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中国科学院空天信息创新研究院
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CropWatch

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Global Agricultural Monitoring

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Aerospace Information Research Institute (AIR), Chinese Academy of Sciences
P.O. Box 9718-29, Olympic Village Science Park
West Beichen Road, Chaoyang
Beijing 100101, China

This bulletin is produced by the CropWatch research team, Aerospace Information Research Institute (AIR), Chinese Academy of Sciences, under the overall guidance of Professor Bingfang Wu.

Contributors are Diego de Abelleyra (Argentina), Rakiya Babamaaji (NASRDA, Nigeria), Jose Bofana (Mozambique), Mengwei Chen (Henan, China), Sheng Chang, Mansour Djamel (Algeria), Abdelrazek Elnashar (Egypt), Li Fu, Zhijun Fu, Wenwen Gao (Shanxi, China), Yueran Hu, Yang Jiao (Hubei, China), Kangjian Jing, Hamzat Ibrahim (NASRDA, Nigeria), Riham Khozam(Syria), Mengxiao Li, Yuanchao Li, Zhongyuan Li (Hubei, China), Wenjun Liu (Yunnan, China), Xiaoyan Liu (Anhui, China), Yuming Lu, Zonghan Ma, Linghua Meng (Jilin, China), Elijah Phiri (Zambia), Elena Proudnikova (Russia), Xingli Qin, Igor Savin (Russia), Jatuporn Nontasiri (OAE, Thailand), Buchsarawan Srilertworakul (OAE, Thailand), Urs Christoph Schulthess (CIMMYT), Grace Simon Mbaiorga (NASRDA, Nigeria), Binfeng Sun (Jiangxi, China), Fuyou Tian, Huanfang Wang, Linjiang Wang, Mingxing Wang (Hubei, China), Qiang Wang (Anhui, China), Yixuan Wang, Yuandong Wang (Jiangxi, China), Zhengdong Wang, Bingfang Wu, Yan Xie, Cong Xu, Jiaming Xu (Zhejiang, China), Nana Yan, Leidong Yang, Zhishan Ye (Anhui, China), Hongwei Zeng, Miao Zhang, Weiye Zang (Hubei, China), Xiwang Zhang (Henan, China), Dan Zhao, Hang Zhao, Xinfeng Zhao, Yifan Zhao (Henan, China), Zhaoju Zheng, Liang Zhu, Weiwei Zhu, and Qifeng Zhuang (Jiangsu, China).

Editor: Fuyou Tian

Photographer of Cover Page: Fangming Wu

Corresponding author: Professor Bingfang Wu
Aerospace Information Research Institute, Chinese Academy of Sciences
Fax: +8610-64858721, E-mail: **cropwatch@radi.ac.cn**, **wubf@aircas.ac.cn**

CropWatch Online Resources: The data and charts of this report are available at http://cloud.cropwatch.com.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 2023, 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	46 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 2023. 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 agri-climatic 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 comprise 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 2023.

Agroclimatic conditions

During this monitoring period, temperature records were broken in different parts of the world. However, the transition from La Niña to El Niño tended to smooth out precipitation. It brought relatively more rainfall to regions that had been drought-stricken, such as the Middle East and Eastern Africa, and parts of South America, such as Argentina. On the other hand, rainfall declined from above-average to average levels in most of Australia. Central Asia continued to have a rainfall deficit. Rainfall was close to the average for most of the USA, Canada and Europe. Flooding created some crop damage in India and China. Central and Northern China benefitted from generally above-average rainfall.

Global crop production situation

Maize: In Brazil, the cultivation area and yield of second maize increased, bringing Brazilian maize production to 100.68 million tonnes (+10.3%). Similarly, China also increased the area by 1.234 million ha, resulting in a production increase by 2.2%, whereas for the USA, an increase by 3.8% is forecasted. Conditions in Europe were generally favorable and slight increases in production can be expected. The sharpest decline was estimated for India, where flooding decreased the area and yield, leading to a decline in production by 9.1% to 17.1 million tonnes. All in all, the supply of maize has rebounded from last year. Global maize production is projected to reach 1.072 billion tonnes, marking an increase of 26.94 million tonnes or 2.6% compared to the decreased production (1.045 billion tonnes) in 2022, yet remaining below the peak in 2021.

Rice: As the world's largest rice producer, China is expected at 193.346 million tonnes, down by 1.0%, due to reduced cultivation areas. Adverse weather conditions, including excessive rainfall during heading and flowering, affected both early-season and single-season rice in its major producing regions and in northern China. Southeast Asian countries, including Bangladesh, Indonesia, the Philippines, Thailand, Myanmar, and Sri Lanka, experienced normal to slightly below-average rainfall during the rainy season, leading to decreased rice yields and resulting in lower rice production. However, in July, excessive rainfall occurred in Pakistan and India, leading to localized flooding. Nevertheless, conditions have been better in Pakistan as compared to last year, when widespread flooding had caused large yield losses. Pakistan's rice production is expected to increase by 6.8%, while India's rice production is estimated to decrease slightly by 0.9%. Vietnam, Cambodia, Nigeria, and the United States saw varying degrees of increased rice production. Overall, the global rice production is forecasted to slightly decline by 4.4 million tonnes or 0.6%.

Wheat: The conditions for production in major wheat-producing countries varied significantly. As compared to last year, agro-climatic conditions improved notably in East Africa and the Middle East. As the world's largest wheat producer, China experienced favorable weather conditions early in the season but frequent rainfall during the late grain-filling and harvest phase. This resulted in a yield of 134.72 million tonnes, an increase of 0.4%. In Russia, wheat production decreased by 3.8% to 82.94 million tonnes, primarily due to a mild drought in May and June. The wheat production of the United States, despite experiencing unfavorable weather conditions during early growth, saw an increase of 7.9% to 55.64 million tonnes. The six largest year-on-year increases, by more than 9%, were estimated for Syria, Ethiopia, Morocco, Turkey, Iran, and Lebanon, where the conditions were better than during the extreme drought year of 2022. Due to an expansion of area and higher yields, production increased in some European countries, such as Hungary (+1.4%), Romania (+5.6%), Italy (+6.4%), and Ukraine (+5.6%). Afghanistan and Central Asian countries, including Kazakhstan, Uzbekistan, and Kyrgyzstan, experienced a reduction in both cultivation areas and yields. In the Southern Hemisphere, production is estimated to decrease in Australia (-11%), Argentina (-14.1%), and Brazil (-3.1%), and increase in South Africa (+8.4%). Global wheat production is estimated to decline by 0.6% to 736.6 million tonnes, which is the lowest production of the past 5 years.

Soybean: Its production increased in the Southern Hemisphere, but the situations in Brazil and Argentina varied significantly. The increase in production in Brazil more than offset the decline in Argentina, resulting in a net increase of 1.71 million tonnes. In China, farmers expanded the area of maize at the expense of soybean, resulting in a decline in production by 5.7% to 17.2 million tonnes. A decline in the area was also estimated for the USA. Its production is forecasted to reach 100.5 million tonnes, 1.25% less than last year. Canada (+3.1%) and India (+1.0%) saw increased production. The cumulative decrease of 1.9 million tonnes in soybean production in the Northern Hemisphere exceeded the increase in the Southern Hemisphere, resulting in a global soybean production decrease of 0.3% to 319.06 million tonnes. Overall, the global soybean supply situation remains relatively stable.

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 105 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. Compared to the previous bulletin, some of the larger MRU with several different phenology and agroclimatic conditions have been subdivided. Thus, the number of MRU was increased by 40 in this bullletin.

1.1 Introduction to CropWatch agroclimatic indicators (CWAIs)

This bulletin describes environmental and crop growth conditions over the period from April 2023 to July 2023, AMJJ, referred to as "reporting period". CWAIs are averages of climatic variables over agricultural areas only inside each MRU and serve the purpose of identifying global climatic patterns. 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. Refer to Annex A for definitions and to table A.1 for 2023 JFMA numeric values of CWAIs by MRU. Although they are expressed in the same units as the corresponding climatological variables, CWAIs are spatial averages limited to agricultural land and weighted by the agricultural production potential inside each area.

We also stress that the reference period, referred to as "average" in this bulletin covers the 15-year period from 2008 to 2022. Although departures from the 2008-2022 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., 2018-2022). 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

During this monitoring period, temperature records were broken in different parts of the world. However, the transition from La Niña to El Niño tended to somewhat smooth out conditions. It brought more rainfall to regions that had been drought-stricken, such as the Middle East and Eastern Africa and parts of South

America, such as Argentina. On the other hand, rainfall returned from above average to average levels in most of Australia.

1.3 Rainfall

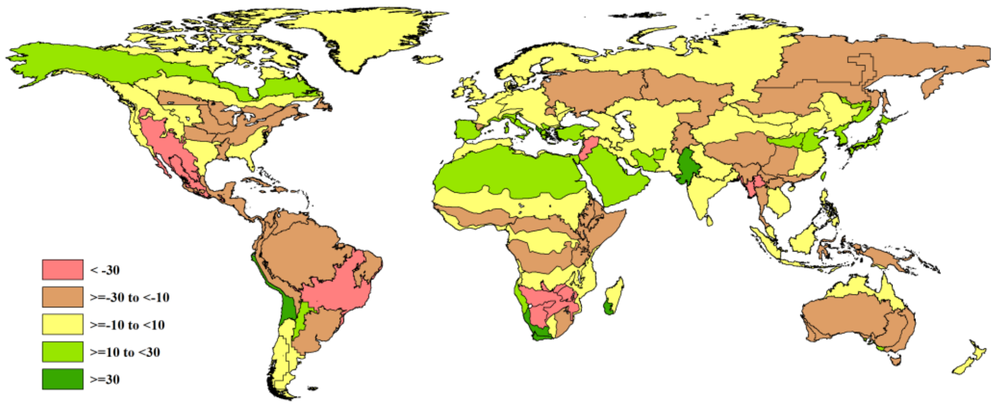

Figure 1.1 Global map of rainfall anomaly (as indicated by the RAIN indicator) by CropWatch Mapping and Reporting Unit: Departure of April 2023 to July 2023 total from 2008-2022 average (15YA), in percent.

As during the previous monitoring period, a general rainfall deficit was observed for South America. It was most severe in Central Brazil (<-30%). In the Pampas of Argentina, southern Brazil, the Amazon Basin and the Andes, the deficit was more moderate, ranging from -30% to -10%. It was also moderate in Central America and southern Mexico. The Mexican Highlands and the Rocky Mountains observed a severe rainfall deficit. A return to average rainfall is notable for California, the northern High Plains, Texas and the South East of the USA. The Midwest, Northeast, and Canadian Prairies experienced a moderate rainfall deficit. In most of Europe, rainfall was near average. Only Russia and Central Asia were affected by a moderate deficit. Severe dry conditions persevered in the Levant. In Africa, the countries bordering the Sahel desert experienced average rainfall. However, total rainfall amounts were still small, since this was just the start of the rainy season. The deficit was moderate in the zones with higher rainfall towards the equator. In Southern Africa, the southwest had above average rainfall, but more inland, Botswana and Mozambique had a severe rainfall deficit. In Asia, rainfall was more than 30% above average in Pakistan, whereas a severe deficit was observed for Myanmar. In Central China, Korea and Japan, rainfall was above average by 10% to 30%. Most of Australia experienced a moderate rainfall deficit.

1.4 Temperatures

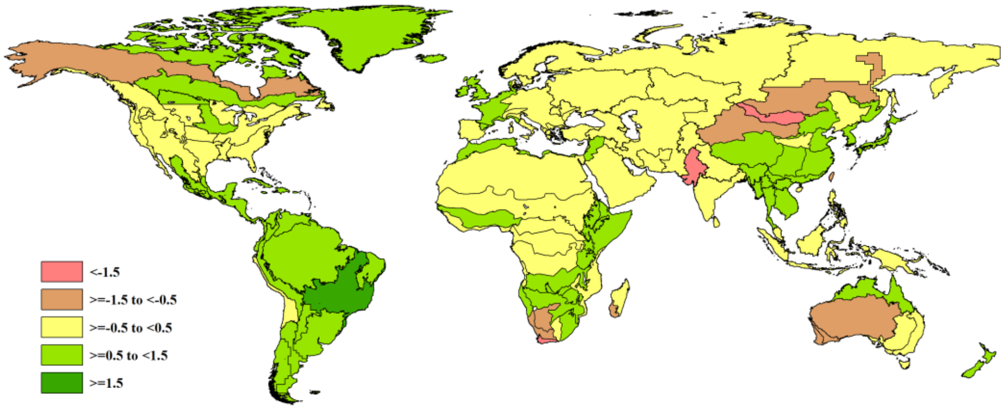

Figure 1.2 Global map of temperature anomaly (as indicated by the TEMP indicator) by CropWatch Mapping and Reporting , Unit: departure of April 2023 to July 2023 average from 2008-2022 average (15YA), in °C.

Temperatures were above average in almost all of South and Central America. The strongest positive departure by more than 1.5ºC was observed for Central and Eastern Brazil. In North America, temperatures in most regions were normal. The only positive departure by more than 0.5ºC was recorded for the Canadian Prairies and the northern Corn Belt. A similar positive departure was observed for most of Western Europe, while the rest of Europe experienced normal temperatures. The Maghreb, the region of the Gulf of Guinea, as well as Eastern and Southern Africa, were moderately warmer than usual, with the positive departures ranging from 0.5 to 1.5ºC. Only the southwestern tip of the African continent experienced cooler than usual temperatures. Pakistan, which had above average rainfall, was cooler by more than 1.5ºC. Southeastern Asia, most of China, Korea and Japan were moderately warmer. Below average temperatures were observed for Mongolia and Eastern Siberia. Temperatures were also cooler by 0.5 to 1.5ºC in Western Australia. All in all, temperature departures were moderate.

1.5 RADPAR

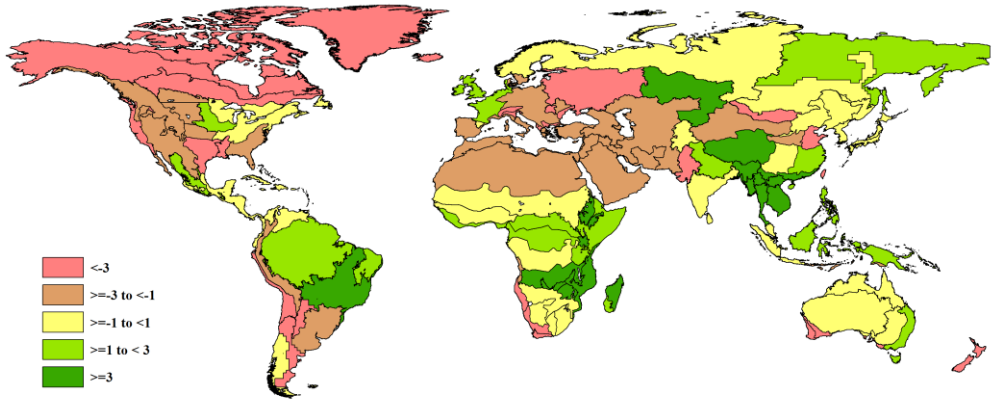

Figure 1.3 Global map of photosynthetically active radiation anomaly (as indicated by the RADPAR indicator) by CropWatch Mapping and Reporting Unit: departure of April 2023 to July 2023 average from 2008-2022 average (15YA), in percent.

In South America, solar radiation was above average by more than 3% in Central Brazil and the Amazon basin. In southern Brazil, Uruguay and most of the crop production regions of Argentina, and the Andes, solar radiation was below average by -1 to -3%. In Central America, conditions were average. The western half of the USA and most of Canada had less sunshine than usual. The strongest negative departures had been recorded for California and the southern High Plains. The Corn Belt and the Northeast of the USA experienced above average or normal solar radiation. In Europe, sunnier conditions were recorded for France, Benelux and the UK. Southwest, Central and Eastern Europe received below average solar radiation.

The strongest negative departures were recorded for Russia west of the Ural. Africa north of the Sahel and the entire Middle East experienced a slightly negative departure from the 15YA. In Central, East, and parts of southern Africa, solar radiation was above average. The only exception was the southwest coast, where solar radiation was below average by more than -3%. The strongest negative departures in Asia were observed for Pakistan, Mongolia and the North China Plain. For most Southeast Asia, a strong positive departure by more than 3% was recorded. In Australia, solar radiation ranged from strongly below average in the southwest to average and moderately above average along the east coast.

1.6 BIOMSS

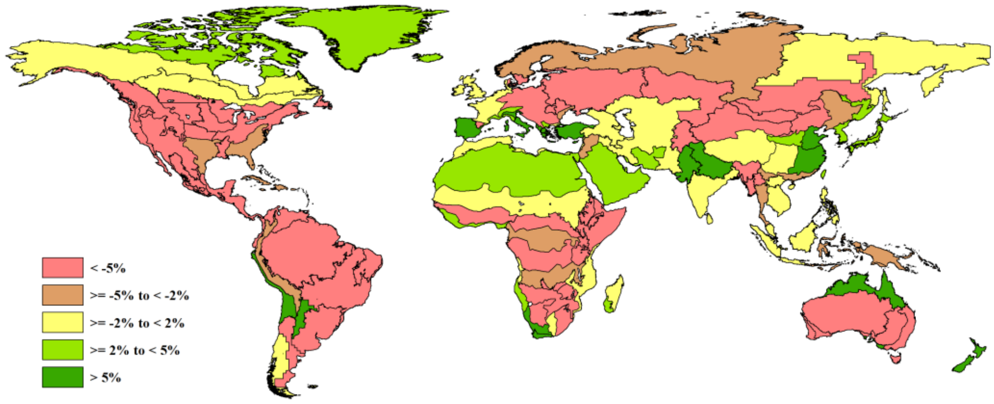

Figure 1.4 Global map of biomass accumulation (as indicated by the BIOMSS indicator) by CropWatch Mapping and Reporting Unit: departure of April 2023 to July 2023 average from 2008-2022 average (15YA), in percent.

Estimated biomass production was by more than 5% below average in almost all of the Americas. This was either due to a rainfall deficit, as in most of South America or less solar radiation, as in the western half of North America. Only for the coastal region of Peru, a positive departure by more than 5% was estimated. In southern Europe and Türkyie, biomass production was above average. In Central and Eastern Europe, it was below average. It was also below average in most of Africa south of the Sahara, whereas a positive departure by more than 5% was estimated for the southwest. In Pakistan and the Gangetic Plains, the North China Plains and southern China, a positive departure by more than 5% was estimated. For most of the crop production regions in Australia, biomass production was estimated by more than 5% below average.

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#.

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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 2023)

	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
West Africa	525	-9	28.0	0.7	1223	1	974	-9
North America	355	-14	19.2	0.2	1321	-2	902	-8
South America	199	-37	18.3	0.4	802	-3	525	-19
S. and SE Asia	892	-6	28.7	0.3	1283	3	1148	2
Western Europe	340	-2	14.8	0.3	1249	0	792	-3
Central Europe and W. Russia	285	-11	14.5	-0.2	1154	-3	764	-8

*Note: Departures are expressed in relative terms (percentage) for all variables, except for temperature, for which absolute departure in degrees Celsius is given. Zero means no change from the average value; relative departures are calculated as (C-R)/R*100, with C=current value and R=reference value, which is the fifteen-year average (15YA) for the same period (April-July) for 2008-2022.*

Table 2.2 Agronomic indicators by Major Production Zone, current season values and departure from 5YA (April -July 2023)

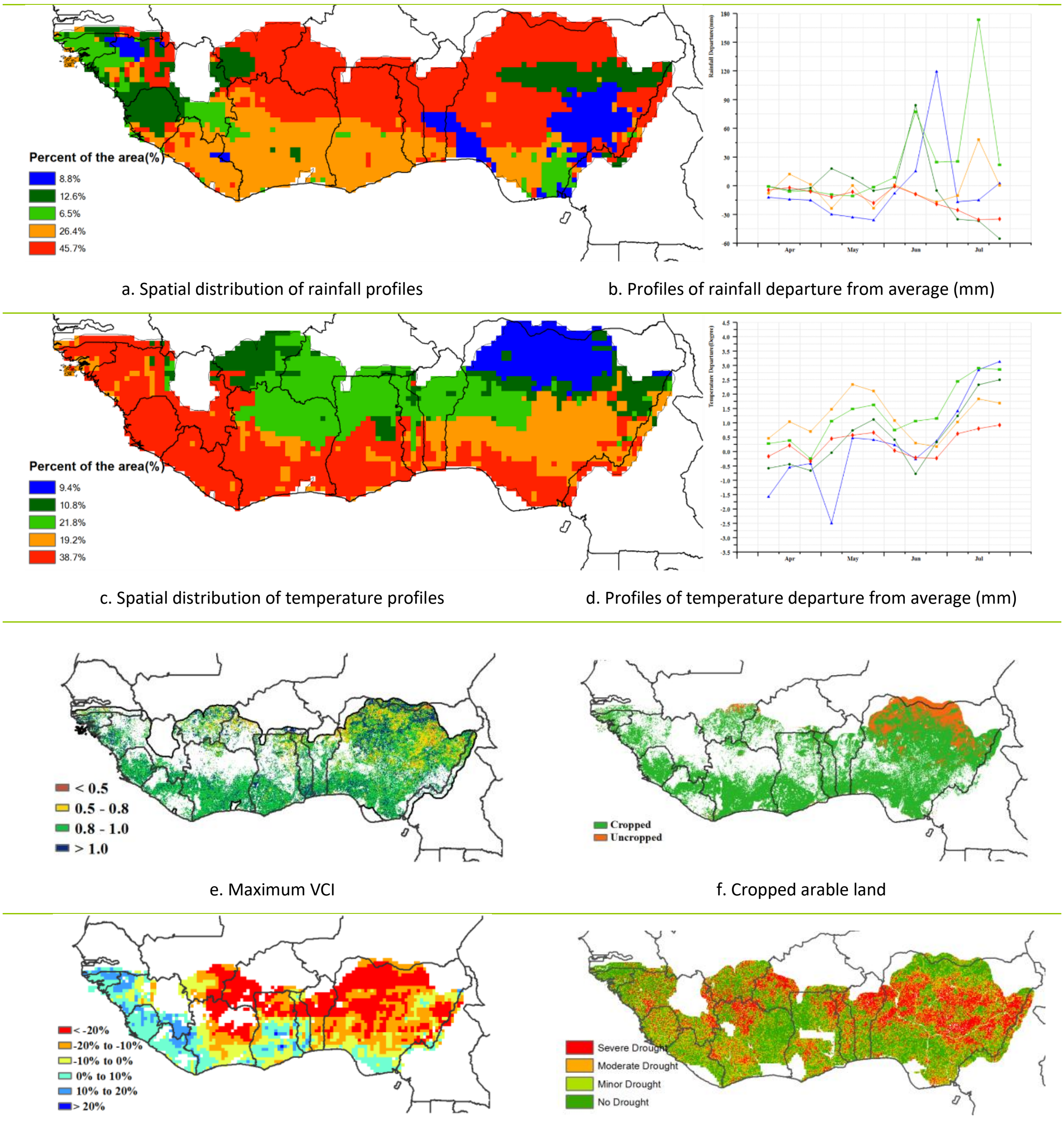
	CALF (Cropped arable land fraction)		Maximum VCI
	Current	5A Departure (%)	Current
West Africa	88	-2	0.91
North America	96	2	0.90
South America	96	-1	0.85
S. and SE Asia	75	-5	0.83
Western Europe	93	-4	0.84
Central Europe and W Russia	99	1	0.89

Note: See note for Table 2.1, with reference value R defined as the five-year average (5YA) for the same period (April-July) for 2018-2022.

2.2 West Africa

The report covers the period (April - July) which coincides with the onset of agriculture activities in the West African region. The crops planted in this period include the main cereal crops (maize, sorghum, millet, and rice) and tuber crops (cassava and yams). In the southern bimodal rainfall areas of the region, seasonal rains had a timely onset. For Nigeria, harvesting of maize in southern areas will conclude by August, while in the central areas, rainfall in May was below average in many parts. The most affected countries in the region (MPZ) in terms of reduced rainfall were Burkina Faso (RAIN -75%), Nigeria (RAIN -20%), Togo (RAIN -19%), Sierra Leone (RAIN -20%), Gabon (-16%), Nigeria (-14%), Côte d'Ivoire (RAIN -11%) and Ghana (RAIN -10%). Temperature for the MPZ was slightly above average (TEMP +0.7°C), with stratified spatial-temporal variation effects across the MPZ and more pronounced departures in the north as compared with the coastal areas of the region. The regional solar radiation was above average (RADPAR +1%), while the potential biomass production was below average (BIOMASS -9%). Most of the countries in the MPZ with reduced biomass production due to reduced rainfall were Burkina Faso (BIOMASS -20%), Nigeria (BIOMASS -15%), Côte d'Ivoire (BIOMASS -8%), Togo (BIOMASS -7%) and Ghana (BIOMASS -6%). Based on the VCIx map as an indication of vegetation cover, the region experienced high vegetative cover (VCIx >0.8) while the vegetation health index (VHI) map also depicts a spatial and temporal pattern affected by moderate to severe drought conditions. At the country level, northern Nigeria and northern Togo were most affected. At the regional level, the cropped arable land fraction slightly reduced (CALF -2%). The lowest CALF values were observed in Nigeria (CALF -12%) and Burkina Faso (CALF -3%). 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 2023.



a. Spatial distribution of rainfall profiles

b. Profiles of rainfall departure from average (mm)

c. Spatial distribution of temperature profiles

d. Profiles of temperature departure from average (mm)

e. Maximum VCI

f. Cropped arable land

g. Biomass accumulation potential departure

h. VHI minimum

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

2.3 North America

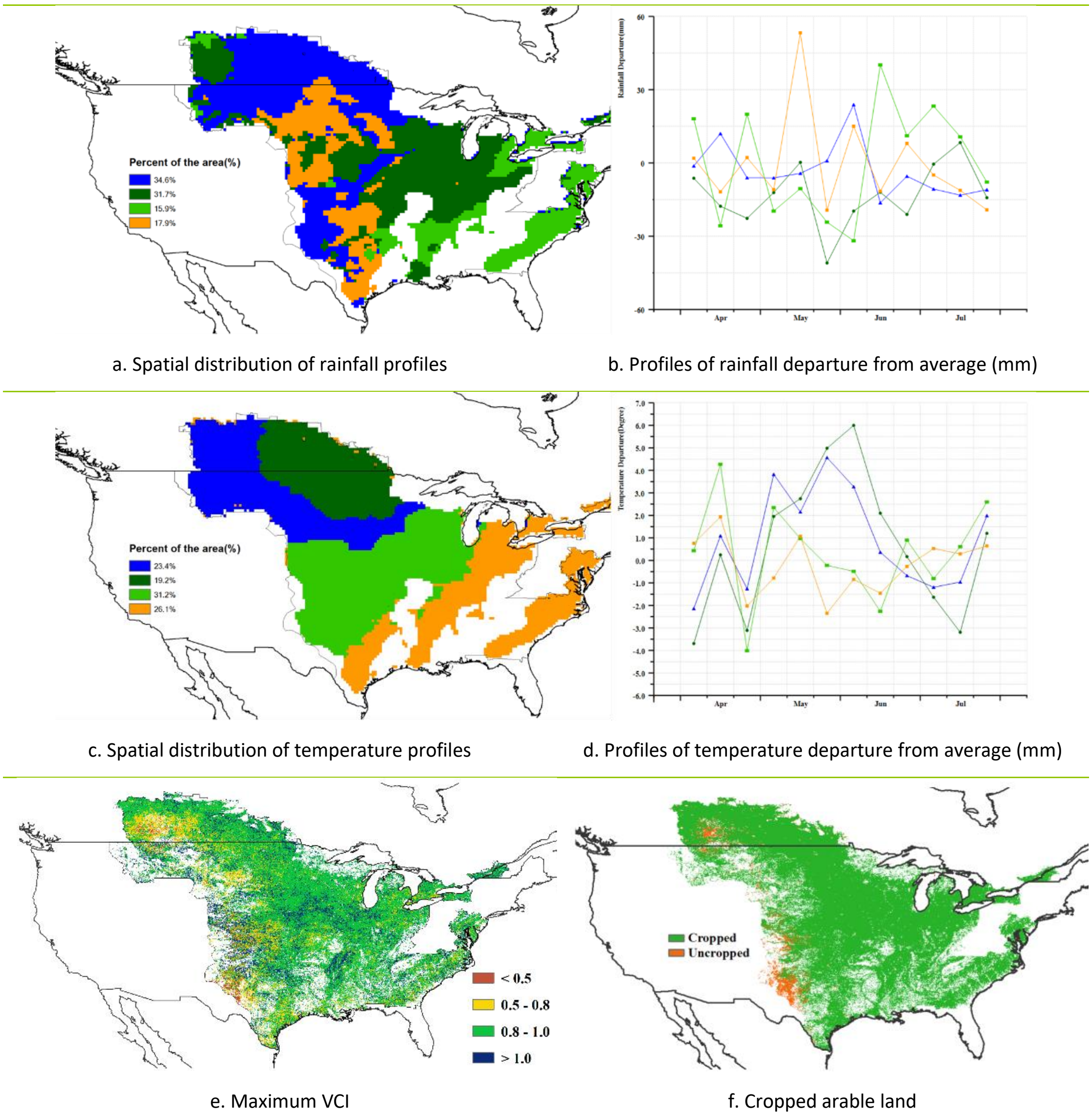
This reporting period began in April and ended in July, covering the harvest period for winter wheat, the sowing and early to mid growth period for maize and soybean, and the grain filling period for spring wheat. The strong heterogeneity of agro-climatic conditions has resulted in diverse crop growth situations.

The agro-climatic conditions in North America are slightly unfavorable, with below-average rainfall and radiation (RAIN -14%, RADPAR -2%) and above-average temperatures (TEMP +0.2°C), resulting in below-average potential biomass (BIOMSS -8%). The temperature cluster analysis showed that temperatures wer above average in the Canadian Prairies and Northern Plains. From late May to mid-June, temperatures were 3-4°C above the 15-year average, favoring crop growth and development. However, the Corn Belt and Southern Plains experienced significant temperature variability, with a peak of warmer than usual weather in April followed by a sharp temperature drop. Temperatures were below average from late May to late June. The rainfall cluster showed that rainfall was below average in the U.S. Corn Belt, Lower Mississippi River, and Plains regions. The reduction was most pronounced in the May to June period. The reduction in rainfall and lower temperatures during key growth stages slowed crop growth and development, resulting in potential biomass below the 15-year average. The VHI minimum indicated soil moisture deficits in the Corn Belt and Plains, with corresponding potential biomass 10-20% below average. The VCIx was 0.90, and the CALF was 2% above the 5-year average.

During the previous reporting period, northern Texas and Kansas had below average rainfall. Conditions improved to some degree, although the precipitation patterns in that regions were variable.

In short, CropWatch has assessed close to average crop conditions in the Southern Prairies, Plains, and Corn Belt regions.

Figure 2.2 North America MPZ: Agroclimatic and agronomic indicators, April to July 2023.



a. Spatial distribution of rainfall profiles

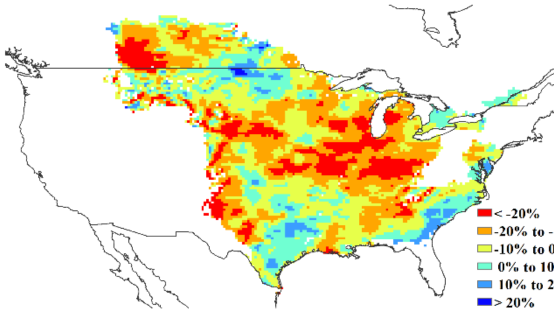
b. Profiles of rainfall departure from average (mm)

c. Spatial distribution of temperature profiles

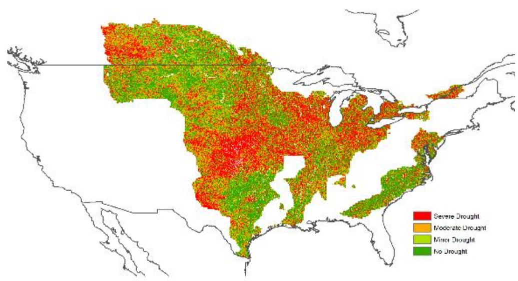
d. Profiles of temperature departure from average (mm)

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 sowing of wheat. It is mainly a fallow period for early summer crops. The situation in South America varied greatly among the different subregions. For Argentina several of the agroclimatic indices were poor. The North of the Brazilian agricultural area showed strong positive temperature anomalies during the entire reporting period and negative anomalies in rainfall during April. For the rest of the MPZ, most indices showed good conditions for crop development.

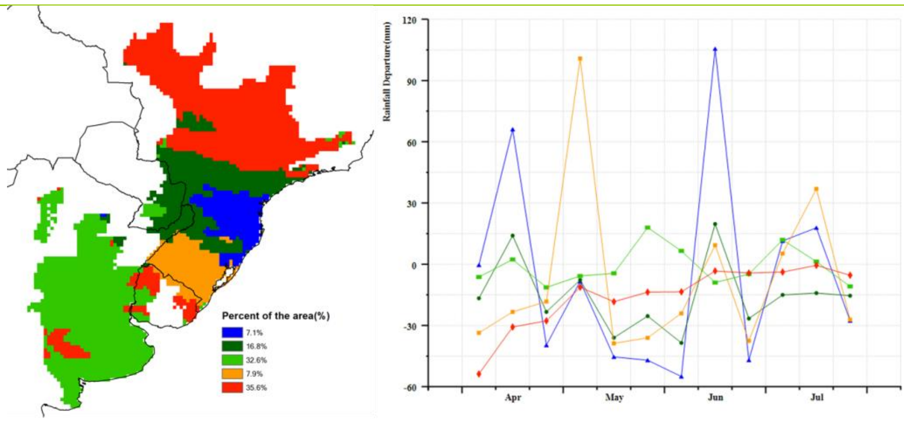
Spatial distribution of rainfall profiles showed five homogeneous profiles. A profile with almost no anomalies (light green profile) was observed in most of Argentina, except for Center East Pampas and North Mesopotamia. The north of the Brazilian agricultural area, including Mato Grosso, Mato Grosso do Sul, Goias, Sao Paulo, and Minas Gerais, as well as part of Uruguay and Center West Pampas in Argentina, showed a profile with negative anomalies at the beginning of the reporting period, with reductions up to mid-June. Thereafter, no more anomalies were observed (red profile). Other profiles sowed higher variability. The dark green profile showed slight positive anomalies in April and mid-June, and negative anomalies from mid-May to the beginning of June and since the end of June. It covered parts of Mato Grosso do Sul, Sao Paulo, Parana and Santa Catarina states, East Paraguay and North Mesopotamia in Argentina. The blue profile showed strong positive anomalies in mid-April and mid-June and negative anomalies at the end of April, from mid-May to the beginning of June, and at the end of June. It was located in Parana and Santa Catarina states. The orange profile showed positive anomalies at the begining of May and in mid-July, and negative anomalies during April, from mid-May to the beginning of June, and at the end of June.

Temperature profiles showed five homogeneous profiles distributed along a north-south gradient. A profile with positive anomalies all along the reporting period, starting with strong positive anomalies, with a tendency to reduce since the end of April (red profile), was observed in part of North Mato Grosso, Goias, and Minas Gerais states in Brazil. A profile with positive anomalies during most of the reporting period, except for a strong negative anomaly was observed in mid-June (blue profile). It covered Mato Grosso, and Sao Paulo states. A profile with low variability showing slight positive and negative anomalies (dark green profile) was observed for West Santa Catarina, Parana, and Sao Paulo states. The light green profile showed high variability with positive anomalies in mid-May, the beginning and end of June, and the beginning of July, and negative anomalies in mid-May, mid-June, and mid-July. This profile was observed in Paraguay, North Mesopotamia in Argentina, and Río Grande do Sul, East Parana and Santa Catarina states. Finally, a profile with high variability showing negative anomalies in mid-April, mid-May, mid-June, and mid-July and positive anomalies in end-April, from mid-May to begging June, end of June, and beginning of June (orange profile) was observed in most of Argentina, Uruguay, and South Rio Grande do Sul state in Brazil.

The BIOMSS departure map showed poor conditions in most of the MPZ. Negative anomalies were observed in Mato Grosso, Mato Grosso do Sul, Goias, Minas Gerais, Sao Paulo and Parana states in Brazil, as well as in part of Center and South Pampas in Argentina. Positive anomalies were observed in North Pampas, West Chaco, and Subtropical Highlands in Argentina. The rest of the MPZ showed a mixture of slight negative and positive anomalies. Maximum VCI showed good conditions, with values higher than 0.8, in almost all Brazilian agricultural areas, Paraguay and East Uruguay. Argentina showed, in general, poor conditions with values below 0.8, except for Mesopotamia, West Subtropical Highlands, and part of South Pampas. Crop Arable Land Fraction was high in almost all the areas of Brazil, Paraguay, and Uruguay. In Argentina uncropped areas were mainly observed in Center and West Pampas.

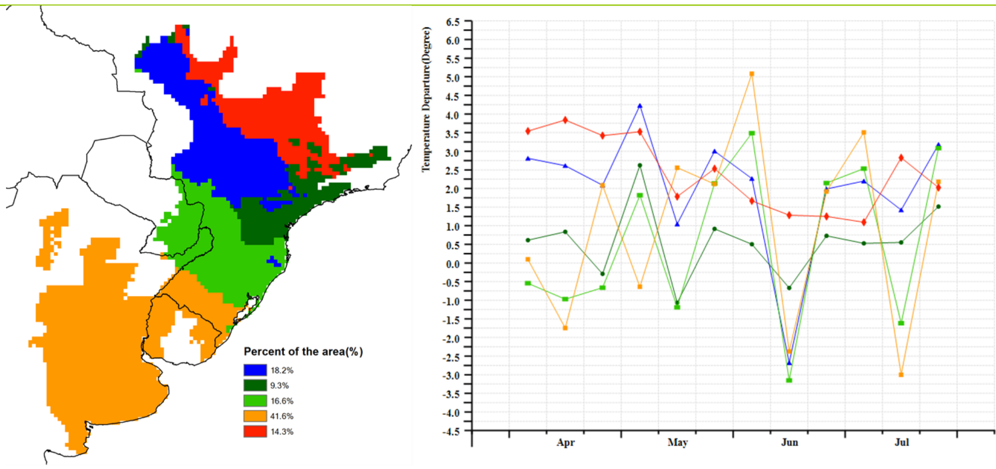
In summary, several agroclimatic indices showed poor conditions in part of Pampas: low VCIx values, low BIOMSS, and some uncropped areas. The north of the the Brazilian agricultural area showed strong positive temperature anomalies all along the reporting period and negative precipitation anomalies during April, as well as negative anomalies in BIOMSS. The rest of the MPZ showed quite good conditions. In most of the MPZ, precipitation deficits became smaller at the end of the reporting period. Temperature anomalies were positive on average.

Figure 2.3 South America MPZ: Agroclimatic and agronomic indicators, April to January 2023.



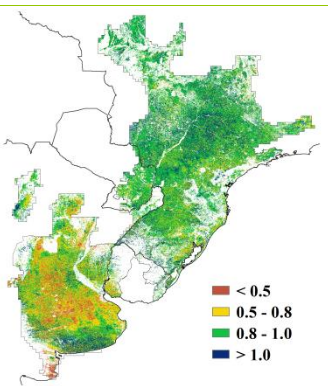
a. Spatial distribution of rainfall profiles

b. Profiles of rainfall departure from average (mm)

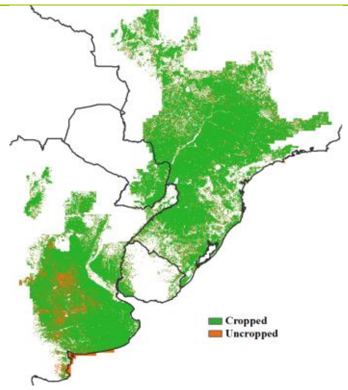


c. Spatial distribution of temperature profiles

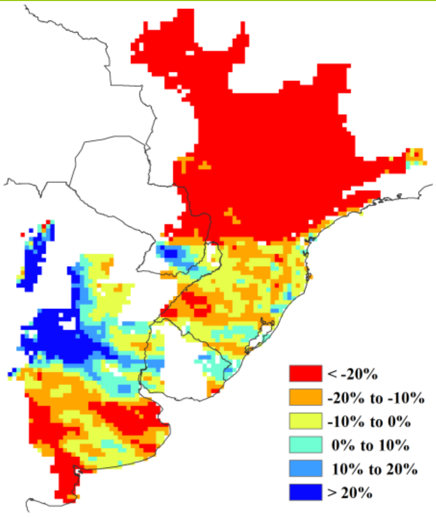
d. Profiles of temperature departure from average (mm)



e. Maximum VCI



f. Cropped arable land



g. Biomass accumulation potential departure

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

2.5 South and Southeast Asia

The South and Southeast Asia MPZ includes India, Bangladesh, Cambodia, Myanmar, Nepal, Thailand, Laos, and Vietnam. This monitoring period covers the harvesting period of winter crops (wheat, dry season rice) in India and Bangladesh, along with the sowing period and the growing period of summer crops (rainy season rice, maize, and soybean) in the entire MPZ.

According to the agroclimatic indicators, the accumulated precipitation was below the 15YA (RAIN -6%), while the RADPAR and the temperature were above the average (RADPAR +3%, TEMP +0.3℃), resulting in an increase in the potential biomass production (BIOMSS +2%). Compared with the 5YA, the CALF decreased by 5% to 75%. The VCIx of the MPZ was 0.83, indicating that the crops were growing well.

The spatial distribution of rainfall profiles shows that the precipitation deficit for 8.3% of the MPZ grew larger over time. Eastern India and southern Myanmar were mostly affected by it. The proportion of cropland in that region is relatively low. The lack of moisture, therefore, had a relatively small impact on food production at the national level. The precipitation for 12% of the MPZ (central and western India) was significantly above the 15YA in late June. On around 14.9% of the MPZ (southeastern and northwestern India), heavy precipitation occurred in late July, leading to flooding disasters. Throughout the monitoring period, the precipitation in 64.7% of the MPZ (northeastern and southern India and Southeast Asia) was close to the average.

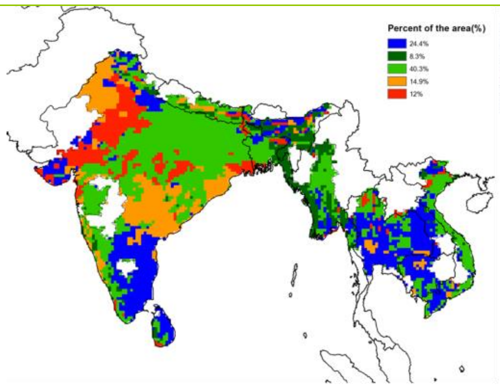
According to the spatial distribution of temperature profiles, the average temperature in 6.3% of the MPZ (Nepal, western Myanmar, and western Thailand) was significantly above the 15YA throughout the monitoring period. The average temperature in 35.7% of the MPZ (Southeast Asia) was slightly above the 15YA. The average temperature in 20.2% of the MPZ (northwestern India) was below the 15YA during the monitoring period but slightly above the average in mid-April and mid-May. The average temperature in 37.8% of MPZ (India) fluctuated around the average.

The BIOMASS departure map displays that the potential biomass in the southeastern and northwestern parts of India was 20% greater than the historical average for the same period, whereas the potential biomass in the southwestern part of India and northern Myanmar was below the average level. The Maximum VCI shows that the index was lower than 0.5 in the western parts of India and some scattered regions, which was related to cropland being left fallow or late planting of rice (uncropped areas in Fig. 2.4e). The index was higher than 1.0 in northwestern India, which indicated that crop condition was better than the 5-year maximum. The VHI Minimum map shows that most of the MPZ was temporarily impacted by drought, except for southern and western India and some scattered regions.

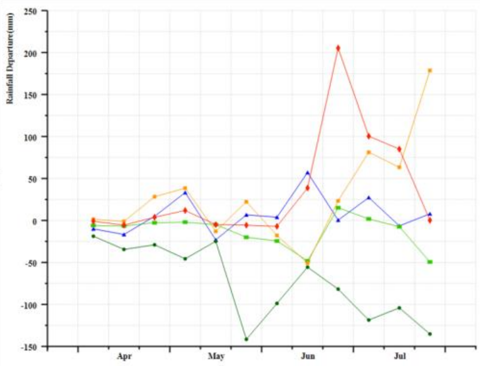
The CALF map indicates that a significant portion of the region was planted, except for central and western India and northern Myanmar.

In general, some parts of India had been affected by high rainfall, leading to the delay of seeding, but the overall crop conditions in the MPZ were expected to be favorable. favorable.

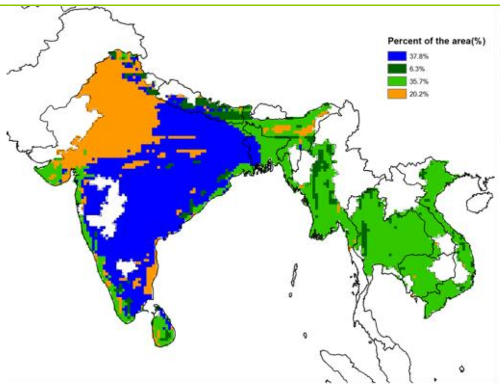
Figure 2.4 South and Southeast Asia MPZ: Agroclimatic and agronomic indicators, April 2023 to July 2023.



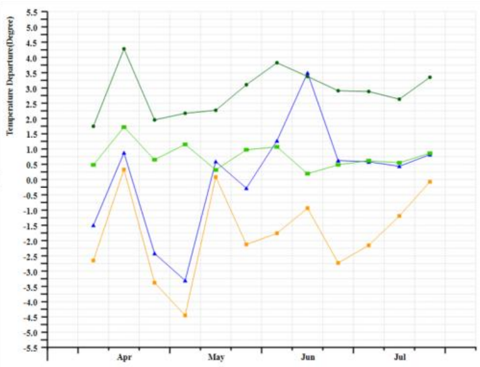
a. Spatial distribution of rainfall profiles



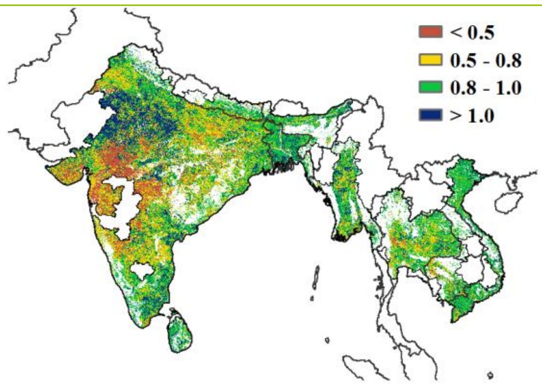
b. Profiles of rainfall departure from average (mm)



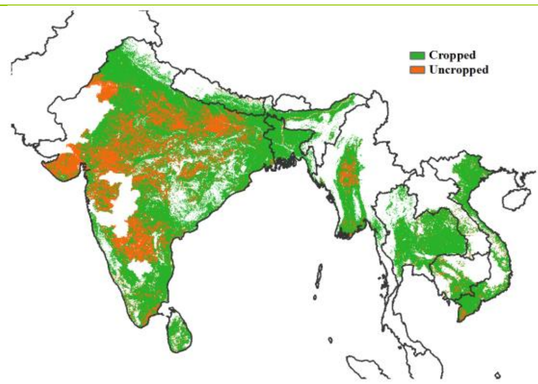
c. Spatial distribution of temperature profiles



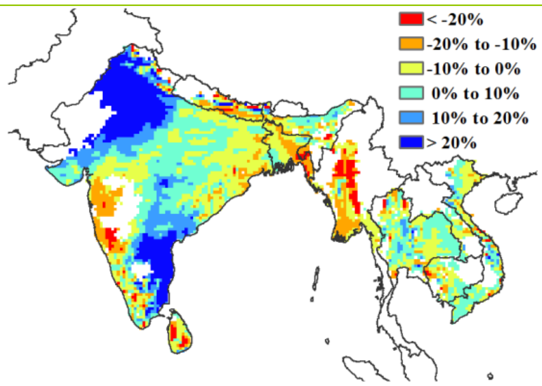
d. Profiles of temperature departure from average (mm)



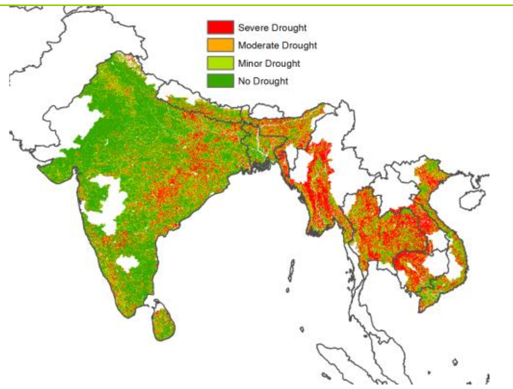
e. Maximum VCI



f. Cropped arable land



g. Biomass accumulation potential departure



h. VHI minimum

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

2.6 Western Europe

This reporting period covers the growth and grainfilling period of winter wheat. Summer crops had been sown in April and May in the Western European Major Production Zone (MPZ). Most crops in this production are mainly rainfed and agro-meteorological conditions play a crucial role. Generally, most part of Spain and Germany, central and eastern France experienced rainfall deficits and warmer-than-usual conditions. Crop conditions in the other regions of the MPZ were above average or close to average based on the interpretation of agro-climatic and agronomic indicators monitored by Cropwatch (Figure 2.6).

The continued precipitation deficit had started last summer and precipitation was slightly below average (-2%) in this reporting period. According to the spatial distribution of rainfall profiles, the spatial and temporal distribution of rainfall varied considerably between countries, and rainfall patterns can be characterized as follows: (1) Precipitation in Spain, central Aquitaine in France, and northeastern Rhône-Alpes region in France, covering 19.8% of the MPZ areas (green areas in Fig. 2.6a), was generally below average during most of the monitoring period, except for the period from late-May to mid-June; (2) 39.7% of the MPZ (the orange area in Fig. 2.6a) received below-average precipitation for almost the entire monitoring period, except for mid-April, early-May, late-June and late-July, when it was slightly above average. This includes most of Germany, central and eastern France; (3) Precipitation was above average in 33.3% of the MPZ (blue areas in Fig. 2.6a), except for the period from mid-May to late-June, when precipitation was significantly below average. This includes UK, northwestern and southern Germany, Brittany, Normandy, Nord-Pas-de-Calais, Picardy of France; (4) For the rest of the monitoring area (7.3%, dark green areas in Fig. 2.6a), covering central, southeastern France, northern and central Italy, precipitation was significantly above average, except for below-average precipitation in early April and late July. The countries with the most severe precipitation deficits were Spain (RAIN -37%), Germany (RAIN -10%) and France (RAIN -4%). The pronounced and intermittent precipitation deficit in the southern and central part of the MPZ may have negatively impacted the yield of winter crops, and as well as the establishment and growth of summer crops.

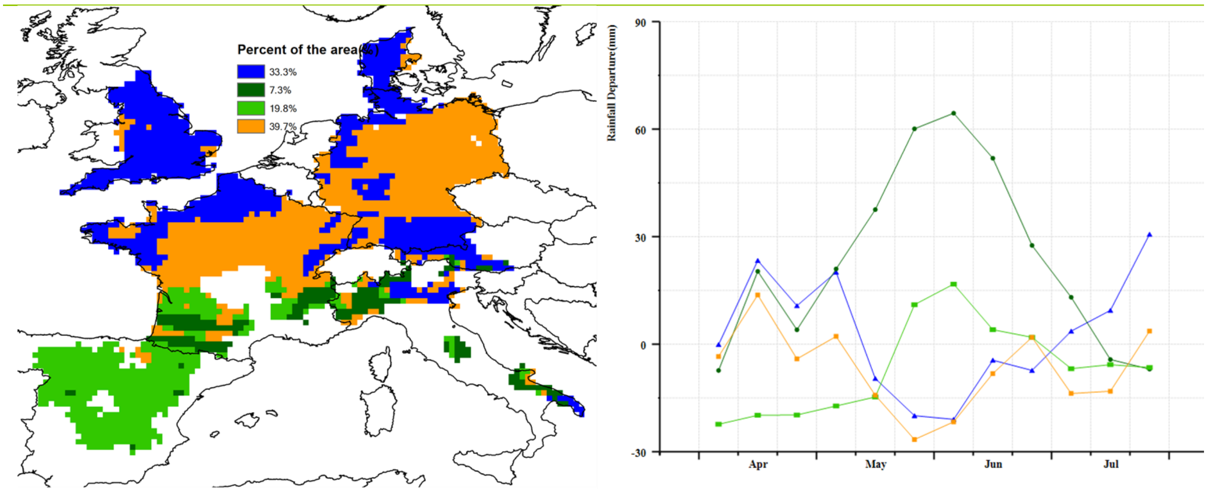
Temperature for the MPZ as a whole was slightly above average (TEMP +0.3%) and radiation was average. As shown in the spatial distribution of temperature profiles, 15.9 percent of the MPZ areas (Spain and northern Italy) experienced significantly warmer-than-usual conditions, except for early-May; 24.4 percent of the MPZ areas (Central and south-eastern Italy, eastern and southern Germany) experienced below-average temperatures throughout the monitoring period, except for mid-June and mid-July; 26.3 percent of the MPZ areas (UK, northern and northwestern Germany) experienced warmer-than-usual conditions during the monitoring period, except for April, late-May, early-June and late-July; 33.4 percent of the MPZ areas (France and western Germany) experienced warmer-than-usual conditions, except for early-April, early-May and late-July. Overall, hot weather swept through the western part of the MPZ in the period from early-June to mid-July, and two heat waves swept through Spain and northern Italy; High temperatures shortened the grain filling stage of crops and accelerated the maturity, which may have reduced crop yields.

Due to the slight precipitation deficit, average radiation, and warmer-than-usual conditions, the potential BIOMSS was 3% below average. The lowest BIOMSS values (-20% and less) were observed for most parts of Spain, most parts of Germany, and northeastern France. In contrast, BIOMSS was above average (+20% and more), mainly in northwestern, central, and southeastern Italy.

The average maximum VCI for the MPZ reached a value of 0.84 during this reporting period. About 93% of arable land was cropped, which was below average compared to the recent five-year average in the whole MPZ. The uncropped areas of arable land were mainly concentrated in Spain and a few pockets in almost all other countries of this MPZ. The VHI minimum map shows that relatively large areas of Spain, central and southern Germany, central and eastern France were affected by persistent drought conditions.

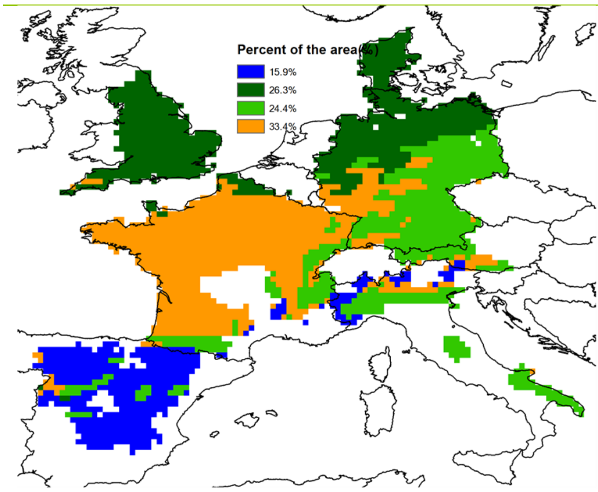
Overall, the conditions of crops in the MPZ were mostly average or close to average. The exception was Spain, where drought conditions severly limited crop production, resulting in poor conditions..

Figure 2.5 Western Europe MPZ: Agroclimatic and agronomic indicators, April to July 2023.

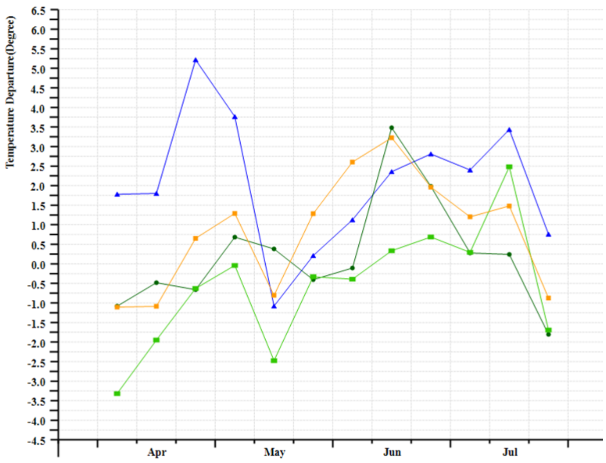


a. Spatial distribution of rainfall profiles

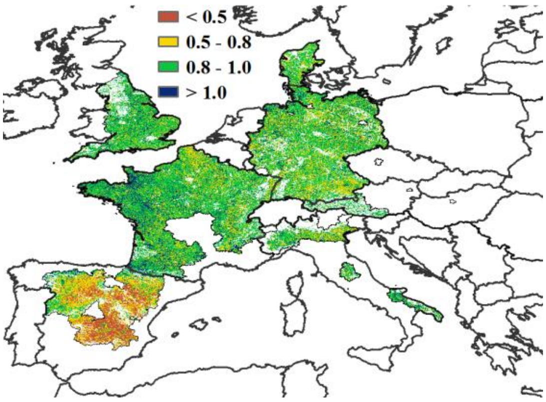
b. Profiles of rainfall departure from average (mm)



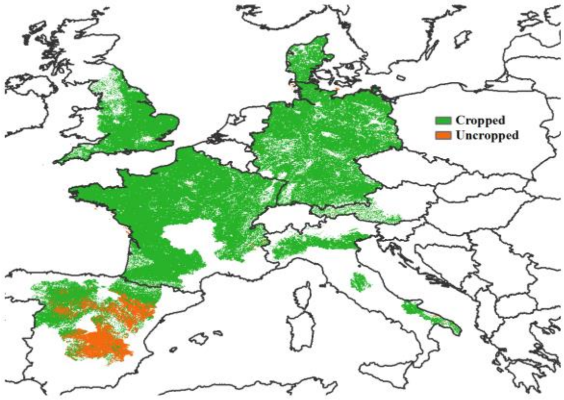
c. Spatial distribution of temperature profiles



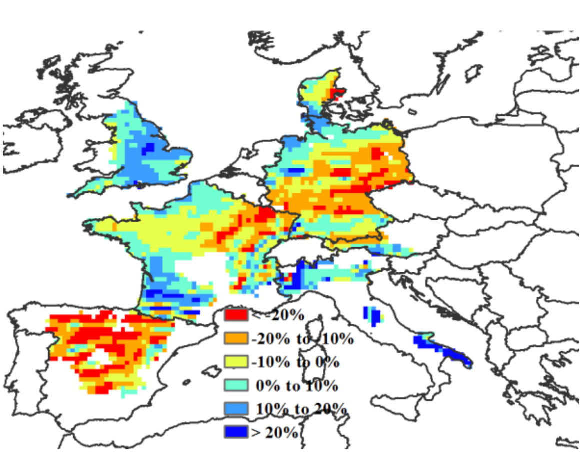
d. Profiles of temperature departure from average (mm)



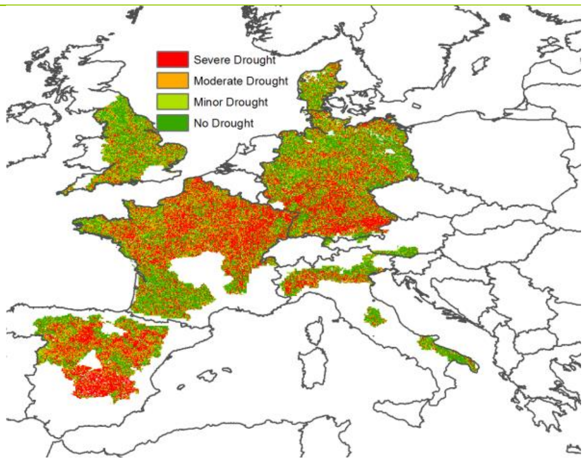
e. Maximum VCI



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 growing period of winter wheat sown last fall and this year's summer crops in the MPZ of central Europe and western Russia. Overall, RADPAR and average temperatures were 3% and 0.2° C lower, respectively, compared to the same period of the last 15 years, and cumulative precipitation was 20% lower, resulting in an 8% reduction in potential cumulative biomass. Cropland area in this MPZ increased slightly by 0.6%, resulting in a proportion of cropland under cultivation of 99%. The best vegetation condition index for the main production area was 0.88, and the crops were in good condition.

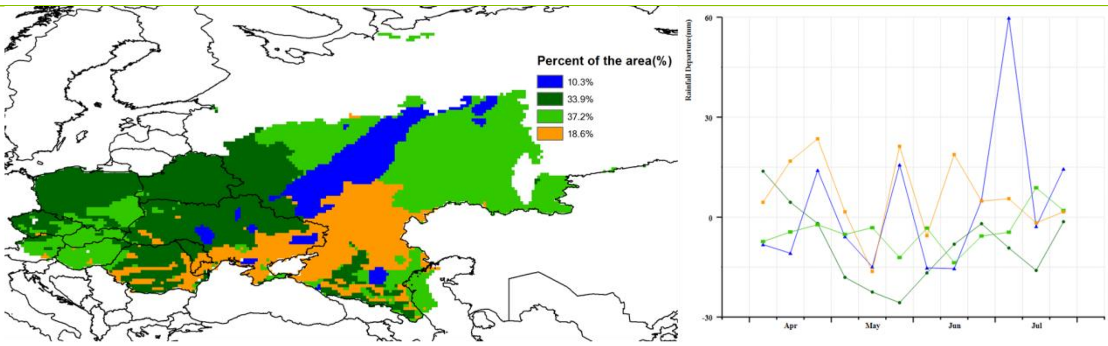
According to the spatial distribution map of precipitation distance level clustering, 37.2% of the MPZ (western Russia, eastern Austria, southeastern Poland, Slovakia, and Hungary) had below-average precipitation from April to early July. Subsequently, it was above average. 33.9% of the MPZ (western Russia, northern Ukraine, northern Moldova, Belarus, the Czech Republic, Poland, and most of Romania) was drier than usual, with above-average precipitation until mid-April, a sharp decrease in May, and stabilization in June and July, although precipitation remained below average. 18.6% of the MPZ (southwestern Russia, southern Ukraine, southern Moldova, parts of Romania) received more precipitation than average. That region received slightly below average precipitation only in mid-May, early June, and mid-July, and above average precipitation in all other periods. Precipitation in 10.3% of the MPZ (Russia and a small part of Ukraine) fluctuated above and below the average until early July, when it jumped to above average.

During this monitoring period, the average temperature in the MPZ fluctuated above and below the average level, and showed significant east-west differences. Among them, 19.3% of the MPZ (eastern part of the MPZ, western Russia) had significantly higher than average temperatures in late April and late May, and significantly lower than average temperatures in mid to late June. 25.7% of the MPZ (MPZ in the central and eastern regions, western Russia) had below average temperatures in early May, late June, and mid July. 28.9% of the MPZ (MPZ in the central and western regions, western Russia, Ukraine, and eastern Belarus) were below average in early May, and temperature fluctuations were relatively small during other periods. The temperature in 26.1% of the MPZ (western part of the MPZ, eastern Ukraine and Belarus, Moldova, Romania, Poland, Slovakia, Hungary, Czech Republic, Austria) fluctuated and increased during the monitoring period. Before mid May, the temperature was below average. In late May, the temperature in the region was higher than the average level, followed by fluctuations above and below the average level, until mid July when the temperature in the region was much warmer than usual.

The results of the potential cumulative biomass spatial distribution map shows a significant decrease by more than 20% in central and western Russia, central Romania, northern Czech Republic, and also scattered in Poland, Belarus, and Ukraine; However, the potential biomass in southwestern Russia and western Hungary is above average (some areas are more than 20% higher). The results of the spatial distribution map of the minimum vegetation health index indicates that some regions in central and western Russia, Belarus, Ukraine, Poland, Czech Republic, and Austria have been affected by short-term droughts.

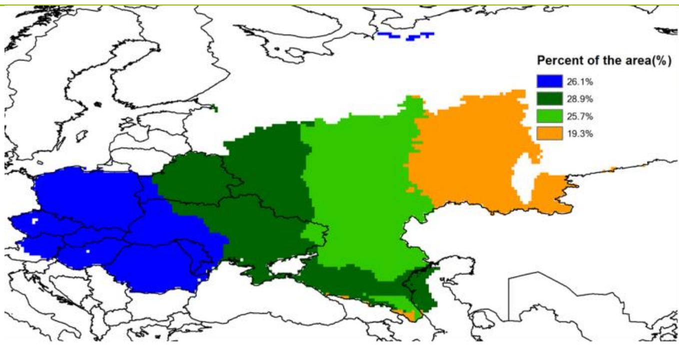
Overall, the below average precipitation in the western and northeastern regions of this MPZ negatively impactwd crop production. In southernUkraine and the Wolga and Caucasus regions of Russia, precipitaton was more favorable. Overall, average crop production can be expected from this MPZ.

Figure 2.6 Central Europe to Western Russia MPZ: Agroclimatic and agronomic indicators, April to July 2023.

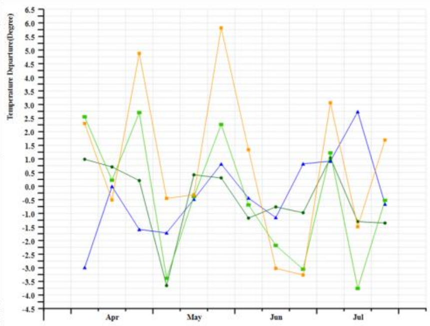


a. Spatial distribution of rainfall profiles

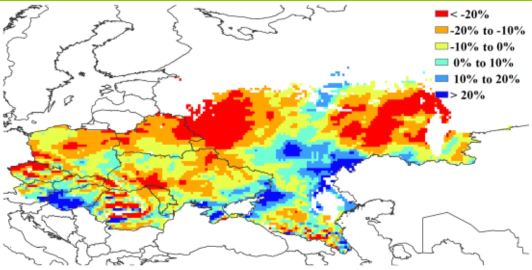
b. Profiles of rainfall departure from average (mm)



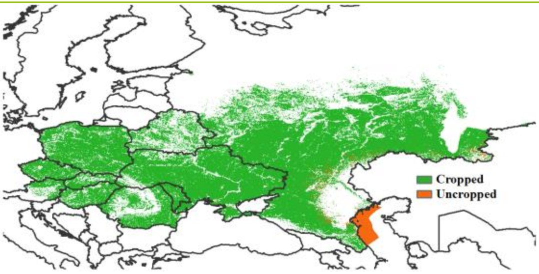
c. Spatial distribution of temperature profiles



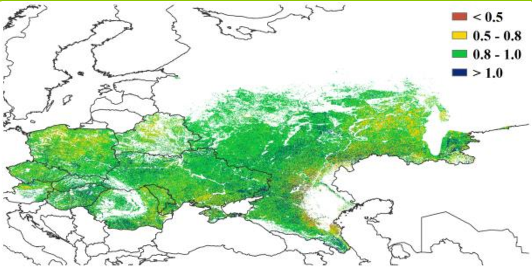
d. Profiles of temperature departure from average (℃)



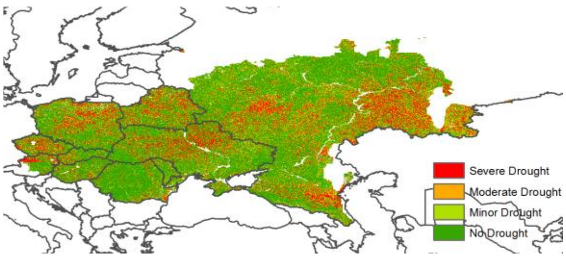
e. Biomass accumulation potential departure



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 46 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 are being dominated by just 4 countries: USA, Brazil, Argentina, and Ukraine. Together, they are supplying three quarters of maize being traded internationally. Brazil has substantially increased its production in recent years, whereas Ukraine’s export has been hampered by the Russian invasion. In Argentina, conditions for maize production were unfavorable due to the lack of rainfall. While Brazil's precipitation was below average, it was still sufficient to ensure good yields. In the USA, a cool spring, yet combined with favorable moisture conditions, delayed the sowing and germination of maize. However, prospects for USA maize production remain favorable. Rainfall was generally above average in July. In Europe, conditions for maize production have been generally favorable as well. Higher rainfall created better conditions for maize in Eastern Europe than last year. Similarly, maize in East Africa has also benefitted from higher rainfall. Above average rainfall has also created favorable conditions for maize production in the North China Plain and in the Northeast of China. Flooding caused some localized damage.

Rice: Most rainfed (Kharif) rice grown in South Asia was sown or transplanted in June and July. So far, monsoon rain has been normal to excessive. Intense rainfall in July caused flooding in parts of India and Pakistan. Nevertheless, prospects are generally favorable, although India has restricted rice exports in response to the floods. In Southeast Asia, where El Niño might cause a rainfall deficit in the coming months, conditions have been rather favorable so far and average production can be expected. The only exception is Myanmar, where the civil conflict is disrupting the supply of inputs. In addition, rainfall has been below average. In the USA, favorable rainfall in California and the South are ensuring good conditions for rice production.

Wheat: Conditions for wheat production have been rather favorable. In the USA, drought during the winter months caused a yield reduction in the southern High Plains. In the other regions, as well as in Canada, conditions were close to normal. Similarly, conditions for winter wheat production in Europe were close to normal. Only Spain had suffered from a severe rainfall deficit. But especially in Central and Eastern Europe, conditions have been quite favorable. In Russia, drier than usual conditions in the Volga regions and the region west of the Ural caused a slight reduction in production. In the other regions, conditions were normal. Similarly, conditions were average in Kazakhstan and in China. Wet conditions during the wheat harvest in late May and early June impacted the quality of wheat produced in Henan, China's most important wheat producer. In Australia, rainfall levels returned to average, which will also bring down wheat yields from the record levels recorded in the past couple of years. In South Africa, rainfall was higher than usual in the Cape Province, which will help produce high yields. In the Highlands of Ethiopia, rainfall has been average, causing favorable production conditions in that region as well.

Soybean: In the USA and Canada, conditions for soybean production have been rather favorable. There were some dry spells in late May and June, but rainfall recovered to above average levels in July, which will ensure favorable conditions during the pod filling stage. Similarly, conditions for soybean production in Europe have also been quite favorable. While the agrometeorological conditions for soybean production in the Ukraine have been rather favorable, production in the conflict zones will be limited. Moreover, the Russian blockade and mining of the ports and bombing of grain handling facilities will most likely reduce exports.

2. Weather anomalies and biomass production potential changes

2.1 Rainfall

In South America, rainfall was more than 30% below average in the center and northeast of Brazil. The deficit was smaller (-10 to -30%) in the south. In Argentina, most of the grain production regions also had a small deficit. Central America generally also received below average rainfall. The deficit was more severe in Mexico and the southern Rocky Mountains in the USA. The Pacific Northwest of the USA received average rainfall, whereas there was a slight deficit in the corn belt and northeast. In Europe, rainfall was greatly reduced in Spain and Portugal. Most countries in the eastern Mediterranean region, including Türkyie, received above average rainfall. In Eastern Europe, some regions of Russia experienced below average rainfall. The Central Asian countries, including Afghanistan, continued to suffer from the prolonged drought. Pakistan and western India had above average rainfall, with a departure by more than 30%. Conditions were mixed in Africa, although most of the continent experienced below average rainfall. Central China had above average rainfall, but its south had a deficit ranging from -10 to -30%. Western and Southeastern Australia experienced below average rainfall. The deficit was larger in the Northeast.

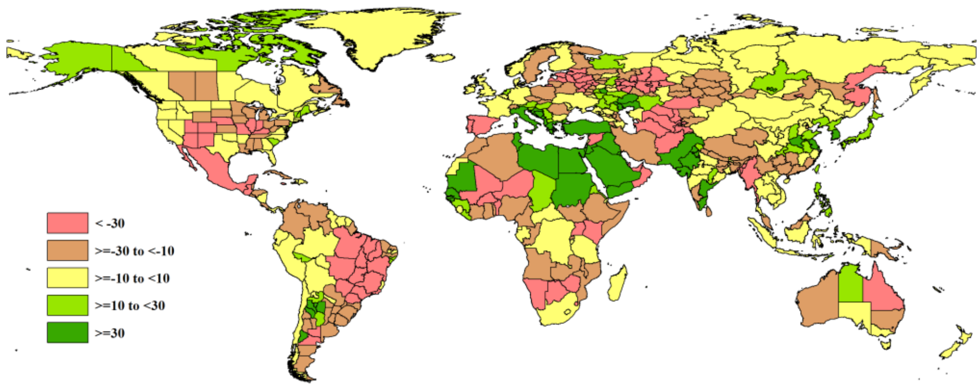


Figure 3.1 National and subnational rainfall anomaly (as indicated by the RAIN indicator) of April 2023 to July 2023 total relative to the 2008-2022 average (15YA), in percent.

(2) Temperatures

In the Americas, south of the USA-Mexican border, temperatures were mostly above average by 0.5 to 1.5ºC. In Central Brazil, temperatures deviated even more strongly from the long-term average. In the USA, California and a few states in the east experienced cooler temperatures (-0.5 to -1.5ºC). In most of the other states, temperatures were average or slightly above average. The Canadian Prairies also experienced warmer than usual weather. The drought-stricken Iberian Peninsula was much warmer than usual. The Ukraine and the neighboring Russian regions were cooler than usual. Warmer temperatures were observed for the region west of the Ural, while for the regions on the other side, as well as in Kazakhstan and Central Asia, cooler temperatures were recorded. Pakistan and the western part of India were also cooler. All of Southeast Asia experienced warmer conditions. The weather in Africa tended to be near average or warmer than usual. Australia had mixed conditions. The West was cooler, and the South and East were average.

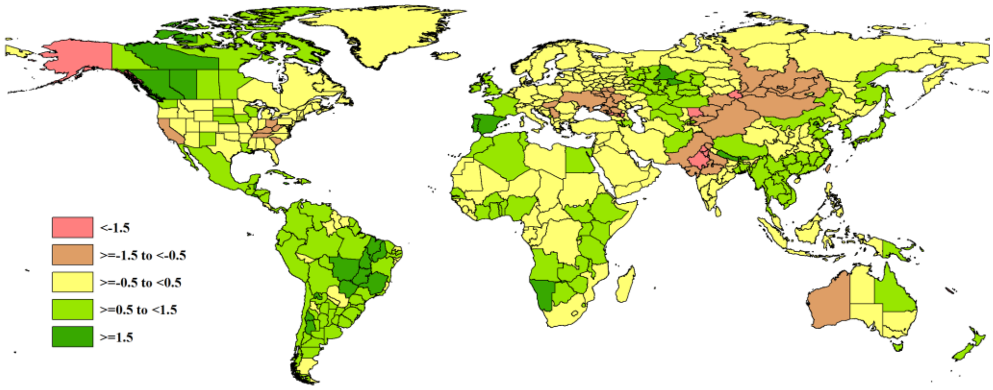


Figure 3.2 National and subnational sunshine anomaly (as indicated by the TEMP indicator) of April 2023 to July 2023 total relative to the 2008-2022 average (15YA), in °C .

2.3 RADPAR

Most of Argentina received below average solar radiation. Especially the Pampas were more cloudy than usual. In Brazil, to the contrary, conditions were more sunny than usual. Most of the USA had below average solar radiation. Especially the western half and the south had below average radiation. In the cornbelt, however, solar radiation was above average, Especially Iowa and Illinois were sunnier than usual. In Western Europe, conditions were sunnier than usual, whereas in central and eastern Europe, solar radiation tended to be more than 3% below average. The region west of the Ural was sunnier. Central China had less sunshine, but its south had above average solar radiation. All of Southeast Asia had above average solar radiation. In Africa, the north tended to receive below average solar radiation, whereas the equatorial and southern regions received above average solar radiation. In Australia, the West had received below average, and the East above average solar radiation.

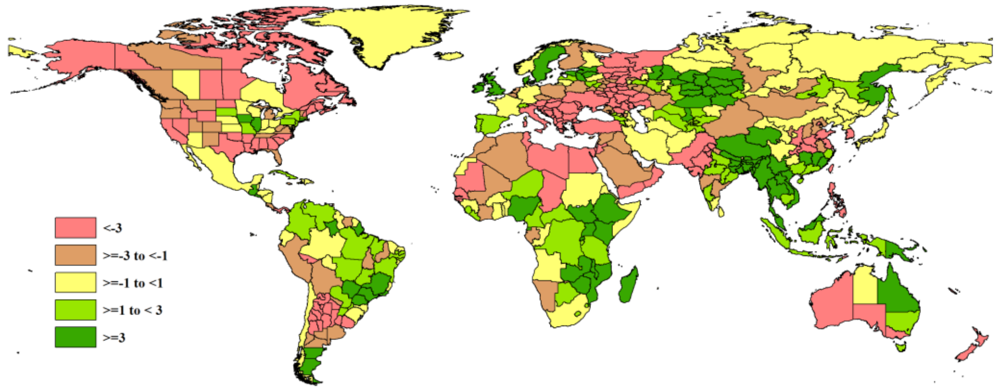


Figure 3.3 National and subnational sunshine anomaly (as indicated by the RADPAR indicator) of April 2023 to July 2023 total relative to the 2008-2022 average (15YA), in percent.

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 tropical ones, solar radiation tends to be the limiting factor. For high-latitude regions, the temperature may also limit biomass production. Most of the important crop production regions of South America had below average biomass production due to the rainfall deficit. Similarly, a strong negative departure was estimated for Mexico and most of the USA. Only Texas, and the northwest and southeast had average biomass production. A negative departure was estimated for the Iberian Peninsula, most of Central and Eastern Europe as well as Siberia and the Middle East. More favorable conditions for biomass production were estimated for Pakistan and most of India. For most of West Africa, below average biomass production was estimated. In China, abundant rainfall created favorable conditions for the North China Plain. In Australia, conditions were predominantly below average.

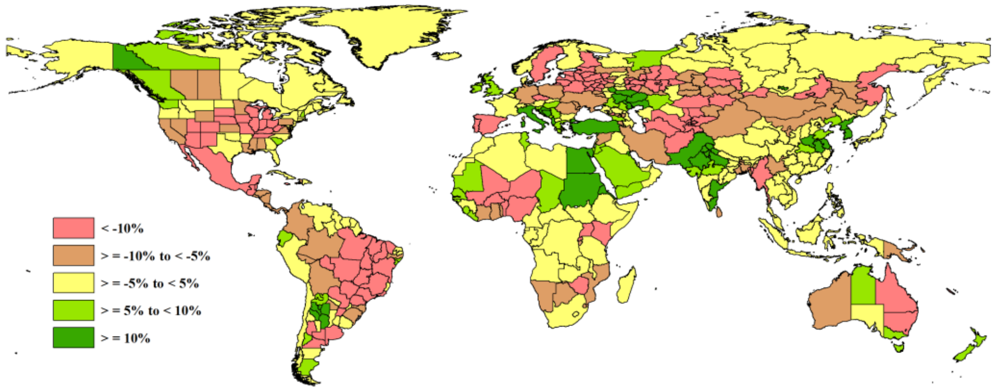


Figure 3.4 National and subnational biomass production potential anomaly (as indicated by the BIOMSS indicator) of of April 2023 to July 2023 total relative to the 2008-2022 average (15YA), in percent.

3.2 Country analysis

This section presents CropWatch analyses for each of 46 key countries (China is addressed in Chapter 4). The maps and graphs refer to crop growing areas only: (a) Phenology of major crops; (b) Crop condition development based on NDVI over crop areas at national scale, comparing the April-July 2023 period to the previous season and the five-year average (5YA) and maximum; (c) Maximum Vegetation Condition Index over arable land (VCIx) for April-July 2023 by pixel; (d) Spatial NDVI patterns up to April-July 2023 according to local cropping patterns and compared to the 5YA; and (e) NDVI profiles associated with the spatial pattern under (d). Next, separate graphs (labeled as figures (f), (g), and subsequent letters) are included to illustrate crop condition development graphs based on NDVI average over crop areas for different agro-ecological zones (AEZ) within a country, again comparing the April-July 2023 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 - 3.50; Crop condition for individual countries ([AFG] Afghanistan to [ZMB] Zambia) including agro-ecological zones (AEZ) from April-July 2023.

AFG AGO ARG AUS BGD BLR BRA CAN DEU DZA 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

[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. Winter wheat got harvested in April and May. The other crops were sown in that time frame as well. Maize will reach maturity in August and rice one month later.

The agro-climatic conditions showed that RAIN decreased by 55%, TEMP increased by 0.5°C and RADPAR increased by 1%. BIOMSS decreased by 14% as compared to the 15YA. The CALF decreased by 41%, reaching only 8%, and the VCIx was recorded at 0.44.

Based on the NDVI-based crop condition development graph, it is evident that the growth of crops remained below both last year's and the five-year average levels.

The last CropWatch bulletin highlighted that adverse agricultural conditions persist in Afghanistan, with negative NDVI departures for 48.2% of the total cropped areas. These challenging conditions are predominantly concentrated in the northern regions of the country, including Balkh, Faryab, and Jowzjan provinces. Afghanistan has been grappling with a four-year-long drought, causing groundwater levels to steadily decline. This year's insufficient rainfall in April and May, coupled with the continued hot and dry climate, has further exacerbated the situation, making water supply even more challenging.

Around 38% of the total cropped areas, mainly located in the central and southern regions of Afghanistan, are experiencing average crop growth. However, some provinces encountered flooding disasters in late July, such as Wardak and Kabul. These events, affecting relatively dispersed and limited agricultural lands, had only a restricted impact at the national level.

Furthermore, Afghanistan's Crop Performance Index (CPI) stood at 0.74, indicating a poor overall agricultural production situation. All in all, the crop conditions in Afghanistan are even worse than last year. In addition, a large portion of arable farm land remained uncropped.

Afghanistan's vulnerability due to fragile infrastructure and a significant portion of its population living below the poverty line amplifies the challenges posed by consecutive years of poor crop growth. The combination of this year's arid conditions and localized flooding disasters has further exacerbated the already dire crop growth situation, escalating the threat to food security. Urgent actions are needed to address these challenges and ensure the well-being of the population.

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).

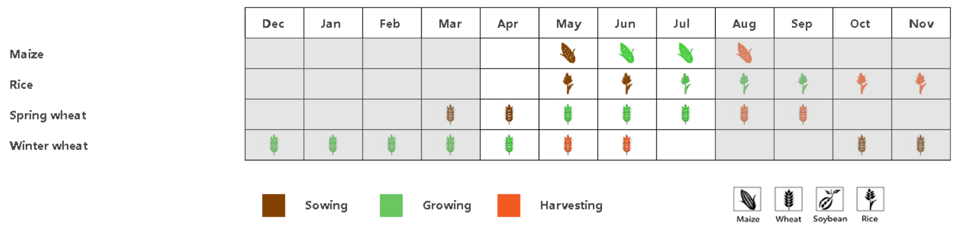
The RAIN in the Central region with sparse vegetation was 51 mm, indicating a decrease of 67% compared to the 15YA. TEMP was 16.0°C, showing an increase of 1.5°C. RADPAR measured 1644 MJ/m2, which represents a 1% increase. The BIOMSS decreased by 18%. The CALF experienced a decrease of 9% as compared to the 5YA, now standing at 10%. The VCIx value was 0.54. According to the NDVI-based crop condition development graph, the crop conditions in this region were below average and similar to last year's levels.

The Dry region experienced reduced RAIN at 74 mm (-10%), accompanied by elevated TEMP at 23.4°C (+0.7°C). RADPAR measured 1634 MJ/m2 (-2%). According to the NDVI-based crop condition development graph, crop conditions were subpar, and CALF was limited to 5% (-10%). The VCIx of 0.31 highlighted poor crop growth.

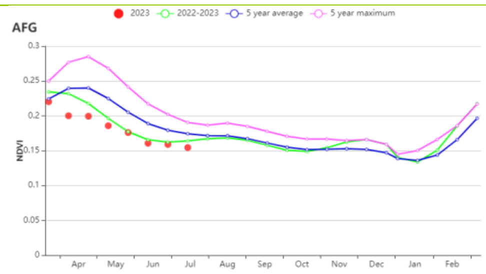
The Mixed dry farming and irrigated cultivation region experienced a substantial RAIN decrease with 127 mm recorded (-60%). The TEMP rose slightly to 17.5°C (+0.2°C), while RADPAR increased to 1613 MJ/m2 (+3%). BIOMSS exhibited a decline of 21% at 559 g DM/m2, and CALF dropped to 13% (-39%). The VCIx value was 0.51. The NDVI graph shows that conditions were below the average and below those of the previous year.

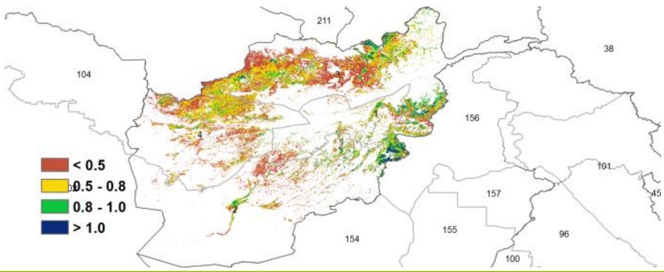
In the Mixed dry farming and grazing region, RAIN was 17 mm, signifying a substantial decrease by 76% compared to the 15YA. TEMP stood at 21.6°C, marking an increase of 0.8°C. RADPAR was measured at 1642 MJ/m2, closely aligning with average levels. CALF was extremely low at 2%, indicating a significant decrease of 77%. The VCIx value was 0.44. BIOMSS measured 491 g DM/m2, displaying a 17% reduction. According to the NDVI-based crop condition development graph, the NDVI values were notably lower than the five-year average, pointing to unfavorable conditions.

Figure 3.5 Afghanistan's crop condition, April - July 2023

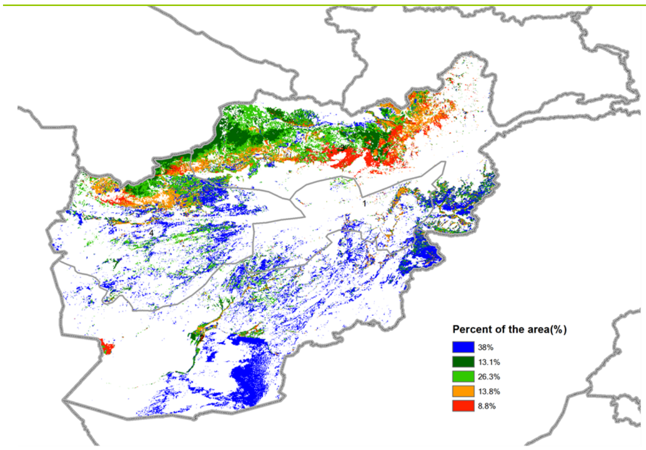


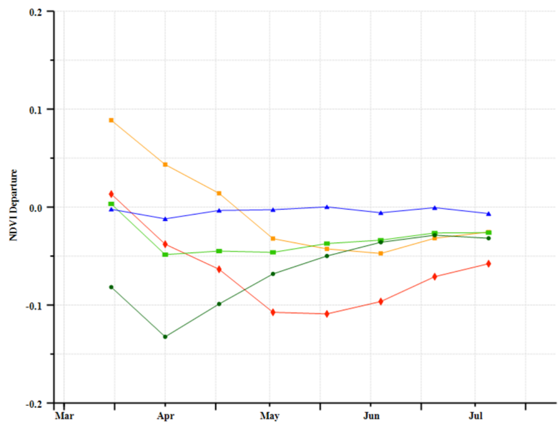
(a) Phenology of major crops



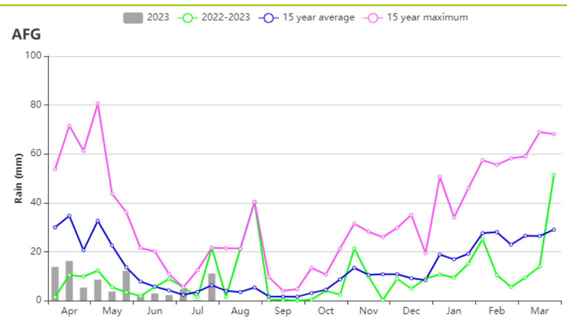


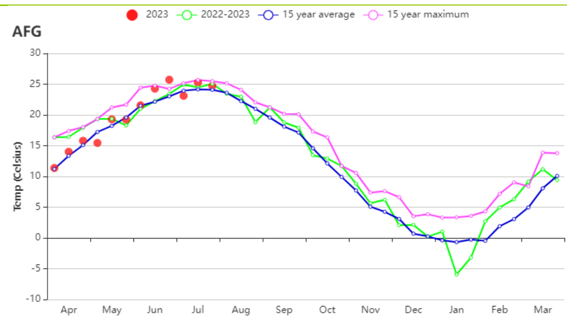
(b) Crop condition development graph based on NDVI (c) Maximum VCI



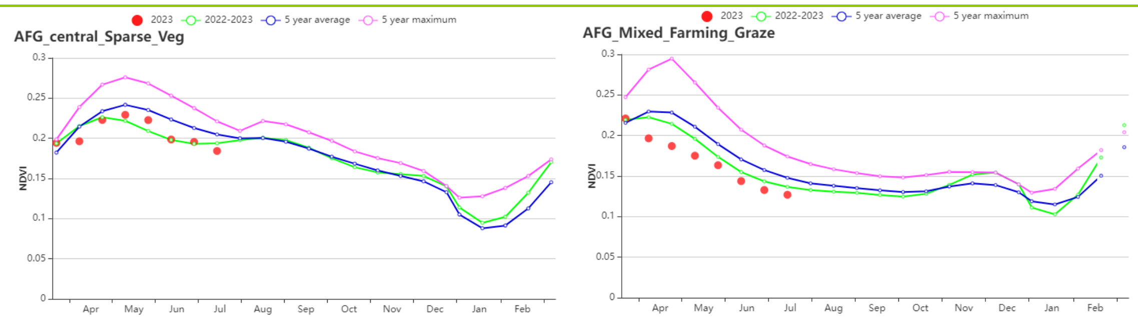


(d) Spatial NDVI patterns compared to 5YA (e) NDVI profiles

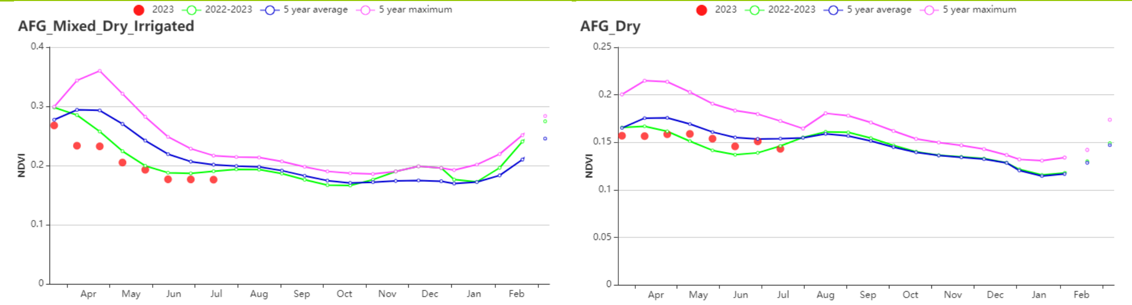




(f) Rainfall profiles (g) Temperature profiles



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



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

Table 3.1 Afghanistan's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, April - July 2023

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Central region	51	-67	16.0	1.5	1644	1	465	-18
Dry region	74	-10	23.4	0.7	1634	-2	589	-6
Dry and irrigated cultivation region	127	-60	17.5	0.2	1613	3	559	-21
Dry and grazing region	17	-76	21.6	0.8	1642	0	491	-17

Table 3.2 Afghanistan's agronomic indicators by sub-national regions, current season's values and departure from 5YA, April - July 2023

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Central region	10	-9	0.54
Dry region	5	-10	0.31
Dry and irrigated cultivation region	13	-39	0.51
Dry and grazing region	2	-77	0.44

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

In Angola, the monitoring period from April to July corresponds to crucial stages in the harvesting of both maize and rice. For this period, land preparation and wheat plantation activities were undertaken in designated wheat planting regions. This timeframe aligns with the colder season, and as evidenced by national agroclimatic indicators, the cumulative rainfall for this period was 168mm. This amount is 13% lower than the fifteen-year historical average. Alongside this, the temperature has risen by 0.7ºC during the same period. Simultaneously, reductions have been observed in the total photosynthetic active radiation, showing a decline of 1%. Taken together, these conditions potentially contribute to a decrease in the overall biomass production within the country, with a decline of 3% in estimated biomass production levels.

The slightly negative anomalies recorded in total rainfall, coupled with the observed temperature rises, exerted a notable impact on the wheat production zone. According to the national crop conditions development based on the NDVI profile, the crop conditions across these regions remained below the five-year historical average throughout the reporting period. However, there also are positive indications within the maximum vegetation condition index (VCIx) for the provinces of Zaire, Uige, Cuanza Norte, Bengo, Luanda, and Huila. Nonetheless, despite the promising outlook for VCIx in these provinces, the spatial NDVI patterns, in conjunction with the NDVI profiles, indicate that crop conditions in these areas still lagged behind the five-year historical average. However, moderate proximity to average crop conditions is reported in 64.4% of the region.

Across the entire nation, the proportion of cropped arable land saw a 1% expansion, while the maximum VCIx reached a value of 0.88. Coupled with a national crop production index of 1.09, the outlook for agricultural yields in Angola during the reporting period appears slightly below average.

Regional Analysis

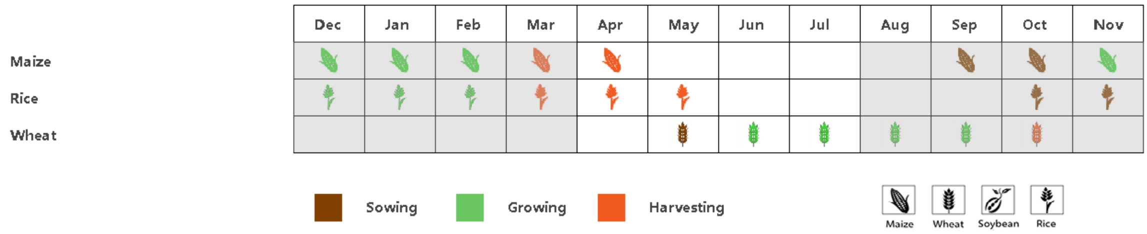
Considering the cropping systems, climate zones, and topographic conditions, CropWatch has divided Angola into five agroecological zones (AEZs), including the Arid zone (5), Central Plateau (6), Humid zone (7), Semi-arid zone (8), and Sub-humid zone (9).

At the regional level, the agroclimatic indicators show that, apart from the arid zone, which recorded a 24% increase in total rainfall, the remaining zones experienced decreases: 10% in the subhumid zone, 20% in the central plateau, 21% in the semiarid zone, and 23% in the humid zone. The recorded temperatures increased in all agroecological zones, with the highest increases observed in the humid zone (TEMP +0.6ºC) and the semiarid zone (TEMP +1.1ºC). During this period, Photosynthetic Active Radiation (RADPAR) decreased in all regions except the arid zone. The combination of increased total rainfall and decreased RADPAR in the arid zone resulted in a 3% increase in total biomass production across the region. Conversely, this indicator recorded a 2% decrease in the humid zone and a 3% decrease in the central plateau, semiarid zone, and subhumid zone.

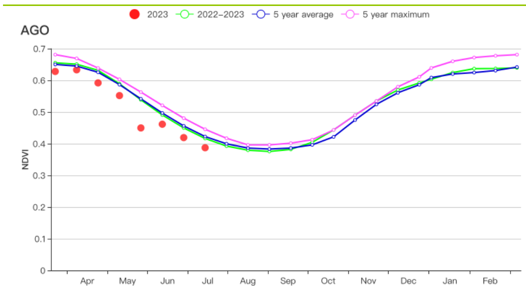
The regional crop development, as depicted by NDVI graphs, reveals unfavorable crop conditions throughout the monitoring period in the semiarid and subhumid zones. The arid and central plateau zones reported conditions close to the average. In the humid zone, crop conditions remained below the average of the past five years from April until the end of May, recovering in June. However, by the end of the monitoring period, crop conditions in this region became less favorable.

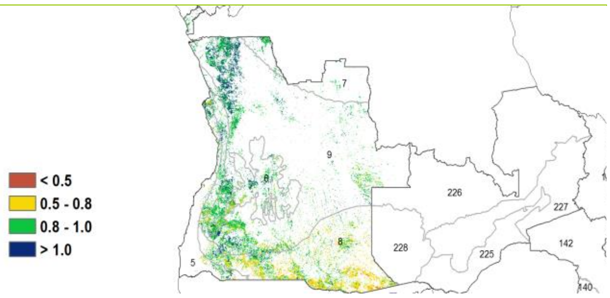
Regarding the agronomic indicators, the arid zone registered a 10% expansion in the total cropped arable land area, whereas in the central plateau and semiarid zone, this expansion was 2%. Increases in Cropped Arable Land Area Fraction (CALF) were also noted in the Sub-humid zone (CALF +1%), while in the Humid zone, it remained around the average. The maximum VCIx observed during this period was 0.94 in the Humid zone, while the lowest value of 0.79 was recorded in the Semiarid zone. The CPI for this period varied from 1 to 1.1.

Figure 3.6. Angola's crop condition, April–July 2023



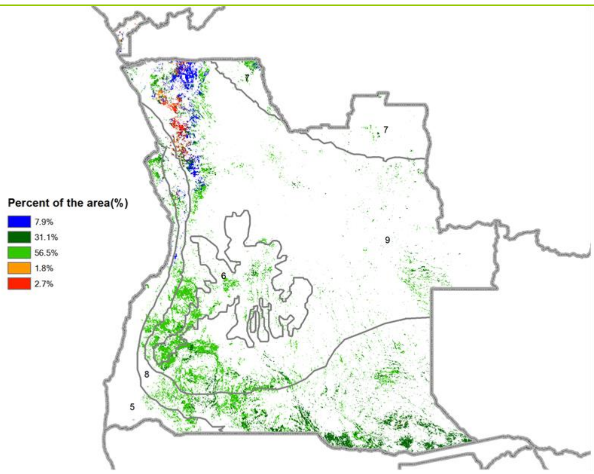
(a) Phenology of major crops

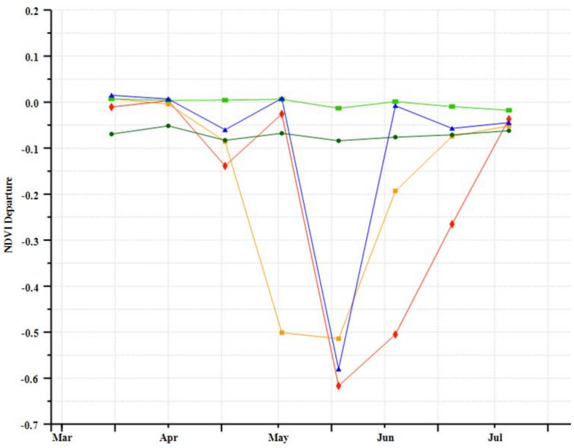




(b) Crop condition development graph based on NDVI

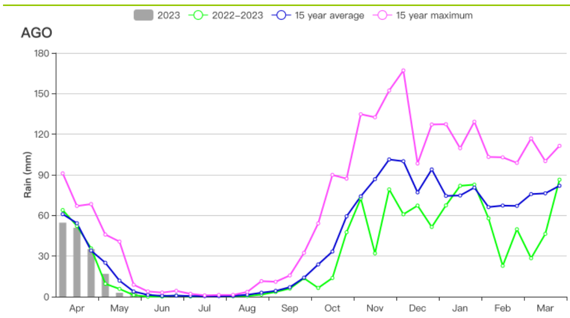
(c) Maximum VCI

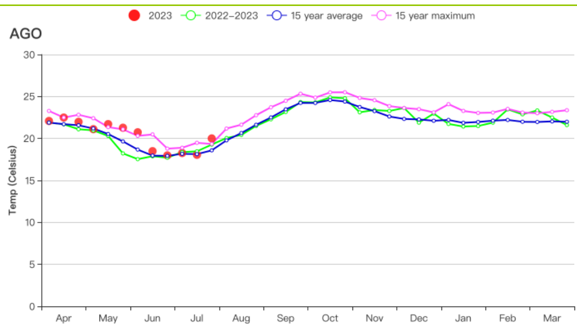




(d) Spatial NDVI patterns compared to 5YA

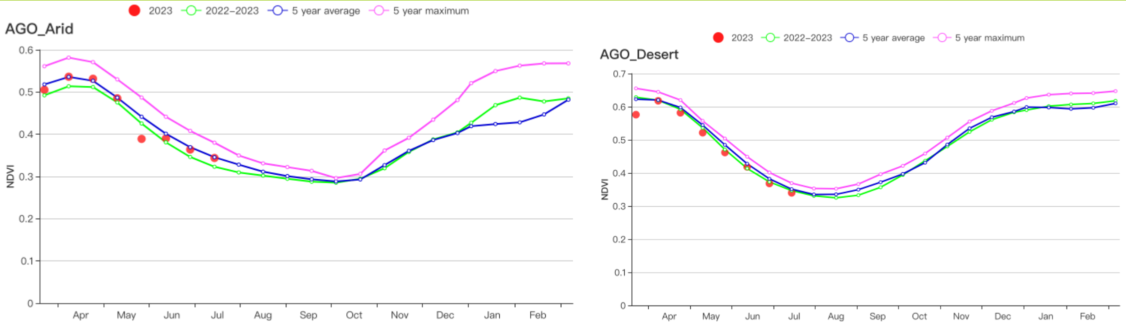
(e) NDVI profiles



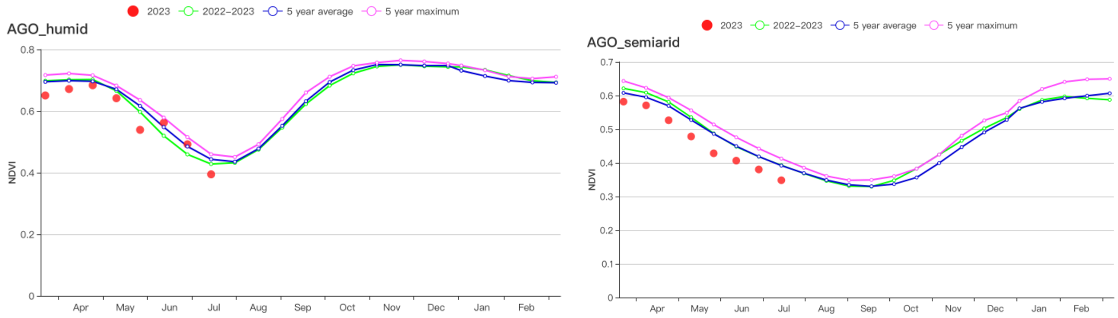


(f) rainfall profiles

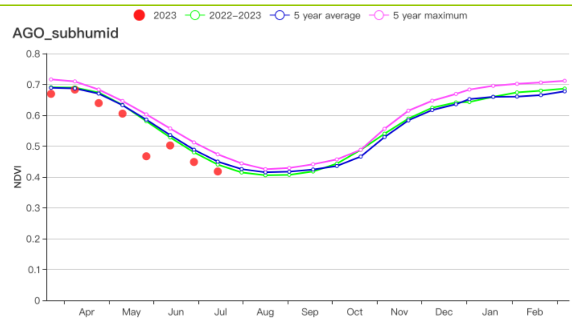
(g) temperature profiles



(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 3.3 Angola's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, April – July 2023

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	174	24	22.4	0.2	1171	-2	569	3
Central Plateau	104	-20	16.4	0.3	1237	-1	438	-3
Humid zone	331	-23	23.1	0.6	1219	-1	846	-2
Semi-Arid Zone	60	-21	20.0	1.1	1180	-1	393	-3
Sub-humid zone	228	-10	20.3	0.4	1210	-1	576	-3

Table 3.4 Angola's agronomic indicators by sub-national regions, current season's values and departure from 5YA, April – July 2023

Region	CALF		Maximum VCI
	Current(%)	Departure from 5YA (%)	Current
Arid Zone	85	10	0.89
Central Plateau	99	2	0.91
Humid zone	100	0	0.94
Semi-Arid Zone	96	2	0.79
Sub-humid zone	100	1	0.93

[AFG] Afghanistan

The reporting period covers mainly the fallow period of summer crops, as well as the harvesting of late maize, soybean and rice, and the sowing of wheat. CropWatch subdivides Argentina into eight agro-ecological zones (AEZ) based on cropping systems, climatic zones, and topography. During this monitoring period, most crops were grown in these four agro-ecological zones, identified by numbers on the NDVI departure cluster map: Chaco (11), Mesopotamia (12), Humid Pampas (13), and Subtropical Highlands (17). The other agro-ecological zones were less relevant. Maize and soybean are planted in the four mentioned AEZs, while rice is planted in North Mesopotamia and East Chaco and wheat is planted in Humid Pampas, Chaco, and South Mesopotamia.

For the whole country, rainfall showed a -9% negative anomaly, TEMP showed a 1.0℃ positive anomaly, and RADPAR showed a 6% negative anomaly. RAIN showed a strong positive anomaly in Subtropical Highlands (+51%) and negative anomalies in Mesopotamia (-23%), Humid Pampas (-11%), and Chaco (-1%). TEMP showed positive anomalies and with similar values in all AEZs: Subtropical Highlands (+1.1℃), Humid Pampas (+1.0℃), Mesopotamia (+1.0℃), and Chaco (+0.9℃). RADPAR showed negative anomalies in all AEZs: Subtropical Highlands (-13%), Chaco (-7%), Humid Pampas (-6%), and Mesopotamia (-1%).

At the national level, rainfall profiles showed values below average several times during the reporting period. TEMP showed variability above and below average values but with a dominance of cases with positive anomalies and with higher values than observed negative anomalies.

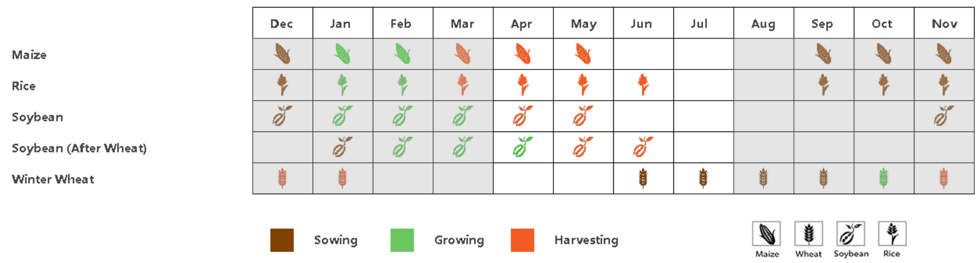
The crop condition development graph based on NDVI showed for the whole country, below average values during April and May, and no anomalies since June. Mesopotamia and Subtropical Highlands showed near average conditions for most of the reporting period but showed a negative anomaly at the beginning of April and a positive anomaly at the end of July. Pampas showed negative anomalies in April and May and nearly no anomalies in June and July. Chaco trended below the 5YA throughout this monitoring period.

Spatial distribution of NDVI profiles determined five homogeneous spatial patterns. A profile with positive anomalies up to the beginning of June, and near no anomalies since the end of June (orange profile) was observed in South Pampas. A profile with a negative anomaly at the beginning of April and positive anomalies since May (dark green profile) was observed in Subtropical Highlands, South Mesopotamia, and North East Pampas. The blue profile showed negative anomalies during April and negative anomalies since May. It was observed in Chaco, North Mesopotamia, and most of Pampas. A profile with negative anomalies during April and May and near no anomalies since June (red profile), was observed in Center East and North Pampas. Finally, a profile with negative anomalies during all the reporting period (light green profile) was observed in Center Pampas.

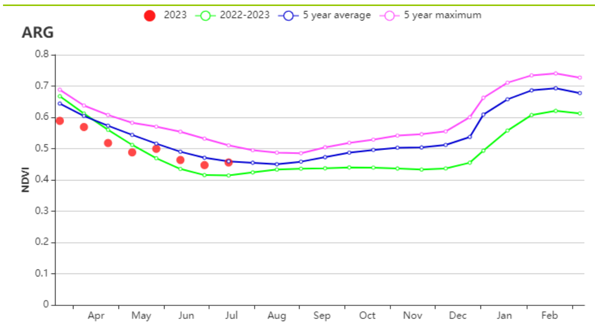
At the national level, BIOMSS showed a negative anomaly of 1%, CALF showed a 3% negative anomaly and VCIx showed an average value of 0.77. BIOMSS showed positive anomalies in Subtropical Highlands (+24%) and Chaco (+3%), and negative anomalies in Mesopotamia (-5%) and Humid Pampas (-4%). CALF showed a strong reduction only in Humid Pampas (-5%) and no anomalies in the rest of the AEZs. Maximum VCI showed good conditions for Subtropical Highlands (0.88) and Mesopotamia (0.82), and regular to poor conditions in Chaco (0.78) and Humid Pampas (0.74). VCIx map showed regular to poor conditions in most of the agricultural areas of the country. The lowest values were observed in the Southern extreme of Pampas (Carmen de Patagones department), as well as in the Center and part of North West Pampas. Good conditions in VCIx were observed in South Pampas, West Subtropical Highlands and North Mesopotamia. Crop Production Index showed values above average for Subtropical Highlands (1.04) and below average for Mesopotamia (0.96), Chaco (0.95) and Humid Pampas (0.88).

In summary, conditions varied greatly among the AEZs. Subtropical Highlands and Mesopotamia showed good conditions in several agroclimatic indices: near no anomalies in NDVI profiles, higher VCIx and CPI. On the contrary, Pampas and Chaco showed higher negative anomalies in NDVI profiles, lower VCIx and CPI values. Pampas also showed a strong anomaly in CALF that can be related to a delay in planting of winter crops. This period is mainly a fallow period for summer crops and includes the final stages of late summer crops. In consequence, soybean and maize production was mostly defined during the last reporting period, which showed poor conditions for Argentina. Better conditions in some of the regions during this period only partially compensated production losses for maize and soybean.

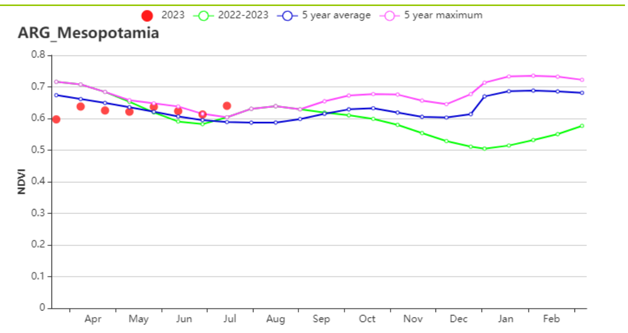
Figure 3.7 Argentina's crop condition, April - July 2023



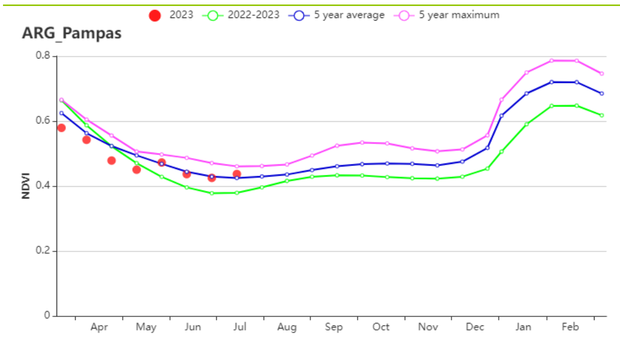
(a) Phenology of major crops



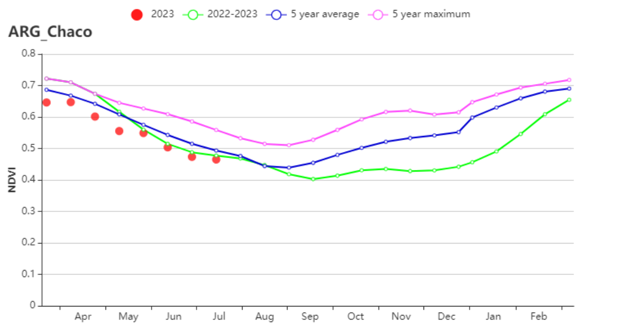
(b) Crop condition development graph based on NDVI (Argentina)



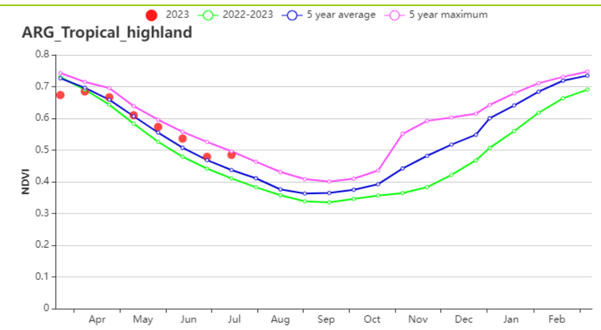
(c) Crop condition development graph based on NDVI (Mesopotamia)



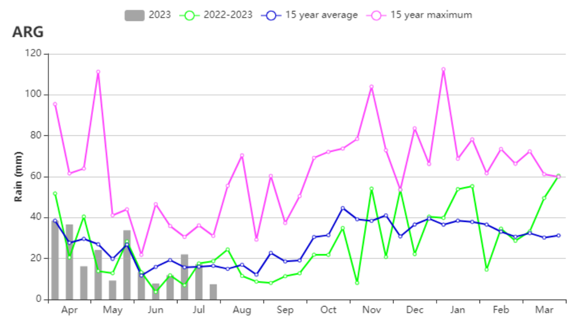
(d) Crop condition development graph based on NDVI (Humid Pampas)



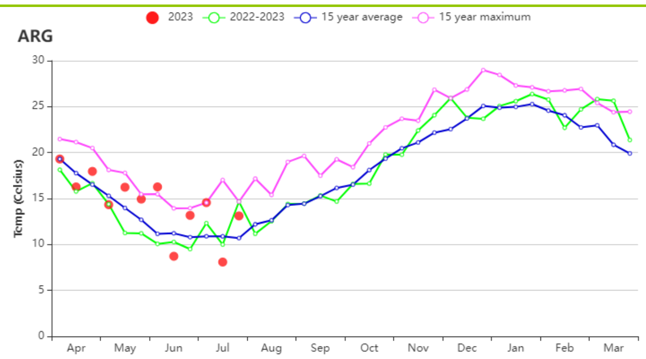
(e) Crop condition development graph based on NDVI (Chaco)

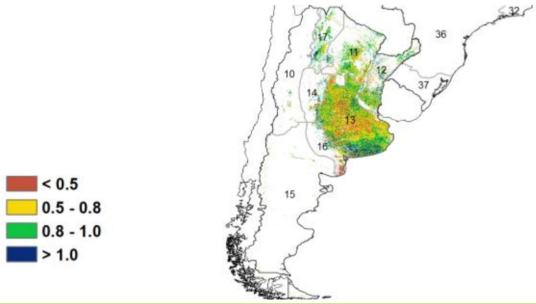


(f) Crop condition development graph based on NDVI (Subtropical Highlands)



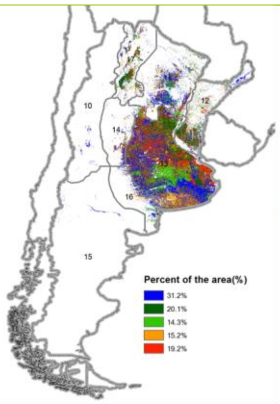
(g) Rainfall profiles

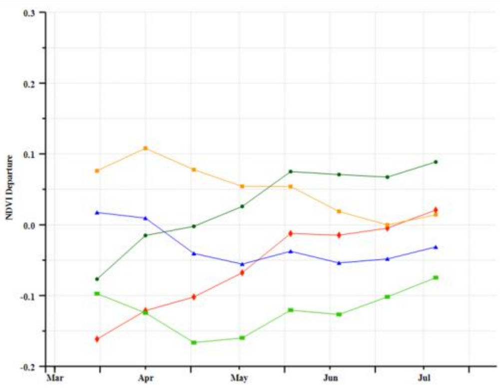




(h) Temperature profiles

(i) Maximum VCI





(j) Spatial NDVI patterns compared to 5YA

(k) NDVI profiles

Table 3.5 Argentina's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, April - July 2023

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Chaco	274	-1	17.1	0.9	594	-7	617	3
Mesopotamia	344	-23	16.1	1	605	-1	720	-5
Humid Pampas	173	-11	13.3	1	568	-6	441	-4
Subtropical Highlands	259	51	14.9	1.1	692	-13	554	24

Table 3.6 Argentina's agronomic indicators by sub-national regions, current season's values and departure from 5YA, April - July 2023

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Chaco	99	0	0.78
Mesopotamia	100	0	0.82
Humid Pampas	88	-5	0.74
Subtropical Highlands	99	0	0.88

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[AUS] Australia

According to the phenology map, Australia's wheat was sown in May, and will be ready for harvest starting in October. Below-average rainfall was received at the national scale (-15%). Both the temperature and radiation were average. Insufficient rainfall resulted in a below-average estimate for biomass (-8%). The agronomic indicators were positive, with a VCIx of 0.74 and an average CALF (+1%).

The national NDVI from April to July was slightly better than last 5-years average, but considerably lower than 5-years maximum. The VCI map also indicates that the crop conditions were overall average. Low values (< 0.5) were mainly found in the southwest and southeast areas of the country. The NDVI departure clustering shows that 15.1% of the cropland remained below average throughout the whole monitoring period, and 16.5% were mostly below, while only 15.9% were favourable.

Overall, the agro-climatic indicators in the reporting period are below last year's levels, but still close to the longerm average. The average CALF and NDVI, and CPI of 0.86 indicate near average 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 had average agro-climatic indicators (RAIN, +1%; TEMP, -0.2°C; RADPAR, -4%), which led to an average biomass accumulation estimation (BIOMSS, 0%). The CALF was also average, and the maximum VCI was 0.81. The condition for this region have been normal, so far. The production of wheat will be determined by the climatic conditions in the next period.

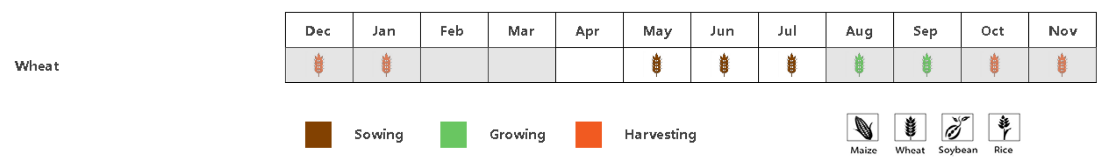
The rainfall was only 81 mm in Subhumid subtropical zone (-45%), which caused a soil moisture deficit. The temperature was average (+0.1 °C), and the radiation was slightly above average (+5%). The biomass was largely below average (-22%). The CALF (-5%), VCIx of 0.59, and the mostly below average NDVI profiles all indicated poor conditions in this AEZ.

The Southwestern wheat encountered a dry (RAIN, -16%), cold (TEMP, -1.1 °C), and cloudy (RADPAR, -5%) period. The biomass was consequently below average (-12%). The CALF was slightly increased by +4%, with a VCIx of 0.69. The NDVIs were above average from April to May, but then below average. The condition in this zone was below average.

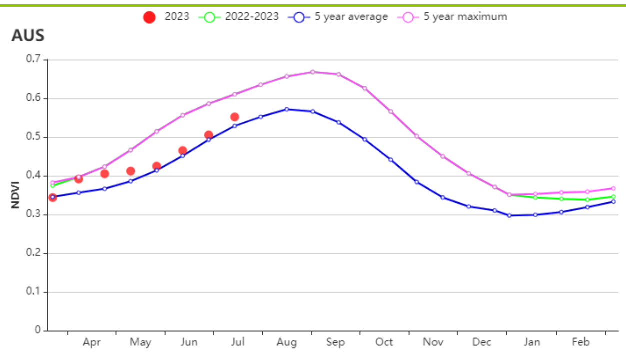
The Wet temperate and subtropical zone was also dry (-19%), but warmer (+0.5 °C). The radiation was average (+2%). The below average rainfall caused a below average biomass (-8%). The CALF was average and VCIx was 0.78. The mostly below average NDVI profile indicates an unfavorable condition.

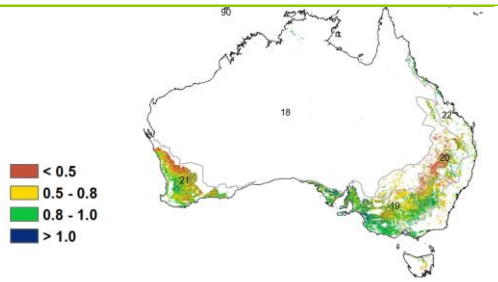
Overall, the conditions in Australia were average to below average, due to the rainfall deficit.

Figure 3.8 Australia's crop condition, April- July 2023

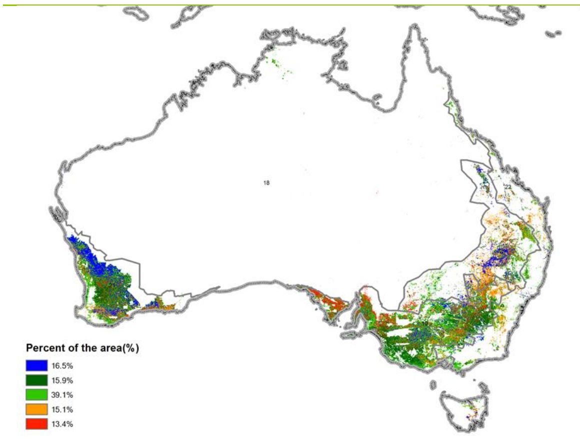


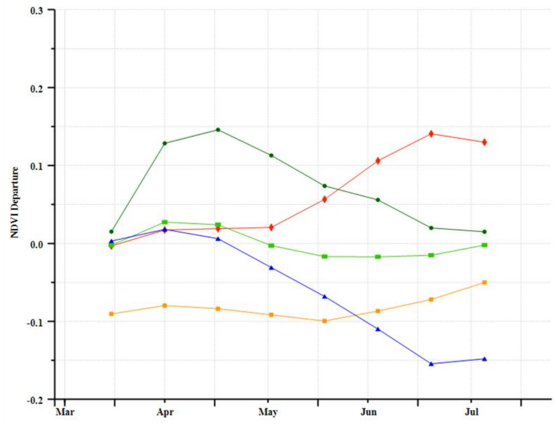
(a). Phenology of major crops



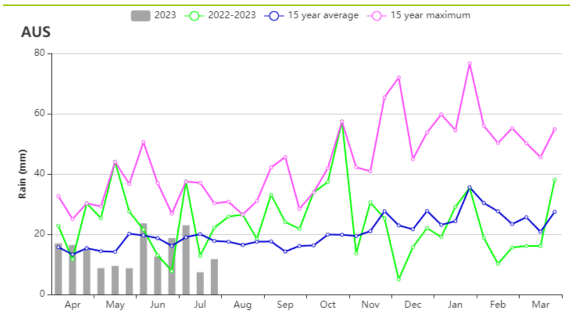


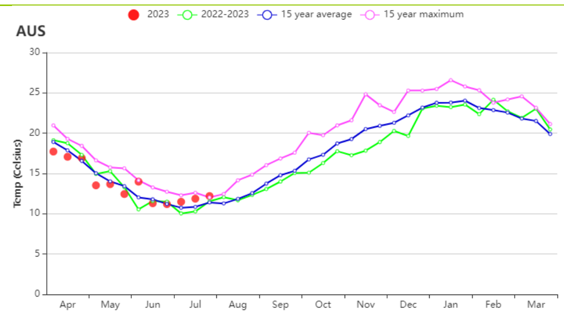
(b) Crop condition development graph based on NDVI (c) Maximum VCI



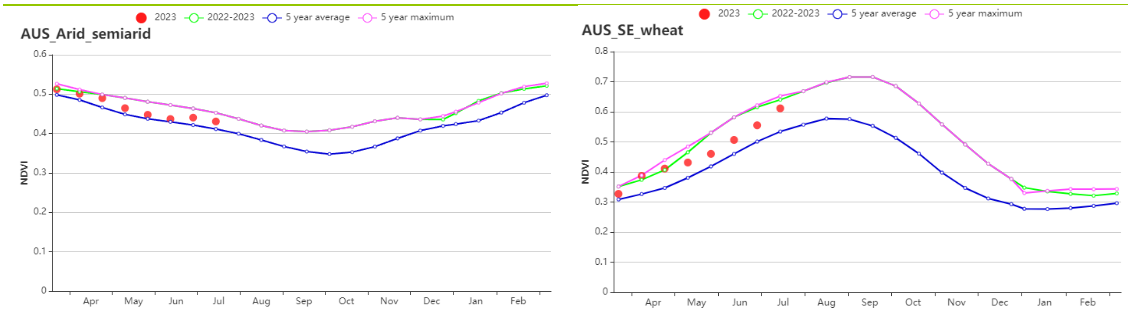


(d) Spatial NDVI patterns compared to 5YA (e) NDVI profiles

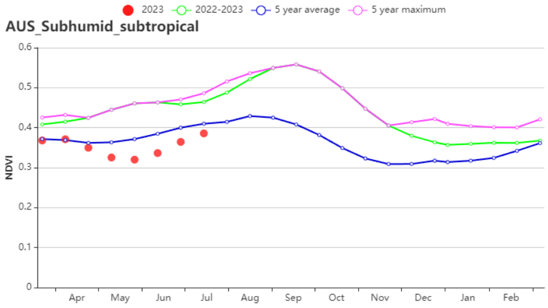


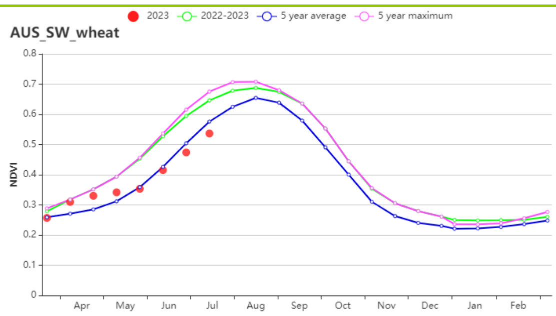


(f) Rainfall profiles (g) Temperature profiles

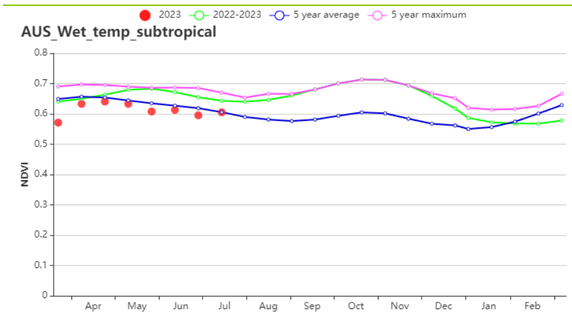


(h) Crop condition development graph based on NDVI (Arid and semiarid zone (left) and Southeastern wheat area (right))





(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 3.7 Australia agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, April - July 2023

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Arid and semiarid zone	152	25	21.7	0.1	1007	-1	522	5
Southeastern wheat area	208	1	11.9	-0.2	544	-4	506	0
Subhumid subtropical zone	81	-45	14.3	0.1	812	5	343	-22
Southwestern wheat area	196	-16	12.9	-1.1	595	-5	483	-12
Wet temperate and subtropical zone	200	-19	13.1	0.5	674	2	523	-8

Table 3.8 Australia’s agronomic indicators by sub-national regions, current season’s values and departure from 5YA, April - July 2023

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Arid and semiarid zone	76	2	0.85
Southeastern wheat area	92	0	0.81
Subhumid subtropical zone	61	-5	0.59
Southwestern wheat area	93	4	0.69
Wet temperate and subtropical zone	99	0	0.78

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[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 May and Aus rice harvest was mostly completed in July. Rainfall was greatly below average (-29%), both TEMP (+0.8℃) and RADPAR (+6%) were higher than the 15YA. The potential biomass decreased by 9%. The national NDVI development graph showed that crop conditions across the country were lower than the 5-year average from April to July and then returned to the average in late July. In April and May, low precipitation was the main reason for poor crop conditions. The large drops in June might have been caused by cloud cover in the satellite images. The spatial NDVI pattern shows that 38.1% of the cultivated area was close to average. The rest of the area, mainly distributed in central Bangladesh, had big drops in late June and early July, but returned to average levels in late July. The maximum Vegetation Condition Index (VCIx) was 0.94, with most areas higher than 0.8 and CALF was 97%. 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 (23), the Gangetic plain (24), the Hills (25), and the Sylhet basin (26).

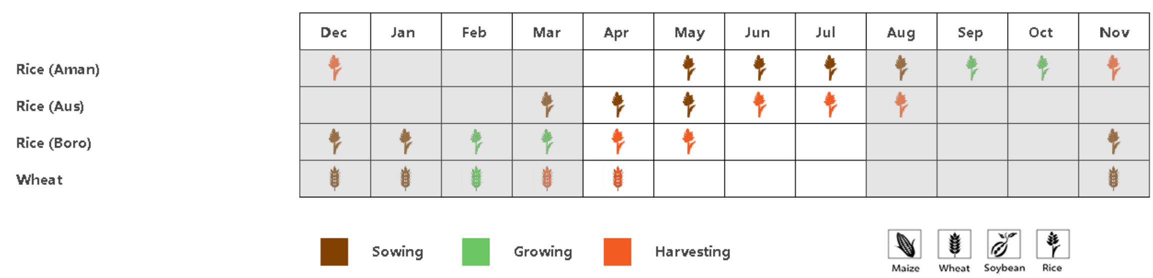
In the Coastal region, rainfall was 17% below average. TEMP and RADPAR were above average (+0.3°C and +3%). The crop condition development graph based on NDVI shows that crop conditions were close to the 5-year average except in late June and early July. CALF was at 91% and VCIx at 0.97. BIOMSS was below average (-7%). Conditions were near average.

The Gangetic plain also experienced a decrease in rainfall (-18%). Both TEMP and RADPAR were above average (+0.7°C and +6%). BIOMASS was slightly below average (-6%). The crop condition development graph based on NDVI shows crop conditions were below the 5-year average except in early April and the end of July. CALF (97%) was average. VCIx was 0.92. They indicated slightly below average conditions in this region.

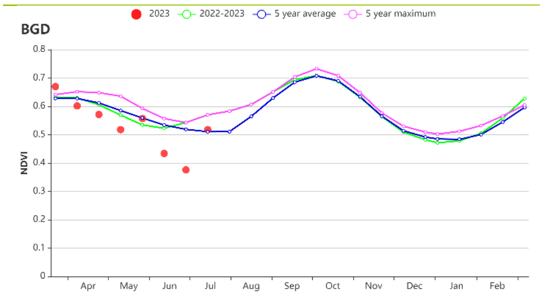
The Hills received the lowest precipitation amount of 706 mm (-63%), both TEMP and RADPAR were above average (+0.7°C and +8%). Estimated biomass production was reduced by 18%. The NDVI development graph showed that crop conditions across the region were close to the 5-year average except for the end of June. CALF (97%) was 1% higher than average. VCIx (0.91) indicated average crop prospects.

Rainfall was greatly below average (-29%) in the Sylhet Basin. TEMP was 1.0°C above average, and RADPAR was 5% 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 at the end of May and July. The BIOMSS was below average (-9%). A high CALF at 99% and VCIx of 0.95 indicated average crop conditions.

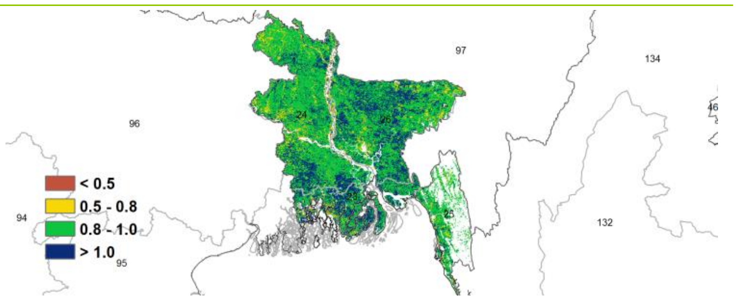
Figure 3.9 Bangladesh's crop condition, April - July 2023



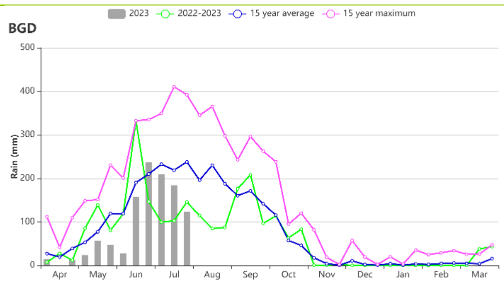
(a). Phenology of major crops



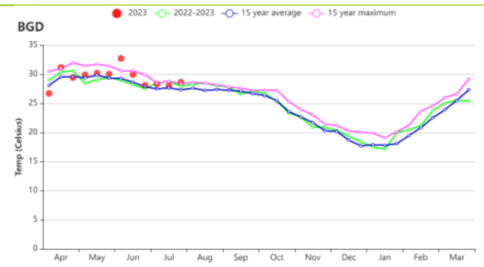
(b) Crop condition development graph based on NDVI



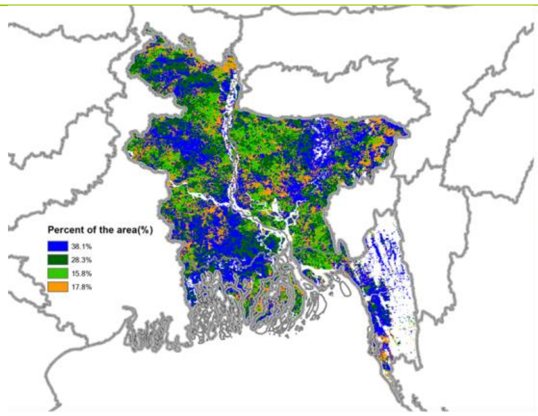
(c) Maximum VCI



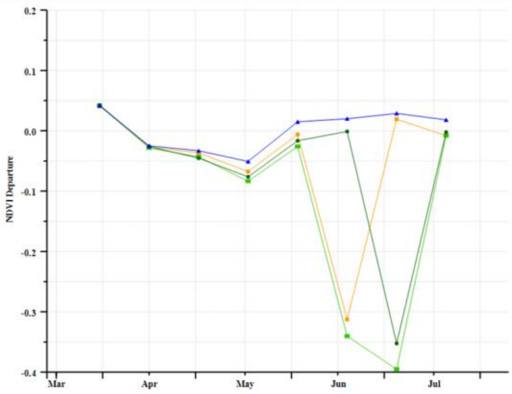
(d) Time series rainfall profile



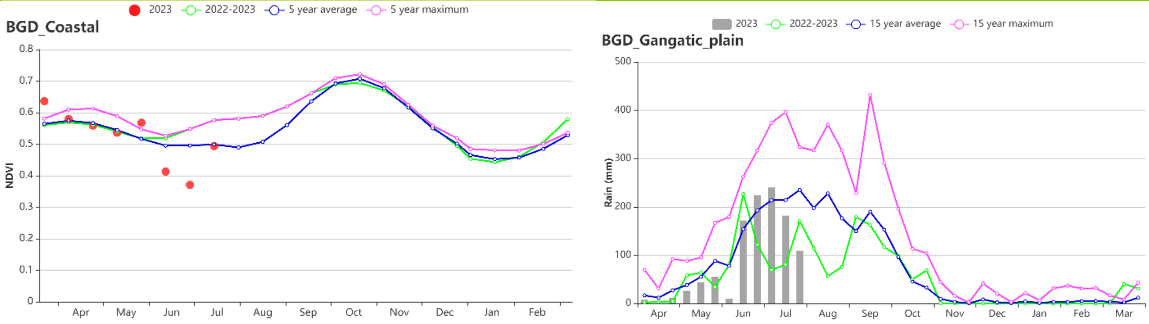
(e) Time series temperature profile



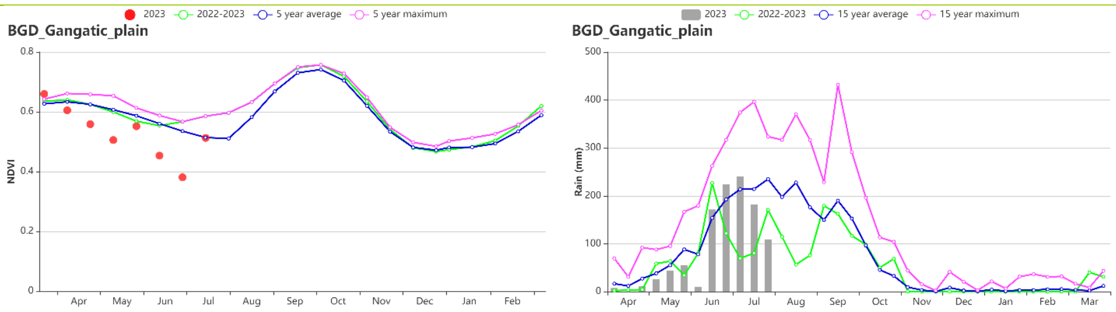
(f) Spatial NDVI patterns compared to 5YA



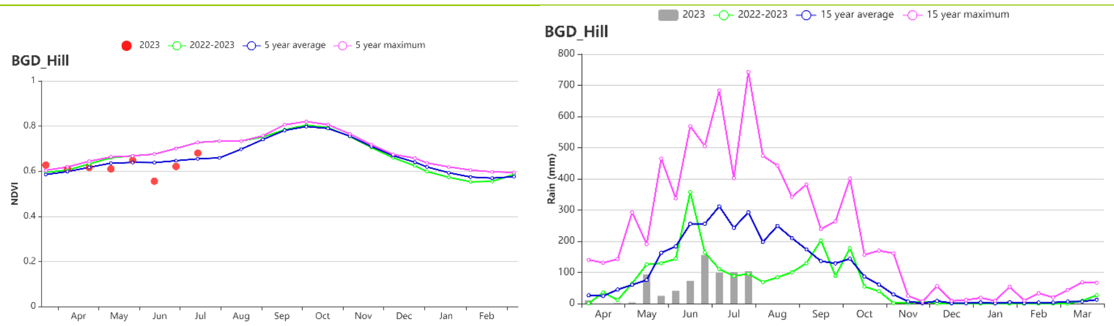
(g) NDVI profiles



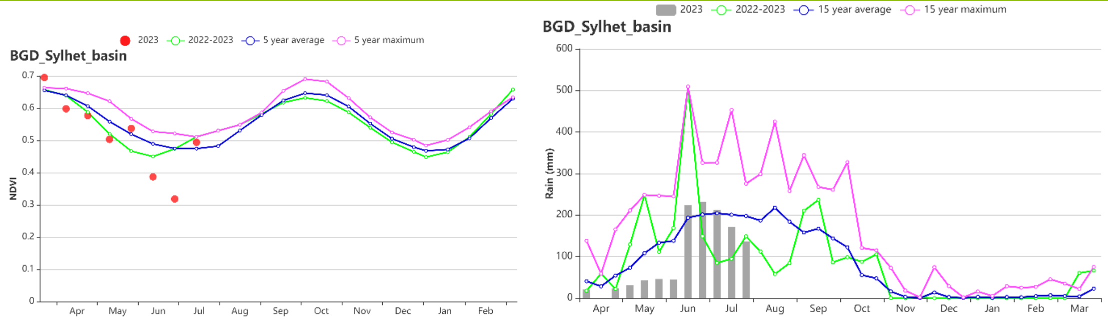
(h) Crop condition development graph based on NDVI (left) and rainfall profile (right) of Coastal region



(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 3.9 Bangladesh's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, April - July 2023

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	1203	-17	29.7	0.3	1365	3	1353	-7
Gangetic plain	1082	-18	30.2	0.7	1335	6	1311	-6
Hills	706	-63	28.0	0.7	1387	8	1259	-18
Sylhet basin	1187	-24	29.2	1.0	1296	5	1393	-9

Table 3.10 Bangladesh's agronomic indicators by sub-national regions, current season's values and departure from 5YA, April - July 2023

Region	CALF		Maximum VCI
	Current (%)	Departure from 5YA (%)	Current
Coastal region	91	5	0.97
Gangetic plain	97	0	0.92
Hills	97	1	0.91
Sylhet basin	99	0	0.95

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[BLR] Belarus

The reporting period covers the planting of spring wheat and summer crops, which ended in late June. Winter wheat harvest started in July. The nationwide rainfall reached 248 mm, which was -23% below the 15YA average. Solar radiation (RADPAR -2%) was slightly below the 15YA, temperature (0.0°C) remained the same as average, the potential biomass was expected to decrease by 14%. For this period, rainfall is a key factor controlling crop growth. Agronomic conditions were generally within the normal range: good values for VCIx (0.85) and cropped arable land fraction (CALF 100%) were observed.

The NDVI development graph was overall below the 5-year average from April to July, especially in Northern Belarus where the trend line was far below average from June to July. The spatial pattern showed large variability across the regions. Crop conditions on about 71.7% of the cropped area were close to the 5-year average. About 28.3% of cropped areas were 0.1 NDVI units below the average, mostly scattered in the north-east and along the northern-western border, due to the significant rainfall decline. The average national VCIx was 0.85, lower than last year's 0.93, indicating generally satisfactory but slightly worsening crop prospects in most crop areas compared to previous periods. The crop production index (CPI) was 1.01. All in all, crop conditions were below average due to the rainfall deficit.

Regional analysis

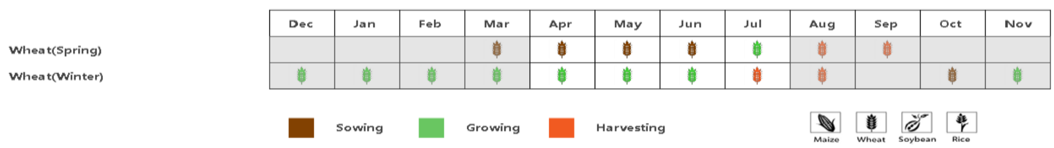
Based on cropping system, climatic zones and topographic conditions, regional analyses are provided for three agro-ecological zones (AEZ), including Northern Belarus (028, Vitebsk, northern area of Grodno, Minsk and Mogilev), Central Belarus (027, Grodno, Minsk and Mogilev and Southern Belarus (029)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

Northern Belarus recorded a minor increase of radiation (1%) and temperature (0.2°C) but a significant decrease of rainfall (-32%). Therefore, BIOMSS was expected to decrease by 20%. The VCIx reached 0.82, slightly below the national average of 0.85, indicating crops in the region were moderately stressed due to lower rainfall. CALF had reached 100%. CPI of 0.97 was close to 1 but lower than other regions. The NDVI development curve was generally below average, especially from June to July.

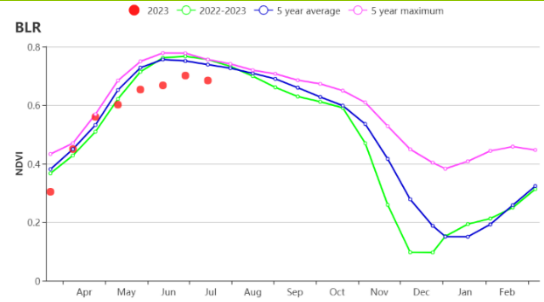
Central Belarus experienced a decrease in solar radiation (-4%) and temperature (-0.1°C) as well as rainfall (-21%). The resulting potential biomass was expected to decrease by approximately 13%. CALF (100%), VCIx (0.86) and CPI of 1.03 indicate close to normal conditions. However, the rainfall deficit and the strong negative departure of the NDVI curve indicate below average conditions.

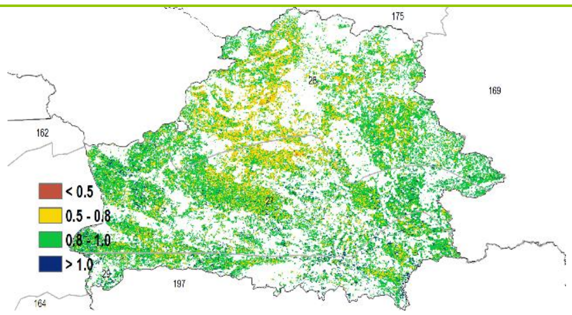
Southern Belarus (southern halves of Brest and Gomel regions) experienced the same agro-climatic condition as the Central area. Lower rainfall (-5%), temperature (-0.4°C) and lower radiation (-6%) were recorded. The BIOMSS is projected to decrease by 5%. Favorable agronomic indicators (CALF 100%, VCIx 0.89) were observed. CPI value was 1.06. The conditions for spring wheat were slightly better than in the other regions.

Figure 3.10 Belarus's crop condition, April – July 2023.

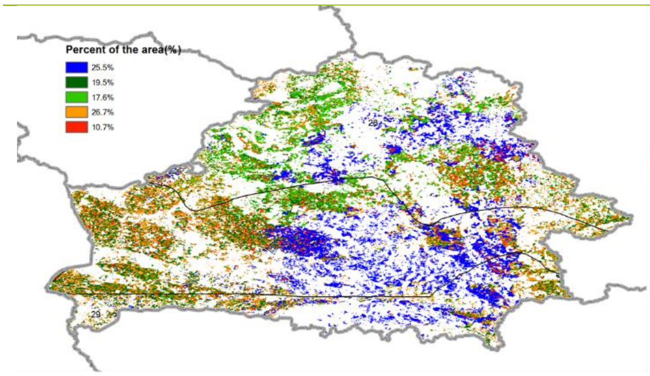


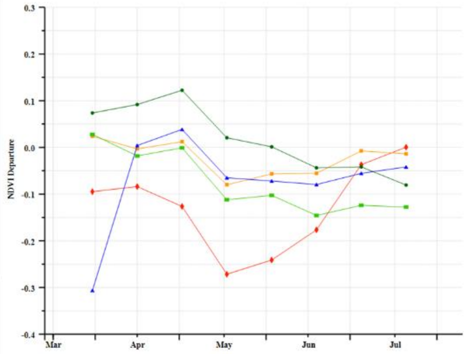
(a). Phenology of major crops



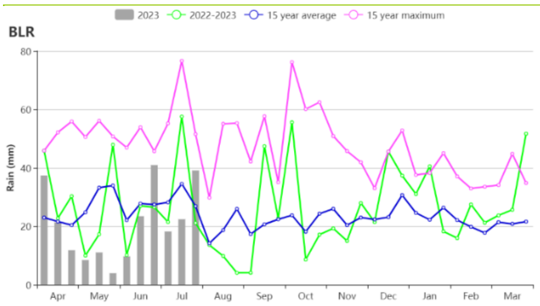


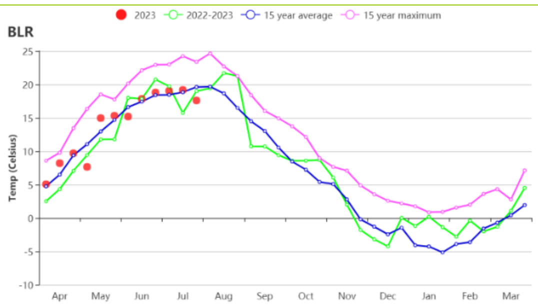
(b) Crop condition development graph based on NDVI (c) Maximum VCI



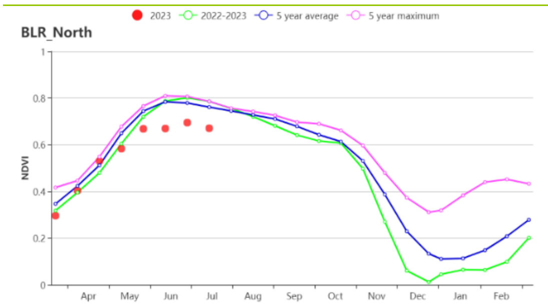


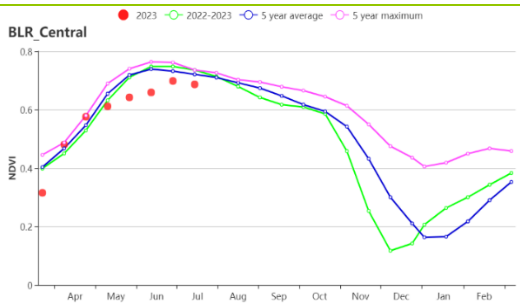
(d) Spatial NDVI patterns compared to 5YA (e) NDVI profiles



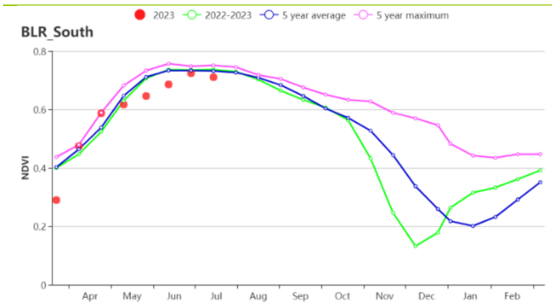


(f)Rainfall time series (g) Temperature time series





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



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

Table 3.11 Belarus's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, April – July 2023.

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m^2)	Departure (%)	Current (gDM/m^2)	Departure (%)
Center	253	-21	14.3	-0.1	1080	-4	734	-13
North	228	-32	13.5	0.2	1108	1	681	-20
South-west	282	-5	14.8	-0.4	1077	-6	780	-5

Table 3.12 Belarus's agronomic indicators by sub-national regions, current season's values and departure from 5YA, April – July 2023.

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Center	100	0	0.86
North	100	0	0.82
South-west	100	0	0.89

[BRA] Brazil

During the monitoring period, the summer crops (maize, soybean, and rice) had reached maturity and got harvested. The only exception is maize in the northeast, which will be harvested starting in October. Wheat was sown from April to May and was approaching its peak growth phase by the end of July. Overall, crop conditions in Brazil remained close to the 5-year average and last year's conditions.

Drier and warmer weather than usual dominated the growing season of summer crops. Agro-climatic indicators at the national scale present generally unfavorable conditions with 40% below average rainfall, 1.4 °C higher temperatures and 3% above average RADPAR. Shortage of rainfall and high temperature and radiation, resulted in BIOMSS being 21% below the 15YA. The prolonged dry and warm weather affected almost the entire country. All the major agricultural states suffered from a rainfall deficit and above average temperatures (+0.6 °C in Santa Catarina to +2.9 °C in Goias). The largest rainfall was observed in Santa Catarina, with a measurement of 501 mm. On the other hand, the least rainfall was recorded in Goias, with only 5 mm. This marked the largest departure from the 15-year average, with a 97% decrease. Radiation departures among the provinces ranged from -0.4% in Rio Grande Do Sul to +9.4% in Sao Paulo. Dry and hot weather resulted in an obvious drop in BIOMSS in all major agricultural-producing states, especially in Sao Paulo (-42%), Goias (-38%), and Minas Gerais (-34%).

The crop development profile based on NDVI for Brazil presents slightly below-average values. The distribution of NDVI departure from the 5YA and the corresponding profiles further illustrate the spatial variations of crop growth conditions. Most crops in Mato Grosso Do Sul, western Parana, and western Sao Paulo (in blue color on the NDVI departure cluster map) presented well above average crop conditions although the region experienced a rainfall deficit. The major reason is the irrigation systems along the Parana River which provide 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 conditions presented below average conditions in the rainfed regions as dry weather conditions played a decisive role. The VCIx map shows a 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.

Despite insufficient precipitation, according to the VCIx map, the values across the country are still considerable. The national VCIx is 0.9, higher compared to the previous monitoring period. It seems that the dry weather did not affect the crop cultivation and the CALF was at 99%, comparable with the 5YA. The CPI value for Brazil is 1.09, which indicates normal conditions.

All in all, although crop conditions in Brazil were below, but close to average and CropWatch estimates the average wheat outputs.

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).

Similar to the dry and hot weather pattern at the national level, all AEZs received below average rainfall ranging from -10% in Coast to -89% in Central Savanna. Above average temperatures were recorded in the eight AEZs, with the largest positive departure of temperature in the Central savanna (+2.7°C) above the 15YA. Meanwhile, above average RADPAR was also observed in most AEZs except for Southern subtropical rangelands (-2%). The continuous dry, hot, and sunny weather conditions in all AEZs hampered crop growth and resulted in lower BIOMSS from -6% to -30%. Among the AEZs, crop condition in Parana River was well below average with the lowest BIOMSS (-30%) compared to other AEZs. The largest VCIx was observed in Northeastern mixed forest and farmland at 0.94, while Central Savanna presented the lowest VCIx at 0.81.

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

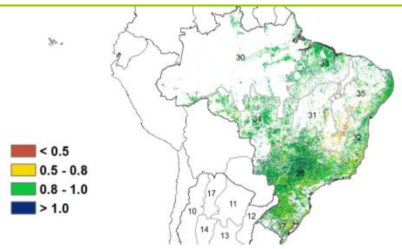
The Central Savanna (31), Mato Grosso (34), and the Parana Basin(36) are the main production areas for maize and soybeans. They received below average rainfall. This resulted in close to normal crop growth conditions, as presented in the NDVI-based crop development profile. While rainfall was all below average, resulting in lower BIOMSS, soil moisture was normal and replenished by irrigation, which benefited crops. The CPI values for the three AEZs were 1.05, 1.12, and 1.10, respectively, confirming favorable prospects for crop production.

Among the AEZs, crop condition in Nordeste (35) was well below average, with the lowest CPI (0.9) and VCIx (0.85) values compared to other AEZs. According to NDVI profiles, crop growth conditions in Nordeste were below average throughout the monitoring period. In addition, CALF was below average (-2%).

According to NDVI profiles, crop growth conditions in Southern Subtropical Rangelands (37) were below average in the first half of the monitoring period. However, precipitation has increased since July, reaching or slightly exceeding the average value. The temperature remains within normal levels. Its RADPAR is the only negative value among the eight AEZs. Due to deficient precipitation in the early stage, there was a slight decrease in potential biomass, but the NDVI has risen in the later period with abundant precipitation, surpassing the average value in July, making up for previous losses and promoting crop growth. Additionally, the cultivated land area has increased. The average VCIx was 0.9, and the CPI was 1.12, reflecting an overall good outlook for summer crops.

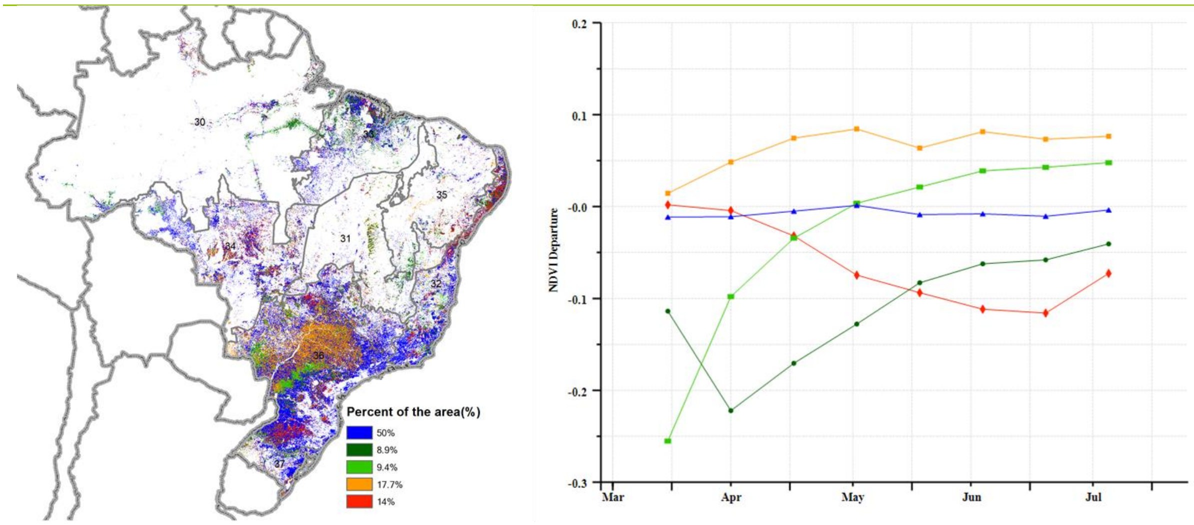
For more indicators and detailed information, please visit CropWatch Explore (http://cropwatch.com.cn/newcropwatch/main.htm).

Figure 3.11 Brazil's crop condition, April - July 2023

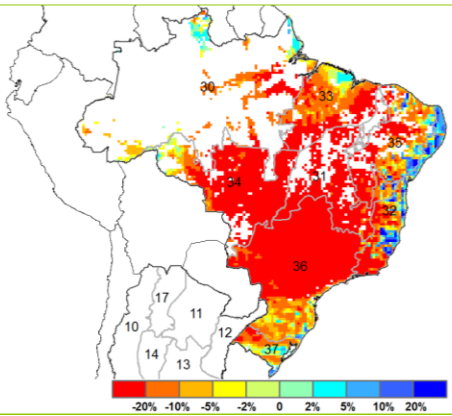


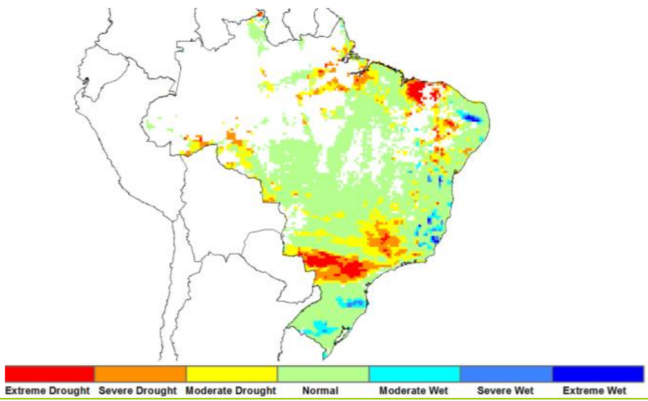
(a) Phenology of major crops (b) Maximum VCI

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

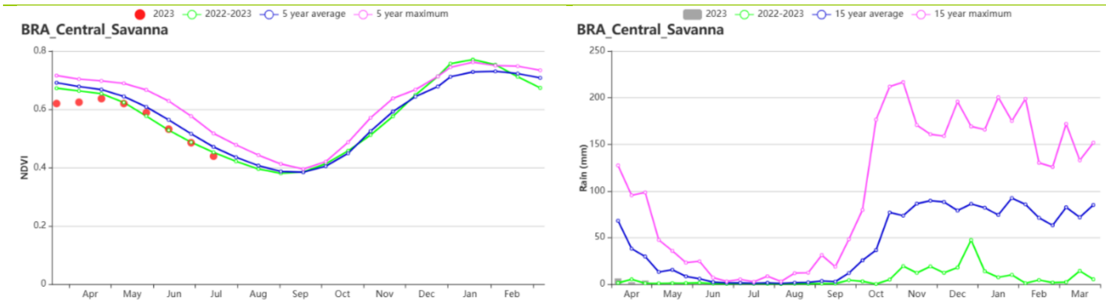


(d) Spatial distribution of NDVI departure from 5YA and NDVI departure profiles corresponding to the clusters

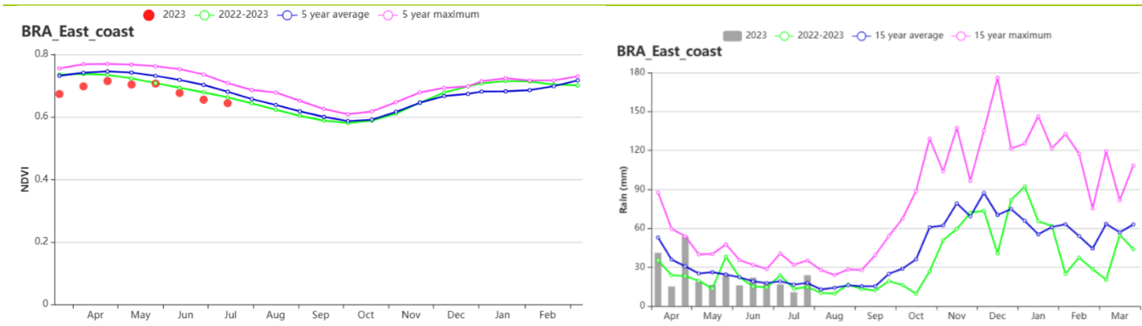




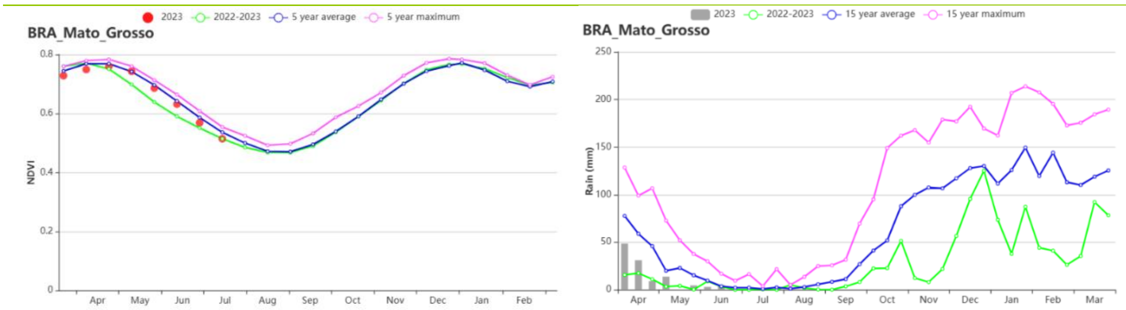
(e) Potential biomass departure from 15YA (f) Meteorological drought measured by standard precipitation index



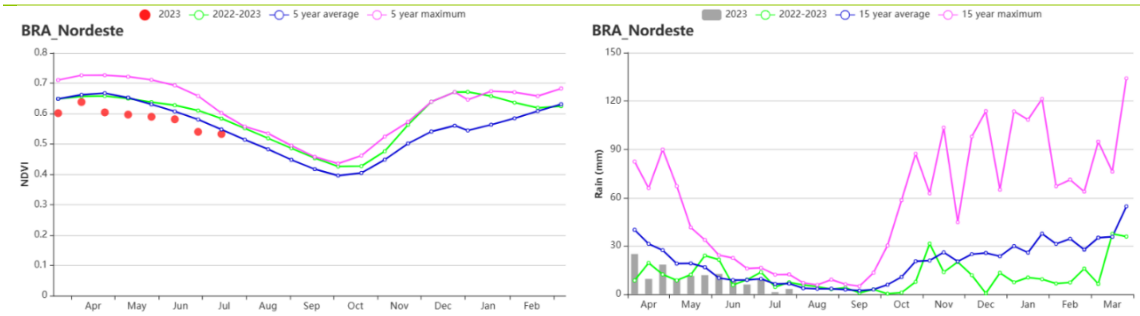
(g) Crop condition development graph based on NDVI (left) and rainfall profile (right) of Central Savanna



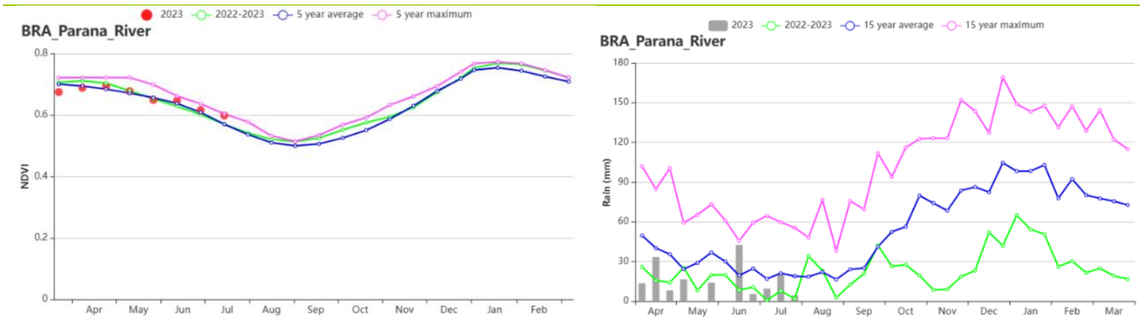
(h) Crop condition development graph based on NDVI (left) and rainfall profile (right) of Coast zone



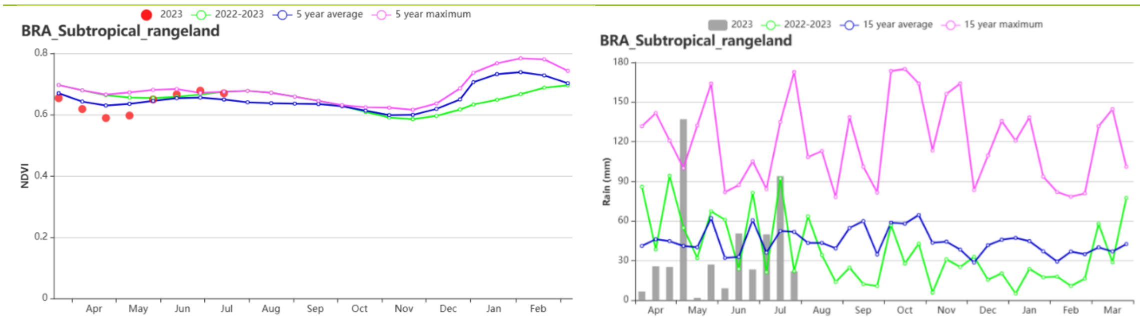
(i) Crop condition development graph based on NDVI (left) and rainfall profile (right) of Mato Grosso



(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 3.13 Brazil's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, April – July 2023

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Amazonas	595	-26	25.7	0.8	1116	1	1093	-12
Central Savanna	21	-89	25	2.7	1086	0	406	-33

Coast	276	-10	21.3	0.7	924	3	745	-6
Northeastern mixed forest and farmland	333	-43	26.5	1.3	1176	2	921	-17
Mato Grosso	115	-56	24.9	1.5	1097	2	524	-28
Nordeste	128	-38	25	1.1	1078	1	601	-13
Parana basin	169	-51	19.8	1.5	906	6	504	-30
Southern subtropical rangelands	472	-12	15.9	0.9	610	-2	784	-9

Table 3.14 Brazil's agronomic indicators by sub-national regions, current season's values and departure from 5YA, April - July 2023

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Amazonas	100	0	0.93
Central Savanna	97	0	0.81
Coast	100	0	0.89
Northeastern mixed forest and farmland	100	0	0.94
Mato Grosso	100	0	0.92
Nordeste	96	-2	0.85
Parana basin	100	0	0.91
Southern subtropical rangelands	99	1	0.90

AFG AGO ARG AUS BGD BLR BRA **CAN** DEU DZA 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

Most of the summer crops, which had been sown in April and May reached the grain-filling period by the end of July. The harvest of winter wheat started in July. Overall, crop conditions were close to average.

According to the CropWatch agroclimatic indicators, Canada experienced drier and warmer conditions. The proportion of irrigated cropland in Canada is only 5% and rainfall is an important factor affecting crop production. The temperature (TEMP 0.9°C) was above the 15-year average while the rainfall (RAIN -5%) and radiation (RADPAR -3%) was below average, which led to average potential biomass (BIOMSS -1%). According to the NDVI development graph, crop conditions were slightly below average, especially at the end of July.

As shown in the NDVI cluster map, the crop conditions were below average at the beginning and recovered to close to average after May on 44.9% of the cropped area, concentrated in the Western Prairies (including the north of Saskatchewan and the middle of Manitoba). Crop conditions on 21% of total cropped land were close to or above average except for the end of July. On 26.8% of total cropped land, crop conditions fluctuated below the average level. In the remaining parts, crop conditions were always below average. The national maximum VCI value was 0.90, and the CALF was slightly above the recent 5-year average (CALF 98%).

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

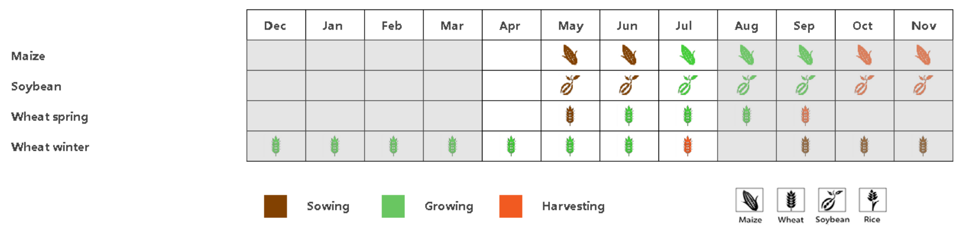
Regional analysis

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

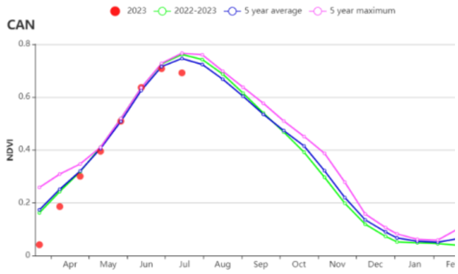
The rainfall in the Prairies, was significantly below average (RAIN 317 mm -12%), while the temperature was above the average (TEMP +1.4°C), and solar radiation was slightly below (RADPAR, -3%). The major crops in this region are winter wheat and spring wheat. According to the NDVI development graph and NDVI profile, crop conditions were below average in July. The negative departures were due to the deficit of precipitation and higher temperatures during the growing period of the summer crops. Crop conditions in the Prairies were slightly below average.

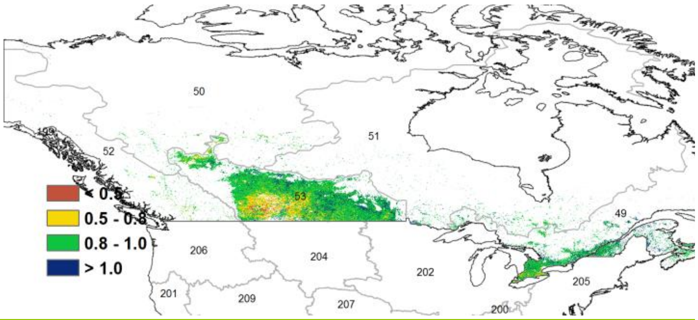
The conditions in the Saint Lawrence were close to average, with average precipitation, temperature and radiation (RAIN 0% TEMP +0.1°C; RADPAR -3%). Altogether, these agroclimatic conditions led to average potential biomass (BIOMSS +1%). According to the NDVI development graph, crop conditions were close 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 2023

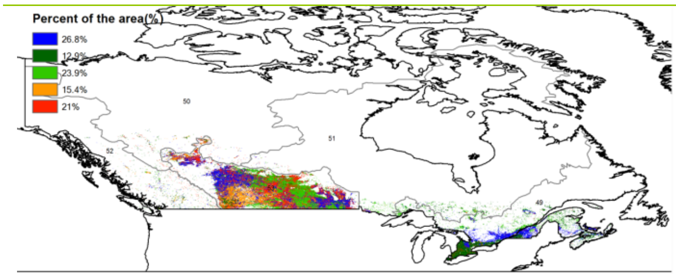


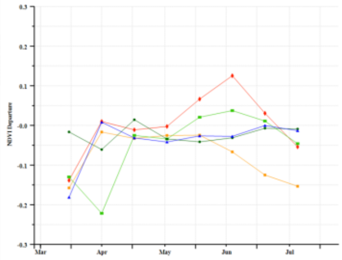
(a) Phenology of major crops



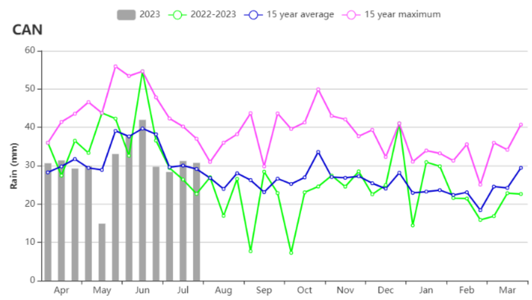


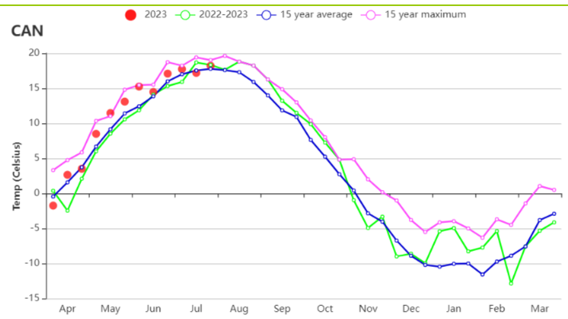
(b) Crop condition development graph based on NDVI (c) Maximum VCI



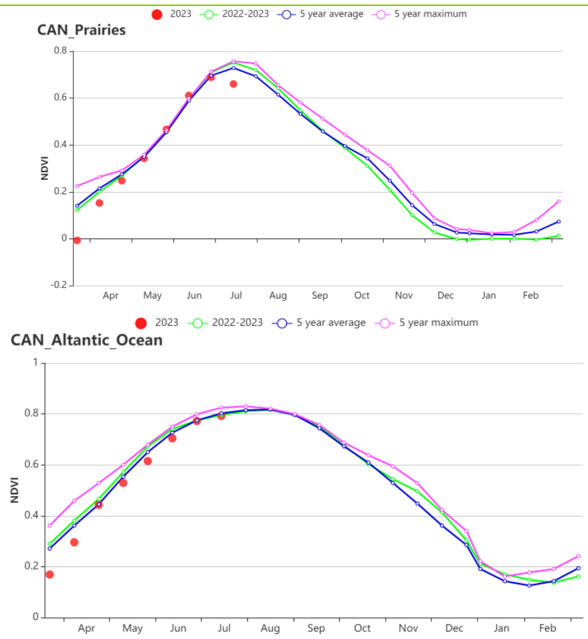


(d) Spatial NDVI patterns compared to 5YA (e) NDVI profiles





(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 3.15 Canada's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, April - July 2023

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Western Canada	381	-1	9.0	1.3	1186	-1	711	6
Prairies	317	-12	12.8	1.4	1204	-3	775	-5

Table 3.16 Canada's agronomic indicators by sub-national regions, current season's values and departure from 5YA, April - July 2023

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Western Canada	97	-1	0.87
Prairies	98	0	0.88

[DEU] Germany

This monitoring period began in April and ended in July. Winter wheat reached maturity in July. The planting of summer crops started in April and was completed by mid-May.

Germany experienced another rainfall deficit which was similar to last year. Total precipitation at the national level was below average (RAIN -10%). As shown in the time series rainfall profile for Germany, precipitation was significantly below-average from mid-May to mid-June. Abundant rain in July caused unfavorable conditions for harvest of the winter cereals. The average temperature (TEMP 13.8°C) and RADPAR (1196 MJ/m2) are the same as the average of the last 15 years. They were above average in June and early July. The precipitation deficit resulted in a 7% decrease in BIOMSS from 15YA.

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 in April, when they were above or close to average. These observations are confirmed by the clustered NDVI profiles: 83.5% 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 0.86. CALF during the reporting period was 100%.

Generally, the agronomic indicators show close to average conditions for most winter crops and below-average conditions for most 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. Frequent rainfall during the harvest period in July negatively impacted grain quality.

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 (56), Mixed Wheat and Sugar beet Zone of the Northwest (57), Central Wheat Zone of Saxony and Thuringia (55), Sparse Crop Area of the East-German Lake and Heathland area (54), Western Sparse Crop Area of the Rhenish Massif (59) and the Bavarian Plateau (58).

Schleswig-Holstein and the Baltic Coast are among the major winter wheat zones of Germany. Temperature was close to average in this region, except in June. Total precipitation was above average (RAIN +6%) and radiation was above average (RADPAR +3%). As a result, BIOMSS is expected to increase by 2% as compared to the average. As shown in the crop condition development graph (NDVI), the values were above average and last year's records until early May, when they dropped to below-average levels. The area has a high CALF (100%) as well as a favorable VCIx (0.88).

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, rainfall, temperatures and radiation were both higher than average (RAIN +1%; TEMP +0.1°C; RADPAR +2%). BIOMSS was same as average. As shown in the crop condition development graph based on NDVI, the values were below average except in April when they were close to the average level. The area has a high CALF (100%) and crop conditions for the region are favorable according to the high VCIx (0.87).

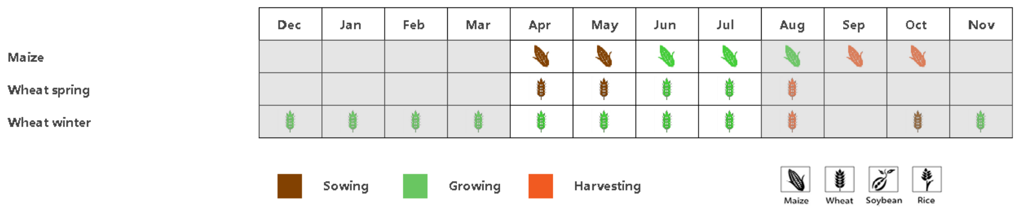
Central Wheat Zone of Saxony and Thuringia is another major winter wheat zone. Rainfall and temperatures were both below average (RAIN -24%; TEMP -0.1°C), but RADPAR was same as average, which led to a decrease in BIOMSS by 13%. As shown in the crop condition development graph based on NDVI, the values were above average until mid-May when they dropped to below-average levels. 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 -31%). Temperatures and radiation were both below average (TEMP -0.2°C; RADPAR -1%). As a result, BIOMSS is expected to decrease by 17% 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 for April when they were above average. The area has a high CALF (100%) and the VCIx was 0.87 for this region.

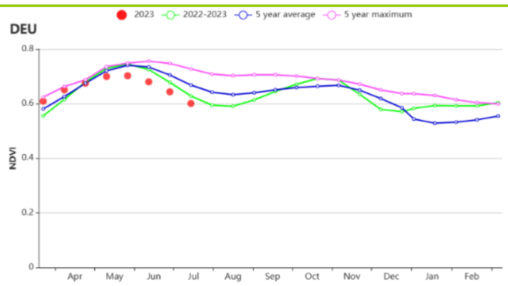
Significantly below-average precipitation was also recorded in the **Western Sparse Crop Area of the Rhenish Massif** (RAIN -24%) with above-average temperature and solar radiation (TEMP +0.4°C; RADPAR +1%). The biomass potential (BIOMSS) decreased by 13% compared to the 15YA. As shown in the crop condition development graph based on NDVI, the values were below average throughout the monitoring period except early April when they were above average. The CALF was 100% for the regions. The VCIx value was 0.86.

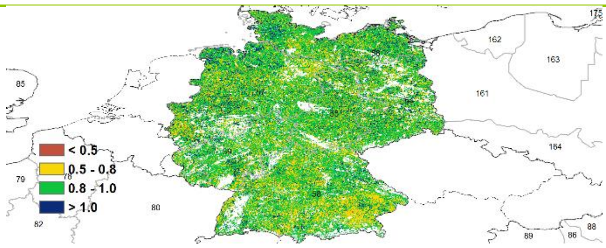
On average, a reduction in rainfall was recorded for the **Bavarian Plateau** (RAIN -10%), with below-average temperature (-0.2°C) and below-average radiation (RADPAR -2%). Compared to the fifteen-year average, BIOMSS decreased by 8%. As shown in the crop condition development graph based on NDVI, the values were above average in April, and below average from mid- May to June. The area had a high CALF (100%) as well as a favorable VCIx (0.86).

Figure 3.13 Germany's crop condition, April – July 2023

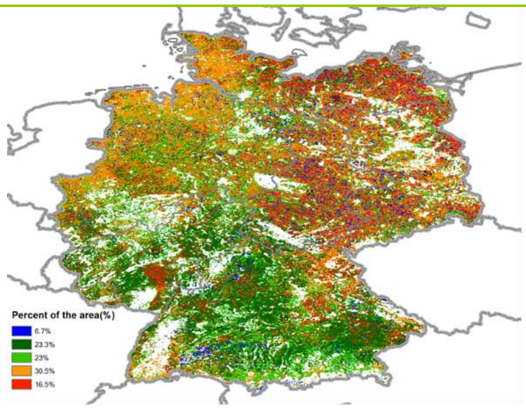


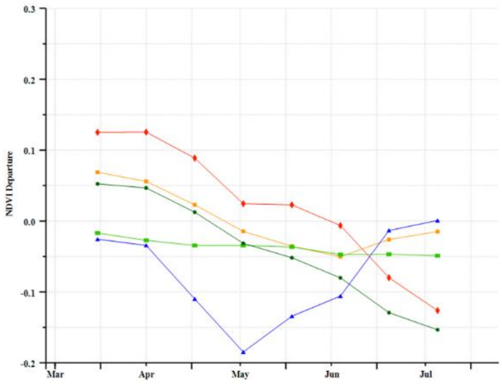
(a) Phenology of major crops





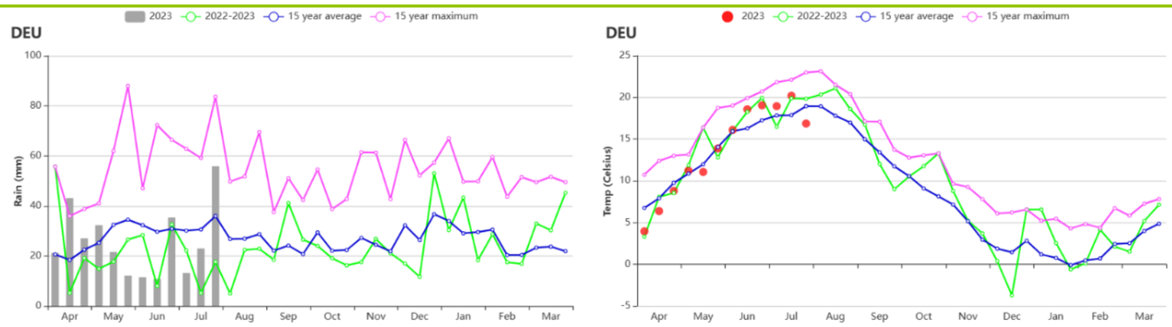
(b) Crop condition development graph based on NDVI (c) Maximum VCI



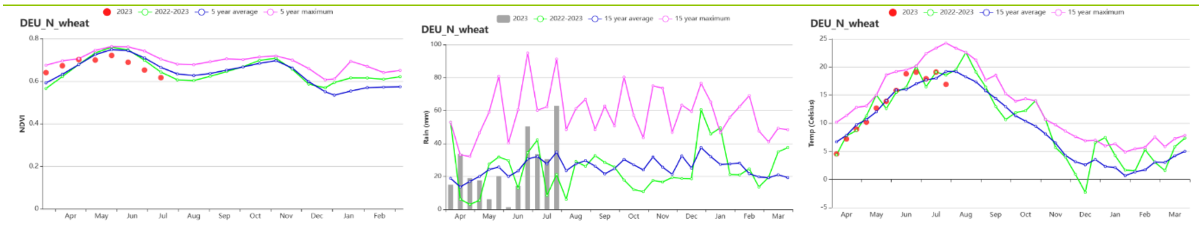


(d) Spatial NDVI patterns compared to 5YA

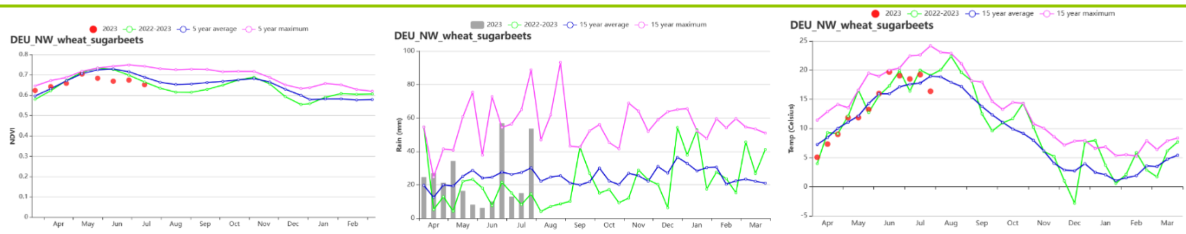
(e) NDVI profiles



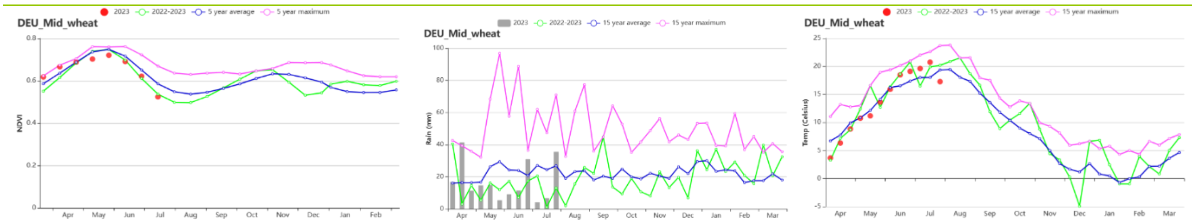
(f) Time series rainfall profile (left) and temperature profile (right) of Germany comparing the April-July 2023 period to the previous season and the five-year average (5YA) and maximum



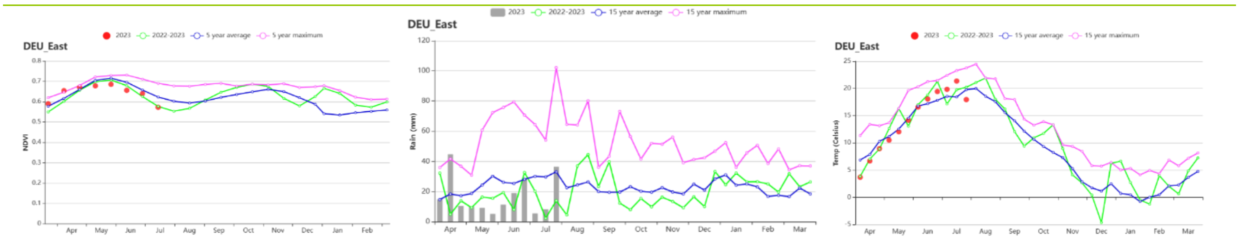
(g) Wheat zone of Schleswig-Holstein and the Baltic Coast crop condition development graph based on NDVI (left), time series rainfall profiles (middle) and temperature (right)



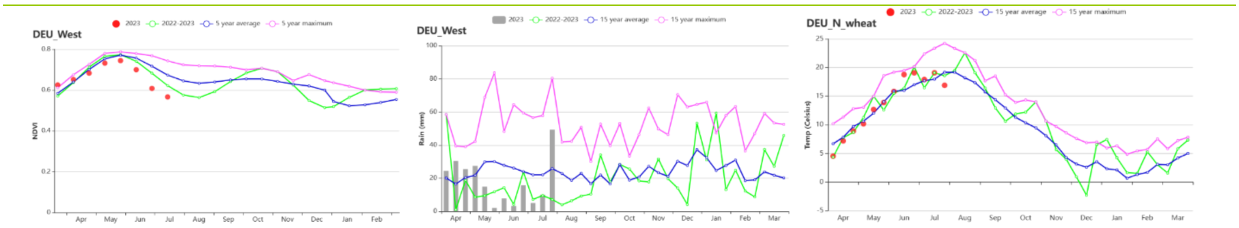
(h) Mixed wheat and sugarbeets zone of the north-west crop condition development graph based on NDVI (left), time series rainfall profiles (middle) and temperature (right)



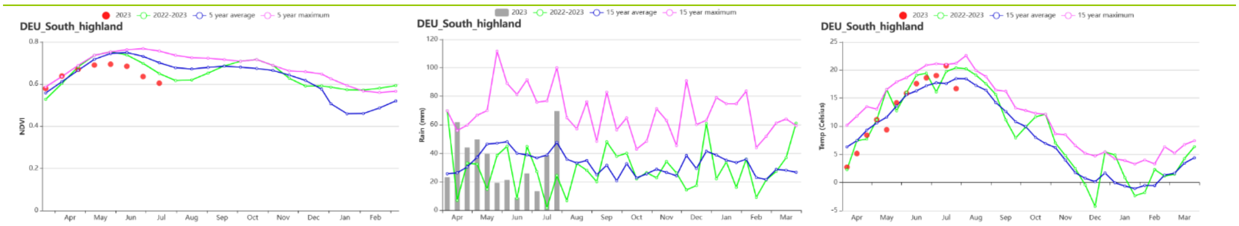
(i) Central wheat zone of Saxony and Thuringia crop condition development graph based on NDVI (left), time series rainfall profiles (middle) and temperature (right)



(j) East-German lake and Heathland sparse crop area crop condition development graph based on NDVI (left), time series rainfall profile (middle) and temperature (right)



(k) Western sparse crop area of the Rhenish massif crop condition development graph based on NDVI (left), time series rainfall profile (middle) and temperature (right)



(l) Bavarian Plateau crop condition development graph based on NDVI (left), time series rainfall profile (middle) and temperature (right)

Table 3.17 Germany agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, April – July 2023

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
East-German lake and Heathland sparse crop area	203	-31	14. 1	-0. 2	1179	-1	659	-17
Central wheat zone of Saxony and Thuringia	202	-24	13. 8	-0. 1	1199	0	653	-13
Mixed wheat and sugarbeets zone of the north-west	286	1	13. 9	0. 1	1167	2	774	0
Wheat zone of Schleswig-Holstein and the Baltic coast	304	6	13. 7	0. 0	1181	3	792	2
Bavarian Plateau	416	-10	13. 3	-0. 2	1226	-2	842	-8
Western sparse crop area of the Rhenish massif	216	-24	14. 2	0. 4	1216	1	686	-13

Table 3.18 Germany agronomic indicators by sub-national regions, current season's values and departure from 5YA, April – July 2023

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
East-German lake and Heathland sparse crop area	100	0	0.87
Central wheat zone of Saxony and Thuringia	100	0	0.86
Mixed wheat and sugarbeets zone of the north-west	100	0	0.87
Wheat zone of Schleswig-Holstein and the Baltic coast	100	0	0.88
Bavarian Plateau	100	0	0.84
Western sparse crop area of the Rhenish massif	100	0	0.86

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[DZA] Algeria

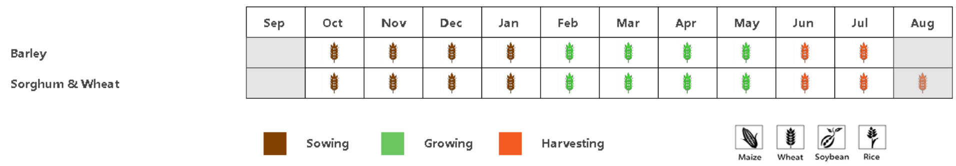
During this reporting period, wheat and other winter crops reached maturity and were harvested in May. The second season for melons and vegetables, cultivated predominantly in the western and central of Algeria, reached its peak growth period in March and April, with harvesting commenced in May and June. The process of preparing the land and conducting late-season planting for potatoes, artichokes, and cauliflowers in Mostaganem and Relizane was slated to commence toward the end of the monitoring period.

Algeria experienced warmer-than-usual weather (TEMP +1.2ºC]. The country received an average rainfall of 118 mm, which is 13% below the 15-year average from April to July. Drought conditions had already prevailed during the previous monitoring period. Radiation was 1% below 15YA. Significant below-average rainfall, in combination with the above-average temperatures, resulted in a 4% reduction in potential biomass.

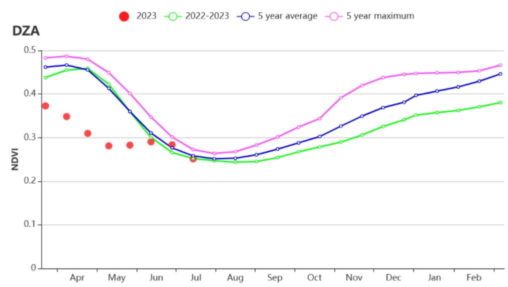
NDVI profiles show that the crop conditions were far below average starting in April to mid-May and reached a close-to-average level by the end of June. The spatial distribution of NDVI departure from 5YA showed average crop conditions for the north of Algeria, while the other regions presented continuously below-average conditions. Accordingly, the VCIx map also presented lower values. At the national level, VCIx was 0.49. CALF was 48% below the 5YA, Indicating severe overall effects of the drought.

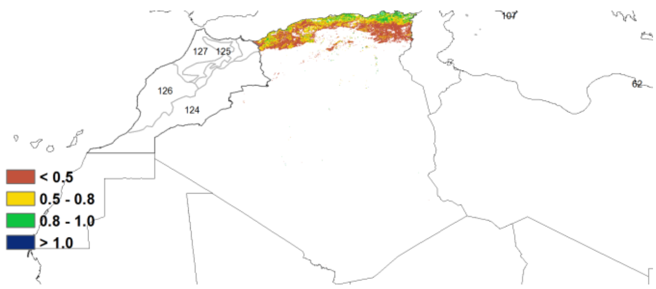
The crop production index of Algeria is 0.60, which is the lowest value during the last 10 years. Hence, the rainfall deficit caused poor crop conditions in Algeria.

Figure 3.14 Algeria's crop condition, April - July 2023



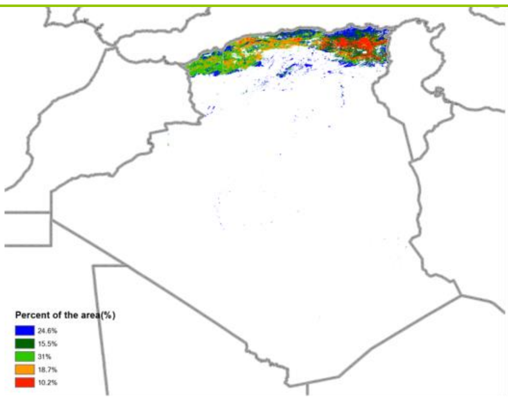
(a) Phenology of major crops



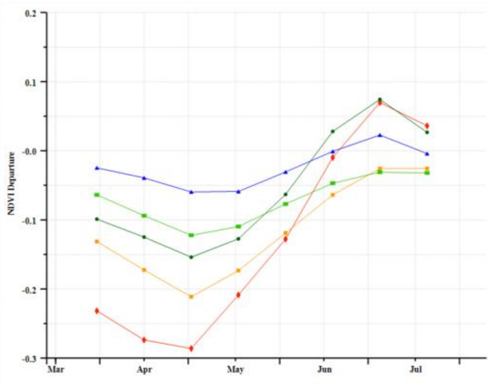


(b) Crop condition development graph based on NDVI

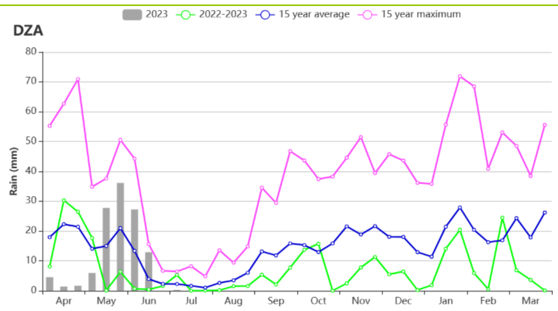
(c) Maximum VCI



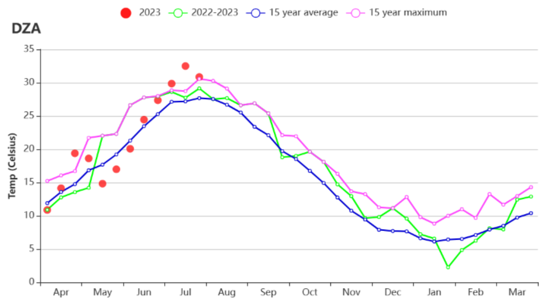
(d) Spatial NDVI patterns compared to 5YA



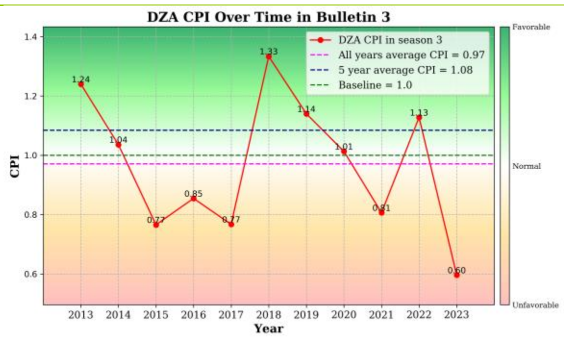
(e) NDVI profiles



(f) Rainfall profiles



(g) Temperature profiles



(h) CPI series for Algeria

Table 3.19 Algeria's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, April - July 2023

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Algeria	118	-13	21.7	1.2	1514	-1	645	-4

Table 3.20 Algeria's agronomic indicators by sub-national regions, current season's values and departure from 5YA, April - July 2023

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Algeria	29	-48	0.49

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[EGY] Egypt

During the monitoring period, winter wheat reached maturity in April and was harvested in May and June. Rice and maize planting started in April. Total rainfall was 10 mm, 73% higher than the 15-year average (15YA). The rainfall index graph shows that most rainfall exceeded the 15YA during April, late May, and the first of June. The average temperature was 24.2°C, higher than the 15YA by 0.6°C. The temperature index graph shows that it fluctuated around 15YA during the monitoring period. RADPAR was below the 15YA by 3.4%, while the BIOMSS was higher than the 15YA by 17%, which can be attributed to the remarkable increase in rainfall. The nationwide NDVI development graph indicates that the crop conditions were close to the 5YA trend in April and subsequently remained below average, but reached close to average again by the end of July. The NDVI spatial pattern shows that 24.3% of the cultivated area was above the 5YA, 31.1% fluctuated around the 5YA, and 44.7% were below the 5YA. The CALF was higher than the 5-year average (5YA) by 1% and VCIx was at 0.77. Overall, the crop conditions were favorable. The nationwide crop production index (CPI) was at 1.09, implying an average to above-average crop production situation.

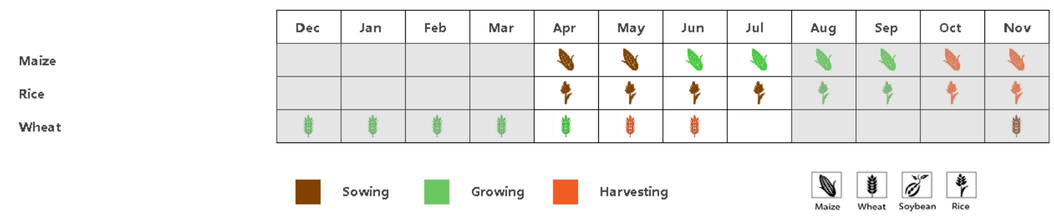
Regional analysis

Based on crop planting systems, climate zones, and topographical conditions, Egypt can be divided into three agroecological zones (AEZs), two of which are suitable for crop cultivation: **the Nile Delta and the southern coast of the Mediterranean (area identified as 60 in the crop condition clusters map)** and **the Nile Valley (61)**.

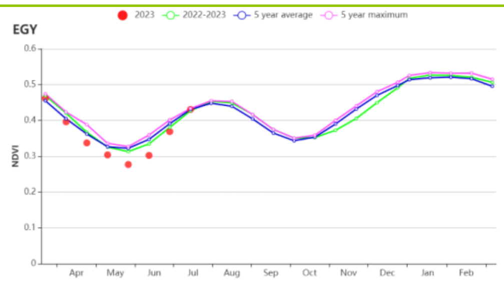
The Nile Delta and the southern coast of the Mediterranean: Rainfall was higher than the 15YA by 25 mm, and the temperature was above the 15YA by 0.5°C. The RADPAR was below the 15YA by 3.4%, while the BIOMSS was at the 15YA. The NDVI-based crop condition development graph shows similar conditions following the national crop development NDVI graph. The CALF was only 1% higher than the 5YA and the VCIx was 0.83. The crop production index (CPI) was at 1.12, implying an above normal crop production situation.

The Nile Valley: Rainfall was higher than the 15YA, and the temperature was above the 15YA only by 0.2°C. The RADPAR was below the 15YA by 3.6% and the BIOMSS was higher than the 15YA by 47%. The NDVI-based crop condition development graph shows similar conditions as the longterm trend. The CALF was lower than the 5YA by 1% and the VCIx was 0.76. The crop production index (CPI) was 1.04, implying a normal crop production situation.

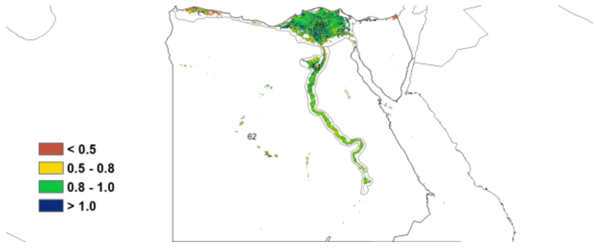
Figure 3.15 Egypt's crop condition, April-July 2023



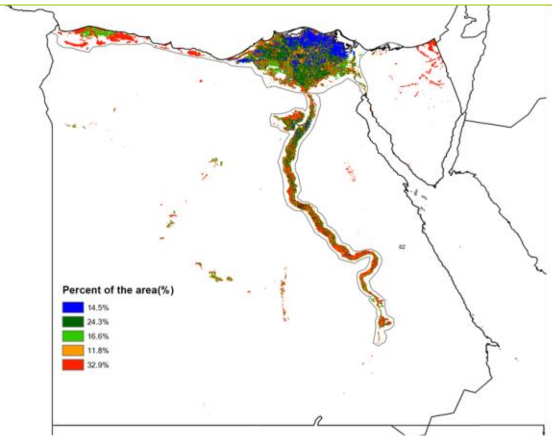
(a) Phenology of major crops



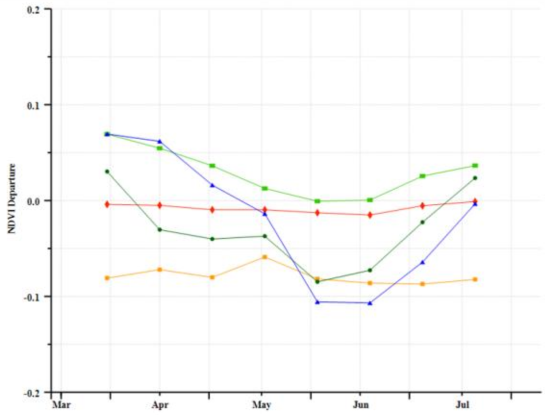
(b) Crop condition development graph based on NDVI



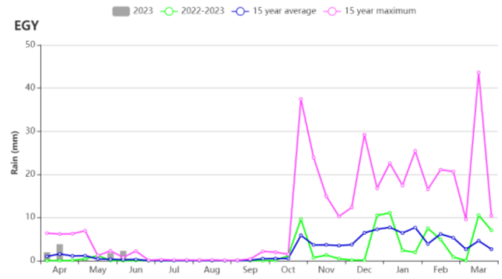
(c) Maximum VCI



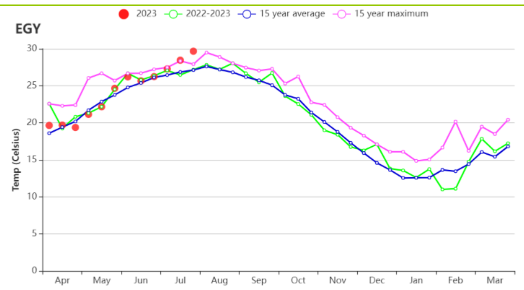
(d) Spatial NDVI patterns compared to 5YA



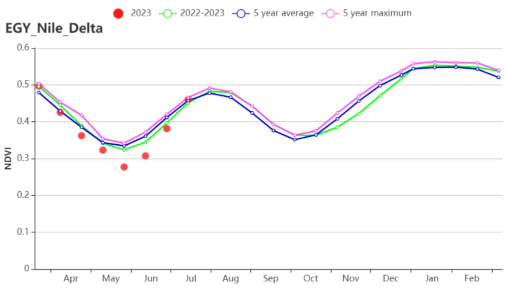
(e) NDVI profiles

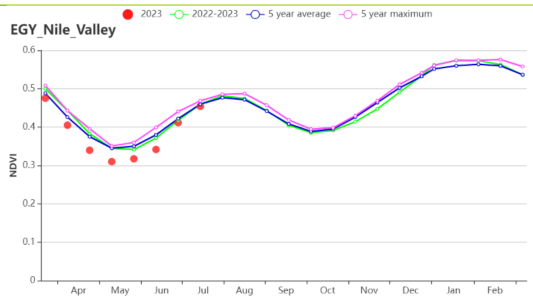


(f) Rainfall profiles



(g) Temperature profiles





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

Table 3.21 Egypt's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, April-July 2023

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m^2)	Departure (%)	Current (gDM/m^2)	Departure (%)
Nile Delta and Mediterranean coastal strip	8	25	24.0	0.5	1537	-3.4	524	0
Nile Valley	8	493	26.9	0.2	1577	-3.6	569	47

Table 3.22 Egypt's agronomic indicators by sub-national regions, current season's values and departure from 5YA, April-July 2023

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Nile Delta and Mediterranean coastal strip	67	1	0.83
Nile Valley	69	-1	0.76

[ETH] Ethiopia

This monitoring period from April to July covers planting season the Meher crops. The main crops are maize, wheat, teff, and sorghum. The agro-meteorological index situation was as follows: RAIN (-20%) was less compared to the 15-year average, TEMP (+0.6 ° C) and RADPAR (+4%) were higher. This caused a reduction in estimated biomass (BIOMSS -4%). The national agronomic situation was characterized by a slightly higher CALF (+3%) than in previous years and a VCIx of 1.0. Overall, crop growth across the country improved significantly compared to last year, even exceeding the 5-year maximum in May and June.

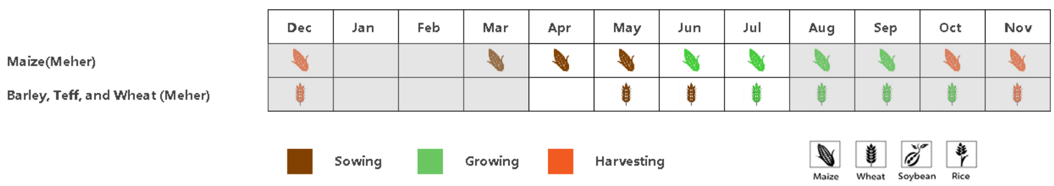
Based on the NDVI spatial clustering map and the VCIx raster map, crop growth was above the 5-year average nationwide. In particular, crop growth was better than the 5-year average in the southeastern and northern parts of the central-northern maize-teff highlands. Parts of the northwestern cereal-root-sesame lowland region also had good crop growth.

Regional analysis

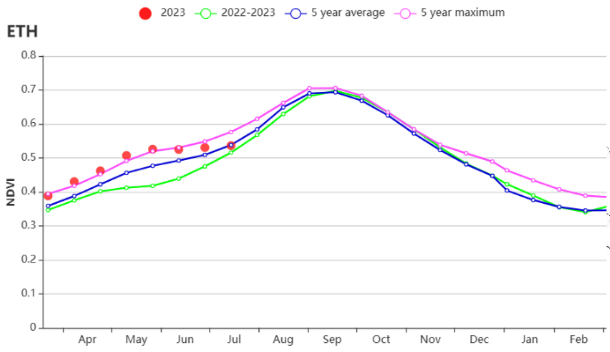
The central-northern maize-teff highlands (63), Great Rift region (65), northwestern cereal-root-sesame lowlands (67), and northwestern sesame irrigated lowlands (68) had similar agro-climatic conditions. RAIN was lower than the 15-year average, TEMP was essentially unchanged, RADPAR was slightly higher, and BIOMSS was slightly below average. CALF for these four regions was essentially unchanged from previous years, and VCIx was slightly below 1.0. Overall, the agrometeorological indices at this site were little changed from the 5-year average, but better than in 2022, so crop growth was essentially near the longterm average in these regions.

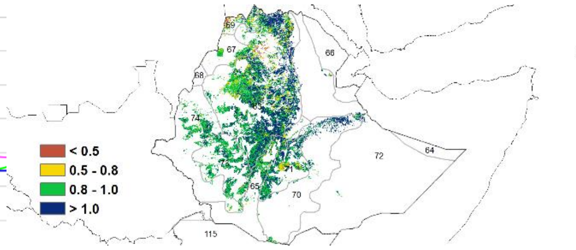
Semi-arid pastoral areas (72) had higher RAIN (+9%) than the 15-year average, as well as an increase in TEMP (+1.3°C), and RADPAR (+1%) was unchanged from previous years. Due to abundant precipitation, the region's potential BIOMSS (+8%) is on the high side. The most significant change is that the region's CALF (+107%) has increased significantly this year compared to previous years. The VCIx for the region is 1.14, which is the highest in the country.

Figure 3.16 Ethiopia's crop condition, April 2023 – July 2023



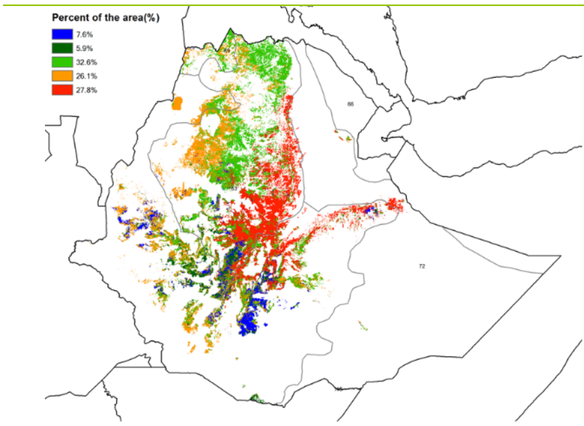
(a) Phenology of major crops

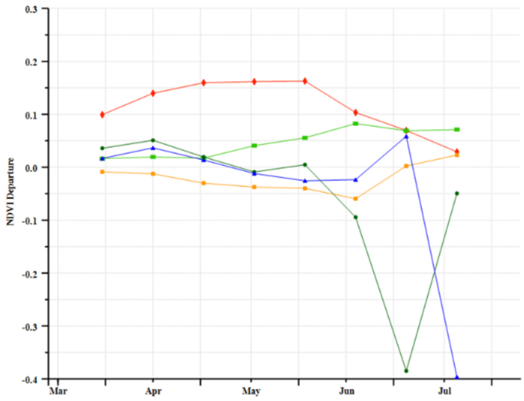




(b) Crop condition development graph based on NDVI

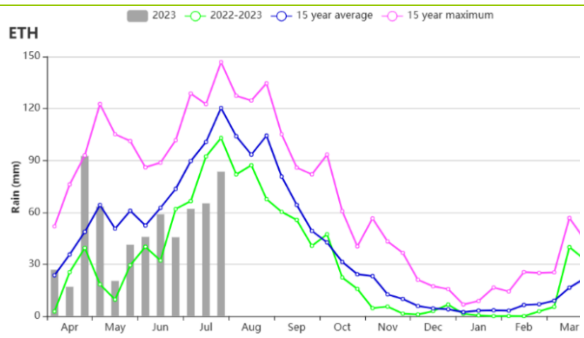
(c) Maximum VCI

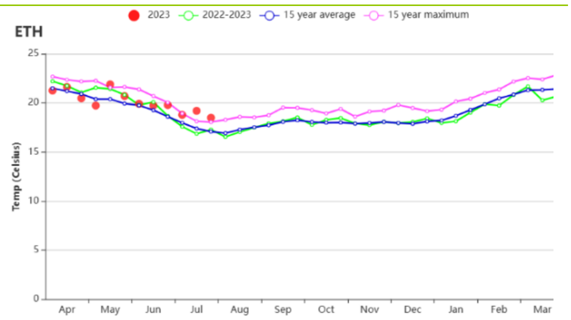




(d) Spatial NDVI patterns compared to 5YA

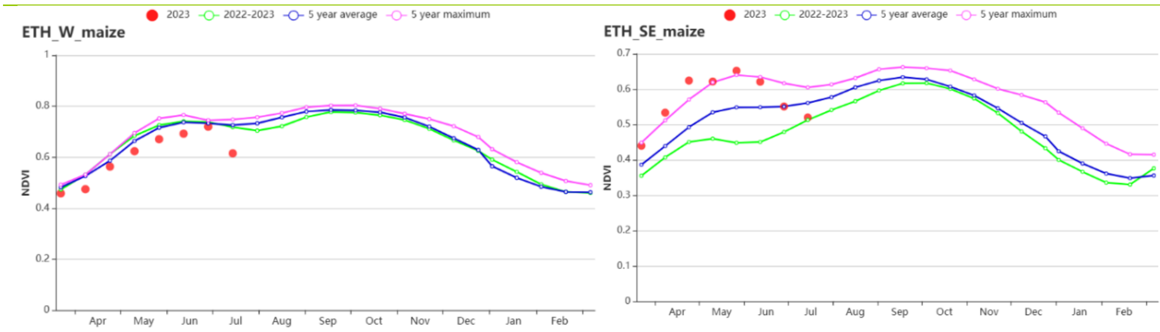
(e) NDVI profiles



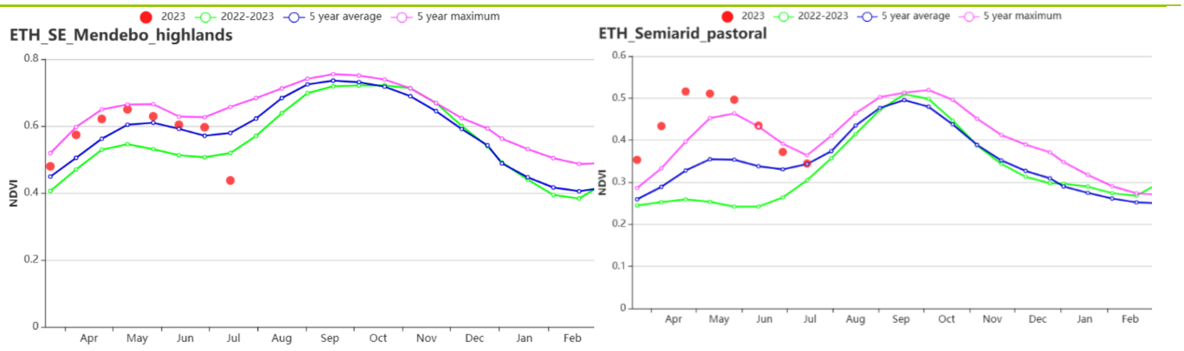


(f) Rainfall profiles

(g) Temperature profiles



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



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

Table 3.23 Ethiopia's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, April 2023 – July 2023

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Northern Arid area	230	146	29.9	-0.6	1379	-4	804	20
Semi-arid pastoral areas	220	9	25.0	1.3	1401	1	791	8
South-eastern mixed maize zone	463	-4	18.9	0.3	1280	6	892	-1
South-eastern Mendebo highlands	405	-25	15.8	0.3	1265	7	765	-9
Western mixed maize zone	1111	-9	22.0	0.6	1193	6	1194	-6

Table 3.24 Ethiopia's agronomic indicators by sub-national regions, current season's values and departure from 5YA, April 2023 – July 2023

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Northern Arid area	0	-100	0.28
Semi-arid pastoral areas	85	107	1.14
South-eastern mixed maize zone	100	5	1.05
South-eastern Mendebo highlands	99	1	0.97
Western mixed maize zone	100	0	0.95

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[FRA] France

This monitoring period covers winter wheat and barley, 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 sugarbeet, potatoes and sunflower starts in August and extends into October. CropWatch agro-climatic indicators show above-average temperature (TEMP +0.7°C) over the period. Temperatures had surpassed the 15-year average during several periods in early May and June to July. RADPAR was at the average. However slightly lower RAIN (-3%) as compared to the 15YA was recorded. Due to the relatively warm temperature and average sunshine conditions, the biomass production potential (BIOMSS) is estimated to have increased by 1% nationwide compared to the 15-year average. The national-scale NDVI development graph shows that the NDVI values were generally close but a bit lower than in the 2022-2023 season and the 5YA especially in June and July. The spatial distribution of maximum VCI (VCIx) across the country reached a range of 0.81-0.93. Overall, suitable temperature and sunshine but slightly dry conditions caused normal but slight below average 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 RAIN were both above average (+0.5°C and +3%, respectively), while RADPAR was below average (-1%). The BIOMSS increased by 1% when compared to the 15YA. The CALF was average, and VCIx was at 0.84. Crop condition development based on NDVI for this region was above and 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 +0.8°C) and sunnier (RADPAR +1%) season was observed, with lower RAIN (-12%). For the crops, BIOMSS was 1% lower than average, CALF was at the average level and VCIx was relatively high at 0.92. The regional NDVI profile also presented a close to average trend in April to mid-May but below average levels in June and July.

In the **Maize-barley and livestock zone along the English Channel**, TEMP was above average by 0.9°C and RADPAR was at the average level. RAIN was lower than average (-5%). BIOMSS was at the 15 years average level. CALF was average and VCIx was relatively high at 0.93. 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 a close to average trend in April and May but below-average conditions in June and July. Overall, RAIN in this period was 23% lower than the 15-year average, while TEMP increased by 0.6°C and RADPAR was at the average level. BIOMSS was about 9% lower than average as the drought condition, while CALF was at the average level, and VCIx was 0.88.

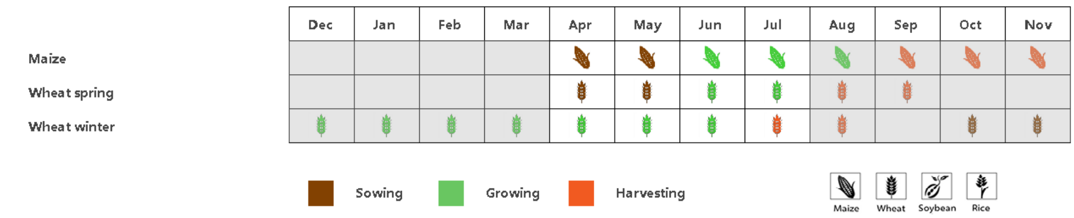
In the **Massif Central dry zone**, TEMP was 0.4°C higher than the average, while RAIN and RADPAR decreased by 7% and 1%. The VCIx was relatively high at 0.91. BIOMSS increased by 3% and CALF was at the average level, which indicated a close to average cropping season in the region. Crop conditions based on the NDVI profile were also showing a close to average trend.

The **Southwestern maize zone** is one of the major irrigated regions in France. The regional NDVI profile also presented a close to average trend during the whole monitoring period except mid-April. TEMP and RAIN was 0.4°C and 13% higher than the average levels, but RADPAR was 1% lower than average. BIOMSS was 7% higher than average, while CALF showed no significant change. The VCIx was recorded at 0.92.

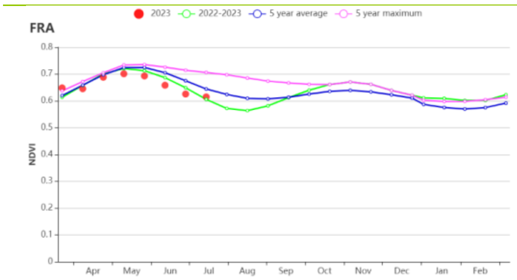
In the **Eastern Alpes region**, the NDVI profile presented a below-average trend. RAIN and RADPAR in the region were 1% and 2% lower than average, while TEMP was higher than average (+0.5°C). BIOMSS was at the 15-year average. CALF was at the average level, and VCIx for the region was recorded at 0.88, indicating overall below-average crop conditions.

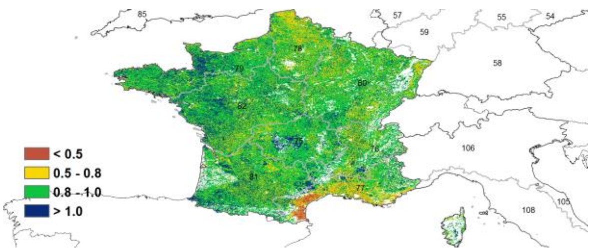
The **Mediterranean zone** also indicated an overall close to but a bit lower than 5 years average NDVI profile. The region recorded a relatively low VCIx (0.81). RAIN and TEMP were 8% and 1.5°C higher than average, while RADPAR was lower (-1%) than average. BIOMSS was increased by 5%, but CALF decreased by 2%. This region is showing close to average crop conditions and agricultural production situation.

Figure 3.17 France's crop condition, April - July 2023



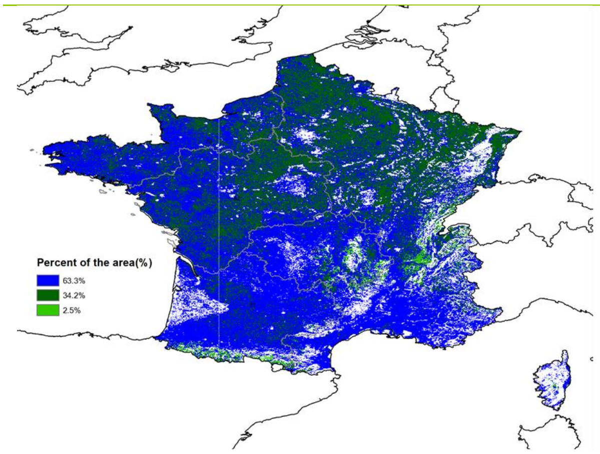
(a) Phenology of major crops

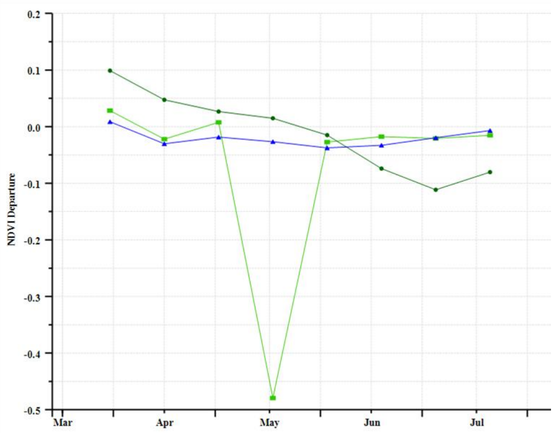




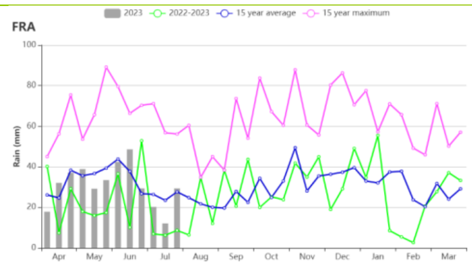
(b) Crop condition development graph based on NDVI

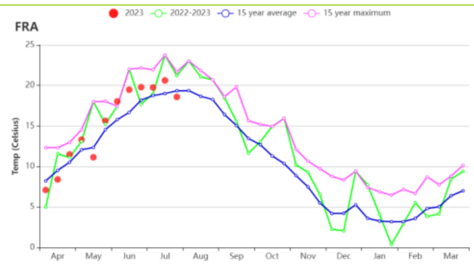
(c) Maximum VCI



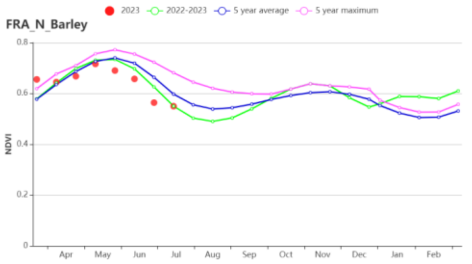


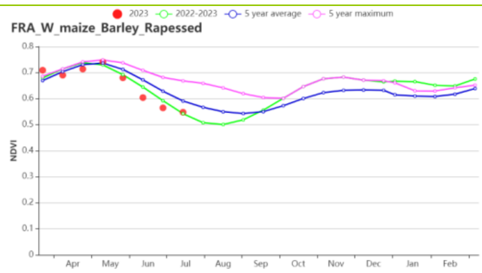
(d) Spatial NDVI patterns compared to 5YA (e) NDVI profiles



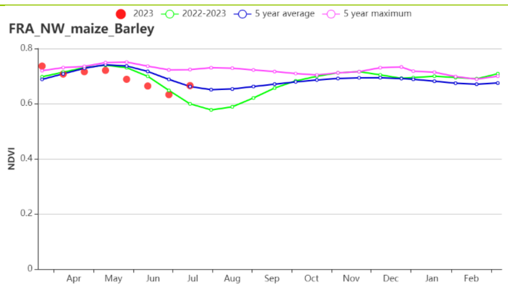


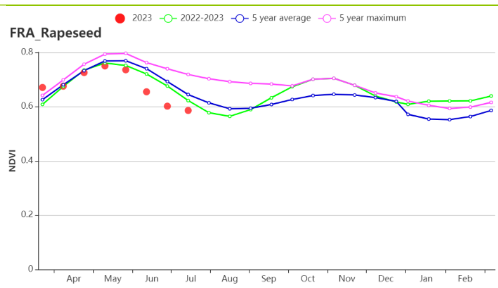
(f) Rainfall profiles (g) Temperature profiles



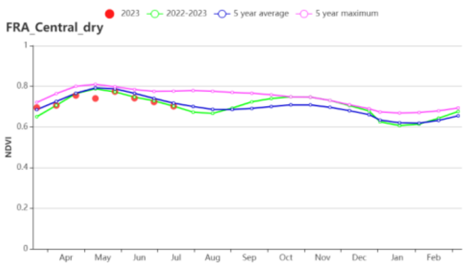


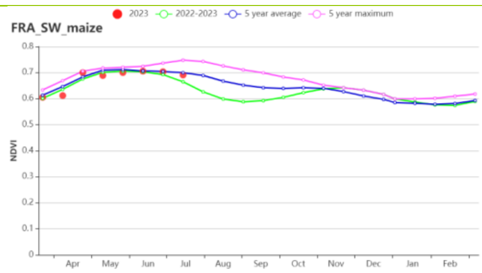
(h) Crop condition development graph based on NDVI (Northern barley region (left) and Mixed maize, Barley and Rapeseed zone (right))



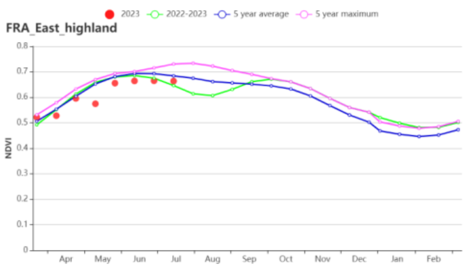


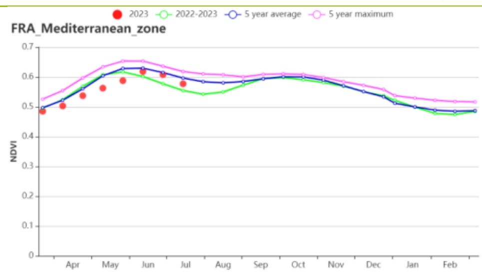
(i) Crop condition development graph based on NDVI (Maize, barley and livestock zone (left) and Rapeseed zone (right))





(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 3.25 France's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, April - July 2023

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Northern Barley zone	318	3	14.8	0.5	1171	-1	816	1
Mixed maize/barley and rapessed zone from the Centre to the Atlantic Ocean	291	-12	16	0.8	1239	1	844	-1
Maize barley and livestock zone along the English Channel	266	-5	14.7	0.9	1188	0	765	0
Rapeseed zone of eastern France	329	-23	14.9	0.6	1230	0	824	-9
Massif Central Dry zone	401	-7	14.4	0.4	1249	-1	965	3
Southwest maize zone	485	13	15.8	0.4	1274	-1	990	7
Alpes region	543	-1	13.9	0.5	1298	-2	920	0
Mediterranean zone	394	8	16.6	1.5	1387	-1	842	5

Table 3.26 France's agronomic indicators by sub-national regions, current season's values and departure from 5YA, April - July 2023

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Northern Barley zone	100	0	0.84
Mixed maize/barley and rapessed zone from the Centre to the Atlantic Ocean	100	0	0.92
Maize barley and livestock zone along the English Channel	100	0	0.93
Rapeseed zone of eastern France	100	0	0.88
Massif Central Dry zone	100	0	0.91
Southwest maize zone	100	0	0.92
Alpes region	98	0	0.88
Mediterranean zone	94	-2	0.81

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

[GBR] Kingdom

During this monitoring period, winter wheat reached the flowering stage in mid to late May. Subsequent grainfilling was completed by mid July. According to the crop condition development graph, crops experienced average or below-average conditions in most of the monioring period. Agro-climatic indicators show that agro-climatic indicators were favourable (RAIN +2%, TEMP +0.6°C, RADPAR +6%). Favourable agro-climatic conditions resulted in above average biomass (BIOMSS +7%). The seasonal RAIN and TEMP profiles presents above-average rainfall in most of the monitoring period, except for a dry spell from May until early June.

The national average VCIx was 0.90. CALF (100%) was unchanged compared to its five-year average. Crop production index was 1.09. The NDVI departure cluster profiles indicate that: (1) 62.3% of arable land experienced average crop conditions (blue line and red line), mainly in south of England. (2) 23% of arable land experienced decreased crop conditions from above-average in April to below-average in July. (3) 14.6% of arable land experienced average crop conditions (dark green line and orange line) experienced average crop conditions in most of the monitoring period with a marked drop of crop conditions in late July or late April, mainly in the east of England. Most likely, the large drops in NDVI can be attributed to cloud cover in the satellite images. Altogether, the conditions for wheat in the UK are assessed to be average.

Regional analysis

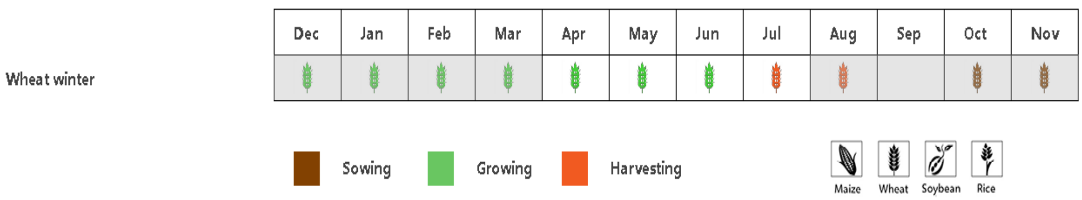
Based on cropping systems, climatic zones, and topographic conditions, three sub-national regions can be distinguished: **Northern barley region（84)**, **Central sparse crop region（83)**, and **Southern mixed wheat and barley region (85)**. All three sub-regions were characterized by unchanged fractions of arable land (CALF) compared to the 5-year average.

In the **Northern barley region**, NDVI was below or close to average. Rainfall was below average (RAIN -10%), temperature and radiation were above average (TEMP +0.7°C, RADPAR +10%). Above-average temperature and radiation resulted in above- average biomass (BIOMSS, +5%). The VCIx was at 0.93. Crop production index was 1.09. Altogether, the output of wheat is expected to be average.

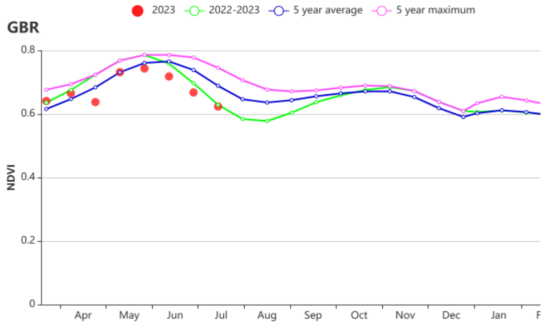
The **Central sparse crop region** is one of the country's major agricultural regions for crop production. Crop conditions was similar with Northern barley region. This region experienced above-average agro-climatic indicators (RAIN +6%， TEMP +0.7° C, RADPAR +6%). Favourable agro-climatic conditions result in above-average biomass (BIOMSS, +4%). The VCIx was at 0.90. Crop production index was 1.08. Altogether, the output of wheat is expected to be average.

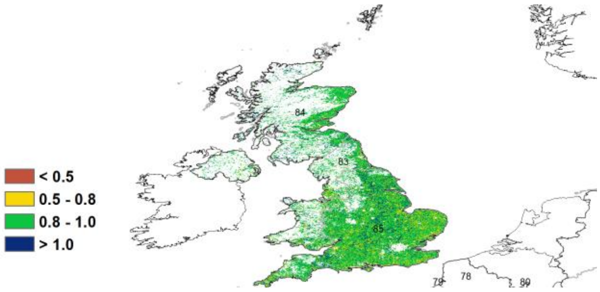
In the **Southern mixed wheat and barley zone**, NDVI was also similar to the other sub-national regions except early April and mid-April. above-average agro-climatic indicators (RAIN +10%， TEMP +0.4° C, RADPAR +4%). Favourable agro-climatic conditions result in above-average biomass (BIOMSS, +10%). The VCIx was at 0.89. Crop production index was 1.08. Altogether, the output of wheat is expected to be average.

Figure 3.18 United Kingdom's crop condition, April - July 2023

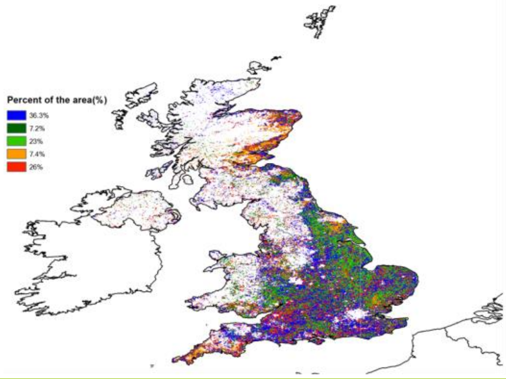


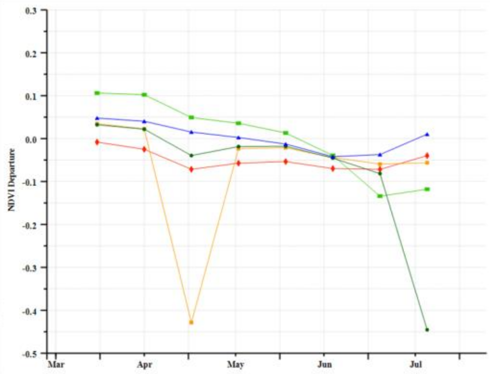
(a) Phenology of major crops



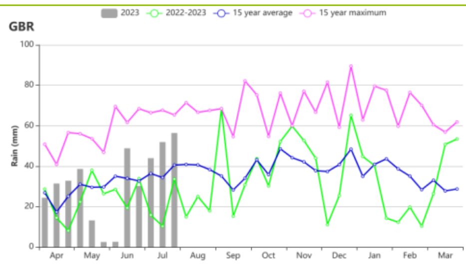


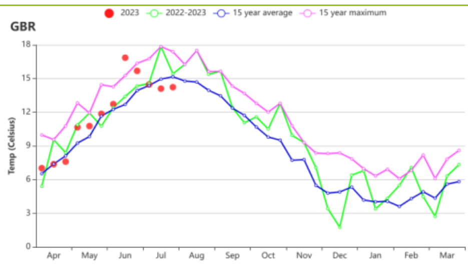
(b) Crop condition development graph based on NDVI (c) Maximum VCI



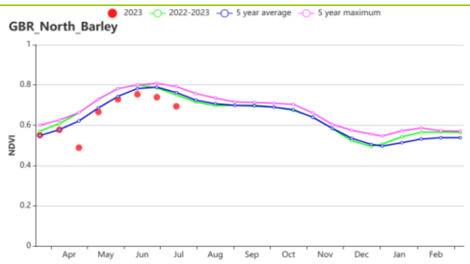


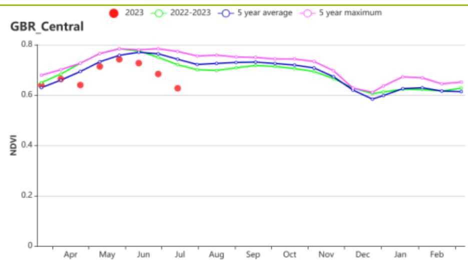
(d) Spatial NDVI patterns compared to 5YA (e) NDVI profiles



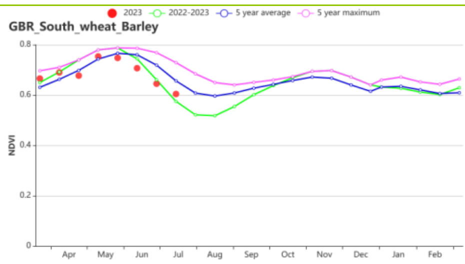


(f) Rainfall profiles (g) Temperature profiles





(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 3.27 United Kingdom's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, April - July 2023

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m^2)	Departure (%)	Current (gDM/m^2)	Departure (%)
Northern Barley region(UK)	390	-10	10.7	0.7	1004	10	821	5
Central sparse crop region (UK)	410	6	11.9	0.7	1018	6	846	4
Southern mixed wheat and Barley zone (UK)	338	10	12.8	0.4	1100	4	835	10

Table 3.28 United Kingdom's agronomic indicators by sub-national regions, current season's values and departure from 5YA, April - July 2023

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Northern Barley region(UK)	100	0	0.93
Central sparse crop region (UK)	100	0	0.90
Southern mixed wheat and Barley zone (UK)	100	0	0.89

[HUN] Hungary

During this reporting period, winter wheat was harvested in June and July. According to the crop condition development graph, NDVI values were above average from April to Mid May, below average in late May, above average in early June and Mid June, and lower than the 5YA in late June and July. Temperature was below average (TEMP -0.6°C) and solar radiation was below average (RADPAR -3%) as compared to the 15YA. The drought situation in Hungary was effectively alleviated during the current monitoring period. The overall rainfall was above average (RAIN +26%), mainly due to the fact that the precipitation was much higher than average in Mid May, early June, late June, and late July. Biomass was above average compared to the 15YA (BIOMSS +10%). The Crop Production Index was 1.12. 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%. Meanwhile, precipitation was abundant during the monitoring period and crop conditions are expected to be above average.

The national average VCIx was 0.93. The NDVI departure cluster profiles indicate that: (1) 25.9% of arable land experienced positive crop conditions during the monitoring period, mainly distributed in Eastern Hungary. (2) 13.1% of arable land experienced above-average crop conditions from April to Mid June, mainly distributed in Eastern Hungary. (3) 21.3% of arable land experienced favorable crop conditions in April and May, mainly distributed in Western Hungary and central Hungary. (4) 31.2% of arable land experienced slightly above-average crop conditions in April, below average from May to mid-June, and above average from late June to July, mainly distributed in Western Hungary and Central Hungary. (5) 8.4% of arable land experienced below-average crop conditions between April and mid-June, above average from late June to July, mainly distributed in Western Hungary.

Regional analysis

Based on cropping systems, climatic zones, and topographic conditions, four sub-national regions are described below: Northern Hungary (88), Central Hungary (87), the Great Plain (Puszta) (86) and Transdanubia (89). During this reporting period, CALF was 100% for all four subregions.

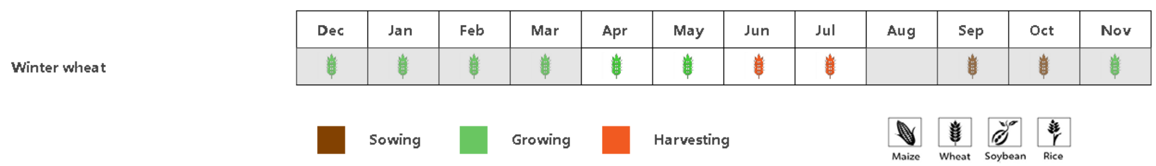
Central Hungary (87) is one of the major agricultural regions in terms of crop production. A sizable share of winter wheat is planted in this region. According to the NDVI development graphs, NDVI values were above average from April to Mid May, below average in late May, above average in early June and Mid June, and lower than the 5YA in late June and July. Temperature and radiation were below average (TEMP -0.4°C and RADPAR -3%, respectively). Potential biomass was above average compared to the 15YA (BIOMSS +7%), mainly due to above-average (RAIN +18%) rainfall. The VCIx was 0.93. The CPI was 1.14. The crop conditions in this region were above average.

The **Puszta (86)** (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 above average from April to Mid May, on par with average in late May, above average in early June and Mid June, and below average in late June and July. Temperature and radiation were below average (TEMP -0.6°C and RADPAR -2%). Potential biomass was above average compared to the 15YA (BIOMSS +5%), mainly due to above-average (RAIN +10%) rainfall. The VCIx was 0.94. The CPI was 1.11. The crop conditions in this region were above average.

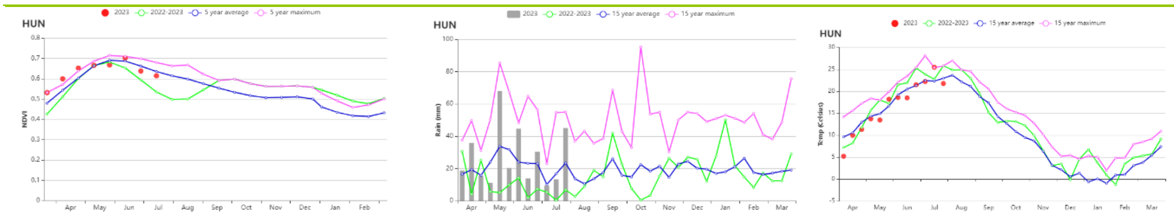
Northern Hungary (88) is another important winter wheat region. According to the NDVI development graphs, NDVI values were above average from April to Mid May, below average in late May, above average in early June and Mid June, and below average in late June and July. Rainfall, temperature, and radiation were below average (RAIN -4%, TEMP -0.3°C and RADPAR -2%, respectively). which resulted in a below-average potential biomass (BIOMSS -3%) compared to the 15YA. The VCIx was 0.97. The CPI was 1.16. The crop conditions in this region were above average.

Southern **Transdanubia (89)** cultivates winter wheat, maize, and sunflower, mostly in Somogy and Tolna counties. According to the NDVI development graphs, NDVI values were above average from April to mid-May, and below average between late May and July. Agro-climatic conditions include above-average rainfall (RAIN +61%) below-average temperature (TEMP -0.9°C) and radiation (RADPAR -5%). Biomass was above average compared to the 15YA (BIOMSS +21%). The maximum VCI was favorable at 0.91. The CPI was 1.10. Due to the heavy rain in May, the precipitation was above average significantly in Mid May, early June, late June, and late July. The unusual precipitation has resulted in localized below-average crop conditions, but overall this has been effective in mitigating the drought, and crop conditions are expected to be above average.

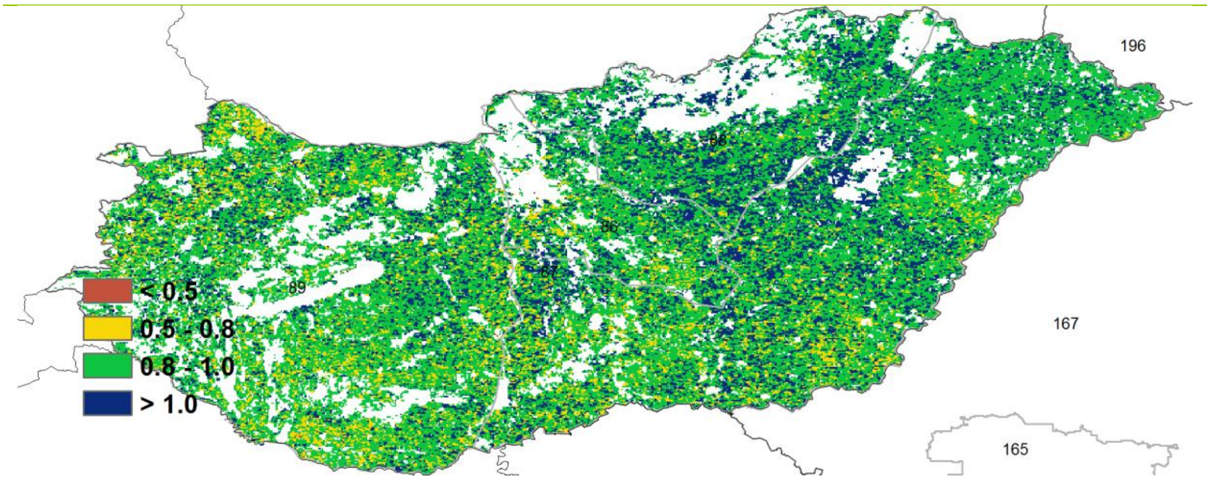
Figure 3.19 Hungary's crop condition, April -July 2023



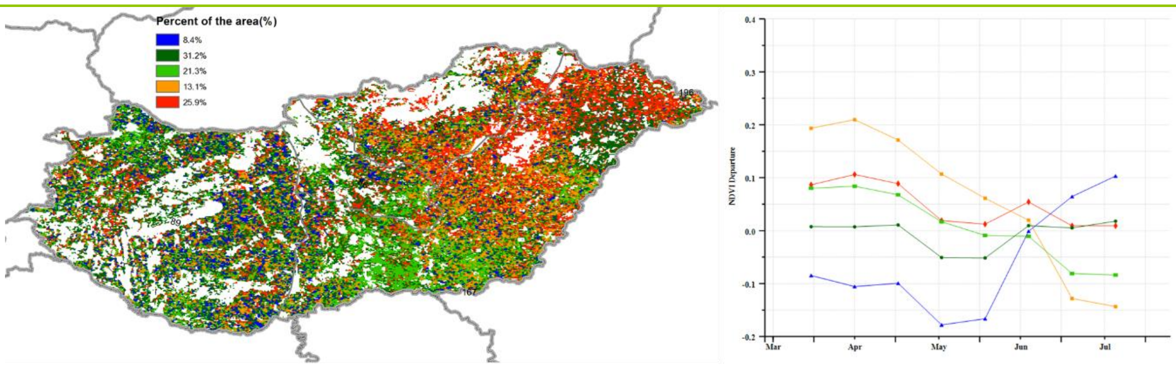
(a). Phenology of major crops



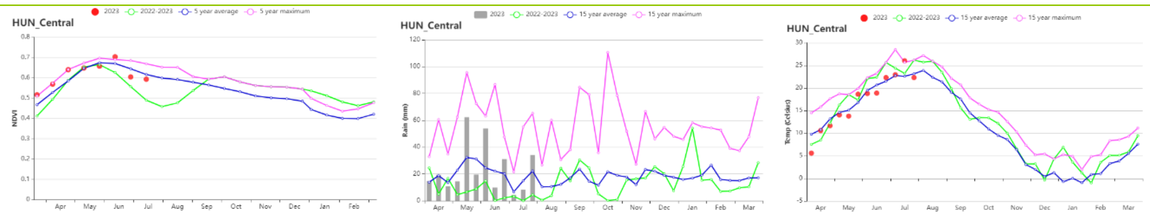
(b) Crop condition development graph based on NDVI, RAIN and TEMP



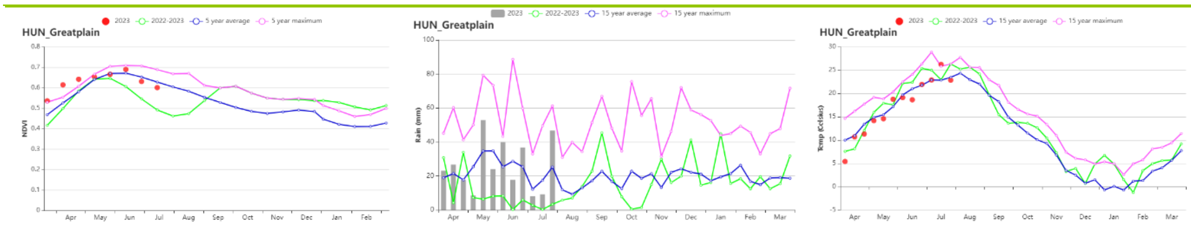
(c) Maximum VCI



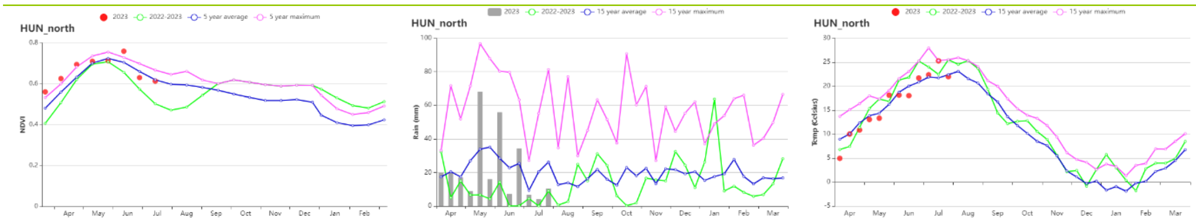
(d) Spatial distribution of NDVI profiles.



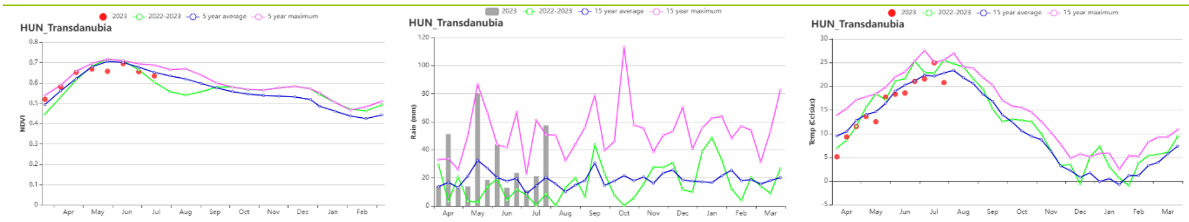
(e) Crop condition development graph based on NDVI, RAIN and TEMP



(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 3.29 Hungary's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, April -July 2023

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Central Hungary	283	18	17.1	-0.4	1293	-3	843	7
Puszta	311	10	17.2	-0.6	1287	-2	895	5
North Hungary	269	-4	16.5	-0.3	1259	-2	795	-3

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Transdanubia	362	61	16.2	-0.9	1276	-5	918	21

Table 3.30 Hungary's agronomic indicators by sub-national regions, current season's values and departure from 5YA, April-July 2023

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current (%)
Central Hungary	100	0	0.93
Puszta	100	0	0.94
North Hungary	100	0	0.97
Transdanubia	100	0	0.91

[IDN] Indonesia

During the monitoring period, harvest of the rainy season crops was completed in June and planting of dry season maize and second rice started in June and July. CropWatch agroclimatic indicators show that temperature and radiation (TEMP +0.2°C, RADPAR +2%) were higher than the 15YA, but rainfall was below average (RAIN -7%), which led to average biomass production (BIOMSS +0%).

According to the national NDVI development graph, crop conditions were slightly below the 5YA during the monitoring period. However, this might be an artifact due to frequent cloud cover in the satellite images, which causes low NDVI values. The NDVI clusters and profiles show that 8% of the cropland (eastern Kalimantan, eastern Sulawesi and central West Papua) was close to the 5YA in April and mid-July. Crop conditions for the 72.4% of cropland (Java, southern Sumatra, eastern, central and western Kalimantan, northern and southern Sulawesi and northern West Papua) were close to the 5YA during the whole monitoring period.

The area of cropped arable land (CALF 100%) in Indonesia was close to the 5YA and the VCIx value was 0.94. This country's Crop Production Index (CPI) was 1.1, indicating above average conditions. Overall, crop conditions can be assessed as close to average, although the drop in rainfall in July might be an indication of an upcoming drought caused by El Niño.

Regional analysis

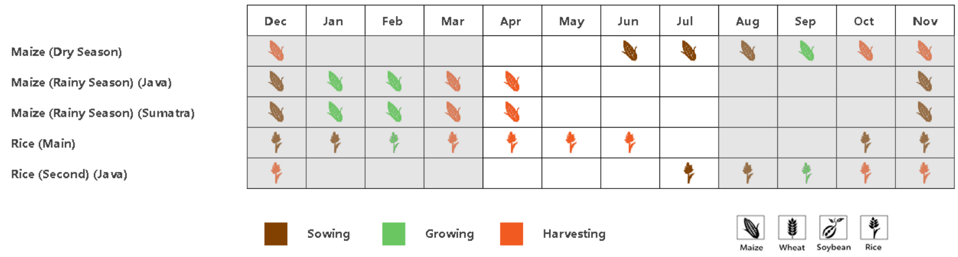
The analysis below focuses on four agro-ecological zones, namely **Sumatra** (92), **Java** (90, the main agricultural region in the country), **Kalimantan** and **Sulawesi** (91), and **West Papua** (93), among which the first three are relevant for crop production. The numbers correspond to the labels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

According to the agroclimatic conditions of **Java**, radiation and temperature were close to average (TEMP +0℃, RADPAR +0%), but precipitation was below the 15YA (RAIN -17%). The resulting potential biomass production was also below the 15YA (BIOMSS -6%). The NDVI development graphs show that crop conditions were below the 5YA in early April, but in other months were close to the average. The Crop Production Index (CPI) in Java was 1.04, and crop production was assessed as close to average.

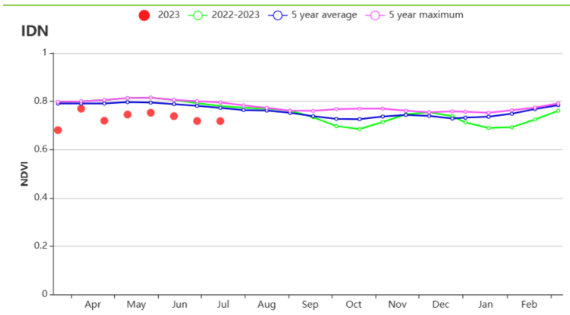
In **Kalimantan** and **Sulawesi**, radiation and temperature were above average (TEMP +0.4℃, RADPAR +4%), but precipitation was below the 15YA (RAIN -10%), while the potential biomass production was close to the average (BIOMSS +0%). According to the NDVI development graph, crop conditions were below the 5YA except for the middle of April. However, a Crop Production Index (CPI) of 1.11 indicates above average conditions for this region.

Precipitation and temperature were above the 15YA (RAIN +5%, TEMP +0.2℃) in **Sumatra**, but radiation was average (RADPAR +0%), which led to an increase of the potential biomass production (BIOMSS +3%). As shown in the NDVI development graph, crop conditions were significantly below the 5YA in early and end April, and close to 5YA in other months. The Crop Production Index (CPI) in Sumatra was 1.12, indicating normal conditions.

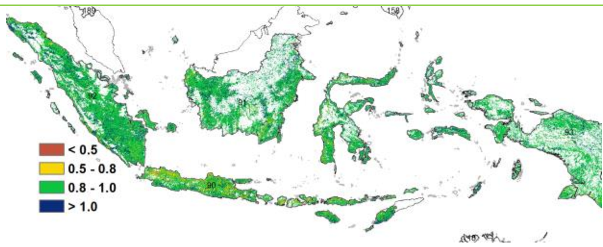
Figure 3.20. Indonesia's crop condition, April 2023 – July 2023



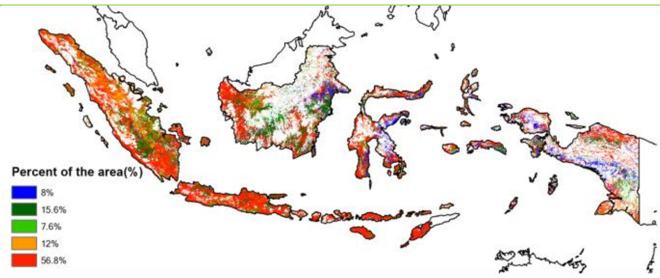
(a). Phenology of major crops



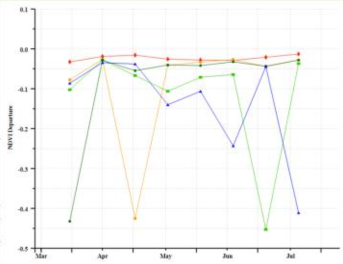
(b) Crop condition development graph based on NDVI



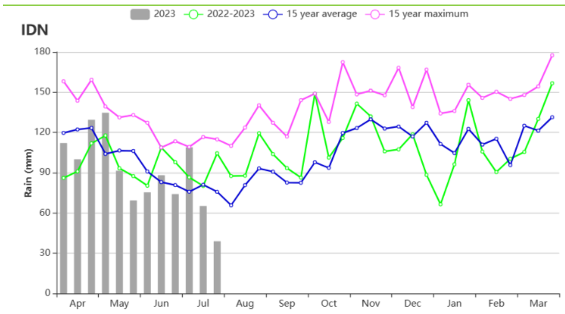
(c) Maximum VCI



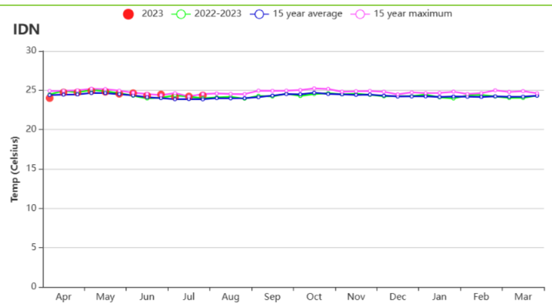
(d) Spatial NDVI patterns compared to 5YA



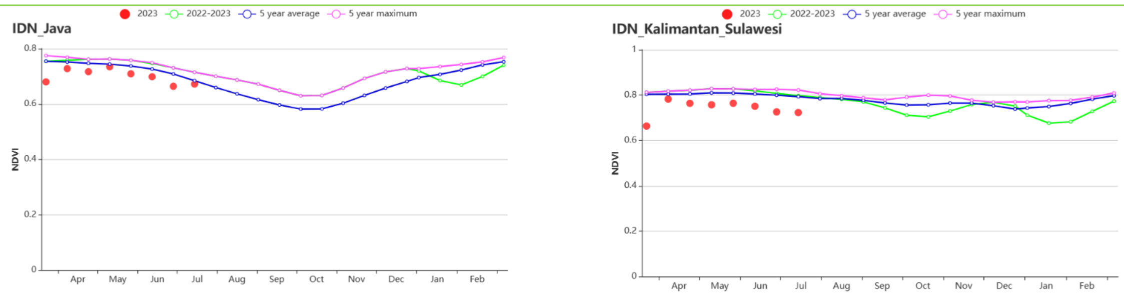
(e) NDVI profiles



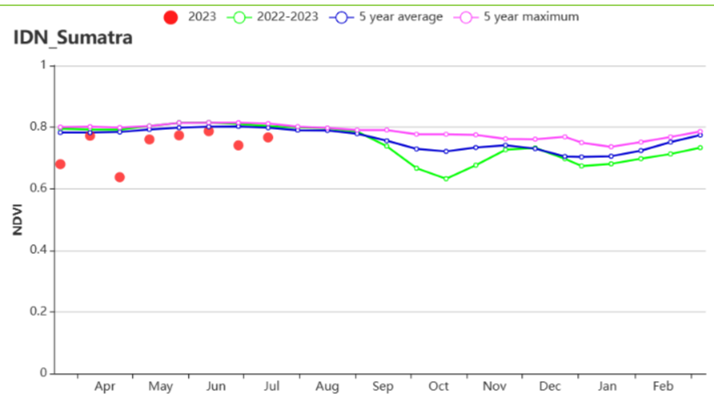
(f)Rainfall profiles



(g)Temperature profiles



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



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

Table 3.31 Indonesia's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, April 2023 – July 2023

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Java	527	-17	24.7	0.0	1166	0	981	-6
Kalimantan and Sulawesi	1042	-10	24.9	0.4	1165	4	1419	0
Sumatra	1029	5	24.9	0.2	1155	0	1417	3
West Papua	1505	-8	23.4	0.2	926	2	1311	-1

Table 3.32 Indonesia's agronomic indicators by sub-national regions, current season's values and departure from 5YA, April 2023 – July 2023

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Java	99	0	0.89
Kalimantan and Sulawesi	100	0	0.95
Sumatra	100	0	0.95
West Papua	100	0	0.95

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

[IND] India

This monitoring period covers the major Kharif cropping season in India, focused on Kharif rice planted in June and harvested in September/October. Other important Kharif crops include maize, soybean.

Nationwide, average temperatures were 0.2°C below normal, while rainfall was 833 mm, 4% above the 15-year average. Solar radiation was 1% above average. The above-average monsoon rains resulted in an 8% increase in estimated biomass compared to the 15-year average.

The NDVI anomaly clustering map shows three changing patterns of crop condition in India since June. The first pattern mainly occurred in the southern part of the Eastern Coastal Region, the northwestern part of the Agriculture Areas in Rajasthan and Gujarat, accounting for 44.4%. It showed a slight decrease in crop condition in mid-June, then recovered and was slightly above average. The second pattern mainly occurred in the Deccan Plateau, accounting for 22.3%, showing a decrease from early June, rebounding in early July, and recovering to slightly above average by late July. The third pattern occurred in the Western Coastal Region, northern part of the Assam and North-Eastern Regions, western part of the Deccan Plateau and southeastern part of the Agriculture Areas in Rajasthan and Gujarat, accounting for 33.3%. In this pattern, the crop condition kept deteriorating from June to late July, and was significantly below the 5-year average.

Correspondingly, in the VCIx distribution map, the regions with the first pattern had relatively better VCIx, mostly above 0.8; the regions with the second pattern had VCIx between 0.5-1.0; the regions with the third pattern generally had VCIx below 0.8, with many areas less than 0.5.

The national average VCIx for India was only 0.86. The cropped land fraction decreased by 8% to 63%, mainly from the Western Coastal Region, Deccan Plateau, Agriculture Areas in Rajasthan and Gujarat, and Gangetic Plain. Part of this decline can be attributed to the floods in July, which affected about 0.5 million hectares. The CPI was 0.83, below the 5-year average of 1.03. Overall, the extreme high temperatures in late May and early June combined with uneven rainfall distribution had adverse impacts on India's agriculture this season. All in all, conditions were average.

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).**

Deccan Plateau:

This region received 706 mm of rainfall, 12% above the 15-year average. Temperatures were 0.3°C below average while solar radiation was 1% above normal. The above-average rains resulted in a 5% increase in estimated biomass. However, the VCIx was only 0.73, below the normal range, and the NDVI development graph also showed crop conditions significantly below average from June to July, indicating poor crop conditions despite the positive rainfall anomaly. The cropped land fraction declined 14%. CPI was only 0.66. Overall, the crop prospects for this region were poor.

Eastern Coastal Region:

With 27% above-average rainfall (680 mm), near-normal temperatures, and average radiation, this region saw a 9% increase in estimated biomass. The VCIx reached 0.85, the cropped land fraction increased 7%, and CPI was 1.03, reflecting favorable crop prospects.

Gangetic Plain:

As a key rice growing area, the Gangetic Plain received 11% above-average rainfall at 670 mm. But temperatures were 0.5°C below normal while radiation increased 2%. The estimated biomass was 12% higher than the 15-year average. However, during the entire growing season, the NDVI development graph only reached the average level in late July, and was below average at other times. The VCIx was just 0.84, cropped land fraction declined 9%, and CPI was 0.88, indicating below-normal crop conditions.

Assam and North-Eastern Region:

This region experienced 24% below-average rainfall during the monsoon at just 1608 mm. However, warmer temperatures (+0.7°C) and 10% above-average radiation compensated for the lower rainfall, resulting in only a 5% drop in estimated biomass. The VCIx was a favorable 0.89, the cropped land fraction was equal to the 5-year average, and CPI was 1.08, indicating near normal crop conditions. **Agriculture Areas in Rajasthan and Gujarat:**

With 74% above-average rainfall, and temperatures -1.2°C below normal while radiation decreased 4%, the VCIx reached 0.92, but the cropped land fraction declined 9%, and CPI was only 0.79, meaning the excessive monsoon rainfall had obvious negative impacts on crop production in this region.

Western Coastal Region:

This region experienced 12% below-average rainfall during the monsoon at just 827 mm. Temperatures were 0.3°C above average while radiation declined 1%. The estimated biomass decreased 6%. The VCIx was only 0.68, the cropped land fraction declined 18%, and CPI was only 0.64, indicating poor crop conditions.

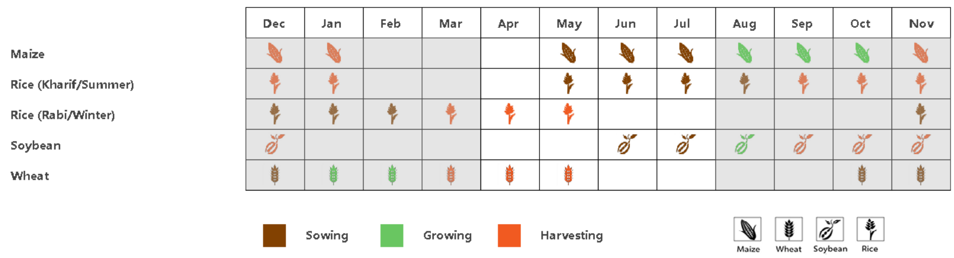
Northwestern Dry Region:

This region saw abundant monsoon rains at 277% above average. Though temperatures were -1.8°C below normal, the estimated biomass increased 46%. The VCIx reached 1.79, the cropped land fraction increased 16%, and CPI was 1.77. The NDVI development graph showed crop conditions significantly higher than the 5-year maximum in June-July, reflecting favorable crop prospects.

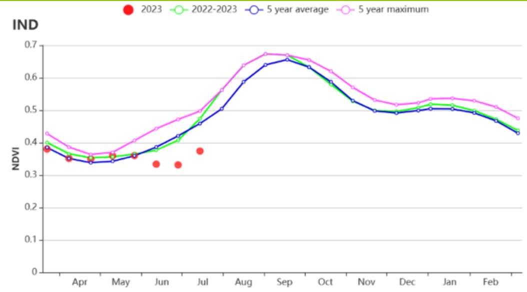
Western Himalayan Region:

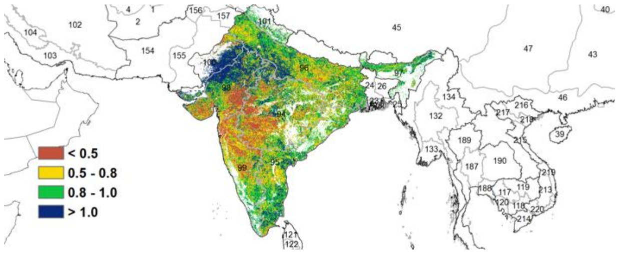
This region received near-average rainfall, with a 5% increase to 603 mm. Temperatures were -0.4°C below average while radiation declined 4%. The estimated biomass increased 9%. The VCIx was 0.90, indicating favorable crop conditions. The cropped land fraction was equal to the 5-year average. CPI was 1.08. The crop prospects for this region were generally normal.

Figure 3.21 India's crop condition, April - July 2023

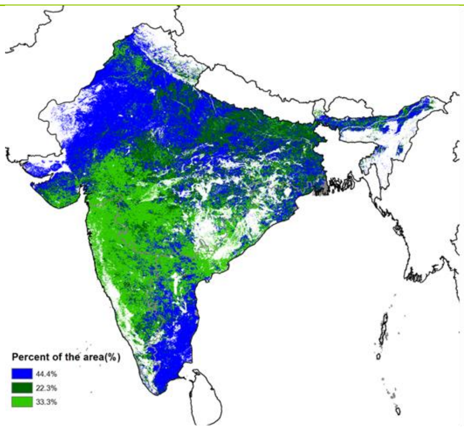


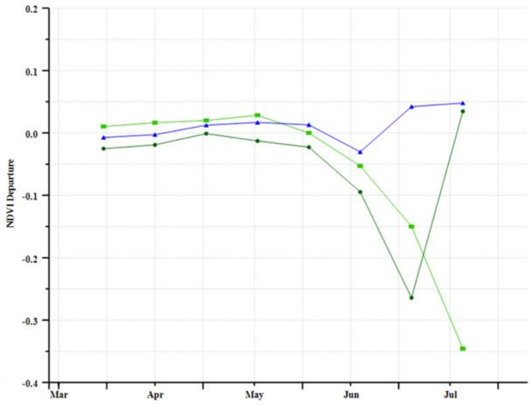
(a) Phenology of major crops



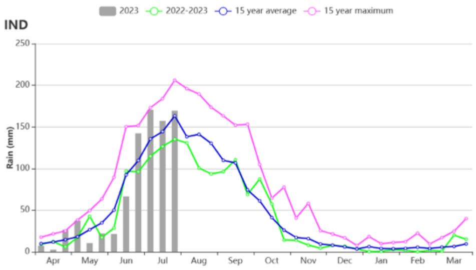


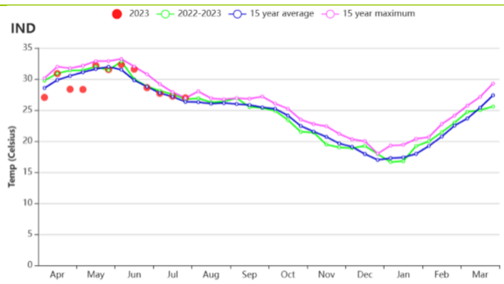
(b) Crop condition development graph based on NDVI (c) Maximum VCI



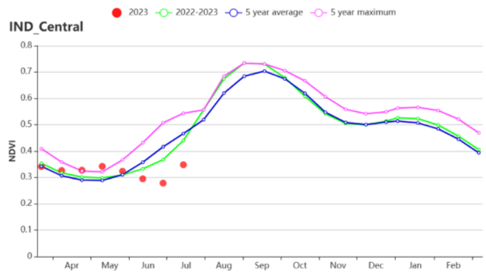


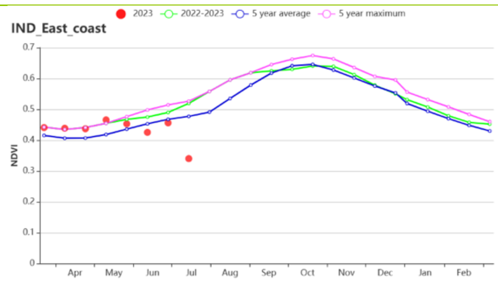
(d) Spatial NDVI patterns compared to 5YA (e) NDVI profiles



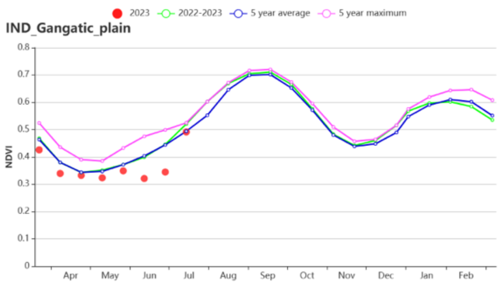


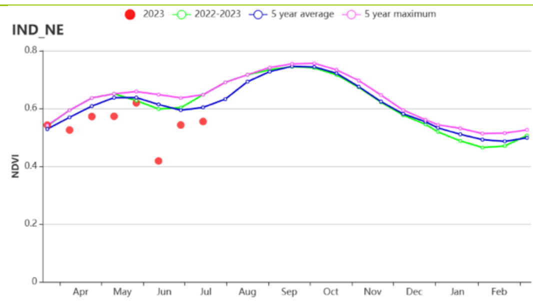
(f) Rainfall profiles (g) Temperature profiles



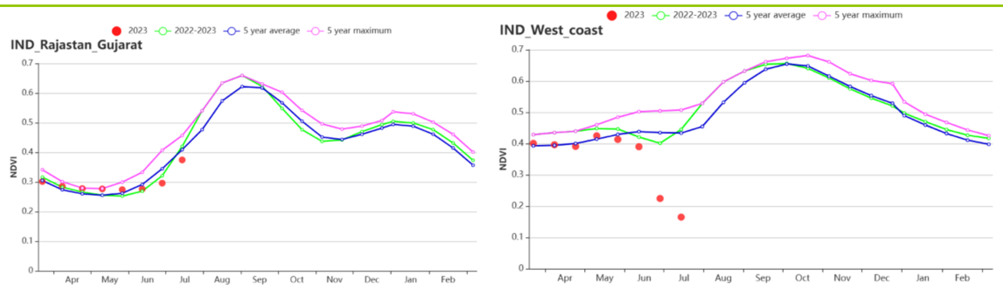


(h) Crop condition development graph based on NDVI (Deccan Plateau (left) and Eastern Coastal Region (right))

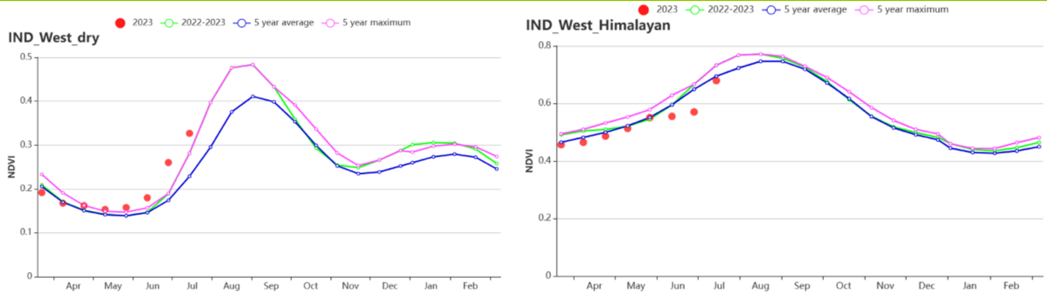




(i) Crop condition development graph based on NDVI (Gangetic Plains (left) and Assam and north-eastern regions (right))



(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 3.33 India's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, April - July 2023

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Deccan Plateau	706	12	30.8	-0.3	1282	1	998	5
Eastern coastal region	680	27	30.2	0.2	1239	0	1042	9
Gangatic plain	670	11	31.4	-0.5	1383	2	1079	12
Assam and north-eastern regions	1608	-24	25.0	0.7	1217	10	1366	-5
Agriculture areas in Rajastan and Gujarat	947	74	30.7	-1.2	1313	-4	1076	20
Western coastal region	827	-12	27.3	0.3	1175	-1	967	-6
North-western dry region	701	277	31.6	-1.8	1382	-7	1047	46
Western Himalayan region	603	5	19.8	-0.4	1392	-4	893	9

Table 3.34 India's agronomic indicators by sub-national regions, current season's values and departure from 5YA, April - July 2023

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Deccan Plateau	61	-14	0.73
Eastern coastal region	78	7	0.85
Gangatic plain	74	-9	0.84

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Assam and north-eastern regions	96	0	0.89
Agriculture areas in Rajastan and Gujarat	48	-9	0.92
Western coastal region	56	-18	0.68
North-western dry region	10	16	1.79
Western Himalayan region	97	-1	0.90

[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 were below the 5-year average throughout the whole monitoring period. The cumulative rainfall was 70 mm, which was 24% below average. The average temperature was 21.8°C (0.3°C above average), whereas the photosynthetically active radiation was 1618 MJ/m2 (1% below average). The potential biomass was 7% lower than the 15-year average due to the poor rainfall. The national maximum vegetation condition index (VCIx) was 0.67, while the cropped arable land fraction (CALF) was at average compared to the past 5 years. The national Crop Production Index (CPI) was 0.91, indicating an unfavorable agricultural production situation.

The NDVI spatial patterns show that from April to July, crop conditions in 18.4% of the cropped areas were above the 5-year average (marked in blue). The orange marked regions (4.4% of the cropped areas), mainly located in the northern part of Golestan, Ardebil, and East Azarbaijan, experienced below-average crop conditions at the beginning and then recovered gradually to around average in the middle of June. The remaining cultivated areas all experienced near average crop conditions during the monitoring period. The spatial pattern of the maximum Vegetation Condition Index (VCIx) was in accord with the spatial distribution of the NDVI profiles.

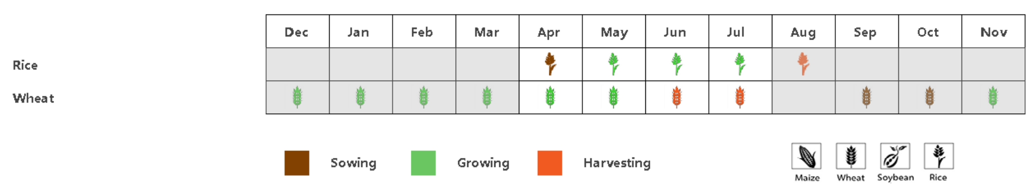
Regional analysis

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 (104)** and the **Coastal lowland and plain areas of the arid Red Sea (103)**.

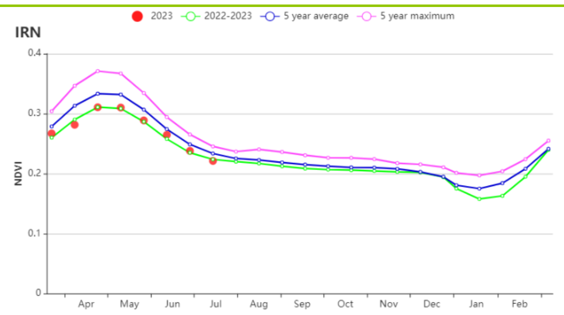
In the **Semi-arid to the subtropical hilly region in the west and the north**, the cumulative precipitation during the monitoring period was 82 mm, 24% below average; the temperature was 19.9°C (+0.3°C), and photosynthetically active radiation was average. The potential biomass was 9% lower than the average. Crop conditions were below the 5-year average throughout the monitoring period. The proportion of cultivated land was 35%, which is 2% lower than the 5YA average. The average VCIx for this region was 0.69, indicating unfavorable crop conditions.

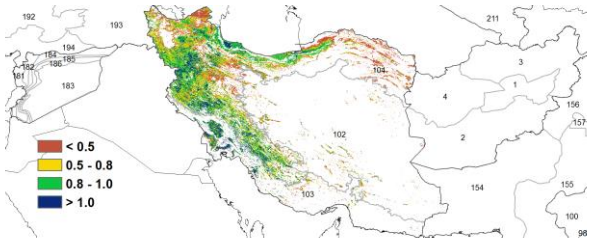
In the **Coastal lowland and plain areas of the arid Red Sea**, the temperature was 0.1°C below average, the accumulated precipitation was 3% below average, and the photosynthetically active radiation was slightly below average (-1%). The potential biomass was 1% below the 15-year average. Crop conditions were generally above the 5YA average. During the monitoring period, CALF was 65% above the average of the last 5-years, indicating more land was cultivated. Regional VCIx was 0.84. All in all, crop conditions were average in this important wheat production region.

Figure 3.22 Iran's crop condition, April 2023 - July 2023



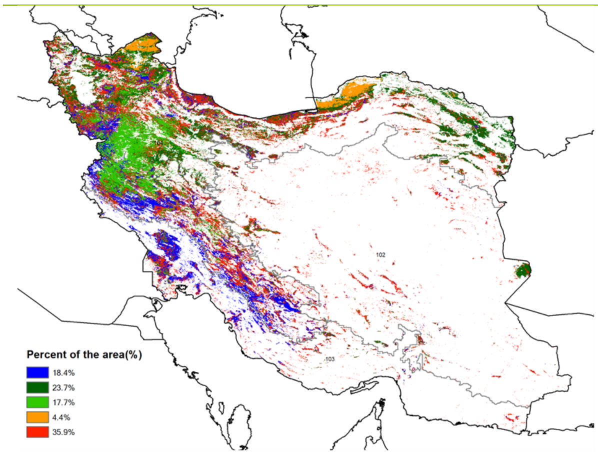
(a) Phenology of major crops

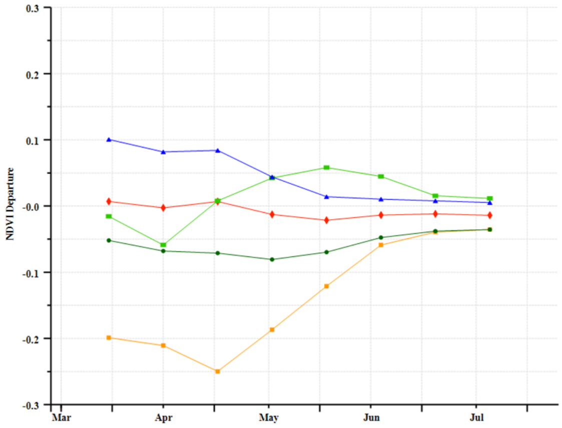




(b) Crop condition development graph based on NDVI

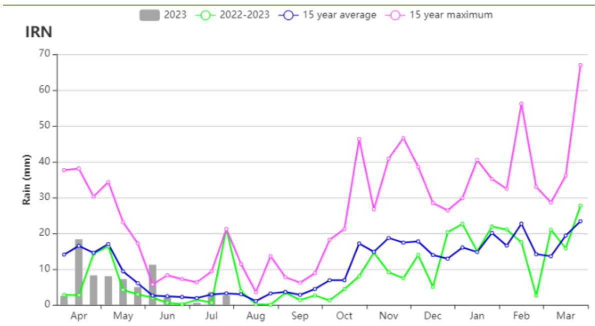
(c) Maximum VCI

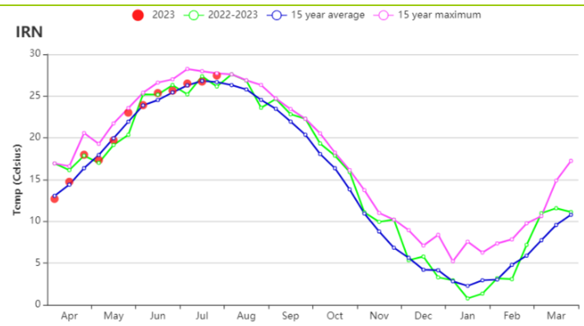




(d) Spatial NDVI patterns compared to 5YA

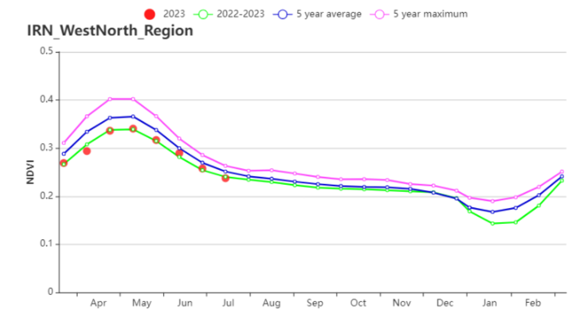
(e) NDVI profiles

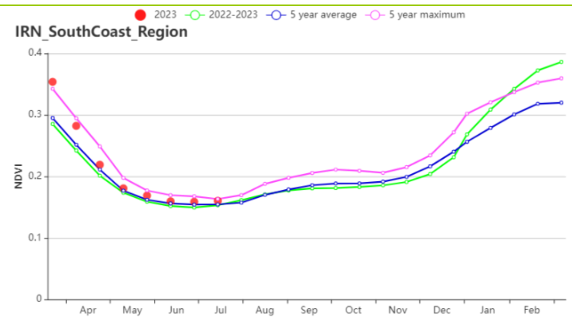




(f) Rainfall profiles

(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 3.35 Iran's agroclimatic indicators by sub-national regions, current season's values, and departure from 15YA, April 2023 - July 2023

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Arid Red Sea coastal low hills and plains	30	-3	31.6	-0.1	1632	-1	611	-1
Semi-arid to sub-tropical western and northern hills	82	-24	19.9	0.3	1610	0	563	-9

Table 3.36 Iran's agronomic indicators by sub-national regions, current season's values, and departure from 5YA, April 2023 - July 2023

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Arid Red Sea coastal low hills and plains	21	65	0.84
Semi-arid to sub-tropical western and northern hills	35	-2	0.69

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

[ITA] Italy

During this reporting period, winter wheat was harvested in June and July. Summer crops, especially maize, rice, sunflower, and soybeans, were planted in April and early May. According to the NDVI development graph, NDVI values were near average in the entire monitoring period. At the national level, temperature (TEMP +0.3 ºC) was above average. The solar radiation (RADPAR -4%) was below the 15YA. Rainfall was above average (RAIN +33%), which resulted in above-average biomass (BIOMSS +15%). CALF was 99%, and VCIx was 0.90.

Except for a few areas in the northern part of the country (Piemonte, Lombardia, and Lazio), the VCIx was above 0.80 for most of the cultivated land. The Crop Production Index (CPI) was 1.07, which means the agricultural production situation was close to average. The proportion of irrigated cropland in Italy is 39.7%. In summary, the unusual precipitation has resulted in localized below-average crop conditions, but the high rainfall helped restore groundwater levels. Crop conditions are expected to be close to average.

About 20.8% of the crops, mainly located in the Po Valley (mainly in Piemonte, Lombardia, and Veneto), showed a positive departure from the 5YA in the whole reporting period. For about 9.7% of the crops, crop conditions were above average in April and the first half of May, and below average between mid May and July. For about 24.7% of the crops, crop conditions were above average in April and May, but below average in June and July, mainly in Piemonte, Lombardia, and Veneto. For about 31.1% of the crops, crop conditions were below average in April and May, but above average in June and July, mainly in Puglia, Marche, and Abruzzi. About 13.7% of the crops experienced below-average crop conditions, scattered in Puglia, mainly in Sassari, Cagliari, Caltanissetta, and Agrigento.

Regional analysis

Based on cropping systems, climatic zones, and topographic conditions, four sub-national zones can be distinguished for Italy. These four regions are East Coast (108), Po Valley (105), Islands (107), and Western Italy (106).

East coast (108) (mainly in Puglia, Marche, and Abruzzi) experienced below-average temperature (TEMP -0.3°C), and solar radiation (RADPAR -5%). Due to heavy rainfall in mid- to early May and mid- to early June, RAIN (+74%) was far above average. The potential production showed an increase (BIOMSS +20%) mainly due to the higher rainfall. VCIx was 0.92. CALF was 99%. The CPI was 1.10. The crop condition development graph indicates that NDVI was average in the entire monitoring period. Good precipitation has been effective in mitigating the drought and crop conditions are expected to be close to average.

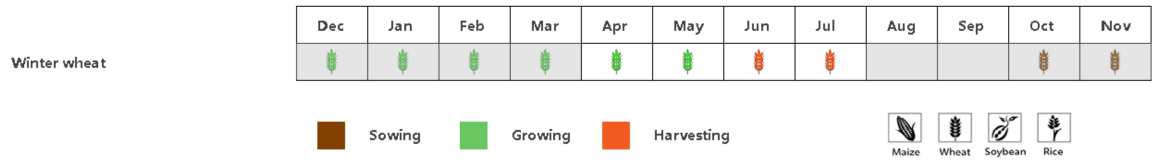
Crop production in the **Po Valley (105)** (mainly in Piemonte, Lombardia, and Veneto) was affected by above rainfall (RAIN +18%) and temperature (TEMP +0.5°C) and below-average solar radiation (RADPAR -4%). BIOMSS was above the 15YA by 9% and VCIx reached 0.87. CALF was 100%. The CPI was 1.04, which indicates that the agricultural production situation was near average. The crop condition development graph indicates above-average between April and mid May and below-average conditions between late May and July. According to the agro-climatic indicators, a near-average output can be expected.

The **Islands (107)** recorded above-average temperature (TEMP +0.3°C) and below-average RADPAR (RADPAR -6%). BIOMSS increased by 22% compared with the 15YA. Rainfall was significantly higher than average (RAIN +94%) due to heavy rainfall from May to mid-June. VCIx was 0.92. CALF was 98%. The CPI was 1.12. NDVI was below average in April and May, and above average in June and July. Good precipitation has been effective in mitigating the drought, and crop conditions are expected to be close to average.

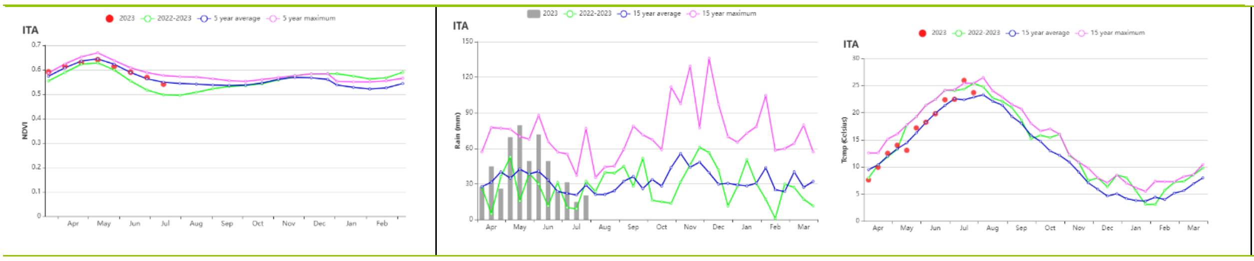
In **Western Italy (106)**, RAIN (RAIN +48%) and TEMP (TEMP +0.2°C) were above average. The solar radiation (RADPAR -4%) was below average. There was a 17% increase in biomass in the area, which was mainly due to higher rainfall in April and May. VCIx reached 0.92. CALF was 100%. The CPI was

1.08. According to the NDVI development graph, NDVI values were near average in the entire monitoring period. Crop conditions are expected to be close to average.

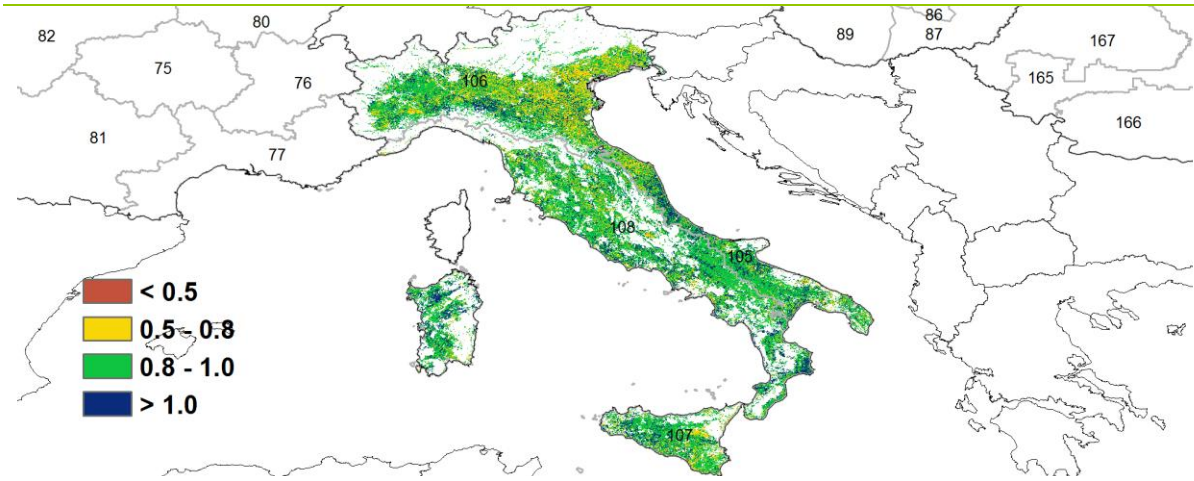
Figure 3.23 Italy's crop condition, April -July 2023



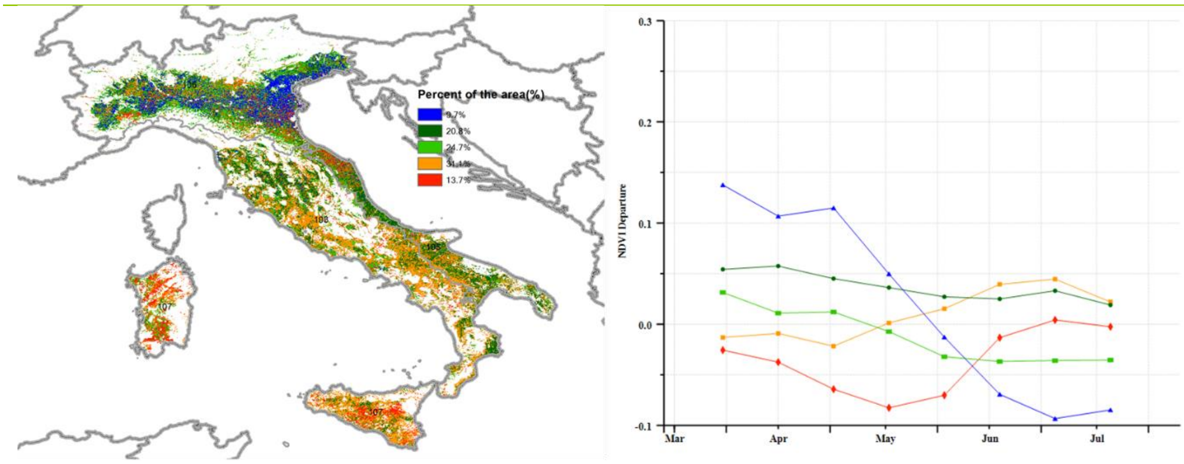
(a). Phenology of major crops



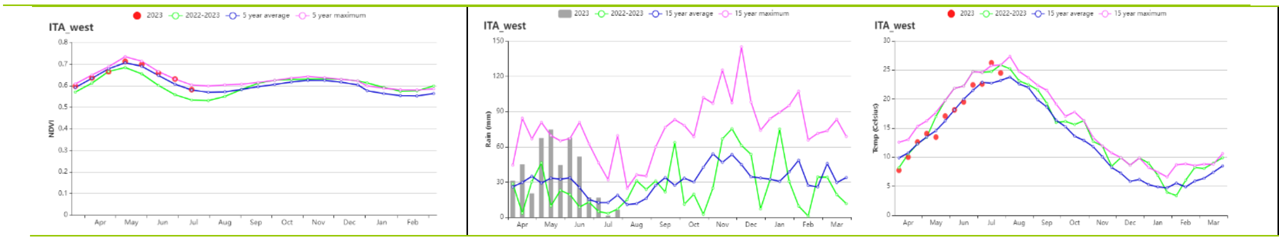
(b) Crop condition development graph based on NDVI, RAIN and TEMP (Italy).



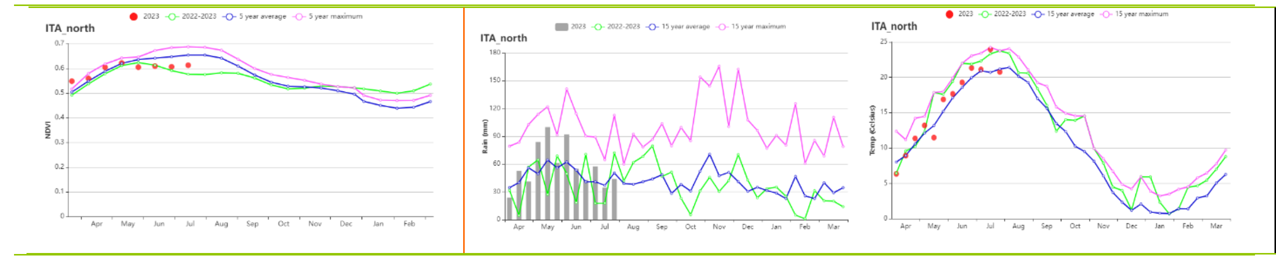
(c) Maximum VCI



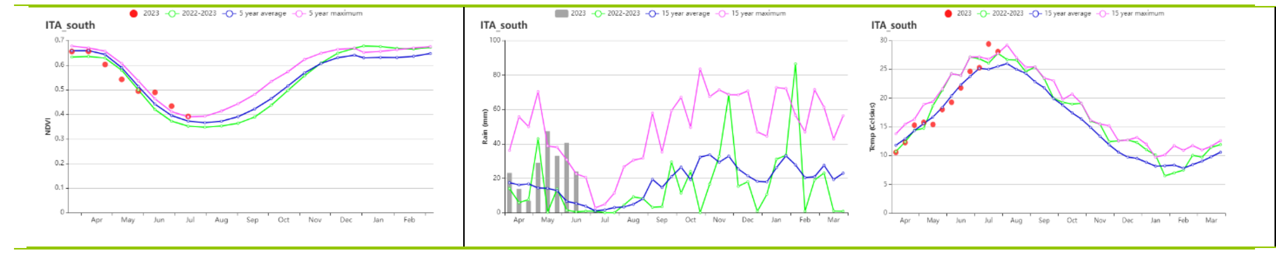
(d)Spatial distribution of NDVI profiles.



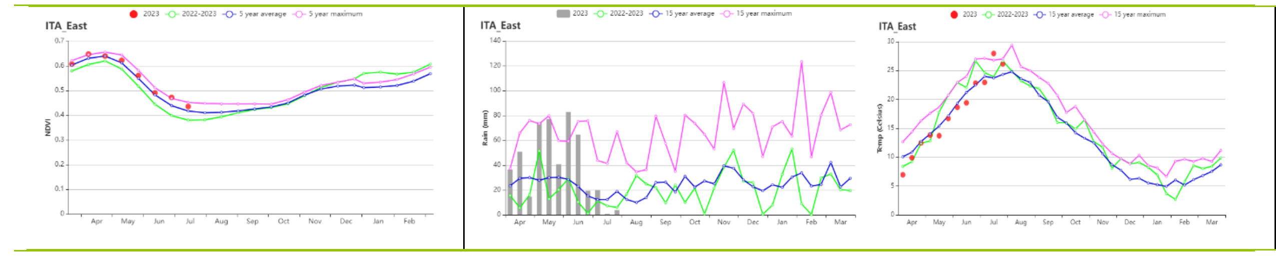
(e) Crop condition development graph based on NDVI, RAIN and TEMP (East Italy).



(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 3.37 Italy's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, April -July 2023

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
East coast	486	74	17.6	-0.3	1358	-5	978	20
Po Valley	688	18	16.0	0.5	1278	-4	1027	9
Islands	219	94	19.7	0.3	1445	-6	758	22
Western Italy	444	48	17.4	0.2	1374	-4	954	17

Table 3.38 Italy's agronomic indicators by sub-national regions, current season's values and departure from 5YA, April - July 2023

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current (%)
East coast	99	0	0.92
Po Valley	100	0	0.87
Islands	98	0	0.92

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current (%)
Western Italy	**100**	**0**	**0.92**

[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. According to the NDVI profiles, the national average NDVI values were generally below average from April to July.

Compared to the 15-year average, accumulated rainfall was below average (RAIN -10%), while the temperature and radiation were above average (TEMP +0.3°C, RADPAR +3%). The dekadal precipitation was below average from the late April to early June. The dekadal temperature mostly fluctuated along the average line except early June, when it exceeded the 15-year maximum. The rainfall deficit and warmer temperatures resulted in a decrease in the BIOMSS index by 5%.

The national average maximum VCI index was 0.71 and the Cropped Arable Land Fraction (CALF) was below average by 6%. The average national CPI was 0.96. According to the national crop condition development graphs, about 85.7% of croplands experienced below average crop conditions from May to July. About 14.3% of croplands, which were distributed in most areas of the Kostanai, Akmola, and North Kazakhstan states in the central north region, and some areas of Almaty state in the east region, experienced poor crop conditions from April to June and then return to above average in July.

According to the agro-climate and agronomic indicators of CropWatch, the output of spring wheat in this season is estimated to be below last year's levels. However, average rainfall levels from mid-June to the end of July helped alleviate the drought and create more favorable conditions for the grain filling phase of wheat, especially in the important northern region.

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).

In the **Northern region**, the accumulated precipitation was below average (RAIN -8%), while the temperature and RADPAR were above average. The rainfall deficit resulted in a decrease of the BIOMSS index by 3%. NDVI profiles show that crop conditions were below average. The average VCIx for this region was 0.69, and the CALF was below average by 6%. The spring wheat production is estimated to be slightly lower than the five-year average.

In the **Eastern plateau and southeastern region**, the accumulated precipitation and temperature were below average (RAIN -14%, TEMP -1.0°C). The lower rainfall and temperature led to a decrease of potential biomass by 11%. The crop conditions for this region were below average during the report period. The average VCIx for this region was 0.77, and CALF was below average by 6%. Output for spring wheat is estimated to be below average.

In the **South region,** the accumulated precipitation was below average by 28%, while the temperature and radiation were above average (TEMP +0.8°C, RADPAR +2%). The combination of agro-climatic indicators resulted in a decrease of the BIOMSS index by 6%. The NDVI profiles show below-average conditions from April to July. The average VCIx for this region was 0.64, and CALF was below average by 10%. The outputs of crops are estimated to be poor.

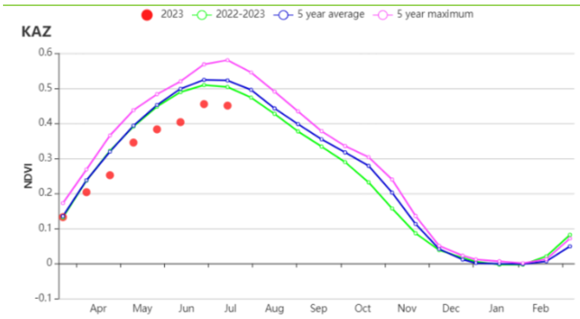
Figure 3.24 Kazakhstan's crop condition, April – July 2023

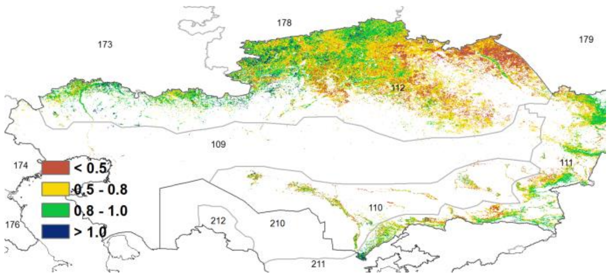
	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
Wheat (Spring)												

Sowing Growing Harvesting

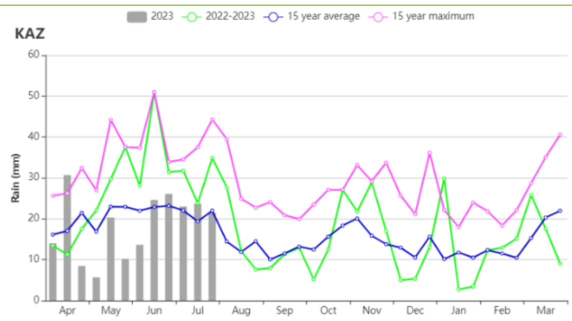
Maize Wheat Soybean Rice

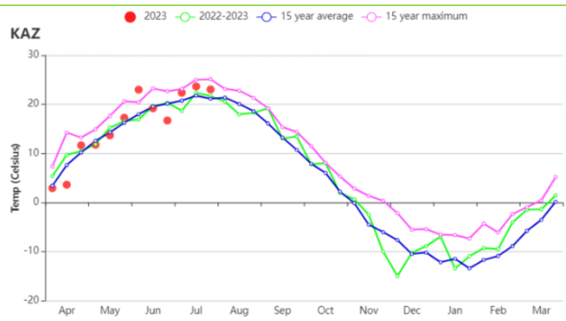
(a). Phenology of major crops



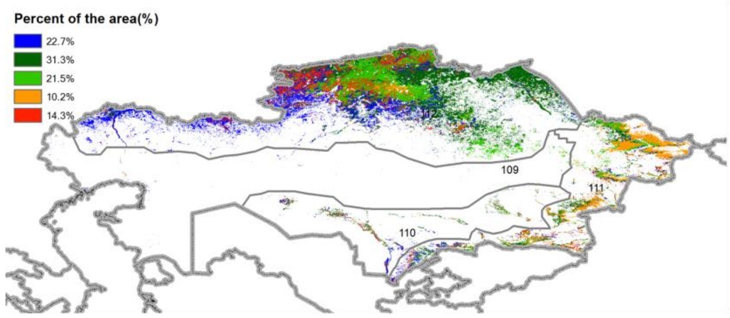


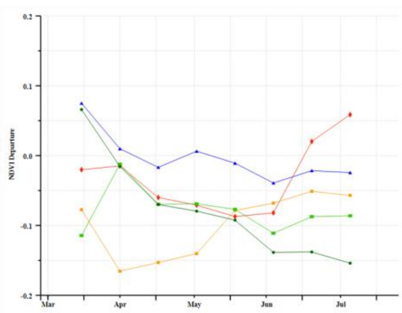
(b) Crop condition development graph based on NDVI (c) Maximum VCI



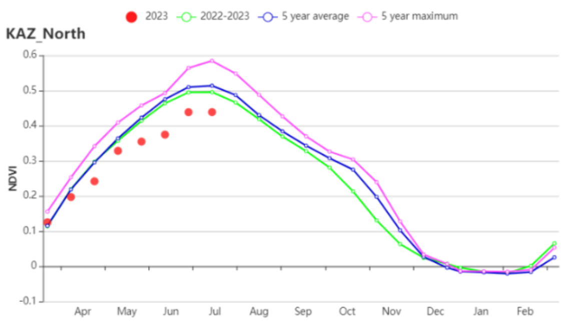


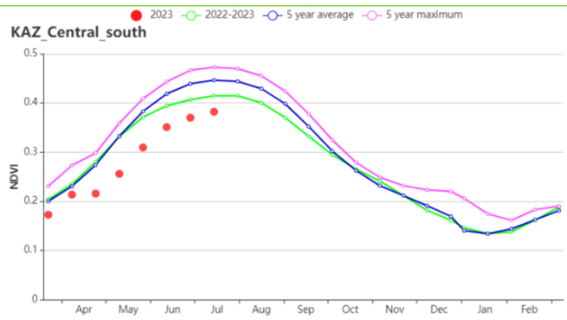
(d) Rainfall Index (e) Temperature Index





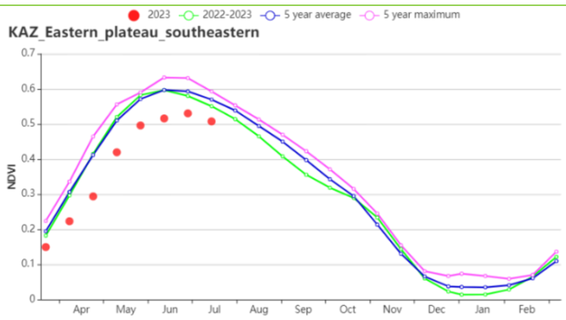
(f) Spatial NDVI patterns compared to 5YA (g) NDVI profiles





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

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



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

Table 3.39 Kazakhstan agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, April – July 2023

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
South zone	77	-28	23.2	0.7	1536	2	616	-6
Eastern plateau and southeastern zone	306	-14	13.8	-1.0	1462	3	662	-11
Northern zone	196	-8	16.0	0.8	1306	3	679	-3

Table 3.40 Kazakhstan, agronomic indicators by sub-national regions, current season's values and departure from 5YA, April – July 2023

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
South zone	52	-10	0.64
Eastern plateau and southeastern zone	85	-6	0.77
Northern zone	75	-6	0.69

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

[KEN] Kenya

Kenya has two distinct rainy seasons. The long rains extend from March through late May, while the short rains span from late October to December. Maize cultivation is feasible during both the long and short rains, whereas wheat cultivation exclusively takes place during the long rains. This report encompasses the monitoring phase spanning from April to July 2023, addressing the initial planting and early growth phases of long rainy season maize and wheat crops.

On a national scale, the total precipitation amounted to 348 mm, which was 43% below the average. The weather exhibited a slight warming trend, and the RADPAR was close to the 15-year average (TEMP +0.7°C, RADPAR +5%). The BIOMSS was 14% lower than the average due to lower rainfall. According to the national rainfall profiles, Kenya generally experienced low precipitation levels and is currently facing severe drought conditions. The Crop Production Index stands at 1.07, indicating a normal agricultural production in the current season. But the NDVI development graph at the national level reveals that the NDVI values were slightly below average.

The cumulative 10-day rainfall data indicated high values compared to the 15-year average in late April. At a sub-national level, only the Eastern coastal region received more rainfall (RAIN +77%). The other three regions experienced reduced rainfall, with the Southwest region exhibiting the most substantial negative deviation in rainfall compared to the 15-year average (RAIN -73%). In general, though lower than average rainfall was observed in Kenya, the current crop growth in Kenya has shown significant improvement compared to last year, primarily due to the heavy rainfall in late April that provided partial relief from the drought. All in all, crop conditions remained below average.

Regional analysis

Considering cropping systems, climatic zones, and topographic conditions, Kenya can be divided into four distinct sub-national agro-ecological regions: the Eastern Coastal Region (113), the Highland Agriculture Zone (114), the Northern Region (115), and the Southwest Region (116).

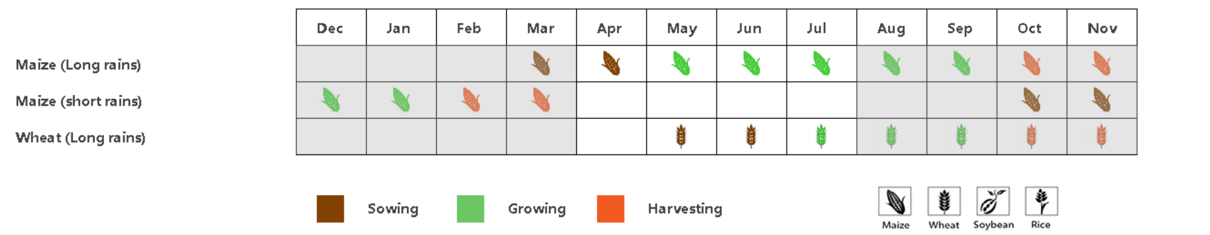
The **Eastern coastal region** experienced a positive departure in rainfall (+77%) and an average temperature that was 0.2°C higher. The VCI reached 0.90, while the CPI stood at 1.12. The heightened rainfall was primarily observed towards the end of April and May. Moreover, the NDVI values reverted to the five-year average due to the rise in precipitation by the end of April. Generally, the high rainfall towards the end of April has resulted in crop growth moving closer to the average level.

In the **Highland agriculture zone**, there was a recorded rainfall of 335 mm, which was 48% below the 15-year average (15YA). Additionally, a substantial reduction in biomass was observed (-17%). The extreme scarcity of precipitation at the start of April led to the delay of maize planting. Following a heavy rainfall towards the end of April, the growth of most crops began to align with the average level. Overall, the growth condition of crops was negatively affected by drought and remained below average. However, it is better than the same period last year.

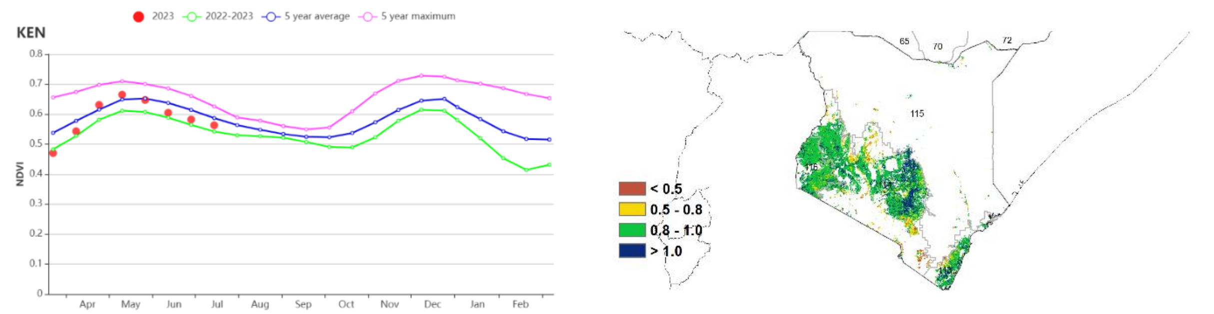
In the **Northern region**, precipitation was below average at 332 mm, decreasing by 23%. However, heavy rainfall at the end of April alleviated the drought situation, resulting in an increase in NDVI values. Nevertheless, due to an extreme decrease in precipitation during June and July, the NDVI values experienced a decline. Overall, the maximum VCIx value was 0.83, and BIOMSS decreased by 4%. This indicates a slight underperformance in vegetation growth in this region.

The largest negative departure in RAIN (-73%) was observed in the **Southwest region**. The main crop in the Southwest region is wheat. Wheat planting occurs between April and June. As a result, the severe drought conditions have caused a postponement in sowing wheat. However, because the wheat has only recently sprouted in July, this delay in planting has not yet been reflected in the NDVI values. In general, the growth of crops in the Southwest region has been negatively impacted by the drought.

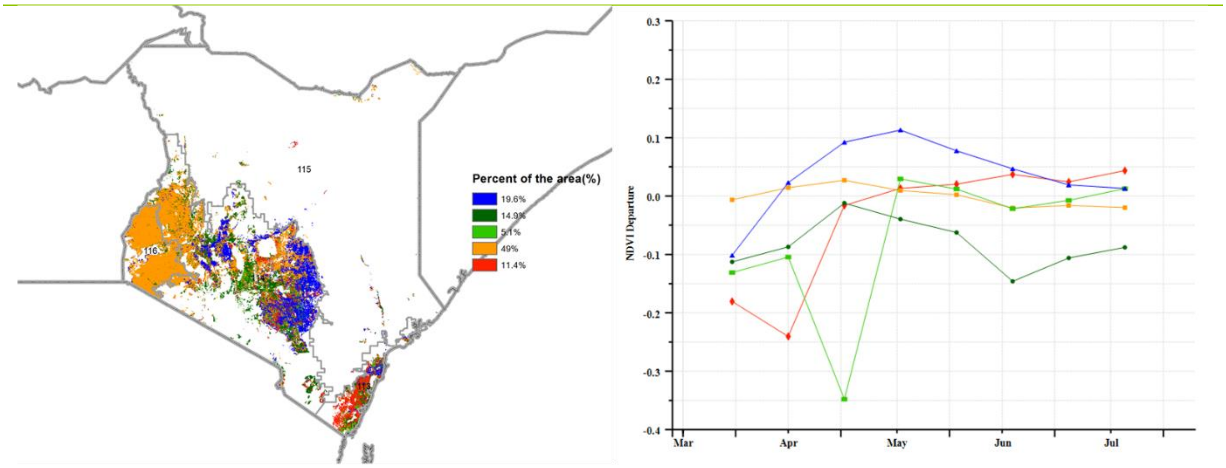
Figure 3.25 Kenya's crop condition, April- July 2023



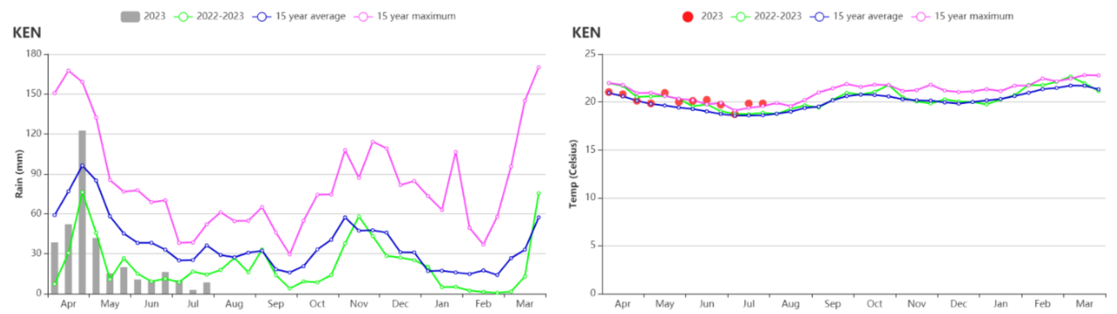
(a) Phenology of major crops



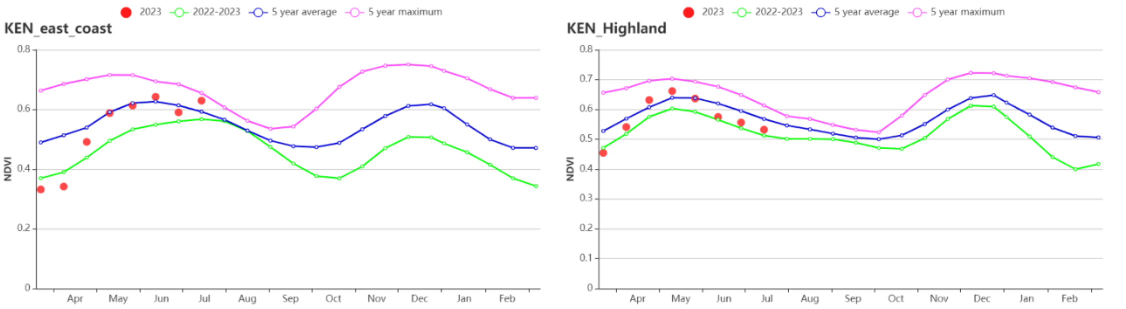
(b) Crop condition development graph based on NDVI (c) Maximum VCI



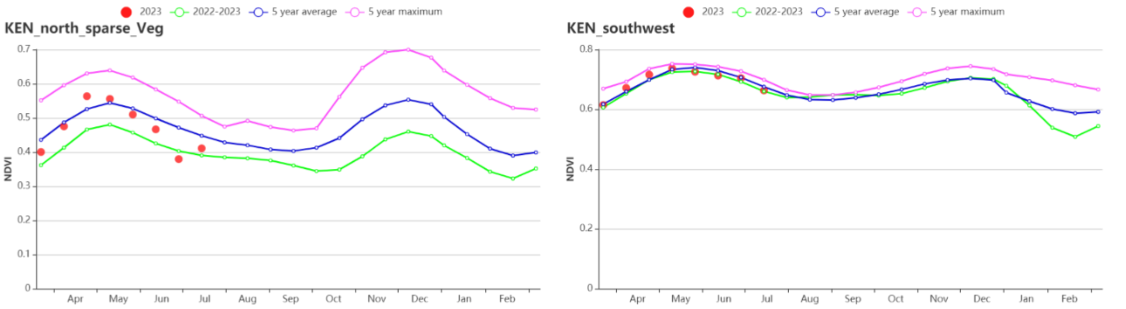
(d) Spatial NDVI patterns compared to 5YA (e) NDVI profiles



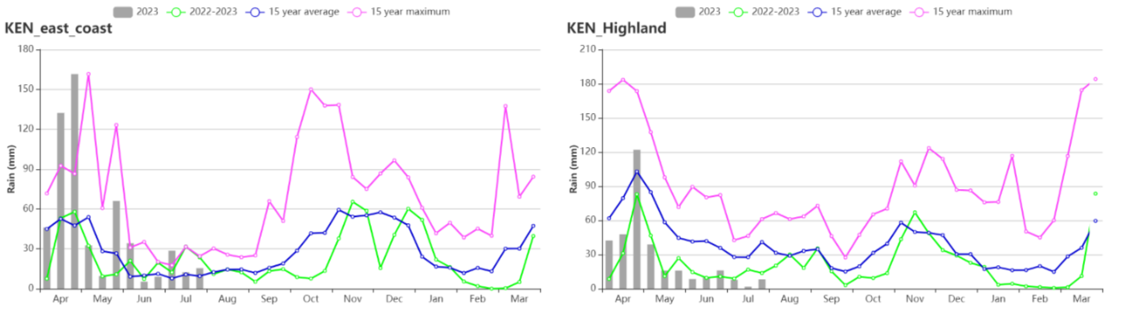
(f) Rainfall profiles (g) Temperature profiles



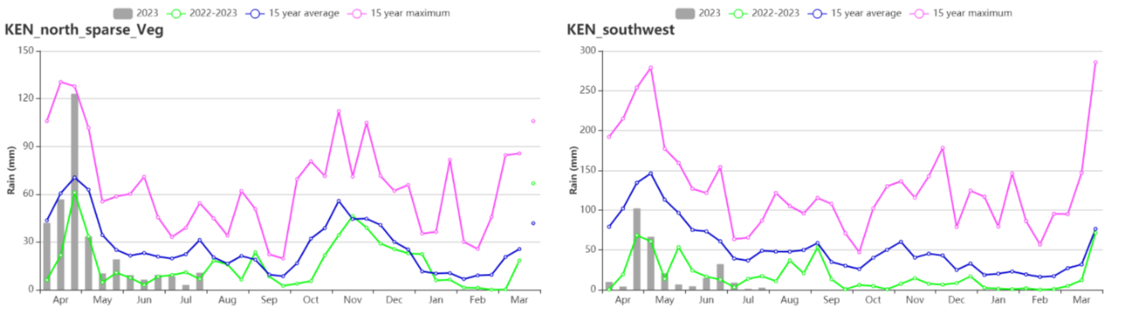
(h) Crop condition development graph based on NDVI, The eastern coastal region (left), The Highland agriculture zone (right)



(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 3.41 Kenya's agro-climatic indicators by sub-national regions, current season's values and departure from 15YA, April-July 2023

Region	RAIN	TEMP	RADPAR	BIOMSS

	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m2)	Departure (%)	Current (gDM/m2)	Departure (%)
Coast	552	77	25.1	0.2	1189	2	1106	20
Highland agriculture zone	335	-48	18.8	0.7	1164	6	710	-17
nothern rangelands	332	-23	23.3	0.7	1262	5	839	-4
South-west	273	-73	19.5	0.9	1173	-1	717	-39

Table 3.42 Kenya's agronomic indicators by sub-national regions, current season's values and departure, April-July 2023

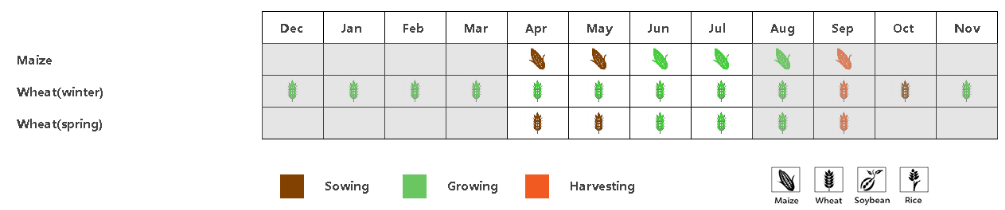
Region	Cropped arable land fraction		Maximum VCI	Crop Production Index (CPI)
	Current (%)	Departure (%)	Current	
Coast	98	6	0.90	1.12
Highland agriculture zone	98	3	0.90	1.07
nothern rangelands	91	15	0.83	1.09
South-west	100	0	0.92	1.09

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

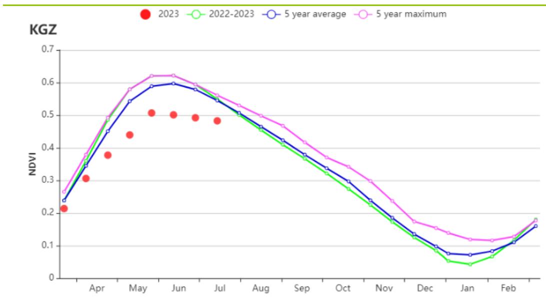
[KGZ] Kyrgyzstan

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 (-20%) and TEMP (-1.0°C) were below average, while RADPAR (+2%) was slightly above average. The combination of the factors resulted in a below-average BIOMSS (-11%) compared to the 15YA. As we can see from the time series of rainfall profile, the precipitation was above the 15-year average only in early April, middle June, early July, and late July, whereas the temperature was higher than the 15YA from early to middle June and from middle to late July only. The nationwide crop conditions were below average throughout the monitoring period. The spatial NDVI clustering profile shows that only 15.8% of the cropped areas (marked in red) enjoyed near average crop conditions during the whole monitoring period. Blue marked regions (14.4% of the cropped areas), mainly distributed in central Issyk-Kul and northern Chuy, suffered from a decline in crop condition at the beginning of the monitoring period (especially in mid-May, when the negative NDVI departure reached 0.2) and recovered to near average at the end of the monitoring period, the reason of which might be the extreme low temperature in early May. Light green marked regions (28.9% of the cropped areas) experienced a slight decline from early April to middle May and then recovered to near average, mainly distributed in northern Issyk-Kul and central Chuy. The remaining cropped areas all had near average crop conditions at the beginning and then dropped to below average at the end of the monitoring period. The spatial pattern of maximum Vegetation Condition Index (VCIx) was in accord with the spatial distribution of the NDVI profiles. Crop Area Land Fraction (CALF) decreased by 4%, and the nationwide VCIx average was 0.76. National Crop Production Index (CPI) was 0.87, indicating poor crop conditions in Kyrgyzstan. Below-average wheat yields should be expected due to the precipitation deficit. Maize harvest will start in September.

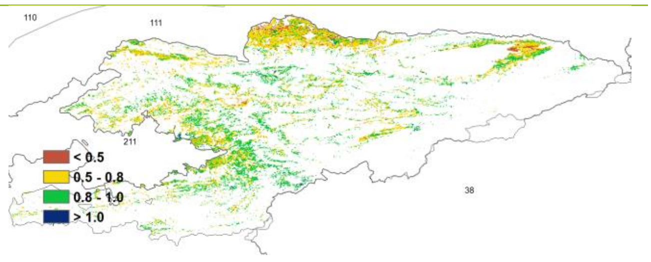
Figure 3.26 Kyrgyzstan's crop condition, April 2023 - July 2023



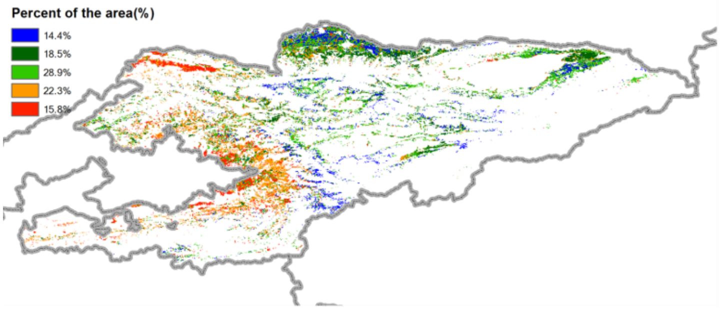
(a) Phenology of major crops



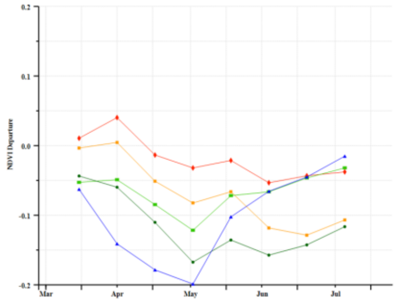
(b) Crop condition development graph based on NDVI



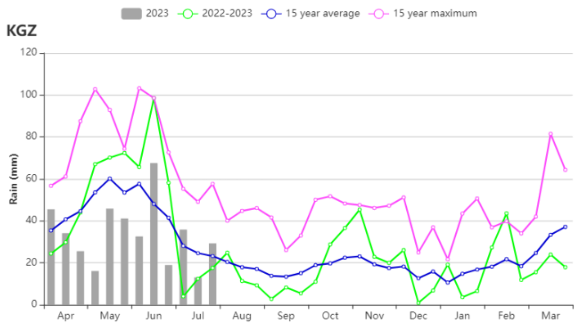
(c) Maximum VCI



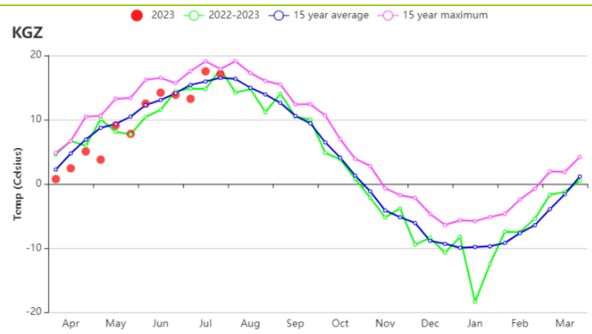
(d) Spatial NDVI patterns compared to 5YA



(e) NDVI profiles



(f) Rainfall profiles



(g) Temperature profiles

Table 3.43 Kyrgyzstan's agroclimatic indicators by sub-national regions, current season's values, and departure from 15YA, April 2023 - July 2023

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Kyrgyzstan	406	-20	9.8	-1.0	1506	2	614	-11

Table 3.44 Kyrgyzstan's agronomic indicators by sub-national regions, current season's values, and departure from 5YA, April 2023 - July 2023

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Kyrgyzstan	92	-4	0.76

[KHM] Cambodia

Cambodia gradually entered the rainy season from April, when the harvest of dry season early rice and dry season maize was completed. Planting of both wet season early rice and wet season maize began in May, followed by the planting of floating rice and medium rice. Soybeans continued to grow throughout the monitoring period and began to mature at the end. According to the CropWatch system, crop growth in Cambodia during this period was slightly anomalous due to rainfall deficits in April and May.

During the monitoring period, Cambodia experienced drier and hotter weather. Compared to the average, precipitation was about 6% (RAIN) lower, with a temperature increase of about 0.7°C (TEMP) and a slight increase in radiation of about 1% (RADPAR). Potential biomass was near average (BIOMASS -1%). The NDVI remained consistently below average. At the end of June and beginning of July, however, the NDVI almost returned to the average level. This is mainly due to the increase in precipitation. The pronounced rainfall deficit in April and May have significantly delayed the planting of rainy season early rice and rainy season maize. However, the normal rainfall in June and July restored the crop's NDVI. Furthermore, the rainfall deficit also increased the proportion of fallow land, leading to a 2% decrease in the CALF. Generally, crop growth across the country can be categorized into three conditions:

1) Approximately 22.9% of the cultivated area (light green) showed a continuous increase in NDVI from slightly below average to above average. These areas are mainly located in the lower Mekong River valley, where crop growth remains normal due to adequate water supply. 2) About 40.5% of the cultivated area (blue and dark green) showed a deterioration in NDVI. By the end of the period, crop growth in these areas was well below average. These areas are mainly located along the Tonle Sap Lake and in the northwestern highlands and have been severely affected by rainfall deficits and declining lake levels. 3) Approximately 36.5% of the cultivated area (red and orange) experienced a decline followed by a recovery in NDVI. These areas are mainly located in the downstream Mekong River and the northwestern region of Tonle Sap Lake. The initial decline is likely due to delayed planting caused by insufficient rainfall, while the subsequent recovery corresponds to increased rainfall.

In a word, despite a high VCIx index value of 0.84, crop growth in the country during the period is estimated to be slightly below average.

Regional analysis

Based on cropping systems, climatic zones, and topographic conditions, four sub-national regions are described below: **The Tonle Sap Lake area**, 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, **Northern Plain and Northeast**, and the **Southwest Hilly region** along the Gulf of Thailand coast.

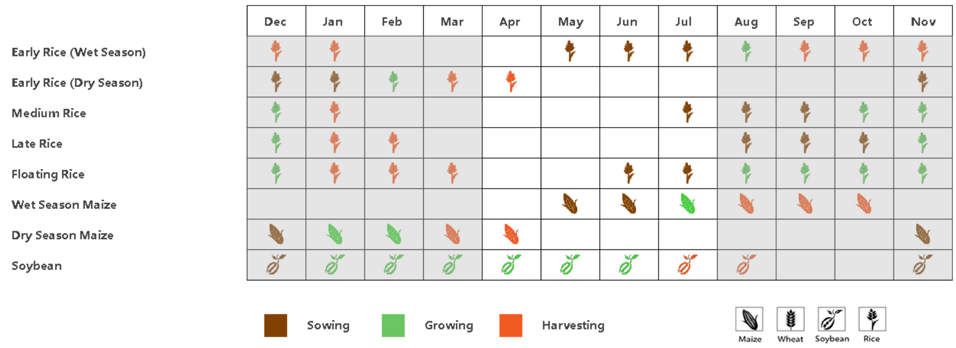
For **the Tonle Sap region** (agro-ecological zone 117), rainfall was deficient (RAIN -12%) and temperatures were slightly warmer than usual (TEMP +0.9°C), while radiation remained at normal (RADPAR) levels, resulting in a 6% (BIOMASS) reduction in potential biomass. The NDVI in this region was well below average before mid-June and showed a slight recovery after mid-June. The deficit of rainfall in April and May led to delayed planting in this region, and the drop in water level of the Tonle Sap Lake was also unfavorable for floating rice growing. Despite a subsequent rise in water levels after June, crop growth was still slightly below average.

The **Mekong Valley region** (agro-ecological zone 118) is the most important agricultural production zone in Cambodia. Precipitation in this region shows a deficit of 4% (RAIN), accompanied by an increase in temperature of 0.7°C (TEMP), while radiation remained normal (RADPAR) levels. The potential biomass is maintained at a normal (BIOMASS) level, as the negative effects of the slightly reduced rainfall seem to be compensated by the increased temperatures. Crop NDVI was also well below average before mid-June and gradually recovered to above average after mid-June. The CALF index shows a fall of around 2% (CALF) in this region.

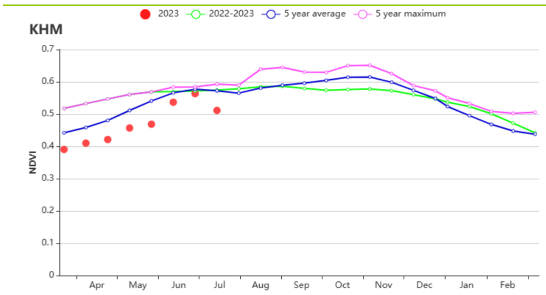
In **the Northern Plain and Northeastern** region (agro-ecological zone 119), there is a 4% (RAIN) deficit in precipitation, coupled with a significant increase in temperature of about 0.7°C (TEMP) and an increase in radiation of about 4% (RADPAR). The potential biomass in this region remains at normal (BIOMASS) levels. Similar to the Mekong Valley region, crop NDVI was well below average before mid-June and gradually recovered to average levels after June. The negative impact of the dry conditions in April and May on crops has been alleviated by the subsequent increase in rainfall, and the area under cultivation remained at a normal (CALF) level.

For **the Southwest Hilly region** (agro-ecological zone 120), the precipitation was slightly higher than average by about 4% (RAIN), with a temperature increase of about 0.3°C (TEMP). However, there was a slight decrease in radiation by about 1% (RADPAR), resulting in a 3% (BIOMASS) decrease in potential biomass. Crop NDVI in this region gradually recovered from well below average to normal levels. Although there was a sharp drop at the end of July, this was mainly due to the cloud cover and precipitation interfering with the remote sensing images. The proportion of cultivated land in this region remained at normal (CALF) levels, with the VCIx index reaching as high as 0.90, indicating an overall healthy crop growth status.

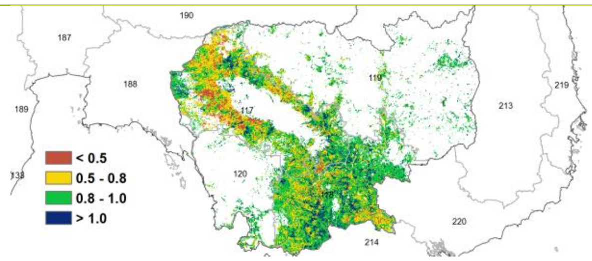
Figure 3.27 Cambodia's crop condition, April 2023 - July 2023



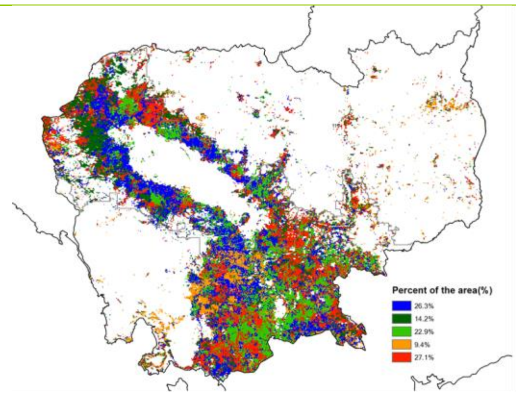
(a) Phenology of major crops



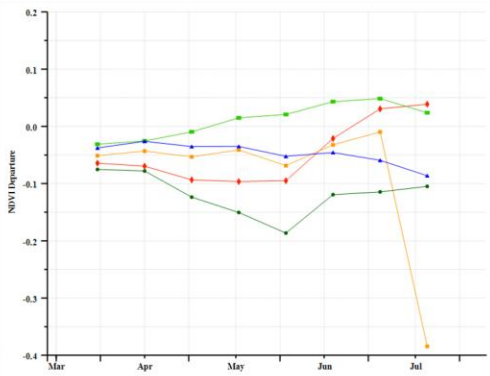
(b) Crop condition development graph based on NDVI



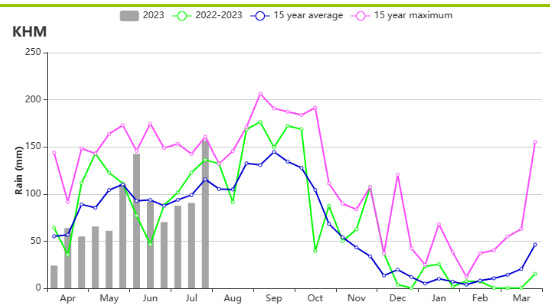
(c) Maximum VCI



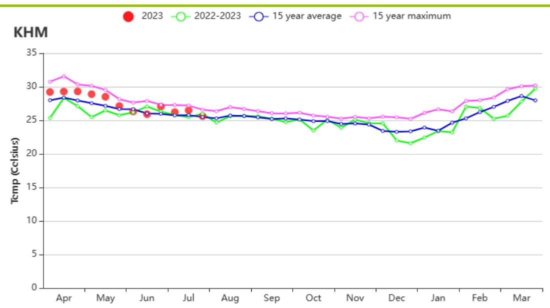
(d) Spatial NDVI patterns compared to 5YA



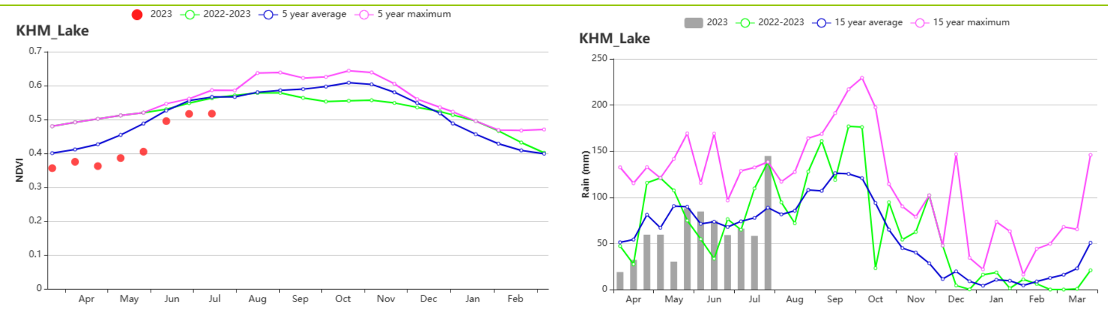
(e) NDVI profiles



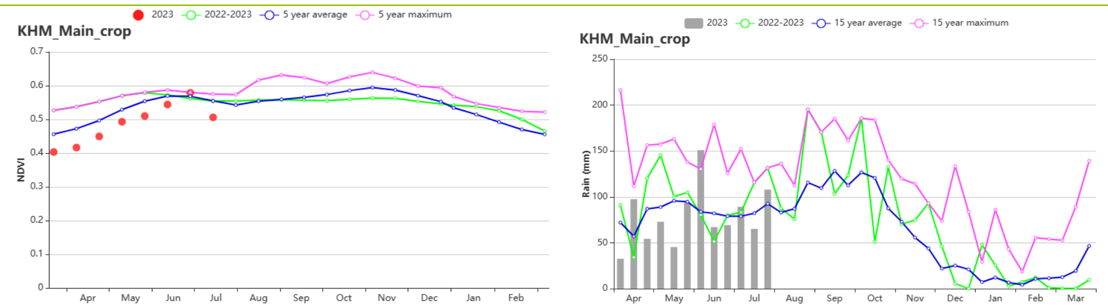
(f) Rainfall profiles



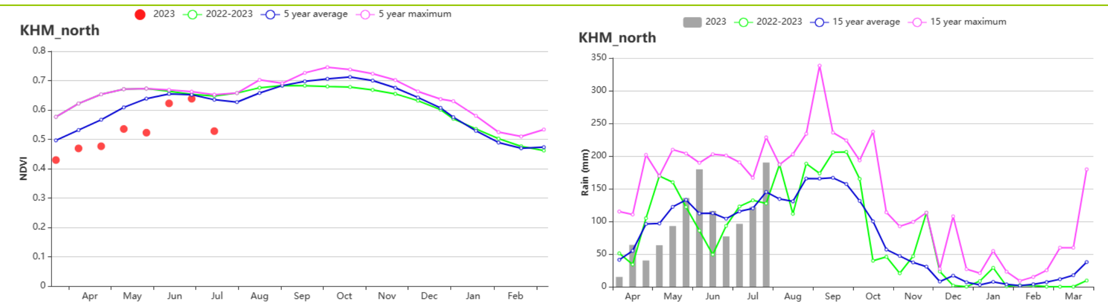
(g) Temperature profiles



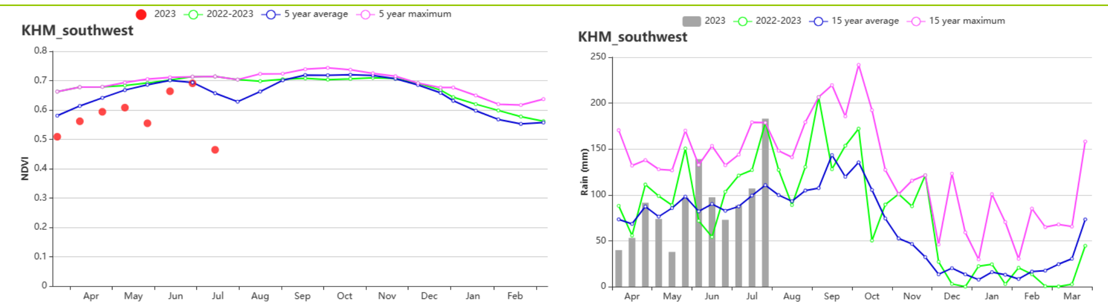
(h) Crop condition development graph based on NDVI (left) and time series rainfall profile (right) in Tonle Sap Lake region



(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 3.45 Cambodia's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, April 2023 - July 2023

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Tonle-Sap	775	-12	28.0	0.9	1186	0	1385	-6
Mekong Valley	946	-4	27.9	0.7	1199	0	1553	0
Northern plain and northeast	1192	-4	27.3	0.7	1209	4	1552	0
Southwest Hilly region	1081	4	25.8	0.3	1194	-1	1487	-3

Table 3.46 Cambodia's agronomic indicators by sub-national regions, current season's values and departure from 5YA, April 2023 - July 2023

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Tonle-Sap	90	-3	0.79
Mekong Valley	91	-2	0.87
Northern plain and northeast	98	0	0.87
Southwest Hilly region	99	0	0.90

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

[LBN] Lebanon

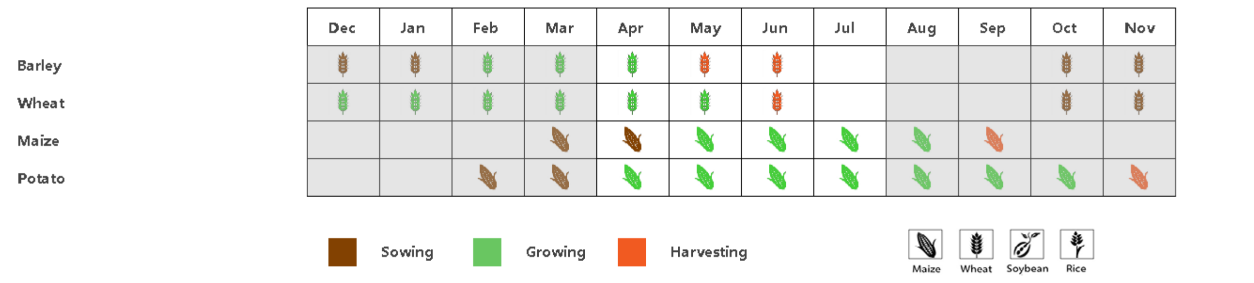
During this monitoring period, winter wheat and Barley reached maturity in June. The planting of summer crops was completed by April. Based on the agroclimatic and agronomic indicators, the crop conditions in Lebanon were generally average.

According to the CropWatch agroclimatic indicators, total precipitation at the national level was above average (RAIN +8%), temperature was slightly above average (TEMP +0.1°C), and radiation was below average (RADPAR -3%). As shown in the time series rainfall profile for Lebanon, precipitation was below average except for mid-April (close to the past 15-year maximum), late May and early June, and monthly precipitation was very unevenly distributed. Most of the country experienced warmer-than-usual conditions during this reporting period, except for mid-April to early May and mid-June; temperatures were above the 15-year maximum in mid to late July. Due to lower solar radiation, the biomass production potential (BIOMSS) was estimated to decrease slightly by 1% nationwide as compared to the fifteen-year average.

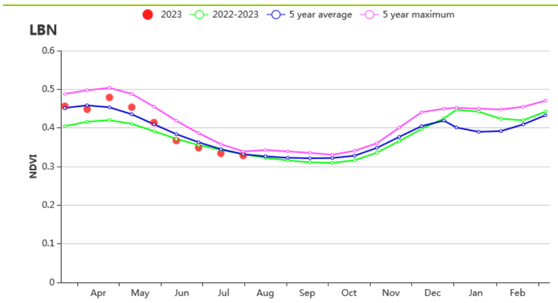
As shown in the crop condition development graph and the NDVI profiles at the national level, NDVI values were average for the first half of April, then decreased to below average, and then increased to above average from May to the first half of June, but were again below average from the second half of June to July. These observations are confirmed by the clustered NDVI profiles: 64.6% of regional NDVI values were above average in May and 78.4% of regional NDVI values were below average from the second half of June to July. 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 was 0.85. CALF during the reporting period was 72%, which was above average (+11%) compared to the recent five-year average.

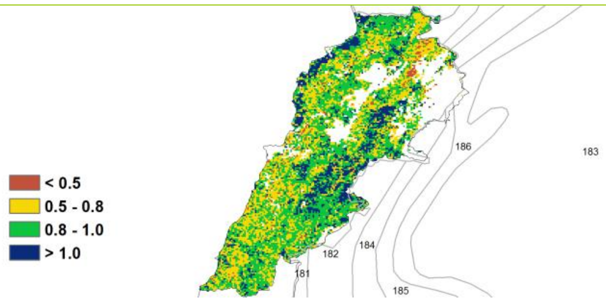
Generally, the agronomic indicators show close to average conditions for most winter and summer crops in Lebanon. The crops are mainly rainfed crops in Lebanon. More rain will be needed in crop production areas of Lebanon to ensure an adequate soil moisture supply during the grain-filling phase of the summer crops.

Figure 3.28 Lebanon's crop condition, April-July 2023



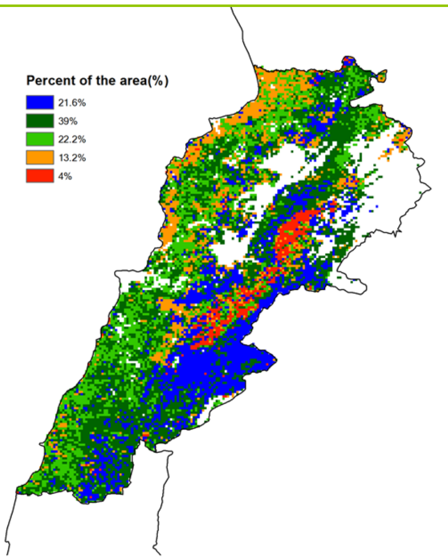
(a). Phenology of major crops

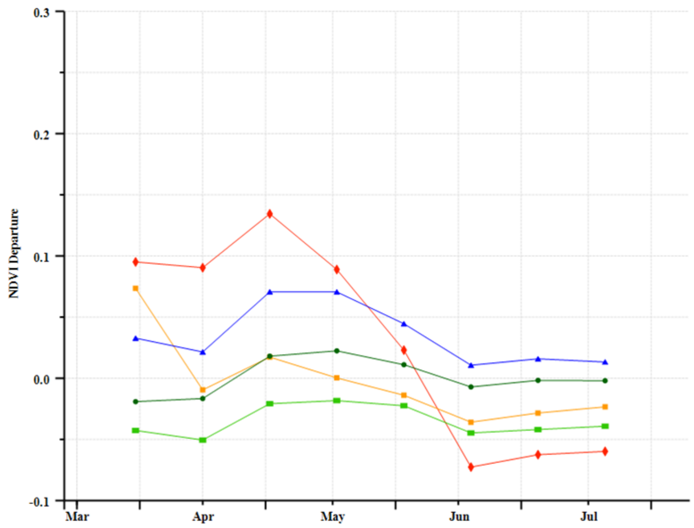




(b) Crop condition development graph based on NDVI

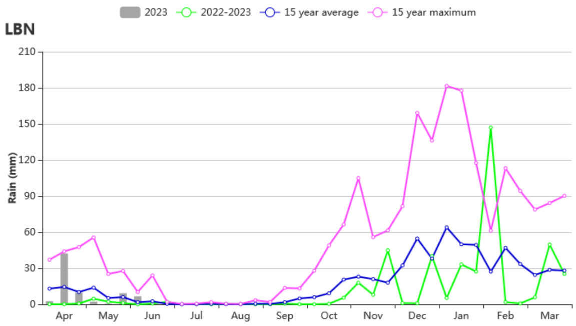
(c) Maximum VCI

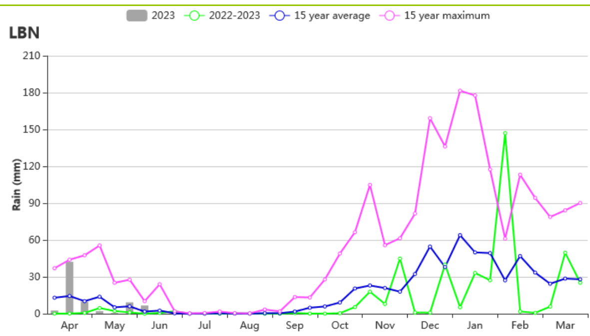




(d) Spatial NDVI patterns compared to 5YA

(e) NDVI profiles





(f) Rainfall profiles

(g) Temperature profiles

[LKA] Sri Lanka

This report covers the second cropping season of Sri Lanka. The sowing of the second Yala season crops (maize and rice) started in April. According to the CropWatch monitoring results, crop conditions were assessed as slightly below average for the monitoring period.

The country experienced the Southwest-Monsoon Season for most of the period. At the national level, precipitation was much lower than the 15YA (RAIN -20%), the temperature (TEMP 0.3°C) was higher, while the radiation (RADPAR 0%) was average. The fraction of cropped arable land (CALF 99%) was slightly up by 1% compared to the 5YA, while BIOMSS was down by 7% compared to the 15YA. As shown in the NDVI development graph, NDVI was slightly below average during most of the period. The maximum VCI for the whole country was 0.94. The CPI was 1.13, which indicates a normal agricultural production situation.

As shown by the NDVI clustering map and profiles, almost all of the country's cropland showed average to below-average crop conditions during the period: 11.1% of the cropland showed an apparent negative NDVI departure value from mid-April to mid-June. 6% of the cropland showed below-average NDVI values in early May, June and late July. 7.9% of the cropland showed below-average NDVI values in early May, June and July. The crop condition for the remaining part was mostly close to average. The maximum VCI showed high values for most of the country.

Regional analysis

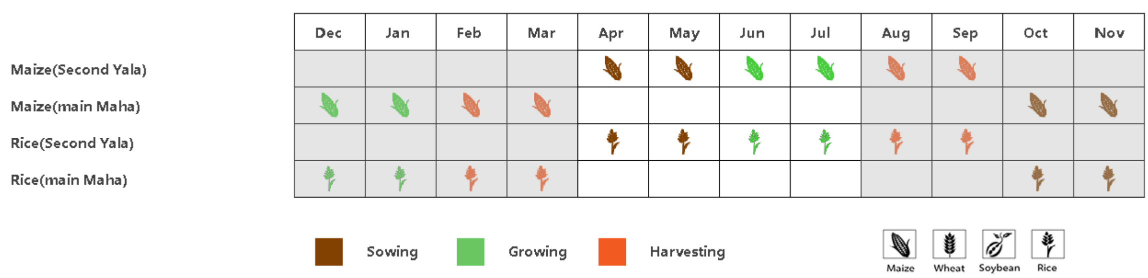
Based on the cropping system, climatic zones and topographic conditions, three sub-national agroecological regions can be distinguished for Sri Lanka. They are the Dry zone (121), the Wet zone (123), and the Intermediate zone (122).

In the **Dry zone**, the recorded RAIN (364 mm) was 17% below average. TEMP was 0.6°C above average while RADPAR was on average. BIOMSS decreased by 7% as compared to the 15YA. CALF was higher than the 5YA level with 99% of cropland utilized. NDVI was similar to that of the whole country. The VCIx for the zone was 0.92. The CPI was 1.12. Overall, crop conditions were assessed as near average for this zone.

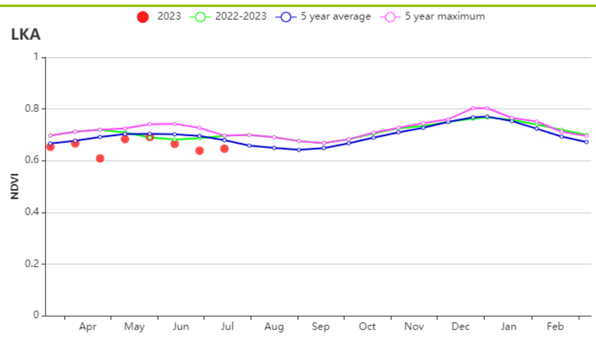
For the **Wet zone**, RAIN (1602 mm) was 20% below average as compared to the 15YA. TEMP and RADPAR decreased by 0.2°C and 1% respectively. BIOMSS was 5% below the 15YA and cropland was fully utilized. NDVI values trended below average, although some of the negative departures can be attributed to cloud cover in the satellite images. The CPI was 1.18. Crop conditions were below average for this zone.

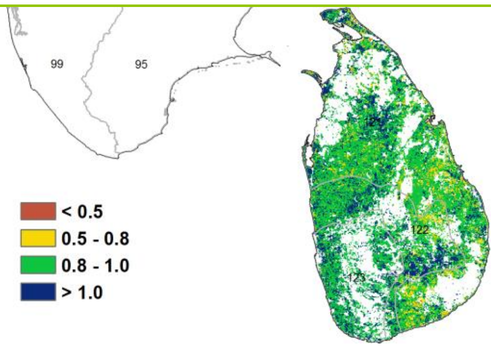
The **Intermediate zone** had a rainfall of 665 mm, which was 32% below average. TEMP and RADPAR were 0.7°C and 2% higher compared to the 15YA. With full use of cropland, BIOMSS was 2% lower than the average. The crop condition was slightly below average and the VCIx value for this zone was 0.93. The CPI was 1.13.

Figure 3.29 Sri Lanka's crop condition, April-July 2023

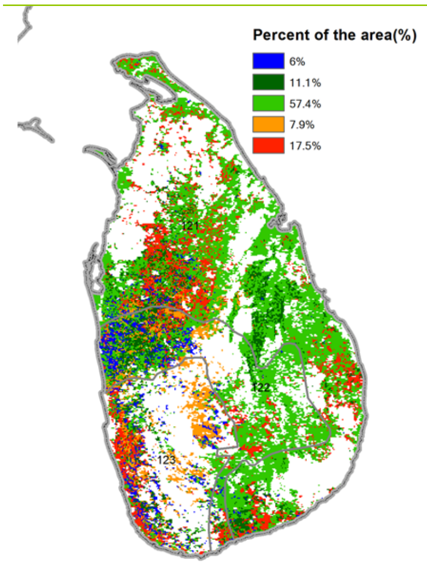


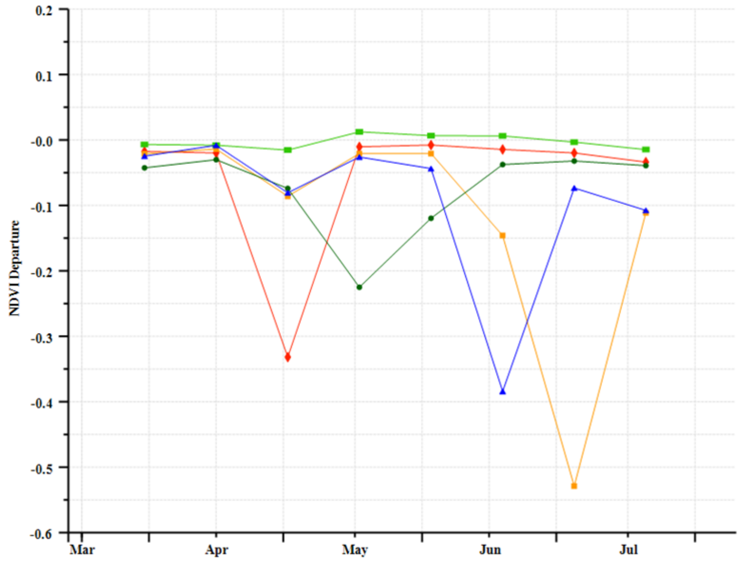
(a) Phenology of major crops



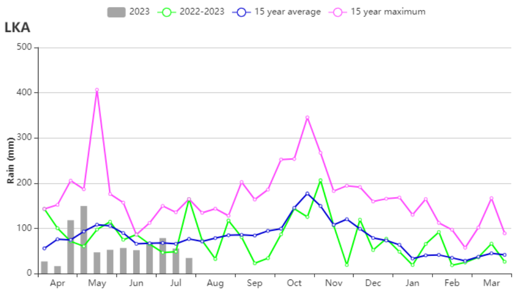


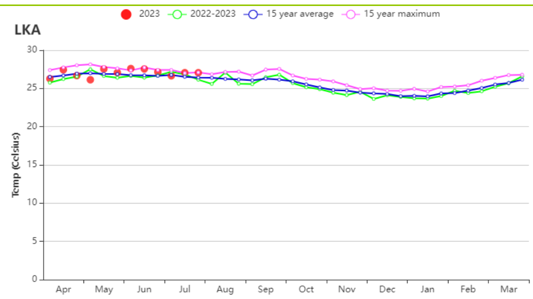
(b) Crop condition development graph based on NDVI (c) Maximum VCI



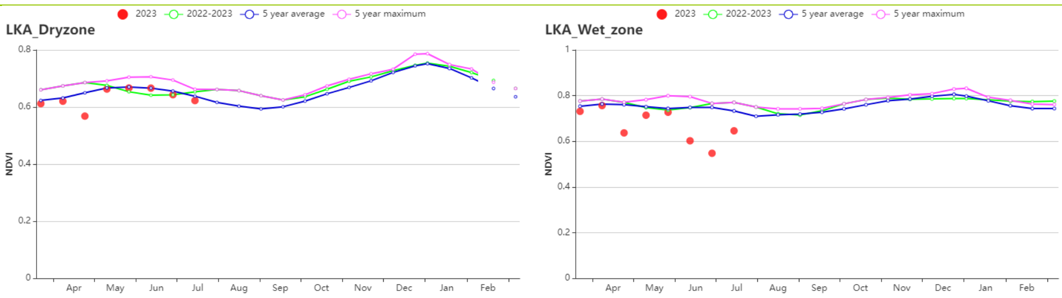


(d) Spatial NDVI patterns compared to 5YA (e) NDVI profiles

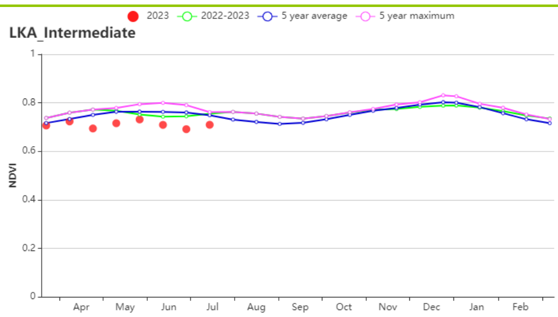




(f) Rainfall profiles (g) Temperature profiles



(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 3.47 Sri Lanka's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, April - July 2023

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Dry zone	364	-17	28.3	0.6	1328	0	963	-7
Intermediate zone	665	-32	25.9	0.7	1228	2	1092	-12
Wet zone	1602	-20	24.4	-0.2	1160	-1	1481	-5

Table 3.48 Sri Lanka's agronomic indicators by sub-national regions, current season's values and departure from 5YA, April - July 2023

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Dry zone	99	2	0.92
Intermediate zone	100	0	0.95
Wet zone	100	0	0.97

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

[MAR] Morocco

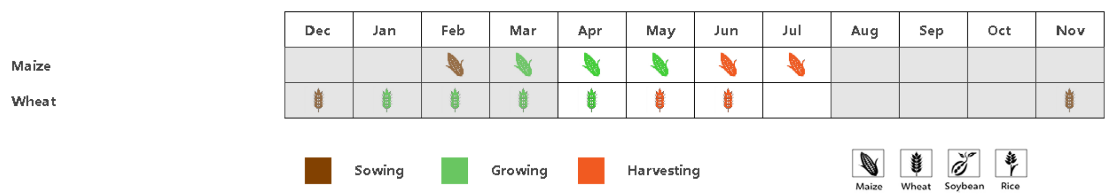
During this monitoring period, wheat reached maturity by the end of April and was harvested in May and June, while Maize matured by the end of May and is harvested in June and July. The cumulative rainfall was 74 mm which is 20% below the 15-year average (15YA). The rainfall index graph shows that the rain was higher than the 15YA from mid-May to the first of June. The average temperature was 21.2 ℃ which is higher than 15YA by 1.0 ℃. The temperature index graph fluctuated around 15YA during the monitoring period. Both RADPAR and BIOMSS were below the 15YA by 1.4% and 4%, respectively. The nationwide NDVI development graph indicates that the crop conditions were below the 5-year average (5YA) during the monitoring period. The NDVI spatial pattern shows that the crop conditions were below the 5YA. This can be confirmed by the NDVI cluster map, where all NDVI clusters were below the 5YA. This also can be attributed to drought conditions due to a reduction in rainfall. The CALF was below the 5-year average (5YA) by 49%, with the VCIx value reaching 0.50, confirming unfavorable crop conditions. The nationwide crop production index (CPI) was at 0.62, implying a below normal crop production situation. In addition, CALF was almost 50% below the 5YA.

Regional Analysis

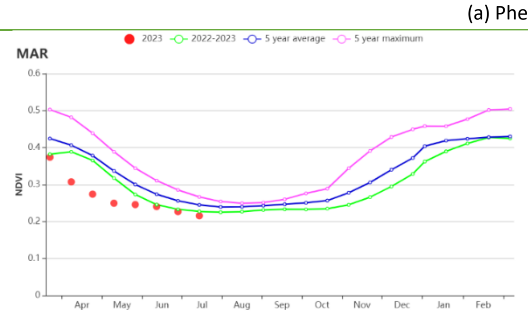
CropWatch delineates three agroecological zones (AEZs) relevant to crop production in Morocco: the Sub-humid northern highlands (area identified as 125 in the crop condition clusters map), the Warm semiarid zone (126), and the Warm subhumid zone (127).

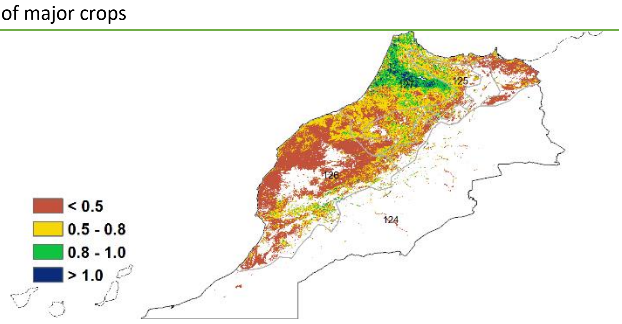
The rainfall was below the 15YA by 9%, 39%, and 7%, while the temperature was above the 15YA by 0.8℃, 1.0℃, and 0.8℃ for the Sub-humid northern highlands, the Warm semiarid zone, and the Warm subhumid zone respectively. The RADPAR was below the 15YA by 1%, 1%, and 2%, and the BIOMSS was below the 15YA by 4%, 4%, and 3% for the Sub-humid northern highlands, the Warm semiarid zone, and the Warm subhumid zone respectively. The NDVI-based crop condition development graphs show similar conditions for the three zones following the national crop development NDVI graph. The CALF was below the 5YA by 49%, 80%, and 36%, and the VCIx was 0.58, 0.38, and 0.64 for the Sub-humid northern highlands, the Warm semiarid zone, and the Warm subhumid zone, respectively, confirming unfavorable crop conditions. The CPI was at 0.48, 0.30, and 0.74 in the Sub-humid northern highlands, the Warm semi-arid zone, and the Warm sub-humid zone, respectively, implying a below-normal crop production situation.

Figure 3.30 Morocco's crop condition, April-July 2023



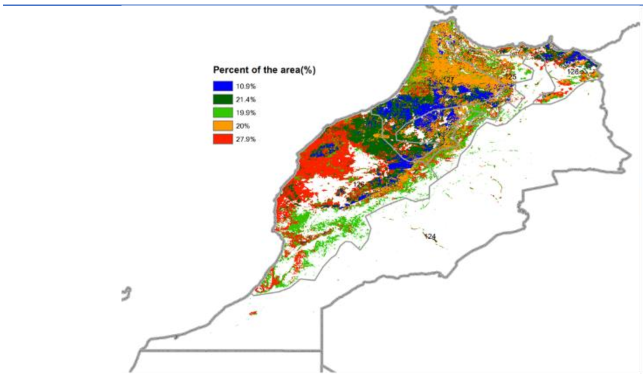
(a) Phenology of major crops

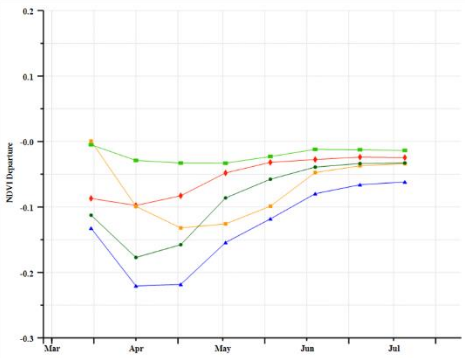




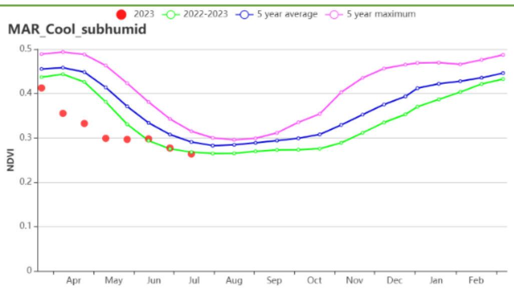
(b) Crop condition development graph based on NDVI

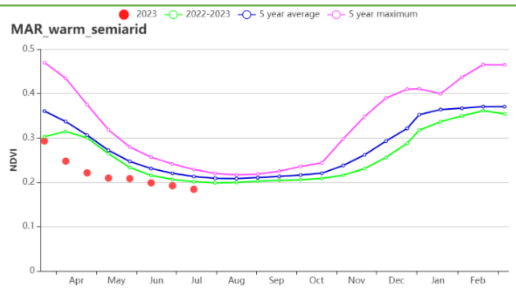
(c) Maximum VCI



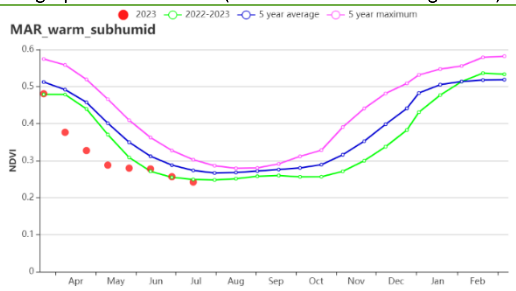


(d) Spatial NDVI patterns compared to 5YA (e) NDVI profiles

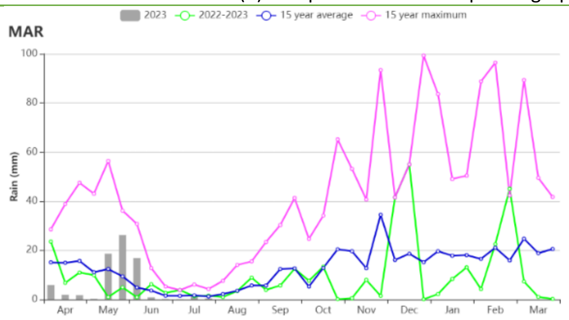


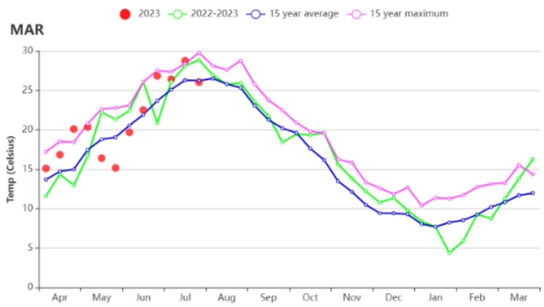


(f) Crop condition development graph based on NDVI (Sub-humid northern highlands).and (g). Warm semiarid zones)



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





(i) Time series profile of rainfall (j) Time series profile of temperature

Table 3.49 Morocco's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, April-July 2023

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m2))	Departure from 15YA (%)	Current (gDM/m2)	Departure from 15YA (%)
Sub-humid northern highlands	121	-9	20	0.8	1551	-1	633	-4
Warm semi-arid zones	38	-39	22	1.0	1598	-1	544	-4
Warm sub-humid zones	109	-7	21	0.8	1545	-2	620	-3

Table 3.50 Morocco's agronomic indicators by sub-national regions, current season's values, and departure from 5YA, April-July 2023

Region	CALF		Maximum VCI
	Current (%)	Departure from 5YA (%)	Current
Sub-humid northern highlands	31	-49	0.58
Warm semi-arid zones	4	-80	0.38
Warm sub-humid zones	42	-36	0.64

[MEX] Mexico

This report covers the production of irrigated wheat, typically sown in November and December, as well as 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.

Agro-climatic conditions showed that RAIN decreased by 37%, TEMP increased by 0.9°C, RADPAR was at the average level, and BIOMSS decreased by 17%. The CALF decreased by 2%. According to the crop condition development graph based on NDVI, overall crop growth in Mexico was below average.

During mid-June, certain regions of Mexico experienced scorching temperatures soaring up to 45 degrees Celsius. Areas such as Chiapas and Puebla states were severely impacted. This persistent heatwave triggered a prolonged period of high temperatures and arid conditions, resulting in acute water scarcity across multiple regions of Mexico. The agricultural sector bore the brunt of this situation, with crop irrigation being significantly compromised.

As the heatwave engulfed the nation, drought conditions emerged in various parts of Mexico. Several key reservoirs, including the Malpaso Dam in the southern part of Chiapas state, witnessed a notable decline in water levels. Crucial crops like corn faced challenges due to insufficient irrigation, thus jeopardizing their growth and yields. Throughout the monitoring period, the crop growth showed a consistent downward trend, particularly during June and July, when it significantly lagged behind the average benchmarks.

With only about 38.3% of cultivated areas demonstrating average crop conditions, and a mere 12.4% exhibiting above-average conditions, the gravity of the situation becomes evident. Coupled with the inadequate rainfall observed in the previous monitoring period, Mexico grapples with a severe water resource crisis. Nearly two-thirds of the country experienced water shortages during this reporting period, manifesting in grim agricultural prospects.

Regional analysis

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

The Arid and semi-arid region in northern and central Mexico encountered a significant 55% decrease in rainfall, with temperature reaching 23.7°C (+0.6°C). RADPAR recorded a value of 1546 MJ/m2, slightly lower by 1%. According to the NDVI-based development graph, crop conditions were close to the average until May, but remained far below average thereafter. The CALF was 61%, displaying a decrease of 3% compared to the five-year average. The VCIx value was 0.61.

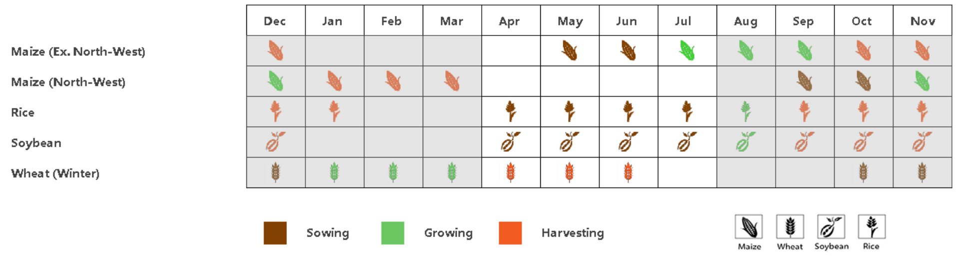
The Humid tropics with summer rainfall region in southeastern Mexico experienced decreased RAIN with 567 mm recorded (36% decrease). TEMP increased to 27.2°C by 1.2°C, while RADPAR slightly rose to 1393 MJ/m2 (+1%). BIOMSS exhibited a reduction of 17% at 1053 g DM/m2. The VCIx value was 0.84. The region's high VCIx of 0.84 indicated generally normal crop growth. However, according to the NDVI-based development graph, conditions were below average.

The Sub-humid temperate region with summer rains in central Mexico experienced decreased RAIN with 456 mm recorded (37% decrease). TEMP increased to 21.9°C by 1.2°C, and RADPAR slightly rose to 1471 MJ/m2 (+1%). BIOMSS exhibited a reduction of 13% at 900 g DM/m2. CALF was stable at 92%, and the VCIx value was 0.65. Crop conditions were below the average level, as indicated by the NDVI-based development graph.

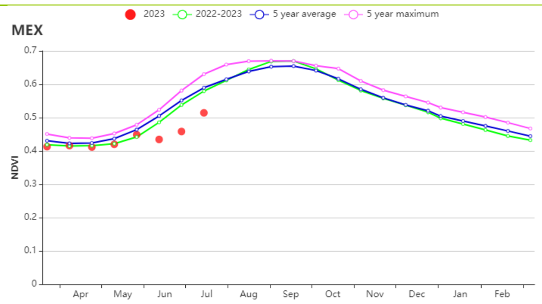
The Sub-humid hot tropics with summer rains region in southern Mexico experienced a notable reduction in RAIN with 502 mm recorded (28% decrease). TEMP rose to 24.5°C (+1°C), while RADPAR remained unchanged. BIOMSS displayed a decline of 14% at 922 g DM/m2. CALF remained steady at 95%, and the

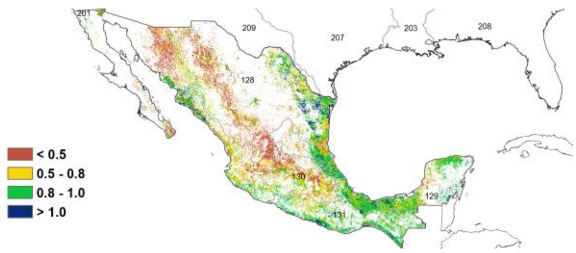
VCIx value was 0.77. According to the NDVI-based development graph, crop conditions were slightly below-average during the four-month period.

Figure 3.31 Mexico's crop condition, April - July 2023



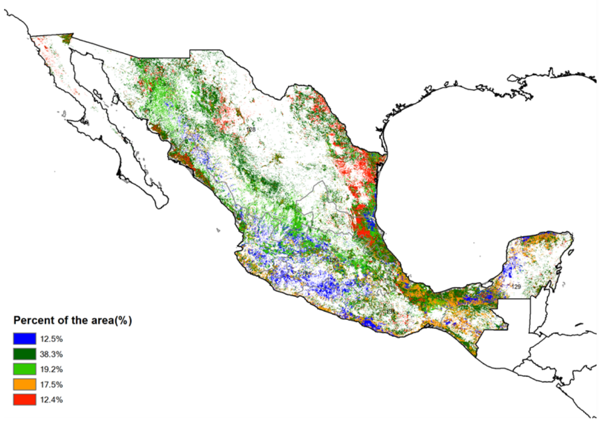
(a) Phenology of major crops

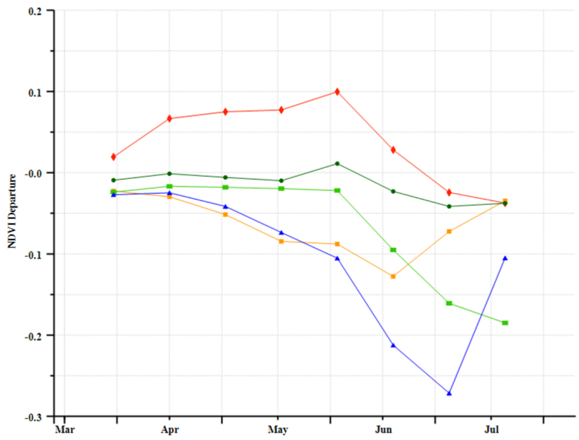




(b) Crop condition development graph based on NDVI

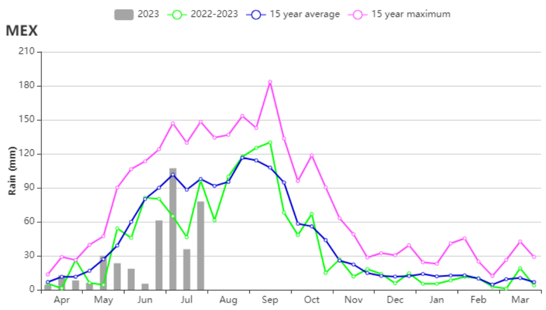
(c) Maximum VCI

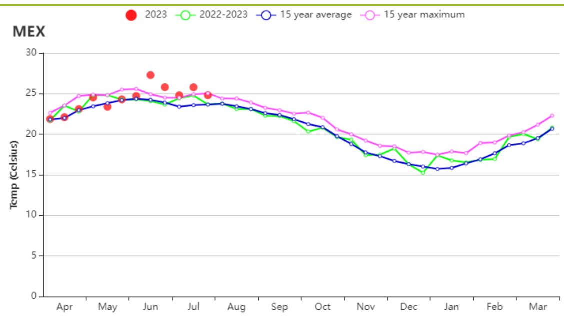




(d) Spatial NDVI patterns compared to 5YA

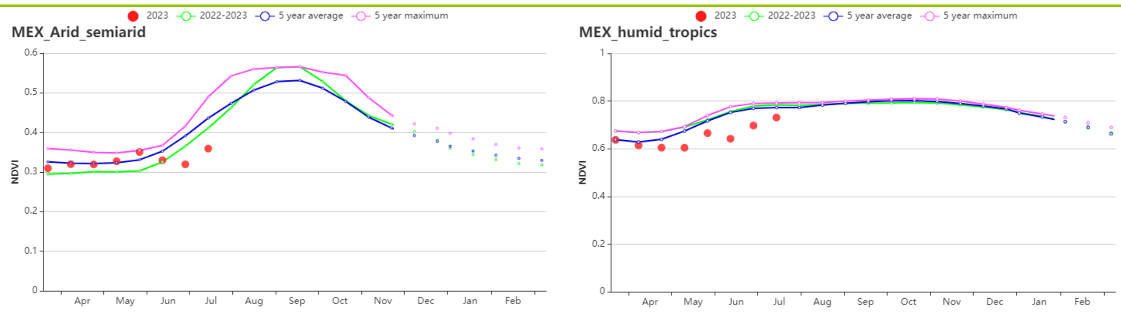
(e) NDVI profiles



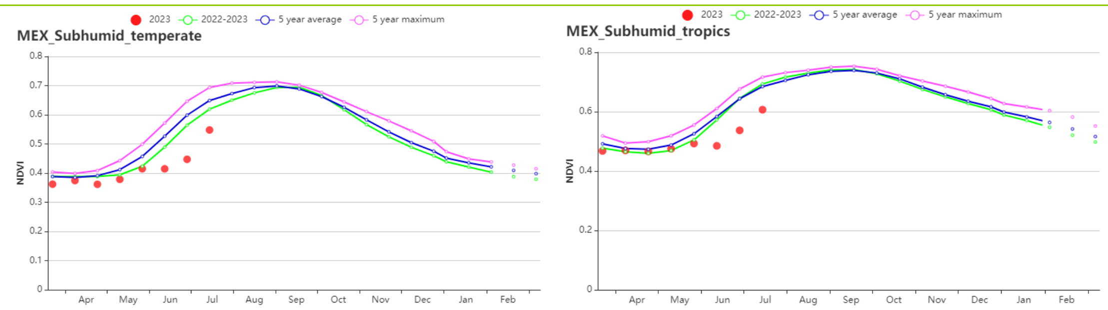


(f) Rainfall profiles

(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 3.51 Mexico's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, April - July 2023

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m^2)	Departure (%)	Current (gDM/m^2)	Departure (%)
Arid and semi-arid regions	171	-55	23.7	0.6	1546	-1	687	-20
Humid tropics with summer rainfall	567	-36	27.2	1.2	1393	1	1053	-17
Sub-humid temperate region with summer rains	456	-37	21.9	1.2	1471	1	900	-13
Sub-humid hot tropics with summer rains	502	-28	24.5	1.0	1458	0	922	-14

Table 3.52 Mexico's agronomic indicators by sub-national regions, current season's values and departure from 5YA, April - July 2023

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Arid and semi-arid regions	61	-3	0.61
Humid tropics with summer rainfall	100	0	0.84
Sub-humid temperate region with summer rains	92	-3	0.65
Sub-humid hot tropics with summer rains	95	0	0.77

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

[MMR] Myammar

During this reporting period, the maize, wheat and second rice were still in the harvesting season. The sowing of the main rice crop started in May. It reached the growing season in July. According to the CropWatch monitoring results, crop conditions were below average.

According to the agroclimatic indicators, the weather in Myanmar continues its drying trend. Compared to the 15YA, RAIN was lower (-31%), while TEMP was higher (+1.0ºC) and RADPAR was up by 9%. As a result of the rainfall deficit, BIOMSS was markedly below the average (-12%). In addition, the prolonged internal conflict keeps disrupting farmers' access to inputs. 87% of cropland was utilized, basically the same as 5YA. NDVI values were below average during the whole monitoring period. The maximum VCI during this period was 0.90. The CPI value was 1.05, which represents an average agricultural production situation for this period.

As shown by the NDVI clusters map and profiles, the crop conditions across the country were generally below average. The whole country’s cropland showed below-average crop conditions during April and May. More than 50% of the cropland recovered to above-average in June. It was mainly distributed throughout the country except for the part of the Center Plain, including Sagaing, Magwe, Bago, Yangon, Ayeyarwady and other clustered areas around the Hills region. The maximum VCI values showed similar distribution as the clusters map.

Regional analysis

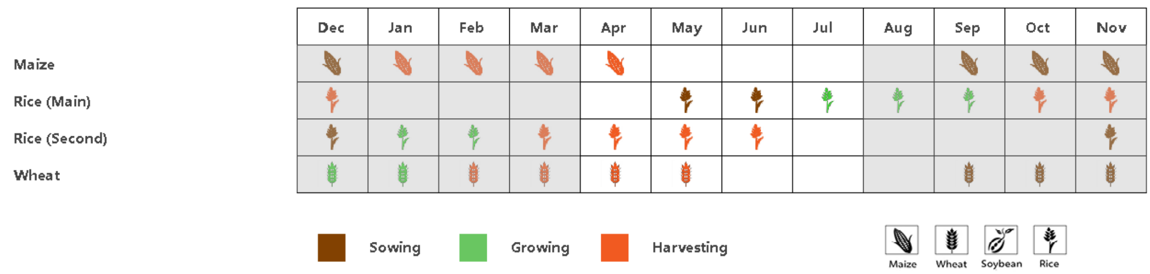
Three sub-national agro-ecological zones (AEZ) can be distinguished for Myanmar based on the cropping system, climatic zones and topographic conditions. They are the Central plain (132), the Hills (134) and the Delta and Southern Coast regions (133).

The **Central Plain** had a marked rainfall deficit (RAIN -40%), and RADPAR and TEMP were up by 11% and 1.5ºC compared to the 15YA. BIOMSS was 17% lower than the 15YA. CALF showed that 82% of the cropland was utilized. The NDVI values were similar to that of the whole country. The VCIx was 0.90. The CPI was 1.05. Crop conditions for this region were below average.

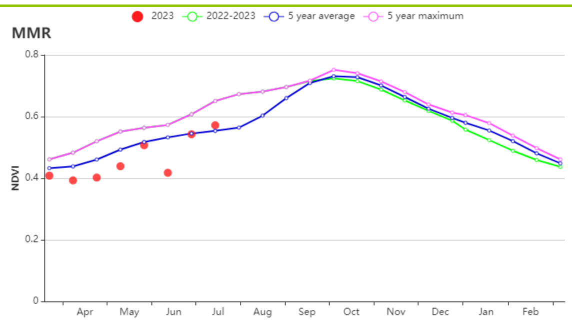
The **Hills region** also had below-average rainfall (RAIN -34%). RADPAR and TEMP increased by 10% and 1.0ºC. BIOMSS was 10% lower than the 15YA. 95% of cropland was utilized. NDVI was below the level of the 5YA for most of the period. The VCIx was 0.91. The CPI was 1.10. Crop conditions are assessed as below the 5YA level.

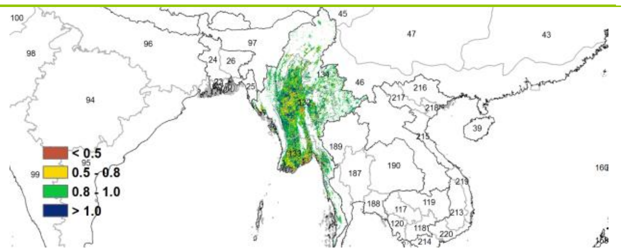
The **Delta and Southern Coast region** had a below-average rainfall (RAIN -23%), similar to the other two sub-national regions. RADPAR and TEMP were 4% and 0.6ºC above average. BIOMSS was 9% lower than the 15YA. The cropland was also not fully utilized (CALF 86%). The NDVI values were below the 5YA during the whole period. VCIx was 0.86. The CPI was 1.02. Crop conditions in this region were below average.

Figure 3.32 Myammar’s crop condition, April-July 2023

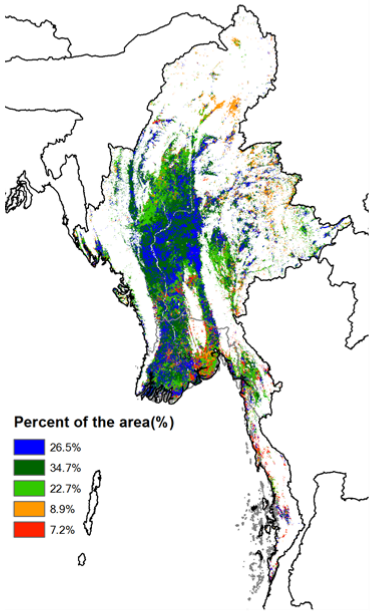


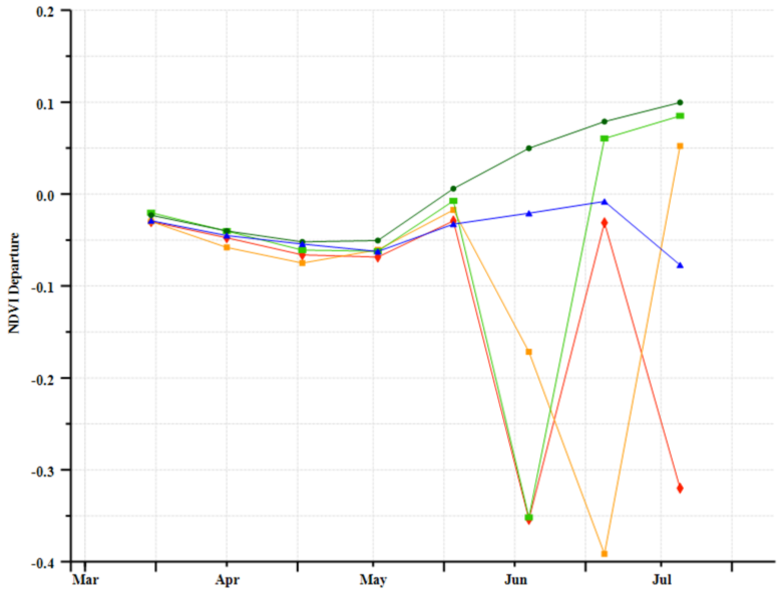
(a) Phenology of major crops



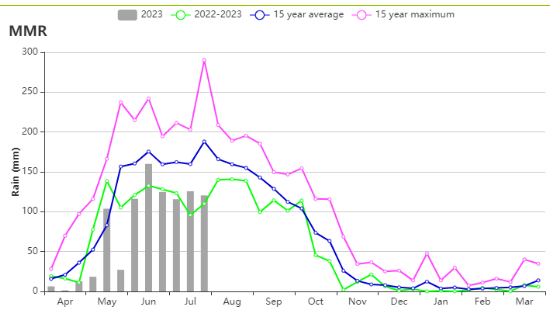


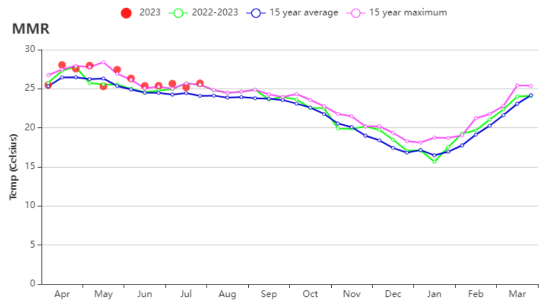
(b) Crop condition development graph based on NDVI (c) Maximum VCI



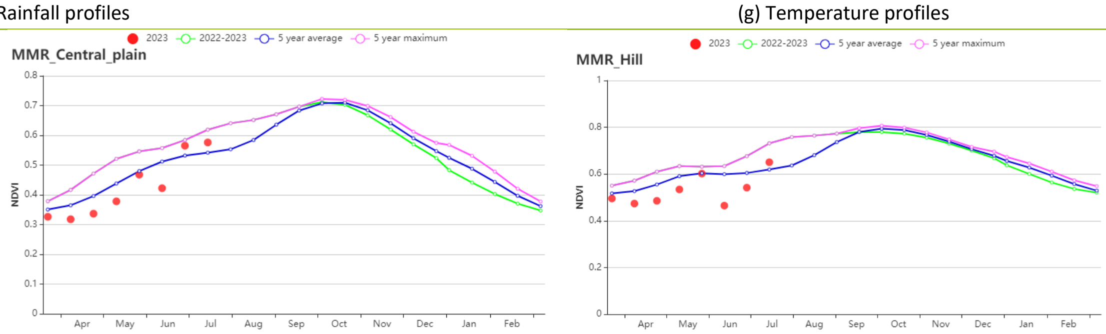


(d) Spatial NDVI patterns compared to 5YA (e) NDVI profiles

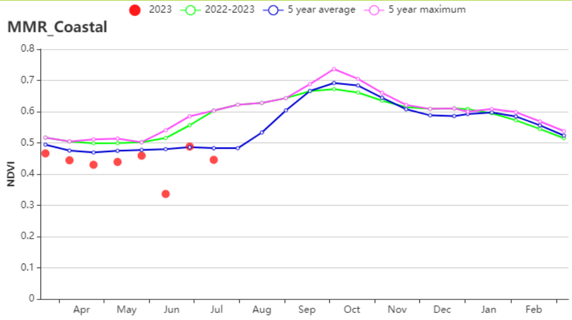




(f) Rainfall profiles (g) Temperature profiles



(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 3.53 Myammar's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, April - July 2023

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Central plain	501	-40	28.0	1.5	1329	11	1023	-17
Delta and southern-coast	1293	-23	28.0	0.6	1278	4	1340	-9
Hills region	1014	-34	24.8	1.0	1261	10	1219	-10

Table 3.54 Myammar's agronomic indicators by sub-national regions, current season's values and departure from 5YA, April - July 2023

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Central plain	82	0	0.90
Delta and southern-coast	86	4	0.86
Hills region	95	0	0.91

[MNG] Mongolia

This reporting period from April to July covers the main crop growing season in Mongolia, which focuses primarily on spring wheat. Mongolia has a short growing period of 120-140 days due to its high latitude location. With only 2.9% of cropland under irrigation, crop growth is highly dependent on rainfall during the April to August wet season. Compared to the 15-year average, accumulated precipitation was 255 mm, 8% below average. Average temperatures were 9.4°C, 1.0°C lower than average. Solar radiation was 1338 MJ/m2, 2% below average. These conditions resulted in a potential biomass 8% below average.

According to the spatial distribution of NDVI profiles, at the beginning of the growing season (June), only 25.7% of the area had slightly above average vegetation conditions. By July, over 69.1% of the area had vegetation conditions slightly above average, consistent with the trend shown in the NDVI time series graph. The VCIx distribution map shows that only the east of Selenge-Onon region had poor crop conditions, while other regions were above 0.8. The national average VCIx was 0.91, indicating overall good vegetation conditions across the country. The CALF was 99%, equal to the 5-year average. The results show that after entering the peak growing season, Mongolia exhibited relatively good crop growth conditions. The CPI for Mongolia was 0.95, also indicating near-normal crop production prospects overall this season. Overall, the cereal production prospects in Mongolia are near normal.

Regional analysis

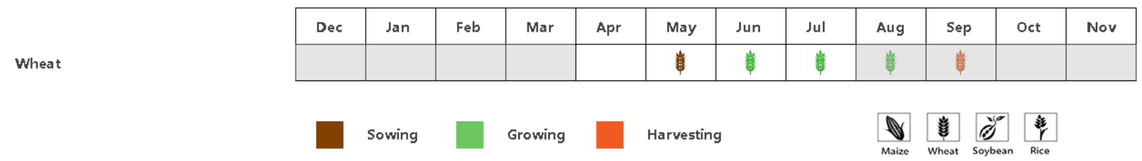
Based on cropping systems, climatic zones, and topographic conditions, Mongolia can be divided into five agro-ecological zones (AEZ): **Altai (135), Gobi Desert (136), Hangai Khuvsgul Region (137), Selenge-Onon Region (138) and Central and Eastern Steppe (139). Altai** and **Gobi Desert** have no cultivated land, so we are mainly concerned with the three regions of **Hangai Khuvsgul Region, Selenge-Onon Region and Central and Eastern Steppe**.

In the **Hangai Khuvsgul region** in northwest Mongolia, accumulated precipitation was close to the 15-year average, while average temperatures were 1.2°C cooler than average, and solar radiation was 5% below average. The NDVI time series graph shows that before July, the vegetation condition was below the 5-year average; in July, it was equal to the average level. The regional VCIx was 0.91, and CALF was 99%, indicating generally normal crop prospects.

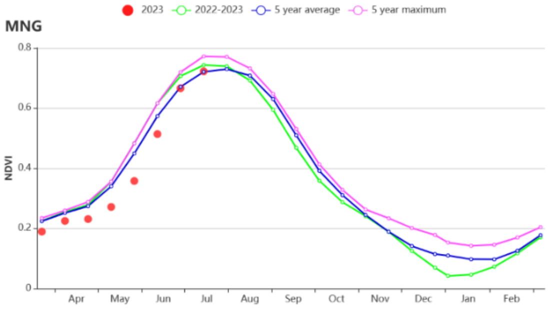
The **Selenge-Onon region** in north-central Mongolia produces around 60% of Mongolia's wheat. Accumulated precipitation, average temperatures and solar radiation were all slightly below average. This resulted in near-normal biomass accumulation. However, the VCIx was 0.92, CALF was 99%, and CPI was 0.97, reflecting generally normal crop conditions in the main wheat zone.

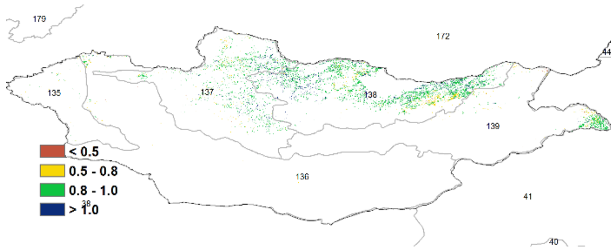
In the **Central and Eastern Steppe region**, accumulated precipitation was 25% below average, while average temperatures were near-normal. This resulted in biomass accumulation that was 17% below average. The VCIx was 0.86 and the CPI was 0.92, indicating somewhat unfavorable crop conditions.

Figure 3.33 Mongolia's crop condition, April - July 2023

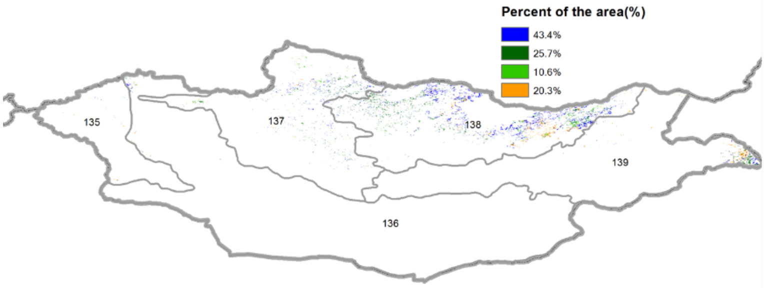


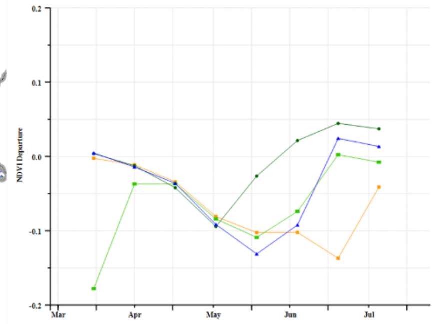
(a) Phenology of major crops



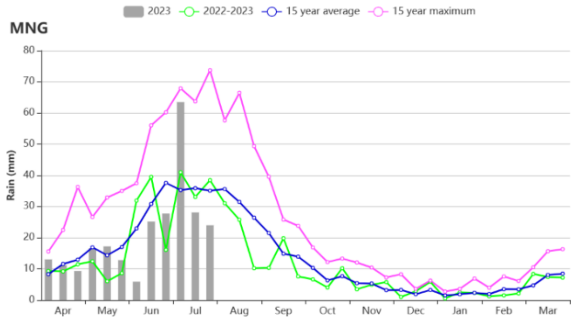


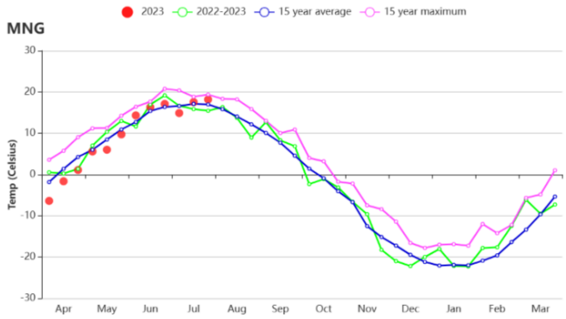
(b) Crop condition development graph based on NDVI (c) Maximum VCI



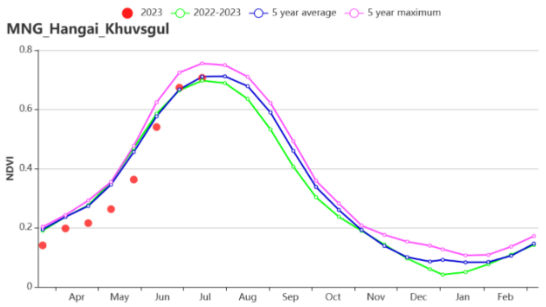


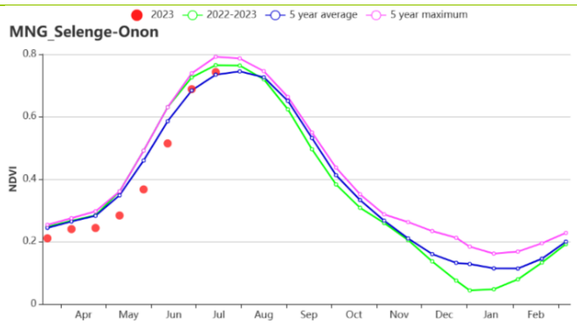
(d) Spatial NDVI patterns compared to 5YA (e) NDVI profiles



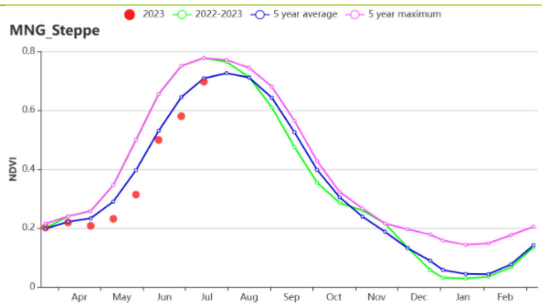


(f) Rainfall profiles (g) Temperature profiles





(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 3.55 Mongolia's agroclimatic indicators by sub-national regions, current season's values, and departure from 15YA, April - July 2023

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m2)	Departure (%)	Current (gDM/m2)	Departure (%)
Hangai Khuvsgul Region	309	2	6.8	-1.2	1325	-5	665	0
Selenge-Onon Region	255	-9	10.0	-1.0	1335	-2	662	-9
Central and Eastern Steppe Region	167	-25	13.2	-0.4	1347	0	577	-17
Altai Region	207	-49	8.0	0.0	1405	4	551	-10
Gobi Desert Region	108	-43	10.0	-1.4	1476	2	426	-24

Table 3.56 Mongolia's agronomic indicators by sub-national regions, current season's values, and departure from 5YA, April - July 2023

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Hangai Khuvsgul Region	100	0	0.91
Selenge-Onon Region	100	0	0.92
Central and Eastern Steppe Region	100	1	0.86
Altai Region	77	-2	0.80
Gobi Desert Region	72	-2	0.77

[MOZ] Mozambique

In Mozambique, crop production predominantly relies on rainfall. This reporting period from April to July encompasses the final stages of growth and harvesting for maize and rice in the northern region. In contrast, in the central region, both crops had already been harvested by the beginning of this monitoring period. Wheat had also been fully harvested across the entire country. The agroclimatic indicators reveal a 23% reduction in rainfall compared to the 15YA. Furthermore, there have been noticeable rises in both temperature (TEMP +0.4ºC) and photosynthetic active radiation (RADPAR +5%). Consequently, these combined conditions have contributed to a 9% decline in overall biomass production across the country (BIOMSS -9%).

The previous monitoring period was marked by intense cyclones and heavy rainfall, which mostly affected the Zambézia province. On the contrary, approximately 17.5% of the cultivated area exhibited consistently favorable crop conditions throughout the entirety of the monitoring period. This was particularly pronounced in the provinces of Manica, Inhambene, and southern Gaza.

The national Vegetation Condition Index (VCIx) stood at 0.91, implying promising prospects for vegetation. Similarly, a positive Vegetation Condition Index (VCIx) was also noted in the southern region, notably in the provinces of Gaza and Inhambane. The national Crop Production Index (CPI) value was 1.04. All in all, the country's production prospects were slightly below average.

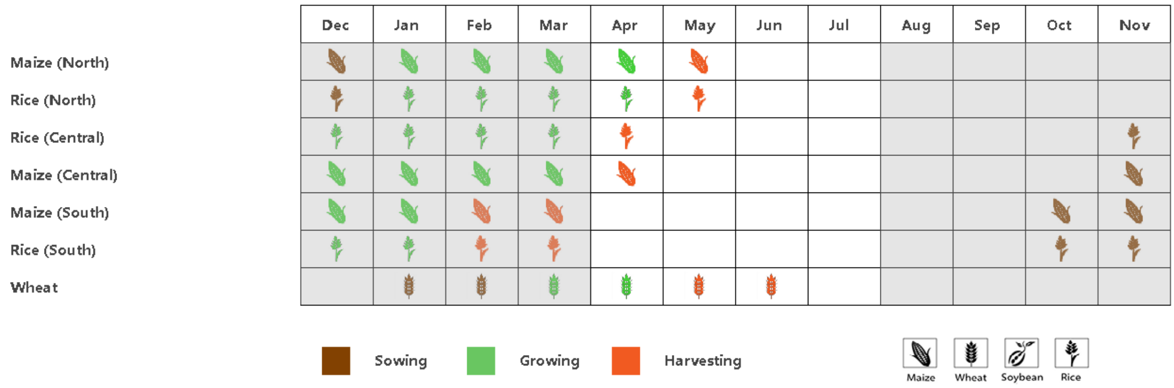
Regional analysis

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).

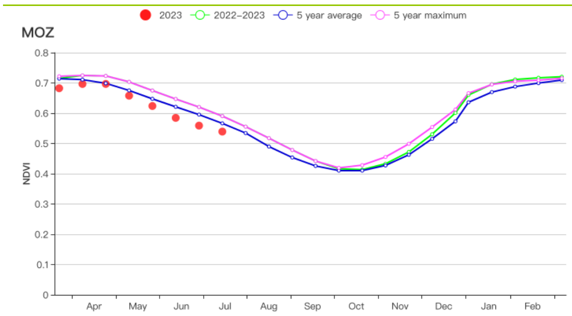
On a regional scale, rainfall was above the 15YA only in the Northern high-altitude areas (RAIN + 1%). Conversely, in the remaining agroecological zones, this crucial indicator experienced a decrease. These drops were as follows: the Buzi basin (-62%), followed by the Low Zambezia River basin (-44%), the Southern region (-28%), and the Northern coast (-13%). Across all agro-ecological regions, both temperature and photosynthetic active radiation demonstrated increases. Notably, the most substantial temperature increases were observed in the Buzi basin (+0.9ºC), while the highest increases in photosynthetic active radiation (RADPAR) were recorded in the Low Zambezia River basin (7%). Resulting from these conditions, the total biomass production experienced a notable decline: by 21% in the Buzi basin, 15% in the Low Zambezia River basin, 8% in the Northern coast, 7% in the Southern region, and 1% in the Northern high-altitude areas.

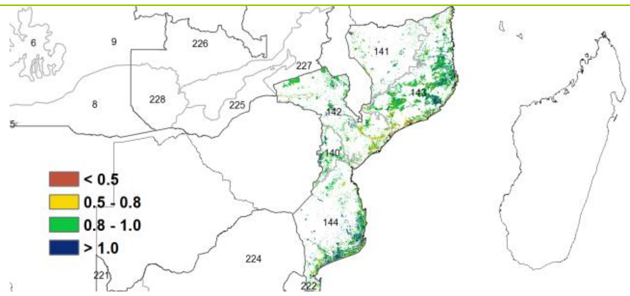
The regional crop condition development graphs based on NDVI reveal below-average crop conditions across the entire monitoring period in the Buzi basin, Low Zambezia River basin, and Northern coast. In contrast, the Northern high-altitude areas and the Southern region-maintained conditions were nearly on par with the average from early May until the end of the monitoring period. Across all agroecological zones, the CALF increased by 1% in both the Low Zambezi River basin and the Southern regions. In the remaining regions, the CALF hovered around the historical average of the past five years. With VCIx values ranging from 0.86 to 0.91, the regional CPI indicated below average conditions.

Figure 3.34 Mozambique's crop condition, April-July 2023



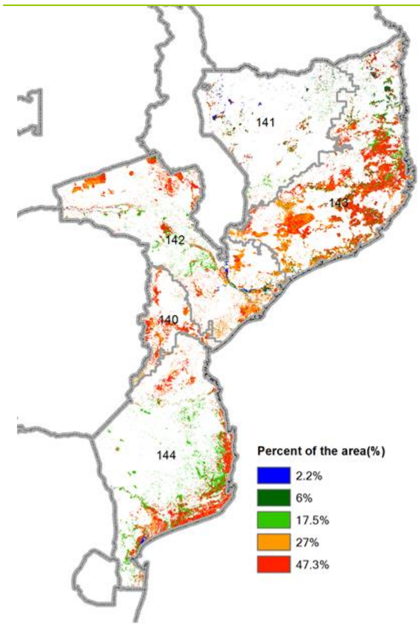
(a) Phenology of major crops

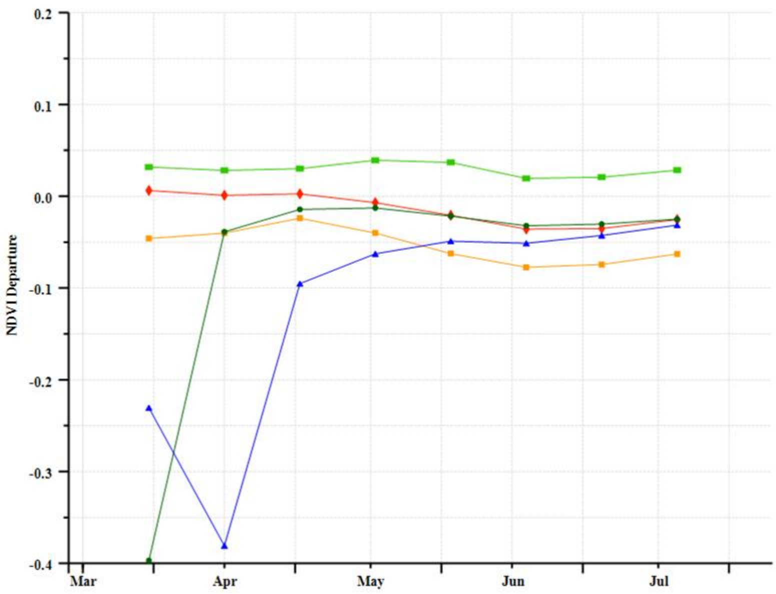




(b) Crop condition development graph based on NDVI

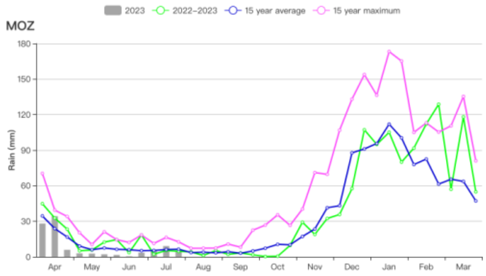
(c) Maximum VCI

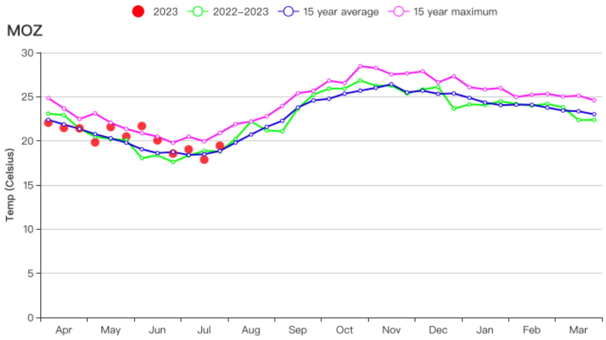




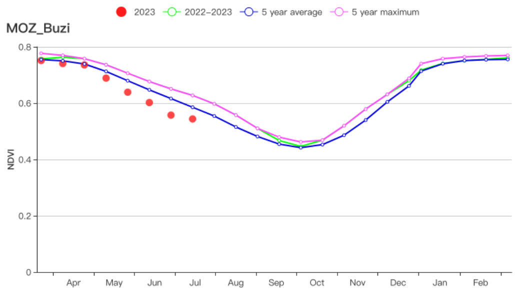
(d) Spatial NDVI patterns compared to 5YA

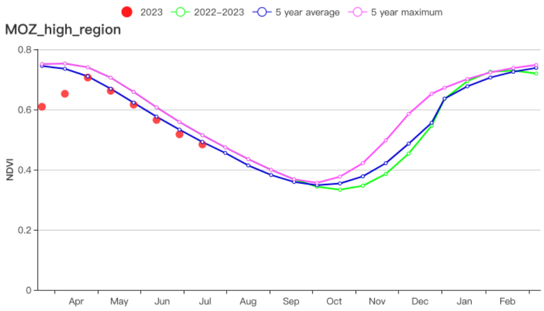
(e) NDVI profiles



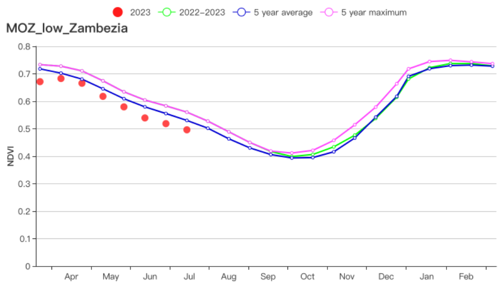


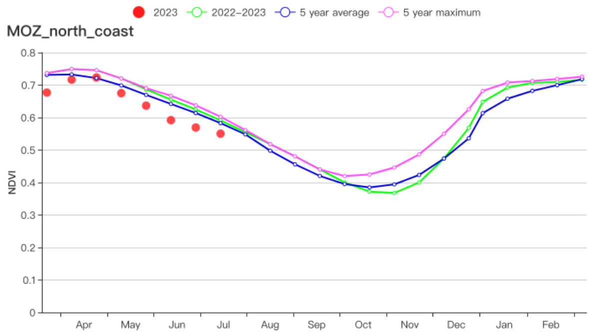
(f) National time-series temperature profiles (g) National time-series rainfall profiles



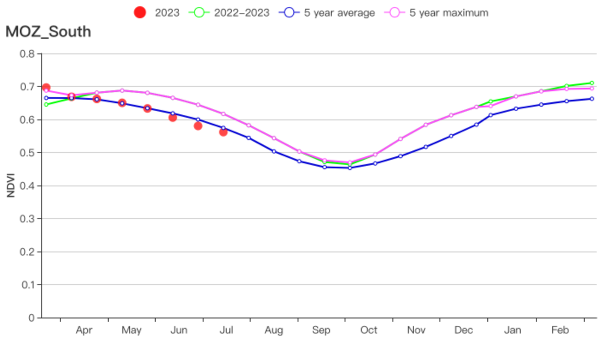


(h) Crop condition development graph based on NDVI-Buzi basin (left), and Northern high-altitude areas (right)





(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 3.57. Mozambique's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, April - July 2023

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Buzi basin	42	-62	18.1	0.9	1044	4	357	-21
Northern high-altitude areas	117	1	19.1	0.1	1058	6	482	-1

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Low Zambezia River basin	72	-44	20.0	0.5	1031	7	427	-15
Northern coast	147	-13	21.1	0.3	1045	5	576	-8
Southern region	76	-28	21.0	0.6	911	2	444	-7

Table 3.58 Mozambique's agronomic indicators by sub-national regions, current season's values and departure from 5YA, April - July 2023

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Buzi basin	100	0	0.92
Northern high-altitude areas	100	0	0.91
Low Zambezia River basin	98	1	0.86
Northern coast	100	0	0.91
Southern region	99	1	0.9

Table 3.59. Mozambique's crop production index April - July 2023

Region	CPI
Buzi basin	1.13
Northern high-altitude areas	1.16
Low Zambezia River basin	0.98
Northern coast	1.09
Southern region	1.05

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[MUS] Mauritius

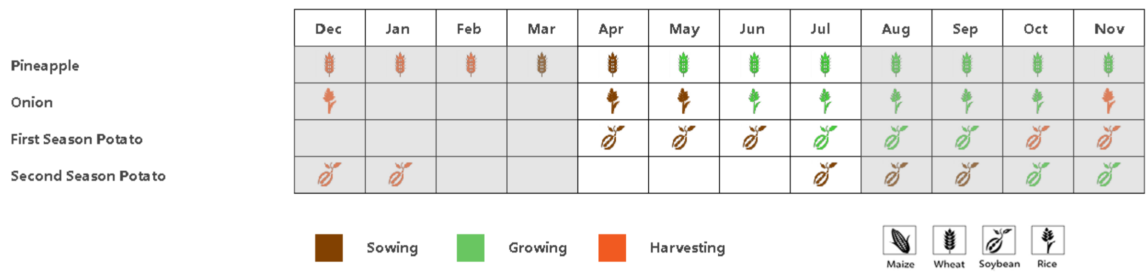
During the period under review in Mauritius, new plantations of onion, pineapple and potato were started. In the case of pineapple along with fresh plantations, harvest was ongoing in regions where the crop had been grown 9 to 12 months back.

In general, crop conditions in Mauritius during the past 3 months, were slightly above average, based on agro-climatic and agronomic indicators recorded. Thus, the season started with a strong departure of+206 mm in rainfall compared to average figures for the last 15 and it was slightly warmer by 0.5 ℃. The amount of sunshine received was equally higher with a mean RADPAR of +1.0 MJ/m2. The bulletin of the Mauritius Meteorological Services for the month of May 2023 indicates that 2023 witnessed the wettest May recorded in the past 10 years with a long term mean of 197%. About two third of the heavy showers occurred during the first ten days and last ten days of the May 2023 compared to the mid-May where amount of rain received was less than that received last year during the same period. In the case of June 2023, even if the middle of the month was very wet with heavy showers exceeding the last 15 years average by over 100%, the rest of the month was deficient in rain. This resulted in a mean departure of -26% when compared to long term average for the month. As for July 2023, amount of rainfall recorded was more in line with the pattern normally recorded during this month of the year but was however less than the last 15 years maximum.

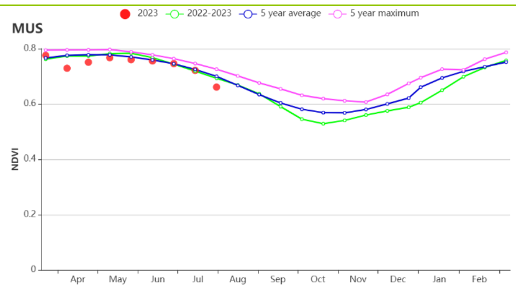
In conclusion, it can be said that although the period started under adverse climatic conditions, over the weeks agro climatic conditions and agronomic factors became more conducive for production for onion, potato and pineapple. Thus prospects for production of these crops in the next quarter are in general highly favorable, provided pests and disease management is conducted properly.

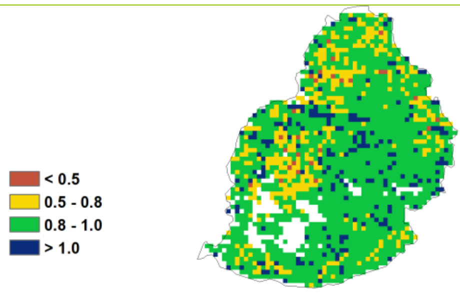
The adverse climatic conditions prevailing at the beginning of the season, resulted in a short delay in the potato and onion season. This resulted in a lower than normal NDVI. However, the warmer than usual Winter (average temperatures hilgher by 0.5 ℃) was favorable for crop growth. Hence the maximum VCI of 0.89 recorded during the season promoted growth of onion, potato and pineapple plants and helped NDVI meet the season's average.

Figure 3.35 Mauritius's crop condition, April 2023 - July 2023

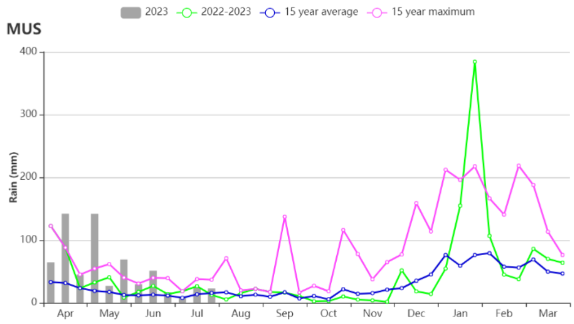


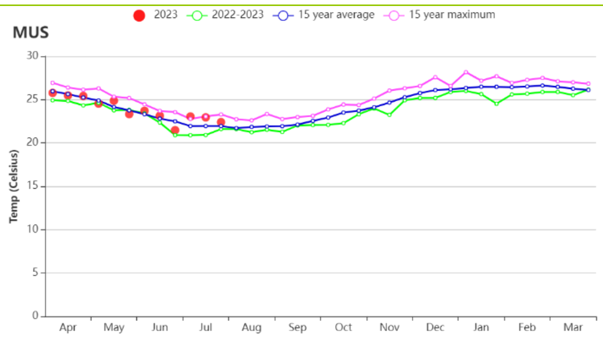
(a) Phenology of major crops





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





(d) Rainfall profiles	(e) Temperature profiles

Table 3.60 Mauritius' agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, April - July 2023

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m^2)	Departure (%)	Current (gDM/m^2)	Departure (%)
Mauritius	644	206	23.8	0.5	951	1	1207	44

Table 3.61 Mauritius' agronomic indicators by sub-national regions, current season's values and departure from 5YA, April - July 2023

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Mauritius	100	0	0.89

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[NGA] Nigeria

This report covers crop conditions for maize, rice, millet and sorghum between the months of April 2023 to July 2023 in Nigeria. Normally, the rains are expected to start fully by late March into early April. However, they tend to fluctuate widely at the beginning of the rainy season. There is a large gradient in rainfall within the country. The northern regions are much drier than the coast.

Overall, rainfall was below average (RAIN -20%) whereas solar radiation (RADPAR +3%) and temperatures (TEMP +0.8°C) were above the 15YA. The resulting biomass was estimated to be below average (BIOMSS -15%). According to the NDVI development graph, crop conditions were slightly unfavorable as they fell below the 5-year average for most of the monitoring period, except for early April, early May and early June, when the crop conditions appear to be leveled with the 5YA.

According to the NDVI departure clustering map, 46.2% of cropland, sparsely distributed around the country, was always slightly below average from April to July. While 29.1% of the cropped area, mostly distributed around the northern part of the country extending towards the middle belt, together with a few patches found around the southern parts, was always slightly above the average throughout this monitoring period. A sharp drop in early June was observed for 8.9% of the cropped area but it gradually returned to average by early July and continued to rise above average for the remaining period. An 8.7% fraction was always trending below average. Meanwhile, a fraction of 7% located around the southern parts, where there has been excessive rainfall and reported cases of flooding experienced a sharp negative departure throughout the entire period.

At the national level, since the rains didn't start on time in most parts of the country, especially in the northern parts, there was a decline in the cropped arable land (CALF -3%). But with a favorable maximum VCI value of around 0.87 and a Crop Production Index (CPI) of 0.98, crop conditions can be assessed as close to average.

Regional Analysis

The analysis focuses on nine agro-ecological zones in the country transiting from North to South, i.e., Sahel Savannah(153), Sudan Savannah(154), Guinea Savannah(148), Derived Savannah(146), Jos Plateau(149), Mountain Forest(152), Lowland Rainforest(150), Freshwater Swamp Forest(147) and Mangrove Forest(151).

The Sahel Savanah is found in the north-eastern part of the country, followed by the Sudan Savanah, which stretches across the entire northern region. The Guinea savannah is the largest, which is a transition between the Sudan Savanah and the Derived Savanah, covering a large portion of the central part of the country. The Derived Savanah, Fresh Water Swamp, Rain Forest and Mangrove Forest are all located in the southern part of the country. While the Jos Plateau and the Mountain Forest are also located in the central part of the country.

In the **Sahel Savanah zone**, the agroclimatic indicators show that accumulated rainfall (RAIN -78%) was far below average due to the late onset of rain, whereas both temperature and radiation (TEMP +0.2°C, RADPAR +2%) were above average, resulting to below-average biomass production (BIOMSS -19%). Also, (CALF -6%) was below average, with a favorable VCIx at 0.84. The crop production index (CPI 1.38) indicates that crop conditions were slightly above normal. The NDVI development graph shows that crop conditions in the area were mostly above average and even reaching above the 5 year maximum at some point.

In the **Sudan Savannah**, the region adopts similar agricultural practices as the Sahel Savanah zone. The agro-climatic condition also shows that accumulated rainfall (RAIN -41%) was below average, while temperature and radiation (TEMP +0.5°C, RADPAR +2%) were above average. And as expected, there was also a significant decrease in the potential biomass (BIOMSS -18%). CALF was also below average by -9% and the maximum VCI was 0.82. The crop conditions also maintained the 5YA except for mid-May.

The **Guinea Savannah** zone also recorded below average rainfall (RAIN -36%), but above-average temperature and radiation (TEMP +1.2°C, RADPAR +4%), potential biomass also dropped (BIOMSS -19%). The CALF was lower than average by -4% and the maximum VCI was 0.89, with a crop production index (CPI 1.04) which is estimated to be normal. The NDVI development graph showed that crop conditions in the area were mostly below the average for most part of the period except for early April, early May and mid-July, when they rose to the 5YA.

The **Mountain Forest** which covers a very little portion in the central part of the country, recorded a rainfall of (RAIN -34%), temperature was at (TEMP +0.9°C), while radiation increased to (RADPAR +1%), and biomass dropped down to (BIOMSS -14%). The CALF was 0%, and the maximum VCI was 1.00.

The **Jos Plateau**, also located in the central region, recorded rainfall of (RAIN -41%), temperature and radiation were also above average (TEMP +1.0°C, RADPAR +6.0%), with the potential biomass down to (BIOMSS -19%). The CALF was -0.40% and the maximum VCI was 0.86. The crop conditions only reached an average in early April and late April, but for the rest of the period, they were far from average, with a recorded crop production index of (CPI 1.07) slightly above normal.

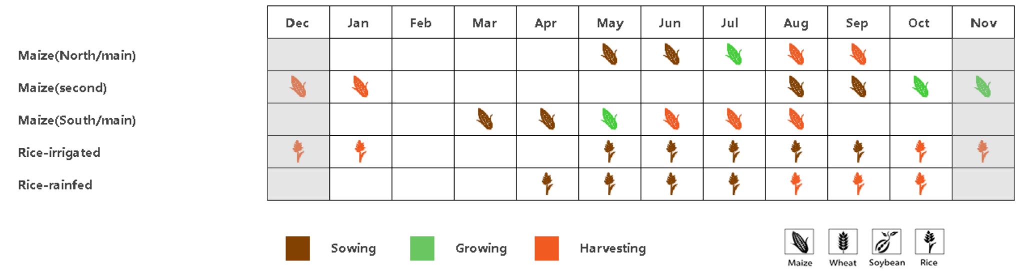
The **Derived Savanah** region recorded below average rainfall (RAIN -15%), warmer temperatures (TEMP +1.0°C) and above average solar radiation (RADPAR +3%). Potential biomass was below average (BIOMSS -12%). CALF was -0.11% and the maximum VCI was at 0.93, while the crop production index (CPI 1.12) was above normal. The NDVI development graph shows that crop condition were variable and mostly below the average throughout the period.

The **Lowland Rain Forest** also recorded an increase in rainfall (RAIN +2%), and warmer temperatures (TEMP +0.5°C). The radiation was at (RADPAR +3.%) and the biomass was also below average (BIOMSS -4.%). The CALF was at -0.13% and the maximum VCI was 0.94. The crop production index (CPI 1.13) was above normal, but the crop condition, according to the NDVI distribution map, was also mostly unstable and below average throughout the period.

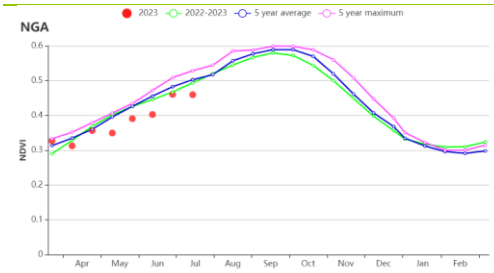
The **Fresh Water Swamp Forest** is located in the southern region of the country and does not cover a large area. Rainfall in this area was at (RAIN +5%) temperature was (TEMP +0.3°C), while radiation fell to +3%, and biomass dropped to (BIOMSS -1%). The CALF was below average by -0.08% and the maximum VCI was 0.94. The crop condition in this area was also irregular and below the average.

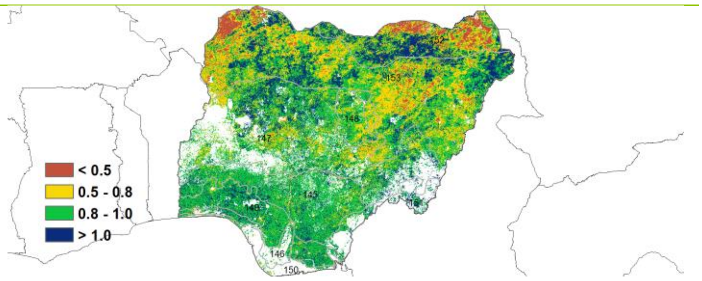
The **Mangroove Forest,** also located in the southern region of the country recorded above average rainfall, temperature and radiation (RAIN +8%, TEMP +0.2°C, RADPAR +3%) with a slightly below average potential biomass production of (BIOMSS -1%), with CALF at -0.02% below average and the maximum VCI of 0.89.

Figure 3.36 Nigeria's crop condition, April-July 2023



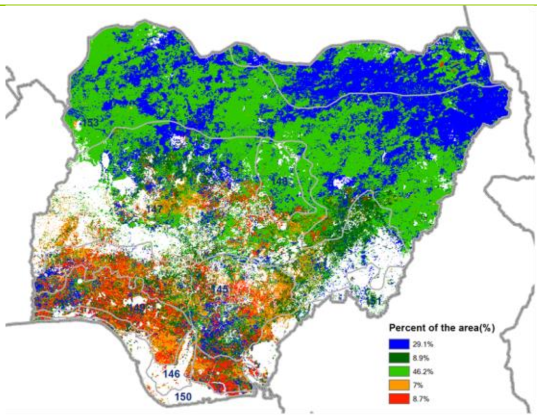
(a) Phenology of major crops

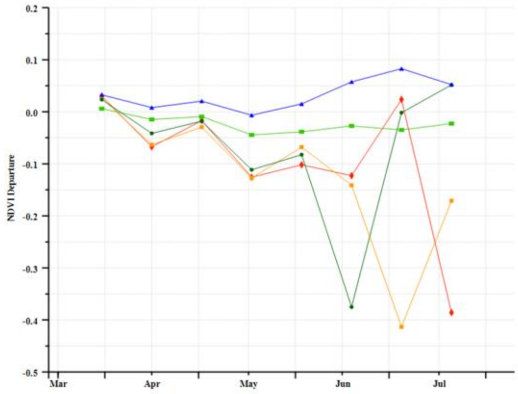




(b) Crop condition development graph based on NDVI

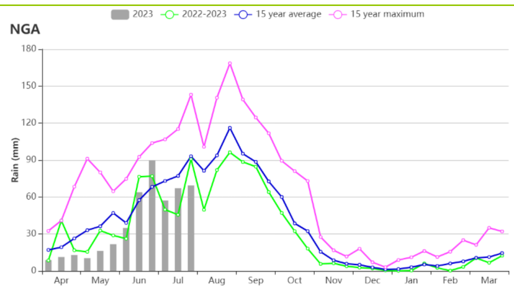
(c) Maximum VCI

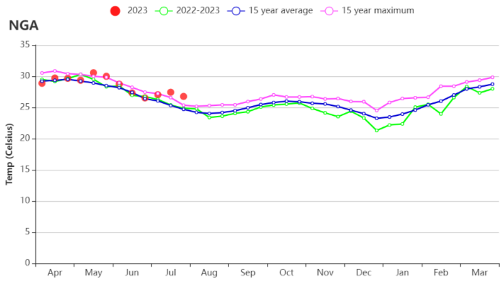




(d) Spatial NDVI patterns compared to 5YA

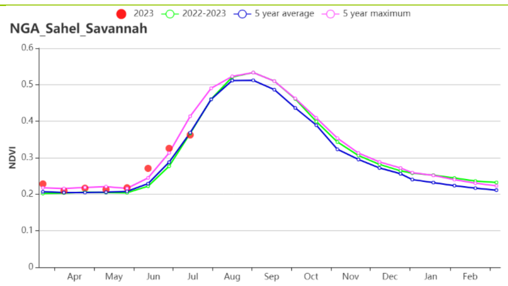
(e) NDVI profiles

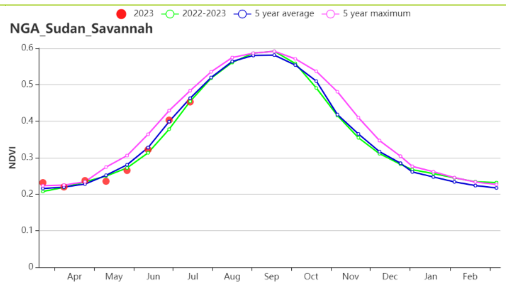




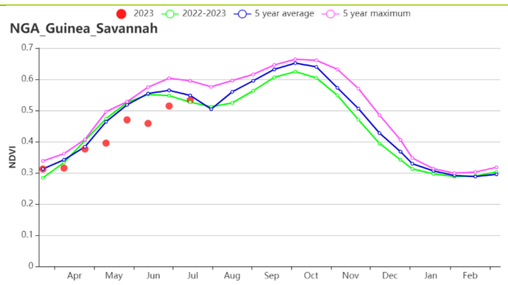
(f) Rainfall profiles

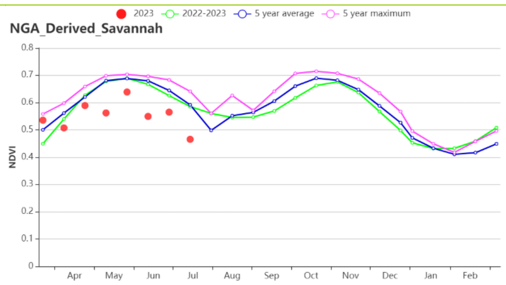
(g) Temperature p rofiles



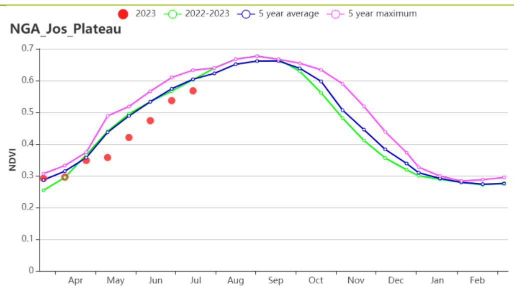


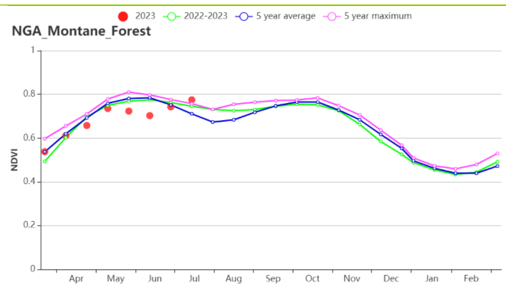
(h) Crop condition development graph based on NDVI(Left:Sahel savannah, Right:Sudan Savannah)



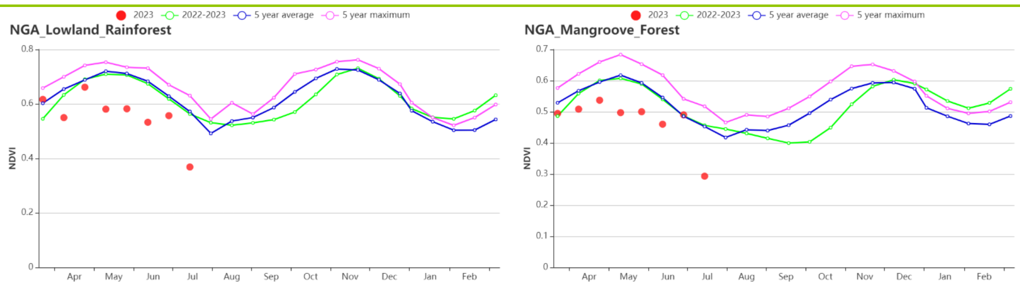


(i) Crop condition development graph based on NDVI(Left:Guinea savannah, Right:Derived Savannah)

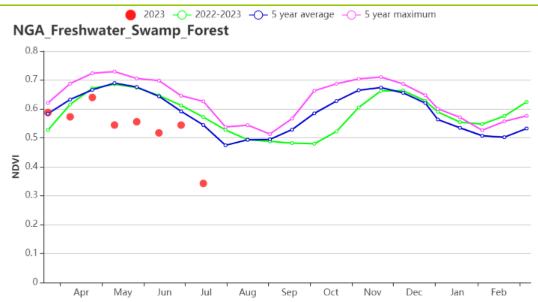




(j) Crop condition development graph based on NDVI(Left:Jos Plateau, Right:Mountain Forest)



(k) Crop condition development graph based on NDVI(Left:Low Land Rainforest, Right:Mangroove Forest)



(l) Crop condition development graph based on NDVI: Freshwater Swamp

Table 3.62 Nigeria's agro-climatic indicators by sub-national regions, current season's values and departure from 15YA. April-July 2023

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Derived Savannah	568	-15	27.5	1.0	1162	3	1089	-12
Freshwater Swamp Forest	1229	5	25.9	0.3	1136	3	1495	-1
Guinea Savannah	315	-36	28.7	1.2	1278	4	867	-19
Jos Plateau	353	-41	26.1	1.0	1295	6	882	-19
Lowland Rainforest	1082	2	26.0	0.5	1128	3	1379	-4
Mangroove Forest	1631	8	25.9	0.2	1138	3	1526	-1
Montane Forest	867	-34	24.1	0.9	1197	1	1179	-14
Sahel Savannah	30	-78	31.9	0.2	1372	2	547	-19
Sudan Savannah	181	-41	30.2	0.5	1320	2	683	-18

Table 3.63 Nigeria's agronomic indicators by sub-national regions, current season's values and departure from 5YA, April-July 2023

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Derived Savannah	99	-0.11	0.93
Freshwater Swamp Forest	98	-0.08	0.94
Guinea Savannah	91	-4	0.89
Jos Plateau	99	-0.40	0.86
Lowland Rainforest	99	-0.13	0.94
Mangroove Forest	93	-0.02	0.90
Montane Forest	100	0	1.00
Sahel Savannah	37	-6	0.85
Sudan Savannah	64	-9	0.82

[PAK] Pakistan

This bulletin encompasses the timeframe spanning April to July. The harvest of winter wheat was concluded in April and May, while the planting of maize and rice commenced in May. Agroclimatic and agronomic indicators indicate average crop conditions between April and July.

Rainfall is not the major factor influencing crop production in Pakistan, primarily due to the high proportion of irrigated cropland, which accounts for 80% of the total. Recent data indicate a remarkable 58% increase in rainfall compared to the 15-year average. Photosynthetically active radiation (RADPAR) fell short by 5% in comparison to the historical average, and air temperatures (TEMP) during this period dropped below the average by 0.7℃. The combined effect of these agroclimatic indicators resulted in an above-average biomass (BIOMSS) production by 19%. At the national level, the rainfall during the period remained generally above average. The highest amounts were observed in late May and late July. Intense precipitation resulted in flooding in some regions, which led to below-average development of NDVI. Poorer crop growth in the areas surrounding and downstream of the rivers can confirm this situation, with the corresponding VCIx values falling below 0.5 in those regions. But the fraction of cropped arable land (CALF) increased by 1% compared with 5YA, which may have a positive effect on the summer crop production.

At the national level, the NDVI development graph indicated above-average conditions for most of this monitoring period. The spatial NDVI patterns and profiles show that 37.4% of the cropped areas were below average in April, while 28.5% were below average in May. About 18.2% of the cropped area was continuously below average, mainly located in the Northern Highlands and some regions along the Indus River basin. Unfavorable conditions due to the flood events since the beginning of June were observed for the Northern Highlands, which resulted in a lower CALF. But it was also above the average of the last 5 years in the other two regions. The Indus River basin, the main rice producing area, had approached average NDVI after transplanting in June. Heavy rainfall and floods affected some areas of Punjab and Sindh in July, but it is too early to assess the full damage that had been created by these floods. The Crop Production Index (CPI) in Pakistan is 1.05, indicating an average agricultural production situation.

Regional analysis

For a more detailed spatial analysis, CropWatch divides Pakistan into three agroecological regions based on geography and agroclimatic conditions: the Lower Indus river basin in South Punjab and Sindh(155), the Northern Highlands(156) and the Northern Punjab(157).

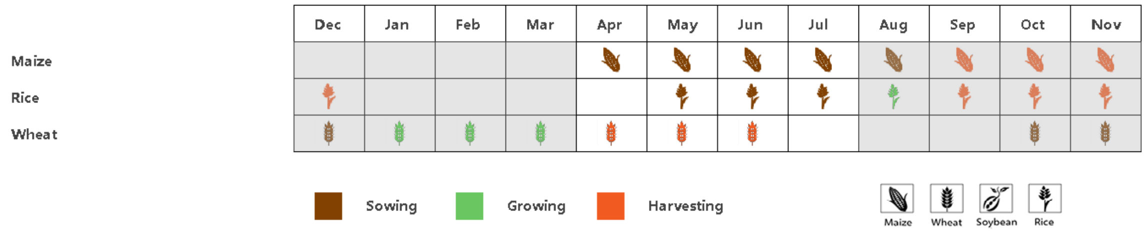
In the **Lower Indus River basin in South Punjab and Sindh(155)**, RAIN was sharply above average by 319% and TEMP was below average by 1.6℃, while RADPAR was below average by 7%. The estimated BIOMSS departure was +34%. The VCIx was at 0.87, which is above normal for this period between the harvest of wheat and the establishment of the summer crops. Together with the vast majority of irrigated land in this region, prospects for the newly established crops are promising. But crops were submerged by floods in some areas of Punjab and Sindh in July, CALF was rather low (40%), but 1% higher than the five-year average. The excessive rains, together with the ensuing floods, may hamper crop production in this region. Overall, the prospects were satisfactory.

In the **Northern Highlands(156)**, RAIN was above average by +2%, whereas RADPAR (-3%) and TEMP(-0.2℃) were below average. The region experienced warmer and drier weather, and the estimated BIOMSS departure was +4%. Wheat conditions were satisfactory. The weather was generally favorable for the establishment of maize. The region achieved a rather low CALF of 54%, which is a decrease by 2% over the 5YA. Crop production is expected to be below average.

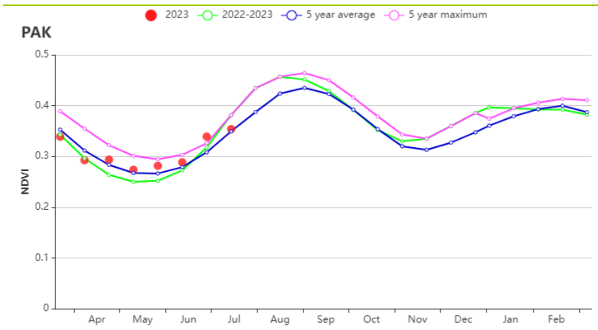
Northern Punjab(157) is the main agricultural region in Pakistan. It recorded more rainfall than usual (RAIN +163%). Both TEMP (-2.3℃) and RADPAR (-7%) were below average. The combination of these factors resulted in above-average estimates of BIOMSS by 37% compared to the recent fifteen-year average.

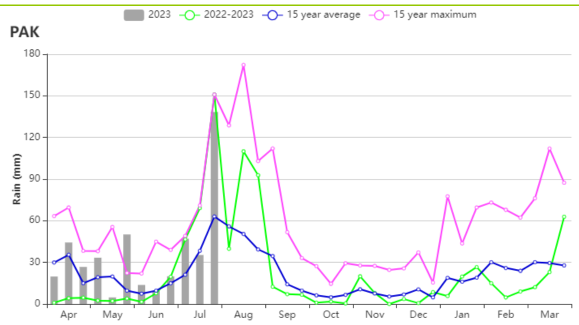
Wheat had above-average NDVI values during the late growth period, which resulted in above-average yields. For summer crops, crop conditions in early July were above average, later slightly below average. This decrease may have resulted from excessive regional rains and floods. The CALF was high (73%), an increase by 3%. The VCIx of 0.87 was also high. Production of summer crops is favorable.

Figure 3.37 Pakistan crop condition, April - July 2023

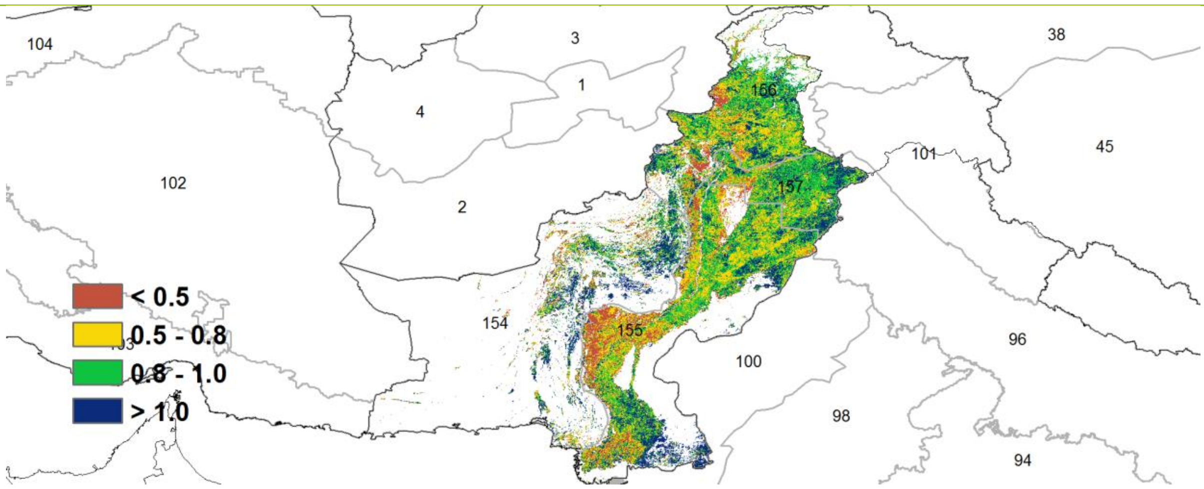


(a) Phenology of major crops

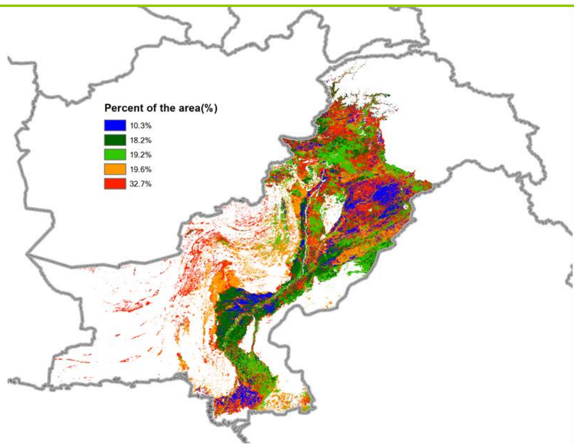


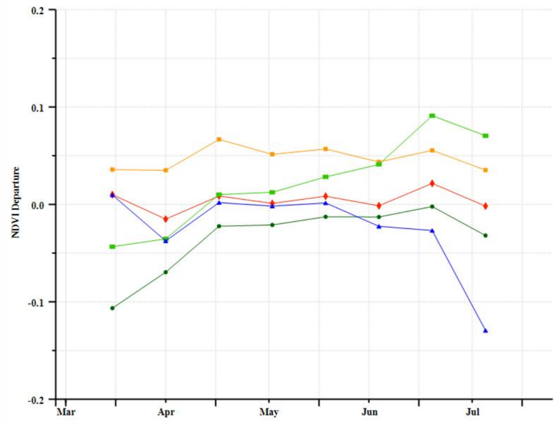


(b) Crop condition development graph based on NDVI (c) Time series precipitation profile



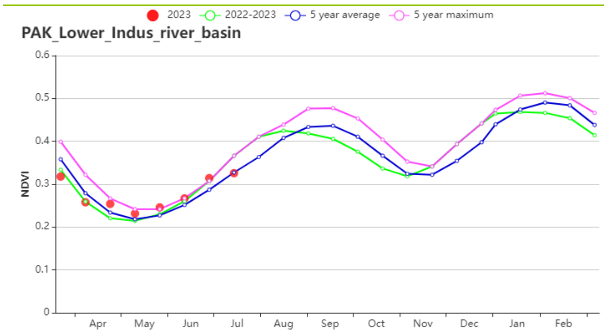
(d) Maximum VCI

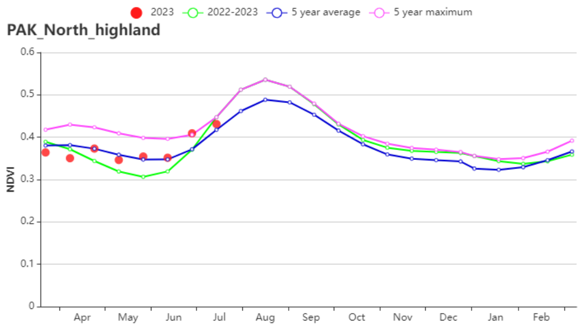




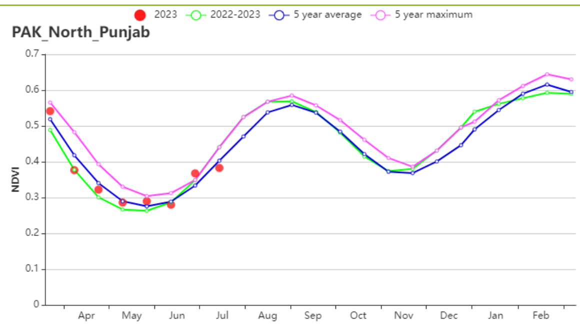
(e) Spatial NDVI patterns compared to 5YA

(f) NDVI profiles





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



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

Table 3.64 Pakistan's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, April - July 2023

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (℃)	Departure (℃)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Lower Indus river basin	450	319	33.1	-1.6	1451	-7	905	34
Northern highlands	385	2	21.1	-0.2	1500	-3	854	4
Northern Punjab	606	163	30.4	-2.3	1401	-7	1163	37

Table 3.65 Pakistan's agronomic indicators by sub-national regions, current season's values and departure from 5YA, April - July 2023

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Lower Indus river basin	40	1	0.87
Northern highlands	54	-2	0.83
Northern Punjab	73	3	0.87

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[PHL] Philippines

In the Philippines, the harvest of second season rice and second season maize concluded in April and May respectively. It was followed by the planting of main season maize and main season rice. Throughout the period, weather conditions were wetter than average (RAIN +18%). Temperatures remained normal (TEMP) and radiation was slightly lower by about 4% (RADPAR). The abundant rainfall and normal temperatures generally favor crop growth and biomass accumulation, resulting in a potential biomass that is about 2% (BIOMASS) higher. The slightly increased rainfall in April and May did not greatly affect the harvest of second season crops. However, the notably increased rainfall in June and July seems to have slightly affected the main season maize harvest. This is in line with the NDVI profile. According to the profile, crop NDVI remained slightly below average throughout April and May, and the gap widened after June.

Based on the spatial NDVI pattern, crop growth across the country can be classified into two patterns: 1) About 77.9% of the cultivated area (dark green, blue and orange) had NDVI values that were generally close to the average level during the period, indicating a normal crop condition in these areas. 2) Approximately 22.1% of the cultivated area (light green) had NDVI values well below average before June. They recovered to normal after June. These areas are mainly located in the northwestern region of Luzon Island.

Considering that the CALF index is close to 100% and the VCIx is as high as 0.95, with a CPI value of 1.11, it is estimated that both the harvest of the second season crops and the growth of the main season crops in the Philippines are generally normal.

Regional analysis

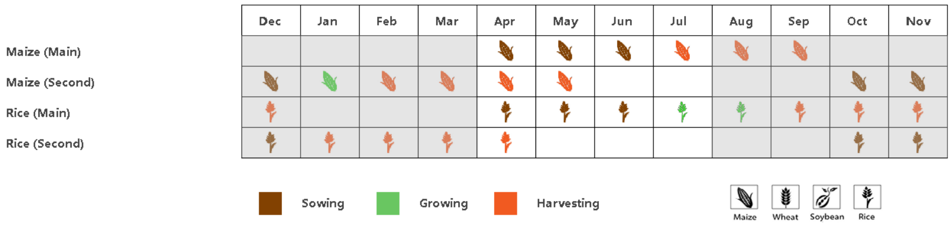
Based on the cropping systems, climatic zones and topographic conditions, three main agro-ecological regions can be distinguished for the Philippines. They are **the Forest region** (agro-ecological zone 153, mostly southern and western islands), **the Hilly region** (agro-ecological zone 154, Island of Bohol, Sebu and Negros), and **the Lowlands region** (agro-ecological zone 155, northern islands).

In **the Forest region**, precipitation has increased by about 17% (RAIN) and temperature by about 0.2°C (TEMP), leading to a 2% (BIOMASS) increase in potential biomass. The radiation in this region is about 4% (RADPAR) lower. The NDVI remained generally at average until mid-May, indicating that the harvest of the second season crops is generally normal. However, after mid-May, the crop NDVI remained slightly below average. Although the significant increase in rainfall in June and July is unfavorable for the maturation and harvest of main season maize, its impact appears to be limited. The VCIx value reached as high as 0.96 and the CPI value is 1.14, both indicating a generally normal crop growth status.

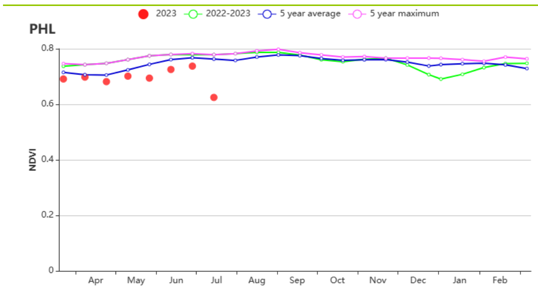
In **the Hilly region**, there was a significant increase in precipitation (RAIN +38%) and a 0.4°C (TEMP) decrease in temperature, accompanied by a 6% (RADPAR) decrease in radiation. The increased rainfall has led to an increase of about 3% (BIOMASS) in potential biomass, indicating that weather conditions during the period were generally favorable for crop growth. With the exception of certain periods, the crop NDVI remained largely at normal levels. However, there were sudden drops in late May and late July, which are thought to be related to cloud cover in satellite imagery. Despite these fluctuations, the VCIx value for this region is as high as 0.96 and the CPI value is 1.13, both of which indicate favorable crop conditions.

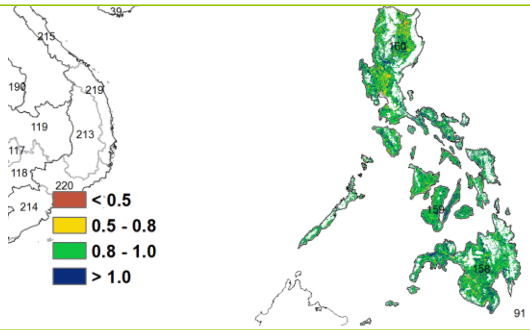
In **the Lowlands region**, precipitation has increased significantly by 16% (RAIN), while temperature and radiation have decreased by 0.2°C (TEMP) and 4% (RADPAR), respectively. The abundant rainfall has resulted in a potential biomass of about 3% (BIOMASS) higher than the average. The NDVI profile suggests that the increased precipitation may have an adversedly influenced NDVI, causing the NDVI to remain consistently below average. This suggests that the excess rainfall has not only adversely affected the harvest of the second season crops, but has also had an unfavorable effect on the growth of the main season crops. Nevertheless, the VCIx is as high as 0.93 and the CPI is 1.09. Therefore, overall crop growth in this region is expected to be normal.

Figure 3.38 Philippines' crop condition, April 2023 – July 2023

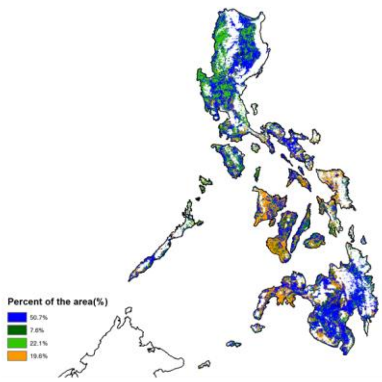


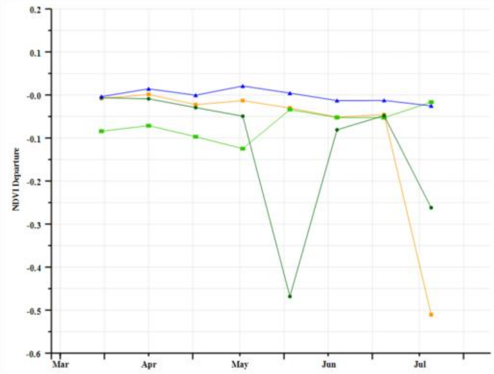
(a) Phenology of major crops



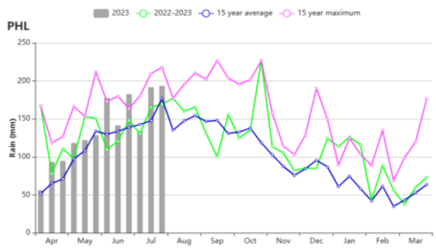


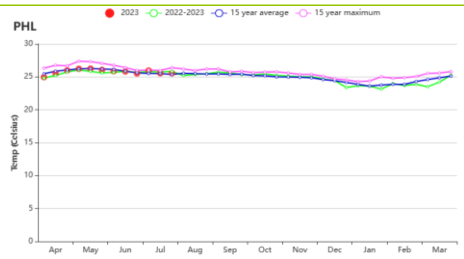
(b) Crop condition development graph based on NDVI (c) Maximum VCI



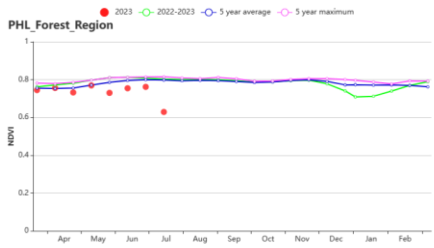


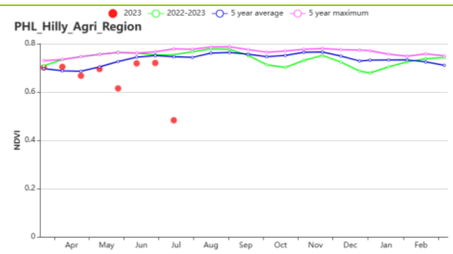
(d) Spatial NDVI patterns compared to 5YA (e) NDVI profiles



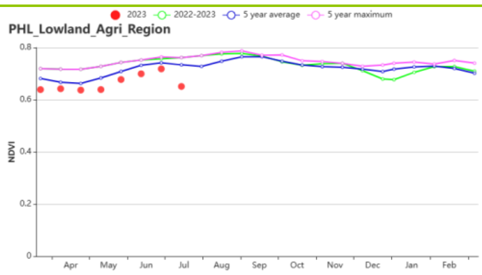


(f) Rainfall profiles (g) Temperature profiles





(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 3.66 Philippines' agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, April 2023 – July 2023

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Forest region	1600	17	25.5	0.2	1217	-4	1518	2
Hilly region	1865	38	26.8	-0.4	1266	-6	1633	3
Lowlands region	1630	16	25.9	-0.2	1278	-4	1532	3

Table 3.67 Philippines' agronomic indicators by sub-national regions, current season's values and departure from 5YA, April 2023 – July 2023

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Forest region	100	0	0.96
Hilly region	100	0	0.96
Lowlands region	100	0	0.93

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[POL] Poland

During the monitoring period, a cold and wet April delayed the development of the winter crops as well as the sowing and establishment of summer crops. The winter wheat harvest started in July.

Rainfall (RAIN -20%), temperatures (TEMP -0.3°C), and solar radiation (RADPAR -2%) were below the average for the same period in the past 15 years. This resulted in a 10% reduction in BIOMSS. Benefiting from above average rainfall from April to the first half of May, NDVI was above the average or even close to the highest level of the same period in the last 5 years, despite low temperatures. In the second half of May, rainfall was significantly below average, which may have caused drought conditions resulting in below average NDVI trends and negatively impacting the grain filling of wheat.

The NDVI departure clustering map shows that NDVI for about 30.6% of crops (marked as "red", mainly distributed in the southeast of Poland) were above average till the second half of May and then quickly dipped below average but slowly recovered in July. The summer crops may have benefitted from the above average rainfall in late June and July. Moreover, 37.0% of crops (marked as "orange" and "blue") were above average before late May, and then dropped significantly. The remaining 32.3% of the arable crops (marked "dark green" and "light green") was below average throughout the period.

CALF reached 100% and VCIx was 0.85. Crops with VCIx values between 0.5 and 0.8 were widely distributed throughout the country, with the exception of the southeast. CPI was 1.03.

Overall, due to the rainfall deficit lasting from mid May to mid June, crop conditions were below average.

Regional analysis

Four agro-ecological zones (AEZ) are examined more closely below. They include the **Northern oats and potatoes areas** (163, the northern half of west Pomerania, eastern Pomerania and Warmia-Masuria), the **Northern-central wheat and sugar-beet area** (162, Kuyavia-Pomerania to the Baltic Sea), the **Central rye and potatoes area** (161, Lubusz to South Podlaskie and northern Lublin), and the **Southern wheat and sugar-beet area** (164) from southern Lower Silesia to southern Lublin and Subcarpathia along the Czech and Slovak borders. The listed administrative units correspond to the Voivodeships.

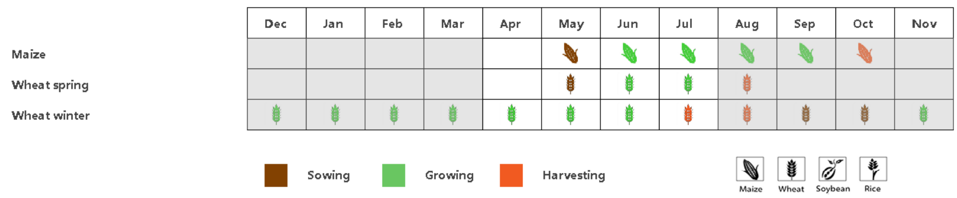
Compared to the average for the same period of the last 15 years, the **Northern oats and potatoes areas** had 24% lower RAIN, 0.1°C higher TEMP, and 1% lower RADPAR. The rainfall deficit caused 13% lower BIOMSS. CALF in the region was 100% and VCIx was 0.81. Crop growth in the region was below average from late May to July. CPI was 0.97. Crop production is expected to be slightly below average.

Rainfall in the **Northern-central wheat and sugar-beet area** was 25% below the average of the last 15 years, TEMP was 0.1°C higher, while RADPAR was above average by 1%, and BIOMSS was 13% lower due to the precipitation deficit. CALF was close to 100% and VCIx was 0.81. NDVI in this subregion was significantly lower than the average of the same period from late May to July. CPI was 0.98. Crop conditions were slightly below average.

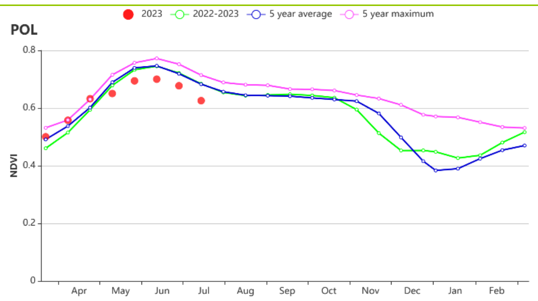
Compared to the 15-year average, all the agrometeorological indicators in the **Central rye and potatoes area** were lower, including 22% lower RAIN, 0.2°C lower TEMP, 2% lower RADPAR and 11% lower BIOMSS. CALF in this region reached 100%, and VCIx was 0.84. NDVI was above the average of the last five years in April and early May, but slowly decreased to below average from late May to July. CPI was 1.03. All in all, the crop conditions were slightly unfavorable.

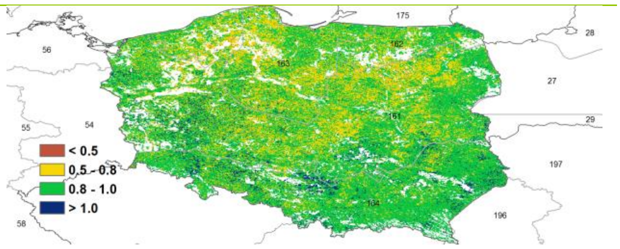
In the **Southern wheat and sugar-beet area**, the smallest rainfall deficit (-14%) was observed. TEMP was also 0.7°C lower than the 15YA. Combined with a 3% lower RADPAR, this led to a 5% lower BIOMSS. CALF in this zone was 100% and VCIx was 0.90. In contrast to the other three subregions, NDVI in this zone was close to average from late May to July. CPI was 1.08. Crop conditions were normal and average yield levels can be expected for this region.

Figure 3.39 Poland's crop condition, April - July 2023

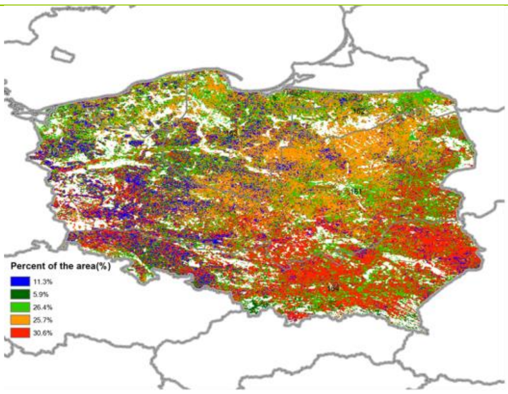


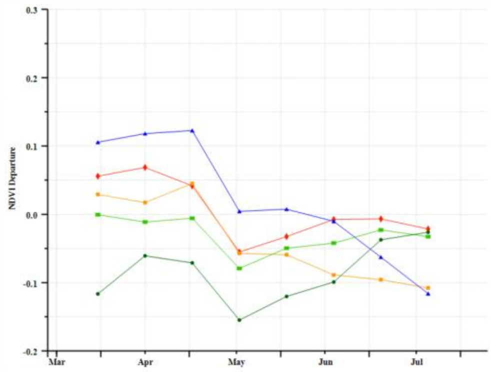
(a). Phenology of major crops



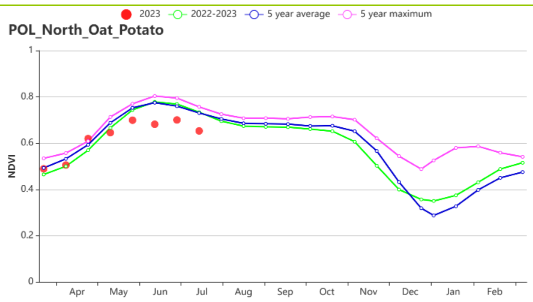


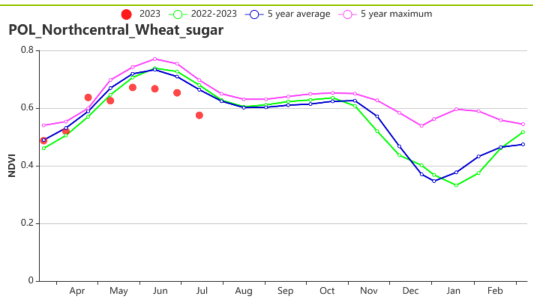
(b) Crop condition development graph based on NDVI (c) Maximum VCI



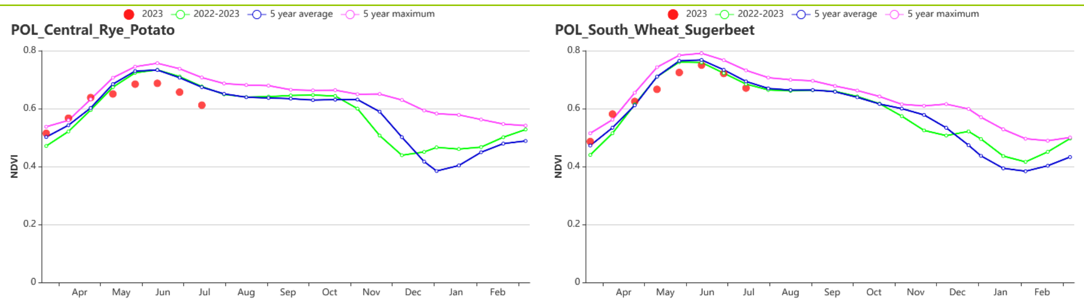


(d) Spatial NDVI patterns compared to 5YA (e) NDVI profiles

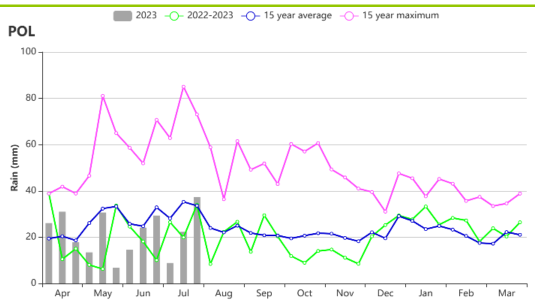




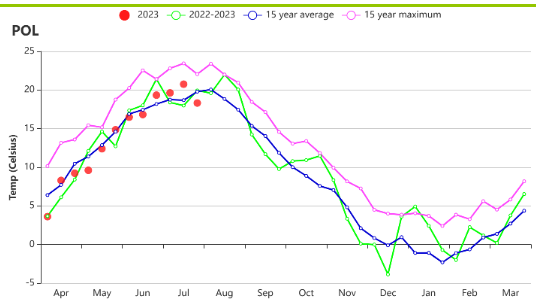
(f) Crop condition development graph based on NDVI, Northern oats and potatoes area (left) and Northern-central wheat and sugar beet area (right).



(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 3.68 Poland's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, April - July 2023

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Northern oats and potatoes areas	247	-24	14	0.1	1130	-1	734	-13
Northern-central wheat and sugarbeet area	221	-25	14.3	0.1	1167	1	705	-13
Central rye and potatoes area	244	-22	14.6	-0.2	1134	-2	741	-11
Southern wheat and sugarbeet area	309	-14	13.5	-0.7	1140	-3	823	-5

Table 3.69 Poland's agronomic indicators by sub-national regions, current season's values and departure from 5YA, April - July 2023

Region	Cropped arable land fraction		Maximum VCI
	Current	Departure (%)	Current
Northern oats and potatoes areas	100	0	0.81
Northern-central wheat and sugarbeet area	100	0	0.81
Central rye and potatoes area	100	0	0.84
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 15% below the 15YA, average temperature was 0.2℃ lower and radiation was slightly below average (-4%). The decrease in rainfall caused a biomass decrease (-7%). The CALF of Romania remained unchanged (100%) and the maximum VCI was 0.90. Compared with last year's drought condition, this reporting period has a better performance. The rainfall time series shows that precipitation was below average in May, early June, impacting the growth of maize and wheat. The temperature was around average for most of the reporting period and even reached the 15-year maximum in the middle of July. The VHI map shows that drought conditions were severe in the eastern region. According to the NDVI development curve, crop conditions were below average from April to June. Only 8.2% (green line) of Romania's 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 summer crops.

Regional analysis

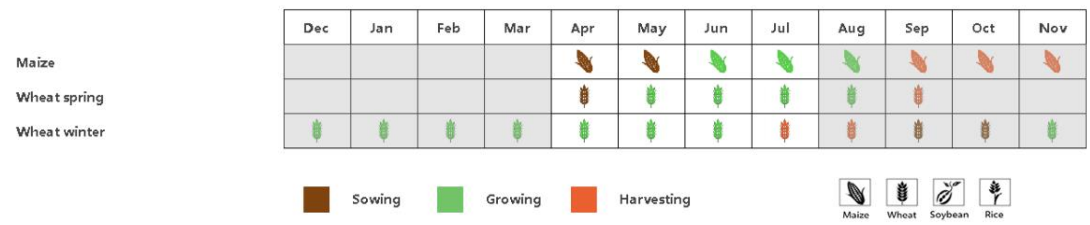
More details are provided below for three main agro −ecological zones: the Central mixed farming and pasture Carpathian hills (165), the Eastern and southern maize, wheat and sugar beet plains (166) and the Western and central maize, wheat and sugar beet plateau (167).

For the Central mixed farming and pasture Carpathian hills, compared to the 15YA, rainfall decreased by 21%, temperature was at average, radiation was below average (RADPAR -3%) and BIOMSS decreased by 9%. According to the NDVI development, crop conditions were below average during the reporting period. The regional average VCI maximum was 0.93. 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.

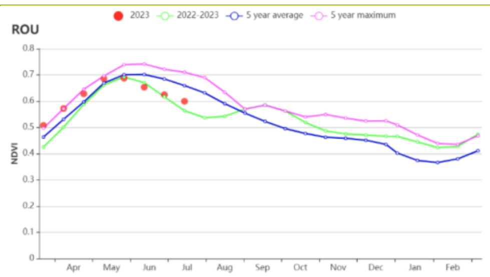
For the Eastern and Southern maize, wheat and sugar beet plains, rainfall decreased by 14%, the temperature was at average and radiation was 4% below average. This resulted in a reduced estimate of biomass (-7%). The NDVI development graph shows that crop conditions dropped to below average from late June to July. The VCIx value of this region was only 0.89. 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. All indicators show that the crop condition in this region was below average.

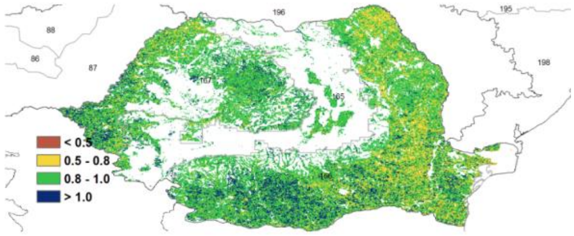
For the Western and central maize, wheat and sugar beet plateau, rainfall was lower than average by 16%. Temperature was also lower than average by 0.5℃, radiation was also lower (RADPAR -3%) and biomass decreased by 9%. Maximum VCI of this region was 0.91. It varied considerably in this region (0.5 to 1.0). CPI was 1.07. The spatial NDVI pattern shows that NDVI was also decreasing over time in the central region (red line), which indicates that crop conditions were unfavorable.

Figure 3.40 Romania's crop condition, April 2023 - July 2023



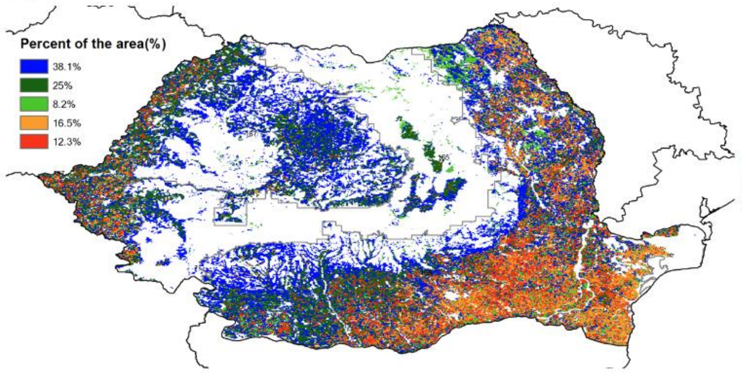
(a) Phenology of major crops

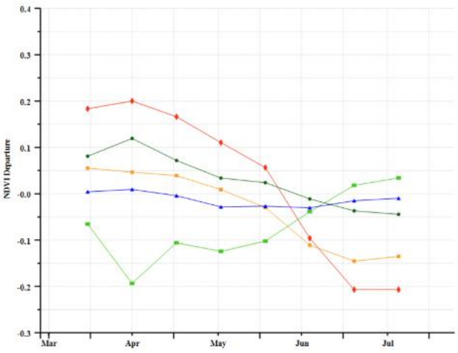




(b) Crop condition development graph based on NDVI

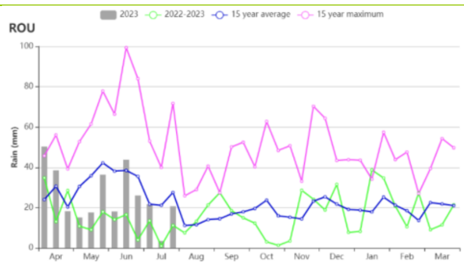
(c) Maximum VCI

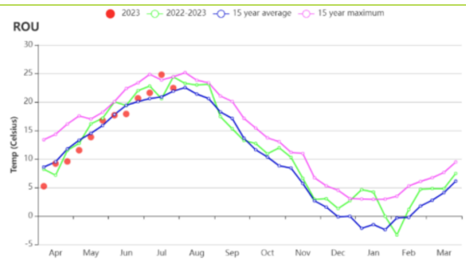




(d) Spatial NDVI patterns compared to 5YA

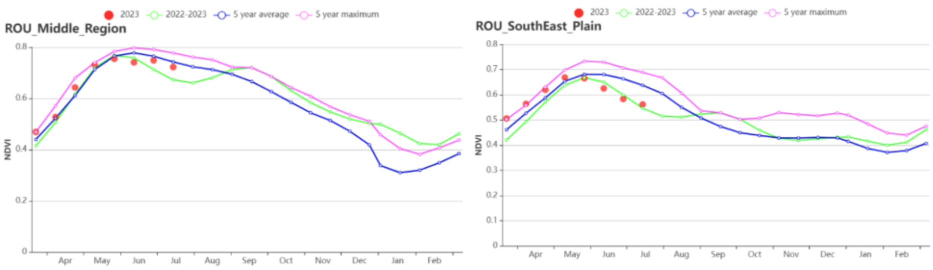
(e) NDVI profiles



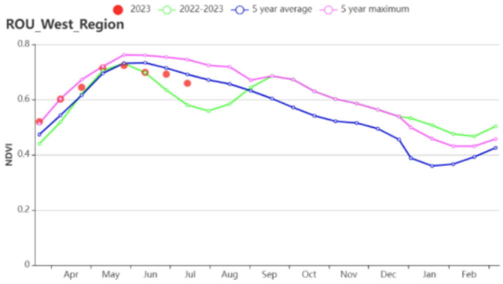


(f) Rainfall profiles

(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 3.70 Romania's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, April - July 2023

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	337	-21	14.1	0	1251	-3	808	-9
Eastern and southern maize wheat and sugarbeet plains	290	-14	17.1	0	1264	-4	816	-7
Western and central maize wheat and sugarbeet plateau	307	-16	15.2	-0.5	1293	-3	802	-9

Table 3.71 Romania's agronomic indicators by sub-national regions, current season's values and departure from 5YA, April - July 2023

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Central mixed farming and pasture Carpathian hills	100	0	0.93
Eastern and southern maize wheat and sugarbeet plains	100	0	0.89
Western and central maize wheat and sugarbeet plateau	100	0	0.92

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

[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 from April to mid-May stayed close to the 5-year average and the previous year's level, then dropped below these two levels. Precipitation from April until June was mainly below the 15-year average, except at the end of April and from the end of June through July, when it was slightly above that level. Temperatures were mostly close to the 15-year average and last year's levels, except in the beginning and middle of June as well as in the middle of July when they reached the 15-year maximum.

NDVI departure varied among the regions. Among the main crop production regions, South Caucasus and North Caucasus regions showed mainly positive NDVI departures. In parts of Central Russia and the Central Black Soil region, NDVI closely followed the trend line until the end of June and then showed a positive departure. In the Middle Volga region, the situation was mixed. Western and southern parts of the region followed the same pattern as the South Caucasus and North Caucasus regions, while the south-eastern part of the region demonstrated negative NDVI departures. The rest of the regions demonstrated mainly negative NDVI departures.

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 range mainly from 0.5 to 1. VCIx in the rest of the regions ranged mostly from 0.5 to 0.8.

Overall, considering NDVI and agroclimatic conditions we expect the yield of winter crops to be close or slightly below the 5-year average and the level of the previous year. The conditions for the crops planted in the spring are slightly less favorable. Yields may stay below the 5-year average and the previous year's level.

Regional analysis

South Caucasus (176)

All agroclimatic indicators were below the 15-year average. Rainfall was down by 12%, temperature by 0.7°C, RADPAR by 1% and BIOMASS by 4%. CALF was by 1% below the 5-year average. VCIx was 0.86. CPI was 1.07. NDVI was mainly close the 5-year average, except at the end of May when it was below these two levels.

Based on NDVI, the winter wheat yield is expected to be close to the last year and to the 5-year average. There is small spring wheat acreage in the region, but its yield is expected to be close to the average as well as the maize yield.

North Caucasus (174)

Rainfall was 16% above the 15-year average. Temperatures and RADPAR were by 0.7°C and 7% below the 15-year average respectively. BIOMASS was by 7% above the 15-year average. CALF was 1% above the 5-year average. VCIx was 0.87. CPI was 1.11. From mid-April to mid-May, NDVI was close to the 5-year maximum, then it dropped to the 5-year average.

According to NDVI, winter wheat yield is expected to be close to the 5-year average or above it. Spring wheat is scarce in the region, but its yield is also expected to be at a 5-year average. The maize yield is also expected to be at or close to the 5-year average.

Central Russia (169)

All agroclimatic indicators were below the 15-year average. Rainfall was down by 31%, temperature by 0.2°C, RADPAR by 1% and BIOMASS by 20%. CALF was equal to the 5-year average. VCIx was 0.93. CPI was 1.10. NDVI was close to the 5-year average and the level of the previous year till mid-May, then it dropped below two these levels.

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

Central Black soils region (170)

Precipitation was 3% higher than the 15-year average. The rest of the agroclimatic indicators were below the 15-year average. Temperature was down by 0.7°C, RADPAR by 6% and BIOMASS by 5%. CALF was equal to the 5-year average. VCIx was 0.96. CPI was 1.11. NDVI was mostly close to the 5-year average and the previous year's level except for the period from mid-May to mid-June when it was below those two levels.

Due to unfavorable agroclimatic conditions winter and spring wheat yield is expected to be slightly below the last year's level and the 5-year average. According to the NDVI, maize yield is expected to be equal to last year's level and equal to the average.

Middle Volga (173)

Temperatures were by 0.5°C above the 15-year average, while the rest of the agroclimatic indicators were below the 15-year average. Atmospheric precipitation was down by 16%, RADPAR by 2% and BIOMASS by 9%. CALF was by 2% below the 5-year average. VCIx was 0.87. CPI was 1.05. Till mid-May, NDVI was close to the 5-year average and the previous year's level, then it dropped below these two levels.

Due to precipitation shortage and higher temperatures, winter and spring wheat yield are likely to be lower than last year and 5-year the average. Maize yield is also likely to be slightly below the average.

Ural and Western Volga (178)

Rainfall and BIOMASS were below the 15-year average by 28% and 16% respectively. Temperature and RADPAR were by 1.3°C and 6% above the 15-year average, respectively. CALF was by 1% below the 5-year average. VCIx was 0.84. The NDVI was below the 5-year average and last year's level during most part of the analyzed period.

Due to increased temperatures and lack of precipitation, winter and spring wheat and maize yield are likely to be below last year's and 5-year average.

Western Siberia (171)

Rainfall and BIOMASS decreased by 13% and 8%, respectively, compared to the 15-year average. Temperature and RADPAR were by 0.2°C and 7% above the 15-year average respectively. CALF was close to the 5-year average. VCIx was 0.81. CPI was 0.94. NDVI was below the 5-year average and last year's value.

There are very few winter crops and maize in this region. Because of rainfall deficit and higher temperatures, spring wheat yield is expected to be below the average of last year.

Middle Siberia (172)

Precipitation, temperature, and BIOMASS were below the 15-year average. Precipitation was down by 10%, temperature by 1.0°C and BIOMASS by 6%. RADPAR was by 1% higher than the 15-year average. CALF was close to the 5-year average. VCIx was 0.86. CPI was 1.00. NDVI was below the 5-year average and the level of the previous year.

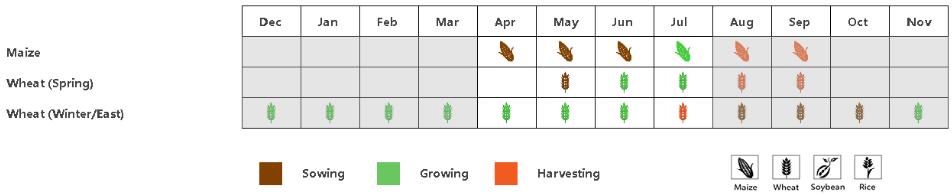
There are no winter crops or maize grown in this region. Due to unfavorable agroclimatic conditions spring wheat yield is expected to be below the average and the last year's level.

Eastern Siberia (179)

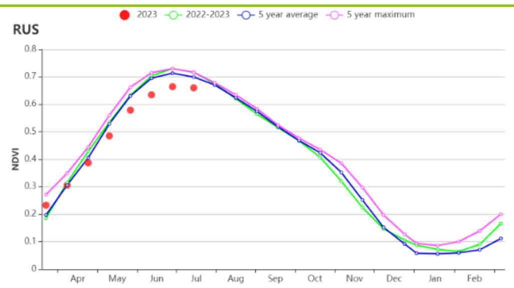
Rainfall and BIOMASS decreased by 32% and 13 % correspondingly compared to the 15-year average. Temperature and RADPAR were higher than the 15-year average by 0.8°C and 5%, respectively. CALF was equal to the 5-year average. VCIx was 0.97. CPI was 1.15. NDVI in the period from April till the beginning of May was close the 5-year average, then it dropped below this level, but bounced back and from mid-May was close to the 5-year maximum.

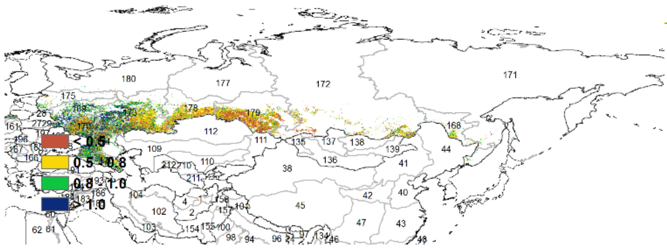
In this region, only few winters and hardly any maize are grown. Spring wheat yield is expected to be above the 5-year average or close to it.

Figure 3.41 Russia's crop condition, April – July 2023

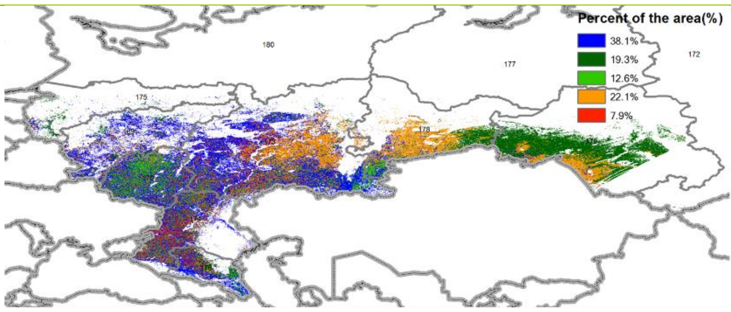


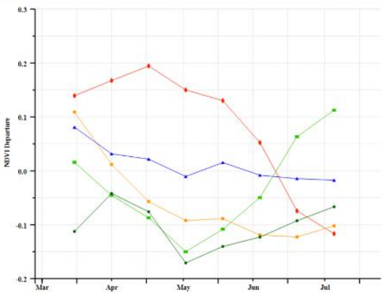
(a) Phenology of major crops



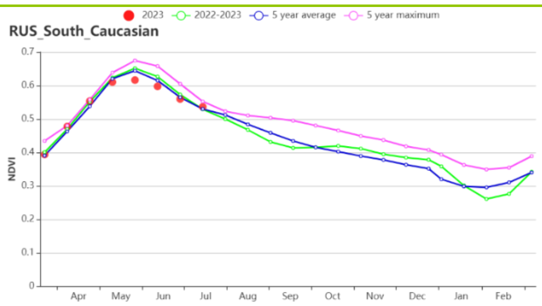


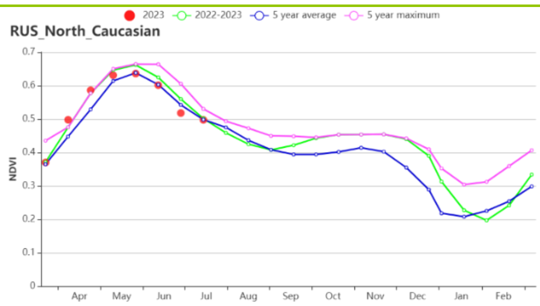
(b) Crop condition development graph based on NDVI (c) Maximum VCI



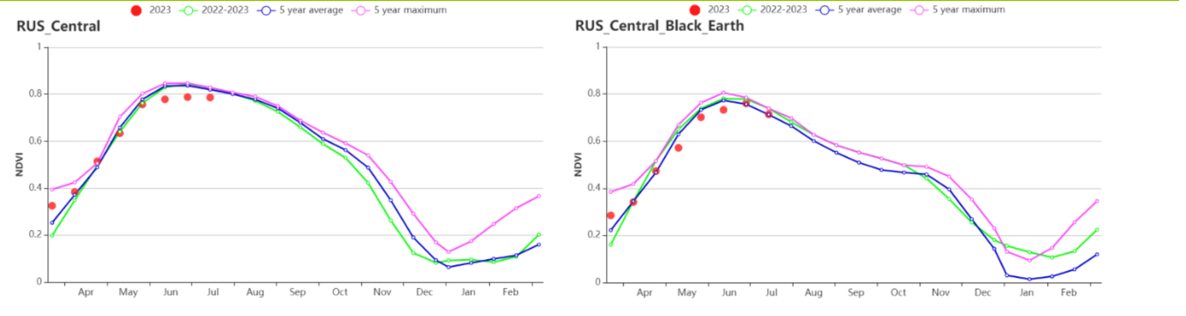


(d) Spatial NDVI patterns compared to 5YA (e) NDVI profiles

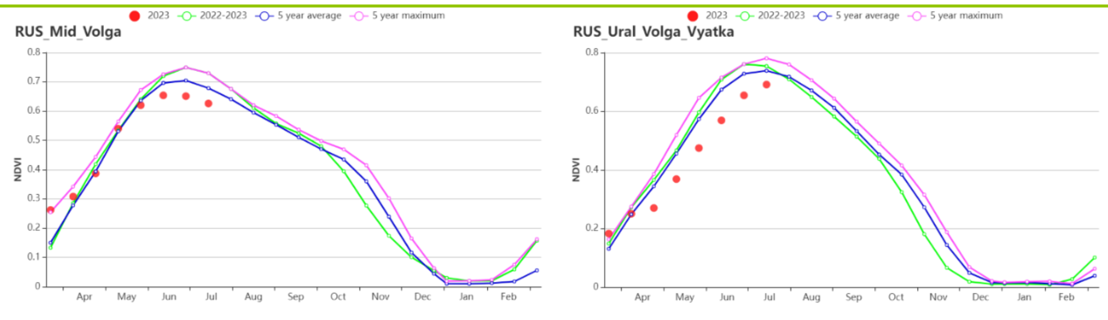




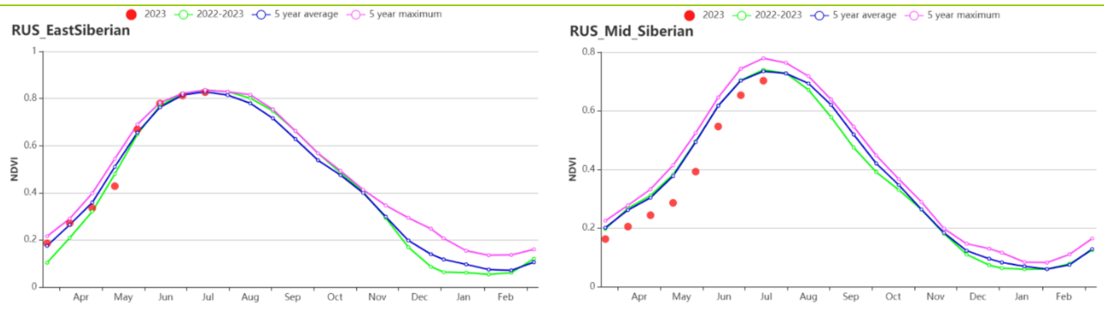
(f) Crop condition development graph based on NDVI, Southern Caucasus (left) and Northen Caucasus (right).



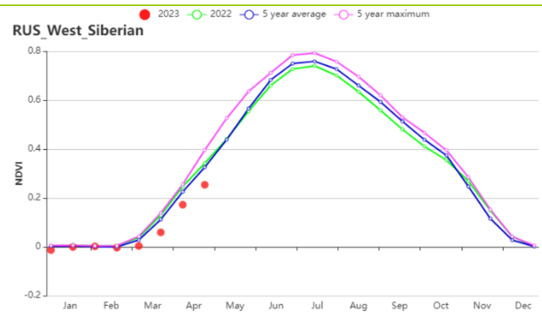
(g) Crop condition development graph based on NDVI, Central Russia (left) and Central black soils area (right).



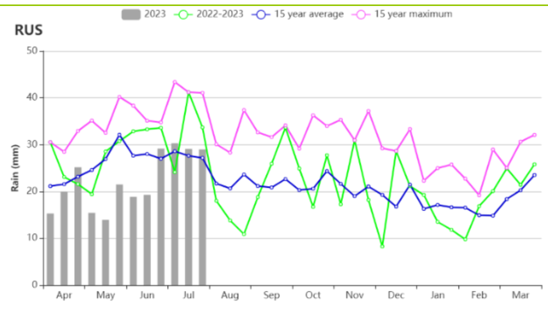
(h) Crop condition development graph based on NDVI, Middle Volga (left) and Ural and western Volga region (right).



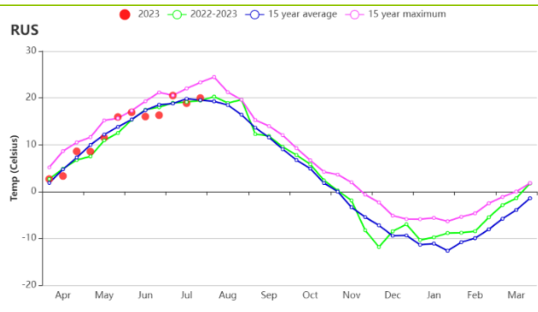
(i) Crop condition development graph based on NDVI, Eastern Siberia (left) and Middle Siberia (right).



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



(k) Rainfall index



(l) Temperature Index

Table 3.72 Russia's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, April – July 2023

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Central Russia	232	-31	12.6	-0.2	1076	-1	670	-20
Central black soils area	320	3	14.0	-0.7	1104	-6	795	-5
Eastern Siberia	301	-32	12.5	0.8	1204	5	761	-13
Middle Siberia	256	-10	9.4	-1.0	1270	1	660	-6
Middle Volga	250	-16	14.0	0.5	1125	-2	723	-9
Northern Caucasus	349	16	16.9	-0.7	1225	-7	880	7
Southern Caucasus	450	-12	14.4	-0.7	1287	-1	825	-4
Ural and western Volga region	199	-28	13.8	1.3	1178	6	623	-16
Western Siberia	261	-13	12.7	0.2	1229	7	715	-8

Table 3.73 Russia's agronomic indicators by sub-national regions, current season's values and departure from 5YA, April – July 2023

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Central Russia	100	0	0.93
Central black soils area	100	0	0.93
Eastern Siberia	100	0	0.97
Middle Siberia	98	0	0.86
Middle Volga	99	2	0.87
Northern Caucasus	96	1	0.87
Southern Caucasus	95	-1	0.86
Ural and western Volga region	99	1	0.84
Western Siberia	99	0	0.81

[SYR] SYRIA

As shown on the penology map, the main crops in Syria include wheat and barley. During the current reporting period from April to July, both barley and wheat were in their respective grain filling stage, and reached maturity in May and June. The proportion of cropland (rain-fed and irrigated) in Syria is about 32.8% and regular rainfall is crucial for crop growth because of most of the cropland in Syria is rain-fed.

Compared to the 15-year average, accumulated rainfall was less than average (RAIN -36%) and radiation was also less than average (RADPAR -2.6%). The temperature was above average (TEMP +0.43°C). The average temperature value for the reporting period was 24.3°C. The temperature was generally above average except in early May and Mid-June. The irregular rain, especially in irrigated land in the second and third regions, which also depend on supplemental irrigation, resulted in a decrease of BIOMSS by 6%. According to the NDVI profiles, the national average NDVI values were above the 5YA during the grain filling periods of barley and wheat in April. The national average VCIx was 0.66 and CALF was above average by 17%. All in all, the rainfall deficit of around 36% caused less than favorable conditions for cereal production. Nevertheless, the agronomic indicators, as well as the NDVI trend curves, indicate close to average conditions.

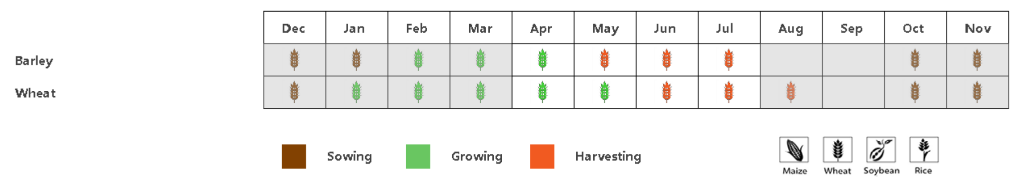
Regional analysis:

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).

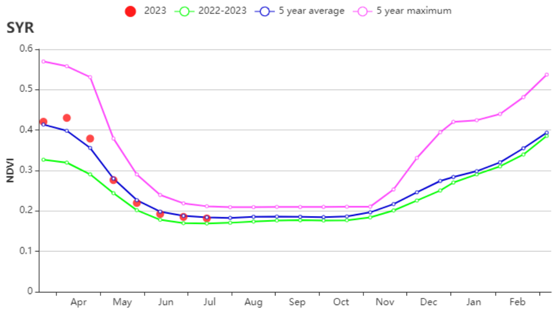
In the first two regions (a and b), the accumulated precipitation was less than average in both regions, and the temperatures were near average. The RADPAR was below average. The shortage in rainfall resulted in a decrease of BIOMSS by 9% to 13%, while the national average VCIx values were not higher than 0.82 for the two regions. Compared to the other regions, the higher CALF values indicated more agricultural activities in this region; for the a) region, it was above its 5YA by 1% and for the b) region, it was up by 5%. According to NDVI profiles of the two regions, crop conditions were close to the 5YA.

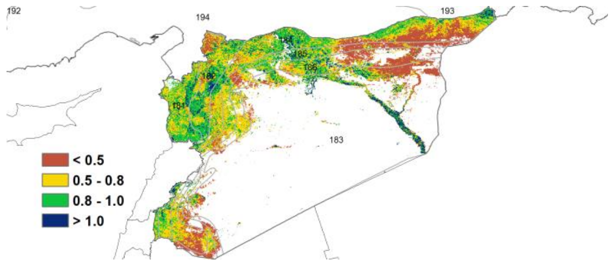
Agro-climatic conditions in the second, third and fourth region were also close to the 5YA. The rainfall was below average by more than 26%, whereas the temperature was above average and RADPAR was below average. The low rainfall led to a decrease in potential biomass by at least 6%. The CALF values in the three regions increased significantly by more than 14%. The average VCIx value in the second region, the third region and the fourth region were 0.65, 0.57 and 0.56. According to NDVI profiles of the three regions, crop conditions were close to the 5YA except for April for 2, 3, 4 zones and May for zone 4. r.

Figure 3.42. Syria's crop condition, April – July 2023



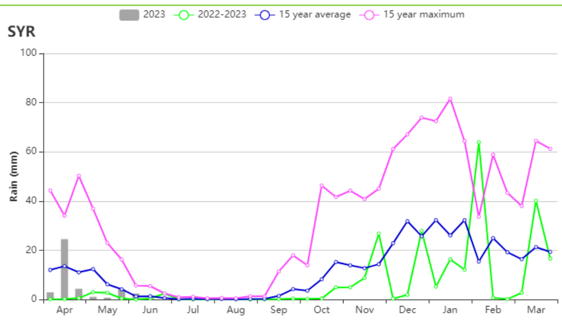
(a). Phenology of major crops

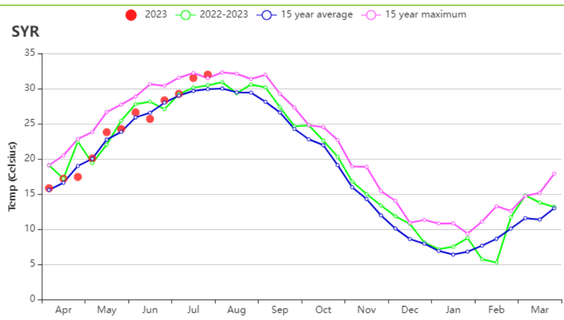




(b) Crop condition development graph based on NDVI

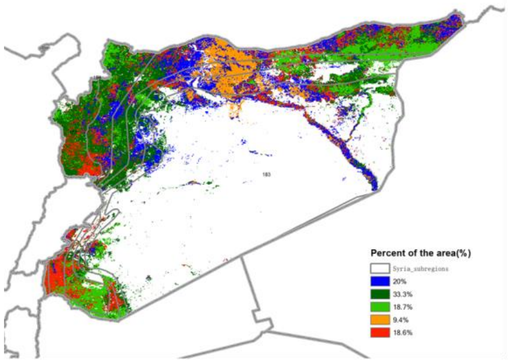
(c) Maximum VCI

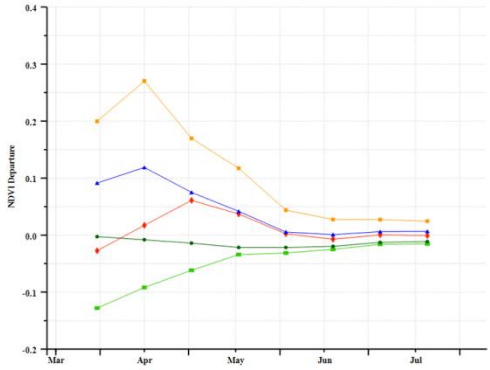




(d) Rainfall profiles

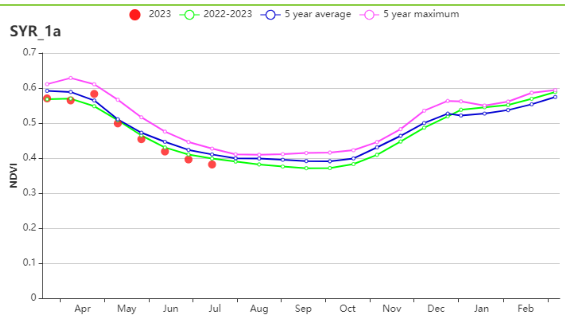
(e) Temperature profiles

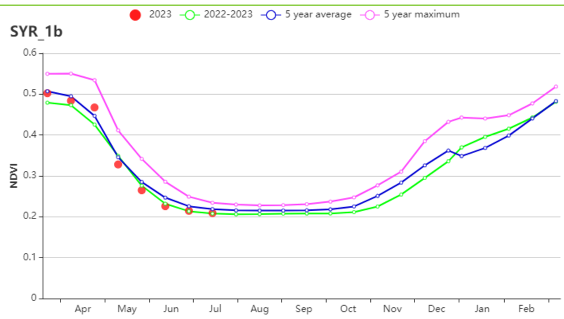




(f) Spatial NDVI patterns compared to 5YA

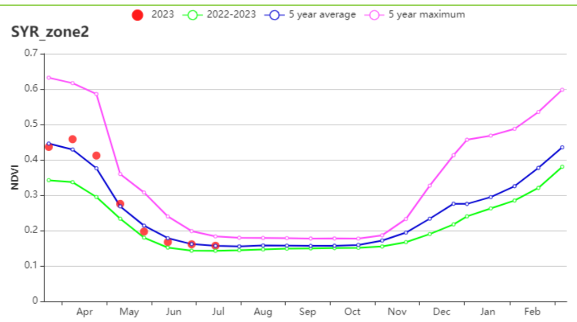
(g) NDVI profiles



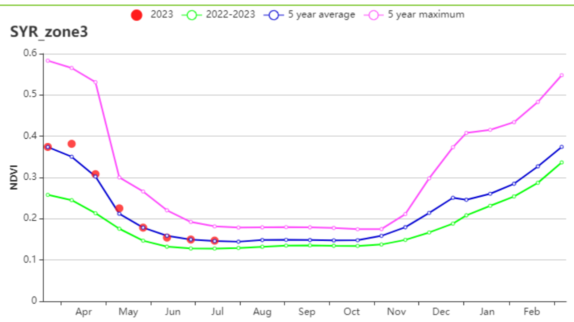


(h) Crop condition development graph based on NDVI (The first(a) region)

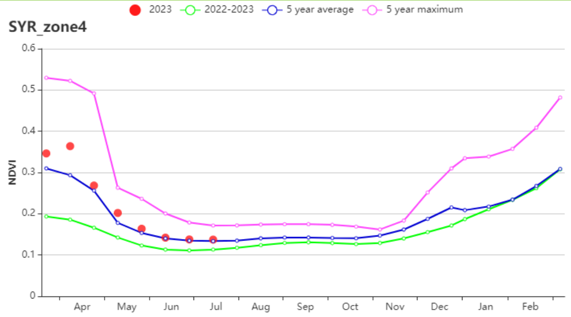
(i) Crop condition development graph based on NDVI (The first (b) region)



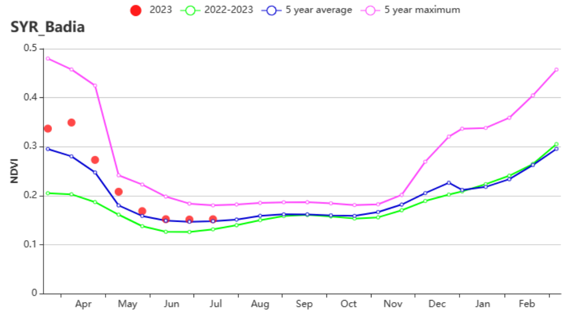
(j) Crop condition development graph based on NDVI (The second region)



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



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



(m) Crop condition development graph based on NDVI (Badia region)

Table 3.74. Syria agro climatic indicators by sub-national regions, current season's values and departure from April - July2023

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
First (a) region	37	-50	21.7	-0.1	1595	-3	559	-13
First (b) region	43	-44	22.0	0.5	1589	-3	570	-9
Badia	25	-32	25.5	0.4	1610	-2	594	-3
Second region	48	-26	24.5	0.6	1576	-3	604	-6
Third region	31	-42	23.9	0.5	1599	-2	580	-6
Forth region	26	-47	24.9	0.5	1607	-2	586	-7

Table 3.75. Syria, agronomic indicators by sub-national regions, current season's values and departure from 5YA, - April - July 2023

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
First (a) region	94	1	0.82
First (b) region	64	5	0.79
Second region	30	34	0.62

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Third region	57	25	0.65
Forth region	35	14	0.57
Badia	30	35	0.56

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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 before June. According to the agroclimatic indicators, Thailand experienced drier and hotter than usual weather in this monitoring period with below-average rainfall (RAIN -6%), above-average temperature (TEMP +1°C), as well as increased sunshine (RADPAR +6%). All these indicators led to average biomass (BIOMSS -2%). The proportion of irrigated cropland in Thailand is 22.5%, and therefore, regular rainfall is vital to sustain crop growth.

The NDVI development graph shows that crop conditions remained noticeably below-average over the entire monitoring period. This was mainly due to a combination of factors: a period of hot and dry weather preceding late-May, followed by flooding, resulting in an overall deviation in crop conditions. Subsequently, crop conditions briefly improved but remained below-average due to temperatures and rainfall approaching normal levels. According to the NDVI departure clustering map, 51.1% of cropland exhibited a slight above-average trend after June, while it remained below-average during April to June, primarily in eastern and western areas. Around 32.4% of the cropped area, primarily located in central, northern, and southern parts, consistently remained below-average conditions, but a slight upward trend emerged after late-May, which reversed in early-July. That could be probably due to the flooding in its northern, eastern, and southern regions on July 3, 2023. The flooding was triggered by the prevailing southwest monsoon situation. About 8.3% of cropland stayed below-average but experienced a sharp drop in July, presumably due to cloud cover in the satellite images. This condition was widespread over most of Thailand, with a concentration in the central and southern parts. For the remaining 8.2% areas in the center of Thailand, a sharp decline was observed in June, and then approached near-average by the end of this monitoring period.

At the national level, almost all arable land was cropped during the season (CALF +99%). VCIx values were around 0.85. The Crop Production Index (CPI) in Thailand is 0.98, which is significantly lower than 1.15 during the same period in previous years. Nevertheless, CropWatch estimates that the crop conditions were below, but close to average, since rainfall has reached average levels starting in late May.

Regional analysis

The regional analysis below focuses on the major 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 (187)**, the **South-eastern horticulture area (188)**, the **Western and southern hill areas (189)**, and the **Single-cropped rice north-eastern region (190)**.

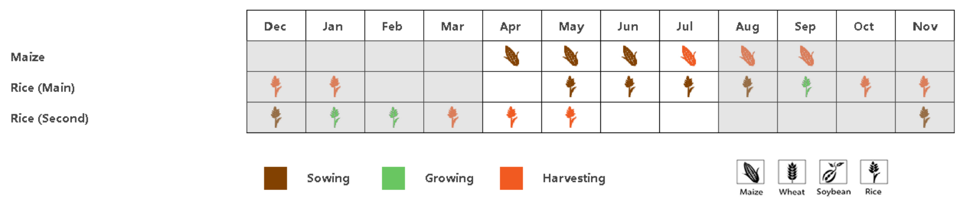
Compared to the 15YA, the **Central double and triple-cropped rice lowlands** experienced hot and rainy conditions. Radiation (RADPAR +8%) was significantly above average, accompanied by higher temperature (TEMP +1.0°C) and rainfall (RAIN +10%). These conditions led to an above-average estimate for BIOMSS (BIOMSS +3%). The NDVI development graph indicates that crop conditions remained below the five-year average throughout the monitoring period. There was a significant decline in early July due to the impact of flooding. Subsequently, the gradual recovery was facilitated by the replenishing effect of rainfall. VCIx was 0.81. Overall, crop conditions were close to average.

Indicators for the **Southeastern horticulture area** show that temperature (TEMP +0.7°C) and radiation (RADPAR +3%) were above-average accompanied by lower rainfall (RAIN -6%). This led to a below-average estimate for BIOMSS (BIOMSS -6%). According to the NDVI development graph, the crop conditions were below average during this monitoring period. The VCIx was at 0.87. All in all, the conditions were unfavorable.

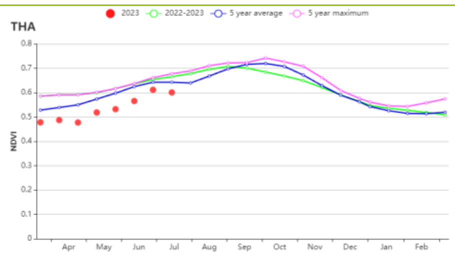
Agroclimatic indicators show that the conditions in the **Western and Southern Hills** were slightly below average: radiation (RADPAR +5%) and temperature (TEMP +0.9°C) were above average, while the rainfall (RAIN, -15%) was below average. These weather conditions led to a 4% decrease in biomass (BIOMSS -4%). According to the NDVI development graph, the crop conditions were below average during the whole monitoring period. The VCIx value was 0.87. Crop conditions are assessed as close to average.

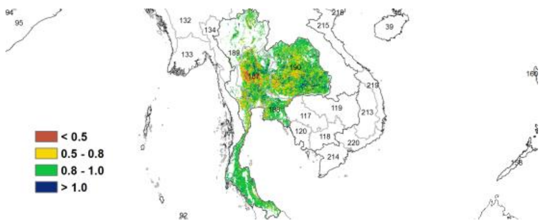
In the **Single-cropped rice north-eastern region**, the rainfall (RAIN, +1%), radiation (RADPAR +6%) and temperature (TEMP +1.2°C) were all above average. All these agroclimatic indicators led to an increase in potential biomass (BIOMSS +1%). According to the NDVI development graph, the crop conditions were close to average in July, but prior to that, they consistently remained significantly below-average. Considering the moderate VCIx value of 0.85, the crop conditions were close to average.

Figure 3.43 Thailand's crop condition, crop calendar from April-July 2023



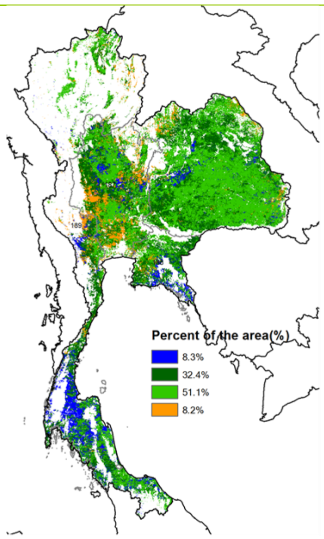
(a) Phenology of major crops

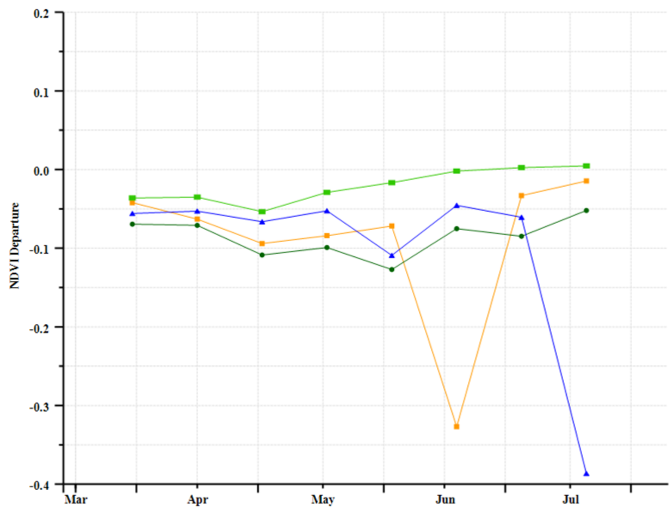




(b) Crop condition development graph based on NDVI

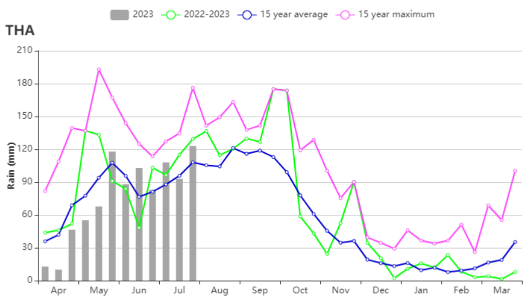
(c) Maximum VCI



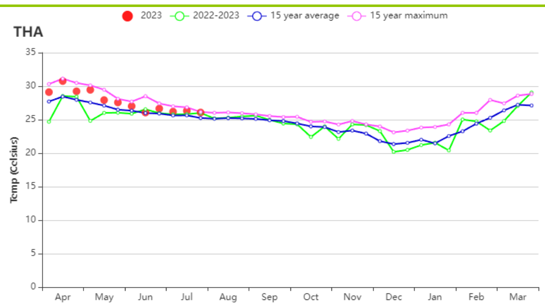


(d) Spatial NDVI patterns compared to 5YA

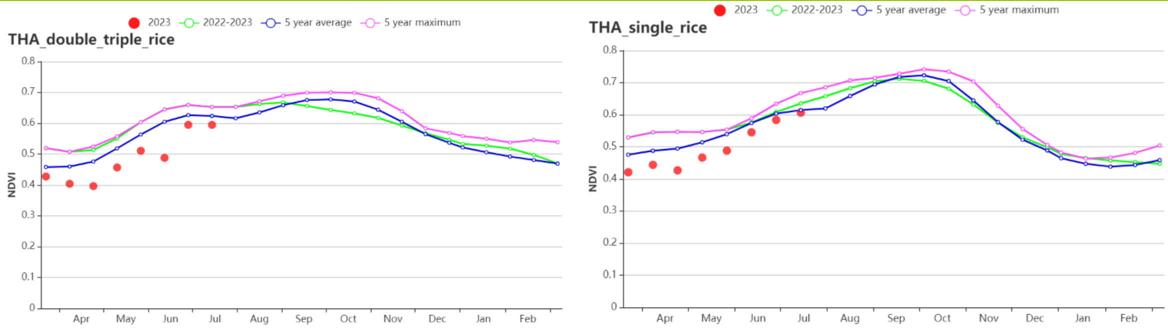
(e) NDVI profiles



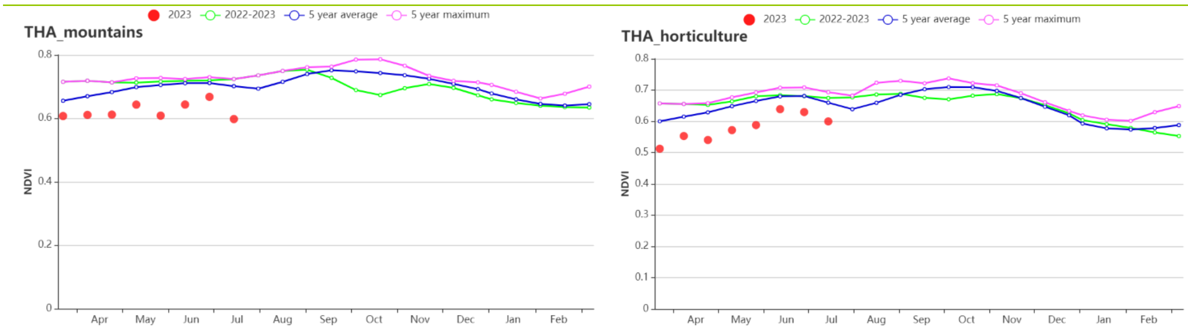
(f) Rainfall profiles



(g) Temperature profiles



(h) Crop condition development graph based on NDVI in 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 3.76 Thailand's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, April - July 2023

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	875	10	28.8	1.0	1277	8	1358	3
South-eastern horticulture area	1032	-6	27.8	0.7	1287	3	1439	-6
Western and southern hill areas	772	-15	26.6	0.9	1281	5	1320	-4
Single-cropped rice north-eastern region	1094	1	28.6	1.2	1241	6	1454	1

Table 3.77 Thailand's agronomic indicators by sub-national regions, current season's values and departure from 5YA, April - July 2023

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Central double and triple-cropped rice lowlands	98	-1	0.81
South-eastern horticulture area	98	-1	0.87
Western and southern hill areas	99	-1	0.87
Single-cropped rice north-eastern region	99	0	0.85

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[TUR] Türkiye

This monitoring period covers the sowing and growing season for rice and maize and the growing and harvesting season for wheat. The proportion of irrigated agricultural land in Turkey is 19.8%, and rainfall is an important factor limiting crop production. At the national level, Turkey's RAIN (+38%) is on the high side compared to the 15YA, while TEMP (-0.2°C) and RADPAR (-4%) are both slightly below average. Crop growth was good across the country due to abundant rainfall.

The NDVI-based crop growth trend line shows that crop growth was basically equal to the average throughout the observation period and better than in 2022. The NDVI distance level clustering map shows that crop growth was better in the Sea of Marmara, the Aegean Sea, most of the Mediterranean region, and the eastern region of the Central Anatolian region, where VCIx was greater than 1.0. The VCI for the whole country is 1.24. Overall, the country's crops are in favorable condition.

Regional analysis

Türkiye includes four agro-ecological regions: **the Black Sea region (191), the Central Anatolia region (192), the Eastern Anatolia region (193) and the Marmara, Aegean, and Mediterranean regions (194).**

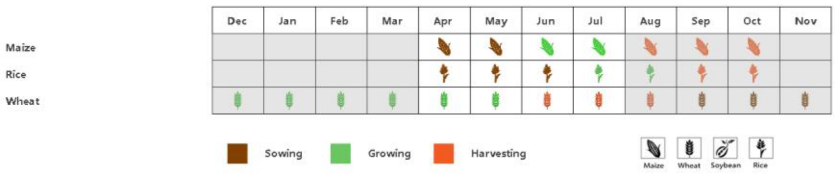
Crop growth was better than average in **the Black Sea region.** Abundant rainfall (+38%) provided favorable growing conditions for crop growth. TEMP (-0.7°C) and RADPAR (-3%) did not vary much. The final result was that BIOMSS was 10% higher than average. CALF (+2%) did not vary much. The mean value of VCIx was as high as 0.96, which is the highest among all four agro-ecological zones of Turkey. CPI was 1.2. Crop growth was favorable, and average to above average crop yields can be expected.

Crop growth in **the Central Anatolian region** was also relatively good. The region had abundant rainfall (+56%), little change in TEMP (-0.4°C) and RADPAR (-4%), resulting in above average BIOMSS (+19%), which was the most pronounced positive departure among the four regions. It is worth noting that CALF (+21%) increased significantly, with a VCIx of 0.93 and a CPI of 1.38, the highest of the four regions. Overall crop growth was favorable.

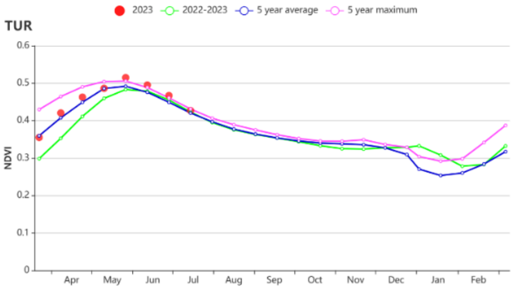
Eastern Anatolia was the only region where rain RAIN (-12%) was below average. This resulted in low potential BIOMSS (-4%). The VCIx (0.87) was the lowest in the region. This indicates that crop growth in the region was average.

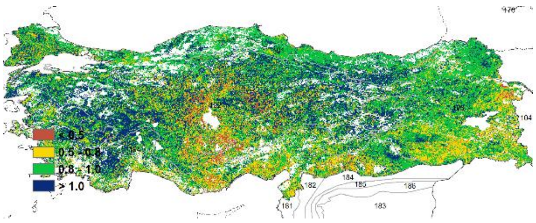
The highest increase in rain (RAIN +67%) was observed for **the Marmara, Aegean and Mediterranean regions.** However, RADPAR was reduced (-6%). Their combined effect, together with temperature, led to an increase in potential cumulative biomass by 16%. VCIx in the region was 0.91 and CPI was 1.15. Conditions were favorable.

Figure 3.44 Türkiye's crop condition, April 2023 - April July 2023



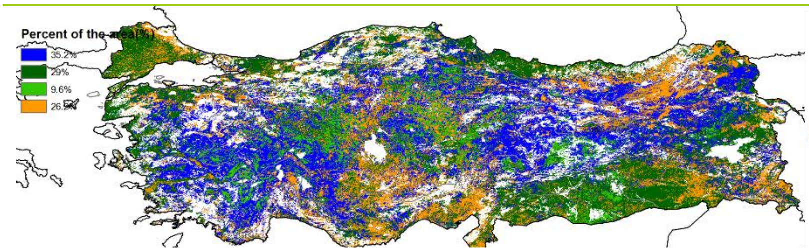
(a). Phenology of major crops

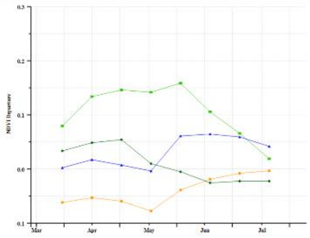




(b) Crop condition development graph based on NDVI

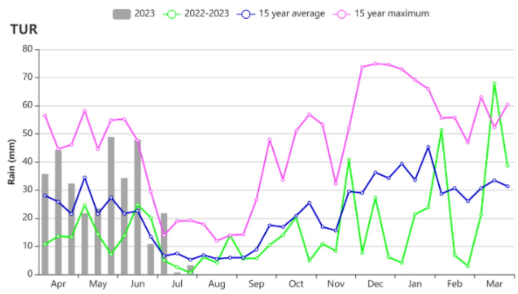
(c) Maximum VCI

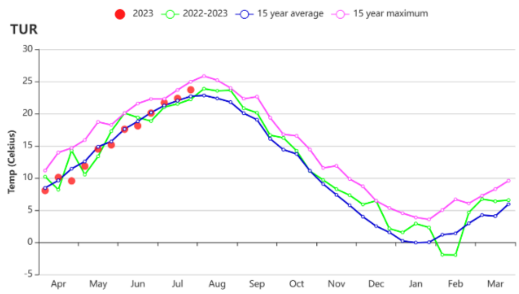




(d) Spatial NDVI patterns compared to 5YA

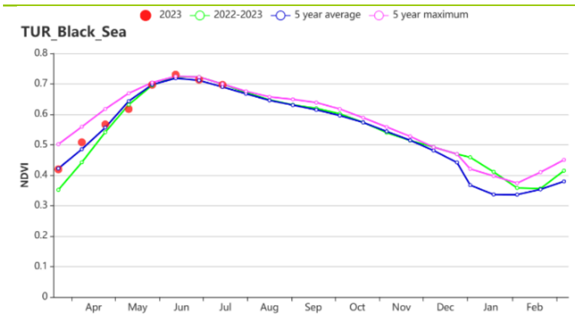
(e) NDVI profiles

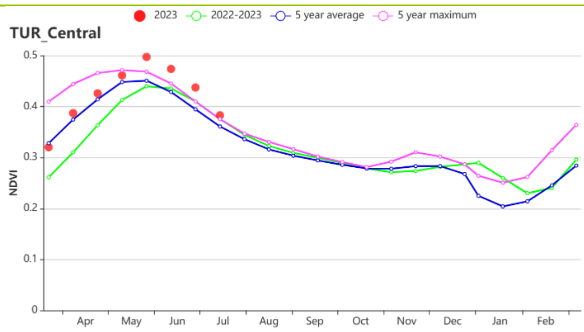




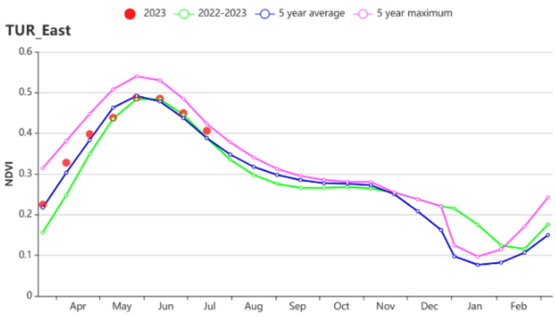
(f) Time series rainfall profile

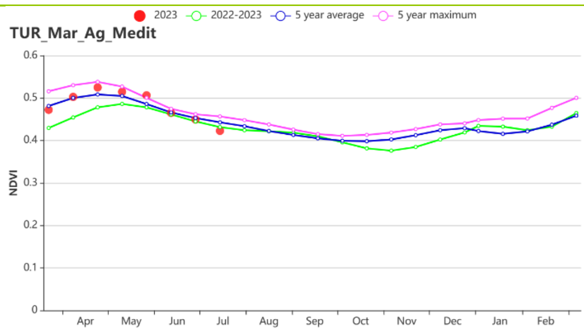
(g) Time series temperature profile





(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))

Table 3.78 Türkiye's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, April 2023 - July 2023

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current(mm)	Departure from 15YA(%)	Current(°C)	Departure from 15YA(°C)	Current(MJ/m2)	Departure from 15YA(%)	Current (gDM/m2)	Departure from 15YA(%)
Black Sea region	541	38	12.2	-0.7	1281	-3	887	10
Central Anatolia region	337	56	15.0	-0.4	1421	-4	822	19
Eastern Anatolia region	264	-12	14.8	0.5	1510	-1	705	-4
Marmara Agean Mediterranean lowland region	299	67	18.7	-0.2	1450	-6	823	16

Table 3.79 Türkiye's agronomic indicators by sub-national regions, current season's values and departure from 5YA, April 2023 - July 2023

Region	CALF		Maximum VCI
	Current(%)	Departure from 5YA(%)	Current
Black Sea region	99	2	0.96
Central Anatolia region	75	21	0.93
Eastern Anatolia region	83	6	0.87
Marmara Agean Mediterranean lowland region	84	7	0.91

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[UKR] Ukraine

In Ukraine, maize and sunflower sowing took place in May and winter wheat harvest started in July during this monitoring period (April to July).

At the national level, CropWatch observed that all agroclimatic indicators were lower than the 15YA. There was a 7% reduction in both rainfall (288 mm) and radiation (1150 MJ/m^2), and the temperature (15.4 ℃) was 0.6 ℃ lower as compared to the 15YA. Based on these climatic conditions, potential biomass was predicted 6% below 15YA. In agronomic aspects, nearly all cropland was cultivated (CALF 100%) despite the ongoing Russia-Ukraine conflict, and the maximum vegetation condition index (VCIx) reached a favorable value of 0.91.

The national NDVI based crop development profile was generally close to the 5YA. A slight decrease of NDVI was detected in May and June, which might be attributed to the lack of rainfall, only 1/6 and 1/3 of 15YA rainfall were received in mid-May and early June, respectively. As shown by the spatial NDVI patterns, NDVI in 83% of the cropland was above or closed to 5YA at the end of this period, while the remaining 17% area was mainly distributed in southern Ukraine such as Kherson and Odessa oblast. In line with the NDVI patterns, VCIx maps confirmed the poorer crop conditions (0.5-0.8 of VCIx) in the Kherson region, which is the front line of the confilict between Russia and the Ukraine.

To sum up, the general conditions for winter wheat were slightly below, but close to normal, while the production of maize might be reduced due to the confilict and the destruction of the Kakhova dam.

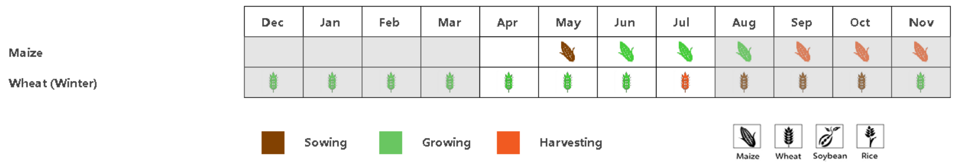
Regional analysis

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** (195) with the Poltava, Cherkasy, Dnipropetrovsk and Kirovohrad Oblasts; **Eastern Carpathian hills** (196) with Lviv, Zakarpattia and Ivano-Frankivsk Oblasts; **Northern wheat area** (197) with Rivne and **Southern wheat and maize area** (198) with Mykolaiv, Kherson and Zaporizhia Oblasts.

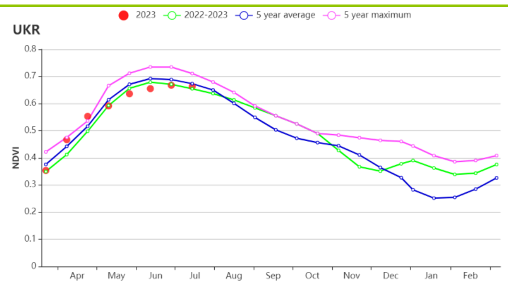
During this monitoring period, three of four AEZs including **Central wheat area, Eastern Carpathian hills and Northern wheat area** shared generally similar patterns in agroclimatic and agronomic conditions, as well as NDVI based crop development curves. All agroclimatic indexes were lower than the 15YA. A rainfall deficit by 13% to 21% was recorded for the **Central wheat area** and **Eastern Carpathian hills**. Temperatures were also cooler by 0.6 ℃ for all AEZs; radiation decreased by 4% (**Eastern Carpathian hills**) to 9% (**Central wheat area**). As a result of poorer agroclimatic conditions in these three AEZs, potential biomass was predicted to be 10% (**Northern wheat area**) to 12% (**Central wheat area**) lower than the 15YA. NDVI based crop development curves were generally below 5YA during May and June in these AEZs, mainly due to the below average rainfall in the two months. CALF reached 100% and VCIx had favorable values from 0.9 to 0.92, which indicates good prospects for winter wheat in these AEZs. Cropped area (CALF) in this season was up to 14% above average, and VCIx values were around 0.81 to 0.9. The crop production index ranged from 1.01 to 1.23, suggesting a normal agricultural production, whereas the NDVI development graph trended near last year's and the 5-year average. All in all, crop conditions indicated close to normal prospects for winter wheat.

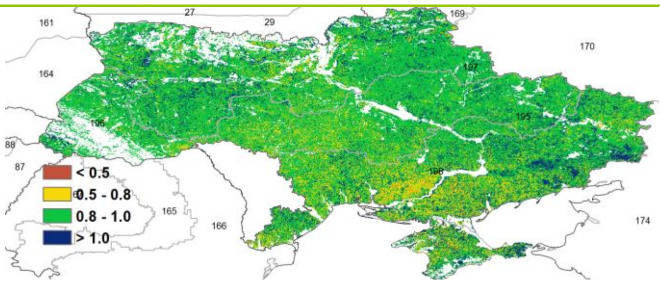
Unlike above AEZs, **southern wheat and maize area** received sufficient rainfall (293mm, +12%), which led to normal potential biomass under cooler temperature (16.6℃, -0.7℃) and lower radiation (1186 MJ/m2, -8%) conditions. The NDVI in the southern wheat and maize area was fluctuating near the 5YA, but the VCIx was the lowest of the four AEZs. Additional attention should pay to this AEZ, which covers the frontline of the confilict.

Figure 3.45 Ukraine's crop condition, April – July 2023

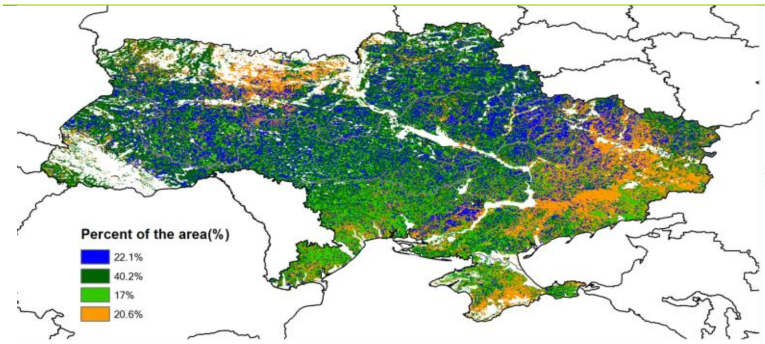


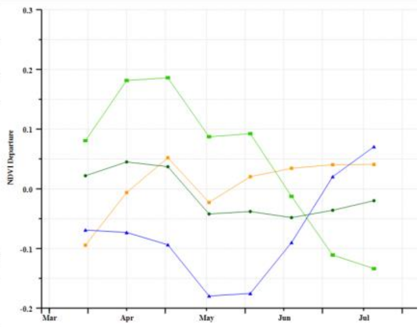
(a). Phenology of major crops



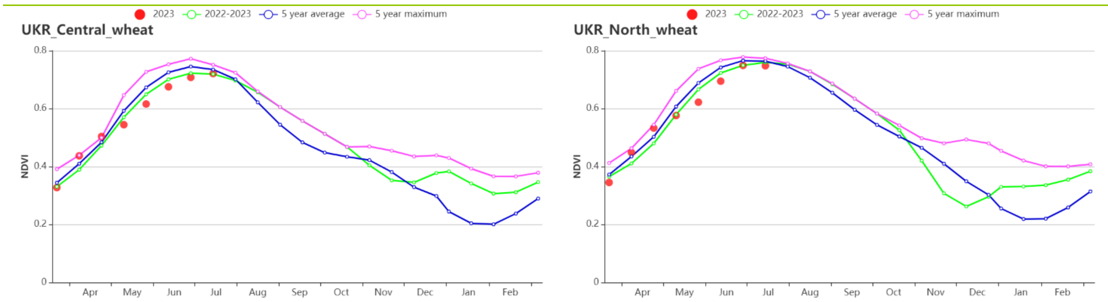


(b) Crop condition development graph based on NDVI (c) Maximum VCI

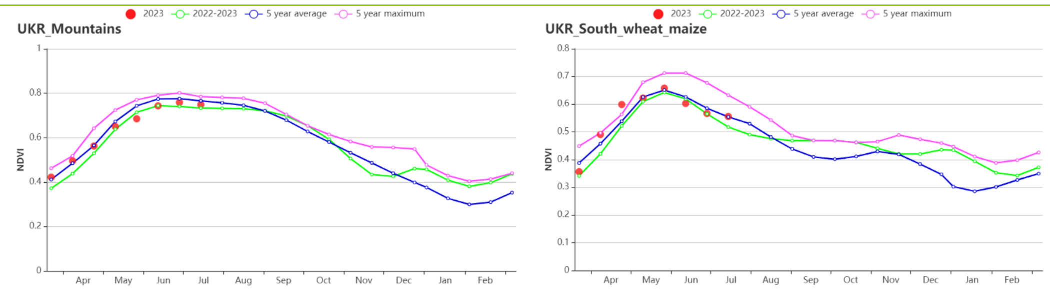




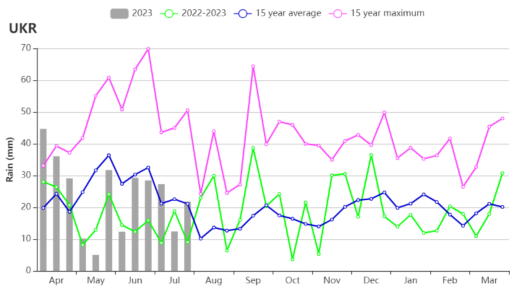
(d) Spatial NDVI patterns compared to 5YA (e) NDVI profiles

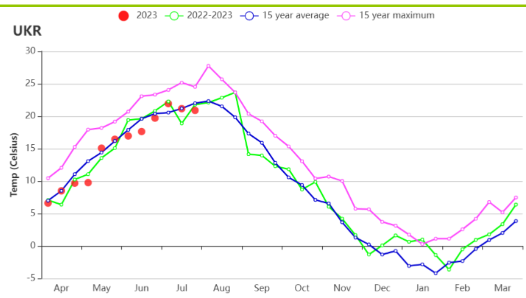


(e) Crop condition development graph based on NDVI (Central wheat area(left) Northern wheat area(right))



(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 3.80 Ukraine's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, April – July 2023

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Central wheat area	263	-13	15.4	-0.6	1134	-9	744	-12
Eastern Carpathian hills	333	-21	13.7	-0.6	1171	-4	824	-11
Northern wheat area	282	-14	14.6	-0.6	1107	-7	774	-10
Southern wheat and maize area	293	12	16.6	-0.7	1186	-8	808	1

Table 3.81 Ukraine's agronomic indicators by sub-national regions, current season's values and departure from 5YA, April – July 2023

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Central wheat area	100	0	0.90
Eastern Carpathian hills	100	0	0.92
Northern wheat area	100	0	0.92
Southern wheat and maize area	100	1	0.89

[USA] United States

The reporting period began in April and ended in July. This is the most critical growing period for most crops, with winter wheat starting to mature in May in the South. Planting of maize, soybeans and spring wheat was completed in May. By the end of July, maize was tasselling and soybeans were flowering and podding. Spring wheat will be harvested in August. Overall, the crop conditions gradually recovered to average levels by the end of July.

Nationally, rainfall during the observation period was 12% below the 15-year average (15YA), the temperature was near normal (TEMP +0.0°C), and radiation was 2% below average. The rainfall time series showed that the weather was dry during the observation period, in particular in late May and early June, which was unfavorable for crop establishment. The temperature time series was close to normal, although the temperatures were considerably warmer in May and late July. Areas from Kansas to South Dakota and the Corn Belt suffered severe rainfall deficits, such as Kansas (-28%), Nebraska (-34%), South Dakota (-24%), Illinois (-40%), Indiana (-39%), Iowa (-23%), Minnesota (-21%), Ohio (-25%) and North Dakota (-25%). These regions are major producers of corn, soybeans, and spring wheat. More rainfall will be required in the upcoming weeks to ensure high production levels. The potential biomass revealed the negative effect of rainfall deficit on biomass. On a national level, potential biomass was 8% below the 15-year average. The departure in potential biomass was 20% less than average in the corn belt and northern plain.

The VCIx indicated that the lack of rainfall has had a slightly adverse impact on the crop conditions. They remained near average or above-average levels in almost all regions, except for the Southern Plains, where they were poor. NDVI departure cluster indicated that crops in the northern Southern Plains, the Northwest region, and the Corn Belt had poor conditions before July and then recovered to average levels at the end of July. Below average temperature was responsible for poor crop condition in the Northwest region that delayed the planting of crops. CALF was 92% which is 2% above the 5-year average. The maximum VCI (VCIx) was 0.89 and the Crop Production Index was 1.10, indicating normal crop growth during this reporting period.

In short, CropWatch assessed that nationwide agricultural production was close to average during the monitoring period. CropWatch will closely monitor the impact of significant rainfall shortage on crop suitation during the next monitoring period because the summer crops will soon enter the critical stage of yield formation.

Regional Analysis

Summer crops are mainly planted in the Corn Belt (202), Northern Plains (204), Lower Mississippi (203), Southern Plains (207), Southeast (208) and Northwest (206). Due to differences in agro-climate, agronomic condition and irrigation infrastructure, the growth conditions are highly heterogeneous spatially.

(1) Corn Belt

The Corn Belt is the major corn and soybean producing region in the United States. It covers Illinois, Iowa, Minnesota, Wisconsin, Ohio, and Michigan. During this period, agro-climatic conditions in the Corn Belt were dominated by a rainfall deficit, with rainfall 28% below 15YA while temperature and radiation were above average (TEMP +0.4°C, RADPAR +1%). The previous period showed that the Corn Belt had a wetter and cooler spring than normal, which lessened the impact of the rainfall deficit observed during this period on crop growth. The water shortage caused a reduction in biomass below the 15YA average (-13%). However, the NDVI development profile showed that crop conditions in the Corn Belt were approaching average levels by the end of July. From late May through early July, continued below-normal precipitation in the Corn Belt caused crop conditions to slightly negatively depart from the long-term trend. They improved to normal levels as July rainfall returned to average levels. The CALF reached 100% during the monitoring period, the VCIx reached 0.93 and the Crop Production Index was 1.11, confirming the improving crop conditions during the monitoring period. August is the critical month for the yield formation of maize and soybean. CropWatch will pay close attention to changes in the agricultural climate and conditions in the region.

(2) Northern Plains

The Northern Plains is the largest spring wheat producer in the United States and a major maize producer. It includes parts of North Dakota, South Dakota, and Nebraska. During the observation period, rainfall and radiation in the Northern Plains were 11% and 2% below the 15YA, while temperature was above average (TEMP +0.4°C), the shortage of rainfall and radiation caused a reduction in Biomass Production Potential to below average levels (-6%). Significantly above average rainfall was observed in the Northern Plains from mid-May to mid-June, providing the necessary soil moisture for crop growth, leading to above average crop conditions. The CALF reached to 94% which is above average (CALF +9%). The VCIx was 0.89, and the Crop Production Index was 1.12, indicating that crop conditions reached an average level. From mid-June, the region experienced continuous rainfall deficits. However, due to adequate soil moisture that had accumulated by then, crop conditions still reached 5YA levels in July, but more rainfall will be needed in August to ensure that soybean and maize yields to remain at relatively high levels.

(3) Lower Mississippi

This is the largest producer of rice in the United States and a major producer of soybeans. It includes Arkansas, Louisiana, Mississippi and part of Missouri. Rice reached the tillering stage in July. During the reporting period, the region experienced dry agro-climatic conditions, with rainfall and radiation 16% and 3% below average, respectively, and temperature 0.2 above average, resulting in a 7% reduction in potential biomass. Thanks to the region's well-developed irrigation infrastructure, crop conditions were little affected by the lack of rainfall. Overall crop growth conditions reached average levels with 100% of CALF, 1.13 of CPI and 0.92 of VCIx.

(4) Southern Plains

The Southern Plains are the major producers of winter wheat, sorghum and cotton, covering Kansas, Oklahoma, Texas and eastern Colorado. By late June, the winter wheat harvest was complete and sorghum and cotton were entering their peak growing season in July. CropWatch agro-climatic indicators show that precipitation and radiation were 5% and 4% below 15YA, respectively, while temperature was 0.1°C above average, resulting in a 6% reduction in biomass production potential. Significant rainfall deficits occurred mainly at the end of June. CALF reached 88% during the period, 5% higher than 5YA. The VCIx was 0.88 and the Crop Production Index was 1.08, indicating average crop conditions. In summary, CropWatch estimates that crop production in the region will reach average levels.

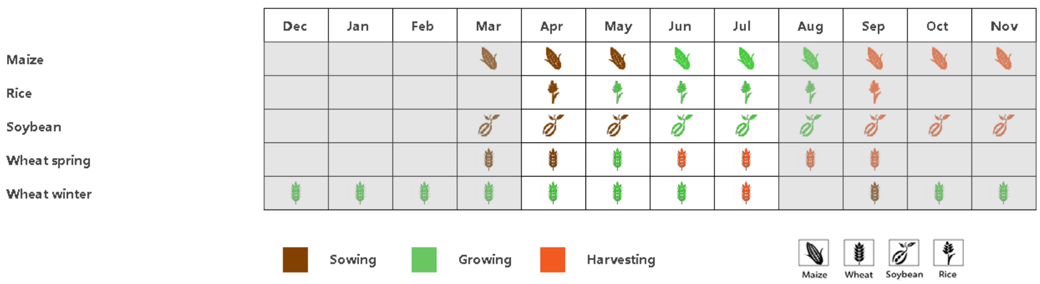
(5) Southeast region

The Southeast region is a major producer of cotton and corn and includes Georgia, Alabama and North Carolina. The NDVI development profile indicated that crop conditions were close to average. Compared to the last 15YA, rainfall (RAIN -3%), temperature (TEMP -0.1°C) and radiation (RADPAR -3%) were slightly below average. Rainfall deficits occurred mainly in May, but were compensated for in mid-June to early July, while air temperatures remained consistently below average from late May to July. Crop conditions declined to slightly below average levels from May onwards. Compared to the 5-year average, CALF and VCIx reached 100% and 0.90, respectively, and the Crop Production Index was 1.08, indicating acceptable crop conditions. In summary, CropWatch expects yields in the region to reach average levels.

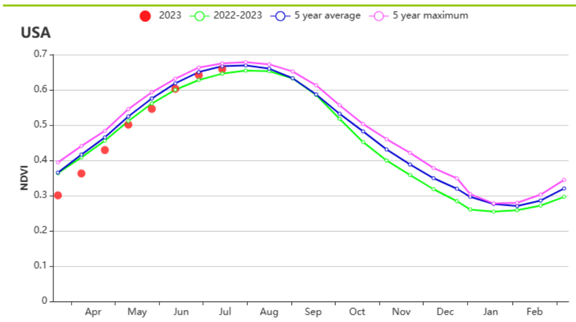
(6) Northwest

The North West region is the second largest producer of winter wheat, but is also an important producer of spring wheat. During the reporting period, winter wheat matured and was harvested before the end of July. The NDVI development profile indicated poor crop condition, which was attributed to delayed planting due to unfavorable weather in the previous reporting period. Agroclimatic conditions were mild and humid, with rainfall and temperature 12% and 0.3°C above average, respectively, while radiation was 3% below average. Compared to 5YA, CALF (82%) was 2% below average. The VCIx reached 0.81 and the Crop Production Index was only 0.94, indicating poor crop conditions during the period. In summary, CropWatch judged crop production in the region to be below average.

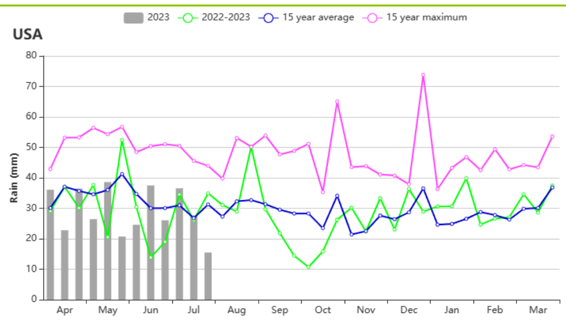
Figure 3.46 United States crop condition, April to July 2023



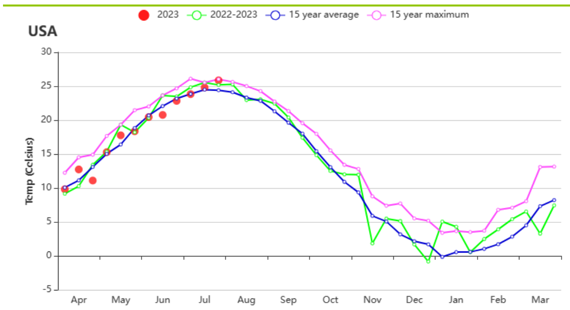
(a). Phenology of United States from April to July 2023



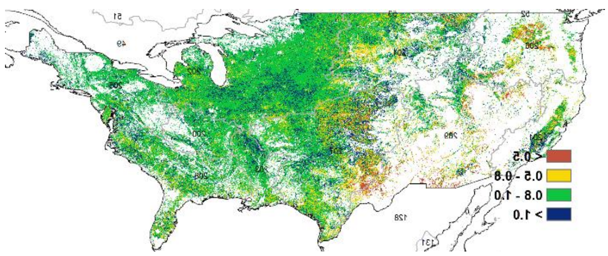
(b). Crop condition development graph based on NDVI



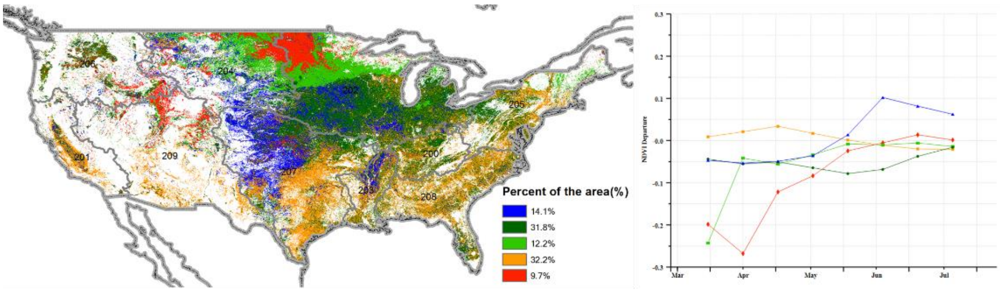
(c). Time series rainfall profile



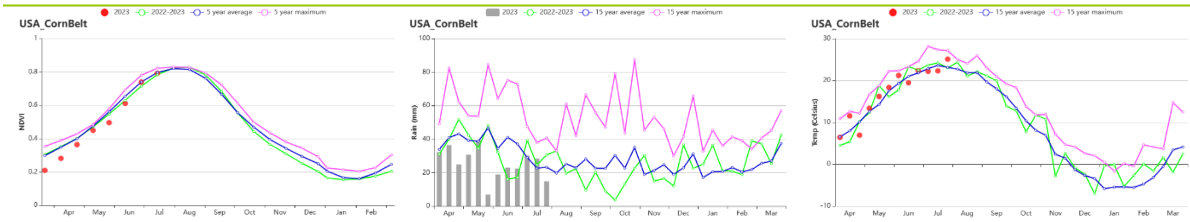
(d). Time series temperature profile



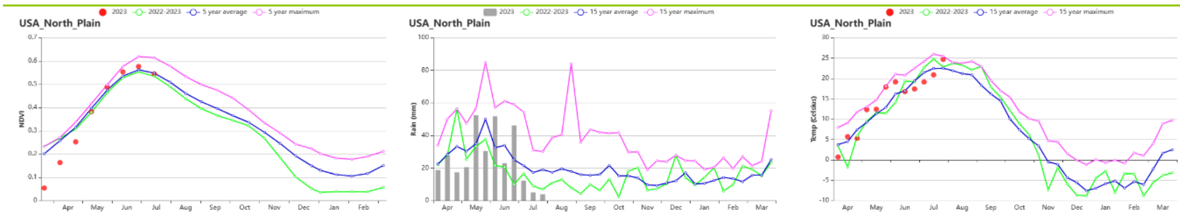
(e). Maximum VCI



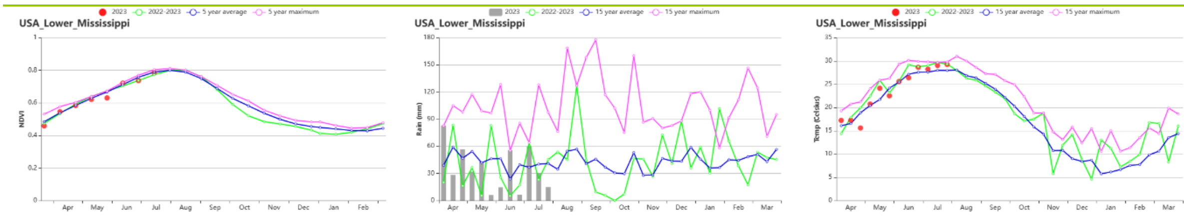
(f). Spatial distribution of NDVI profiles



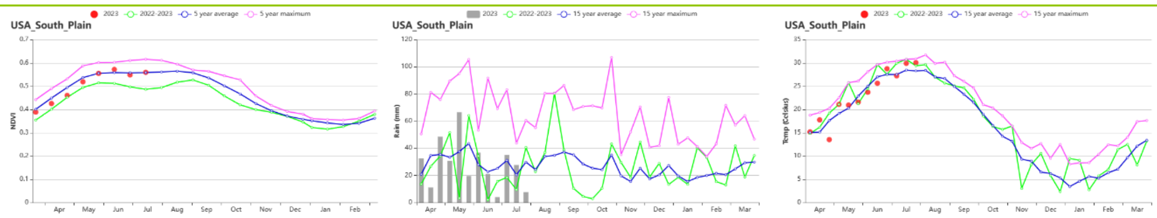
(g) Crop condition development graph based on NDVI, Time series precipitation profile and temperature profile(The Corn Belt)



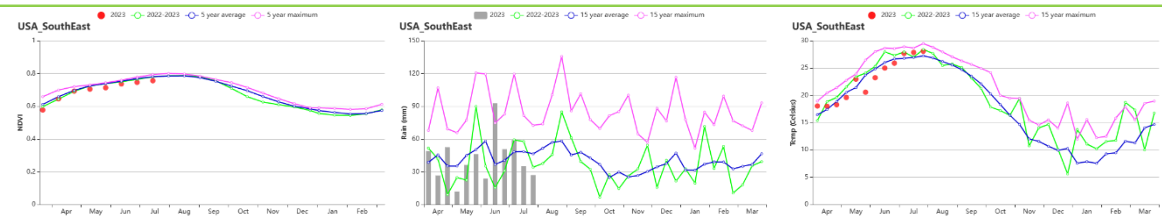
(h). Crop condition development graph based on NDVI, Time series precipitation profile and temperature profile (The Northern Plains).



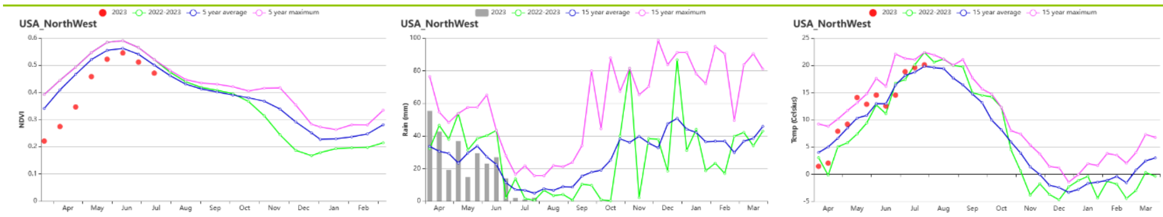
(i). Crop condition development graph based on NDVI, Time series precipitation profile and temperature profile(The Lower Mississippi)



(j). Crop condition development graph based on NDVI, Time series precipitation profile and temperature profile (The Southern Plains).



(k). Crop condition development graph based on NDVI, Time series precipitation profile and temperature profile(The Southeast region)



(l). Crop condition development graph based on NDVI, Time series precipitation profile and temperature profile(The Northwest region)

Table 3.82.United States' agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, April - July 2023

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m2)	Departure (%)	Current (gDM/m2)	Departu (%)
Blue Grass region	324	-30	19.3	-0.7	1344	-1	933	-16
California	96	-5	16.4	-0.7	1546	-5	527	-6
Corn Belt	308	-28	17.1	0.4	1294	1	869	-13
Lower Mississippi	432	-16	23.7	0.2	1342	-3	1102	-7
North-eastern areas	439	0	15.9	-0.2	1240	-1	970	-4
Northwest	267	3	12.3	0.3	1357	-3	682	2
Northern Plains	309	-11	14.4	0.4	1355	-2	792	-6
Southeast	511	-3	23.0	-0.1	1364	-3	1204	-1
Southwest	96	-52	18.0	0.1	1563	-2	547	-21
Southern Plains	341	-5	23.0	0.1	1373	-4	909	-6

Table 3.83 United States'agronomic indicators by sub-national regions, current season's values and departure, October April - July 2023

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Blue Grass region	100	0	0.93
California	84	14	0.88
Corn Belt	100	0	0.93
Lower Mississippi	100	0	0.92
North-eastern areas	100	0	0.95
Northwest	82	-2	0.81
Northern Plains	94	9	0.89
Southeast	100	0	0.90

Southwest	41	1	0.75
Southern Plains	88	5	0.88

[UZB] Uzbekistan

This monitoring period from April to July 2023 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. Among the CropWatch agroclimatic indicators, the radiation (RADPAR) and temperature (TEMP) were slightly above average (+1% and +0.6°C), while rainfall (RAIN) was below average (-52%) compared to the 15-year average (15YA). The precipitation was significantly below the 15YA, except for the beginning of April. The temperature was generally close to the 15YA, but was higher than average in early June and late July. The biomass accumulation (BIOMSS) decreased by 14% compared to the 15YA. At the national level, the NDVI development graph indicates that besides April (close to the 5YA), the crop conditions were significant below the five-year average in this monitoring period.

The maximum Vegetation Condition Index (VCIx) was 0.71, 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 cropped arable land fraction (CALF, 61%) decreased by 13% compared to its five-year average. The NDVI departure cluster profiles indicate that: (1) 36.5% of arable land (green) showed generally normal but slightly unfavorable conditions in this monitoring period, mainly in the west and south of the country. (2) 18.4% of arable land (blue), mainly in the central area of the Eastern hilly cereals, had much better crop conditions than average in April and May, but turns to unfavorable conditions in June and July. (3) 19.1% of arable land (orange) had unfavorable conditions during April to June, but returned to the average level in July. (4) 26% of arable land (red) had slightly better conditions in April, while unfavorable conditions than average in the rest of the monitoring period. The crop production index (CPI) was 0.79. Prospects for crop production are estimated to be unfavorable.

Regional analysis

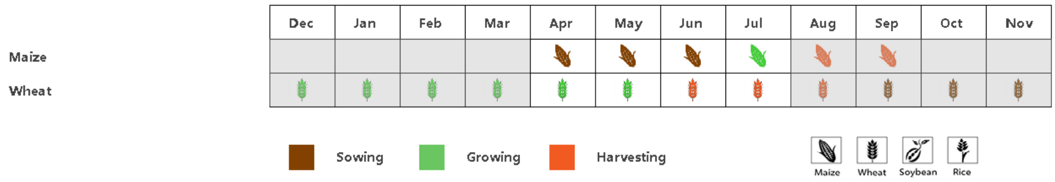
Based on cropping systems, climatic zones and topographic conditions, three sub-national agro-ecological regions (AEZ) can be distinguished for Uzbekistan: **Central region with sparse crops (210), Eastern hilly cereals zone (211), and Aral Sea cotton zone (212)**.

In the **Central region with sparse crops**, the NDVI development graph shows that the crop conditions were generally below average. RAIN and RADPAR were below average (-40% and -1%), while TEMP was slightly above average (+0.9°C). The VCIx was 0.72 and BIOMSS decreased by 6% compared to the 15YA. The CALF was 71%, which was slightly increased by 4% compared to the 5YA. The agro-climatic conditions of this region were unfavorable.

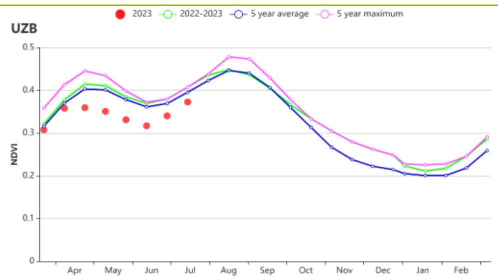
In the **Eastern hilly cereals zone**, RAIN was below average (-53%), while RADPAR and TEMP were slightly above average (+2% and +0.5°C). The CALF was 63% and decreased by 12% compared to the 5YA. The average VCIx index was 0.69. The NDVI-based crop condition development graph shows that the crop conditions were significantly below the five-year average in this monitoring period. The BIOMSS decreased by 16%. The prospects for crop production were unfavorable.

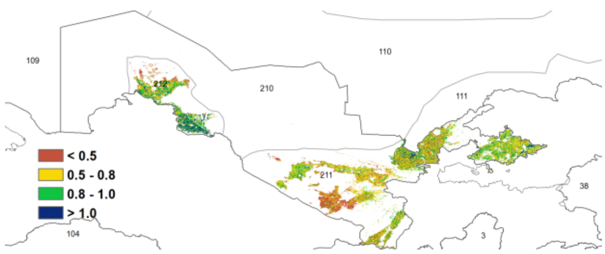
In the **Aral Sea cotton zone**, RAIN and RADPAR were below average (-23% and -4%), while TEMP was slightly above average (+1.0°C). These agroclimatic conditions resulted in a slight decrease in BIOMSS (-5%) in this AEZ. The CALF(50%) decreased by 15% compared to the 5YA and the maximum VCI index was 0.79. The agro-climatic conditions of this region were slightly unfavorable.

Figure 3.47 Uzbekistan's crop condition, April - July 2023

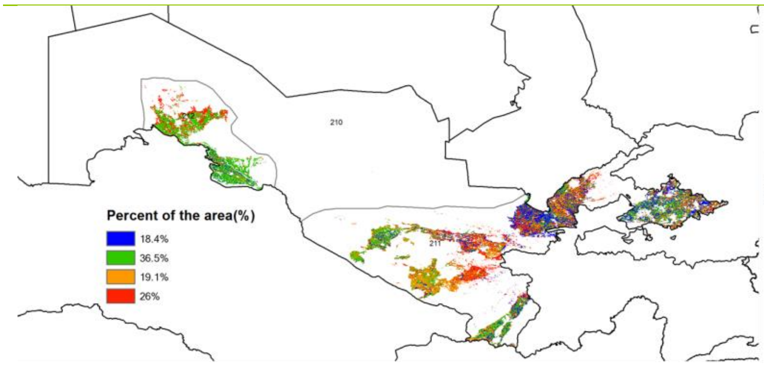


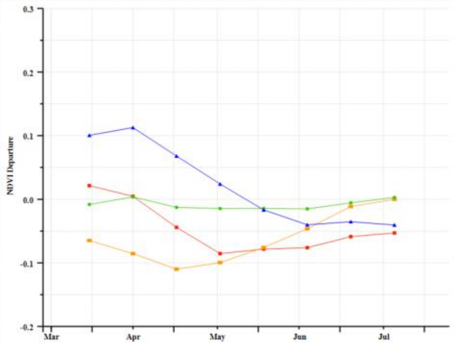
(a) Phenology of major crops



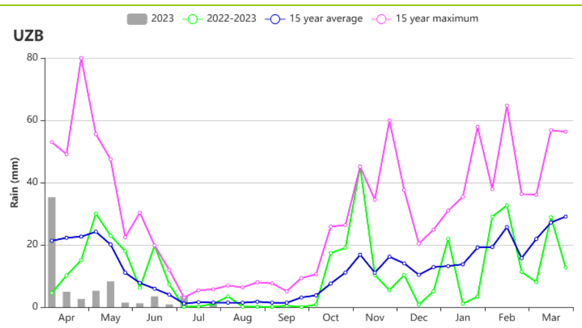


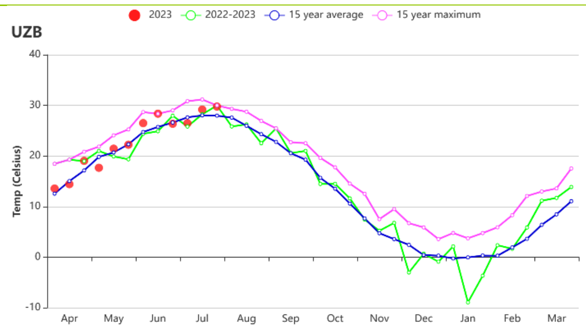
(b) Crop condition development graph based on NDVI (c) Maximum VCI



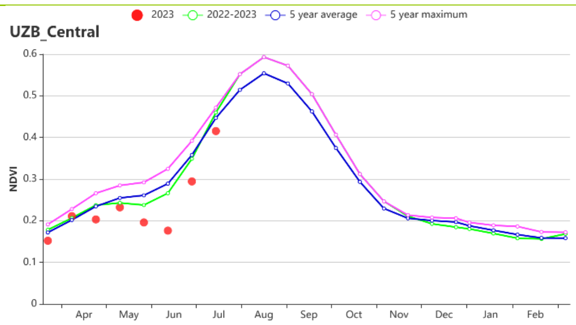


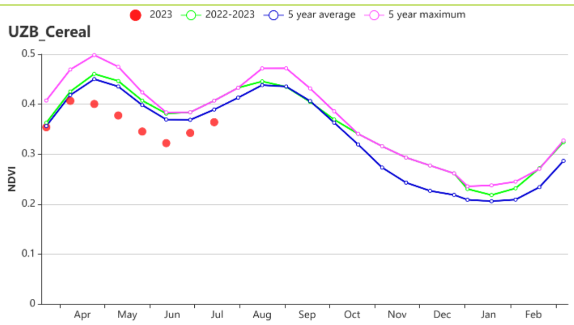
(d) Spatial NDVI patterns compared to 5YA (e) NDVI profiles



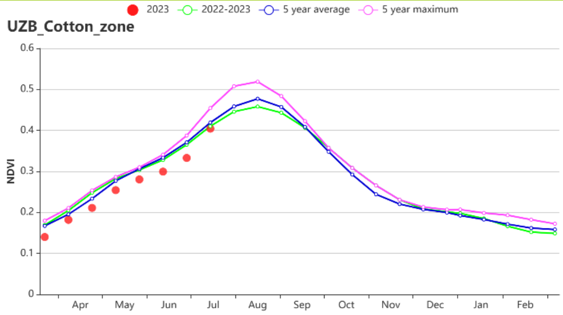


(f) Rainfall profiles (g) Temperature profiles





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



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

Table 3.84 Uzbekistan's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, April - July 2023

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	27	-40	26.0	0.9	1544	-1	573	-6
Eastern hilly cereals zone	74	-53	22.5	0.5	1594	2	592	-16
Aral Sea cotton zone	21	-23	26.2	1.0	1485	-4	554	-5

Table 3.85 Uzbekistan's agronomic indicators by sub-national regions, current season's values and departure from 5YA, April - July 2023

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Central region with sparse crops	71	4	0.72
Eastern hilly cereals zone	63	-12	0.69
Aral Sea cotton zone	50	-15	0.79

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

[VNM] Vietnam

This report covers the entire period from the sowing to the 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 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 in controlling crop production. CropWatch agro-climatic indicators showed TEMP (25.7°C, +0.8°C) was above the average. Although there was a higher RADPAR (1267 MJ/m2, 5%), BIOMSS(1433 gDM/m2) was the same as the 15YA due to the below-average RAIN (1039 mm, -9%). The VCIx was 0.92, and the CALF (97%, 0%) was at 5YA. The CPI in this monitoring period was 1.11, which represents a normal crop production situation.

Based on the NDVI development graph, the crop conditions were below the 5YA throughout the whole monitoring period. The precipitation was below average during the monitoring period except in June. The temperature was also below the 15YA in the whole monitoring period. The spatial distribution of the NDVI profiles shows that the crop conditions in most of the country were below average during the whole monitoring period. But 5.5% of the national crop land exceeded the average in May and June. The drops in NDVI are most likely artifacts caused by cloud cover in the satellite images. Therefore, crop conditions can be assessed as normal.

Regional analysis

Based on cropping systems, climatic zones, and topographic conditions, Vietnam can be divided into several agro-ecological zones (AEZ): **Central Highlands (213), Mekong River Delta (214), North Central Coast (215), North East (216), North West (217), Red River Delta (218), South Central Coast (219) and South East (220)**.

In the Central Highlands, RAIN was above the 15YA (1294 mm, +5%), and TEMP was above the 15YA (24.0°C, +0.4°C). Due to a 5% RADPAR increase, BIOMSS also increased slightly (1465 gDM/m², +4%). CALF was 99%, and VCIx was 0.94. The crop condition development graph based on the NDVI indicated that the crop conditions were near the average in most of the monitoring period. Because of the influence of the clouds in the satellite images, the NDVI suddenly dropped below the 5YA in July. The CPI was 1.14. Crop conditions were expected to be above average.

In the Mekong River Delta, the TEMP (28.2°C, 0.3°C) was above the average. The RAIN (1028 mm, -2%) and RADPAR (1258 MJ/m², -2%) were below 15YA. The BIOMASS (1627 gDM/m², 1%) was above average. VCIx was 0.90 and CALF was 86%. According to the NDVI −based development graph, crop conditions were below the 5YA in most of the monitoring period, and there was a sharp drop in July, which may have been caused by the cloud cover in the satellite images. The CPI was 1.12. The crop conditions were expected to be slightly below average.

In the North Central Coast, the TEMP (25.8°C, +1.0°C) was above the average. Although the RADPAR (1294 MJ/m2, +7%) was above the average, the BIOMSS (1346 gDM/m2) was at an average level; this condition can be attributed to the decrease of RAIN (846 mm, -12%). The VCIx was 0.91, and CALF was 99%. According to the crop condition development graph, the NDVI was below the average throughout the whole monitoring period. The CPI was 1.06. The crop conditions in this region are expected to be below the average due to the impacts of rainfall deficit.

In the North East, the TEMP (25.1°C, +1.2°C) was above the average. Although the RADPAR increased by 5%, the BIOMSS still dropped by 1%, which may have been caused by the decrease in RAIN (1235 mm, -14%). CALF was 100% and VCIx was 0.94. According to the crop condition development graph, the NDVI was close to the 5YA in May but dropped in April and June, which may have been caused by the cloud cover in the satellite images. The CPI was 1.12. The crop conditions were close to the average.

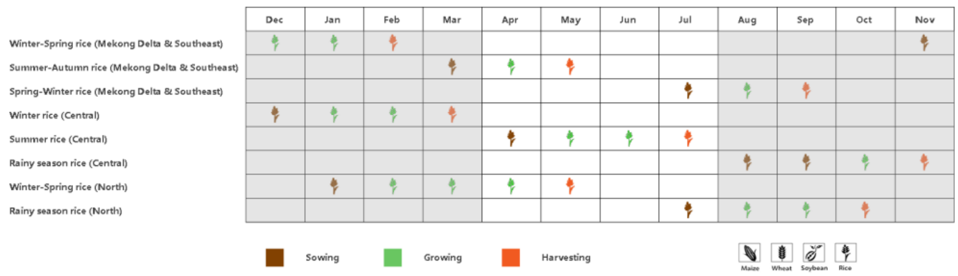
In the North West, the TEMP (24.4°C, +1.4°C) was above the average. Although the RAIN (987 mm, -14%) decreased by 14%, the BIOMSS was above average, which may have been caused by the increase of RADPAR (1311 MJ/m2, +9%). CALF was 100% and VCIx was 0.93. According to the agroclimatic indicators, crop conditions were generally near the 5YA during the whole monitoring period. The CPI was 1.12. The crop conditions were close to the average.

In the Red River Delta, TEMP (27.3°C, +0.5°C) was above the average. Although the RADPAR increased by 2%, the BIOMSS still dropped by 4%, which may have been caused by the decrease in RAIN (925 mm, -16%). CALF was 97% and VCIx was 0.90. According to the agroclimatic indicators, crop conditions were generally near the 5YA during most of the monitoring period, and there was a sharp drop in April, which may have been caused by the cloud cover in the satellite images. The CPI was 1.12. The crop conditions were close to the average.

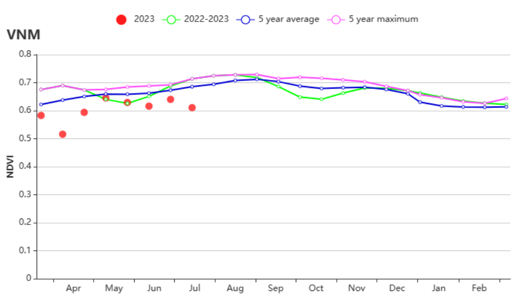
In the South Central Coast, TEMP (25.3°C, +1.0°C) and RADPAR (1353 MJ/m^2, +10%) were above the average. Although RAIN (801 mm) decreased by 16%, BIOMSS (1281 gDM/m2) was still above the average (+1%). CALF was 97%, and VCIx was 0.93. According to the crop condition development graph, crop conditions were generally near or slightly above the 5YA during the whole monitoring period. The CPI was 1.15. Crop conditions were expected to be favorable.

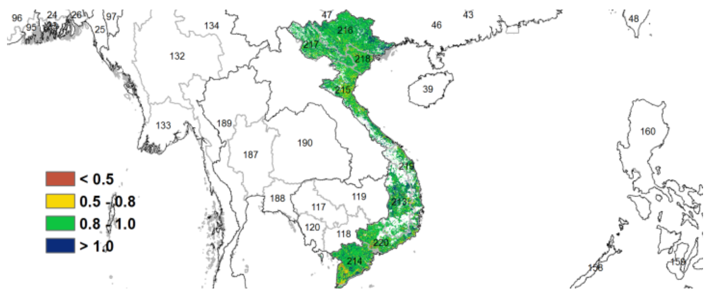
In the South East, the RAIN (1164 mm, -2%) was lower than the 15YA. But with the RADPAR (1254 MJ/m², 1%) close to the average and the TEMP (26.8°C, 0.5°C) increased by 0.5°C, the resulting BIOMASS (1463 gDM/m², -1%) showed a slight decrease by 1%. CALF was 95%, and VCIx was 0.90. According to the agroclimatic indicators, crop conditions were generally near the 5YA during most of the monitoring period, and there was a sharp drop in July, which may have been caused by the cloud cover in the satellite images. The CPI was 1.12. Crop production in this region was close to the 5YA.

Figure 3.48 Vietnam's crop condition, April - July 2023



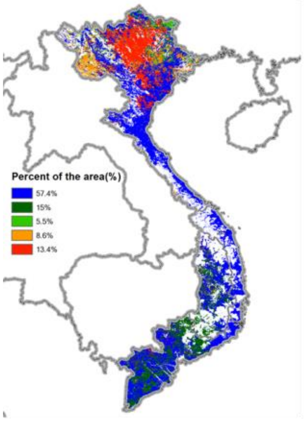
(a) Phenology of major crops

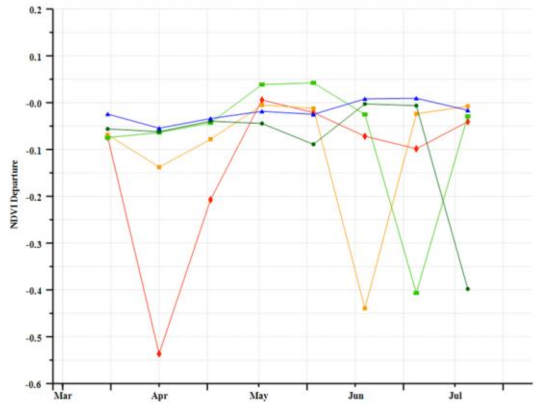




(b) Crop condition development graph based on NDVI

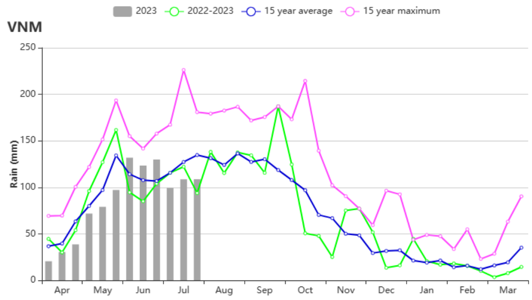
(c) Maximum VCI

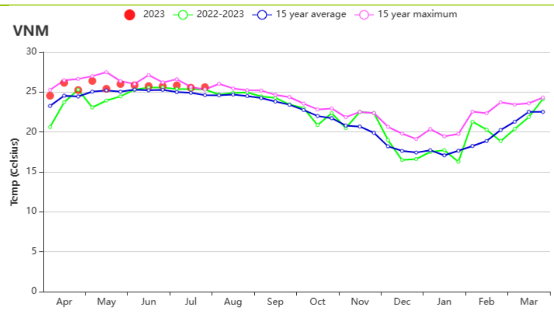




(d) Spatial NDVI patterns compared to 5YA

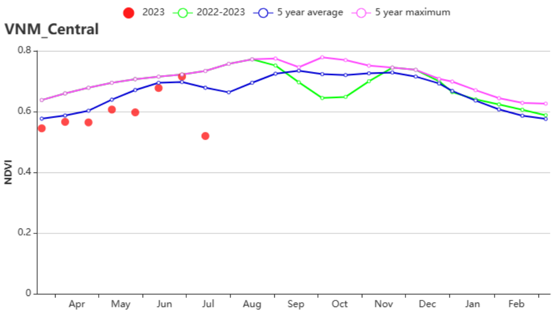
(e) NDVI profiles

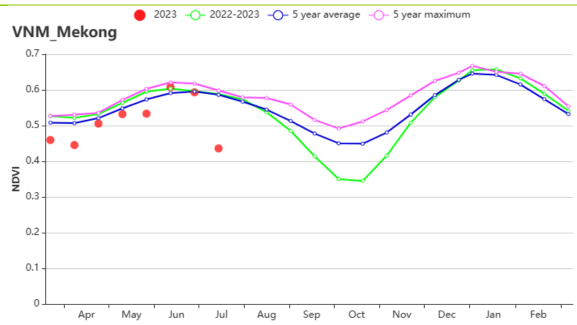




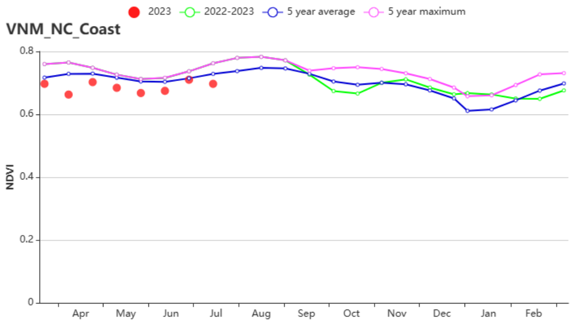
(f) Rainfall profiles

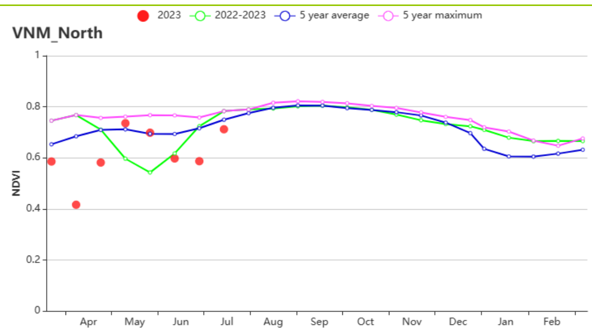
(g) Temperature profiles



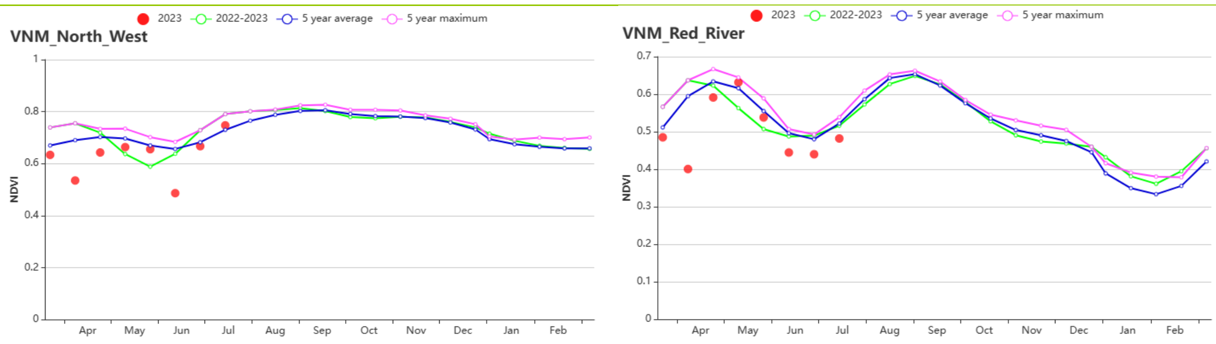


(h) Crop condition development graph based on NDVI Central Highlands Vietnam (left), and Mekong River Delta (right).

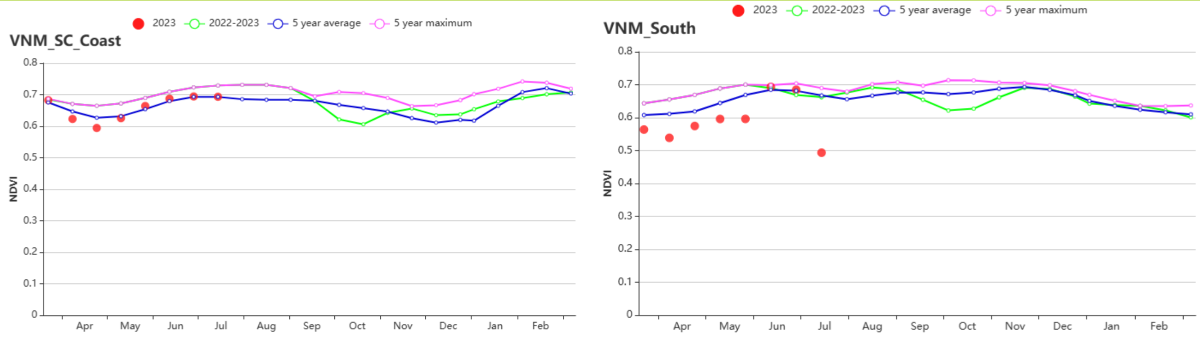




(i) Crop condition development graph based on NDVI North Central Coast Vietnam (left), and North East Vietnam (right).



(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 3.86 Vietnam's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, April - July 2023

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Central Highlands	1294	5	24.0	0.4	1223	5	1465	4
Mekong River Delta	1028	-2	28.2	0.3	1258	-2	1627	1
North Central Coast	846	-12	25.8	1.0	1294	7	1346	0
North East	1235	-14	25.1	1.2	1217	5	1464	-1
North West	987	-14	24.4	1.4	1311	9	1429	1
Red River Delta	925	-16	27.3	0.5	1230	2	1429	-4
South Central Coast	801	-16	25.3	1.0	1353	10	1281	1
South East	1164	-2	26.8	0.5	1254	1	1463	-1

Table 3.87 Vietnam's agronomic indicators by sub-national regions, current season's values and departure from 5YA, April - July 2023

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Central Highlands	99	0	0.94
Mekong River Delta	86	2	0.90
North Central Coast	99	1	0.91
North East	100	0	0.94
North West	100	0	0.93
Red River Delta	97	0	0.90

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
South Central Coast	97	1	0.93
South East	95	0	0.90

AFG AGO ARG AUS BGD BLR BRA CAN DEU DZA 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

[ZAF] South Africa

From April to July, soybean and maize are the main crops being produced. 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. According to the agroclimatic indicators, South Africa experienced drier and hotter than usual weather in this monitoring period with below-average rainfall (RAIN -8%), above-average temperature (TEMP +0.4°C), as well as average sunshine (RADPAR 0%). All these indicators led to below-average biomass (BIOMSS -3%).

Based on the NDVI development graph, the crop conditions were below average before early June, after which they improved. This was mainly due to a spell of hot and dry weather in early May, followed by an increase in rainfall that progressively boosted crop conditions to reach near or above average. According to the NDVI departure clustering map, about 32.3% of the cropland was below average before mid-May and gradually improved to above average, mainly in the central and northern parts. Around 45.1% of the cropped area, mainly located in the central and southwestern parts, was consistently below average during the whole monitoring period. For the remaining 22.5% of the area, crop conditions were above-average in the entire monitoring period. Among these, 4.9% of the area experienced a decline in early July, primarily due to reduced rainfall. 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.

At the national level, most arable land was cropped during the season (CALF +88%), and VCIx was around 0.85. The Crop Production Index (CPI) in South Africa is 0.97. CropWatch estimates that the crop conditions were average, but favorable for wheat in the Mediterranean zone.

Regional analysis

The regional analysis below focuses on the major agro-ecological zones of South Africa, which are mostly based on cropping systems, climatic zones, and topography. Agro-ecological zones include the Arid and desert zones (221), the Humid Cape Fold mountains (222), the Mediterranean zone (223), and the Dry Highveld and Bushveld maize areas (224).

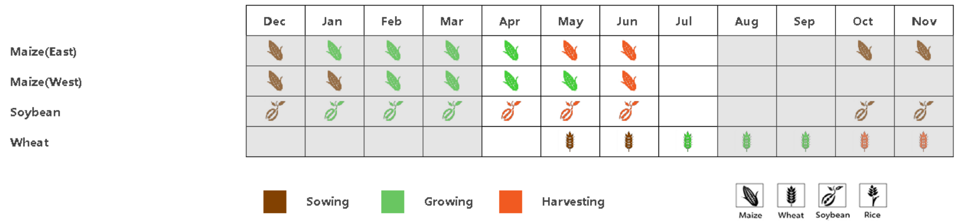
For the Arid and desert zones, the agroclimatic indicators show that rainfall was significantly above average (RAIN +20%), the temperature (TEMP -0.5°C) and radiation (RADPAR -2%) were slightly below-average , which resulted in above-average biomass (BIOMSS +5%). According to the NDVI development graph, the crop conditions were generally below-average before early-June. However, crop conditions subsequently reached the 5-year average and even above the 5-year maximum in the remaining duration of the monitoring period. The VCIx was 0.82. Crop production is expected to be above-average.

In the Humid Cape Fold mountains, the temperature (TEMP +0.2°C) was slightly above-average, while rainfall (RAIN -3%) and radiation (RADPAR -1%) were below-average. These conditions led to a below-average estimate for BIOMSS (BIOMSS -2%). According to the NDVI development graph, crop conditions were below average until mid-June, followed by an increase and almost reached the 5-year maximum. The VCIx was 0.89. Overall, crop conditions were generally normal.

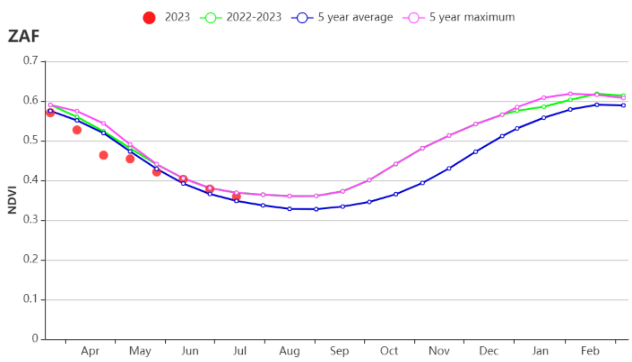
In the Mediterranean zone, the temperature (TEMP -1.7°C) and radiation (RADPAR -7%) were below average, accompanied by higher rainfall (RAIN +38%). Notably, during this monitoring period, the area was in the rainy season. The estimated potential biomass (BIOMSS +11%) was significantly increased by 11% due to sufficient rainfall. According to the NDVI development graph, crop conditions were notably above average, even surpassing the 5-year maximum except towards the end of July. The VCIx was 0.94. Crop conditions were favorable during the whole monitoring period in this important wheat production region.

In the Dry Highveld and Bushveld maize areas, the agroclimatic indicators show that the rainfall (RAIN -29%) was significantly below-average, accompanied by above-average temperature (TEMP +0.7°C) and radiation (RADPAR +1%). Potential biomass (BIOMSS -10%) decreased by 10%. According to the NDVI development graph, crop conditions were below average until mid-June, and then approached average. The VCIx was 0.83. In all, the crop conditions were below-average.

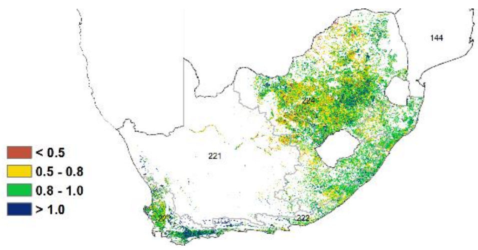
Figure 3.49 South Africa's crop condition, April - July 2023



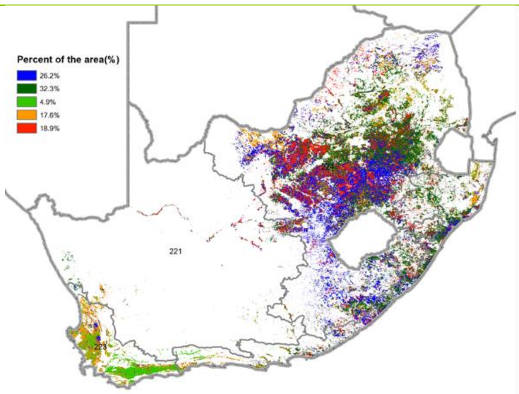
(a) Phenology of major crops



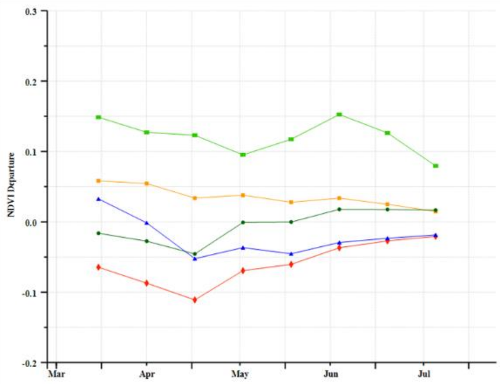
(b) Crop condition development graph based on NDVI



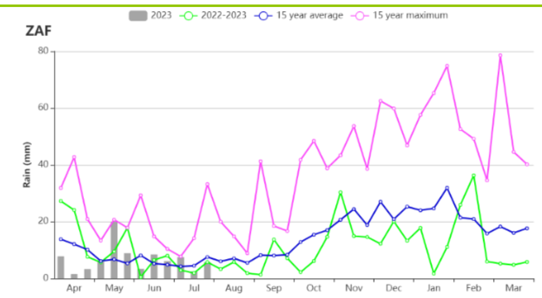
(c) Maximum VCI



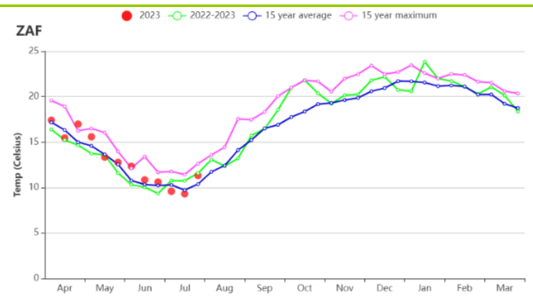
(d) Spatial NDVI patterns compared to 5YA



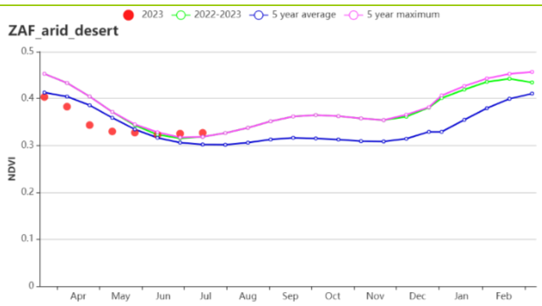
(e) NDVI profiles

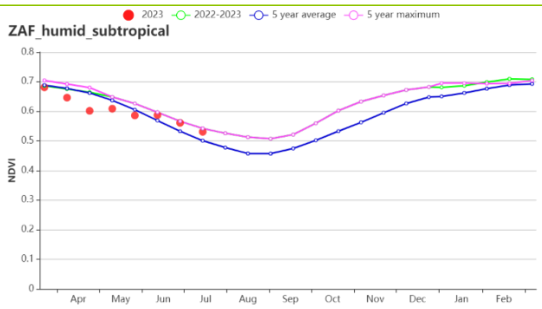


(f) Rainfall profiles

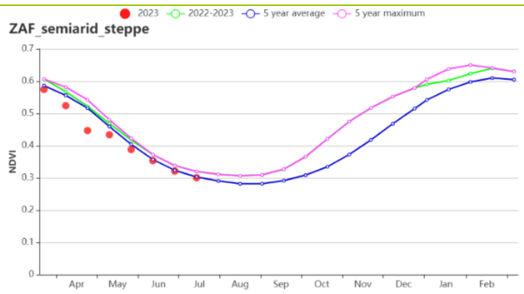


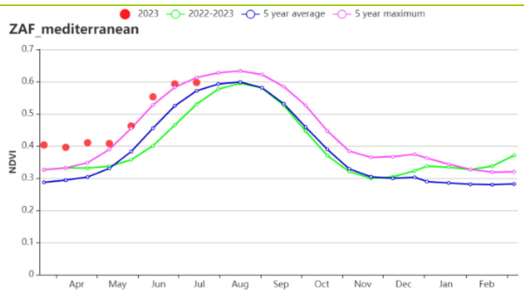
(g) Temperature profiles





(h) Crop condition development graph based on NDVI Arid and desert zones (left) and Humid Cape Fold mountains (right)





(i) Crop condition development graph based on NDVI Dry Highveld and Bushveld maize areas (left) and Mediterranean zone (right)

Table 3.88 South Africa's agro-climatic indicators by sub-national regions, current season's values and departure from 15YA, April - July 2023

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Arid and desert zones	96	20	11.9	-0.5	803	-2	335	5
Humid Cape Fold mountains	131	-3	14.7	0.2	779	-1	431	-2
Mediterranean zone	344	38	11.4	-1.7	637	-7	624	11
Dry Highveld and Bushveld maize areas	47	-29	12.9	0.7	929	1	267	-10

Table 3.89 South Africa's agronomic indicators by sub-national regions, current season's values and departures from 5YA, April - July 2023

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Arid and desert zones	39	-18	0.82
Humid Cape Fold mountains	98	1	0.89
Mediterranean zone	89	4	0.94
Dry Highveld and Bushveld maize areas	88	-1	0.83

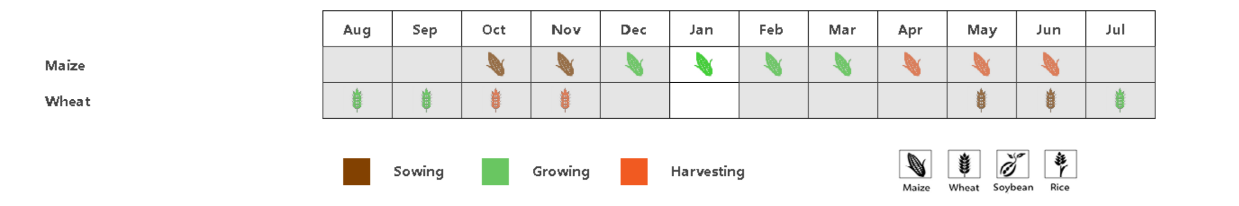
[ZMB] Zambia

The report covers the cessation of the rainy season. The dominant agriculture activity during this season was the harvesting of the maize, sorghum and legume crops (May - July) and planting of winter wheat (April-May) and horticultural crops. The observed annual rainfall was below the 15YA (RAIN -17%), the temperature increased (TEMP +0.9℃), and radiation also increased (RADPAR +5%). The potential biomass production increased as well (BIOMSS +4%). The cropped arable land fraction (CALF) was at 99% with a VCIx value of 0.84. Conditions for crop production were below average due to the prevailing precipitation deficit, which had been observed during the previous monitoring period as well.

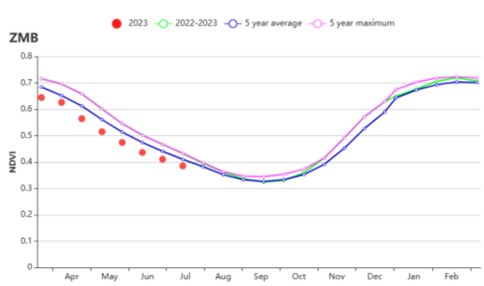
Regional Analysis

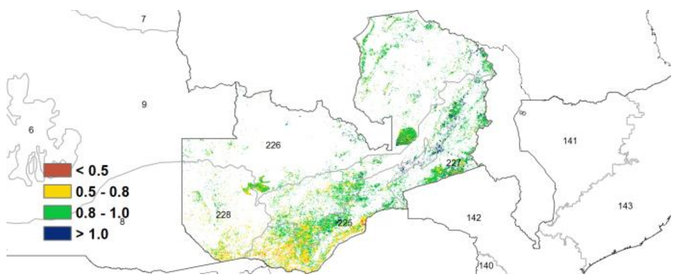
Zambia is subdivided into four main crop production zones, namely the Northern high rainfall zone, Central-eastern and southern plateau, Western semi-arid plain and Luangwa Zambezi rift valley. The Northern high rainfall zone, which predominantly receives higher rainfall, had an increase in rain (RAIN +4%), and warmer temperatures (TEMP +0.7℃). Radiation also increased (RADPAR +3%), and the potential biomass production increased (BIOMASS +1%) as well. The observed cropped arable land fraction (CALF) was at 100% and VCIx was at 0.88. The Central-Eastern and Southern plateau, the main crop production region in the country, received reduced rainfall (RAIN -28%), which resulted in decreased biomass production (BIOMASS -1%). Cropped arable land fraction (CALF) was at 99%, while VCIx was 0.87. In the Western semi-arid plain, the rainfall deficit was much more severe (RAIN -77%). This resulted in reduced biomass production (BIOMASS -4%), because the predominantly sandy soils have a low water holding capacity. Similarly, the Luangwa-Zambezi Rift Valley, the driest zone, also had a severe reduction in rainfall (RAIN -85%), increased temperature (TEMP +1.2℃), increased radiation (RADPAR +5%) and a reduction in potential biomass production (BIOMASS -18%). CALF was at 97% and VCIx at 0.79. At the regional level, the Crop Production Index (CPI) was above 1.0 except for Western semi-arid zone (CPI = 0.88).

Figure 3.50 Zambia’s crop condition, April - July 2023

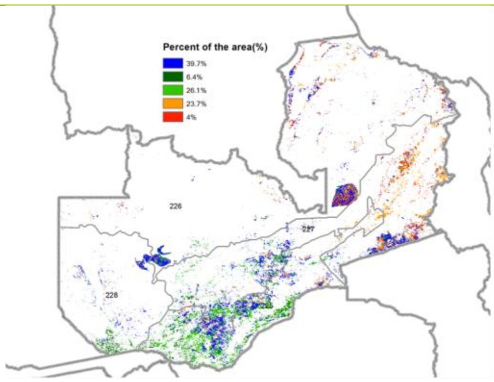


(a) Phenology of major crops

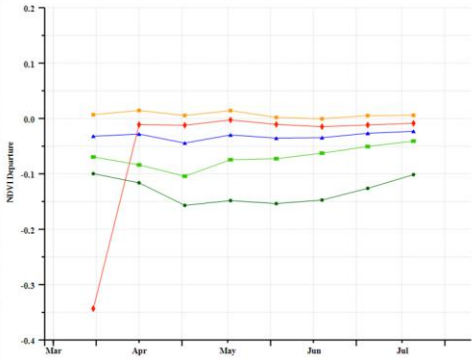




(b) Crop condition development graph based on NDVI

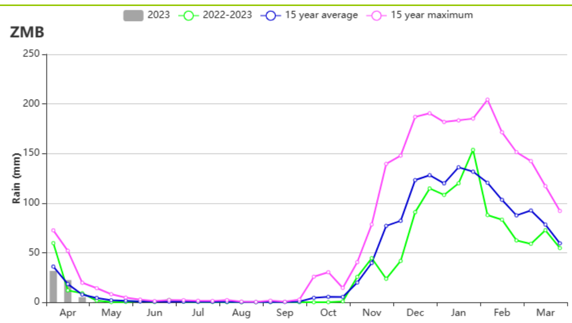


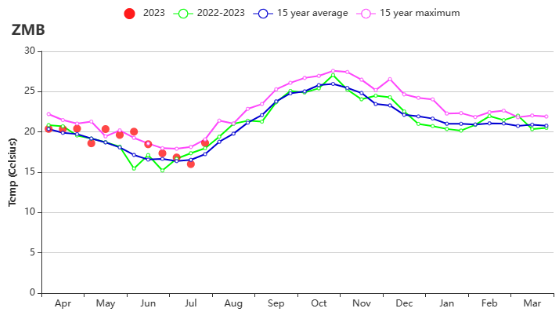
(c) Maximum VCI



(d) Spatial NDVI patterns compared to 5YA

(e) NDVI profiles





(f) Rainfall profiles

(g) Temperature profiles

Table 3.90 Zambia's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, April - July 2023

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Luangwa-Zambezi rift valley	6	-85	19.2	1.2	1177	5	280	-18
Western semi-arid plain	8	-77	19.7	1.2	1208	3	334	-4
Central-eastern and southern plateau	44	-28	18.7	0.8	1164	7	366	-1
Northern high rainfall zone	114	4	18.6	0.7	1210	3	450	1

Table 3.91 Zambia's agronomic indicators by sub-national regions, current season's values and departure from 5YA, April - July 2023

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Luangwa-Zambezi rift valley	97	1	0.79
Western semi-arid plain	99	0	0.76
Central-eastern and southern plateau	99	2	0.87
Northern high rainfall zone	100	0	0.88

Chapter 4. China

After a brief overview of the agro-climatic and agronomic conditions in China over the reporting period (section 4.1), Chapter 4 then presents China's crop prospects (section 4.2), describes the situation by region, focusing on the seven most productive agro-ecological regions of the east and south: Northeast China, Inner Mongolia, Huanghuaihai, Loess region, Lower Yangtze, Southwest China, and Southern China (section 4.3). Section 4.4 describes trade prospects of major cereals and soybean. Additional information on the agro-climatic indicators for agriculturally important Chinese provinces is listed in table A.11 in Annex A.

4.1 Overview

Most of the summer crops, such as semi-late rice, maize, and soybean, were in the field during the reporting period. This period also covers the harvest of early rice and winter wheat. The sowing of late rice was completed in July. The agro-climatic conditions were near average, with rainfall below average (-10%), temperature (+0.5°C) and RADPAR (+1%) slightly above average. On the combined effects of agroclimatic indicators, BIOMSS was close to the 15YA. National crop area land fraction (CALF) was average, the national maximum Vegetation Condition Index (VCIx) was 0.88, and the national Crop Production Index (CPI) was 1.06, indicating an overall favorable crop condition.

According to the time series rainfall profile, above-average rainfall was observed nationwide in early April and late July. Three of the main agricultural regions of China recorded above-average rainfall, with the largest positive departure occurring in Huanghuaihai (+27%), while another three regions recorded below-average rainfall, with the largest negative departure occurring in southern China (-21%). At the country level, rainfall anomalies fluctuated largely over time and space. As can be seen from the spatial distribution of rainfall profiles, 68.3% of the cropped areas (marked in blue) recorded near-average precipitation. 18% of the cropped areas (marked in deep green) experienced slightly below average rainfall during most of the monitoring period, mainly distributed in some parts of Yunnan, Guizhou, Guangdong, Guangxi, Fujian, and Jiangxi. The remaining 13.8% of the cropped areas (marked in light green), mainly located in Beijing, Hebei, some parts of Shandong, Liaoning, and the eastern part of Lower Yangtze region, received around average rainfall except for late July. As influenced by the super typhoon Doksuri, extreme rainfall (more than 135mm/dekad) fell over the Lower Yangtze region and Huanghuaihai in late July, causing some damage to summer crops. Fujian and Hebei were among the most severely affected provinces, and the area of flooded cropland was reported to be 37,396 and 319,700 hectares, respectively. Persistent heavy rainfall has not only led to flooded cropland and crop lodging but also to urban flooding, and mudslides, resulting in large economic losses. Apart from late July, Henan Province also experienced continuous heavy rainfall in late May. Starting from May 23rd, efforts were made to swiftly harvest crops in the mature wheat-growing areas of southern Henan.

In terms of temperature conditions, all of the main agricultural regions in China recorded average to above-average temperatures, with the largest positive departure occurring in Southern China (+0.9°C). Temperatures fluctuated during the monitoring period as follows: 39.3% of the cultivated regions, marked in blue, had relatively small temperature fluctuations, with the largest absolute temperature anomalies less than 1.5℃. 34.1% of the cultivated regions (marked in deep green), mainly distributed in most parts of Huanghuaihai, central and northeastern Lower Yangtze region, saw above-average temperatures in the middle of April with an anomaly of more than 4.0°C. The remaining 26.6% of the cultivated areas (marked in light green) encountered the largest below-average temperatures, exhibiting an anomaly exceeding

4.5℃, mainly distributed in the Loess region, the northern part of South West China, and the northwestern part of Lower Yangtze.

When it comes to RADPAR, Huanghuaihai (-3%), Loess region (-2%), and Inner Mongolia (-1%) all had negative RADPAR anomalies, whereas the largest positive departure was recorded for southern China (+6%). As for BIOMSS, the situation was quite different among all the main producing regions, with departures between -5% (Inner mongolia) and +11% (Huanghuaihai). With regard to VHIn, high values (above 35%) were widespread in China, indicating limited water deficit effects on most of the summer crops. CALF was average in all of the main agricultural regions as compared to the 5YA. The VCIx values were higher than 0.8 in almost all the main producing regions of China, with values between 0.83 (Huanghuaihai) and 0.94 (North East China), except for Inner Mongolia (0.79).

Table 4.1 CropWatch agroclimatic and agronomic indicators for China, April - July 2023, departure from 5YA and 15YA

Region	Agroclimatic indicators				Agronomic indicators	
	Departure from 15YA				Departure from 5YA	Current period
	RAIN (%)	TEMP (°C)	RADPAR (%)	BIOMSS (%)	CALF (%)	Maximum VCI
Huanghuaihai	27	0.6	-3	11	0	0.83
Inner Mongolia	0	0.6	-1	-5	0	0.79
Loess region	11	0.0	-2	4	0	0.84
Lower Yangtze	-8	0.5	2	6	0	0.91
Northeast China	1	0.2	0	-2	0	0.94
Southern China	-21	0.9	6	-2	0	0.93
Southwest China	-12	0.6	1	0	0	0.91

Figure 4. 1 China crop calendar

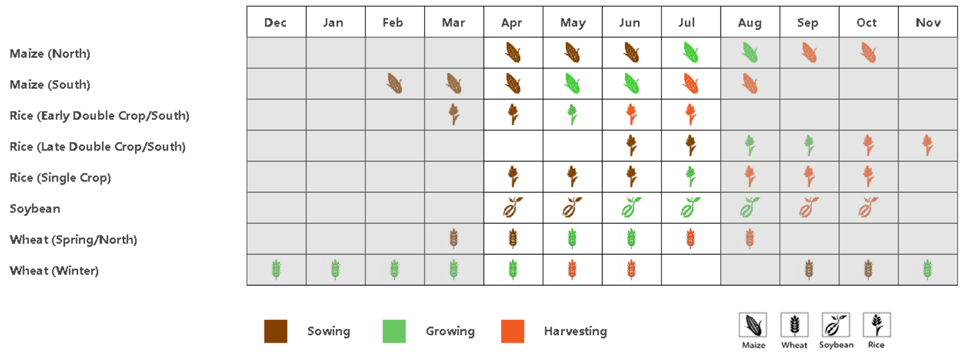


Figure 4.2 China spatial distribution of rainfall profiles, April to July 2023

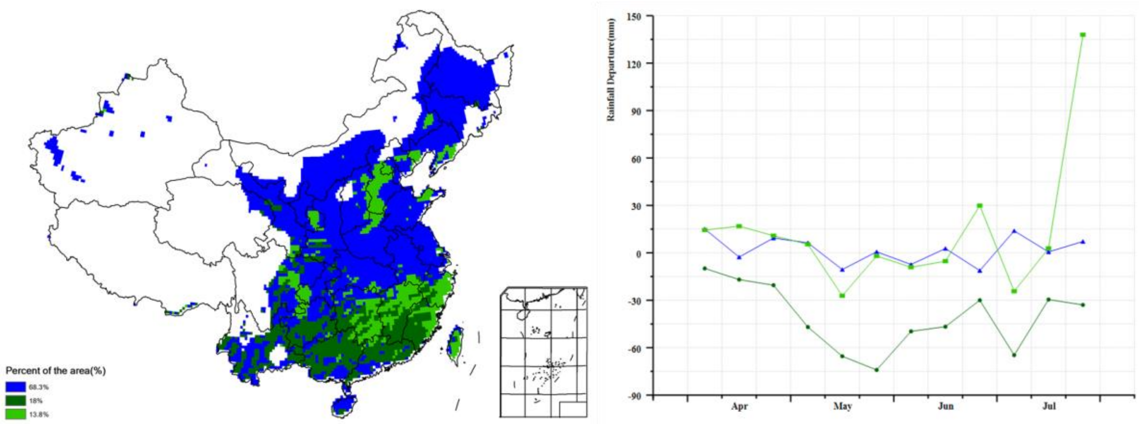


Figure 4.3 China spatial distribution of temperature profiles, April to July 2023

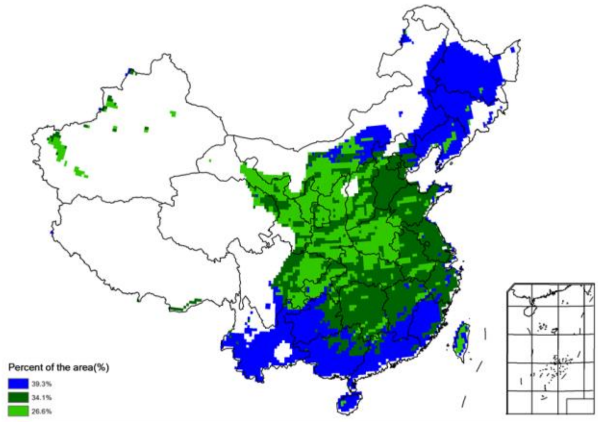


Figure 4.4 China cropped and uncropped arable land, by pixel, April to July 2023

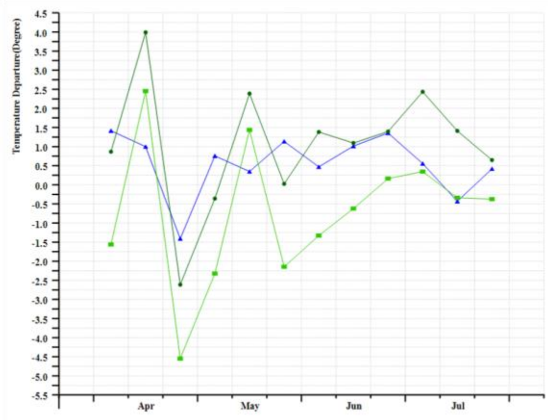
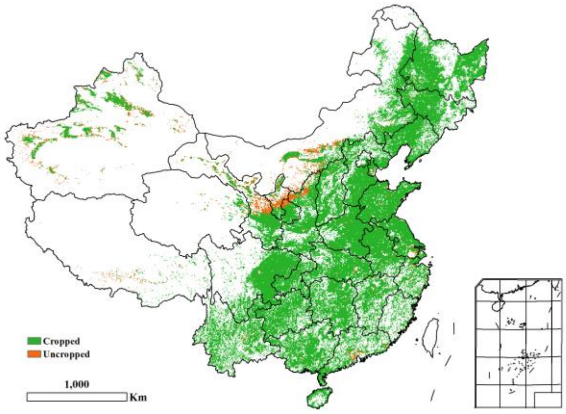


Figure 4.5 China maximum Vegetation Condition Index (VCIx), by pixel, April to July 2023



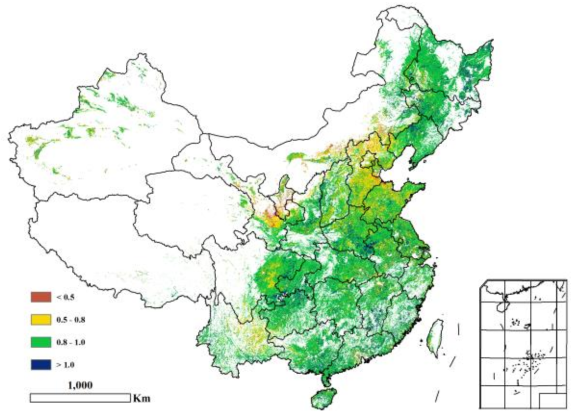


Figure 4.6 China biomass departure map from 15YA, by pixel, April to July 2023

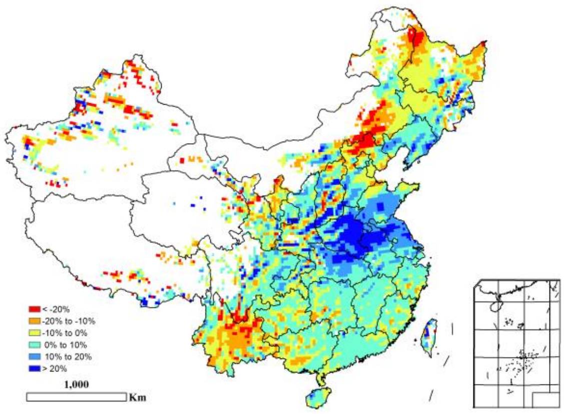


Figure 4. 7 China minimum Vegetation Health Index (VHIn), by pixel, April to July 2023

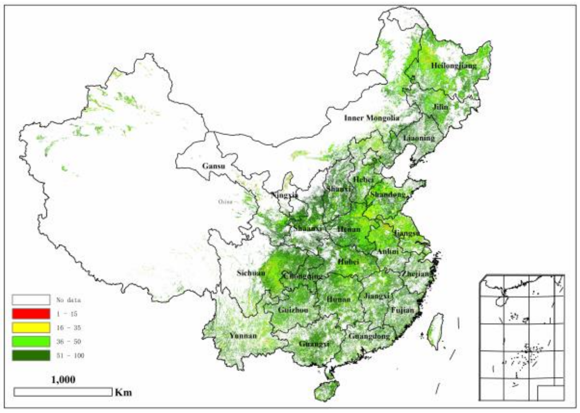
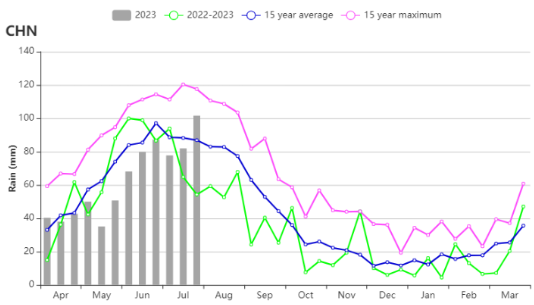


Figure 4. 8 China time series rainfall, April to July 2023



4.2 China's crop production

Utilizing a comprehensive fusion of remote sensing data from diverse sources including Fengyun-3, European Space Agency Sentinel-1/2 satellites, and the US Landsat 8 satellite, and incorporating ground-truth measurements from nearly a million sample points across major agricultural regions such as Northeast, North China, Northwest, and Southwest China, the present study undertook the monitoring of sowing areas and crop conditions for China's major staple crops in the year 2023. By integrating nationwide 10-meter resolution arable land data, agricultural meteorological information, and crop yield monitoring models, a meticulous analysis was conducted. This analysis encompassed a thorough re-evaluation of the 2023 summer grain and winter wheat yields, and entailed the projection of yields for key crops including maize, rice, soybean, autumn grains, and the aggregate annual cereal output for China.

(1) Annual Grain Production Forecast
The total annual grain production for the year 2023 (comprising autumn grains, summer grains, and early rice) is projected to reach 648.42 million tons, indicating an increase of 1.709 million tons, representing a growth rate of 0.3% compared to 2022 (Table 1). Notably, the top five grain-producing provinces, namely Heilongjiang, Henan, Shandong, Jilin, and Anhui, have all achieved year-on-year production increments, thus laying a robust foundation for a bountiful annual grain harvest.

Employing the latest remote sensing data, a reassessment of the total summer grain production for 2023 yields a figure of 142.405 million tons, marking a year-on-year augmentation of 1.79 million tons. Within this context, the increase in the planted area for summer grains is noted at 1.6% compared to the previous year. However, a persistent series of precipitation events during the maturation and harvest phase of summer crops led to a decline of 1.4% in the yield per unit area. Consequently, the total summer grain production registers a marginal increment of 0.1% year-on-year.

In the initial stages of summer grain cultivation, favorable hydrothermal conditions prevailed, and field moisture content remained conducive, resulting in superior crop growth in comparison to typical years. Nonetheless, a substantial and prolonged period of precipitation coupled with overcast skies prevailed across multiple major provinces in North China during late May to early June, coinciding with the maturation and harvest phase of summer grains. This meteorological pattern proved unfavorable for the grain filling process of winter wheat, and the provinces of Henan and Anhui experienced prolonged precipitation during their wheat harvesting period, further contributing to the occurrence of "sprouting wheat" in certain regions. As a consequence, the yield per unit area of summer grains was compromised, exhibiting a decline of 1.4% compared to initial estimates made in May, resulting in an equivalent year-on-year drop in yield for both provinces.
The total production of early rice in 2023 is estimated at 27.393 million tons, reflecting a decrease of 1.57 million tons, corresponding to a decline of 0.6% compared to the preceding year. Within this context, the cultivated area for early rice witnessed a year-on-year reduction of 23.2 thousand hectares (approximately 348 thousand mu), marking a decrease of 0.4%. Concurrently, the average yield per unit area exhibited a slight year-on-year decrease of 0.1%.

During the initial growth stages of early rice, the synchronous occurrence of favorable rainfall and warmth within the primary cultivation regions yielded meteorological conditions conducive to the developmental progress and yield formation of early rice. However, commencing from the middle to late June, a pronounced period of heavy rainfall prevailed over the middle and lower reaches of the Yangtze River and the southern regions of China. This temporal alignment coincided with the heading and flowering phase of early rice, hindering the process of pollination and adversely affecting the yield formation. Additionally, during the maturation and harvest phase of early rice, the primary producing regions were confronted with the impact of Typhoon "Taili", resulting in a composite effect on yield. As a result, provinces such as Guangxi, Hubei, Hunan, and Jiangxi experienced respective year-on-year declines in early rice yield by 1.1%, 4.3%, 1.8%, and 0.9%. Consequently, the nationwide average yield of early rice underwent a minor year-on-year reduction.

The aggregate production of autumn crops (encompassing maize, medium-season rice, late-season rice, spring wheat, soybeans, coarse grains, and tuber crops) is projected to reach 478.621 million tons in 2023, marking an increase of 1.688 million tons, corresponding to a growth rate of 0.4% compared to 2022. Throughout the growth phase of autumn crops, the agricultural meteorological conditions have, on the whole, favored crop growth and yield formation, resulting in a more favorable crop production scenario compared to the previous year.

The impact of Typhoon "Dusurei" led to the impairment of autumn crops such as maize and first-season rice in certain regions within Beijing-Tianjin-Hebei and parts of the Northeast. Consequently, the total autumn crop production in Hebei registered a year-on-year decrease of 2.5%. However, the noticeable increase in maize planting area within the Northeastern region mitigated the effects of flood-related damage, thereby not yielding a decline in autumn crop production. Simultaneously, Typhoon "Dusurei" furnished water replenishment to major producing regions, which overall resulted in a positive net effect on the nationwide production of major autumn crops such as maize and rice.

Table 4.2 Projected Production and Year-on-Year Changes in Major Grain-Producing Provinces for 2023

province	Winter crops		Early rice		Summer crops		Annual food	
	Production （million tons）	Variation (%)	Production （million tons）	Variation (%)	Production （million tons）	Variation (%)	Production （million tons）	Variation (%)
Anhui	14.821	1.1	1.123	6.2	20.987	4.1	36.931	2.9
Chongqing					7.992	1.7	7.992	1.7
Fujian			0.890	1.0	5.156	-0.7	6.046	-0.4
Gansu	3.376	-5.3			6.914	1.0	10.289	-1.1
Guangdong			4.340	4.5	7.603	-3.0	11.943	-0.4
Guangxi			4.690	-1.0	9.314	-0.8	14.004	-0.9
Guizhou					12.303	-2.9	12.303	-2.9
Hebei	12.566	0.5			20.726	-2.5	33.293	-1.4
Heilongjiang					79.812	4.3	79.812	4.3
Henan	32.897	0.7			25.018	2.6	57.915	1.6
Hubei	5.985	-3.2	0.821	-5.2	18.491	-0.6	25.297	-1.4
Hunan			8.795	-1.8	18.554	-1.9	27.349	-1.9
Inner Mongoria					32.515	-2.7	32.515	-2.7
Jiangsu	13.970	-0.1			20.287	-0.2	34.257	-0.2
Jiangxi			5.754	-1.9	9.864	-0.9	15.618	-1.3
Jilin					44.411	8.9	44.411	8.9
Liaoning					20.622	-3.3	20.622	-3.3
Ningxia					2.709	-3.1	2.709	-3.1
Shaanxi	3.861	-5.0			7.520	-1.4	11.380	-2.6
Shandong	27.278	0.5			20.410	-0.5	47.688	0.1
Shanxi	2.336	-0.1			8.798	-5.9	11.134	-4.7
Sichuan	5.813	-2.4			26.024	-1.7	31.837	-1.8
Xinjiang	5.264	2.8			9.683	-3.1	14.947	-1.1
Yunnan					14.635	-4.6	14.635	-4.6
Zhejiang			0.564	-3.9	6.248	-0.7	6.812	-1.0
Subtotal	128.167	0.0	26.977	-0.5	456.595	0.6	611.739	0.4
Other	14.238	1.4	0.417	-6.4	22.027	-4.0	36.681	-2.0
National	142.405	0.1	27.393	-0.6	478.621	0.4	648.420	0.3

(2) Forecast for Production of Major Grain and Oil Crops

The production of major grain and oil crops in China for the year 2023, including maize, rice, wheat, and soybeans, is anticipated to be 577.465 million tons, denoting an increase of 2.555 million tons, corresponding to a growth rate of 0.4% year-on-year. Within this context, maize and wheat are expected to achieve year-on-year increases, while rice and soybeans are predicted to undergo decreases (Table 2).

China's maize cultivation area is projected to expand by 1,234 thousand hectares, leading to an estimated yield augmentation of 5.049 million metric tons. The total maize production for the year 2023 is forecasted to reach 232.24 million metric tons, representing a notable year-on-year growth rate of 2.2%. Remote sensing monitoring indicates that the maize cultivation area for China in 2023 encompasses 42,096 thousand hectares, demonstrating a year-on-year increase of 3.0%. Within this, Heilongjiang Province exhibits the most pronounced expansion in maize cultivation area, with an increase of 564 thousand hectares year-on-year, corresponding to a concurrent reduction in soybean planting area. Likewise, Jilin Province records a year-on-year increase of 522 thousand hectares in maize cultivation area. Changes in maize cultivation area for other provinces are all below 50 thousand hectares.
Throughout the maize growing season, several major production regions experienced adverse agricultural weather conditions such as extreme high temperatures, excessive rainfall, and localized flooding. The nationwide average maize yield is projected to be 368 kilograms per mu (approximately 2,448 kilograms per mu), representing a year-on-year reduction of 0.8%. In the early to mid-July period, the Huang-Huai regions of North China witnessed a phase of heatwaves, leading to the widespread curling of maize leaves. However, due to timely irrigation practices in the region, the impact of high temperatures remained relatively limited. Towards the end of July and the beginning of August, Typhoon "Dusurei" brought about extreme heavy rainfall to areas such as Zhuozhou in the Beijing-Tianjin-Hebei region, resulting in maize damage. This contributed to a year-on-year decrease of 4.1% in the average maize yield across Hebei Province. The same typhoon induced significantly above-average precipitation in the northeastern region, affecting crops in areas such as Wuchang, Shangzhi, Mudanjiang in southern Heilongjiang Province, and Shulan in eastern Jilin Province. However, the impact on maize production in these provinces was relatively minor. While the average maize yield in Heilongjiang and Jilin experienced slight decreases of 0.2% and 0.4% year-on-year, respectively, due to increased planting area, maize production in these two provinces saw respective year-on-year increases of 8.3% and 11.3%. Overall, the impact of Typhoon "Dusurei" on the national maize production remained limited.

Impacted by the reduction in national rice planting area, the total rice production is expected to decrease by 1,988,000 metric tons. The projected nationwide total rice production is 193.346 million tons, signifying a year-on-year reduction of 1.0%. Within this context, early rice is expected to decrease by 0.6% year-on-year. The production of medium-season rice/first-season rice is forecasted to be 132.069 million tons, marking a year-on-year reduction of 1.68 million tons, corresponding to a decrease of 1.3%. The projected production of late-season rice is 33.884 million tons, indicating a decrease of 151 thousand tons, roughly a decline of 0.4% year-on-year.

In northern regions where first-season rice is cultivated, a period of consecutive heavy rainfall during the heading and flowering phase adversely affected pollination and yield formation of rice. Furthermore, this weather pattern led to flooding of 207.6 thousand mu of rice fields in Heilongjiang and Jilin provinces. Consequently, rice production in Heilongjiang, Jilin, and Liaoning provinces saw respective year-on-year reductions of 0.2%, 3.4%, and 0.9%.

In the Yangtze River Basin, the agricultural weather conditions were better than the previous year, yet the reduction in planting area led to marginal year-on-year decreases in rice production for provinces such as Jiangxi, Hunan, Hubei, and Sichuan. On the other hand, Anhui and Henan provinces witnessed substantial increases in rice production, with increments of 1.57 billion catties (78.5 million kilograms) and 350 million catties (17.5 million kilograms) respectively, representing year-on-year growth rates of 4.9% and 4.8%.

The soybean planting area has decreased by 618 thousand hectares year-on-year, leading to a projected reduction in production of 1.03 million metric tons. The total national soybean production for 2023 is estimated to be 17.156 million metric tons, reflecting a year-on-year decline of 5.7%. However, this production figure remains notably higher than that of 2021. The nationwide soybean planting area is 9,233 thousand hectares, which is a reduction of 618 thousand hectares (or a decrease of 6.3%) compared to 2022. Despite this reduction, it still stands as the second largest planting area since the implementation of the soybean revitalization plan. The average yield per unit area for soybeans is projected to increase by 0.7%, reaching 1,867 kilograms per hectare.

The decrease in soybean planting area in 2023 can be attributed to two main factors. Firstly, due to comparable profitability between soybeans and maize, some farmers still opt to cultivate maize. Secondly, the reduction in soybean planting area is related to the annual rotation of maize and soybeans in Heilongjiang, a major soybean-producing province. The soybean planting area in Heilongjiang has decreased to 4,642 thousand hectares, marking a year-on-year reduction of 320 thousand hectares, a decline of 6.4%. This reduction in planting area has led to a year-on-year decrease of 470 thousand tons in soybean production in the province. Meanwhile, the soybean planting area in Inner Mongolia has further increased to 1,520 thousand hectares, representing a year-on-year increase of 34 thousand hectares or 2.3%. However, due to drought conditions affecting soybean-producing regions, the yield per unit area has decreased by 2.4% year-on-year, resulting in a marginal reduction of 0.1% in soybean production for the autonomous region. Changes in soybean production for other provinces and regions are relatively minor year-on-year.

The maturation phase of winter wheat was impacted by continuous rainfall, leading to the emergence of sprouted wheat and mold in some production areas, which resulted in a decrease in yield per unit area. However, the total production of wheat still increased by 525 thousand tons year-on-year. By employing remote sensing data covering the entire growth cycle of wheat and ground observation data, a reassessment of the nationwide wheat production for 2023 yields a figure of 134.723 million tons, indicating a year-on-year growth rate of 0.4%. Within this context, the total winter wheat production amounts to 128.958 million tons, marking an increase of 442 thousand tons, corresponding to a growth rate of 0.3%. Concurrently, the total spring wheat production is 5.765 million metric tons, reflecting an increase of 82 thousand tons, denoting a growth rate of 1.4% year-on-year.

Table 4.3 China Corn, Rice, Wheat and Soybean Production (Tons) and Variation (%), 2023

province	Maize		Rice		Wheat		Soybean	
	2023 (million tons)	Variation (%)	2023 (million tons)	Variation (%)	2023 (million tons)	Variation (%)	2023 (million tons)	Variation (%)
Anhui	3.719	3.6	16.873	4.9	14.347	1.2	1.018	-5.0
Chongqing	2.022	1.9	4.695	1.6				
Fujian			2.251	0.0				
Gansu	5.573	1.4			2.623	0.5		
Guangdong			10.320	0.0				
Guangxi			9.866	-0.9				
Guizhou	4.949	-3.8	5.369	-2.0				
Hebei	18.822	-2.5			12.200	0.0	0.194	-3.6
Heilongjiang	47.518	8.3	22.727	-0.2			6.301	-6.9
Henan	15.567	2.1	3.877	4.8	32.751	0.7	0.857	2.7
Hubei			14.777	-0.9	4.484	0.3		
Hunan			24.574	-1.9				
Inner Mongoria	22.712	-3.1			1.980	0.2	1.704	-0.2
Jiangsu	2.135	-0.1	1.607	-0.3	13.667	0.7	0.832	0.8
Jiangxi			14.410	-1.3				
Jilin	35.693	11.3	5.688	-3.4			0.725	0.7
Liaoning	15.760	-4.2	4.606	-0.9			0.453	5.1
Ningxia	1.640	-2.9	0.463	-3.7				
Shaanxi	3.714	-2.4	1.004	2.7	3.816	-4.7		
Shandong	19.281	-0.4			26.948	0.1	0.702	-2.4
Shanxi	8.796	-5.9			2.313	2.1	0.159	-4.0
Sichuan	6.415	-1.8	14.616	-1.6	1.940	-1.6		
Xinjiang	7.141	-3.9			5.164	2.9		
Yunnan	6.399	-3.5	5.399	-5.9				
Zhejiang			6.154	-1.0				
Subtotal	227.856	1.9	183.768	-0.5	122.233	0.5	12.944	-3.7

province	Maize		Rice		Wheat		Soybean	
	2023 (million tons)	Variation (%)	2023 (million tons)	Variation (%)	2023 (million tons)	Variation (%)	2023 (million tons)	Variation (%)
National	232.240	2.2	193.346	-1.0	134.723	0.4	17.156	-5.7

4.3 Regional analysis

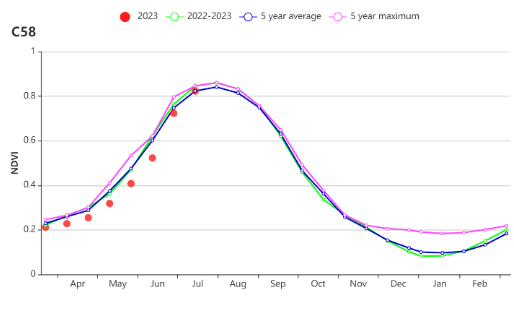
Figures 4.9 through 4.15 present crop condition information for each of China's seven agricultural regions. The provided information is as follows: (a) Phenology of major crops; (b) Crop condition development graph based on NDVI, comparing the current season up to July 2023 to the previous season, to the five-year average (5YA), and to the five-year maximum; (c) Spatial NDVI patterns for April to July 2023 (compared to the (5YA)); (d) NDVI profiles associated with the spatial patterns under (c); (e) maximum VCI (over arable land mask); and (f) biomass for April to July 2023. Additional information about agro-climatic indicators and BIOMSS for China is provided in Annex A.

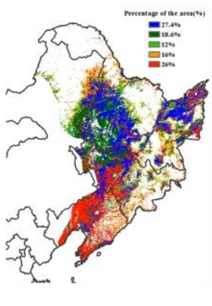
Northeast region

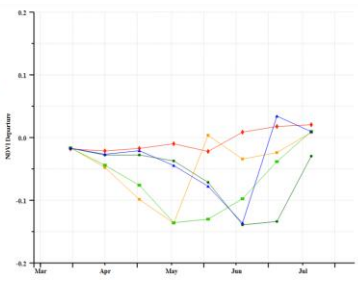
This current monitoring period covers the sowing and the first half of the growing season of main crops in the Northeast of China (April to July 2023). CropWatch Agroclimatic Indicators (CWAIs) show that precipitation was slightly above average. The total precipitation increased by 1%. It was below the average level in May and June, and above the average level in July. The photosynthetically active radiation was close to average, and the temperature was below average (TEMP 0.2℃). This resulted in a potential biomass estimate that was 2% below the fifteen-year average level. Most parts of Heilongjiang province and the western part of Jinlin province were below average due to low precipitation, causing a mild drought.

The crop conditions during the monitoring period were slightly below average before July and recovered to average levels till the end of July. Meanwhile, great spatial variations existed in the region. As shown by NDVI clusters and profiles, 27.4% of cropland experienced a steady decline until mid June and then increased to average levels. This area was mostly distributed in Heilongjiang province and western Jilin province. About 18.6% of cropland in the region was mostly below average. It was mainly located in western Heilongjiang province, indicating that crops in this area were in relatively poor condition. About 26% of cropland was slightly negative, mainly concentrated over Liaoning province. Most parts of the Northeast of China were below average from April to June and improved in July, and this is due to a slight drought caused by below average precipitation in the early stage. In addition, the maximum VCI shows that all provinces of the Northeast of China were above 0.8, except for a small part of western Heilongjiang province due to drought and western Jilin province due to local drought and floods in the early stage. On the other hand, flooding that occurred in early August negatively affected crops locally in Wuchang, Shangzhi and Mudanjiang in central southern Heilongjiang province and Shulan in eastern Jilin province, accounting for about 4% of the cropland area in the region. All in all, crop development until June was below average but recovered to average levels in July. Prospects for crop production are average.

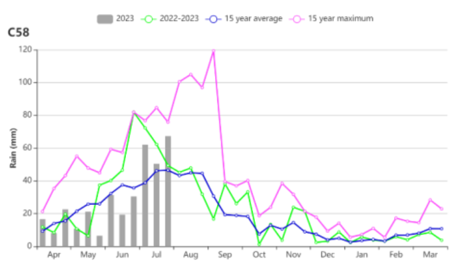
Figure 4. 9 Crop condition China Northeast region, April - July 2023

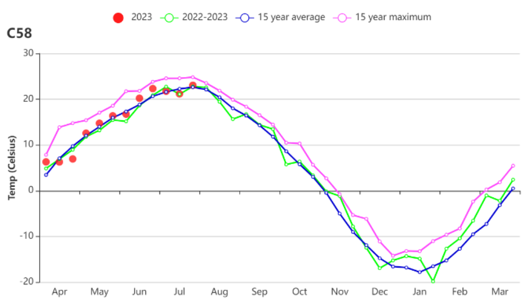






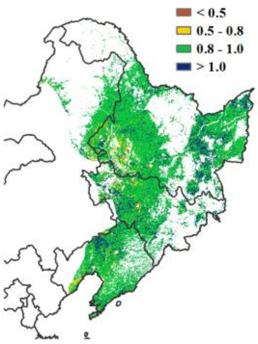
(a) Crop condition development graph based on NDVI (b) Spatial NDVI patterns compared to 5YA (c) NDVI profiles



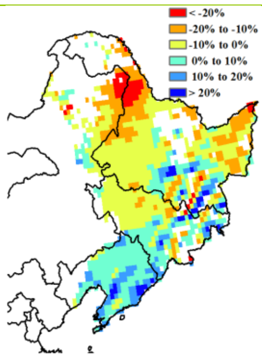


(d)Time series rainfall profile

(e)Time series temperature profile



(f) Maximum VCI

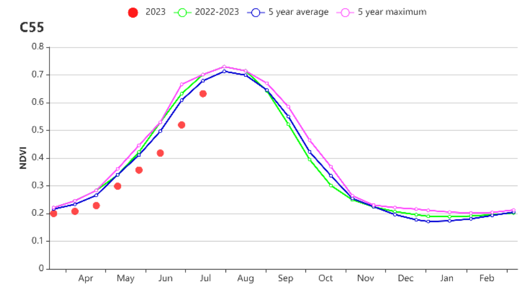


(g) Biomass departure

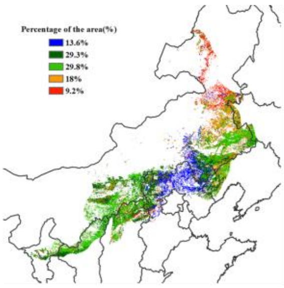
Inner Mongolia

During the reporting period, single season crops (maize, wheat, and soybean) were grown in Inner Mongolia. Overall, RAIN was close to the 15YA. TEMP (+0.6°C) was slightly above average, while RADPAR was slightly below average (-1%). BIOMASS (-5%) was also below 5YA. The temporal distribution for these indicators was very uneven. Precipitation was insufficient in May and June, which may have a negative impact on the rain-fed crops. As illustrated in the crop development graph from April to July, almost all cropped areas displayed consistently below-average NDVI, and more than 70% of the area had a sustained decrease in northern Hebei, central and eastern Inner Mongolia. This is confirmed by VCIx values being lower than 0.8 in these areas, where the biomass accumulation potential (BIOMSS) was also well below average. In July, crop conditions returned to the average for most areas due to the increasing precipitation, but excessive precipitation in late July may have affected crop growth. The fraction of cropped arable land (CALF) was 95%, and VCIx was 0.79. Crop conditions were slightly below average during the reporting period, which is consistent with the agricultural production situation index (0.94). The season's final outcome will depend on weather conditions in August and September.

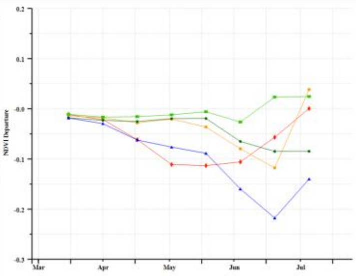
Figure 4. 10 Crop condition China Inner Mongolia, April - July 2023



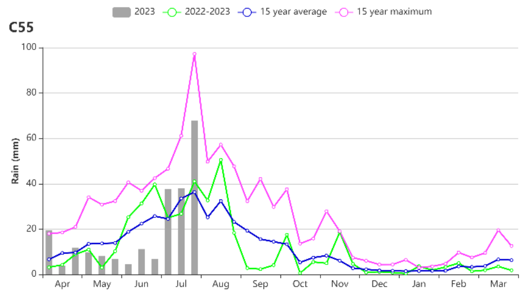
(a) Crop condition development graph based on NDVI



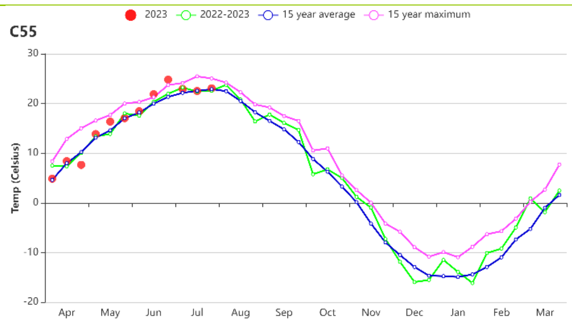
(b) Spatial NDVI patterns compared to 5YA



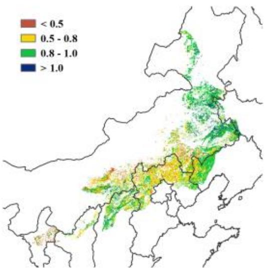
(c) NDVI profiles



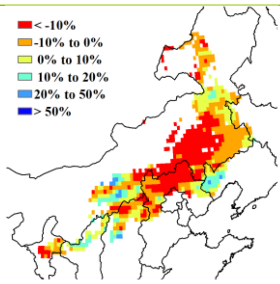
(d) Time series rainfall profile



(e) Time series temperature profile



(f) Maximum VCI



(g) Biomass departure

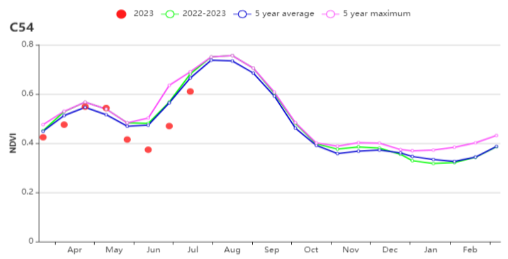
Huanghuaihai

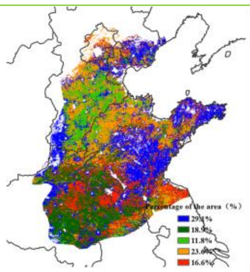
Winter wheat, maize, peanut and soybean are the main crops that grew in this monitoring period (April to July 2023) in Huanghuaihai. Agro-climatic indicators showed that precipitation (+27%), and temperature (+0.6°C) in this area were above the 15YA, but radiation (-3%) was below. As a result of these indicators, an increase in crop biomass production potential was estimated (BIOMSS+11%). Below-average BIOMSS was located in northern Shandong and eastern Hebei. The CALF was unchanged in 5YA.

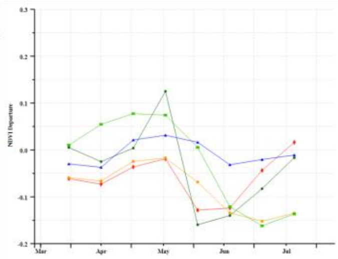
According to the NDVI development graph, crop growth was favorable since April, and even exceeded the maximum in mid-May due to sufficient rainfall and above-average temperatures. Continuous rain led to a serious deterioration in crop conditions after June. As the NDVI departure clustering map showed, the whole region generally experienced poor conditions after June. 23.6% of the cropland was always below the average, widely located in western and northern Shandong, and northern Anhui (yellow color in the NDVI departure clustering map), especially cropland in Beijing was severely affected by flooding in late July. Only 11.8% of the cropped area concentrated in eastern Hebei trended above average before June. Crop conditions in eastern Henan and northern Anhui (accounting for 18.9% of the total area) began to improve starting mid-April due to the abundant rainfall and were higher than the average. However, the harvest of winter wheat in late May and early was negatively affected by frequent rainfall. This caused a drop in wheat quality.

The maximum VCI value was 0.83, and the Crop Production Index (CPI) is 1.0. Overall, crop conditions were average during the period.

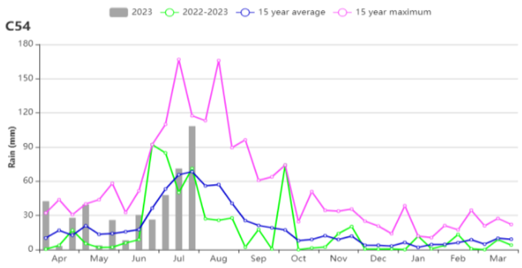
Figure 4. 11 Crop condition China Huanghuaihai, April - July 2023

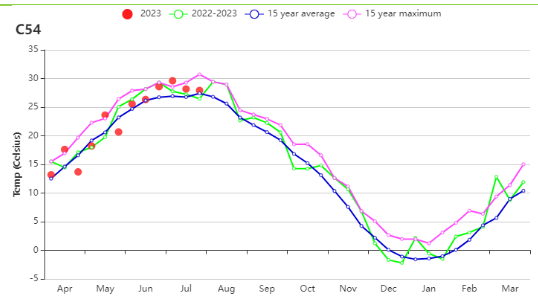




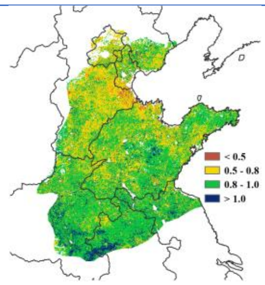


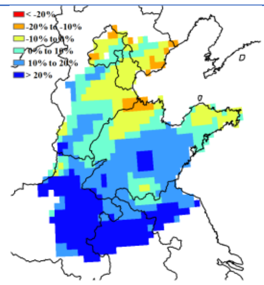
(a) Crop condition development graph based on NDVI (b) Spatial NDVI patterns compared to 5YA (c) NDVI profiles





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





(f) Maximum VCI (g) Biomass departure

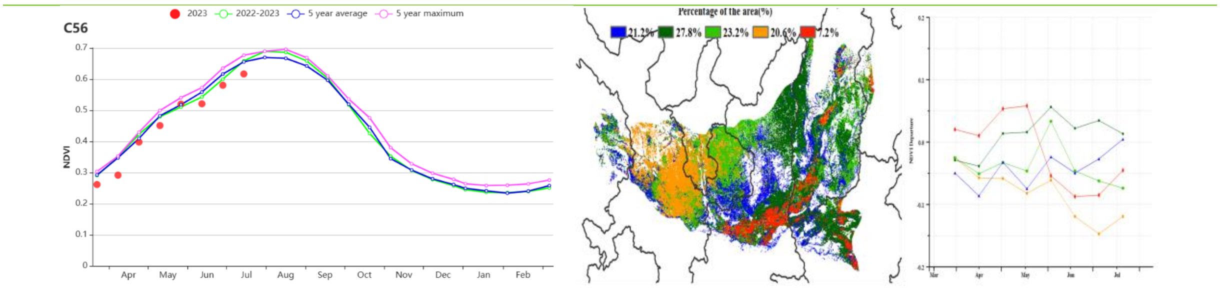
Loess region

During the reporting period, winter wheat was harvested from early to mid-June, while summer maize was planted in late June.

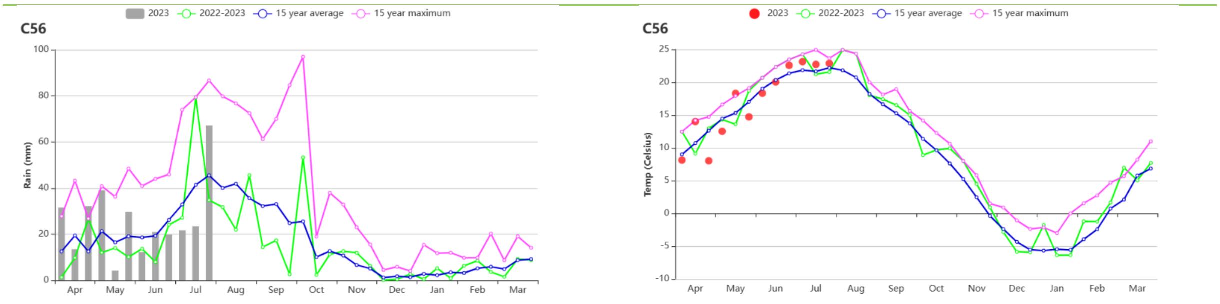
The CropWatch Agroclimatic Indicators (CWAIs) show that radiation in this area was below average (RADPAR -2%), and the average temperature was unchanged(TEMP +0.0℃), but precipitation was above average (RAIN +11%), which brought the potential biomass above the 15YA by 4%. During the monitoring period, precipitation exceeded the 15-year maximum in early and late April, while the precipitation remained below average from early June to mid-July . According to the regional NDVI development map, the overall crop condition in the Loess region was slightly below the 5YA.

The NDVI departure cluster profiles indicate that crop conditions in most regions were below average in April. But approximately 50% of the regions recovered to close to average in late July. These regions are mainly distributed in most parts of northwestern Henan, Shaanxi and Shanxi provinces. About 7.2% of the region had above-average crop growth from April to May but it subsequently declined below the average in June. These regions are primarily concentrated in southwestern Shanxi and southern Shaanxi Province. The Maximum VCI map shows high VCIx values in most cropped areas of the region, with an average value of 0.84. The fraction of cropped arable land under cultivation is 96%, which remains consistent with the average of the 5YA. The CPIx in the region was 0.96, which is less than 1, and the crop production situation was generally normal.

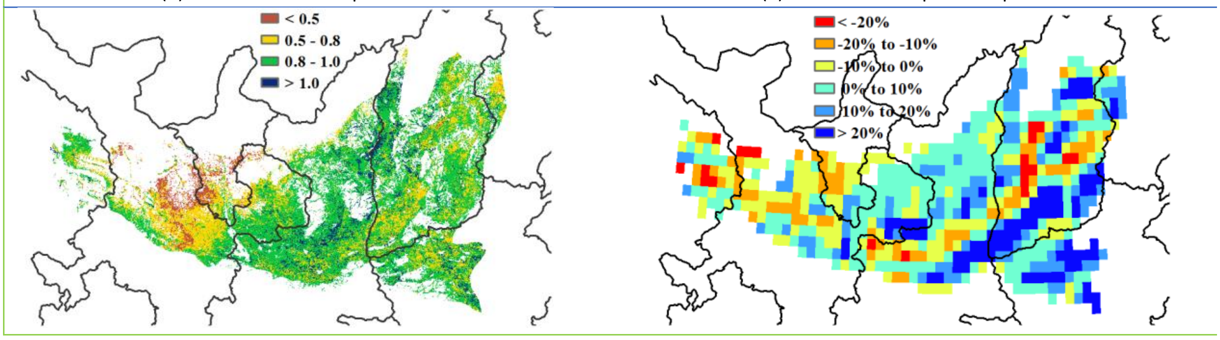
Figure 4. 12 Crop condition China Loess region, April - July 2023



(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

Lower Yangtze region

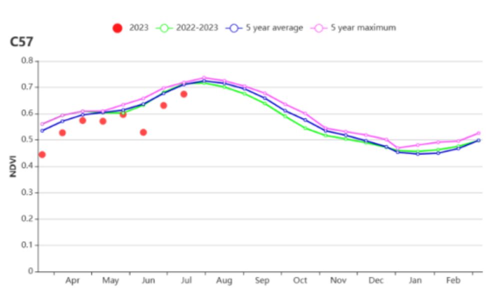
During this monitoring period, winter wheat and rapeseed had reached maturity by June in Hubei, Henan, Anhui and Jiangsu provinces. The semi-late and late rice crops are still growing in the south and the center of the region including Jiangsu, Fujian, Jiangxi, Hunan, and Hubei provinces, while early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

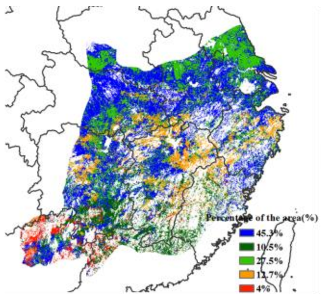
According to the CropWatch agro-climatic indicators, the accumulated precipitation was 8% below the average. Temperature and photosynthetically active radiation were 0.5℃ and 2% higher than the 15-year averages, respectively. The agro-climatic condition with abundant sunlight resulted in an increase of biomass potential production by 6%. The rainfall profile indicates that late June and late July precipitation exceeded the 15-year average.

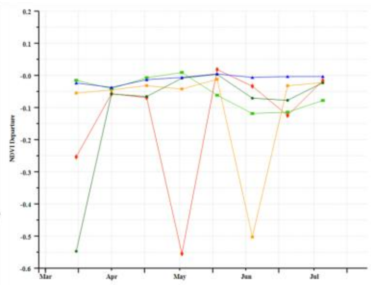
As shown in the NDVI development graph, crop conditions were slightly below the 5-year average. 45.3% of the monitoring area, including the northern parts of the region such as Anhui, Henan, southern Jiangsu, and Hubei, as well as Hunan, and central Jiangxi, showed crop conditions close to average. The crop conditions in other parts were slightly below average. The potential biomass departure indicates that the agro-climatic conditions were generally above average in most areas, with potential biomass departure values mostly in the range of 0-20%. The potential biomass in the northern part of this region was slightly better than the other regions, which was generally consistent with the NDVI distribution. The average VCIx of this region was 0.90, and most of the area had VCIx values ranging from 0.8 to 1.

In general, the crop conditions in the Lower Yangtze region were close to average.

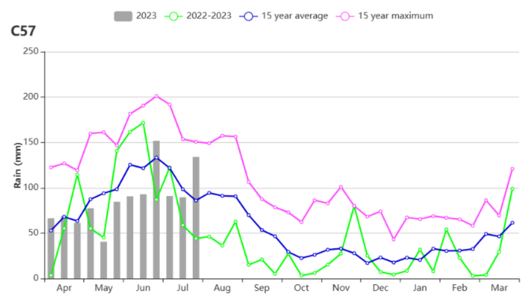
Figure 4. 13 Crop condition China Lower Yangtze region, April - July 2023

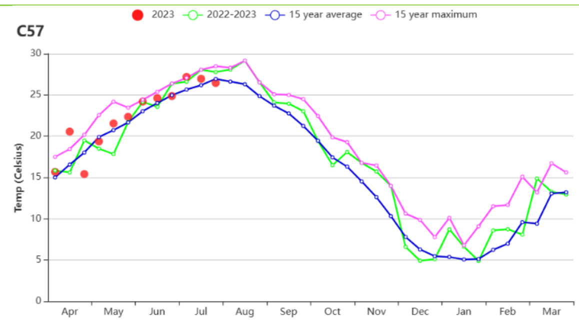




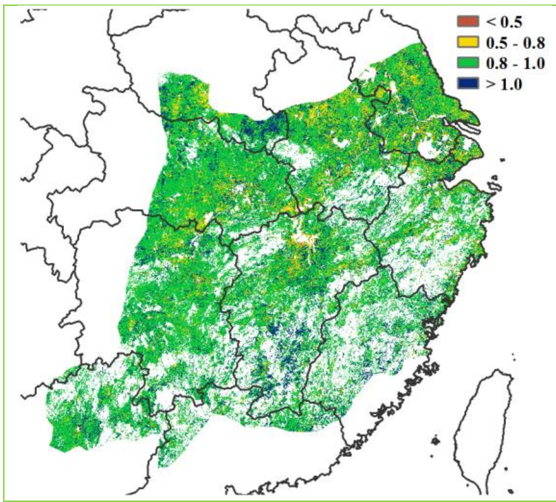


(a) Crop condition development graph based on NDVI (b) Spatial NDVI patterns compared to 5YA (c) NDVI profiles

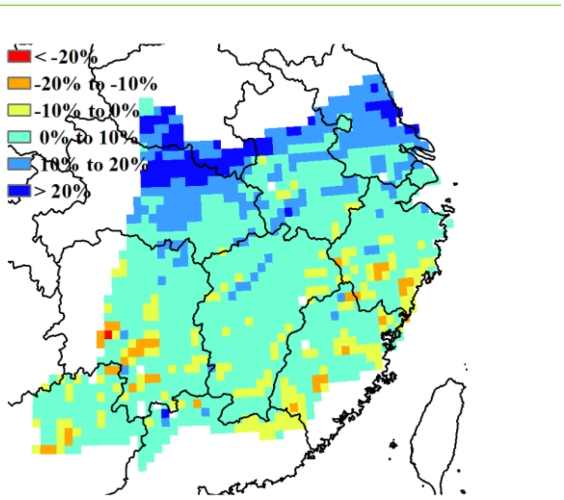




(d)Time series rainfall profile (e)Time series temperature profile



(f) Maximum VCI



(g) Biomass departure

Southwest region

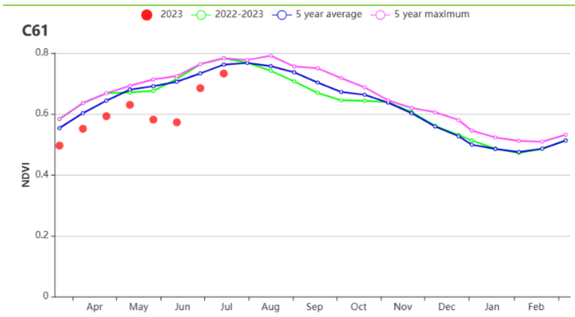
The reporting period covers the harvest of winter wheat in southwestern China, which was concluded by late April. Summer crops (including semi-late rice, late rice, and maize) are still growing. In general, crop conditions in the southwest region were slightly below the average of the last five years.

According to the CropWatch agro-climatic indicators, the drier and warmer than usual weather continued from the previous reporting period, with precipitation of 790 mm (-12%), and the TEMP was 0.6℃ higher than 15YA， RADPAR was close to the average (+1%). The higher temperatures and lower rainfall led to a slight decrease in potential biomass. The maximum Vegetation Condition Index (VCI) was 0.91, lower than 0.94 in the same period of last year. The CALF was similar to previous years, indicating full utilization despite the less favorable weather conditions.

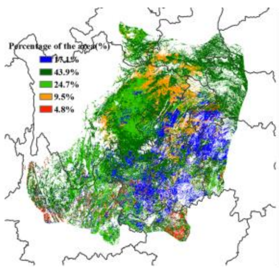
The NDVI-based crop condition profiles continued below the 5-year average throughout the reporting period. The crop condition development graph based on NDVI shows that crop conditions were slightly below average in almost all regions during this monitoring period, especially in the light green areas (about 24.7% of the region) located mainly in the eastern part of Sichuan and the northern part of Yunnan. The Maximum VCI map also shows this phenomenon. This was mainly due to the drier and warmer weather. The potential biomass map shows that northern Yunnan has been particularly affected.

In summary, due to the lasting warmer and drier than usual weather, crop conditions in Southwest China were slightly poorer than average.

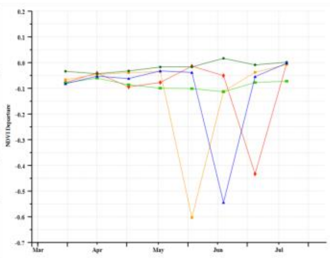
Figure 4. 14 Crop condition China Southwest region, April - July 2023



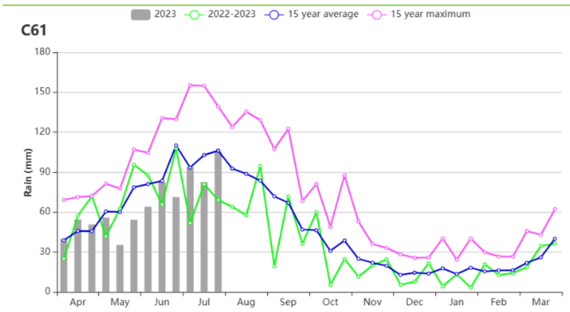
(a) Crop condition development graph based on NDVI



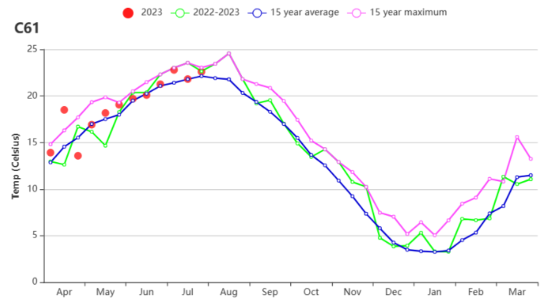
(b) Spatial NDVI patterns compared to 5YA



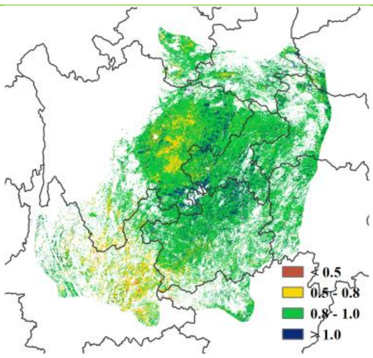
(c) NDVI profiles



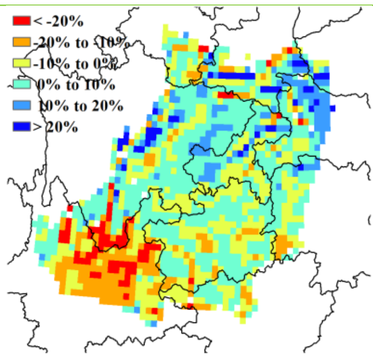
(d)Time series rainfall profile



(e)Time series temperature profile



(f) Maximum VCI



(g) Biomass departure

Southern China

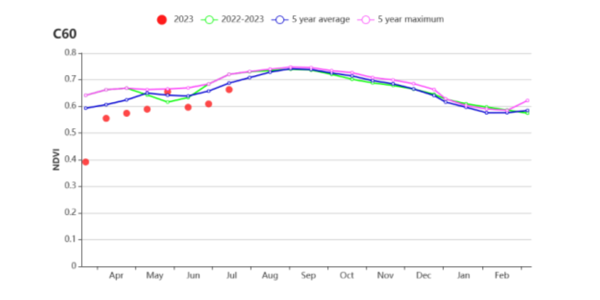
During the monitoring period, the harvest of early rice had been completed. In July, late rice was partially transplanted. The crop condition development graph based on NDVI showed that the crop conditions were below the five-year average.

According to the CropWatch agro-climatic indicators, the accumulated precipitation during this period was 1063 mm (-21%), which was lower than the average for the same period in the past 15 years. The temperature was 23.5℃ (+0.9℃), which was higher than the average, and RADPAR was 6% higher. The potential biomass was 2% lower due to the lower precipitation. CALF was slightly above the average for the same period in the past 5 years.

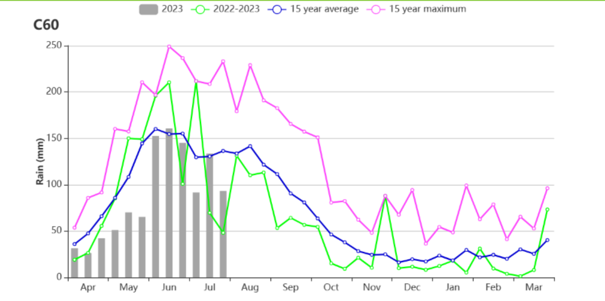
According to the NDVI departure clustering map and the profiles, crop condition in 41.1% of the region's cropland was close to the average throughout the monitoring period. Due to insufficient precipitation, the crop conditions in the eastern part of Guangxi and Guangdong experienced a significant decrease in the first half of April. However, it approached average thereafter. Crop conditions in certain areas of Yunnan and the western and southeastern parts of Guangxi experienced a significant decline in June and July. BIOMSS shows below-average biomass in Yunnan and Western Guangxi, which may be associated with a decrease in precipitation. The VCIx for the whole region was 0.93.

In general, crop condition in Southern China was slightly below average in the monitoring period.

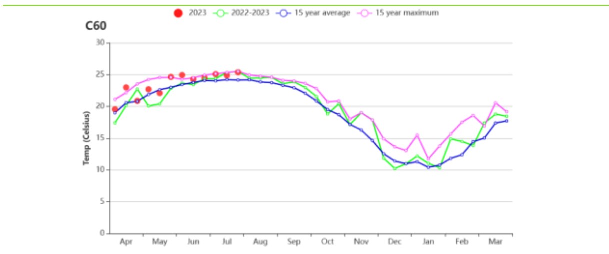
Figure 4. 15 Crop condition Southern China, April - July 2023



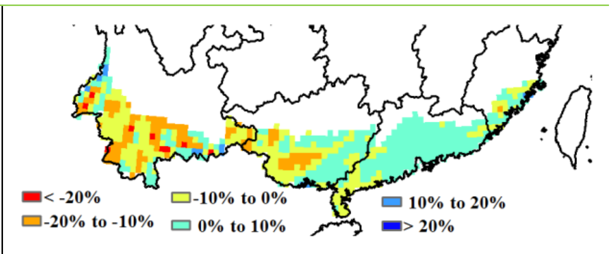
(a) Crop condition development graph based on NDVI



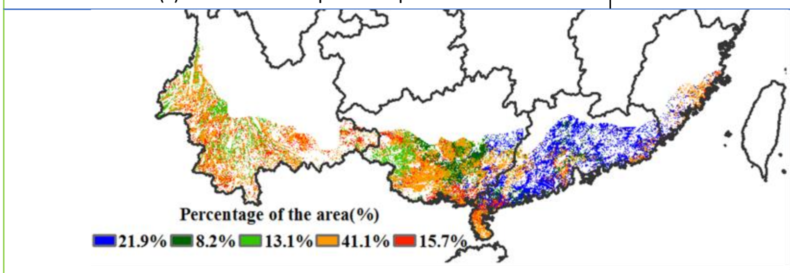
(b)Time series rainfall profile



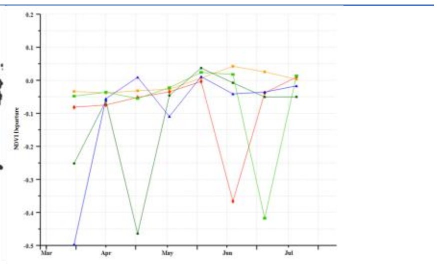
(c)Time series temperature profile



(d) Biomass departure



(e) Spatial NDVI patterns compared to 5YA



(f) NDVI profiles

4.4 Major crops trade prospects

Maize

In the first half of the year, China imported 12.033 million tonnes of maize, a decrease of 11.5% compared to the previous year. The main source countries for corn imports were the United States, Ukraine, and Brazil, accounting for 39%, 36%, and 18.4% of the total imports, respectively.

Rice

In the first half of the year, China imported 1.806 million tonnes of rice, a decrease of 49.6% compared to the previous year. The main source countries for rice imports were Vietnam, Myanmar, Thailand, India, and Pakistan, accounting for 38.1%, 21%, 12.8%, 11.8%, and 8.1% of the total imports, respectively.

Wheat

In the first half of the year, China imported 8.011 million tonnes of wheat and wheat products, a growth of 62.1% compared to the previous year. The primary source countries for wheat imports were Australia, Canada, and France, accounting for 63.2%, 16.6%, and 10.2% of the total imports, respectively.

Soybean

In the first half of the year, China imported 52.575 million tonnes of soybeans, an increase of 13.6% compared to the previous year. The primary source countries for soybean imports were Brazil, the United States, Argentina, and Canada, accounting for 56.5%, 37.5%, 2.7%, and 1.8% of the total imports, respectively.

Trade prospects for major cereals and oil crop in China for 2023

On the basis of remote sensing-based production prediction in major agricultural producing countries in 2023 and the Major Agricultural Shocks and Policy Simulation Model, it is predicted that the import of major grain crops will decrease in 2023. The details are as follows:

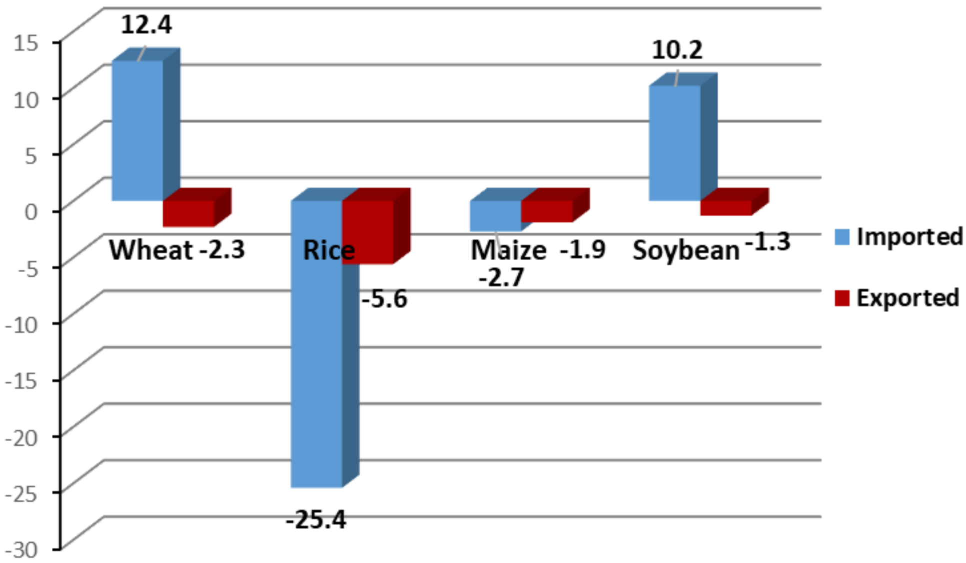
In 2023, China's maize imports will decrease by 2.7%, and exports will reduce by 1.9%. Influenced by the international wheat-maize price ratio, maize's utilization for livestock feed in the first half of the year has been partially replaced by wheat. This has led to a decrease in maize imports. However, with positive factors such as the opening of the Brazilian maize export channel to China, maize imports are expected to increase in the latter half of the year. It is projected that China's maize imports will decrease slightly in 2023.

In 2023, China's rice import will decrease by 25.4%, while exports will decrease by 5.6% in 2023. Factors such as India's new export restrictions have contributed to increased variability in global rice trade. Coupled with production reductions due to disasters and other factors, China's demand for rice imports has weakened. It is anticipated that China's rice imports will decrease in 2023.

In 2023, China's wheat imports will increase by 12.4%, while exports will decrease by 2.3% in 2023. The main driving factors behind China's wheat imports include strong demand for high-quality specialized wheat domestically and an increase in consumption for livestock feed. With economic recovery post the COVID-19 pandemic, China's wheat imports are expected to remain at a relatively high level in 2023.

In 2023, China's soybean import will increase by 10.2%, while exports will remain relatively stable. Despite vigorous efforts to enhance domestic soybean oilseed production capacity, imported soybeans remain the primary raw material for soybean processing. Countries like Brazil and the United States continue to be the main sources of soybean imports for China. It is anticipated that China's soybean imports will increase in 2023.

Figure 4. 16 **Rate of change of imports and exports for rice, wheat, maize, and soybean in China in 2023 (%)**



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 2023 (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 47 major producers and exporters are estimated and predicted from January to mid-August 2023. This assessment included remote sensing monitoring, predictions, and verification of yield for major staple crops (corn, rice, wheat, and soybean) that were either in their growing period or close to harvest. The results are as follows.

Production estimates

From April to July 2023, the world transitioned steadily from La Niña to El Niño, despite temperature records being broken continuously. The occurrence of extreme events during this period was generally weaker compared to 2022, resulting in a less adverse impact on the production of crops. Remote sensing monitoring indicated that the global production of crops in 2023 reached 2.877 billion tonnes, an increase of approximately 17.1 million tonnes or about 0.60%. Specifically, maize production is projected to reach 1.072 billion tonnes, marking an increase of 26.94 million tonnes or 2.6% compared to the decreased production (1.045 billion tonnes) in 2022, yet remaining below the peak in 2021. Global rice production is estimated at 750 million tonnes, with a decrease of 4.4 million tonnes or 0.6%. Global wheat production is forecasted to be 736 million tonnes, down by 4.45 million tonnes or 0.6%. Global soybean production is anticipated to reach 319 million tonnes, reflecting a decrease of 0.99 million tonnes or 0.3% (Table 5.1).

Table 5.1 2023 cereal and soybean production estimates in thousand tonnes. Δ is the percentage of change of 2023 production when compared with corresponding 2022 values.

	Maize		Rice		Wheat		Soybean	
	2021	Δ%	2021	Δ%	2021	Δ%	2021	Δ%
Afghanistan					3,090	-14.6		
Angola	2,730	-0.2	47	-4.2				
Argentina	49,690	-9.6	1,791	-3.0	10,943	-14.1	42,005	-18.9
Australia					28,662	-11.0		
Bangladesh	3,517	-5.3	47,796	-0.4				
Belarus					2,856	-4.5		
Brazil	100,679	10.3	11,137	-1.9	7,510	-3.1	106,615	12.1

	Maize		Rice		Wheat		Soybean	
	2021	Δ%	2021	Δ%	2021	Δ%	2021	Δ%
Cambodia			9,871	0.8				
Canada	11,349	-2.2			27,951	-6.6	7,823	3.1
China	232,240	2.2	193,346	-1.0	134,723	0.4	17,156	-5.7
Egypt	6,214	2.6	6,953	5.6	11,331	0.8		
Ethiopia	7,869	37.6			4,713	38.1		
France	13,239	1.9			33,422	0.2		
Germany	4,239	-3.1			23,906	-4.7		
Hungary	5,110	5.2			4,514	1.4		
India	17,113	-9.1	174,607	-0.9	97,584	4.7	13,674	1.0
Indonesia	18,714	-2.3	64,508	-1.2				
Iran			2,521	-2.6	12,040	9.7		
Italy	5,673	11.6			7,836	6.4		
Kazakhstan					11,726	-9.5		
Kenya	2,329	20.4			301	11.5		
Kyrgyzstan	673	-12.9			614	-17.4		
Mexico	24,221	4.6			3,494	-13.0		
Mongolia					309	3.6		
Morocco					6,942	14.8		
Mozambique	2,254	2.2	398	-0.4				
Myanmar	1,864	-3.7	22,886	-7.0				
Nigeria	10,031	5.0	4,528	10.7				
Pakistan	5,864	2.0	10,968	6.8	25,093	-1.9		
Philippines	7,884	6.1	20,809	-2.3				
Poland					10,031	-2.5		
Romania	11,240	-0.3			7,333	5.6		
Russia	13,981	2.3			82,942	-3.8	3,799	-0.4
South Africa	12,211	3.0			1,730	8.4		
Sri Lanka			2,428	-2.4				
Thailand	3,928	-8.6	37,765	-2.8				
Turkey	6,621	1.9			18,770	11.3		
Ukraine	25,854	1.9			22,625	5.6		
United Kingdom					12,440	-1.6		
USA	377,377	3.8	11,246	5.2	55,640	7.9	100,478	-1.2
Uzbekistan					6,558	-21.3		
Vietnam	4,984	-4.5	46,754	0.1				
Zambia	3,656	2.8			246	0.1		
Syria					3,147	53.1		
Algeria					1,684	-35.3		
Laos			3,780	0.5				
Lebanon					151	51.0		
Sub-total	993,348	2.8	674,138	-0.9	682,858	-0.1	291,551	-0.1

	Maize		Rice		Wheat		Soybean	
	2021	Δ%	2021	Δ%	2021	Δ%	2021	Δ%
Others	78,765	0.3	76,040	2.1	52,754	-6.9	27,505	-2.8
Global	1,072,113	2.6	750,178	-0.6	735,613	-0.6	319,056	-0.3

Maize

The three leading maize-producing countries experienced production increases, providing a foundation for global growth, yet maize production in 2023 remained below the peak of 2021. As the world's largest maize producer, the United States encountered delayed spring temperatures during planting, coupled with lower rainfall in late May affecting germination and early growth. However, the overall normal rainfall since late June in the main producing regions provided suitable moisture conditions for maize production, projecting a production increase to 377.38 million tonnes, a significant increase of 13.78 million tonnes or 3.8%. China witnessed increased maize cultivation area, with overall higher rainfall favoring maize production in the Huang-Huai-Hai region and Northeast, even though localized flooding occurred. Consequently, China's maize production increased to 232.24 million tonnes, an increase of 5.05 million tonnes of 2.2%. Brazil experienced both a decrease in the first-season maize and an expansion of planting areas for the second-season maize. Due to improved irrigation and increased yields for the second season, Brazil's total maize production is anticipated to reach 100.68 million tonnes, reflecting a 10.3% increase. Compared to the extremely hot and dry conditions in 2022, Europe's most maize-producing countries generally enjoyed favorable weather conditions in 2023. Benefitting from overall abundant rainfall, countries like France, Hungary, Italy, Ukraine, and Russia experienced increased maize yields of 1.9%, 5.2%, 11.6%, 1.9%, and 2.3%, respectively. Ethiopia and Kenya in the Horn of Africa rebounded from drought, experiencing a significant recovery in maize production with increases of 37.6% and 20.4%, respectively. Several countries in Africa, including Mexico, Nigeria, Pakistan, Mozambique, Zambia, and South Africa, witnessed varying degrees of increased maize production. Argentina, however, was affected by continuous drought, resulting in a substantial reduction in maize production by 9.6%. India's maize production was negatively affected by flooding, leading to decreased cultivation areas and yields, projecting a reduction of 9.1% to 17.11 million tonnes.

Rice

Most rice-producing countries experienced a slight decrease in rice production, resulting in a global decline of 4.4 million tonnes or 0.6%. As the world's largest rice producer, China is expected to be 193.346 million tonnes of total rice production, down by 1.0% due to reduced cultivation areas. Adverse weather conditions, including excessive rainfall during heading and flowering, affected both early-season and single-season rice in major producing regions and northern China. Southeast Asian countries, including Bangladesh, Indonesia, the Philippines, Thailand, Myanmar, and Sri Lanka, experienced normal to slightly below-average rainfall during the rainy season, leading to decreased rice yields and resulting in lower rice production. However, excessive rainfall occurred in Pakistan and India in July, leading to localized flooding. Pakistan's rice production was expected to increase by 6.8%, while India's rice production decreased slightly by 0.9%. Vietnam, Cambodia, Nigeria, and the United States saw varying degrees of increased rice production. Overall, the global rice production and supply remained stable.

Wheat

The production for major wheat-producing countries varied significantly. Agro-climatic conditions improved notably in East Africa and the Middle East, leading to increased wheat production. Conversely, South America and Australia witnessed decreased wheat production. As the world's largest wheat producer, China experienced favorable weather conditions earlier in the season, but "flooding during grain-filling" impacted wheat yield during the maturity period, resulting in a yield to 134.72 million tonnes, an increase of 0.4%, However, decreased by 1.6 million tonnes compared with prediction in May. India and Pakistan experienced normal agro-climatic conditions during the wheat growth period. Due to irrigation, yields were higher compared to the extreme heat in 2022, with India's wheat planting area increasing and yielding a production increase of 4.7%. Pakistan, however, faced a yield reduction of 1.9% due to decreased cultivation areas of 4.3%. In Russia, wheat production decreased to 82.94 million tonnes, a decrease of 3.8%, primarily due to drought during May and June. The wheat production of the United States, despite experiencing unfavorable weather conditions during early growth, saw an increase of 7.9% to 55.64 million tonnes. Syria, Ethiopia, Morocco, Turkey, Iran, and Lebanon, the 6 largest increases among the major wheat-producing countries, experienced recovery increases in wheat production compared to the extreme drought year of 2022, with an increase of more than 9%. European countries, such as Hungary, Romania, Italy, and Ukraine saw increased wheat cultivation areas and yields, with an increase in production of 1.4%, 5.6%, 6.4%, and 5.6%, respectively. Afghanistan and Central Asian countries, including Kazakhstan, Uzbekistan, and Kyrgyzstan, experienced a reduction in both cultivation areas and yields. In the Southern Hemisphere, Australia, Argentina, and Brazil witnessed decreased wheat production by 11.0%, 14.1%, and 3.1% respectively, while wheat production in South Africa increased by 8.4%. Overall, while wheat production in major producing countries remained relatively stable, global wheat production decreased by 0.6% due to significant reductions in other countries, even resulting in the lowest production in 5 years. This decline, combined with Russia’s cessation of exporting agricultural products from Black Sea ports, has led to a tense global wheat supply situation.

Soybean

Soybean production increased in the Southern Hemisphere, but the situations in Brazil and Argentina varied significantly. Northern Hemisphere soybean cultivation areas decreased, resulting in an overall production reduction. Global soybean production decreased slightly by 0.3%. Argentina's soybean production was severely impacted by continuous drought and low rainfall throughout the growing period, leading to a substantial reduction in both cultivation areas and yields. The soybean production decreased to 42.01 million tonnes, a reduction of up to 9.77 million tonnes, reaching the largest reduction for the 5 years. In contrast, Brazil experienced normal rainfall, and adequate water supply during the crucial pod-filling period resulted in increased yields. As a result, Brazil's soybean production recovered to 106.61 million tonnes, an increase of 12.1%, offsetting the impact of reduced production in Argentina and resulting in an increased soybean production by a cumulative 1.71 million tonnes in Argentina and Brazil. The United States and China witnessed favorable agro-climatic conditions during the soybean growth period, with suitable moisture and temperature contributing to favorable yields. However, both countries experienced a reduction in cultivation areas, leading to production decreases of 1.2% and 5.7%, respectively. Canada and India saw increased soybean production by 3.1% and 1.0% respectively, while Russia's soybean production slightly decreased by 0.4%. The cumulative decrease by 1.9 million tonnes in soybean production in the Northern Hemisphere, exceeded the increase in the Southern Hemisphere, resulting in a global soybean production decrease to 319.06 million tonnes, a decrease of 0.3%. Overall, the global soybean supply situation remained relatively stable.

5.2 Disaster events

Introduction

This section covers the April-July 2023 disaster events worldwide. Among others, this section highlights the current situation of global flood events, desert locusts as well as the current food production and international food prices situation in the context of Russia-Ukraine conflict.

Global Food insecurity situation: As the global population continues to grow and environmental pressures mount, achieving and maintaining food security becomes a complex and multifaceted issue. This encompasses not only the production and distribution of food but also the stability of food systems in the face of a deadly combination of factors such as political conflicts, economic shocks, climate extremes, and soaring fertilizer prices, which are at the root of the rising numbers. Since 2022, the economic fallout of the COVID-19 pandemic, combined with the Russia and Ukraine conflict, has pushed prices up and put food out of reach for millions of people across the world. As a result, according to the World Food Program (WFP), up to 783 million people (about one in ten of the world's population) still go to bed hungry each night. Estimates from 73 countries also indicate that more than 345 million people (representing an increase of almost 200 million since early 2020, pre-COVID-19 levels) are facing high levels of food insecurity, and over 40 million people across 51 countries are experiencing emergency or worse levels of acute food insecurity in 2023.

Extreme conditions by type

Conflicts

Russia-Ukraine conflict: The Russia and Ukraine conflict from February 2022 resulted in trade disruptions. While global prices for food have since retreated from their peaks, they remain considerably higher compared to pre-COVID levels. This has contributed to notable domestic inflation in food prices across many countries. Amidst the ongoing conflict, pessimistic export prospects for Ukraine continues in 2023. Producers in the region continue to grapple with high fuel and input costs, and low product prices. Russia halted the Black Sea Grain Initiative as of July 17. Hence, grains cannot be shipped out of Ukraine's Black Sea ports anymore.

CropWatch's assessment of crop conditions based on NDVI profiles in this region during the April-July 2023 reporting period reveals that the conditions for wheat were relatively favorable. Although these conditions initially declined, they rebounded by the end of the reporting period, surpassing those observed during the same period in 2022, shortly after the war began. The pace at which the region recovers, along with the eventual stabilization of global market dynamics and food security implications, hinges largely on the resolution of the conflict.

Ongoing conflicts in Sudan and South Sudan: Despite the signing of a peace agreement in 2018, the situation in South Sudan has taken a concerning turn, as the number of armed groups operating within the country has increased. This escalation in conflict is compounded by the impact of climate change, which has manifested in the form of remarkably intense rainfall, further exacerbating the challenges faced by the nation. The resulting floods have uprooted communities from their homes, leaving them not only displaced but also grappling with the severe lack of essential resources, such as food and clean water. The intersection of conflict and climate-induced disasters has culminated in a deeply distressing scenario for the people of South Sudan. More than 7.8 million individuals within the country are anticipated to confront a critical deficit in meeting their basic food requirements throughout the year 2023. This figure marks a distressing escalation from the already troubling statistic of 6.3 million people who experienced food insecurity in the preceding year, 2022. The consequences of these circumstances are disheartening and shocking. These figures underscore the urgent need for comprehensive and immediate interventions, both domestically and through international aid efforts, to address the complex interplay between conflict, climate change, and the impending food crisis that South Sudan is grappling with.

The situation is also quite dire in the Sudan. In April, an armed conflict between the military and a rebel leader started. So far, it has resulted in 1.1 million refugees and 3 million internally displaced people. Rainfed crop production is limited to the period from July to October. The lack of inputs, such as seeds and fuel, disrupted the timely sowing of the crops in some regions.

Desert locust

During the month of April to May, the Desert Locust situation remained calm. However, the small outbreak that developed from the spring breeding in March increased in Saudi Arabia in April. By the end of April, some late hopper groups, bands, and new immature adult groups were observed. Furthermore, in Northwest Africa, there were small hopper groups and bands present in the south of the Atlas Mountains in Morocco, as well as further south in Western Sahara, and control measures were carried out.

By the end of the April-July report period, the situation remained calm (**Figure 1**). However, Due to the conclusion of spring breeding and management efforts in Saudi Arabia, small clusters and swarms migrated to northern Yemen and traversed the country's interior where control measures were implemented. Hopper and adult groups were addressed in the Nile Valley of Sudan, as well as along the Red Sea coastline of Eritrea, where some ventured into the highlands. Adult locusts were observed in north-eastern Ethiopia, northwestern Somalia, and the southern regions of Oman and Egypt.

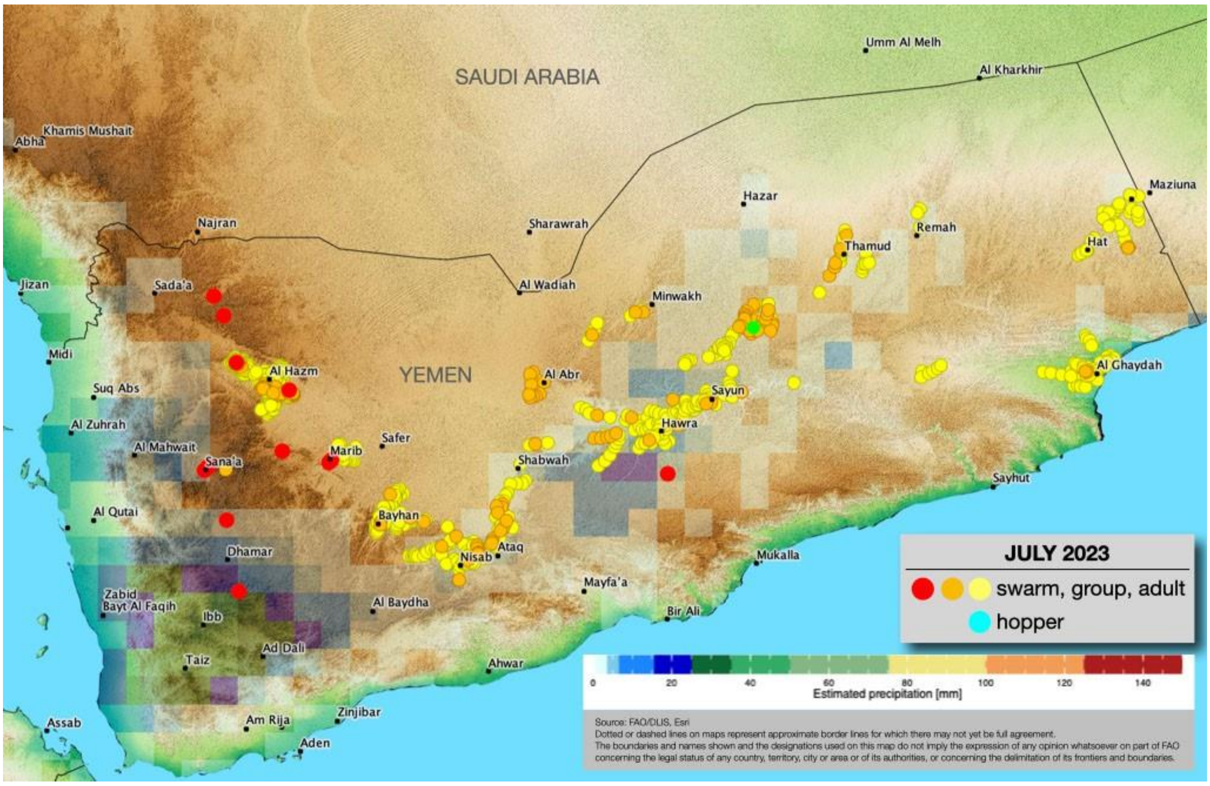


Figure 5.1. Desert Locust situation in July 2023

In the western sector, adult locusts were sighted in the northern Sahel of Mauritania, where the initial summer generation of hoppers emerged in the latter part of the month. A limited number of adult locusts were also noted in Niger. Spring control operations concluded in Morocco, resulting in only a small presence of adult locusts in Algeria. The onset of the southwest monsoon was experienced in the Indo-Pakistan region, where a small number of adult locusts were present.

As for the forecast, favorable rainfall is expected in the northern Sahel region from Mauritania to western Eritrea. This will lead to minor breeding activities accompanied by scattered hoppers during the months of August and September, followed by fledging after mid-September. In early August, there might be a few small clusters or swarms in northern Ethiopia. According to model predictions, limited rainfall is anticipated in the summer breeding areas of Yemen and Indo-Pakistan.

Floods events

China: Typhoon Doksuri and Khanun have made a powerful impact on China's north-eastern provinces: Heilongjiang, Jilin, and Liaoning. These provinces play a crucial role in China's agricultural output as they are known as the nation's main sources of grain. The increasing frequency of extreme weather events is causing serious concerns in China's agriculture sector. This trend is pushing Beijing to prioritize self-sufficiency, which has become even more important due to disruptions in the global market stemming from the Russia-Ukraine conflict.

Heilongjiang's Wuchang City, renowned for producing the highest quality rice in the nation, has not been spared from the recent impact of the typhoon. China's Ministry of Emergency Management reported that flooding has affected more than 2,720 hectares (6,721 acres) of its farmland, including 2,436 hectares of rice, as of Friday. **Figure 2** shows some of the impacted cropland in Shulan City, Jilin province. This continuous downpour has led to more than 15,000 hectares of productive agricultural land being submerged. Meanwhile, in the mountainous western outskirts of Beijing, an extended period of heavy rainfall has caused significant damage.

Figure 5.2 Impacted cropland in Shulan City, Jilin province
(Source: https://www.theguardian.com/world/2023/aug/07/china-floods-rain-weather-deaths-jilin-province-shulan-city)

India: With data from CropWatch's agronomic indicators revealing an increase in national rainfall compared to the average of the past fifteen years by 4%, North Lakhimpur experienced a notable downpour of 164 mm within a 24-hour span by June 15th. This led to the Singra River overflowing its banks, causing flooding in Nowboicha Town within the Lakhimpur District. Substantial impacts on the lives of Indian citizens have been documented.

Given that the heavy rainfall has caused damage to recently planted crops intended for winter harvesting, India has taken the step of halting the export of non-basmati varieties of rice. The retail prices of rice have risen by 3% in June alone and by 11.5% over the past year. Considering these developments, the government aims to curb food inflation by reserving a larger portion of the grain supply for the domestic market.

Drought

Situation in the Maghreb Region: The Maghreb region has been grappling with an continuing drought in recent years, and its profound repercussions are notably affecting crop yields. In contrast to historical trends, the forthcoming crop harvest in the region is anticipated to fall significantly below the established average. The intensity of the drought had escalated particularly in late March and early April, hampering the photosynthesis process of winter cereals since the flowering stage.

Afghanistan: Afghanistan has been experiencing below-normal rainfall since October 2020. These conditions have affected the accumulation of snow during the winter season, which is critical for water access during the spring and summer agricultural seasons. This persistent drought across Afghanistan is taking its toll on farmers, and its economy - a third of which is generated by agriculture, and food security. The drought situation in the country is exacerbated by climate change which leads to intensifying pressure on water resources. This situation has left nearly 20 million people in a state of food insecurity during the least productive season of 2023. However, recent reports from the WFP indicate that by October 2023, this number may decrease to 15.3 million (including 2.8 million people in Integrated Food Security Phase Classification (IPC) Phase 4 aimed at sustained humanitarian assistance.

Argentina: During the summer of 2022-20023 an unprecedented drought intensified causing extensive crop failures and a macro-economic crisis. This period of abnormally low precipitation was the outcome of a 3 consecutive La Niña events worsened by frequent and strong heatwaves. While its impact upon crop production has not been accurately estimated yet, the idea that crops were decimated by the drought is widespread. We contend that the description of the spatial variation in the drought magnitude and of its impacts upon crops contributes to identify differences in management practices and environmental factors that may improve Argentinean agriculture resilience to climate change. Therefore, here we sought to map drought severity and its impacts on extensive grain crops performance using standard satellite remote sensing products.

Our study area encompassed ca. 33 Mhas as mapped by the National Crop Type Map produced yearly by INTA. Climatological drought was characterized by means of the standard Palmer Drought Severity Index generated by the University of Idaho [1] and accessed through the Google Earth Engine platform. Agricultural drought was quantified through the ratio of evapotranspiration to potential evapotranspiration (ET:PET) taken from the MOD16A2 product at 500m and 16 days spatiotemporal resolution. Finally, the temporal dynamic of the NDVI from the MOD13A1 product was used as a proxy for crop performance. Both, ET:PET and NDVI, were standardized on a 16 day basis (i.e. 2022 observations were subtracted to the mean of 2001-2021 for that 16 days interval and divided by the standard deviation).

Preliminary results showed that the difference between 2022 and the mean of 2001-2021 PDSI averaged over all cropland area amounted to -5,48 (standard deviation: 0,25) almost doubling the -3 threshold usually assumed to represent severe to extreme drought (Figure. 3). The temporal dynamics over the year 2022 of the standardized ET:PET ratio and NDVI differed among regions. Both, agricultural drought conditions and the crop radiation interception were the lowest –except for a short summer period- in the cold southern Pampa as evidenced by the ET-PET and NDVI aggregated over the Tres Arroyos county (Figure 3).

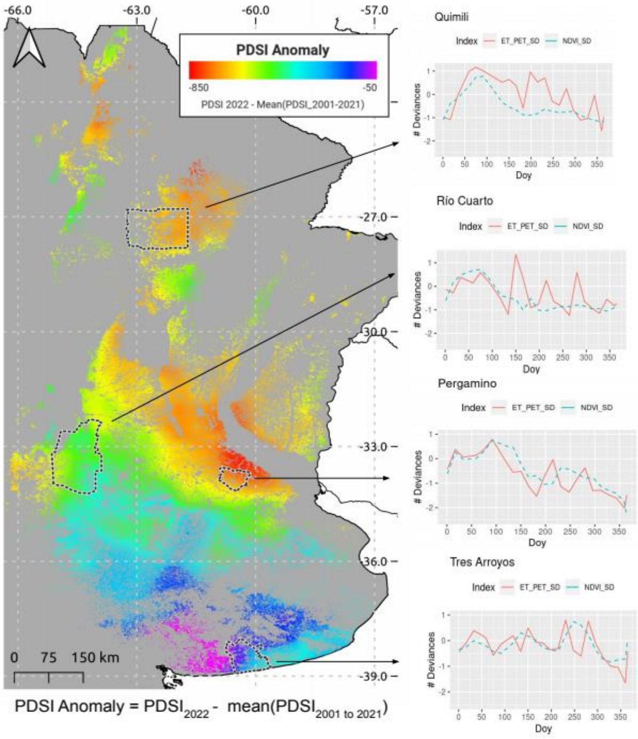


Figure 5.3 Climatological drought assessed by the PDSI anomaly over overall croplands of Argentina. Insets: Standardized ET:PET and NDVI time series for 4 distinct agricultural counties.

Contrarily, Pergamino, a county located in the main agricultural area of Argentina, experienced severe reduction in crop ET and radiation interception with only a short fallow period, centered around day of year 100, of above normal conditions. The rest of the year the drought and its impacts intensified reaching -2 standard deviation from the 2001-2021 means. In turn, Rio Cuarto, one of the most important maize producing counties, displayed mild drought conditions –and its concomitant crop impacts, neither exceeded the -1 standard deviation - albeit being located to the west were precipitation are lower than Pergamino. Finally, Quimilí (Moreno) county in the warmer Santiago del Estero province, drought conditions developed over the second half of the 2022 where croplands were fallowing.

These results agree with our observations through periodic crop surveys and with recent studies. Particularly, there is evidence that the shallow water table significantly contributes to crop ET to the mid-west of the Argentinean croplands (as observed in Rio Cuarto) and thus may have alleviated the effects of low precipitation. On the other hand, in Pergamino and the surrounding counties of the Rolling Pampas cover crops as well as double cropping are frequent and may underlie the acute drought effects therein.

5.3 Update on El Niño

According to the Australian Bureau of Meteorology, predictions for the El Niño – Southern Oscillation (ENSO) are at El Niño ALERT status. Sea surface temperatures (SSTs) in the tropical Pacific have exceeded the threshold for an El Niño event and climate models suggest this is likely to persist at least until the end of this year.

Figure 5.3 shows the progression of the standard Southern Oscillation Index (SOI) over the past 12 months from July 2022 to July 2023. The SOI has remained in negative territory and at low values over the past four months, dropping to -18.5 in May. The average SOI for the past two months has been -7 or lower. While the SOI is an important indicator for tracking tropical pressure changes, a broader range of atmospheric and oceanic conditions need to be considered when assessing ENSO status. This includes winds, cloud, ocean currents, surface and sub-surface ocean temperatures, and the outlook over the next few months.

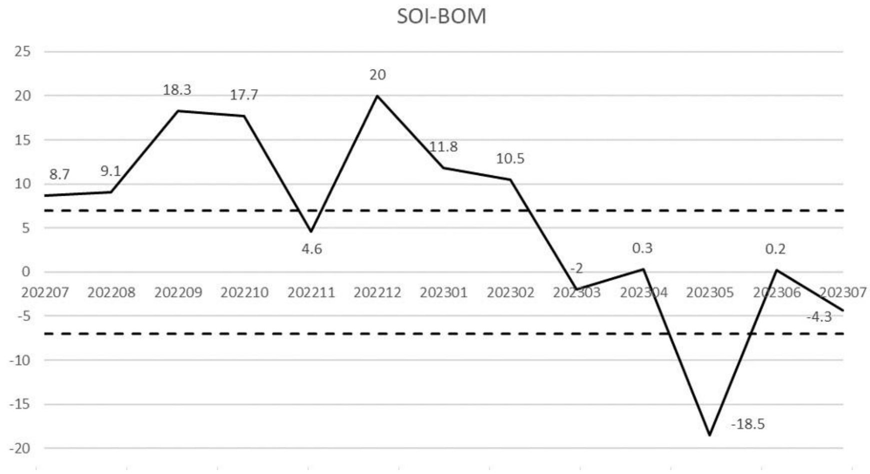


Figure 5.4 Monthly time series of the SOI-BOM from July 2022 to July 2023(Source: http://www.bom.gov.au/climate/enso/soi/)

Another commonly used measure of El Niño is called the Oceanic Niño Index (ONI). Figure 5.4 shows the progression of several ONI values and their locations. In June 2023, the values for the three key NINO indices were: NINO3 1.33° C, NINO3.4 0.89° C, NINO4 0.67° C. The May and June data indicate the gradual warming of the tropical Pacific with sea surface temperatures approaching or exceeding historical averages.

In June 2023, sea surface temperatures (SSTs) across almost all the tropical Pacific equatorial region were above average. The anomalous warmth in the eastern tropical Pacific was more than 4° C above average, with positive anomalies extending to the far eastern areas near the South American coast.

Closer to Australia, the Coral Sea continued to experience anomalously warm SSTs, more than 1.2° C above average for much of the region. Warm SST anomalies also persisted in the southern Tasman Sea, extending from southeast of Australia to around the south of New Zealand's South Island. Cool anomalies less than 1.2° C below average remained around the western Australian coastline.

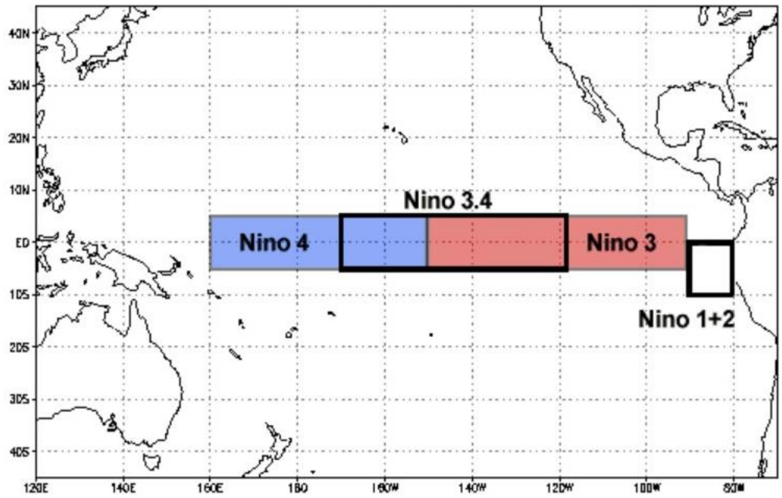


Figure 5.5 **NINO Region Distribution Map（Source: https://www.ncdc.noaa.gov/teleconnections/enso/sst）**

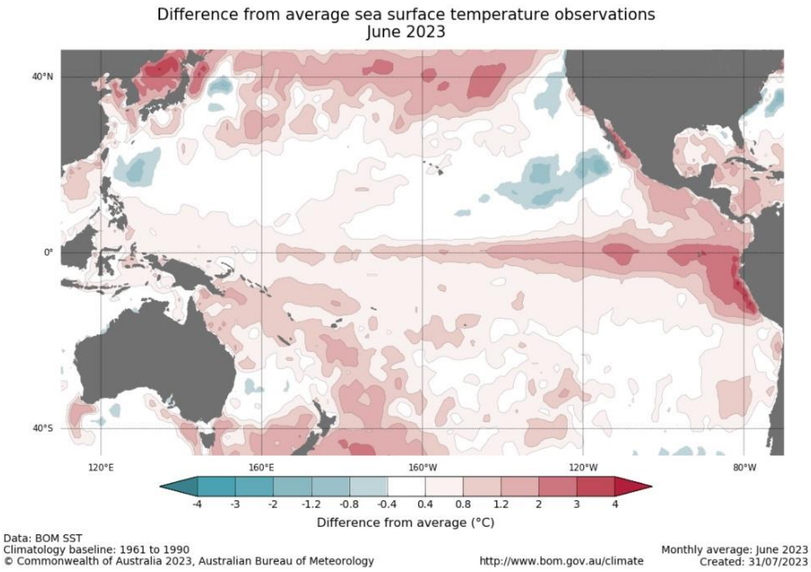


Figure 5.6 Monthly temperature anomalies for January 2023 (Source: http://www.bom.gov.au/climate/enso/wrap-up/#tabs=Sea-surface)

In summary, the tropical Pacific is currently undergoing a warming phase during the southern hemisphere winter. Central and eastern Pacific SSTs are currently above El Niño thresholds. Climate models indicate the central and eastern tropical Pacific may warm further. All surveyed models indicate temperatures will remain above El Niño thresholds at least until the end of this year. If the atmosphere responds to this warming, El Niño is likely to occur.

If the emerging El Niño intensifies as predicted, its effects are likely to be felt across many global regions. An El Niño typically brings drier conditions to parts of Australia, Southeast Asia and southern Africa, increasing risks for agricultural production and wildfires. Wetter than usual weather is expected in South America, the southern U.S. and East Africa, which could lead to flooding concerns. The position of the jet stream over the Pacific and cyclone activity may also be impacted.

Table 5.2 ONI (° C) Anomaly Values from May 2023 to June 2023(Source: https://www.cpc.ncep.noaa.gov/data/indices/sstoi.indices)

Year	Month	NINO3	NINO3.4	NINO4
2023	5	+1.02 °C	+0.53 °C	+0.39 °C
2023	6	+1.33 °C	+0.89 °C	+0.67 °C

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Annex A. Agroclimatic indicators

Table A.1 April 2023 - July 2023 agroclimatic indicators and biomass by global Monitoring and Reporting Unit (MRU)

105 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_zone1 (Cameron, Central African Republic, and South Sudan)	706	-18	24.3	0.5	1196	3	1263	-5
C02	Equatorial central Africa_zone2 (North DRC, Equatorial Guinea, Uganda, Republic of Congo)	830	-9	23.5	0.3	1139	1	1317	-3
C03	Equatorial central Africa_zone3 (South DRC, Rwanda, Burundi, Gabon)	347	-19	23.1	0.4	1206	1	845	-6
C04	Equatorial central Africa_zone4 (Angola, Zambia, and Malawi)	98	-9	18.3	0.7	1170	3	421	-3
C05	East African highlands	554	-27	19.4	0.6	1250	4	862	-9
C06	Gulf of Guinea zone1 (Nigeria, Benin, Togo, Ghana, Cote d'Ivoire, Guinea, and Guinea_Bissau)	353	-22	28.5	0.8	1241	1	905	-12
C07	Gulf of Guinea zone2 (South Nigeria, Liberia, Sierra Leone, south Ghana, south Cote d'Ivoire, and west Genua)	1026	9	25.8	0.3	1147	1	1428	2
C08	Horn of Africa	236	-24	21.2	0.7	1202	3	686	-6
C09	Madagascar(main)	240	-5	19.9	0.4	979	4	673	-2
C10	SW Madagascar	88	38	20.6	-0.5	997	2	439	5
C11	North Africa Mediterranean	91	-8	21.8	1.0	1534	-2	605	-1
C12	Sahel	307	-1	30.3	0.4	1318	0	812	1
C13	Southern Africa_zone1 (West Angolan coast)	296	3	22.4	-0.1	1195	-1	677	0
C14	Southern Africa_zone10 (Middle part of South Africa)	60	-5	12.6	0.2	894	-1	285	-1
C15	Southern Africa_zone2 (southeastern Kenya, East Tanzania, and Mozambique)	194	9	20.8	0.4	1033	4	583	-1
C16	Southern Africa_zone3 (South Zambia)	6	-84	19.1	1.2	1200	5	300	-12
C17	Southern Africa_zone4 (Zimbabwe)	14	-77	17.8	1.0	1111	6	286	-20
C18	Southern Africa_zone5 (Northeast of Namibia, Botswana, and south Zimbabwe and Mozambique)	17	-61	18.6	1.3	1071	0	297	-8
C19	Southern Africa_zone6 (West Namibia coast)	53	12	19.8	0.5	1166	-4	387	4
C20	Southern Africa_zone7 (Southeast Namibia, Southwest Botswana, and northeast of South Africa)	11	-64	13.6	-0.6	931	-1	196	-21

C21	Southern Africa_zone8 (South Africa and southwest Namibia)	207	44	12.8	-1.2	722	-5	485	12
C22	Southern Africa_zone9 (western part of South Africa, Lesotho, and Eswatini)	64	-21	12.8	0.6	907	1	296	-8
C23	S. Africa Western Cape	291	32	11.5	-1.6	639	-7	579	10
C24	British Columbia To Colorado	298	-10	10.4	0.5	1349	-3	656	-6
C25	America northern great plains_canada	280	-22	13.4	1.2	1234	-3	750	-10
C26	America northeastern great plains	297	-29	18.3	0.6	1333	2	880	-12
C27	America northwestern great plains	311	-10	15.5	0.4	1357	-1	821	-6
C28	Nnorth of high plain	258	-23	21.1	0.2	1416	-1	845	-10
C29	America corn belt	383	-15	15.7	0.0	1230	-1	907	-8
C30	America cotton belt_Mexican coastal plain	372	5	24.8	0.2	1360	-5	943	-3
C31	America cotton belt_lower Mississippi	441	-15	23.9	0.3	1341	-4	1114	-7
C32	America cotton belt_high plain	478	-4	21.8	-0.2	1351	-3	1142	-2
C33	Sub_boreal North America	354	-3	11.4	1.2	1114	-4	798	2
C34	America West Coast	184	-3	14.8	-0.4	1437	-3	578	-6
C35	Sierra Madre	412	-44	21.5	0.9	1498	2	802	-18
C36	SW Mexico and N. Mexico highlands	92	-51	20.2	0.3	1558	-2	589	-16
C37	Northern South and Central America	899	-18	25.2	0.9	1253	1	1169	-8
C38	Caribbean	510	-12	26.5	0.7	1429	0	1186	-4
C39	Central_Northern Andes	215	114	14.7	-0.2	1109	-3	452	18
C40	Central_Northern Andes	450	-24	14.5	0.7	1034	-1	589	-5
C41	Brazil Nordeste	163	-28	24.8	1.0	1071	1	646	-10
C42	Central_Eastern Brazil	120	-57	22.9	1.7	1005	3	522	-27
C43	Amazon	490	-23	24.8	0.9	1085	1	939	-12
C44	Central_North Argentina	223	22	16.3	0.8	644	-11	539	13
C45	SE Brazil_Concepcion_Bahia Blanca	316	-21	15.4	0.8	632	-1	613	-10
C46	SW Southern Cone	782	3	7.9	0.6	473	0	577	1
C47	Semi_arid Southern Cone	104	-8	10.8	0.8	685	-4	288	-7
C48	Caucasus	307	0	16.2	-0.1	1442	-2	736	0
C49	Central Asia Pamir mountains	262	-27	17.1	0.1	1560	0	661	-10
C50	Western Asia (Kazakhstan,Uzbekistan,Turkmenistan,Iran et.al)	119	9	23.1	0.4	1527	-1	634	-2
C51	Western Asia(Syrian, Jordan,Israel, et.al)	48	-35	24.1	0.5	1575	-3	604	-4
C52	Gansu-Xinjiang (China)	249	-5	15.2	-1.1	1413	-1	621	-8
C53	Hainan (China)	855	-7	26.8	0.3	1377	3	1422	2
C54	Huanghuaihai (China)	436	27	22.8	0.6	1280	-3	1005	11
C55	Inner Mongolia (China)	226	0	16.8	0.6	1366	-1	685	-5

C56	Loess region (China)	315	11	17.1	0.0	1336	-2	827	4
C57	Lower Yangtze (China)	1048	-8	22.4	0.5	1108	2	1421	6
C58	Northeast China	347	1	15.7	0.2	1262	0	833	-2
C59	Qinghai-Tibet (China)	962	-15	11.1	0.8	1248	7	721	-1
C60	Southern China	1063	-21	23.5	0.9	1195	6	1390	-2
C61	Southwest China	790	-12	19.0	0.6	1072	1	1163	0
C62	Taiwan (China)	1036	15	24.5	-0.9	1201	-6	1233	2
C63	East Asia	604	12	15.2	0.7	1193	-1	969	3
C64	Southern Himalayas_zone111 (Vietnam, Laos, Myanmar)	1053	-11	24.7	1.2	1270	7	1425	-1
C65	Southern Himalayas_zone112 (Myanmar)	618	-33	24.3	1.3	1280	9	1120	-14
C66	Southern Himalayas_zone12 (India, Myanmar, Bangladesh,Bhutan)	1397	-25	24.8	0.9	1229	11	1262	-7
C67	Southern Himalayas_zone222 (Nepal, India)	651	5	28.7	-0.3	1380	2	999	9
C68	Southern Asia	801	3	29.6	0.2	1243	0	1038	1
C69	Southern Japan and Korea	994	16	18.9	1.0	1182	-1	1249	5
C70	Mongolia region (Western of Mongolia)	204	5	5.9	-2.1	1432	-4	507	-10
C71	S. Asia Punjab to Gujarat	820	101	30.8	-1.5	1352	-6	1068	30
C72	SE Asia islands_zone1 (Indonesia, Malaysia)	954	-1	25.0	0.2	1176	0	1380	2
C73	SE Asia islands_zone2 (Indonesia, Malaysia)	1176	-3	25.2	0.3	1215	2	1482	1
C74	SE Asia islands_zone3 (Indonesia, Papua New Guinea)	1350	-10	23.6	0.3	989	2	1312	-2
C75	SE Asia mainland_zone1 (Myanmar, Bangladesh)	850	-39	28.8	0.9	1358	8	1169	-13
C76	SE Asia mainland_zone2 (Thailand, Myanmar, Laos)	1076	-2	27.1	0.9	1249	4	1456	0
C77	SE Asia mainland_zone3 (Cambodia, Vietnam, Thailand, Laos)	952	-12	27.0	0.8	1273	5	1345	-3
C78	Eastern Siberia	289	-11	9.8	-0.2	1162	2	737	-2
C79	Eastern Central Asia (Eastern of Mongolia)	247	-11	10.1	-0.7	1291	0	660	-7
C80	North Australia_zone1 (Timor_Leste, Indonesia, Papua New Guinea)	536	4	25.2	0.1	1106	-2	964	-4
C81	North Australia_zone2 (Northern Australia)	172	7	21.6	0.9	979	0	587	8
C82	Australia Queensland to Victoria _zone1 (Southeast Australia_coast)	180	-23	12.0	0.1	658	3	482	-12
C83	Australia Queensland to Victoria _zone21 (Southeast Australia Marrin Darling)	131	-14	13.5	0.0	664	0	417	-6
C84	Australia Queensland to Victoria _zone22 (Southeast Australia Adeleid)	350	14	12.4	-0.2	422	-8	736	8
C85	Australia Nullarbor_Darling_zone1 (Southwest Australia)	125	-20	12.9	-1.1	625	-3	392	-17
C86	Australia Nullarbor_Darling_zone2 (Southwest Australia)	244	-15	13.0	-1.1	578	-6	569	-10
C87	New Zealand	391	5	9.6	0.7	404	-9	680	7
C88	Boreal Eurasia	312	-7	9.5	-0.2	1094	1	689	-4

C89	Ukraine to URAL Mountains	261	-16	13.9	-0.1	1123	-3	734	-10
C90	Mediterranean Europe and Turkey	258	21	17.6	0.5	1440	-2	745	6
C91	W. Europe _zone1 (Germany, Poland, Switzerland, Czechia, Hungary, Austria, and Balkans countries)	334	-3	14.4	-0.2	1223	-2	797	-5
C92	W. Europe_ zone10 (Northwestern Greece and southwestern of Albania)	457	53	17.0	-0.2	1391	-5	964	16
C93	W. Europe_zone2 (Southeastern of Romania, Moldova, and southwestern Urania)	248	3	17.6	-0.4	1254	-5	760	-3
C94	W. Europe__zone3 (Ebro River, Zaragoza, Spain)	150	-26	18.4	1.4	1443	0	631	-12
C95	W. Europe_zone4 (Northeastern of Italy and southwestern coast of France)	384	11	18.0	1.1	1383	-2	856	3
C96	W. Europe_zone5 (North Italy)	589	21	17.5	0.0	1304	-4	1066	7
C97	W. Europe_zone6 (Switzerland, North Italy and west Austria)	806	10	10.7	0.4	1227	-3	854	3
C98	W. Europe_zone7 (Ireland, United Kingdom, France, Belgium, Netherland)	358	-2	14.0	0.6	1166	2	845	2
C99	W. Europe_zone8 (Northwest of turkey and northeast of Greece)	287	-3	18.2	0.2	1359	-5	849	2
C100	W. Europe_zone9 (North Greece and North Macedonia)	397	14	16.8	0.0	1387	-3	890	3
C101	Boreal North America	431	24	5.4	-0.9	908	-10	594	-2
C102	URAL to Altai Mountains	240	-16	13.8	0.4	1285	5	669	-9
C103	Australian Desert (Central Australia)	92	-20	14.8	-0.8	730	-1	356	-16
C104	Old World Deserts	39	15	28.3	0.4	1587	-3	603	3
C105	Sub Arctic America (IceLand)	135	6	-2.9	0.9	1122	-8	280	4

Table A.2 April 2023 - July 2023 agroclimatic indicators and biomass by country

Country code	Country name	RAIN Current (mm)	RAIN 15YA Departure (%)	TEMP Current (°C)	TEMP 15YA Departure(°C)	RADPAR Current (MJ/m²)	RADPAR 15YA Departure (%)	BIOMSS Current (gDM/m²)	BIOMSS 15YA Departure (%)
ARG	Argentina	238	-9	14.4	1.0	595	-6	505	-1
AUS	Australia	172	-15	13.6	0.0	676	0	472	-8
BGD	Bangladesh	1095	-29	29.4	0.8	1336	6	1336	-9
BRA	Brazil	236	-40	23.1	1.4	1018	3	648	-21
KHM	Cambodia	1020	-5	27.5	0.7	1199	1	1508	-1
CAN	Canada	369	-5	11.5	0.9	1138	-3	756	-1
CHN	China	753	-10	19.9	0.5	1187	1	1016	1
EGY	Egypt	10	73	24.2	0.6	1544	-3	546	17
ETH	Ethiopia	622	-20	20.1	0.6	1293	4	931	-4
FRA	France	370	-4	15.3	0.7	1254	0	864	0
DEU	Germany	307	-10	13.8	0.0	1196	0	763	-7
IND	India	833	4	29.4	-0.2	1283	1	1054	8
IDN	Indonesia	1088	-7	24.5	0.2	1111	2	1342	0
IRN	Iran	70	-24	21.8	0.3	1618	-1	575	-7
KAZ	Kazakhstan	222	-10	15.7	0.3	1362	3	670	-5
MEX	Mexico	391	-37	24.4	0.9	1478	0	819	-17

MMR	**Myanmar**	932	-31	26.3	1.0	1282	9	1177	-12
NGA	**Nigeria**	464	-20	28.5	0.8	1251	3	869	-15
PAK	**Pakistan**	443	58	24.9	-0.7	1473	-5	860	19
PHL	**Philippines**	1634	18	25.8	0.0	1248	-4	1534	2
POL	**Poland**	262	-20	14.1	-0.3	1139	-2	759	-10
ROU	**Romania**	310	-15	15.9	-0.2	1268	-4	817	-7
RUS	**Russia**	267	-15	13.3	0.0	1169	0	716	-9
ZAF	**South Africa**	81	-8	13.0	0.4	884	0	329	-3
THA	**Thailand**	907	-6	27.7	1.0	1269	6	1379	-2
TUR	**Turkey**	325	38	16.1	-0.2	1434	-4	801	12
GBR	**United Kingdom**	376	2	11.9	0.6	1049	6	835	7
UKR	**Ukraine**	288	-7	15.4	-0.6	1150	-7	786	-6
USA	**United States**	349	-12	18.6	0.0	1338	-2	836	-8
UZB	**Uzbekistan**	69	-52	22.9	0.6	1583	1	584	-14
VNM	**Vietnam**	1039	-9	25.7	0.8	1267	5	1433	0
AFG	**Afghanistan**	83	-55	20.0	0.5	1628	1	548	-14
AGO	**Angola**	168	-13	20.3	0.7	1198	-1	506	-3
BLR	**Belarus**	248	-23	14.0	0.0	1092	-2	721	-14
HUN	**Hungary**	326	26	16.7	-0.6	1276	-3	886	10
ITA	**Italy**	508	33	17.3	0.3	1347	-4	942	15
KEN	**Kenya**	348	-43	20.1	0.7	1182	5	773	-14
LKA	**Sri_Lanka**	755	-20	27.0	0.3	1273	0	1109	-7
MAR	**Morocco**	74	-20	21.2	1.0	1571	-1	574	-4
MNG	**Mongolia**	255	-8	9.4	-1.0	1338	-2	641	-8
MOZ	**Mozambique**	102	-23	20.3	0.4	1016	5	481	-9
ZMB	**Zambia**	61	-17	18.9	0.9	1186	5	370	-4
KGZ	**Kyrgyzstan**	406	-20	9.8	-1.0	1506	2	614	-11
SYR	**Syria**	40	-36	24.3	0.4	1588	-3	596	-6
DZA	Algeria	118	-13	21.7	1.2	1514	-1	645	-4
LBN	Lebanon	73	7.7	19.6	0	1620	-3	568	-1
MUS	Mauritius	644	206	23.8	0.5	951	1	1207	44

*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 April 2023 - July 2023 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	174	-20	12.5	0.9	556	-3	419	-14
Chaco	291	-11	17.4	0.9	592	-4	619	-9
Cordoba	141	18	14.1	1.1	601	-12	417	18
Corrientes	350	-27	16.7	1.1	609	2	723	-12
Entre Rios	287	-16	14.9	1.0	558	-7	652	3
La Pampa	74	-45	12.7	1.1	588	-2	285	-22
Misiones	454	-24	17.0	0.6	684	3	902	-3
Santiago Del Estero	288	64	16.5	1.0	573	-15	617	33
San Luis	68	-21	12.4	0.9	653	-6	280	-4
Salta	254	24	15.1	1.1	710	-11	540	7
Santa Fe	222	-12	15.8	1.2	577	-7	564	3
Tucuman	236	98	13.5	1.3	732	-12	544	40

Table A.4 April 2023 - July 2023 agroclimatic indicators and biomass (by state)

	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 (%)
New South Wales	132	-28	11.9	-0.1	686	2	399	-13
South Australia	224	7	13.3	-0.3	514	-7	540	2
Victoria	288	10	10.6	-0.2	455	-4	591	5
W. Australia	194	-10	14.2	-1.0	649	-5	491	-10

Table A.5 April 2023 - July 2023 agroclimatic indicators and biomass (by state)

	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 (%)
Ceara	280	-28	26.0	0.8	1173	1	869	-11
Goias	5	-97	24.5	2.9	1094	1	369	-38
Mato Grosso Do Sul	101	-61	22.5	1.7	944	9	486	-30
Mato Grosso	53	-77	25.0	1.6	1116	3	467	-33
Minas Gerais	54	-74	20.8	1.7	975	4	393	-34
Parana	325	-34	17.2	0.7	805	6	642	-25
Rio Grande Do Sul	474	-18	15.7	0.9	637	0	806	-8
Santa Catarina	501	-13	15.0	0.6	689	0	817	-8
Sao Paulo	74	-74	20.1	1.4	933	9	400	-42

Table A.6 Canada, April 2023 - July 2023 agroclimatic indicators and biomass (by province)

	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 (%)
Alberta	311	-11	12.6	2.0	1247	-1	740	-5
Manitoba	352	-8	12.5	0.7	1090	-9	838	0
Saskatchewan	291	-14	12.9	1.2	1192	-3	756	-6

Table A.7 India, April 2023 - July 2023 agroclimatic indicators and biomass (by state)

	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 (%)
Andhra Pradesh	680	47	30.5	-0.1	1188	-3	1060	17
Assam	2093	-15	25.1	0.3	1171	11	1505	1
Bihar	669	-15	32.0	0.3	1425	7	1040	-2
Chhattisgarh	777	16	30.5	0.1	1266	2	1006	3
Daman and Diu	1471	42	29.2	-0.1	1417	-2	1079	-2

Delhi	1211	325	30.5	-2.8	1366	-6	1333	58
Gujarat	1043	60	30.4	-0.7	1307	-6	1035	10
Goa	1665	-18	27.3	0.7	1295	5	1113	-10
Himachal Pradesh	723	20	20.0	-1.1	1379	-5	985	15
Haryana	959	272	30.5	-2.6	1365	-6	1276	59
Jharkhand	568	-14	30.9	0.3	1344	5	971	-3
Kerala	1379	-14	25.6	0.1	1222	2	1387	-5
Karnataka	568	-14	27.1	0.3	1148	1	933	-1
Meghalaya	1673	-21	24.9	0.0	1199	9	1414	-5
Maharashtra	826	2	29.6	0.1	1213	-3	954	-4
Manipur	908	-49	23.0	0.9	1259	12	1286	-9
Madhya Pradesh	656	3	30.7	-0.7	1326	2	982	5
Mizoram	810	-49	24.9	0.5	1347	10	1299	-13
Nagaland	1710	-17	20.7	-0.8	1118	4	1381	-1
Orissa	756	5	30.5	0.5	1255	2	1016	-3
Puducherry	825	-17	29.4	-0.3	1318	1	1187	7
Punjab	791	154	30.0	-2.5	1367	-6	1230	45
Rajasthan	852	140	31.2	-1.9	1340	-4	1085	40
Sikkim	728	22	21.5	4.1	1370	1	836	2
Tamil Nadu	582	33	28.6	0.1	1223	1	1036	13
Tripura	829	-51	28.4	1.0	1324	8	1357	-15
Uttarakhand	462	-16	23.6	0.2	1405	-2	918	10
Uttar Pradesh	531	0	32.0	-0.8	1403	2	1033	12
West Bengal	1101	-1	30.9	0.9	1337	4	1148	-6

Table A.8 Kazakhstan, April 2023 - July 2023 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	177	-17	15.7	0.9	1329	5	647	-6
Karagandinskaya	110	-43	15.4	1.0	1418	5	538	-20
Kustanayskaya	224	1	16.1	1.1	1272	2	718	2
Pavlodarskaya	176	-20	15.4	0.4	1343	6	645	-9
Severo kazachstanskaya	199	-21	14.8	1.1	1282	9	671	-8
Vostochno kazachstanskaya	225	-23	13.1	-0.6	1463	5	665	-10
Zapadno kazachstanskaya	304	57	17.9	0.0	1193	-10	869	22

Table A.9 Russia, April 2023 - July 2023 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.	210	-34	13.7	1.0	1192	2	672	-17
Chelyabinskaya Oblast	188	-32	14.0	1.0	1179	1	638	-16
Gorodovikovsk	240	-19	18.0	-0.5	1291	-3	842	-5

Krasnodarskiy Kray	380	3	13.6	-0.9	1224	-2	854	1
Kurganskaya Oblast	167	-36	14.5	1.5	1213	8	592	-19
Kirovskaya Oblast	273	-13	12.3	0.6	1002	-4	728	-7
Kurskaya Oblast	273	-11	14.0	-0.7	1120	-5	756	-10
Lipetskaya Oblast	329	12	13.8	-0.8	1090	-7	804	-2
Mordoviya Rep.	308	-2	13.5	-0.1	1094	-4	790	-5
Novosibirskaya Oblast	255	-12	12.9	0.4	1206	8	688	-10
Nizhegorodskaya O.	348	13	13.1	0.0	1072	-3	806	0
Orenburgskaya Oblast	212	-15	15.8	0.6	1231	-2	708	-5
Omskaya Oblast	239	-15	13.8	1.2	1220	11	689	-8
Permskaya Oblast	189	-41	12.8	1.3	1075	3	610	-23
Penzenskaya Oblast	339	10	13.6	-0.4	1079	-7	852	4
Rostovskaya Oblast	335	20	17.0	-0.8	1222	-7	911	8
Ryazanskaya Oblast	328	4	13.7	-0.4	1081	-5	764	-9
Stavropolskiy Kray	397	-8	17.0	-0.5	1278	-4	924	-5
Sverdlovskaya Oblast	170	-42	13.3	1.5	1135	6	569	-25
Samarskaya Oblast	170	-42	15.3	0.7	1170	-3	639	-21
Saratovskaya Oblast	339	27	15.5	-0.3	1144	-9	889	13
Tambovskaya Oblast	446	51	13.9	-0.9	1081	-10	919	12
Tyumenskaya Oblast	254	-6	13.6	1.4	1182	11	660	-10
Tatarstan Rep.	190	-39	14.1	0.9	1141	1	640	-21
Ulyanovskaya Oblast	200	-35	14.3	0.4	1133	-2	678	-17
Udmurtiya Rep.	189	-38	13.2	1.1	1057	-1	614	-21
Volgogradskaya O.	294	26	16.6	-0.6	1166	-10	838	10
Voronezhskaya Oblast	364	22	14.6	-1.0	1121	-9	878	5

Table A.10 United States, April 2023 - July 2023 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	472	4	22.4	-0.1	1330	-3	1091	-2
California	93	-5	16.6	-0.7	1550	-5	522	-7
Idaho	258	4	11.9	0.1	1401	-5	682	1
Indiana	292	-39	18.2	-0.2	1307	0	876	-21
Illinois	291	-40	19.3	0.4	1356	3	897	-19
Iowa	341	-23	18.1	0.6	1341	4	924	-11
Kansas	248	-28	21.8	0.4	1404	-1	879	-10
Michigan	340	-15	14.1	0.4	1211	-2	825	-12
Minnesota	329	-21	14.9	0.5	1221	0	861	-8
Missouri	269	-38	20.7	0.3	1382	2	885	-18

Montana	324	-3	12.7	0.4	1345	-3	769	-5
Nebraska	232	-34	19.0	0.7	1396	0	806	-15
North Dakota	375	2	14.7	0.3	1231	-4	922	4
Ohio	326	-25	17.0	-0.6	1277	-1	913	-14
Oklahoma	374	2	22.9	-0.4	1369	-3	996	-1
Oregon	249	4	12.9	0.2	1364	-2	663	3
South Dakota	277	-25	17.2	0.7	1371	2	828	-11
Texas	356	8	25.4	0.2	1363	-6	915	-3
Washington	285	7	13.6	0.6	1312	-2	709	6
Wisconsin	315	-26	14.9	0.5	1230	0	841	-13

Table A.11 China, April 2023 - July 2023 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	871	13	22.4	0.3	1129	-3	1336	12
Chongqing	996	14	20.0	0.0	968	-8	1290	4
Fujian	1001	-24	22.3	0.8	1135	8	1412	1
Gansu	336	-5	13.9	-0.1	1313	0	772	-1
Guangdong	1261	-20	24.7	0.5	1153	2	1549	2
Guangxi	1147	-21	23.9	0.7	1101	2	1453	-1
Guizhou	856	-22	19.6	0.7	949	0	1259	-1
Hebei	265	7	20.6	1.3	1355	-2	754	-4
Heilongjiang	299	-9	15.4	0.3	1242	0	795	-6
Henan	516	32	22.3	0.0	1233	-4	1142	19
Hubei	909	15	21.0	0.2	1096	-4	1343	10
Hunan	1010	-13	22.1	0.6	1084	3	1409	2
Jiangsu	852	35	22.4	0.5	1143	-5	1281	14
Jiangxi	1203	-9	22.7	0.5	1116	6	1493	4
Jilin	390	5	16.0	0.2	1284	0	894	0
Liaoning	420	20	17.4	0.2	1299	0	930	8
Inner Mongolia	217	-5	16.1	0.5	1348	-1	665	-7
Ningxia	158	-9	16.4	-0.4	1391	-2	630	-6
Shaanxi	462	3	17.7	-0.2	1234	-4	924	5
Shandong	394	17	22.3	0.6	1289	-4	984	8
Shanxi	271	12	17.7	0.3	1358	-2	785	4
Sichuan	829	-4	17.6	0.5	1117	0	1092	1
Yunnan	721	-27	19.3	1.1	1224	13	1085	-8
Zhejiang	1014	-8	21.4	0.7	1072	2	1373	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**.**

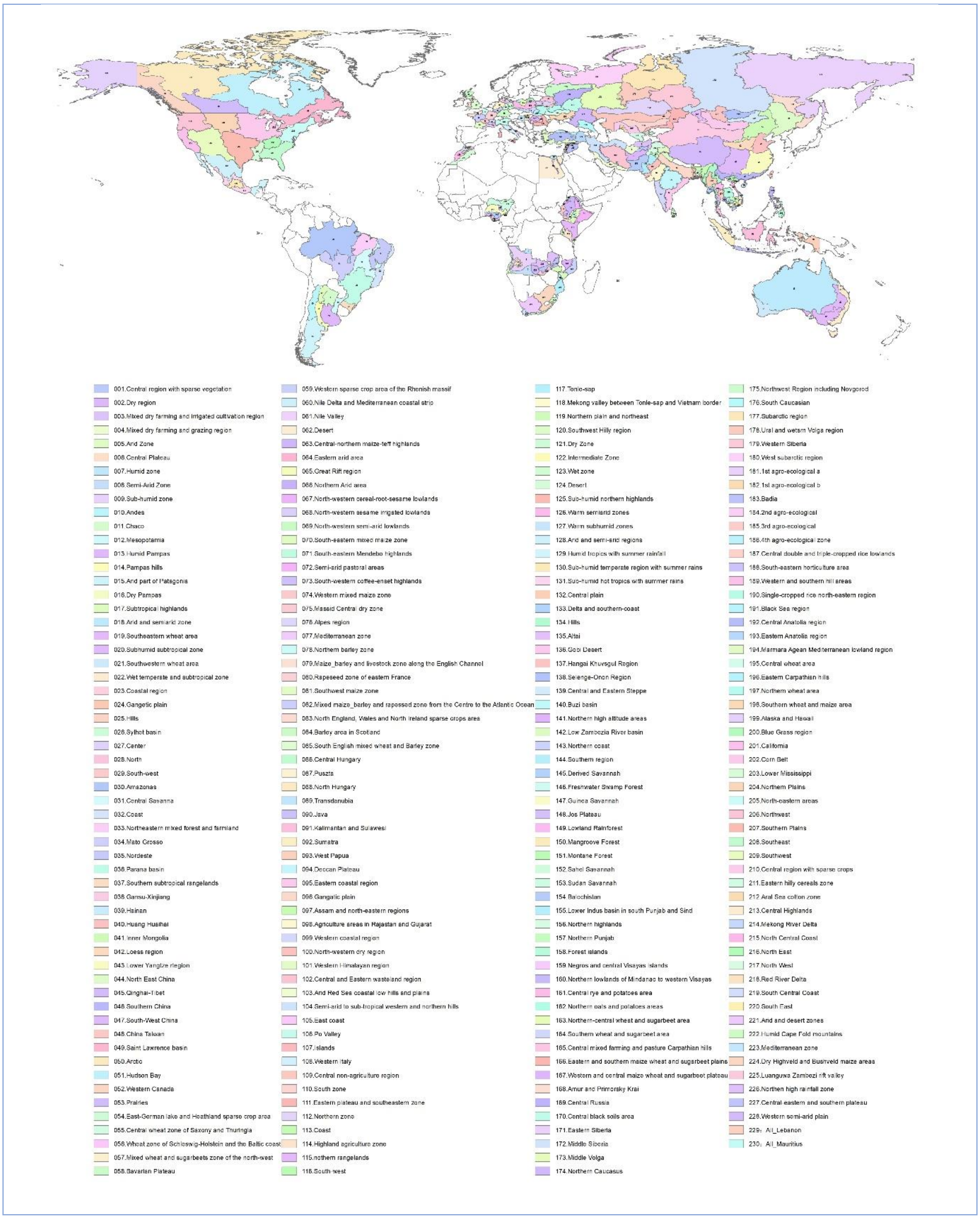
Agroecological zones for 47 key countries

Overview

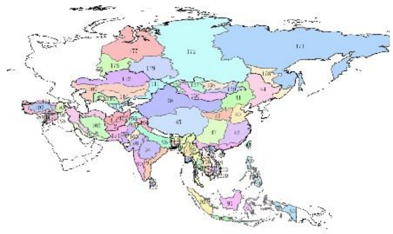
230 agroecological zones for the 47 key countries across the globe

Description

47 key agricultural countries are divided into 230 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 47 key countries. Some regions are more relevant for rangeland and livestock monitoring, which is also essential for food security.


001.Central region with sparse vegetation
002.Dry region
003.Mixed dry farming and irrigated cultivation region
004.Mixed dry farming and grazing region
005.Arid Zone
006.Central Plateau
007.Humid zone
008.Semi-Arid Zone
009.Sub-humid zone
010.Andes
011.Chaco
012.Mesopotamia
013.Humid Pampas
014.Pampas hills
015.And part of Patagonia
016.Dry Pampas
017.Subtropical highlands
018.Arid and semiarid zone
019.Southeastern wheat area
020.Subhumid subtropical zone
021.Southwestern wheat area
022.Wet temperate and subtropical zone
023.Coastal region
024.Gangetic plain
025.Hills
026.Sylhet basin
027.Center
028.North
029.South-west
030.Amazonas
031.Central Savanna
032.Coast
033.Northeastern mixed forest and farmland
034.Mato Grosso
035.Nordeste
036.Parana basin
037.Southern subtropical rangelands
038.Gansu-Xinjiang
039.Hainan
040.Huang Huaihai
041.Inner Mongolia
042.Loess region
043.Lower Yangtze rlegion
044.North East China
045.Qinghai-Tibet
046.Southern China
047.South-West China
048.China Taiwan
049.Saint Lawrence basin
050.Arctic
051.Hudson Bay
052.Western Canada
053.Prairies
054.East-German lake and Heathland sparse crop area
055.Central wheat zone of Saxony and Thuringia
056.Wheat zone of Schleswig-Holstein and the Baltic coast
057.Mixed wheat and sugarbeets zone of the north-west
058.Bavarian Plateau
059.Western sparse crop area of the Rhenish massif
060.Nile Delta and Mediterranean coastal strip
061.Nile Valley
062.Desert
063.Central-northern maize-teff highlands
064.Eastern arid area
065.Great Rift region
066.Northern Arid area
067.North-western cereal-root-sesame lowlands
068.North-western sesame irrigated lowlands
069.North-western semi-arid lowlands
070.South-eastern mixed maize zone
071.South-eastern Mendebo highlands
072.Semi-arid pastoral areas
073.South-western coffee-enset highlands
074.Western mixed maize zone
075.Massid Central dry zone
076.Alpes region
077.Mediterranean zone
078.Northern barley zone
079.Maize_barley and livestock zone along the English Channel
080.Rapeseed zone of eastern France
081.Southwest maize zone
082.Mixed maize_barley and rapessed zone from the Centre to the Atlantic Ocean
083.North England, Wales and North Ireland sparse crops area
084.Barley area in Scotland
085.South English mixed wheat and Barley zone
086.Central Hungary
087.Puszta
088.North Hungary
089.Transdanubia
090.Java
091.Kalimantan and Sulawesi
092.Sumatra
093.West Papua
094.Deccan Plateau
095.Eastern coastal region
096.Gangatic plain
097.Assam and north-eastern regions
098.Agriculture areas in Rajastan and Gujarat
099.Western coastal region
100.North-western dry region
101.Western Himalayan region
102.Central and Eastern wasteland region
103.And Red Sea coastal low hills and plains
104.Semi-arid to sub-tropical western and northern hills
105.East coast
106.Po Valley
107.Islands
108.Western Italy
109.Central non-agriculture region
110.South zone
111.Eastern plateau and southeastern zone
112.Northern zone
113.Coast
114.Highland agriculture zone
115.nothern rangelands
116.South-west
117.Tonle-sap
118.Mekong valley between Tonle-sap and Vietnam border
119.Northern plain and northeast
120.Southwest Hilly region
121.Dry Zone
122.Intermediate Zone
123.Wet zone
124.Desert
125.Sub-humid northern highlands
126.Warm semiarid zones
127.Warm subhumid zones
128.Arid and semi-arid regions
129.Humid tropics with summer rainfall
130.Sub-humid temperate region with summer rains
131.Sub-humid hot tropics with summer rains
132.Central plain
133.Delta and southern-coast
134.Hills
135.Altai
136.Gobi Desert
137.Hangai Khuvsgul Region
138.Selenge-Onon Region
139.Central and Eastern Steppe
140.Buzi basin
141.Northern high altitude areas
142.Low Zambezia River basin
143.Northern coast
144.Southern region
145.Derived Savannah
146.Freshwater Swamp Forest
147.Guinea Savannah
148.Jos Plateau
149.Lowland Rainforest
150.Mangroove Forest
151.Montane Forest
152.Sahel Savannah
153.Sudan Savannah
154.Balochistan
155.Lower Indus basin in south Punjab and Sind
156.Northern highlands
157.Northern Punjab
158.Forest islands
159.Negros and central Visayas islands
160.Northern lowlands of Mindanao to western Visayas
161.Central rye and potatoes area
162.Northern oats and potatoes areas
163.Northern-central wheat and sugarbeet area
164.Southern wheat and sugarbeet area
165.Central mixed farming and pasture Carpathian hills
166.Eastern and southern maize wheat and sugarbeet plains
167.Western and central maize wheat and sugarbeet plateau
168.Amur and Primorsky Krai
169.Central Russia
170.Central black soils area
171.Eastern Siberia
172.Middle Siberia
173.Middle Volga
174.Northern Caucasus
175.Northwest Region including Novgorod
176.South Caucasian
177.Subarctic region
178.Ural and wetsm Volga region
179.Western Siberia
180.West subarctic region
181.1st agro-ecological a
182.1st agro-ecological b
183.Badia
184.2nd agro-ecological
185.3rd agro-ecological
186.4th agro-ecological zone
187.Central double and triple-cropped rice lowlands
188.South-eastern horticulture area
189.Western and southern hill areas
190.Single-cropped rice north-eastern region
191.Black Sea region
192.Central Anatolia region
193.Eastern Anatolia region
194.Marmara Agean Mediterranean lowland region
195.Central wheat area
196.Eastern Carpathian hills
197.Northern wheat area
198.Southern wheat and maize area
199.Alaska and Hawaii
200.Blue Grass region
201.California
202.Corn Belt
203.Lower Mississippi
204.Northern Plains
205.North-eastern areas
206.Northwest
207.Southern Plains
208.Southeast
209.Southwest
210.Central region with sparse crops
211.Eastern hilly cereals zone
212.Aral Sea cotton zone
213.Central Highlands
214.Mekong River Delta
215.North Central Coast
216.North East
217.North West
218.Red River Delta
219.South Central Coast
220.South East
221.Arid and desert zones
222.Humid Cape Fold mountains
223.Mediterranean zone
224.Dry Highveld and Bushveld maize areas
225.Luanguwa Zambezi rift valley
226.Northen high rainfall zone
227.Central eastern and southern plateau
228.Western semi-arid plain
229: All_Lebanon
230: All_Mauritius

Asia



- 001.Central region with sparse vegetation
- 002.Dry region
- 003.Mixed dry farming and irrigated cultivation region
- 004.Mixed dry farming and grazing region
- 023.Coastal region
- 024.Gangetic plain
- 025.Hills
- 026.Sylhet basin
- 038.Gansu-Xinjiang
- 039.Hainan
- 040.Huang Huaihai
- 041.Inner Mongolia
- 042.Loess region
- 043.Lower Yangtze rtegion
- 044.North East China
- 045.Qinghai-Tibet
- 046.Southern China
- 047.South-West China
- 048.China Taiwan
- 090.Java
- 091.Kalimantan and Sulawesi
- 092.Sumatra
- 093.West Papua
- 094.Deccan Plateau
- 095.Eastern coastal region
- 096.Gangatic plain
- 097.Aasam and north-eastern regions
- 098.Agriculture areas in Rajastan and Gujarat
- 099.Western coastal region
- 100.North-western dry region
- 101.Western Himalayan region
- 102.Central and Eastern wasteland region
- 103.Arid Red Sea coastal low hills and plains
- 104.Semi-arid to sub-tropical western and northern hills
- 109.Central non-agriculture region
- 110.South zone
- 111.Eastern plateau and southeastern zone
- 112.Northern zone
- 117.Tonle sap
- 118.Mekong valley between Tonle sap and Vietnam border
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- 122.Intermediate Zone
- 123.Wet zone
- 132.Central plain
- 133.Delta and southern-coast
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- 181.1st agro ecological a
- 182.1st agro-ecological b
- 183.Radia
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- 185.3rd agro-ecological
- 186.4th agro ecological zone
- 187.Central double and triple cropped rice lowlands
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- 214.Mekong River Delta
- 215.North Central Coast
- 216.North East
- 217.North West
- 218.Red River Delta
- 219.South Central Coast
- 220.South East
- 229: All_Lebanon

Europe

- 027.Center
- 028.North
- 029.South-west
- 054.East-German lake and Heathland sparse crop area
- 055.Central wheat zone of Saxony and Thuringia
- 056.Wheat zone of Schleswig-Holstein and the Baltic coast
- 057.Mixed wheat and sugarbeets zone of the north-west
- 058.Bavarian Plateau
- 059.Western sparse crop area of the Rhenish massif
- 075.Massid Central dry zone
- 076.Alpes region
- 077.Mediterranean zone
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- 108.Western Italy
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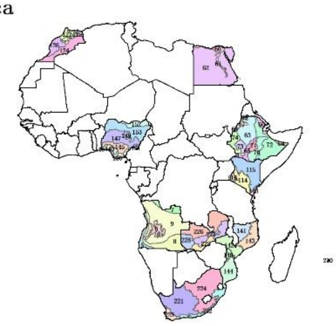
- 163.Northern-central wheat and sugarbeet area
- 164.Southern wheat and sugarbeet area
- 165.Central mixed farming and pasture Carpathian hills
- 166.Eastern and southern maize wheat and sugarbeet plains
- 167.Western and central maize wheat and sugarbeet plateau
- 169.Central Russia
- 170.Central black soils area
- 173.Middle Volga
- 174.Northern Caucasus
- 175.Northwest Region including Novgorod
- 176.South Caucasian
- 180.West subarctic region
- 195.Central wheat area
- 196.Eastern Carpathian hills
- 197.Northern wheat area
- 198.Southern wheat and maize area

Africa



- 005.Arid Zone
- 006.Central Plateau
- 007.Humid zone
- 008.Semi-Arid Zone
- 009.Sub-humid zone
- 060.Nile Delta and Mediterranean coastal strip
- 061.Nile Valley
- 062.Desert
- 063.Central-northern maize-teff highlands
- 064.Eastern arid area
- 065.Great Rift region
- 066.Northern Arid area
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- 068.North-western sesame irrigated lowlands
- 069.North-western semi-arid lowlands
- 070.South-eastern mixed maize zone
- 071.South-eastern Mendebo highlands
- 072.Semi-arid pastoral areas
- 073.South-western coffee-enset highlands
- 074.Western mixed maize zone
- 113.Coast
- 114.Highland agriculture zone
- 115.nothern rangelands
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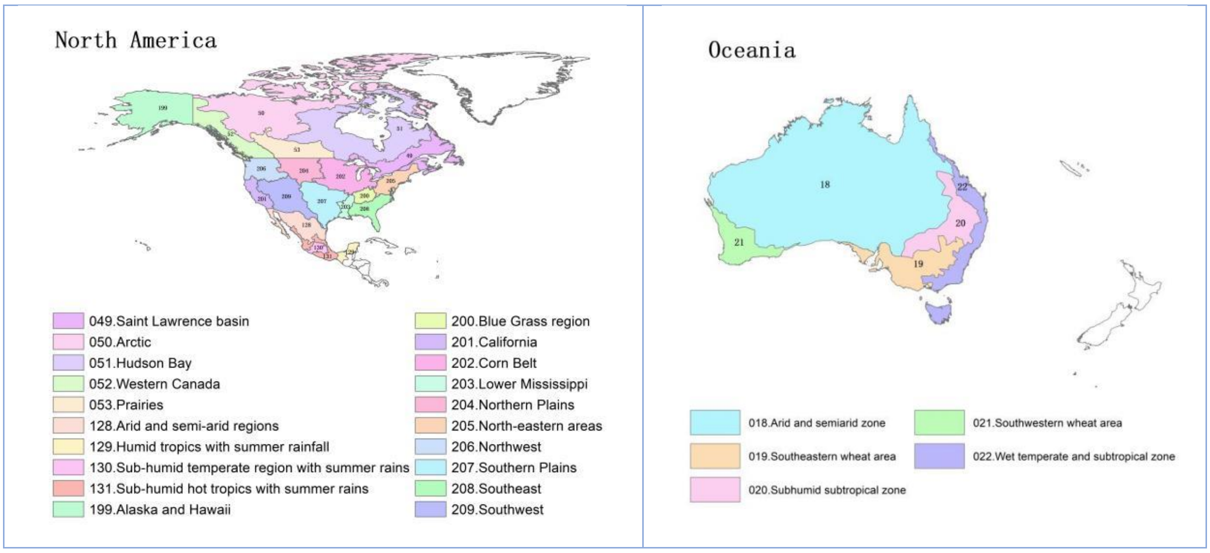
- 225.Luanguwa Zambezi rift valley
- 226.Northen high rainfall zone
- 227.Central-eastern and southern plateau
- 228.Western semi-arid plain
- 230: All_Mauritius

South America

- 010.Andes
- 011.Chaco
- 012.Mesopotamia
- 013.Humid Pampas
- 014.Pampas hills
- 015.Arid part of Patagonia
- 016.Dry Pampas
- 017.Subtropical highlands
- 030.Amazonas
- 031.Central Savanna
- 032.Coast
- 033.Northeastern mixed forest and farmland
- 034.Mato Grosso
- 035.Nordeste
- 036.Parana basin
- 037.Southern subtropical rangelands



CropWatch indicators

The CropWatch indicators are designed to assess the condition of crops and the environment in which they grow and develop; the indicators—RAIN (for rainfall), TEMP (temperature), and RADPAR (photosynthetically active radiation, PAR)—are not identical to the weather variables, but instead are value-added indicators computed only over crop growing areas (thus for example excluding deserts and rangelands) and spatially weighted according to the agricultural production potential, with marginal areas receiving less weight than productive ones. The indicators are expressed using the usual physical units (e.g., mm for rainfall) and were thoroughly tested for their coherence over space and time. CWSU are the CropWatch Spatial Units, including MRUs, MPZ, and countries (including first-level administrative districts in select large countries). For all indicators, high values indicate "good" or "positive."

INDICATOR			
BIOMSS			
Biomass accumulation potential			
Crop/ satellite	Grams dry matter/m^2, pixel or CWSU	An estimate of biomass that could potentially be accumulated over the reference period given the prevailing rainfall and temperature conditions.	Biomass is presented as maps by pixels, maps showing average pixels values over CropWatch spatial units (CWSU), or tables giving average values for the CWSU. Values are compared to the average value for the recent fifteen years, with departures expressed in percentage.
CALF			
Cropped arable land and cropped arable land fraction			
Crop/ Satellite	[0,1] number, pixel or CWSU average	The area of cropped arable land as fraction of total (cropped and uncropped) arable land. Whether a pixel is cropped or not is decided based on NDVI twice a month. (For each four-month reporting period, each pixel thus has 8 cropped/ uncropped values).	The value shown in tables is the maximum value of the 8 values available for each pixel; maps show an area as cropped if at least one of the 8 observations is categorized as "cropped." Uncropped means that no crops were detected over the whole reporting period. Values are compared to the average value for the last five years, with departures expressed in percentage.
CROPPING INTENSITY			
Cropping intensity Index			
Crop/ Satellite	0, 1, 2, or 3; Number of	Cropping intensity index describes the extent to which arable land is used over	Cropping intensity is presented as maps by pixels or spatial average pixels values for MPZs, 45

INDICATOR			
	crops growing over a year for each pixel	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.	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, 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, 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 / 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, per CWSU. For the MPZs, regular rainfall is shown as typical time profiles over the spatial unit, with a map showing where the profiles occur and the percentage of pixels concerned by each profile.
TEMP			
CropWatch indicator for air temperature, based on pixel-based temperature			
Weather / satellite	°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, per CWSU. For the MPZs, regular temperature is illustrated as typical time profiles over the spatial unit, with a map showing where the profiles occur and the percentage of pixels concerned by each profile.
VCIx			
Maximum vegetation condition index			
Crop/ Satellite	Number, pixel to CWSU	Vegetation condition of the current season compared with historical data. Values usually are [0, 1], where 0 is "NDVI as bad as the worst recent year" and 1 is "NDVI as good as the best recent year." Values can exceed the range if the current year is the best or the worst.	VCIx is based on NDVI and two VCI values are computed every month. VCIx is the highest VCI value recorded for every pixel over the reporting period. A low value of VCIx means that no VCI value was high over the reporting period. A high value means that at least one VCI value was high. VCI is shown as pixel-based maps and as average value by CWSU.
VHI			
Vegetation health index			

INDICATOR			
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 crop 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 the VCIx, CALF, land productivity and area of irrigated and rainfed cropland in the current monitoring period and the same period in the past five years for the spatial unit, a mathematical model proposed by CropWatch is used to calculate the index expressed as a normalized value. A value of 1.0 represents the basic normal crop production situation in the current period for the spatial unit, and the higher the value, the better the crop production situation in the current period. Conversely, the lower the value, the worse the crop production situation for the spatial unit in the current 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.

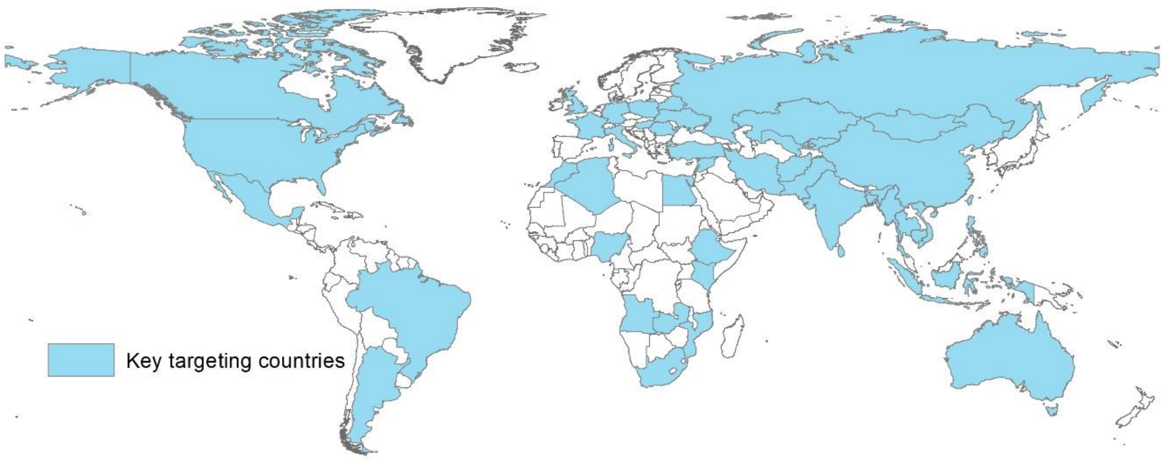
CropWatch spatial units (CWSU)

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.

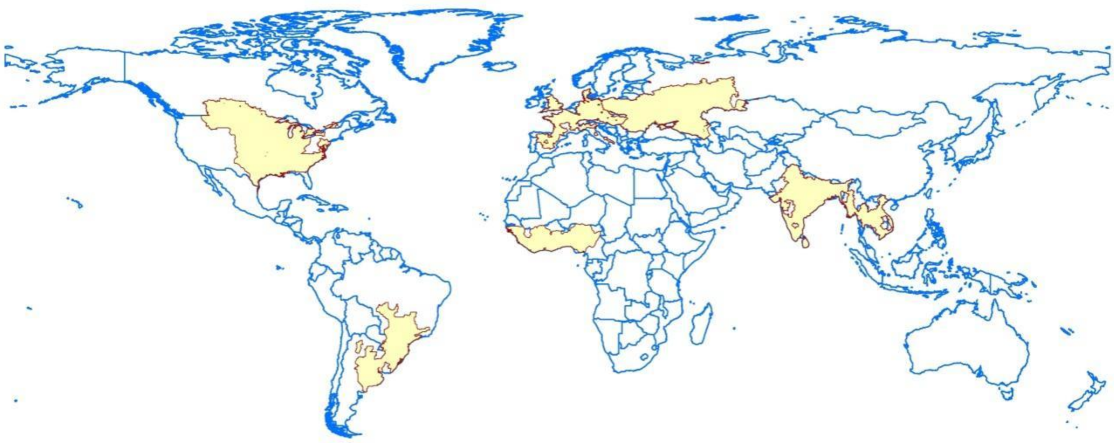
SPATIAL LUNITS	
CHINA	
Overview	*Description*
Seven monitoring regions	The seven regions in China are agro-economic/agro-ecological regions that together cover the bulk of national maize, rice, wheat, and soybean production. Provinces that are entirely or partially included in one of the monitoring regions are indicated in color on the map below.


Heilongjiang
North East China
Inner Mongolia
Jilin
Inner Mongolia
Liaoning
Gansu
Ningxia
Shanxi
Hebei
Loess region
Shandong
Huang Huaihai
Shaanxi
Jiangsu
Anhui
Sichuan
Hubei
Chongqing
Zhejiang
South-West China
Lower Yangtze
Jiangxi
Guizhou
Hunan
Fujian
Yunnan
Guangxi
Guangdong
Southern China

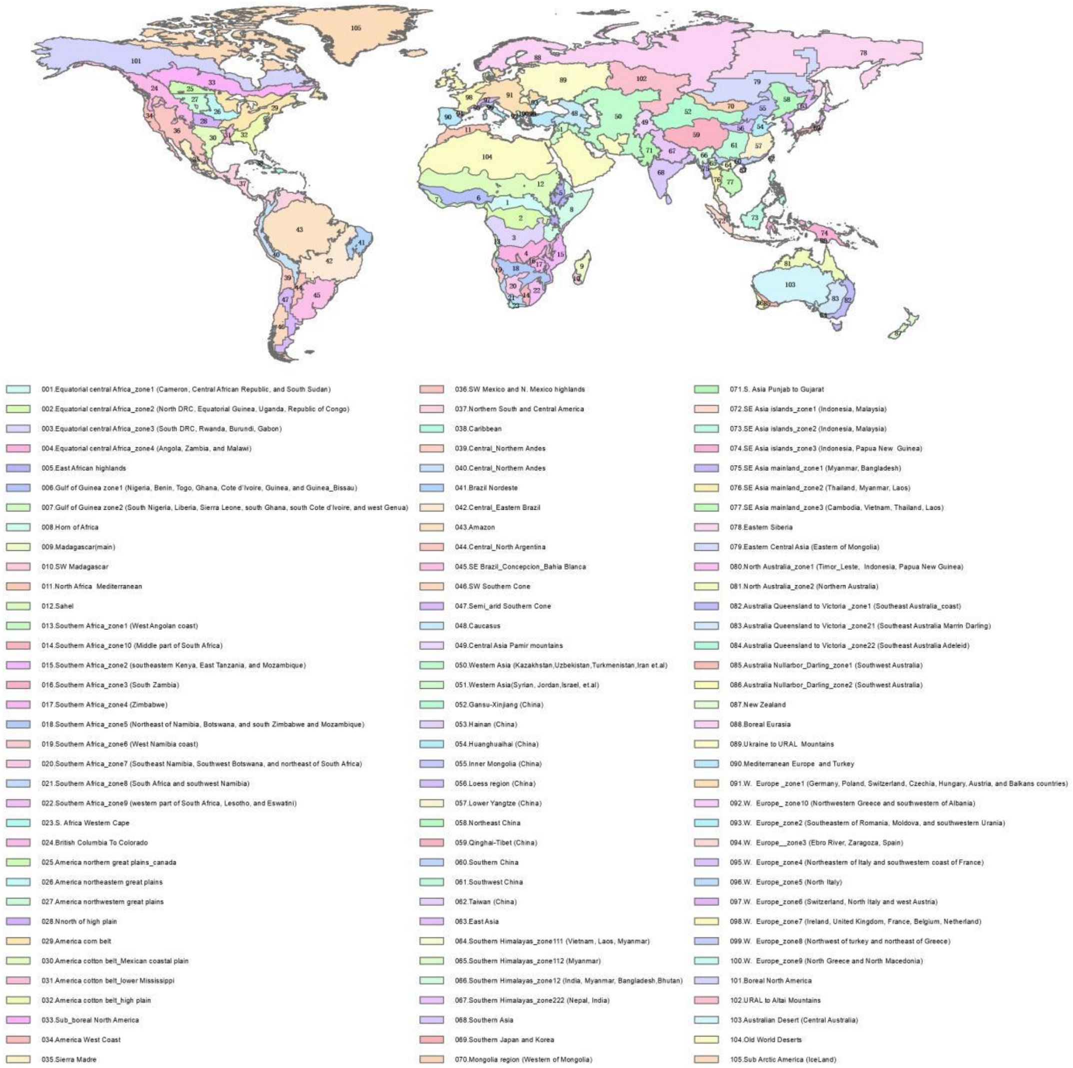
Countries (and first-level administrative districts, e.g., states and provinces)	
Overview	*Description*
"Forty six plus one" countries to represent main producers/exporters and other key countries.	CropWatch monitored 47 countries together represent more than 80% of the production of maize, rice, wheat 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 "46 + 1," referring to 46 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*
105agro-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 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 47 countries monitored by CropWatch, yield variation for each crop is calibrated against NDVI time series, using the following equation:

$$\Delta Yield_i = f(NDVI_i, NDVI_{i-1})$$

Where $NDVI_i$ and $NDVI_{i-1}$ are taken from the time series of the spatial average of NDVI over the crop specific mask for the current year and the previous year. For NDVI values that correspond to periods after the current monitoring period, average NDVI values of the previous five years are used as an average expectation. $\Delta Yield_i$ is calculated by regression against average or peak NDVI (whichever yields the best regression), considering the crop phenology of each crop for each individual country.

A different method is used for areas. For China, CropWatch combines remote-sensing based estimates of the crop planting proportion (cropped area to arable land) with a crop type proportion (specific type area to total cropped area). The planting proportion is estimated based on an unsupervised classification of high resolution satellite images from HJ-1 CCD and GF-1 images. The crop-type proportion for China is obtained by the GVG instrument from field transects. The area of a specific crop is computed by multiplying farmland area, planting proportion, and crop-type proportion of the crop.

To estimate crop area for wheat, soybean, maize, and rice outside China, CropWatch relies on the regression of crop area against cropped arable land fraction of each individual country (paying due attention to phenology):

$$Area_i = a + b * CALF_i$$

Where, a and b are the coefficients generated by linear regression with area from FAOSTAT or national sources and CALF (Cropped Arable Land Fraction) from CropWatch estimates.

Data notes and bibliography

Notes

[1] Although Yemen is not part of the Horn of Africa (HoA), it is geographically close and maintains close links to the region. The countries of the HoA are grouped in the regional development association IGAD (Inter-governmental Authority on Development, with headquarters in Djibouti). IGAD has recently established the IGAD Drought Disaster Resilience and Sustainability Initiative (IDDRSI, 2016).

[2] Under-investment in agriculture was one of the main drivers of the 2008 crisis of high food prices (Mittal 2009, ATV 2010), even if several other local and global triggering factors can be identified (Evans 2008).

[3] Previous large humanitarian crises were those of the West African Sahel (from the early sixties to the mid eighties), the Ethiopian droughts of the mid-eighties, the Indian Ocean tsunami of 2004, several large earthquakes (for example, Haiti, 2010), and floods and medical emergencies (such as the West African Ebola outbreak, 2013-16).

[4] http://www.agrhymet.ne/eng/index.html

[5] http://www.icpac.net/

[6] Belg is harvested before or during October.

[7] "Purely man-made disasters" is, however, a concept that deserves a closer look, as many wars and insurgencies are partially triggered by shortages of natural resources, including land. As such, most “man-made disasters” do have an environmental component.

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Online resources

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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:

Professor Bingfang Wu
Aerospace Information Research Institute,
Chinese Academy of Sciences, Beijing, China
E-mail: cropwatch@radi.ac.cn,
wubf@aircas.ac.cn