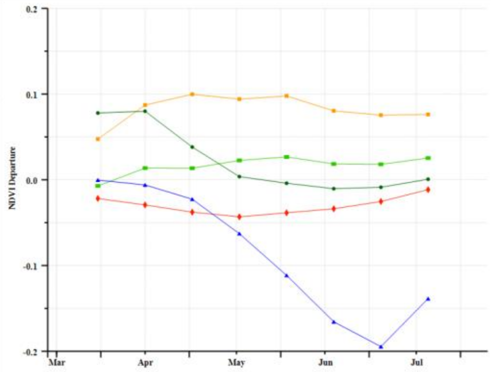




(b) Crop condition development graph based on NDVI

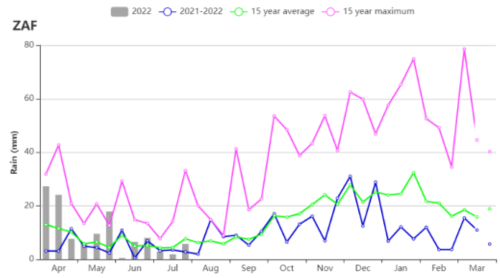
(c) Maximum VCI

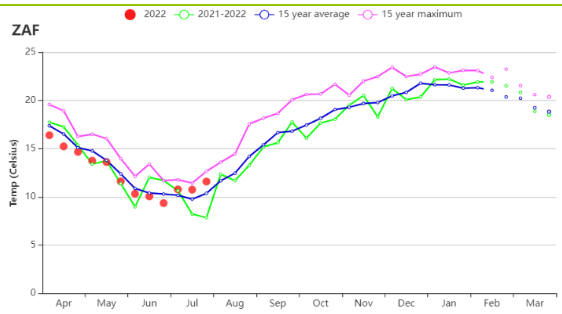




(d) Spatial NDVI patterns compared to 5YA

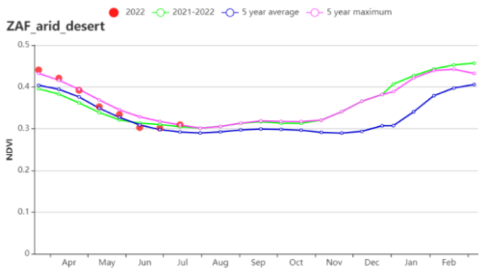
(e) NDVI profiles

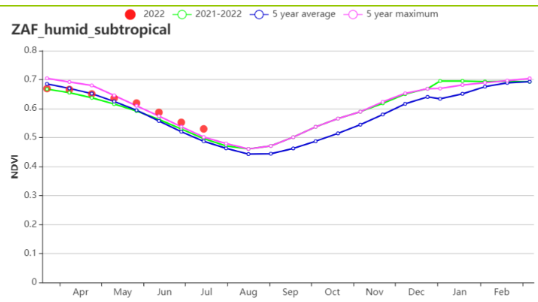




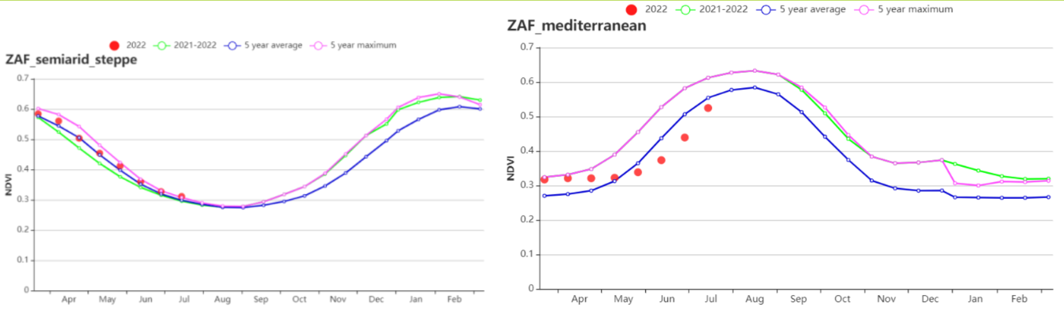
(f) Rainfall profiles

(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 3.84 South Africa's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, April - July 2022

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Arid and desert zones	95	18	11.8	-0.6	813	-1	330	3
Humid Cape Fold mountains	181	35	14.2	-0.4	761	-4	503	15
Mediterranean zone	173	-33	12.1	-1.2	712	4	439	-23
Dry Highveld and Bushveld maize areas	102	59	12.1	-0.2	893	-4	351	20

Table 3.85 South Africa's agronomic indicators by sub-national regions, current season's values and departure from 5YA, April-July 2022

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Arid and desert zones	59	35	0.91
Humid Cape Fold mountains	97	2	0.90
Mediterranean zone	82	-1	0.72
Dry Highveld and Bushveld maize areas	95	11	0.91

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 SYR THA TUR UKR USA UZB VNM ZAF **ZMB**

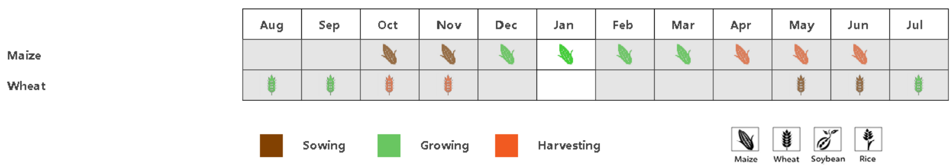
[ZMB]Zambia

The reports cover the cessation of the rainy season and the onset of the irrigated season. The dominant agricultural activities during this season were the harvesting of field crops (May-July) and the planting of winter wheat (April-May) and horticultural crops. Observed rainfall showed a 24% positive departure from the 15YA, temperature (TEMP) departure was negligible, radiation (RADPAR) showed a negative anomaly (-1%) and potential biomass production (BIOMSS) showed a positive departure by 3%. The cropped arable land fraction (CALF) showed a 2% increase and maximum VCI value was 0.96. The observed average agronomic indicators indicate favorable overall crop growth condition. Cereal supplies in the 2021/22 are estimated to exceed the five‑year average on account of the near-record harvest in 2021 with domestic supplies of maize, the primary staple food, sufficient to satisfy domestic utilization and to allow the country to build stocks and increase exports.

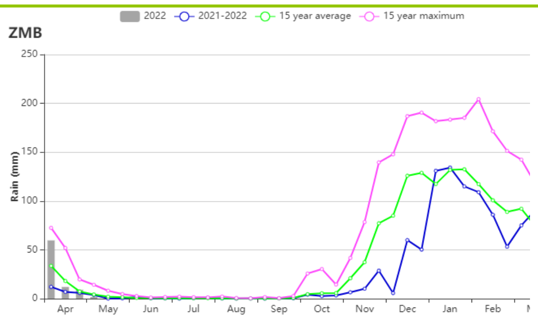
Regional Analysis

Regional analysis 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, rainfall had increased by 13% above the 15YA, temperature was near average (-0.1°C), while the radiation increased by 2% leading to a 3% increase in potential biomass production. The observed cropped arable land fraction (CALF) was at 99.8% with a positive departure of 0.3% from the 5YA and VCIx was at 0.95. The Central-eastern and southern plateau, the zone where most agriculture production takes place in the country, received 58% more rainfall than the 15YA, resulting in increased biomass production (+7%), positive CALF departure (+2.2%) and VCIx of 0.99. The Western semi-arid plain received below-average rainfall (-28%) which could have resulted in reduced biomass production (-5%) as the zone has predominantly sandy soils characterized by low water holding capacity to support plant growth. The Luangwa-Zambezi Rift Valley had a positive departure in rainfall (+22%) and temperature (+0.1%) and a negative departure in radiation (-3%) and biomass (-1%). The CALF was at 99.8% (+4.5%) and VCIx of 0.94. This region is associated with low rainfall and normally affected by drought and dry spells.

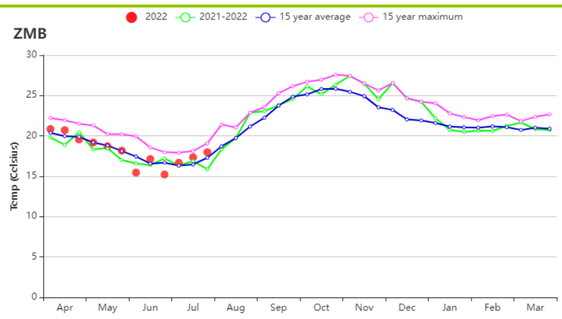
Figure 3.47 Zambia's crop condition, April- July 2022



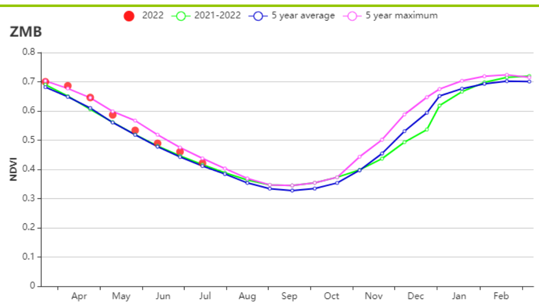
(a). Crop Phenology



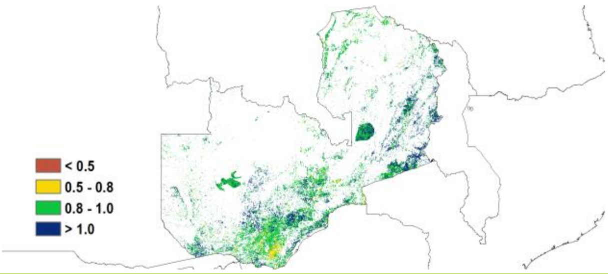
(b) Time series rainfall profile



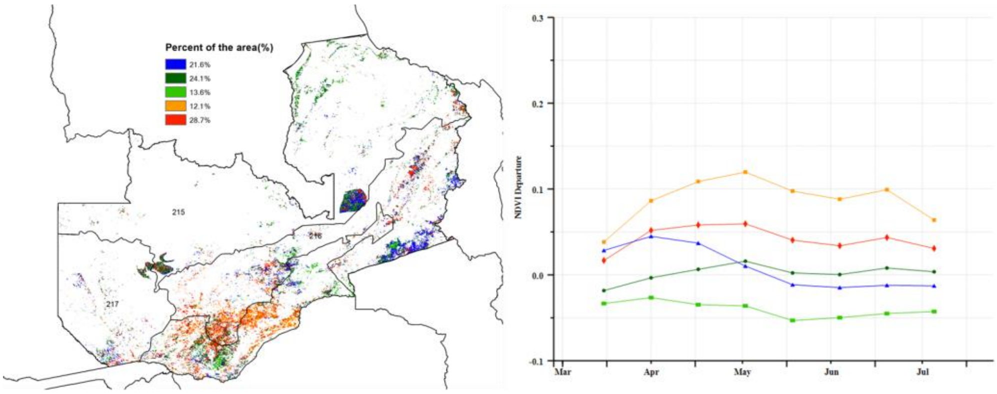
(c) Time series temperature profile



(d) Crop condition development graph based on NDVI



(e) Maximum VCI



(f) Spatial distribution of NDVI profiles

Table 3.86 Zambia's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, April - July 2022

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Luangwa-Zambezi rift valley	48.1	22	18.2	0.1	1082	-3	339	-1
Western semi-arid plain	25.5	-28	18.8	0.2	1122	-5	331	-5
Central-eastern and southern plateau	90	58	17.9	-0.1	1086	-1	393	7
Northern high rainfall zone	118.6	13	17.9	-0.1	1193	2	457	3

Table 3.87 Zambia's agronomic indicators by sub-national regions, current season's values and departure from 5YA, April-July 2022

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Luangwa-Zambezi rift valley	99.8	4.5	0.94
Western semi-arid plain	99.7	0.7	0.97
Central-eastern and southern plateau	99.9	2.2	0.99
Northern high rainfall zone	99.8	0.3	0.95

Chapter 4. China

After a brief overview of the agro-climatic and agronomic conditions in China over the reporting period (section 4.1), Chapter 4 presents an updated estimate of major cereals and soybean production at provincial and national level as well as summer crops production and total annual outputs (4.2) and describes the situation by region, focusing on the seven most productive agro-ecological regions of the east and south: Northeast China, Inner Mongolia, Huanghuaihai, Loess region, Lower Yangtze, Southwest China, and Southern China (4.3). Section 4.4 describes trade prospects (import/export) of major crops. Additional information on the agro-climatic indicators for agriculturally important Chinese provinces are 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 overall at average, with rainfall slightly below average (-4%), temperature (+0.2°C) and RADPAR (+3%) slightly above average. There are significant regional differences among agro-climatic indicators, showing a spatial pattern of persistent high temperature in the south and above average precipitation in the northeast.

According to the time series rainfall profile, above-average rainfall was observed nationwide in late April, late May, from early June to middle June, and early July. Three of the main agricultural regions of China recorded above-average rainfall, with the largest positive departure occurring in Northeast China (+35%), while three of the main agricultural regions of China recorded below-average rainfall, with the largest negative departure occurring in Southwest China (-9%). At the country level, rainfall anomalies fluctuated largely over time and space. As can be seen from the spatial distribution of rainfall profiles, 63.5% of the cropped areas (marked in light green) recorded near average precipitation. 10.1% of the cropped areas, mainly located in the eastern part of Southern China and southern part of Lower Yangtze region, received significantly above-average rainfall (more than +90 mm/dekad) during middle June and early July, which might cause difficult conditions for the harvest of early rice. The remaining 26.5% of cropped areas experienced the largest negative departure of rainfall (almost -60 mm/dekad) during middle July, occurred mainly in the province of Anhui, Jiangsu, Zhejiang, Jiangxi, Guizhou, and some parts of Sichuan, Yunnan, Guangxi and Fujian.

Five of the main agricultural regions in China recorded above-average temperatures, with the largest positive departure occurring in Huanghuaihai (+0.9°C), while only two region recorded below-average temperature (-0.1°C in Southern China, -0.3°C in Northeast). Temperatures fluctuated during the monitoring period as follows: 33.8% of the cultivated regions, marked in light green, had relatively small temperature fluctuations, with the largest positive temperature anomalies by approximately +2.0℃ in early April. 33.8% of the cropped areas in Southern China, southern part of Southwest China and Lower Yangtze region had negative temperature anomalies by more than -3.0℃ in middle May. The remaining 32.4% of the cultivated regions, marked in dark green, had positive temperature anomalies in early April and from early June to early July. Northeast China was the only region in which RADPAR was below average (-1%), whereas the largest positive departure was recorded for the Loess region (+6%).

As for BIOMSS, the situation was quite different among all the main producing regions, with the departures between -3% (Huanghuaihai, Loess region and Lower Yangtze region) and +10% (Northeast China). CALF increased slightly in the Loess region (+1%) and was near average in other main agricultural regions as compared to the 5YA.

The maximum vegetation condition index (VCIx) reached a high value of 0.92 at the national scale, indicating an overall favorable condition in China. The VCIx values were higher than 0.9 in almost all the main producing regions of China, with values between 0.90 and 0.95, except for the Loess region (0.89).

Table 4.1 CropWatch agroclimatic and agronomic indicators for China, April - July 2022, departure from 5YA and 15YA

Region	Agroclimatic indicators				Agronomic indicators	
	Departure from 15YA (2007-2021)				Departure from 5YA (2017-2021)	Current period
	RAIN (%)	TEMP (°C)	RADPAR (%)	BIOMSS (%)	CALF (%)	Maximum VCI
Huanghuaihai	1	0.9	3	-3	0	0.90
Inner Mongolia	4	0.3	0	0	0	0.90
Loess region	-8	0.8	6	-3	1	0.89
Lower Yangtze	-6	0.2	5	-3	0	0.91
Northeast China	35	-0.3	-1	10	0	0.95
Southern China	0	-0.1	3	-2	0	0.93
Southwest China	-9	0.2	4	-1	0	0.94

Figure 4.1 China crop calendar

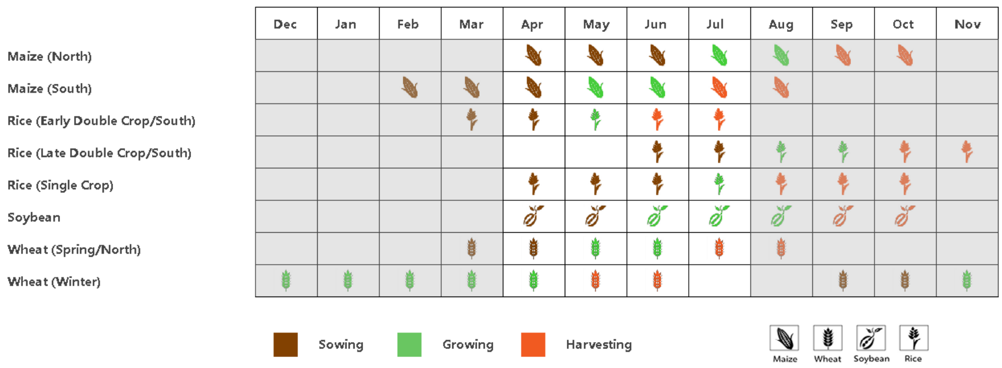


Figure 4.2 China spatial distribution of rainfall profiles, April to July 2022

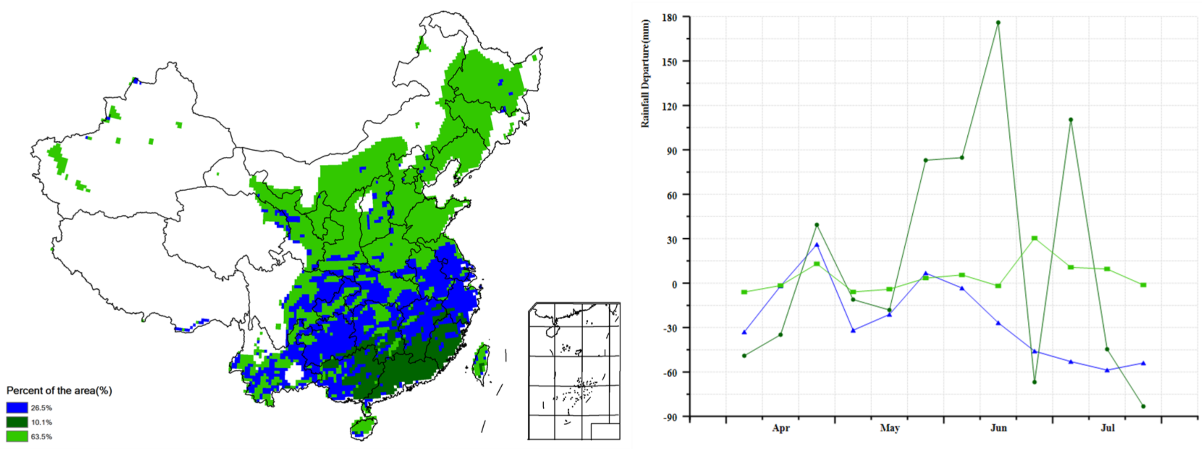
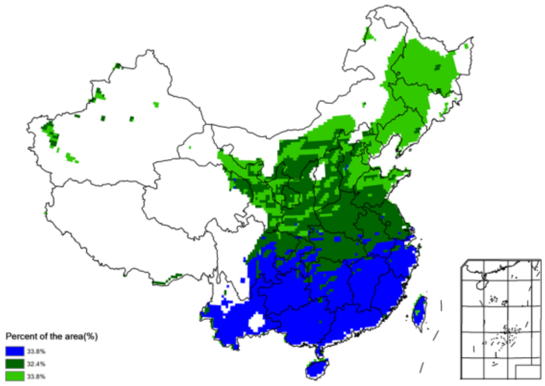


Figure 4.3 China spatial distribution of temperature profiles, April - July 2022



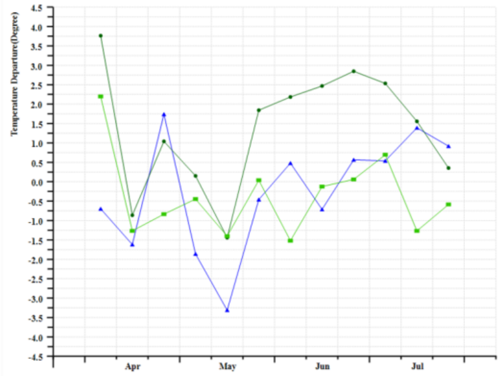


Figure 4.4 China cropped and uncropped arable land, by pixel, April - July 2022

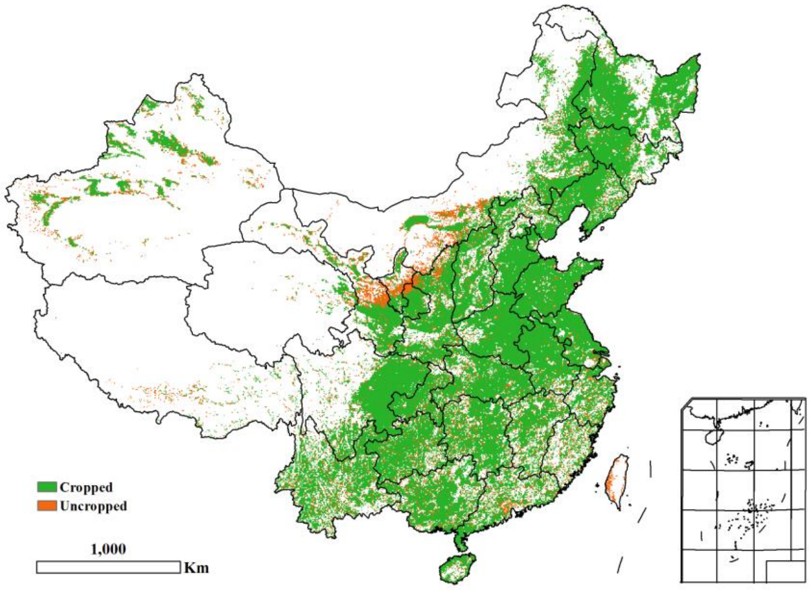


Figure 4.5 China maximum Vegetation Condition Index (VCIx), by pixel, April - July 2022

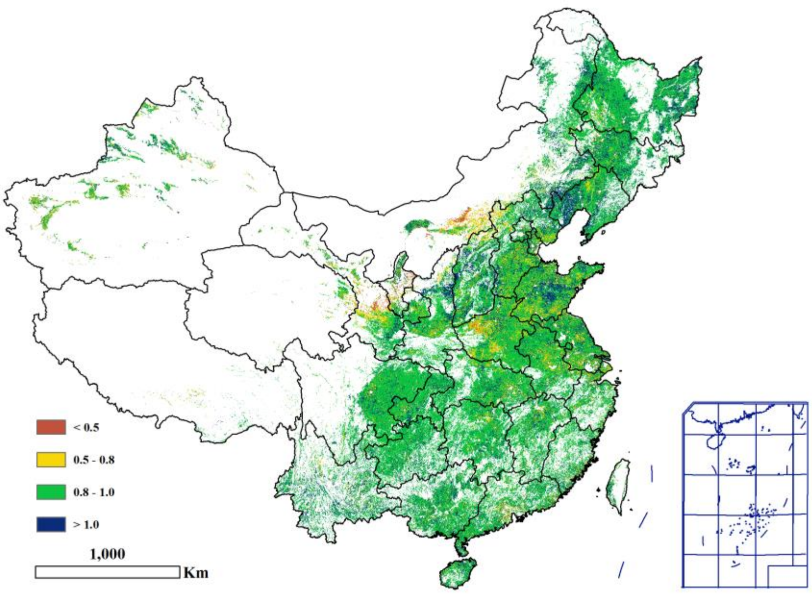


Figure 4.6 China biomass departure map from 15YA, by pixel, April - July 2022

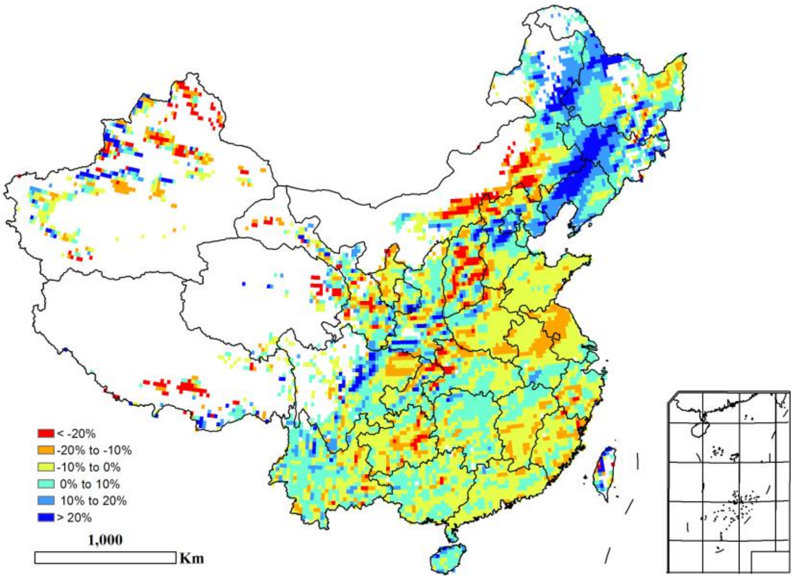
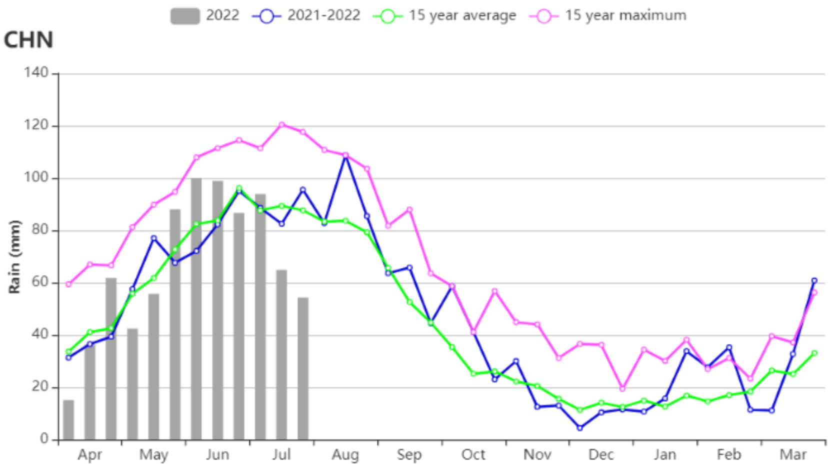


Figure 4.7 Time series rainfall profile for China



4.2 China's crop production

In order to estimate the production of crops in China, CropWatch used ESA Sentinel 1/2, Landsat 8 and Gaofen-1/2 domestic satellite and other multi-source remote sensing data, combined with the latest meteorological information on agriculture. Its survey data consist of nearly one million ground-based sample points in major agricultural production areas in the Northeast, North China Plain, Northwest, Southwest, Northwest and Southwest of China. In addition, CropWatch uses a nationwide 10 m resolution arable land map, the remote sensing index model, and a yield estimation model based on meteorological data to quantify and forecast the production of maize, rice and soybean as well as summer crops production in China in 2022. It also made a final estimate of summer crops and winter wheat production in China for the 2021/22 season.

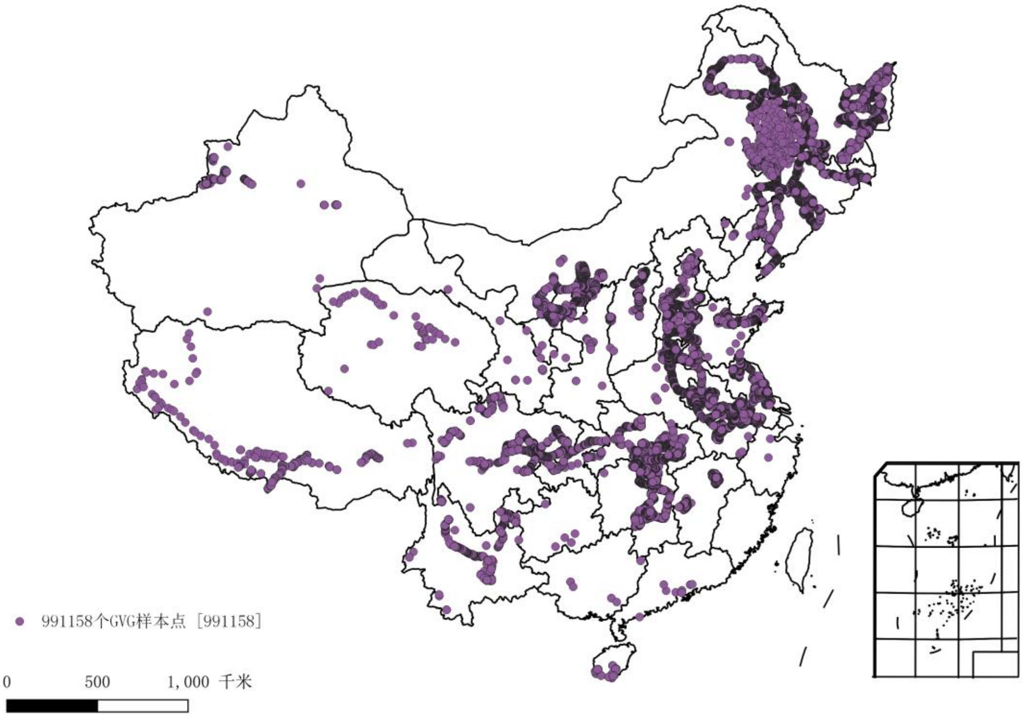


Figure 4.8 GVG field samples

Total annual grain production in 2022 is expected to be 643.6 million tons, a decrease of 8.62 million tons or 1.3% from the same period last year. Among them, the total staple crops (mainly wheat and rice) production remains close to 2021 at 331.24 million tons. The total output of summer crops (including maize, semi-late rice, late rice, spring wheat, soybeans, root and tuber crops and other minor crops) is expected to be 473.82 million tons, a decrease of 7.89 million tons or 1.6% from 2021. The latest remote sensing data were used to revise the total winter crops production at 142.23 million tons in 2022, a decrease of 980,000 tons or 0.7% year-on-year. The decrease was due to a reduction in total winter crop area by 1.9%, but good agro-meteorological conditions during the grainfilling period helped increase the yield per unit area by 1.2% (Table 4.2).

Table 4.2 Production per unit area and total output forecast of China's main summer crop producing provinces in 2022

	2021	2022			
	production (thousand tonnes)	Area change (%)	Yield change (%)	Production change (%)	Production (kiloton)
Hebei	12764	-3.5	1.6	-2.0	12508
Shanxi	2241	1.3	3.0	4.4	2339
Jiangsu	13964	-1.5	1.7	0.2	13988
Anhui	15096	-2.5	-0.4	-2.9	14661
Shandong	27249	-2.2	1.9	-0.4	27152
Henan	33188	-3.7	2.2	-1.6	32653
Hubei	6226	-2.1	1.5	-0.6	6185
Sichuan	5820	-0.6	2.9	2.3	5956
Shaanxi	4135	-0.9	-0.8	-1.7	4065

	2021	2022			
	production (thousand tonnes)	Area change (%)	Yield change (%)	Production change (%)	Production (kiloton)
Gansu	3517	0.9	0.4	1.3	3563
Xinjiang	5077	-1.3	2.1	0.8	5118
Sub total	129278			-0.8	128190
Other provinces	13925			0.8	14037
China	143203	-1.9	1.2	-0.7	142227

Maize: China's total maize production in 2022 is estimated at 222.76 million tons, down 11.08 million tons or 4.7% year-on-year, the largest reduction in the last 10 years. Remote sensing monitoring shows that China's maize planted area will be 40.862 million hectares in 2022, a decrease of 1.359 million hectares (about 20.39 million mu) or 3.2% year-on-year. Interviews with farmers showed that the main reason for the decrease in maize acreage in 2022 was the increase in soybean planting subsidies, which motivated farmers to plant more soybeans and reduce the area under maize, with the most significant areas of maize acreage reduction in Heilongjiang and Inner Mongolia.

During the growing season of maize, several major production areas were affected by unfavorable agrometeorological conditions such as extreme drought or local flooding, which adversely affected the yield, estimated to be 5,452 kg/ha nationwide, a decrease of 1.6% year-on-year. The northeast region is the largest maize producing area in China, and this year's significantly higher-than-usual precipitation in that region caused localized flooding in northwestern Heilongjiang Province, central Jilin Province and north-central Liaoning Province. Coupled with a significant reduction in maize acreage in Heilongjiang and northeastern Inner Mongolia, this resulted in a year-over-year decrease in maize production in the four provinces and regions of Heilongjiang, Jilin, Liaoning and Inner Mongolia by 14.0%, 1.6%, 3.4% and 7.7% respectively. The Yangtze River basin experienced higher than usual temperatures and less rainfall in July. This resulted in a serious meteorological drought in Anhui, Chongqing and Sichuan provinces. Irrigation in Anhui Province helped alleviate the drought. However, in Chongqing and Sichuan corn production is estimated to be reduced by 3.3% and 9.4% respectively.

Rice: The total national rice production is expected to be 197.01 million tons, an increase of 0.58 million tons or about 0.3% year-on-year. The estimate for early rice production is 27.55 million tons, an increase of 0.9% year-on-year, for semi-late rice / single rice it is 134.47 million tons, an increase of 0.2% year-on-year, and for late rice it is 34.99 million tons, the same as in 2021.

The national early rice planting area in the main producing provinces was 5.228 million hectares, an increase of 0.022 million hectares or 0.4% year-on-year, mainly due to the implementation of a new subsidy policy for double cropping rice planting. Another factor was the decrease in off-farm employment opportunities due to the pandemic. The national early rice yield was 5,269 kg/ha, an increase of 0.6% year-on-year. The increase in yield and area contributed to an increase of 0.25 million tons of early rice production to 27.55 million tons, an increase of 0.9%. Early rice production in Anhui, Hubei and Guangdong decreased by 2.2%, 3.7% and 1.3% year-on-year respectively, while the rest of the major early rice producing provinces achieved an increase in production.

The agro-meteorological conditions for production in the northern semi-late rice / single rice producing areas have been generally good. The single rice production in Heilongjiang Province increased by 2.5% year-on-year, while the continuous heavy precipitation in Jilin and Liaoning was unfavorable for the flowering of single rice, resulting in a year-on-year decrease of 0.9% and 1.2% in rice production in the two provinces, respectively. Persistent extreme heat in the main rice producing areas of the Yangtze River Basin is affecting grain filling, leading to a year-on-year decrease in rice production in Sichuan, Hubei and Jiangxi provinces, with rice production expected to decrease by 3.9%, 1.8% and 0.2% year-on-year, respectively. Persistent extreme heat is impacting single-season late rice production in the main producing provinces of late rice in the middle and lower reaches of the Yangtze River.

Soybeans: Total national soybean production in 2022 is expected to be 18.15 million tons, an increase of 3.81 million tons or 26.5% year-on-year, the largest increase in the past 10 years. The national soybean planted area is 9.851 million hectares, the largest planted area since the implementation of the soybean revitalization program, an increase by 2,043 million hectares (about 30.65 million mu), or about 26.2%, compared with 2021; the national soybean yield per unit area is 1,843 kg/ha, an increase of 0.3%.

The large increase in areas planted is due to an increase in various subsidies for specific planting methods, arable land rotation and use of improved seeds. They helped make soybean production more profitable. In Heilongjiang and Inner Mongolia, the two major soybean-producing provinces, planting area increased by 1.384 million hectares and 0.438 million hectares. It is estimate that this will lead to an increase in production by 1.93 million tons and 0.480 million tons, an increase of 40.3% and 39.6% respectively. Henan, Hebei, Jiangsu, Shaanxi and other provinces have also increased soybean production to varying degrees.

Wheat: Using remote sensing data and ground observation data for the full growth period of wheat, the national wheat production in 2022 was estimated at 134.23 million tons, a decrease of 0.64 million tons, or 0.5%, year-on-year. Among them, the total production of winter wheat is 128.52 million tons, a decrease of 0.65 million tons or 0.5%, and the total production of spring wheat is 5.71 million tons, basically the same as in 2021.

Table 4.3 China maize, rice, wheat and soybean production (thousand tonnes) and variation (%) in 2022

	Maize		Rice		Wheat		Soybeans	
Province	2022 (thousand tonnes)	Variation (%)	2022 (thousand tonnes)	Variation (%)	2022 (thousand tonnes)	Variation (%)	2022 (thousand tonnes)	Variation (%)
Anhui	3545	-0.2	16523	0.6	14181	-2.0	1060	-1.3
Chongqing	2051	-3.3	4810	0.8				
Fujian			2233	1.0				
Gansu	5326	-4.2			2610	5.2		
Guangdong			10431	-0.6				
Guangxi			9983	0.4				
Guizhou	5147	-0.7	5480	-1.1				
Hebei	19297	0.4			12199	-2.0	201	2.4
Heilongjiang	43222	-14.0	22899	2.5			6721	40.3
Henan	15246	-0.7	3863	2.3	32508	-1.6	834	3.3
Hubei			14990	-1.8	4470	-0.1		
Hunan			25337	0.8				
Inner Mongolia	22734	-7.7			1975	0.2	1690	39.6
Jiangsu	2035	-7.2	16663	2.5	13574	-0.6	808	5.2
Jiangxi			14968	-0.2				
Jilin	30910	-1.6	5744	-0.9			709	-13.4
Liaoning	15791	-3.4	4537	-1.2			422	-3.4
Ningxia	1689	-0.3	488	8.8				
Shaanxi	3807	-0.1	983	-2.9	4003	-1.3		
Shandong	18933	-1.5			26909	-0.4	707	-1.1

	Maize		Rice		Wheat		Soybeans	
Province	2022 (thousand tonnes)	Variation (%)	2022 (thousand tonnes)	Variation (%)	2022 (thousand tonnes)	Variation (%)	2022 (thousand tonnes)	Variation (%)
Shanxi	9474	3.2			2264	4.4	166	4.5
Sichuan	6535	-9.4	14610	-3.9	1972	2.7		
Xinjiang	7268	4.6			5017	1.1		
Yunnan	6629	3.2	6157	4.5				
Zhejiang			6241	-0.5				
Subtotal	219639	-4.6	186940	0.3	121683	-0.8	13316	21.3
other	3123	-10.9	10070	0.0	12546	2.8	4835	43.4
China	222762	-4.7	197010	0.3	134229	-0.5	18151	26.5

4.3 Regional analysis

Figures 4.10 through 4.16 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 October 2021 to the previous season, to the five-year average (5YA), and to the five-year maximum; (c) Spatial NDVI patterns for July to October 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 July to October 2021. Additional information about agro-climatic indicators and BIOMSS for China is provided in Annex A.

Northeast region

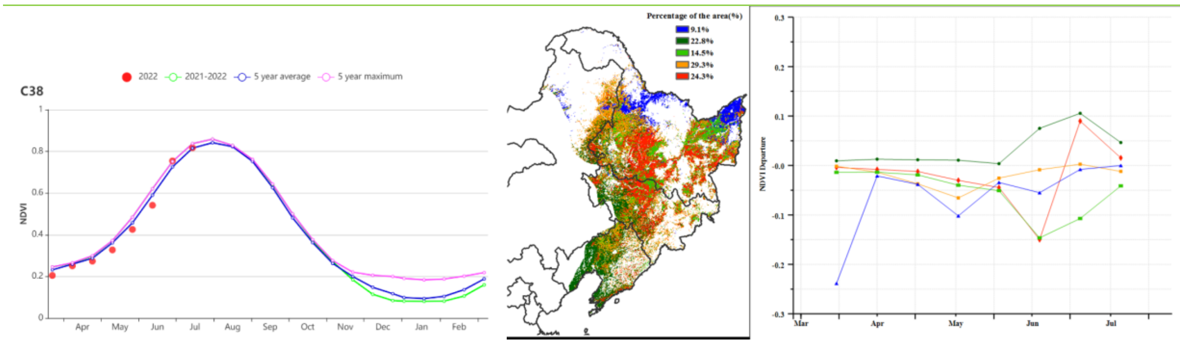
This report covers the period from the sowing to the peak of the growing season of main crops in the northeast of China (April to July 2022). CropWatch Agroclimatic Indicators (CWAIs) show that the precipitation greatly deviated from the average levels. The total precipitation increased by 35% from the 15YA. It was above average from late May to late July. The photosynthetically active radiation was below average (RADPAR -1%) and the temperature was below average (TEMP -0.3℃). The high precipitation is overall beneficial for crops, resulting in a potential biomass estimate that was 10% above the fifteen-year average level. However, great variability was observed within this region, with higher positive departures mostly in the western part and negative departures commonly distributed in the eastern part. Significantly below average BIOMSS was mostly located in central and northeastern Heilongjiang province.

The crop conditions during the monitoring period in general were slightly below average from April to June and slightly above average in July, but spatial variations existed. As shown by NDVI clusters and profiles, 22.8% of cropland over Liaoning province and western Jilin province were positive. 9.1% of cropland over northeastern Heilongjiang province and Heihe were negative, indicating that crops in this area were in relatively poor condition. Most parts of Heilongjiang province and central and western Jilin were significantly below average in June and improved in July. In addition, as shown by the crop map of 2021 and 2022, soybean planting area in Heilongjiang and Inner Mongolia and other places has increased significantly, replacing maize.

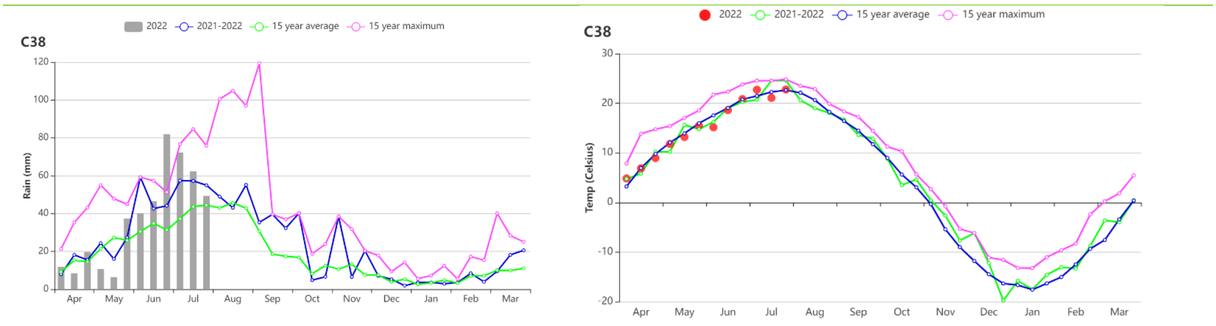
The maximum VCI shows that most parts of the Northeast of China were above 0.8, except for a small part in the waterlogged areas. This was mainly due to the flooding caused by significantly above average precipitation. During the field survey, it was confirmed that some fields in low lying areas were damaged by waterlogging and the flooding. NDVI departure maps at the end of July also presented below-average crop conditions, mostly along the rivers and in low land areas.

Overall, crop conditions were normal for this region.

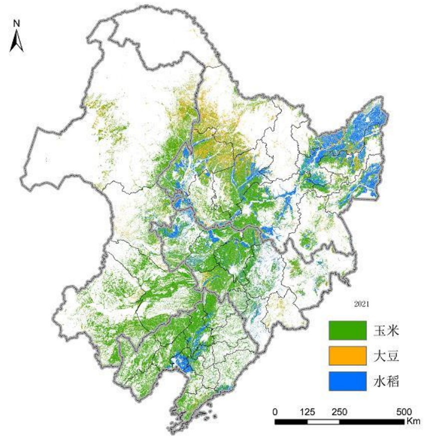
Figure 4.9 Crop condition China Northeast region, April - July 2022



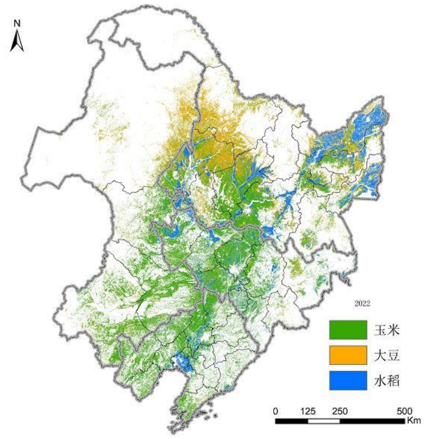
(a) Crop condition development graph based on NDVI (b) Spatial NDVI patterns compared to 5YA (c) NDVI profiles



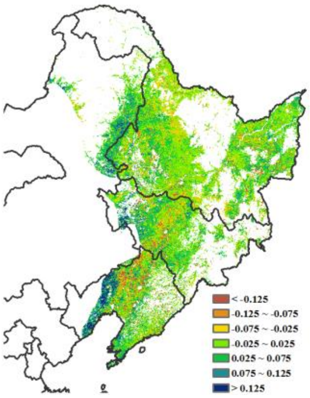
(d) Time series rainfall profile (e) Time series temperature profile



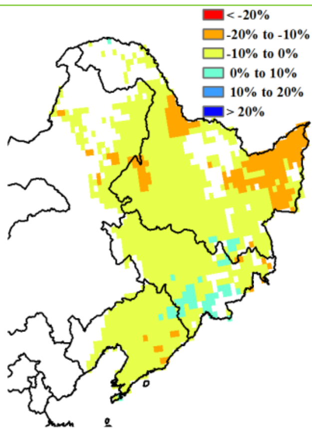
(f) Crop map in 2021



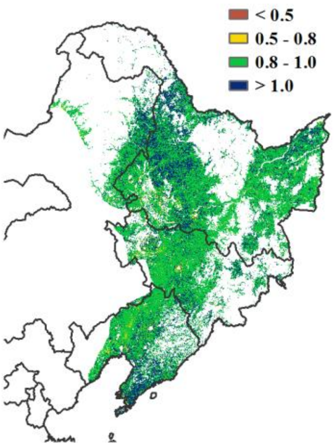
(g) Crop map in 2022



(h) NDVI departure from 5YA at end of July



(i) Biomass departure from 15YA



(j) Maximum VCI

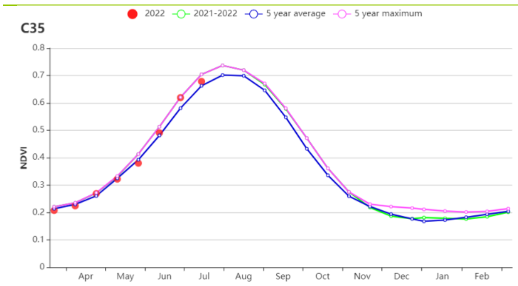
(k) Waterlogged areas in Heilongjiang province

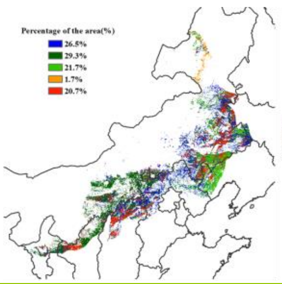
Inner Mongolia

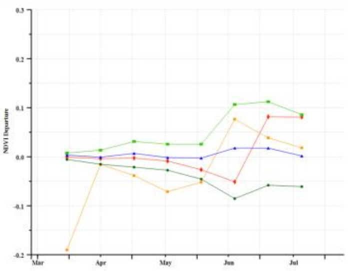
During the reporting period, single season crops (maize, wheat and soybean) were grown in Inner Mongolia. Overall, the crop conditions were normal. Both RAIN (+4%) and TEMP (+0.3°C) were slightly above average. RADPAR was close to average, resulting in an average estimate for BIOMSS. The spatial and temporal distribution for these indicators was very uneven. Precipitation was insufficient in some region in Northern Shaanxi, Central Ningxia and Central Inner Mongolia, which may have had a negative impact on the rain-fed crops. As illustrated in the crop development graph from May to July, 29.3% of the cropped areas displayed consistently below-average NDVI in the precipitation deficit affected areas mentioned above from May to July. This is confirmed by VCIx values being lower than 0.5 in these areas, where the biomass accumulation potential (BIOMSS) was also well below average. 26.5% of the cropped areas displayed consistently average NDVI during the reporting period, while the rest of the cropped areas improved in June and July.

The fraction of cropped arable land (CALF) reached 95%; VCIx was above average (0.90). Crop conditions were slightly above average during the reporting period, which is consistent with the agricultural production situation index (1.14). The final outcome of the season will depend on weather conditions in August and September.

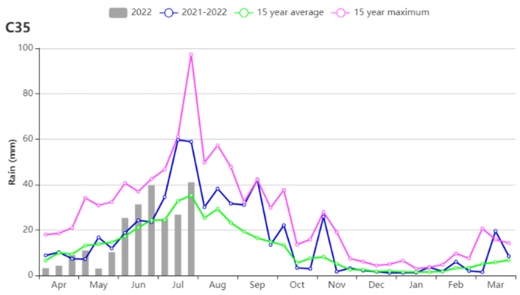
Figure 4.10 Crop condition China Inner Mongolia, April - July 2022

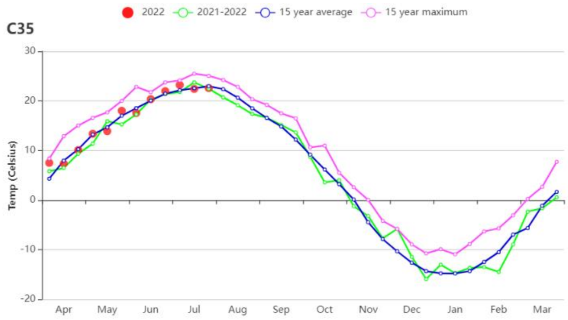






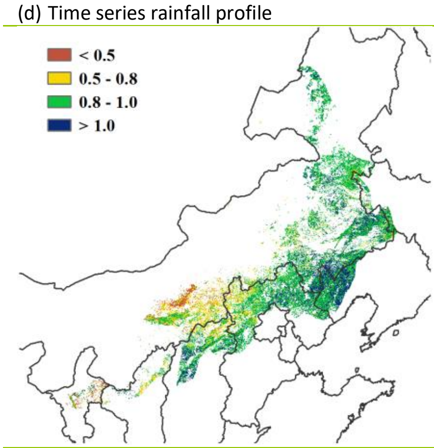
(a) Crop condition development graph based on NDVI (b) Spatial NDVI patterns compared to 5YA (c) NDVI profiles

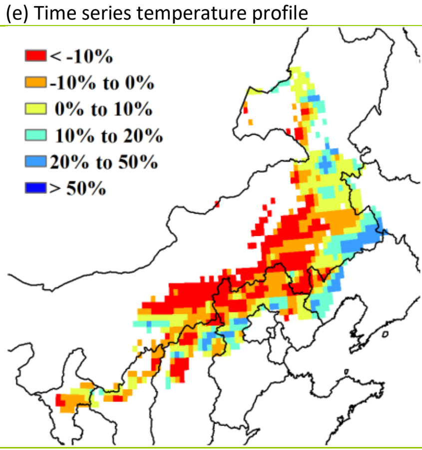




(d) Time series rainfall profile

(e) Time series temperature profile





(f) Maximum VCI

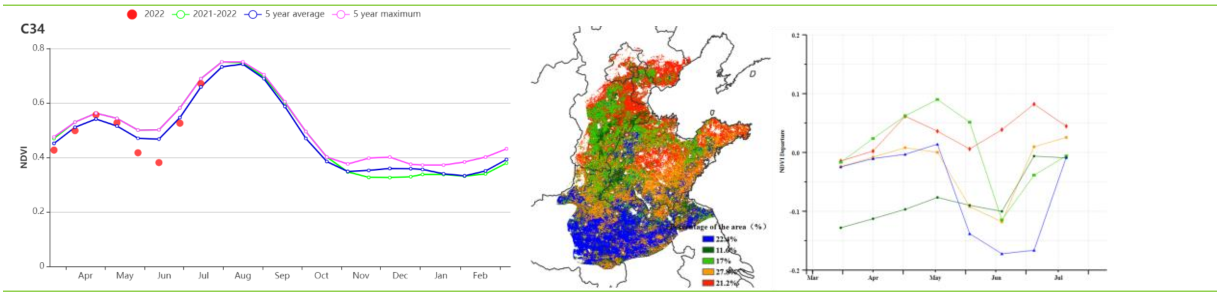
(g) Biomass departure from 15YA

Huanghuaihai

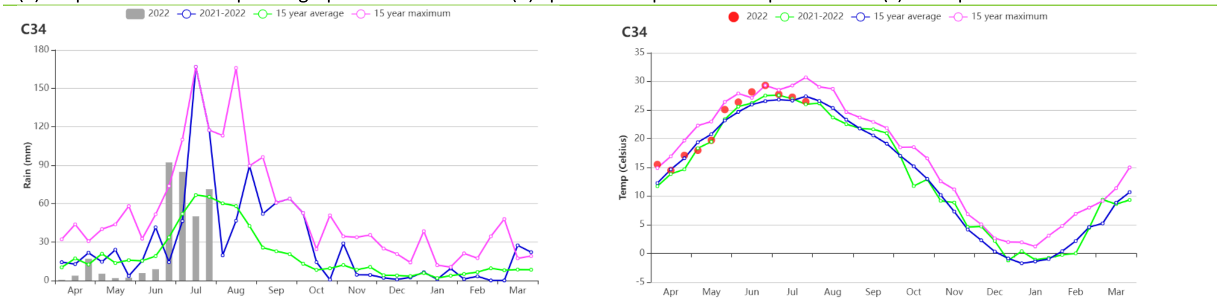
Winter wheat and summer maize are the main crops that grew in this monitoring period (April to July) in Hanghuaihai. The winter wheat harvest ended in mid-June, a few days later than usual because of the delayed sowing in October of last year. Maize was planted after the harvesting of winter wheat. Agro-climate indicators showed that radiation (+3%), precipitation (+1%), and temperature (+0.9°C) in this area were above the 15YA. Below-average precipitation between April and mid-June caused a 3% decrease in potential biomass. The CALF is similar to the 5YA and the maximum VCI value was 0.9.

The NDVI-based crop growth profile indicated a rapid decline in May and early June, which marked the maturity of winter wheat. High rainfall in late June and early July helped with the establishment of maize and the NDVI curve reached average levels by the end of this monitoring period. As the NDVI clusters and profiles showed, only 21.2% of the cropland in Central Shandong, Northeastern Shandong, and the Bohai Bay area was higher than the 5YA after mid-April. Wheat was harvested in most areas by mid-June. As precipitation increased, the emergence and early growth of maize after sowing were faster than in previous years thereafter. The crop conditions reached or even were above the average level by the end of July. In general, the crop conditions in the whole region were normal.

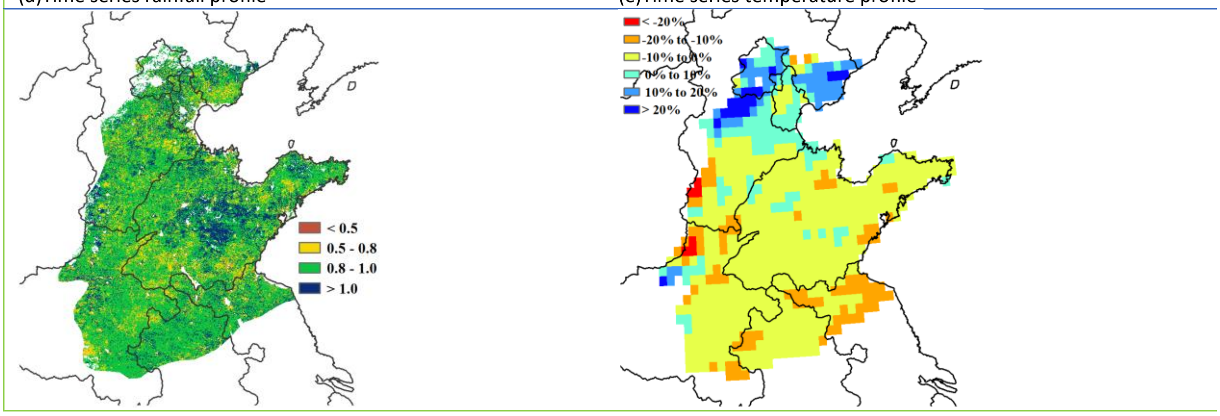
Figure 4.11 **Crop condition China Huanghuaihai, April - July 2022**



(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 from 15YA

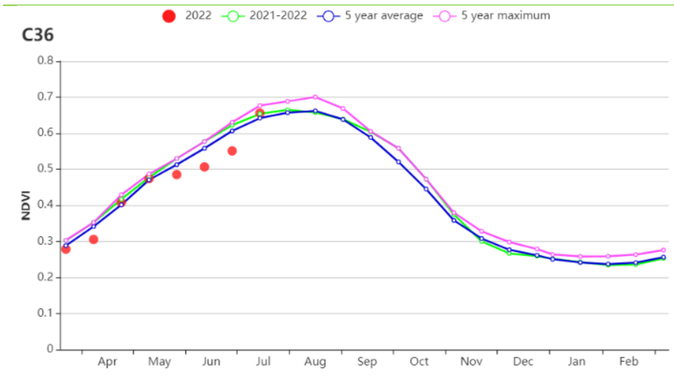
Loess region

During the reporting period, winter wheat was harvested from early to mid-June, while summer maize was planted in late June. The crop conditions in the Loess region were close to the 5YA.

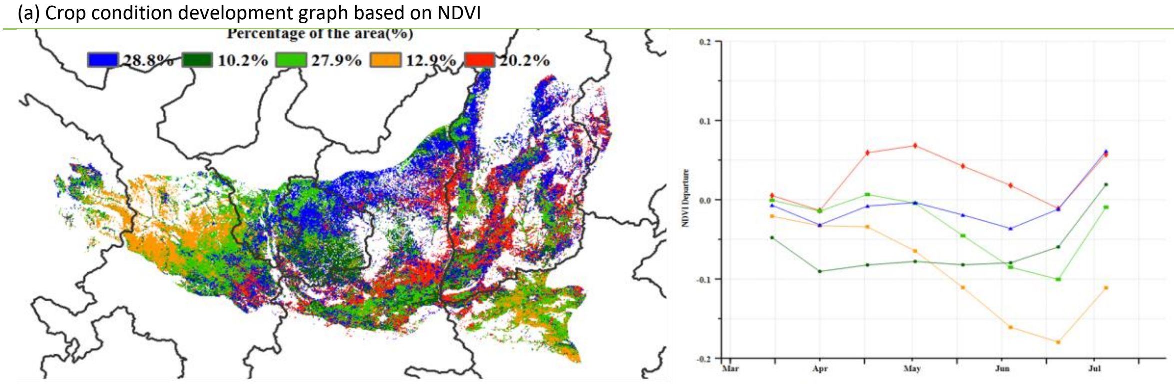
The CropWatch Agroclimatic Indicators (CWAIs) in the Loess Region show that the weather conditions were generally normal, precipitation was below average by 8%, the temperature increased by 0.8°C, and radiation was above the 15YA by 6%. Due to the overall low precipitation, potential biomass dropped by 3% compared to the 15YA. During the monitoring period, the precipitation exceeded the 15-year maximum in late April and mid-July, resulting in flooding in some areas of Gansu and Shanxi, while the precipitation remained below average from early May to early July. Temperatures fluctuated from April to May, and were slightly above average from June to early July, then dropped to below average in late-July.

As can be seen from the regional NDVI development graph, the crop conditions were generally close to the 5YA during the monitoring period, except for June, which was significantly lower than the average level due to the extreme high temperature weather. NDVI clusters and profiles show that crop conditions in most regions were close to normal. Approximately 20.2% of the region was above average from late April to mid-June, mainly in Shanxi and Shaanxi provinces. In addition, about 12.9% of the area was below average from June to early July, mainly in central Gansu and northwestern Henan. The Maximum VCI map shows high VCIx values in most cropped areas of the region with an average value of 0.89 but the VCIx was below 0.5 in central Gansu. CALF was at 96% which is 1% above the 5YA. The APSI index of the region is greater than 1, so the agricultural production situation is improving. In conclusion, the agricultural conditions in the Loess region were close to average, and the production situation in central Gansu Province still depends on subsequent agro-climatic conditions.

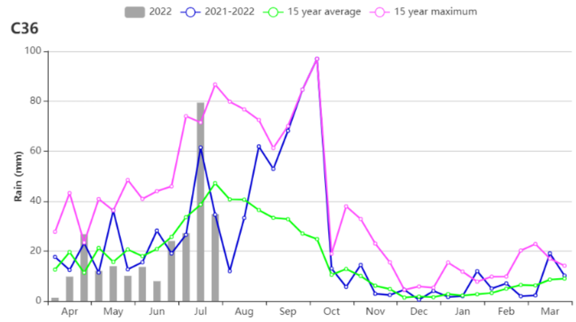
Figure 4.12 Crop condition China Loess region, April - July 2022

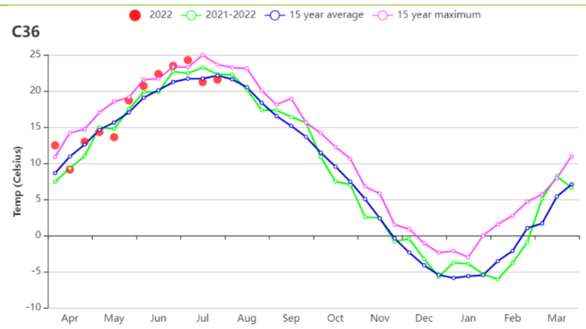


(a) Crop condition development graph based on NDVI

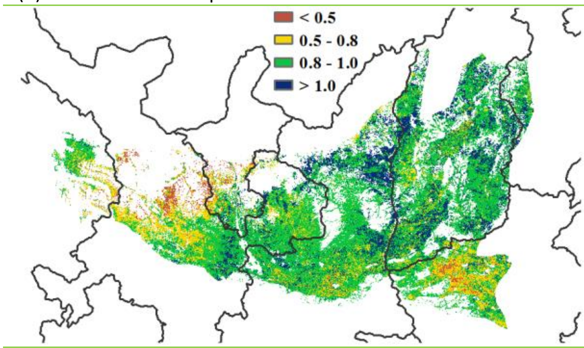


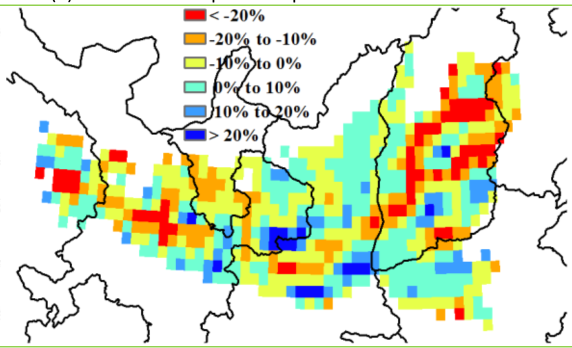
(b) Spatial NDVI patterns compared to 5YA (c) NDVI profiles





(d)Time series rainfall profile (e)Time series temperature profile





(f) Maximum VCI (g) Biomass departure from 15YA

Lower Yangtze region

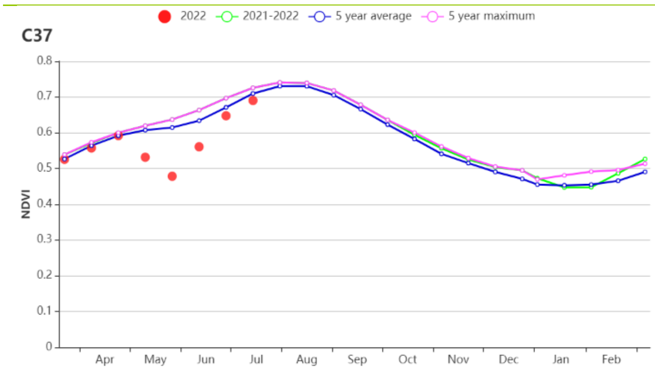
During this monitoring period, winter wheat and rapeseed had reached maturity by June in Hubei, Henan, Anhui and Jiangsu provinces. The semi-late and late rice crops are still growing in the south and the center of the region including Jiangsu, Fujian, Jiangxi, Hunan, and Hubei provinces, while early rice has been harvested.

According to the CropWatch agro-climatic indicators, the accumulated precipitation from April to July was 6% below the long-term average in this region, the temperature and photosynthetically active radiation were 0.2℃ and 5% higher than the 15-year averages, respectively. The rainfall profiles also indicate that below average precipitation occurred in middle and late July. The slightly dry agro-climatic conditions resulted in a 3% negative departure of the biomass production potential.

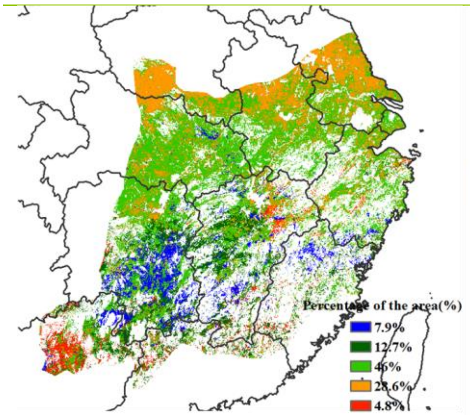
As shown in the NDVI departure clustering map and the profiles, 46% of the region, mainly distributed in the central part, had crop growth close to previous years. In the northern part of the region, including southern Henan, central Anhui and central Jiangsu, the crop growth was slightly lower than the average, and the potential biomass departure map shows a similar spatial pattern in this part with values between -20% and -10% (the orange area). The potential biomass departure in other areas was close to average and varied between -10% and 10%. The average VCIx of this region was 0.91, and most of the area had VCIx values ranging from 0.8 to 1.

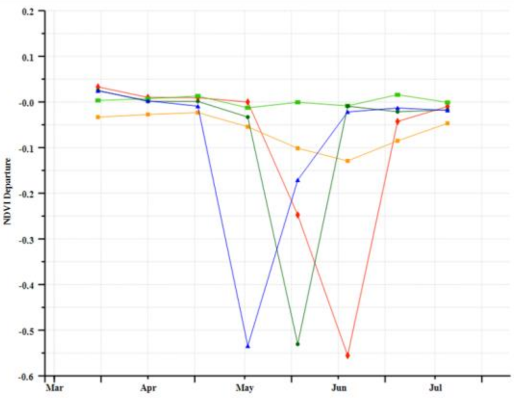
The crop conditions in the Lower Yangtze region were normal. However, the continuous high temperature and decrease of precipitation since July will negatively impact subsequent crop growth.

Figure 4.13 Crop condition China Lower Yangtze region, April - July 2022

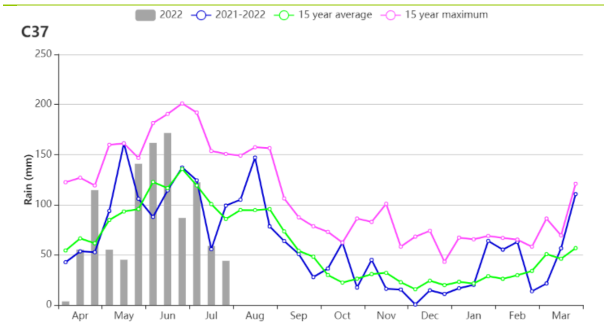


(a) Crop condition development graph based on NDVI

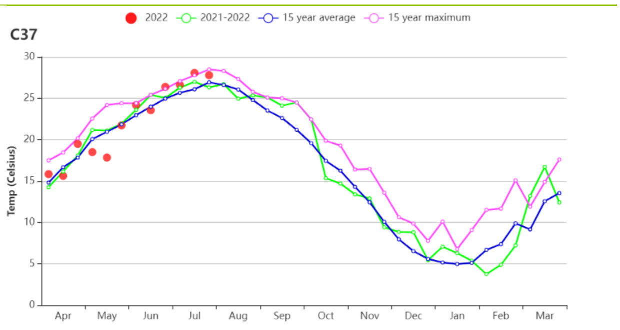




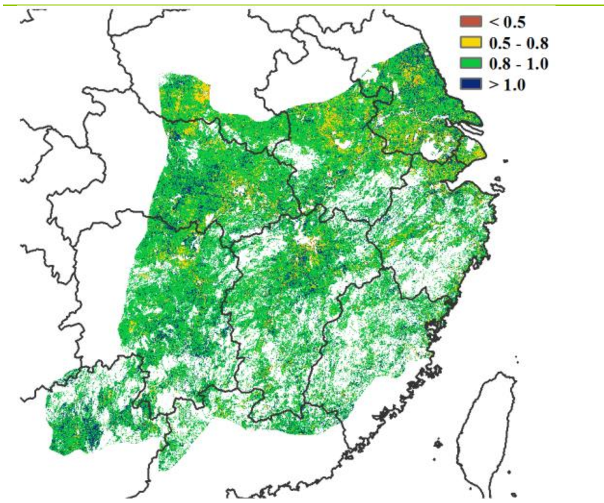
(b) Spatial NDVI patterns compared to 5YA (c) NDVI profiles



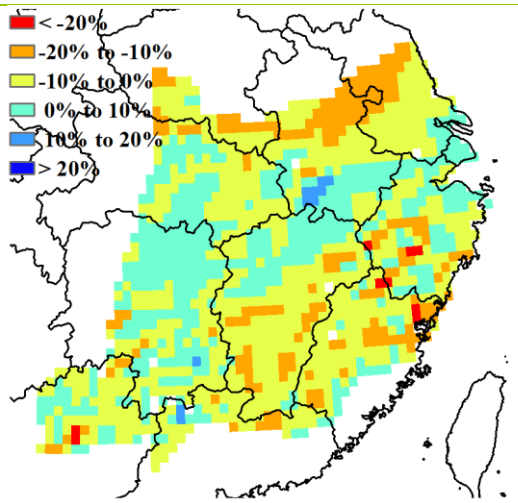
(d)Time series rainfall profile



(e)Time series temperature profile



(f) Maximum VCI



(g) Biomass departure from 15YA

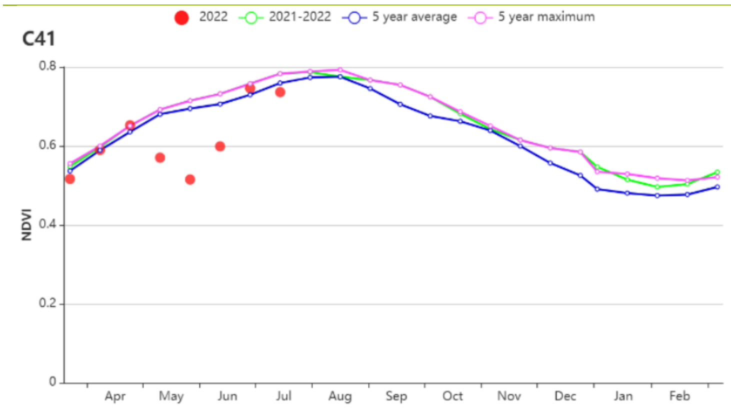
Southwest region

The reporting period covers the harvest of winter wheat in southwestern China, which was concluded by late April. Summer crops (including semi-late rice, late rice and maize) are still growing. In general, crop condition in the southwest region is below the average of the last five years.

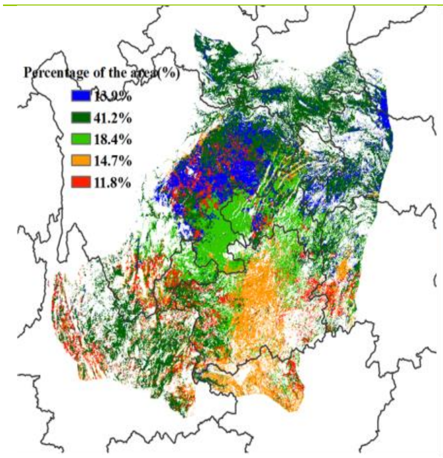
According to the CropWatch agro-climatic indicators the accumulated precipitation during this period was 817 mm (-9%), which was lower than the average for the same period in the past 15 years. Temperature was 18.6℃ (+0.2℃), which was slightly higher than the average, and RADPAR was 4% higher. The potential biomass was 1% lower due to the lower precipitation. CALF was the same as the average of the same period in the past 5 years, reflecting the overall normal condition of arable land utilization in this reporting period.

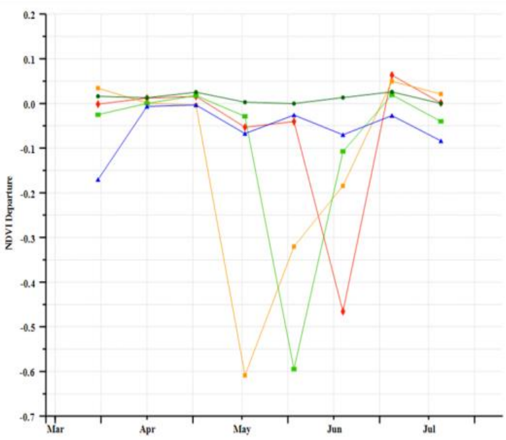
According to the NDVI departure clustering map and the profiles, crop condition in the north and southwest (about 41.2% of the region's cropland) were slightly above average throughout the monitoring period, while most of the Sichuan basin was affected by extreme heat and low rainfall, and crop conditions were significantly below average. Crop conditions in parts of southern Sichuan and western Hunan (about 11.8% of the region's cropland) were below average for most of the monitoring period and only rebounded to slightly above average at the end of the monitoring period. BIOMSS shows below-average biomass in the Guizhou region which may be associated with a substantial decrease in precipitation in Guizhou (-23%). The VCIx for the whole region was 0.94, indicating that crop conditions in southwest China were generally normal.

Figure 4.1 Crop condition China Southwest region, April - July 2022

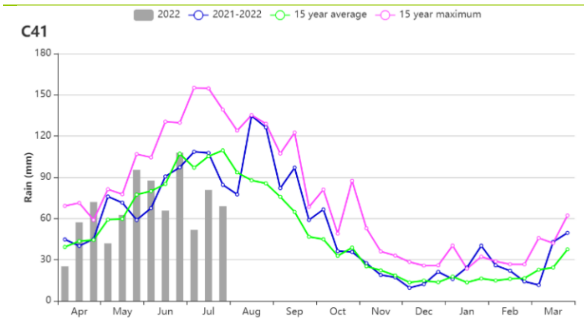


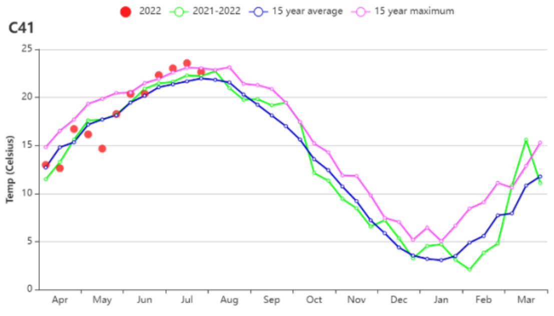
(a) Crop condition development graph based on NDVI





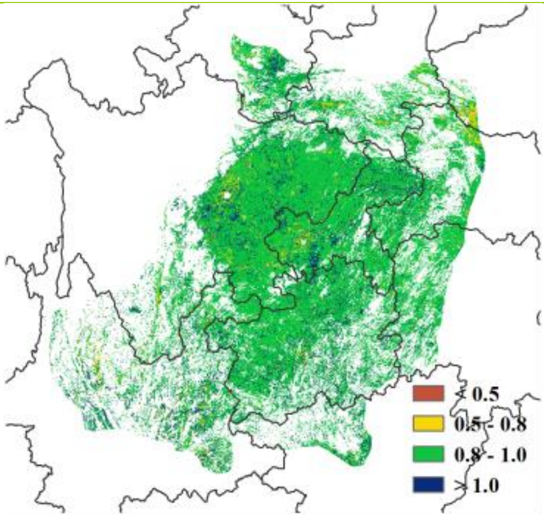
(b) Spatial NDVI patterns compared to 5YA (c) NDVI profiles

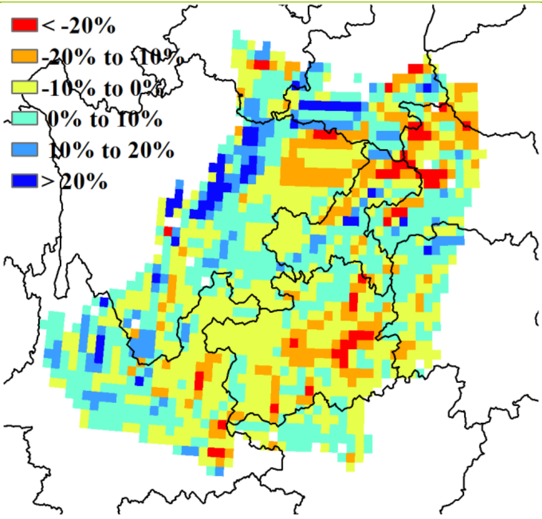




(d)Time series rainfall profile

(e)Time series temperature profile





(f) Maximum VCI

(g) Biomass departure from 15YA

Southern China

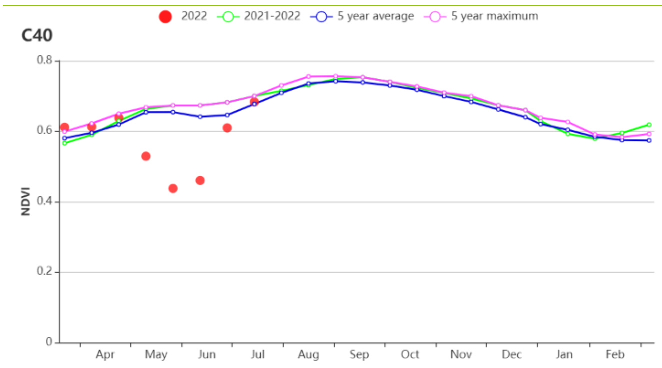
During the monitoring period, the harvest of wheat and early rice had been completed. Spring maize also reached maturity. In July, late rice was partially transplanted. The crop condition development graph based on NDVI showed that the crop conditions initially were better than the five-year average, but in May and June rapidly fell below the average level, and returned to the normal level at the end of the monitoring period.

For the whole region, although total rainfall was the same as the average, it was concentrated in May, June and early July, which hampered crop growth. Temperature was 22.5℃ (-0.1℃), slightly below the average, RADPAR was 3% higher. The biomass was 2% below average. CALF was the same as the average of the same period in the past 5 years, reflecting the overall normal condition of arable land utilization during this reporting period.

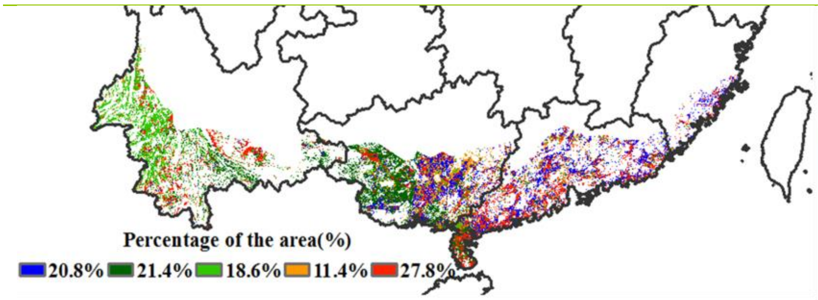
According to the NDVI departure clustering map and the profiles, values were close to average in most regions before May. Since mid-May, parts of Southern China have been hit by continuous heavy rainfall. Floods occurred in some regions of South China affecting farmland in low-lying areas. The continuous heavy precipitation resulted in poor crop conditions in those flooding areas. In July, with high temperature, less rainfall and more sunshine in most parts of the region, combined with sufficient precipitation in the early stages, the overall meteorological conditions were conducive for crop growth and NDVI in most regions of Southern China returned to average levels. The average VCIx of the Southern China region was 0.93, and most areas had VCIx values ranging from 0.80 to 1.00.

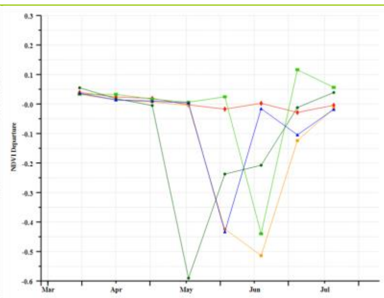
In general, crop condition in Southern China was slightly below average in some periods, it returned to normal at the end of the monitoring period.

Figure 4.14 Crop condition Southern China, April - July 2022



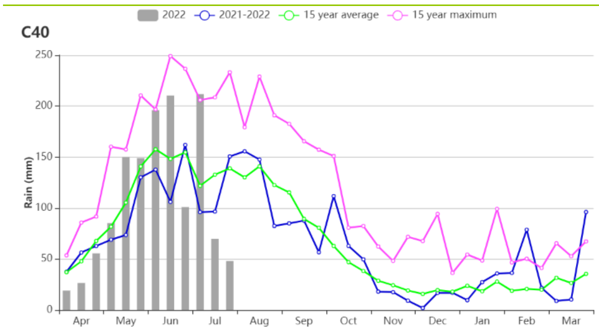
(a) Crop condition development graph based on NDVI

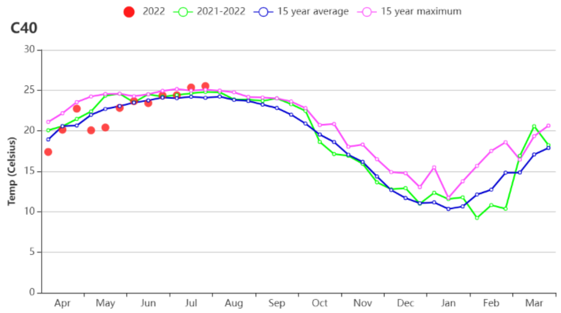




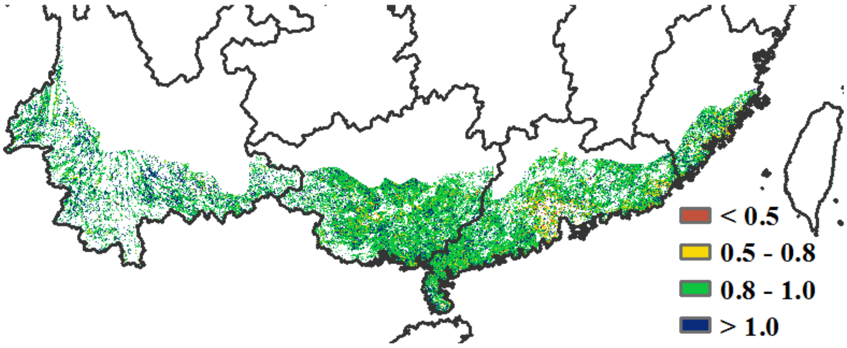
(b) Spatial NDVI patterns compared to 5YA

(c) NDVI profiles

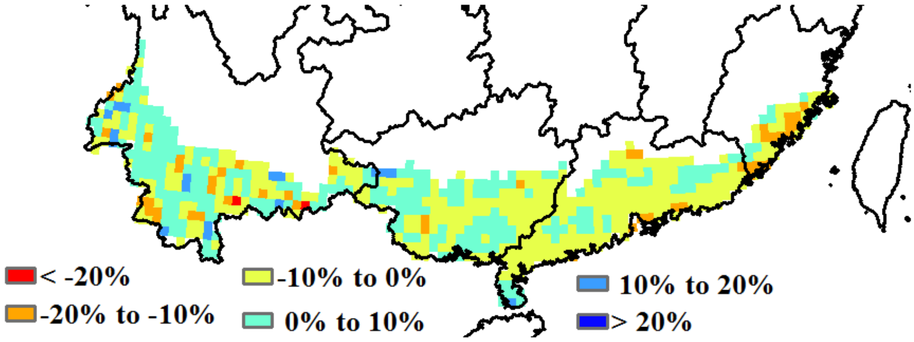




(d)Time series rainfall profile (e)Time series temperature profile



(f) Maximum VCI



(f) Biomass departure from 15YA

4.4 Major crops trade prospects

(1) International trade for major cereals and oil crop in China

Maize

In the first half of the year, China imported 13.594 million tonnes of maize, a decrease of 11.1% over the previous year. The main import source countries were the United States and Ukraine, accounting for 62.0% and 36.1% of the total import volume, respectively. The import volume was US $4.427 billion. The export of maize was 600 tonnes, a decrease of 85.9% over the previous year, and the export value was US $610.8 thousand.

Rice

In the first half of the year, China imported 3.5803 million tonnes of rice, an increase of 40.2% over the previous year. The main import sources were India, Pakistan, Vietnam, Myanmar and Thailand, accounting for 34.5%, 25.6%, 12.3%, 11.2% and 10.2% of the total import volume, respectively. The import volume was US $1.509 billion. The export of rice was 982.3 thousand tonnes, a decrease of 25.5% over the previous year. It was mainly exported to Egypt, Turkiye, Papua New Guinea, Sierra Leone and South Korea, accounting for 29.6%, 12.3%, 8.5%, 7.6% and 6.8% of the total export volume respectively. The export volume was US $456 million.

Wheat

In the first half of the year, China imported 4.9416 million tonnes of wheat, a decrease of 7.8% over the previous year. The main import source countries were Australia, France and Canada, accounting for 60.8%, 29.5% and 9.4% of the total import volume, respectively. The import volume was US $1.841 billion. Wheat exports were 76.6 thousand tonnes, an increase of 1.14 times over the previous year, mainly exported to Afghanistan, with an export value of US $35.0424 million.

Soybean

In the first half of the year, China imported 46.2835 million tonnes of soybeans, a decrease of 5.4% over the previous year. The main import source countries were Brazil and the United States, accounting for 59.9% and 37.9% of the total import volume, respectively. The import volume was US $30.003 billion. Soybean exports were 47.6 thousand tonnes, an increase of 18.7% over the previous year, mainly exported to South Korea, Japan and North Korea, accounting for 48.2%, 26.2% and 9.1% of the total export.

(2) Trade prospects for major cereals and oil crop in China for 2022

On the basis of remote sensing-based production prediction in major agricultural producing countries in 2022 and the Major Agricultural Shocks and Policy Simulation Model, it is predicted that the import of major grain crops will increase slightly in 2022. The details are as follows:

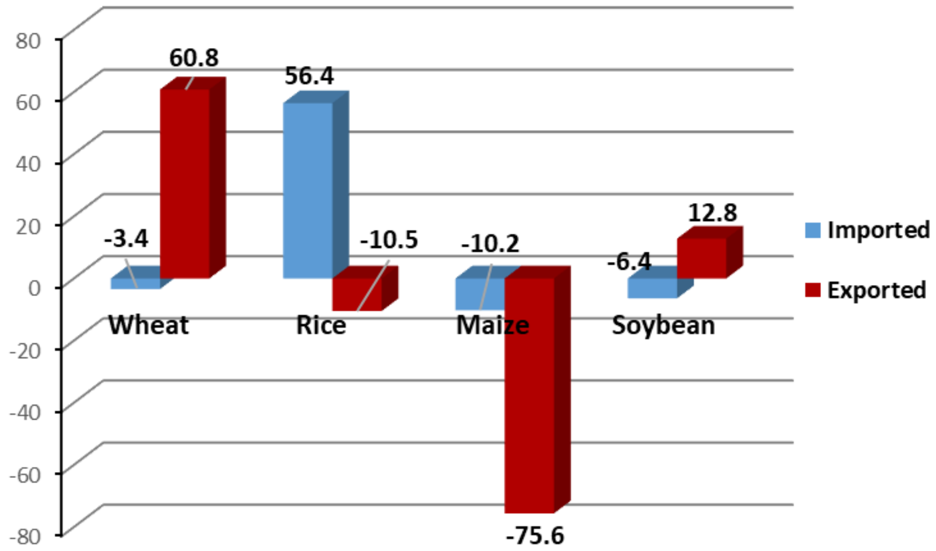
In 2022, China's maize import will significantly decrease in 2022, with a year-on-year decrease of 10.2% and an export decrease of 75.6%. Since the beginning of this year, affected by factors such as the crisis in Ukraine and the global drought, the efficiency of global maize trade has declined, and China's import speed has slowed down. It is expected that China's maize import will decline significantly in 2022.

In 2022, China's rice import increased by 56.4%, and export decreased by 10.5%. Affected by the global extreme high temperature and other factors, India and other major exporting countries are facing production reduction, and the global import pattern will be affected. However, from the domestic perspective, due to the recovery of food and beverage consumption and the increase of feed demand, the import kept increasing throughout the year.

In 2022, China's wheat import decreased by 3.4% and export increased by 60.8% in 2022. Since the beginning of this year, the global wheat price has been running at a high level, and China's wheat import power is insufficient. It is expected that the wheat import will decrease slightly in 2022.

In 2022, China's soybean import will decrease by 6.4%, and export will increase by 12.8%. Due to the comprehensive impact of domestic soybean oil production, feed demand decline and low pressing profit, it is expected that the soybean import will be significantly reduced throughout the year.

Figure 4.15 Rate of change of imports and exports for rice, wheat, maize, and soybean in China in 2022 (%)



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 2020 (section 5.1), as well as sections on recent disaster events (section 5.2), and an update on El Niño (5.3).

5.1 CropWatch food production estimates

Methodological introduction

CropWatch production estimates are based on a combination of remote-sensing models combined with CropWatch global agro-climatic and agronomic indicators as well as meteorological data from over 20,000 meteorological weather stations around the world. The major grain crops (maize, rice, wheat) and soybean production of 43 major producers and exporters are estimated and predicted for 2022. The results are as follows.

Production estimates

Overall, extreme heat and dry weather in Europe in 2022 led to reduced crop yields in most European countries, and extreme heat also occurred in the Horn of Africa, South America and the Yangtze River Basin in China, affecting the production of crops. 2022 global maize production is expected to be 1.037 billion tonnes, a decrease of 40.68 million tonnes or 3.8%, it is the largest decrease in the past five years. Global rice production is expected to be 768 million tonnes with an increase of 3.54 million tonnes or 0.5%. Global wheat production is expected to be 708 million tonnes, a reduction of 12.68 million tonnes or 1.8%. Global soybean production is expected to be 320 million tonnes with a slight decrease of 0.2%. The overall supply situation of crop production is tightening (Table 5.1).

Maize

The main maize producing countries in the Northern Hemisphere are affected by high temperature and dry weather. Both maize cultivation area and production declined; the Southern Hemisphere countries have expanded their maize acreage and production increased. In the 2022 Northern Hemisphere summer, extreme heat and dry weather had a serious adverse impact on agricultural production in Europe, resulting in reduced maize yields in France, Germany, Hungary, Italy, Romania, Ukraine and other countries. Hungary, Italy, and Romania were the most severely affected countries. Their maize yields declined by more than 10%; the crisis in the Ukraine limited the country's agricultural production. Both area and yield fell sharply, resulting in a large decline by 34% or 12.22 million tonnes in the country's maize production to 23.72 million tonnes. The U.S. is the world's top maize producer. It experienced drought conditions in its main maize-producing regions in June, resulting in a decrease in maize production to 363.59 million tonnes, down by 17.51 million tonnes or 4.6 %. China's maize acreage shrank, and the high temperature and drought in the Yangtze River basin and flooding in some northern areas led to a reduction in maize production to 222.76 million tonnes, down by 11.08 million tonnes or 4.7%. The continued drought in Ethiopia and Kenya in the Horn of Africa led to a 20.1% and 7.8% reduction in production, respectively. Production in Canada, Nigeria, Vietnam and other countries was slightly reduced. As the largest maize producer in the Southern Hemisphere, Brazil suffered from persistent drought conditions. The first season maize production fell by 8.7%; the second season maize acreage increased by 9.2% because in April, during the grain filling period, agricultural conditions were significantly better than the same period last year. Yield increased by 6.7%. The second season total maize production increased significantly by 16.5%, prompting Brazil's total maize production to reach 91.3 million tonnes, an increase of 9.6%; Argentina and South Africa maize production is estimated to be 54.97 million tonnes (+2.9%) and 11.86 million tonnes (+3.5%), respectively.

Rice

Production in the important rice producing countries increased slightly, prompting an increase of 3.54 million tonnes in global rice production. Asian rice production is dominant in the world, and China is the world's largest rice producer. Although local areas were affected by high temperatures, drought or flooding. But the national rice production generally remained stable. Rice production is expected to increase slightly by 0.3% to 197.01 million tonnes. Southeast Asian countries are in the rainy season. Precipitation has generally been normal for Thailand, Vietnam, Indonesia, the Philippines, Myanmar and Bangladesh. Pakistan has received significantly more precipitation, causing local flooding. But overall conditions are still conducive to the growth of rice. Production is estimated to increase by 6.8%. In central and north-central India, precipitation is significantly below average, but the main rice producing areas have well-developed irrigation systems, and the dry and hot weather has less of an impact on rice production. The country's rice production is expected to decline slightly by 1.7%. Rice production in Cambodia, the U.S. and Nigeria also declined by varying degrees. Overall, the global rice production and supply situation is basically stable.

Wheat

Global wheat acreage shrank. In addition, drought and extreme heat caused unfavorable conditions in some production regions and the global wheat production has declined for two consecutive years. In Western and Central Europe, the temperatures were 1℃ to 5℃ above average. In combination with a rainfall deficit, most countries suffered from the dual impact of shortened wheat filling period and severe drought. Romania was the country that was most severely affected and its wheat production decreased by 13.2%. In India and Pakistan, a heat wave led to a shorter filling period, resulting in a yield decline by 2.8% and 4.9%, respectively. Total wheat production is estimated at 93.24 million tonnes and 25.57 million tonnes, respectively. Due to droughts, Morocco (-33%), Ethiopia (-20.7%), Kenya (-16,6%) and Afghanistan (-7,4%) saw sharp declines in their wheat production. In Iran, wheat acreage and yields fell simultaneously, resulting in a decline of the country's wheat production by 13.4%. Among the major wheat-producing countries, only Australia, Brazil, Canada, Mexico and Kazakhstan and Kyrgyzstan in Central Asia have increased wheat production. Total global wheat production has fallen to the lowest level in the past five years, and the tight situation of global wheat supply is expected to continue.

Soybean

Production in major soybean exporting countries declined, while production in China, the largest importer, increased significantly. The United States and Brazil are the world's two largest soybean exporters. Production is estimated at 102.36 million tonnes and 95.14 million tonnes, respectively, a decrease of 2.35 million tonnes and 1.16 million tonnes or 2.2% and 3.3%. The main reason for the reduction in soybean production in the United States is the low precipitation and high temperatures in the main soybean producing areas in June and July, affecting soybean flowering and podding, while Brazil is mainly affected by persistent drought conditions, which reduced yields. In contrast, China, the largest soybean importer, increased its soybean acreage significantly this year, prompting Chinese soybean production to reach 18.15 million tonnes, the highest production in nearly 10 years, an increase of 3.81 million tonnes or 26.5%. This increase offesets reductions in U.S. and Brazilian production. Soybean production in Canada and India decreased by 260,000 tonnes and 440,000 tonnes, respectively, while soybean production in Russia and Argentina increased by 230,000 tonnes and 170,000 tonnes, respectively. Overall, the global soybean supply situation is basically normal.

Table 5.1 2022 cereal and soybean production estimates in thousand tonnes. Δ is the percentage of change of 2022 production when compared with corresponding 2021 values.

	Maize		Rice		Wheat		Soybean	
	2022	Δ%	2022	Δ%	2022	Δ%	2022	Δ%
Afghanistan	`				3,617	-7		
Angola	2,737	4	49	10				
Argentina	54,971	3	1,846	-3	17,216	-4	51,774	0
Australia					29,991	1		
Bangladesh	3,989	2	49,411	3				
Belarus					2,991	-1		
Brazil	91,305	10	11,354	-4	7,490	2	95,137	-1
Cambodia			9,791	-1				
Canada	11,786	-3			29,936	4	7,588	-3
China	222,762	-5	197,010	0	134,229	0	18,151	27
Egypt	5,875	0	6,591	2	11,240	-2		
Ethiopia	5,394	-20			2,862	-21		
France	14,153	-9			33,361	-6		
Germany	4,675	-6			25,095	-4		
Hungary	4,429	-22			4,452	-10		
India	17,867	-2	178,823	-2	93,244	0	12,554	-3
Indonesia	16,648	0	67,224	1				
Iran			2,590	6	10,974	-13		
Italy	5,087	-19			7,362	-5		
Kazakhstan					12,953	15		
Kenya	2,087	-9			243	-17		
Kyrgyzstan	773	25			744	41		
Mexico	23,268	-6			4,015	17	818	-8
Mongolia					299	-5		
Morocco					6,050	-33		
Mozambique	2,204	5	400	0				
Myanmar	1,935	2	25,858	4				

Nigeria	9,380	-10	4,090	-4				
Pakistan	5,558	1	12,125	7	25,573	-3		
Philippines	7,433	5	21,289	4				
Poland					10,292	-5		
Romania	11,270	-13			6,945	-13		
Russia	13,664	1			52,451	-3	3,817	7
South Africa	11,861	4			1,543	-15		
Sri Lanka			2,585	2				
Thailand	4,299	1	40,676	1				
Turkey	6,496	2			16,859	0		
Ukraine	23,723	-34			21,433	-11		
United Kingdom					12,644	-2		
USA	363,593	-5	10,891	-4	51,572	-1	102,361	-2
Uzbekistan					8,336	11		
Vietnam	5,221	-3	46,695	0				
Zambia	3,556	-1			239	7		
Sub-total	957,998	-4	689,298	0	646,250	-2	293,671	-1
Others	78,506	0	78,260	3	61,451	3	26,078	-2
Global	1,036,503	-4	767,558	0	707,701	-2	319,748	0

Global Crop Production Index

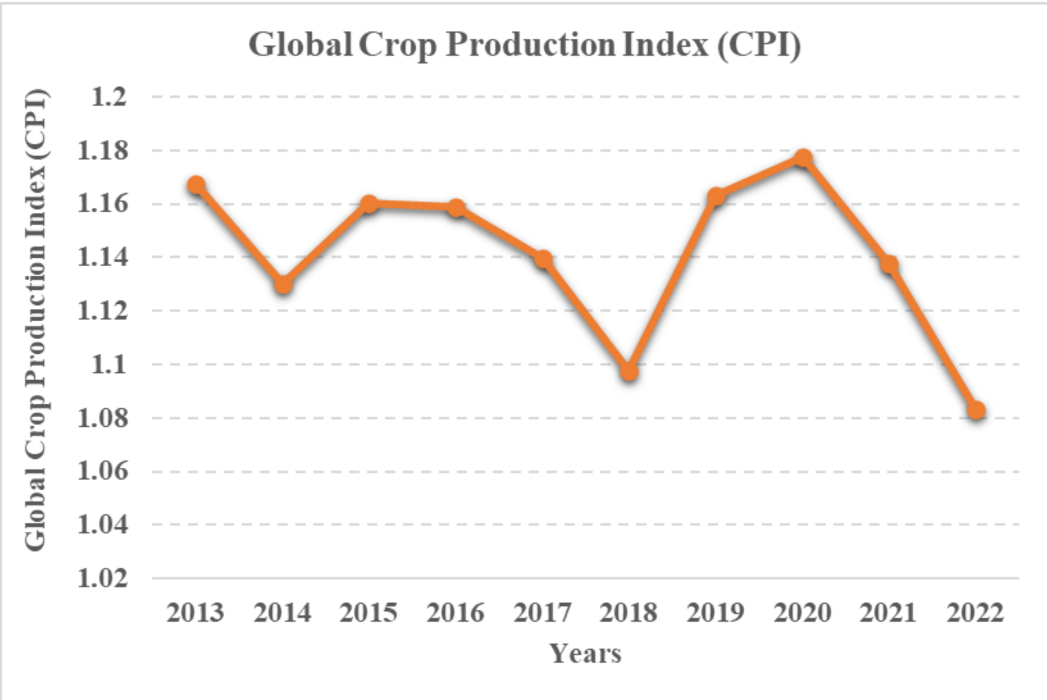


Figure 5.1 **Global agricultural production situation index from April to July of the past 10 years**

The Crop Production Index (CPI) is an indicator that CropWatch is developing and testing to characterize the agricultural production situation in a designated area. The index takes into account the distribution of irrigated and rainfed cropland, VCIx, CALF, land productivity, and crop acreage in a designated area to measure the production situation in a given growing season in a normalized value.

Over the 10-year period, the production situation was poor in 2018 and 2022, and the production situation in 2020 was the highest in the 10-year period (CPI=1.18). Starting from 2021, the global agricultural production situation decreases significantly for two consecutive years, and in 2022 it decreases significantly to the worst in the 10-year period (CPI=1.08). This is consistent with the trend reflected in the global agroclimatic indicators monitored by CropWatch.

5.2 Disaster events

The number of people suffering from acute food hunger is expected to increase in 2022-2023, which was around 817 million in 2021, as estimated by FAO. According to the recently released 2022 State of Food Security and Nutrition in the World (SOFI) report (**https://www.fao.org/3/cc0639en/cc0639en.pdf**), the world continues to lose ground in its efforts to end hunger, food insecurity, and malnutrition in all its forms by 2030 due to several natural and man-made disasters affecting health and food production. This report summarizes those major disasters global wide.

Russia-Ukraine conflict

The Russia-Ukraine conflict that began on 24 Feb. 2022 has caused extensive damage and loss of life, spread across rural areas, and sparked massive population displacement. More than 3.6 million people have been forced to abandon their homes and flee across borders to safety. Millions more are internally displaced. It is clear that the crisis has resulted in a massive and more deteriorating food insecurity situation, disrupted livelihoods during the agricultural growing season in Ukraine, and has also affected global food security. Nearly 50 countries depend on the Russian Federation and Ukraine for at least 30 percent of their wheat import needs. Out of these countries, 26 source over 50 percent of their wheat imports from these two countries. In that context, this crisis keeps disrupting global markets and food supplies. It has caused a challenge for food security in many countries, especially for low-income food import-dependent countries and vulnerable population groups.

Before the crisis in Ukraine, international food commodity prices had reached an all-time high. This was mostly due to market conditions but also due to high prices of energy, fertilizers, and all other agricultural services. The crisis has aggravated the situation. In March 2022, the FAO Food Price Index reached a new historical record high, up 12.6 % from February and 33.6 % from its level a year earlier, and 15.8 % higher than the peak in February 2011. In Lebanon, food prices rocketed by 332 percent, Iranian food bills jumped by 87 percent, and Turkish grocery costs rose by 95 percent. Moreover, the currencies of Zimbabwe, South Sudan, Turkey, Sri Lanka, Laos, and Malawi have lost at least 25 percent of their value against the greenback, leading to a price increase for local companies or governments purchasing global commodities, which are priced in U.S. dollars. As a result, a total of 345 million people in 82 countries are in danger of dying because of insufficient food, according to World Food Program. Despite the recent easing of prices in the commodity markets, food, fuel, and fertilizer remain significantly more expensive than a year ago. Following efforts by multi-faceted, Russia and Ukraine signed an agreement with Turkey and the United Nations in Istanbul on July 22 regarding the outbound shipment of agricultural products from Black Sea ports, reopening three ports in southern Ukraine, including the port of Odessa. By the end of August, the volume of agricultural products shipped out of Ukrainian ports under the agreement framework had exceeded 1 million tons. With the increase in the volume of agricultural products shipped out of Ukraine, international food prices have fallen further, and related initiatives have also enabled the World Food Program to resume purchasing wheat from Ukraine to provide food aid to countries such as Ethiopia and Yemen to alleviate local famine problems.

Figure 5.2 The FAO Food Price Index reached a new historical record high In March 2022.

(Source: https://www.fao.org/worldfoodsituation/foodpricesindex/en/)

The conflict between Russia and Ukraine has affected the summer crop production in Ukraine. The crop growth based on NDVI shows that it is always lower than the historical average level in this period, especially in the conflict affected areas in the southeast, with the best vegetation state index lower than 0.5.

Accodgin to the monitoring of remote sensing data, by the end of July, the proportion of arable land planted in the main wheat-corn producing region of southeastern Ukraine was only 70% and about 30% of the arable land was affected by the conflict and could not be sown, compared with 94% in the same period in 2021; Kherson, Odessa, Nikolaev, Crimea, Zaporozhye, Donetsk and Dnepropetrovsk oblasts in southeastern Ukraine were the most significantly affected, with the proportion of cultivated land falling by 48%, 42%, 33%, 29%, 28%, 12% and 12% respectively. The conflict led to a significant reduction in the area planted with corn and other fall crops, while the ongoing drought led to a year-on-year decline in crop yields, resulting in a significant decline in the country's corn production to 23.72 million tons, down 12.22 million tons or 34% year-on-year, and most other fall crops, including sunflowers, also had varying degrees of yield reduction.

Floods

In Pakistan, over 1 million people were affected by heavy rains and floods, including 580 people killed and 939 injured during the summer of 2022. Pakistan has received over 60 % of its total normal monsoon rainfall in just three weeks since the start of the monsoon season in July. Heavy rains have resulted in urban and flash floods and landslides, particularly affecting Balochistan, Khyber Pakhtunkhwa (KP), and Sindh provinces. Compared to pre-monsoon levels, rainfall has increased by 267% in Balochistan and 183% in Sindh, causing substantial damage to lives, infrastructure, and livelihoods. Some 107,000 livestock (including 29,000 large ruminants) have perished because of the floods. Over 1,000 animal shelters have been damaged, and over 1 million acres of crops have been affected by the recent floods. The recent Integrated Phase Classification (IPC) analysis of acute food insecurity projects that over 955,000 people will be food insecure in the flood-affected areas of Balochistan between July and November 2022.

Figure 5.3 Over 50 Villages in Pakistan Submerged in Flash Floods: Report.

(Source: https://www.ndtv.com/world-news/over-50-villages-in-pakistan-submerged-in-flash-floods-report-3210040)

In Sudan, the massive floods during the summer season in 2022 have caused the death of 52 people, while another 25 were injured. The floods have also destroyed about 8,900 houses and damaged another 20,600 in 12 Sudanian states. As of 14 Aug., the estimated number of people affected by heavy rains and floods since May exceeds 146,000. The rainy season in Sudan usually starts in June and lasts up to September, with the peak of rains and flooding observed between August and September. The Nile River water level increased during July last week but remains below the alert level. The Atbara River water level, some 300 km northeast of Khartoum, exceeded the alert level on 6 August due to heavy rain in eastern Sudan and the north-western part of Ethiopia. Compared to the same period last year, the water levels along the five major stations remain below the alert level.

In the Nelson region, New Zealand, massive floods are currently occurring, causing damage to roads and homes and forcing more than 1200 households to evacuate. The floods came after four days of heavy rains brought by an 'atmospheric river' starting on 19 Aug. 2022. The higher than a usual number of atmospheric rivers driven by climate change is likely playing a major role in New Zealand floods in addition to high air and sea surface temperatures. As the atmosphere warms, it can hold more moisture, increasing the likelihood of extremely heavy rainfall events.

Figure 5.4 Flooded properties in the Nelson region of New Zealand on Friday, 19 Aug. 2022.

(Source: https://www.theguardian.com/world/2022/aug/19/new-zealand-floods-could-take-years-to-clean-up-with-1200-people-displaced)

Drought

Europe is now hit by the most severe drought in 500 years. The drought conditions have deteriorated this summer as repeated heatwaves roll across the continent. July was reportedly the driest month in France for 60 years. By August, 100 villages had run out of drinking water, and water use had been restricted in nearly all metropolitan departments of France. Consequently, the national maize harvest is expected to be 18.5% lower than in 2021, and milk shortages are expected to follow. In Germany, the River Rhine's water level fell to 30 cm in August. The Rhine is one of Europe's most important trade routes. In Romania, water restrictions were introduced in July 2022 in preparation for drought since the national government has warned citizens not to use drinking water for other purposes such as irrigation, industrial needs, swimming pools, grass, or watering gardens. Spain and Portugal have suffered their driest climate for at least 1,200 years, with severe implications for food production and tourism. Droughts severely impact the landscape and the region's agriculture: the current meteorological conditions threaten to ruin this season's crops, which are to be exported to other European countries. Satellite images revealed that the Almendra reservoir in the Castilla León autonomous region, the third-largest reservoir in Spain, is currently at only 35.9% of its capacity. According to environmentalists, the Tagus River, the longest in the region, is at risk of drying up completely. The reservoirs at the mouth of the river Tagus have lost 23.53 cubic hectometers until mid-August and currently store 566.14 cubic hectometers, representing only 22.5% of their capacity. In the United Kingdom, July 2022 was the driest month since 1935. Agriculture fields and heathland have dried up, and reservoir levels are at a 25-year low.

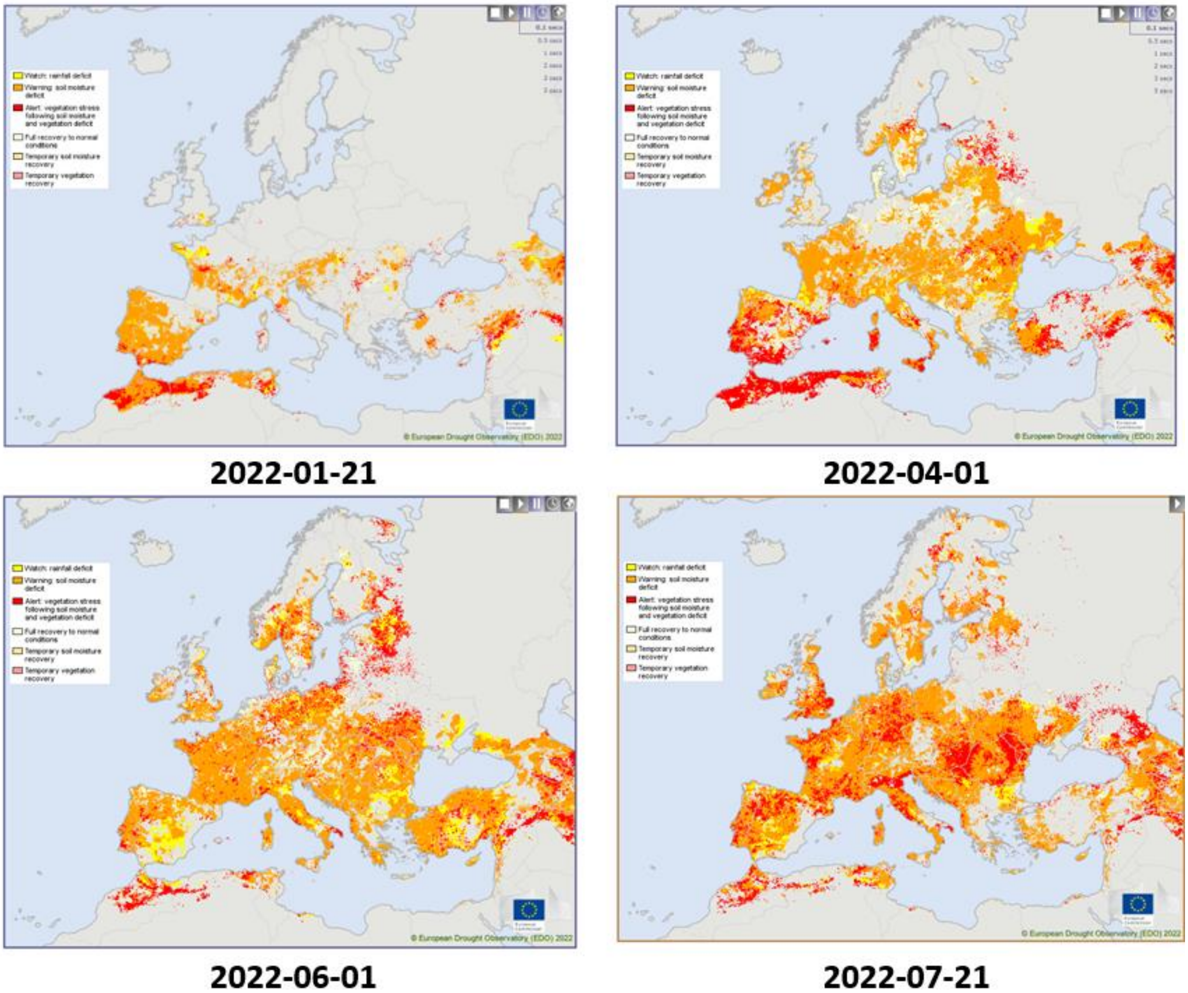


Figure 5.5 Drought propagation in Europe during the current summer as observed by EOD- the European Drought Observatory.

(Source: https://edo.jrc.ec.europa.eu/edov2/php/index.php?id=1000)

In Afghanistan, people continue to face the highest prevalence of insufficient food consumption globally. For nearly ten consecutive months, over 90 percent of the population has faced insufficient food consumption. Drought conditions exacerbated the extreme hunger and poverty that the country is already facing. Intense summer heat and a weak spring rainy season have effectively spelled doom for a meaningful harvest in the country. About 70% of households are unable to meet basic food and non-food needs, with particularly devastating effects for homes headed by widows, the elderly, people with disabilities, and children. An estimated 3 million children are at risk of malnutrition and susceptible to diseases such as acute watery diarrhea and measles due to weakened immunity.

The Horn of Africa, which stretches from Eritrea in the north through Ethiopia and Djibouti to the southern tips of Kenya and Somalia, is experiencing its worst drought in more than 40 years. More than 18 million people face severe hunger in Ethiopia, Somalia, and Kenya. Around 7 million children are acutely malnourished, and 1.5 million people have been displaced. A combination of several factors such as COVID-19, climate change, and armed conflicts is pushing up international food and fuel prices. The region has experienced lower-than-average rainfall for four consecutive years. Ukraine Crisis has impacted wheat and fertilizer supplies to the Horn of Africa. At the same time, the drought has devastated farming, with millions of livestock deaths and significant drops in food production because of failed harvests. The UN estimated that the cost of an average food basket has risen by 66% in Ethiopia and 36% in Somalia, leaving many people unable to afford even basic items. Millions of livestock animals have died due to the drought in Ethiopia (1 million), Kenya (1.5 million), and Somalia.

In China, a nationwide drought alert was issued on 19 August 2022 as a long-running severe heatwave occurred in China's heavily populated southwest. The abnormal atmospheric circulation is the main reason for the drought in the middle and lower reaches of Yangtze River and Sichuan and Chongqing areas. This year, the weak intensity of plum rains, coupled with the few typhoons deep inland in July and August, the subtropical high-pressure anomaly, resulting in persistent low precipitation, high temperature, long lasting high temperature weather and strong extremes, and rapid development of meteorological drought. The record-breaking drought has caused some rivers in China, including parts of the Yangtze, to dry up. The Yangtze is the world's third largest river, providing drinking water to more than 400 million Chinese people, and is the most vital waterway to China's economy. The low water level in Yangtze River has affected hydropower, halted shipping. The situation was even graver in Sichuan province, which gets more than 80% of its energy from hydropower. The water flow to Sichuan's hydropower reservoirs dropped by half with the increase of electricity demand by 25% this summer. The reduction in hydropower has also reportedly affected downstream populations, including Chongqing city and Hubei province. Overall, the drought has affected at least 2.46 million people and 2.2m hectares of agricultural land in Sichuan, Hebei, Hunan, Jiangxi, Anhui, and Chongqing. But after that, in western part of China including south-central Shaanxi, the northern part of the Sichuan basin, the Han River, the western part of the Yellow River and the Huaihuai River, meteorological drought will begin to mitigate this situation due to the high precipitation process.

Figure 5.6 The Jialing River bed at the confluence with the Yangtze River is exposed due to drought on 18 August, 2022 in Chongqing, China.

(Source: https://www.cnbc.com/2022/08/19/china-issues-first-national-drought-emergency-scorching-temperatures-.html)

CropWatch carried out meteorological drought and agricultural drought monitoring in 6 provinces and cities in the Yangtze River Basin of China (including Anhui, Jiangxi, Hubei, Hunan, Chongqing, and Sichuan), and assessed the mitigation effect of meteorological drought. In general, a severe meteorological drought occurred in the Yangtze River Basin from July to August, but the agricultural drought was not serious, and the mitigation effect of farmland infrastructure was good.

Since July 2022, serious meteorological drought has occurred in 6 provinces and cities in the Yangtze River Basin (Fig. 1). In mid July, the rainfall deficit mainly occurred in most of Jiangxi and Western Sichuan, and in the middle of Jiangxi, Western Hubei, southwestern Hunan, Chongqing, and Western Sichuan in late July; In August, the meteorological drought intensified, mainly in Jiangxi, Hunan, Hubei, and the central part of Sichuan. In addition to the continuous high temperature weather, the drought affected area in the middle of the month further increased, and the meteorological drought was further aggravated.

Meteorological drought causes soil water deficit, causes agricultural drought (Fig. 2), and affects crop growth. As of the middle of August, the drought affected area of arable land reached 51.94 million mu (Table 1), accounting for 13.7% of the total area of arable land in the region. Among them, Sichuan Province in the upper reaches of the basin suffered the most drought, reaching 19.16 million mu, accounting for 21.5% of the total cultivated land area of the province, mainly distributed in the central and eastern regions. The proportion of cultivated land affected by drought in Chongqing is 18.6%, of which the proportion of moderate drought and above is more than 60%, which is distributed in the West and North. The drought affected areas of Anhui, Jiangxi, Hubei, and Hunan provinces account for 9-12% of the total cultivated land area, and the drought affected area is between 4-10 million mu. The proportion of moderate drought and above is more than 5%, mainly distributed in the northwest of Anhui Province, the north central of Jiangxi Province, the north and south of Hubei, and the East and north of Hunan.

There are obvious differences in the scope and intensity of meteorological drought and agricultural drought, which reflect the mitigation effect of drought relief measures. Drought mitigation measures such as irrigation and terracing have alleviated the impact of meteorological drought on crop growth (Fig. 3), so that the crop growth of most cultivated land affected by meteorological drought has not been greatly affected, and the cultivated land with agricultural drought is mainly light and medium drought (Fig. 2). Compared with the area affected by meteorological drought, the agricultural drought area in Jiangxi Province has decreased by 70%, Hubei and Hunan provinces by 60-70%, Anhui Province by 50%, Chongqing by about 50%, and Sichuan Province by about 40%. The reason for the low mitigation effect in Chongqing and Sichuan is that the agricultural drought in sloping farmland accounts for a large proportion.

Table 5. 2 Drought affected area and proportion of cultivated land in 6 provinces (municipalities directly under the central government) in the Yangtze River Basin of China

Province/municipality	Affected area by at least slight drought (thousand mu)	Proportion of drought affected area to total cultivated land（%）	
		slight drought or above	moderate drought or above
Anhui	9330	10.9	5.7
Jiangxi	4100	9.7	5.4
Hubei	7830	11.2	5.8
Hunan	5260	9.3	4.8
Chongqing	6250	18.6	11.2
Sichuan	19160	21.5	9.8
Total	**51940**	**13.7**	**7.2**

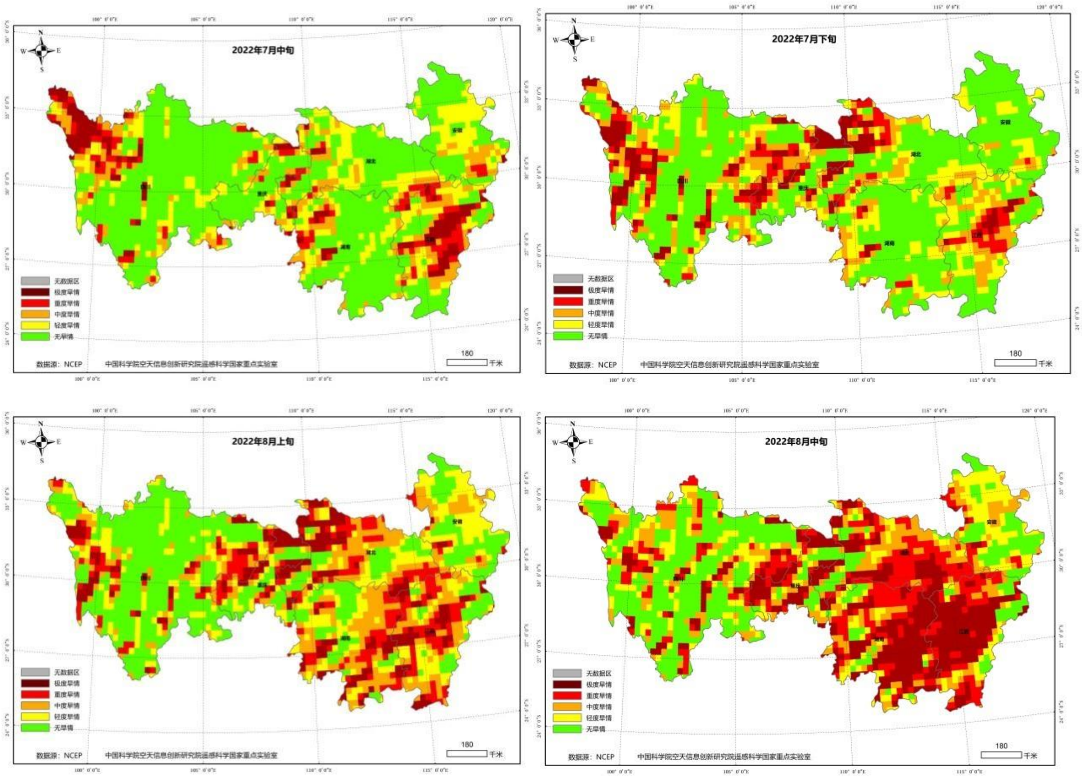


Figure 5.7 Distribution map of meteorological drought time in 6 provinces (municipalities directly under the central government) in the Yangtze River Basin from mid July to mid August 2022.

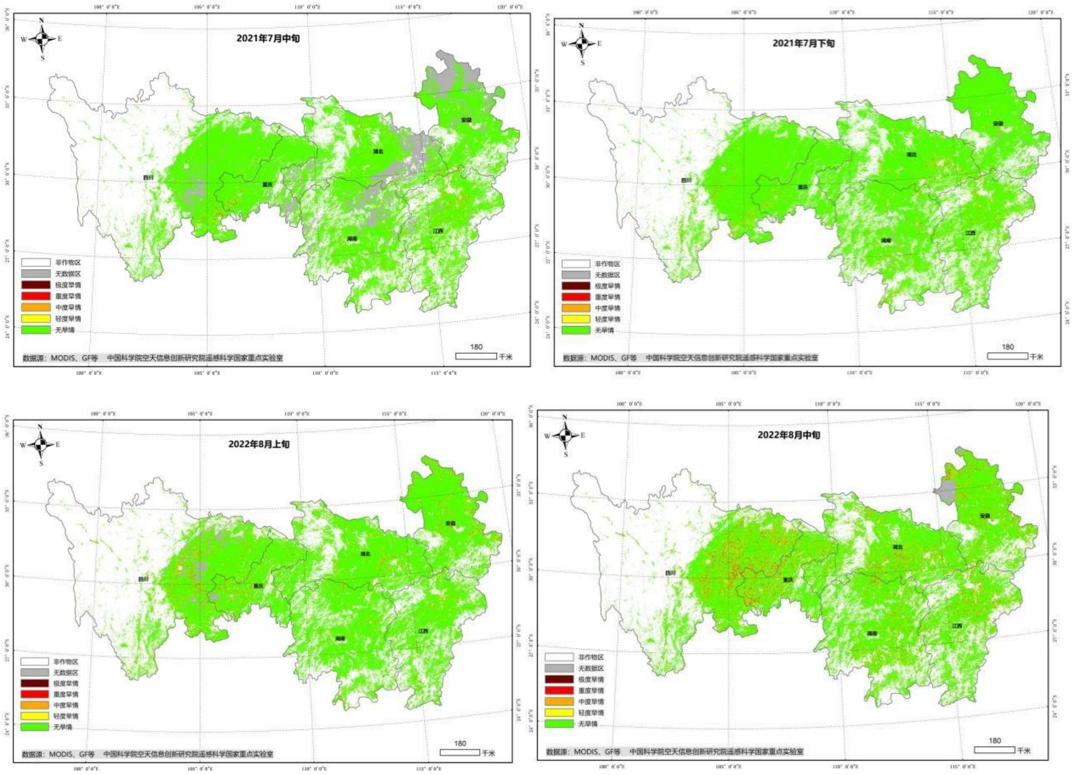


Figure 5.8 Spatial distribution map of cultivated land drought in 6 provinces (municipalities directly under the central government) in the Yangtze River Basin from mid July to mid August 2022.

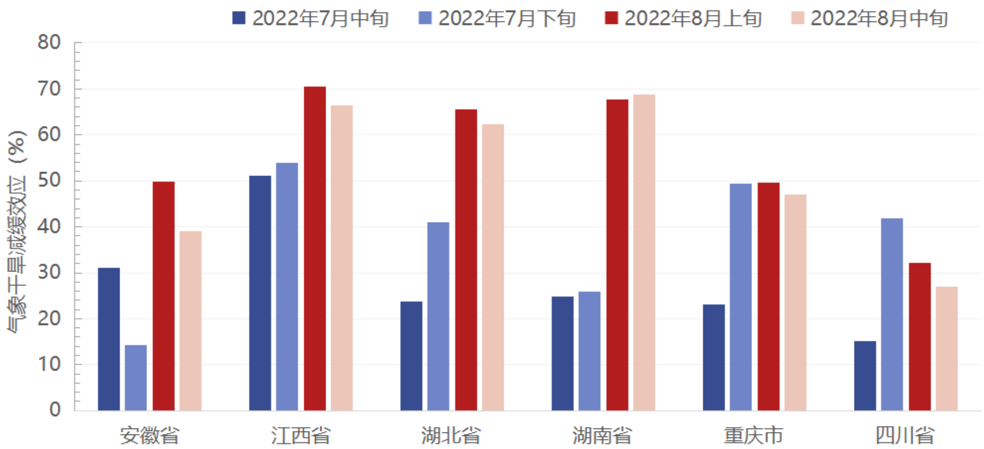


Figure 5.9 Mitigation effect of meteorological drought in 6 provinces (municipalities directly under the central government) in the Yangtze River Basin from mid July to mid August 2022.

Covid-19

The COVID-19 pandemic remains a real threat to lives and food chains in 2022. The pandemic fully exposed the vulnerability of the global agri-food system to shocks and stresses, highlighting the need for transformation and action to make it more resilient and inclusive. The spread of COVID-19 led to significant global disruptions to household livelihoods and food security. Income losses due to the COVID-19 restrictive measures had pushed households into more severe food insecurity and less diverse nutritional outcomes. In 2022, the World Bank's support to developing countries in the Middle East and North Africa exceeded US$5 Billion to mitigate the impacts of COVID-19 and the crisis in Ukraine on the economy and food security.

Desert Locust

Desert Locust is the most destructive migratory pest in the world. They are ravenous eaters who consume their own weight per day, targeting food crops and forage. Starting in early 2020, a massive desert locust upsurge broke out across greater Eastern Africa, Southwest Asia, and the area around the Red Sea, as favorable climatic conditions allowed widespread pest breeding. According to the FAO's latest updates, the current situation was calm in all regions during June and July 2022. Only low numbers of solitarious adults and hoper groups were reported in July 2022 from different sites in the summer breeding areas in the interior of Sudan, and few isolated immature solitarious adults were reported in the summer breeding areas of Marib Governorate in Yemen. As the predictable weather models indicated, above-normal rains are likely in summer breeding areas during August and September, small-scale breeding will occur in the northern Sahel from Mauritania to western Eritrea, and in breeding areas with sufficient rainfall, particularly in Sudan and Yemen, and along both sides of the Indo-Pakistan border. Limited breeding may also occur in northeast Ethiopia and Somalia if good rains fall during the forecast period. These breeding activities will cause locust numbers to increase slightly by the end of the forecast period, which requires vigilance and regular surveys to be maintained in the summer breeding areas.

5.3 Update on El Niño

According to the Australian Government Bureau of Meteorology, the El Niño-Southern Oscillation (ENSO) outlook remains at La Niña WATCH, meaning there is around a 50% chance (double of the normal likelihood) of La Niña forming later in 2022. The current situation is as follows: ENSO indicators are currently at neutral levels. However, some atmospheric indicators, such as the Southern Oscillation Index, continue to show a residual La Niña-like signal. Trade winds have also recently re-strengthened in the western Pacific (more La Niña-like).

Figure 5.10 illustrates the behavior of the standard Southern Oscillation Index (SOI) for the period from July 2021 to July 2022. The SOI has remained positive and high (greater than +7) for the past four months while trending downward in July. Much of the persistent positive SOI signal is due to high pressure systems over Tahiti. While the SOI is an important index that tracks changes in tropical air pressure, a much wider range of atmospheric and oceanic conditions is considered when assessing the status of ENSO. This includes winds, clouds, ocean currents, and both surface and sub-surface ocean temperatures, as well as outlooks for the months ahead.

Another commonly used measure of El Niño is known as the Oceanic Niño Index (ONI). Figure 5.11 shows several ONIs and their locations. Values of the three key NINO indices for June 2022 were: NINO3 −0.3°C, NINO3.4 −0.4°C, and NINO4 −0.3°C (Data for the full month of July is not yet available). It implies that the average sea surface temperature in all three regions is lower than the historical average. Moreover, cool anomalies have weakened, while warm anomalies around northern Australia and to Australia's northeast have strengthened as compared to May. This indicates that La Niña weakened slightly in intensity in June.

Sea surface temperature (SSTs) for June 2022 (Figure 5.12) were generally close to average close to the equator across the Pacific, but SSTs were slightly cooler than average over much of the tropical central and eastern Pacific south of the equator and in some scattered areas north of the equator. Cool anomalies were strongest close to South America. Warm SST anomalies were present over much of the Maritime Continent.

In summary, La Niña continues to be active in the tropical Pacific from April to July but is becoming weaker. La Niña's impact during the Northern Hemisphere summer is generally neutral. It mainly affects winter and spring. In some regions, however, this convention is broken. For example, La Niña was a factor in the hot weather in June in Henan and Hebei, China, and even more so in late July and early August, causing many cities to break historical temperature records. In addition, it caused above-average rainfall over much of northern and eastern Australia during the monitoring period. La Niña events also increased the chances of flooding in Southeast Asia. They also increased the risk of drought and mountain fires in the southwestern United States, and created multiple hurricane, cyclone and monsoon patterns in the Pacific and Atlantic Oceans, as well as triggering weather anomalies in other regions.

During the next monitoring period, La Niña is likely to continue and may bring more flooding to the southern part of China. Brazil is prone to experience droughts during La Niña events. Attention should also be paid to La Niña in the fall and winter (northern hemisphere), which tends to bring cold winters. There is about a 50% chance that La Niña will continue later in 2022, yet the form of La Niña's impact varies by country and region.

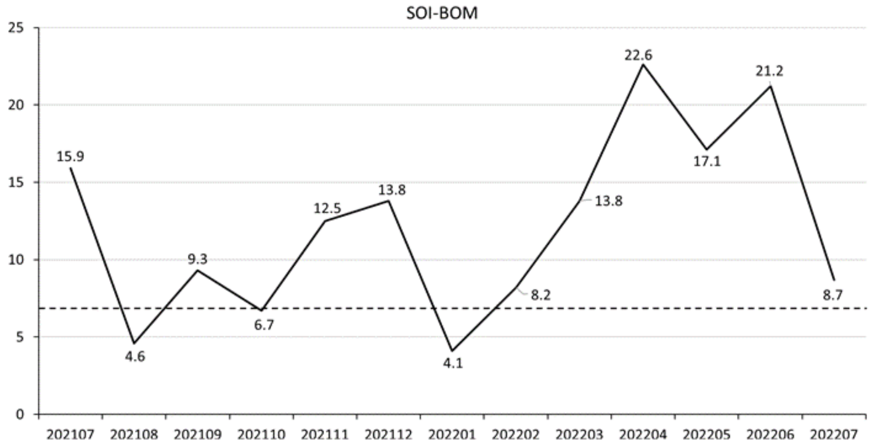


Figure 5.10 Monthly SOI-BOM time series from July 2021 to July 2022

(Source: http://www.bom.gov.au/climate/enso/soi/)

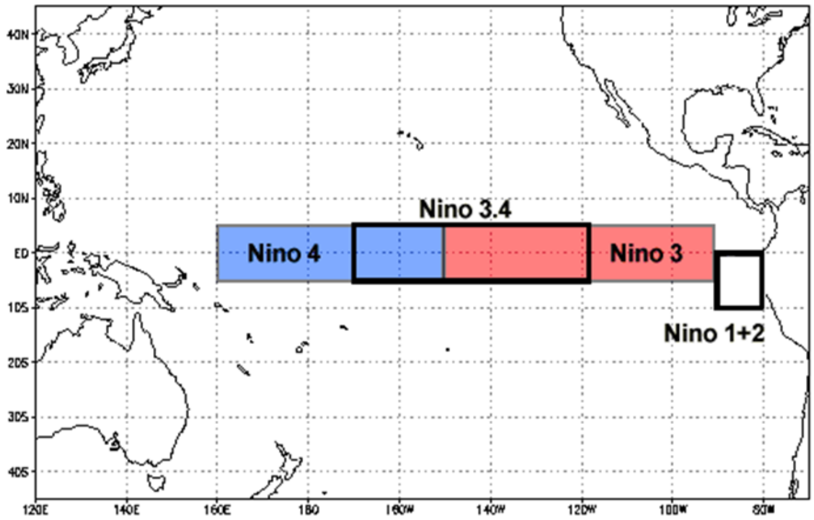


Figure 5.11 Map of NINO Region

(Source: https://www.ncdc.noaa.gov/teleconnections/enso/sst)

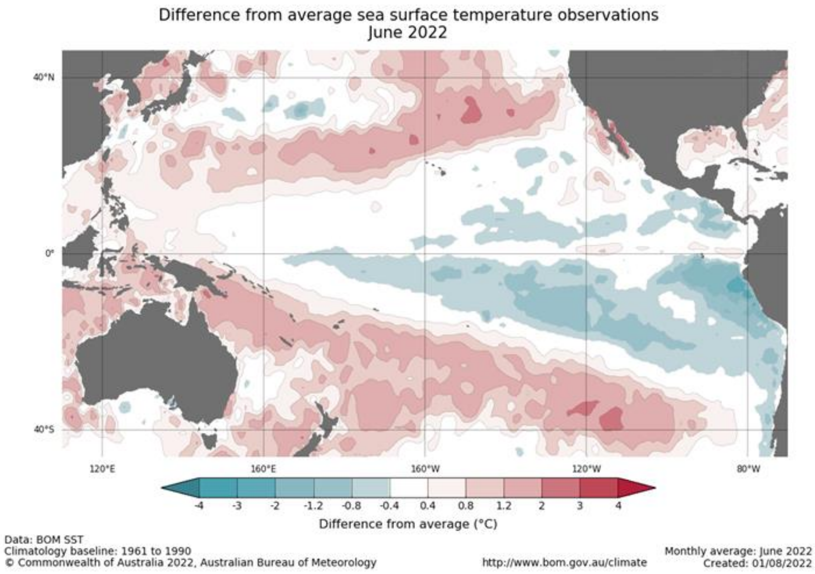


Figure 5.12 Monthly temperature anomalies in the tropical Pacific for June 2022

(Source: http://www.bom.gov.au/climate/enso/wrap-up/#tabs=Sea-surface)

Source

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Plunging global food and fuel costs offer poor countries little relief - The Washington Post

http://www.bom.gov.au/climate/enso/wrap-up/#tabs=Overview

Annex A. Agroclimatic indicators

Table A.1 April 2022 – July 2022 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	524	-14	22.3	0.0	1173	2	951	-5
C02	East African highlands	455	-41	19.2	0.4	1235	4	771	-19
C03	Gulf of Guinea	538	-11	27.2	0.1	1181	-1	1061	-5
C04	Horn of Africa	137	-57	21.0	0.5	1213	4	581	-21
C05	Madagascar (main)	294	18	19.4	-0.1	891	-5	716	5
C06	Southwest Madagascar	82	21	21.1	-0.1	960	-2	415	-3
C07	North Africa-Mediterranean	71	-29	21.9	1.2	1551	-1	594	-3
C08	Sahel	346	13	30.0	0.0	1292	-1	848	7
C09	Southern Africa	128	14	17.4	0.0	985	-3	444	6
C10	Western Cape (South Africa)	165	-27	12.1	-1.1	698	2	439	-18
C11	British Columbia to Colorado	343	5	9.3	-0.7	1363	-2	669	-4
C12	Northern Great Plains	364	-3	16.5	-0.1	1321	-2	885	-3
C13	Corn Belt	434	-2	15.9	0.1	1240	0	980	0
C14	Cotton Belt to Mexican Nordeste	385	-15	24.3	1.2	1427	2	1018	-6
C15	Sub-boreal America	429	19	9.2	-1.1	1087	-7	789	0
C16	West Coast (North America)	264	46	14.7	-0.6	1434	-4	632	3
C17	Sierra Madre	530	-29	21.2	0.5	1499	2	884	-11
C18	SW U.S. and N. Mexican highlands	162	-14	20.4	0.4	1584	0	659	-7
C19	Northern South and Central America	1111	2	24.2	-0.1	1247	1	1271	0
C20	Caribbean	607	5	25.7	-0.1	1445	2	1294	5
C21	Central-northern Andes	406	-30	14.0	0.2	1082	3	510	-15
C22	Nordeste (Brazil)	195	-13	24.4	0.6	1085	3	686	-4
C23	Central eastern Brazil	107	-63	22.4	1.3	1054	9	478	-34
C24	Amazon	489	-24	24.3	0.4	1106	4	943	-12
C25	Central-north Argentina	121	-34	15.0	-0.5	732	1	404	-15
C26	Pampas	354	-12	14.3	-0.2	648	1	620	-9

C27	Western Patagonia	821	10	6.5	-0.8	470	0	540	-5
C28	Semi-arid Southern Cone	94	-17	9.3	-0.8	719	1	292	-6
C29	Caucasus	217	-30	16.3	0.0	1485	1	649	-13
C30	Pamir area	250	-30	18.5	1.4	1586	2	669	-9
C31	Western Asia	134	26	23.2	0.5	1547	0	654	2
C32	Gansu-Xinjiang (China)	271	5	16.6	0.4	1424	-1	649	-4
C33	Hainan (China)	988	9	25.6	-1.0	1341	1	1482	7
C34	Huanghuaihai (China)	344	1	22.9	0.9	1361	3	873	-3
C35	Inner Mongolia (China)	230	4	16.5	0.3	1382	0	715	0
C36	Loess region (China)	261	-8	17.9	0.8	1443	6	766	-3
C37	Lower Yangtze (China)	1059	-6	22.1	0.2	1135	5	1300	-3
C38	Northeast China	447	35	15.2	-0.3	1252	-1	923	10
C39	Qinghai-Tibet (China)	974	-14	11.5	1.2	1211	3	717	-2
C40	Southern China	1322	0	22.5	-0.1	1158	3	1393	-2
C41	Southwest China	817	-9	18.6	0.2	1106	4	1153	-1
C42	Taiwan (China)	1116	23	24.3	-1.2	1197	-6	1244	3
C43	East Asia	577	9	14.9	0.5	1212	1	971	4
C44	Southern Himalayas	884	-16	27.2	0.8	1302	5	1072	-3
C45	Southern Asia	681	-15	29.8	0.3	1279	4	1006	-3
C46	Southern Japan and the southern fringe of the Korea peninsula	871	3	19.0	1.2	1210	2	1217	3
C47	Southern Mongolia	152	-24	7.9	-0.1	1488	0	534	-5
C48	Punjab to Gujarat	569	46	32.5	0.2	1434	0	947	17
C49	Maritime Southeast Asia	1206	-2	24.6	0.2	1156	4	1439	3
C50	Mainland Southeast Asia	1112	-4	26.4	-0.3	1269	5	1454	3
C51	Eastern Siberia	353	10	10.0	0.0	1125	-1	783	5
C52	Eastern Central Asia	298	9	11.1	0.3	1309	1	746	6
C53	Northern Australia	504	34	24.0	0.5	1078	1	924	12
C54	Queensland to Victoria	277	39	12.6	0.0	592	-8	575	16
C55	Nullarbor to Darling	244	4	13.8	-0.3	596	-5	585	6
C56	New Zealand	444	21	9.4	0.5	440	0	676	7
C57	Boreal Eurasia	334	-1	9.7	-0.1	1088	1	709	-1
C58	Ukraine to Ural mountains	320	4	13.2	-0.9	1134	-2	821	1
C59	Mediterranean Europe and Turkey	130	-40	18.0	0.9	1510	3	619	-13
C60	W. Europe (non Mediterranean)	246	-32	15.2	0.8	1276	4	717	-15

C61	Boreal America	317	-9	6.5	0.3	1043	4	601	-1
C62	Ural to Altai mountains	387	37	13.7	0.3	1212	0	842	15
C63	Australian desert	134	-7	14.9	-0.4	668	-2	451	-3
C64	Sahara to Afghan deserts	46	42	28.4	0.5	1618	-1	576	-2
C65	Sub-arctic America	131	4	-3.4	0.3	1196	-2	278	3

Table A.2 April 2022 – July 2022 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/m^2)	RADPAR 15YA Departure (%)	BIOMSS Current (gDM/m^2)	BIOMSS 15YA Departure (%)
ARG	Argentina	240	-8	12.8	-0.5	632	0	460	-10
AUS	Australia	276	39	13.7	0.0	631	-7	582	15
BGD	Bangladesh	1297	-17	28.9	0.2	1316	5	1449	-1
BRA	Brazil	244	-39	22.6	0.9	1048	6	641	-22
KHM	Cambodia	1161	9	26.3	-0.6	1244	6	1601	5
CAN	Canada	422	9	9.9	-0.7	1141	-3	771	1
CHN	China	797	-4	19.6	0.2	1207	3	1000	-1
EGY	Egypt	2	-75	24.2	0.6	1585	-1	374	-21
ETH	Ethiopia	521	-34	19.9	0.4	1275	4	824	-16
FRA	France	249	-37	16.3	1.8	1372	10	753	-14
DEU	Germany	253	-28	14.3	0.5	1243	4	716	-14
IND	India	702	-14	30.1	0.5	1315	4	985	1
IDN	Indonesia	1146	-2	24.5	0.2	1125	4	1399	4
IRN	Iran	70	-27	21.9	0.5	1644	1	579	-6
KAZ	Kazakhstan	333	38	15.7	0.3	1306	-1	794	14
MEX	Mexico	513	-18	23.9	0.5	1503	2	904	-8
MMR	Myanmar	1079	-22	25.7	0.5	1211	3	1267	-6
NGA	Nigeria	509	-14	27.9	0.2	1207	0	978	-5
PAK	Pakistan	314	18	27.1	1.5	1553	0	792	11
PHL	Philippines	1601	18	25.7	-0.2	1297	0	1560	5
POL	Poland	246	-26	14.2	-0.3	1179	2	733	-14
ROU	Romania	175	-52	16.8	0.6	1361	3	668	-24
RUS	Russia	353	14	12.8	-0.5	1152	-2	835	7
SYR	Syria	10	-86	24.9	1.0	1650	2	559	-13
ZAF	South Africa	117	36	12.3	-0.3	859	-3	380	12
THA	Thailand	1079	14	26.2	-0.5	1255	5	1490	7
TUR	Turkey	151	-36	16.4	0.1	1518	2	618	-14
GBR	United Kingdom	279	-27	12.1	0.8	994	1	695	-12
UKR	Ukraine	200	-35	15.5	-0.6	1238	0	673	-19
USA	United States	366	-7	19.1	0.5	1370	0	878	-3
UZB	Uzbekistan	135	-3	23.2	0.8	1559	0	667	-2
VNM	Vietnam	1128	0	24.5	-0.4	1263	5	1472	3
AFG	Afghanistan	88	-52	20.7	1.3	1642	2	585	-8
AGO	Angola	171	-10	19.4	-0.3	1207	0	501	-4
BLR	Belarus	338	6	13.2	-1.0	1104	-1	833	-1
HUN	Hungary	116	-55	18.3	0.9	1361	3	592	-27
ITA	Italy	300	-21	18.5	1.6	1450	3	784	-4
KEN	Kenya	272	-57	20.0	0.6	1156	3	710	-22
LKA	Sri_Lanka	1072	15	26.6	-0.2	1244	-3	1244	4
MAR	Morocco	74	-22	21.0	0.9	1557	-2	586	-1
MNG	Mongolia	257	-5	10.7	0.2	1394	2	684	0
MOZ	Mozambique	173	32	19.9	-0.1	933	-4	583	11

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 (%)
ZMB	Zambia	87	24	18.1	0.0	1128	-1	395	3
KGZ	Kyrgyzstan	564	14	10.6	-0.3	1495	2	709	3

*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 Oct- Jan.*

Table A.3 Argentina, April 2022 – July 2022 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	138	-36	11.0	-0.5	604	5	371	-24
Chaco	441	41	15.6	-0.9	562	-10	748	12
Cordoba	60	-50	12.6	-0.3	716	5	269	-24
Corrientes	640	37	14.9	-0.7	543	-10	923	14
Entre Rios	322	-5	13.0	-0.8	604	1	587	-7
La Pampa	83	-38	11.0	-0.5	640	7	297	-18
Misiones	542	-11	16.3	-0.1	669	1	927	-1
Santiago Del Estero	140	-19	14.6	-0.9	664	-3	422	-8
San Luis	44	-49	11.0	-0.5	731	5	223	-24
Salta	145	-28	13.7	-0.2	783	-2	452	-10
Santa Fe	211	-15	13.8	-0.8	607	-3	480	-12
Tucuman	93	-21	11.9	-0.3	824	-1	361	-6

Table A.4 Australia, April 2022 – July 2022 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	272	52	12.0	0.0	613	-9	568	25
South Australia	179	-15	13.3	-0.3	537	-3	477	-11
Victoria	258	-3	10.8	0.0	453	-5	559	-1
W. Australia	226	4	15.0	-0.2	654	-4	579	6

Table A.5 Brazil, April 2022 – July 2022 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	312	-19	25.8	0.5	1147	-1	938	-4
Goias	1	-100	23.7	2.2	1171	9	230	-63
Mato Grosso Do Sul	49	-82	22.1	1.5	981	14	416	-41

	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 (%)
Mato Grosso	35	-85	24.4	1.0	1168	8	426	-40
Minas Gerais	36	-83	20.4	1.3	1052	13	356	-41
Parana	199	-61	17.4	0.9	830	11	586	-33
Rio Grande Do Sul	695	21	14.5	-0.3	604	-6	970	10
Santa Catarina	436	-26	14.5	0.2	701	2	809	-10
Sao Paulo	52	-83	20.2	1.6	955	13	370	-48

Table A.6 Canada, April 2022 – July 2022 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	367	6	9.8	-1.0	1215	-4	781	0
Manitoba	586	59	10.4	-1.6	1083	-10	884	5
Saskatchewan	370	11	10.7	-1.3	1177	-5	819	2

Table A.7 India, April 2022 – July 2022 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	370	-24	30.9	0.3	1237	2	851	-7
Assam	2160	-12	24.7	-0.1	1076	1	1474	-2
Bihar	453	-46	32.8	1.2	1409	7	966	-10
Chhattisgarh	508	-26	30.7	0.4	1294	5	915	-7
Daman and Diu	996	-6	29.4	0.1	1452	1	1080	-2
Delhi	363	33	33.9	0.6	1478	2	967	16
Gujarat	628	-5	30.9	-0.2	1403	1	980	4
Goa	1471	-30	27.0	0.4	1260	2	1268	2
Himachal Pradesh	231	-62	23.5	2.5	1515	4	671	-23
Haryana	359	46	34.0	0.9	1485	3	914	15
Jharkhand	435	-37	31.3	0.8	1340	6	939	-7
Kerala	1320	-20	25.2	-0.3	1233	4	1392	-5
Karnataka	570	-18	27.2	0.3	1176	4	940	-2
Meghalaya	2249	6	24.3	-0.5	1082	-2	1459	-2
Maharashtra	790	-3	29.9	0.4	1275	2	1007	2
Manipur	1455	-19	22.2	0.2	1156	4	1411	0
Madhya Pradesh	663	5	31.7	0.4	1367	6	1024	10
Mizoram	1514	-6	24.0	-0.4	1243	2	1521	1
Nagaland	2113	4	20.4	-1.2	990	-9	1370	-1
Orissa	576	-22	30.3	0.4	1296	6	972	-8
Puducherry	633	-41	29.5	-0.2	1325	3	1059	-6
Punjab	378	27	34.0	1.5	1495	3	857	2
Rajasthan	681	111	32.9	-0.2	1406	1	990	31
Sikkim	646	-1	21.3	4.1	1435	7	896	8

	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 (%)
Tamil Nadu	282	-41	29.1	0.7	1223	1	808	-15
Tripura	1633	-6	27.2	-0.2	1248	2	1622	2
Uttarakhand	103	-82	26.6	3.3	1566	10	632	-25
Uttar Pradesh	378	-29	33.9	1.1	1437	5	907	-1
West Bengal	855	-26	30.7	0.7	1366	7	1174	-5

Table A.8 Kazakhstan, April 2022 – July 2022 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	262	27	15.5	0.7	1283	2	762	12
Karagandinskaya	190	-1	15.6	1.3	1383	3	690	4
Kustanayskaya	316	46	14.8	-0.3	1177	-6	830	19
Pavlodarskaya	308	43	15.8	0.8	1297	3	831	19
Severo kazachstanskaya	321	27	14.4	0.7	1170	0	802	10
Vostochno kazachstanskaya	374	31	14.5	0.8	1426	3	836	14
Zapadno kazachstanskaya	259	36	16.9	-1.1	1229	-8	806	14

Table A.9 Russia, April 2022 – July 2022 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.	429	35	11.8	-1.0	1060	-9	893	10
Chelyabinskaya Oblast	376	36	12.3	-0.7	1083	-7	863	14
Gorodovikovsk	174	-40	18.4	-0.2	1283	-4	689	-22
Krasnodarskiy Kray	305	-17	14.4	-0.2	1267	1	799	-6
Kurganskaya Oblast	399	54	12.8	-0.2	1078	-4	889	22
Kirovskaya Oblast	410	31	10.8	-1.0	962	-8	867	11
Kurskaya Oblast	342	16	13.7	-1.0	1149	-3	888	8
Lipetskaya Oblast	341	19	13.6	-1.1	1155	-2	899	12
Mordoviya Rep.	353	13	12.4	-1.3	1052	-8	874	6
Novosibirskaya Oblast	351	22	13.1	0.6	1142	3	839	10
Nizhegorodskaya O.	360	19	11.9	-1.3	1021	-8	883	10
Orenburgskaya Oblast	352	41	14.1	-1.0	1166	-8	884	19
Omskaya Oblast	412	48	13.4	0.8	1081	-1	879	17

	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 (%)
Permskaya Oblast	385	19	10.9	-0.7	948	-9	856	8
Penzenskaya Oblast	359	19	13.0	-1.1	1130	-3	901	11
Rostovskaya Oblast	177	-36	17.6	-0.2	1300	-1	691	-18
Ryazanskaya Oblast	367	20	12.9	-1.3	1087	-5	911	11
Stavropolskiy Kray	300	-30	17.0	-0.5	1294	-3	801	-17
Sverdlovskaya Oblast	351	16	11.5	-0.3	1012	-5	844	11
Samarskaya Oblast	453	55	13.5	-1.2	1124	-7	987	22
Saratovskaya Oblast	337	30	14.8	-1.0	1220	-3	893	15
Tambovskaya Oblast	333	16	13.7	-1.1	1185	-1	883	10
Tyumenskaya Oblast	371	37	12.5	0.3	1032	-3	870	19
Tatarstan Rep.	468	53	12.0	-1.2	1030	-9	927	15
Ulyanovskaya Oblast	418	38	12.9	-1.1	1074	-8	929	14
Udmurtiya Rep.	407	35	11.2	-1.0	961	-10	877	12
Volgogradskaya O.	189	-19	16.6	-0.6	1275	-2	694	-8
Voronezhskaya Oblast	279	-4	14.8	-0.8	1247	1	823	0

Table A.10 United States, April 2022 – July 2022 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	452	-1	23.5	1.1	1377	0	1038	-7
California	97	1	17.3	0.0	1610	-1	542	-3
Idaho	276	15	10.9	-1.2	1419	-4	653	-3
Indiana	455	-3	18.6	0.2	1290	-2	1117	2
Illinois	482	2	18.9	0.0	1270	-4	1134	3
Iowa	441	1	17.3	-0.2	1254	-3	1042	1
Kansas	327	-9	22.2	1.0	1396	-1	918	-7
Michigan	367	-7	14.0	0.2	1215	-2	909	-2
Minnesota	414	1	14.0	-0.6	1184	-4	937	0
Missouri	459	7	20.7	0.4	1329	-2	1089	2
Montana	294	-12	11.4	-1.1	1368	-1	753	-7
Nebraska	243	-32	19.4	1.1	1420	2	830	-13
North Dakota	412	13	13.3	-1.2	1258	-2	919	4
Ohio	406	-5	17.8	0.3	1275	-1	1051	0
Oklahoma	391	2	24.6	1.6	1398	-1	982	-3
Oregon	352	55	11.7	-1.2	1309	-6	717	13
South Dakota	287	-22	16.7	0.2	1375	2	835	-11
Texas	220	-38	27.0	2.1	1466	2	831	-14
Washington	422	68	11.6	-1.6	1234	-8	766	17
Wisconsin	398	-6	14.4	-0.1	1199	-3	950	-1

Table A.11 China, April 2022 – July 2022 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	636	-18	22.9	0.9	1261	9	1145	-4
Chongqing	718	-19	20.4	0.4	1148	9	1220	-2
Fujian	1287	-2	21.5	0.1	1079	2	1317	-6
Gansu	328	-8	14.4	0.5	1378	5	774	-1
Guangdong	1635	6	24.1	-0.1	1158	2	1471	-4
Guangxi	1435	2	22.8	-0.3	1122	4	1446	-2
Guizhou	838	-23	18.7	-0.2	1002	5	1212	-5
Hebei	233	-4	19.8	0.4	1399	1	777	0
Heilongjiang	351	10	14.8	-0.3	1260	1	891	7
Henan	352	-11	23.3	1.1	1363	7	907	-6
Hubei	652	-19	21.5	0.7	1243	10	1195	-3
Hunan	1126	-2	21.6	0.1	1080	3	1370	0
Jiangsu	469	-27	23.1	1.4	1303	9	1040	-7
Jiangxi	1203	-8	22.0	-0.2	1061	0	1380	-4
Jilin	535	50	15.5	-0.3	1261	-2	981	11
Liaoning	554	66	16.9	-0.3	1238	-5	961	12
Inner Mongolia	243	9	15.8	0.2	1357	0	723	2
Ningxia	142	-19	17.3	0.5	1500	6	631	-6
Shaanxi	427	-6	18.7	0.8	1391	9	887	1
Shandong	400	23	22.4	0.7	1351	1	861	-5
Shanxi	203	-16	18.2	0.8	1448	5	712	-5
Sichuan	895	5	17.5	0.4	1131	1	1085	1
Yunnan	953	-4	17.9	-0.2	1073	0	1171	0
Zhejiang	849	-22	21.1	0.3	1131	7	1289	-3

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**.**

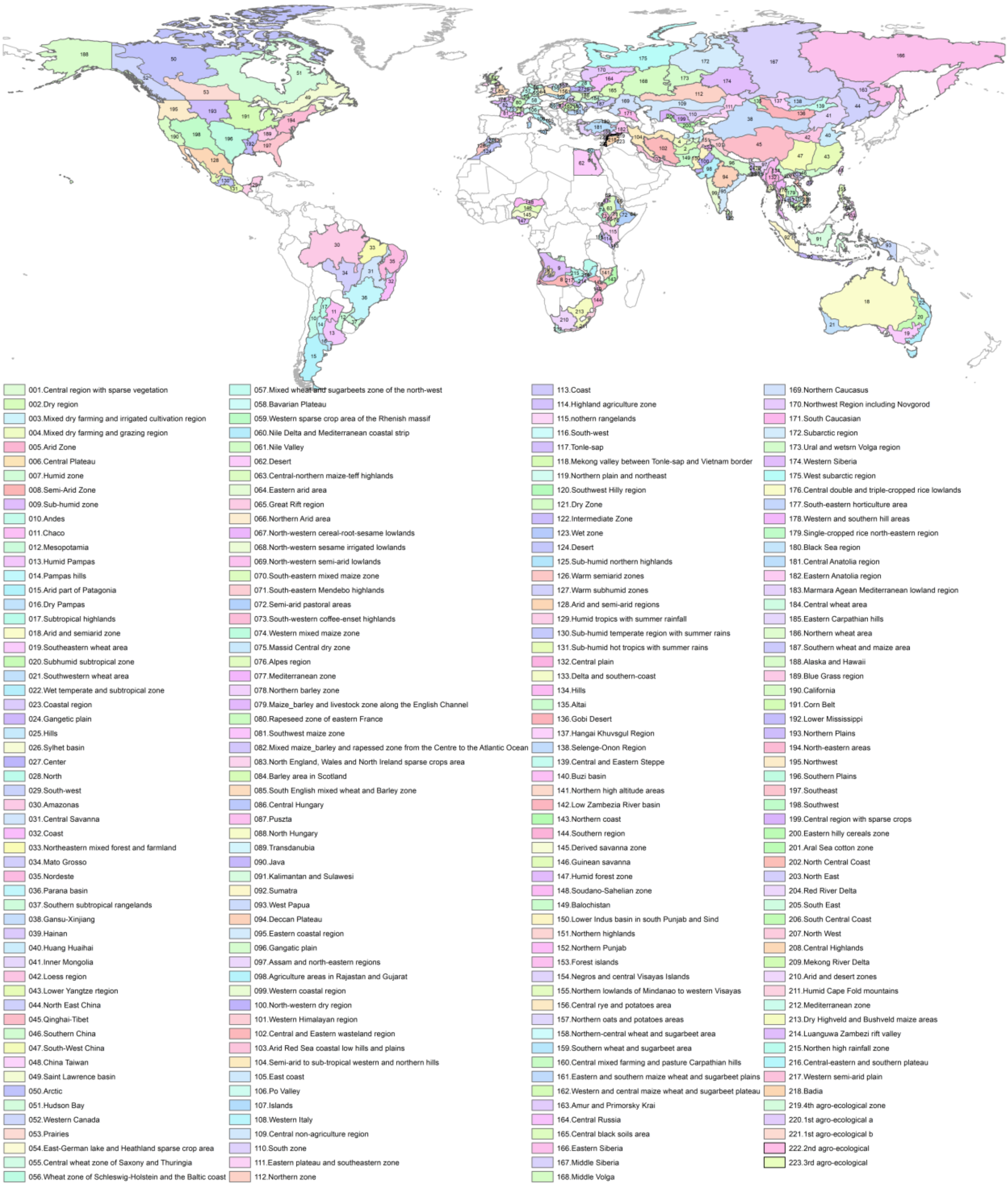
Agroecological zones for 43 key countries

Overview

223 agroecological zones for the 44 key countries across the globe

Description

43 key agricultural countries are divided into 223 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 selected 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 sunshine (RADPAR) 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 15 years (2005-2020), with departures expressed in percentage.
CALF			
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 (2015-2020), 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 (2015-2020), 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 (2005-2020), 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 and satellite	Liters/m^2, CWSU	The spatial average (for a CWSU) of rainfall accumulation over agricultural pixels, weighted by the production potential.	RAIN is shown as the percent departure of the RAIN value for the reporting period, compared to the recent fifteen-year average (2005-2020), per CWSU. For the MPZs, regular rainfall is shown as

INDICATOR			
			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 (2005-2020), 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 calculated based on time series NDVI during the monitoring period and the same period during the past five years. Peak NDVI during the monitoring period was compared with the maximum NDVI during the same period for the previous five years. VCIx is shown as pixel-based maps and as average value by CWSU.
VHI			
Vegetation health index			
Crop/ Satellite	Number, pixel to CWSU	The average of VCI and the temperature condition index (TCI), with TCI defined like VCI but for temperature. VHI is based on the assumption that "high temperature is bad" (due to moisture stress), but ignores the fact that low temperature may be equally "bad" (crops develop and grow slowly, or even suffer from frost).	Low VHI values indicate unusually poor crop condition, but high values, when due to low temperature, may be difficult to interpret. VHI is shown as typical time profiles over Major Production Zones (MPZ), where they occur, and the percentage of pixels concerned by each profile.
VHIn			
Minimum Vegetation health index			
Crop/ Satellite	Number, pixel to CWSU	VHIn is the lowest VHI value for every pixel over the reporting period. Values usually are [0, 100]. Normally, values lower than 35 indicate poor crop condition.	Low VHIn values indicate the occurrence of water stress in the monitoring period, often combined with lower than average rainfall. The spatial/time resolution of CropWatch VHIn is 16km/week for MPZs and 1km/dekad for China.
CPI			
Crop Production Index			
Crop/ Satellite	Number, pixel to CWSU	The average agricultural production situation for the same period in the past five years was used as a benchmark to make an overall estimate of the current season's agricultural production situation.	Based on VCIx, CALF, land productivity and crop cultivation area of irrigated and rainfed cropland of the spatial unit in the current monitoring period and the same period in the past 5 years, the index is calculated by a mathematical model proposed by CropWatch and expressed as a normalized value, the value of 1.0 represents the basic normal agricultural production situation in the current season, and the larger the value

INDICATOR			
			represents the better agricultural production situation of the spatial unit in the current monitoring period.

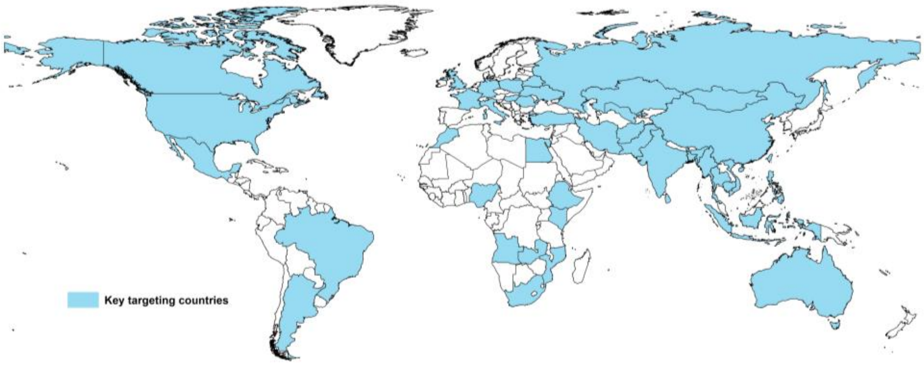
Note: Type is either "Weather" or "Crop"; source specifies if the indicator is obtained from ground data, satellite readings, or a combination; units: in the case of ratios, no unit is used; scale is either pixels or large scale CropWatch spatial units (CWSU). Many indicators are computed for pixels but represented in the CropWatch bulletin at the CWSU scale.

CropWatch spatial units (CWSU)

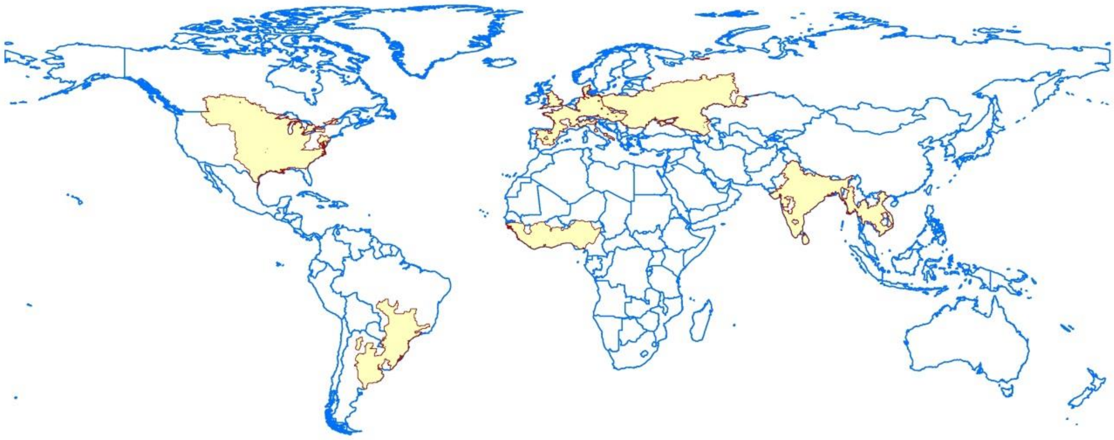
CropWatch analyses are applied to four kinds of CropWatch spatial units (CWSU): Countries, China, Major Production Zones (MPZ), and global crop Monitoring and Reporting Units (MRU). The tables below summarize the key aspects of each spatial unit and show their relation to each other. For more details about these spatial units and their boundaries, see the CropWatch bulletin online resources.

SPATIAL LUNITS	
CHINA	
Overview	*Description*
Seven monitoring regions	The seven regions in China are agro-economic/agro-ecological regions that together cover the bulk of national maize, rice, wheat, and soybean production. Provinces that are entirely or partially included in one of the monitoring regions are indicated in color on the map below.

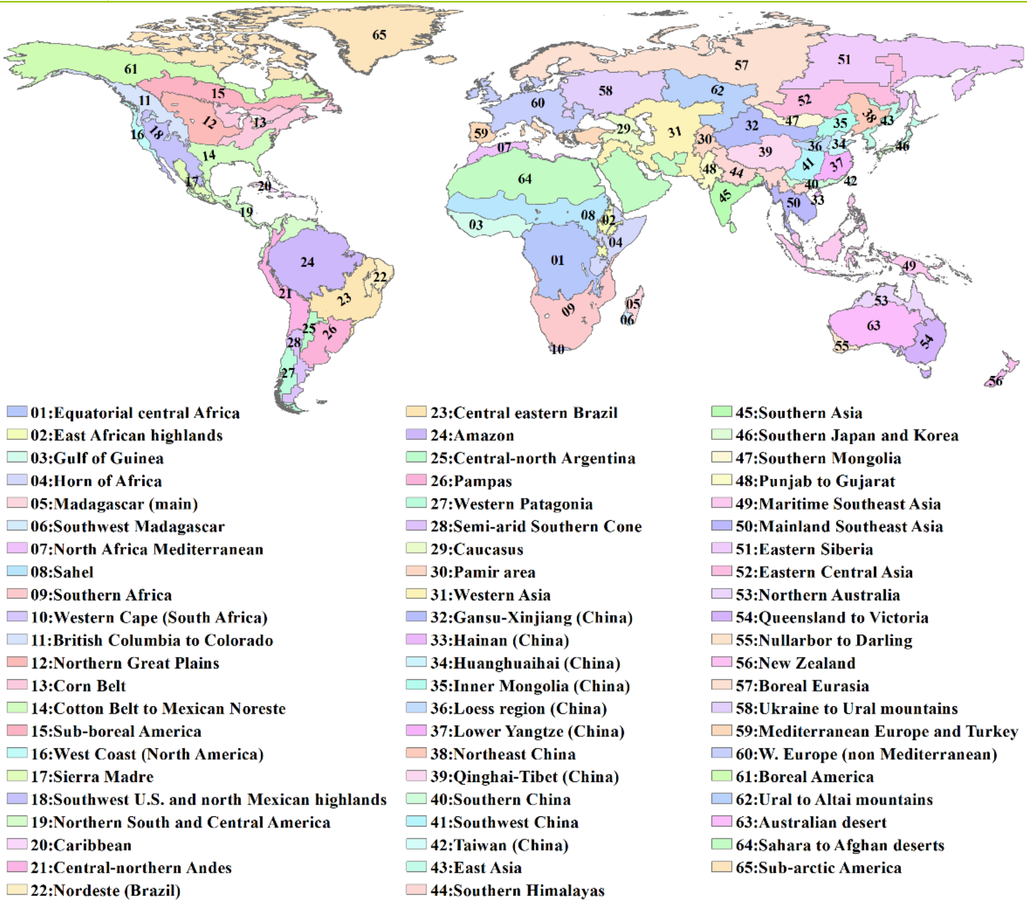
Countries (and first-level administrative districts, e.g., states and provinces)	
Overview	*Description*
"43+1" countries to represent main producers/exporters and other key countries.	CropWatch monitored countries together represent more than 80% of the production of maize, rice, wheat and soybean, 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 "43 + 1," referring to 43 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*
Six globally important areas of agricultural production	The six MPZs include West Africa, South America, North America, South and Southeast Asia, Western Europe and Central Europe to Western Russia. The MPZs are not necessarily the main production zones for the four crops (maize, rice, soybean, wheat) currently monitored by CropWatch, but they are globally or regionally important areas of agricultural production. The seven zones were identified based mainly on production statistics and distribution of the combined cultivation area of maize, rice, wheat and soybean.



Global Monitoring and Reporting Unit (MRU)	
Overview	*Description*
65 agro-ecological/agro-economic units across the world	MRUs are reasonably homogeneous agro-ecological/agro-economic units spanning the globe, selected to capture major variations in worldwide farming and crops patterns while at the same time providing a manageable (limited) number of spatial units to be used as the basis for the analysis of environmental factors affecting crops. Unit numbers and names are shown in the figure below. A limited number of units (e.g., MRU-63 to 65) are not relevant for the crops currently monitored by CropWatch but are included to allow for more complete coverage of global production. Additional information about the MRUs is provided online under **www.cropwatch.com.cn** .



Production estimation methodology

The main concept of the CropWatch methodology for estimating production is the calculation of current year production based on information about last year's production and the variations in crop yield and cultivated area compared with the previous year. The equation for production estimation is as follows:

$$Production_i = Production_{i-1} * (1 + \Delta Yield_i) * (1 + \Delta Area_i)$$

Where i is the current year, $\Delta Yield_i$ and $\Delta Area_i$ are the variations in crop yield and cultivated area compared with the previous year; the values of $\Delta Yield_i$ and $\Delta Area_i$ can be above or below zero.

For the 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):

$$Area_i = a + b * CALF_i$$

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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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