CropWatch Bulletin

QUARTERLY REPORT ON GLOBAL CROP PRODUCTION

Monitoring Period:
July 2023 - October 2023

Volume 23, No. 4
(No. 131)
November 30, 2023

中国科学院空天信息创新研究院
Aerospace Information Research Institute, Chinese Academy of Sciences

CropWatch

GEOGLAM
Global Agricultural Monitoring

November 2023

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, Zhongyuan Li (Hubei, China), Wenjun Liu (Yunnan, China), Xiaoyan Liu (Anhui, China), Zonghan Ma, Linghua Meng (Jilin, China), Elijah Phiri (Zambia), Elena Proudnikova (Russia), Xingli Qin, Igor Savin (Russia), Jatuporn Nontasiri (OAE, Thailand), Pich Rothana (Cambodia), Buchsarawan Srilertworakul (OAE, Thailand), Urs Christoph Schulthess (CIMMYT), Grace Simon Mbaiorga (NASRDA, Nigeria), Men Sothy (Cambodia), Binfeng Sun (Jiangxi, China), Fuyou Tian, 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: Cong Xu

Photographer of Cover Page: Yan Xie

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/.

Contents

LIST OF TABLES

LIST OF FIGURES

Abbreviations

5YA	Five-year average, the average for the four-month period from July to October of for 2018-2022; one of the standard reference periods.
15YA	Fifteen-year average, the average for the four-month period from July to October for 2008-2022; 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 July and October 2023, a period referred to in this bulletin as the JASO (July, Ausust, September and October) period or just the "reporting period.", while the information on disaster events was updated until mid-October. The bulletin is the 131th 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, 46 major agricultural countries, and 230 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 October 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 July to October 2023.

Agroclimatic conditions

During this monitoring period, new temperature records were observed. October, the last month of this monitoring period, was the fifth consecutive month of record-warm global temperatures. Despite of the warmer temperatures, crop losses were limited, mainly due to a change in precipitation patterns caused by the transition from La Niña to El Niño. One of the few regions affected by severe drought and extremely high temperatures was the Amazon basin and adjacent Mato Grosso in Brazil. Never in the 120 years since measurements of water levels of the Rio Negro at Manaus began, have water levels been that low. Deforestation, El Niño and climate change are the culprits. The current drought and heat wave are also impacting the sowing of the soybean crop in Mato Grosso.

Global crop production situation

Since 2021, the CPI has remained below 1.0 for three consecutive years, indicating that frequent extreme events caused by climate change have constrained stable increases in global and regional grain production. In 2023, the global CPI from July to October (0.972) is still at a lower level within the past 11 years, it has shown a slight improvement compared to the same period in 2022 (CPI=0.970).

Maize: Agroclimatic conditions have been favorable in most of the world's major maize exporting countries in 2023. CropWatch estimates that global maize production increases by 2.4% to 1,069 million tonnes. The largest increases come from the three main producers: USA (+12.8 million tonnes), followed by Brazil (+9.4 million tonnes) and China (+5.6 million tonnes). After a mixed start of the growing season caused by low rainfall, conditions greatly inproved in the USA during this monitoring period. China's maize production increased by 2.4% due to the expansion of the maize cultivation area. Brazil experienced a decrease in the first-season maize and an expansion of planting areas for the second-season maize, boosting total maize production to reach 100.68 million tonnes. Compared to the extremely hot and dry conditions in 2022, Europe's important maize-producing countries generally enjoyed favorable weather conditions in 2023. Only Romania was affected by drought conditions. 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.

Rice: Most rice-producing countries experienced a slight decrease, resulting in global rice production of 753.41 million tonnes, which is 0.3% below last year's level. As the world's largest rice producer, China is expected at 195.813 million tonnes, a slight increase of 0.2%, mainly due to the recovery from the last year's extremely high temperature and drought in the Yangtze River Basin, prompting an increase in production of mid- and late-stage rice. In India and Pakistan, a late onset of the monsoon season and irregular rainfall patterns caused brief periods of drought, but also flooding conditions, causing yield losses. However, in Pakistan, conditions were still better than last year, causing an increase in production by 11.8%. For most of Southeast Asia, slight yield reductions are estimated, with the exception of Cambodia (+5.4%). The United States (+5.7%) and Nigeria (+12.1%) also saw varying degrees of increased rice production. Overall, the global rice production remained stable.

Wheat: The production for major wheat-producing countries varied significantly. The total wheat production in the main producing countries was almost stable, but the total production of other countries has decreased by a large margin. The global wheat production in 2023 is estimated to be 732.84 million tonnes, down by 1.0%. It has been reduced for the third consecutive year and reached the lowest level in the past five years. Wheat in the Northern Hemisphere countries has been mainly harvested from June to September, and the production is in line with the August 2023 monitoring results. Overall, wheat production recovered in East Africa, while it decreased in many Central Asian countries. In the Southern Hemisphere, affected by lower rainfall, both wheat cultivated area and yields in Australia fell sharply, with production declining by 26.2%; on the contrary, agroclimatic conditions in the other wheat-producing regions were generally normal, leading to production increases in Brazil (+6.9%) and South Africa (+2.8%). Frequent rainfall during the harvest season caused some quality issues due to sprouting in Germany, Poland and Kazakhstan. Good rainfall in the winter wheat production regions of Europe and Asia in October helped with the germination and establishment of the new crop.

Soybean: Global soybean production in 2023 is expected to be 318.13 million tonnes, a reduction of 0.6%. The southern hemisphere soybean production increased, but the difference between the production in Brazil and Argentina is stark. Soybean production in Argentina was significantly reduced by 18.9%, while Brazil increased by 12.1%, and the cumulative production of soybeans in the two countries increased by 1.71 million tonnes. The northern hemisphere soybean acreage declined, resulting in an overall reduction in soybean production. The United States witnessed favorable agro-climatic conditions during the soybean growth period, with suitable moisture and temperature contributing to favorable yields. However, due to the reduction in cultivated area, production decreased by 1.2%. China's soybean acreage shrinkage led to a 5.6% decrease in soybean production; India's and Canada's soybean production increased by 3.8% and 0.6%, respectively, while Russia's soybean production decreased slightly by 0.4%. The cumulative decrease of 2.82 million tonnes in soybean production in the Northern Hemisphere exceeded the increase in the Southern Hemisphere, resulting in a global soybean production decrease of 0.6%.

All in all, CropWatch estimates that the global production of maize, rice, wheat and soybean in 2023 will reach 2.874 billion tonnes, an increase of approximately 14.14 million tonnes or about 0.50%

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 July 2023 to October 2023, JASO, 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 JASO 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

October, the last month of this monitoring period, was the fifth consecutive month of record-warm global temperatures. According to the National and Oceanic Atmospheric Administration (NOAA), there is a greater than 99% probability that 2023 will rank as the warmest year on record. From January to October, the largest positive temperature departures were observed all the way from the South of the USA to

Patagonia in South America, the Maghreb, Eastern Europe, a belt along the equator in Africa and Eastern China. Near average temperatures were observed only in the Western USA.

The onset of El Niño changed some global rainfall patterns. Argentina and Eastern Africa, which experienced strong rainfall deficits until mid 2023, started to receive higher precipitation, causing flooding in Ethiopia, Kenya and Somalia. The people in these countries are going through crisis upon crisis.

1.3 Rainfall

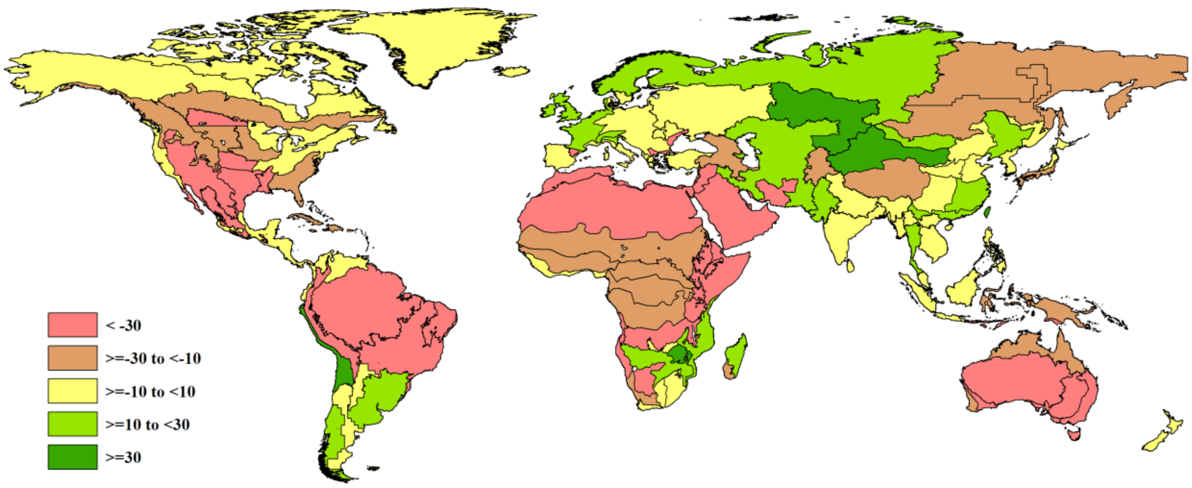


Figure 1.1 Global map of rainfall anomaly (as indicated by the RAIN indicator) by CropWatch Mapping and Reporting Unit: Departure of July 2023 to October 2023 total from 2008-2022 average (15YA), in percent.

In South America, the pattern of the rainfall deficit changed from the previous report. Paraguay, Uruguay, southern Argentina and Chile received average to above average rainfall, while a rainfall deficit had been recorded before. The Andes in Bolivia, Peru, and Ecuador, as well as the Amazon basin, Central and Northeastern Brazil, had a strong rainfall deficit of more than -30%. Conditions in Central America were average. The Mexican Highlands, as well as the western USA and the Southern High Plains, had a strong rainfall deficit (<-30%). The only exception was the West Coast, where rainfall was average. In the northern High Plains of USA, as well as the Canadian Prairies, the deficit ranged from -10 to -30%. Most of the Midwest and the East of the USA received normal precipitation. The strongest deficit was observed for East Africa, and the countries North of the Sahel. Only south-east Africa had average to above precipitation. In the Levant, the drought conditions continued, with a rainfall deficit greater than -30%. In the Caucasus and Central Asia, apart from Afghanistan, the situation had improved to above average (+10 to +30%) and more. The Ural region in Russia, as well as Kazakhstan, South Asia, South-East Asia and Eastern China had average to above average precipitation. In Australia, a strong rainfall deficit, greater than -30%, was observed for all crop production regions, apart from the southwest of Australia, where the deficit ranged from -10 to 30%.

1.4 Temperatures

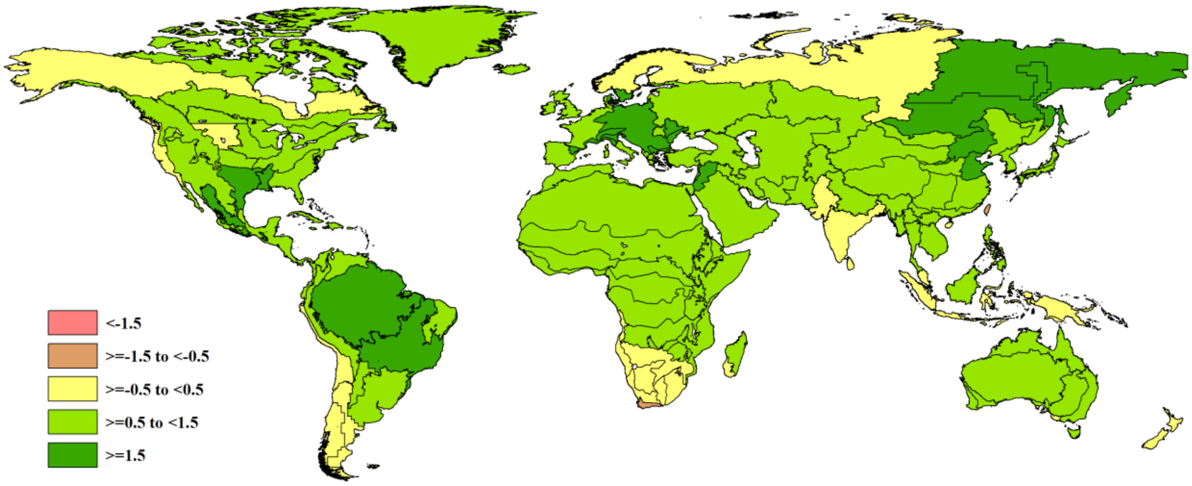


Figure 1.2 Global map of temperature anomaly (as indicated by the TEMP indicator) by CropWatch Mapping and Reporting , Unit: departure of July 2023 to October 2023 average from 2008-2022 average (15YA), in °C.

Except for the Cape Province in South Africa, all land surfaces experienced average or above temperatures ranging from 0.5 to 1.5ºC above the 15YA. The strongest positive departures of +1.5ºC or more were recorded for the Amazon Basin and the Mexican Highlands. Much warmer temperatures (>+1.5ºC) were recorded for Central Europe, the Levant, Eastern Siberia, and the North China Plain. In Southern Africa, as well as the South of Argentina, Chile and the West Coast of the USA, South Asia and northern Siberia, temperatures were close to the long-term average.

1.5 RADPAR

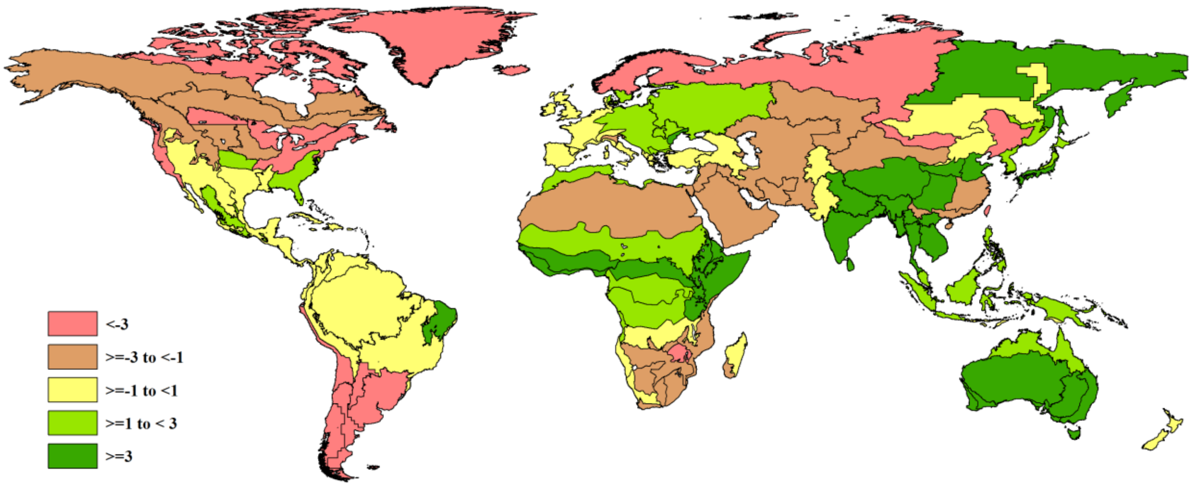


Figure 1.3 Global map of photosynthetically active radiation anomaly (as indicated by the RADPAR indicator) by CropWatch Mapping and Reporting Unit: departure of July 2023 to October 2023 average from 2008-2022 average (15YA), in percent.

In South America, only the northeast of Brazil had above average solar radiation by more than +3%. The same regions in South America that received above-average precipitation had below-average solar radiation by more than -3%. In the other areas of South America, the radiation was average, as well as in Central America and the southern United States. The Mexican Highlands and the Southeast of the USA had above average solar radiation (+1 to +3%), whereas in the West and the Southern Plains of the USA, solar radiation was average. The West Coast, as well as the Midwest and Northeast of the USA, Quebec, Ontario, and the Canadian Prairies, had below-average radiation by more than -3%. In all of the other regions of North America, solar radiation was reduced by -1 to -3%. A reduction in solar radiation by -1 to -3% was also observed for the southeast of Africa. In the African countries along the equator, solar radiation was above average. Western Europe had average solar radiation, whereas in Eastern Europe, it was above average. In the Middle East and Central Asia, it was below average by -1 to -3%. In South and Southeast Asia and the North China Plain, solar radiation was above average by more than +3%. In Southeast China, it was below average by -1 to -3%. Positive departures were recorded for the Malay Archipelago and all of Australia.

1.6 BIOMSS

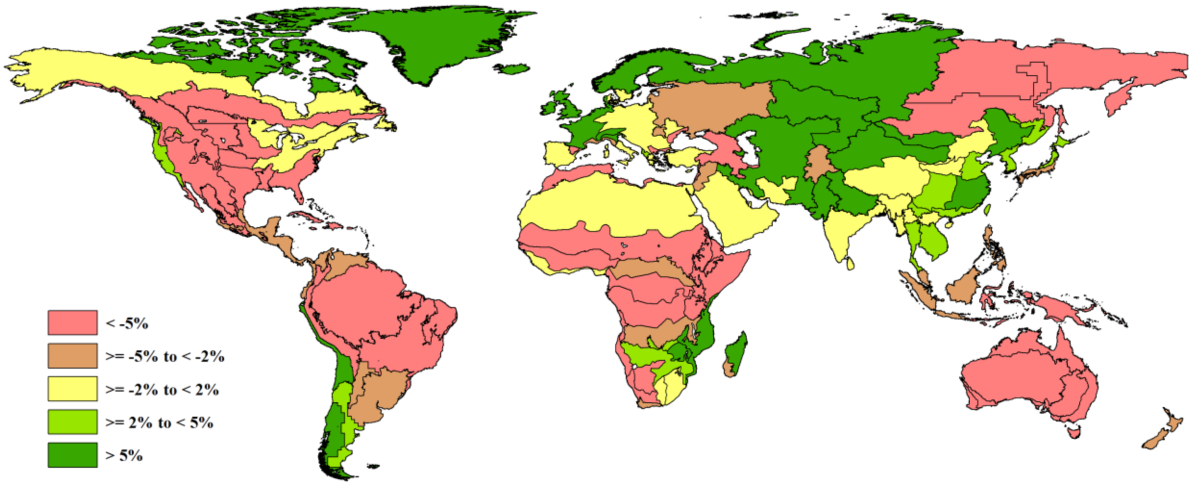


Figure 1.4 Global map of biomass accumulation (as indicated by the BIOMSS indicator) by CropWatch Mapping and Reporting Unit: departure of July 2023 to October 2023 average from 2008-2022 average (15YA), in percent.

Estimated biomass production was by more than 5% below average in almost all of the Americas. This was mainly due to a rainfall deficit. The regions with positive departures were Patagonia, all of Chile, and the West coast of the USA. The Midwest and north-eastern regions of the USA had average biomass production. In Africa, the biomass anomaly map also matched the rainfall departure map. Only the southeast of Africa had positive departures in biomass estimates. Scandinavia and most of Western Europe, apart from the Iberian Peninsula, had a positive departure of biomass by more than +5%. For the European regions of Russia, a negative departure by -2 to -5% had been estimated. In Central Asia, the Ural, the Indo-Gangetic Plain, East and Southeast Asia, a positive departure had been estimated as well. For the Malayan Archipelago, a negative departure by -2 to -5% had been calculated, whereas for Australia, the negative departure was even stronger (<-5%).

Chapter 2. Crop and environmental conditions in major production zones

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

2.1 Overview

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

Table 2.1 Agroclimatic indicators by Major Production Zone, current value and departure from 15YA (July-October 2023)

	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 (%)
West Africa	776	-16	26.0	1.2	1149	5	1159	-11
North America	265	-24	21.4	0.9	1126	-1	751	-13
South America	289	-16	20.5	0.9	972	-5	611	-17
S. and SE Asia	1360	1	26.0	0.6	1134	5	1396	2
Western Europe	361	19	17.2	1.3	961	0	793	5
Central Europe and W. Russia	227	-10	16.6	1.4	911	3	649	-5

*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 (July-October) for 2008-2022.*

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

	CALF (Cropped arable land fraction)		Cropping Intensity		Maximum VCI
	Current (%)	Departure from 5YA (%)	Current (%)	Departure from 5YA (%)	Current
West Africa	98	1	129	-4	0.93
North America	95	2	109	1	0.87
South America	87	-1	134	3	0.82
S. and SE Asia	96	0	153	1	0.89
Western Europe	90	0	134	2	0.86
Central Europe and W Russia	96	1	120	2	0.84

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

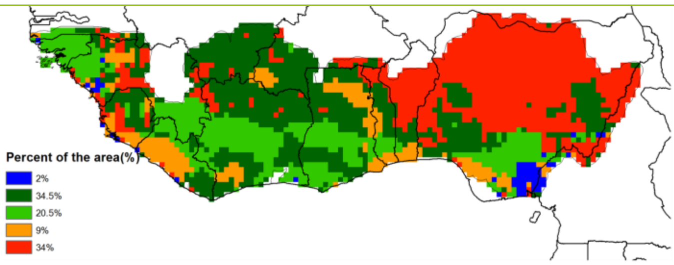
2.2 West Africa

The report covers agroclimatic indicators of 11 countries in the West African Region (MPZ) characterized by the main rainy season. Planting of maize, sorghum, millet, and rice under both rainfed and irrigated conditions started in July. Tuber crops such as yam were being harvested, while rice harvest is expected to extend into December and January. Based on the CropWatch agroclimatic indicators of the MPZ, average rainfall was below the 15YA (RAIN -16%), whereas the temperature and the RADPAR were above the 15YA (TEMP +1.2%, RADPAR +5%), however the estimated biomass decreased (BIOMSS -11%). CALF was increased by 0.9% compared with the 5YA, reaching 98% and the VCIx of the MPZ was 0.93.

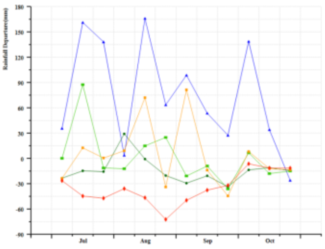
For individual countries in the MPZ, increased rainfall was observed in Equatorial Guinea (RAIN +17%), Guinea Bissau (RAIN +7%), Liberia (RAIN +5%) and Gabon (RAIN +2%) while reduction in rainfall occurred in Burkina Faso (RAIN -43%), Nigeria (RAIN -28%), Togo (RAIN -23%), Ghana (-14%), Sierra Leone (RAIN -11%), Cote d Ivoire (RAIN -10%). These country-specific deviations in rainfall are reflected in the spatial distribution of rainfall profiles: Nigeria and Burkina Faso were severely affected by the rainfall deficit. Despite the regional solar radiation being above average (RADPAR +5%), the rainfall deficits caused a below average estimation of potential biomass in Burkina Faso (BIOMASS -26%), Nigeria (BIOMASS -20%), Togo (BIOMASS -11%) Ghana (BIOMASS -6%), and Côte d'Ivoire (BIOMASS -2%). Based on the VCIx map, the MPZ experienced good crop condition (VCIx >0.8) however, the vegetation health index (VHI) map depicts a spatial and temporal pattern affected by moderate to severe drought conditions. At the regional level, the cropped arable land fraction slightly increased (CALF +0.9%), while at the country level, the lowest CALF values were above 93%, which could be attributed to the generally wet environments.

Rainfall deficits limited crop production in the north-eastern regions of this MPZ, especially in Burkina Faso and Nigeria. In the other regions, rainfall was close to average levels, causing normal crop conditions.

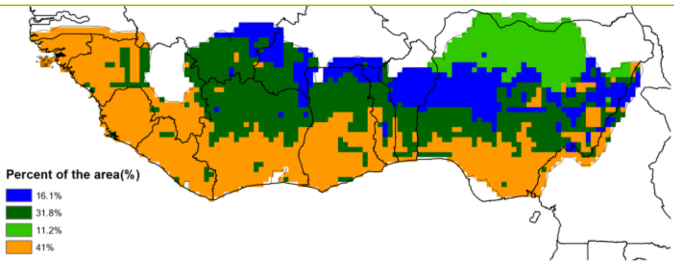
Figure 2.1 West Africa MPZ: Agroclimatic and agronomic indicators, July to October 2023.



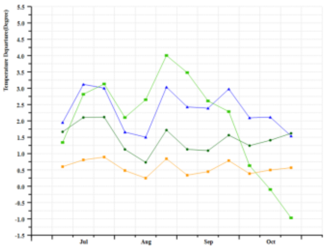
a. Spatial distribution of rainfall profiles



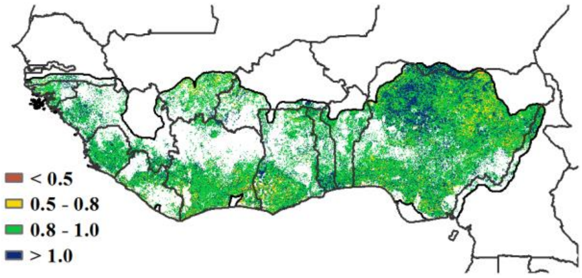
b. Profiles of rainfall departure from average (mm)



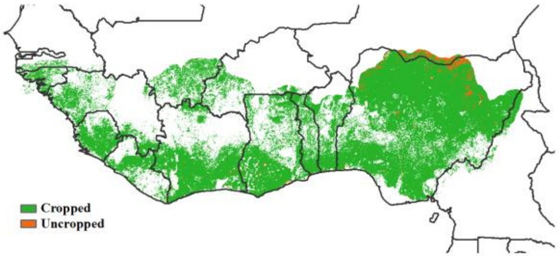
c. Spatial distribution of temperature profiles



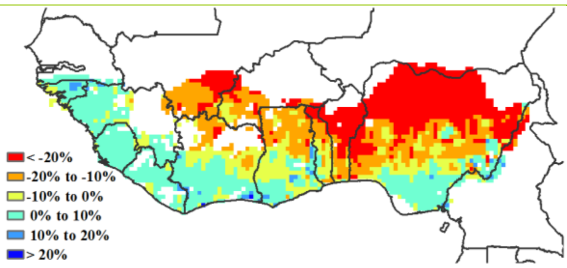
d. Profiles of temperature departure from average (mm)



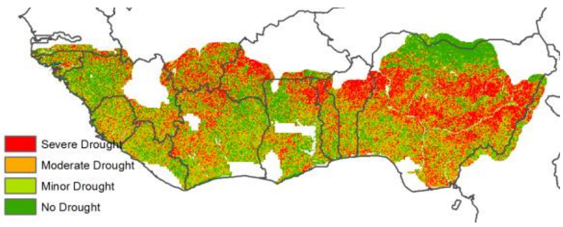
e. Maximum VCI



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

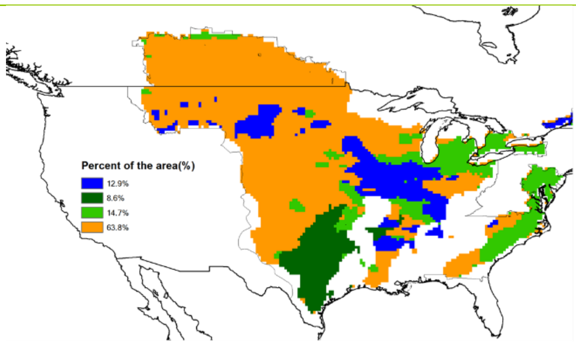
This report covers the flowering, grain filling, and maturity stages of maize and soybeans. Spring wheat was harvested in August in the northern United States and Canada. Overall, conditions in the Southern Plains were exceptionally dry and hot, while the eastern region experienced more favorable conditions.

As a whole, dry and hot weather prevailed in the main production areas of North America, with rainfall and RADPAR both below average (ΔRAIN -24%, ΔRADPAR -1%), and temperatures(ΔTEMP +0.9°C) higher than the 15-year average . Affected by the rainfall deficit and high temperatures, estimated biomass was below average (ΔBIOMSS -12%). However, agricultural meteorological conditions showed high spatial variability. The Lower Mississippi and the area from the Canadian Prairies to the Southern Plains experienced below-average rainfall throughout the reporting period, along with a significant warming trend. This resulted in a below-the-15YA estimate of potential biomass (BIOMSS -20%). The Corn Belt also experienced dry and hot weather, with potential biomass close to the average. Abundant rainfall in early August effectively replenished soil moisture for maize and soybeans at the flowering and filling stages and facilitated yield formation. After August, as maize and soybeans entered the maturity and harvest stage, the slightly below-the-15YA rainfall created good conditions for harvest.

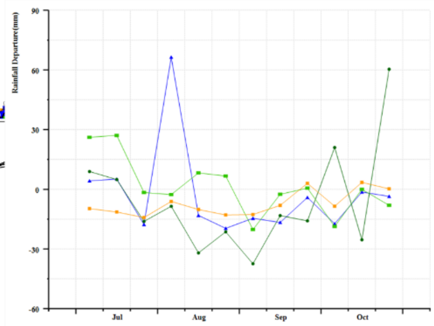
The VHIm reflected drought conditions in the Canadian Prairies, Northern Corn Belt, and Southern Plains during the reporting period. The VCIx reached 0.86, with poor crop conditions observed in the southern parts of the Canadian Prairies and Southern Plains, while favorable conditions were observed in the Corn Belt. Compared to the 5-year average, higher average CALF (+2%) was observed for the whole region.

In summary, the CropWatch assessment indicates poor crop conditions in the Southern Plains and average crop conditions in the Corn Belt.

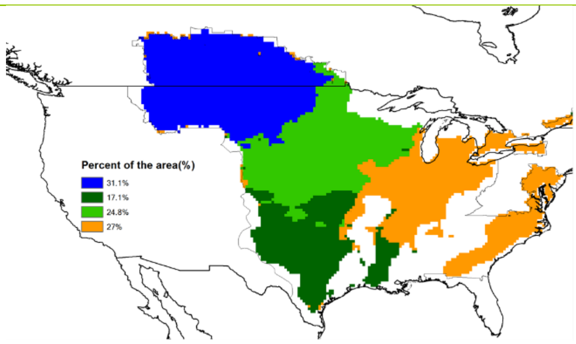
Figure 2.2 North America MPZ: Agroclimatic and agronomic indicators, July to October 2023.



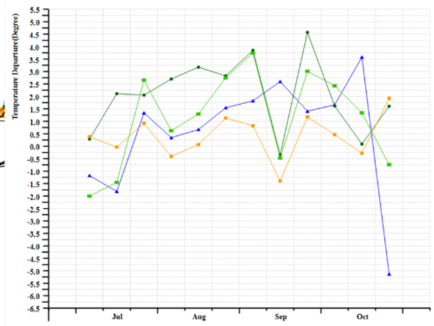
a. Spatial distribution of rainfall profiles



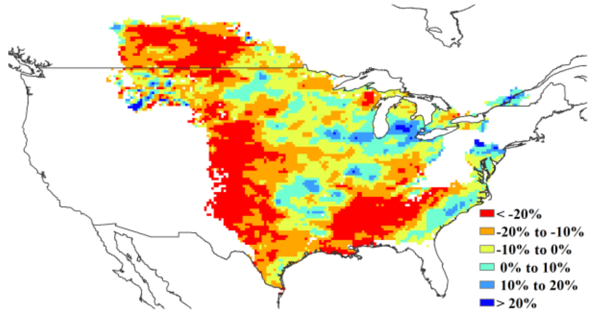
b. Profiles of rainfall departure from average (mm)



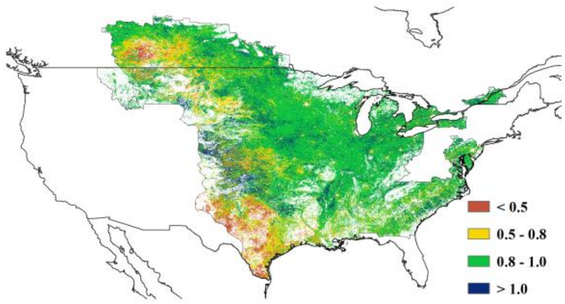
c. Spatial distribution of temperature profiles



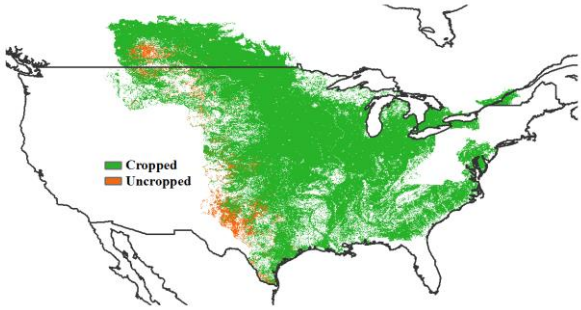
d. Profiles of temperature departure from average (mm)



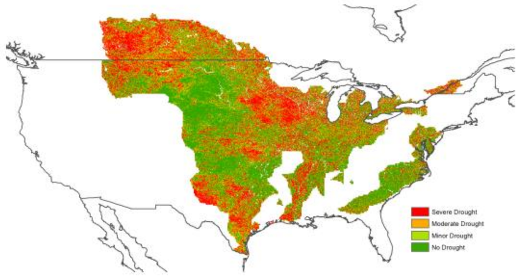
e. Biomass accumulation potential departure



f. Maximum VCI



g. Cropped and uncropped arable land



h. VHI minimum

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

2.4 South America

The South and Southeast Asia MPZ includes India, Bangladesh, Cambodia, Myanmar, Nepal, Thailand, Laos, and Vietnam. This monitoring period covers the growth and harvest period of summer rice, maize, and soybean.

The reporting period covers the main growing period of winter crops in humid areas and the planting of early maize and rice. Part of the period is fallow period for summer crops. Conditions were close to normal in most of the Major Production Zones (MPZ), but some indices (CALF and VCIx) showed poor conditions in West Pampas, East Subtropical highlands and North West Chaco. North of Brazilian agricultural area (Mato Grosso, Mato Grosso do Sul, Goias, Minas Gerais and Sao Paulo) showed also anomalies in temperature and rain, as well as low BIOMSS values.

Spatial distribution of rainfall profiles showed five different patterns. A stable pattern with near no anomalies (dark green profile) was observed in most of Argentina's agricultural area (most of Pampas, Subtropical Highlands and Chaco), and Uruguay. A pattern with near no anomalies during almost the entire period, and a strong positive anomaly at the end of October (red profile) was observed in North East Pampas and South Mesopotamia in Argentina and West Uruguay. Two similar patterns with strong positive anomalies at the beginning of September and during October (Orange and Light green profiles) were observed in North Mesopotamia in Argentina, South East Paraguay and North Rio Grande do Sul, Santa Catarina and Parana states in Brazil. Finally, a pattern with near no anomalies up to August and negative anomalies in September (blue profile) and October was observed in Mato Grosso, Mato Grosso do Sul, Goias, Minas Gerais and Sao Paulo in Brazil. Trends in precipitation anomalies need to be considered, as the nmorth of the MPZ showed a tendency to decrease at the end of the reporting period (possible drying process) and the center of the MPZ showed a tendency to increase precipitation (possible recovery process).

Temperature profiles showed four homogeneous patterns located approximately in a North-South gradient. Northern agricultural areas, including states of Mato Grosso, Goias and Minas Gerais in Brazil, showed a profile with near +2°C anomalies from July to the beginning of September and an increment during mid-September and October showing positive anomalies of near +5°C (orange profile). A similar profile but with higher anomalies (near +4°C) during the end of July, August and the beginning of September (blue profile) was observed in Mato Grosso do Sul, Sao Paulo and North Parana states in Brazil. The other two profiles (dark and light green) showed negative and positive anomalies. Both profiles showed negative anomalies of nearly -2°C in mid-July and positive anomalies of nearly +3°C during the end of July and beginning of August. The dark green profile showed positive anomalies during September, while the light green profile showed nearly no anomalies during September and October. A dark green profile covers East Paraguay, North Mesopotamia in Argentina and in South Parana and Santa Catarina states in Brazil. The light green profile was observed for the rest of Argentina, Uruguay and Rio Grande do Sul state in Brazil.

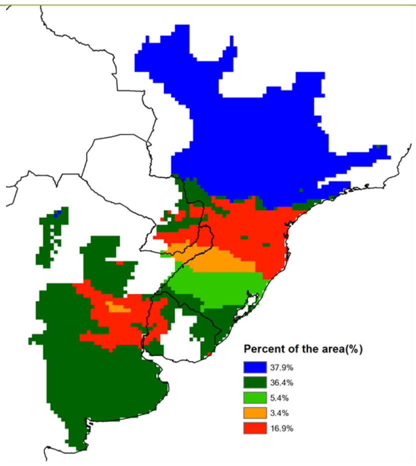
The CALF map showed several uncropped areas in Center and West Pampas, Chaco, and East Subtropical Highlands in Argentina, reflecting the typical sparse planting of winter crops in drier areas like West Pampas, West Subtropical Highlands and North East Chaco, but also reflecting reduced planting of winter crops or a delay in the planting of summer crops in some of the humid areas like Center Pampas and South Chaco. North of the MPZ (Mato Grosso and Goias states in Brazil) also showed uncropped areas but in a much lower magnitude.

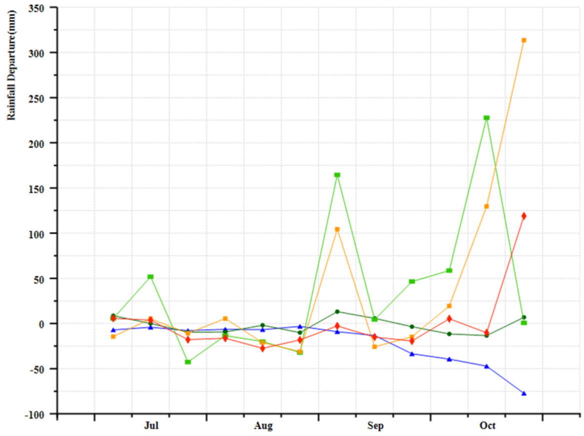
BIOMSS showed strong negative anomalies (lower than -20 %) in Mato Grosso, Mato Grosso do Sul, Goias, Minas Gerais, Sao Paulo and North Parana states in Brazil. Most of the Pampas in Argentina showed regular to strong negative anomalies. The rest of the MPZ showed good conditions in BIOMSS with positive anomalies.

Maximum VCI showed poor conditions in Center and West Pampas and Chaco in Argentina. Excep for some areas in Mato Grosso and Minas Gerais in Brazil, the rest of the MPZ showed good conditions for VCIx.

In summary, several indices showed poor conditions in part of Pampas, Chaco and Subtropical Highlands in Argentina (CALF and VCIx). Pampas also showed poor conditions in BIOMSS. North of Brazilian agricultural area, including Mato Grosso, Mato Grosso do Sul, Goias Sao Paulo, and Minas Gerais states, need to be carefully watched, because poor conditions were also observed in some indices: high positive temperature anomalies, negative precipitation anomalies at the end of the reporting period, and strong negative anomalies in BIOMSS.

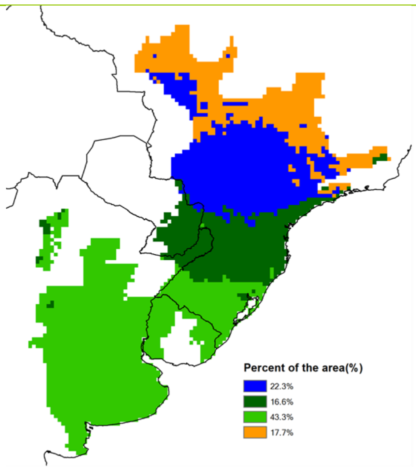
Figure 2.3 South America MPZ: Agroclimatic and agronomic indicators, July to October 2023.

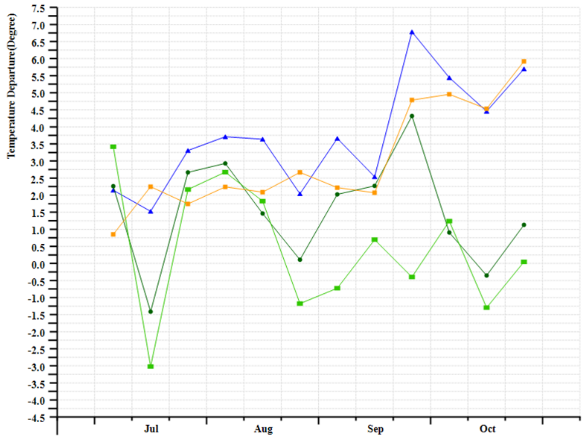




a. Spatial distribution of rainfall profiles

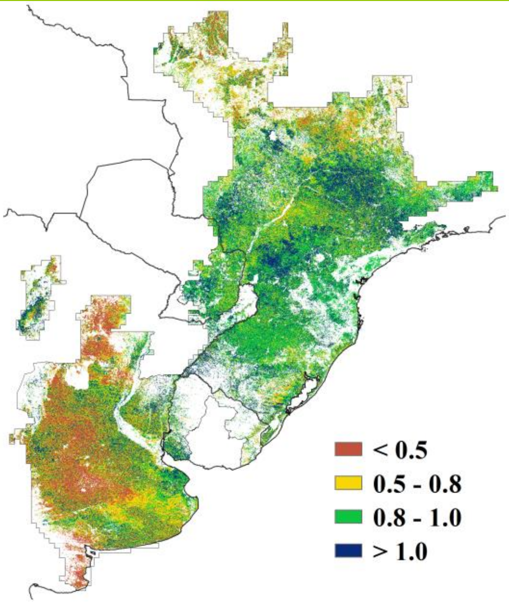
b. Profiles of rainfall departure from average (mm)

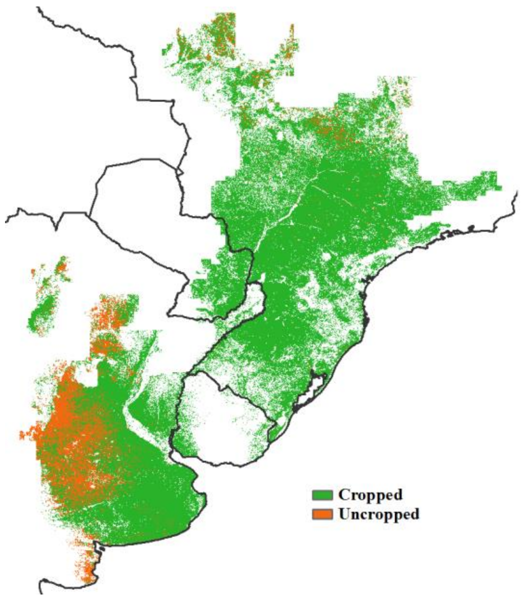




c. Spatial distribution of temperature profiles

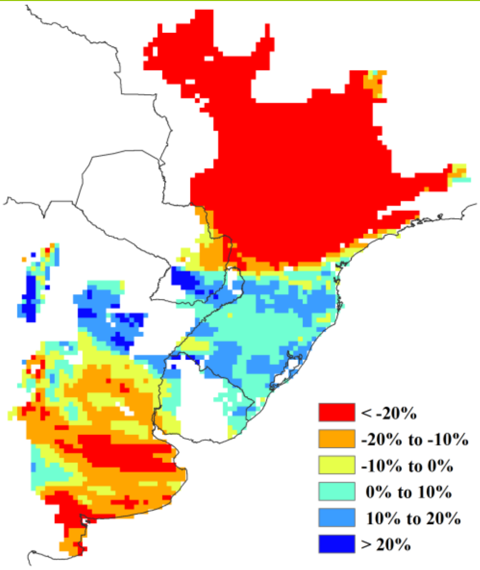
d. Profiles of temperature departure from average (mm)





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 growth and harvest period of summer rice, maize, and soybean.

According to the agroclimatic indicators, the accumulated precipitation and the temperature were slightly above the average (ΔRAIN +1%, ΔTEMP +0.6℃). Meanwhile, RADPAR was above the average (ΔRADPAR +5%), which led to an increase in the potential biomass production (ΔBIOMSS +2%). The CALF of 96%, indicates that in most areas of the MPZ, crops were cultivated. The CALF was similar to the values observed during the past five years. In addition, VCIx of the MPZ was 0.89, indicating that the crops were growing well.

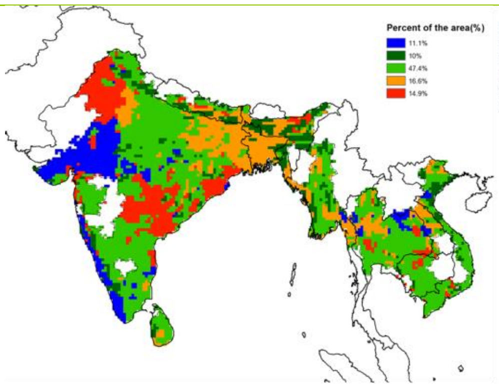
Throughout the entire monitoring period, the spatial distribution of rainfall profiles indicates that the precipitation for 47.4% of the MPZ (northern and southern India, Myanmar, Thailand, Cambodia, and Vietnam) was close to the 15YA. Additionally, 10% of the MPZ, covering northern and eastern India, Nepal, Myanmar, and Vietnam, experienced precipitation levels below the 15YA. During the monitoring period, the precipitation for 16.6% of the MPZ (northern and eastern India, Bangladesh, Myanmar, Thailand, Laos, and northern Vietnam) fluctuated between the mean and above-average levels. Around 14.9% of the MPZ (mainly in southeastern and northwestern India) experienced intense precipitation in late July, which caused flooding conditions. Other regions (accounting for 11.1% of the MPZ) showed rainfall conditions with strong fluctuations, mainly in the western and western coastal areas of India.

Based on the spatial distribution of temperature profiles observed throughout the entire monitoring period, it was found that the average temperature in 2.2% of the MPZ, specifically in Nepal, was significantly above the 15YA. Moreover, in 24.4% of the MPZ, which includes eastern and southern India, Myanmar, Thailand, Cambodia, and Vietnam, the average temperature was slightly above the average. The average temperature in 56.9% of the MPZ (India, Bangladesh, south Myanmar, Thailand, Cambodia, and Vietnam) was close to the average. The average temperature in 16.4% of the MPZ (mainly in northwestern India) was below the 15YA during the monitoring period but slightly above the average in early September and late October.

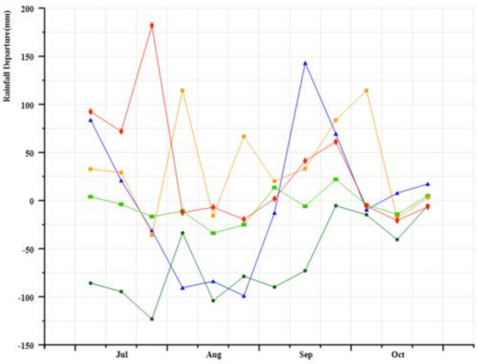
The BIOMASS departure map illustrates that the potential biomass mainly in northern India and Nepal exceeded the historical average for the same period by 20%. Conversely, the potential biomass in the southern part of India was observed to be below the average level. The Maximum VCI shows that the index was below 0.5 in the southern and western parts of India and some scattered regions. The VHI Minimum map shows that most of the MPZ was temporarily impacted by drought, except for southern and western India, northern Myanmar, eastern Thailand, and some scattered regions. The CALF map indicates that a substantial portion of the arable land in the MPZ was planted, and the uncultivated arable land was scattered mainly in southern and western India.

Overall, the crop conditions in the MPZ are expected to be favorable.

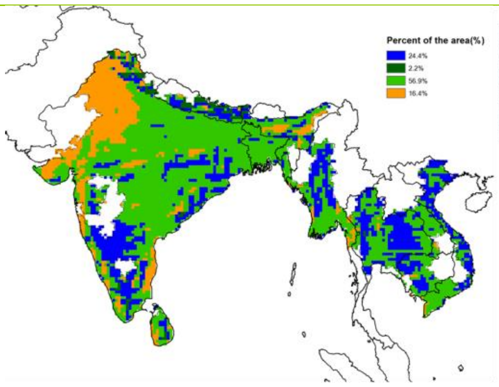
Figure 2.4 South and Southeast Asia MPZ: Agroclimatic and agronomic indicators, July to October 2023.



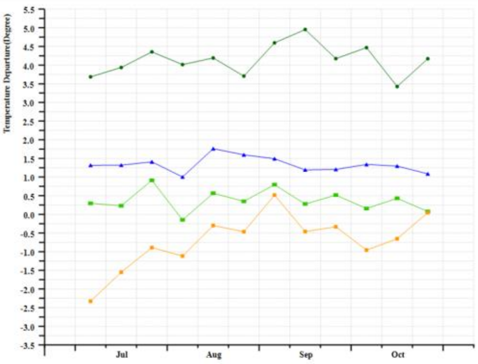
a. Spatial distribution of rainfall profiles



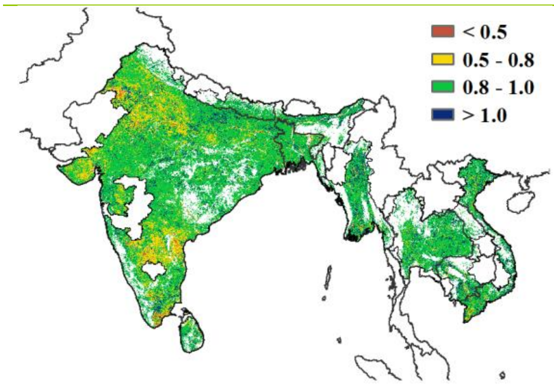
b. Profiles of rainfall departure from average (mm)



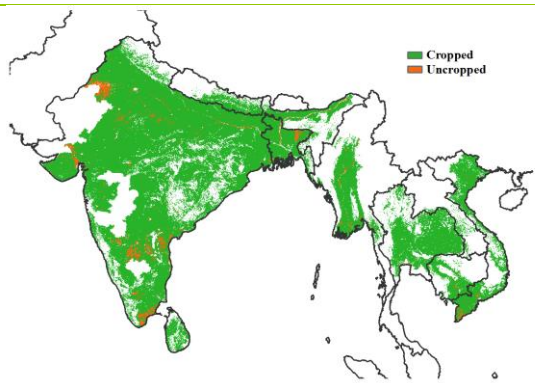
c. Spatial distribution of temperature profiles



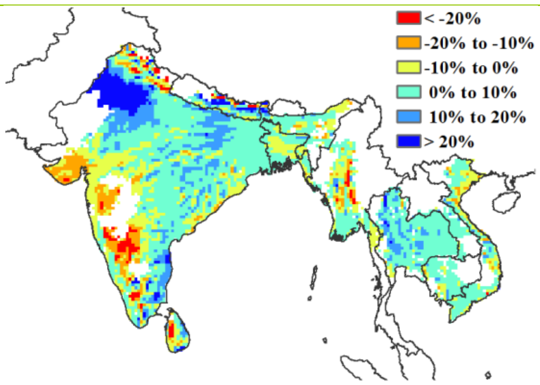
d. Profiles of temperature departure from average (mm)



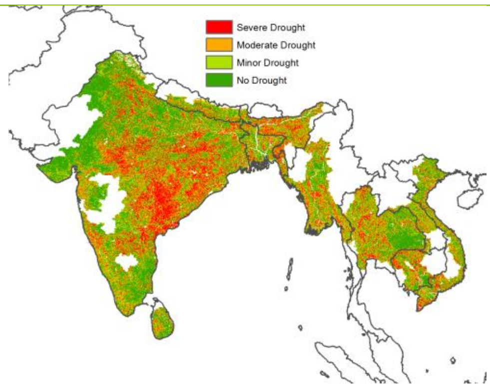
e. Maximum VCI



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 period covers the key growing and harvesting periods periods of summer crops, and the sowing of winter crops in the major production zone (MPZ) of Western Europe. Most of the crops in this MPZ are mainly rain-fed crops, and changes in agrometeorological conditions severely affect the growth of these crops. Generally, most parts of Germany, France, and UK had sufficient precipitation and warmer-than-usual conditions, while parts of Spain and Italy experienced high temperatures and rainfall deficits. Crop conditions were above average in most parts of this MPZ based on the interpretation of agro-climatic and agronomic indicators monitored by Cropwatch (Figure 2.5).

CropWatch agroclimatic indicators show that the persistent precipitation deficit that had been observed during the last year ended during this monitoring period. Precipitation was significantly above average (+19%). According to the spatial distribution of rainfall profiles, the spatial and temporal distribution of rainfall varied considerably between countries. The rainfall patterns can be characterized as follows: (1) 24.4% of the MPZ (the blue area in Figure 2.5a) received above-average precipitation for almost the entire monitoring period, except for the period before mid-July, mid-August, and September to early October, when it was significantly below average. This includes most of southern Germany (North Rhine-Westphalia, Hesse, Thuringia, Rhineland-Palatinate, Baden-Wurttemberg, Bavaria), and northern France (Basse-Normandie, Haute-Normandie, Ile-de-France, Nord-Pas-de-Calais Picardie, Alsace Champagne-Ardenne Lorraine); (2) Precipitation in most of the United Kingdom and north-west Germany (north of Lower Saxony, west of Schleswig-Holstein, Mecklengurg-Western Pomerania), covering 18.6% of the MPZ areas (dark green areas in Figure. 2.5a), was generally above average during most of the monitoring period, except for the period from mid-August to early-September, and from late-September to early-October; (3) Precipitation was below or equal to average in 42.6% of the MPZ (green areas in Figure. 2.5a), with the exception of above-average precipitation after the first half of October, this includes most part of Spain, south-east Italy, Bretagne, Pays de la Loire, Centre, Languedoc-Roussillon Midi-Pyrenees in France; (4) For the rest of the monitoring area (14.5%, yellow areas in Figure. 2.5a), covering north-west Italy, west of Aquitaine Limousin Poitou-Charentes, east of Auvergne Rhone-Alpes, east of Bourgogne Franche-Comte in France, precipitation fluctuated slightly above and below average until mid-August, then fluctuated sharply above and below average until the end of the monitoring period. Especially in late-August, mid-September and mid-late October, the precipitation was significantly above average. On a national scale, Spain (ΔRAIN, +18%), Germany (ΔRAIN, +13%), United Kingdom (ΔRAIN, +12%) and France (ΔRAIN, +11%) all received significantly above-average precipitation, except for Italy (ΔRAIN, -2%). Flowering and grain filling for the summer crops in those countries benefitted from favorable precipitation in July and August and appropriate irrigation conditions, ensuring normal yield levels. However, excessive precipitation in mid-to-late October was unfavourable for the harvesting of the summer crops, but it helped with the germination and establishment of the winter crops.

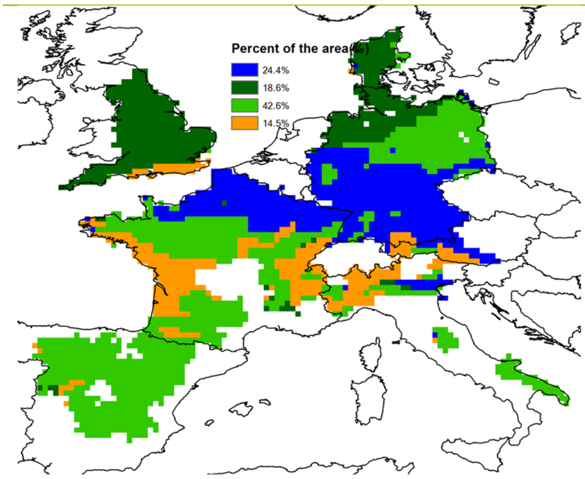
CropWatch agroclimatic indicators also show that warmer-than-usual conditions (ΔTEMP +1.3°C) and average sunshine conditions for the MPZ. As shown in the spatial distribution of temperature profiles, most parts of this MPZ experienced above-average temperatures during the monitoring period, with the exception of Spain and north-west, north-east and south-east Italy, which experienced significantly below-normal temperature departures by up to -4ºC in late July and early August. The spatial distribution of temperature profiles also indicates that there were four periods of unusually warm weather in mid-July, mid-August, early-September and early-October, especially in France, Germany, Spain, north-west, north-east and south-east Italy.

Due to favourable precipitation conditions and average radiation, the potential BIOMSS was 5% above average. The lowest BIOMSS values (-20% and less) were observed in northern and north-eastern Spain, and south-eastern Italy. In contrast, BIOMSS was above average (+20% and more), mainly in northern Germany, north-west Italy, northern and western France, western Spain and the southern United Kingdom.

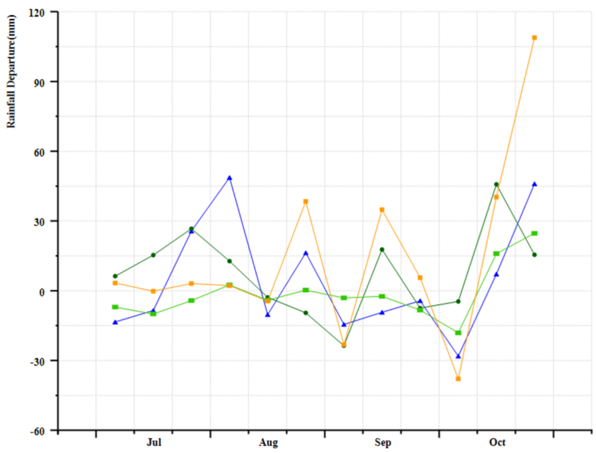
The average maximum VCI for the MPZ reached a value of 0.84 during this reporting period. About 90% of arable land was cropped, which was the same as the recent five-year average in the whole MPZ. The uncropped areas of arable land were mainly concentrated in Spain, south-east Italy, and a few pockets in almost all other countries of this MPZ. The VHI minimum map shows that relatively large areas of Spain, southern Germany, central, northern and eastern France, eastern United Kingdom were affected by drought conditions. Cropping intensity reached 134%, which was up by 2% compared to the five-year-average across the MPZ.

Overall, the conditions of crops in the MPZ were mostly average to above average.

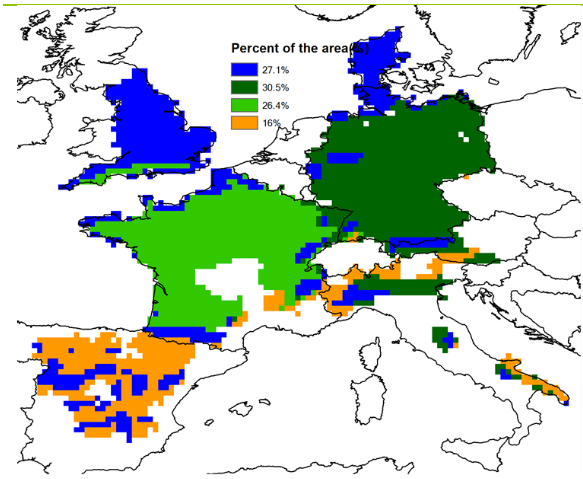
Figure 2.5 Western Europe MPZ: Agroclimatic and agronomic indicators, July to October 2023.



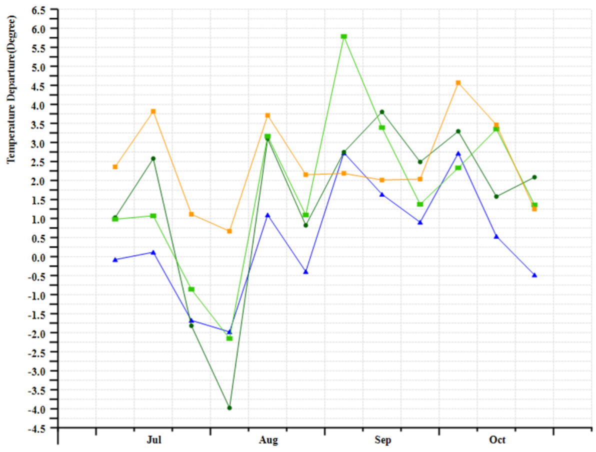
a. Spatial distribution of rainfall profiles



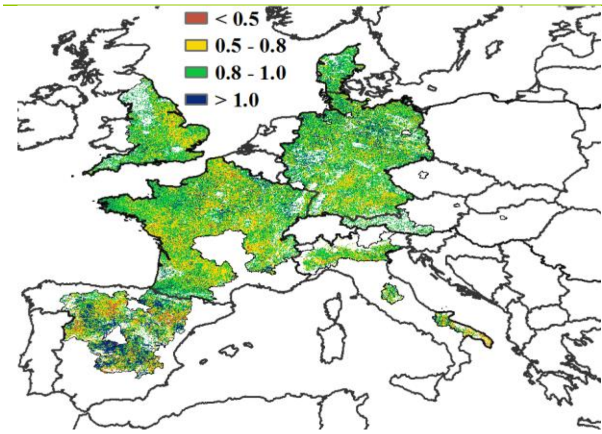
b. Profiles of rainfall departure from average (mm)



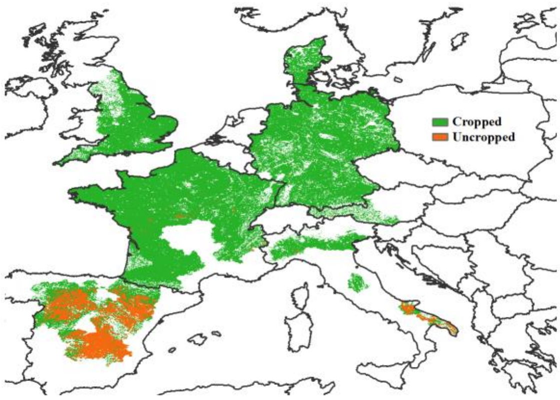
c. Spatial distribution of temperature profiles



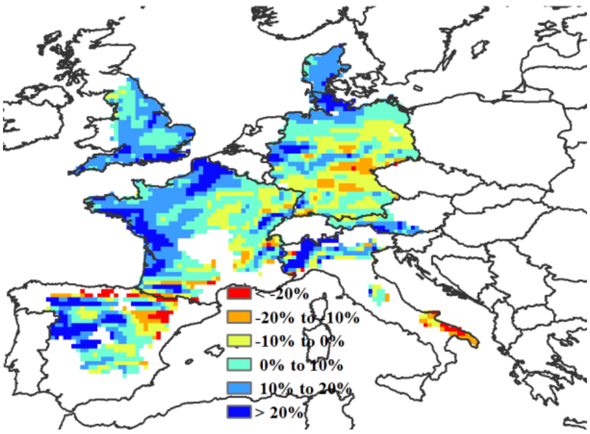
d. Profiles of temperature departure from average (mm)



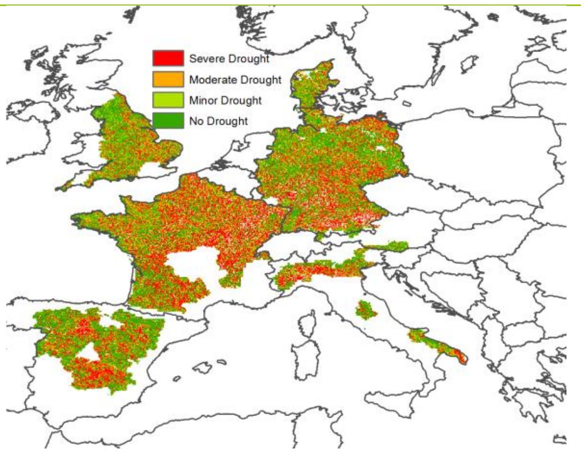
e. Maximum VCI



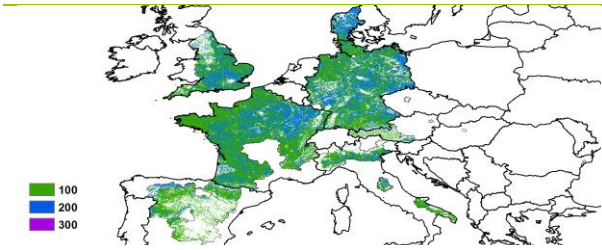
f. Cropped arable land



g. Biomass accumulation potential departure



h. VHI minimum



i. Cropping intensity

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

2.7 Central Europe to Western Russia

This monitoring period covers the harvest period of summer crops and the sowing period of winter crops. In general, the agroclimatic indicators in this MPZ were close to average, with lower precipitation (ΔRAIN -10%), higher temperature (ΔTEMP +1.4℃), and higher RADPAR (ΔRADPAR +3%), as compared to the 15YA.

According to the spatial distribution map of rainfall departures, the precipitation in most areas of the MPZ in central Europe and western Russia fluctuated around the mean during the monitoring period. The specific spatial and temporal distribution characteristics were as follows: (1) In early July, 20.2% of the MPZ received above-average precipitation (ΔRAIN +70 mm); in mid to late July, 41.8% of the MPZ, mainly in western Russia, had precipitation levels that were mostly consistent with the area's mean precipitation. (2) From early August to late August, 87.6% of the MPZ received below-average precipitation, mainly in the central part of the MPZ in western Russia, Ukraine, Moldova, and eastern Poland; the eastern and western regions of the MPZ (accounting for 12.4% of the MPZ) experienced significant precipitation fluctuations. (3) From early September to late September, the precipitation in the entire MPZ was below-average (ΔRAIN -20 mm). (4) From late September to mid-October, the precipitation in the MPZ increased, with a decrease in precipitation in the southern part of Russia and some areas (accounting for 12% of the MPZ) starting from mid-October. The southern part of Russia, southern Ukraine, Moldova, Romania, and northeastern Hungary (accounting for 25.6% of the MPZ) had precipitation levels that were below average from early July to late October.

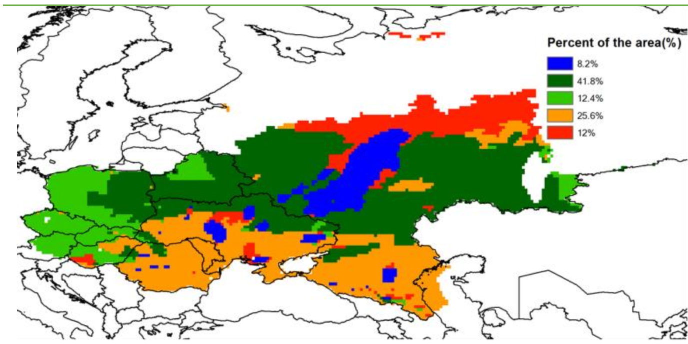
According to the average temperature departure map, temperatures in the MPZ varied significantly during the monitoring period. The specific spatial and temporal characteristics were as follows: (1) From early July to mid-July, 36% of the MPZ had above-average temperatures, mainly in Belarus, Poland, Czech Republic, Slovakia, Hungary, Romania, western and central Ukraine, and eastern Austria; from the late July to early August, 36% of the MPZ had below average temperature. (2) From mid-August to late September, although the temperatures in the MPZ fluctuated, there was an overall significant increase, reaching the highest distance level during the monitoring period (ΔTEMP +6.2℃). (3) From late September to late October, the temperatures in the MPZ all decreased, but 59.5% of the areas were higher than the average temperature. (4) Except for the period from late July to early August when Belarus, Poland, Czech Republic, Slovakia, Hungary, Romania, western and central Ukraine, and eastern Austria were below the average temperature, the temperatures in the rest of the monitoring period had above-average temperatures.

The CropWatch agronomic indicators show that most of the arable land in the MPZ was planted, with a CALF value of 96% (1% above average), and the uncultivated arable land was scattered mainly in southeastern Russia and southern Ukraine. The potential biomass in the MPZ was lower than the average of the last 5 years (ΔBIOMSS -5%). The areas with a 10% higher potential biomass were mainly located in southeastern Russia and the southwestern part of the MPZ. Affected by localized drought or war conditions, areas with more than 20% lower potential biomass were mainly located in southern and central Russia, southern Ukraine, central Moldova, central Romania, and parts of the Czech Republic.

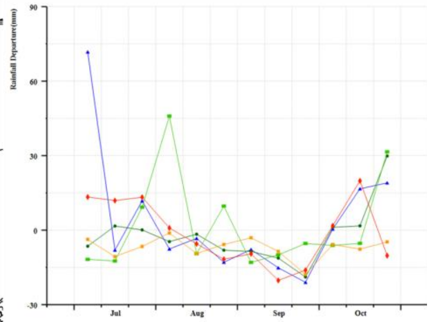
The VCIx showed a significant spatial difference in the MPZ, with an average value of 0.84. The regions below 0.8 were mainly located in southeastern Russia, southern Ukraine, Moldova, eastern and southern Romania, eastern Hungary, south-western Slovakia, and most of Poland. The VHI minimum map shows that the severe drought areas were mainly located in the Southern and

Eastern regions of the MPZ. Cropping intensity was 120%, which was 2% higher as compared to the five-year average across the MPZ.Overall, CropWatch agroclimatic and agronomic indicators indicate that crop growth was expected to be slightly below average during this monitoring period.

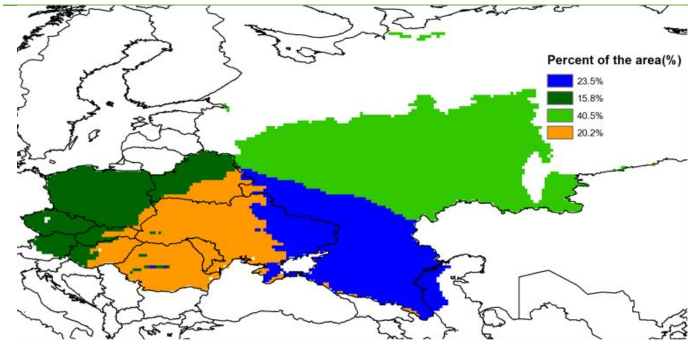
Figure 2.6 Central Europe to Western Russia MPZ: Agroclimatic and agronomic indicators, July to October 2023.



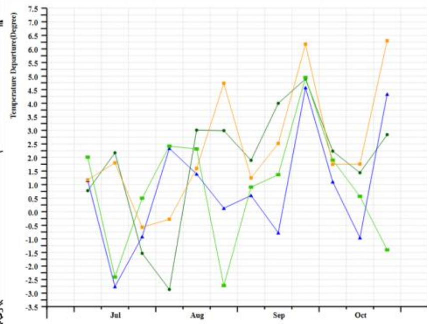
a. Spatial distribution of rainfall profiles



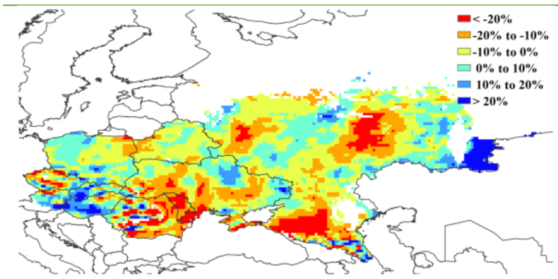
b. Profiles of rainfall departure from average (mm)



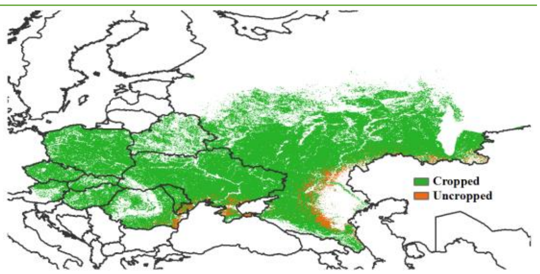
c. Spatial distribution of temperature profiles



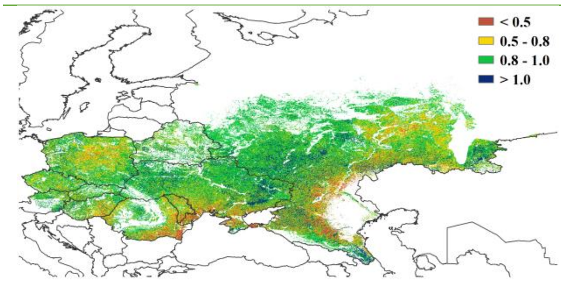
d. Profiles of temperature departure from average (℃)



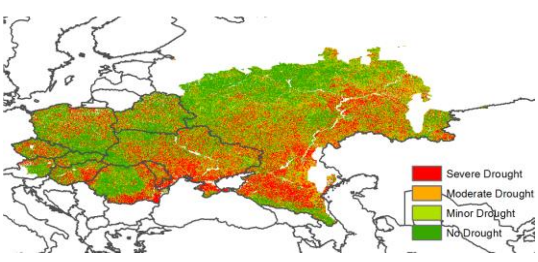
e. Biomass accumulation potential departure



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 46 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. No maize production took place in the southern hemisphere during this monitoring period. In the USA and Mexico, conditions for maize production were generally favorable. In Europe, Romania suffered from a rainfall deficit. Production in Western Europe benefitted from favorable moisture and temperature conditions. In the Ukraine, rainfall was sufficient to create favorable conditions for maize growth. In Ethiopia, average rainfall patterns helped produce a normal maize crop. Similarly, conditions for maize production in the North China Plain and the Northeast of China were favorable due to above average rainfall. Although unfavorable weather early in the planting period combined with Some localized flooding caused some damage that reduced yields, this was more than compensated for by an increase in area as compared to last year. Hence, conditions for maize production were generally favorable in the northern hemisphere.

Rice: Most rainfed (Kharif) rice grown in South Asia was sown or transplanted in June and July. Localized flooding, as well as irregular rainfall patterns, caused some yield losses in India and Pakistan. In Southeast Asia, conditions for rice production were normal. Only Indonesia was affected by drought. Irrigated rice production in California, the second largest rice producer of the USA, after Arkansas, benefitted from the abundant rainfall of the last winter season, which helped replenish water levels in the dams and guarantee the water supply. In the South of the USA, a rainfall deficit caused a reduction in production.

Wheat: Winter wheat harvest in the northern hemisphere concluded in August, whereas harvest of spring wheat grown in the northern regions lasted until October. The Canadian Prairies, the Northern Plains of the USA, Russia, and Kazakhstan are the major producers of spring wheat in the northern hemisphere. While rainfall conditions had improved during this monitoring period, spring wheat grown in Russia and Kazakhstan had suffered from a rainfall deficit during the previous monitoring period. Frequent rainfall during the harvest period, such as in Germany, Poland and in Kazakhstan, caused some challenges for farmers and impacted the grain quality. In the southern hemisphere, rainfall was below average in Australia. However, last year's abundant rains had helped restore soil moisture. Therefore, farmers could still harvest an average crop, despite of the lack of rainfall. In South Africa, cooler and wetter than normal conditions caused favorable conditions for wheat production. In Argentina, wheat had suffered from the dry conditions caused by the severe drought and the improved rainfall had started too late. In Brazil, abundant rainfall in Parana and Rio Grande do Sul in September and October has caused challenging conditions for harvest.

Soybean: No soybean was harvested during the monitoring period in the southern hemisphere. Planting of soybeans in Brazil started in October. Goias, Mato Grosso, Mato Grosso do Sul and Minas Gerais were affected by very hot and dry conditions in October. The severe drought conditions are likely to cause a delay in germination and crop establishment. In the USA and the Saint Lawrence Basin in Canada, conditions for soybean production were generally favorable, aided by normal rainfall and average temperatures. Similarly, conditions for soybean production in Europe, especially in the Ukraine, were normal. Above average rainfall helped China produce good yields.

2. Weather anomalies and biomass production potential changes

2.1 Rainfall

In South America, rainfall was more than 30% below average in the Amazon and center of Brazil. Further south, the rainfall distribution varied greatly among the regions. The southern Pampas also had a rainfall deficit that was greater than -30%, while the situation in the other provinces of Argentina and in Chile was better. Rain in Central America was close to or above average. This period covers the rainy season in Mexico. In this country, the rainfall deficit varied by -10 to -30%. This will have negative implications for the production of irrigated crops in the coming dry winter months, as the reservoirs could not get fully replenished. In the USA, California and the northeast had above average rainfall (+10 to +30%). In the Midwest, rainfall was close to average, but the more southern and western states had rainfall deficits of up to -30% or higher. In Canada, the Prairies were affected by a strong deficit (<-30%), whereas in the other eastern provinces, rainfall was closer to the 15YA or even above. All of Western Europe had above average rainfall, whereas for the eastern Europe, a deficit was observed. The strongest deficit occurred in Romania. The European part of Russia also had a rainfall deficit. The situation greatly improved for the drought-stricken Central Asian countries. In South and Southeast Asia, the conditions were mixed, ranging from average to slightly above average (+10 to+30%). The Malayan Archipelago had a deficit ranging from -10 to -30%, whereas in Australia, it exceeded 30%. In Africa, this was the dry season for the Maghreb. Hence, the deficit had little impact on crop production in those countries. However, most of the other African countries also received less than average precipitation. Mozambique, Zimbabwe and Mauretania had the strongest positive departures by more than +30%.

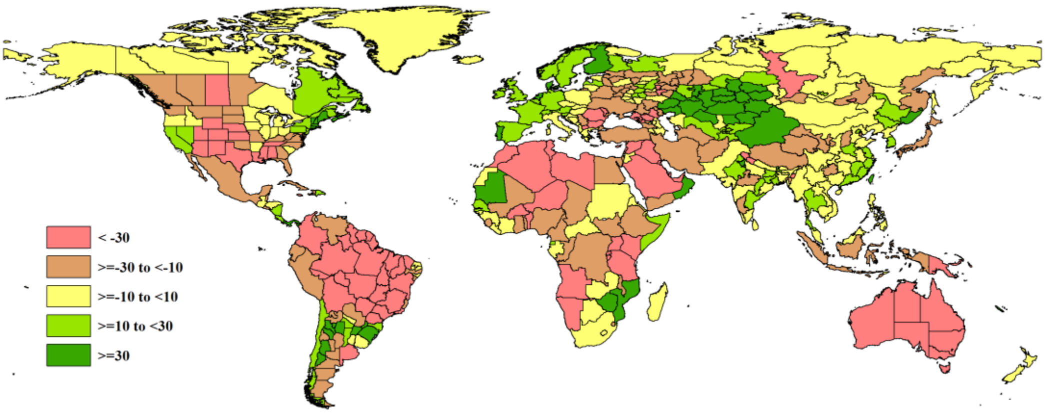


Figure 3.1 National and subnational rainfall anomaly (as indicated by the RAIN indicator) of July 2023 to October 2023 total relative to the 2008-2022 average (15YA), in percent.

(2) Temperatures

The temperature anomalies at the provincial levels pretty much match those at the MRU level. It was warmer in almost all crop production regions. The only exceptions were the Punjab in Pakistan and Kyrgyzstan. Warmer temperatures by more than +1.5°C were recorded for almost all of Brazil and the south-central states of the USA. Algeria, Tunisia, Benin, Burkina Faso, most of Europe and the Himalayas, the North China Plain, Japan and New South Wales also experienced much warmer (>+1.5°C) than usual temperatures. Temperatures were close to the average in the Northwest and eastern half of the Midwest of the USA, as well as in Ontario and the Central Provinces of Canada. Average temperatures were also recorded for southern Africa and most of India. In the other regions, the temperature departures were positive, ranging from +0.5 to +1.5°C.

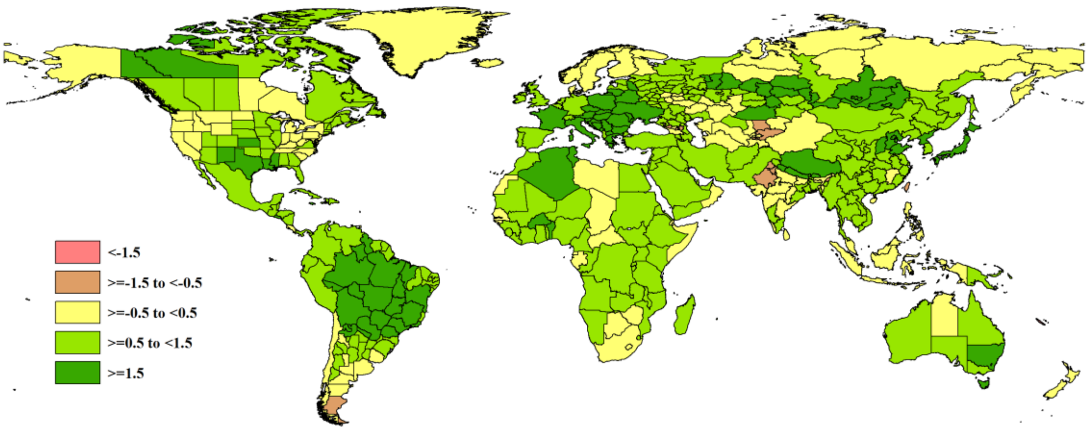


Figure 3.2 National and subnational sunshine anomaly (as indicated by the TEMP indicator) of July 2023 to October 2023 total relative to the 2008-2022 average (15YA), in °C .

2.3 RADPAR

Most of Argentina received below average solar radiation (<-3%). In Brazil, the situation was mixed. Radiation departures were generally in the positive range. Colombia and Venezuela had strong positive departures (>+3%). In Central America, radiation levels were below average and in Mexico and the southern USA, they were above. In its northern half, as well as in most of the crop production regions of Canada, solar radiation levels were below average by more than 1%. The strongest negative departures (<-3%) were recorded for the Northwest, upper Midwest and the Northeast of the USA. In Africa, Zimbabwe and Mozambique also had strong negative departures. Countries along the equator generally had a positive departure from the 15YA by up to +3% or more. In Western Europe, radiation levels were average. In Eastern Europe, positive departures by more than 3% had been recorded. In Central Asia, solar radiation was below average. But in South and Southeast Asia and Australia, strong positive departures by more than +3% had been recorded.

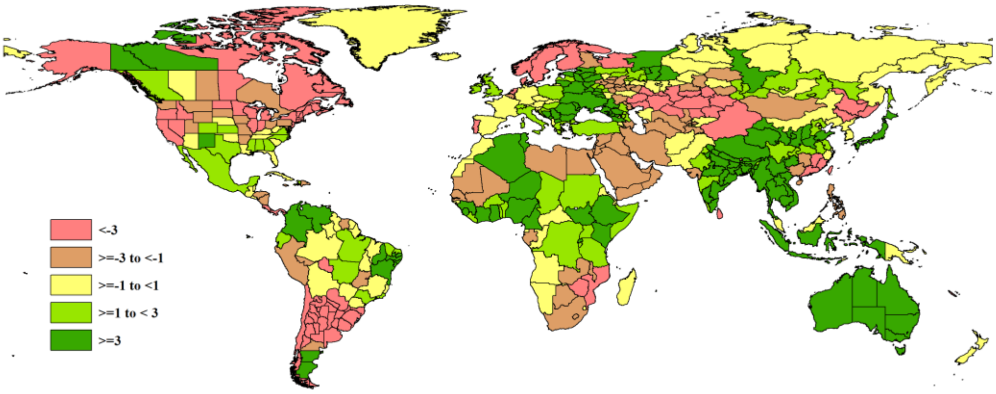


Figure 3.3 National and subnational sunshine anomaly (as indicated by the RADPAR indicator) of July 2023 to October 2023 total relative to the 2008-2022 average (15YA), in percent.

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. In Brazil and the southern Pampas in Argentina, rainfall was the limiting factor. This resulted in biomass production estimates that were 10% below the 15YA. A similar deficit was estimated for Mexico, the Plain states and South of the USA. For the West Coast as well as the Northeast and Ontario and Quebec in Canada, a positive departure in biomass production had been estimated. In Western and Central Europe, biomass production was normal or above average. Only in parts of Eastern Europe, negative departures were estimated, especially for Romania and the Ukraine. Strong positive departures were estimated for Central Asia, the Punjab in Pakistan, Senegal, Somalia and Zimbabwe. For most of the countries in the Sahel, a negative departure had been calculated. In South and Southeast Asia, the conditions were mixed, although the departures were generally in the positive range (+5 to +10%). For Australia, a strong negative departure greater than -10% was estimated.

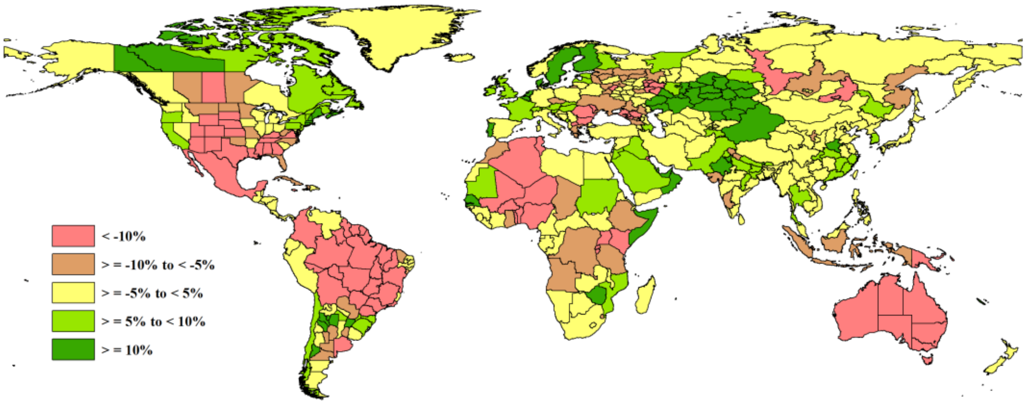


Figure 3.4 National and subnational biomass production potential anomaly (as indicated by the BIOMSS indicator) of of July 2023 to October 2023 total relative to the 2008-2022 average (15YA), in percent.

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 July-October 2023 period to the previous season and the five-year average (5YA) and maximum; (c) Maximum Vegetation Condition Index over arable land (VCIx) for July-October 2023 by pixel; (d) Spatial NDVI patterns up to July-October 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 July-October 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 July-October 2023.

[AFG] Afghanistan

In Afghanistan, wheat, maize, and rice are the primary cereals cultivated. The sowing of spring wheat occurs in March and April, with the harvest period in August and September. Maize sowing begins in May, leading to an August harvest. Similarly, rice is sown in May or June, and the harvesting takes place between October and November.

The agro-climatic conditions showed that RAIN decreased by 27%, TEMP increased by 0.5°C and RADPAR was at an average level. BIOMSS decreased by 3% as compared to the 15YA. The CALF decreased by 4%, reaching only 6%, and the VCIx was recorded at 0.20.

The NDVI-based crop condition development graph clearly indicates that crop growth has consistently been below both the levels observed last year and the average of the past five years.

Most of the total cropped areas in Afghanistan showed slightly below-average crop conditions, accounting for 86.6%, while another 3.7% of the total cropped areas was significantly below average, mainly in northern regions including Balkh, Faryab, Badghis, Kunduz, Samangan, and Sarpol provinces. Only 5.7% of the total cropped areas maintained above-average crop performance throughout the monitoring period, primarily in eastern provinces with better irrigation facilities, such as Khost and Laghman.

Furthermore, Afghanistan's Crop Performance Index (CPI) was 0.96, a slight improvement from the previous period but still indicating a poor overall agricultural production situation. The earlier high temperatures and drought had numerous adverse effects, such as causing rivers to dry up, leading to severe water deficits for crop growth. Afghanistan's limited and fragile infrastructure exacerbated the dire situation. All in all, conditions for crop production in Afghanistan were very poor.

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).

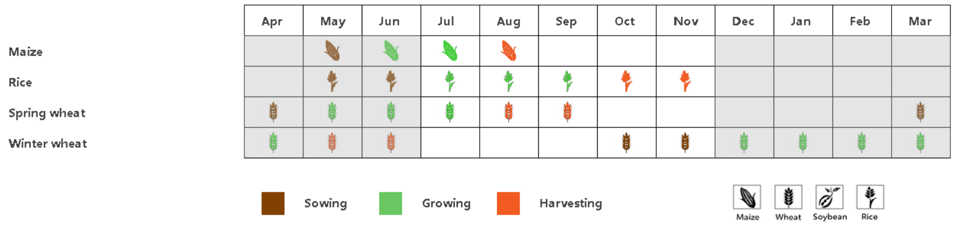
The RAIN in the Central region with sparse vegetation was 13 mm, indicating a significant decrease of 61% compared to the 15YA. TEMP was 16.7°C, an increase of 1.6°C. RADPAR measured 1465 MJ/m2, which represented a 1% increase. The BIOMSS decreased by 6%. The CALF experienced a decrease of 19% as compared to the 5YA, now standing at 6%. The VCIx value was 0.34. NDVI-based crop condition graphs indicated below-average crop conditions.

In the Dry region, rainfall fell by 5% to 34 mm, accompanied by increased TEMP at 22.7°C (+1.1°C). RADPAR measured 1464 MJ/m2 (-1%). According to the NDVI-based crop condition development graph, crop conditions were lower than the average and last year, and CALF was limited to 5% (+9%). The VCIx of 0.24 highlighted poor crop growth.

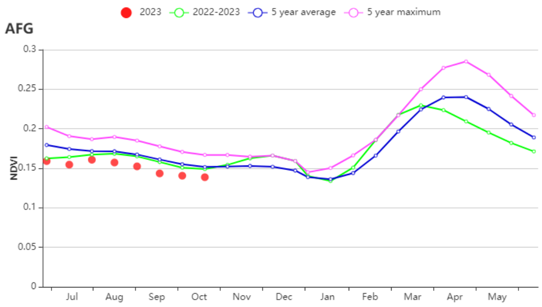
The Mixed dry farming and irrigated cultivation region experienced a significant 30% decrease in rainfall to 52 mm. The TEMP rose slightly to 17.7°C (+0.1°C), while RADPAR was 1417 MJ/m2. BIOMSS declined by 5% to 415 g DM/m2, and CALF dropped to 11% (-6%). The VCIx value was 0.23. The NDVI graph showed that conditions were below the average and below those of the previous year.

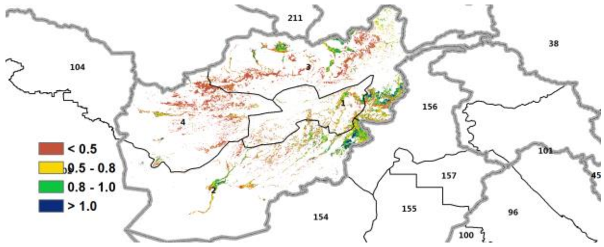
In the Mixed dry farming and grazing region, RAIN was 3 mm. It decreased by 64% compared to the 15YA. TEMP stood at 20.7°C, marking an increase of 0.4°C. RADPAR was measured at 1456 MJ/m2, closely aligning with average levels. CALF was extremely low at 0.3%, indicating a decrease of 22%. The VCIx value was 0.09. BIOMSS was down by 8% to 337 g DM/m2. 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, July - October 2023



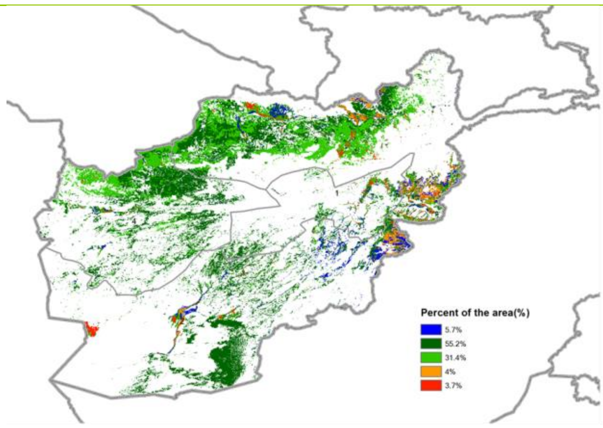
(a) Phenology of major crops

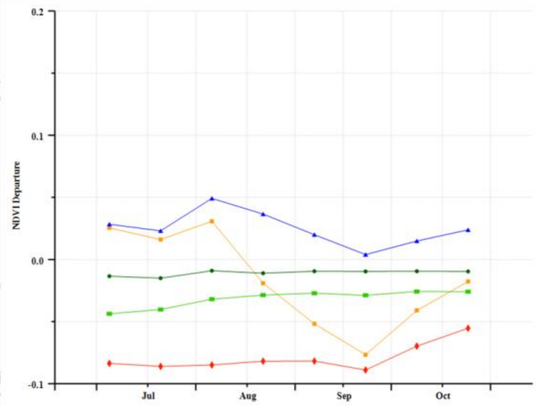




(b) Crop condition development graph based on NDVI

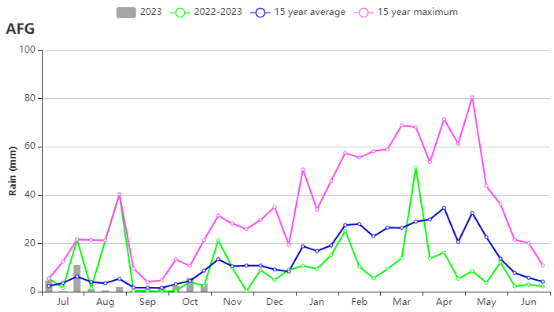
(c) Maximum VCI

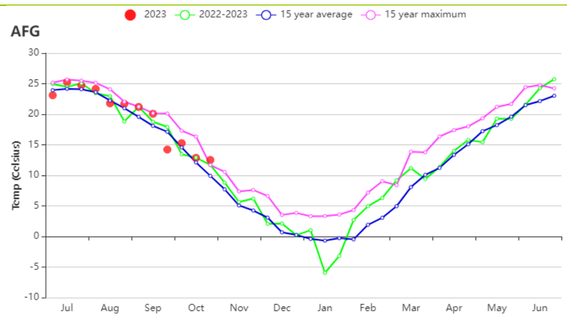




(d) Spatial NDVI patterns compared to 5YA

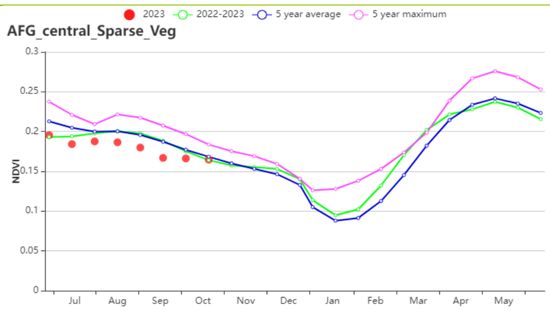
(e) NDVI profiles

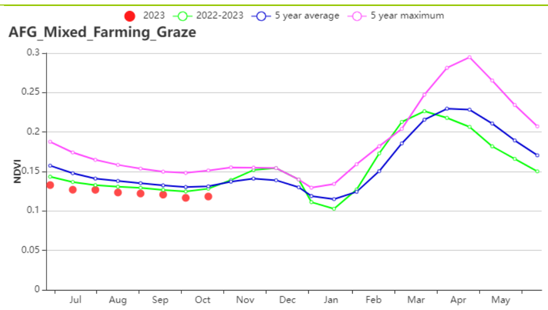




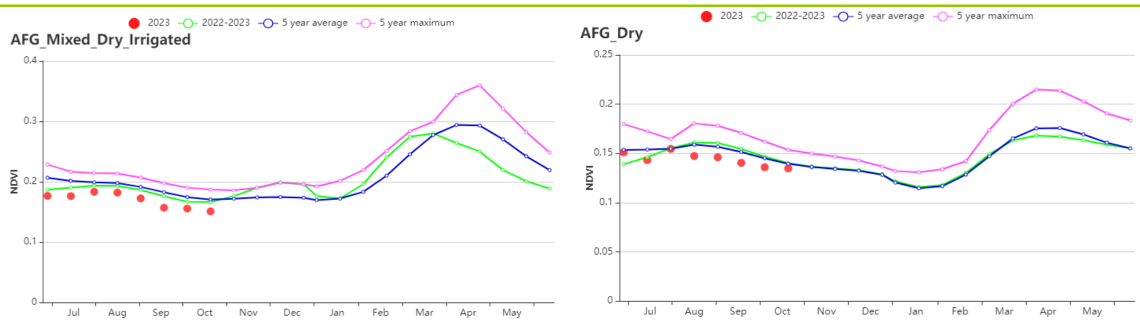
(f) Rainfall profiles

(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, July - October 2023

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Central region	13	-61	16.7	1.6	1465	1	311	-6
Dry region	34	-5	22.7	1.1	1464	-1	423	2
Dry and irrigated cultivation region	52	-30	17.7	0.1	1417	0	415	-5
Dry and grazing region	3	-64	20.7	0.4	1456	-1	337	-8

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

Region	Cropped arable land fraction		Cropping intensity		Maximum VCI
	Current (%)	Departure (%)	Current (%)	Departure (%)	Current
Central region	6	-19	122	6	0.34
Dry region	5	9	130	5	0.24
Dry and irrigated cultivation region	11	-6	129	9	0.23
Dry and grazing region	0	-22	102	-3	0.09

[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.

National Analysis

During the monitoring period spanning from July to October 2023, coinciding with maize sowing and the growth and harvesting stages of wheat, there were notable deviations from average agroclimatic conditions. Specifically, a decrease of 38% in rainfall (ΔRAIN) was observed, alongside a modest temperature increase of 0.6ºC, while photosynthetic active radiation remained around the average level. However, the forecast for the upcoming season, predominantly covering the maize growth period, indicates a likelihood of wetter-than-average conditions due to El Niño. There was a 10% decrease in estimated biomass production compared to the average of the past fifteen years. These reductions in total biomass production could be attributed to the adverse effects of decreased rainfall and increased temperatures.

The crop conditions development graph based on the Normalized Difference Vegetation Index (NDVI) clearly demonstrates the negative impact of agroclimatic indicators on wheat production areas. Throughout the monitoring period, crop conditions remained below the five-year average. This below-average performance was further confirmed by spatial NDVI patterns and NDVI profile graphs in comparison to the five-year average, revealing that only 6.9% of the region's arable land exhibited positive anomalies from early September to the monitoring period's end. Regions displaying positive anomalies during this period were primarily located in the provinces of Cuanza Norte, Luanda, and Bengo. The fraction of cropped arable land (CALF) decreased by 16% compared to the five-year average. The maximum vegetation condition index for the country stood at 0.70, with the most favorable conditions observed in the northern provinces. Crop intensity increased by 2%. All in all, conditions for wheat production were slightly unfavorable.

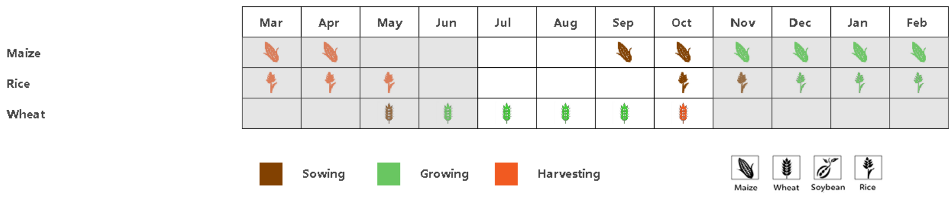
Regional Analysis

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).

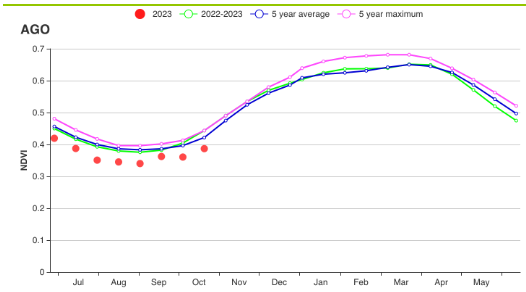
Looking at a regional level, the agroclimatic indicators revealed significant decreases in rainfall across all agroecological zones as compared to the 15YA: a reduction of 66% in the Arid zone, 61% in the Semi-arid zone, 57% in the Central Plateau, 36% in the Sub-humid zone, and 35% in the Humid zone. Conversely, temperatures increased across all agroecological zones, with the most substantial rises observed in the Humid zone (ΔTEMP +0.8℃) and the Semi-arid zone (ΔTEMP +0.7℃). Photosynthetic active radiation exhibited minor variation, ranging between -1 and 1. These combined conditions resulted in decreased total biomass production across all agro-ecological regions, with reductions highlighted as follows: 17% in the Central Plateau, 13% in the Arid and Humid zones, 12% in the Sub-humid zone, and 6% in the Semi-arid zone.

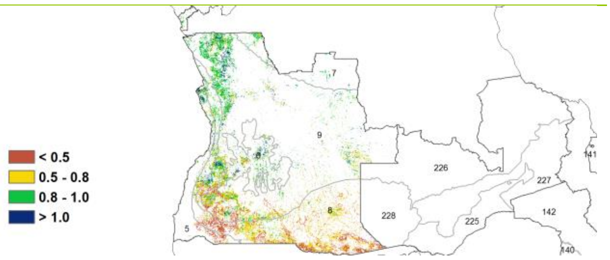
Analysis of regional crop development graphs indicates that crop conditions remained below average throughout the entire monitoring period in all agro-ecological zones. Consequently, the Cropped Arable Land Fraction (CALF) exhibited distinct changes within these zones: a 52% decrease in the Semi-arid zone, a 3% decrease in the Sub-humid zone, and a 25% increase in the Arid zone. Meanwhile, CALF remained approximately consistent with the past five years' average in the Central plateau and the Humid zone. The Vegetation Condition Index (VCIx) ranged from 0.67 to 0.89 during this period. Additionally, cropping intensity during the same period experienced a 12% increase in the Arid zone, a 3% increase in the Sub-humid zone, and a 1% increase in the Semi-arid zone. Conversely, a 13% decrease was observed in the Humid zone, and a 2% decrease occurred in the Central plateau. Above 1 Crop Production Index (CPI) values were noted in the Semi-arid and Sub-humid zones.

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

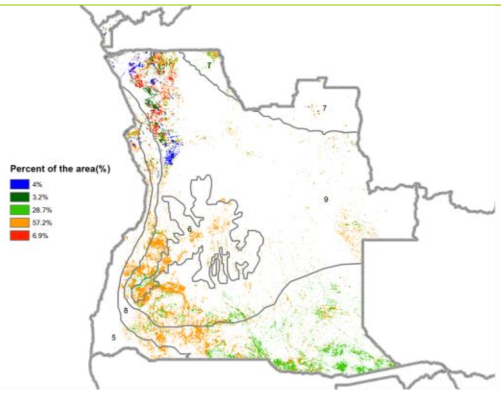


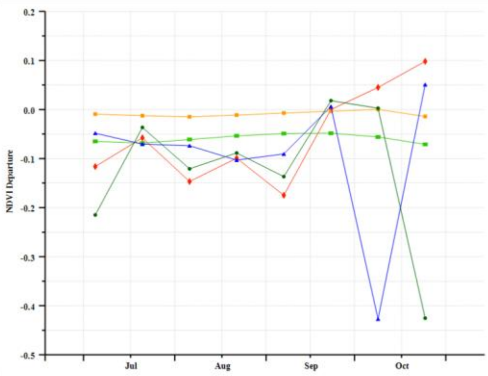
(a) Phenology of major crops



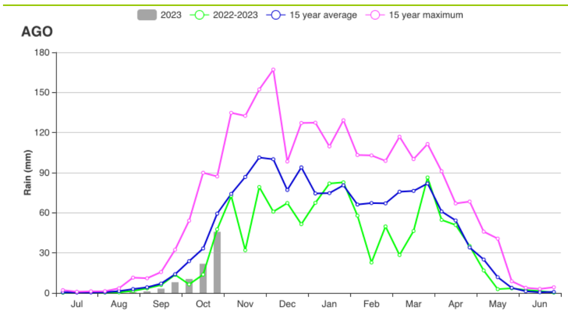


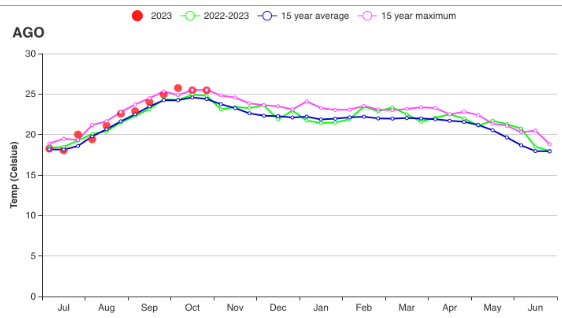
(b) Crop condition development graph based on NDVI (c) Maximum VCI



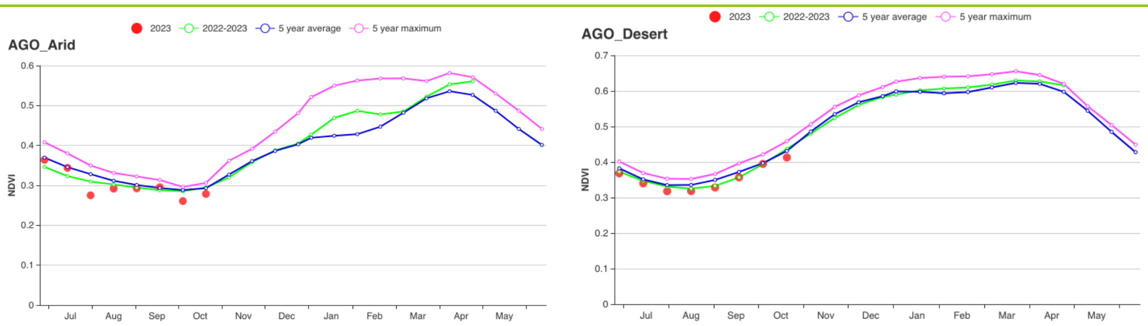


(d) Spatial NDVI patterns compared to 5YA (e) NDVI profiles

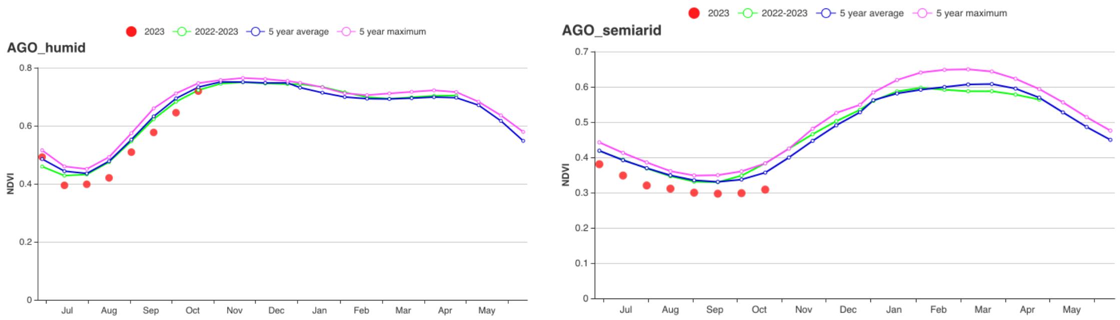




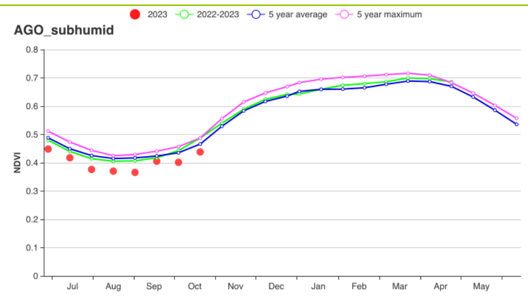
(f) rainfall profiles (g) temperature profiles



(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, July – October 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	29	-66	22.3	0.5	1357	1	482	-13
Central Plateau	61	-57	19.5	0.5	1366	0	447	-17
Humid zone	328	-35	24.7	0.8	1295	1	884	-13
Semi-Arid Zone	15	-61	22.0	0.7	1374	-1	436	-6
Sub-humid zone	119	-36	22.4	0.5	1316	0	540	-12

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

Region	Cropped arable land fraction		Cropping intensity		Maximum VCI
	Current (%)	Departure (%)	Current (%)	Departure (%)	Current
Arid Zone	28	25	126	12	0.67
Central Plateau	43	1	105	-2	0.80
Humid zone	100	0	116	-13	0.89
Semi-Arid Zone	18	-52	105	1	0.57
Sub-humid zone	60	-3	117	3	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

[ARG] Argentina

The reporting period covers the main growing stages of winter crops and the sowing of early maize and rice. Part of the period is a fallow period for summer crops. CropWatch subdivides Argentina into eight agro-ecological zones (AEZ) based on cropping systems, climatic zones, and topography; they are identified by numbers on the NDVI departure cluster map. During this monitoring period, most crops were grown in the following four AEZs: Chaco (11), Mesopotamia (12), Humid Pampas (13), and Subtropical Highlands (17). The other agro-ecological zones were less relevant for this period. Wheat is planted in East Subtropical Highlands, Chaco, Mesopotamia and Center, South and East Pampas. Maize is planted in all the AEZs, while rice is planted in North Mesopotamia and East Chaco. Crop conditions in Argentina showed quite variability over main agricultural areas. Several indices showed poor conditions in part of Pampa and Chaco. The rest of the MPZs showed good conditions.

For the whole country, rainfall showed a +14% positive anomaly, TEMP showed a slight positive anomaly (+0.7℃) and RADPAR showed a negative anomaly of -7%. RAIN showed positive anomalies in Mesopotamia (+48%) and Chaco (+17%), and negative anomalies in Humid Pampas (-20%) and near no anomaly in Subtropical Highlands (-1%). TEMP showed slight positive anomalies in the four AEZs: Subtropical Highlands (+1.2℃), Mesopotamia (+1℃), Chaco (+0.9℃) and Humid Pampas (+0.4℃). RADPAR showed negative anomalies in these AEZs: Chaco (-9%), Mesopotamia (-9%), Subtropical Highlands (-8%) and Pampas (-6%). At the national level, rainfall profiles showed slight negative anomalies during most of the reporting period (in July, August, September and October) and strong positive anomaly events at the beginning of September and end of October. TEMP profile showed positive and negative anomalies during July and August and near average values during September and October.

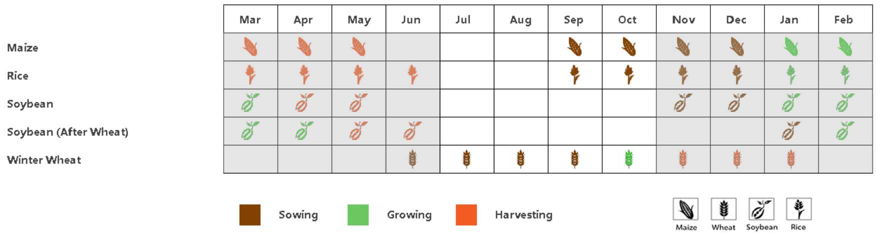
At the national level, the crop condition development graph based on NDVI showe near average values from July to September and below average values during October. Nevertheless, values were above or similar to those observed during last year. Chaco showed negative anomalies in NDVI during all of the reporting period, with stronger anomalies since August. Mesopotamia and Subtropical Highlands showed near and above average values during most of the reporting period, except at the end of October when a negative anomaly was observed. Pampas showed near average values during most of the period and a negative anomaly at the end of October.

Spatial distribution of NDVI profiles determined five homogeneous spatial patterns. A profile with negative anomalies all along the reporting period and with a tendency to decrease at the end (light green profile), was observed in South West, Center and North East Pampas and South Chaco. A profile with almost stable negative anomalies near -0.05 along the reporting period (red profile) was observed in most of Pampas, South Chaco and North Subtropical Highlands. A profile with near no anomalies (blue profile) was observed mainly in East, South and West Pampas, North Mesopotamia, East Chaco and Center Subtropical Highlands. A profile with positive anomalies during July and August with a tendency to decrease NDVI anomaly values, showing negative values since the end of September (dark green profile), was mainly observed in North East Pampas, South Mesopotamia and South Subtropical Highlands. Finally, a profile with slight positive anomalies at the beginning and end of the reporting period, and higher positive anomalies during August, September and October (orange profile) was observed in Center Mesopotamia, North East Pampas and South Subtropical Highlands.

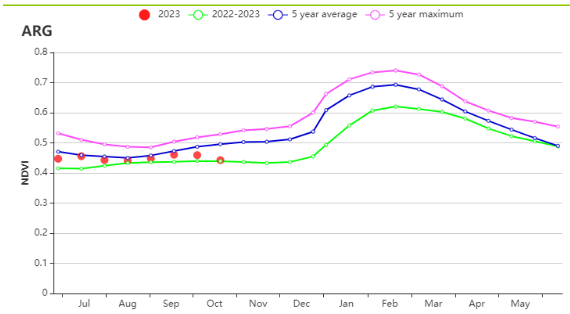
At the national level, BIOMSS showed a negative anomaly of -3%, CALF showed a -5% negative anomaly and VCIx showed an average value of 0.70. BIOMSS showed positive anomalies in Chaco (+7%), Subtropical Highlands (+6%) and Mesopotamia (+5%) and a strong negative anomaly in Humid Pampas (-14%). CALF showed a strong negative anomaly in Chaco (-15%) and a slight negative anomaly in Pampas (-2%). No anomaly was observed in Mesopotamia and a strong positive anomaly was detected in Subtropical Highlands. Maximum VCI showed good conditions for Mesopotamia (0.90) and Subtropical Highlands (0.85) and regular to poor conditions in Pampas (0.69) and Chaco (0.60). The VCIx map showed the worst conditions in Center and South Chaco and Center and West Pampas. The Crop Production Index showed values quite above average for Subtropical Highlands (1.53), values near average for Mesopotamia (1.02) and Pampas (0.99) and values quite below average for Chaco (0.59).

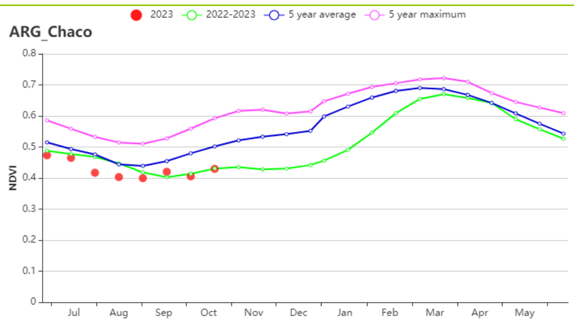
In summary, conditions were variable among the AEZs. Pampas and Chaco showed poor conditions in several of the indices, while Mesopotamia and Subtropical Highlands showed in general good conditions. Pampas showed negative anomalies in BIOMSS and RAIN, contrasting with the other MPZs. Chaco showed a strong reduction in CALF, and negative NDVI anomalies during most of the reporting period. Pampas and Chaco showed regular to low VCIx values in most of the area. CALF reduction in Chaco can reflect a reduction in planting of wheat, as well as a delay in planting of summer crops. Despite regular to poor conditions observed in Chaco and Pampas, results of most indices are quite better than during last year, expecting increments in wheat production for this growing season.

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

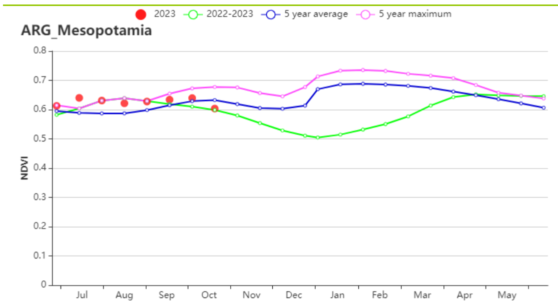


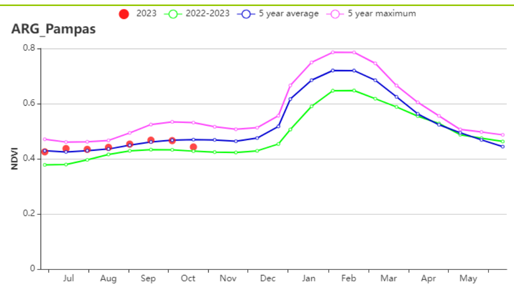
(a) Phenology of major crops



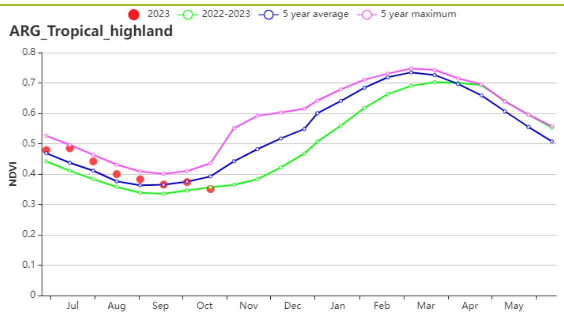


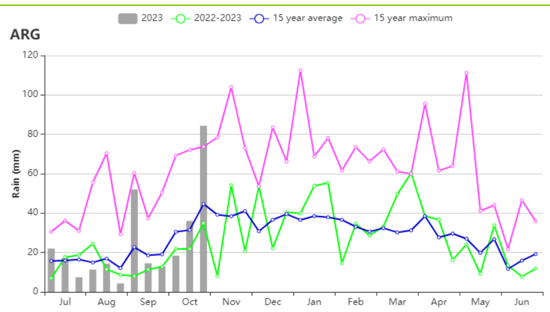
(b) Crop condition development graph based on NDVI(Argentina) (c) Crop condition development graph based on NDVI(Chaco)



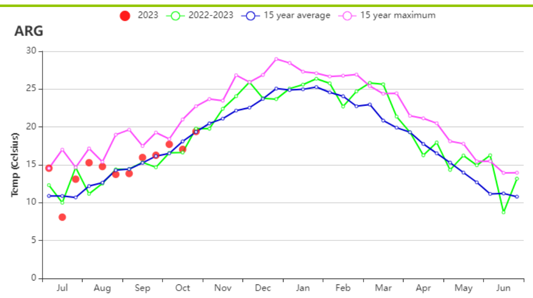


(d) Crop condition development graph based on NDVI(Mesopotamia)(c) Crop condition development graph based on NDVI(Humid Pampas)

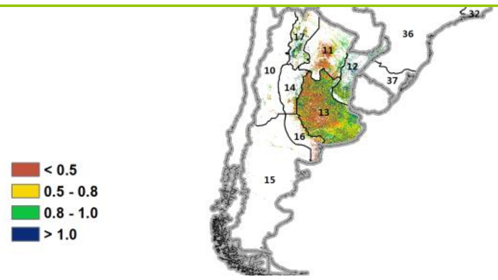




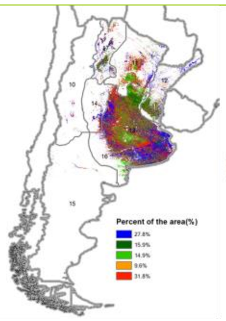
(f) Crop condition development graph based on NDVI(Subtropical Highlands) (g) Rainfall profiles



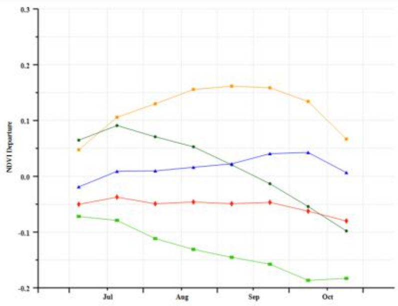
(h) Temperature profiles



(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, , July - October 2023

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Chaco	280	17	18.7	0.9	855	-9	672	7
Mesopotamia	665	48	16.7	1	789	-9	861	5
Humid Pampas	171	-20	13.1	0.4	836	-6	472	-14
Subtropical Highlands	139	-1	17	1.2	1027	-8	503	6

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

Region	Cropped arable land fraction		Cropping Intensity		Maximum VCI
	Current (%)	Departure (%)	Current (%)	Departure (%)	Current
Chaco	69	-15	111	-7	0.6
Mesopotamia	99	0	117	-13	0.9
Humid Pampas	71	-2	127	0	0.69
Subtropical Highlands	74	18	114	1	0.85

[AUS] Australia

The current period covers the main growth periods of wheat and barley. The weather was drier and warmer than usual, but the national NDVI profile was close to the last 5-year average.

From July to October, Australia suffered a nationwide rainfall deficit (RAIN -43%). The rainfall profile showed that only early July and early October reached average levels. The average temperature was higher (TEMP +1.2°C) while the sunshine was above average (RADPAR +7%). The rainfall deficit led to a decrease in biomass (BIOMSS -21%). The agronomic indicators, with a VCIx of 0.75, a decreased CALF (-3%) and CI (-3%) indicate below, but close to average crop conditions.

The conditions in the four main wheat production states (New South Wales, South Australia, Victoria, and Western Australia) were generally similar, with largely below-average rainfall (ranging from -31% to -50%), slightly warmer temperatures (ranging from +0.5°C to +1.5°C), above-average sunshine (ranging from +5% to +9%). These conditions led to a decrease in estimated biomass production, ranging from -17% to -22% below average.

Spatially, the VCI map shows that the VCIx in Australia were mostly ranging from 0.8 to 1.0, with low values of less than 0.5 appearing in eastern and southwestern Australia. The spatial NDVI profiles show the same pattern. Only 11.6% of croplands had above average NDVI, while nearly 70% encountered below average levels. Overall, the crop conditions for Australia were close to, but below average.

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 below average rainfall (-41%). Temperatures (+1.0°C) and solar radiation (+8%) were above average. Consequently, the average biomass accumulation was estimated as 22% lower than the last 15 years' average. The CALF was slightly increased (+3%), but the cropping intensity was decreased (-3%). The VCIx and CPI were 0.83 and 0.99, respectively. However, the NDVI profile showed that the conditions were better than last 5 years' average. The NDVI nearly reached the maximum in the late August. This could be explained by the normal conditions in the previous period and an acceptable rainfall from July to August. An above average production can be expected.

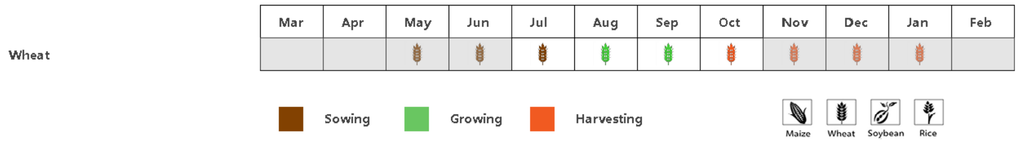
The rainfall was only 56 mm in the **Subhumid subtropical zone** (-66%). Both the temperature (+1.7°C) and radiation were above average (+8%). The estimated BIOMAS was largely below average (-27%). The CALF (-18%), cropping intensity (-7%) were also negative, and the maximum VCI was very low (0.54). The NDVI profile, which was below average in the whole period, also confirms the poor conditions.

The **Southwestern wheat zone** also encountered a dry (RAIN, -31%), warm (TEMP, +1.0°C), and sunny (RADPAR, +5%) period. The biomass was consequently below average (-18%). The CALF decreased by 7%, with a VCIx of 0.76. The NDVIs were below average for the whole period. The condition in this zone was below average.

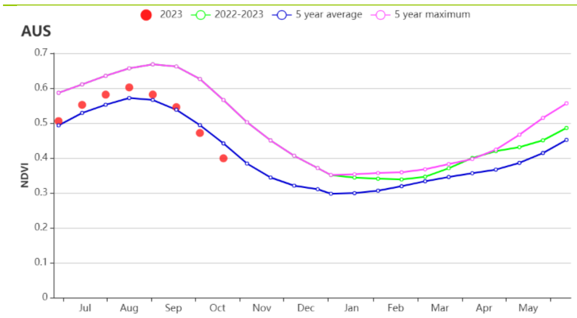
The **Wet temperate and subtropical zone** had similar agro-climatic indicator departures. The rainfall was below average (-38%), the temperature (+1.2°C) and radiation (+6%) were both above average. Due to the low rainfall, the biomass was decreased by 15%. The CALF (-4%) and cropping intensity (-3%) were also slightly below average. The maximum VCI was 0.68. The NDVIs from July to October were near the last 5 year's average. An unfavorable to average condition was indicated.

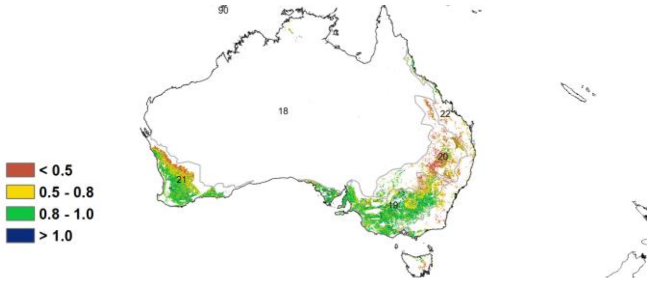
Overall, combining the agro-climatic and agronomic indicators, the crop conditions in the JASO period were mostly unfavorable. However, the crops still benefitted from soil moisture that had accumulated during the previous monitoring periods. All in all, near average cereal production can be expected for Australia.

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

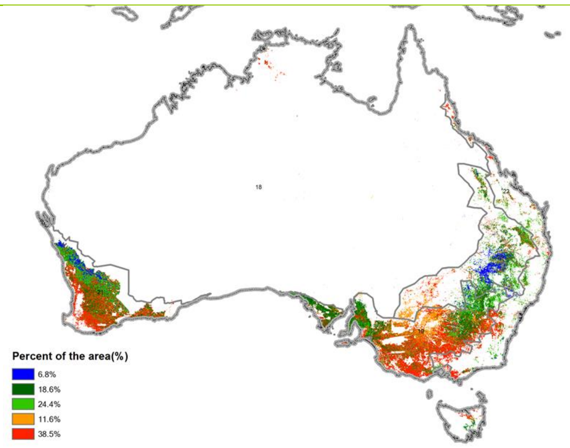


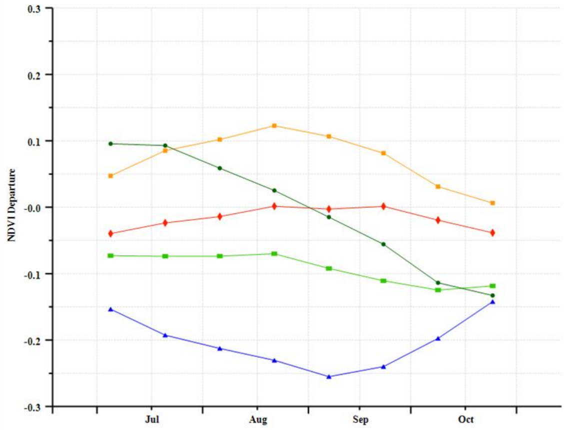
(a) Phenology of major crops



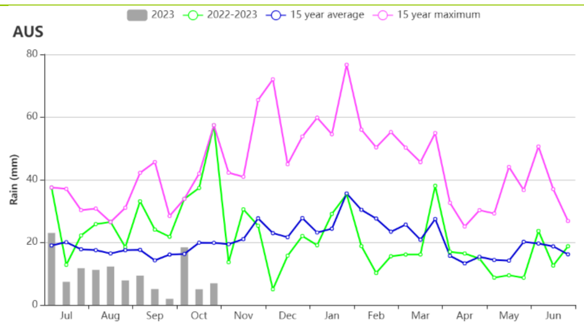


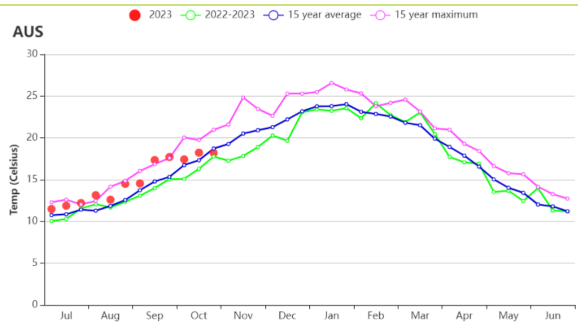
(b) Crop condition development graph based on NDVI (c) Maximum VCI



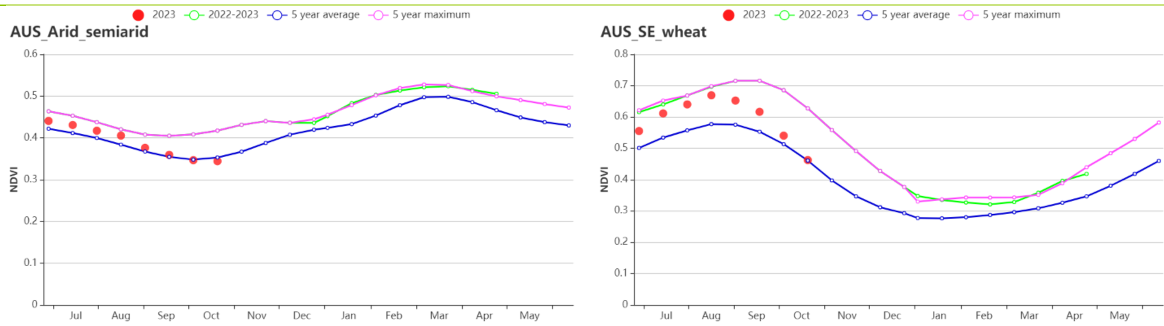


(d) Spatial NDVI patterns compared to 5YA (e) NDVI profiles

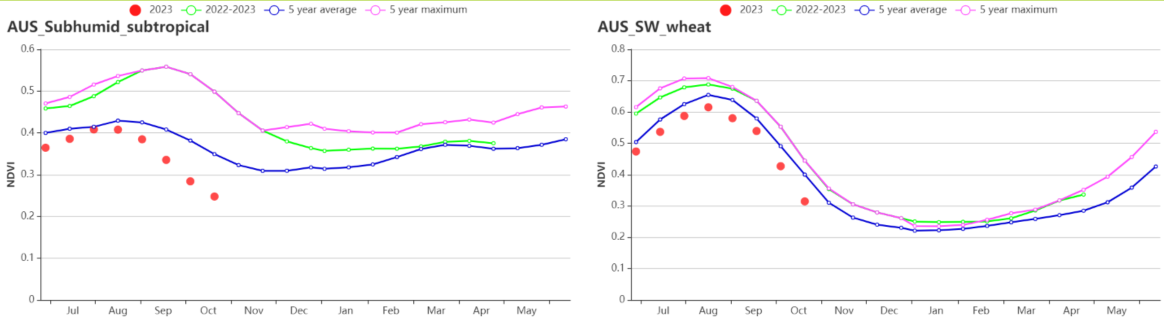




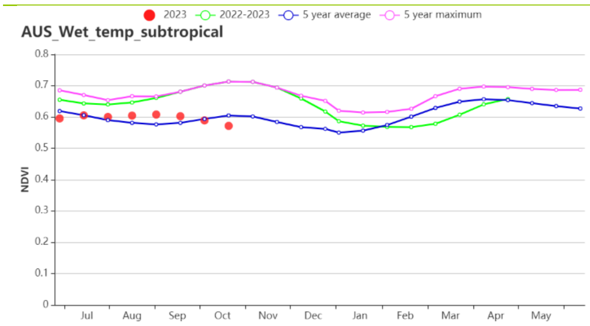
(f) Rainfall profiles (g) Temperature profiles



(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's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, , July - October 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	39	-46	22.9	0.3	1274	3	411	-17
Southeastern wheat area	137	-41	12.9	1.0	895	8	443	-22
Subhumid subtropical zone	56	-66	16.8	1.7	1139	8	381	-27
Southwestern wheat area	166	-31	13.9	1.0	900	5	496	-18
Wet temperate and subtropical zone	151	-38	14.1	1.2	987	6	513	-15

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

Region	Cropped arable land fraction		Cropping intensity		Maximum VCI
	Current (%)	Departure (%)	Current (%)	Departure (%)	Current
Arid and semiarid zone	60	8	115	0	0.79
Southeastern wheat area	96	3	104	-3	0.83
Subhumid subtropical zone	49	-18	106	-7	0.54
Southwestern wheat area	87	-7	103	1	0.76
Wet temperate and subtropical zone	90	-4	110	-3	0.68

[BGD] Bangladesh

During this reporting period, the harvest of the Aus rice crop was completed in August. This period also covers the sowing and growth of Aman Rice, which will be harvested in the next period. For the whole reporting period, rainfall was close to 15YA. Both TEMP and RADPAR were above average (TEMP +0.6℃, RADPAR +5%). BIOMSS was also above the 15-year average (+1%). Continuous hot weather affected crop growth. The national NDVI development graph showed that overall crop conditions were below the 5-year average and returned to the average at the end of October. The spatial NDVI pattern showed that all crops were closed to average, 17.3% of the cultivated area had a sudden drop in early August and about 11.3% showed a sharp drop at the end of September due to cloud cover in the satellite images. The maximum Vegetation Condition Index (VCIx) was 0.88, with most areas showing values higher than 0.8 and CALF was slightly above the 5YA (+1%). The Cropping intensity was 163% (-6%) and Crop Production Index (CPI) was 0.96. 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).

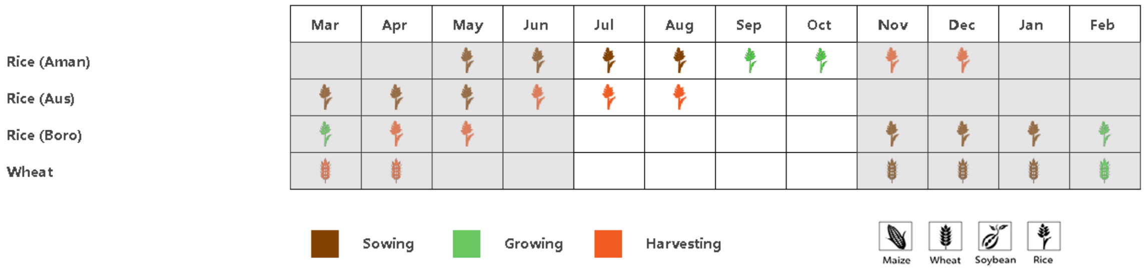
In the Coastal region, RAIN was above average (ΔRAIN +2%). Both TEMP and RADPAR were above average (ΔTEMP +0.6°C and RADPAR +3%). The potential biomass was slightly above average (BIOMASS +1%). The crop condition development graph based on NDVI shows that crop conditions were below the 5-year average and returned to the average at the end of October. Cropping intensity (CI 152%) was lower than the 5YA by 6%. CALF was 93% (+1%) and VCIx was 0.87, Crop Production Index (CPI) was 0.94. Overall, crop conditions were below but close to average for this zone.

RAIN was slightly below average (ΔRAIN -1%) in the Gangetic Plain. Both TEMP and RADPAR were above average (ΔTEMP +0.6°C and RADPAR +6%, respectively). The BIOMSS was slightly above average (+1%). The crop condition development graph based on NDVI shows that crop conditions were slightly below the 5YA except at the end of July and early September and returned to the 5-year average at the end of October. During the monitoring period, CALF (97%) was above average (+1%) while cropping intensity was below the 5YA (-6%). VCIx was 0.90 and the Crop Production Index (CPI) was 0.96. Crop conditions of this region were close to the average.

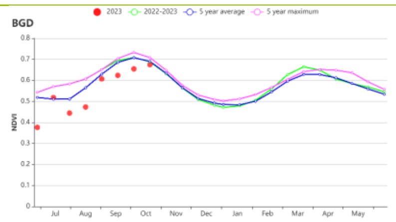
The Hills recorded less rainfall (ΔRAIN -15%). Warmer temperature (ΔTEMP +0.4℃) and more sunshine (RADPAR +7%) were also recorded. But potential biomass for the Hills was estimated 1% lower than the 15YA average. The crop conditions experienced a deterioration from near average to below average. Uneven rainfall affected the agricultural activities of rice and cropping intensity was below the 5YA (-7%). CALF was 98% and VCIx was 0.92, Crop Production Index (CPI) was 0.95. Overall, crop conditions were close to the average.

The Sylhet basin had more rainfall (ΔRAIN +7%). Both TEMP and RADPAR were above the 15YA (ΔTEMP +0.6℃ and RADPAR +6%, respectively). Potential biomass for the Hills was estimated to be 1% higher than the 15YA. CALF was above the 5YA (CALF +1%) while CI was lower than the 5YA (CI -6%) and VCIx was 0.85 for the area. Crop development based on NDVI was slightly above or near average in this period except at the end of August. Crop Production Index (CPI) was 0.96. Based on the above information, near-average prospects for rice in the zones can be expected.

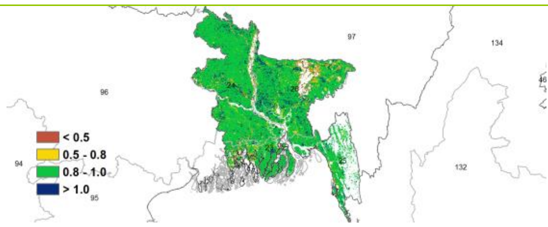
Figure 3.9 Bangladesh's crop condition, July - October 2023



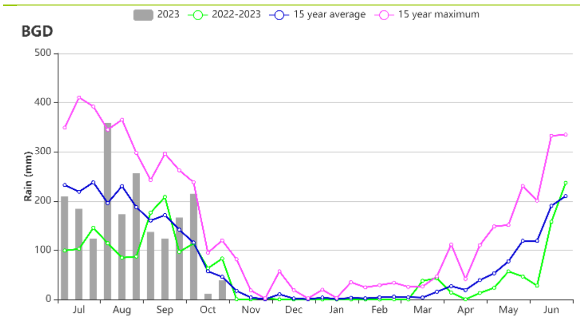
(a). Phenology of major crops



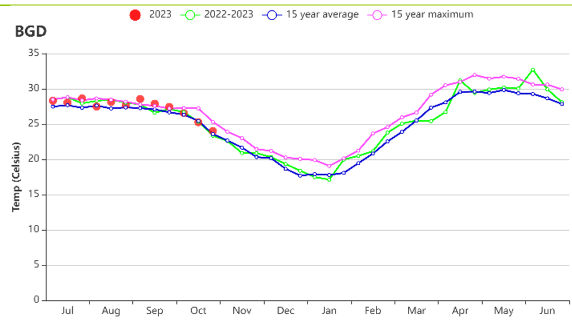
(b) Crop condition development graph based on NDVI



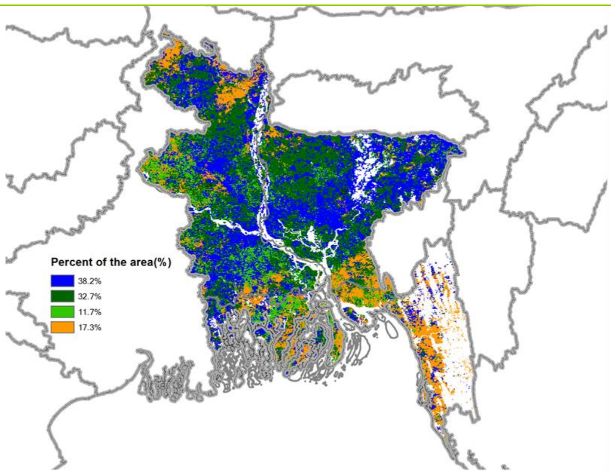
(c) Maximum VCI



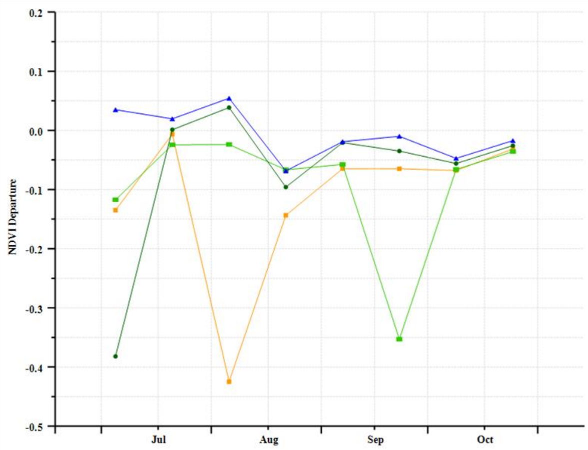
(d) Time series rainfall profile



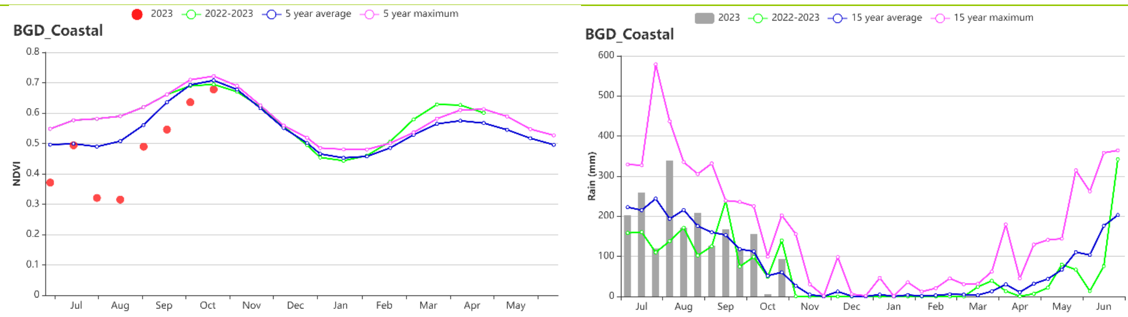
(e) Time series temperature profile



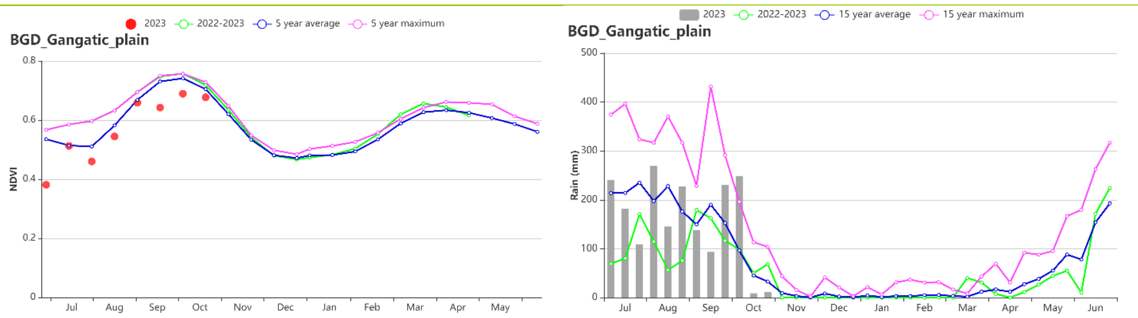
(f) Spatial NDVI patterns compared to 5YA



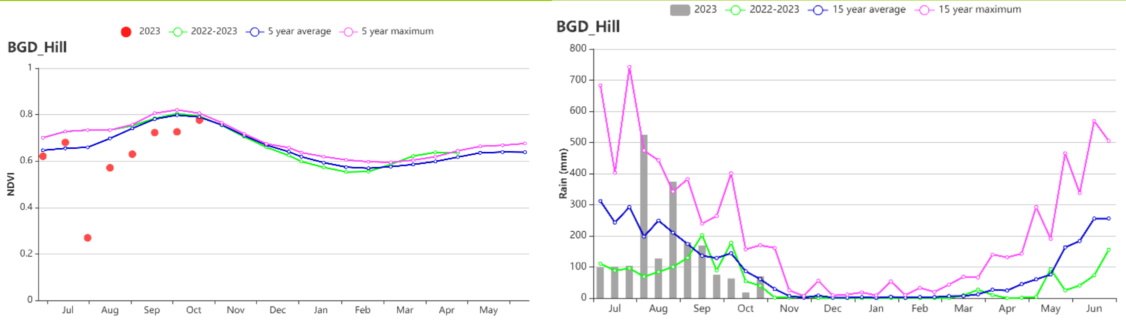
(g) NDVI profiles



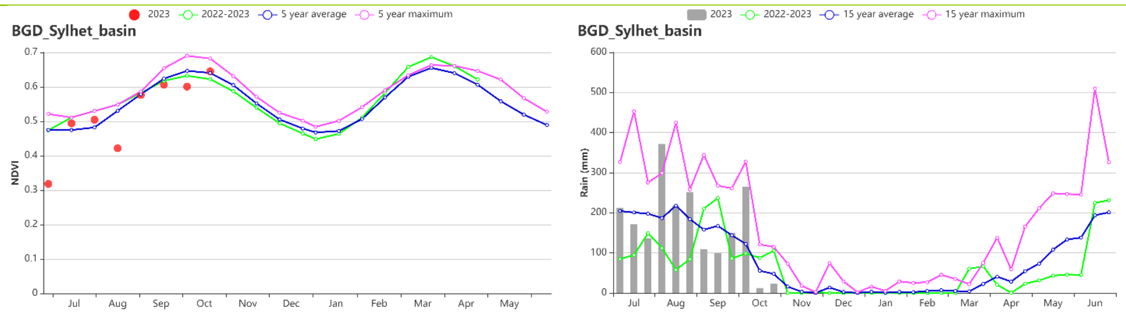
(h) Crop condition development graph based on NDVI (left) and rainfall profile (right) of Coastal region



(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, July - October 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, July - October 2023

Region	Cropped arable land fraction		Cropping intensity		Maximum VCI
	Current (%)	Departure(%)	Current (%)	Departure (%)	Current
Coastal region	93	1	152	-6	0.87
Gangetic plain	97	1	175	-6	0.90
Hills	98	0	141	-7	0.92
Sylhet basin	89	1	156	-6	0.85

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

[BLR] Belarus

The reporting period includes the harvesting of spring wheat from August to September and the planting of winter wheat in October. The nationwide rainfall amount was 240 mm, 13% below the 15YA average. Average temperatures were warmer (+1.9°C) and solar radiation was above average (RADPAR, 847 MJ/m², +6%). The potential biomass was below average (-4%). Agronomic conditions were generally favorable: good values of VCIx (0.88), cropping intensity (CI, 115%) and cropped arable land fraction (CALF, 100%) were observed. High rainfall in late October helped with the establishment of the new winter wheat crop.

Belarus had experienced a rainfall deficit during the previous monitoring period. Therefore, NDVI values stayed below average in July. High rainfall in late July and early August helped NDVI recover to average levels. The national VCIx map shows that crop condition in about 69.2% of cropped areas were close to or slightly above the 5-year average, but the other areas remained below average. According to the VCIx distribution map, VCIx was satisfactory in most cropped areas of the country (above 0.8), indicating fair crop prospects, while low values were mostly scattered in the northern area. The agricultural production index was above 1.0 (CPI, 0.96), indicating average prospects.

Regional analysis

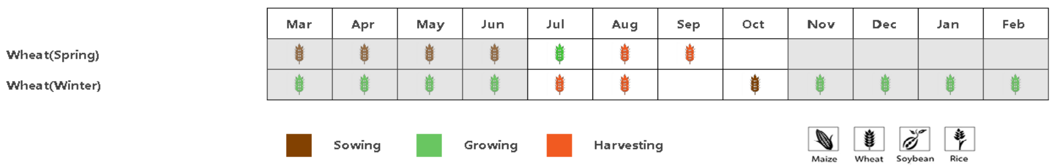
Regional analyses are provided for three agro-ecological zones (AEZ) defined by their cropping systems, climatic zones, and topographic conditions, including Northern Belarus (028, Vitebsk, the northern area of Grodno, Minsk and Mogilev), Central Belarus (027, Grodno, Minsk and Mogilev and Southern Belarus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

North Belarus recorded a solar radiation increase (7%) combined with slightly higher temperatures (+1.8°C) and lower rainfall (-11%). Potential biomass decreased by 3% below average. The VCIx had reached 0.86, and CALF had reached 100%, with a CPI of 0.91. The NDVI development curve was generally near average level.

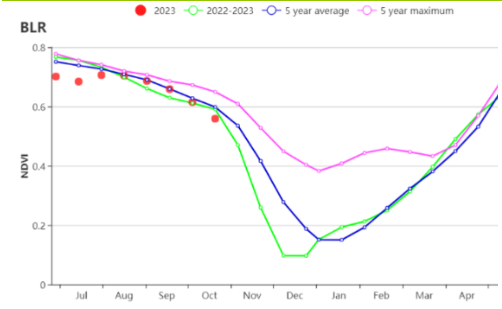
Central Belarus also experienced increased radiation (+6%) and slightly higher temperature (+2.0°C) and decreased rainfall (-14%). Similar to northern Belarus, high CALF (100%), VCIx (0.89) and CPI (0.99) were also recorded. The NDVI growth curve was generally near the average trend from July to October. The potential biomass decreased by about 5%.

Precipitation in Southern Belarus was also below the 15YA average level (-11%), and the temperature was slightly higher by 2.0°C and radiation increased by 5%. Potential biomass was expected to decrease by 3%. The CALF and the VCIx were 100% and 0.91 respectively, with an CPI of 0.99.

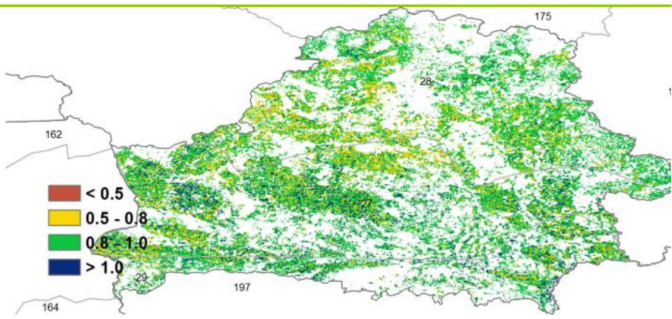
Figure 3.10 Belarus's crop condition, July - October 2023.



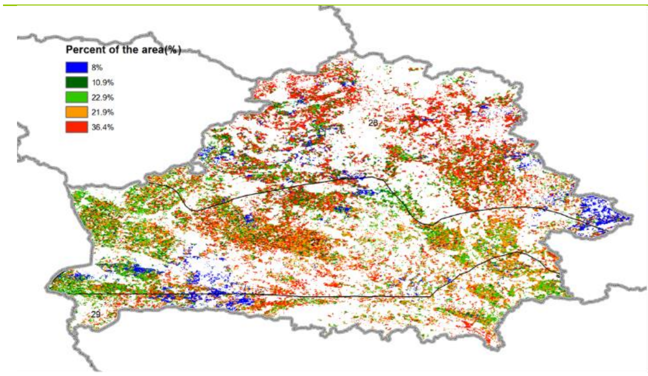
(a). Phenology of major crops



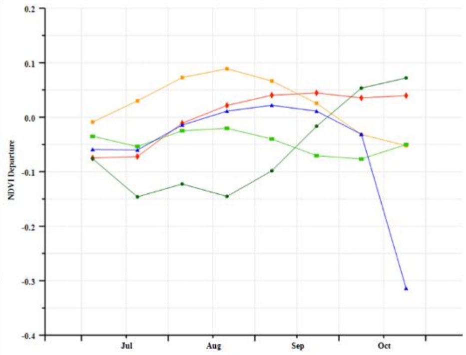
(b) Crop condition development graph based on NDVI



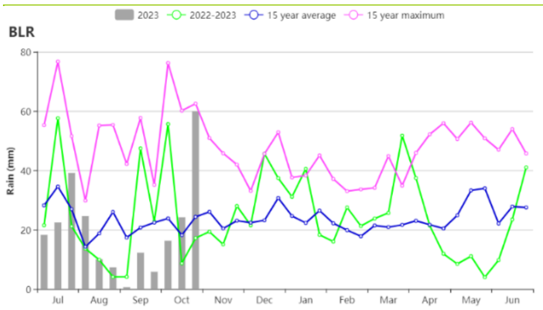
(c) Maximum VCI



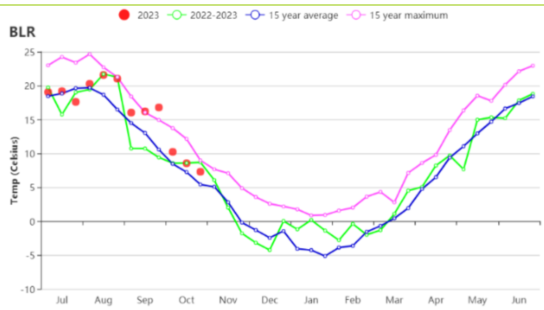
(d) Spatial NDVI patterns compared to 5YA



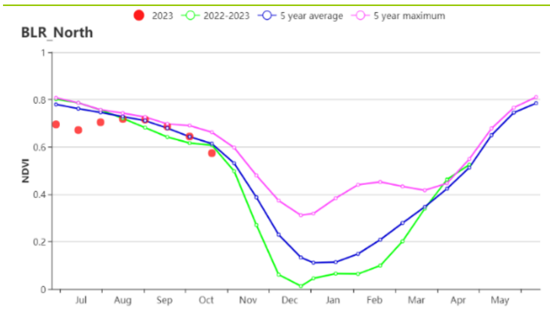
(e) NDVI profiles



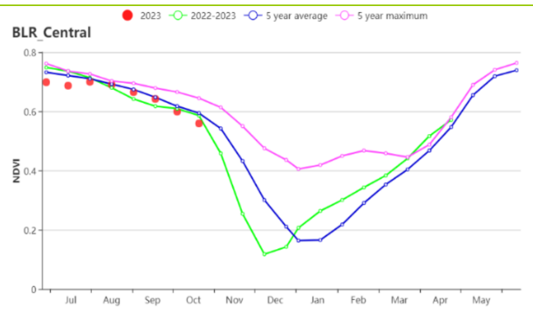
(f)Rainfall time series



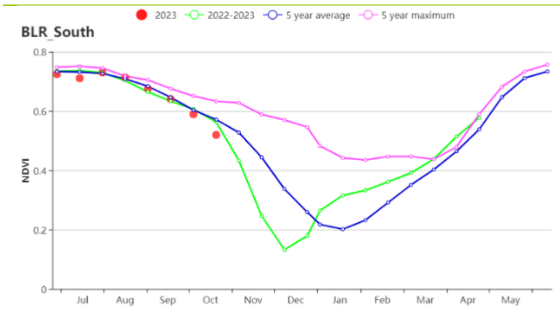
(g) Temperature time series



(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, July - October 2023

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Center	228	-14	16.6	2.0	858	6	653	-5
North	264	-11	15.3	1.8	821	7	703	-3
South-west	214	-11	17.3	2.0	885	5	635	-3

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

Region	Cropped arable land fraction		Cropping Intensity		Maximum VCI
	Current (%)	Departure (%)	Current (%)	Departure (%)	Current
Center	100	0	118	1	0.89
North	100	0	107	-5	0.86
South-west	100	0	123	2	0.91

[BRA] Brazil

This reporting period (July to October) covers the main growing period of wheat. Its harvest is still ongoing and will conclude by December. The harvest of maize in the North-east is also ongoing while the harvest of rice in north and northeast and the second maize in central and southern Brazil had concluded by August. The sowing of summer crops (maize, soybean, and rice) in Central and Southern Brazil started in October and will last until the end of December.

The current monitoring period covers the end of the dry season and the start of the rainy season. Precipitation profiles indicate that precipitation was in general well below the average of the last 15 years and the start of the wet season was delayed in comparison to the long-term average. The dry weather together with the late start of the wet season might delay the sowing, emergence and early development of summer crops.

The 2023-2024 winter crops growing season was dominated by overall dry and warmer-than-usual weather in Brazil. CropWatch Agro-climatic Indicators (CWAIs) present below-average conditions with 49% lower rainfall, 2.3°C higher temperature and average radiation compared with the 15YA during this monitoring period. The significantly below-average rainfall and above-average temperature was unfavorable for crops, resulting in a 25% reduction of potential biomass. Dry weather conditions were wide-spread across all of Brazil with only four states receiving above-average rainfall, including Rio Grande Do Sul (+60%), Santa Catarina (+23%), Paraiba (+10%), and Alagoas (+3%). The extreme dry weather was observed in several major agricultural producing states such as Goias, Mato Grosso, Mato Grosso Do Sul, Sao Paulo and Minas Gerais with over 70% negative rainfall anomalies. Similarly, the largest temperature anomalies were observed in those five major states where temperatures were more than 2.6ºC higher than the 15YA and temperatures in all major agricultural producing states presented above average conditions. Negative and positive anomalies of radiation were observed in different states with the largest positive departure in Pernambuco at 7% above average and the largest negative departure in Rio Grande Do Sul, 9% below average. Low rainfall and high temperatures triggered severe water stress. The BIOMSS was in general well below average on the BIOMSS departure map.

The crop condition development graph based on NDVI for Brazil presents close to average values during the reporting period. The chart showing proportions of different crop condition categories from July to October 2023 showed that 32% of the Brazil had below average crop conditions in early September and 28% in late October, which indicates that the water stress negatively affected crop development in Brazil. It is worth mentioning that at the same time, southern Brazil suffered from extreme heavy rainfall, resulting in floodings, which also had a negative impact on crop growth. Crop conditions varied, especially since September. Spatially, crops in the south and east presented above-average NDVI as they benefited from the normal or above average rainfall while NDVI in other regions stayed at or below average according to the NDVI departure clustering maps and profiles. Mato Grosso and Goias suffered from prolonged dry weather conditions resulting in significant negative NDVI departures (red color in figure e). It is also noteworthy that part of Mato Grosso Do Sul presented continuous improvements in crop condition since July although the region received limited rainfall. This is mainly due to the irrigation systems.

The VCIx map presented similar patterns with high values (> 0.8) in the northeast coast and Parana River Basin while VCIx values was lower (<0.8) in central Brazil, especially the Central Savanna zone. At the national level, VCIx was 0.85 and CALF was 1% above the 5YA. At the annual base, cropping intensity increased by 6%, indicating that the total cultivated crop area was at an above average level.

All in all, crop conditions in Brazil were sightly below average and the establishment of the summer crops was delayed due to the late start of the wet season. The crop production index (CPI) in Brazil is 1.07, reflecting an overall above average crop prospect. The main reason is that wheat production in Parana and Rio Grande Do Sul was less affected by dry weather. Wheat production is expected to be above average level. As it is still at early stage of the summer crops, the outputs for 2023-2024 summer season crops will mainly depend on the weather conditions in the coming months.

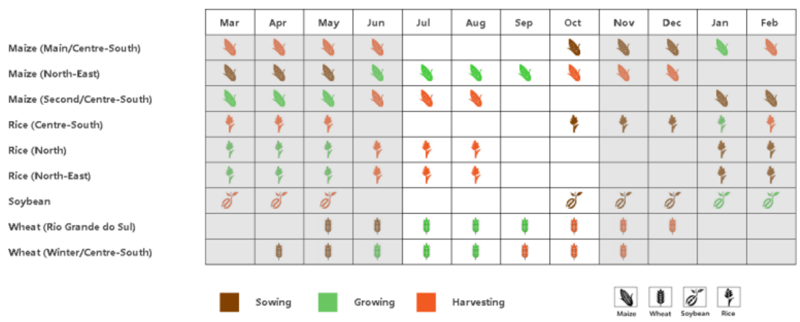
Regional analysis

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). All the AEZs received significantly below average rainfall (-37% to -92%) except for Southern subtropical rangelands (59% above average) and above average temperature (0.5 °C to 2.9 °C). Central Savanna, Mato Grosso and Nordeste received less than 50 mm rainfall during the last four months. Considering the current agriculture practices, this bulletin focus on Central Savanna (31), Mato Grosso zone (34), the Nordeste (35), Parana River (36), and Southern subtropical rangelands (37). The overall dry and hot weather resulted in below-average BIOMSS (-9% to -39%) in most zones except for Southern subtropical rangelands (9% above average), where rainfall was above average.

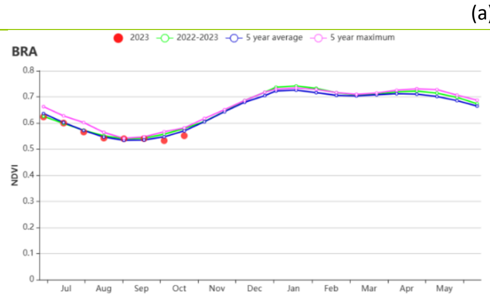
Brazilian wheat is mostly cultivated in Southern subtropical rangelands and the Parana basin. Rainfall in the southern subtropical rangelands zone was the highest among the AEZs at 952 mm which is the only one higher than the average with 59% above average rainfall. Great temporal differences were observed during the last four months with large negative departures from the 15YA in late July to late August, while rainfall was above or close to average in other months, especially in early September to mid October with significantly higher than average rainfall, resulting in floodings. In general, the crops were less affected by the below average rainfall but slightly affected by flooding as reflected by the highest VCIx values at 0.93 among the AEZs. CALF in the region was 1% above the 5YA, and the CI was 3% above the 5YA. Wheat production was still at above-average levels estimated by CropWatch with crop production index (CPI) value at 1.06. In the Parana basin, rainfall was 37% below average, resulting in a 27% drop in BIOMSS. Thanks to the accessibility of water and irrigation facilities, crop condition was normal or above the 5YA level according to the NDVI-based crop development profile. During the wheat growing period, CALF was 2% higher compared with the 5YA and CI was 136%, 6% above the 5YA. Average VCIx value in the region was 0.90. CropWatch puts the wheat production in the region at an above-average level, with crop production index (CPI) at 1.13, the highest among the AEZs in Brazil.

Dry and hot weather resulted in below-average crop conditions in Central Savanna, Mato Grosso zones and Nordeste as shown in NDVI-based crop development profiles. They had lower than average rainfall with higher than average temperature, leading to below-average BIOMSS. VCIx values in Central Savanna, Mato Grosso zones and Nordeste were also the lowest among the AEZs. Accordingly, CPI values in the three regions were 0.91, 0.89 and 0.78 respectively, ranking as the lowest three AEZs values in Brazil.

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

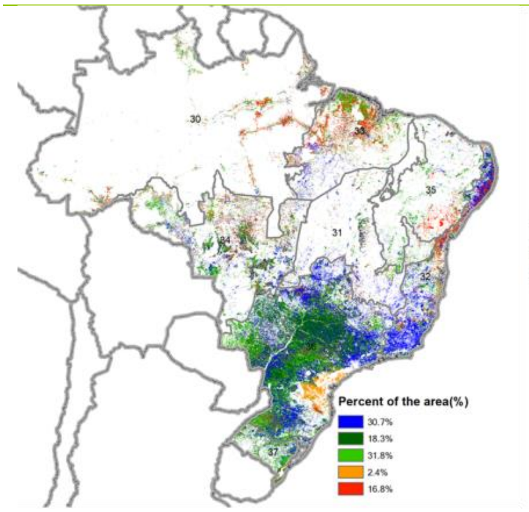


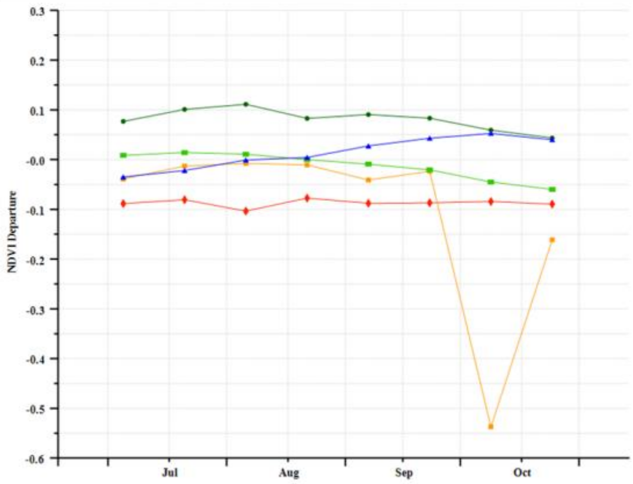
(a) Phenology of major crops



(b) Crop condition development graph based on NDVI

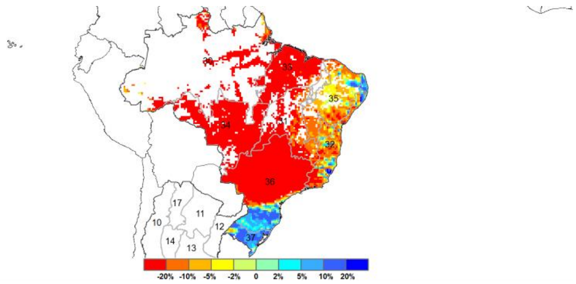
(c) Maximum VCI





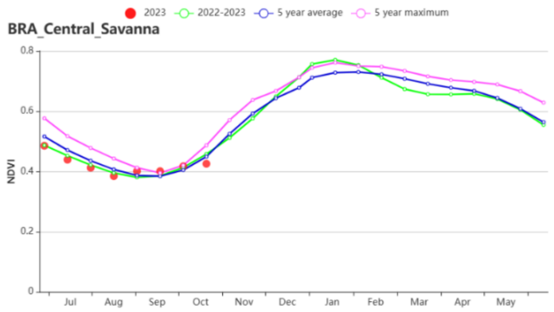
(d) Spatial NDVI patterns compared to 5YA

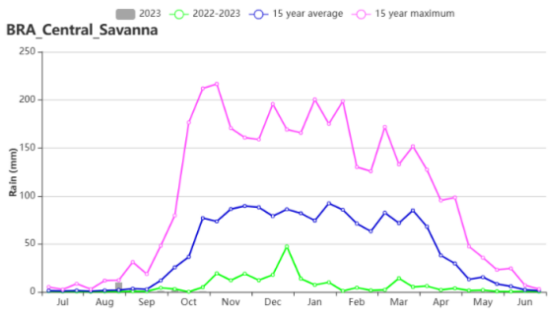
(e) NDVI profiles



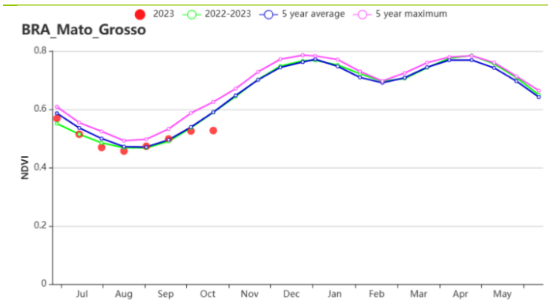
(f) Rainfall profiles

(g) Potential biomass departure from 15YA

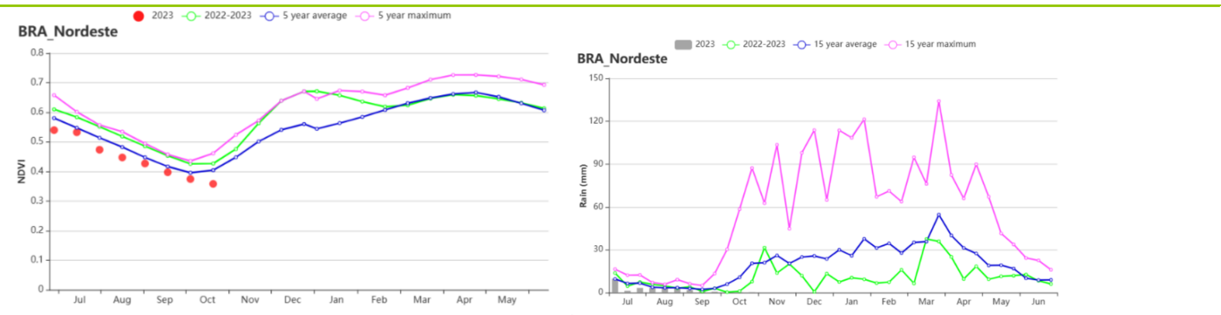




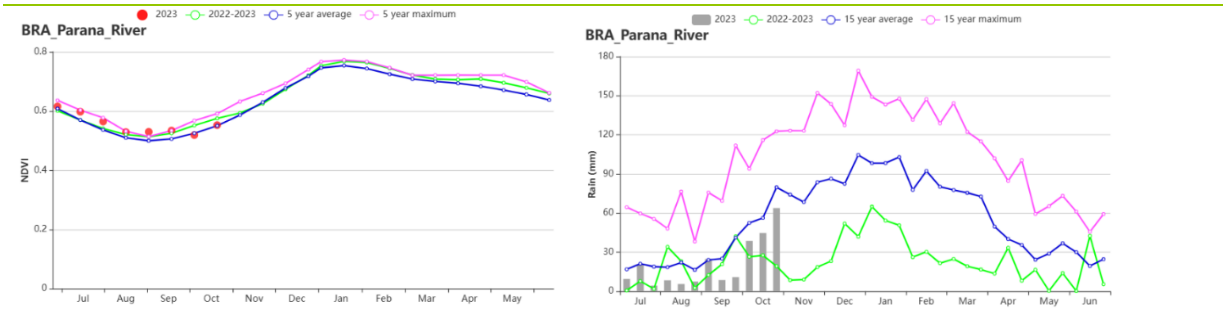
(h) Crop condition development graph based on NDVI (left) and rainfall profile (right) of Central Savanna



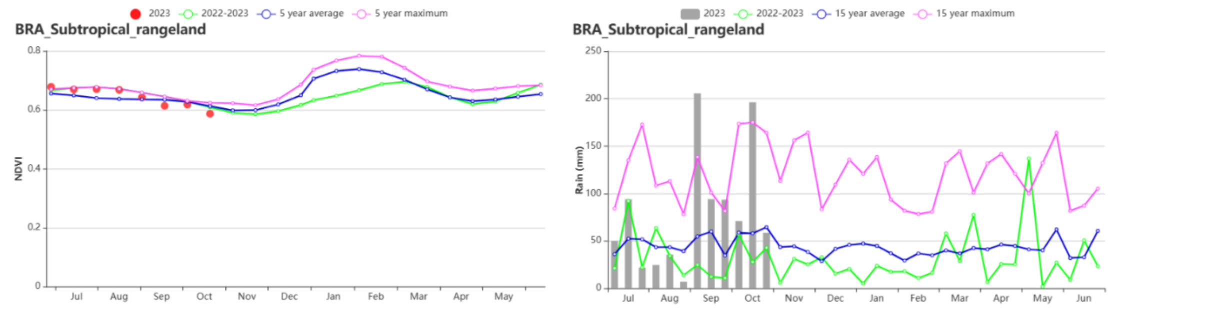
(i) Crop condition development graph based on NDVI (left) and rainfall profile (right) of Mato Grosso



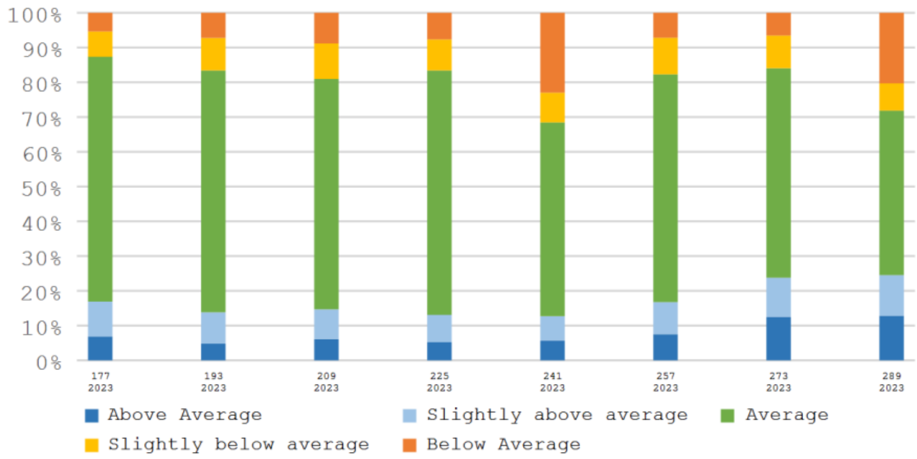
(j) Crop condition development graph based on NDVI (left) and rainfall profile (right) of Nordeste



(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



(m) Proportion of different crop condition categories, July - October 2023

Table 3.13 Brazil’s agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, July - October 2023

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Amazonas	151	-63	28.7	2.1	1257	1	695	-32

Central Savanna	22	-87	27.2	2.6	1243	0	472	-22
Coast	176	-37	22.4	1.6	1050	4	676	-9
Northeastern mixed forest and farmland	50	-76	28.8	1.7	1292	1	555	-31
Mato Grosso	18	-92	28.8	2.6	1165	0	446	-39
Nordeste	31	-61	25.9	1.3	1295	4	505	-10
Parana basin	247	-37	23.2	2.9	1040	-2	599	-27
Southern subtropical rangelands	952	59	15.7	0.5	767	-8	1049	9

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

Region	**Cropped arable land fraction**		**Cropping Intensity**		**Maximum VCI**
	Current (%)	**Departure (%)**	**Current (%)**	**Departure (%)**	**Current**
Amazonas	100	0	143	-3	0.86
Central Savanna	69	-6	132	11	0.70
Coast	100	1	125	8	0.90
Northeastern mixed forest and farmland	99	0	133	-4	0.87
Mato Grosso	87	-3	152	10	0.73
Nordeste	76	1	134	12	0.74
Parana basin	97	2	136	6	0.90
Southern subtropical rangelands	99	1	132	3	0.93

[CAN] Canada

The monitoring period spans from July to October, 2023, which covers the harvest of wheat in August and September. Soybean and maize were harvested in October in the Saint Lawrence Basin. The sowing of winter wheat started in September. It is mainly grown in the Saint Lawrence Basin. According to the CropWatch agroclimatic indicators, Canada had warmer and dryer weather than usual in this reporting period. The overall condition was slightly below the five-year average.

The temperatures were 0.9℃ above the 15-year average, while rainfall and radiation were below average by 6% and 3%, respectively. All these indicators led to a decrease of potential BIOMSS by 4%. According to the NDVI cluster map, the crop conditions for 39.5% of cropped land were always close to the average. For 19.7% of total cropped land (marked in blue), mainly located in the south of Saskatchewan and Alberta, the crops were below average but recovered to above average in October. In regions accounting for 21.1% of the total cropped area, the crop condition was close to average but deteriorated to below average in August, mainly in the south of Saskatchewan. For the rest of the regions, accounting for 19.7% of the total cropped area, crop conditions were below average during this monitoring period. For the whole year, the crop intensity was 104%, with a decrease of 1% when compared with the 5YA. The national maximum VCI value was 0.87, while CALF was slightly below average (CALF -2%).

In short, considering the agro-climatic, and agronomic indicators and that the crop production index (CPI) was 0.94 during this monitoring period, the overall conditions of the summer crops in Canada are assessed as slightly below average.

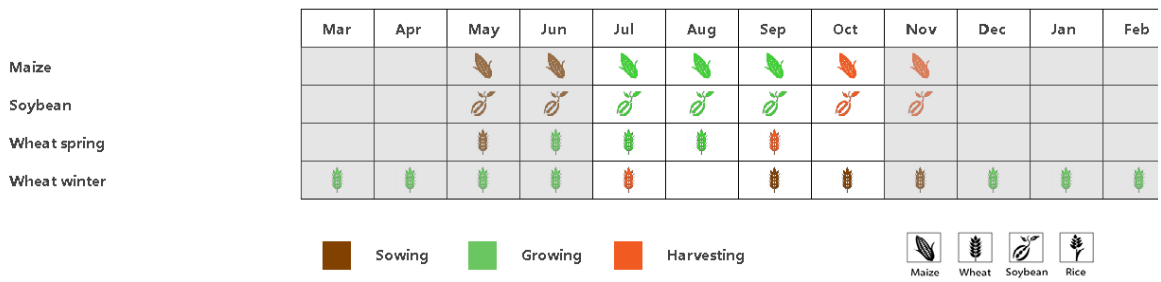
Regional analysis

The Prairies (Zone 53) and Saint Lawrence Basin (Zone 49) are the major agricultural regions in Canada.

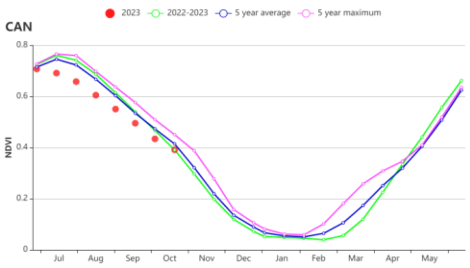
The Prairies is the main food production region in Canada. The major crops in this region are winter wheat and spring wheat, as well as canola and sunflowers. The weather was drier and warmer than the 15YA. The rainfall was significantly below average (RAIN 170 mm, -23%), while the temperature was slightly above average (TEMP +0.9℃) with slightly below average radiation (RADPAR -3%). According to the rainfall profile in the Prairies, rainfall was significantly below average at the beginning of July and the entire month of September. The deficit of rainfall led to a below-average potential production (BIOMSS -12%). According to the NDVI development graph, the crop conditions were below average in this region. All in all, crop production can be assessed as slightly below average in this region.

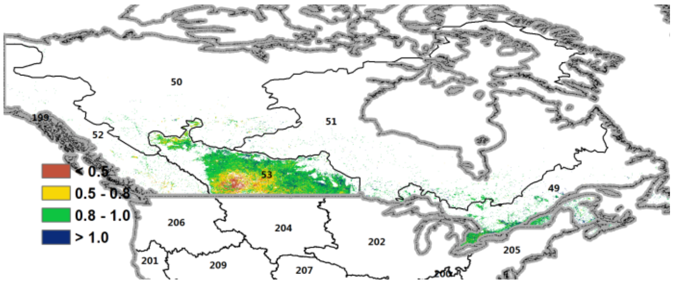
The conditions in the Saint Lawrence basin were significantly warmer (TEMP +0.9°C) and wetter (RAIN +11%) than the 15YA, while radiation was slightly below average (RADPAR, -4%) and the potential BIOMSS experienced a 5% increase. According to the NDVI development graph, crop conditions had reached average levels before September but decreased slightly below average after that. Production in this region is estimated as average.

Figure 3.12 Cananda's crop condition, July - October 2023

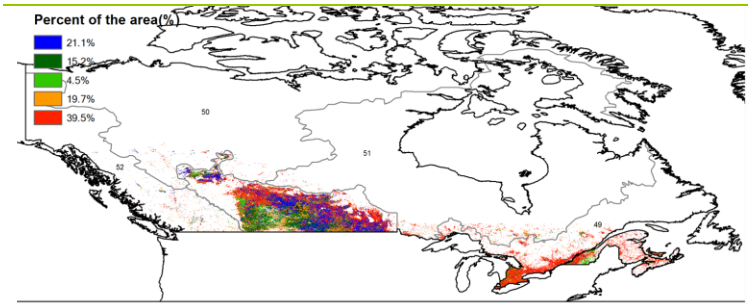


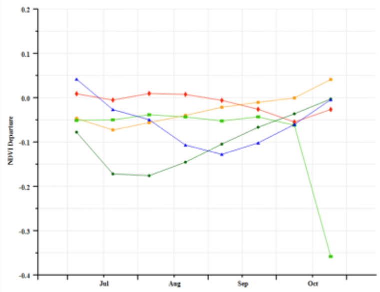
(a) Phenology of major crops



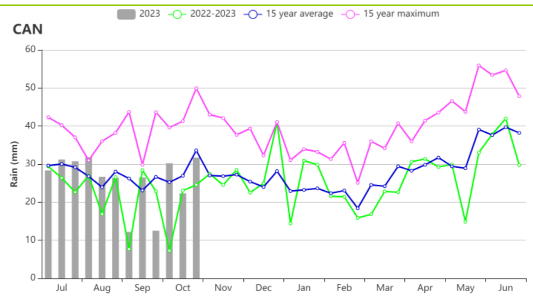


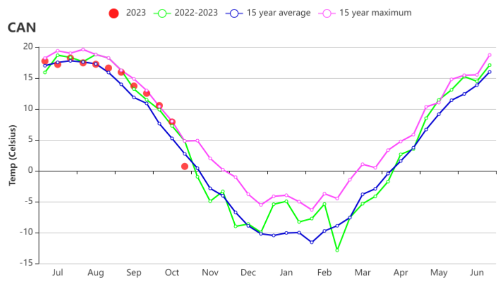
(b) Crop condition development graph based on NDVI (c) Maximum VCI



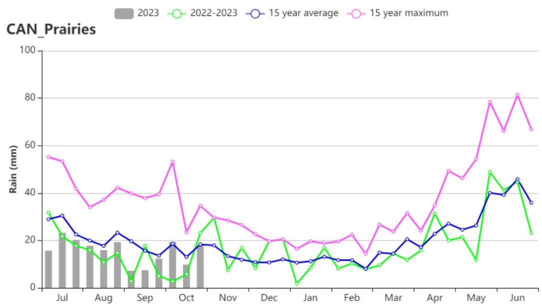


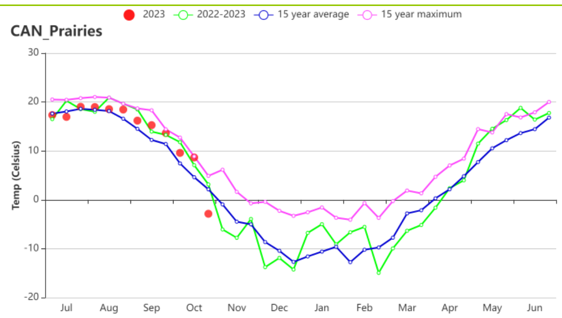
(d) Spatial NDVI patterns compared to 5YA (e) NDVI profiles



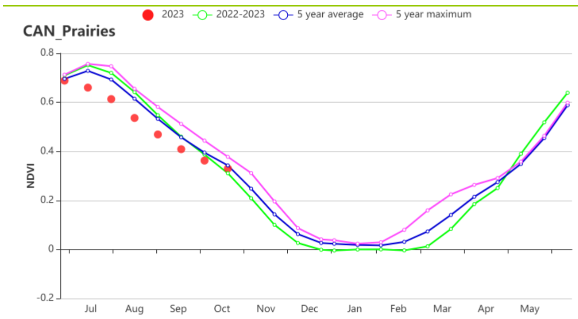


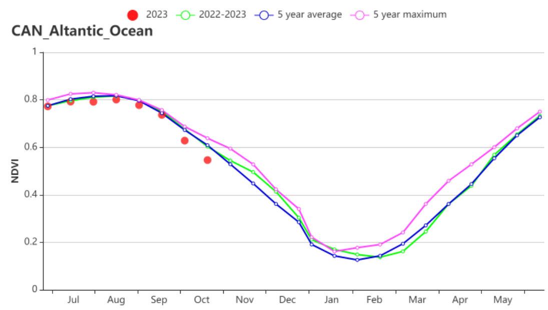
(f) Rainfall profiles (g) Temperature profiles





(h) Rainfall time series for Prairies (i) Temperature time series for Prairies





(j) Crop condition development graph based on Prairies (left) and Saint Lawrence (right))

Table 3.15 Cananda's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, , July - October 2023

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m^2)	Departure (%)	Current (gDM/m^2)	Departure (%)
Saint Lawrence basin	476	11	15.2	0.9	865	-4	950	5
Prairies	186	-23	14.2	0.8	942	-3	571	-12

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

Region	Cropped arable land fraction		Cropping Intensity		Maximum VCI
	Current (%)	Departure (%)	Current (%)	Departure (%)	Current
Saint Lawrence basin	100	0	113	0	0.95
Prairies	95	-3	101	0	0.84

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

[DEU] Germany

During this monitoring period, the harvest of summer crops was mostly completed by the end of October, whereas the sowing of canola and winter wheat started in September. Based on the agroclimatic and agronomic indicators, the crop conditions in Germany were generally close to average in most regions.

According to the CropWatch agroclimatic indicators, total precipitation (ΔRAIN +13%) and temperature (ΔTEMP +1.3°C) were above average, while radiation was average at the national level. As shown in the time series rainfall profile for Germany, precipitation was overall above average, but significantly below average in September and early October. Most of the country experienced warmer-than-usual conditions during this reporting period, except for late July and early August. The biomass production potential (BIOMSS) was estimated to increase by 3% nationwide as compared to the fifteen-year average.

As shown in the crop condition development graph and the NDVI profiles at the national level, NDVI values were below the 5YA in July and October, but otherwise above or in line with the average. A notable decrease in precipitation from mid-May to mid-June significantly impacted winter wheat growth, leading to low NDVI values in July. These observations are confirmed by the clustered NDVI profiles: all regional NDVI values were below average in July and October, and over a quarter of the regional NDVI values were below average from August to September. These negative departures were due to below-average rainfall in the early stages of growth. Overall VCIx for Germany was 0.87. CALF was 100% during the reporting period. The cropping intensity decreased by 4% compared to the recent five-year average.

The crops are mainly rainfed crops in Germany, and irrigation rates are relatively low (7.2%). Adequate precipitation in late July and early August mitigated the impact of early drought conditions on summer crops. The Crop Production Index (CPI) is 1.0, which represents the basic normal agricultural production situation in the current season. Frequent rainfall during the harvest period in October negatively impacted grain quality.

All in all, crop conditions in Germany for this monitoring period can be assessed as fair.

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. Radiation was close to average in this region. Total precipitation was above average (ΔRAIN +28%) and temperature was above average (ΔTEMP +0.8°C). As a result, BIOMSS is expected to increase by 14% as compared to the average. As shown in the crop condition development graph (NDVI), the values were below average during this monitoring period, except for August, when NDVI was above average. The area has a high CALF (100%) as well as a favorable VCIx (0.88). The cropping intensity decreased by 3% as compared to the average.

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, radiation was close to average in this region. Total precipitation was above average (ΔRAIN +20%) and temperature was above average (ΔTEMP +1.1°C). BIOMSS is expected to increase by 8% as compared to the average. As shown in the crop condition development graph based on NDVI, the values were above average except in July and October, when they were below the average level. The area has a high CALF (100%) and crop conditions for the region are favorable according to the high VCIx (0.9). The cropping intensity decreased by 6% as compared to the average.

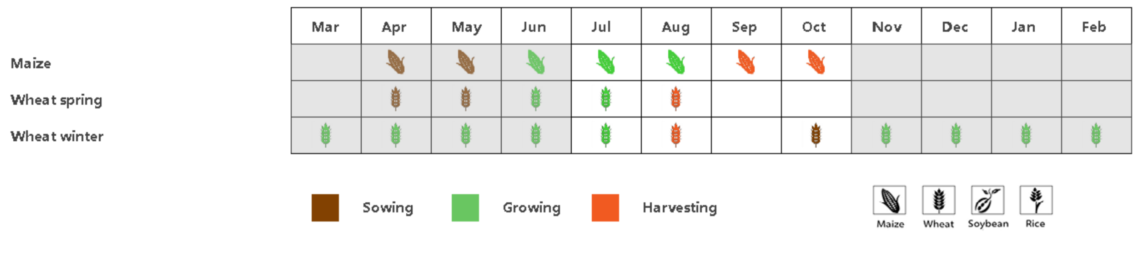
Central Wheat Zone of Saxony and Thuringia is another major winter wheat zone. Temperatures and radiation were both above average (ΔTEMP +1.6°C; ΔRADPAR +2%), but rainfall was below average (ΔRAIN -6%), which led to a decrease in BIOMSS by 3%. As shown in the crop condition development graph based on NDVI, the values were above average except in July and October, when they were below the average level. The area has a high CALF (100%) and the VCIx was 0.88 for this region. The cropping intensity increased by 2% as compared to the average.

Significantly below-average precipitation was recorded in the **East-German Lake and Heathland Sparse Crop Area** (ΔRAIN -11%). But temperatures and radiation were both above average (ΔTEMP +1.6°C; ΔRADPAR +2%). As a result, BIOMSS is expected to decrease by 3% as compared to the average. As shown in the crop condition development graph based on NDVI, the values were above or near average except for July and October when they were below average. The area has a high CALF (100%) and the VCIx was 0.88 for this region. The cropping intensity increased by 5% as compared to the average.

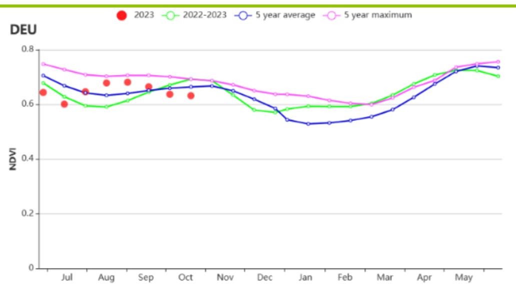
Total precipitation (ΔRAIN +17%), and temperature were above average (ΔTEMP +1.5°C) in the **Western Sparse Crop Area of the Rhenish Massif** with below-average solar radiation (ΔRADPAR -1%). The biomass potential (BIOMSS) increased by 3% compared to the 15YA. As shown in the crop condition development graph based on NDVI, the values were above average throughout the monitoring period except in early July and late October, when they were below average. The CALF was 100% for the regions. The VCIx value was 0.88. The cropping intensity decreased by 3% as compared to the average.

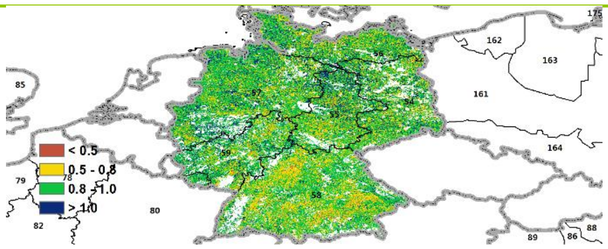
Total precipitation, temperature and radiation were above average in the **Bavarian Plateau** (ΔRAIN +9%; ΔTEMP +1.5°C; ΔRADPAR +1%). Compared to the fifteen-year average, BIOMSS decreased by 2%. As shown in the crop condition development graph based on NDVI, the values were above or near average except for July and October, when they were below average. The area had a high CALF (100%) as well as a favorable VCIx (0.83). The cropping intensity decreased by 7% as compared to the average.

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

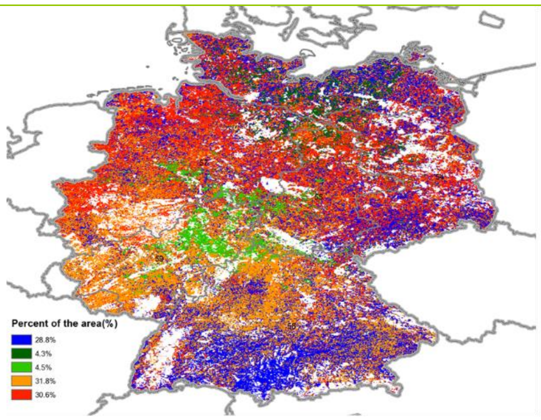


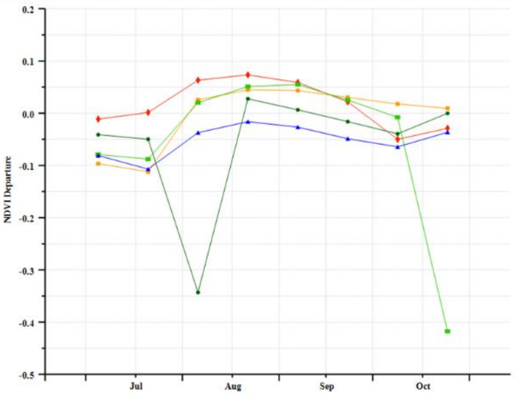
(a) Phenology of major crops



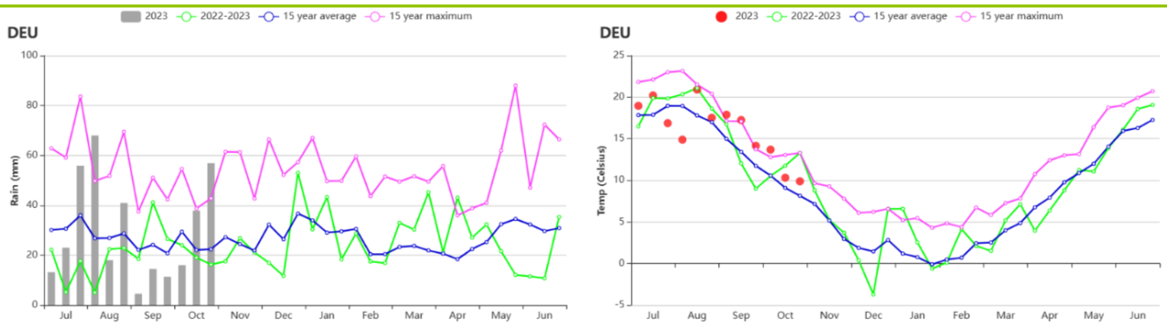


(b) Crop condition development graph based on NDVI (c) Maximum VCI

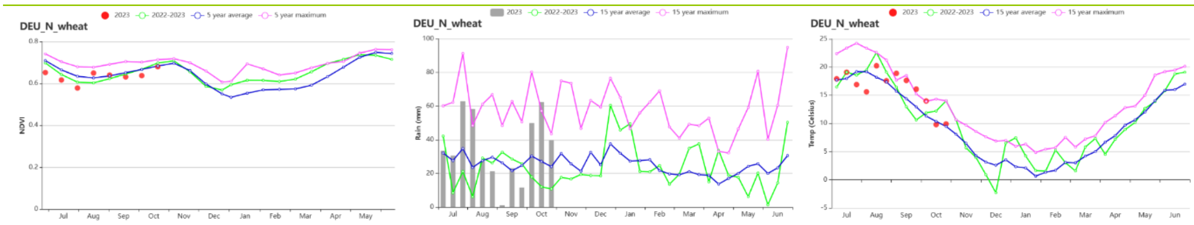




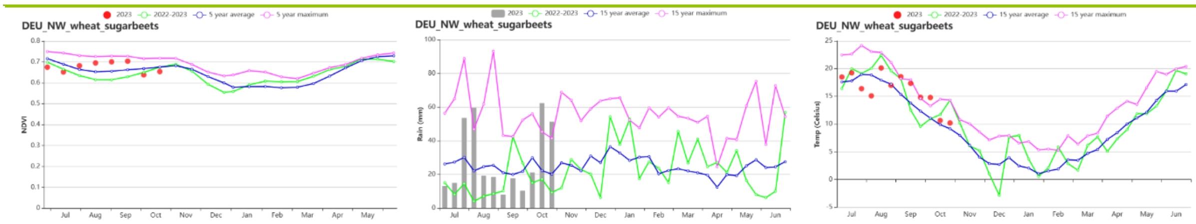
(d) Spatial NDVI patterns compared to 5YA (e) NDVI profiles



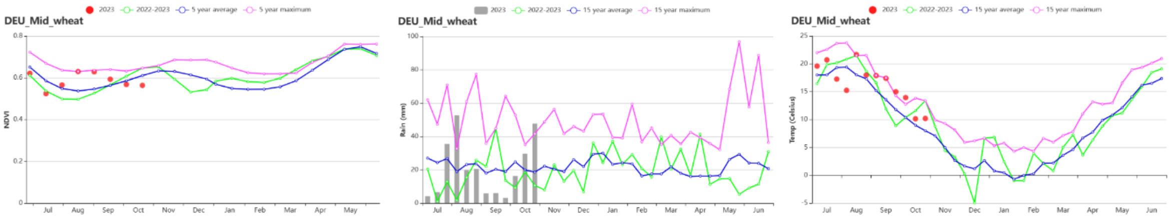
(f) Time series rainfall profile (left) and temperature profile (right) of Germany comparing the July-October 2023 period to the previous season and the five-year average (5YA) and maximum



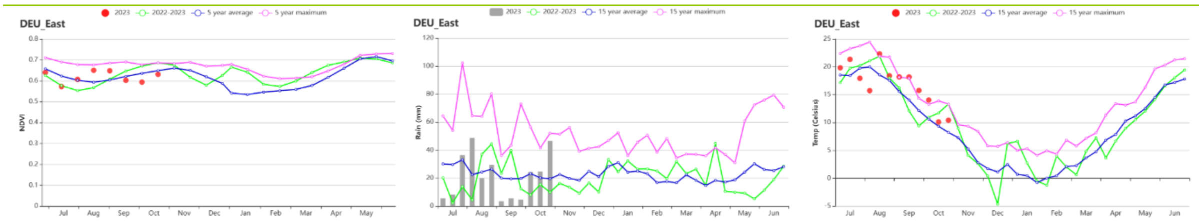
(g) Wheat zone of Schleswig-Holstein and the Baltic Coast crop condition development graph based on NDVI (left), time series rainfall profiles (middle) and temperature (right)



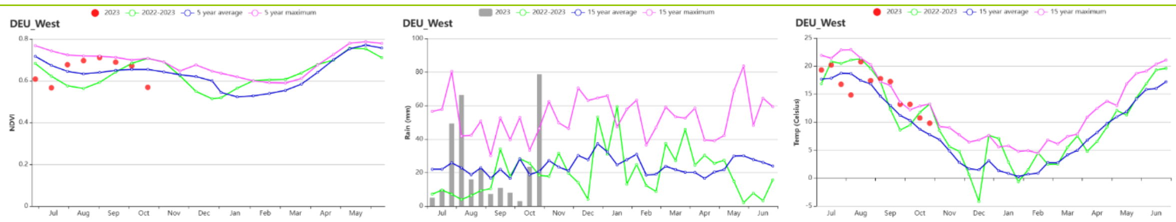
(h) Mixed wheat and sugarbeets zone of the north-west crop condition development graph based on NDVI (left), time series rainfall profiles (middle) and temperature (right)



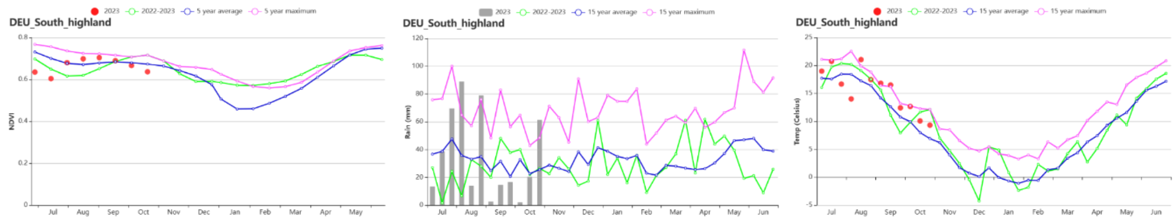
(i) Central wheat zone of Saxony and Thuringia crop condition development graph based on NDVI (left), time series rainfall profiles (middle) and temperature (right)



(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, July – October 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	257	-11	16.9	1.6	873	2	712	-3
Central wheat zone of Saxony and Thuringia	248	-6	16.4	1.6	882	2	683	-3
Mixed wheat and sugarbeets zone of the north-west	349	20	16.1	1.1	823	0	805	8
Wheat zone of Schleswig-Holstein and the Baltic coast	422	28	16.1	0.8	798	0	891	14
Bavarian Plateau	422	9	15.6	1.5	957	1	806	-2
Western sparse crop area of the Rhenish massif	300	17	15.9	1.5	880	-1	718	3

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

Region	Cropped arable land fraction		Cropping Intensity		Maximum VCI
	Current (%)	Departure (%)	Current (%)	Departure (%)	Current
East-German lake and Heathland sparse crop area	100	0	152	5	0.88
Central wheat zone of Saxony and Thuringia	100	0	149	2	0.88
Mixed wheat and sugarbeets zone of the north-west	100	0	131	-6	0.90
Wheat zone of Schleswig-Holstein and the Baltic coast	100	0	134	-3	0.88
Bavarian Plateau	100	0	134	-7	0.83
Western sparse crop area of the Rhenish massif	100	0	146	-3	0.88

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

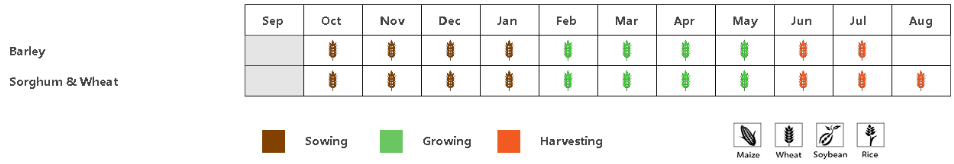
[DZA] Algeria

In this monitoring phase, we are observing the maturation of potatoes, artichokes and the harvest season of vegetables. Meanwhile, the cereal zone has not yet started land preparations. According to the NDVI-based crop condition development graph, the conditions in Algeria were below the 5-year average throughout the whole monitoring period.

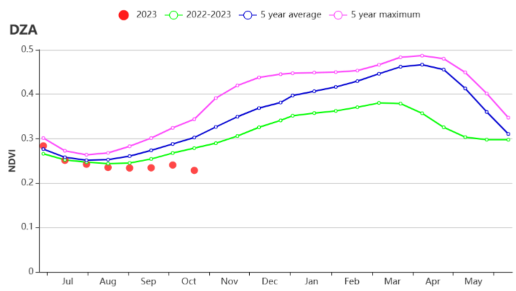
The cumulative rainfall was 16 mm, which was 84% below average. The average temperature was 24.8°C. It was higher than the 15YA by 1.3°C, and the photosynthetically active radiation was 1351 MJ/m2 (3% above average). The potential biomass indicates a negative departure (BIOMSS -20%) due to insufficient rainfall. The national maximum vegetation condition index (VCIx) was 0.51, while the cropped arable land fraction (CALF) was 11% below the 5YA. The national Crop Production Index (CPI) was 1.02. Radiation was 3% below 15YA.

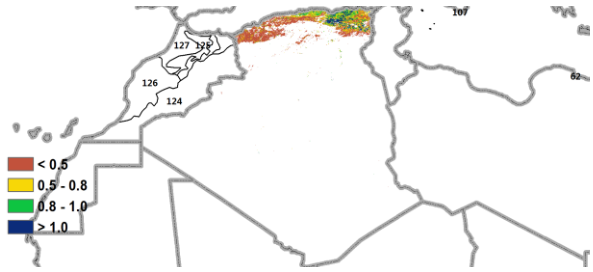
The NDVI spatial distribution shows that from July to October, crop conditions in 53.4% of the cropped areas were below the 5-year average (marked in orange). The blue marked regions (26.4% of the cropped areas), mainly located in the eastern region, experienced average crop conditions at the beginning and then recovered gradually to around below-average in the middle of August. The remaining cultivated areas all experienced below 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.

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

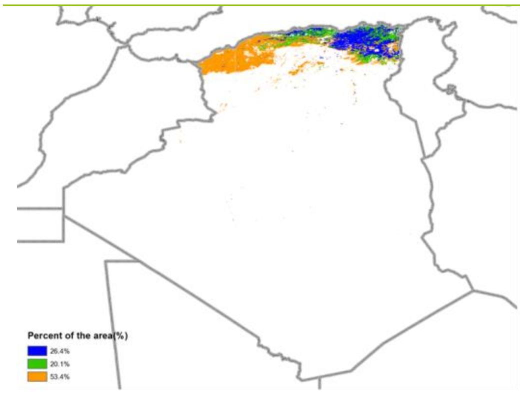


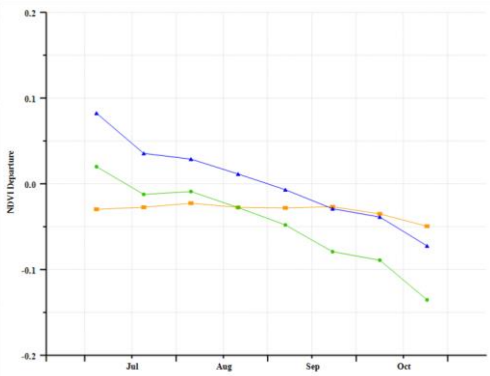
(a) Phenology of major crops





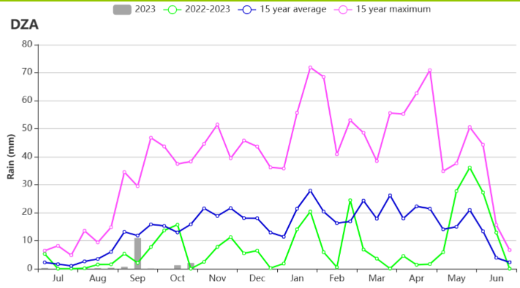
(b) Crop condition development graph based on NDVI (c) Maximum VCI

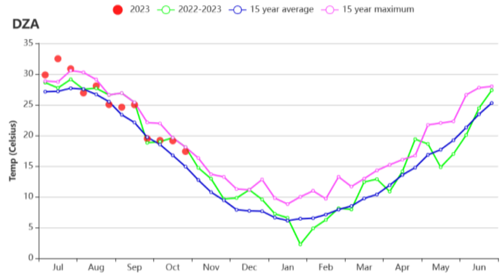




(d) Spatial NDVI patterns compared to 5YA

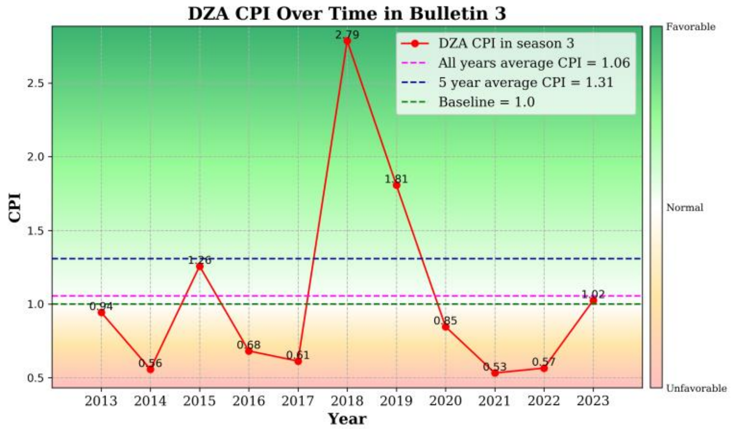
(e) NDVI profiles





(f) Rainfall profiles

(g) Temperature profiles



(h) CPI over time in bulletin 3

[EDY] Egypt

The reporting period from July to October covers the growth and harvest of the main summer crops including maize and rice while winter wheat sowing is about to start in early November. The average rainfall reached 6mm which is 24% lower than the 15-year average (15YA). The rainfall profile shows that the rainfall did not exceed 6 mm. The average temperature was 26.8°C which is higher than the 15YA by 1.2°C. Generally, the temperature profile shows that temperatures were higher than the 15YA. Both RADPAR and BIOMSS were lower than 15YA by 2.5% and 2% respectively. The decrease in BIOMSS can be attributed to the decrease in rainfall. The nationwide NDVI profile was below the 5-year average (5YA) except for the end of July, where it was at the 5YA, and the start of August, where it was slightly higher than the 5YA. The NDVI spatial pattern shows that 12.6% of the cultivated area was above the 5YA, 39.2% fluctuated around the 5YA, and 48.3% was below the 5YA. The Maximum Vegetation Condition Index (VCIx) map shows that the condition of the current crops was near average. The dominant VCIx values ranged between 0.50 and 1. This finding agrees with the whole country's VCIx value of 0.72. CALF was higher than the 5YA by only 2%. The nationwide crop production index (CPI) was at 1, implying a normal crop production situation. In general, the crop conditions were favorable.

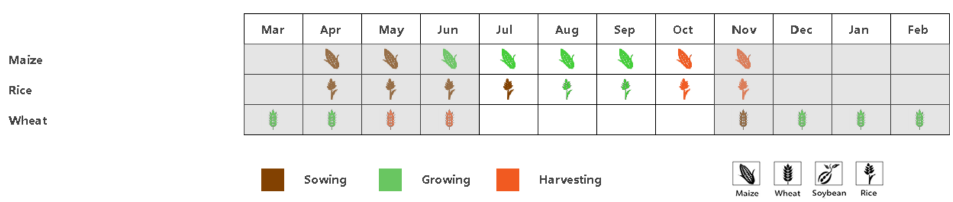
Regional analysis

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. These are 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).

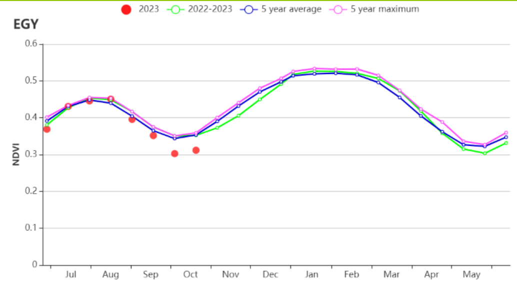
Nile Delta and the southern coast of the Mediterranean (zone 60): The average rainfall was 6 mm (26% below the 15YA) while the temperature was at 26.8°C which is higher than the 15YA by 1.1°C. Both RADPAR and BIOMSS were lower than the 15YA by 2.4% and 1% respectively. Generally, the NDVI development graph followed the nationwide NDVI profile. CALF exceeded the 5YA by 3% with a maximum VCI at 0.74 confirming favorable crop conditions. The cropping Intensity estimate was at 180%, indicating a mixture of single and double-cropping. The CPI was at 1.03, implying above normal crop production situation.

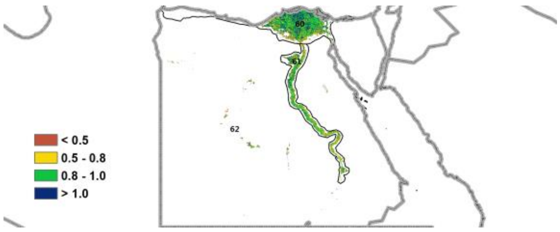
Nile Valley (zone 61): The average rainfall was at 1 mm which is below the 15YA by 20% while the temperature was at 28.7°C (1.0°C higher than the 15YA). Both RADPAR and BIOMSS were lower than the 15YA by 3.5%, and 18% respectively. Generally, the NDVI development graph follows the nationwide NDVI profile. CALF was at the 5YA with VCIx values at 0.77, confirming favorable crop conditions. The cropping Intensity estimate was at 170%, indicating a mixture of single and double-cropping. The CPI was at 0.93, implying below-normal crop conditions.

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

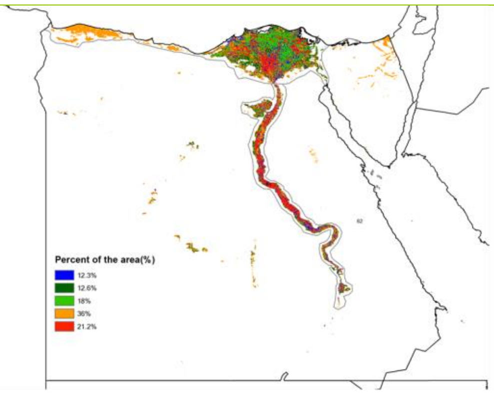


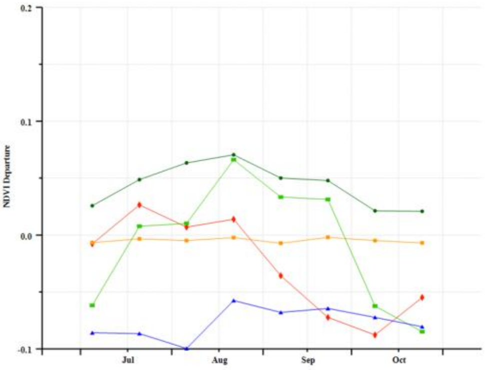
(a) Phenology of major crops



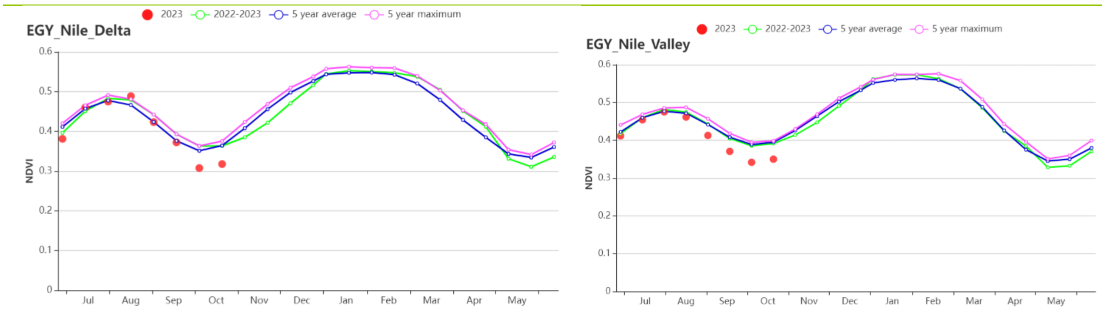


(b) Crop condition development graph based on NDVI (c) Maximum VCI

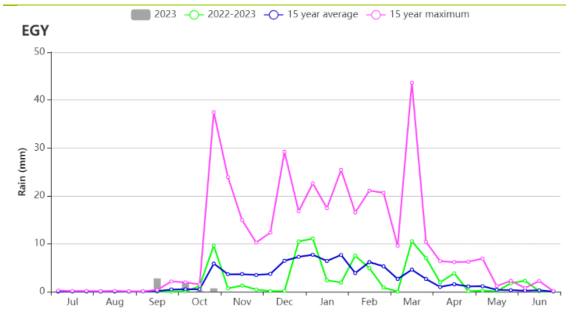


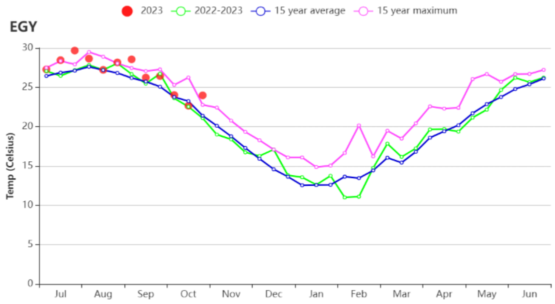


(d) Spatial NDVI patterns compared to 5YA (e) NDVI profiles



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





(g) Time series profile of rainfall (h) Time series profile of temperature

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

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Nile Delta and Mediterranean coastal strip	6	-26	26.8	1.1	1349	-2.4	475	-1
Nile Valley	1	-20	28.7	1.0	1384	-3.5	202	-18

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

Region	Cropped arable land fraction		Cropping Intensity		Maximum VCI
	Current (%)	Departure (%)	Current (%)	Departure (%)	Current
Nile Delta and Mediterranean coastal strip	66	3	180	16	0.74
Nile Valley	70	0	170	12	0.77

[ETH] Ethiopia

The main food crops in Ethiopia are teff, wheat, barley, and maize. The monitoring period is from July to October and encompasses the main growing and developmental seasons of all Meher crops. Cumulative precipitation had dropped by 29% compared to the 15YA (20% in the previous monitoring period), but both average temperature (+1.2°C) and photosynthetically active radiation (+6%) were slightly higher than the 15YA. Precipitation deficit resulted in a slight 10% decrease in biomass compared to the 15YA. The crop condition development graph based on NDVI for Ethiopia shows values were below the 5YA in early August, September and late October Due to the lack of rainfall. The NDVI departure clustering map shows a good crop development in most of the regions, except for the negative departure pattern in the southern region. The mean maximum VCI for Ethiopia is 0.91. The Maximum VCI graph shows the same pattern as the NDVI departure clustering map. The cropped arable land fraction decreased by 1% compared to 5YA. In conclusion, the crop conditions were generally still below average levels.

Regional analysis

In the Semi-arid pastoral areas (72), a typical livestock production zone, cumulative precipitation decreased by 21%. Mean temperature and photosynthetically active radiation were close to the 15-year average (TEMP +2.4° C, RADPAR 0%) and cumulative potential biomass decreased by 5%. At the same time, the NDVI values in the region were mostly lower than the 5-year average for the reporting period. The maximum VCI was 0.66. Compared to the 5-year average, CALF decreased by 17%. Cropping index was 121%. Overall, the outlook for livestock production is not very good.

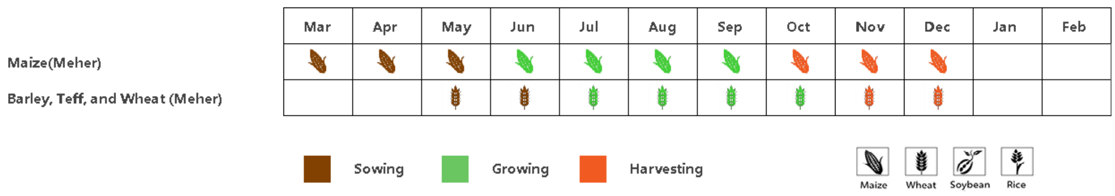
The central-northern maize-teff highlands (63) and the Southeastern Mendebo highlands zone (71) had similar agro-climatic conditions. Cumulative precipitation was lower than the 15-year average(RAIN -36%,-43%), Mean temperature(TEMP +1.5,+0.8ºC) and photosynthetically active radiation (RADPAR +6%,+6%) were slightly higher than the 15YA, and BIOMSS was below average(BIOMASS -13%,-17%). CALF for these two regions was essentially unchanged from previous years, and VCIx was slightly below 1.0. Overall, crop conditions in these regions were affected by drought.

In the South-eastern mixed maize zone (70), precipitation (RAIN -30%) is insufficient, but sunshine (RADPAR +4%) were adequate, temperature (TEMP +1.0° C) was suitable and cumulative potential biomass was lower than the average (-9%). The crop condition development graph based on NDVI shows that NDVI overall was below the 5YA, with a marked decline in early August. The maximum VCI was 0.83 and CALF was 98%, equal to the 5-year average. Cropping index was 116%. CropWatch estimates an average condition for autumn grain production in the region.

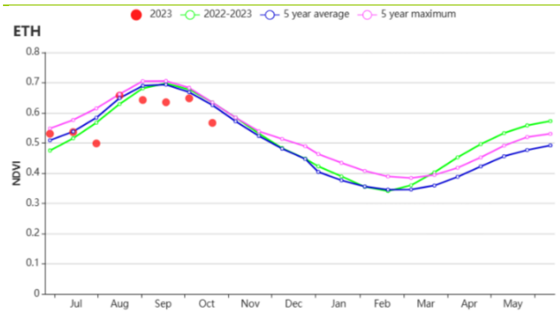
In the Western mixed maize zone (74), maize is the most important crop planted in the Meher season. The cumulative precipitation (RAIN +2%), average temperature (TEMP +0.8° C) and photosynthetically active radiation (RADPAR +9%) in the area were close to the 5-year average and estimated cumulative biomass was close to the 15-year average (-3%). The maximum VCI is 0.96 and CALF (100%) remains unchanged. Cropping index was 121%. The crops were in favorable conditions according to the CropWatch indicators.

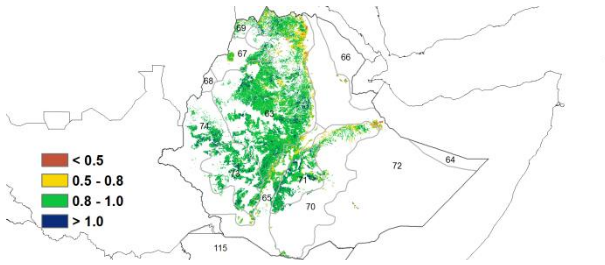
The northern arid area (66) is an agricultural area in northern Ethiopia. Due to the war, the cropped arable land fraction was almost zero and a severe food shortage is developing.

Figure 3.16 Ethiopia's crop condition, July - October 2023



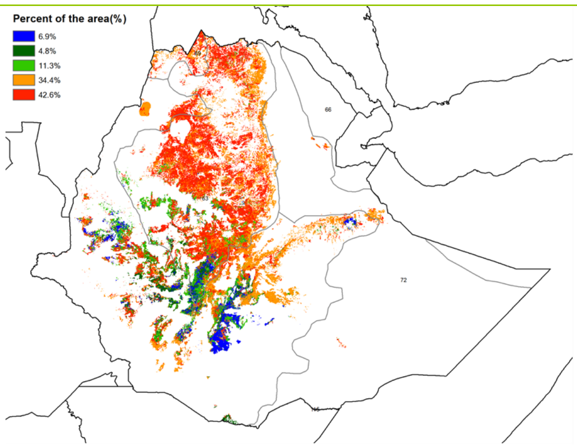
(a) Phenology of major crops

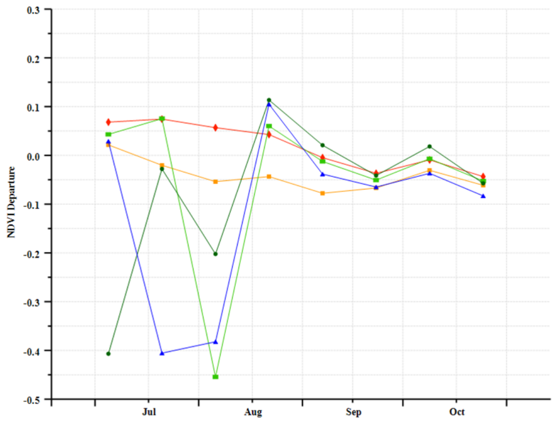




(b) Crop condition development graph based on NDVI

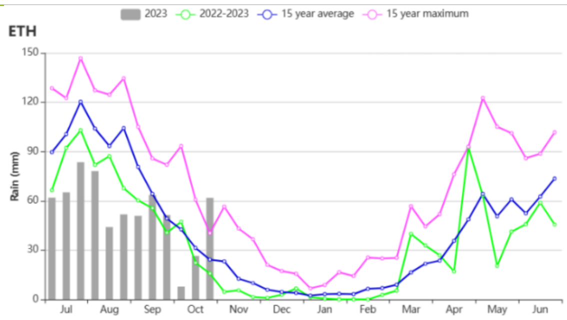
(c) Maximum VCI

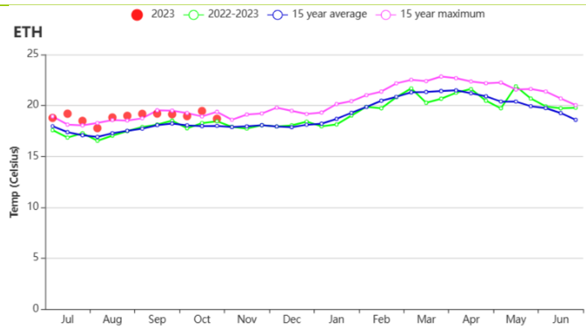




(d) Spatial NDVI patterns compared to 5YA

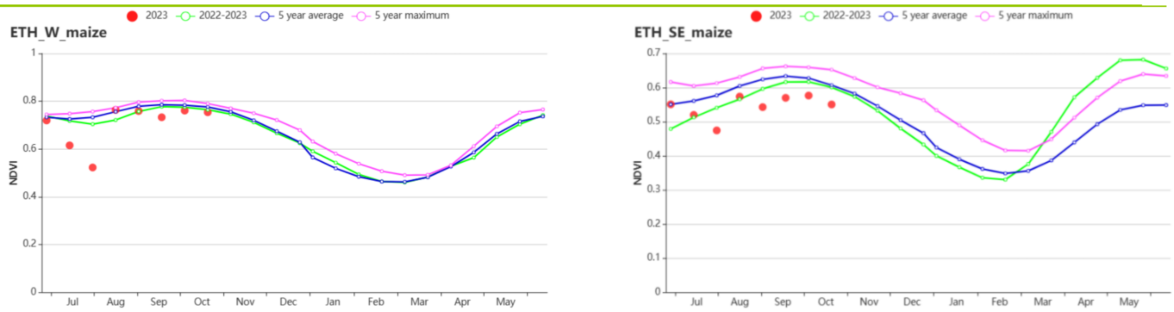
(e) NDVI profiles



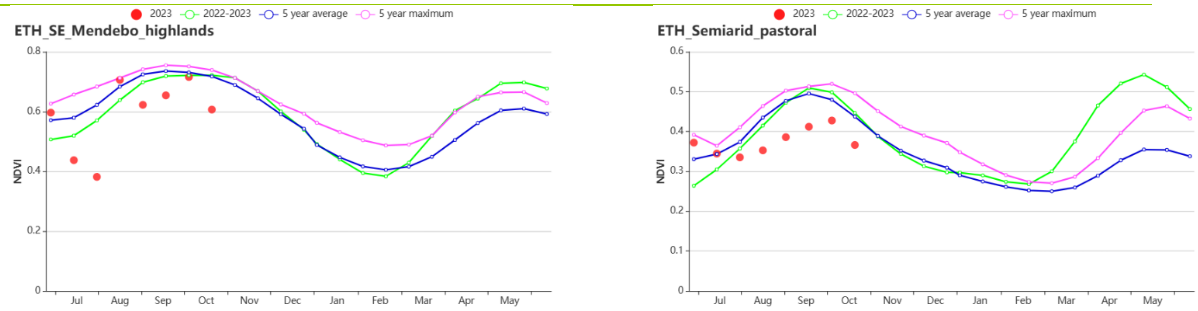


(f) Rainfall profiles

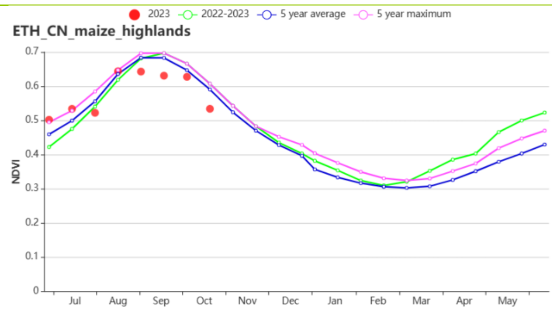
(g) Temperature profiles



(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))



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

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

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Central-northern maize-teff highlands	613	-36	18.5	1.5	1306	6	830	-13
Northern Arid area	98	-21	30.1	0.7	1330	-2	687	-3
Semi-arid pastoral areas	132	-21	25.4	2.4	1359	0	632	-5
South-eastern mixed maize zone	261	-30	19.2	1.0	1231	4	724	-9
South-eastern Mendebo highlands	276	-43	15.6	0.8	1185	6	654	-17
Western mixed maize zone	1347	2	20.4	0.8	1187	9	1179	-3

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

Region	Cropped arable land fraction		Cropping intensity		Maximum VCI
	Current (%)	Departure (%)	Current (%)	Departure (%)	Current
Central-northern maize-teff highlands	98	-1	113	-5	0.90
Northern Arid area	0	-100	0	0	0.00
Semi-arid pastoral areas	64	-17	121	7	0.66
South-eastern mixed maize zone	98	1	116	-3	0.83
South-eastern Mendebo highlands	100	0	144	4	0.94
Western mixed maize zone	100	0	121	1	0.96

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

[FRA] France

This monitoring period covers the harvest of winter wheat in July and August, closely followed by the harvest of spring wheat. Maize harvest started in September. The sowing of winter wheat started in October and will be completed in November. CropWatch agro-climatic indicators showed above-average temperatures over the period (TEMP +1.7°C). Temperatures surpassed the 15-year maximum during several periods except in late July and early August. RAIN was also higher than the average (RAIN +11%), especially in mid- and late October. Sunshine was at the average level. Due to favorable rainfall and the relatively warm temperature conditions, the biomass production potential (BIOMSS) is estimated to have increased by 5% nationwide compared to the 15-year average. Cropping intensity was above average by 2%. The national-scale NDVI development graph shows that the NDVI values were close to the trend of the 5-year average but below average in early July and early September. The spatial distribution of maximum VCI (VCIx) across the country reached 0.83. CALF was at the average level. Overall, above average rainfall and warmer temperatures during the summer season caused favorable growth conditions for most France's agricultural regions.

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: (75) **Massif Central dry zone**, (76) **Eastern Alpes region**, (77) **the Mediterranean zone**, (78) **Northern barley region**, (79) **Maize-barley and livestock zone along the English Channel**, (80) **Rapeseed zone of eastern France**, (81) **Southwestern maize zone**, and (82) **Mixed maize/barley and rapeseed zone from the Center to the Atlantic Ocean**.

In the **Massif Central dry zone**, TEMP and RAIN were 1.7°C and 3% higher than the average, respectively, while RADPAR was at the average level. CALF was at the average level. Cropping intensity decreased by 7%. The VCIx was at 0.82, and BIOMSS slightly decreased by 1%. Crop conditions of this region, based on the NDVI profile, were close to the average trend in July and August but dropped to below-average levels in September and October.

In the **Eastern Alpes region**, the NDVI profile presented a close to average and then below average trend. RAIN in the region was at the average level, while TEMP was higher than average (+1.9°C) and RADPAR was 3% higher than the 15YA. BIOMSS was also at the 15-year average. Cropping intensity was 4% lower than average. VCIx for the region was recorded at 0.82 and CALF was at the average level.

The **Mediterranean zone** indicated an overall below-average NDVI profile. The region recorded a relatively low VCIx (0.78). RADPAR (+1%) and TEMP (+2.4°C) were above average, while RAIN was significantly lower than average (-18%). Cropping intensity decreased by 1%. BIOMSS decreased by 7% and CALF decreased by 3%.

In the **Northern barley region**, warm (TEMP +1.4°C) and wet (RAIN +33%) weather was observed while sunshine was slightly below average (RADPAR -1%) over the monitoring period. The BIOMSS increased by 17% when compared to the 15-year average. The CALF was at the average level, and VCIx was relatively low at 0.8. Cropping intensity decreased by 8%. Crop condition development based on NDVI for this region was below the 5-year average in July, then above average in August and September, and lastly dropped below average level in October.

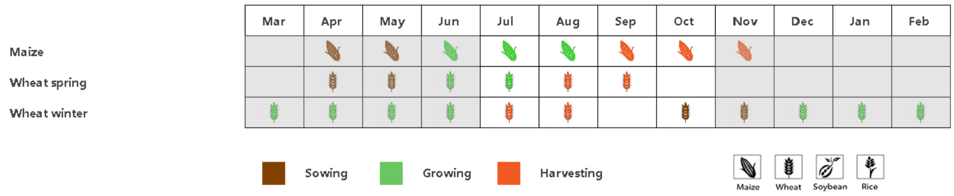
In the **Maize-barley and livestock zone along the English Channel**, TEMP and RAIN were above average by 1.4°C and 26%. RADPAR was lower than the average (-2%). BIOMSS increased by 15%. Cropping intensity decreased by 2%. CALF was average and VCIx was relatively high, at 0.88. The regional NDVI profile presented an overall close to the average trend, but was below average levels in early July and in October.

In the **Rapeseed zone of eastern France**, the NDVI profile showed great fluctuation during the monitoring period. It was below average in July, and then above average in August and September, finally back to below average in October. Overall, RAIN in this period was 8% higher than the 15-year average, while TEMP increased by 1.7°C and RADPAR was at average level. BIOMSS was about 3% higher than average, while CALF was at the average level, and VCIx was 0.85. Cropping intensity was higher than the average level by 6%.

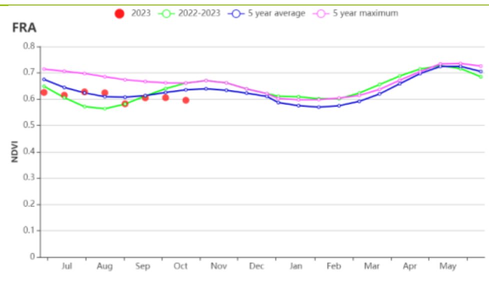
The **Southwestern maize zone** is one of the major irrigated regions in France. The regional NDVI profile presented a close to but below-average trend during the whole monitoring period except a big drop at the end of August. The VCIx was 0.84. BIOMSS was 3% higher than average. CALF was at the average level. Cropping intensity was above the average by 9%. RAIN in the period was above average (RAIN +5%), while TEMP was 1.4°C higher than average, and RADPAR was at the average level.

In the **Mixed maize/barley and rapeseed zone from the Center to the Atlantic Ocean**, muggy (TEMP +1.8°C, RAIN +35%) and overcast weather (RADPAR -2%) was observed during the monitoring period. BIOMSS was above the average level by 13%, the NDVI profile showed the regional crop conditions were close to and above average levels except in early July, when it was below the average. Cropping intensity was higher than the average level by 10%. The CALF was at the average level, and VCIx was 0.82.

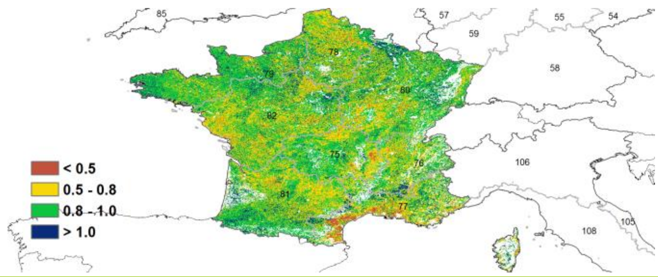
Figure 3.17 France's crop condition, July - October 2023



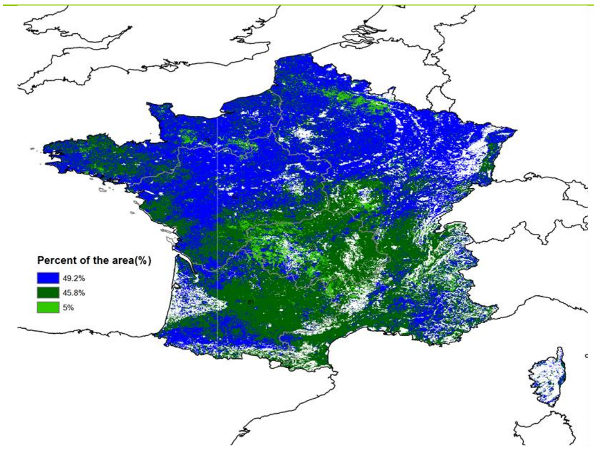
(a) Phenology of major crops



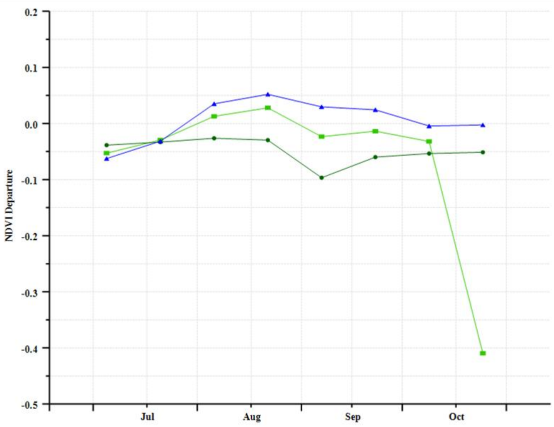
(b) Crop condition development graph based on NDVI



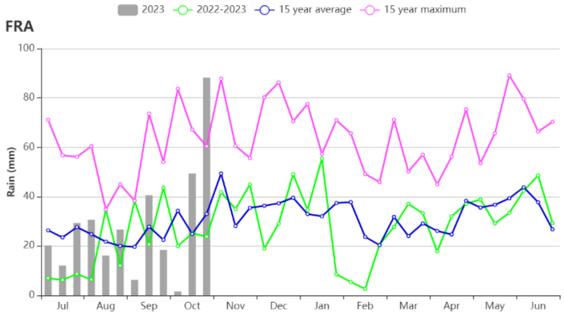
(c) Maximum VCI



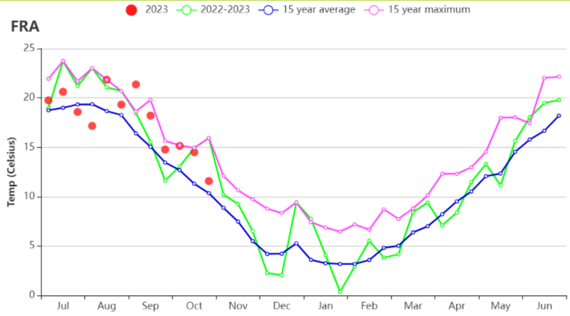
(d) Spatial NDVI patterns compared to 5YA



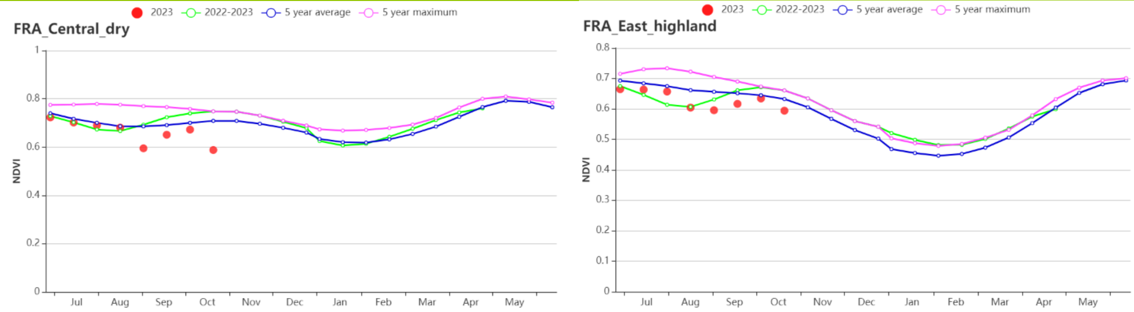
(e) NDVI profiles



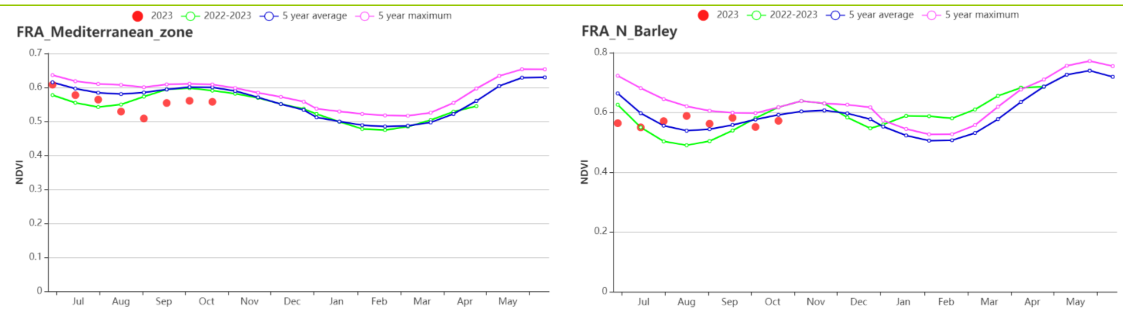
(f) Rainfall profiles



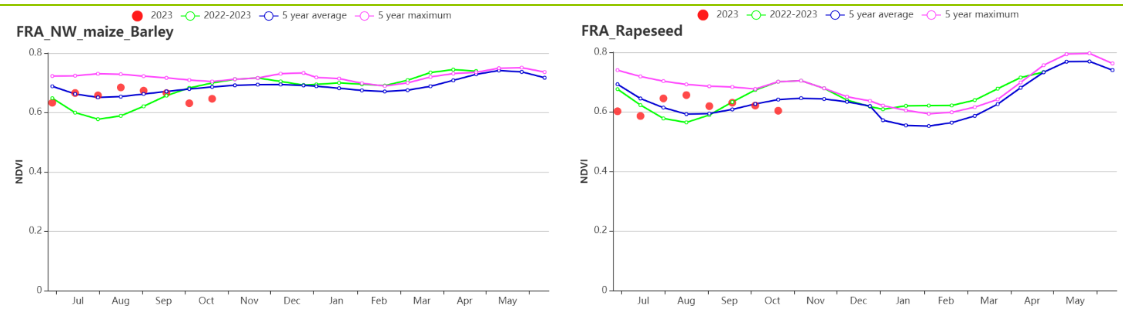
(g) Temperature profiles



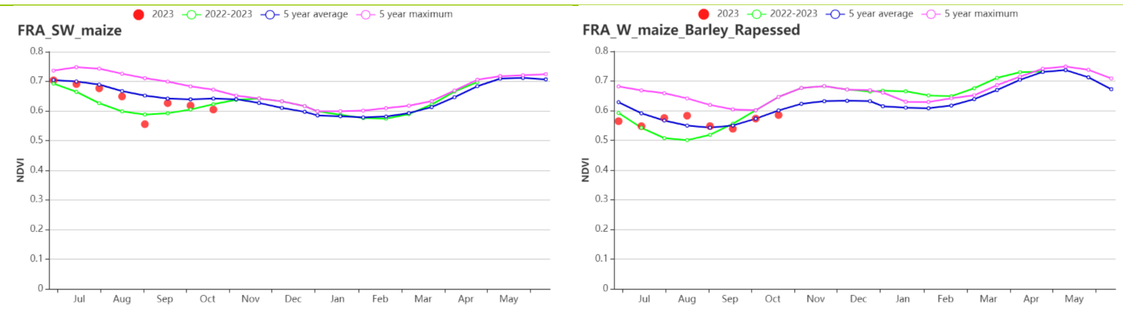
(h) Crop condition development graph based on NDVI (Dry Massif Central zone (left) and (Eastern Alpes region (right))



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



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



(k) Crop condition development graph based on NDVI (Southwest maize zone (left) and Mixed maize, Barley and Rapeseed zone (right))

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

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Massif Central Dry zone	320	3	17.0	1.7	1039	0	779	-1
Alpes region	437	0	16.5	1.9	1119	3	859	0
Mediterranean zone	245	-18	19.2	2.4	1176	1	689	-7
Northern Barley zone	376	33	17.1	1.4	857	-1	863	17
Maize barley and livestock zone along the English Channel	336	26	17.0	1.4	855	-2	816	15
Rapeseed zone of eastern France	378	8	17.1	1.7	954	0	817	3
Southwest maize zone	308	5	18.4	1.4	1083	0	805	3
Mixed maize/barley and rapessed zone from the Centre to the Atlantic Ocean	337	35	18.6	1.8	944	-2	801	13

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

Region	Cropped arable land fraction		Cropping intensity		Maximum VCI
	Current (%)	Departure (%)	Current (%)	Departure (%)	Current
Massif Central Dry zone	100	0	115	-7	0.82
Alpes region	98	0	119	-4	0.82
Mediterranean zone	93	-3	116	-1	0.78
Northern Barley zone	100	0	135	-8	0.80
Maize barley and livestock zone along the English Channel	100	0	118	-2	0.88
Rapeseed zone of eastern France	99	0	146	6	0.85
Southwest maize zone	100	0	130	9	0.84
Mixed maize/barley and rapessed zone from the Centre to the Atlantic Ocean	98	0	134	10	0.82

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

Summer crops reached maturity in September and October. At the same time, the sowing of winter cereals had started. Agro-climatic indicators show that rainfall, temperature and radiation were all above average (Δ RAIN, +12%; TEMP +0.6℃, RADPAR +3%). The seasonal RAIN profile shows that the rainfall was above average in July and October, but below average in August. The temperature was below average in July and above average in September. The estimated biomass was above average (+10%). NDVI values were below or close to average in the monitoring period. The national average VCIx was 0.87. It was higher than during the corresponding period in 2022. Crop production index was 0.94, slightly below average. CALF (100%) was unchanged compared to the five-year average. Cropping intensity was 141. The NDVI departure cluster profiles indicate that: (1) 48.7% of arable land experienced average crop conditions, mainly in the south of the UK. (2) 31.7% of arable land experienced slightly below-average crop conditions, mainly in the east of the UK. （3）The other areas experienced fluctuating below-average crop conditions. The marked drops in July and August in some areas can be attributed to cloud cover in the satellite images. Altogether, the conditions in the UK are assessed as below average, mainly due to the rainfall deficits that had been observed in May and August.

Regional analysis

Based on cropping systems, climatic zones, and topographic conditions, three sub-national regions are described below: **Northern barley regio**n （84）, **Central sparse crop region （83）** and **Southern mixed wheat and barley region （85）**. All three sub-regions are characterized by an unchanged fraction of arable land (CALF) compared to the 5YA.

In the **northern barley region**, NDVI was below average. All the agroclimatic indicators are above average (Δ RAIN, +3%; TEMP +0.3℃, RADPAR +8%), which results in an above average estimate of biomass (BIOMSS +5%). This region is cultivated with a mixture of single and double cropping systems, and the CI (+8%) was above average, while the VCIx was at 0.91. Crop production index was 0.96. Conditions were below average.

The **Central sparse crop region** is one of the country's major agricultural regions for crop production. The crop condition development graph based on NDVI was below average. Rainfall and temperature were above average (Δ RAIN +12%), temperature (TEMP +0.7℃) and radiation was close to average. Above average rainfall and temperature resulted in above-average biomass（BIOMSS +7%). This region is cultivated with a mixture of single and double cropping systems, and the CI was below average (+1%), while the VCIx was at 0.92. Crop production index was 0.96. Overall, the situation was below average.

In the **Southern mixed wheat and barley zone**, NDVI was below or close to average. This region experienced the largest positive rainfall excess (ΔRAIN +24%), temperature (TEMP +0.8°C) was significantly above average and radiation (RADPAR +1%) was close to average. The abundant rainfall and significantly above-average temperature resulted in the markedly above-average biomass (BIOMSS +14%). This region is cultivated with a mixture of single and double cropping systems, and the CI was below average (-2%), while the VCIx was at 0.85. Crop production index was 0.94. Overall, the conditions were below average, due to the lack of rainfall during the previous monitoring period.

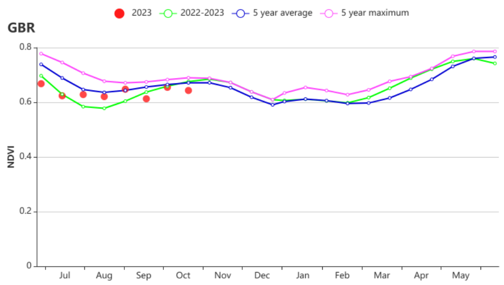
Figure 3.18 United Kingdom's crop condition, July - October 2023

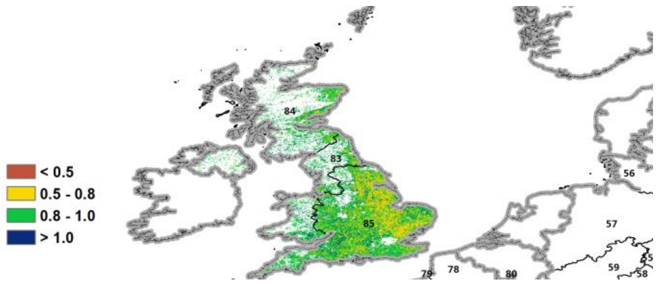
	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
Wheat winter												

Sowing Growing Harvesting

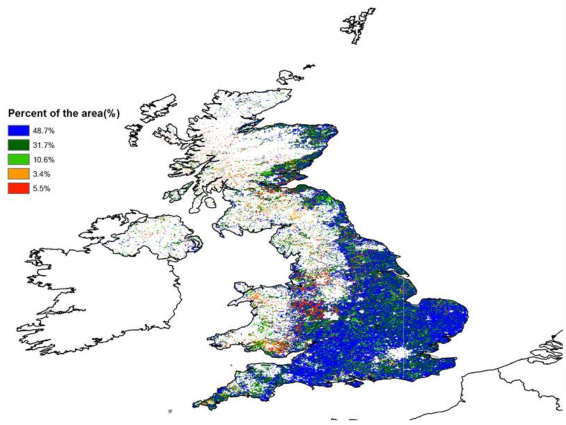
Maize Wheat Soybean Rice

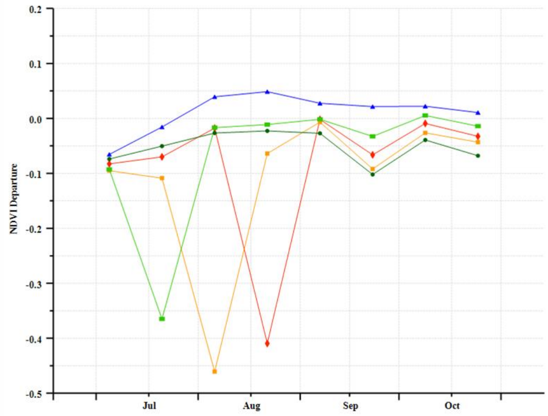
(a) Phenology of major crops



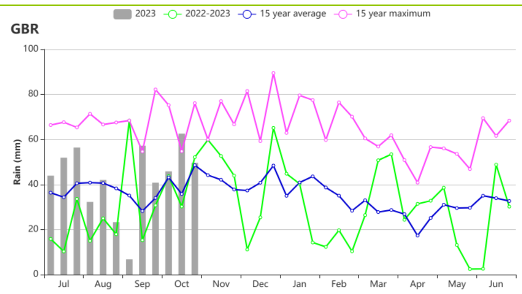


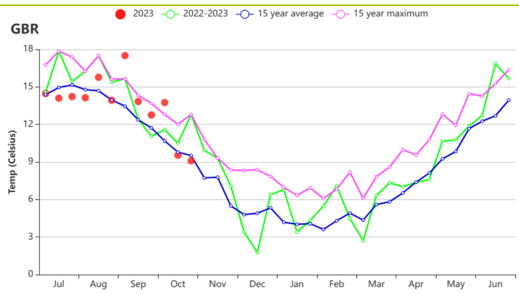
(b) Crop condition development graph based on NDVI (c) Maximum VCI



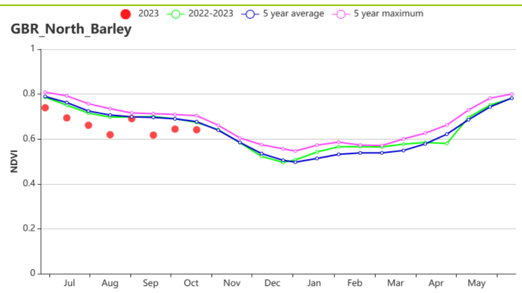


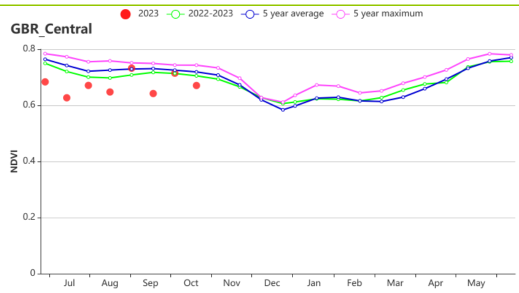
(d) Spatial NDVI patterns compared to 5YA (e) NDVI profiles



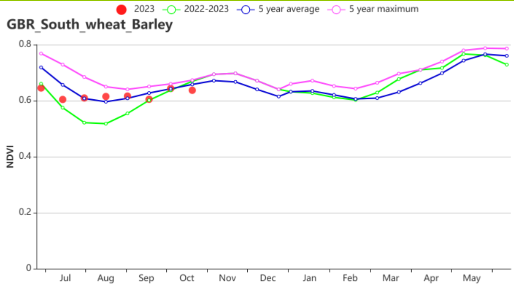


(f) Rainfall profiles (g) Temperature profiles





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



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

Table 3.25 United Kingdom's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, July - October 2023

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Northern Barley region (UK)	589	3	11.8	0.3	629	8	869	5
Central sparse crop region (UK)	540	12	13.3	0.7	636	0	920	7
Southern mixed wheat and Barley zone (UK)	429	24	15.0	0.9	733	1	891	14

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

Region	Cropped arable land fraction		Cropping intensity		Maximum VCI
	Current (%)	Departure (%)	Current (%)	Departure (%)	Current
Northern Barley region (UK)	100	0	159	8	0.91
Central sparse crop region (UK)	100	0	138	1	0.92
Southern mixed wheat and Barley zone (UK)	100	0	137	-2	0.85

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

[HUN] Hungary

During this monitoring period, the harvest of winter wheat was mostly completed by the end of July. Harvest of the summer crops, such as maize and sunflowers, started in September. Sowing of the new winter wheat crop was completed by October.

At the national level, accumulated rainfall was above average (ΔRAIN +5%), temperature increased by 2.1°C, and radiation was also above average (ΔPADPAR +2%). BIOMSS was above average (ΔBIOMSS +9%). According to the national NDVI development graphs, NDVI was below average in July, September, and October, while it was equal to the average in August. The Cropping Intensity (CI) was 145% (+10%). The maximum VCI value reached 0.81 at the national level and the cropped arable land fraction (CALF) was at 100%.

Some spatial and temporal detail is provided by the NDVI clusters: 38.3% of arable land in Hungary was below average during this monitoring period, distributed mainly in the Great Plain (Puszta). 29.7% of arable land in Hungary was above average during this monitoring period, distributed mainly in eastern Hungary and western Hungary. 12.7% of arable land in Hungary was above average from July to early September and below average mid-September to October, scattered throughout Hungary. 19.3% of arable land in Hungary was above average from July to early August and below average mid-August to October, scattered throughout in the Great Plain and central Hungary.

There was a prolonged period with a large rainfall deficit from August to September. It caused a drop in NDVI to below average levels starting from September. All in all, conditions for crop production can be assessed as fair in all regions of Hungary. High rainfall in late October helped with the germination and early development of the winter cereals.

Regional analysis

Based on cropping systems, climatic zones and topographic conditions, Hungary is divided into four sub-r egions: Northern Hungary (88), Central Hungary (87), the Great Plain (Puszta) (86) and Transdanubia (89). Specific observations for the reporting period are included for each region.

Central Hungary (87) is one of the major agricultural regions in terms of crop production. A sizeable share of winter wheat, maize and sunflower is planted in this region. According to the national NDVI development graphs, NDVI was below average in July, September, and October, while it was equal to the average in August. Agro-climatic conditions include below-average rainfall (ΔRAIN -5%), and above-average radiation (ΔRADPAR +2%) and temperature (ΔTEMP +2.3°C). Biomass was above average (ΔBIOMSS +9%). The VCIx was 0.79. CALF was 99%. Cropping intensity was 147% (+19%). However, NDVI remained below average starting from September due to the rainfall deficit.

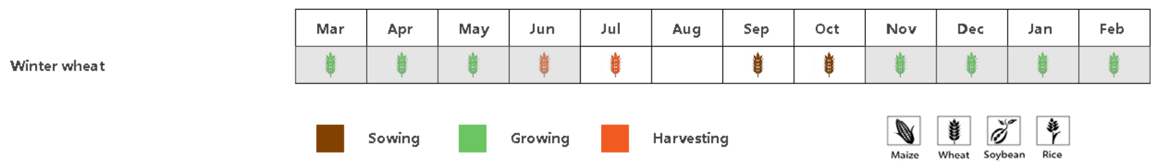
The **Puszta (86)** region mainly grows winter wheat, maize and sunflower, especially in the counties of Jaz-Nagykum-Szolnok and Bekes. According to the NDVI development graphs, crop conditions were below average during this monitoring period. Total rainfall was below average (-3%). Temperature (ΔTEMP +2.2°C) and radiation (ΔRADPAR +3%) was above average. Biomass was above average (ΔBIOMSS +7%). The maximum VCI was 0.76. CALF was 99%. Cropping intensity was 136% (+5%).

Northern Hungary (88) is another important winter wheat region. According to the NDVI development curve, crop conditions were hovering around the average in July and Auguest, below average in September and October. Total rainfall was below average (ΔRAIN -22%). Temperature (ΔTEMP +2.5°C) and radiation

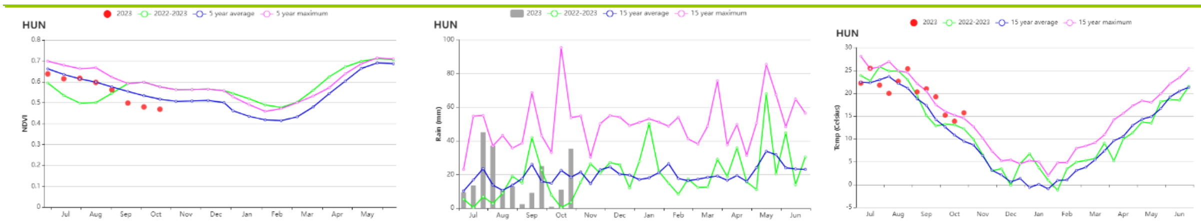
(ΔRADPAR +1%) was above average. Biomass was above average (BIOMSS -1%). The maximum VCI was 0.82. Cropping intensity was 154% (+13%). CALF was 100%.

Southern Transdanubia (89) cultivates winter wheat, mostly in Somogy and Tolna counties. According to the NDVI development curve, crop conditions were hovering around the average in July and August, below average in September and October. The rainfall was above average (ΔRAIN +22%). Temperature (ΔTEMP +1.7°C) and radiation (ΔRADPAR +1%) was above average. Estimated biomass increased (ΔBIOMSS +14%). The maximum VCI was 0.87. Cropping intensity was 152% (+14%). CALF was 100%.

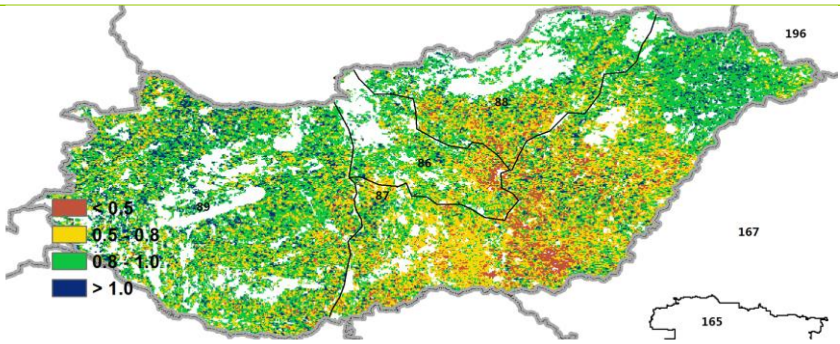
Figure 3.19 Hungary's crop condition, July -October 2023



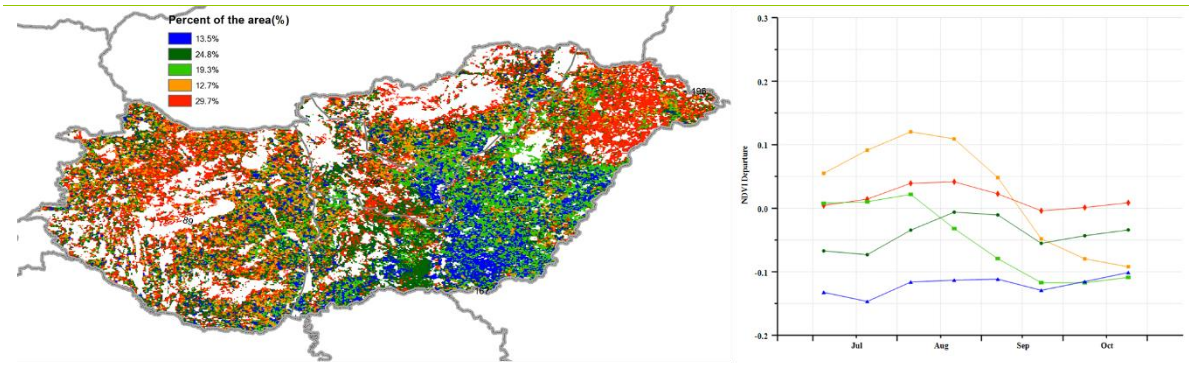
(a). Phenology of major crops



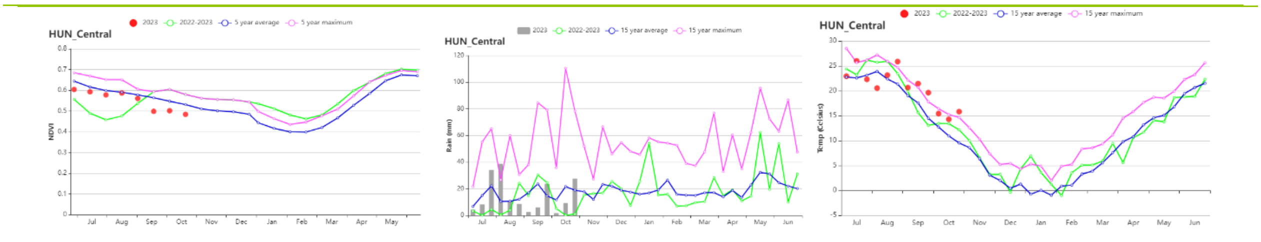
(b) Crop condition development graph based on NDVI, RAIN and TEMP



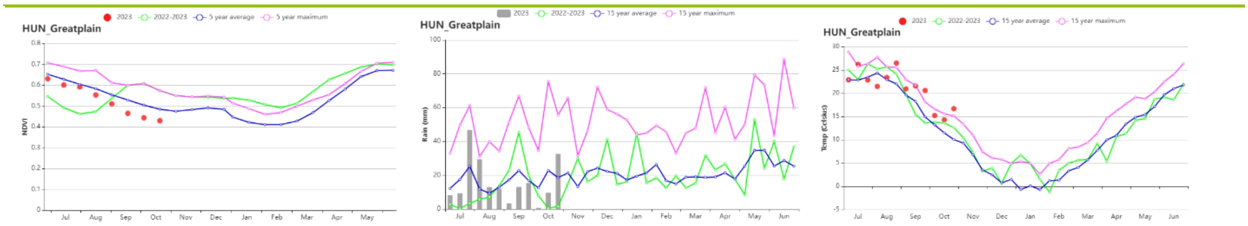
(c) Maximum VCI



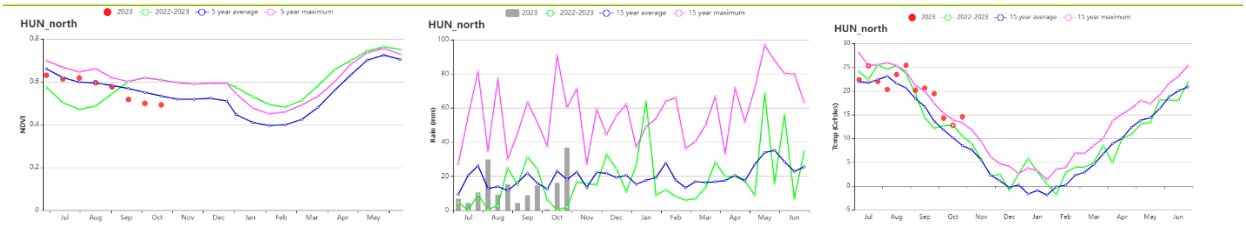
(d) Spatial distribution of NDVI profiles.



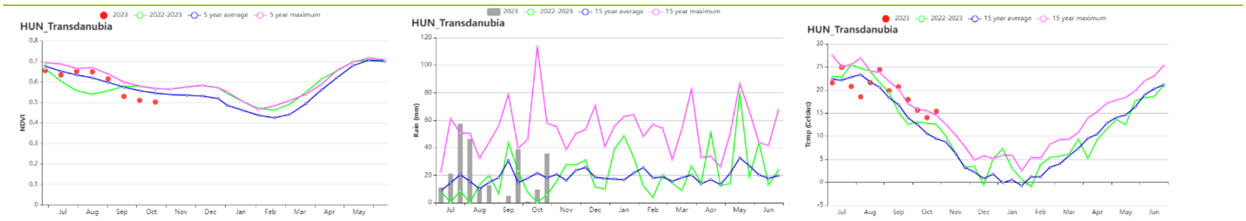
(e) Crop condition development graph based on NDVI, RAIN and TEMP (Central Hungary)



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



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



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

Table 3.27 Hungary's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, July -October 2023

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Central Hungary	176	-5	20.7	2.3	1054	2	677	9
Puszta	192	-3	21.0	2.2	1064	3	705	7
North Hungary	157	-22	20.0	2.5	1012	1	624	-1
Transdanubia	251	22	19.6	1.7	1053	1	750	14

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

Region	Cropped arable land fraction		Cropping Intensity		Maximum VCI
	Current (%)	Departure (%)	Current (%)	Departure (%)	Current (%)
Central Hungary	99	0	147	19	0.79
Puszta	99	0	136	5	0.76
North Hungary	100	0	154	13	0.82
Transdanubia	100	0	152	14	0.87

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

[IDN] Indonesia

During the monitoring period, the dry season maize and secondary rice were planted in July and August, and their harvest began in October.

CropWatch agroclimatic indicators show that temperature and radiation (TEMP +0.4°C, RADPAR +3%) were higher than the 15YA, but rainfall was below average (RAIN -19%), which led to average biomass production (BIOMSS -8%).

According to the national NDVI development graph, crop conditions were slightly below the 5YA during the monitoring period. NDVI clusters and profiles showed that crop conditions across most of **Indonesia** were close to average at the end of the monitoring period. The exception was 21.2% of cropland, which is located in central and southern **Sumatra** as well as northern **Java**. This region experienced below-average crop conditions due to a severe rainfall deficit caused by the El Niño weather phenomenon.

The area of cropped arable land (CALF 99%) in **Indonesia** was below the 5YA and the VCIx value was 0.93. The Cropping Intensity (CI) for this region is 145, which is 6 points higher than the value from the 5YA. This country's Crop Production Index (CPI) was 0.98, indicating close to average conditions. In summary, the crop production situation is estimated as below the average.

Regional analysis

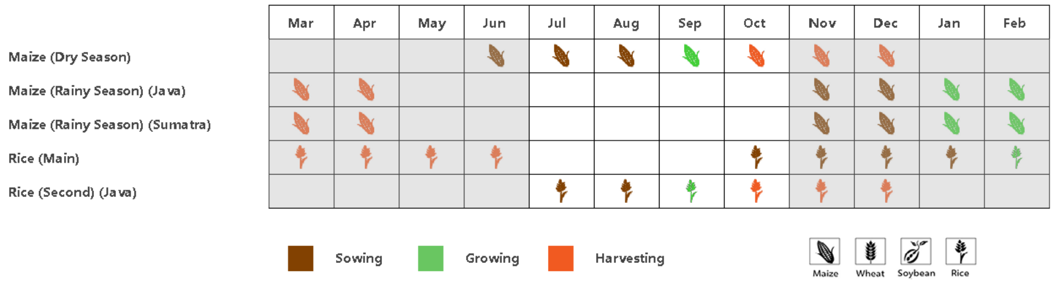
The analysis below focuses on four agro-ecological zones, namely **Sumatra** (92), **Java** (90, the main agricultural region in the country), **Kalimantan** and **Sulawesi** (91), and **West Papua** (93), among which the first three are relevant for crop production. The numbers correspond to the labels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

In **Java**, radiation and temperature were above average (RADPAR +2%, TEMP +0.2℃), but precipitation was below the 15YA (RAIN -71%), while the potential biomass production was below average (BIOMSS -27%). As shown in the NDVI development graph, crop conditions were close to the 5YA in July, and below the 5YA in other months. The Cropping Intensity (CI) for this region was 143, which was 10 points higher than the value from the 5YA. However, The Crop Production Index (CPI) in **Java** was 0.96, and crop production can be assessed as below average. The strong rainfall deficit and steady decline of the NDVI development curve below the long term average indicate below average crop conditions.

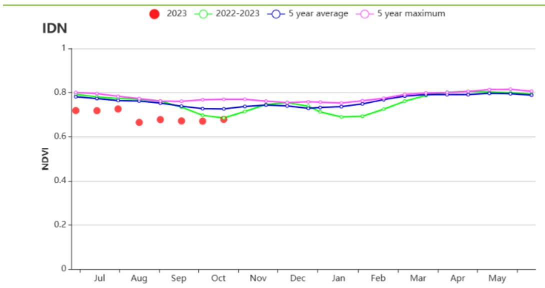
Temperature and radiation were above the 15YA (TEMP +0.6℃, RADPAR +5%) in **Kalimantan** and **Sulawesi**, but precipitation was below the average (RAIN -26%), which led to a reduction of the potential biomass production (BIOMSS -8%). The NDVI development graphs showed that crop conditions were below the 5YA during the entire monitoring period. In **Kalimantan** and **Sulawesi**, the Cropping Intensity (CI) was 150, which had increased by 11 points compared to 5YA. The Crop Production Index (CPI) of 0.98 indicates below-average conditions in this region. The rainfall deficit and NDVI development curve indicate below average conditions.

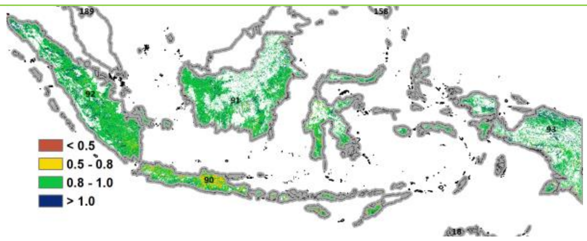
According to the agroclimatic conditions of **Sumatra**, radiation and temperature were above the average (TEMP +0.5℃, PADPAR +2%), but precipitation was below the 15YA (RAIN -4%), which led to average biomass production (BIOMSS -3%). According to the NDVI development graph, crop conditions were significantly below the 5YA in August and October. The Cropping Intensity (CI) for this region is 140, which is 3 points higher than the value from the 5YA. The Crop Production Index (CPI) in **Sumatra** was 0.98, which indicated close to average conditions. All in all, conditions can be assessed as close to, but below average.

Figure 3.20 Indonesia's crop condition, July - October 2023



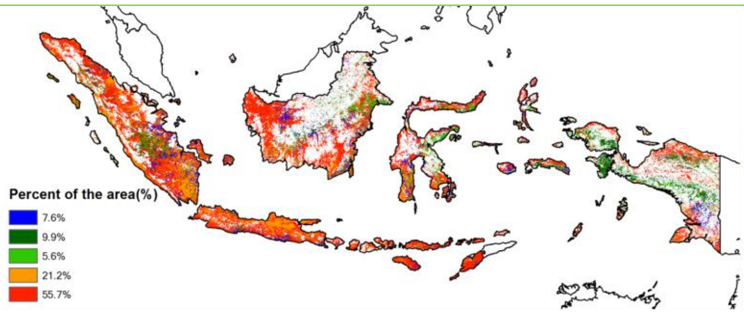
(a)Phenology of major crops

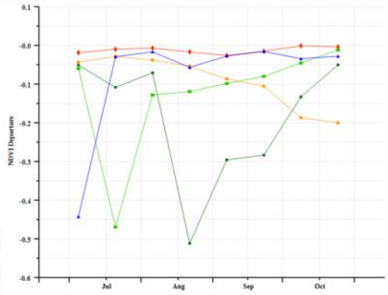




(b)Crop condition development graph based on NDVI

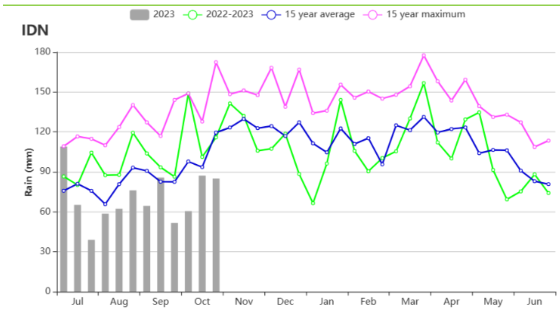
(c)Maximum VCI

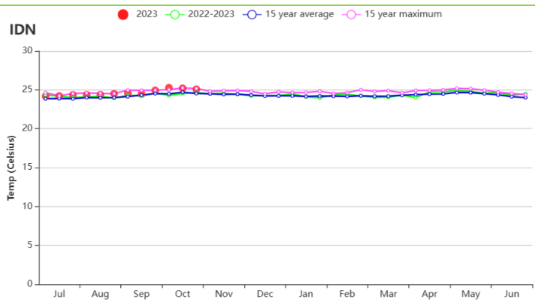




(d)Spatial NDVI patterns compared to 5YA

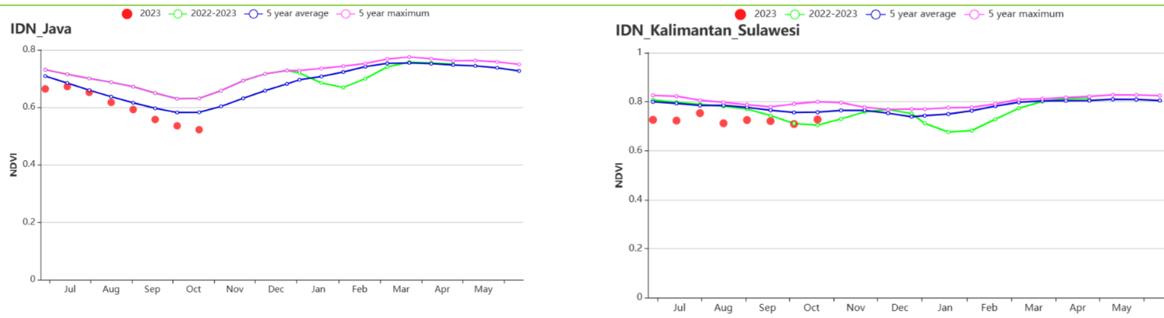
(e)NDVI profiles



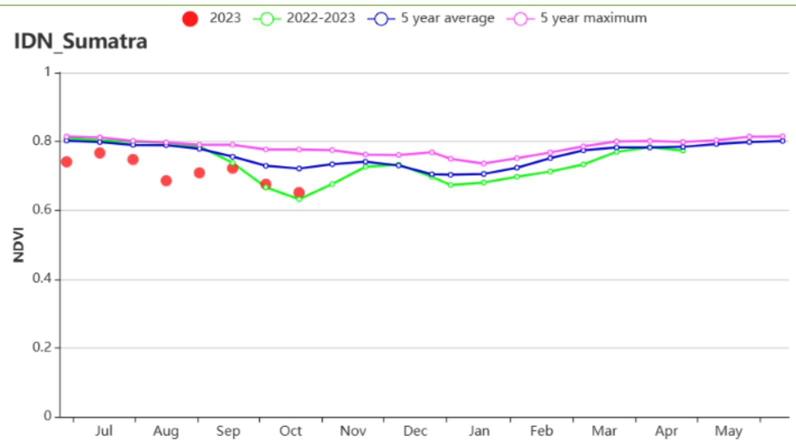


(f)Rainfall profiles

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

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Java	104	-71	25.0	0.2	1318	2	611	-27
Kalimantan and Sulawesi	737	-26	25.1	0.6	1263	5	1236	-8
Sumatra	911	-4	25.0	0.5	1222	2	1325	-3
West Papua	1327	-14	23.2	0.3	992	1	1227	-6

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

Region	Cropped arable land fraction		Cropping Intensity		Maximum VCI
	Current (%)	Departure (%)	Current (%)	Departure (%)	Current
Java	98	0	0.85	10	0.85
Kalimantan and Sulawesi	100	0	0.94	11	0.94
Sumatra	100	0	0.94	3	0.94
West Papua	100	0	0.95	1	0.95

[IND] India

This report covers the monsoon season in India. The main crops grown were Kharif rice (planted from May to August, being harvested from September to October), maize (sown from May to July, harvested from August to October), and soybeans (sown from June to July, harvested from September to October). Winter wheat sowing started in late October. Nationwide, the NDVI development curve trended below average throughout this monitoring period.

The agricultural meteorological indicators of India show that, compared to the average level of the same period in the past 15 years, the average temperature and photosynthetically active radiation (PAR) were avove average, with an increase of 0.4°C and 5%, respectively. The accumulated precipitation over the past four months was slightly lower than the average. Precipitation fluctuations caused alternating droughts and floods, with precipitation anomalies of 12.2% and 18.1% in July and September, but -22.7% and -18.6% in August and October, respectively. The combined effects of changes in temperature, solar radiation and rainfall caused a potential increase by 3% in biomass. The overall maximum vegetation condition index (VCIx) in India was relatively low at 0.87. From the spatial distribution of VCIx, it can be seen that the values were below 0.80 in the northwest and southern regions. From the spatial clustering NDVI anomaly map, it can be seen that during the entire monitoring period, for 50.1% of the northwest and eastern coastal areas, crop growth was close to or above the average level, for 25.1% of the central region, the crop growth was below the average level from early July to the end of August, and for 24.8% of the southern region, crop growth was below the average level in July. Compared with the average level of the same period in the past 5 years, the proportion of cultivated land was at a normal level. The crop production index was 0.93, indicating a slight reduction in crop production during the current season. This was mainly due to the precipitaiton deficit in August. All in all, crop conditions in India can be assessed as slightly below average, due to irregular precipitation patterns, causing floods and drought conditions.

Regional analysis

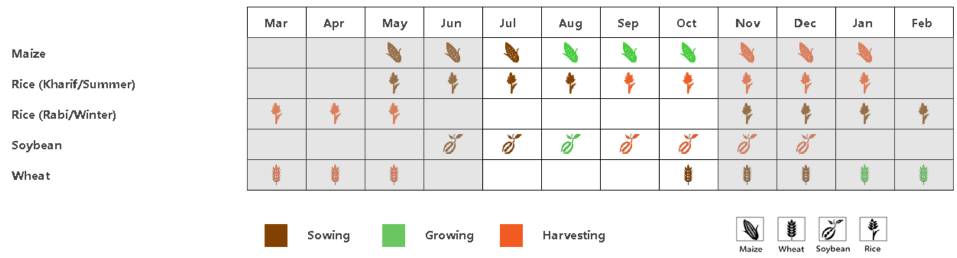
According to crop cultivation system, climate zone, and terrain conditions, India is divided into 8 agricultural ecological zones, namely the Deccan Plateau region (94), the eastern coastal region (95), the Ganges Plain region (96), the Assam and Northeast regions (97), the Rajasthan and Gujarat agricultural regions (98), the western coastal region (99), the northwest arid region (100), and the western Himalaya region (101).

The agricultural meteorological indicators in the eastern coastal region, central region, and Ganges Plain are similar. Compared to the average level of the same period in the past 15 years, the overall precipitation was above average. The average temperature and PAR were slightly higher than the average level, resulting in potential biomass exceeding the average value. Compared with the average level of the same period in the past five years, the proportion of cultivated land in the three regions was close to the average or slightly lower level. The cropping intensity index was close to the average or slightly lower, and the utilization rate of arable land was at a normal level. The crop growth NDVI profile shows that during most of the monitoring period, due to irregular precipitation, the crop growth was lower than the average level of the past five years. The NDVI decline at the end of July in the eastern coastal area is related to the flood disaster in late July with a precipitation anomaly of 72.8%, and the NDVI decline in the central region from late July to early August is related to flood disaster in July with monthly precipitation anomaly of 16.2%, The NDVI decline in the Ganges Plain in early July and early August is related to flood disasters with precipitation anomalies of 44% and 21.5% in early July and early August, respectively. The crop production index in the three regions ranges from 0.87 to 0.9, indicating that the crop growth condition was below the average level.

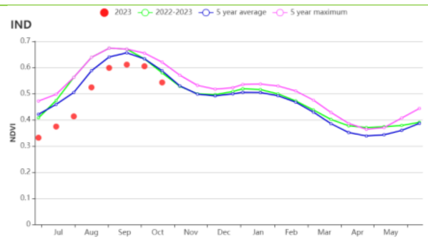
The agricultural meteorological indicators in the agricultural ecological regions of Rajasthan and Gujarat, and the northwest arid region are similar. Compared with the average level of the same period in the past 15 years, the cumulative precipitation and PAR were both higher than the average level, but the average air temperature was slightly lower than the average level, and the potential biomass was above average. Compared with the average of the same period in the past 5 years, the proportion of cultivated land and the cropping intensity index were both higher than the average, indicating that cultivated land had a high utilization rate. The agricultural areas of Rajasthan and Gujarat had precipitation anomalies of 41.7% and 55.7% in July and September, respectively. The precipitation anomalies were -59.3% in August. Due to floods and droughts, the NDVI profile shows that crop growth was generally below average in the agricultural areas of Rajasthan and Gujarat. In the northwest arid region, the precipitation was relatively scarce in July, with an 15-year average annual precipitation of 153.3 mm. The initial abundant precipitation during the monitoring period actually increased the utilization rate of farmland and promoted crop growth. However, with the succession of drought and flood from August to September, there was an earlier NDVI decline compared with the average profile. The crop production index in both regions was not higher than 0.84, indicating that the crop growth was below the average level.

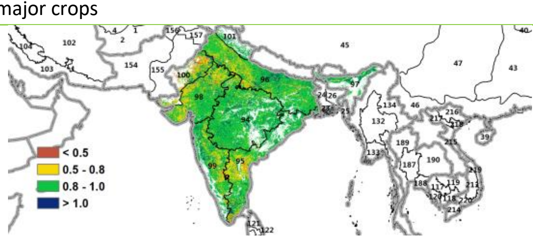
The agricultural meteorological indicators in the western coastal areas, the western Himalayan mountains, and northeastern India are similar. Compared with the average levels of the same period in the past 15 years, temperature and PAR were both above average, while cumulative precipitation was below average, and potential biomass was close to or lower than average. The proportion of cultivated land cultivation and the cropping intensity index are comparable to the average level of the same period in the past five years. Crop growth NDVI profile shows an NDVI decline at the end of July and September in the western coastal areas affected by floods, with precipitation anomaly of 72.8% in late July and a precipitation anomaly of 69% in late September. The NDVI in the western Himalayan Mountains was close to the average level, and the NDVI decline in early July and early August was related to 44.7% of the precipitation anomaly in early July and -33.7% of the precipitation anomaly from mid July to early August, respectively. The NDVI in northeastern India was close to the average level, and NDVI decline in August was related to an anomaly of 35.7% in early August precipitation. The crop production index of the three regions are 0.87, 0.93, and 0.93 respectively, indicating that the crop growth was below the average level.

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



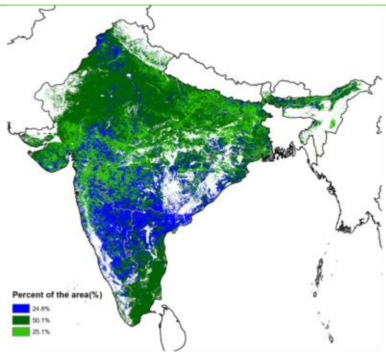
(a)Phenology of major crops





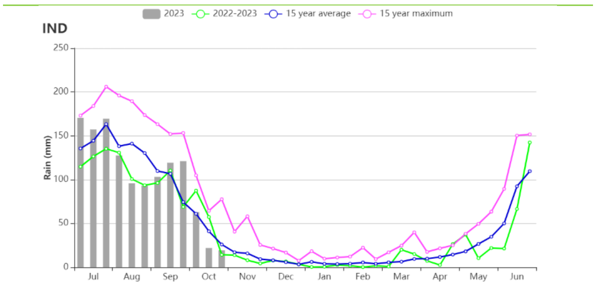
(b)Crop condition development graph based on NDVI

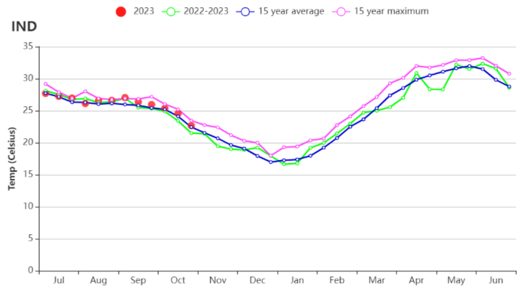
(c)Maximum VCI



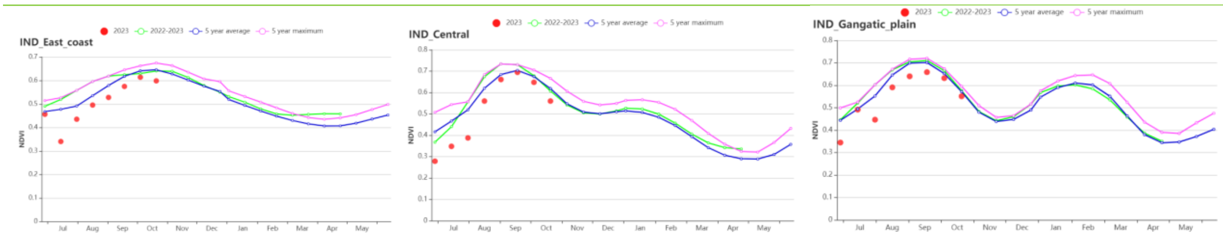
(d)Spatial NDVI patterns compared to 5YA

(e)NDVI profiles

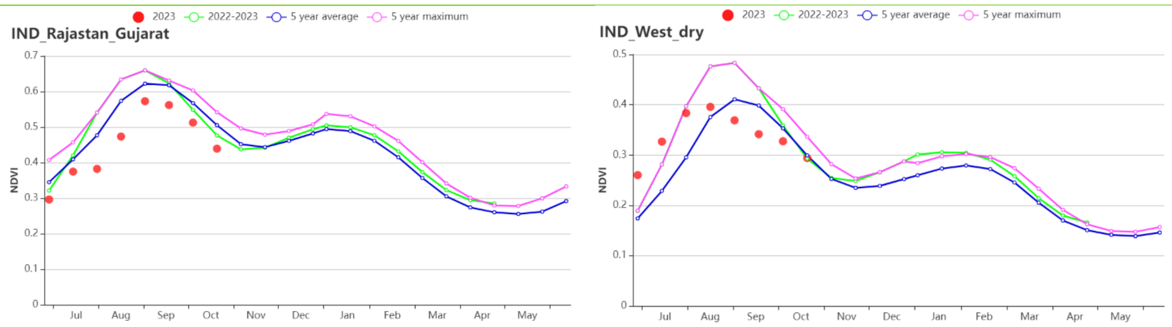




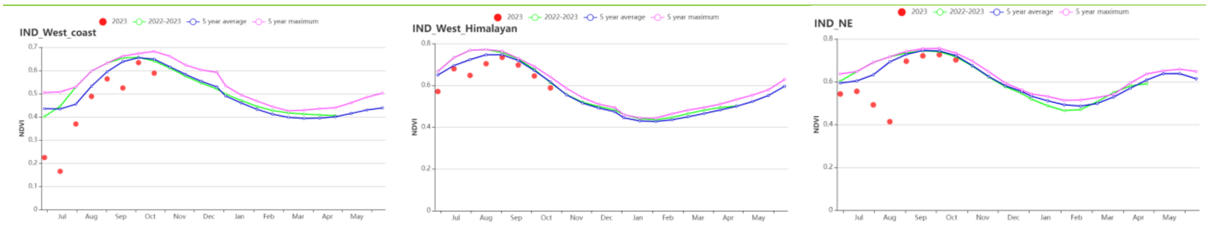
(f)Rainfall profiles (g)Temperature profiles



(h) crop growth NDVI profile (eastern coastal region, central region, and Ganges Plain)



(i) crop growth NDVI profile（Rajasthan and Gujarat and the northwest arid region)



(j) Crop growth NDVI profile（western coastal areas, the western Himalayan mountains, and northeastern India)

Table 3.31 India’s agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, July - October 2023

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Deccan Plateau	1140	3	25.7	0.3	1134	7	1369	3
Eastern coastal region	1121	9	27.1	0.6	1163	4	1369	3
Gangatic plain	1256	9	27.6	0.3	1194	5	1432	8
Assam and north-eastern regions	2164	-11	24.4	0.5	1005	8	1456	1
Agriculture areas in	1050	4	27.1	-0.2	1093	2	1207	3

Rajastan and Gujarat								
Western coastal region	1268	-9	24.5	0.5	998	2	1181	-7
North-western dry region	594	37	30.0	-0.6	1186	-2	977	15
Western Himalayan region	605	-34	19.9	1.2	1266	5	832	-6

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

Region	Cropped arable land fraction		Cropping Intensity		Maximum VCI
	Current (%)	Departure (%)	Current (%)	Departure (%)	Current
Deccan Plateau	99	0	154	6	0.90
Eastern coastal region	92	-2	140	-3	0.85
Gangatic plain	98	0	178	6	0.87
Assam and north-eastern regions	96	0	149	0	0.93
Agriculture areas in Rajastan and Gujarat	95	0	151	5	0.84
Western coastal region	96	-1	133	-6	0.87
North-western dry region	52	8	126	8	0.78
Western Himalayan region	99	0	143	2	0.93

[IRN] Iran

By the end of August, the harvest of irrigated potatoes and rice, which are summer crops, was reaching its completion. The sowing of winter crops like wheat and barley commenced in September. According to the NDVI-based crop condition development graph, the crop conditions in Iran during this whole monitoring period were slightly below the 5-year average. The accumulative rainfall was down by 27%. The photosynthetically active radiation was 2% below average, whereas the average temperature was 0.7℃ above average. The potential biomass was 4% smaller than the 15-year average. The national maximum vegetation condition index (VCIx) was 0.59, while the cropped arable land fraction (CALF) was 3% above the average of the past 5 years. The national average Crop Production Index (CPI) was 0.84, indicating an unfavorable crop production status.

The NDVI spatial patterns show that from July to October, 2.1% (marked in blue) of the cropped area had slightly above-average crop conditions throughout the whole monitoring period. 85.3% (marked in dark green and light green) of the cropped area experienced around-average crop conditions. 3.6% of the cropped area (marked in red) had near-average crop conditions at first, and then rose to slightly-above average from late September. 9% of the cropped area (marked in orange) experienced slightly below-average crop conditions during the whole monitoring period, mainly distributed in some parts of Mazandaran, Golestan, and Sistan and Baluchestan. The spatial pattern of maximum Vegetation Condition Index (VCIx) was in accord with the spatial distribution of the NDVI profiles. Crop production during this period depended on irrigation, which resulted in fair conditions.

However, the prolonged drought will also have a negative impact on the sowing and establishment of rainfed winter wheat, which is mainly grown in the north-west of the country and Fars province.

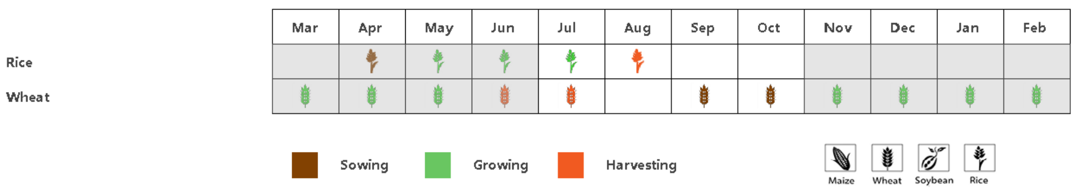
Regional Analysis

Based on farming system, climate, and topographic conditions, Iran can be subdivided into three regions, two of which are the main areas for crop production, namely the **semi-arid to the subtropical hilly region in the west and the north (104)** and the **coastal lowland in the arid red sea plain area (103)**.

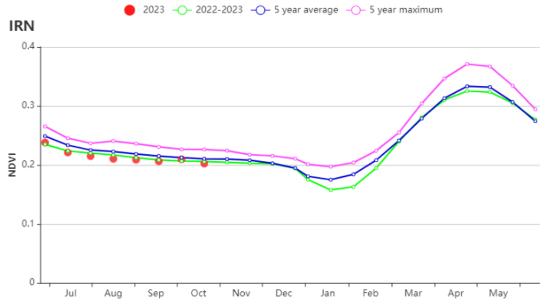
In the **semi-arid to the subtropical hilly region in the west and the north**, the cumulative precipitation during the monitoring period was 51 mm, 25% below average. Temperature was 0.5℃ above average and photosynthetically active radiation was slightly below the 15YA (-1%). The potential biomass was 5% lower than average. Crop conditions were slightly below the 5-year average. The proportion of cultivated land was 13%, which was 3% larger than the 5YA. Cropping intensity (CI) was at average. The average VCIx for this region was 0.65, indicating fair crop prospects.

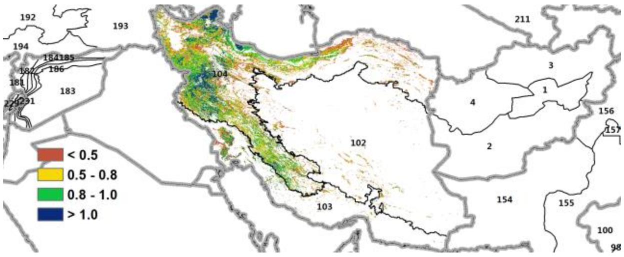
In the **coastal lowland in the arid red sea plain area**, the temperature was 1.2℃ above average. The accumulated precipitation was only 6 mm, 63% below average. The photosynthetically active radiation was 2% below average. The potential biomass was 6% smaller than the 15-year average. During the monitoring period, CALF was 12% above the 5YA, while CI was 2% below the 5YA. Although the NDVI-based crop condition graph expressed slightly better-than-average crop conditions, the value of VCIx was only 0.45. The crop prospects were fair.

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

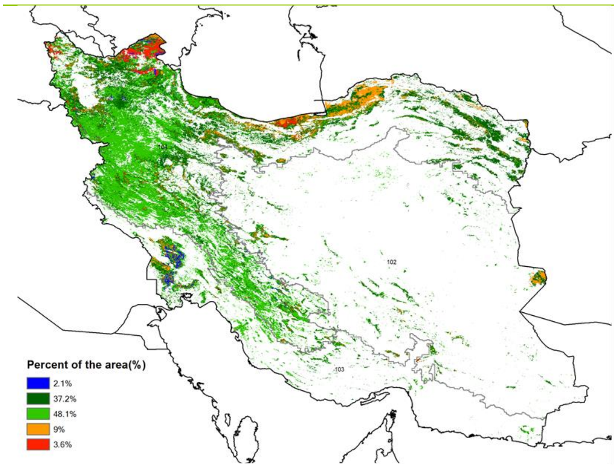


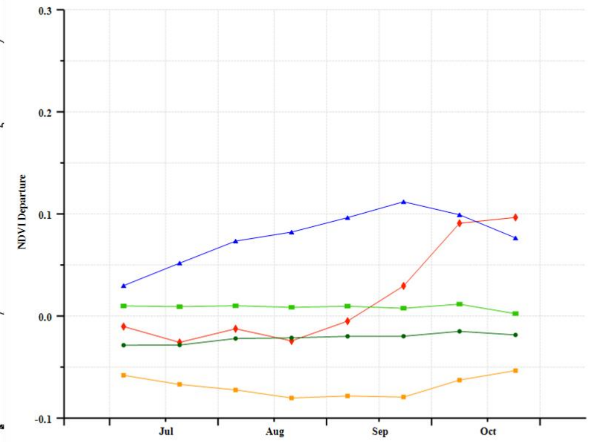
(a) Phenology of major crops



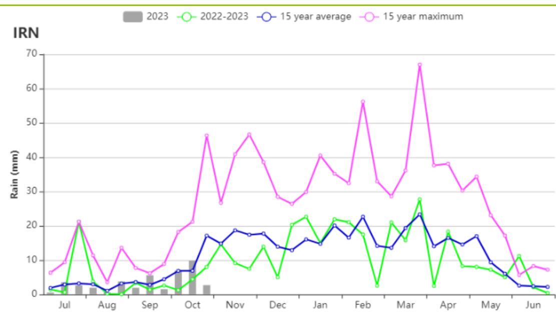


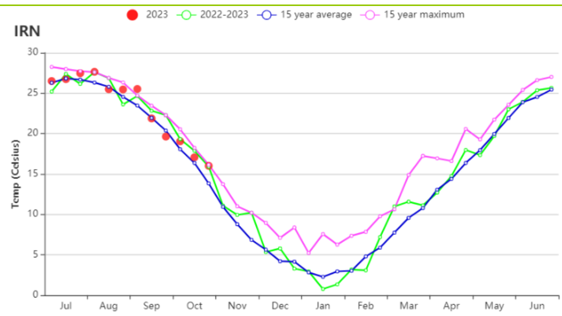
(b) Crop condition development graph based on NDVI (c) Maximum VCI



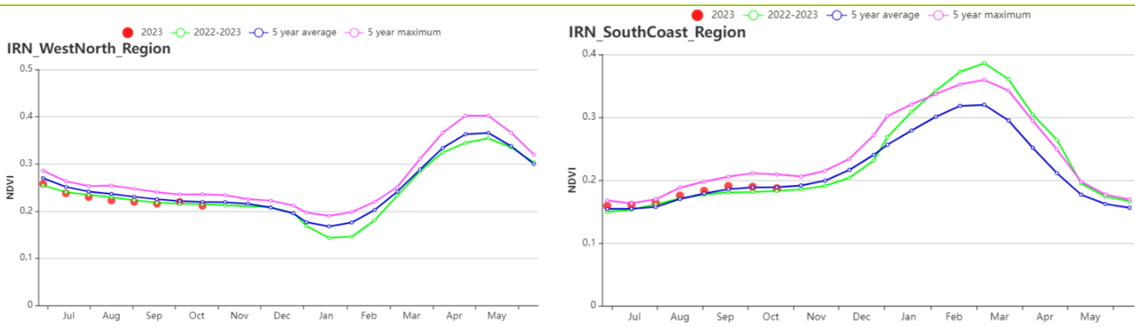


(d) Spatial NDVI patterns compared to 5YA (e) NDVI profiles





(f) Rainfall profiles (g) Temperature profiles



(h) Crop condition development graph based on NDVI (semi-arid to the subtropical hilly region in the west and the north (left) and coastal lowland in the arid red sea plain area (right))

Table 3.33 Iran's agroclimatic indicators by sub-national regions, current season's values, and departure from 15YA, July - October 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	6	-63	34.2	1.2	1436	-2	422	-6
Semi-arid to sub-tropical western and northern hills	51	-25	21.4	0.5	1387	-1	447	-5

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

Region	Cropped arable land fraction		Cropping intensity		Maximum VCI
	Current (%)	Departure (%)	Current (%)	Departure (%)	Current
Arid Red Sea coastal low hills and plains	9	12	110	-2	0.45
Semi-arid to sub-tropical western and northern hills	13	3	108	0	0.65

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, the winter wheat harvest concluded in July, and the new crop was sown in October. At the national level, rainfall was 2% below the 15-year average, while radiation and temperature were slightly higher. Biomass and CALF were slightly below average. The national VCIx was 0.77. The crop condition development graph indicates that NDVI was above average in July and then gradually declined to average and below average levels by mid-September. In summary, overall crop conditions were significantly below average in September and October. However, the peak period for sowing of the winter crops is in November.

Analyzing NDVI clusters and corresponding departure profiles, approximately 13.9% of cropland (highlighted in red), primarily located in northern Italy (Piemonte and Lombardia), exhibited a positive departure from the 5-year average from September to October. About 11.0% of arable land experienced below-average crop conditions (highlighted in blue). Around 75.1% of arable land (highlighted in orange, light green, and dark green), mainly in Lombardia, Lazio, Catania, and Sardegna, encountered below-average conditions in July and August but reached above-average conditions between September and October.

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).

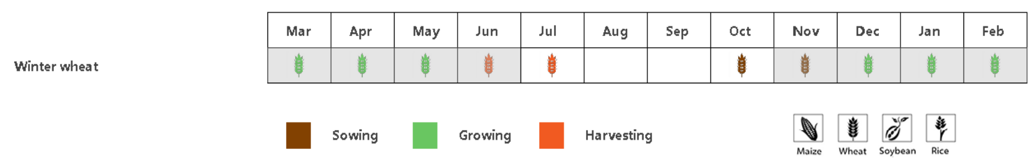
The **East Coast**, primarily in Puglia, Marche, and Abruzzi, experienced below-average rainfall (RAIN -44%). Biomass decreased by 15%, and CALF decreased by 1% to reach 62%. The NDVI curve was below average in September and October. This situation suggests that the region was impacted by reduced rainfall during September and October, potentially causing delays in wheat planting.

Po Valley covering Piemonte, Lombardia, and Veneto, was affected by slightly higher rainfall (RAIN +18%) and temperature (TEMP +2%). Biomass was 12% above the 15-year average, VCIx was 0.80, and the crop condition was near average.

Islands recorded below-average precipitation (RAIN -72%). Biomass decreased by 22%, VCIx was 0.51 (the lowest among the four AEZs), and the Cropping Intensity was the lowest. The NDVI curve was significantly below average in September and October due to the rainfall deficit.

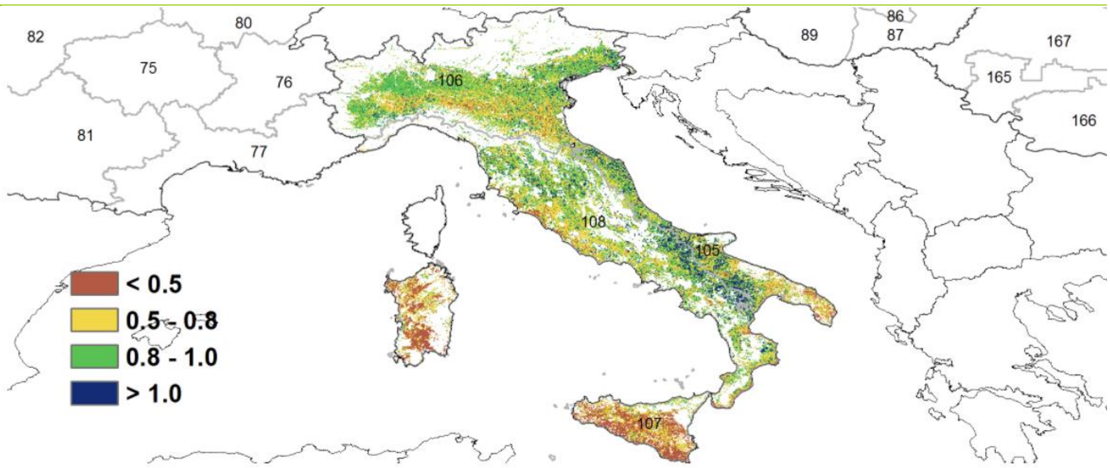
Western Italy experienced below-average rainfall (ΔRAIN -21%). Biomass decreased by 7%, and VCIx was 0.82. The NDVI curve was remained below average in September and October despite two decades with above average rainfall in September and October.

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

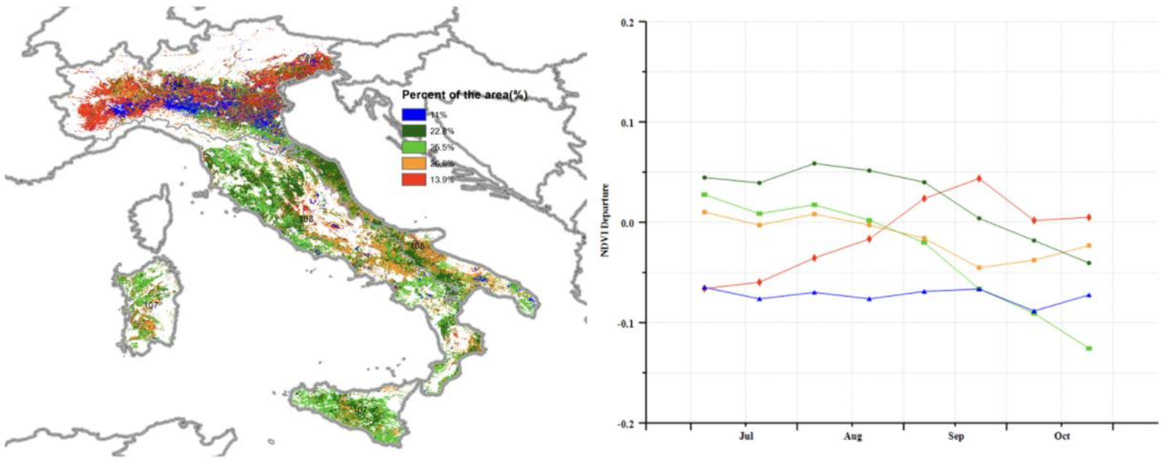


(a) Phenology of major crops

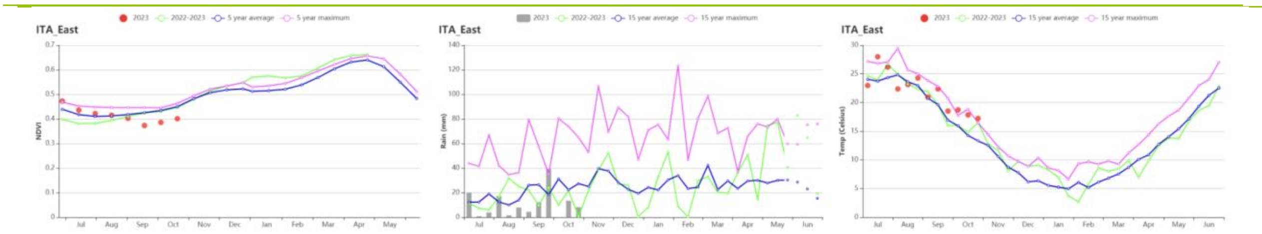
(b) Crop condition development graph based on NDVI, RAIN and TEMP (Italy).



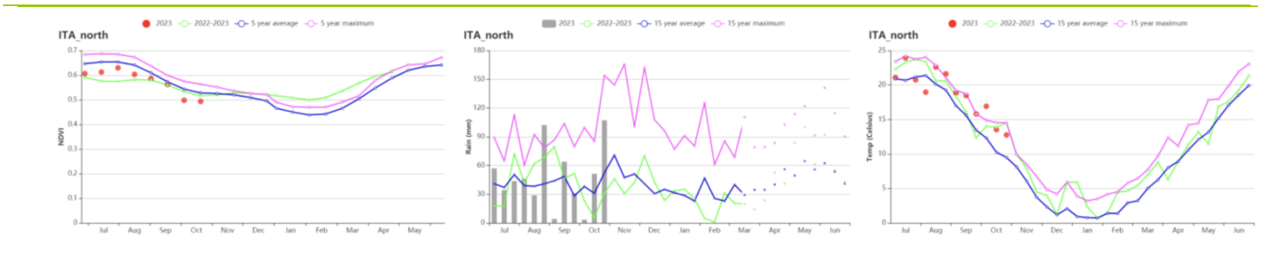
(c) Maximum VCI



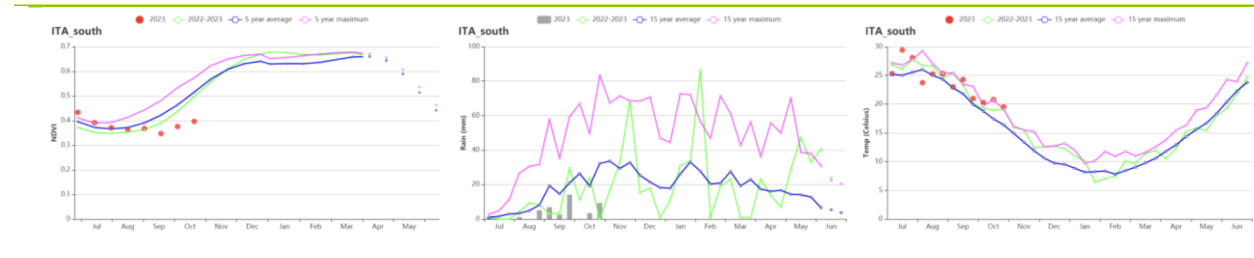
(d)Spatial distribution of NDVI profiles.



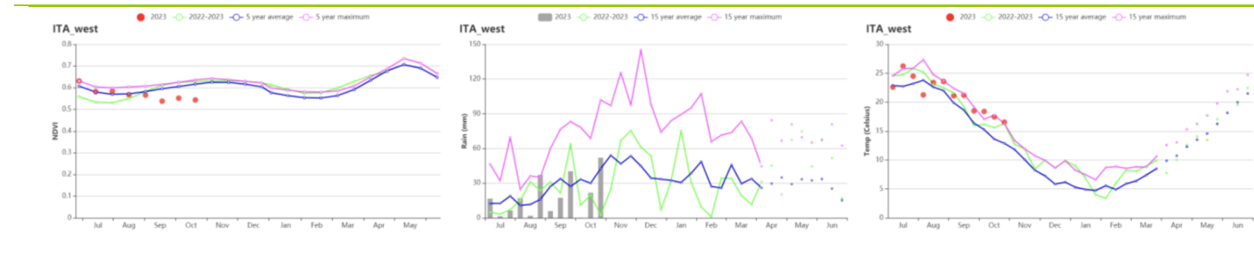
(e) Crop condition development graph based on NDVI, RAIN and TEMP (East Italy).



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

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m^2)	Departure (%)	Current (gDM/m^2)	Departure (%)
East Coast	129	-44	21.9	1.5	1222	4	628	-15
Po Valley	577	18	18.8	2.0	1064	-2	973	12
Islands	44	-72	23.8	1.5	1308	2	519	-22
Western Italy	218	-21	21.2	1.7	1206	3	717	-7

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

Region	Cropped arable land fraction		Cropping Intensity		Maximum VCI
	Current (%)	Departure (%)	Current (%)	Departure (%)	Current
East Coast	62	-1	113	-1	0.82
Po Valley	99	0	129	10	0.80
Islands	52	-21	108	1	0.51
Western Italy	96	1	124	1	0.82

[KAZ] Kazakhstan

This report covers the growth and harvest of spring wheat, which was the main cultivated crop during this monitoring period in Kazakhstan. 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 below average from July to August, and return to above average from early September to October.

Compared to the 15-year average, accumulated rainfall and temperature were above average (RAIN +73%, TEMP +0.8°C), while the radiation was below average (RADPAR -4%). The dekadal precipitation was mostly above average from July to October, and exceeded the 15-year maximum in early and later August, September and late October. The dekadal temperature was far above average in July, early August and early October. The abundant rainfall and warmer temperatures resulted in a significant increase in the BIOMSS index by 32%.

The national average maximum VCI index was 0.76 and the Cropped Arable Land Fraction (CALF) was below average by 6%. The cropping intensity was slightly above average by 1%. The average national CPI was 0.97, indicating generally normal conditions. According to the national crop condition development graphs, about 70.8% of croplands experienced below average crop conditions from July to August, and then returned to above average from September. About 10.5% of croplands, which were distributed in some areas of the Kostanai and Akmola states in the central north region, Batysdy Kazakstan state in the northwest region, and Kyzylorda and Almaty states in central south region, experienced favorable crop conditions from July to October. About 18.7% of croplands scattered in central-north region experienced poor crop conditions from July to September.

According to the agro-climate and agronomic indicators of CropWatch, due to the adverse impacts of the rainfall deficit in May and June, which caused poor crop establishment and above average rainfall during the harvest season, the output of spring wheat is estimated to be below last year's levels.

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).

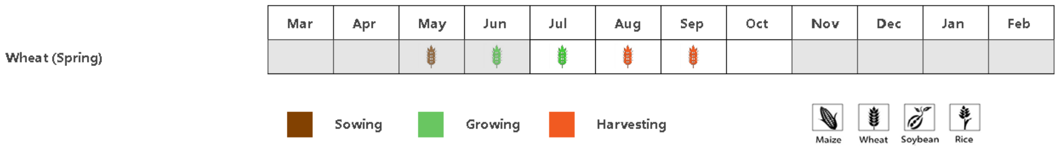
In the **Northern region**, the accumulated precipitation was far above average (RAIN +79%). The abundant rainfall and warm temperature (TEMP +1.0°C) resulted in a significant increase of the BIOMSS index by 39%. However, NDVI profiles show that crop conditions were below average during the growth season. It might be attributed to the negative impact of the rainfall deficit in May and June. The average VCIx for this region was 0.75, and the CALF was below average by 5%. The cropping intensity was slightly above average by 1%. The spring wheat production is estimated to be lower than the five-year average.

In the **Eastern plateau and southeastern region**, the accumulated precipitation and temperature were above average (RAIN +66%, TEMP +0.2°C). Although the higher rainfall led to an increase of potential biomass by 20%, the crop conditions for this region were below average during this reporting period. The average VCIx for this region was 0.78, and CALF was below average by 6%. Output for spring wheat is estimated to be below average.

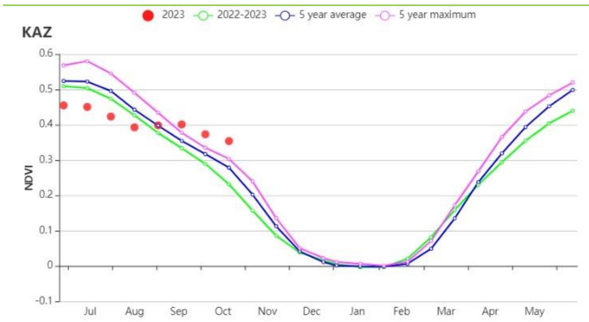
In the **South region,** the accumulated precipitation was above average by 67%, and the temperature was also above average (TEMP +1.2°C). The combination of agro-climatic indicators resulted in an increase of the BIOMSS index by 13%. The NDVI profiles show below-average conditions from July to October. The average

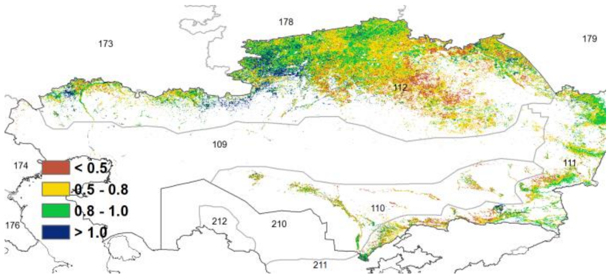
VCIx for this region was 0.64, and CALF was below average by 18%. The outputs of spring crops are estimated to be poor.

Figure 3.24 Kazakhstan's crop condition, July - October 2023



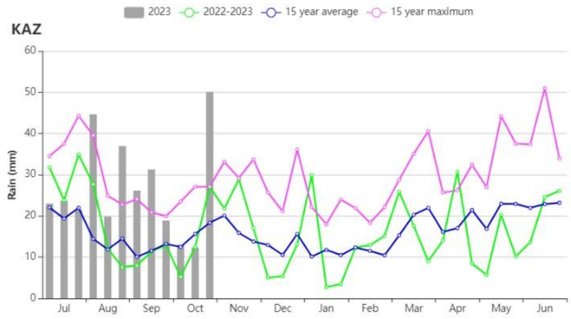
(a). Phenology of major crops

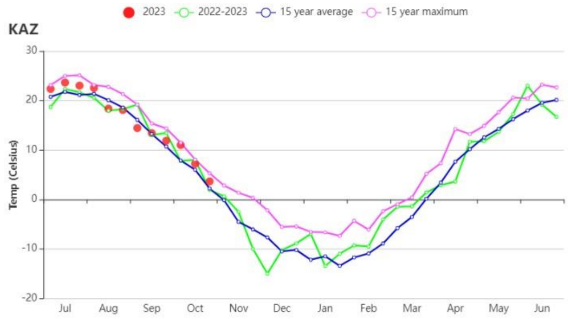




(b) Crop condition development graph based on NDVI

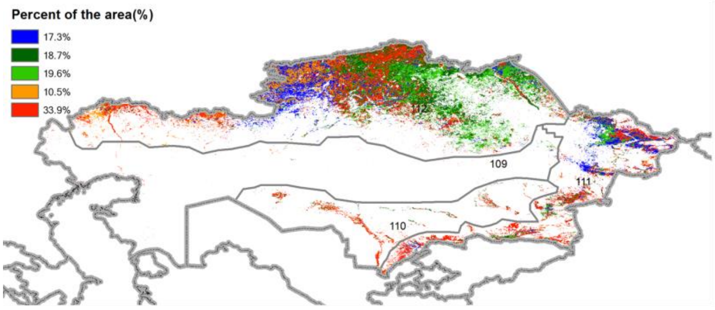
(c) Maximum VCI

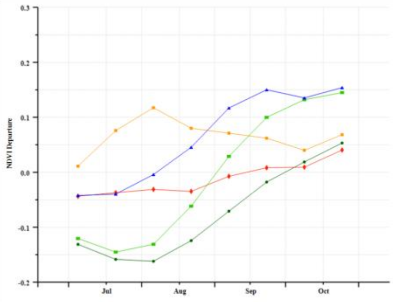




(d) Rainfall Index

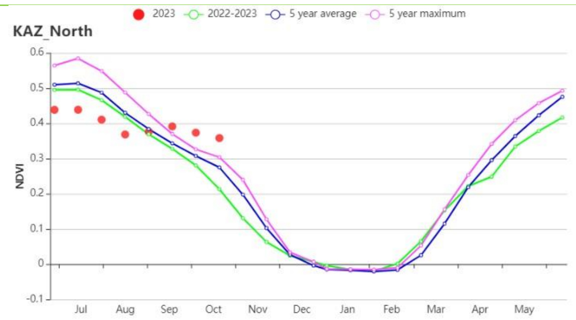
(e) Temperature Index

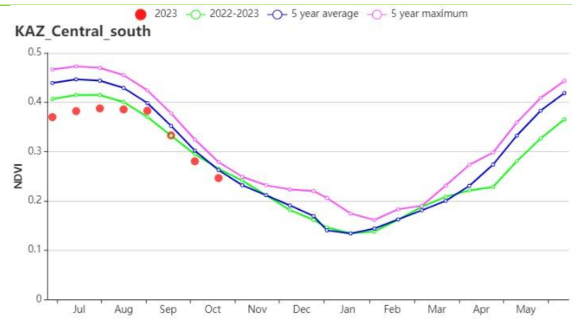




(f) Spatial NDVI patterns compared to 5YA

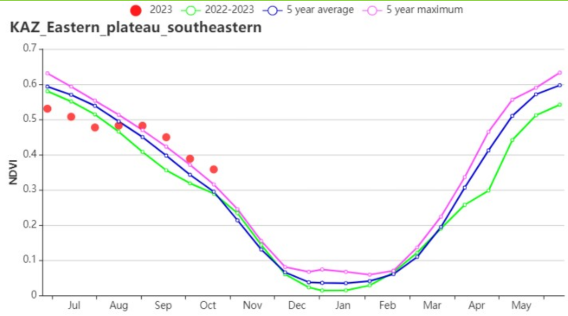
(g) NDVI profiles





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

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



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

Table 3.37 Kazakhstan agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, July - October 2023

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
South zone	96	67	22.8	1.2	1196	-5	540	13
Eastern plateau and southeastern zone	405	66	14.9	0.2	1106	-4	713	20
Northern zone	307	79	15.6	1.0	889	-5	761	39

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

Region	Cropped arable land fraction		Cropping Intensity		Maximum VCI
	Current (%)	Departure (%)	Current (%)	Departure (%)	Current
South zone	43	-18	101	0	0.64
Eastern plateau and southeastern zone	74	-6	102	1	0.78
Northern zone	68	-5	102	1	0.75

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 undergoes two distinct rainy seasons, with the long rains occurring from March to late May and the short rains from late October to December. Maize cultivation takes place during both the long and short rains, while wheat is only grown during the long rains. This report, covering the monitoring period from July to October 2023, focuses on the crucial wheat and long rain maize growing and harvesting stages.

On a national scale, Kenya has been grappling with severe drought conditions since 2020. In this monitoring period, precipitation measured 135 mm, a stark 59% below the average. The National rainfall profile indicates that precipitation levels were consistently below the 15YA, although the situation improved in October. At the sub-national level, rainfall was below average in all regions except for the Eastern coast. The Southwest region faced the most significant negative departure compared to the 15-year average (ΔRAIN -94%). The NDVI development graph at the national level indicates that throughout the monitoring period, NDVI values were slightly below the 5-year average.

According to NDVI clusters and corresponding departure profiles, the blue and orange regions exhibited slightly higher NDVI values than the average, indicating good crop growth, with relatively high VCIx values. In the central region, the red areas initially showed lower NDVI values in early August, but the corresponding VCIx values ranged from 0.8 to 1.0, indicating close to normal crop growth conditions. The light and dark green areas, covering 30.1% of the national cropland, are primarily located in the highland agricultural zone. NDVI values were below the average, indicating poor crop growth, consistent with regions showing relatively low VCIx values. Overall, the Eastern coastal and Southwest regions enjoyed favorable water supply conditions and optimal crop growth, while the other areas were affected to varying degrees by drought.

Regional Analysis

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

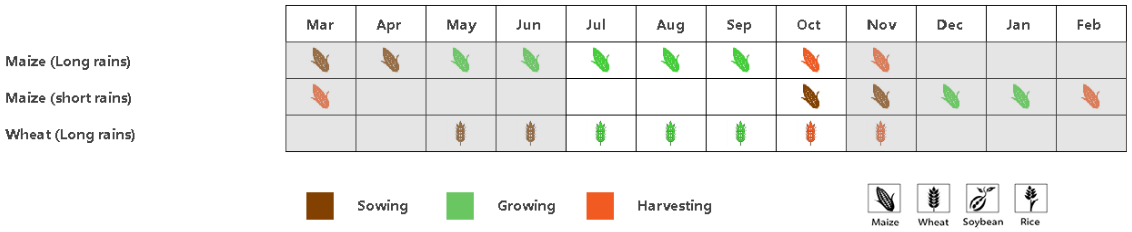
In the **Eastern Coastal Region**, rainfall was above average by 31%, with temperatures and RADPAR slightly higher than the average. BIOMSS was 22% higher than the 15Y. The maximum VCI was 0.89, and CALF increased by 8% to reach 96%. The NDVI curve closely followed the five-year average. Overall, crop conditions in the coastal area are favorable, with promising prospects for both livestock and crop production.

The **Highland Agriculture Zone** received 119 mm of rain, 66% below the 15YA. Low precipitation (ΔRAIN -22%) resulted in a notable biomass reduction. The maximum VCI recorded was 0.71, CALF was reduced to 73% (ΔCALF -9%). Cropping Intensity was 164%. NDVI was slightly below the 5YA, particularly in late July and September, indicating the negative impact of the rainfall deficit on the growth of crops like wheat and long-rain maize. Overall, drought conditions affected crop growth in the upland agricultural areas with below-average rainfall.

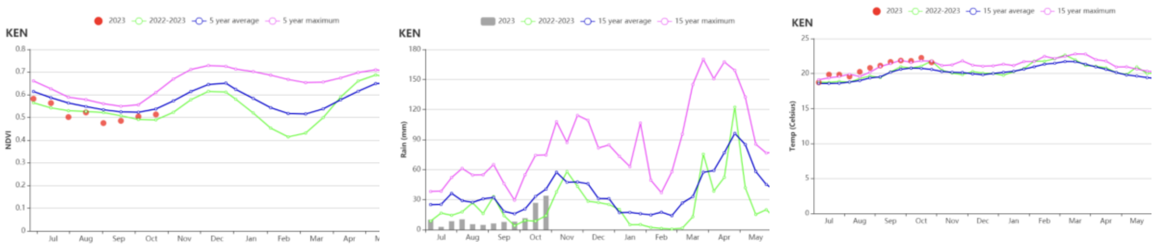
In the **Northern Rangelands Region** precipitation was significantly below average at 166 mm (RAIN -35%). BIOMSS was also below average (ΔBIOMSS -3%). The NDVI development graph showed values below average. CALF was reduced to 59% (ΔCALF -4%), Cropping Intensity was 142%. Overall, the situation of crop growth in this area was unfavorable.

The **Southwest Region** encompassing districts like Narok, Kajiado, Kisumu, Nakuru, and Embu experienced the largest negative departure in rainfall (ΔRAIN -94%). Indicator values observed include RADPAR (ΔPADPAR -7%), and BIOMSS (ΔBIOMSS -58%). The NDVI curve was slightly below the 5YA, especially from August to early September. Conditions were unfavorable.

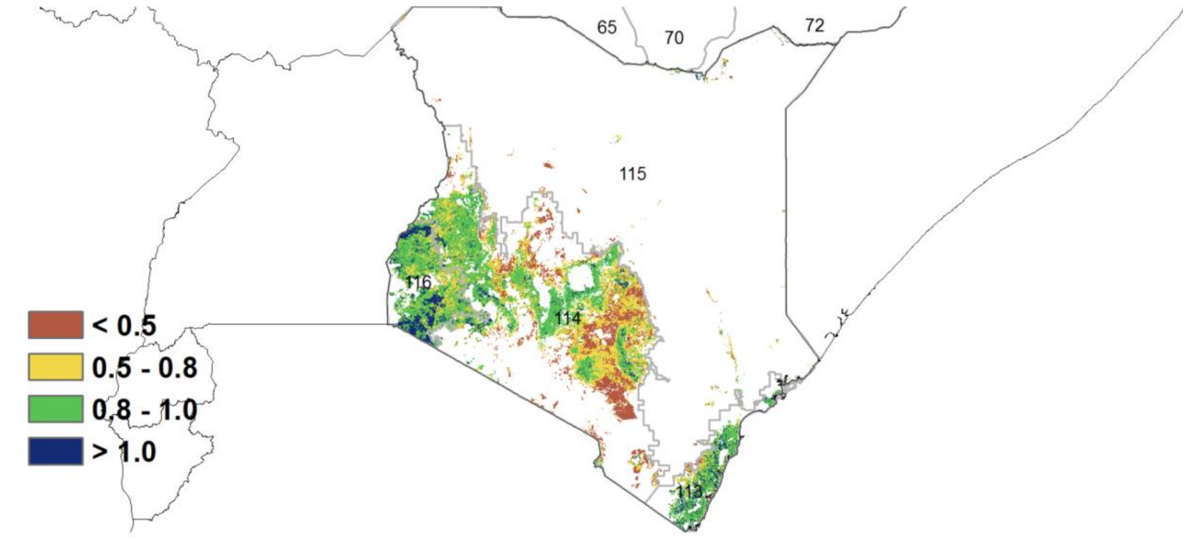
Figure 3.25 Kenya's crop condition, July-October 2023



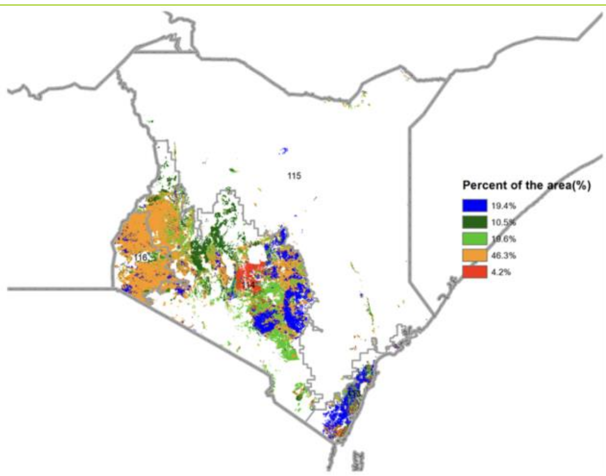
(a) Phenology of major crops

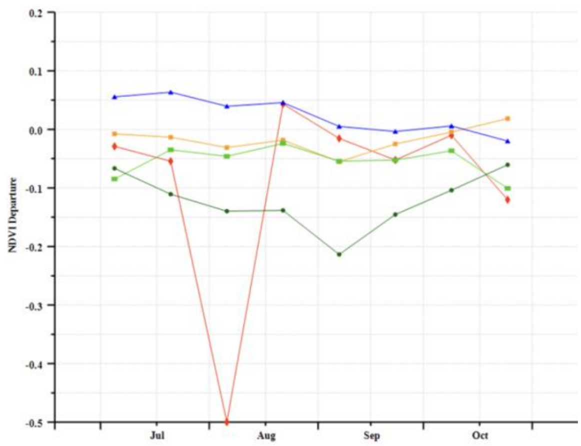


(b) Crop condition development graph based on NDVI, RAIN and TEMP (Kenya).

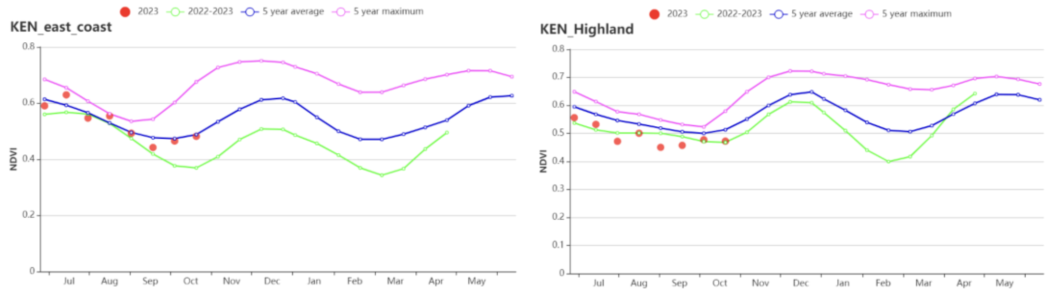


(c) Maximum VCI

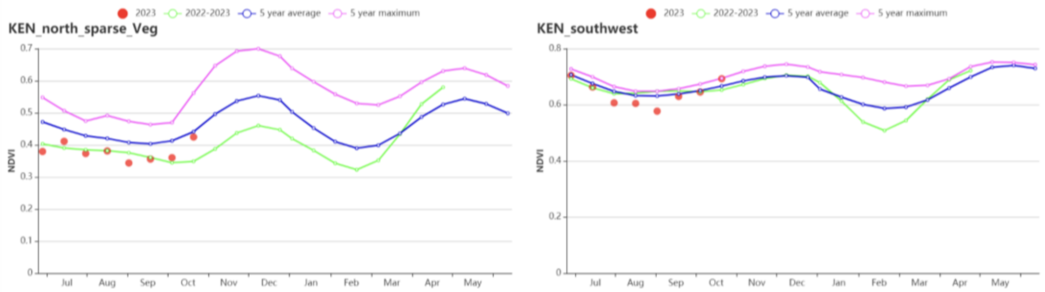




(d) Spatial NDVI patterns compared to 5YA (e) NDVI profiles



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



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

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

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m^2)	Departure (%)	Current (gDM/m^2)	Departure (%)
Coast	300	31	25.0	0.6	1269	3	1014	22
Highland agriculture zone	119	-66	19.5	1.2	1225	7	539	-22
northern rangelands	166	-35	23.8	1.1	1302	5	681	-6
South-west	33	-94	20.9	1.7	1148	-7	406	-58

Table 3.40 Kenya's agronomic indicators by sub-national regions, current season's values and departure, July - October 2023

Region	Cropped arable land fraction		Cropping Intensity		Maximum VCI
	Current (%)	Departure (%)	Current (%)	Departure (%)	Current
Coast	96	8	153	-1	0.89
Highland agriculture zone	73	-9	164	26	0.71
northern rangelands	59	-4	142	6	0.65
South-west	100	0	163	42	0.92

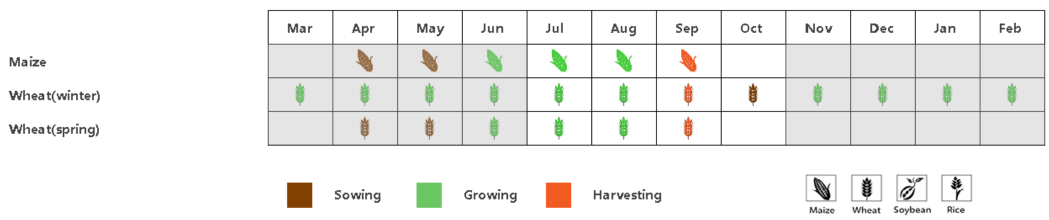
AFG AGO ARG AUS BGD BLR BRA CAN DEU DZA EGY ETH FRA GBR HUN IDN IND IRN ITA KAZ KEN **KGZ** KHM LBN LKA MAR MEX MMR MNG MOZ MUS NGA PAK PHL POL ROU RUS SYR THA TUR UKR USA UZB VNM ZAF ZMB

[KGZ] Kyrgyzstan

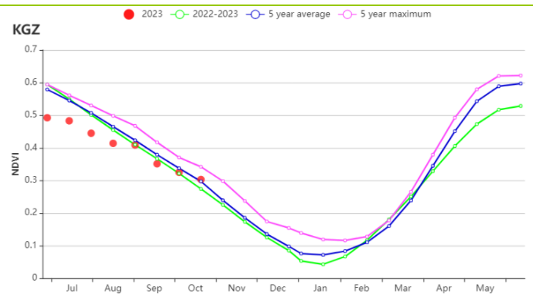
The reporting period covers the growth and harvest of wheat and maize. On the whole, crop conditions were below the 5-year average at first and then recovered to average or even slightly above average. The rainfall deficit, which had been observed during the previous monitoring period, caused low NDVI values in July and August. However, during this period, RAIN increased (+11%), TEMP was below average (-0.8 ℃), and RADPAR was slightly below average (-1%). The combination of these factors resulted in a slightly above-average BIOMSS (+2%) as compared to the 15YA. The time series precipitation profile shows that precipitation was higher than average in early and late July, early and late August, late September, and October. The temperature profile indicates that temperatures were only a bit higher than the 15-year average in middle and late July and late October.

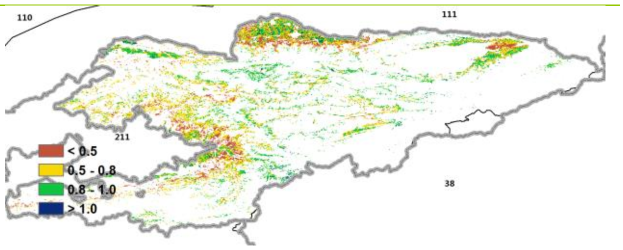
The spatial NDVI clustering profile shows that only 40.4% of the cultivated area (marked in orange and red) had average or above-average crop conditions. The remaining cultivated area (marked in blue, dark green and light green) had below to slightly below average crop conditions at the beginning of the monitoring period and then recovered to average or slightly above average, widely dispersed over the country. The spatial pattern of the maximum Vegetation Condition Index (VCIx) was in accord with the spatial distribution of the NDVI profiles. CALF decreased by 13%, and the nationwide VCIx average was 0.71. Cropping intensity was 101%. The national average Crop Production Index (CPI) was 0.80. Crop conditions in Kyrgyzstan can be assessed as fair.

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



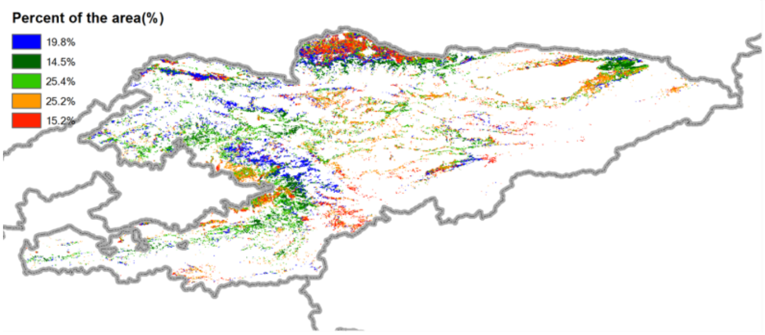
(a) Phenology of major crops

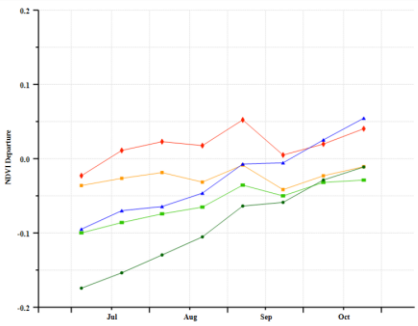




(b) Crop condition development graph based on NDVI

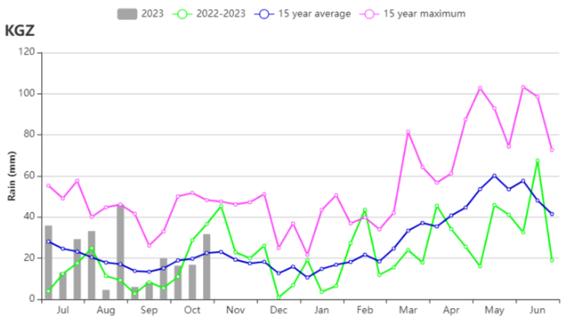
(c) Maximum VCI



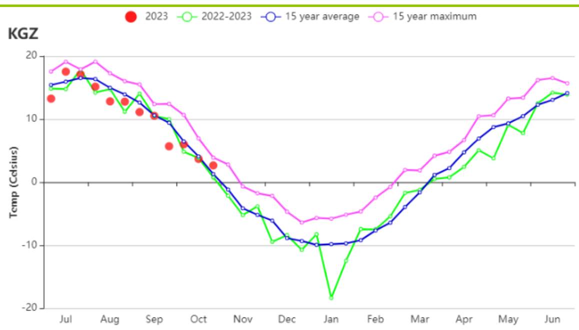


(d) Spatial NDVI patterns compared to 5YA

(e) NDVI profiles



(f) Rainfall profiles



(g) Temperature profiles

Table 3.41 Kyrgyzstan's agroclimatic indicators by sub-national regions, current season's values, and departure from 15YA, July - October 2023

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Kyrgyzstan	262	11	10.7	-0.8	1277	-1	531	2

Table 3.42 Kyrgyzstan's agronomic indicators by sub-national regions, current season's values, and departure from 5YA, July - October 2023

Region	Cropped arable land fraction		Cropping intensity		Maximum VCI
	Current (%)	Departure (%)	Current (%)	Departure (%)	Current
Kyrgyzstan	76	-13	101	-1	0.71

[KHM] Cambodia

During this inspection period, Cambodia experienced the rainy season (to the end of October). September marked the end of the early rice harvest (monitoring season). This period also covered the sowing and growth of medium and later rice. Maize sown in July is harvested through October. Throughout the monitoring period, soybeans keep growing and eventually start to mature. CropWatch indicators show that sufficient rainfall and sunshine in this period enhanced crop growth in Cambodia.

Cambodia experienced warmer and clearer weather during the monitoring. According to Cropwatch agricultural conditions, rainfall is close to average (RAIN), while temperatures and radiation are above average 0.6℃ (TEMP) and 8% (RADPAR). Potential biomass is 3% (BIOMASS) higher than the average. According to the NDVI development graph, crop conditions are close to average. The drop point of mid-August and September may be due to the clouds. According to the NDVI cluster map, in 34.8% of the total cultivated area, crop conditions were always above average during the inspection period, located in the Tonle Sap and Mekong River valleys, including Siem Reap, Kampong Chhnang, Kampong Cham, Kampong Speu, Prey Veng. In 31.3% of the total cultivated area, crop conditions were below average (red and orange areas) for most of the inspection period, located southeast of the Mekong Valley; In the northwest, in 20.3% of the area (blue zone), crop conditions were below average at the beginning of the monitoring period, but there was a slight recovery after September to average. For the rest, crop conditions fluctuated around average but worsened below average after September. All considered that the calf was slightly above average by 1% and the VICx was 0.94 crop hours, expecting the crop condition to be near average.

Regional analysis

The 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.

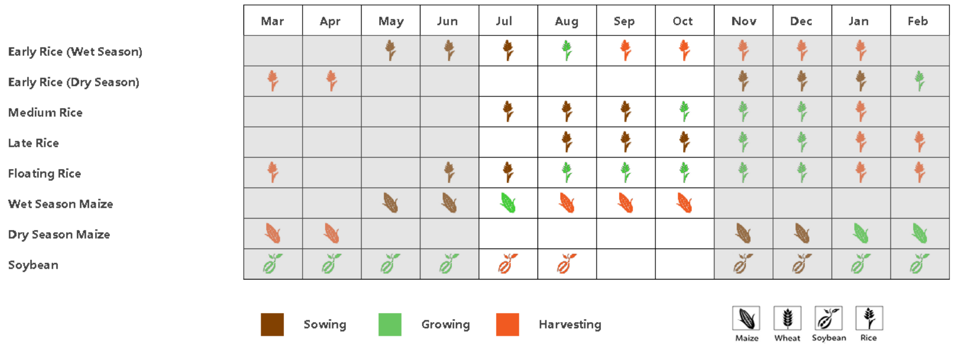
For the **Tonle Sap region** (agroecological zone 117), rainfall was sufficient (RAIN +3%) and temperatures were slightly warmer (TEMP +0.7°C), while radiation getting over than the normal (RADPAR +8%) levels, resulting in a 3% (BIOMASS) increasing in potential biomass. The NDVI was slightly below average except for September and mid-October when it was close to average. Therefore, crop growth in the Tonle Sap agroecological zone was slightly below but near average in the whole period of monitoring.

The **Mekong Valley region** (agro-ecological zone 118) is the most important agricultural production zone in Cambodia. Precipitation in this region was near average, accompanied by an increase in temperature of 0.7°C (TEMP), while there was decrease in radiation by about 8% (RADPAR), resulting in a 2% increase of BIOMASS,as the sufficient rainfall and a slightly increased temperature. Crop NDVI was also well below average before mid-August and gradually recovered to above average after August. The CALF index shows a fall of around 2% (CALF) levels, with the VCIx index reaching as high as 0.94, indicating an overall healthy crop growth status.

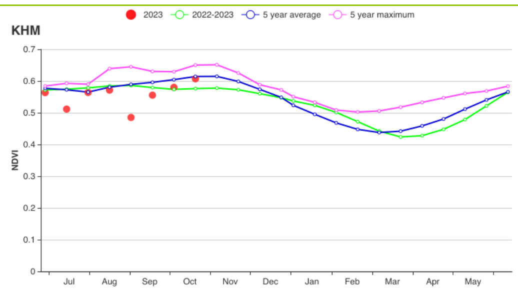
For the **Northern Plain and Northeastern region** (agro-ecological zone 119), there is a 5% (RAIN) deficit in precipitation, coupled with an increase in temperature of about 0.6°C (TEMP) and an increase in radiation of about 9% (RADPAR). The potential biomass in this region above normal (BIOMASS, +3). Similar to the Tonle Sab region, crop NDVI was well at normal and drop down inSeptember due to cloud cover. The CALF index shows near the average levels, with the VCIx index reaching as high as 0.93, indicating an overall healthy crop growth status.

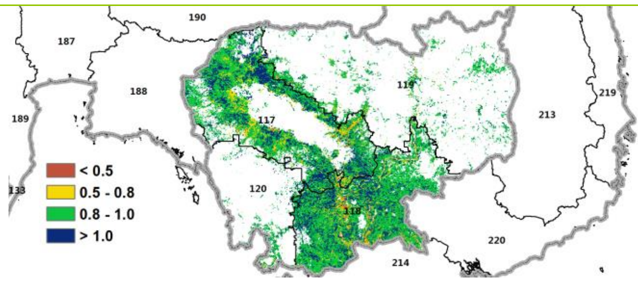
For the **Southwestern Hilly region** (agro-ecological region 120), rainfall is about 19% (RAIN) above average with a decreased temperature of about 0.4 ° C (TEMP). Separately, there was a slight decrease of radiation of about 6% (RADPAR). The estimated potential biomass was slightly below average (BIOMASS -1%). NDVI crops in the region have recovered slightly from below average to normal levels. Although there was a sharp drop in late July largely due to cloud cover satellite images. The proportion of arable land in the area remains normal (CALF), with the VCIx index reaching as high as 0.95, indicating an overall healthy crop growth situation.

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



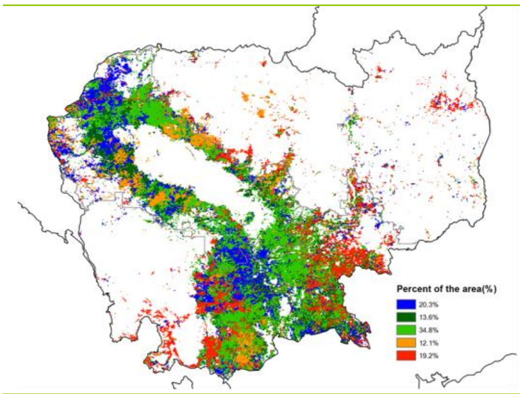
(a) Phenology of major crops

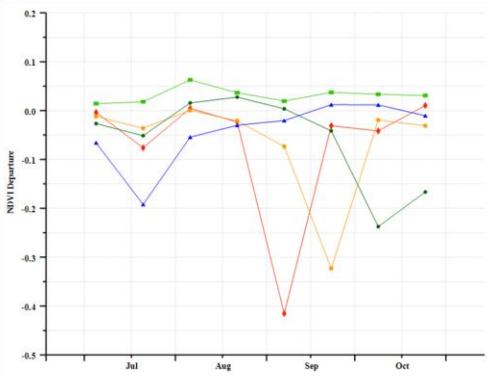




(b) Crop condition development graph based on NDVI

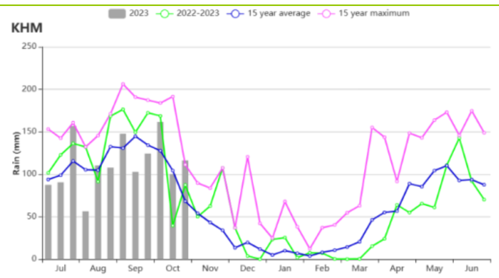
(c) Maximum VCI

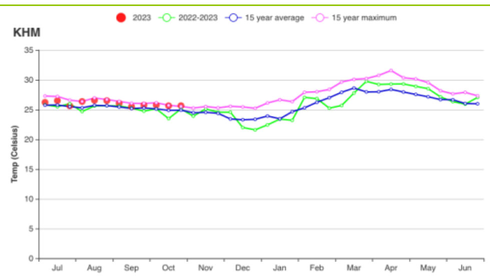




(d) Spatial NDVI patterns compared to 5YA

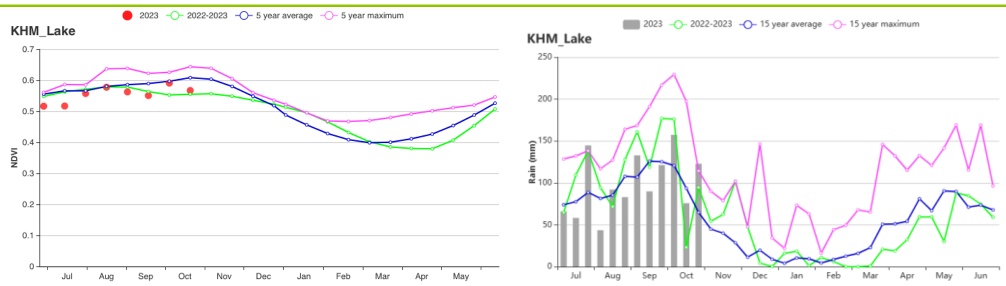
(e) NDVI profiles



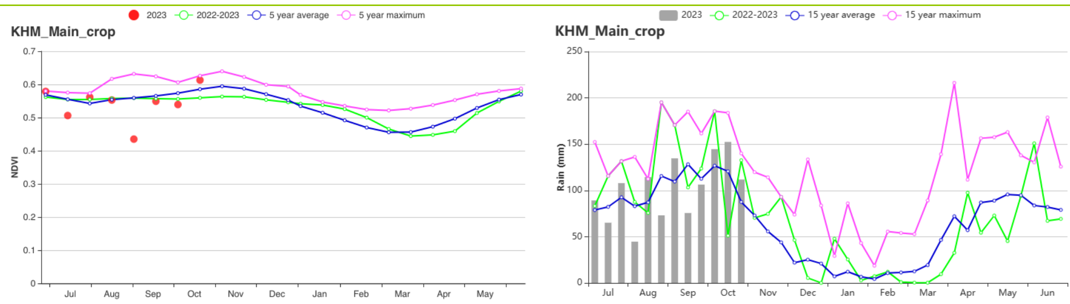


(f) Rainfall profiles

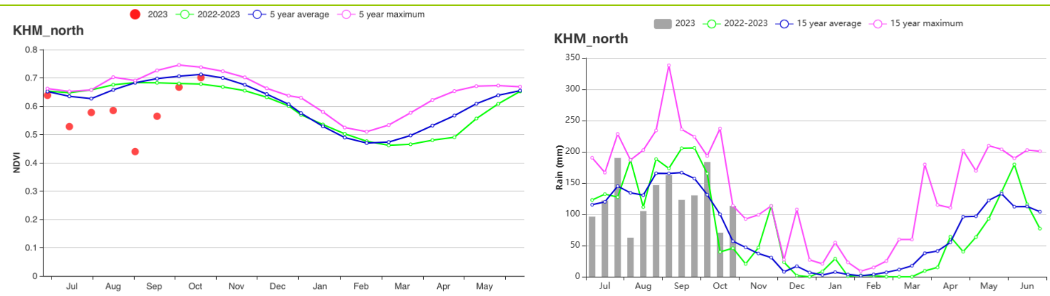
(g) Temperature profiles



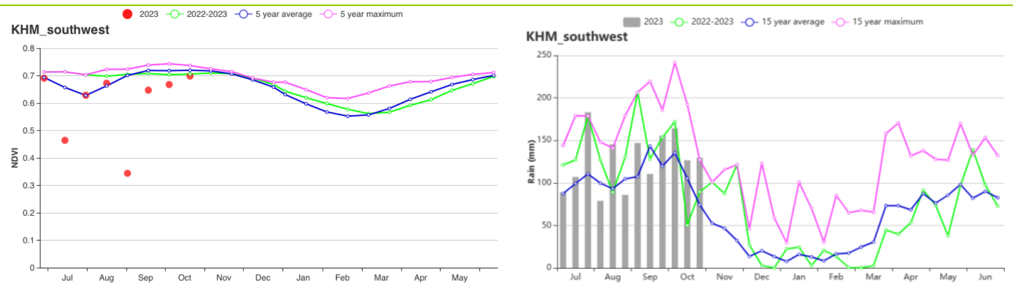
(h) Crop condition development graph based on NDVI (left) and time series rainfall profile (right) in Tonle Sap Lake region



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

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Tonle-Sap	1188	3	26.3	0.7	1189	8	1600	3
Mekong Valley	1219	0	26.5	0.7	1209	8	1643	2
Northern plain and northeast	1506	-5	25.7	0.6	1163	9	1646	3
Southwest Hilly region	1522	19	24.8	0.4	1145	6	1553	1

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

Region	Cropped arable land fraction		Cropping Intensity		Maximum VCI
	Current (%)	Departure (%)	Current (%)	Departure (%)	Current
Tonle-Sap	98	0	138	5	0.94
Mekong Valley	97	2	141	-1	0.94
Northern plain and northeast	99	0	132	-3	0.93
Southwest Hilly region	100	1	135	-8	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

[LBN] Lebanon

This reporting period covers the key growing period of maize and potatoes, the harvesting period of maize, and the sowing period of wheat in Lebanon. Maize reached maturity in August and potatoes reached maturity in October, the planting of wheat started in October. Based on the agroclimatic and agronomic indicators, the crop conditions in Lebanon were generally below average from July to August, then progressively close to average, equal to average, and slightly above average from September to October.

Lebanon experienced a significant and severe precipitation deficit (ΔRAIN -47%), temperature was above average (ΔTEMP +1.1°C), and radiation was below average (RADPAR -2%). As shown in the time series rainfall profile for Lebanon, precipitation was below average throughout this monitoring period. Most of the region experienced warmer-than-usual conditions during this reporting period, or even above the maximum for the past 15 years, except for late-October, when it was below average. Due to severe rain deficit and lower solar radiation, the biomass production potential (BIOMSS) was estimated to decrease slightly by 2% nationwide as compared to the fifteen-year average.

As shown in the crop condition development graph and the NDVI profiles at the national level, NDVI values were below average from July to August, then progressively close to average, equal to average, and slightly above average from September to October.These observations are confirmed by the clustered NDVI profiles: 42.6% of regional NDVI values were below average before October, and only 17.5% of regions NDVI values were significantly above average throughout this monitoring period. 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 0.76. CALF during the reporting period was 29%, which was the same as average compared to the recent five-year average.

Generally, the agronomic indicators show below or close to average conditions for most summer crops in Lebanon.

Regional analysis

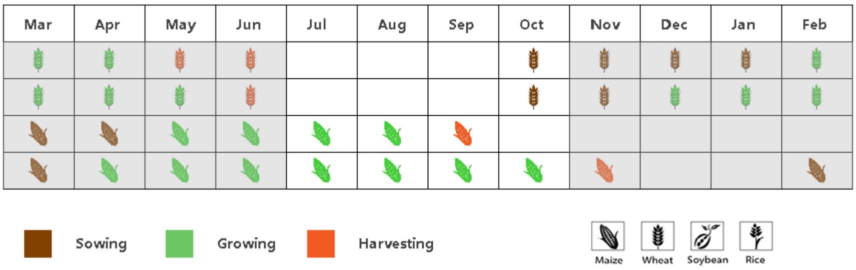
Based on cropping systems, climatic zones, and topographic conditions, three sub-national agro-ecological regions are adopted for Lebanon. They include: Bekaa Valley Zone (231), Western Coastal Zone (230) and Mountainous region (229).

Bekaa Valley Zone is the major crop production zone of Lebanon. Temperature (+1.3°C) was significantly above average in this region, and even higher than the maximum of the last 15 years. Total precipitation was significantly below average (ΔRAIN -48%), and radiation was also below average (RADPAR -3%). As a result, BIOMSS is expected to decrease by 3% as compared to the average. As shown in the crop condition development graph (NDVI), the values were below average until September and then average from September to October. The area has a low CALF (9%). It decreased by 3% as compared to the average, and the VCIx was 0.73. Cropping intensity reached 106%, which was up by 1% compared to the five-year-average across this region.

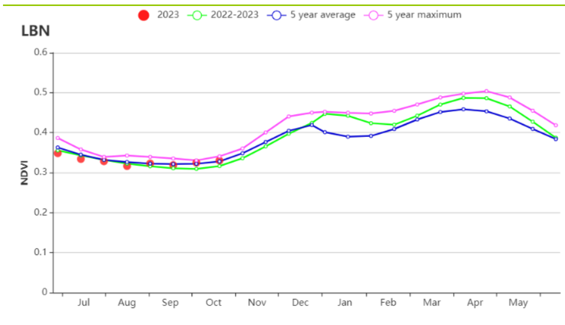
Western Coastal Zone is another major crop zone. Rainfall and RADPAR were both below average (ΔRAIN -15%; RADPAR -3%), but temperature (ΔTEMP +0.2°C) was slightly above average, which led to a decrease in BIOMSS by 4%. As shown in the crop condition development graph based on NDVI, the values were below average from July to September and then above average in October. The CALF was 54%, an increase by 1% as compared to the average, and the VCIx was 0.76. Cropping intensity reached 106%, which was up by 2% compared to the five-year-average across this region.

On average, a large reduction in rainfall was recorded for the **Mountainous region** (ΔRAIN -47%), with above-average temperature (+1.1°C) and below-average radiation (RADPAR -2%). Compared to the fifteen-year average, BIOMSS decreased by 7%. As shown in the crop condition development graph based on NDVI, the values were below or close to average until September and then average from September to October. The area had an unchanged CALF (29%), as well as a favorable VCIx (0.76). Cropping intensity reached 104%, which was up by 2% compared to the five-year-average across this region.

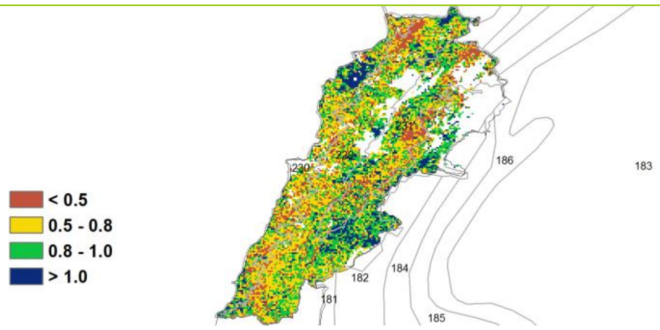
Figure 3.28 Lebanon's crop condition, July-October 2023



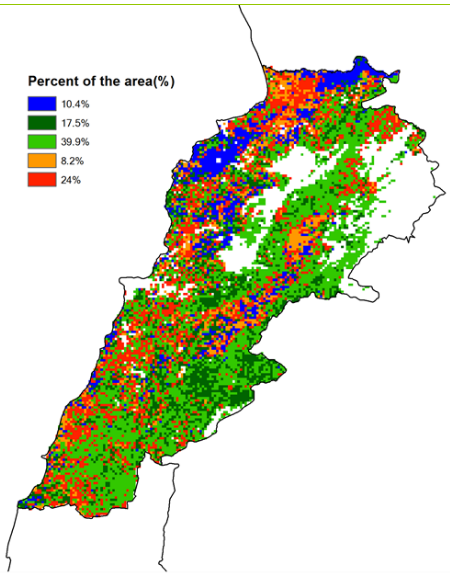
(a). Phenology of major crops



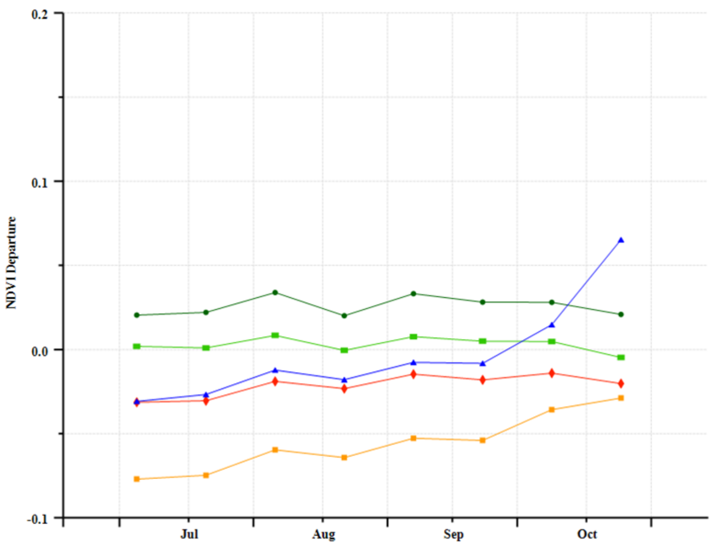
(b) Crop condition development graph based on NDVI



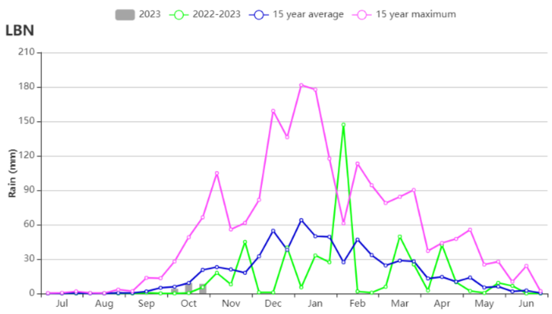
(c) Maximum VCI



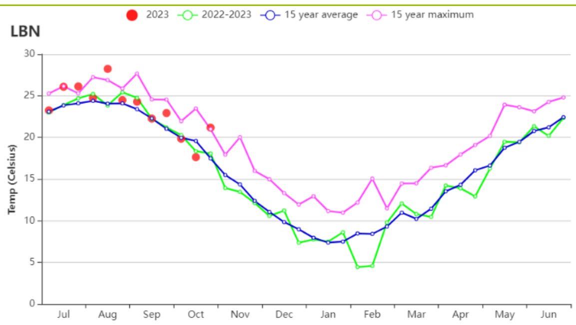
(d) Spatial NDVI patterns compared to 5YA



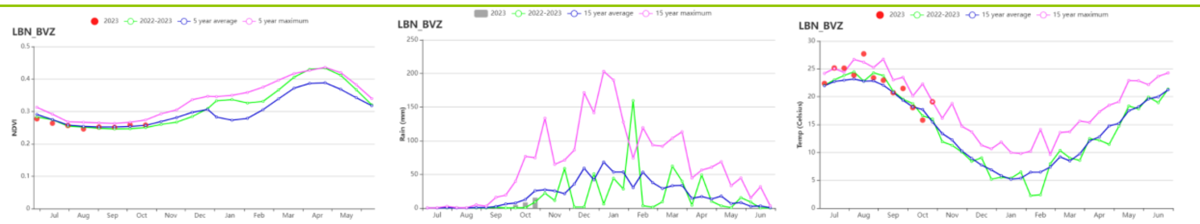
(e) NDVI profiles



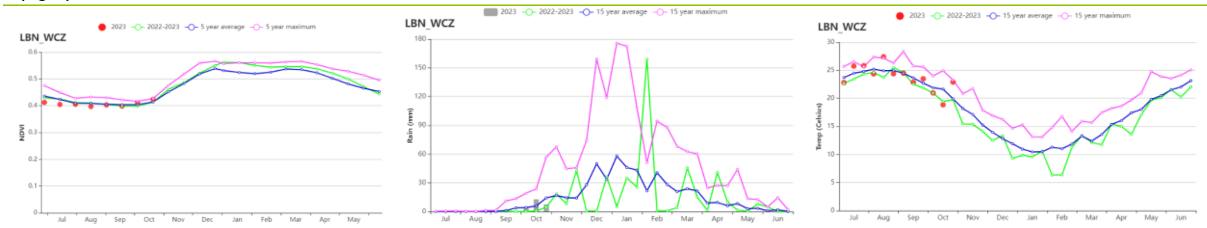
(f) Rainfall profiles



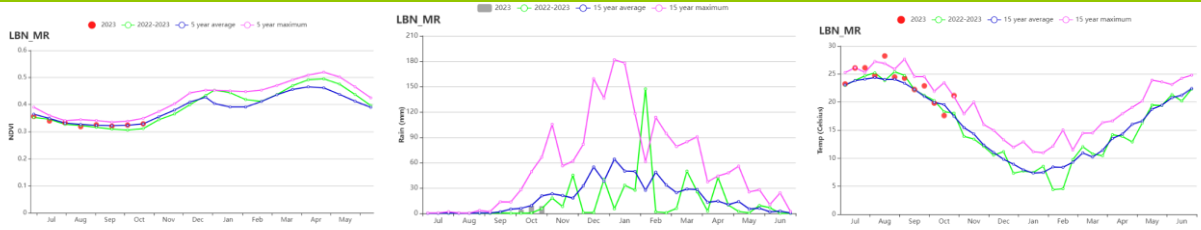
(g) Temperature profiles



(f) Bekaa Valley Zone crop condition development graph based on NDVI (left), time series rainfall profiles (middle) and temperature (right)



(g) Western Coastal Zone crop condition development graph based on NDVI (left), time series rainfall profiles (middle) and temperature (right)



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

Table 3.45 Lebanon agro-climatic indicators by sub-national regions, current season's values and departure from 15YA, July-October 2023

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Bekaa_Valley_Zone	29	-48	22.1	1.3	1412	-3	493	-8
Mountainous_region	23	-47	23.4	1.1	1415	-2	502	-7
Western_Coastal_Zone	26	-15	23.7	0.2	1411	-3	509	-4

Table 3.46 Lebanon agronomic indicators by sub-national regions, current season's value and departure from 5YA, July-October 2023

Region	Cropped arable land fraction		Cropping Intensity		Maximum VCI
	Current (%)	Departure (%)	Current (%)	Departure (%)	Current
Bekaa_Valley_Zone	**9**	**-3**	**106**	**1**	**0.73**
Mountainous_region	**29**	**0**	**104**	**2**	**0.76**
Western_Coastal_Zone	**54**	**1**	**106**	**2**	**0.76**

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

[LKA] Sri Lanka

This report covers two cropping seasons of Sri Lanka. The second Yala season crops (maize and rice) were planted in April and May and harvested from August to October. According to the CropWatch monitoring results, crop conditions were assessed as below average for the monitoring period. Planting of the main Maha crops started in October.

The country experienced the Southwest-Monsoon Season for most of the period. It was followed by the Second Inter-monsoon Season in October. At the national level, precipitation was higher than the 15YA (△RAIN 10%), the temperature (△TEMP 0.3°C) was also higher, while the radiation (RADPAR -5%) was lower. The fraction of cropped arable land (CALF 99%) was near the 5YA, while BIOMSS was slightly down by 1% compared to the 15YA. As shown in the NDVI development graph, NDVI was below average during most of the period, especially in early September. The maximum VCI for the whole country was 0.92. The CPI was 1.00, 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: 40.1% of the cropland generally showed no NDVI departures for the whole period, which was mainly distributed in the eastern part. The crop condition for the remaining part was below-average, in which the abnormal NDVI values in early September and October can be attributed to cloud cover in the satellite images. The maximum VCI showed high values for most of the country except for the northeastern part.

Regional analysis

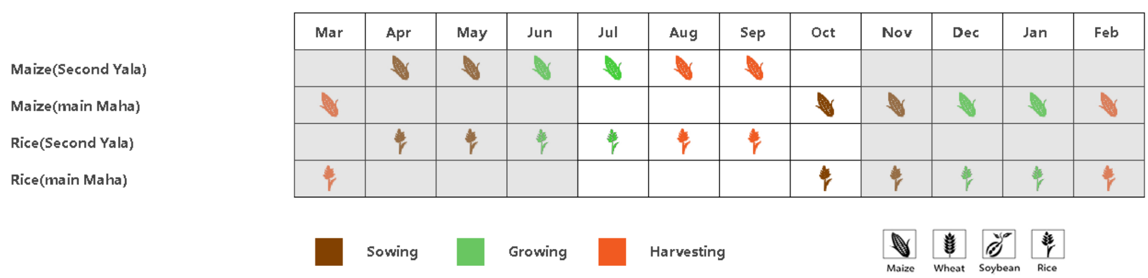
Based on the cropping system, climatic zones and topographic conditions, three sub-national agroecological regions can be distinguished for Sri Lanka. They are the Dry zone (121), the Intermediate zone (122), and the Wet zone (123).

In the **Dry zone**, the recorded RAIN (605 mm) was on average. TEMP was 0.6°C above average, while RADPAR was 2% below average. BIOMSS increased by 1% as compared to the 15YA. CALF was 1% higher than the 5YA level with 98% of cropland utilized. NDVI was average at the start and end of the monitoring period, while it was below average for other months. The VCIx for the zone was 0.90. The CPI was 1.00. Overall, crop conditions were assessed as below average for this zone.

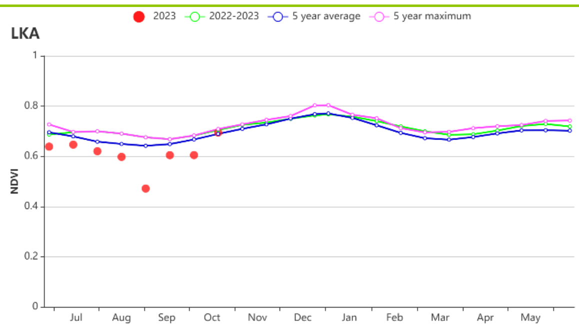
The **Intermediate zone** had a rainfall of 1203 mm, which was 3% above average. TEMP was 0.7°C higher compared to the 15YA, while RADPAR was decreased by 4%. With full use of cropland, BIOMSS was 4% lower than the average. NDVI was similar to that of the whole country. The VCIx value for this zone was 0.95. The CPI was 1.00.

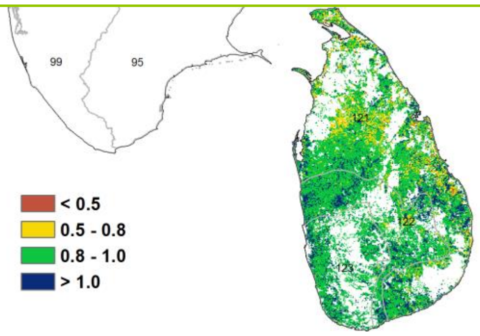
For the **Wet zone**, RAIN (2607 mm) was 17% above average as compared to the 15YA. TEMP and RADPAR decreased by 0.3°C and 11% respectively. BIOMSS was 4% below the 15YA and cropland was fully utilized. The CPI was 1.01. Crop conditions were below average for this zone.

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

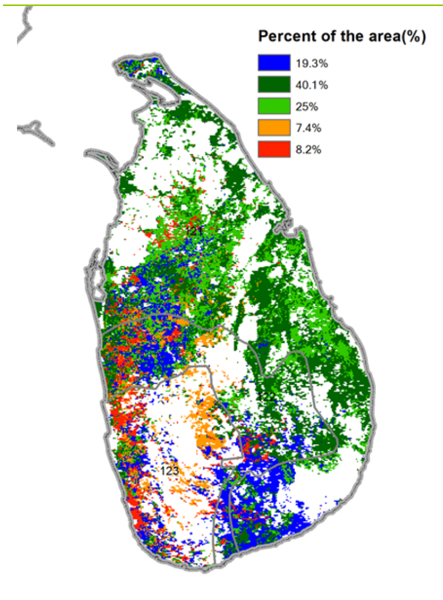


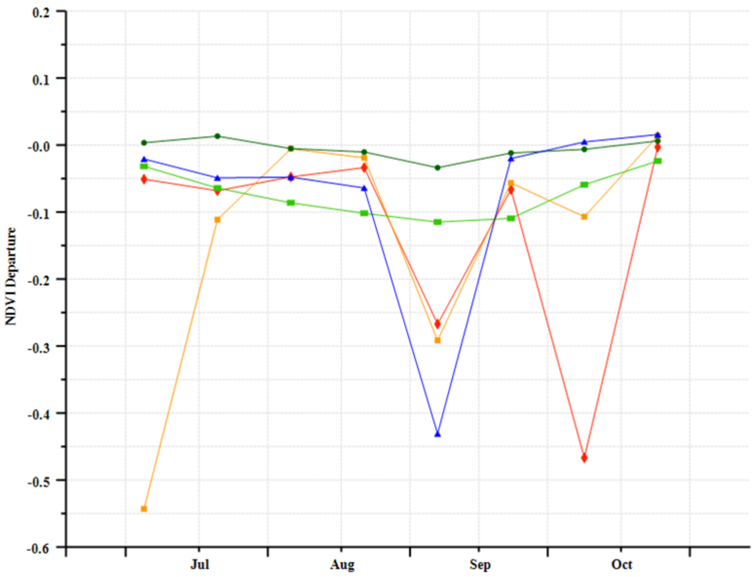
(a) Phenology of major crops



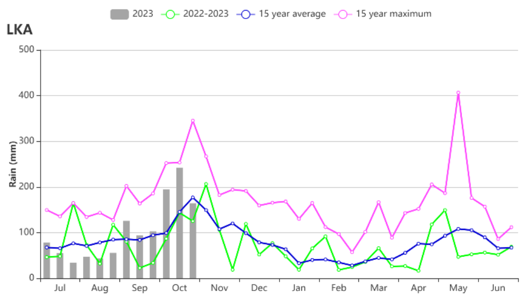


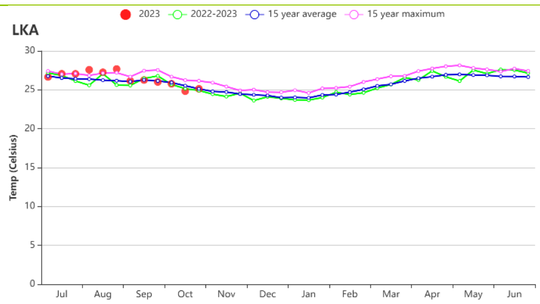
(b) Crop condition development graph based on NDVI (c) Maximum VCI



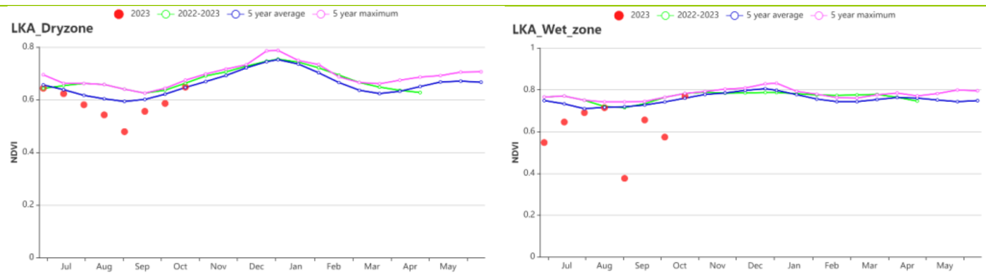


(d) Spatial NDVI patterns compared to 5YA (e) NDVI profiles

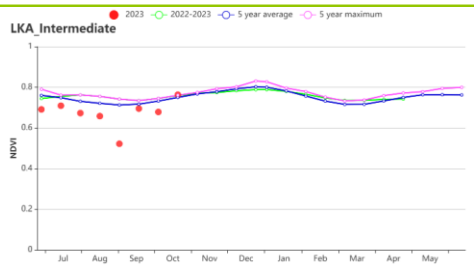




(f) Rainfall profiles (g) Temperature profiles



(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, July - October 2023

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Dry zone	605	0	27.8	0.6	1236	-2	1143	1
Intermediate zone	1203	3	25.3	0.7	1115	-4	1207	-4
Wet zone	2607	17	23.8	-0.3	1035	-11	1481	-4

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

Region	Cropped arable land fraction		Cropping Intensity		Maximum VCI
	Current (%)	Departure (%)	Current (%)	Departure (%)	Current
Bekaa_Valley_Zone	9	-3	106	1	0.73
Mountainous_region	29	0	104	2	0.76
Western_Coastal_Zone	54	1	106	2	0.76

[MAR] Morocco

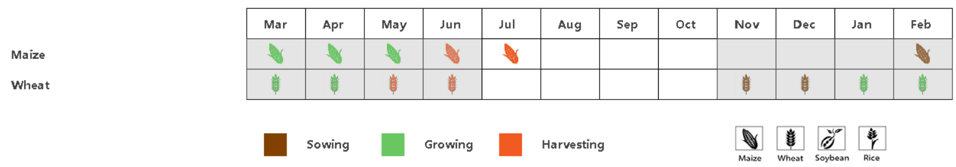
The reporting interval from July to October covers the harvesting period of maize, which was concluded in July. No cereal crops are grown during this monitoring period because of low rainfall during the summer months. After the current monitoring period, the sowing of winter wheat is going to start in November. The cumulative rainfall was 49 mm which is lower than the 15-year average (15YA) by 43%. The rainfall profile shows that the rainfall did not exceed 20 mm and fell mainly during October. The average temperature was 23.6°C (0.9°C higher than the 15YA). The temperature profile shows that the temperature fluctuated around the average. Both RADPAR and BIOMSS were lower than the 15YA by 0.3% and 8%, respectively. The decrease in BIOMSS can be attributed to the decrease in rainfall. The nationwide NDVI profile was below the 5-year average (5YA) during the reporting period. The NDVI spatial pattern shows that only 4.6% of the cultivated area was above the 5YA while the rest was below the 5YA. The Maximum Vegetation Condition Index (VCIx) map shows that the condition of the current crops was below average where the dominant VCIx values were below 0.5. This finding agrees with the whole country's VCIx value of 0.38. CALF was lower than the 5YA by 31%. The nationwide crop production index (CPI) was at 0.71 implying below normal crop production situation. However, most land was left fallow during the summer months.

Regional analysis

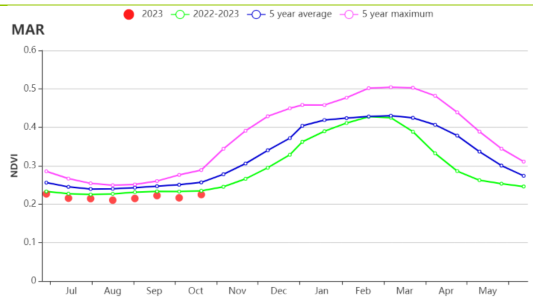
CropWatch adopts three agroecological zones (AEZs) relevant to crop production in Morocco: the Sub-humid northern highlands (area identified as 125 in the crop condition clusters map), the Warm semiarid zone (126), and the Warm sub-humid zone (127).

Rainfall was below the 15YA by 41%, 56%, and 35% while the temperature was higher than the 15YA by 0.6°C, 0.8°C, and 0.7°C in the three zones in their listed order, respectively. RADPAR was at 15YA in zones 125 and 126 while it was lower the 15YA in zone 127 by 1%. In the three zones, BIOMSS was lower than 15YA by 9%, 9%, and 7% respectively. The NDVI development graph shows that crop conditions were below the average in the three zones following the nationwide NDVI profile. CALF was below the 5YA by 25%, 62%, and 26% with maximum VCI values at 0.39, 0.34, and 0.42 for zones 125, 126, and 127 respectively, implying below-average crop conditions. Cropping Intensity estimates were at 101%, 100%, and 102% for the three zones in their listed order, respectively, indicating all regions dominated by single cropping during the investigation period. In three zones, CPI was at 0.70, 0.46, and 0.75, respectively, implying below normal crop production situation following the nationwide CPI.

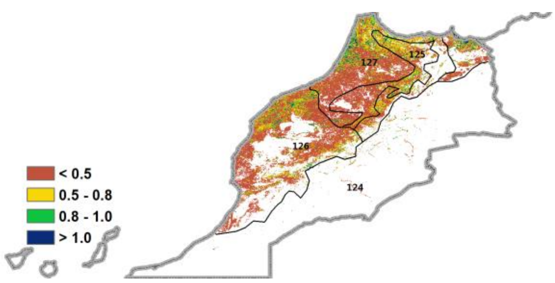
Figure 3.30 Morocco's crop condition, July - October 2023



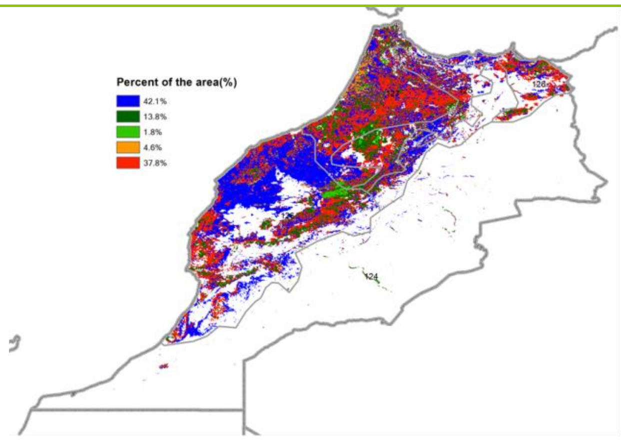
(a) Phenology of major crops

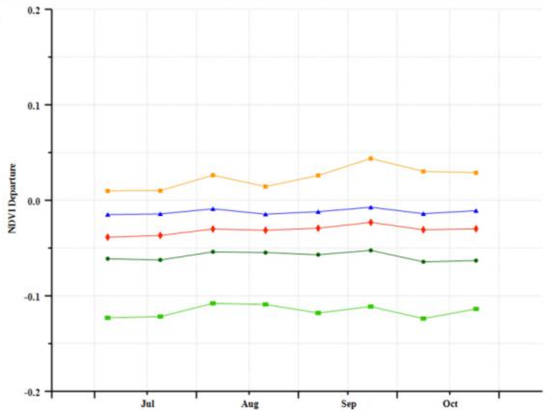


(b) Crop condition development graph based on NDVI



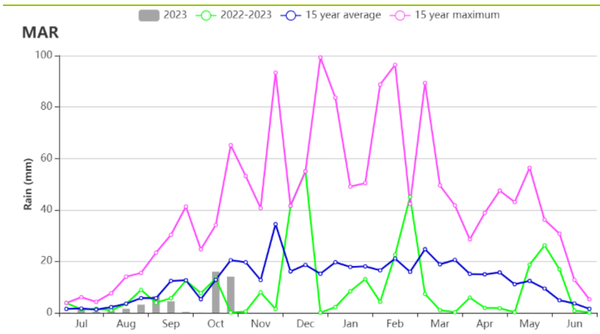
(c) Maximum VCI

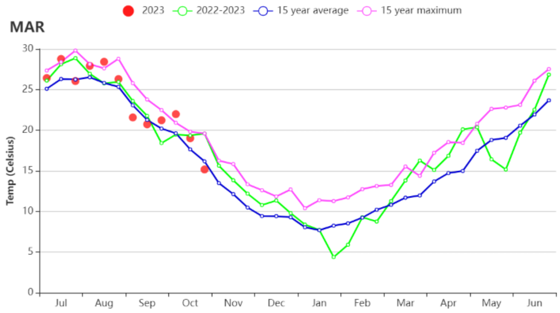




(d) Spatial NDVI patterns compared to 5YA

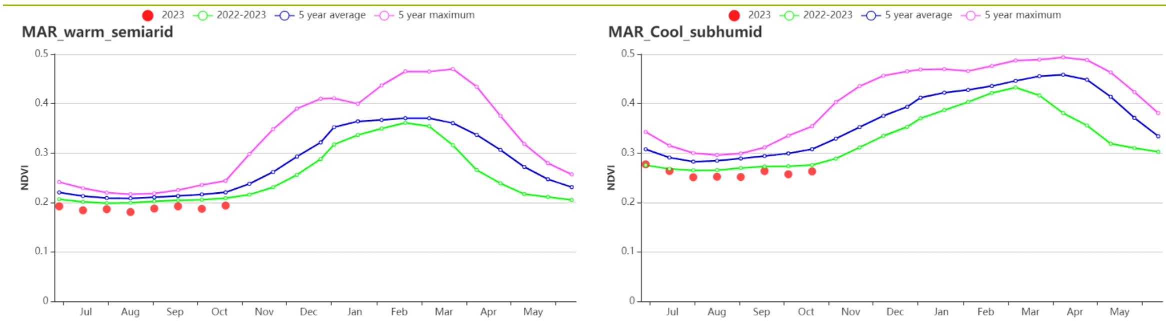
(e) NDVI profiles



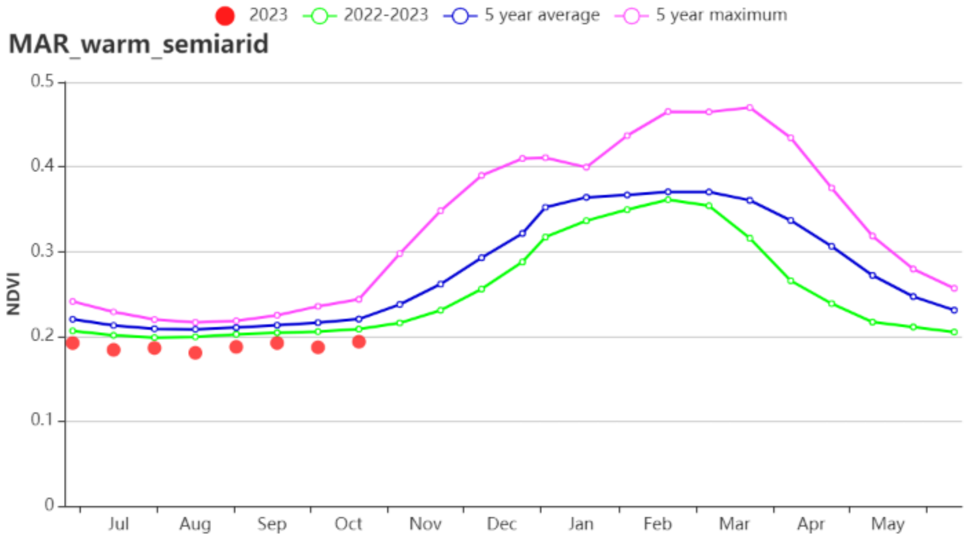


(f) Rainfall profiles

(g) Temperature profiles



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



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

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

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m2)	Current (mm)	Departure (%)	Current (°C)
Sub-humid northern highlands	62	-41	23.1	0.6	1352	0	549	-9
the Warm semiarid zone	30	-56	23.9	0.8	1369	0	509	-9
Warm sub-humid zone	65	-35	23.3	0.7	1343	-1	552	-7

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

Region	Cropped arable land fraction		Cropping Intensity		Maximum VCI
	Current (%)	Departure (%)	Current (%)	Departure (%)	Current (%)
Sub-humid northern highlands	13	-25	101	0	0.39
the Warm semiarid zone	1	-62	100	-1	0.34
Warm sub-humid zone	10	-26	102	0	0.42

[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.

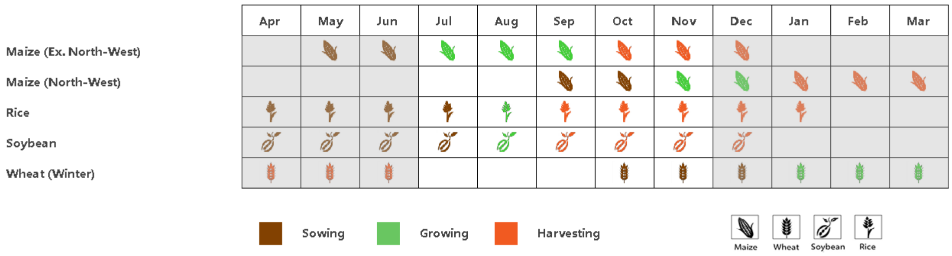
The Arid and semi-arid region in northern and central Mexico encountered a significant 60% decrease in RAIN, with average TEMP reaching 24.5°C (+1.9°C). RADPAR recorded a value of 1307 MJ/m2. According to the NDVI-based development graph, crop conditions were significantly below average throughout the monitoring period. The CALF was 55%, marking a 31% decrease from the five-year average. The VCIx value was 0.56.

The Humid tropics region with summer rainfall in southeastern Mexico experienced decreased RAIN with 1152 mm recorded (11% decrease). TEMP increased by 0.9°C to 25.7°C, and RADPAR remained unchanged. BIOMSS exhibited a reduction of 17% at 1421 g DM/m2. The VCIx value was 0.91. The region's high VCIx of 0.91 indicated generally normal crop growth. However, according to the NDVI-based development graph, conditions were close to but slightly below the average.

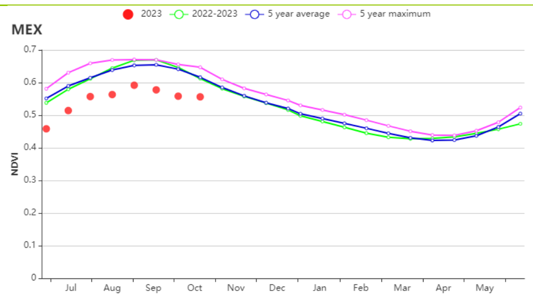
The Sub-humid temperate region with summer rains in central Mexico experienced decreased RAIN with 874 mm recorded (28% decrease). TEMP increased to 20.0°C by 1.2°C, and RADPAR slightly rose to 1262 MJ/m2 (+3%). BIOMSS exhibited a reduction of 5% at 1103 g DM/m2. CALF was stable at 91%, and the VCIx value was 0.79. Crop conditions were below the average level, as indicated by the NDVI-based development graph.

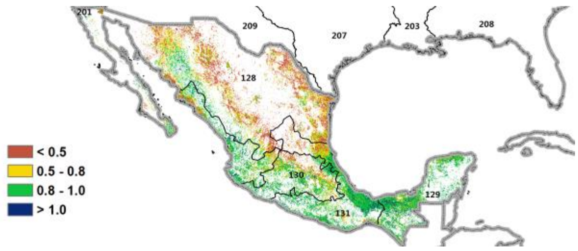
The Sub-humid hot tropics with summer rains region in southern Mexico experienced a notable reduction in RAIN with 1023 mm recorded (17% decrease). TEMP rose to 23.6°C (+1.3°C), while RADPAR increased by 1%. BIOMSS displayed a decline of 5% at 1226 g DM/m2. CALF remained steady at 93%, and the VCIx value was 0.84. According to the NDVI-based development graph, crop conditions were below-average during the four-month period.

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



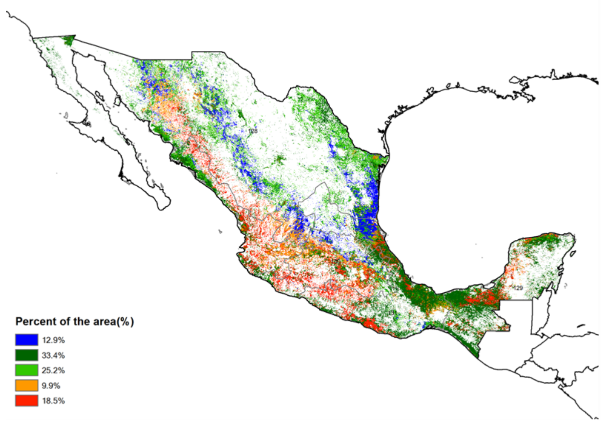
(a) Phenology of major crops

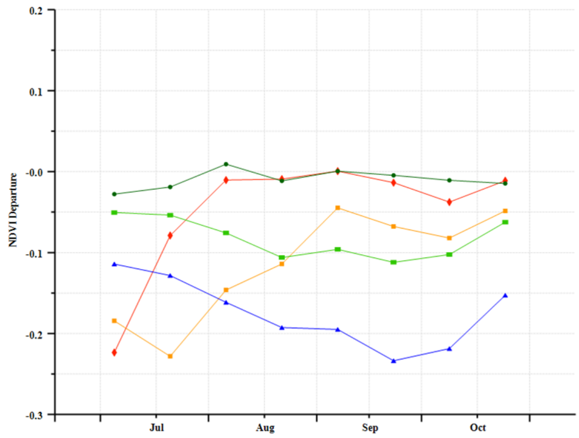




(b) Crop condition development graph based on NDVI

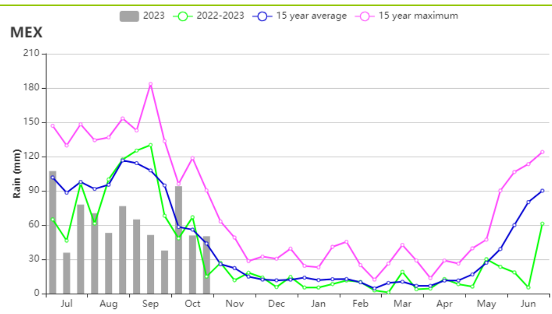
(c) Maximum VCI

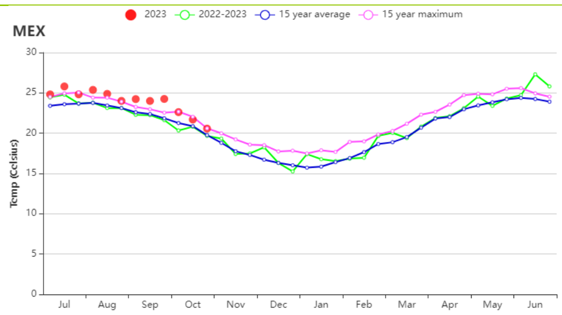




(d) Spatial NDVI patterns compared to 5YA

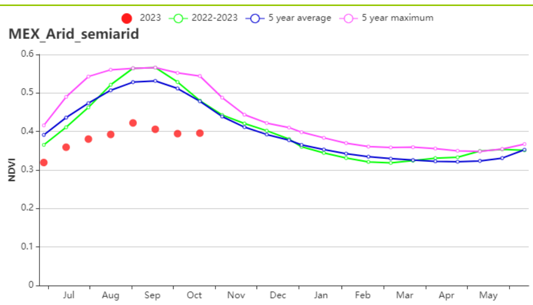
(e) NDVI profiles

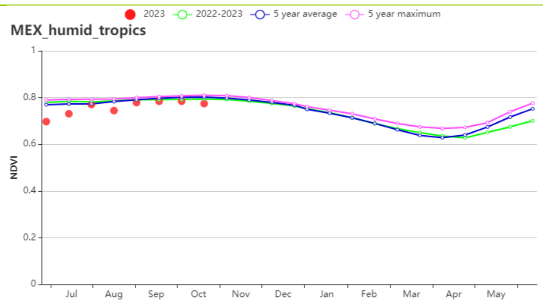




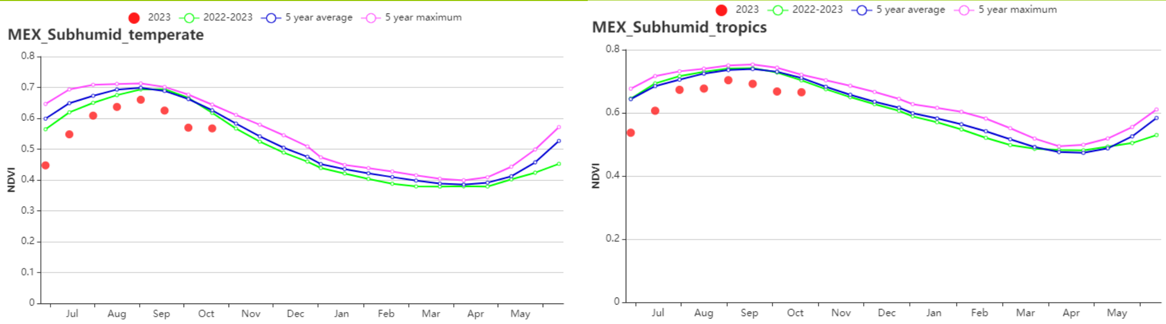
(f) Rainfall profiles

(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, July - October 2023

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Arid and semi-arid regions	292	-60	24.5	1.9	1307	1	776	-27
Humid tropics with summer rainfall	1152	-11	25.7	0.9	1264	0	1421	-2
Sub-humid temperate region with summer rains	874	-28	20.0	1.2	1262	3	1103	-5
Sub-humid hot tropics with summer rains	1023	-17	23.6	1.3	1250	1	1226	-5

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

Region	Cropped arable land fraction		Cropping intensity		Maximum VCI
	Current (%)	Departure (%)	Current (%)	Departure (%)	Current
Arid and semi-arid region	55	-31	114	-1	0.56
Humid tropics with summer rainfall	100	0	130	6	0.91
Sub-humid temperate region with summer rains	91	-7	109	-2	0.79
Sub-humid hot tropics with summer rains	93	-3	117	-3	0.84

[MMR] Myammar

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

According to the agroclimatic indicators, the rainfall deficit in Myanmar appeared to be easing. Compared to the 15YA, RAIN was lower (-5%), while TEMP was higher (+0.7ºC), and RADPAR was up by 4%. BIOMSS was on average. 98% of cropland was utilized, 1% higher than 5YA. NDVI values were average in July, while declined substantially in August, and tended to recover after that. The maximum VCI during this period was 0.94. The CPI value was 1.02, 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 heterogeneous and generally below average. 28.3% of the cropland, distributed mainly in the Central Plain, generally showed average crop conditions. More than 50% of the cropland showed near average crop conditions in July, September and October, but was apparently below average in August. 15.7% of the cropland showed below-average crop conditions in August and early September. The maximum VCI values showed a similar distribution as the cluster map.

Regional analysis

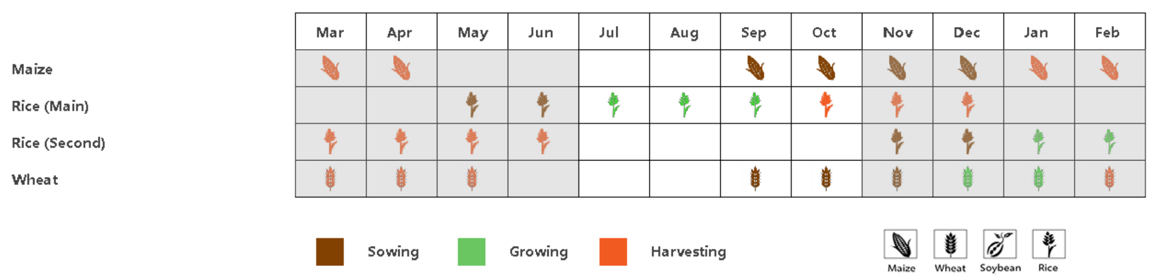
Three sub-national agro-ecological zones (AEZ) can be distinguished for Myanmar based on the cropping system, climatic zones and topographic conditions. They are the Central Plain (132), the Delta and Southern Coast regions (133), and the Hills (134).

The **Central Plain** had a marked rainfall deficit (RAIN -18%), and RADPAR (+7%) and TEMP (+1.0ºC) were higher as compared to the 15YA. BIOMSS was 3% lower than the 15YA. CALF showed that 98% of the cropland was utilized. The NDVI values were similar to that of the whole country. The VCIx was 0.95. The CPI was 1.04. Crop conditions for this region were below average.

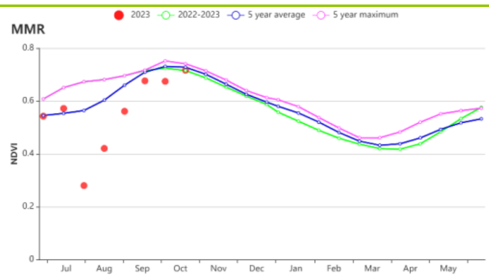
The **Delta and Southern Coast region** had an above-average rainfall (RAIN 8%). RADPAR was 1% below average, while TEMP was 0.3ºC above average. BIOMSS was on average. The cropland was also not fully utilized (CALF 96%). The NDVI values were below the 5YA during almost the whole period. VCIx was 0.92. The CPI was 1.01. Crop conditions in this region were below average.

The **Hills region** also had below-average rainfall (RAIN -8%). RADPAR and TEMP increased by 4% and 0.7ºC. BIOMSS (+1%) was slightly higher than the 15YA. 99% of cropland was utilized. NDVI was below the level of the 5YA for most of the period. The VCIx was 0.95. The CPI was 0.98. Crop conditions are assessed as below the 5YA level.

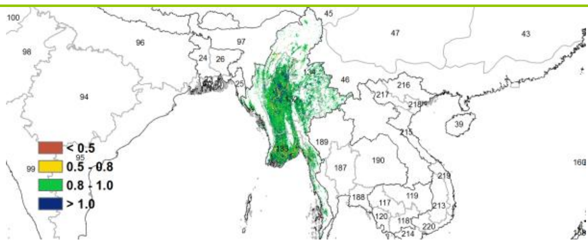
Figure 3.32 Myammar's crop condition, July - October 2023



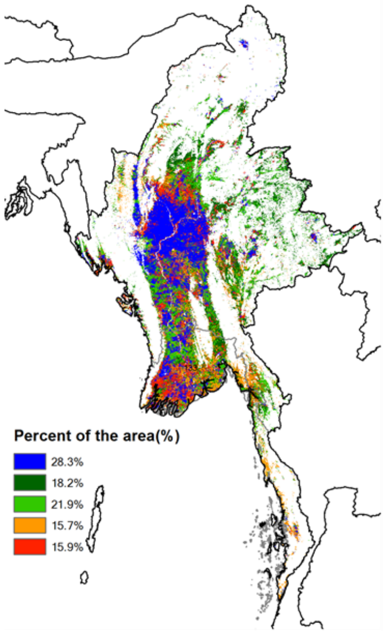
(a) Phenology of major crops

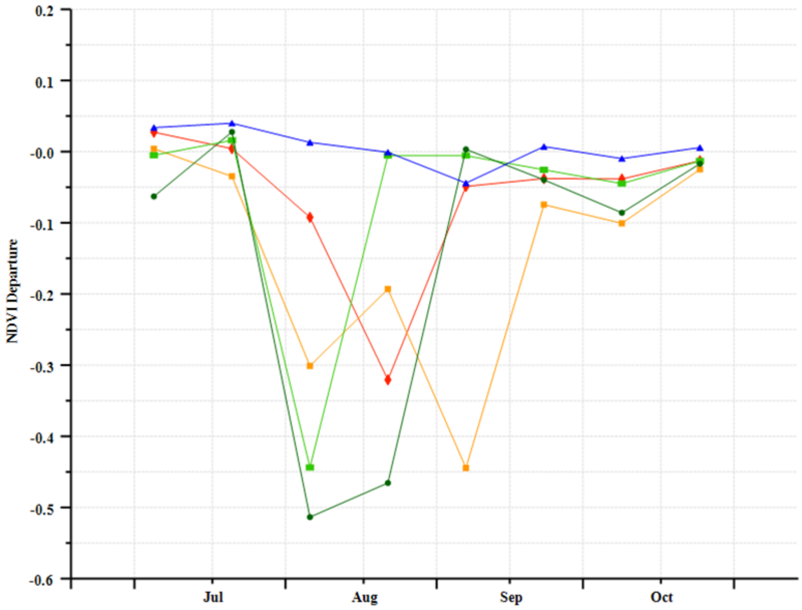


(b) Crop condition development graph based on NDVI



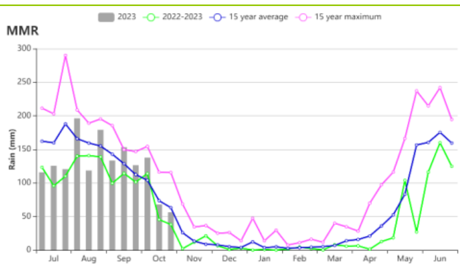
(c) Maximum VCI

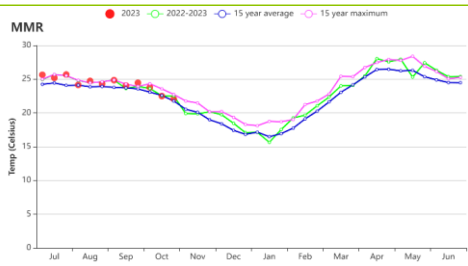




(d) Spatial NDVI patterns compared to 5YA

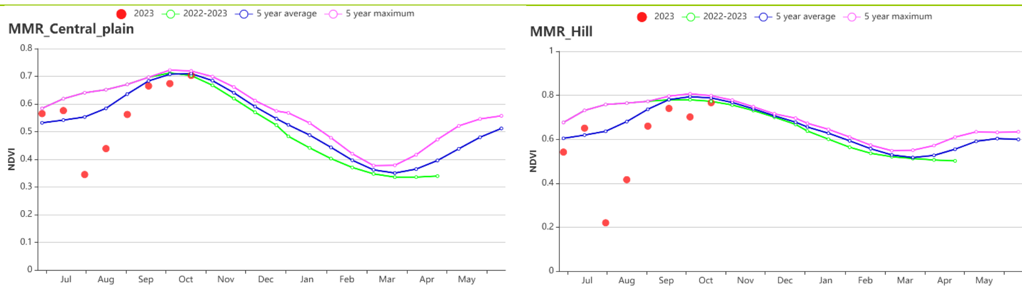
(e) NDVI profiles



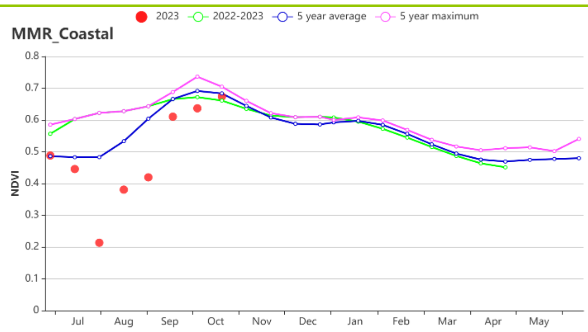


(f) Rainfall profiles

(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 in Delta and Southern Coast region

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

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m^2)	Departure (%)	Current (gDM/m^2)	Departure (%)
Central plain	914	-18	25.2	1.0	1142	7	1370	-3
Delta and southern-coast	2102	8	26.0	0.3	1084	-1	1605	0
Hills region	1638	-8	23.1	0.7	1018	4	1426	1

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

Region	Cropped arable land fraction		Cropping intensity		Maximum VCI
	Current (%)	Departure (%)	Current (%)	Departure (%)	Current
Central plain	98	1	138	1	0.95
Delta and southern-coast	96	1	181	8	0.92
Hills region	99	0	159	4	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

[MNG] Mongolia

The monitoring period, from July to October, is critical for wheat cultivation, Mongolia's primary cereal crop. In Mongolia, where a mere 2.9% of cropland is irrigated. Hence, rainfall has a big impact on crop production.

RAIN was close to average (ΔRAIN +1%). A notable increase in TEMP (+1.5°C) was measured. This rise in TEMP could have both positive and negative implications depending on the region. Warmer conditions may have accelerated crop growth in some areas (The Hangai Khuvsgul region and Selenge-Onon region), while potentially stressing crops in others (The Central and Eastern Steppe Region). Photosynthetically Active Radiation (RADPAR) was slightly below the average by 3%. The biomass accumulation potential (BIOMSS) was 3% higher than the 15-year average.

The Maximum VCI map indicates that most of the country, especially in the central agricultural zones like Hangai Khuvsgul Region and Selenge-Onon Region, has green to blue areas, denoting generally healthy vegetation conditions for the season. This aligns well with the slightly above-average NDVI readings, confirming that despite some areas of concern, the majority of the country has experienced good to excellent vegetation health during this period. And the average VCIx was 0.93. The stability in the cropped arable land fraction, consistently at 99%, indicates a sustained use of arable land for agriculture, showcasing effective land utilization patterns. Cropping intensity (CI) was slightly below average (ΔCI, -1%).

Overall, the crop conditions in Mongolia during this monitoring period were generally normal. CropWatch predicts a 3.6% increase in wheat production in 2023 compared to 2022.

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**.

Hangai Khuvsgul region:

In the Hangai Khuvsgul region of Mongolia, the period of July to October 2023 showed some distinct agroclimatic and agronomic trends. The region experienced a 5% increase in RAIN compared to the 15-year average, with a current measurement of 317 mm. This is indicative of a wetter season than usual. TEMP showed a significant rise, being 1.7°C higher than the average, at 8.4°C. RADPAR was slightly below average by 3%. BIOMSS in this region was 9% higher than the 15-year average, reflecting an increased potential for crop biomass accumulation due to favorable rainfall. The cropped arable land fraction remained stable at 99%, with no significant departure from the 5-year average. The cropping intensity was slightly lower at 101%, a 1% decrease from the 5-year average. The Maximum VCI was 0.92, suggesting generally good vegetation health and condition.

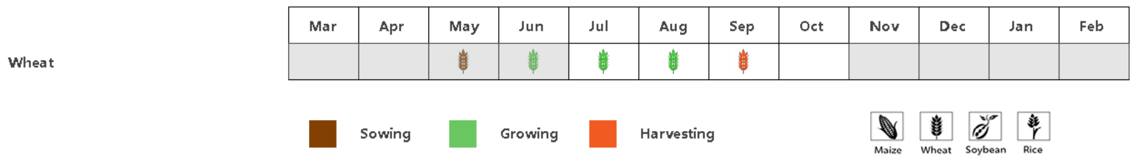
Selenge-Onon region:

The Selenge-Onon region, a crucial agricultural area of Mongolia, displayed a slightly different set of agroclimatic conditions. The RAIN was 3% higher than the 15-year average, with a current measurement of 286 mm, indicating a marginally wetter season. TEMP was also above the average by 1.3°C. This warmer temperature, coupled with adequate rainfall, likely contributed positively to crop growth. RADPAR was below the average by 3%. BIOMSS saw a minor increase of 2% compared to the 15-year average. The cropped arable land fraction was 100%, and the cropping intensity was 101%, both indicating effective utilization of arable land. The Maximum VCI was 0.94, reflecting healthy crop conditions overall.

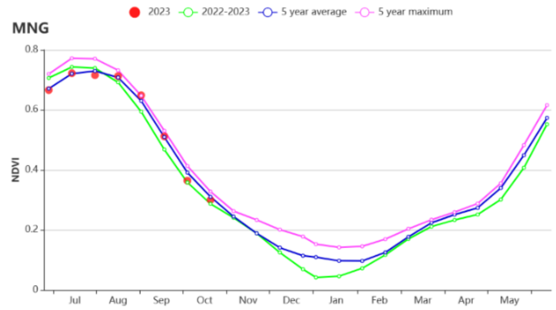
Central and Eastern Steppe Region:

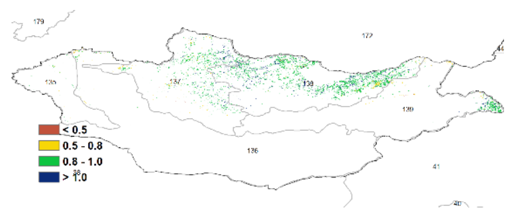
In the Central and Eastern Steppe region, the agroclimatic conditions were more challenging. RAIN saw a significant decrease of 18% compared to the 15-year average, with a total of of 185 mm. This reduction in rainfall could have impacted crop water availability. TEMP was slightly higher than average by 1.2°C. RADPAR was near the average, with a minor 1% decrease. BIOMSS experienced a notable decrease of 10% from the 15-year average, likely impacted by reduced rainfall. The cropped arable land fraction was 99%, with a minor 1% decrease from the 5-year average. The cropping intensity remained stable at 100%. The Maximum VCI was 0.91, indicating reasonably good crop conditions despite the reduced rainfall.

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



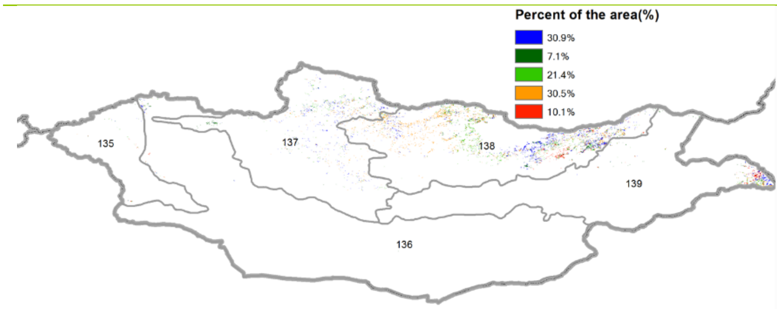
(a). Phenology of major crops

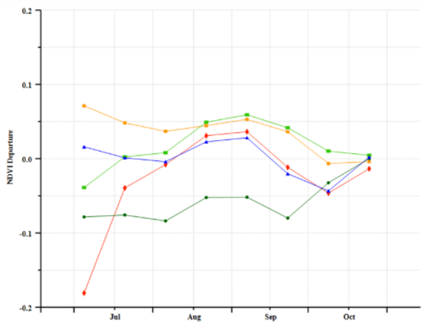




(b) Crop condition development graph based on NDVI

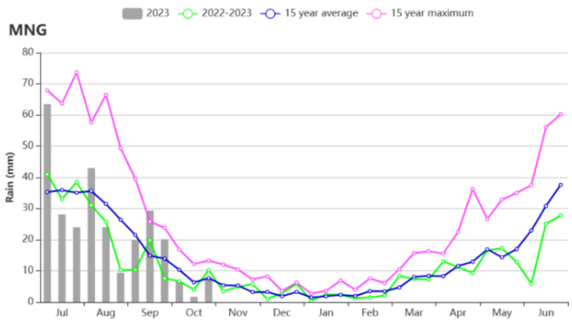
(c) Maximum VCI

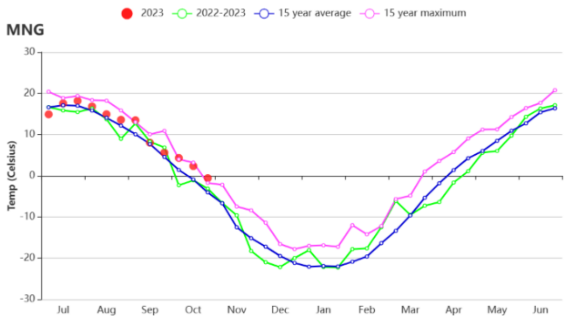




(d) Spatial NDVI patterns compared to 5YA

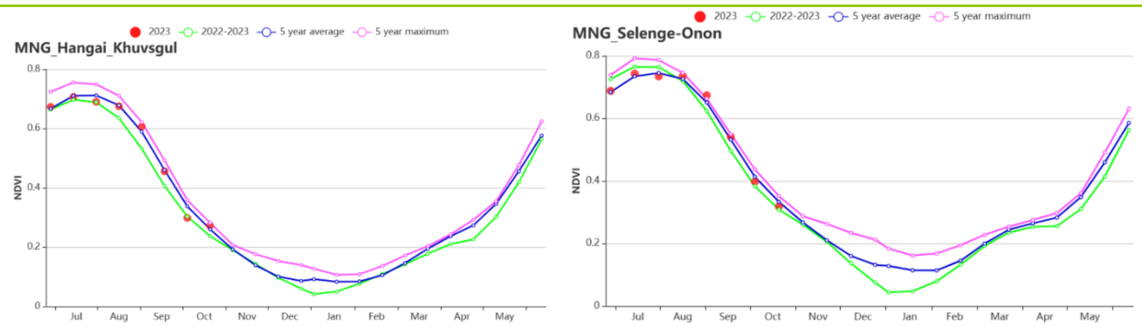
(e) NDVI profiles



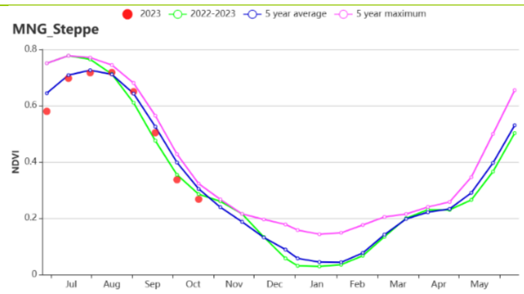


(f) Rainfall profiles

(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, July - October 2023

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m2)	Departure (%)	Current (gDM/m2)	Departure (%)
Hangai Khuvsgul Region	317	5	8.4	1.7	1023	-3	652	9
Selenge-Onon Region	286	3	11.2	1.3	1003	-3	668	2
Central and Eastern Steppe Region	185	-18	14.3	1.2	1015	-1	572	-10
Altai Region	187	-48	9.6	2.8	1087	5	475	-10
Gobi Desert Region	135	-31	12.4	2.5	1118	3	419	-13

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

Region	Cropped arable land fraction		Cropping intensity		Maximum VCI
	Current (%)	Departure (%)	Current (%)	Departure (%)	Current
Hangai Khuvsgul Region	99	0	101	-1	0.92
Selenge-Onon Region	100	0	101	-2	0.94
Central and Eastern Steppe Region	99	-1	100	0	0.91
Altai Region	76	-6	100	-1	0.80
Gobi Desert Region	69	-11	101	0	0.79

[MOZ] Mozambique

In Mozambique, less than 10% of cultivated arable land is under irrigation, making crop production primarily reliant on rainfall. During the July to October 2023 monitoring period, which coincides with the dry season, rice and maize planting started in October. Rainfall (+22.6%) was above average, although the levels were still very low since this was the dry period. Additionally, the temperature rose by 0.6°C while photosynthetic active radiation decreased by 3%. These combined indicators provided favorable conditions for the planting period of rice and maize in the southern region, leading to an 8% increase in total biomass production during their early development stages compared to the average of the past fifteen years.

The national crop development graph, based on the Normalized Difference Vegetation Index (NDVI), revealed that crop conditions across the country were slightly below the average of the past five years initially but recovered to the average by late August, remaining consistent until the end of the reporting period. However, despite this recovery in late August, spatial analysis of NDVI patterns compared to the five-year average and NDVI profiles showed that only 31% of the country experienced above-average crop conditions. According to the Vegetation Condition Index map, these favorable conditions were observed in the northern province of Nampula, the coastal region of Sofala province, and the irrigated areas of Gaza and Maputo provinces. Agronomic indicators during this period indicated a slight decrease in the cropped arable land fraction (ΔCALF -1%) with a maximum VCI of 0.77. Nevertheless, with cropping intensity increasing by 2% compared to the fifteen-year average and the anticipation of favorable agroclimatic conditions for the upcoming agricultural season, there are promising prospects for crop production in Mozambique.

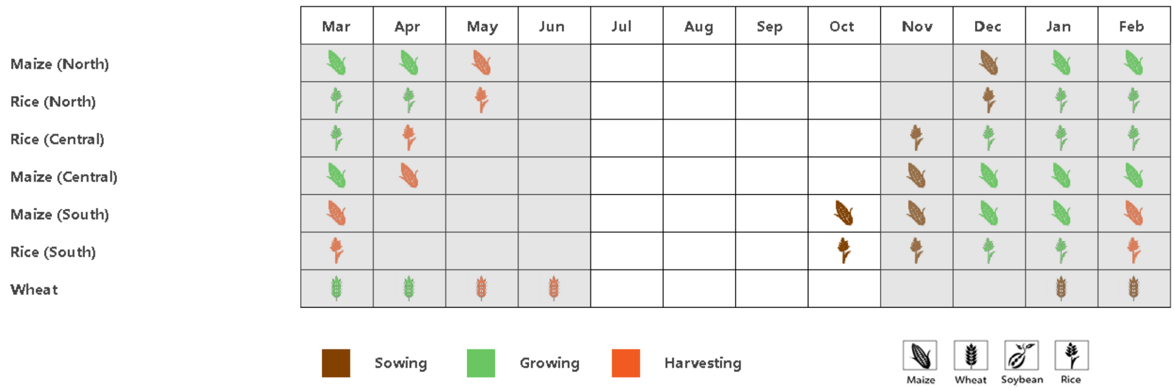
Regional analysis

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

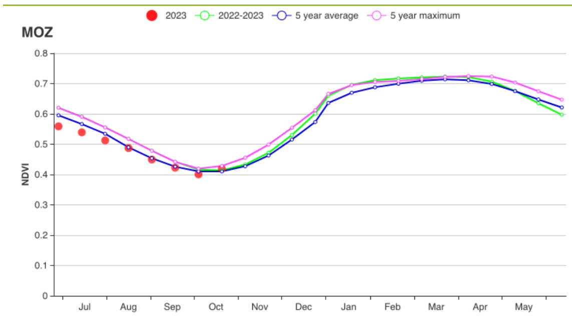
Overall, at the regional level, agroclimatic indicators showed positive anomalies in both rainfall and temperature. During this period, rainfall increased by 88% in the Buzi basin, 68% in the Low Zambezia river basin, and 59% in the Southern region. Significant decreases were observed in the Northern high-altitude areas (ΔRAIN -42%). Additionally, there was a 1% decrease in the Northern coast. Except for the Southern region, where the temperature was around the average of the past fifteen years, it increased in the remaining agroecological zones, with the highest increase (TEMP +0.8ºC) observed in the Northern high-altitude areas. Regarding photosynthetic active radiation, except for the Northern high-altitude areas (RADPAR +1), it decreased in all remaining agroecological regions, with the highest decrease observed in the Buzi basin (RADPAR -7%). Collectively, these indicators led to increases in total biomass production: Buzi basin (BIOMSS +19%), Southern region (BIOMSS +18%), Low Zambezia river basin (BIOMSS +14%), and Northern coast (BIOMSS +1%). However, in the Northern high-altitude areas, total biomass production decreased by 5%.

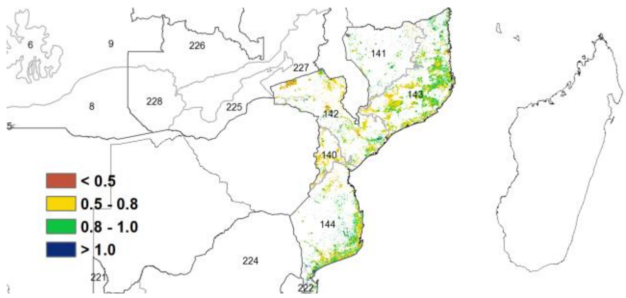
Regional crop condition development graphs based on NDVI indicate that crop conditions were below the average of the past 5 years in the Buzi basin, Low Zambezia river basin, and Northern coast. In the Northern high-altitude areas, crop conditions were around the average, while in the southern regions, the crop conditions were favorable. They were situated around the average during July and gradually improved. By the end of the reporting period, they were well above the average of the past 5 years, as well as above the same period of last season and above the 5-year maximum. Variations in cropped arable land fraction were also observed. For instance, CALF rose by 3% in the Buzi basin and Southern region. Nevertheless, it decreased by 4% in the Low Zambezia river basin, 3% in the Northern high-altitude areas, and 2% in the Northern coast. The Northern high-altitude areas recorded an increase of 5% in cropping intensity, and the maximum VCIx over the different agroecological regions varied from 0.69 to 0.82, with cropping production index values above 1 observed in the Northern high-altitude areas.

Figure 3.34 Mozambique's crop conditions, July - October 2023



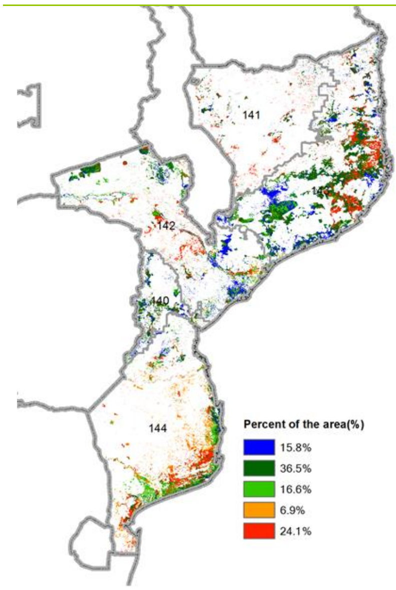
(a) Phenology of major crops

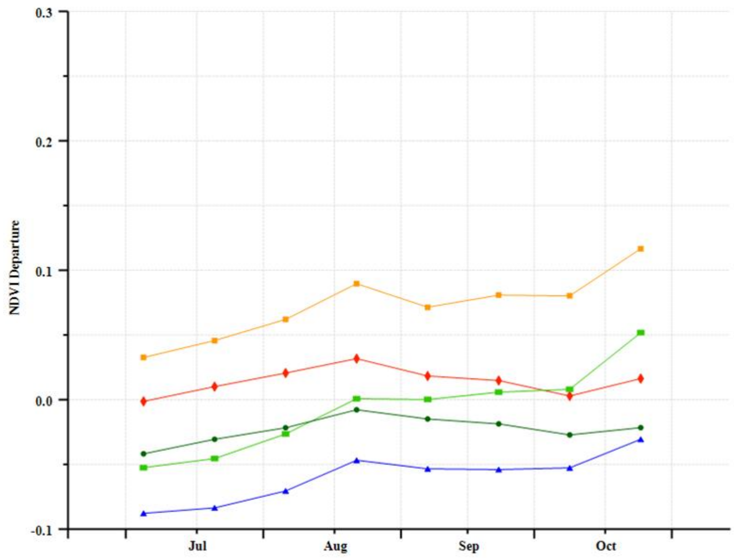




(b) Crop condition development graph based on NDVI

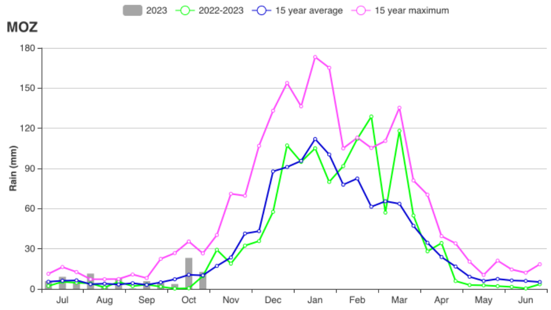
(c) Maximum VCI



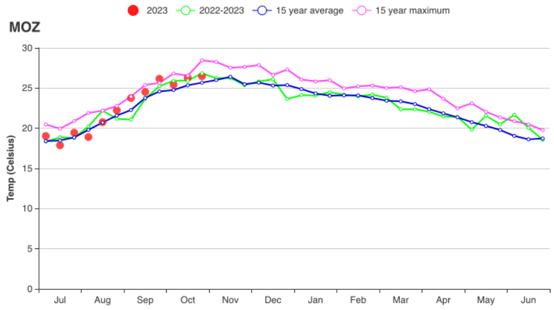


(d) Spatial NDVI patterns compared to 5YA

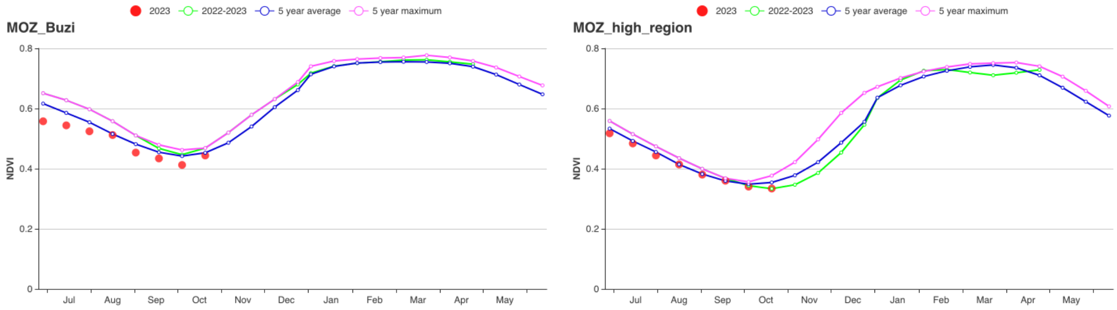
(e) NDVI profiles



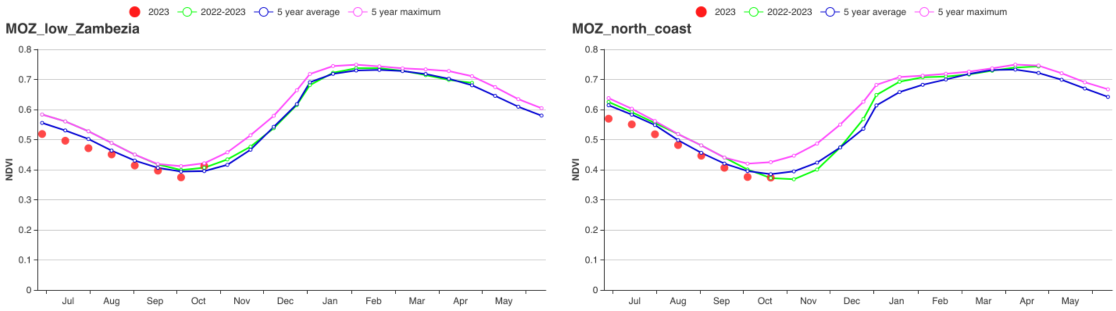
(f) National time-series rainfall profiles



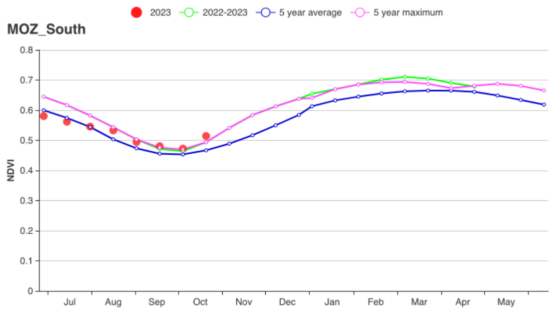
(g) National time-series temperature profiles



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



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



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

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

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Buzi basin	128	88	20,4	0,7	1142	-7	570	19
Northern high-altitude areas	25	-42	22,5	0,8	1212	1	433	-5
Low Zambezia River basin	108	68	22,8	0,5	1153	-4	573	14
Northern coast	73	-1	23,6	0,7	1155	-2	545	1
Southern region	149	59	21,6	0,0	994	-6	622	18

Table 3.58 Mozambique's agronomic indicators by sub-national regions, current season's values, and departure from 15YA, July - October 2023

Region	Cropped arable land fraction		Cropping Intensity		Maximum VCI
	Current (%)	Departure (%)	Current (%)	Departure from 5YA (%)	Current
Buzi basin	93	-3	103	-1	0,69
Northern high-altitude areas	85	3	114	5	0,82
Low Zambezia River basin	70	-4	107	3	0,73
Northern coast	96	-2	103	1	0,77
Southern region	95	3	104	0	0,80

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

[MUS] Mauritius

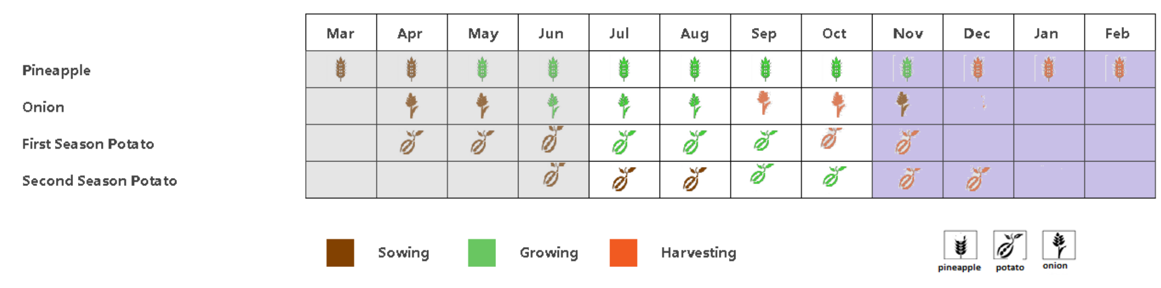
From July to October 2023, onion and potato plantations were in active growth and maturation stages in Mauritius. By the end October 2023, harvest of the two crops neared completion. In the case of pineapple harvest of mature fruits was ongoing together with new plantations started, as per land availability. Moreover, in some regions of the island, the sowing of onion March started.

In general, the overall crop conditions during the period in Mauritius were slightly above average, based on agro-climatic and agronomic indicators recorded for the quarter. Actually, the rainfall and temperature figures recorded during the past four months did not exactly reflect the usual pattern for the season. Hence, even if the mean of 121 mm rainfall received during July 2023 was within the normal range for the Winter season in Mauritius, August 2023 on its side was by far wetter than the long term mean, with 130% rain received during that specific month. However, September and October 2023 were drier than the norm with only 56% and 74% rainfall received respectively, compared to the long term average. The bulletin of the Mauritius Meteorological Services for the month of August 2023 mentions that it was equally a very warm month. Consequently, on the whole, the fourth quarter of 2023 recorded a high departure of +34% in rainfall in comparison to average figures for the last 15 years and it was even warmer by 1.2oC. The amount of sunshine received was equally higher with a mean RADPAR (+7%).

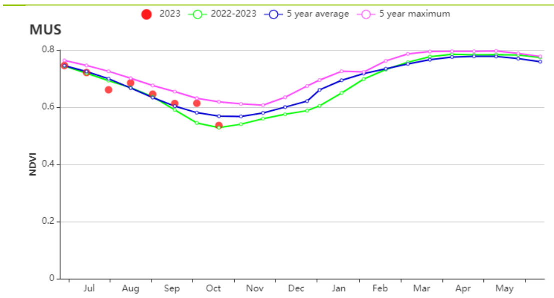
The humid August month promoted onion and potato growth and development, while the warm and dry days during September and October were highly favorable for potato. At the same time the latter helped the NDVI reach the season`s average. This is illustrated in the Crop condition classification table where up to 90% crops benefitted from favourable conditions for crop growth.nd onion harvests. The 100% CALF and maximum VCI of 0.92 were equally conducive for crop production and a promising yield. Cropping intensity was below average (-4%).

In conclusion, it can be said that although agro climatic indicators during period under review deviated slightly from the norm, the anomaly was actually favorable to an improved quality of potato, onion, and pineapple produced during the season. Prospects for crop production during the next quarter of the year will depend on amount of rainfall received in November 2023 and the status of pests and diseases at the field level.

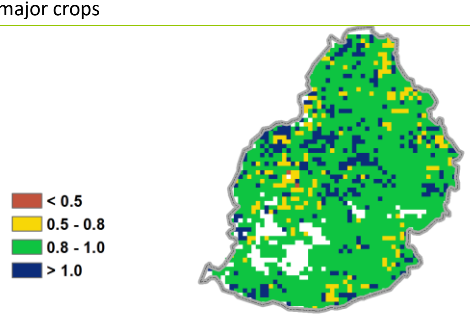
Figure 3.35 Mauritius's crop condition, July - October 2023



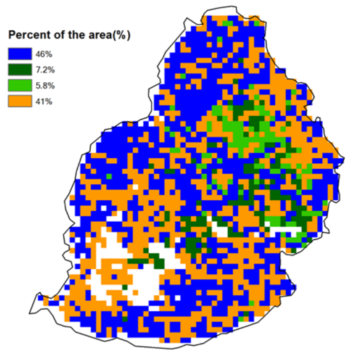
(a) Phenology of major crops

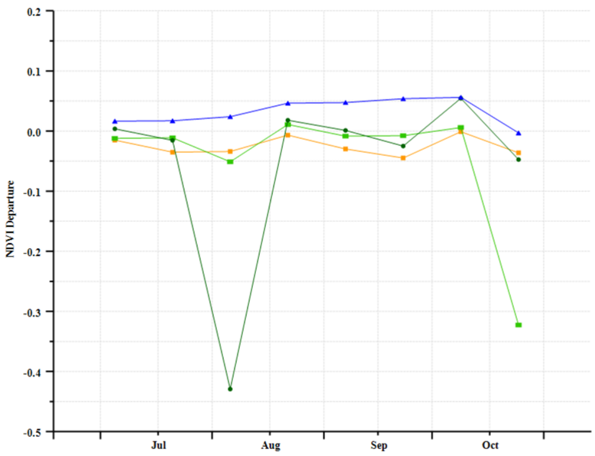


(b) Crop condition development graph based on NDVI



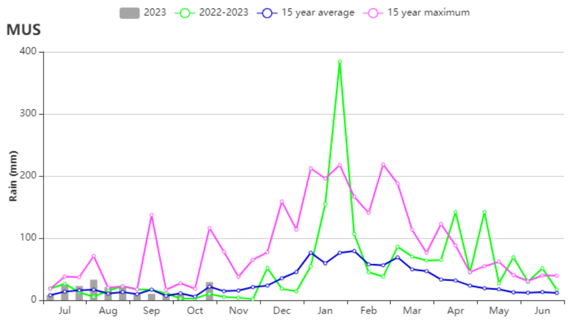
(c) Maximum VCI

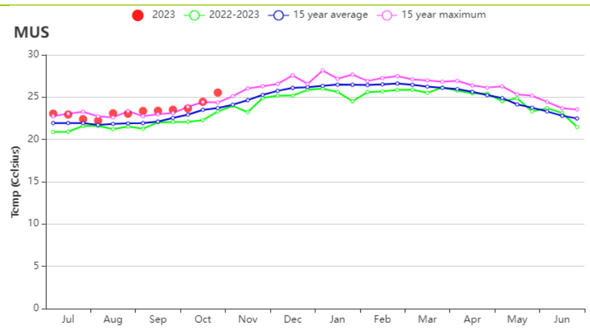




(d) Spatial NDVI patterns compared to 5YA

(e) NDVI profiles





(f) Rainfall profiles

(g) Temperature profiles

Table 3.59 Mauritius's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, July-October 2023

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Mauritius	203	34	23.4	1.2	1184	7	848	17

Table 3.60 Mauritius's agronomic indicators by sub-national regions, current season's values and departure from 5YA, July - October 2023

Region	Cropped arable land fraction		Cropping Intensity		Maximum VCI
	Current (%)	Departure (%)	Current (%)	Departure from 5YA (%)	Current
Mauritius	100	1	114	-4	0.92

[NGA] Nigeria

This report covers the rainy season, and thus the main period for crop production. The major crops being produced are: maize, rice, millet and sorghum.

The rain was usually higher in the southern parts of Nigeria than in the northern parts. There was late commencement of planting generally due to the fluctuations in the beginning of rainfall in the country. According to the forecast of the Nigerian Meteorological Agency (NiMet), the onset of rainfall in central states was expected to take place between April and May, while in the northern states, it was expected to start between June and July. The planting season was predicted to be normal in most parts of the country, with a few areas beginning earlier or later. The growing season in southern parts of the country was expected to last between 250 and 300 days, and 100 to 200 days in the North. However, areas around Kwara, Oyo, Lagos, Nasarawa, Benue, Bayelsa, and Rivers States had a shorter-than-normal growing season. While prolonged growing seasons were experienced in parts of Plateau, Kaduna, Edo, and Imo States.

Overall, rainfall was below average (RAIN -28%), but solar radiation (RADPAR +7%) and temperature (TEMP +1.5°C) were above the 15YA. The resulting biomass was estimated to be below average (BIOMSS -20%). Based on the NDVI development graph, crop conditions were slightly unfavorable as they fell below the 5-year average throughout the monitoring period, but they were near the 2022-2023 conditions in early July and late October 2023.

The NDVI departure clustering map, shows that 10.2% of cropland, sparsely distributed around the country, was always slightly below average from July to October. While 61.9% 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 average throughout the monitoring period. Another 7.6% of the total land area was below average almost throughout the reporting period except for early October, when it was slightly above average. A total of 13.6%, found mainly in the central part of the country and sparsely distributed in the southern regions, was near average throughout the monitoring period. The sharp drop in early August can be attributed to cloud cover in the satellite images.

At the national level, since it was the peak of the rainy season for all parts of the country, there was no departure for the cropped arable land (CALF 0%) from 5YA. Also, there was a favorable maximum VCI value of 0.91 and a Crop Production Index (CPI) of 1.19. Crop conditions were mixed. The lack of rainfall caused reduced crop growth in the northern Savannah regions. In the more humid southern regions, rainfall was sufficient to produce a good crop.

Regional Analysis

The analysis focuses on nine (9) agro-ecological zones, transiting from north to south. These are Sahel Savannah (152), Sudan Savannah (153), Guinea Savannah (147), Derived Savannah (145), Jos Plateau (148), Montane Forest (151), Lowland Rainforest (149), Freshwater Swamp Forest (146) and Mangrove Forest (150).

In the Sahel Savanah zone, the agroclimatic indicators showed that accumulated rainfall (RAIN -84%) was far below average due to the late onset of rain, whereas both temperature and radiation (TEMP +1.6°C, RADPAR +4%) were above average, resulting in a below-average biomass production (BIOMSS -38%). Also, CALF (-8%) was below average. VCIx was at 0.80. Cropping intensity was below average (-15%). The crop production index (CPI 1.01) indicate that crop conditions were normal. The NDVI development graph showed that crop conditions in the area were mostly below the 5-year average in almost all of the reporting period.

In the Sudan Savannah, the region adopted similar agricultural practices as the Sahel Savanah zone. The agro-climatic condition showed that accumulated rainfall (RAIN -64%) was below average, while temperature and radiation (TEMP +1.9°C, RADPAR +5%) were above average. There was a significant decrease in the potential biomass (BIOMSS -34%). CALF was average with 0% departure and the maximum VCI was 0.91. Cropping intensity was slightly below average (-1%). The NDVI development graph shows that the crop conditions were close to the 5-year average.

The Guinea Savannah zone also recorded below average rainfall (RAIN -45%), but above-average temperature and radiation (TEMP +1.8°C, RADPAR +9%), potential biomass also dropped (BIOMSS -19%). The CALF was at average with 0% departure. Cropping intensity was slightly below agerage(-1%) and the maximum VCI was 0.95, with a crop production index (CPI 1.02) 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 mid-August, mid-September and late October when they rose to the 5YA.

The Montane Forest which covers a very little portion in the central part of the country, recorded a rainfall of (RAIN -26%), temperature was at (TEMP +1.0°C), while radiation increased to (RADPAR +12%), and biomass dropped down to (BIOMSS -1%). The CALF was at average with 0% departure. Cropping intensity was below agerage(-6%) and the maximum VCI was 0.98. The NDVI development graph showed that crop conditions were mainly below the 5-year average throughout the reporting period except for early July and early September when they were near average. However, the crop condition was above the 5-year maximum in mid-July 2023.

The Jos Plateau, also located in the central region, recorded rainfall of (RAIN -53%), temperature and radiation were also above average (TEMP +1.7°C, RADPAR +9%), with the potential biomass was down to (BIOMSS -19%). The CALF was 0% and the maximum VCI was 0.92. Cropping intensity was slightly below average (-1%). The NDVI development graph showed that the crop conditions were all below the 5-year average except in mid-August when the value was above both the 5-year average and 5-year maximum with a recorded crop production index of (CPI 1.00) slightly above normal.

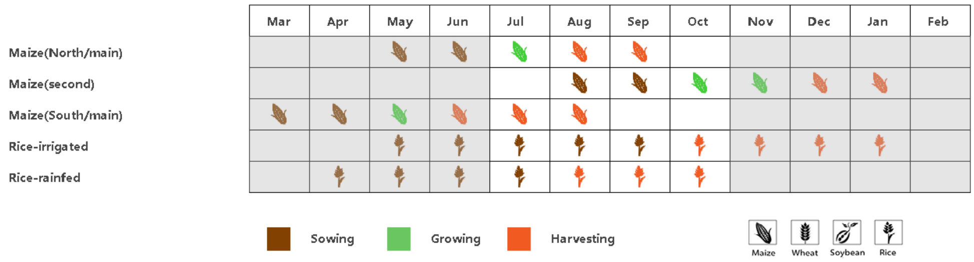
The Derived Savanah region recorded below average rainfall (RAIN -7%), warmer temperatures (TEMP +1.0°C) and above average solar radiation (RADPAR +9%). Potential biomass was below average (BIOMSS -7%). CALF was 0%, and the maximum VCI was at 0.93. Cropping intensity was below average (-3%), and the crop production index (CPI 0.98) was above normal. The NDVI development graph showed that crop conditions were variable and mostly below the 5-year average throughout the period.

The Lowland Rain Forest recorded an increase in rainfall (RAIN +8%), and warmer temperatures (TEMP +0.7°C). The radiation was above average (RADPAR +5%) and the biomass was also below average (BIOMSS -2%). The CALF was at 0% as there was no significant departure and the maximum VCI was 0.92. Cropping intensity was below average (-12%). The crop production index (CPI 0.98) was below normal and the crop condition, according to the NDVI development graph, was also typically unstable and below the 5-year average throughout the period.

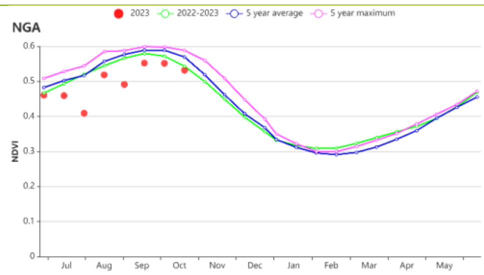
The Fresh Water Swamp Forest is located in the southern region of the country and does not cover a large area. Rainfall in this area was at (RAIN 0%) temperature was (TEMP +0.5°C), while radiation fell to -1%, and biomass dropped to (BIOMSS -2%). The CALF was above average by +1% and the maximum VCI was 0.90. Cropping intensity was below average (-5%). The crop condition in this area was also irregular and below the 5-year average.

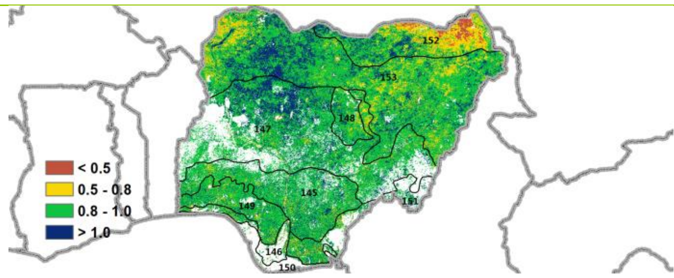
The Mangrove Forest located in the southern-most part of the country recorded below average rainfall (RAIN -1%), above average temperature (TEMP +0.4°C) and radiation fell below average (RADPAR -2%) and a slightly below average potential biomass production of (BIOMSS -2%), with CALF above average at +3% and a maximum VCI of 0.87. Cropping intensity was slightly below average (-1%). Also, the NDVI development graph showed irregular crop conditions which were mainly below the 5-year average throughout the reporting period except for early July when it was on average.

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



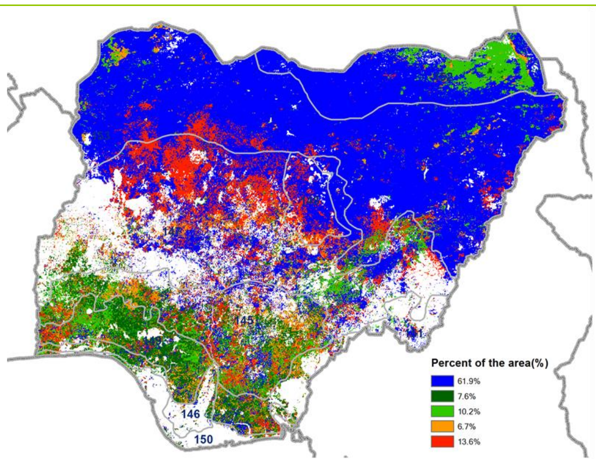
(a) Phenology of major crops

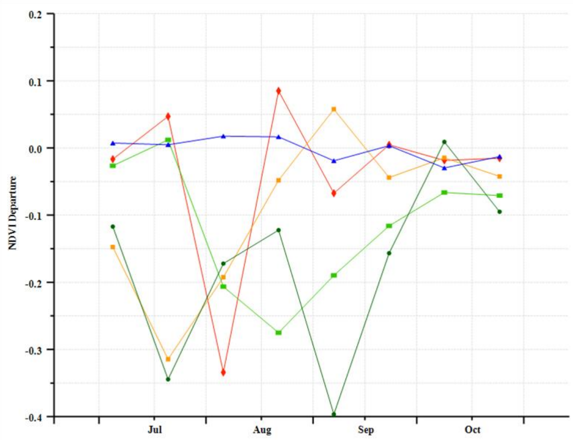




(b) Crop condition development graph based on NDVI

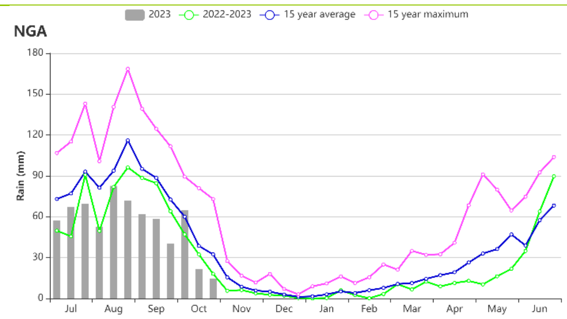
(c) Maximum VCI

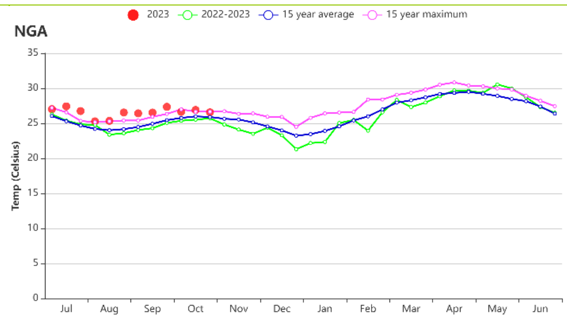




(d) Spatial NDVI patterns compared to 5YA

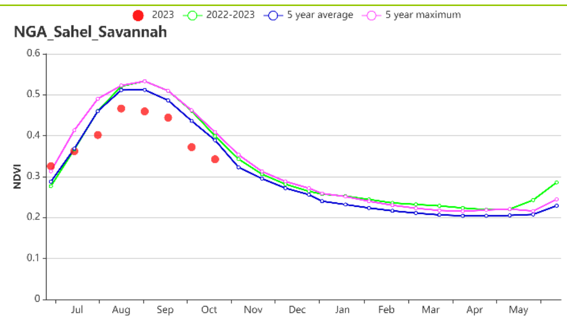
(e) NDVI profiles

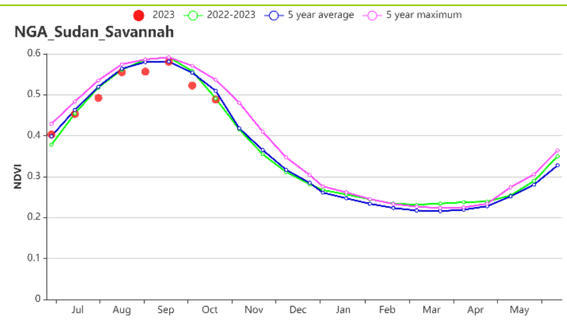




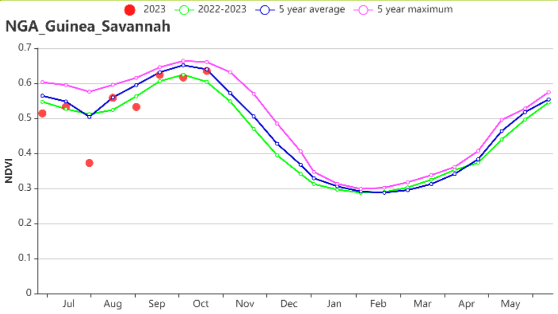
(f) Rainfall profiles

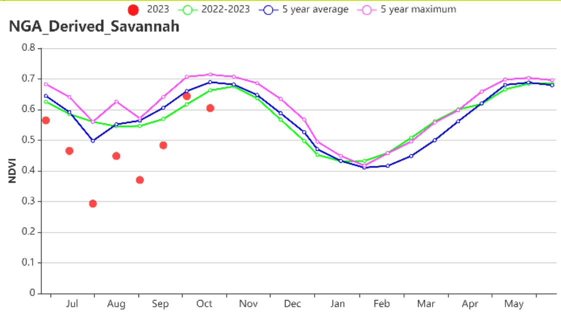
(g) Temperature profiles



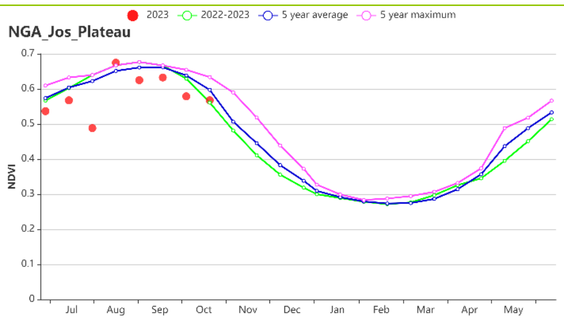


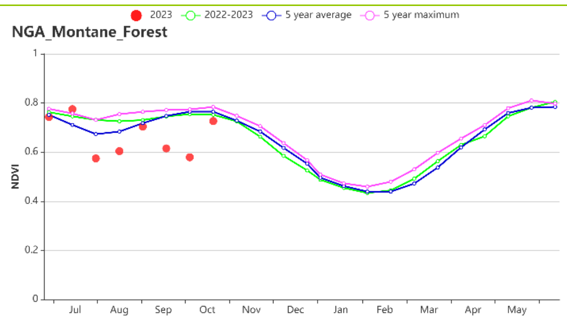
(h) Crop condition development graph based on NDVI(Left:Sahel savannah, Right:Sudan Savannah)



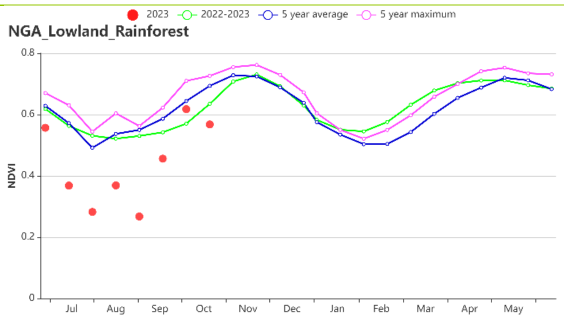


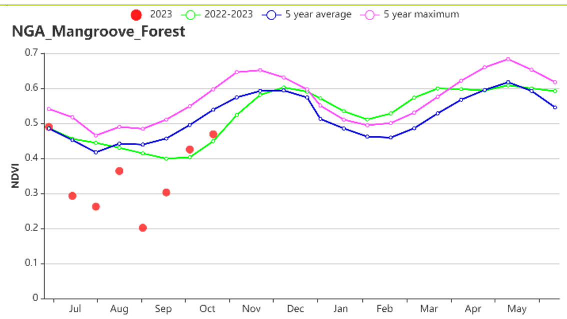
(i) Crop condition development graph based on NDVI(Left:Guinea savannah, Right:Derived Savannah)



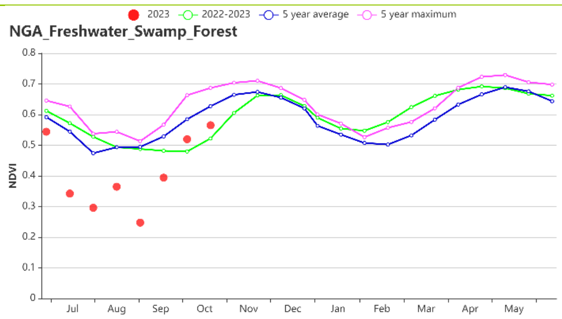


(j) Crop condition development graph based on NDVI(Left:Jos Plateau, Right:Mountain Forest)





(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 3.61 Nigeria's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, July - October 2023

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Derived savannah	949	-7	25.4	1.0	1116	9	1327	-7
Freshwater Swamp Forest	1529	0	24.9	0.5	952	-1	1483	-2
Guinea Savannah	446	-45	26.5	1.8	1229	9	1062	-19
Jos Plateau	505	-53	24.0	1.7	1266	9	1094	-19
Lowland Rainforest	1589	8	24.7	0.7	1005	5	1464	-2
Mangroove Forest	1949	-1	24.8	0.4	952	-2	1494	-2
Montane Forest	1179	-26	22.1	1.0	1223	12	1348	-1
Sahel Savannah	61	-84	30.3	1.6	1233	4	562	-38
Sudan Savannah	227	-64	28.1	1.9	1239	5	746	-34

Table 3.62 Nigeria's agronomic indicators by sub-national regions, current season's values and departure from 5YA , July - October 2023

Region	Cropped arable land fraction		Cropping Intensity		Maximum VCI
	Current (%)	Departure (%)	Current (%)	Departure (%)	Current
Derived Savannah	99	0	145	-3	0.93
Freshwater Swamp Forest	97	1	166	-5	0.90
Guinea Savannah	99	0	117	-1	0.95
Jos Plateau	100	0	106	-1	0.92
Lowland Rainforest	99	0	164	-12	0.92
Mangroove Forest	91	3	165	-1	0.87
Montane Forest	100	0	113	-6	0.98
Sahel Savannah	71	-8	102	-15	0.80
Sudan Savannah	93	0	101	-1	0.91

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

[PAK] Pakistan

The reporting period covers the production period for the main crops, maize and rice, which were harvested in October. Additionally, sowing of winter barley and wheat started in October. The agroclimatic and agronomic indicators suggest rather unfavorable crop conditions between July and October.

RAIN was slightly below average (-3%), while TEMP(+0.6℃) was higher than average and RADPAR（-1%) was lower. This resulted in a slight increase in estimated BIOMSS (+5%). Heavy monsoon rains in late July caused flooding conditions in many areas, mainly in the provinces of Punjab, Sindh, and along the Lower Indus River. However, in the Northern highland region, the rainfall deficit that started in August resulted in drought conditions. The fraction of cropped arable land (CALF) decreased by 2% compared to the previous five years average.

As shown by the nationwide NDVI development graph, crop conditions were below average since late August, then reached average levels in October. Further, the spatial NDVI patterns and profiles indicate that 10.1% of the cropped areas presented continuously below-average conditions during the reporting period, mostly distributed in southern Punjab and along the Lower Indus River. About 50.8% of cropland, distributed in three main production areas, presented below-average conditions in August. The floods had a serious impact on crop growth in Sindh and parts of Punjab, and the drought also impacted on crop growth in Northern Highland, both of which had a maximum VCI lower than 0.5. At the annual scale, even though cropping intensity increased by 4%, the cropped arable land fraction was lower than the average by 2%. All in all, crop production estimates for the summer crops are below average.

Regional analysis

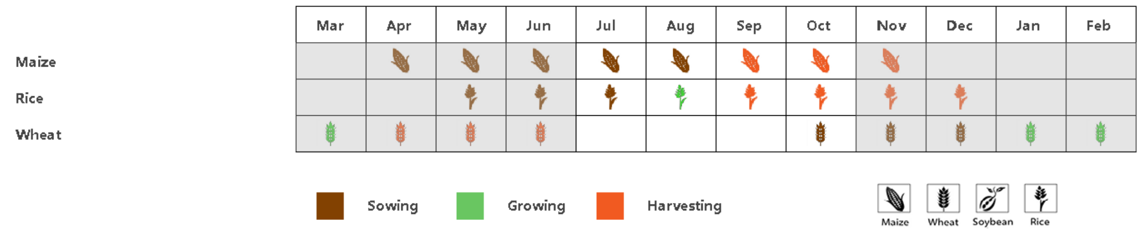
For a more detailed spatial analysis, CropWatch subdivides Pakistan into three agro-ecological regions based essentially on geography and agro-climatic conditions: the Lower Indus river basin(150), the Northern highlands(151), and the Northern Punjab(152) region.

Compared to average, RAIN recorded above-average values (+75%), and both TEMP(-0.4℃) and RADPAR（-3%）were below average in the **Lower Indus River basin**(150). The estimated BIOMSS was 12% above average. NDVI dropped to below average in early August but later recovered to average in October. Since August, the crop conditions were consistently below average, mainly due to heavy rainfall and floods, located in northern Sindh and along the Lower Indus basin. The CALF value of 60% was less than the average by 2% and the VCIx was 0.75. Overall, summer crop production is expected to be below average.

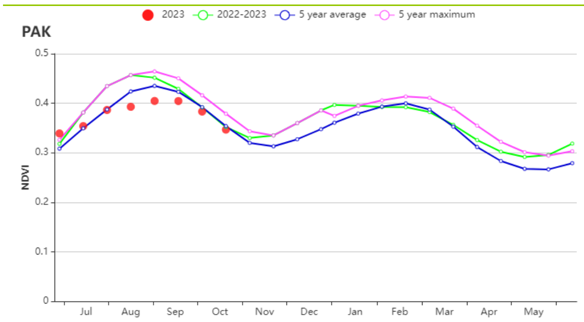
In the **Northern highland**(151) region, RAIN decreased by 37%, while TEMP was above average by 1.3℃. BIOMSS decreased by 6%. The region showed a low CALF of 59%, which was less than the 5YA by 3%. The NDVI profile stayed above average during early July and early August, but it declined to below average until October due to less rainfall and high temperature. The VCIx was 0.77. In short, the situation for the region is assessed as below average.

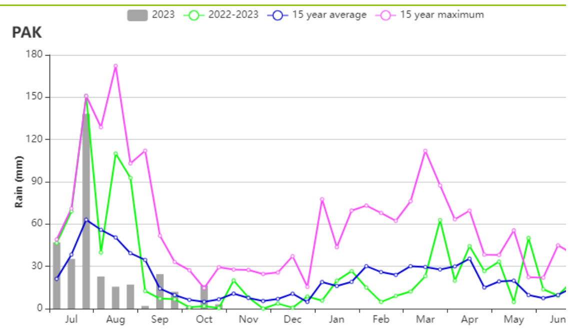
In the **Northern Punjab**(152) region, which is the main agricultural region of Pakistan, RAIN increased by 42%. Both TEMP(-0.8℃) and RADPAR(-2%) were below average. The resulting BIOMSS was above average by 18%. The NDVI profile presented below average conditions during late July and early September due to abundant monsoon rains. Subsequently, the crop conditions were close to the average. In addition, CALF in this area was 80% and down by 2% compared to the 5YA, but cropping intensity increased by 6%, indicating that the total cultivated crop area was at an above-average level. Overall, the summer crop production potential for the region is assessed as average.

Figure 3.37 Pakistan's crop condition, July-October 2023



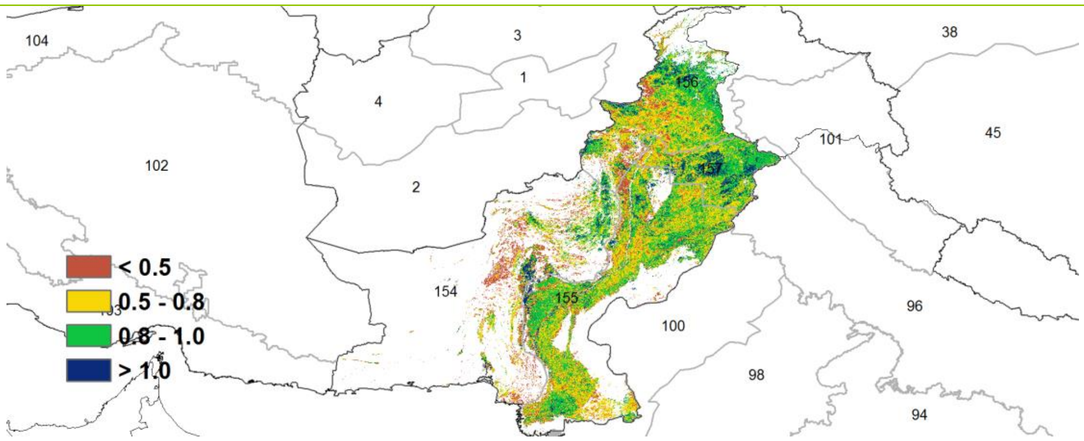
(a). Phenology of major crops



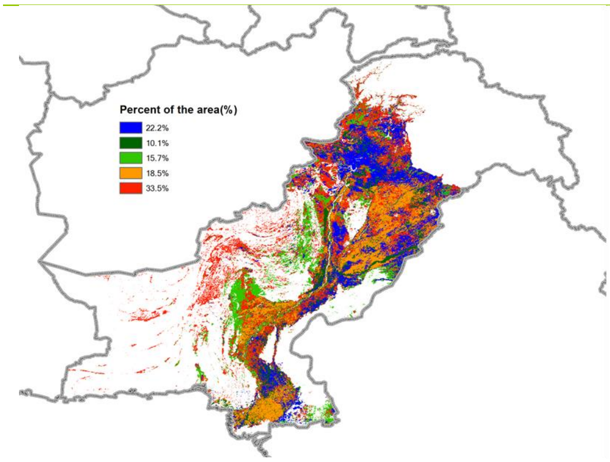


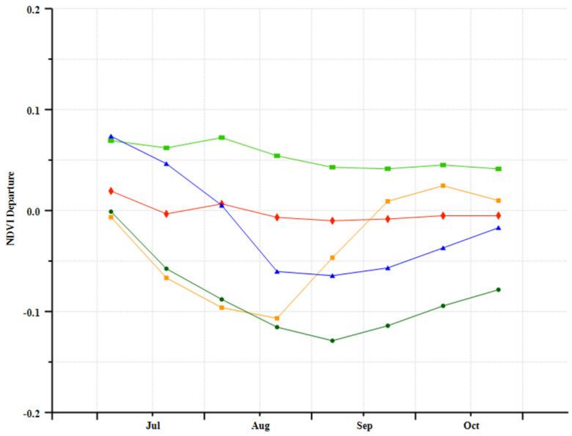
(b) Crop condition development graph based on NDVI

(c) Time series precipitation profile



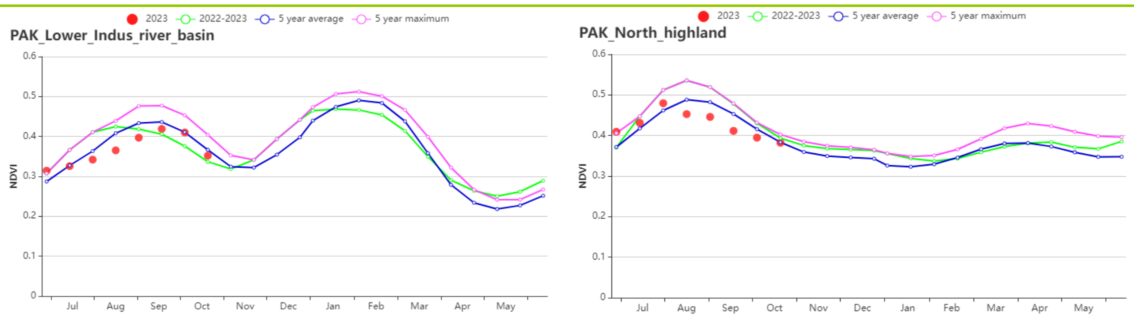
(d) Maximum VCI



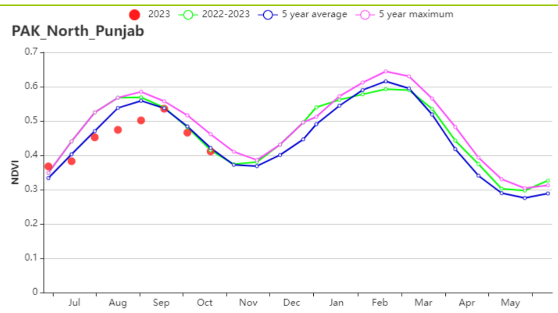


(e) Spatial NDVI patterns compared to 5YA

(f) NDVI profiles



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



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

Table 3.63 Pakistan's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, July - October 2023

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (℃)	Departure (℃)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Lower Indus river basin	387	75	32.2	-0.4	1272	-3	790	12
Northern highland	238	-37	22.7	1.3	1367	0	698	-6
Northern Punjab	561	42	29.9	-0.8	1239	-2	1025	18

Table 3.64 Pakistan's agronomic indicators by sub-national regions, current season's values and departure from 5YA, July - October 2023

Region	Cropped arable land fraction		Cropping Intensity		Maximum VCI
	Current (%)	Departure (%)	Current (%)	Departure (%)	Current
Lower Indus river basin	60	-2	153	5	0.75
Northern highland	59	-3	130	1	0.77
Northern Punjab	80	-2	176	6	0.83

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

[PHL] Philippines

The main season maize in the Philippines are harvested in September, together with the gradual harvest of the main season rice. Subsequently, the second season rice and second season maize are planted. During the monitoring period, there was a slight 3% (RAIN) increase in precipitation in the Philippines, and the average temperature rose by approximately 0.3°C (TEMP), while radiation decreased by about 2% (RADPAR). Continuous overcast weather resulted in a potential biomass decrease of around 2% (BIOMASS). Excessive precipitation in mid to late July and continuous overcast conditions caused cloud cover in the satellite images, which explains the sharp decline in NDVI. However, crop conditions appear unaffected and remained stable. The Philippines' VCIx reached as high as 0.95, with the CALF was close to 100%. The crop production index was 0.99 (CPI), and the cropping index was 137% (CI). Considering both the agro-climatic and agronomic indicators in the Philippines, it is estimated that the overall crop conditions were normal.

Regional analysis

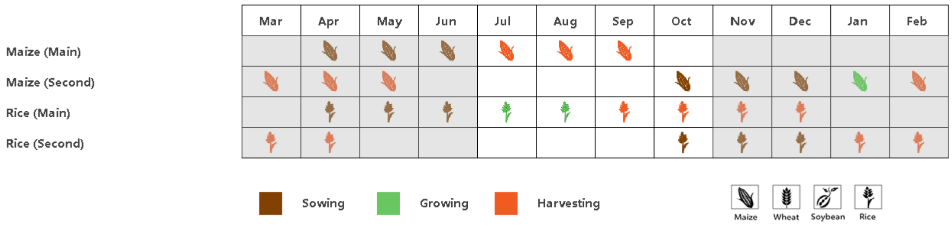
Based on the cropping systems, climatic zones and topographic conditions, three main agro-ecological regions can be distinguished for the Philippines. They are the Forest region (mostly southern and western islands), the Hilly region (Island of Bohol, Sebu and Negros), and the Lowlands region (northern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

In the Forest region (agro-ecological zone 153), there was an 8% (RAIN) increase in precipitation, a rise of about 0.3°C (TEMP) in average temperature, and a decrease of around 4% (RADPAR) in radiation, with potential biomass (BIOMASS) approaching normal levels. Consistent with the national level NDVI trend, the crop NDVI in this region experienced a decline in mid to late July, subsequently remaining slightly below average. By the end of the monitoring period, the crop NDVI had recovered to average levels. However, the lower NDVI was primarily due to interference from continuous overcast conditions on satellite imagery. The VCIx in this region reached as high as 0.95, with the CALF was close to 100%. The Crop Production Index is 1.00 (CPI), and the Cropping Index slightly increased by 1% (CI). The overall crop conditions were normal in this region.

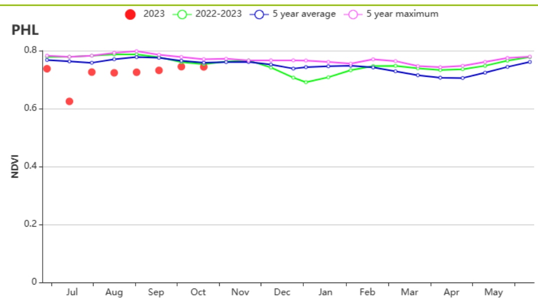
In the Hilly region (agro-ecological zone 154), there was an 11% (RAIN) increase in precipitation, a slight decrease of 0.1°C (TEMP) in average temperature, and a 3% (RADPAR) reduction in radiation. The lower temperatures and reduced sunlight contributed to a decrease of approximately 2% (BIOMASS) in potential biomass, indicating slightly unfavorable weather conditions for crop growth in this region. The crop NDVI fluctuated significantly due to the influence of precipitation and cloud cover, with the most notable decline occurring in mid to late July. The VCIx in this region reached as high as 0.97, with the Crop Production Index at 1.00 (CPI), and the Cropping Index slightly decreasing by 1% (CI). The overall crop conditions were normal in this region.

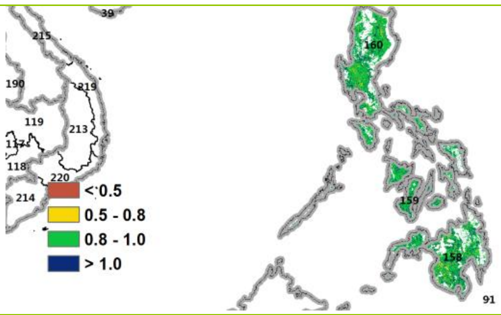
In the Lowlands region (agro-ecological zone 155), there was a 2% (RAIN) decrease in precipitation, with radiation (RADPAR) maintaining normal levels and an average temperature higher by approximately 0.3°C (TEMP). The lower precipitation resulted in a potential biomass decrease of about 1% (BIOMASS) compared to the average. The growth trend of NDVI in this region indicates that the elevated precipitation seemed to have had an adverse impact on the crop's NDVI, keeping it consistently below average. Although the impact of precipitation was temporary, with the crop NDVI quickly recovering to slightly below average levels, the significantly elevated precipitation in mid to late July was unfavorable for the harvest of main season maize. The VCIx in this region was as high as 0.95, with the Crop Production Index at 0.99 (CPI), and the Cropping Index was slightly lower by 3% (CI). It is estimated that the production of main season rice in this region was normal.

Figure 3.38 Philippines' crop condition, July – October 2023



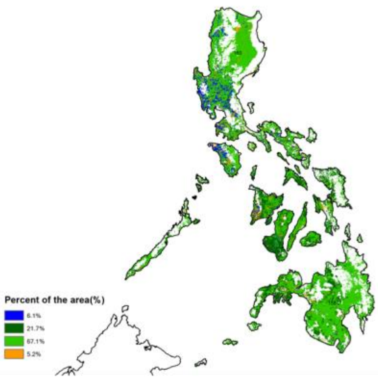
(a) Phenology of major crops

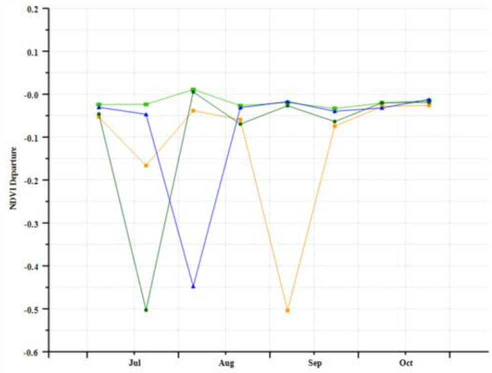




(b) Crop condition development graph based on NDVI

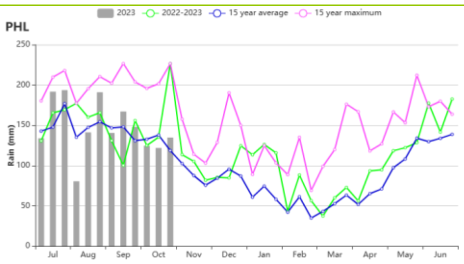
(c) Maximum VCI

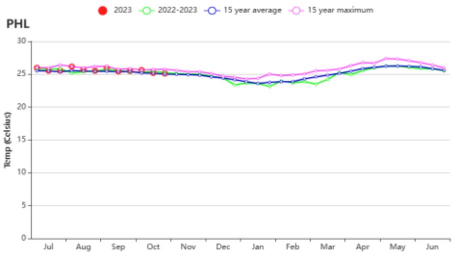




(d) Spatial NDVI patterns compared to 5YA

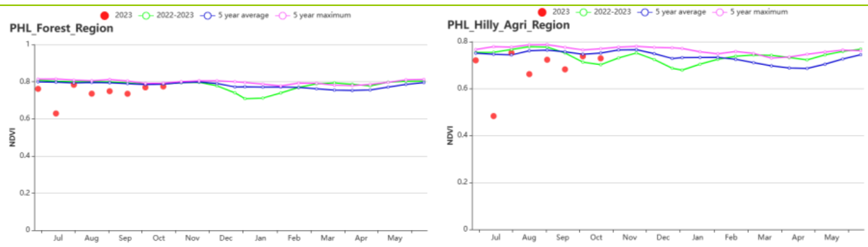
(e) NDVI profiles



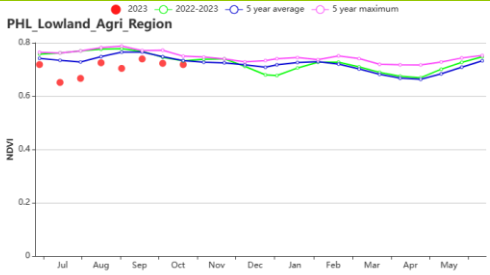


(f) Rainfall profiles

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

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Forest region	1620	8	25.5	0.3	1186	-4	1528	0
Hilly region	1912	11	26.6	-0.1	1223	-3	1589	-2
Lowlands region	1894	-2	25.6	0.3	1178	0	1558	-1

Table 3.66 Philippines' agronomic indicators by sub-national regions, current season's values and departure from 5YA, July - October 2023

Region	Cropped arable land fraction		Cropping Intensity		Maximum VCI
	Current (%)	Departure (%)	Current(%)	Departure(%)	Current
Forest region	100	0	127	1	0.95
Hilly region	100	0	137	-1	0.97
Lowlands region	100	0	147	-3	0.95

[POL] Poland

The monitoring period covers the harvest of spring and winter wheat in July and August, as well as the main growth period of maize and its harvest in September and October. The planting of the new winter crops started in September. During this monitoring period, the rainy conditions in late July and August were not conducive to the harvesting of winter cereals, while the warm and dry weather in September favored crop harvesting as well as planting for the next season. Compared with the average of the last 15 years, precipitation at the national scale was 4% lower, temperature and photosynthetic effective radiation were higher by 1.7℃ and 1%, respectively, and the potential biomass was close to the average. Furthermore, CALF was up to 100% and VCIx was 0.82. CI was 138%, 1% higher than the average of the last 5 years. CPI was 0.95, indicating that crop conditions were slightly below the average of the last 5 years.

Based on the NDVI development curve, crop growth was already below average in the previous monitoring period. It recovered to close average levels thanks to abundant rainfall in August and dropped slightly below the average in October. However, average to above-average rainfall in October created favorable conditions for the sowing of the winter cereals, while conditions for the sowing of canola were on the dry side in September. The distribution map of VCIx shows that VCIx in the central region are mainly between 0.5 and 0.8, while the western and the southeastern regions were mainly above 0.8, which is related to the fact that the central and the northern regions had suffered from more severe water shortages in the previous monitoring period. This is also reflected in the NDVI profiles clustering map, which shows that up to 47.5% of the country's cultivated land (labeled "light green," "dark green," and "blue") crop growth was below average throughout the entire monitoring period in almost all areas, but mainly in the central and northern parts of the country. Another 16.3% of cultivated areas (labeled "red") were significantly above average after August and remained slightly above average until the end of the monitoring period, mainly in the west and in parts of the southeast. The remaining 36.2% of cultivated land (labeled "orange") showed a slow increase in crop growth from the average level in July to above average in October, mainly in the southern region.

Overall, crop growth in Poland was slightly below average, with lower crop yields in most areas, except in the south. Conditions for the sowing of winter wheat were favorable.

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.

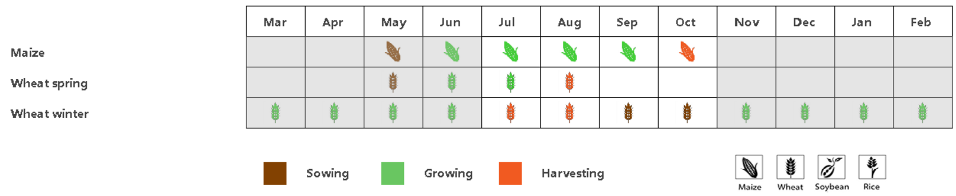
Compared to the average of the last 15 years, precipitation in the **Northern oats and potatoes area** was 6% lower, temperature was 1.5℃ higher, RADPAR was 1% higher, leading to a lower BIOMSS (ΔBIOMSS, -3%). CALF was 100% and VCIx was 0.83. Crop growth was below average until mid-August, when it started to reach close to average levels. Excessive precipitation in August was not conducive to the harvesting of winter crops. But dry and warm weather in September favored the harvesting of summer crops and planting for the next season. Overall, it appears that cereal production can be expected to be lower than the average of the last five years. In addition, the CI for the year was 130%, close to the average. CPI was 0.94.

In the **Northern-central wheat and sugar-beet area**, rainfall was close to average, temperatures were 1.5℃ higher, RADPAR was 1% higher, resulting in a 2% higher BIOMSS. The percentage of cultivated land was 100% and VCIx was 0.78. The NDVI development graph reflects the high temperatures and low precipitation in June and July. It subsequently recovered with the recharge of sufficient precipitation in August and reached close to average levels in early September, and then declined to slightly below average levels thereafter. CI of this sub-district was 121%, 8% lower than the average, and the annual crop planting was lower than in previous years. CPI was 0.90.

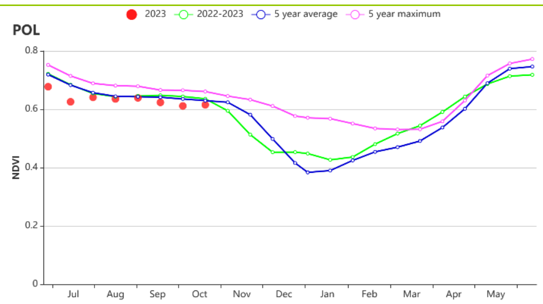
Compared with the average of the last 15 years, in the **Central rye and potatoes area**, precipitation was 7% lower, temperature was 1.8°C higher, RADPAR was 1% higher. This led to a 1% lower BIOMSS. CALF was 100% and VCIx was 0.80. The crop growth in the zone was similar to the Northern-central area. It was close to average only in late August and early September, but below average thereafter. Overall, the crop growth and the crop yield were below the average. CI of this sub-district was 137%, which was slightly higher by 1% compared to the average. CPI was 0.94.

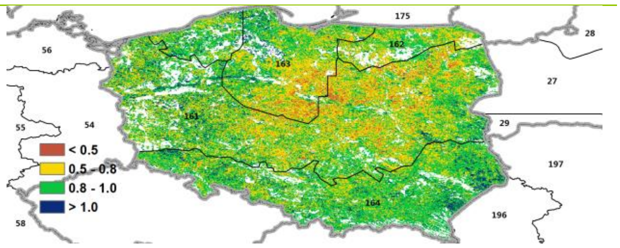
In the **Southern wheat and sugar-beet area**, precipitation was 7% lower, temperature was 1.8°C higher, RADPAR was 2% higher, resulting in a 1% higher BIOMSS as compared to the 15YA. CALF was 100% and VCIx was 0.88. Benefiting from sufficient water and favorable temperatures in the previous monitoring period, crop growth in the current monitoring period was close to average, and by the end of the monitoring period, crop growth was above average. Overall, the crop growth was normal. CI of this sub-district was 151%, which was 6% higher than the average. CPI was 1.01.

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



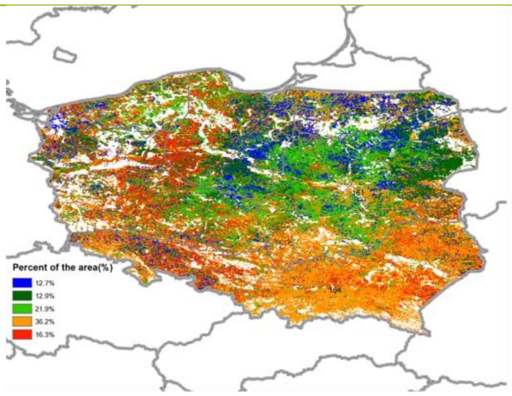
(a). Phenology of major crops

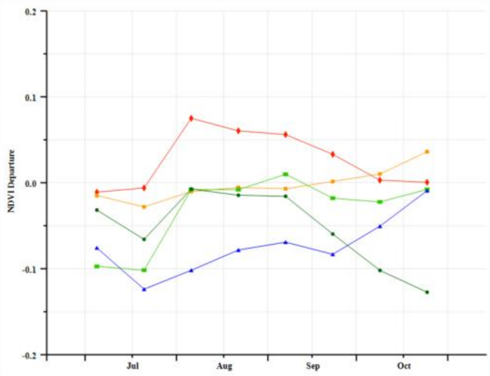




(b) Crop condition development graph based on NDVI

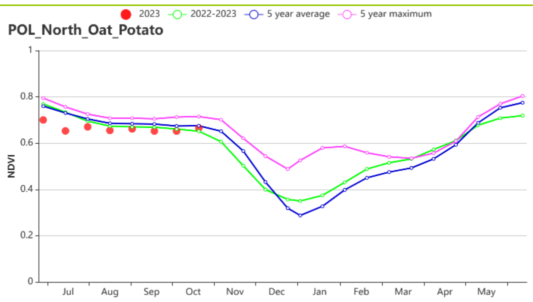
(c) Maximum VCI

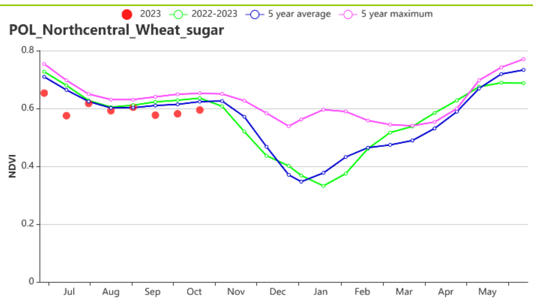




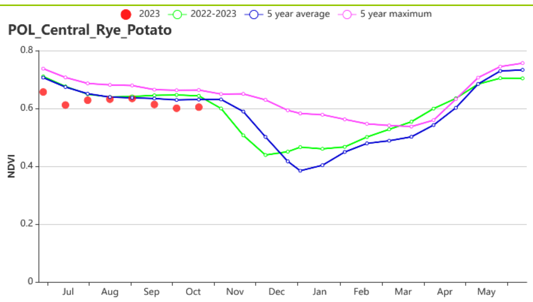
(d) Spatial NDVI patterns compared to 5YA

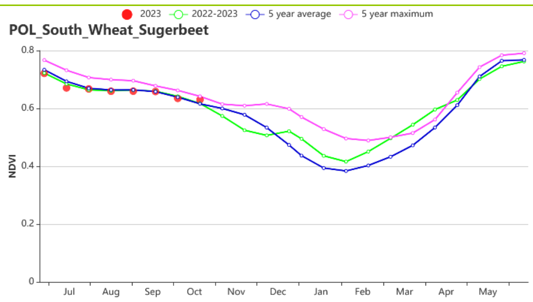
(e) NDVI profiles



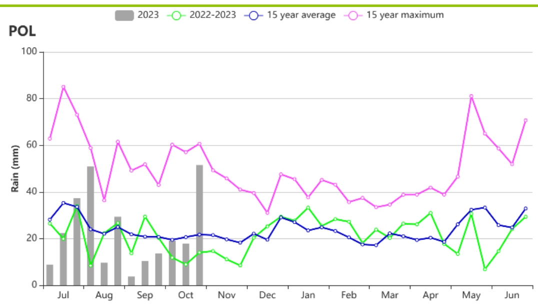


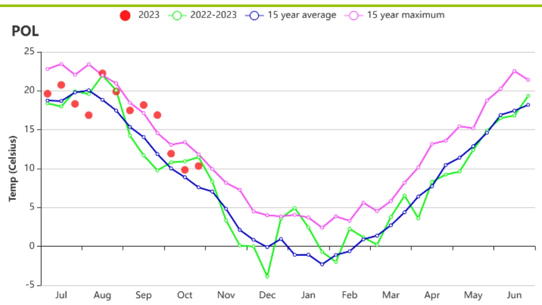
(f) Crop condition development graph based on NDVI, Northern oats and potatoes area (left) and Northern-central wheat and sugar beet area (right).





(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 3.67 Poland's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, July - October 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	294	-6	16.2	1.5	807	1	741	-3

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Northern-central wheat and sugarbeet area	284	0	16.7	1.6	829	1	742	2
Central rye and potatoes area	260	-7	17.3	1.8	851	1	716	-1
Southern wheat and sugarbeet area	282	-7	16.6	1.8	917	2	756	1

Table 3.68 **Poland's agronomic indicators by sub-national regions, current season's values and departure from 5YA, July - October 2023**

Region	Cropped arable land fraction		Cropping Intensity		Maximum VCI
	Current (%)	Departure (%)	Current (%)	Departure (%)	Current
Northern oats and potatoes areas	100	0	130	0	0.83
Northern-central wheat and sugarbeet area	100	0	121	-8	0.78
Central rye and potatoes area	100	0	137	1	0.80
Southern wheat and sugarbeet area	100	0	151	6	0.88

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

[ROU] Romania

The reporting period includes the harvest of wheat (which started in July), the sowing of the 2023-24 winter wheat (which started in September) and also the harvest of maize and other summer crops in September. Overall, crop conditions were not good. Rainfall was below the 15YA by 41%, TEMP was above average by 2.5℃, whereas RADPAR was a bit higher than average (ΔRADPAR +5%) and BIOMSS was below average (Δ BIOMSS -12%). The nationwide NDVI profile shows that crop conditions were lower than average during the whole reporting period. Compared with the same period of last year, the crop conditions were better in July and early August only. The temperature fluctuated around above-average levels, and rainfall was below average nearly throughout the whole reporting period. It seems that Romania experienced a more intense drought than last year. Mainly the southeast suffered from unfavorable crop conditions. The CALF of Romania during the reporting period was 94%, 4% lower than average, and the maximum VCI was 0.75, which was relatively low. The cropping intensity was 125 and 3% higher than average. According to the spatial distribution of VCIx, the southeast regions have lower values (<0.5), indicating a very bad situation for crops. The NDVI pattern profile shows that nearly all regions experienced a sharp decrease in September and October. Hence, production prospects for this important region of Romania are unfavorable. The CPI of Romania's Eastern and Southern Maize, Wheat and Sugar Beet Plains was only 0.77, the lowest among all three subregions.

Regional analysis

More spatial detail is 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).

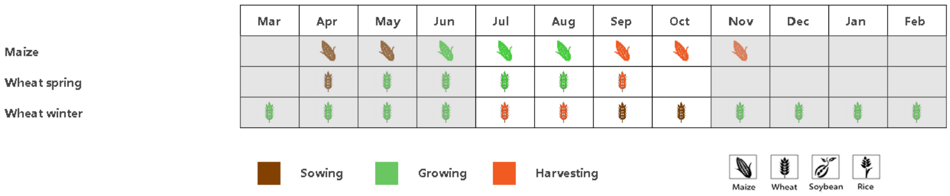
For the Central mixed farming and pasture Carpathian hills, rainfall decreased by as much as 41% below average while temperature increased by 2.6℃ and radiation increased by 6%, and BIOMSS decreased by 14%. The maximum VCI map shows values above 0.8, with the regional average at 0.88. The NDVI spatial distribution shows that NDVI was below average only in October. As this AEZ occupies only a small fraction of cropland in Romania, a small patch of irrigated land in Transylvania, its fair NDVI cannot represent much of Romania's crop production. The cropping intensity is 135, 18% higher than average.

For the Eastern and Southern maize, wheat and sugar beet plains, rainfall decreased by 53%, temperature increased by 3.0℃, radiation increased by 4% and biomass decreased by 16%. Summer heat and a rainfall deficit induced drought in this region. The NDVI development graph shows that crop conditions were largely lower than average, and also worse than during last year's drought conditions. VCIx value of this region was only 0.70 and according to the distribution map, VCIx values were below 0.5 in some of the central and middle region (counties of Tulcea and Constanta), representing about 14.3% of national cropland. The cropping intensity was 121, 1% lower than the five-year average.

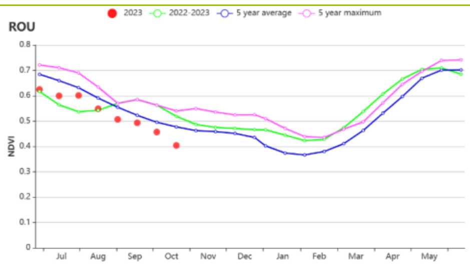
For the Western and central maize, wheat and sugar beet plateau, rainfall was lower than average by 24%, temperature was average (ΔTEMP +1.9℃) and radiation was a bit higher (ΔRADPAR +5%), and biomass decreased by 3%, the smallest in all three sub regions. Spatial NDVI profiles show that crop condition was worse than average during August to October, covering the last growing period of maize. Maximum VCI of this region was 0.82. The VCI spatial distribution was between 0.5 and 1.0. The cropping intensity was 131, 9% higher than average.

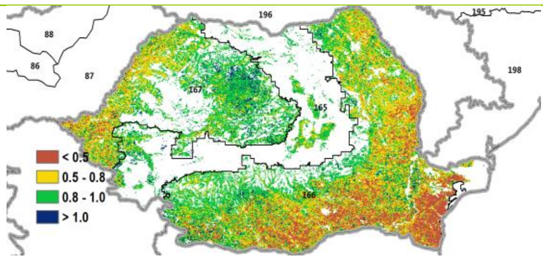
Overall, the widespread lack of rainfall and summer heat had a negative impact on crop conditions, and the production prospects were unfavorable.

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



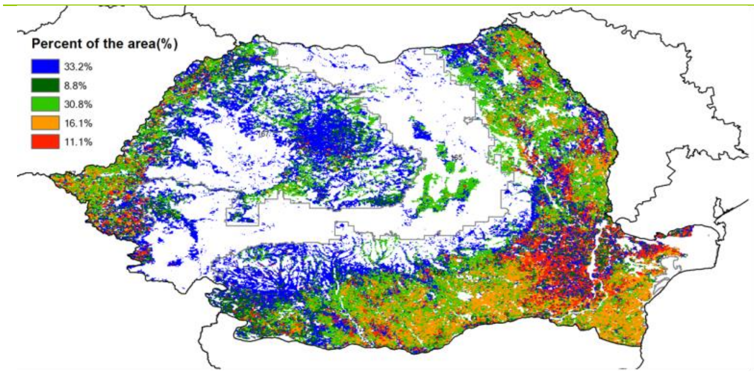
(a) Phenology of major crops

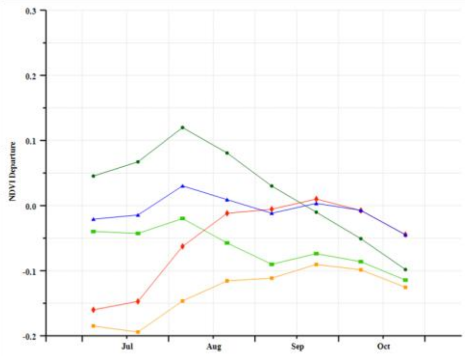




(b) Crop condition development graph based on NDVI

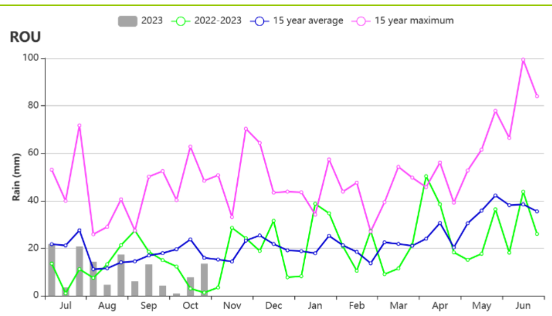
(c) Maximum VCI

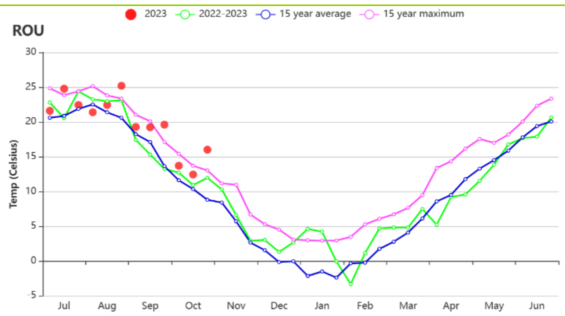




(d) Spatial NDVI patterns compared to 5YA

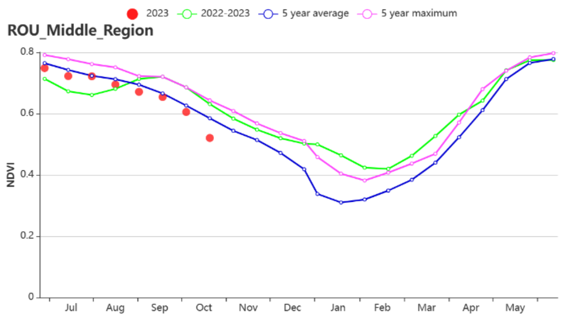
(e) NDVI profiles

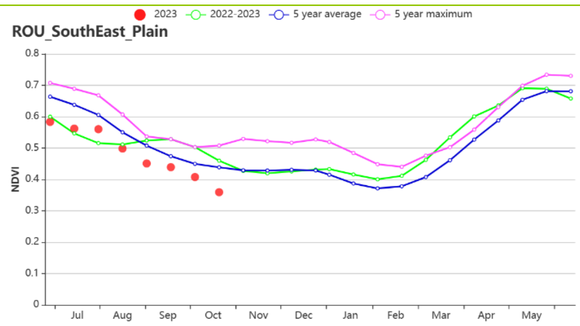




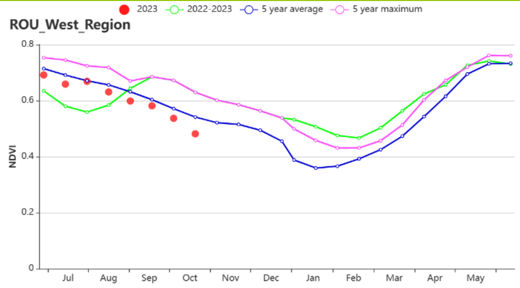
(f) Rainfall profiles

(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 3.69 Romania's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, July-October 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	148	-41	17.6	2.6	1117	6	580	-14
Eastern and southern maize wheat and sugarbeet plains	93	-53	21.4	3.0	1115	4	539	-16
Western and central maize wheat and sugarbeet plateau	167	-24	18.7	1.9	1110	5	631	-3

Table 3.70 Romania's agronomic indicators by sub-national regions, current season's values and departure from 5YA, July - October 2023

Region	Cropped arable land fraction		Cropping Intensity		Maximum VCI
	Current (%)	Departure (%)	Current(%)	Departure from 5YA(%)	Current
Central mixed farming and pasture Carpathian hills	100	0	135	18	0.88
Eastern and southern maize wheat and sugarbeet plains	91	-6	121	-1	0.70
Western and central maize wheat and sugarbeet plateau	99	-1	131	9	0.82

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

This monitoring period from July to October is the main time for crop harvest in Russia. Winter crops are harvested from late June to late July and spring crops are harvested from mid-August to late September. The sowing of winter crops begins in October. Therefore, weather conditions during the monitoring period are important for both spring and winter crops.

During the analyzed period, rainfall was mainly close to the 15-year average, except in September when precipitation was below this level, and at the end of October when it exceeded the 15-year maximum.

Temperatures in Russia during the monitoring period from July to August were mainly close to the 15-year average and last year's values except at the beginning of July and October and the end of September when they reached the 15-year maximum.

According to the national CropWatch data, NDVI during the monitoring period was mainly below the 5-year average and the level of the previous year, except in September when it was close to these levels.

Crop conditions with VCIx above 0.8 are observed in the Central and Black soil regions. VCIx in South and North Caucasus regions ranges from 0.5 to 0.8. The spring crop producing regions (Volga, Urals, Siberia) also showed VCIx ranging from 0.5 to 0.8. 11.5% of the territory (mainly located in Central black soil region) showed clear positive NDVI departure during most of the analyzed period except for October. Positive NDVI departure since the middle of August was observed in Eastern, Middle and Western Siberia regions as well as in Ural and western Volga region (28% of the territory). 44% of the territory showed NDVI departure close to 0 (mainly South and North Caucasus regions as well as south-western and northern part of Middle Volga). 16.5 % of the territory located mainly in west-northern part of Middle Volga had negative NDVI departure during the whole analyzed period.

For harvesting winter crops, the situation was favorable in most regions of Russia. The condition of early spring crops and meteorological conditions of the last stages of their development indicate that their yield will be below the 5-year average in almost all the regions. Conditions for sowing winter crops in the 2023/2024 season were close to the average in all regions.

Regional analysis

South Caucasus

Rainfall and BIOMASS were below the 15-year average by 25% and 12% respectively. Temperature and RADPAR were above the 15-year average by 0.5°C and 3%, respectively. The CALF was by 5% above the 5-year average. Cropping intensity was by 8 % above the 5-year average. The VCIx was 0.8. Crop production index was 1.1, meaning that the crop production situation was better than normal.

Until August NDVI was close to the 5-year average and the level of the previous year then it dropped below the 5-year average but stayed close to the previous year until the middle of September.

Judging by the index values, the yield of winter crops is likely to be lower than in the previous year. Winter crop 2023/2024 sowing and status are below last year's levels.

North Caucasus

Rainfall and BIOMASS were below the 15-year average by 33% and 10% respectively. Temperature and RADPAR were above the 15-year average by 0.9°C and 3%, respectively. The CALF was by 3% above the 5-year average. Cropping intensity was 5% above the 5-year average. VCIx was 0.77. The crop production index was 1.1, meaning that the crop production situation was better than normal.

Till the middle of August, NDVI was close to the 5-year average and the level of the previous year, then it dropped below these levels. Summer crop yield can be expected to be close to the last year's level. The yield of winter crops is likely to be lower than in the previous year. Winter crop 2023/2024 sowing and status at the end of the analyzed period was worse than in the previous year due to the dry conditions in late September and early October.

Central Russia

Rainfall and BIOMASS were below the 15-year average by 9% and 5% respectively. Temperature and RADPAR were above the 15-year average by 0.9°C and 2%, respectively. CALF was equal to the 5-year average. Cropping intensity was by 3% below the 5-year average. VCIx was 0.92. Crop production index was 1 meaning that the crop production situation was normal. NDVI was mainly below last year's average and the 5-year average except for the period from the middle of August till the beginning of September when it reached both of these levels and in mid-September when NDVI reached the 5-year maximum for that period. The yield of 2022/2023 winter crop can be expected to be below last year's and the 5-year average, while the yield of spring and summer crops should be close to the 5-year average. The 2023/2024 winter crops sowing campaign is likely to be close to normal.

Central Black Soil region

Rainfall and temperature were above the 15-year average by 4% and by 0.7°C correspondingly. RADPAR increased by 2% relative to the 15-year average. BIOMASS decreased by 1% relative to the 15-year average. The CALF was similar to the 5-year average. Cropping intensity was by 1% below the 5-year average. VCIx was 0.92. Crop production index was 1.1, indicating that the crop production situation was better than normal. In July NDVI was close to the 5-year average and the level of the previous year. Then it increased reaching 5-year maximum until the middle of September when it dropped below the 5-year average and the level of the previous year. The yield of winter and spring crops is expected to be close to the last year and close to 5-year average. Summer crop yield should be also close the average. The 2023/2024 winter crop sowing campaign is likely to be worse than normal.

Middle Volga

Rainfall and BIOMASS were below the 15-year average by 3% and 1% correspondingly. Temperature was above the 15-year average by 0.8°C. RADPAR was close to the 15-year average. CALF increased by 2% relative to the 5-year average. Cropping intensity was by 2% below the 5-year average. VCIx was 0.83. Crop production index was 1. During the analyzed period NDVI stayed mainly below the 5-year average and the level of the previous year. The yield of winter, spring, and summer crop is expected to be below the last year and 5-year average. The 2023/2024 winter crop germination and establishment is likely to be delayed, due to low soil moisture content.

Ural and western Volga

All agroclimatic indicators were above the 15-year average. Rainfall increased by 25% temperature by 1.3°C, RADPAR by 1% and BIOMASS by 16%. CALF increased by 1% relative to the 5-year average. Cropping intensity was by 1% below the 5-year average. VCIx was 0.85. Crop production index was 1. Till September NDVI was below the 5-year average and the last year's value, then it stayed at these levels except mid-September and mid-October when it reached 5-year maximum. The yield of winter, spring, and summer crops is expected to be below last year's and the 5-year average. The 2023/2024 sowing campaign is likely to be better than normal.

Western Siberia

In Western Siberia, rainfall increased by 35% over the 15-year average. Temperature was by 1.6°C above the 15-year average. RADPAR was by 1% below the 15-year average. BIOMASS increased relative to the 15-year average by 21%. CALF was down by 1% relative to the 5-year average. Cropping intensity was by 1% below the 5-year average. VCIx was 0.86. Crop production index was 1. NDVI was below last year's value and the 5-year average till mid-August then it increased reaching 5-year maximum in September. There are very few winter crops in this region. According to the NDVI graph, the yield of spring and summer crops is expected to be slightly below the 5-year average and below the level of the previous year.

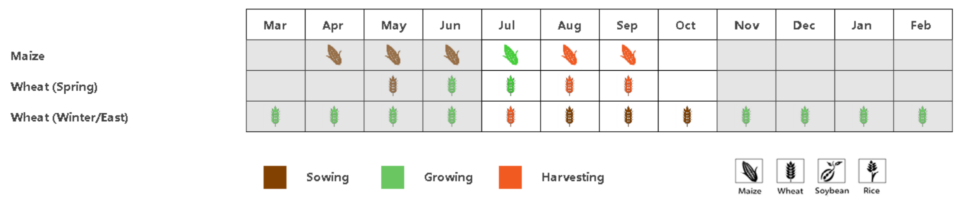
Middle Siberia

Rainfall and BIOMASS were below the 15-year average by 15% and 7% correspondingly. Temperature and RADPAR were above the 15-year average by 1.7°C and 1%, respectively. CALF decreased by 1% relative to the 5-year average. Cropping intensity was by 1 % below the 5-year average. VCIx was 0.88. Crop production index was 1. NDVI was below last year's value and the 5-year average till mid-August then it increased, reaching these two levels. According to the charts, the yield of spring, and summer crops is expected to be below the 5-year average and the level of the previous year.

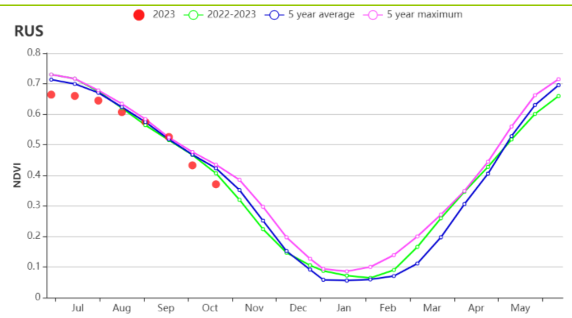
Eastern Siberia

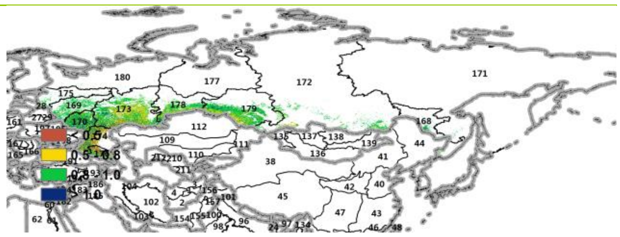
Rainfall and BIOMASS were below the 15-year average by 21% and 8% correspondingly. Temperature and RADPAR were above the 15-year average by 1.4°C and 1%, respectively. The CALF was similar to the 5-year average. Cropping intensity was by 3% below the 5-year average. VCIx was 0.97. Crop production index was 1. NDVI was close to the 5-year average and the last year's value until September when it improved and reached the 5-year maximum dropping below the level of the previous year in October. According to the graphs, the spring and summer crop yield is expected to be close to the 5-year average.

Figure 3.41 Russia's crop condition, July - October 2023



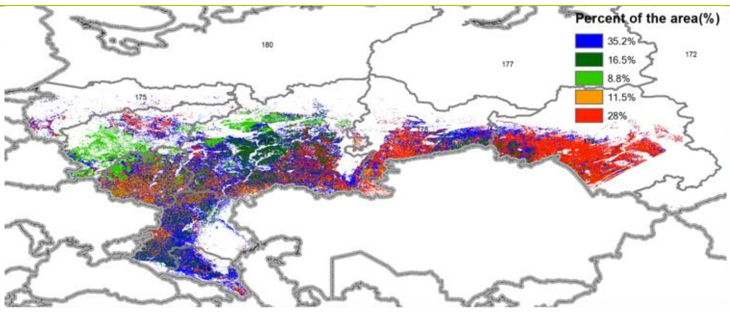
(a). Phenology of major crops

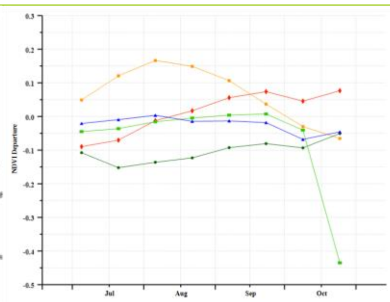




(b) Crop condition development graph based on NDVI

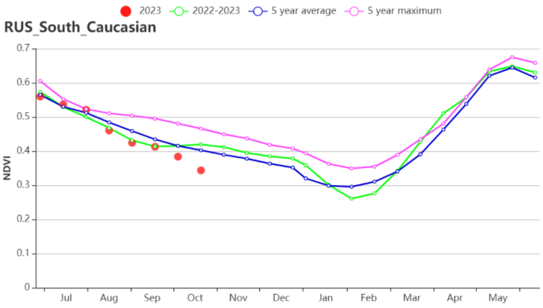
(c) Maximum VCI

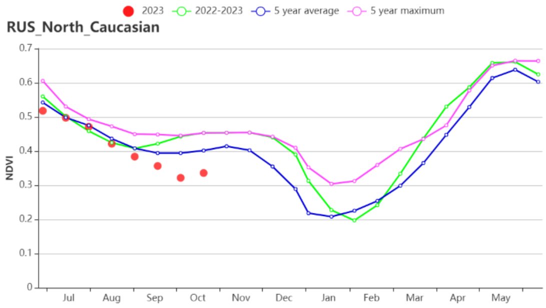




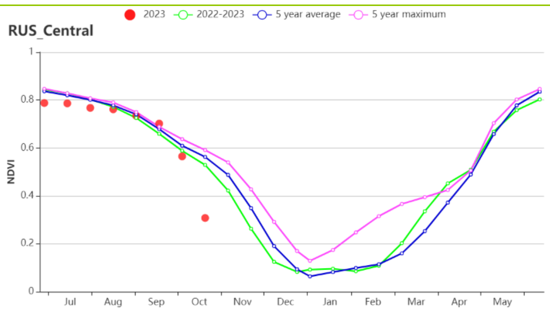
(d) Spatial NDVI patterns compared to 5YA

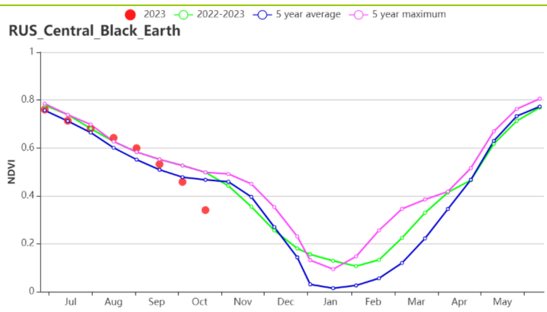
(e) NDVI profiles



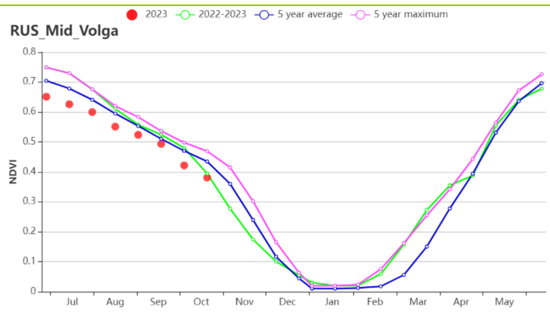


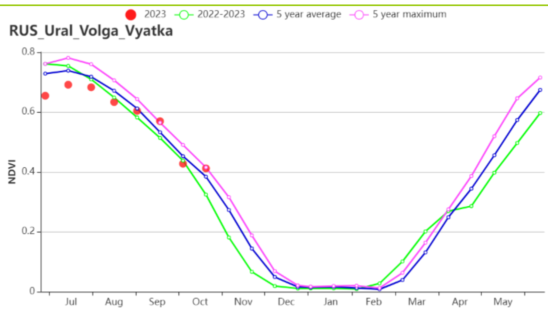
(f) Crop condition development graph based on NDVI, Southern Caucasus (left) and Northen Caucasus (right).



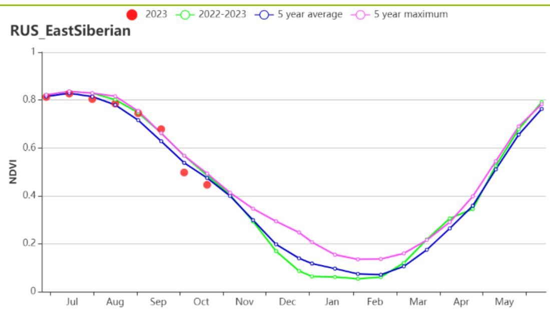


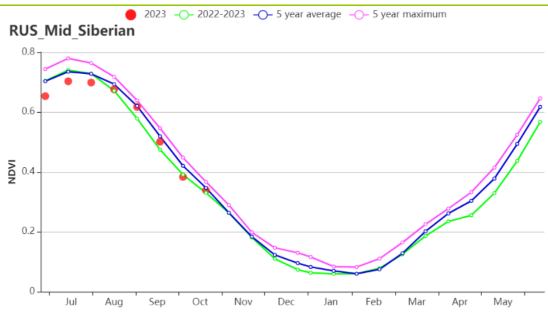
(g) Crop condition development graph based on NDVI, Central Russia (left) and Central black soils area (right).



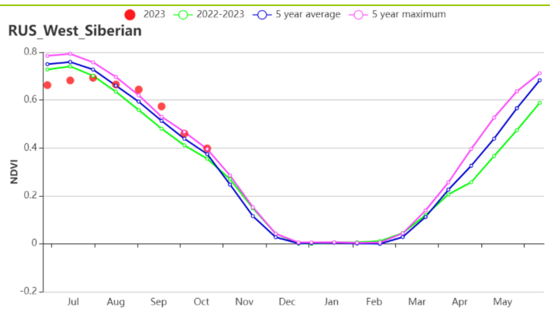


(h) Crop condition development graph based on NDVI, Middle Volga (left) and Ural and western Volga region (right).

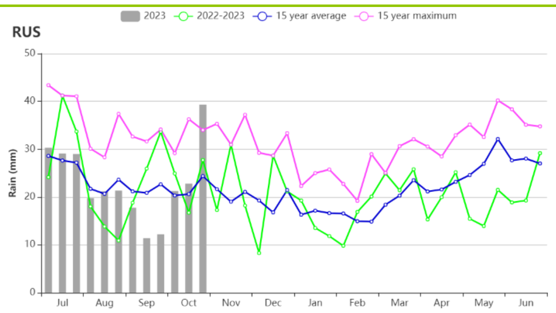




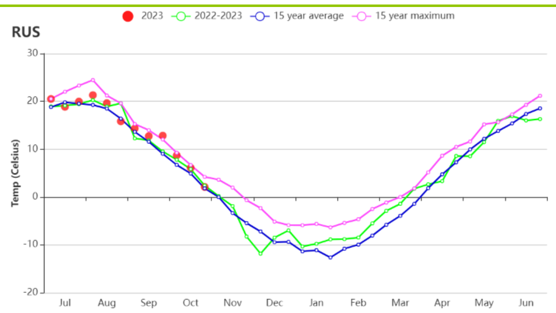
(i) Crop condition development graph based on NDVI, Eastern Siberia (left) and Middle Siberia (right).



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



(h) Rainfall index



(i) Temperature Index

Table 3.71 Russia's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, July - October 2023

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Central Russia	275	-9	13.9	0.9	747	2	693	-5
Central black soils area	239	4	15.6	0.7	863	2	632	-1
Eastern Siberia	394	-21	14.6	1.4	866	1	824	-8
Middle Siberia	248	-15	11.1	1.7	929	1	602	-7
Middle Volga	257	-3	14.4	0.8	805	0	665	-1
Northern Caucasus	135	-33	19.7	0.9	1073	3	571	-10
Southern Caucasus	247	-25	17.4	0.5	1115	3	648	-12
Ural and western Volga region	313	25	13.5	1.3	769	1	744	16
Western Siberia	372	35	13.4	1.6	805	-1	822	21

Table 3.72 Russia's agronomic indicators by sub-national regions, current season's values and departure from 5YA, July – October 2023

Region	Cropped arable land fraction		Cropping Intensity		Maximum VCI
	Current (%)	Departure (%)	Current (%)	Departure (%)	Current
Central Russia	100	0	103	-3	0.92
Central black soils area	100	0	110	-1	0.92
Eastern Siberia	100	0	104	-3	0.97
Middle Siberia	97	-1	103	-1	0.88
Middle Volga	97	2	104	-2	0.83
Northern Caucasus	86	3	124	5	0.77
Southern Caucasus	79	5	121	8	0.80
Ural and western Volga region	99	1	100	-1	0.85
Western Siberia	98	-1	100	-1	0.86

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

[SYR] SYRIA

As shown on the penology map, the main crops in Syria include wheat and barley. Sowing of these crops started in October. 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 (ΔRAIN -48%) and radiation was also less than average (ΔRADPAR -2%). The temperature was above average (ΔTEMP +1.5°C). The average temperature value for the reporting period was 28.2°C. The temperatures were generally above average. 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 4%. According to the NDVI profiles, the national average NDVI values were close to the 5YA. The national average VCIx was 0.44 and CALF was 8% (ΔCALF +22%).

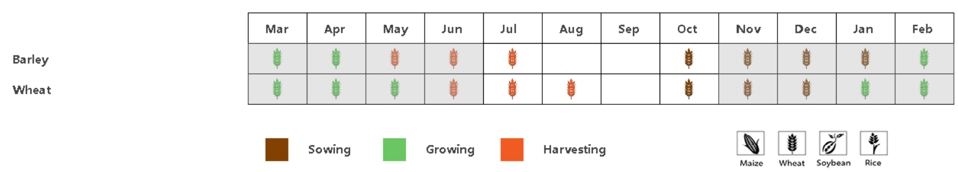
Regional analysis:

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).

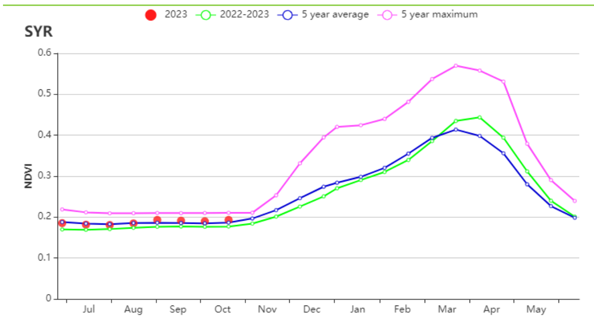
In the first region (b), the accumulated precipitation was less than average, and the temperature was above average in both (a, b) regions. The RADPAR was below average. The weather conditions resulted in a decrease of BIOMSS by 5% to 9%, while the national average VCIx values were not higher than 0.88 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 12% and for the b) region, it was up by 11%. According to NDVI profiles of the b region, crop conditions were close to the 5YA.

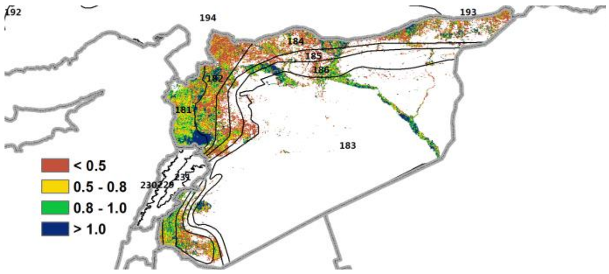
Agro-climatic conditions in the second, third and fourth regions were below 5YA. The rainfall was below average by more than 65%, whereas the temperatures were above average and RADPAR was below average. The low rainfall led to a decrease in potential biomass by 10%. The CALF values in the three regions increased significantly by more than 49%, but the CALF values for these regions were at low levels. The average VCIx values in the second region, the third region and the fourth region were 0.43, 0.29 and 0.23. According to NDVI profiles of the three regions, crop conditions were close to the 5YA.

Figure 3.42. Syria's crop condition, July - October 2023



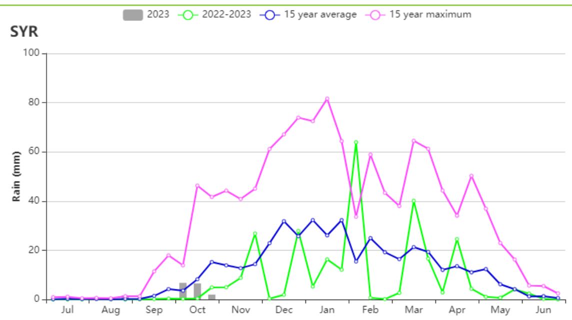
(a). Phenology of major crops

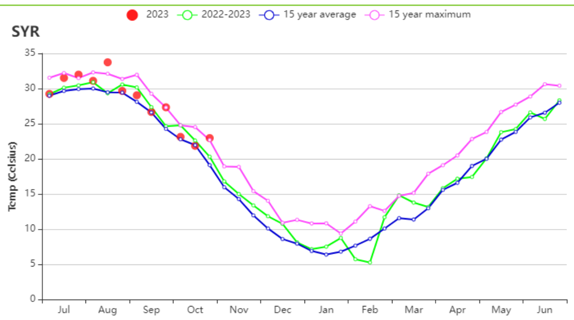




(b) Crop condition development graph based on NDVI

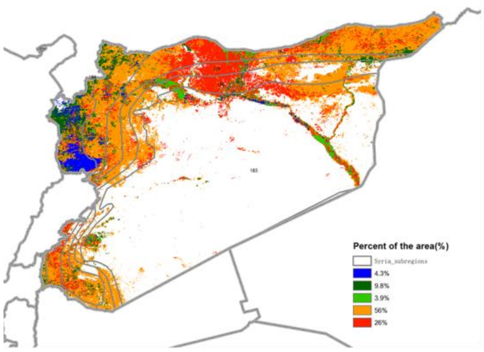
(c) Maximum VCI

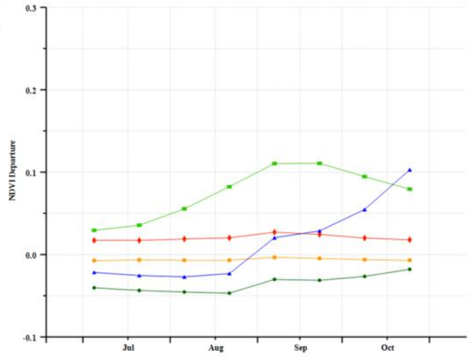




(d) Rainfall profiles

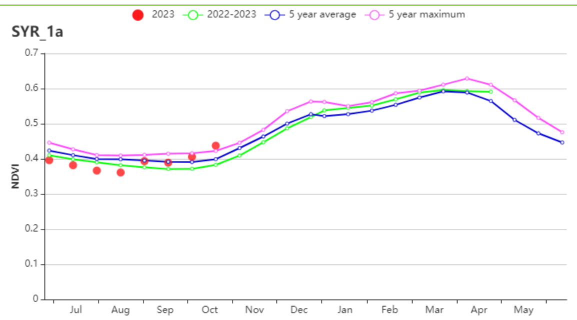
(e) Temperature profiles

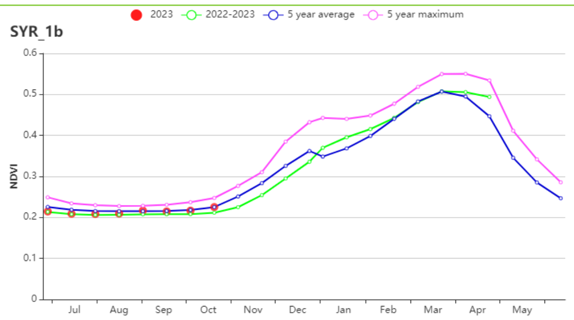




(f) Spatial NDVI patterns compared to 5YA

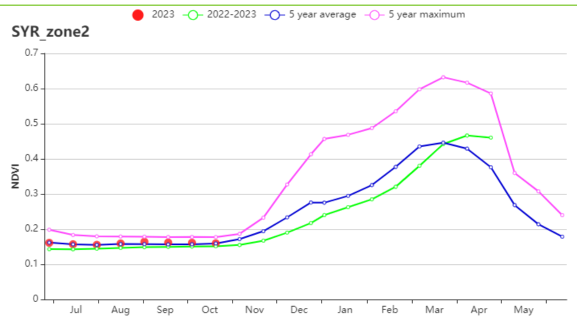
(g) NDVI profiles

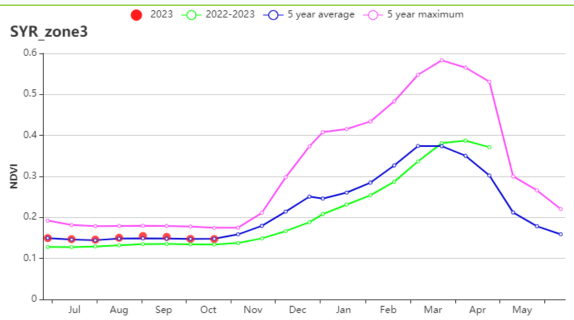




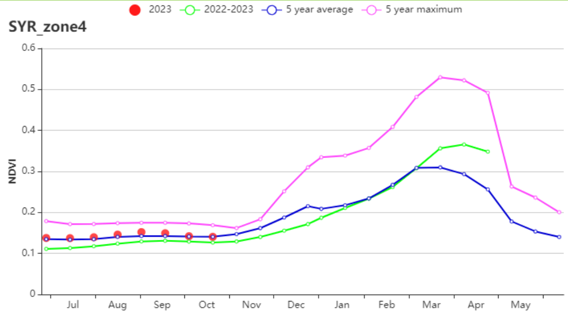
(h) Crop condition development graph based on NDVI (The first(a) region)

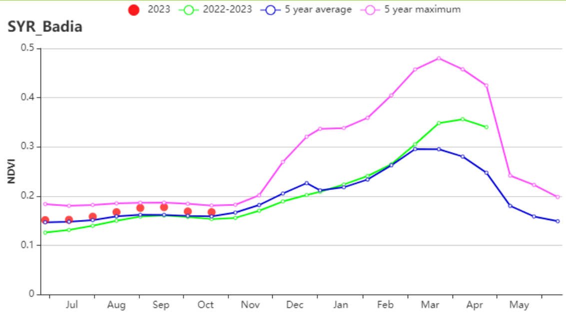
(i) Crop condition development graph based on NDVI (The first (b) region)





(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 3.73 Syria agro climatic indicators by sub-national regions, current season's values and departure from July - October 2023

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m^2)	Departure (%)	Current (gDM/m^2)	Departure (%)
First (a) region	53	0	25.6	0.7	1385	-2	570	-5
First (b) region	25	-48	25.9	1.5	1393	-2	523	-9
Badia	5	-76	29.1	1.6	1399	-2	490	-8
Second region	11	-65	28.5	1.7	1385	-2	497	-10
Third region	8	-72	27.7	1.6	1398	-2	495	-10
Forth region	6	-76	28.6	1.6	1399	-2	493	-10

Table 3.74 Syria, agronomic indicators by sub-national regions, current season's values and departure from 5YA, - July - October 2023

Region	Cropped arable land fraction				Maximum VCI
	Current (%)	Departure (%)	Current (%)	Departure (%)	Current
First (a) region	58	12	104	1	0.88
First (b) region	3	11	102	0	0.67
Badia	6	51	111	-2	0.33
Second region	1	49	101	0	0.43
Third region	2	112	104	-1	0.29
Forth region	4	55	106	-5	0.23

[THA] Thailand

This monitoring period covers most of the growth cycle of main rice and the harvest of maize in Thailand. According to the agroclimatic indicators, Thailand experienced wetter and warmer weather in this monitoring period with above-average rainfall (RAIN +12%), radiation (RADPAR +9%), and temperature (TEMP +0.8°C) from July to October. All these indicators led to a favorable biomass (BIOMSS +5%).

The NDVI development graph shows that the crop conditions remained near average over the entire monitoring period. From early August to late September, the NDVI showed sharp drops due to cloud cover in the satellite images and flooding conditions. The temperature was generally above average, exceeding a 15-year maximum in late August and mid-October. The rainfall was obviously higher than average throughout the whole monitoring period except for mid-August and mid-October, steadily increasing and peaking in mid-September, surpassing the maximum observed over the 15-year average.

According to the NDVI departure clustering map, 39.2% exhibited a slightly below-average trend before October and recovered to slightly above average by late October, located in the central and some cultivated areas in the southern and central regions. In the southern parts of these areas, crop conditions were minimally affected due to the late onset of the floods. In an area accounting for 18.8% of the total cropped area, mostly located in central and eastern parts, crop conditions were close to average but deteriorated significantly to below average in early August and early September, presumably due to cloud cover in the satellite images. Similar sharp drops in early August and late September were observed for 13.5% of the cropped area. Those areas, predominantly located in the eastern part of Thailand, were hit by the cyclone, resulting in flooding and crop losses. For the remaining 28.5%, located in the central and northern part of Thailand, a sharp negative departure was observed in early August, and then reached average levels by the end of this monitoring period.

At the national level, all arable land was cropped during the season (CALF 100%) with below-average crop intensity (CI -5%), but favorable VCIx values of around 0.93. The Crop Production Index (CPI) in Thailand is 0.99. CropWatch estimates that the overall crop conditions were close to average.

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).

For the Central double and triple-cropped rice lowlands, the agroclimatic indicators show that the rainfall, radiation, and temperature were above average (RAIN +26%, RADPAR +13%, TEMP +0.8°C), which resulted in above-average biomass (BIOMSS +8%). The NDVI development graph indicates that crop conditions remained below the five-year average throughout the monitoring period. There were significant declines in NDVI observed in early August and early September due to the impact of flooding. Subsequently, there was a gradual recovery to near-average levels. Considering the favorable VCIx value of 0.92, the crop condition is assessed as slightly below average.

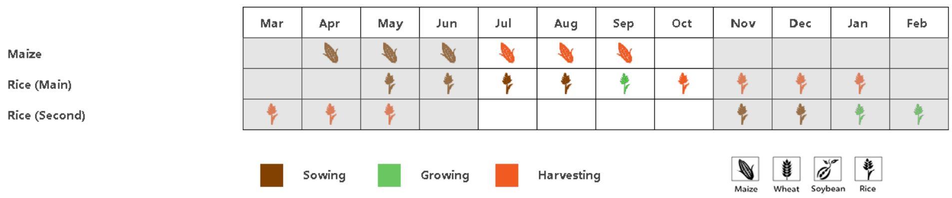
According to agroclimatic indicators for the South-eastern horticulture area, temperature and rainfall were above average (TEMP +0.7°C, RAIN +7%), while solar radiation was slightly below average (RADPAR -3%). This led to an above-average estimation for potential biomass accumulation (BIOMSS +2%). According to the NDVI development graph, crop conditions were close to the 5-year average in July, and recovered back to near average in October. There were significant declines in NDVI observed in early

August and late September, attributable to cloud cover. The NDVI development graph as well as a VCIx of 0.93, indicate average crop conditions.

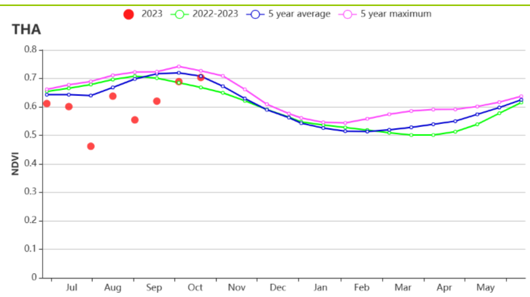
Agroclimatic indicators show average conditions in the Western and southern hills: rainfall and radiation were above average (RAIN +10%, RADPAR +4%), and the temperature was slightly above average (TEMP +0.6°C), resulting in an increase in biomass (BIOMSS +4%). Throughout the monitoring period, except for mid August and late October, the crop conditions were below average. However, cloud cover in the satellite images may have severely affected the NDVI values in this cloudy region. The VCIx was at 0.93. Overall, after adjusting for the cloud cover impacts, the crop conditions were near average.

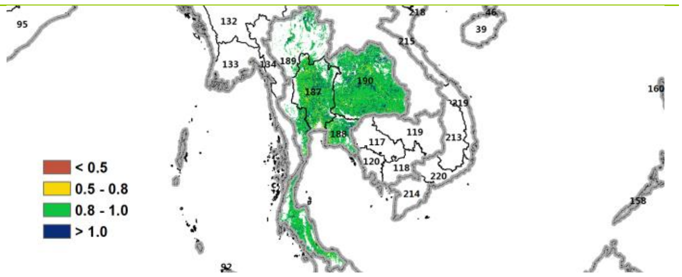
Indicators for the Single-cropped rice north-eastern region show above-average rainfall, radiation, and temperature (RAIN +12%, RADPAR +9%, TEMP +0.8°C), resulting in increased biomass accumulation potential (BIOMSS +6%). As depicted in the NDVI development graph, the crop conditions were near average in late August and late October. Throughout the remaining monitoring period, the imagery was consistently influenced by cloud cover. Considering the satisfactory VCIx value of 0.93, the crop conditions were average.

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

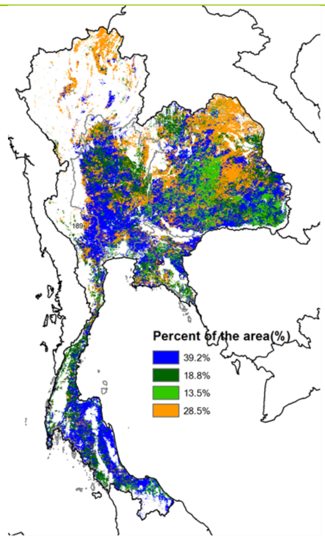


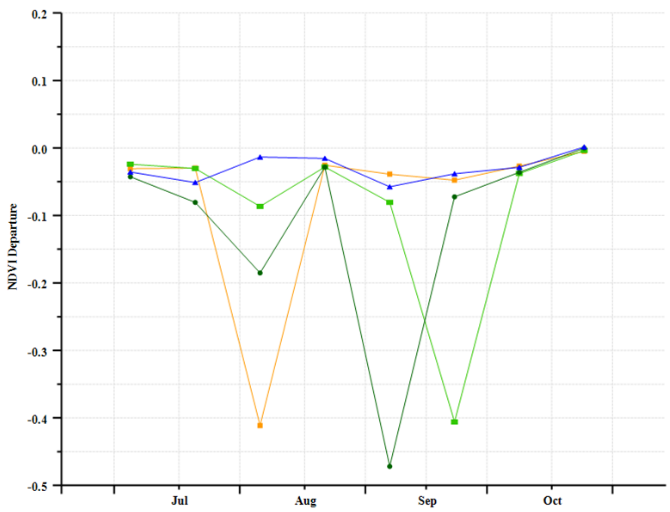
(a) Phenology of major crops



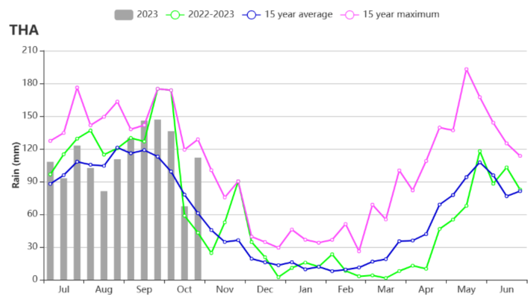


(b) Crop condition development graph based on NDVI (c) Maximum VCI

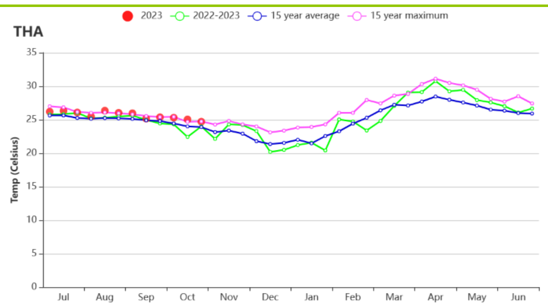




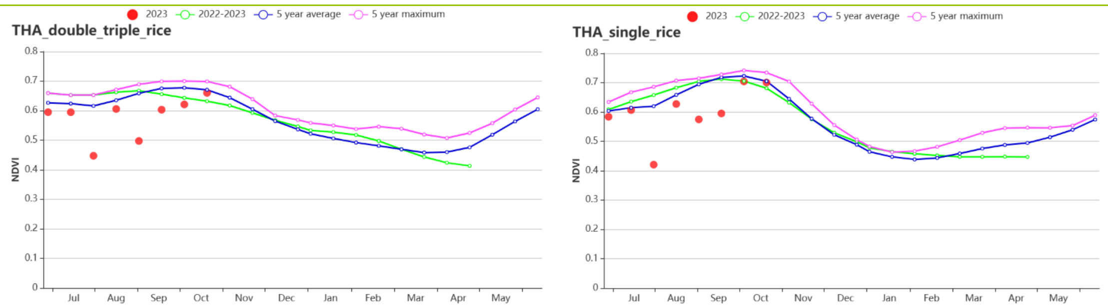
(d) Spatial NDVI patterns compared to 5YA (e) NDVI profiles



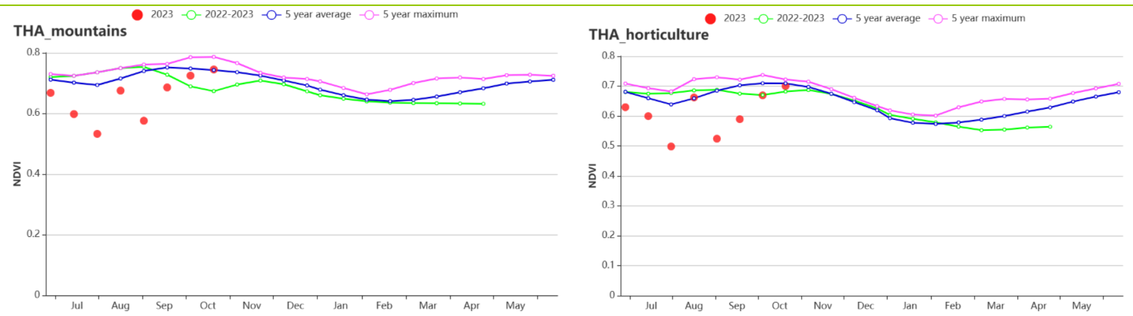
(f) Rainfall profiles



(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 3.75 Thailand's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, July - October 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	1467	26	26.2	0.8	1212	13	1630	8
South-eastern horticulture area	1460	7	26.4	0.7	1202	7	1606	2
Western and southern hill areas	1216	10	25.0	0.6	1158	4	1500	4
Single-cropped rice north-eastern region	1505	12	26.1	0.8	1195	9	1640	6

Table 3.76 Thailand's agronomic indicators by sub-national regions, current season's values and departure from 5YA, July - October 2023

Region	CALF		Cropping Intensity		Maximum VCI
	Current (%)	Departure from 5YA(%)	Current (%)	Departure from 5YA(%)	Current
Black Sea region	99	0	145	0	0.92
Central Anatolia region	99	0	126	-8	0.93
Eastern Anatolia region	100	0	125	-7	0.93
Marmara Agean Mediterranean lowland region	100	0	123	-6	0.93

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

[TUR] Türkiye

This monitoring period marks the late growth and harvesting period for wheat and the growing season for rice and maize in Türkiye. The proportion of annually irrigated agricultural land in Türkiye is 19.8%, and agrometeorological conditions play a significant role in crop growth. Agrometeorological conditions indicate a 13% decrease in rainfall compared to the 15-year average, while temperatures were 1.4°C above average. Photosynthetically active radiation (RADPAR) and potential biomass accumulation (BIOMSS) were on par with the 15-year average, suggesting that suitable temperature conditions and sunlight supported photosynthesis and biomass production.

The NDVI-based crop growth process line shows that NDVI values were essentially the same as the 5-year average during the monitoring period. An increase in the area of cropped arable land (19% above average) and a robust Vegetation Condition Index (VCI at 0.94) further highlight the favorable conditions for crop growth. Despite a reduction in rainfall in September, a recovery in October rainfall, coupled with suitable temperatures, created generally normal conditions.

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).

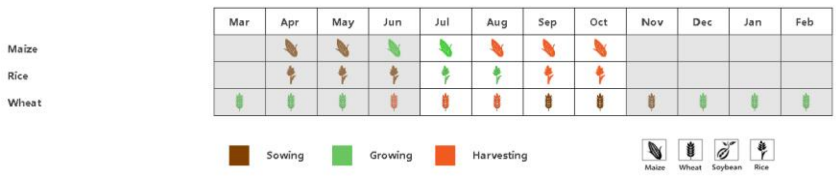
In the Black Sea region (191), despite a 19% decrease in long-term average RAIN, an increase in TEMP (+0.5°C) and RADPAR (+8%) provided good conditions for crop growth. The NDVI-based crop growth development curve shows slightly below NDVI trends in August-September in this region. The region maintained a high Vegetation Condition Index (VCIx at 0.92), indicating favorable crop growth conditions with average yield.

The Central Anatolia region (192) was the only one which had above average precipitation (RAIN +3%). The NDVI-based crop growth and development curves showed that the NDVI values were higher than the 5-year average throughout the monitoring period, especially in July when the NDVI values were above the 5 year maximum, indicating that the crops were growing well. Both biomass (+7%) and cropped arable land fraction (+47%) were significantly higher than the average, with a VCIx reaching 1.09, indicating relatively favorable conditions.

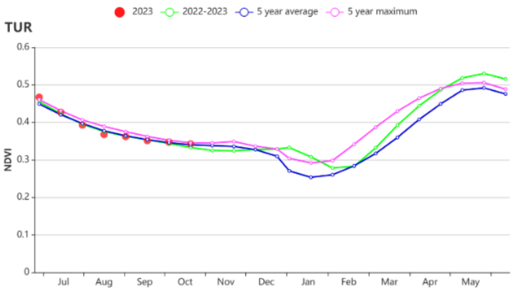
The Eastern Anatolia region (193) faced a 40% decrease in precipitation compared to the long-term average. This resulted in a decrease in biomass, VCIx at 0.85 indicates that crop growth had been affected. However, a 22% increase in the cropped arable land fraction can somewhat compensate for the shortcomings in crop vigor. The NDVI-based crop growth and development curves showed NDVI values near the 5-year average throughout this monitoring period, indicating normal conditions.

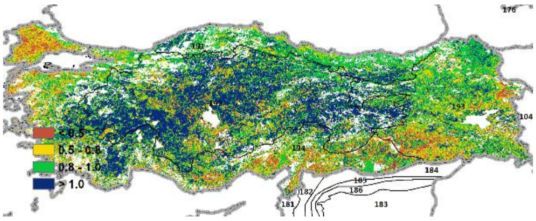
In the regions of the Sea of Marmara, the Aegean, and the Mediterranean (194), although the precipitation was 6% below the long-term average, good temperature and sunlight conditions led to a 1% increase in potential biomass. Crop growth and development curves based on NDVI showed a slightly below average trend. Slight increases in the cropped arable land fraction (+4%) and cropping intensity (+4%) were noted. With a VCIx of 0.83, the crop growth condition in the region is fair.

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



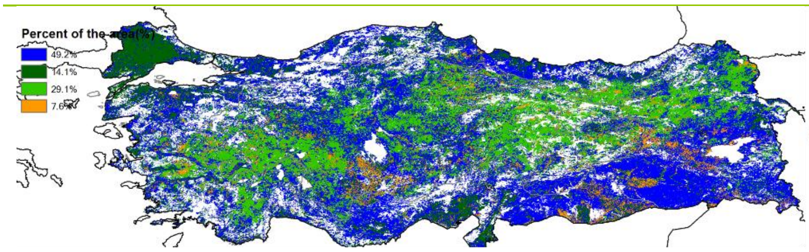
(a). Phenology of major crops

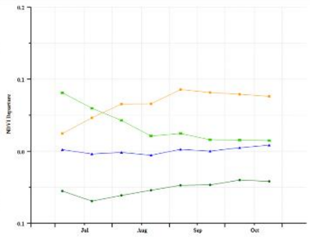




(b) Crop condition development graph based on NDVI

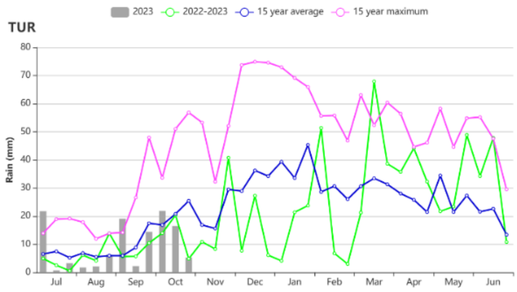
(c) Maximum VCI

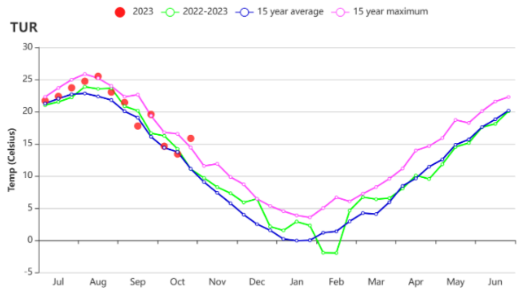




(d) Spatial NDVI patterns compared to 5YA

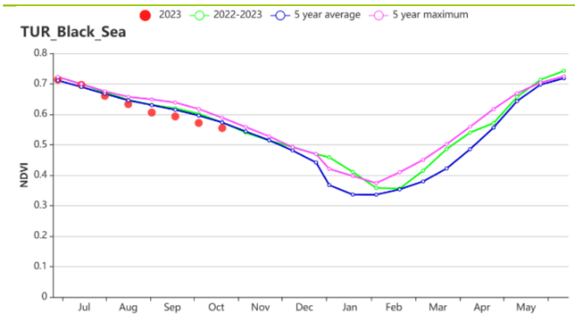
(e) NDVI profiles

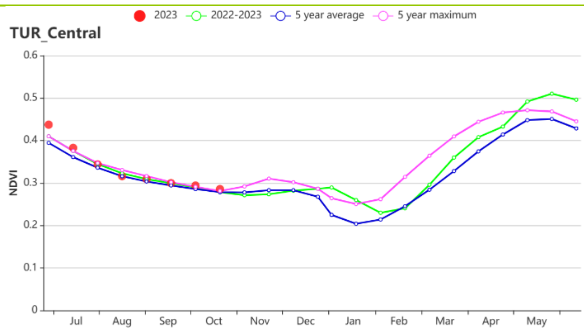




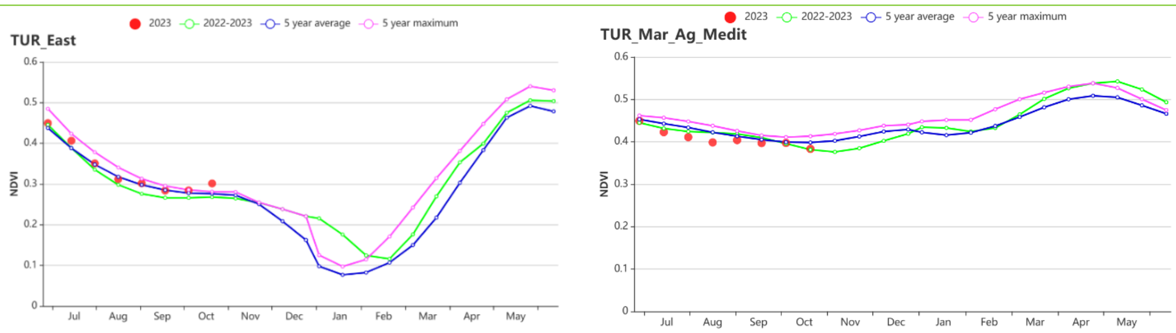
(f) Time series rainfall profile

(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 3.77 Türkiye's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, July 2023 - October 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	231	-19	15.6	0.5	1192	8	625	-9
Central Anatolia region	105	3	19.3	1.5	1306	2	542	7
Eastern Anatolia region	85	-40	18.9	1.5	1339	1	505	-6
Marmara Agean Mediterranean lowland region	106	-6	23.3	1.6	1314	-1	590	1

Table 3.78 Türkiye's agronomic indicators by sub-national regions, current season's values and departure from 5YA, July 2023 - October 2023

Region	CALF		Cropping Intensity		Maximum VCI
	Current (%)	Departure from 5YA(%)	Current (%)	Departure from 5YA(%)	Current
Black Sea region	98	5	133	6	0.92
Central Anatolia region	51	47	109	0	1.09
Eastern Anatolia region	55	22	103	1	0.85
Marmara Agean Mediterranean lowland region	60	4	120	4	0.83

[UKR] Ukraine

The current monitoring period covers the growth period of maize until its harvest in September and October. Winter wheat was harvested in July. Sowing of the new winter wheat crop started in September. A rainfall deficit was observed at the national level (RAIN, 158 mm, -22%). Temperatures were above average by 1.9ºC and radiation was 5% higher than the 15YA. Based on above agroclimatic indicators, CropWatch predicted the potential biomass would be 6% lower than usual (BIOMSS, 580 g DM/m2). CALF and the cropping intensity attained average levels of 0.96 and 124, respectively. The VCIx reached a high value of 0.86, indicating that lower rainfall did not adversely affect the crops.

Remote sensing based national level crop condition development profile showed NDVI was close to or marginally higher than the 5YA before October, confirmed by NDVI spatial patterns. The NDVI of 68.2% cropped area showed some negative departures in October. VCIx distribution suggested crop conditions (VCIx below 0.5) were not favorable in southern Ukraine, such as Odessa, Zaporizhia, Kherson and Crimea, i.e., the frontline of the Russia-Ukraine War.

In summary, the rainfall deficit started in September, and thus had a limited impact on crop growth, as can be seen in the NDVI development curves. Therefore, the overall situation can be assessed as normal, apart from the war affected production regions in the south-east.

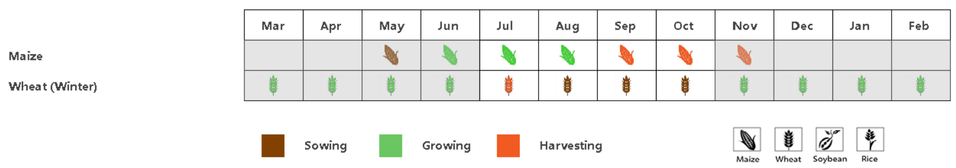
Above average rainfall in the second half of October helped with the germination and establishment of the winter cereals.

Regional analysis

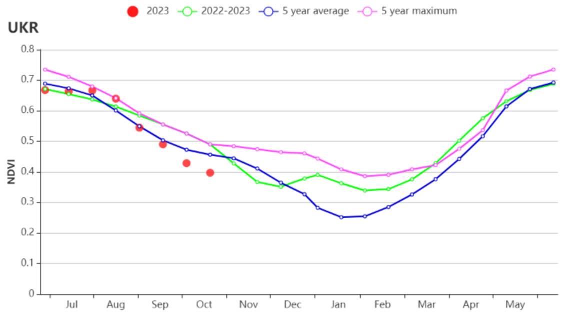
Regional analyses are provided for four agro-ecological zones (AEZ) defined by their cropping systems, climatic zones and topographic conditions. They are referred to as Central wheat area (195) with the Poltava, Cherkasy, Dnipropetrovsk and Kirovohrad Oblasts; Eastern Carpathian hills (196) with Lviv, Zakarpattia and Ivano-Frankivsk Oblasts; Northern wheat area (197) with Rivne and Southern wheat and maize area (198) with Mykolaiv, Kherson and Zaporizhia Oblasts.

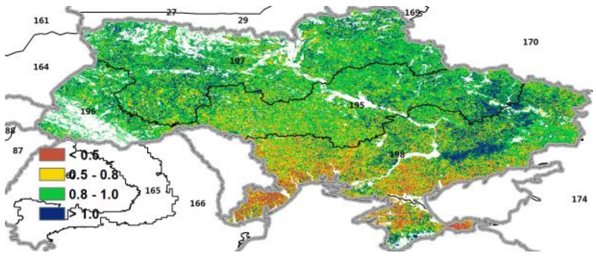
All four AEZs experienced similar patterns of agroclimatic and agronomic indicators, which could be characterized as drier (negative rainfall departures ranging from -17 to -28%) and warmer temperatures ranging from 1.6 to 2.2°C. Solar radiation was above average by 5 to 6%. As a result of the rainfall deficit, potential biomass was predicted to be 4 to 7% lower than 15YA. CALF was high, ranging from 0.9 to 1 and VCIx ranged from 0.8 to 0.91. The factors indicate general good crop condition. However, it was noticed that NDVI based development curves were below 5YA starting in October, except for Eastern Carpathian hills, which might be attributed to the lack of rain in September. Crop Intensity in Eastern Carpathian hills was close to average. In Central wheat area and Northern wheat area, crop intensities were below average (-1% and -4%, respectively), while it was above average in Southern wheat and maize area (+6%).

Figure 3.45 Ukraine's crop condition, July 2023 - October 2023

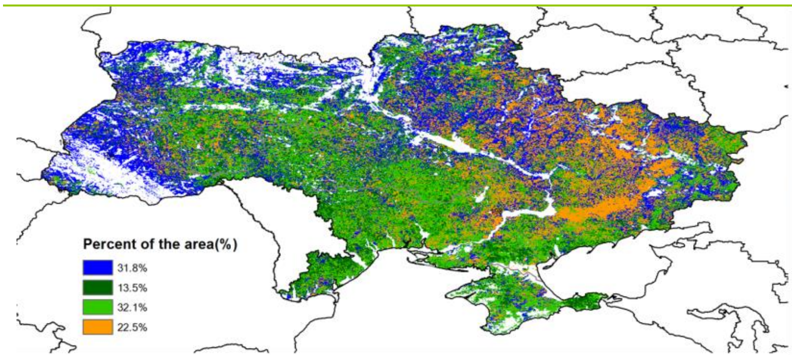


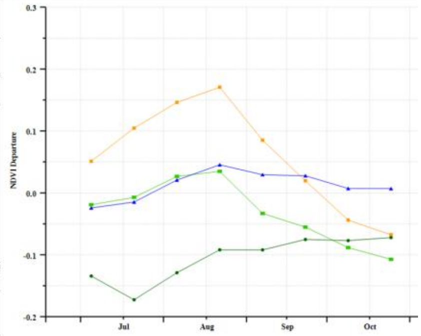
(a). Phenology of major crops



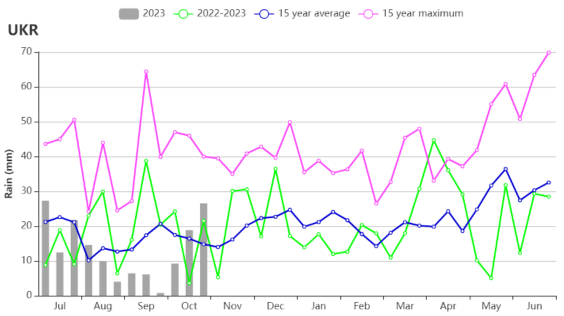


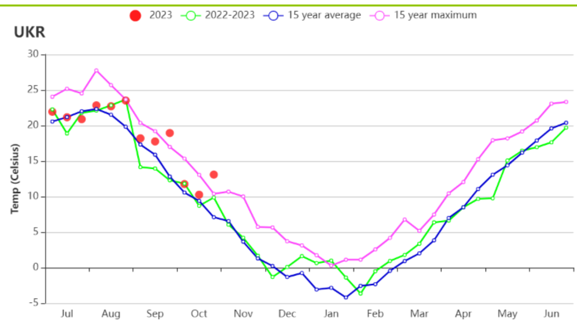
(b) Crop condition development graph based on NDVI (c) Maximum VCI



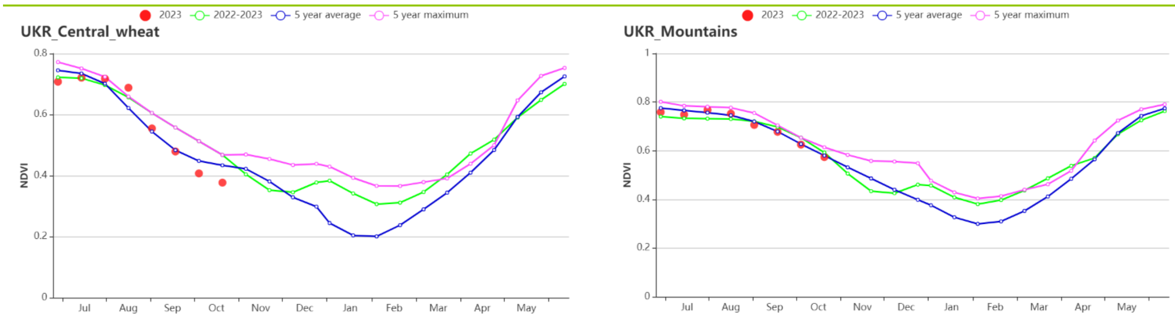


(d) Spatial NDVI patterns compared to 5YA (e) NDVI profiles

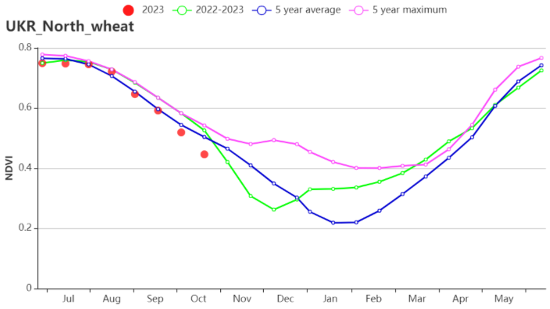


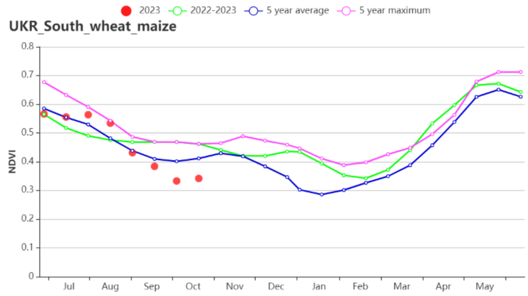


(f) Time series rainfall profile (g) Time series temperature profile



(h) Crop condition development graph based on NDVI (Central wheat area and Eastern Carpathian hills)





(j) Crop condition development graph based on NDVI (Northern wheat area and Southern wheat and maize area)

Table 3.79 Ukraine's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, July 2023 - October 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(%)
Central wheat area	152	-18	18.6	1.9	998	5	559	-6
Eastern Carpathian hills	192	-28	17.1	2.2	1003	5	644	-7
Northern wheat area	187	-17	17.6	2.1	943	6	609	-4
Southern wheat and maize area	120	-26	20.0	1.6	1067	5	551	-7

Table 3.80 Ukraine's agronomic indicators by sub-national regions, current season's values and departure from 5YA, July 2023 - October 2023

Region	CALF		Cropping Intensity		Maximum VCI
	Current(%)	Departure from 5YA(%)	Current(%)	Departure from 5YA(%)	Current
Central wheat area	100	0	120	-1	0.88
Eastern Carpathian hills	100	0	134	0	0.91
Northern wheat area	100	0	120	-4	0.91
Southern wheat and maize area	91	1	130	6	0.80

[USA] United States

This reporting period from July to October 2023 covers the flowering, grain filling, and maturity stages of maize, rice, and soybeans, and the harvest of spring wheat in the United States. Overall, crop growth conditions were slightly below average.

At the national level, the agro-climatic indicators show below-average rainfall (ΔRAIN -22%) and radiation (ΔRADPAR -1%). Together with above-average temperatures (ΔTEMP +0.8ºC) these indicators resulted in below-average potential biomass (ΔBIOMASS -10%). The rainfall time series shows dry weather during the monitoring period, with a significant deficit from mid-August to late September, adversely affecting crop growth. The temperature time series indicates a noticeable increase in temperature from mid-July to mid-September, fluctuating near the 15-year maximum, and returning to normal levels by October. The Great Plains, Southeast, and Lower Mississippi experienced widespread rainfall deficits. States with severe rainfall shortages include Kansas (-40%), Nebraska (-38%), Texas (-37%), Montana (-18%), North Dakota (-15%), and Missouri (-15%). In these areas with insufficient rainfall, temperatures were at least 0.3°C higher than the average. The eastern part of the Corn Belt generally had better agricultural meteorological conditions, with rainfall levels close to average in Indiana (-6%), Illinois (+3%), Ohio (-5%), and Michigan (+6%).

Spatial differences in agro-climatic conditions led to diverse agronomic conditions. The overall Vegetation Condition Index (VCIx) nationwide reached 0.87. Poor crop conditions (VCIx < 0.5) occurred in some areas of the Southern Plains and Northwest due to water stress, while crop conditions in other regions were generally normal (VCIx > 0.8). NDVI anomaly clusters and their curves also indicated a strong spatial variability in crop conditions. The Corn Belt exhibited good crop growth conditions, while the northern plain experienced suboptimal conditions at the end of August due to drought. The Southern Plains and Lower Mississippi encountered high temperatures and drought after August, resulting in crop growth below the average level. Nationally, the cropped arable land fraction (CALF) was higher than the five-year average (+2%), in particular in the Northern Plains, where CALF was significantly higher than the five-year average (+12%). The Crop Production Index was 1.0, indicating a normal crop production situation in the United States during the reporting period.

In short, CropWatch assessed diverse crop conditions and overall close average production in the United States.

Regional Analysis

The crop conditions of the Corn Belt (202), Northern Plains (204), Lower Mississippi (203), Northwest (206), Southern Plains (207), and Southeast region (208) are summarized below.

(1) Corn Belt

The Corn Belt covers Illinois, Iowa, Minnesota, Wisconsin, Ohio, and Michigan, and it is the most important maize and soybean-producing region in the United States. During this reporting period, dryer than usual weather prevailed in the western Corn Belt, with rainfall (ΔRAIN -9%) and radiation (ΔRADPAR -4%) below average, and temperatures above average (ΔTEMP +0.7°C). In the preceding monitoring period (April to July), the Corn Belt also experienced overall dry conditions, leading to a notable 4% decrease in the current potential cumulative biomass compared to the 15-year average. NDVI development curve shows that from late August to late September, continuous below-average rainfall and temperatures nearing the 15-year maximum resulted in slightly below average vegetation cover during those months. Throughout the monitoring period, the CALF was 100%, VCIx reached 0.93, and the Crop Production Index was 0.99, confirming that crop growth conditions were generally normal. CropWatch assesses that crop yields in the Corn Belt are close to average.

(2) Northern Plains

The Northern Plains, which includes parts of North Dakota, South Dakota, and Nebraska, is the largest spring wheat-growing region and an important corn-producing region in the United States. The reporting period was characterized by dry and warm weather, with rainfall (ΔRAIN -24%) and radiation (ΔRADPAR -2%) below average, and temperatures above average (ΔTEMP +0.4°C). This resulted in a potential biomass estimate that was 12% below the average level (ΔBIOMASS -12%). The rainfall profile indicates a severe lack of rainfall from

July to August in the Northern Plains. However, during the previous monitoring period (May to June), rainfall was significantly above average. Hence, stored soil moisture alleviated the impact of insufficient rainfall on crop growth in the current monitoring period. After August, rainfall returned to normal levels, prompting crop growth conditions to surpass the average level. The cropped arable land fraction was 91%, exceeding the average level by 12%. The VCIx was 0.86, and the Crop Production Index was 1.06, indicating favorable crop production. In conclusion, CropWatch estimates that crop production in this region was above average due to a significant increase in CALF.

(3) Lower Mississippi

It is the biggest rice-producing area and an important soybean producing zone in the United States. It includes Arkansas, Louisiana, Mississippi, and Missouri. The rainfall (ΔRAIN -42%) was far below average, temperatures were above average (ΔTEMP +1.7°C), and radiation was average (ΔRADPAR +0%). This combined effect resulted in a potential biomass (ΔBIOMASS -18%) below the average level. Starting from mid-July, rainfall remained consistently below average throughout the monitoring period, and temperatures remained above average, significantly impacting crops during the harvesting stage. The NDVI curve shows that crop growth gradually fell below average starting in August. The average VCIx was 0.88, the CALF was 100%, and the Crop Production Index (CPI) was 0.98, indicating below average crop production conditions. In conclusion, CropWatch estimates that crop production in this region was below average.

(4) Northwest

The Northwest region is the second-largest winter wheat production area in the United States and is also important for spring wheat production. During the monitoring period, winter wheat reached maturity, with the majority harvested before August. In the reporting period, rainfall and radiation were slightly below average (ΔRAIN -6%, ΔRADPAR -4%), while temperatures were above average (ΔTEMP +0.2°C), resulting in an above average estimate for potential biomass production (ΔBIOMASS +2%). The NDVI curve shows that the NDVI remained below average until August. As emphasized in the previous bulletin, even though the agro-meteorological conditions were favorable in the previous period, the crop conditions never reached the average level due to the delay in the sowing of the spring wheat crop. Below-average crop conditions persisted until the crop was ripe for harvest. Compared to 5YA, CALF (71%) was 2% higher than average and the VCIx index was 0.83, indicating average crop growth during this period. In short, CropWatch expects below average crop production in the region.

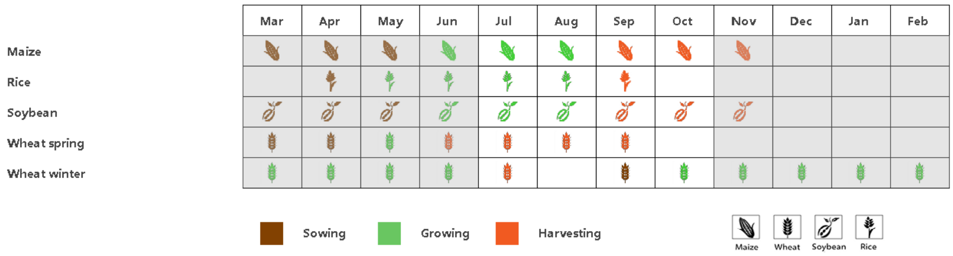
(5) Southern Plains

The Southern Plains is the most important region for winter wheat, sorghum, and cotton production, and it includes Kansas, Oklahoma, Texas, and eastern Colorado. Agri-climatic indicators show below-average rainfall (ΔRAIN -31%), while temperatures and radiation were above average (ΔTEMP +1.6°C, ΔRADPAR +1%). These factors resulted in below average potential biomass (ΔBIOMASS -16%). During the monitoring period, the NDVI curve was below the five-year average, indicating poor crop conditions. Starting from late July, a significant reduction in rainfall and temperatures reaching the 15-year maximum led to a gradual deterioration in crop growth conditions. The cropped arable land fraction was 87%, which was 5% higher than the five-year average. The VCIx was only 0.79, indicating unfavorable crop production conditions. In summary, CropWatch estimates that crop production in the Southern Plains was below average.

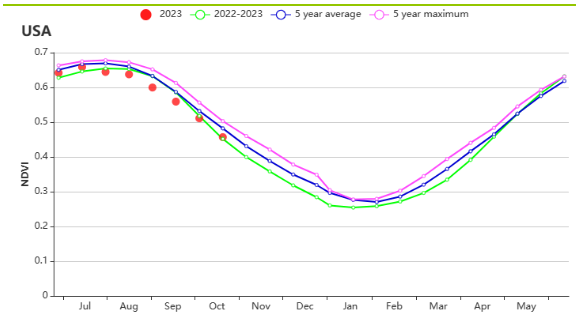
(6) Southeast region

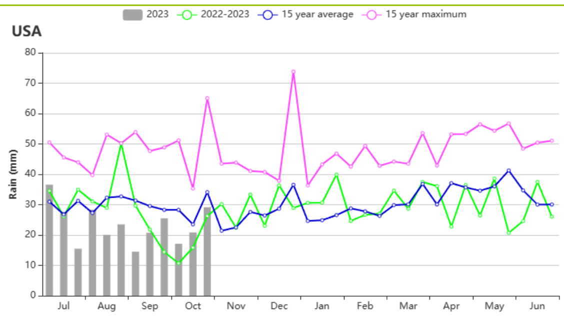
The Southeast is an important cotton and corn-producing region. It includes the states of Georgia, Alabama, and North Carolina. During the reporting period, rainfall was below average (ΔRAIN -32%), while temperatures and radiation were above average (ΔTEMP +0.8°C, ΔRADPAR +2%), leading to a below average estimate of potential biomass (ΔBIOMASS -12%). The NDVI curve indicates that crop conditions were close to the five-year average. The VCIx was 0.87 and the Crop Production Index (CPI) was 0.97. In summary, CropWatch estimates that crop production in the region was slightly below average.

Figure 3.46 United States crop condition, July - October 2023



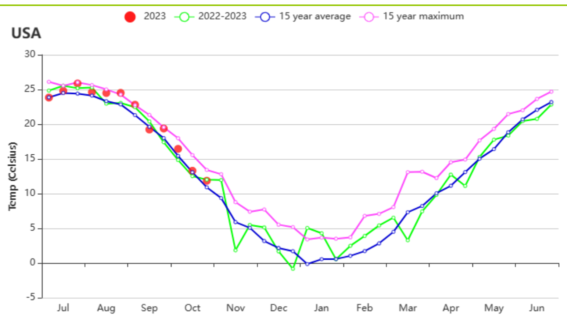
(a) Phenology of United States from July to October 2023

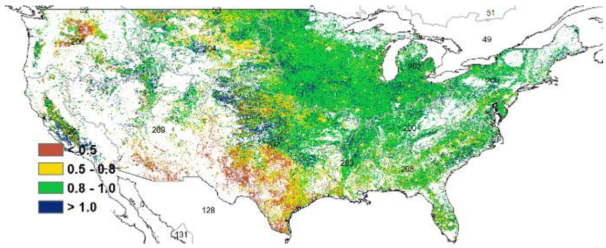




(b) Crop condition development graph based on NDVI

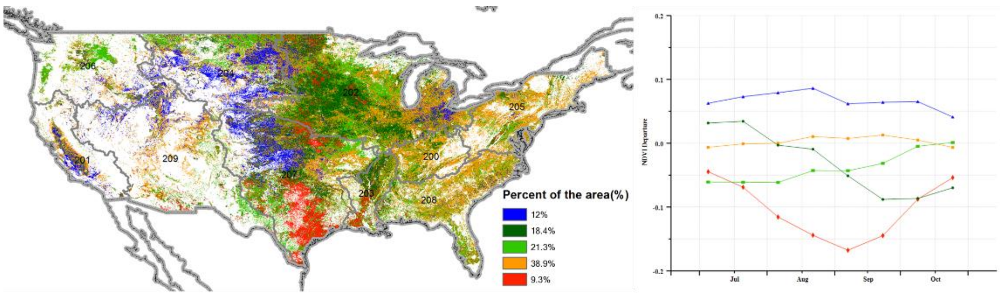
(c) Time series rainfall profile



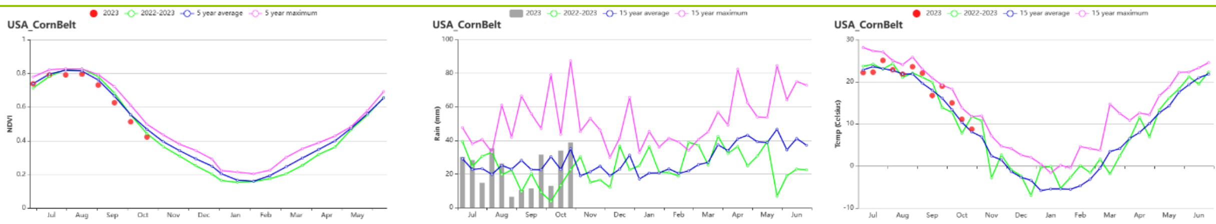


(d) Time series temperature profile

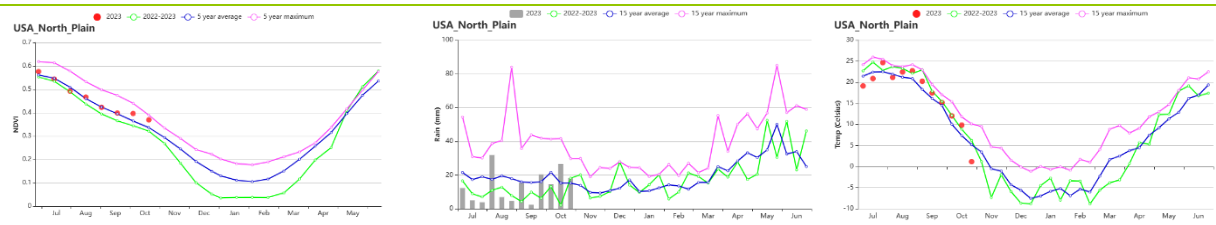
(e) Maximum VCI



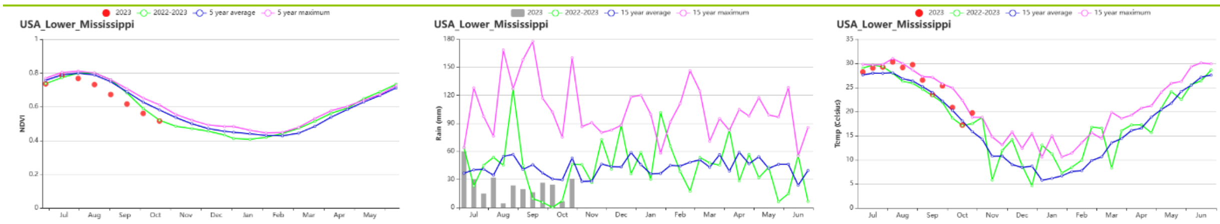
(f) Spatial distribution of NDVI profiles



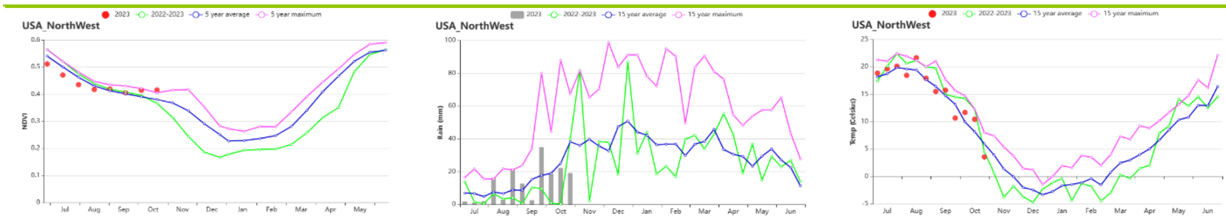
(g) Crop condition development graph based on NDVI, Time series precipitation profile and temperature profile(The Corn Belt)



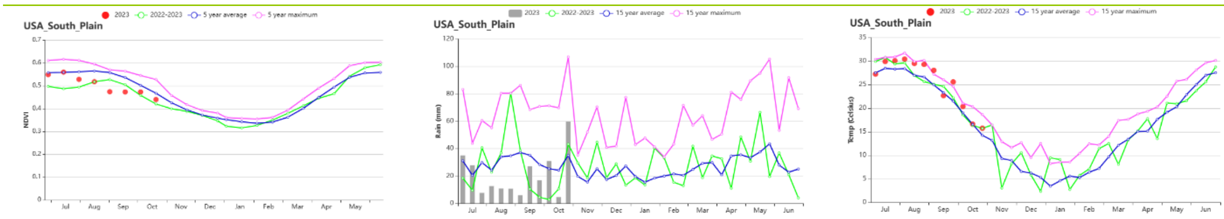
(h). Crop condition development graph based on NDVI, Time series precipitation profile and temperature profile (The Northern Plains).



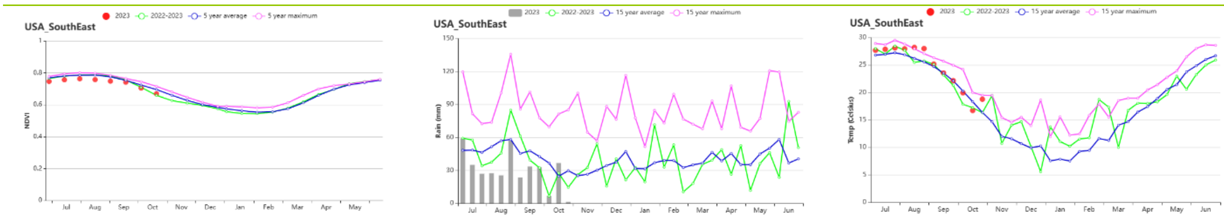
(i). Crop condition development graph based on NDVI, Time series precipitation profile and temperature profile(The Lower Mississippi)



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



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



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

Table 3.81 United States' agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, July-October 2023

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m2)	Departure (%)	Current (gDM/m2)	Departure (%)
Blue Grass region	256	-28	20.8	0.2	1159	0	794	-14
California	71	14	19.9	-0.2	1317	-6	514	7
Corn Belt	280	-8	19.2	0.7	1049	-4	783	-4
Lower Mississippi	290	-42	25.7	1.5	1183	0	890	-18
North-eastern areas	450	15	18.2	0.4	1012	-3	983	5
Northwest	156	-6	15.4	0.2	1144	-4	536	2

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m2)	Departure (%)	Current (gDM/m2)	Departure (%)
Northern Plains	162	-24	17.2	0.4	1140	-2	587	-12
Southeast	366	-32	24.5	0.8	1223	2	1010	-12
Southwest	102	-63	20.7	1.2	1315	1	556	-24
Southern Plains	250	-31	25.5	1.6	1236	1	764	-16

Table 3.82 United States'agronomic indicators by sub-national regions, current season's values and departure, July-October 2023

Region	Cropped arable land fraction		Cropping Intensity		Maximum VCI
	Current (%)	Departure (%)	Current (%)	Departure (%)	Current
Blue Grass region	100	0	109	0	0.92
California	48	11	122	6	1.01
Corn Belt	100	0	110	-1	0.93
Lower Mississippi	100	0	103	-2	0.88
North-eastern areas	100	0	119	4	0.93
Northwest	71	2	126	6	0.83
Northern Plains	91	12	111	-2	0.86
Southeast	100	0	102	0	0.87
Southwest	40	-2	126	7	0.73
Southern Plains	87	5	105	-1	0.79

[UZB] Uzbekistan

This monitoring period from July to October 2023 covers the growing and harvesting stage of maize, as well as the harvest stage (July and August) and the sowing stage (September and October) of wheat. Summer precipitation is minimal, as rain falls mostly during winter. Most of the summer crops are irrigated. Among the CropWatch agroclimatic indicators, rainfall (RAIN) and temperature (TEMP) were slightly above average (ΔRAIN +12% and ΔTEMP +0.1°C), while radiation (RADPAR) was slightly below average (ΔRADPAR -2%) compared to the 15-year average (15YA). The precipitation was significantly above the 15YA in late August. The temperature was generally close to the 15YA, but was slightly higher than average in late July and late October. The biomass accumulation (BIOMSS) slightly increased by 1% compared to the 15YA. At the national level, the NDVI development graph indicates that besides early September and late October, when it was close to the 5YA, the crop conditions were significantly below the five-year average.

The maximum Vegetation Condition Index (VCIx) was 0.73. 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 agricultural areas with maximum VCI indices above 0.8 were in Andijon Province, Namangan Province, Ferghana Province, Khorezm Province, and the eastern part of Bukhoro Province. The cropped arable land fraction (CALF, 56%) decreased by 6% compared to its 5YA. The cropping intensity was 113%, which had slightly increased by 3%. As shown in the NDVI cluster graph and profiles, only about 18.2% of arable land (light green) had above-average crop conditions during the whole monitoring period, mainly in the central and east areas of the Eastern hilly cereals, and along the Amu Darya River. 25.7% of arable land (red), distributed discretely in the Eastern hilly cereals, had average crop conditions in most of the monitoring period, but unfavorable conditions in late September and beginning of October. 23.2% of arable land (orange) had unfavorable conditions during July to August, but turned to better crop conditions than average in September and October. The other 32.9% of arable land (blue and dark green) had unfavorable crop conditions during the whole monitoring period. The crop production index (CPI) was 0.90. Prospects for crop production in Uzbekistan are estimated to be close to normal.

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)**.

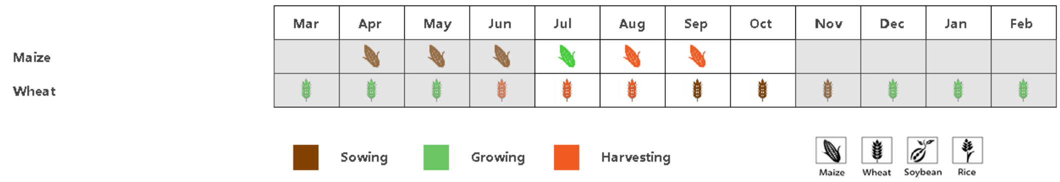
In the **Central region with sparse crops**, the NDVI development graph shows that the crop conditions were generally below average. RAIN and RADPAR were below average (ΔRAIN -15% andΔRADPAR -3%), while TEMP was above average (ΔTEMP +0.7°C). The VCIx was 0.82 and BIOMSS slightly decreased by 2% compared to the 15YA. The CALF was 77%, which was close to the 5YA (just slightly decreased by 1%). The cropping intensity was equal to the 5YA. The NDVI-based crop condition development graph shows that the crop conditions were unfavorable in July and then slightly better than average during the rest of the monitoring period. However, it is noteworthy that the crop condition in this AEZ had little impact on the crop production of Uzbekistan since the crop fields are sparse in the region.

In the **Eastern hilly cereals zone**, RADPAR was slightly below average (ΔRADPAR -2%), while RAIN and TEMP were above average (ΔRAIN +11% and ΔTEMP +0.1°C). The CALF was 56%. It decreased by 5% compared to the 5YA. The average VCIx index was 0.74. The NDVI-based crop condition development graph shows that the crop conditions were slightly below the 5YA in this monitoring period, except early September, when it was close to the 5YA. The BIOMSS was the same as the average. The cropping intensity increased by 6% compared to the 5YA. The prospects for crop production were average.

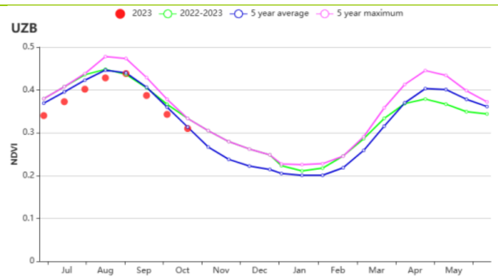
In the **Aral Sea cotton zone**, RADPAR was below average (ΔRADPAR -4%), while RAIN and TEMP were above average (ΔRAIN +57% andΔTEMP +0.7°C). These agroclimatic conditions resulted in a slight increase in

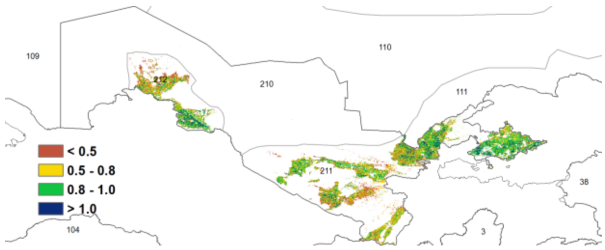
BIOMSS (+3%) in this AEZ. The CALF (58%) decreased by 11% compared to the 5YA and the maximum VCI index was 0.71. The cropping intensity was equal to the 5YA. The NDVI-based crop condition development graph shows that the crop conditions were slightly below the 5YA in this monitoring period, except in late October. The agro-climatic conditions of this region were slightly unfavorable.

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



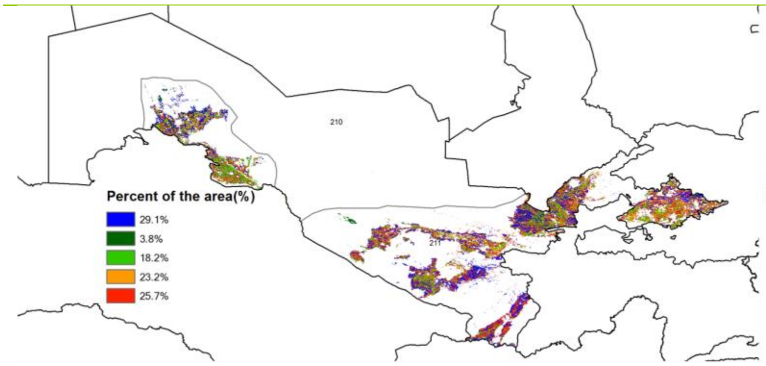
(a) Phenology of major crops

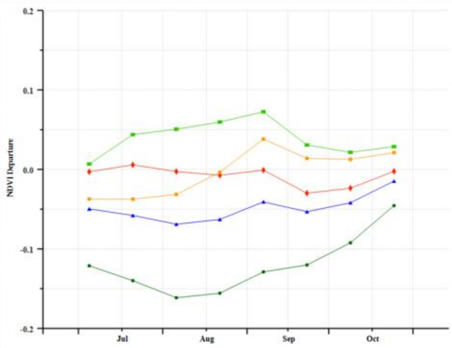




(b) Crop condition development graph based on NDVI

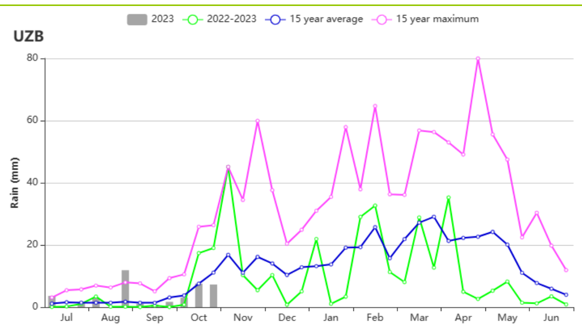
(c) Maximum VCI

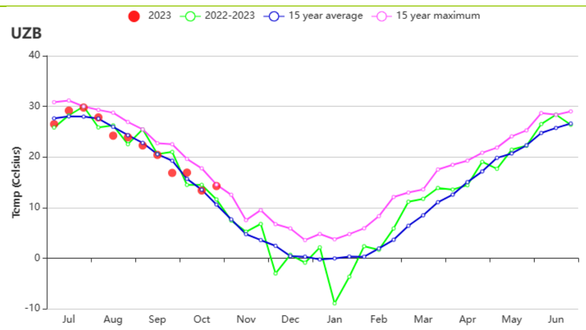




(d) Spatial NDVI patterns compared to 5YA

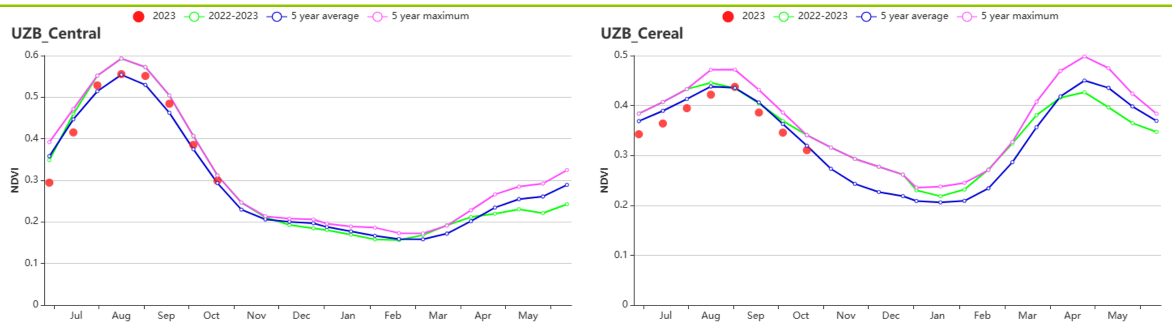
(e) NDVI profiles



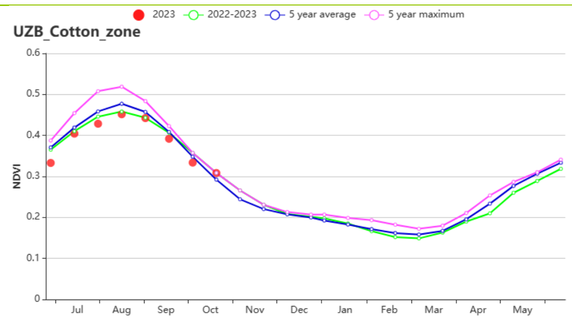


(f) Rainfall profiles

(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 3.83 Uzbekistan's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, July - October 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	12	-15	24.4	0.7	1300	-3	454	-2
Eastern hilly cereals zone	44	11	21.9	0.1	1345	-2	487	0
Aral Sea cotton zone	20	57	24.0	0.7	1250	-4	459	3

Table 3.84 Uzbekistan's agronomic indicators by sub-national regions, current season's values and departure from 5YA, July - October 2023

Region	Cropped arable land fraction		Cropping Intensity		Maximum VCI
	Current (%)	Departure (%)	Current (%)	Departure (%)	Current
Central region with sparse crops	77	-1	100	0	0.82
Eastern hilly cereals zone	56	-5	116	5	0.74
Aral Sea cotton zone	58	-11	101	0	0.71

[VNM] Vietnam

This monitoring period covers the entire growth period from sowing to harvesting of Spring-Winter rice in the Mekong River Delta and rainy season rice in the North. In July, summer rice in Central Vietnam was harvested, followed by the planting of rainy season rice in August and September, which will be harvested in November.

The proportion of irrigated cropland in Vietnam is 32%. Therefore, precipitation is an important factor controlling crop production. CropWatch agro-climatic indicators shows slightly decreased RAIN (ΔRAIN -7%) and increased TEMP (ΔTEMP +0.9°C) compared to the 15-year average. With the decreased precipitation, the BIOMSS (1488 gDM/m2) was the same as 15YA due to the increase in RADPAR (ΔRADPAR +4%). The VCIx was 0.94 and the CALF was at the 5YA. The cropping intensity (153%) was at an average level. The crop production index in this monitoring period was 1.00, which represented a normal crop production situation.

Based on the NDVI development graph, the crop conditions were below the 5-year average throughout the whole monitoring period. Particularly in August, the NDVI showed a sharp drop which may have been caused by cloud cover in the satellite images. During the whole monitoring period, precipitation was generally below the 15YA but surpassed the average in late September and late October. The temperature was above the 15-year average. As to the spatial distribution of NDVI profiles, the crop conditions in most of the country were below average during the whole monitoring period. The drops in NDVI are most likely caused by cloud cover in the satellite images. The peaks in all clusters were close to the average. 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, the TEMP (ΔTEMP +0.6°C) was above the average. Although the RAIN decreased by 7%, the BIOMSS still had a slight increase (ΔBIOMSS +1%), which may have been caused by the increase of RADPAR by 8%. The cropping intensity (147%) decreased by 4%. CALF was 100% and VCIx was 0.96. According to the crop condition development graph, the NDVI dropped in late July, early August and early September, which may have been caused by the cloud cover in the satellite images， while NDVI fluctuated around the average level in other times. The CPI was 1.01. The crop conditions were close to the average.

In the Mekong River Delta, the TEMP (ΔTEMP +0.3°C) was above the average. Although the RAIN (ΔRAIN -1%) was below the 15YA, the BIOMASS (ΔBIOMSS +1%) was above average due to the increase of the RADPAR (ΔRADPAR +3%). The cropping intensity (179%) dropped by 2%. VCIx was 0.89 and CALF was 90%. 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 and late August, which may have been caused by the cloud cover in the satellite images. The CPI was 1.01. Crop production was expected to be close to the average.

In the North Central Coast, due to significantly decreased RAIN (ΔRAIN -10%), increased TEMP (ΔTEMP +1.0°C) and RADPAR (ΔRADPAR +1%), the BIOMSS showed a decrease compared to the 15YA (ΔBIOMSS -1%). VCIx was 0.93 and CALF was 98%. The cropping intensity (129%) decreased by 4%. According to the NDVI-based development graph, the crop conditions were below the 5YA during the whole monitoring period. NDVI dropped sharply in late July, which may have been caused by cloud cover in the satellite images. The CPI was 0.98. Crop conditions in this region were slightly below the average.

In the North East, TEMP and RADPAR were both above the average (ΔTEMP +1.2°C; ΔRADPAR +4%). Although RAIN decreased (ΔRAIN -9%), BIOMSS was at an average level. The cropping intensity was higher than the 5YA (+3%). CALF was 100% and VCIx was 0.95. According to the NDVI-based development graph, the NDVI was below the 5YA during the whole monitoring period. Because of the influence of the clouds in the satellite images the

NDVI suddenly dropped below the 5YA in August. The CPI was 0.98. Overall, the crop conditions were estimated to be below the average.

In the North West, the TEMP (ΔTEMP +1.0°C) was above the average. Although the RAIN decreased by 14%, the BIOMSS (ΔBIOMSS +2%) was above average, which may have been caused by the increase of RADPAR (ΔRADPAR

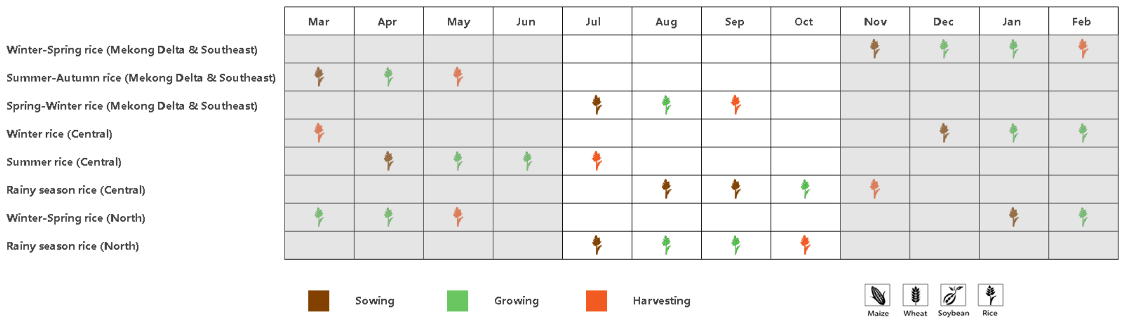
+3%). CALF was 100% and VCIx was 0.96. According to the agroclimatic indicators, crop conditions were generally near the 5YA in most of the monitoring period. In August, the NDVI dropped sharply because of the influence of the clouds in the satellite images. The CPI was 0.99. The crop conditions were close to the average.

In the Red River Delta, increased TEMP (ΔTEMP +0.9°C), sharply decreased RAIN (ΔRAIN -22%), and increased RADPAR (ΔRADPAR +2%) all resulted in decreased BIOMSS (ΔBIOMSS -5%). The CALF was 97% and the VCIx was 0.93. The region showed a high cropping intensity of 178, above the 5YA by 9%. According to the crop condition development graph, crop conditions were below the 5YA in most of the monitoring period, particularly in August, the NDVI dropped sharply which may have been caused by cloud cover in the satellite images. The CPI was 1.02. The crop conditions were below the average.

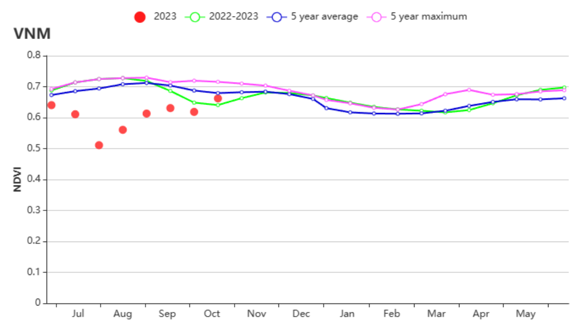
In the South Central Coast, TEMP was above average (ΔTEMP +1.3°C). Although the RAIN decreased by -8%, the BIOMSS still enhanced by 1%, which may have been caused by the significant increase of RADPAR (ΔRADPAR +10%). CALF was 97% and VCIx was 0.95. The cropping intensity was 130%, with a drop of 6%. According to the crop condition development graph, crop conditions were generally near the 5YA during the whole monitoring period. The CPI was 1.04. Crop conditions were expected to be favorable.

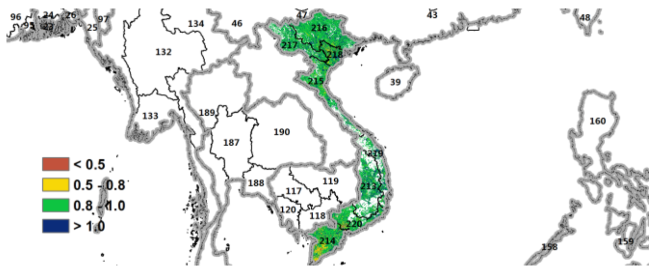
In the South East, the RAIN (ΔRAIN -1%) was lower than the 15YA. But with the TEMP (ΔTEMP +0.6°C) close to the average and the RADPAR increased significantly by 7%, the resulting BIOMASS showed a slight increase by 1%. CALF was 96% and VCIx was 0.92. The cropping intensity (142%) decreased by 1%. According to the crop condition development graph, crop conditions fluctuated greatly. In mid-July and late August, the NDVI was far below average because of the influence of the clouds in the satellite images. The CPI was 1.01. Crop production in this region were estimated to be near average.

Figure 3.48 Vietnam's crop conditions, July – October 2023



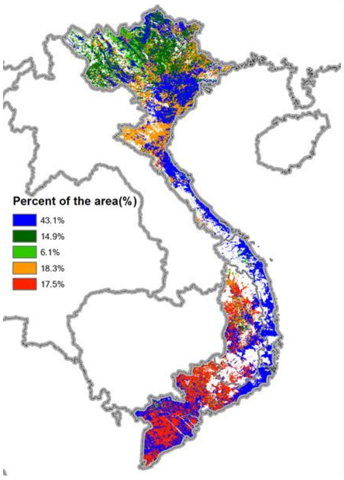
(a) Phenology of major crops

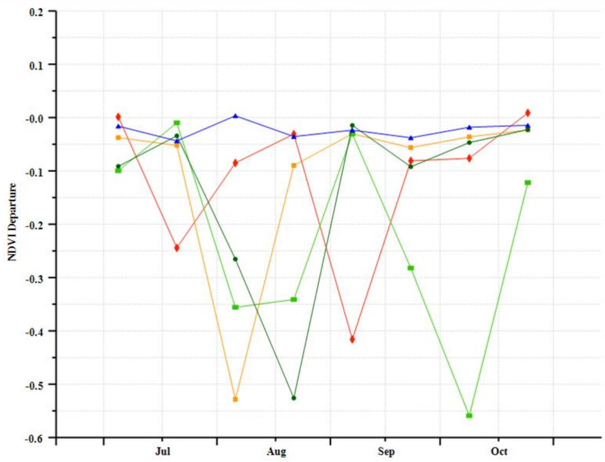




(b) Crop condition development graph based on NDVI

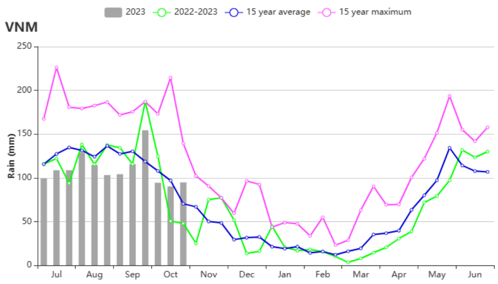
(c) Maximum VCI

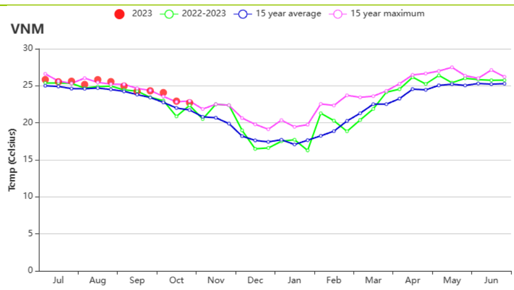




(d) Spatial NDVI patterns compared to 5YA

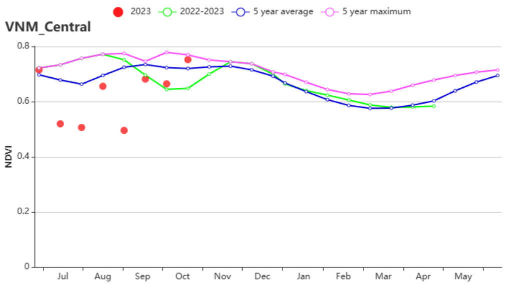
(e) NDVI profiles

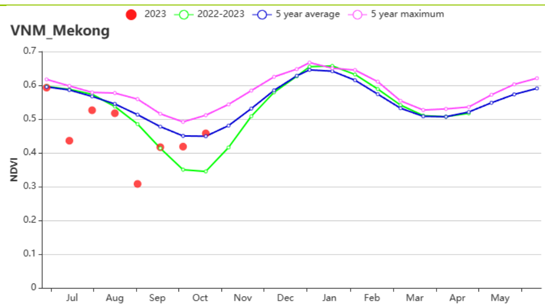




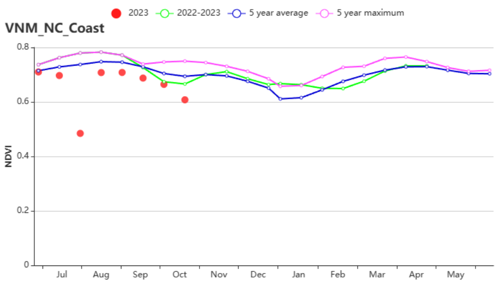
(f) Rainfall profiles

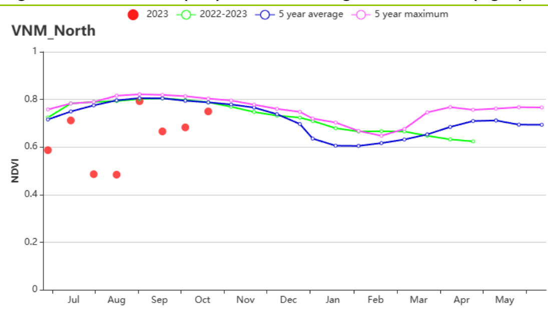
(g) Temperature profiles



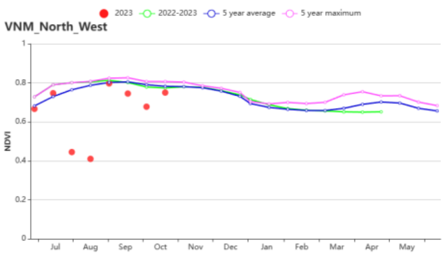


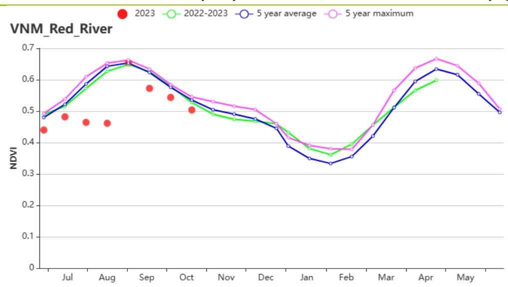
(h) Crop condition development graph based on NDVI Central Highlands Vietnam (left), and Mekong River Delta (right).



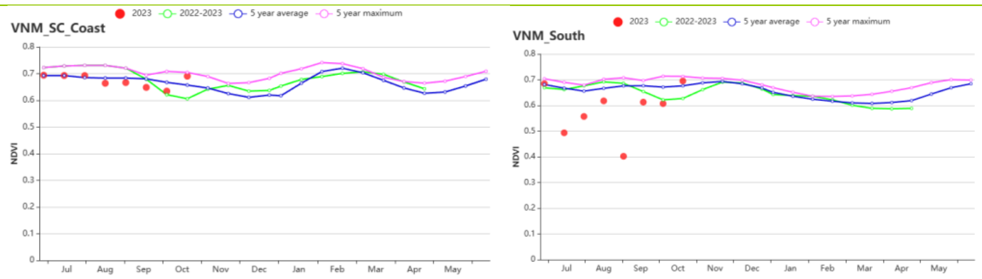


(i) Crop condition development graph based on NDVI North Central Coast Vietnam (left), and North East Vietnam (right).





(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 3.85 Vietnam's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, July – October 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(%)
Central Highlands	1438	-7	23.1	0.6	1123	8	1460	1
Mekong River Delta	1321	-1	27.0	0.3	1245	3	1700	1
North Central Coast	1283	-10	24.6	1.0	1087	1	1435	-1
North East	1398	-9	24.7	1.2	1151	4	1482	0
North West	1153	-8	22.8	1.0	1117	3	1402	2
Red River Delta	1197	-22	27.2	0.9	1182	2	1535	-5
South Central Coast	1202	-8	24.7	1.3	1193	10	1401	1
South East	1567	-1	25.8	0.6	1240	7	1563	1

Table 3.86 Vietnam's agronomic indicators by sub-national regions, current season's values and departure from 5YA, July – Octobery 2023

Region	CALF		Cropping Intensity		Maximum VCI
	Current(%)	Departure from 5YA(%)	Current(%)	Departure from 5YA(%)	Current
Central Highlands	100	0	147	-4	0.96
Mekong River Delta	90	1	179	-2	0.89
North Central Coast	98	0	129	-4	0.93
North East	100	0	162	3	0.95
North West	100	0	157	4	0.96
Red River Delta	97	1	178	9	0.93
Region	97	1	130	-6	0.95
Central Highlands	96	1	142	1	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

[ZAF] South Africa

In South Africa, wheat is the main crop being produced during this monitoring period. In the east, maize sowing started in October. Soybean planting also started in October.

At the national level, the CropWatch agroclimatic indicators show that radiation and temperature were slightly below the 15-year average (RADPAR -1%; TEMP -0.1℃), while rainfall was above the average by 3%, respectively. All these indicators led to a decrease in potential BIOMASS by 1%.

The maximum vegetation condition index (VCIx) was only 0.68, and the cropped arable land fraction (CALF) increased slightly by 4% compared with the last 5 years. According to the VCIx, conditions in the Dry Highveld and Bushveld maize areas were worse than in the other three regions. As to the spatial distribution of the NDVI cluster map, crop conditions on about 15% of the cropland were below average during the whole monitoring period, 65.9% were on average from July to August, most in North West and Free State Province. About 36.9% of the cropland, most located in Mpumalanga, Western Cape and Eastern Cape Province were above average starting in September. Overall, crop conditions were slightly above average, especially in the Mediterranean zone, which is the main wheat production region of South Africa.

Regional analysis

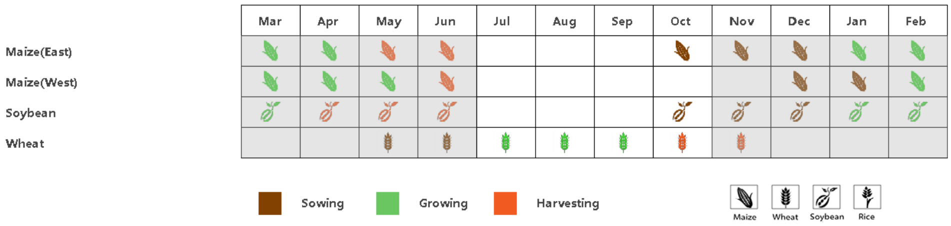
In the Arid and desert zones, RAIN (-1%) ,TEMP (-0.1°C) and RADPAR (-2%) were slightly below average. BIOMSS decreased slightly by 5%. CALF increased significantly (+60%) and VCIx was 0.88. The cropping intensity was average (112%, -5%), indicating cropland utilization rate was normal. The crop condition development graph based on NDVI indicates that the crop conditions were generally above the 5-year average and even near the 5-year maximum in July and August. Crop production is expected to be favorable.

In the Humid Cape Fold mountains, the TEMP (-0.1°C) and RADPAR (-1%) were below average. But the RAIN increased by 4%.Under these conditions, BIOMSS was slightly below the 15-year average (-1%). CALF was 83% and VCIx was 0.81. The cropping intensity was average (106%, -1%), indicating cropland utilization rate was normal. The crop condition development graph based on NDVI also indicates favorable crop conditions.

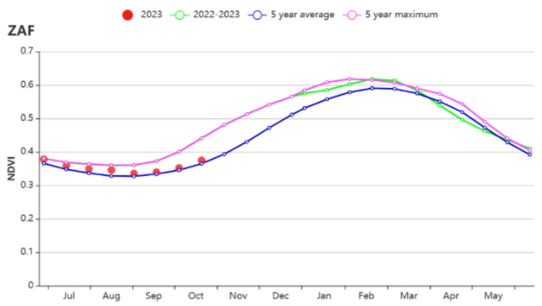
In the Mediterranean zone, the major wheat production region, the TEMP decreased by 0.9°C and RADPAR was slightly below average (-1%). RAIN was above the average(+4%). The BIOMSS was decreased by 4%. CALF increased slightly (92%, 6%) and VCIx was 0.94. The cropping intensity was average (111%, +7%), indicating cropland utilization rate was normal. According to the crop condition development graph, the crop conditions were generally above the 5-year average and even near the 5-year maximum in most months. Crop conditions were generally favorable.

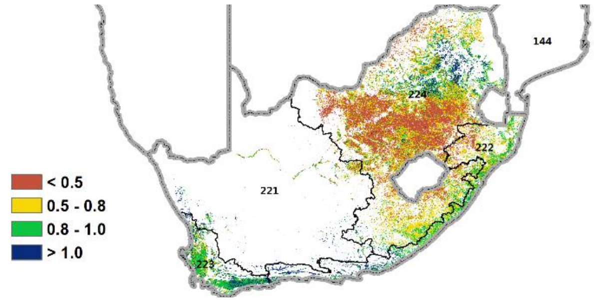
In the Dry Highveld and Bushveld maize areas, the TEMP was average and RADPAR (-1%) was below average. But the RAIN increased by 4%. Under these conditions, BIOMSS was slightly below the 15-year average (-1%). CALF was 17% and VCIx was 0.62. The cropping intensity was average (102%, 0%), indicating that the cropland utilization rate was normal. The crop condition development graph based on NDVI shows that the NDVI was near the 5-year average for all the period. In all, the crop conditions were favorable.

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



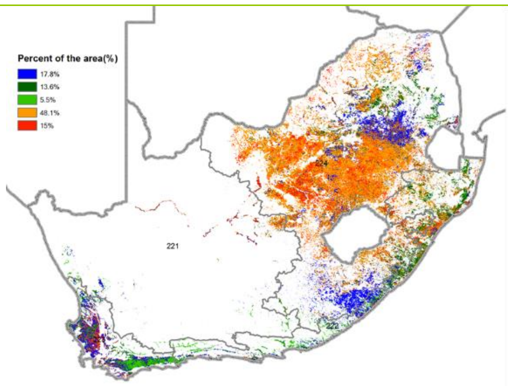
(a) Phenology of major crops

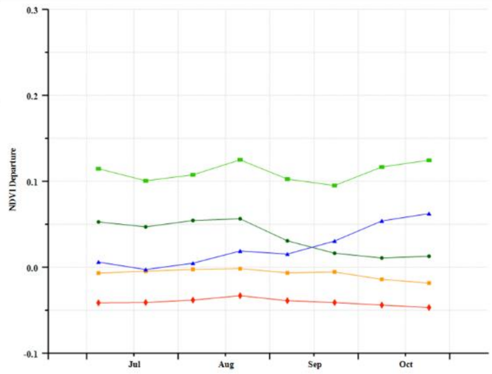




(b) Crop condition development graph based on NDVI

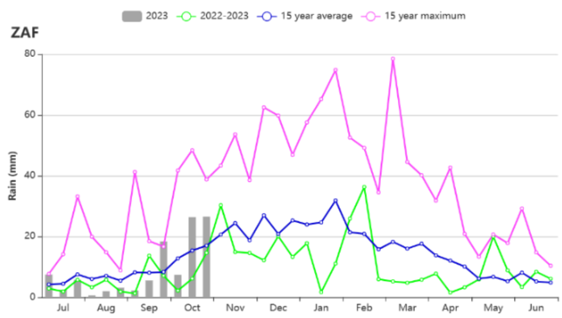
(c) Maximum VCI

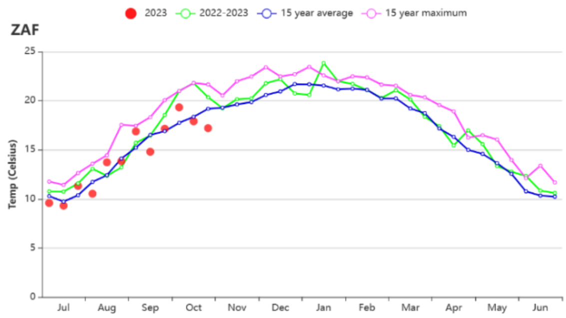




(d) Spatial NDVI patterns compared to 5YA

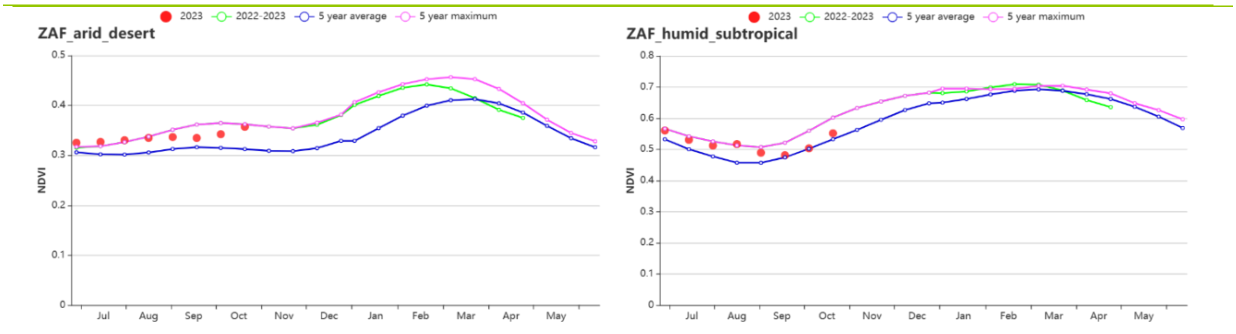
(e) NDVI profiles



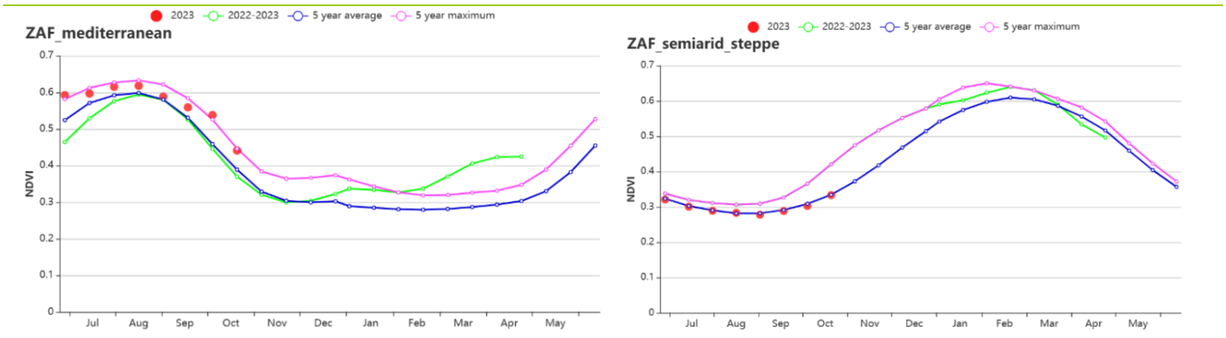


(f) Rainfall profiles

(g) Temperature profiles



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



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

Table 3.87 South Africa's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, , July - October 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	77	-1	13.2	-0.1	1093	-2	349	-5
Humid Cape Fold mountains	202	4	15.3	0.1	957	-1	576	-1
Mediterranean zone	224	4	11.5	-0.9	948	-1	546	-4
Dry Highveld and Bushveld maize areas	83	3	14.4	0.0	1157	-1	385	-1

Table 3.88 South Africa's agronomic indicators by sub-national regions, current season's values and departure from 5YA, , July - October 2023

Region	Cropped arable land fraction		Cropping Intensity		Maximum VCI
	Current (%)	Departure (%)	Current (%)	Departure (%)	Current
Arid and desert zones	36	60	112	-5	0.88
Humid Cape Fold mountains	83	3	106	-1	0.81
Mediterranean zone	92	6	111	7	0.94
Dry Highveld and Bushveld maize areas	17	2	102	0	0.62

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**

[ZMB] Zambia

This reporting period (July to October, 2023) covers the dry season. The major crops cultivated during this period include winter wheat (July - September), sugarcane and horticultural crops. The onset of the rainy season occurs in November for the Northern parts of the country and later in December for the rest of the country. The observed rainfall during this monitoring period was near the 15YA (RAIN +1%). It fell mainly in October. The temperature increased (TEMP +0.7℃) while radiation decreased (RADPAR -2%). The potential biomass production increased (BIOMSS +3%). The cropped arable land fraction (CALF) was at 35% with a VCIx value of 0.68 and the resulting crop intensity increased (+2%). These conditions indicated a dry environment with extreme soil moisture deficits unless crop production is supported by irrigation infrastructure systems.

Regional Analysis

Zambia is subdivided into four main crop production zones, namely the Northern high rainfall zone (226), Central-eastern and southern plateau (227), Western semi-arid plain (228) and Luangwa Zambezi rift valley (225).

Northern high rainfall zone (226): Predominantly receives higher rainfall, had a decrease in rainfall (RAIN -19%), and warmer temperatures (TEMP +0.6℃), decreased radiation (RADPAR -1%), and the increased biomass production (BIOMASS +1%). The observed cropped arable land fraction (CALF) was at 77% and VCIx was at 0.82.

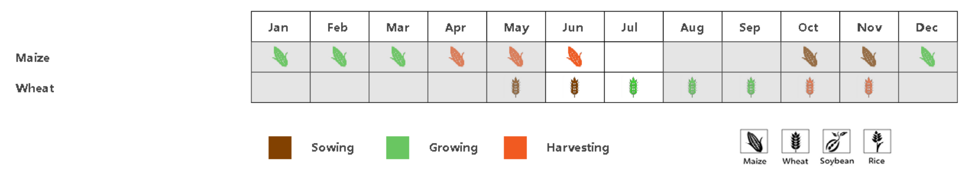
Central-Eastern and Southern plateau (227): This region is the grain belt for the country, the region received increased rainfall (RAIN +31%), and decreased biomass production (BIOMASS -1%). Cropped arable land fraction (CALF) of the region was at 30%, while VCIx was 0.72.

Western semi-arid plain (228): This region received increased rainfall (RAIN +53%), biomass production (BIOMASS +4%) however the Cropped arable land fraction decreased (CALF -25%).

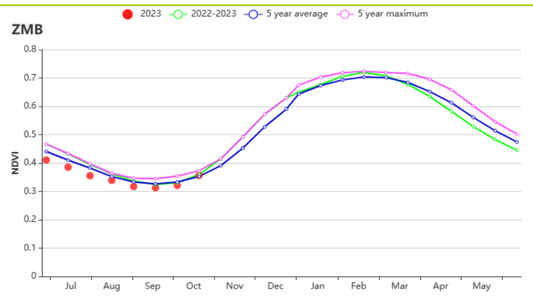
Luangwa-Zambezi Rift Valley (225: This is the driest zone in the country, the rainfall increased (RAIN +57%), temperature increased (TEMP +0.8℃), radiation decreased (RADPAR -3%) however potential biomass production increased (BIOMASS +4%). CALF was at 15% and VCIx at 0.56.

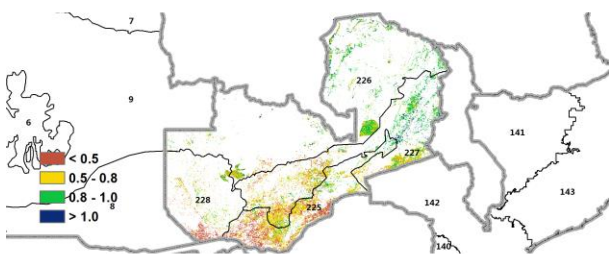
At the regional level, the Crop Production Index (CPI) was below 1.0 except for Central-Eastern and Southern plateau (CPI = 1.17), the grain basket of the country.

Figure 3.50 Zambia's crop condition, July - October 2023



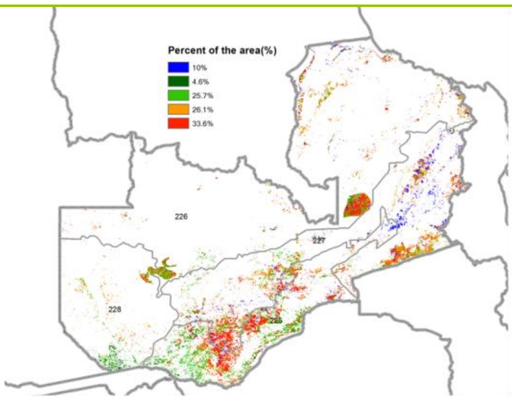
(a) Phenology of major crops



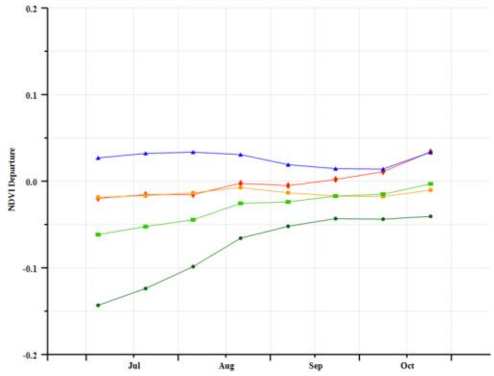


(b) Crop condition development graph based on NDVI

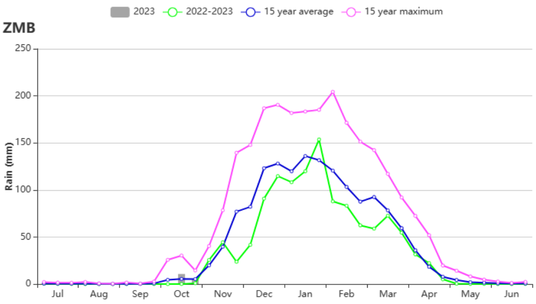
(c) Maximum VCI



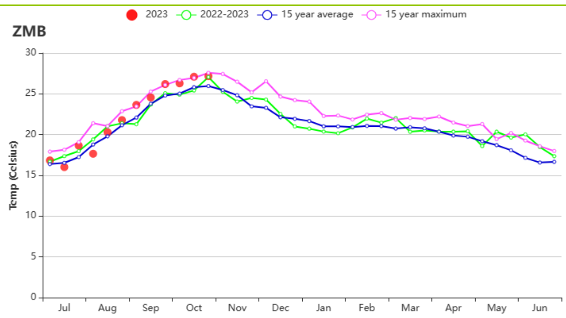
(d) Spatial NDVI patterns compared to 5YA



(e) NDVI profiles



(f) Rainfall profiles



(g) Temperature profiles

Table 3.89 Zambia's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, , July - October 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 (225)	13	57	22.3	0.8	1343	-3	434	4
Northen high rainfall zone (226)	27	-19	21.8	0.6	1400	-1	466	1
Central-eastern and southern plateau (227)	15	31	22.2	0.8	1339	-3	436	4
Western semi-arid plain (228)	17	53	22.8	0.8	1361	-2	457	4

Table 3.90 Zambia's agronomic indicators by sub-national regions, current season's values and departure from 5YA, , July - October 2023

Region	Cropped arable land fraction		Cropping Intensity		Maximum VCI
	Current (%)	Departure (%)	Current (%)	Departure (%)	Current
Luangwa Zambezi rift valley (225)	15	-49	106	1	0.56
Northen high rainfall zone (226)	77	-4	106	-1	0.82
Central-eastern and southern plateau (227)	30	-5	108	2	0.72
Western semi-arid plain (228)	25	-52	102	1	0.53

Chapter 4. China

After a brief overview of the agro-climatic and agronomic conditions in China over the reporting period (section 4.1), Chapter 4 presents an updated estimate of major cereals and soybean production as well as of summer crops production and total annual outputs at provincial and national levels (4.2) and describes the situation by region, focusing on the seven most productive agro-ecological regions of China: Northeast China, Inner Mongolia, Huanghuaihai, Loess region, Lower Yangtze, Southwest China, and Southern China (4.3). Section 4.4 describes the 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

From the perspectives of agroclimatic indicators, the overall conditions were generally fair in China from July to October 2023. Temperature and rainfall were above average by 0.9°C and 7%, respectively, while radiation was at average. As a result, the potential biomass was 4% larger than the 15YA. The maximum Vegetation Condition Index (VCIx) was quite high at 0.92. The national Cropping Intensity (CI) was 1% above the 5YA. Moreover, the mean of CALF for the whole country was at an average level compared to the 5YA. The national mean value of Crop Production Index (CPI) was 0.98, suggesting that the crop production status was at a normal level.

During the monitoring period, all of the main agricultural regions of China recorded absolute rainfall anomalies less than 20%, with the largest positive rainfall departure of 17% (North East China) and the largest negative rainfall departure of 5% (Loess region). According to the spatial distribution of rainfall profiles, dark green and light green marked regions (95.5% of the cultivated regions) had around average rainfall during the whole monitoring period. It is worth noting that 4.5% of the cultivated regions (marked in blue) experienced positive rainfall departure larger than 250 mm/dekad in early September, mainly located in Guangdong, Taiwan, and some parts of Guangxi, Jiangxi, and Fujian. Although the overall data shows that rainfall conditions were quite favorable, extreme rainfall in some areas caused flooding and exerted a negative impact on the crops. For the AEZ of Northeast China, the affected areas of maize, rice, and soybeans were 323,000, 138,000, and 51,000 hectares, respectively.

All of the main agricultural regions in China recorded above-average temperatures ranging from +0.6℃ (Lower Yangtze region) to +1.6℃ (Huanghuaihai and Loess region). The map of the spatial distribution of temperature profiles indicates that temperatures fluctuated during the monitoring period as follows: 52.6% of the cultivated regions experienced relatively smooth temperature variation, while other regions had some fluctuations in temperature during certain periods. 33.1% of the cultivated regions had larger-than-average temperatures throughout the monitoring period and experienced positive temperature departure larger than +3.0℃ in early September and late October, mainly located in Huaihuaihai, Loess region and some parts of Inner Mongolia and North East China. The remaining 14.3% of the cultivated regions had mainly average to above-average temperatures during the whole monitoring period, with negative departures in the middle of July and early August, mainly in North East China.

As for RADPAR, all of the main agricultural regions in China received around-average radiation as compared to the 15YA, with the absolute departure being less than 5%. With respect to BIOMSS, only Loess region (-1%) and Inner Mongolia (-2%) had small negative departures, while all the others had positive BIOMSS departures with a range from +3% (South West China) to +7% (North East China). As can be seen in the spatial distribution of potential biomass departure from the 15YA, most parts of China had positive departures, but there were areas with negative departures, mainly concentrated in some parts of the Loess region and Inner Mongolia, as confirmed by the statistics at the AEZ level.

The VCIx values were all greater than or equal to 0.87 in all of the main producing regions of China, with values between 0.87 (Inner Mongolia) and 0.96 (North East China). Nationally, CALF was at or around average in all AEZs of China as compared to the 5YA. Among them, Inner Mongolia (-1%) and Loess region (-3%) recorded slightly below-average CALF, while all the remaining regions showed an average CALF. When it comes to the cropping intensity (CI), values of 200% are mainly concentrated in the North China Plain with the wheat-maize rotation system, while values of 300% are sparsely distributed in Southwestern and Southern China. The largest CI departure occurred in Southwest China (+13%), and the CI in other AEZs was near the 5YA values. High VHIn values were widely distributed, suggesting that almost no crops suffered from water stress. Regarding CPI values for AEZs, the lower Yangtze region had the biggest CPI value at 1.02, while Inner Mongolia had the smallest CPI value at 0.92.

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

Region	Agroclimatic indicators				Agronomic indicators		
	Departure from 15YA (2007-2021)				Departure from 5YA (2017-2021)		Current period
	RAIN (%)	TEMP (°C)	RADPAR (%)	BIOMSS (%)	CALF (%)	Cropping intensity (%)	Maximum VCI
Huanghuaihai	8	1.6	5	4	0	0	0.91
Inner Mongolia	-1	1.6	1	-2	-1	-1	0.87
Loess region	-5	1.3	5	-1	-3	-3	0.88
Lower Yangtze	13	0.6	-2	6	0	3	0.94
Northeast China	17	0.9	-4	7	0	-5	0.96
Southern China	14	0.7	-1	4	0	1	0.94
Southwest China	-3	0.9	4	3	0	13	0.94

Figure 4.1 China crop calendar

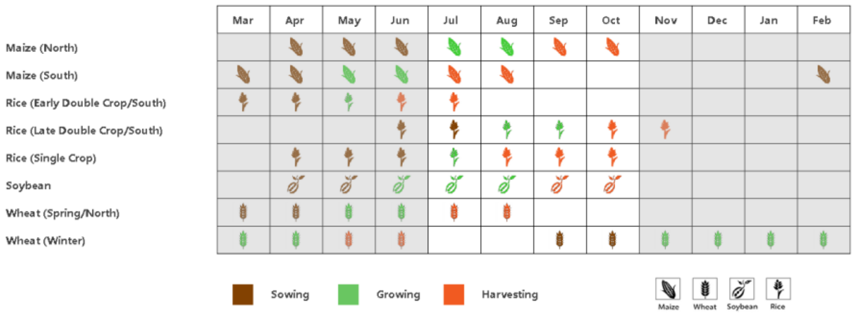


Figure 4.2 China spatial distribution of rainfall profiles, July to October 2023

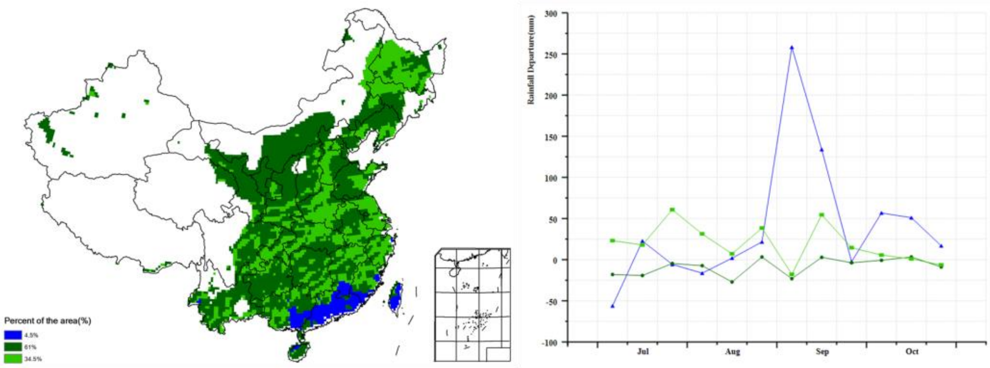


Figure 4.3 China spatial distribution of temperature profiles, July to October 2023

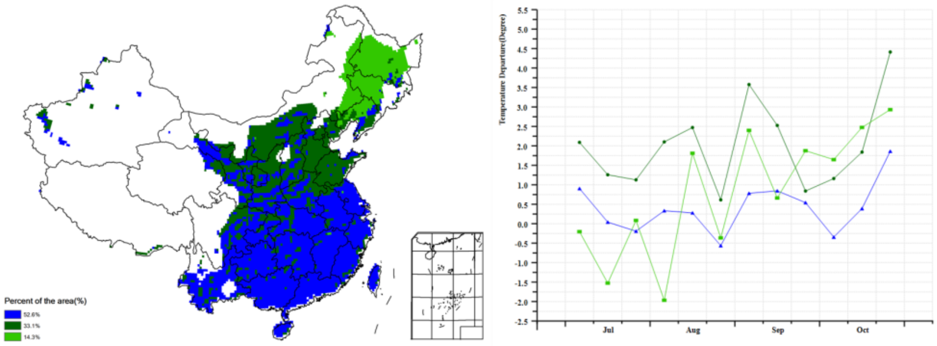


Figure 4.4 China cropped and uncropped arable land, by pixel, July to October 2023

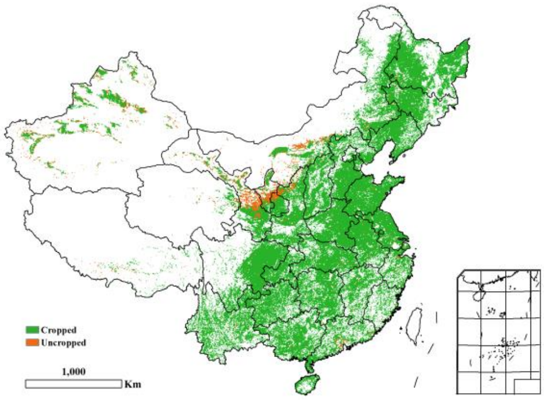


Figure 4.5 China maximum Vegetation Condition Index (VCIx), by pixel, July to October 2023

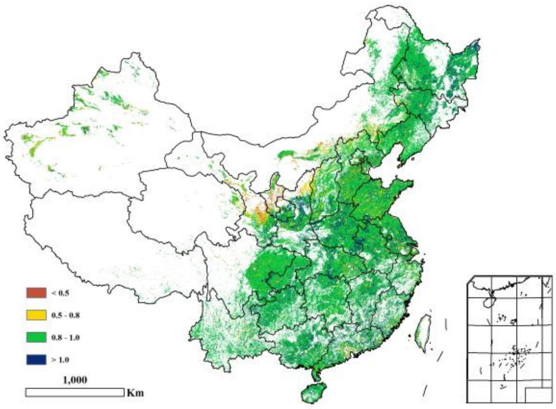


Figure 4.6 China biomass departure map from 15YA, by pixel, July to October 2023

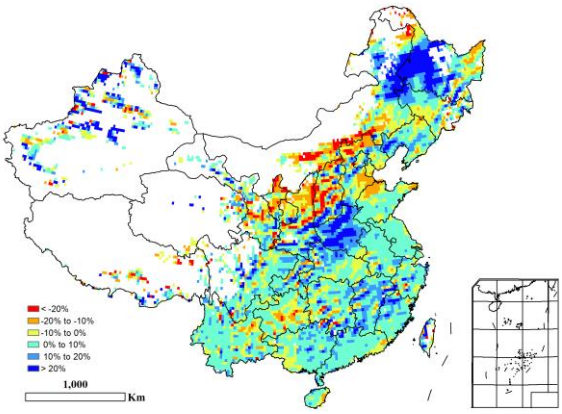


Figure 4. 7 China minimum Vegetation Health Index (VHIn), by pixel, July to October 2023

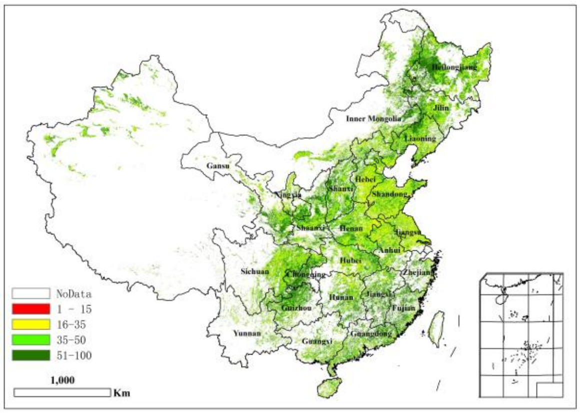
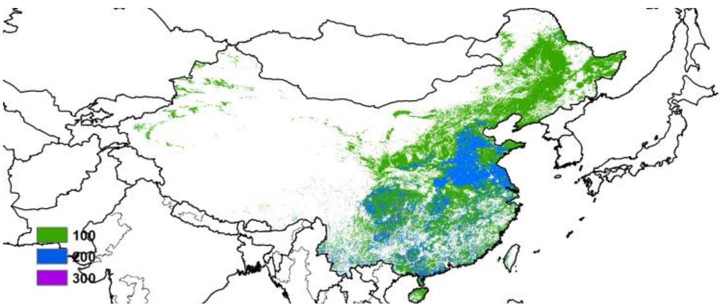


Figure 4. 8 China Cropping Intensity (CI), by pixel, July to Oct 2023



4.2 China's crop production

This report covers the 2023 the major grain and oil crops' sowing areas and growth in China. The analysis is based on multi-source remote sensing data from FY-3, ESA's Sentinel-1/2, and the U.S. Landsat 8 satellites. Additionally, nearly one million ground-measured sample points across major agricultural areas in Northeast, North, Northwest, and Southwest China were used.

This monitoring combined national data on 10-meter resolution cultivated land, agricultural meteorological information, and crop yield models. The production of maize, rice, soybeans, and summer crops, along with China's total annual grain output for 2023, were reviewed and confirmed.

(1) Annual food production

In 2023, China's total grain output reached 652.046 million tons, a 0.8% increase, adding 5.34 million tons from the previous year. The rise is attributed to expanded summer crop areas, including maize. Summer crops, such as maize, mid-season and late rice, spring wheat, soybean, coarse grains, and tubers, totaled 482.247 million tons. This is a 1.1% increase, or 5.31 million tons more than in 2022.

Major grain-producing provinces like Heilongjiang, Henan, Shandong, Jilin, and Anhui reported significant production gains. Their output exceeded 2022 levels, especially in Heilongjiang and Jilin. The Yangtze River basin provinces, like Zhejiang, Anhui, Jiangxi, Hubei, Hunan, and Chongqing, improved greatly compared to the extreme weather of 2022. Their autumn and annual grain yields increased. Notably, summer crops in Zhejiang, Anhui, and Hubei increased by over 3% year-on-year. However, the northwest region and the Loess Plateau saw a decrease in autumn and total grain production. In South China, frequent typhoons and heavy rains led to reduced grain yields in provinces such as Guangdong and Guangxi.

Table 4.2 China's Summer Crops and Annual Grain Production and Variation in 2023

Province	Summer Crops Production (Thousand Tons)	Year-over-Year Change (%)	Annual Grain Production (Thousand Tons)	Year-over-Year Change (%)
Hebei	18822	-2.5		
Shanxi	8796	-5.9		
Inner Mongolia	23027	-1.7		
Liaoning	15760	-4.2	4624	-0.5
Jilin	35693	11.3	5688	-3.4
Heilongjiang	47888	9.2	22727	-0.2
Jiangsu	2135	-0.1	16097	-0.3
Zhejiang			6419	3.3
Anhui	3719	3.6	16874	4.9
Fujian			2273	1.0
Jiangxi			14619	0.1
Shandong	19281	-0.4		
Henan	15567	2.1	3877	4.8
Hubei			15339	2.9
Hunan			25019	-0.1
Guangdong			10255	-0.6
Guangxi			9849	-1.1
Chongqing	2022	1.9	4695	1.6
Sichuan	6415	-1.8	15062	1.4
Guizhou	4949	-3.8	5369	-2.0
Yunnan	6399	-3.5	5562	-3.1
Shaanxi	3642	-4.3	1004	2.7
Gansu	5335	-2.9		
Ningxia	1640	-2.9	463	-3.7
Xinjiang	7141	-3.9		
National Total	232757	2.4	195813	0.2

(2) Forecasts of production of staple food and oil crops

In 2023, China's major grain and oilseed crops (maize, rice, wheat, and soybeans) produced 580.623 million tons. This was a 5.55 million-ton increase, a growth of 1.0%. Maize, rice, and wheat saw a year-on-year increase, while soybeans decreased (Table 4.2).

Maize: Production reached 232.757 million tons, up by 5.57 million tons, a 2.4% increase. The main reason was a 3.0% increase in planting area, adding 1.234 million hectares. Heilongjiang and Jilin saw the most significant increases, adding 564,000 hectares and 522,000 hectares, respectively. Flooding in Hebei, Heilongjiang, and Jilin negatively impacted production. National average yield per ha decreased by 0.6%. In early August, Typhoon Kanu caused flooding in the Songhua River basin, affecting 323,000 hectares of maize in central and southern Heilongjiang and eastern Jilin.

Maize production varied across major provinces. Heilongjiang, Jilin, Anhui, Henan, and Chongqing increased by 9.2%, 11.3%, 3.6%, 2.1%, and 1.9%, respectively. Other provinces saw decreases, with notable declines in Shanxi and Liaoning, mainly due to reduced planting area and yield.

Soybeans: China's total production was 17.169 million tons, a decrease of 1.02 million tons or 5.6%. The decrease was mainly due to reduced planting area, linked to maize-soybean rotation and lower comparative benefits of planting soybeans over maize in the Northeast.

The national soybean planting area was 9.233 million hectares, the second largest since the Soybean Revitalization Plan. It decreased by 618 thousand hectares, a 6.3% reduction. The average yield increased by 0.7%. In major producing areas, Heilongjiang reduced its area by 320 thousand hectares, a 6.4% decrease, leading to a 440,000 ton drop in production. Jiangsu, Jilin, and Liaoning increased production by 0.8%, 0.7%, and 5.1%, respectively.

Table 4.3 China's 2023 Maize, Rice, Wheat, and Soybean Production and Variance

Province	Maize Production (Thousand Tons)	Variance (%)	Rice Production (Thousand Tons)	Variance (%)	Wheat Production (Thousand Tons)	Variance (%)	Soybean Production (Thousand Tons)	Variance (%)
Hebei	18822	-2.5			12200	0.0	194	-3.6
Shanxi	8796	-5.9			2313	2.1	159	-4.0
Inner Mongolia	23027	-1.7			1980	0.2	1704	-0.2
Liaoning	15760	-4.2	4624	-0.5			453	5.1
Jilin	35693	11.3	5688	-3.4			725	0.7
Heilongjiang	47888	9.2	22727	-0.2			6327	-6.5
Jiangsu	2135	-0.1	16097	-0.3	13667	0.7	832	0.8
Zhejiang			6419	3.3		0.0		
Anhui	3719	3.6	16874	4.9	14347	1.2	1018	-5.0
Fujian			2273	1.0				
Jiangxi			14619	0.1				
Shandong	19281	-0.4			26948	0.1	702	-2.4
Henan	15567	2.1	3877	4.8	32751	0.7	857	2.7
Hubei			15339	2.9	4484	0.3		
Hunan			25019	-0.1				
Guangdong			10255	-0.6				
Guangxi			9849	-1.1				
Chongqing	2022	1.9	4695	1.6				
Sichuan	6415	-1.8	15062	1.4	1940	-1.6		
Guizhou	4949	-3.8	5369	-2.0				
Yunnan	6399	-3.5	5562	-3.1				
Shaanxi	3642	-4.3	1004	2.7	3816	-4.7		

Gansu	5335	-2.9			2623	0.5		
Ningxia	1640	-2.9	463	-3.7				
Xinjiang	7141	-3.9			5164	2.9		
National Total	232757	2.4	195813	0.2	134723	0.4	17169	-5.6

Rice: China's total rice production in 2023 was 195.813 million tons, an increase of 0.2% or 0.48 million tons from the previous year. Early rice produced 27.393 million tons, down 0.6% or 150,000 tons. semi-late rice/single rice production was 134.06 million tons, up by 310,000 tons or 0.2%. Late rice production was 34.359 million tons, a 1.0% or 0.32 million tons increase.

In 2023, the Yangtze River Basin saw better agricultural weather conditions during the middle and late rice growing period compared to 2022. Anhui, Hubei, Hunan, Jiangxi, and Zhejiang, the main middle and late rice-producing provinces, all achieved increased yields. The Yangtze River Basin’s total rice output increased by 1.51 million tons year-on-year.

In the Northeast's single-season rice area, continuous heavy rains during the flowering period adversely affected pollination and yield formation. This led to a total loss of 138,000 hectares of rice in Heilongjiang and Jilin due to floods. Rice production in Heilongjiang and Jilin decreased by 0.2% and 3.4%, respectively, totaling a reduction of 0.27 million tons.

Table 4.4 China's 2023 Provincial Early, Middle, Late Rice Production and Variance (%)

Province	Early Rice Production (Thousand Tons)	Variance (%)	Middle/Single-Season Rice Production (Thousand Tons)	Variance (%)	Late Rice Production (Thousand Tons)	Variance (%)
Liaoning			4624	-0.5		
Jilin			5688	-3.4		
Heilongjiang			22727	-0.2		
Jiangsu			16097	-0.3		
Zhejiang	564	-3.9	5019	4.7	836	0.1
Anhui	1123	6.2	14079	4.5	1672	7.1
Fujian	890	1.0			1383	0.9
Jiangxi	5754	-1.9	2982	0.9	5883	1.7
Henan			3877	4.8		
Hubei	821	-5.2	11273	3.7	3245	2.6
Hunan	8795	-1.8	8486	1.2	7738	0.5
Guangdong	4340	4.5			5915	-4.1
Guangxi	4690	-1.0			5159	-1.2
Chongqing			4695	1.6		
Sichuan			15062	1.4		
Guizhou			5369	-2.0		
Yunnan			5562	-3.1		
Shaanxi			1004	2.7		
Ningxia			463	-3.7		
National Total	27393	-0.6	134060	0.2	34359	1.0

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 October 2023 to the previous season, to the five-year average (5YA), and to the five-year maximum; (c) Spatial NDVI patterns for July to October 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 July to October 2023. Additional information about agro-climatic indicators and BIOMSS for China is provided in Annex A.

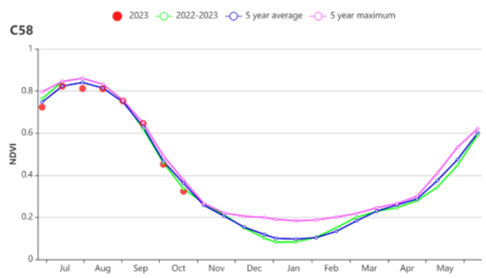
Northeast region

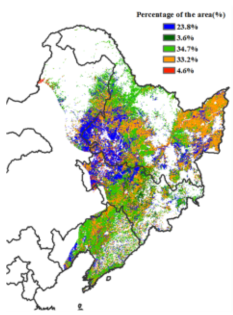
The current monitoring period (July to October) covered the peak of the summer crops in July until the harvest in September and October in northeast China. The crops, including maize, rice and soybeans, reached the maturity stage in August to September in Heilongjiang, Jilin and Liaoning provinces, and the harvest was mostly completed by the end of October. CropWatch Agroclimatic Indicators (CWAIs) show that the precipitation greatly deviated from the average level. The total precipitation increased by 17% (ΔRAIN+17%). It was above average from July to late August. The photosynthetically active radiation was above average (ΔRADPAR +4%), and the temperatures were above average (ΔTEMP +0.9°C). Altogether, the potential biomass was 7% above the fifteen-year average level.

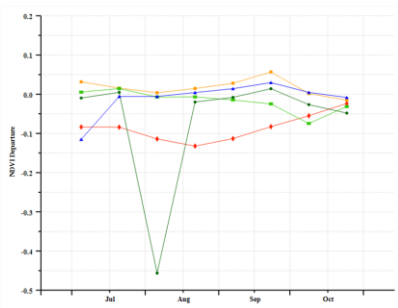
The crop conditions during the monitoring period were in general, slightly above average, but spatial variations existed. The maximum VCI shows that all provinces of the Northeast of China were above 0.8, except for a small part of western northeast China near the rivers. This was mainly due to the flooding caused by significant above average rainfall. According to flooding monitoring using remote sensing, the total affected area of the Songhua River Basin was 791,000 hectares. The affected area of maize was 323,000 hectares, rice was 138,000 hectares and soybeans was 51,000 hectares, the affected area of other crops was 278,000 hectares. In addition, VCIx map also reflects that the growth of crops in the saline alkaline areas of Daqing, Songyuan, Yingkou and Panjin was slightly poor.

In general, crops in northeast China grew well in 2023, with good prospects for crop yield.

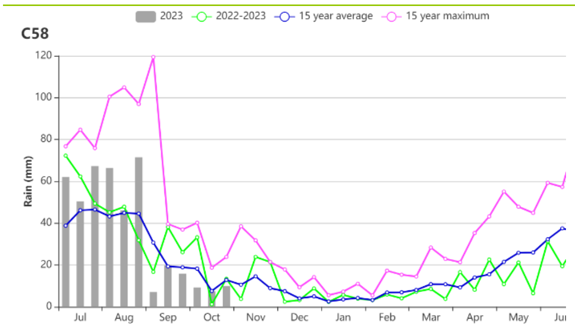
Figure 4. 9 Crop condition China Northeast region, July - October 2023

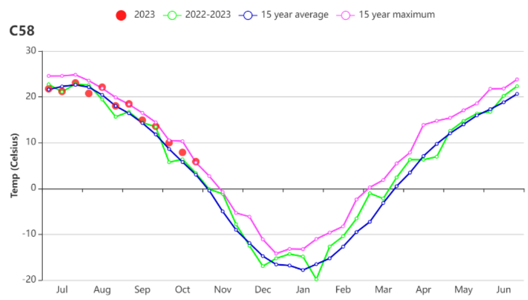




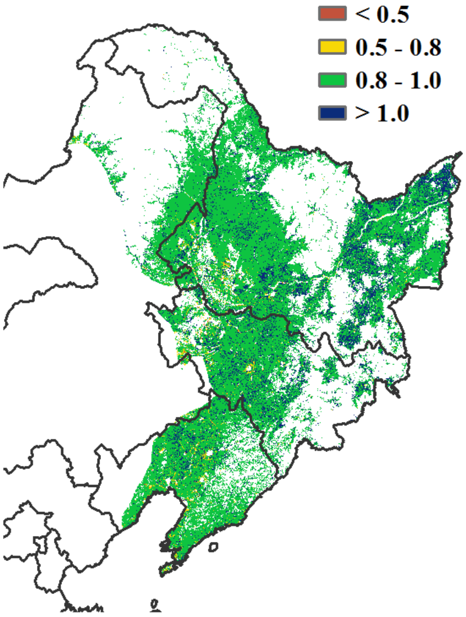


(a) Crop condition development graph based on NDVI (b) Spatial NDVI patterns compared to 5YA(c) NDVI profiles

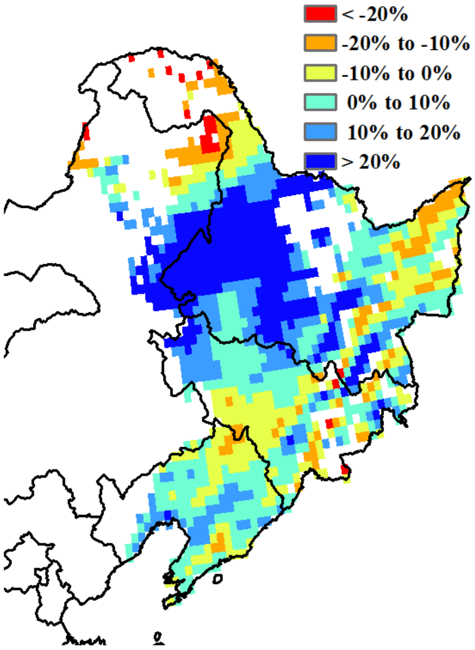




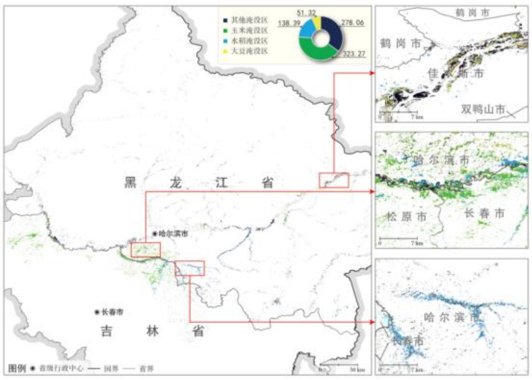
(d)Time series rainfall profile (e)Time series temperature profile



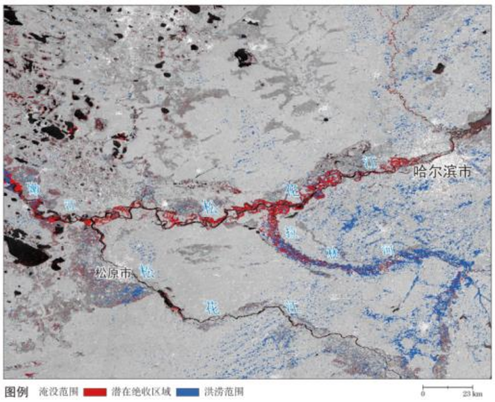
(f) Maximum VCI



(g) Biomass departure



(g) Flooding area in Northeast China in August 2023



(h) Flooding area on both sides of the Songhua River in August 2023

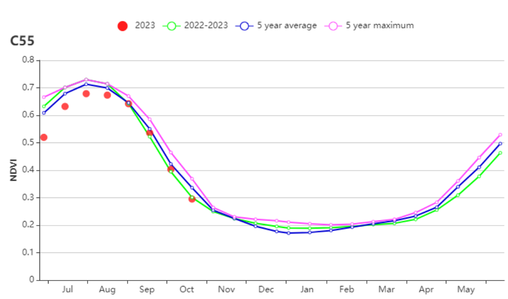
(i) Photos of the scene of farmland flooding in Northeast China in August 2023

Inner Mongolia

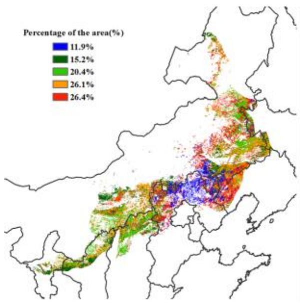
During this monitoring period, maize and soybean are the main summer crops grown in Inner Mongolia.

CropWatch Agroclimatic Indicators showed that rainfall was slightly below average (ΔRAIN, -1%). TEMP (+1.6°C) and RADPAR (+1%) were both above average. Potential biomass was slightly below average (BIOMASS, -2%). The NDVI development graph indicated slightly below-average crop conditions in July and August, and average levels thereafter. Sufficient precipitation in July had a positive impact on the rain-fed crops and the crop conditions returned the average levels, but continuous warmer than usual weather from August to October affected the crops. The spatial NDVI patterns show that 38.3% of the crops were below the 5YA and returned to near but slightly below average, mainly distributed in central Inner Mongolia. 15.2% were below the 5YA during this period. The rest of the cropped areas were near average. The fraction of cropped arable land (CALF) reached 95%. Crop intensity was 100% and VCIx was 0.87. On the whole, Inner Mongolia is expected to have close to average crop production.

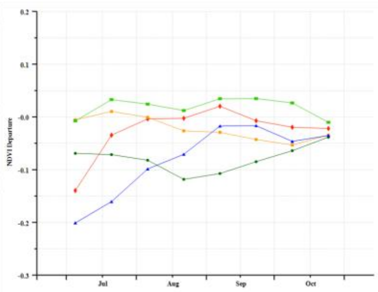
Figure 4. 10 Crop condition China Inner Mongolia, July- October 2023



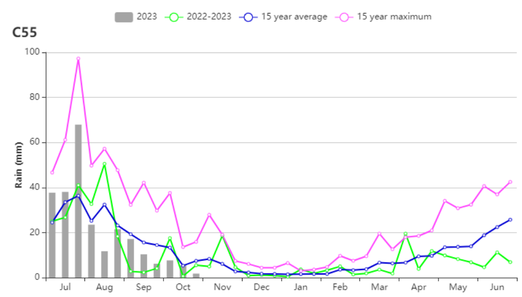
(a) Crop condition development graph based on NDVI



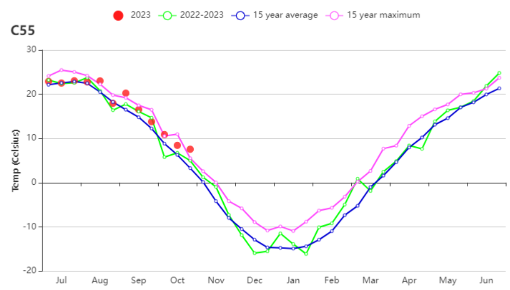
(b) Spatial NDVI patterns compared to 5YA



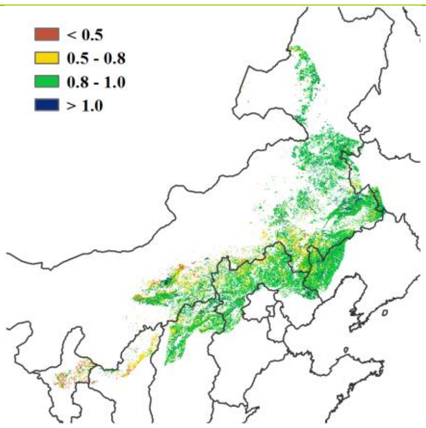
(c) NDVI profiles



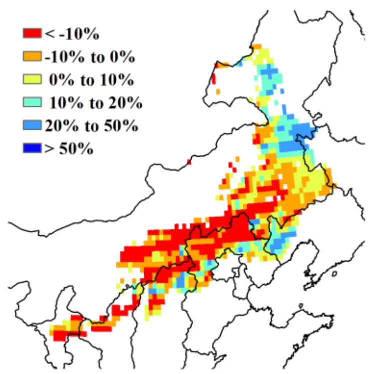
(d) Time series rainfall profile



(e) Time series temperature profile



(f) Maximum VCI



(g) Biomass departure

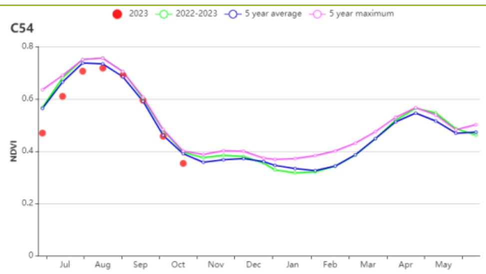
Huanghuaihai

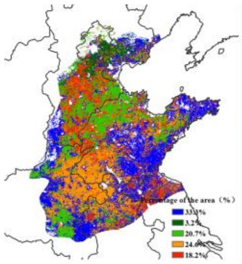
During the current monitoring period (July to October 2023), the main crops grown were maize and winter wheat. Summer maize reached maturity in late September to early October. Winter wheat sowing began in early October. Agro-climatic indicators showed that precipitation (RAIN +8%), temperature (+1.6°C), and RADPAR (+5%) in this area were above the 15YA. As a result of these indicators, an increase in crop biomass production potential was estimated (BIOMSS +4%). Above-average BIOMSS was located in eastern Henan and Langfang, Hebei.

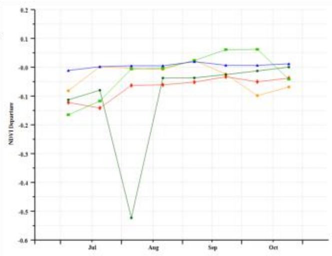
Planting of maize after harvest of winter wheat was slightly delayed due to frequent rainfall during the wheat harvest period in late May and early June. This caused a shift in the NDVI development curve. It reached peak levels starting in August. Above-average temperature benefited the maturation of maize in September. As the NDVI departure clustering map shows, only 33.3% of the cropped area trended above average after mid-July, widely located in southern Shandong, and eastern Henan (blue color in the NDVI departure clustering map). Approximately 3.2% of the croplands concentrated in the Beijing-Tianjin-Hebei Urban Agglomeration trended far below average at the end of July due to the extreme flooding. More than 300,000 hectares of maize were affected.

The CALF was unchanged, and the maximum VCI value was 0.91. The Crop Production Index (CPI) is 1.0. In general, the overall crop conditions during the monitoring period were normal.

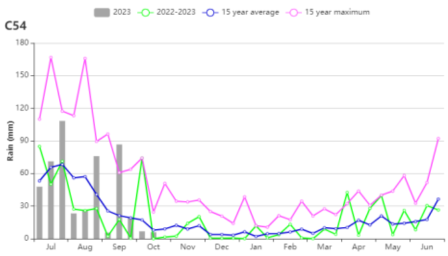
Figure 4. 11 Crop condition China Huanghuaihai, July - October 2023

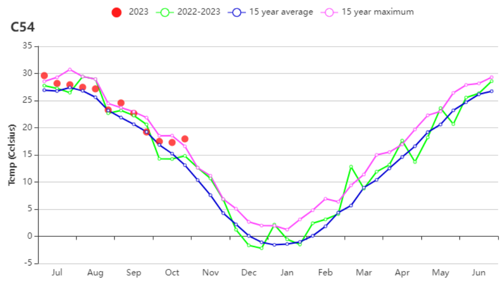






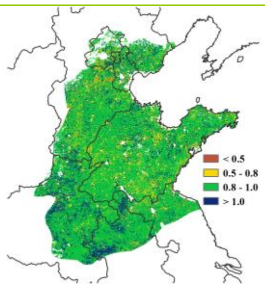
(a) Crop condition development graph based on NDVI (b) Spatial NDVI patterns compared to 5YA (c) NDVI profiles

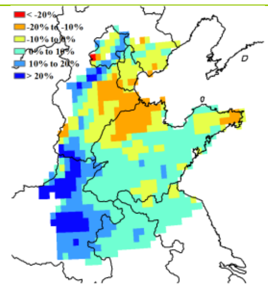




(d)Time series rainfall profile

(e)Time series temperature profile





(f) Maximum VCI

(g) Biomass departure

Loess region

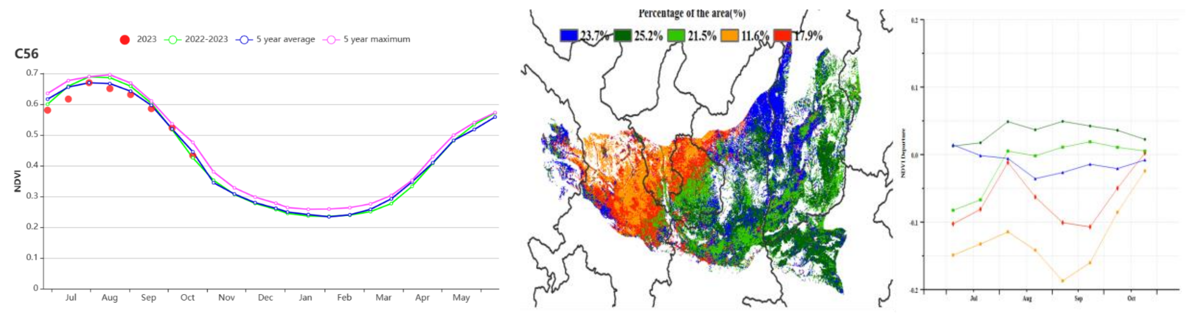
During the reporting period, maize was harvested in late September and early October. Sowing of winter wheat was completed in late October.

The CropWatch Agro-climatic Indicators (CWAIs) show that the temperature (TEMP +1.3℃) and radiation (RADPAR +5%) in this region exceeded the 15YA, whereas precipitation was below (RAIN -5%). The combination resulted in a diminished potential for biomass production (BIOMSS -1%) compared to the average. According to the regional NDVI development map, the overall crop condition in the Loess region was below average in July and then recovered to the 5YA.

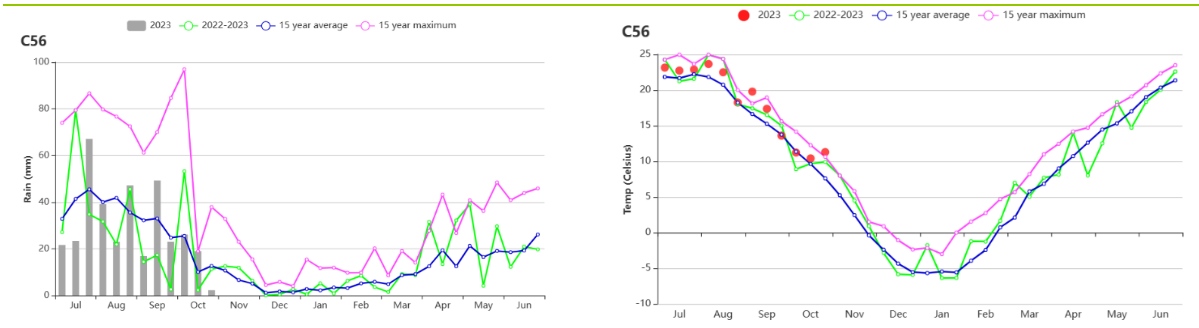
The NDVI departure cluster profiles indicate that about 29.5% of the regions experienced significant fluctuations in crop growth. They were significantly below average in July and September, but gradually recovered to the average in late October. These regions are mainly distributed in parts of Northwest Shaanxi, Gansu, and Ningxia provinces. Crop conditions in other areas were close to the average during the monitoring period. The Maximum VCI value was 0.88, lower than the 0.93 in the same period of last year. The fraction of cropped arable land under cultivation is 94%, which was 3% below the 5YA. The CPIx in the region was 0.93, which is less than 1.

In general, the crop conditions in the Loess region were average.

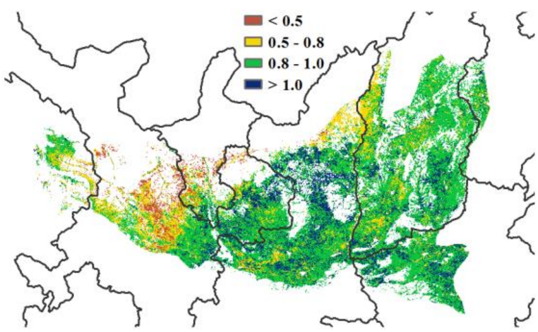
Figure 4. 12 Crop condition China Loess region, July - October 2023



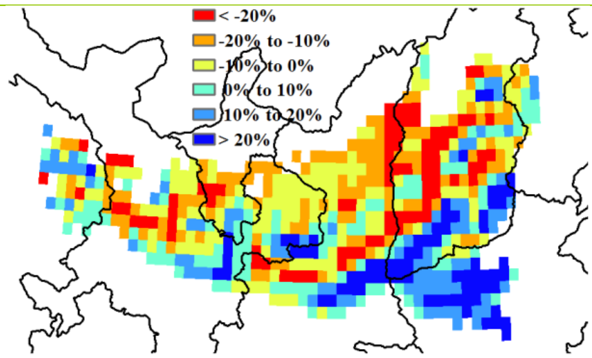
(a) Crop condition development graph based on NDVI (b) Spatial NDVI patterns compared to 5YA(c) NDVI profiles



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



(f) Maximum VCI



(g) Biomass departure

Lower Yangtze region

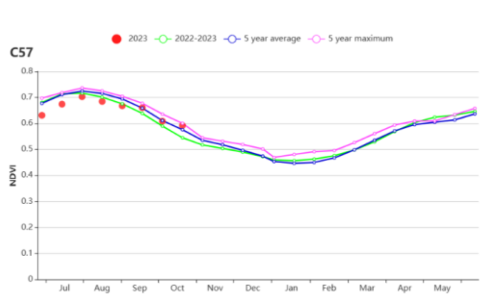
By October, the autumn grain crops such as late rice and maize had been harvested in the Lower Yangtze region.

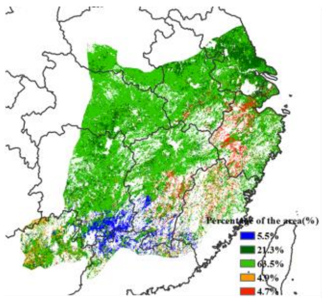
According to the CropWatch agro-climatic indicators, the accumulated precipitation and temperature were 13% and 0.6℃ higher than the 15-year averages, respectively. The photosynthetically active radiation was slightly below average (RADPAR -2%) because of increased number of rainy days. The above-average precipitation and temperature resulted in an increase of biomass potential production by 6%, as compared to the 15YA.

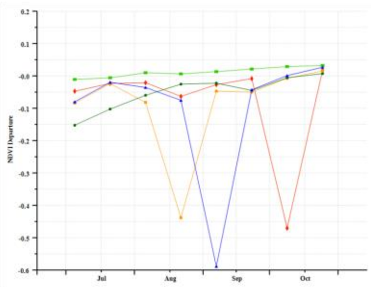
As shown in the NDVI development graph, the crop growth was generally close to the average level during this period. 63.5% of the area, mostly distributed in the northern, central, and western parts of the region, including Jiangsu, Anhui, Hubei, Hunan, southern Henan and northern Jiangxi provinces, presented near-average crop conditions throughout this monitoring period. The potential biomass departure map shows a similar spatial pattern with most areas having values between -10% and +20%. The average VCIx of this region was 0.94, and most of the area had VCIx values ranging from 0.8 to 1, indicating that the crop growth was generally normal during the peak growth period.

Overall, the crop conditions in the Lower Yangtze region were normal.

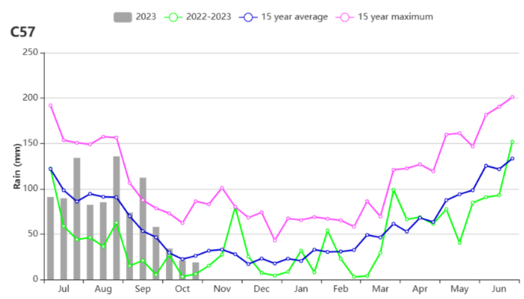
Figure 4.13 **Crop condition China Lower Yangtze region, July - October 2023**

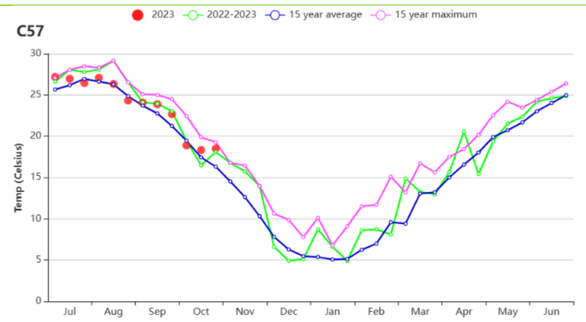




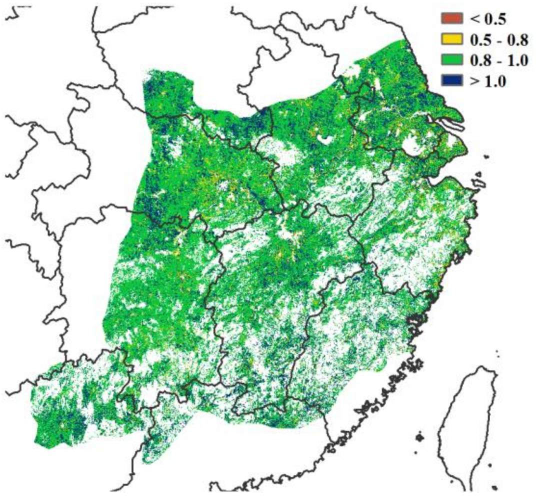


(a) Crop condition development graph based on NDVI (b) Spatial NDVI patterns compared to 5YA (c) NDVI profiles

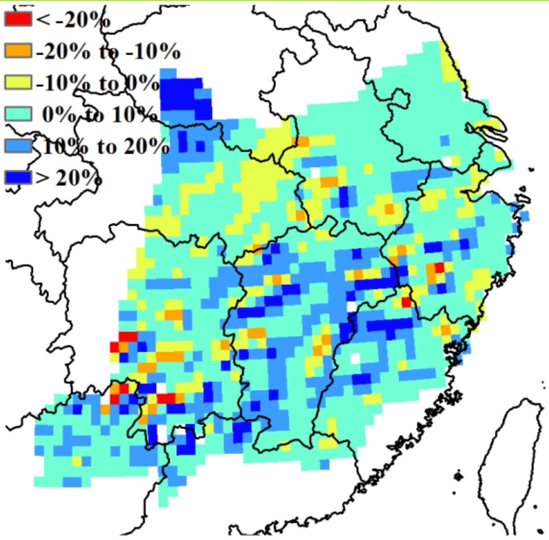




(d)Time series rainfall profile (e)Time series temperature profile



(f) Maximum VCI



(g) Biomass departure

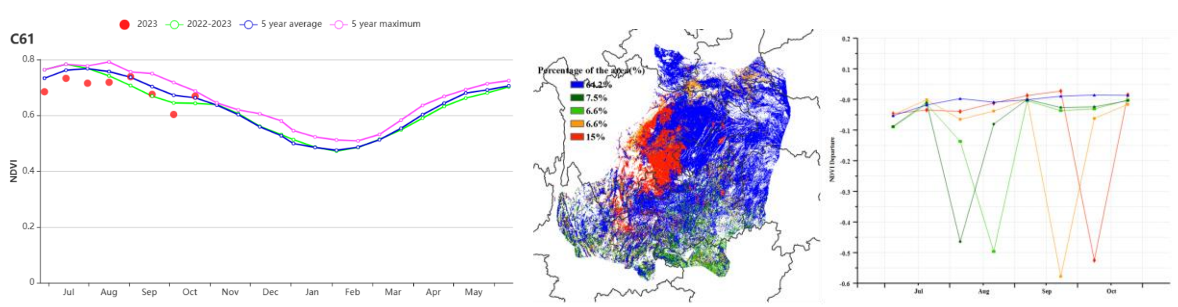
Southwest region

This reporting period covers the growth and maturity stages of summer crops, including late rice, semi-late rice, and maize. Their harvest was followed by the sowing of winter wheat in some fields. Overall, water and thermal conditions were favorable during this monitoring period, with crop conditions close to the average levels of previous years.

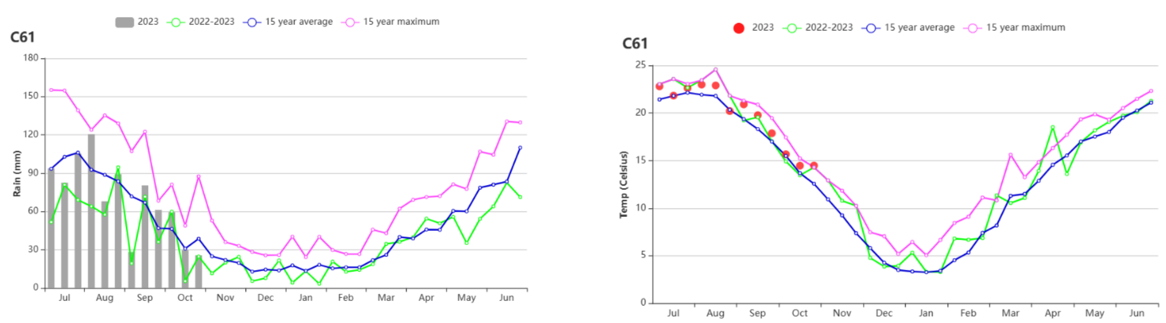
Agroclimatic indicators showed that the precipitation in the region was 844mm, 3% lower than the 15-year average, but still sufficient to meet crop water requirements. The average temperature was 19.7°C, 0.9°C higher than the 15-year average. Due to the increased number of sunny days, radiation was slightly above average (+4%). Good sunlight and thermal conditions led to above-average potential biomass (+3% vs average). The potential biomass departure map shows that potential biomass in parts of the northeast region was more than 10% higher than average, while parts of the southeast region were slightly below average, mostly within 10% below the average.

Agricultural indicators show the region's VCIx reached 0.94. The VCIx map shows that VCIx values for almost all areas were above 0.8, with a few areas even above 1.0, indicating good crop conditions across the region. The region had full cropland area utilization (CALF=100%), while the cropping index decreased slightly (-3%). According to the Crop condition development graph based on NDVI, the red areas accounting for 15% of the region's area (mainly in the central west) had slightly below average crop conditions at the beginning of the monitoring period but kept improving, reaching above average levels by the end of the monitoring period. The rest of the region maintained average crop conditions. The CPI was 0.98, further demonstrating good agricultural production conditions.

Figure 4. 14 Crop condition China southwest region, July - October 2023

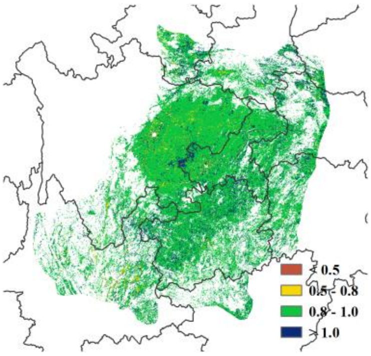
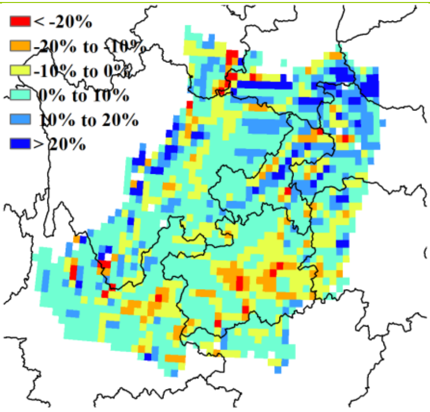


(a) Crop condition development graph based on NDVI (b) Spatial NDVI patterns compared to 5YA (c) NDVI profiles



(d)Time series rainfall profile

(e)Time series temperature profile

	
(f) Maximum VCI	(g) Biomass departure

Southern China

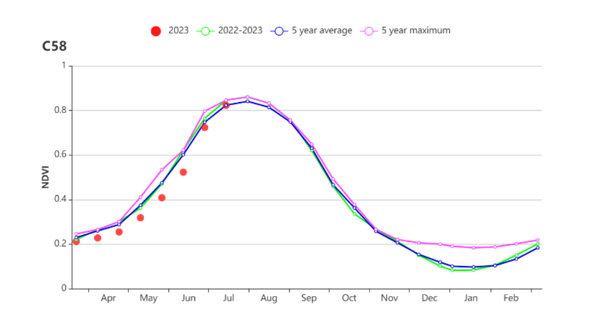
By October, late rice had reached maturity in Southern China. According to the regional NDVI profile, crop conditions trended below the 5-year average.

According to the CropWatch agro-climatic indicators, the accumulated precipitation and temperature were both above average (ΔRAIN +14% and ΔTEMP +0.7°C). Radiation was slightly below average (ΔRADPAR -1%). Potential biomass was above average (ΔBIOMASS +4%), primarily as a result of increased precipitation and temperature.

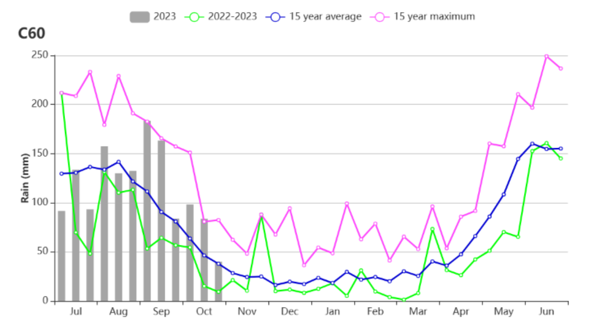
According to the NDVI departure clustering map and the profiles, the crop conditions in the region were slightly below average. The main reason of the below average crop condition is the cyclones and the extreme high rainfall which resulted in insufficient solar energy especialy during the key growth period of semi-late rice and late rice. The high rainfall also resulted in local flooding which damaged average yield for semi-late rice and late rice. This sharp drop was caused by cloud cover in the satellite images. 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 0-10%. The average VCIx of this region was 0.94, and most of the area had VCIx values ranging from 0.8 to 1.

In general, the crop conditions in Southern China were below average.

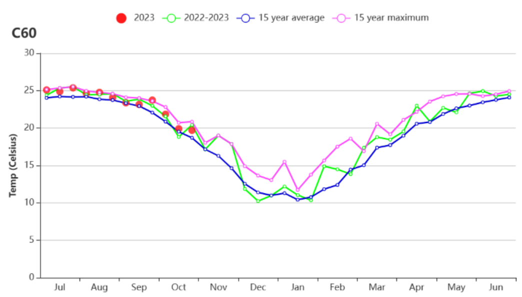
Figure 4. 15 Crop condition Southern China, July - October 2023



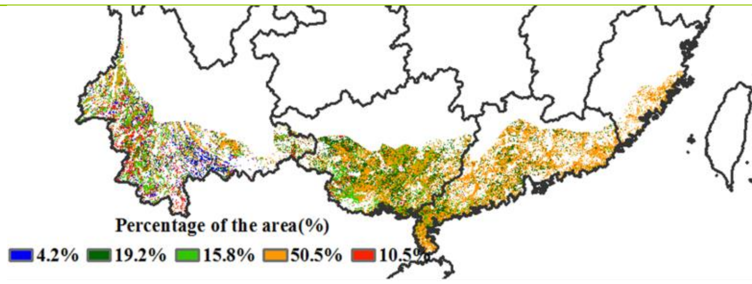
(a) Crop condition development graph based on NDVI



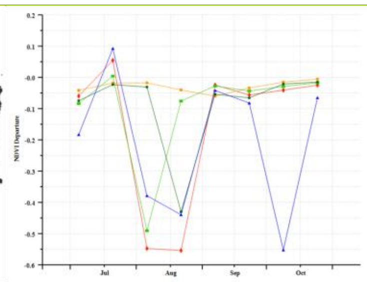
(b)Time series rainfall profile



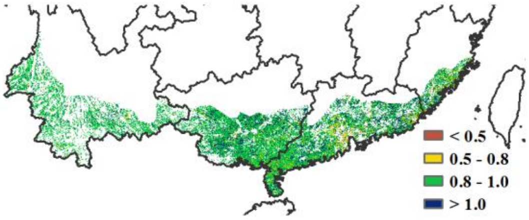
(c)Time series temperature profile



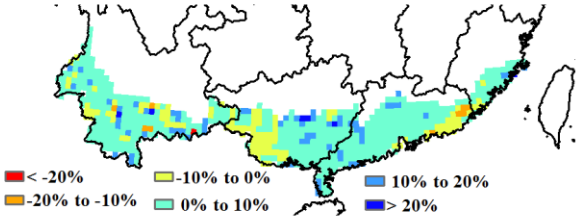
(d) Spatial NDVI patterns compared to 5YA



(e) NDVI profiles



(f) Maximum VCI



(g) Biomass departure

4.4 Major crops trade prospects

International trade prospects for major cereals and oil crop in China

Maize

In the first three quarters, China imported 16.555 million tonnes of maize, a 10.3% decrease from the previous year. The major sources of maize imports were the United States, Ukraine, and Brazil, accounting for 37.5%, 32.2%, and 22.8% of the total imports, respectively.

Rice

In the first three quarters, China imported 2.147 million tonnes of rice, a 57.5% decrease compared to the previous year. The main sources of rice imports were Vietnam, Myanmar, Thailand, India, and Cambodia, accounting for 39.4%, 20.4%, 14.4%, 11.2%, and 7.4% of the total imports, respectively.

Wheat

The model predicts a 35.2% increase in China's wheat imports and a 4.5% decrease in exports in 2023. With global wheat stocks remaining high and production increasing, the loose supply-demand situation prompts China to actively purchase wheat from Europe and the Americas, leading to a substantial increase in wheat imports in 2023.

Soybean

In the first three quarters, China imported 77.799 million tonnes of soybeans, a 14.4% increase from the previous year. The primary sources of soybean imports were Brazil, the United States, and Argentina, representing 69.6%, 25.5%, and 2.0% 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:

Maize

In 2023, China's maize imports will increase by 11.3%, and exports will reduce by 2.5%. Although global maize production is expected to grow, drought conditions in major producing regions like Brazil, coupled with reduced river levels affecting shipping and increased transportation costs, are expected to impact Brazil's maize exports. The fourth quarter is anticipated to see an increase in maize arrivals from Brazil, contributing to a year-on-year import growth.

Rice

In 2023, China's rice import will decrease by 40.1%, and exports will decrease by 3.8% in 2023. Due to India implementing rice export restrictions, international rice prices remain high, leading importers to slow down their procurement pace. It is anticipated that rice imports will continue to decline in the fourth quarter, resulting in a significant year-on-year reduction.

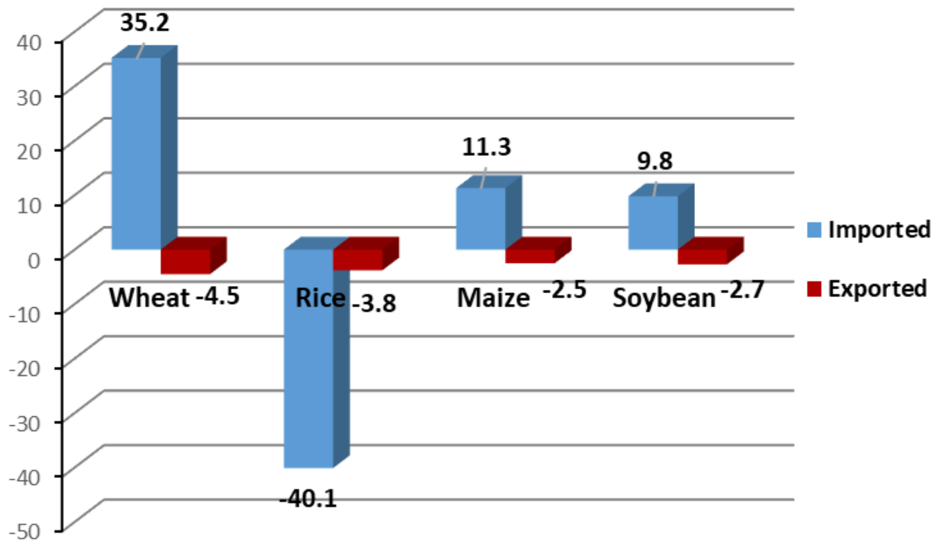
Wheat

In 2023, China's wheat imports will increase by 35.2%, while exports will decrease by 4.5%. With global wheat stocks remaining high and production increasing, the loose supply-demand situation prompts China to actively purchase wheat from Europe and the Americas, leading to a substantial increase in wheat imports in 2023.

Soybean

In 2023, China's soybean import will increase by 9.8%, while exports will decrease by 2.7%. Global soybean production is expected to reach a new high, ensuring a plentiful supply. However, the rising risk of transportation disruptions due to persistent drought and conflicts, coupled with an expected decline in domestic soybean production, will significantly increase soybean imports throughout the year.

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 agroclimatic 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 and verification of yield for major staple crops (corn, rice, wheat, and soybean) that were either in their growing period or close to harvest.

Global Crop Production Index

The annual fluctuation of the Crop Production Index (CPI) effectively reflects changes in global crop production conditions. Since 2021, the CPI has remained below 1.0 for three consecutive years, indicating that frequent extreme events caused by climate change have constrained stable increases in global and regional grain production. In 2023, although global high temperatures persisted, the prolonged drought in the Middle East and East Africa was alleviated, and the agroclimatic conditions in most major agricultural countries in Europe were generally favorable. Overall, the adverse impacts of extreme climate events on the production of major cereals and oil crops were less severe than in 2022. Therefore, even though the global CPI from July to October 2023 (0.972) is still at a lower level within the past 11 years, it has shown a slight improvement compared to the same period in 2022 (CPI=0.970).

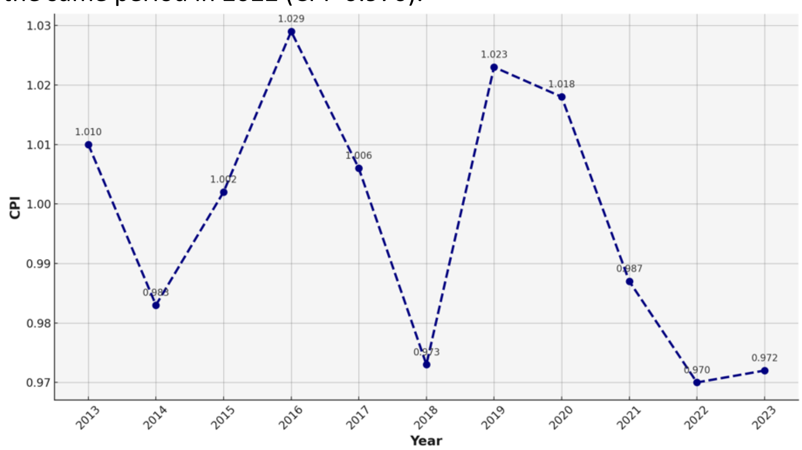


Figure 5.1. Global crop production index for the current monitoring period (July to October) over the last 11 years

Production estimates

Remote sensing monitoring indicated that the global production of crops in 2023 reached 2.874 billion tonnes, an increase of approximately 14.14 million tonnes or about 0.50%. Specifically, maize production is projected to reach 1.070 billion tonnes, marking an increase of 24.71 million tonnes or 2.4%. Global rice production is estimated at 753 million tonnes, with a decrease of 1.16 million tonnes or 0.2%. Global wheat production is forecasted to be 733 million tonnes, down by 7.23 million tonnes or 1.0%. Global soybean production is anticipated to reach 318 million tonnes, reflecting a decrease of 1.91 million tonnes or 0.6% (Table 5.1). The Middle East, East Africa, and other arid areas have seen a marked increase in rainfall compared to last year. The drought that has lasted for several years has been alleviated, and the crop condition was better than in previous years. Most of the main agricultural producing countries in Europe generally had favorable agroclimatic conditions, and crop yields were better than those of last year. The southern part of South America, the Maghreb, Spain, and Central Asia have suffered from severe drought, and crop production is unfavorable. In general, 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.

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	
	2023	Δ%	2023	Δ%	2023	Δ%	2023	Δ%
Afghanistan						-14.6		
Angola	2.73	-0.2	0.05	-4.2				
Argentina	49.69	-9.6	1.79	-3	13.62	6.9	42.01	-18.9
Australia					23.78	-26.2		
Bangladesh	3.52	-5.3	47.22	-1.6				
Belarus					2.86	-4.5		
Brazil	100.68	10.3	11.14	-1.9	8.23	6.2	106.61	12.1
Cambodia			10.32	5.4				
Canada	11.11	-4.3			27.95	-6.6	7.54	-0.6
China	232.76	2.4	195.81	0.2	134.72	0.4	17.17	-5.6
Egypt	6	-1	6.86	4.2	11.33	0.8		
Ethiopia	5.87	2.6			3.25	-4.7		
France	13.02	0.2			33.42	0.2		
Germany	4.46	1.8			23.91	-4.7		
Hungary	5.43	11.8			4.51	1.4		
India	17.01	-9.7	174.77	-0.8	97.58	4.7	13.02	-3.8
Indonesia	18.48	-3.5	64.09	-1.8				
Iran			2.7	4.3	12.04	9.7		
Italy	5.48	7.8			7.84	6.4		
Kazakhstan					11.73	-9.5		
Kenya	2.31	19.6			0.28	3.3		
Kyrgyzstan	0.67	-12.9			0.61	-17.4		
Mexico	24.22	4.6			3.49	-13		
Mongolia					0.31	3.6		
Morocco					6.94	14.8		

	Maize		Rice		Wheat		Soybean	
	2023	Δ%	2023	Δ%	2023	Δ%	2023	Δ%
Mozambique	2.25	2.2	0.4	-0.4				
Myanmar	1.86	-3.7	23.39	-4.9				
Nigeria	10.26	7.4	4.59	12.1				
Pakistan	5.68	-1.2	11.47	11.7	25.09	-1.9		
Philippines	7.88	6.1	21.14	-0.7				
Poland					10.03	-2.5		
Romania	11.73	4.1			7.33	5.6		
Russia	14.19	3.8			82.94	-3.8	3.8	-0.4
South Africa	12.21	3			1.64	2.8		
Sri Lanka			2.44	-2				
Thailand	3.93	-8.6	38.14	-1.8				
Turkey	6.61	1.7			18.77	11.3		
Ukraine	26.06	2.7			22.62	5.6		
United Kingdom					12.44	-1.6		
USA	376.38	3.5	11.3	5.7	55.64	7.9	100.48	-1.2
Uzbekistan					6.56	-21.3		
Vietnam	4.98	-4.5	45.9	-1.7				
Zambia	3.66	2.8						
Syria					3.15	53.1		
Algeria					1.68	-35.3		
Laos			3.86	2.6				
Lebanon					0.15	51		
Sub-total	991.12	2.5	677.37	-0.4	679.81	-0.5	290.63	-0.4
Others	78.77	0.3	76.04	2.1	53.03	-6.5	27.51	-2.8
Global	1069.88	2.4	753.41	-0.2	732.84	-1	318.13	-0.6

Maize

Agroclimatic conditions have been favorable in most of the world's major corn-producing countries in 2023, with global maize production increasing by 24.71 million tonnes, the largest increase in production in a decade. The United States, China, and Brazil are the world's main maize producers. Among them, the United States encountered cooler than usual spring temperatures during the planting period, coupled with lower rainfall in late May, affecting germination and early growth and resulting in a delayed growth period. However, the improved agroclimatic conditions since June in the main producing regions promoted the growth and development of maize and yield formation. The generally normal weather conditions in its main producing areas resulted in a production increase to 376.38 million tonnes, a significant increase of 12.78 million tonnes or 3.5%. China's maize production increased 2.4% due to the expansion of the maize cultivation area. Brazil experienced a decrease in the first-season maize and an expansion of planting areas for the second-season maize, boosting total maize production to reach 100.68 million tonnes, an increase of 9.37 million tonnes or 10.3%. Compared to the extremely hot and dry conditions in 2022, Europe's important maize-producing countries generally enjoyed favorable weather conditions in

2023. Benefiting from overall abundant rainfall, countries such as Russia, France, Ukraine, Romania, Hungary, and Italy had yield increases by 3.8%, 0.2%, 2.7%, 4.1%, 11.8%, and 7.8%, respectively. Due to the recession of the La Niña, Kenya, located in the Horn of Africa, experienced a significantly increased rainfall, which compensated for the soil moisture deficit caused by the previous drought, and its maize production increased by 19.6%, which was the largest increase in production among maize-producing countries. Ethiopia's maize production increased by 2.6%. Argentina was affected by continuous drought, resulting in a substantial reduction in maize production by 9.6%. Although rainfall since late March returned to normal. However, by then maize was already close to maturity. India's maize production was negatively affected by flooding, leading to decreased cultivation areas and yields, projecting a reduction of 9.7%.

Rice

Most rice-producing countries experienced a slight decrease in rice production, resulting in global rice production of 753.41 million tonnes, a decrease of 1.16 million tonnes or 0.2%. As the world's largest rice producer, China is expected at 195.813 million tonnes, a slight increase of 0.2%, mainly due to the recovery from the extremely high temperature and drought in the Yangtze River Basin, prompting an increase in production of mid- and late-stage rice. The Philippines, Bangladesh, Vietnam, Indonesia, Thailand, Sri Lanka, and Myanmar were affected by the uneven spatial and temporal distribution of rainfall. Rice yields were all down slightly, with production decreasing by 0.7%, 1.6%, 1.7%, 1.8%, 1.8%, 2.0% and 4.9%, respectively. Affected by flooding, India's rice production was down slightly by 0.8%. In the southern hemisphere, in Brazil, Argentina, and Angola, due to the shrinkage of rice planting areas, rice production fell by 1.9%, 3.0%, and 4.2%, respectively. In July, excessive rainfall occurred in Pakistan, leading to localized flooding, but the scope of the impact of flooding was significantly smaller than in 2022. Pakistan's rice production increased by 11.7%, Cambodia, the United States, and Nigeria saw varying degrees of increased rice production of 5.4%, 5.7%, and 12.1%, respectively. Overall, the global rice production remained stable.

Wheat

The production for major wheat-producing countries varied significantly. The total wheat production in the main producing countries was almost stable, but the total production of other countries has decreased by a large margin. The global wheat production in 2023 is estimated to be 732.84 million tonnes, down by 1.0%. It has been reduced for the third consecutive year and reached the lowest in the past five years. Wheat in the Northern Hemisphere countries has been harvested from June to August, and the production is in line with the August 2023 monitoring results. Overall, wheat production recovered in East Africa and the Middle East and generally recovered slightly in Europe, while wheat production decreased in many Central Asian countries. In the Southern Hemisphere, affected by lower rainfall, both wheat cultivated area and yields in Australia fell sharply, with production declining by 26.2%; on the contrary, agroclimatic conditions in wheat-producing areas of Brazil, Argentina, and South Africa were generally normal, and wheat yields increased, prompting an increase in wheat production by 6.9%, 6.2%, and 2.8%, respectively.

Soybean

Global soybean production in 2023 is expected to be 318.13 million tonnes, a reduction of 0.6%. The southern hemisphere soybean production increased, but the difference between the production in Brazil and Argentina is stark. Soybean production in Argentina was significantly reduced by 18.9%, while Brazil increased by 12.1%, and the cumulative production of soybeans in the two countries increased by 1.71 million tonnes. The northern hemisphere soybean acreage declined, resulting in an overall reduction in soybean production. The United States witnessed favorable agroclimatic conditions during the soybean growth period, with suitable moisture and temperature contributing to favorable yields, and agroclimatic conditions were generally favorable until the crops had reached maturity in the main producing areas. However due to the reduction in cultivated area, production decreased by 1.2%. China's soybean acreage shrinkage led to a 5.6% decrease in soybean production; India's and Canada's soybean production increased by 3.8% and 0.6%, respectively, while Russia's soybean production decreased slightly by 0.4%. The cumulative decrease of 2.82 million tonnes in soybean production in the Northern Hemisphere exceeded the increase in the Southern Hemisphere, resulting in a global soybean production decrease of 0.6%.

5.2 Disaster events

Introduction

This section covers the July-October 2023 disaster events worldwide. Among others, this section highlights the current situation of global flood events, desert locusts and the impact of conflicts on the global food security.

Global food situation: Global food insecurity presents an increasingly intricate challenge driven by the expanding global population and mounting environmental pressures. This issue transcends mere food production and distribution, encompassing the stability of food systems. These systems contend with a dangerous amalgamation of factors, including political conflicts, economic instability, extreme climate events, and high fertilizer prices, all contributing to the intensifying crisis. Since 2022, the economic aftermath of the COVID-19 pandemic compounded by the Russia-Ukraine conflict has sparked price hikes, making food unaffordable for millions worldwide. According to the World Food Program, the number of individuals facing acute food insecurity or being at risk of it surged from 135 million across 53 countries before the pandemic to 345 million spanning 79 countries in 2023—merely a span of two years.

Extreme conditions by type

Conflicts

West Africa: West Africa, encompassing Burkina Faso, Mali, and Niger, grapples with persistent food insecurity, posing significant challenges in accessing adequate food across widespread areas within these nations. The prevalence of level 3 of the Integrated Food Security Phase Classification (IPC) and above conditions underscores the severity of the issue, largely attributed to the disruption of agricultural practices, trade routes, and crucial food aid operations. These disruptions have been caused by ongoing conflicts and pervasive insecurity plaguing the region.

In **Burkina Faso**, the ongoing conflict has profoundly affected an estimated population of around 360,000 individuals, with 75% originating from Sahelian localities. This isolated population faces severe shortages of essential resources such as food, water, and medicine. Many households are experiencing considerable to severe deficits in food consumption while witnessing the erosion of their coping mechanisms. The situation has escalated as the conflict persists, with an alarming estimated 3.3 million people in Burkina Faso struggling with hunger as of September. Within this distressing statistic, approximately 650,000 individuals are confronting extreme hunger, representing an acute food crisis resulting in the tragic loss of lives due to insufficient food access (classified as IPC phase 5). In **Niger**, despite experiencing above-average rainfall conducive to crop development, preliminary forecasts suggest cereal production is anticipated to be below average. Similarly, **Mali** faces significant challenges due to conflicts. A majority of the population falls within IPC phases 2 (stressed) and 3 (crisis). However, the country has observed favorable rainfall conditions since the start of the cropping season, providing promising prospects for crop growth and potential improvement in food production.

Desert locust

At the beginning of the reporting period, the general situation of desert locusts was under control as the locust survey took place. However, small groups and swarms migrated into northern Yemen post-spring breeding and control measures also took place in Saudi Arabia. Despite Yemen's dry conditions unsuitable for breeding, efforts to control the locusts persisted. Similarly, some control measures were implemented in the interior regions of Sudan. By the end of the reporting, the locust situation remained relatively calm (Figure 5.1). Summer breeding persisted in Sudan's interior, leading to the presence of small hoppers, adult groups, bands, and swarms, while adult locusts appeared along the Red Sea coast. Saudi Arabia observed hopper groups, bands, and adult groups in specific areas of the Red Sea coast, and adults were sighted on Yemen's coast. Isolated locusts were also spotted in Mauritania, Niger, and Chad. The potential for summer breeding in the northern Sahel, from Mauritania to western Eritrea, remained limited.

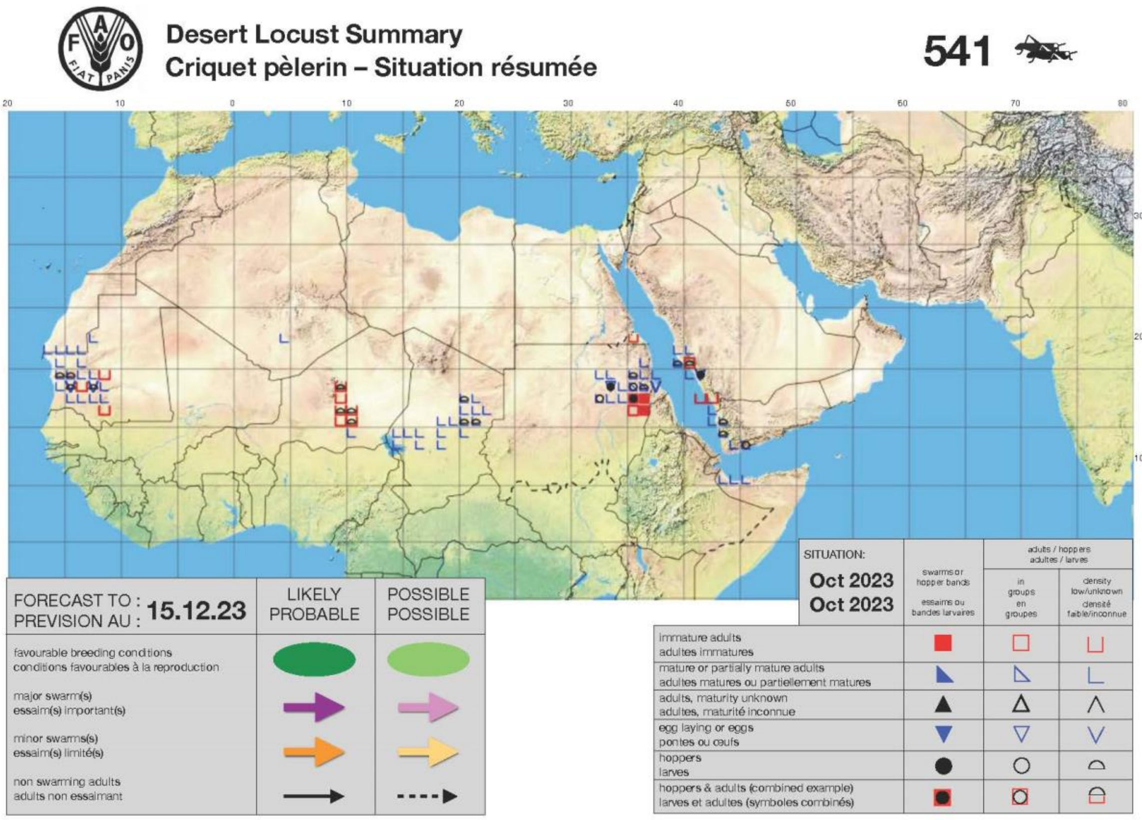


Figure 5.2. Desert Locust situation in October 2023

With the onset of the winter season across the Red Sea and the Gulf of Aden, substantial rainfall has been experienced in southeast Egypt, Sudan, Eritrea, Saudi Arabia, Yemen, and northwest Somalia. This meteorological shift, coupled with anticipated above-average rains forecasted for November and December, signals the initiation of the first generation of hoppers and adult locusts. A subsequent generation is expected to emerge around January 2024, persisting until March or April. Preventive control efforts primarily focus on operations in Sudan and Saudi Arabia, employing biopesticides in parts of Somalia and potentially extending to areas of Yemen, Egypt, and Eritrea.

Floods, Cyclone and Earthquark

Yemen: Cyclone Tej, which struck the Al Maharah governorate on October 22, 2023, resulted in the displacement of thousands of people. Recent statistics indicate that more than 5,939 individuals were displaced, and over 400 homes were destroyed because of this cyclone. Additionally, the agricultural sector suffered significant losses, with over 5,000 hectares of crops damaged. The impact of this damage to cropland will undoubtedly have direct repercussions on the region's food security. Coupled with ongoing conflicts that are already exerting pressure on international food prices, this incident exacerbates the challenges faced by the population in ensuring access to adequate food supplies.

Libya: Agriculture serves as the foundation of the Libyan economy. However, the flooding incident in the latter half of 2023 plunged thousands into a state of emergency. On September 10, 2023, the aftermath of storm Daniel passing through the Mediterranean basin led to catastrophic floods triggered by intense rainfall, affecting Libya. This calamity resulted in a reported death toll of 5,300 individuals, with thousands more missing and 33,000 displaced from their homes. Remote sensing data assessments indicated that a mere 3000 hectares of flooded land were designated as cropland, constituting a small proportion of the total affected area. The impact on the agricultural sector extended beyond cropland. The flood event inflicted significant damage on irrigation networks, roads, markets, grain storage facilities, and other crucial infrastructure that support agricultural operations. Moreover, since several flood-affected regions were coastal areas, it's likely that the fisheries sector also faced severe consequences.

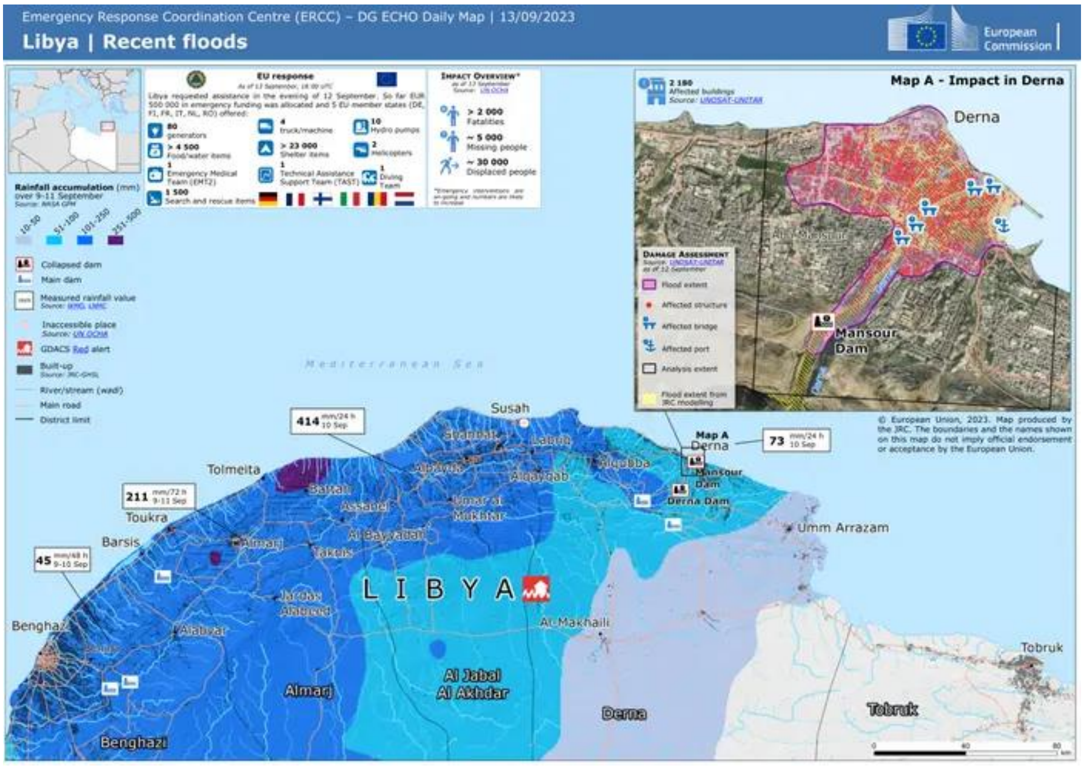


Figure 5.3. Flood situation report in Lybia as of 13 September 2023

Morocco: Morocco recently experienced a devastating earthquake measuring 6.8 magnitude that struck the regions of High Atlas and Marrakesh in central Morocco. This catastrophic event resulted in the tragic loss of over 1,000 lives and caused extensive destruction to numerous homes and buildings. The impact of this earthquake transcended urban areas, as its epicenter was situated within small farming villages. Consequently, these communities and their agricultural systems suffered severe disruption, significantly impacting food production and distribution systems crucial for the nation’s food security.

Drought

Global overview: Throughout the reporting period, persistent dry conditions prevailed predominantly across Canada, South America, Australia, and the Mediterranean region. The trend of anomalously warm conditions persisted across all continents during October 2023. This past October marked a record-warm period for Asia and South America, while Africa, Europe, and North America experienced the second-warmest October on record. Despite these warm conditions, a significant portion of the world's agricultural lands continued to suffer from low soil moisture and depleted groundwater levels. These environmental factors have had a detrimental impact on vegetation conditions.

Amazon Drought Crisis: The Brazilian Amazon has long grappled with rampant deforestation, a persistent issue that, albeit showing a promising 42.5% decrease between January and July 2023 compared to the same period in 2022, now faces an acute drought crisis. This severe drought affecting the Brazilian rainforest coincides with historically low precipitation levels observed across eight states in northern and north-eastern Brazil, marking a 40-year low. The prolonged dry spell is exacerbating the degradation of the world's largest and most diverse rainforest. Certain regions within the Amazon are undergoing a transformation from lush, moisture-rich ecosystems—integral for storing substantial amounts of heat-trapping gases—into drier environments that are now releasing these gases into the atmosphere. This alarming shift poses a dual threat to the global battle against climate change and the preservation of biodiversity. The repercussions of this situation reverberate as a devastating blow, not only affecting the fragile equilibrium of the Amazon but also amplifying the challenges in safeguarding our planet's climate stability and the irreplaceable biodiversity of this vital ecosystem. The Amazon rainforest's drought has brought about significant challenges for communities reliant on family farming in the river's floodplains. This dire situation has disrupted crucial aspects of their livelihoods, impacting both the transportation of products and grains along the Amazon River and the transmission of electricity.

5.3 Update on El Niño or La Niña

According to the Australian Government Bureau of Meteorology, the El Niño phenomenon continues to persist in the tropical Pacific. Atmospheric and oceanic indicators of the El Niño-Southern Oscillation (ENSO) reflect a mature El Niño phenomenon. Sea surface temperatures (SSTs) across the tropical Pacific remain above El Niño thresholds, with warmer than average SSTs supporting elevated surface temperatures. In the atmosphere, cloud, wind, and pressure patterns are consistent with El Niño conditions. Climate model forecasts indicate the central to eastern Pacific may continue to warm, with SSTs likely to remain above El Niño thresholds into the early austral spring 2024. Overall, the ocean-atmosphere coupled system reflects an intensification of the El Niño phenomenon.

Figure 5.3 shows the evolution of the standard Southern Oscillation Index (SOI) values from October 2022 to October 2023. Over the past four months, SOI values have remained negative and in a consistently low range (close to or below -7), with a downward trend from July to September, dropping to -12.7 and -13.6 in August and September respectively, before bouncing back up in October. Three-month average SOI values of -7 or lower are an important indicator for the occurrence of El Niño events.

Figure 5.4. Monthly SOI-BOM time series from October 2022 to October 2023(Source: http://www.bom.gov.au/climate/enso/soi/**)**

Another commonly used measure of El Niño events is called the Oceanic Niño Index (ONI). Figure 5.4 shows the locations of several NINO indices and their values for October 2023. The values for the three key NINO indices in October 2023 are: NINO3 +2.0°C, NINO3.4 +1.24°C, NINO4 +1.59°C.

This means the average sea surface temperatures across these three regions are markedly above historical average levels.

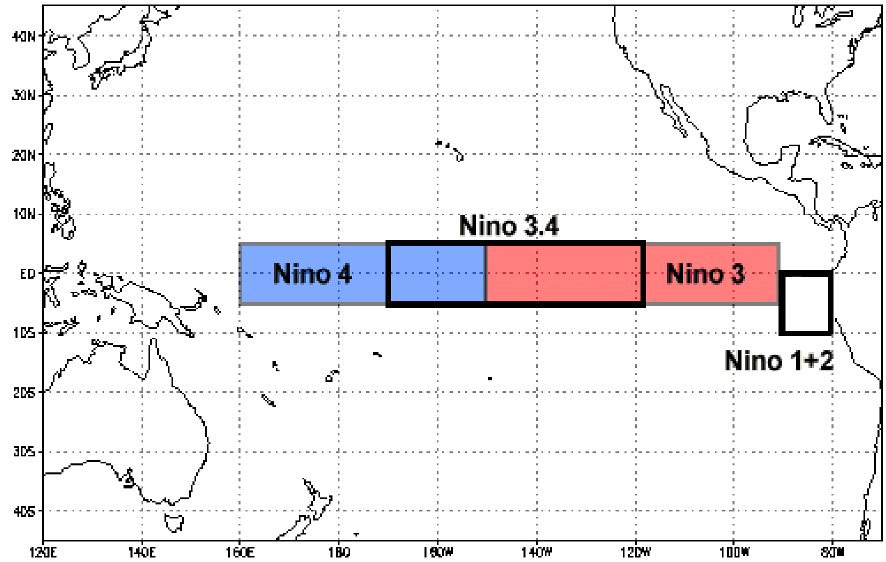


Figure 5.5. Map of NINO Region（Source: https://www.ncdc.noaa.gov/teleconnections/enso/sst）

Sea surface temperatures (SSTs) for October 2023 (Figure 5.5) were above average across the central and eastern tropical Pacific, exceeding El Niño thresholds. International climate models indicate the central and eastern tropical Pacific may continue to warm further. All models surveyed indicate sea temperatures will remain above El Niño thresholds into the early austral spring 2024.

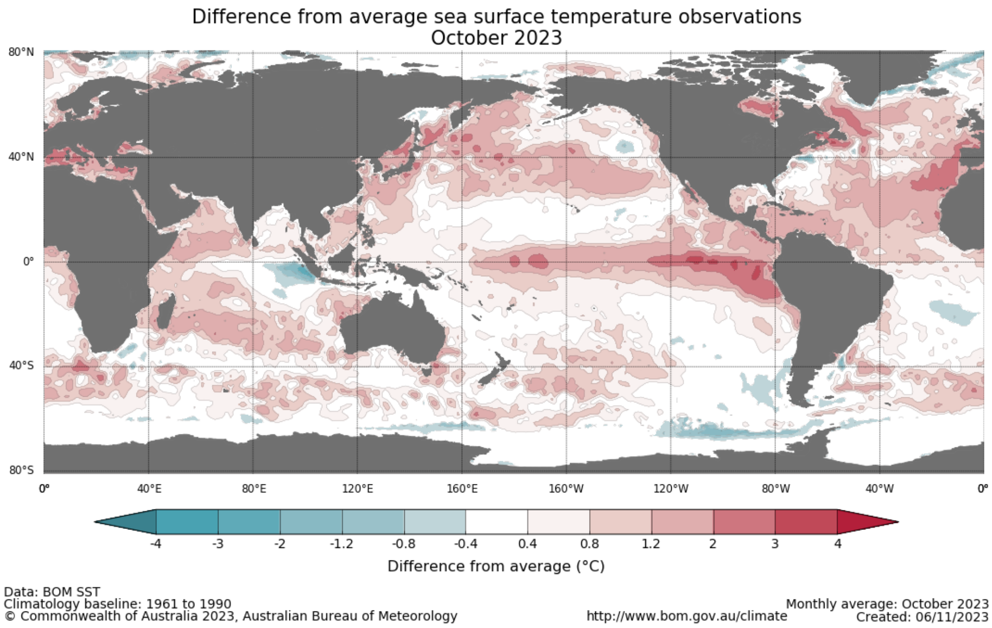


Figure 5.6. Monthly temperature anomalies for October 2023(Source: http://www.bom.gov.au/climate/enso/wrap-up/#tabs=Sea-surface**)**

Table 5.2 ONI (°C) Anomaly Values from September 2023 to October 2023(Source: https://www.cpc.ncep.noaa.gov/data/indices/sstoi.indices**)**

Year	Month	NINO3	NINO3.4	NINO4
2023	9	+2.07 °C	+1.1 °C	+1.53 °C
2023	10	+2 °C	+1.24 °C	+1.59 °C

According to the latest forecasts from NOAA's Climate Prediction Center, at least a "strong" El Niño event (≥1.5°C for ≥3.4°C) is likely to persist through January-March 2024. In the November-January season, the event has a 35% chance of becoming "historically strong" (≥2.0°C). Stronger El Niño events increase the odds of El Niño-related climate anomalies but do not necessarily equate to severely impactful events. In summary, the El Niño event is expected to continue through northern hemisphere spring, with a 62% chance during April-June 2024.

Global warming continues to influence Australian and global climate. Global sea surface temperatures (SSTs) from April to October were the highest on record. Since national records began in 1910, Australia's climate has warmed by 1.48 ± 0.23°C. El Niño often brings drier conditions to parts of Australia, Southeast Asia and southern Africa, increasing risks to agricultural production and wildfires. Pacific jet streams and tropical cyclone activity may also be affected.

The occurrence of El Niño not only leads to climate anomalies in Southeast Asia, Australia, and Africa but also typically results in flooding in southern China, drought in the north, drought in India, increased rainfall in East Africa, reduced rainfall in Southeast Asia, and humid conditions with abundant rainfall in the Gulf of Mexico region, including Texas and Florida. Along the Pacific coast, the northwestern United States and the Rocky Mountain region are prone to drought during El Niño events. Additionally, El Niño events usually bring increased precipitation to southern South America, the southern United States, the Horn of Africa, and certain areas in Central Asia, potentially leading to flooding issues.

Reference

https://www.wfp.org/emergencies/global-food-crisis

https://arabcenterdc.org/resource/food-insecurity-in-palestine-and-the-russia-ukraine-war-the-worst-is-yet-to-come/

https://reliefweb.int/report/saudi-arabia/desert-locust-update-17-july-2023

https://www.fao.org/ag/locusts/en/info/info/index.html

https://reliefweb.int/disaster/tc-2023-000212-yem

https://storymaps.arcgis.com/stories/e451e32a054847469b1c1c731a8e5cff

https://reliefweb.int/report/libya/libya-flood-response-humanitarian-update-28-september-2023-enar

https://reliefweb.int/disaster/fl-2023-000168-lby

https://foodforafrika.com/2023/09/10/morocco-earthquake-cgiar-stands-with-farmers/

https://www.hortidaily.com/article/9559093/earthquake-in-morocco-large-scale-agriculture-spared/

https://bnn.network/world/morocco/agricultural-impact-of-moroccan-earthquake-and-droughts-a-comprehensive-review/

NOAA National Centers for Environmental Information, Global Drought Narrative for October 2023, published online November 2023, retrieved on November 16, 2023, from **https://www.ncei.noaa.gov/access/monitoring/monthly-report/global-drought/202310**.

https://cropmonitor.org/documents/Frontpage/AMIS_EW_synthesis_202311.jpg

https://www.fao.org/3/cc8566en/cc8566en.pdf

https://fews.net/west-africa/burkina-faso/alert/april-2023

https://fews.net/fr/west-africa/burkina-faso/mise-jour-des-messages-cles/septembre-2023

https://reliefweb.int/report/burkina-faso/food-security-burkina-faso-worsening-amid-continued-conflict-warns-irc#:~:text=An%20estimated%202.2%20million%20people,food%20(IPC%20phase%205).

https://reliefweb.int/report/sudan/sudan-food-security-crisis-intensifies-amid-ongoing-conflict-and-economic-challenges
https://www.ipcinfo.org/fileadmin/user_upload/ipcinfo/docs/IPC_Sudan_Acute_Food_Insecurity_Jun2023_Feb2024_report.pdf
https://reliefweb.int/report/world/food-security-monitor-september-2023
https://www.nytimes.com/2023/10/17/climate/amazon-rainforest-drought-climate-change.html
https://www.nature.com/articles/d41586-023-03469-6
https://valorinternational.globo.com/economy/news/2023/10/05/amazon-drought-affects-everything-from-agriculture-to-power-supply.ghtml

Annex A. Agroclimatic indicators and BIOMSS

Table A.1 July 2023 - October 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)	897	-19	23.0	0.8	1203	4	1372	-4
C02	Equatorial central Africa_zone2 (North DRC, Equatorial Guinea, Uganda, Republic of Congo)	1018	-13	23.4	0.6	1145	1	1353	-6
C03	Equatorial central Africa_zone3 (South DRC, Rwanda, Burundi, Gabon)	338	-28	24.5	0.7	1270	2	844	-12
C04	Equatorial central Africa_zone4 (Angola, Zambia, and Malawi)	35	-30	21.2	0.8	1355	-1	447	-3
C05	East African highlands	498	-35	18.8	1.2	1245	6	762	-14
C06	Gulf of Guinea zone1 (Nigeria, Benin, Togo, Ghana, Cote d'Ivoire, Guinea, and Guinea_Bissau)	599	-24	26.3	1.3	1187	5	1163	-11
C07	Gulf of Guinea zone2 (South Nigeria, Liberia, Sierra Leone, south Ghana, south Cote d'Ivoire, and west Genua)	1342	0	24.5	0.6	1026	5	1485	2
C08	Horn of Africa	115	-34	21.9	0.9	1287	3	572	-6
C09	Madagascar(main)	190	10	20.8	1.1	1140	1	667	6
C10	SW Madagascar	30	-19	22.5	0.3	1207	-1	435	-3
C11	North Africa Mediterranean	28	-67	24.6	1.2	1355	1	501	-13
C12	Sahel	463	-22	27.9	1.1	1234	3	971	-9
C13	Southern Africa_zone1 (West Angolan coast)	80	-46	22.9	0.4	1310	1	524	-15
C14	Southern Africa_zone10 (Middle part of South Africa)	55	7	14.2	-0.2	1172	-2	339	-1
C15	Southern Africa_zone2 (southeastern Kenya, East Tanzania, and Mozambique)	104	26	23.0	0.7	1156	-2	581	9
C16	Southern Africa_zone3 (South Zambia)	10	1	22.2	0.8	1354	-3	434	2
C17	Southern Africa_zone4 (Zimbabwe)	64	135	20.3	0.5	1258	-4	465	15

C18	Southern Africa_zone5 (Northeast of Namibia, Botswana, and south Zimbabwe and Mozambique)	37	14	20.6	0.4	1272	-2	428	3
C19	Southern Africa_zone6 (West Namibia coast)	4	-81	21.2	0.4	1425	0	391	-6
C20	Southern Africa_zone7 (Southeast Namibia, Southwest Botswana, and northeast of South Africa)	8	-47	15.7	0.3	1228	-2	268	-7
C21	Southern Africa_zone8 (South Africa and southwest Namibia)	104	-14	13.4	-0.3	1041	-1	413	-8
C22	Southern Africa_zone9 (western part of South Africa, Lesotho, and Eswatini)	108	2	14.2	0.0	1121	-1	425	-1
C23	S. Africa Western Cape	220	5	11.7	-0.8	932	-2	545	-3
C24	British Columbia To Colorado	195	-29	13.1	0.5	1134	-1	548	-12
C25	America northern great plains_canada	147	-34	15.1	0.8	974	-3	529	-18
C26	America northeastern great plains	259	-14	20.2	1.0	1095	-3	768	-6
C27	America northwestern great plains	162	-24	18.3	0.4	1131	-2	600	-13
C28	Nnorth of high plain	178	-41	23.7	1.4	1242	2	699	-19
C29	America corn belt	381	4	18.1	0.5	1000	-4	895	1
C30	America cotton belt_Mexican coastal plain	269	-31	27.2	1.8	1249	1	799	-15
C31	America cotton belt_lower Mississippi	295	-43	26.0	1.6	1187	0	896	-19
C32	America cotton belt_high plain	352	-29	23.4	0.7	1197	1	971	-10
C33	Sub_boreal North America	265	-11	12.8	0.8	857	-1	667	-6
C34	America West Coast	137	-4	18.0	-0.2	1222	-4	542	3
C35	Sierra Madre	820	-35	21.1	1.5	1250	3	1020	-15
C36	SW Mexico and N. Mexico highlands	114	-62	22.4	1.3	1306	0	590	-23
C37	Northern South and Central America	1208	-9	24.7	1.1	1218	1	1350	-3
C38	Caribbean	643	-12	27.3	1.0	1357	-1	1278	-7
C39	Central_Northern Andes	108	71	15.1	0.2	1300	-4	418	19
C40	Central_Northern Andes	333	-36	15.8	1.4	1185	0	579	-8
C41	Brazil Nordeste	52	-46	25.5	1.2	1272	4	530	-8
C42	Central_Eastern Brazil	74	-71	26.1	2.7	1145	1	519	-28
C43	Amazon	179	-56	27.7	2.0	1207	1	689	-27
C44	Central_North Argentina	140	-9	18.6	1.1	955	-8	502	-2
C45	SE Brazil_Concepcion_Bahia Blanca	497	17	16.3	1.0	833	-6	738	-2

C46	SW Southern Cone	815	21	6.4	-0.1	715	-4	598	7
C47	Semi_arid Southern Cone	104	5	11.0	0.3	983	-5	355	4
C48	Caucasus	152	-23	19.4	0.8	1258	1	574	-5
C49	Central Asia Pamir mountains	141	-23	18.1	0.5	1375	-1	523	-2
C50	Western Asia (Kazakhstan, Uzbekistan, Turkmenistan, Iran et.al)	94	28	23.5	0.8	1291	-2	521	6
C51	Western Asia (Syrian, Jordan, Israel, et.al)	15	-57	28.0	1.6	1383	-2	502	-4
C52	Gansu-Xinjiang (China)	270	31	16.4	0.6	1139	-2	590	6
C53	Hainan (China)	1421	8	26.3	0.5	1191	-1	1512	1
C54	Huanghuaihai (China)	477	8	23.6	1.6	1119	5	955	4
C55	Inner Mongolia (China)	249	-1	17.5	1.6	1098	1	671	-2
C56	Loess region (China)	358	-5	18.1	1.3	1134	5	810	-1
C57	Lower Yangtze (China)	935	13	23.7	0.6	1043	-2	1302	6
C58	Northeast China	433	17	16.5	0.9	961	-4	852	7
C59	Qinghai-Tibet (China)	987	-14	12.7	1.4	1050	6	752	1
C60	Southern China	1391	14	23.4	0.7	1074	-1	1441	4
C61	Southwest China	844	-3	19.7	0.9	1001	4	1181	3
C62	Taiwan (China)	1633	71	25.2	-1.0	1049	-13	1201	4
C63	East Asia	680	3	18.3	1.4	968	2	1005	3
C64	Southern Himalayas_zone111 (Vietnam, Laos, Myanmar)	1229	-7	23.7	1.0	1130	4	1445	1
C65	Southern Himalayas_zone112 (Myanmar)	1039	-7	22.2	0.9	1092	6	1384	1
C66	Southern Himalayas_zone12 (India, Myanmar, Bangladesh, Bhutan)	1970	-9	23.9	0.7	1003	7	1404	1
C67	Southern Himalayas_zone222 (Nepal, India)	1117	0	25.5	0.6	1190	6	1284	6
C68	Southern Asia	1305	4	26.1	0.5	1108	4	1346	0
C69	Southern Japan and Korea	837	-12	23.0	1.4	1123	8	1195	-4
C70	Mongolia region (Western of Mongolia)	188	22	7.7	0.8	1083	-5	504	10
C71	S. Asia Punjab to Gujarat	837	11	28.5	-0.3	1153	-1	1064	9
C72	SE Asia islands_zone1 (Indonesia, Malaysia)	878	-2	25.1	0.4	1238	2	1248	-4
C73	SE Asia islands_zone2 (Indonesia, Malaysia)	1196	-7	25.3	0.5	1227	2	1446	-2
C74	SE Asia islands_zone3 (Indonesia, Papua New Guinea)	1027	-21	23.4	0.3	1082	2	1167	-8
C75	SE Asia mainland_zone1 (Myanmar, Bangladesh)	1496	-9	26.6	0.6	1165	5	1513	-2
C76	SE Asia mainland_zone2 (Thailand, Myanmar, Laos)	1534	13	25.2	0.5	1139	4	1535	4

C77	SE Asia mainland_zone3 (Cambodia, Vietnam, Thailand, Laos)	306	-16	12.7	1.7	850	4	692	-9
C78	Eastern Siberia	264	-10	11.4	1.5	953	0	629	-5
C79	Eastern Central Asia (Eastern of Mongolia)	116	-58	25.3	0.1	1288	0	628	-24
C80	North Australia_zone1 (Timor_Leste, Indonesia, Papua New Guinea)	75	-23	22.3	0.6	1250	2	497	-5
C81	North Australia_zone2 (Northern Australia)	140	-45	13.4	1.3	978	8	484	-21
C82	Australia Queensland to Victoria _zone1 (Southeast Australia_coast)	77	-54	15.2	1.3	1011	8	387	-26
C83	Australia Queensland to Victoria _zone21 (Southeast Australia Marrin Darling)	193	-41	12.3	0.4	754	8	547	-24
C84	Australia Queensland to Victoria _zone22 (Southeast Australia Adeleid)	105	-39	14.3	1.3	937	6	424	-20
C85	Australia Nullarbor_Darling_zone1 (Southwest Australia)	210	-28	13.7	0.8	877	5	567	-17
C86	Australia Nullarbor_Darling_zone2 (Southwest Australia)	350	-9	8.2	-0.1	686	-1	625	-5
C87	New Zealand	453	15	11.0	0.5	688	-4	750	5
C88	Boreal Eurasia	239	-9	15.6	1.2	852	3	657	-4
C89	Ukraine to URAL Mountains	175	9	20.9	1.3	1257	0	612	0
C90	Mediterranean Europe and Turkey	290	-2	17.4	1.8	968	1	731	0
C91	W. Europe _zone1 (Germany, Poland, Switzerland, Czechia, Hungary, Austria, and Balkans countries)	338	0	21.0	1.4	1228	1	827	3
C92	W. Europe_ zone10 (Northwestern Greece and southwestern of Albania)	77	-51	21.8	2.4	1113	5	506	-15
C93	W. Europe_zone2 (Southeastern of Romania, Moldova, and southwestern Urania)	85	-36	20.9	1.8	1231	1	525	-9
C94	W. Europe__zone3 (Ebro River, Zaragoza, Spain)	290	-5	20.8	2.1	1148	0	751	-2
C95	W. Europe_zone4 (Northeastern of Italy and southwestern coast of France)	487	16	20.5	1.5	1078	-2	978	9
C96	W. Europe_zone5 (North Italy)	737	20	13.3	2.0	1041	0	900	11

C97	W. Europe_zone6 (Switzerland, North Italy and west Austria)	414	16	16.1	1.2	857	0	852	8
C98	W. Europe_zone7 (Ireland, United Kingdom, France, Belgium, Netherland)	67	-69	22.9	2.5	1208	3	532	-22
C99	W. Europe_zone8 (Northwest of turkey and northeast of Greece)	178	-40	20.9	2.3	1210	2	644	-17
C100	W. Europe_zone9 (North Greece and North Macedonia)	439	-7	8.0	0.3	602	-2	633	-1
C101	Boreal North America	357	48	14.0	1.1	876	-2	774	26
C102	URAL to Altai Mountains	45	-57	16.4	1.2	1069	6	331	-27
C103	Australian Desert (Central Australia)	18	-40	29.5	1.1	1436	-1	443	-1
C104	Old World Deserts	183	3	0.6	1.4	594	-6	324	7
C105	Sub Arctic America (IceLand)	1430	3	25.5	0.7	1169	6	1579	3

Table A.2 July 2023 - October 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	295	14	15.0	0.7	851	-7	555	-3
AUS	Australia	120	-43	14.9	1.2	997	7	451	-21
BGD	Bangladesh	1999	0	27.3	0.6	1148	5	1636	1
BRA	Brazil	155	-49	25.8	2.3	1148	0	582	-25
KHM	Cambodia	1363	0	26.0	0.6	1178	8	1625	3
CAN	Canada	311	-6	13.8	0.9	893	-3	675	-4
CHN	China	808	7	20.7	0.9	1047	0	998	4
EGY	Egypt	6	-24	26.8	1.2	1352	-2	372	-2
ETH	Ethiopia	646	-29	18.9	1.2	1255	6	868	-10
FRA	France	339	11	17.7	1.7	999	0	800	5
DEU	Germany	360	13	16.0	1.3	879	0	787	3
IND	India	1261	-1	26.1	0.4	1118	5	1304	3
IDN	Indonesia	845	-19	24.6	0.4	1199	3	1178	-8
IRN	Iran	42	-27	23.2	0.7	1403	-2	445	-4
KAZ	Kazakhstan	321	73	15.8	0.8	968	-4	729	32
MEX	Mexico	770	-28	23.9	1.4	1273	1	1008	-15
MMR	Myanmar	1531	-5	24.3	0.7	1068	4	1435	0
NGA	Nigeria	663	-28	26.6	1.5	1173	7	986	-20
PAK	Pakistan	335	-3	25.4	0.6	1334	-1	731	5
PHL	Philippines	1768	3	25.6	0.3	1184	-2	1546	-1
POL	Poland	275	-6	16.9	1.7	864	1	734	0
ROU	Romania	128	-41	19.8	2.5	1113	5	576	-12
RUS	Russia	275	-1	14.4	1.1	849	1	687	0
ZAF	South Africa	108	3	14.3	-0.1	1112	-1	423	-1

THA	Thailand	1356	12	25.7	0.7	1183	7	1576	5
TUR	Turkey	116	-13	20.3	1.4	1302	1	560	1
GBR	United Kingdom	513	12	13.6	0.6	676	3	893	10
UKR	Ukraine	158	-22	18.6	1.9	1005	5	580	-6
USA	United States	279	-22	20.9	0.8	1140	-1	739	-10
UZB	Uzbekistan	42	12	22.1	0.1	1336	-2	481	1
VNM	Vietnam	1317	-7	24.7	0.9	1158	4	1488	0
AFG	Afghanistan	34	-27	19.7	0.5	1442	0	394	-3
AGO	Angola	92	-38	22.3	0.6	1334	0	509	-10
BLR	Belarus	240	-13	16.1	1.9	847	6	670	-4
HUN	Hungary	212	5	20.2	2.1	1049	2	710	9
ITA	Italy	332	-2	20.8	1.8	1166	1	764	-2
KEN	Kenya	135	-59	20.8	1.2	1233	5	599	-18
LKA	Sri_Lanka	1238	10	26.5	0.3	1171	-5	1240	-1
MAR	Morocco	49	-43	23.6	0.9	1358	0	527	-8
MNG	Mongolia	277	1	10.8	1.5	1013	-3	639	3
MOZ	Mozambique	92	33	22.6	0.6	1131	-3	552	8
ZMB	Zambia	19	1	22.2	0.7	1364	-2	448	3
KGZ	Kyrgyzstan	262	11	10.7	-0.8	1277	-1	531	2
SYR	Syria	17	-48	28.2	1.5	1388	-2	505	-4
DZA	Algeria	16	-84	24.8	1.7	1351	3	487	-20
LBN	Lebanon	23	-47.2	23.4	1	1415	-2	502	-2
MUS	Mauritius	203	34	23.4	1.2	1184	7	848	17

*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 July 2023 - October 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 (%)
Buenos Aires	166	-31	11.8	0.3	818	-3	468	-18
Chaco	302	14	19.1	1.1	833	-9	707	6
Cordoba	108	-15	14.6	0.5	900	-9	400	-9
Corrientes	778	73	17.4	0.9	769	-10	955	12
Entre Rios	391	8	14.9	0.8	788	-8	687	-6
La Pampa	142	-17	12.3	0.0	830	-7	445	-6
Misiones	961	56	18.9	1.5	834	-6	1086	8
Santiago Del Estero	195	34	18.0	0.5	916	-9	561	12
San Luis	95	-13	12.9	0.2	926	-7	369	-6
Salta	141	-18	17.7	1.6	1037	-7	516	-2
Santa Fe	288	16	16.3	0.8	828	-9	629	1
Tucuman	154	66	15.0	1.1	1025	-11	503	25

Table A.4 July 2023 - October 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 (%)
New South Wales	100	-50	14.0	1.5	1033	9	413	-22
South Australia	111	-49	13.6	0.5	874	8	407	-30
Victoria	208	-31	11.2	0.6	779	8	525	-17
W. Australia	149	-32	15.2	0.9	952	5	482	-18

Table A.5 July 2023 - October 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 (%)
Ceara	25	-59	27.4	0.8	1408	3	542	-10
Goias	10	-95	27.9	3.2	1207	-2	438	-35
Mato Grosso Do Sul	48	-84	27.1	3.6	1078	0	473	-39
Mato Grosso	11	-95	28.8	2.7	1188	1	437	-39
Minas Gerais	56	-78	23.9	2.9	1130	1	491	-26
Parana	339	-38	20.4	2.6	963	-1	732	-22
Rio Grande Do Sul	1006	61	15.9	0.7	775	-9	1055	8
Santa Catarina	801	23	16.3	1.3	798	-7	1062	9
Sao Paulo	75	-78	23.9	3.2	1087	3	490	-38

Table A.6 Canada,July 2023 - October 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 (%)
Alberta	202	-12	13.4	1.1	962	0	570	-8
Manitoba	228	-20	14.5	0.5	845	-8	662	-9
Saskatchewan	143	-37	14.5	0.8	945	-2	516	-19

Table A.7 India, July 2023 - October 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 (%)
Andhra Pradesh	997	12	26.7	0.5	1132	4	1317	2
Assam	2508	-9	25.1	0.4	990	9	1505	1
Bihar	1497	11	27.5	0.4	1167	5	1547	8
Chhattisgarh	1317	11	25.7	0.4	1155	8	1470	6

Daman and Diu	1342	-13	27.8	0.2	1156	0	1167	-11
Delhi	1422	111	27.8	-0.8	1211	4	1434	26
Gujarat	1061	-6	27.6	0.0	1051	-2	1084	-8
Goa	2429	-12	25.5	0.6	1101	7	1589	1
Himachal Pradesh	686	-32	20.0	0.7	1241	5	898	-5
Haryana	1003	60	28.4	-0.5	1228	5	1269	22
Jharkhand	1400	13	26.2	0.5	1182	4	1553	5
Kerala	2210	8	24.1	0.1	1070	2	1465	-1
Karnataka	841	-22	24.3	0.8	1027	7	1109	-8
Meghalaya	2459	-7	24.2	0.0	961	5	1468	0
Maharashtra	1269	0	25.0	0.3	1012	2	1267	-3
Manipur	1339	-33	21.9	0.5	995	12	1383	1
Madhya Pradesh	1015	-11	25.8	0.3	1134	9	1340	3
Mizoram	1673	-18	23.5	0.1	1097	10	1549	2
Nagaland	2127	-6	20.9	-0.6	889	2	1347	-1
Orissa	1425	6	26.4	0.7	1173	6	1517	3
Puducherry	1156	-23	27.9	0.3	1211	6	1476	3
Punjab	796	19	28.0	-0.8	1215	2	1123	9
Rajasthan	909	23	28.1	-0.5	1150	1	1148	15
Sikkim	1265	45	20.6	3.2	1035	-5	1058	16
Tamil Nadu	861	3	27.1	0.7	1136	4	1240	5
Tripura	1392	-27	26.4	0.5	1133	10	1598	-1
Uttarakhand	669	-36	22.3	1.8	1238	10	935	-6
Uttar Pradesh	1032	-3	27.9	0.4	1202	8	1410	8
West Bengal	2062	12	27.4	0.7	1157	3	1630	3

Table A.8 Kazakhstan, July 2023 - October 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	311	83	15.3	1.3	882	-6	752	38
Karagandinskaya	251	65	15.2	1.8	945	-7	699	35
Kustanayskaya	371	116	15.1	0.5	870	-5	848	55
Pavlodarskaya	341	79	15.6	1.6	879	-4	825	44
Severo kazachstanskaya	351	61	14.4	1.3	823	-1	803	33
Vostochno kazachstanskaya	399	62	14.4	1.3	1042	-3	792	27
Zapadno kazachstanskaya	192	46	18.3	0.3	969	-4	609	15

Table A.9 Russia, July 2023 - October 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.	328	15	13.5	0.8	805	0	752	8
Chelyabinskaya Oblast	361	48	13.5	0.8	810	-1	795	25
Gorodovikovsk	86	-55	21.5	1.4	1137	6	549	-19
Krasnodarskiy Kray	201	-33	16.4	1.2	1006	5	650	-13
Kurganskaya Oblast	289	24	14.1	1.5	780	1	736	18
Kirovskaya Oblast	278	-12	13.1	1.2	711	2	696	-5
Kurskaya Oblast	229	0	15.9	1.1	912	6	627	-1
Lipetskaya Oblast	252	14	15.4	0.6	856	2	635	2
Mordoviya Rep.	264	-2	14.2	0.4	785	-3	658	-4
Novosibirskaya Oblast	377	39	13.5	1.7	783	1	823	21
Nizhegorodskaya O.	340	19	13.8	0.6	739	-2	728	4
Orenburgskaya Oblast	251	33	15.7	0.4	889	-3	670	16
Omskaya Oblast	357	46	13.7	1.7	735	-3	811	30
Permskaya Oblast	288	-13	13.0	1.6	722	5	728	0
Penzenskaya Oblast	212	-16	14.5	0.4	834	-1	604	-10
Rostovskaya Oblast	131	-24	20.0	1.0	1080	4	584	-7
Ryazanskaya Oblast	311	20	14.7	0.4	778	-2	699	3
Stavropolskiy Kray	141	-50	20.4	1.2	1138	6	605	-23
Sverdlovskaya Oblast	254	-10	13.0	1.7	751	5	668	-1
Samarskaya Oblast	190	-20	15.6	0.9	850	-1	583	-11
Saratovskaya Oblast	177	-9	16.4	0.4	931	-1	571	-5
Tambovskaya Oblast	246	10	15.4	0.3	854	-1	625	-2
Tyumenskaya Oblast	324	29	13.4	1.6	728	0	747	18
Tatarstan Rep.	231	-21	14.4	1.1	773	0	636	-11
Ulyanovskaya Oblast	169	-37	14.9	0.9	814	-2	543	-21
Udmurtiya Rep.	263	-14	13.6	1.5	726	2	701	-2
Volgogradskaya O.	137	-14	18.4	0.7	982	-1	541	-4
Voronezhskaya Oblast	201	2	16.7	0.6	927	1	588	-3

Table A.10 United States, July 2023 - October 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	376	-6	24.5	1.1	1169	-1	944	-4
California	70	14	20.1	-0.2	1320	-6	516	6
Idaho	129	-3	15.6	0.2	1188	-5	533	3
Indiana	291	-6	20.0	0.3	1064	-5	852	-1
Illinois	343	4	20.8	0.7	1081	-5	897	3
Iowa	275	-9	19.9	1.0	1105	-2	802	-2
Kansas	186	-41	24.2	1.6	1225	2	750	-16
Michigan	348	6	16.7	0.1	938	-6	831	0
Minnesota	263	-9	17.4	1.0	974	-5	721	-7
Missouri	292	-15	22.3	0.9	1140	-2	849	-7
Montana	148	-18	15.7	0.3	1123	-3	552	-9
Nebraska	158	-39	21.4	1.2	1191	0	658	-17
North Dakota	217	-12	17.2	0.3	1022	-4	673	-6
Ohio	279	-6	18.9	0.0	1063	-2	834	-1
Oklahoma	287	-15	25.9	1.5	1224	1	858	-8
Oregon	160	4	15.9	0.0	1157	-4	537	7
South Dakota	208	-16	19.7	0.8	1130	-1	668	-12
Texas	239	-37	27.9	2.0	1267	1	763	-18
Washington	184	-13	16.0	0.3	1080	-3	553	0
Wisconsin	277	-3	17.6	1.1	977	-6	734	-4

Table A.11 China, July 2023 - October 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	756	8	23.7	0.7	1035	1	1177	5
Chongqing	937	8	21.5	0.6	1002	2	1278	5
Fujian	1179	24	23.5	0.7	1034	-5	1398	7
Gansu	353	-15	15.1	1.1	1088	6	765	-1
Guangdong	1548	25	25.3	0.5	1065	-9	1545	5
Guangxi	1292	9	24.1	0.7	1109	-1	1491	5
Guizhou	775	-13	20.3	0.8	1005	4	1229	-1
Hebei	320	-3	21.0	2.1	1121	3	769	-3
Heilongjiang	416	26	15.7	0.7	923	-5	846	10
Henan	569	26	23.2	1.1	1106	5	1098	16
Hubei	714	4	22.3	0.7	1056	2	1178	5
Hunan	760	-3	23.3	0.7	1055	-1	1252	4
Jiangsu	816	18	24.1	0.9	1045	2	1162	3
Jiangxi	951	17	23.9	0.3	1031	-5	1357	9
Jilin	459	14	16.7	0.8	985	-4	864	4
Liaoning	449	4	19.4	1.4	1040	0	897	4

Inner Mongolia	252	8	16.5	1.3	1062	-1	660	0
Ningxia	174	-25	17.6	1.3	1152	4	615	-9
Shaanxi	548	0	18.8	1.1	1083	4	900	1
Shandong	407	-9	23.5	1.7	1143	7	919	-1
Shanxi	289	-14	18.4	1.7	1148	5	751	-4
Sichuan	951	1	18.6	1.0	971	3	1119	4
Yunnan	1003	-2	18.5	0.9	1005	8	1193	3
Zhejiang	1058	13	23.4	0.9	1020	-1	1346	5

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**.**

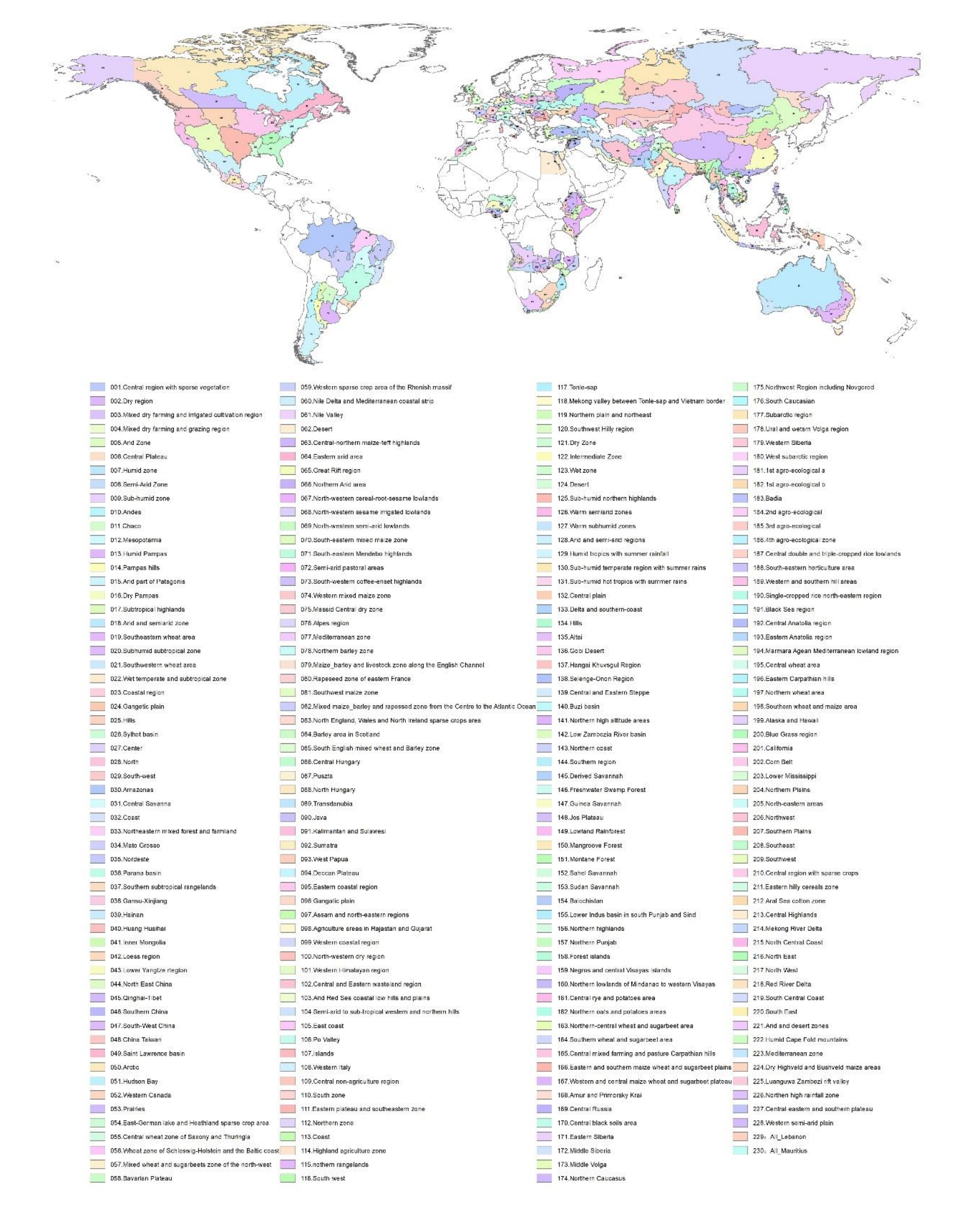
Agroecological zones for 47 key countries

Overview

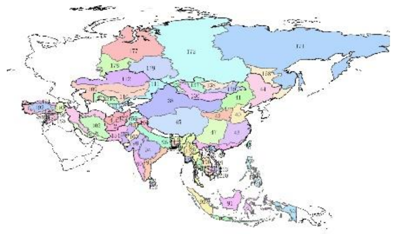
230 agroecological zones for the 47 key countries across the globe

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.Arid 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.Arid 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 wetsrn 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

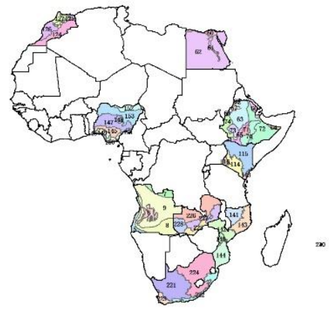


- 001.Central region with sparse vegetation
- 002.Dry region
- 003.Mixed dry farming and irrigated cultivation region
- 004.Mixed dry farming and grazing region
- 023.Coastal region
- 024.Gangetic plain
- 025.Hills
- 026.Sylhet basin
- 038.Gansu-Xinjiang
- 039.Hainan
- 040.Huang Huaihai
- 041.Inner Mongolia
- 042.Loess region
- 043.Lower Yangtze rlegion
- 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.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.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
- 119.Northern plain and northeast
- 120.Southwest Hilly region
- 121.Dry Zone
- 122.Intermediate Zone
- 123.Wet zone
- 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
- 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
- 168.Amur and Primorsky Krai
- 171.Eastern Siberia
- 172.Middle Siberia
- 177.Subarctic region
- 178.Ural and welsrn Volga region
- 179.Western Siberia
- 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
- 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
- 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
- 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
- 105.East coast
- 106.Po Valley
- 107.Islands
- 108.Western Italy
- 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
- 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

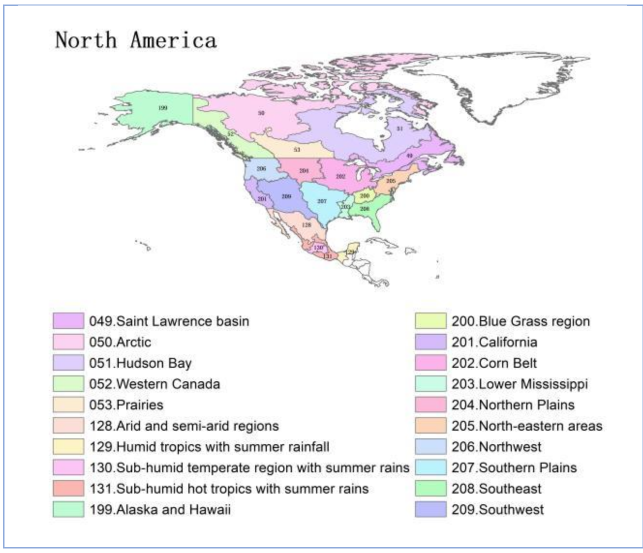
Africa

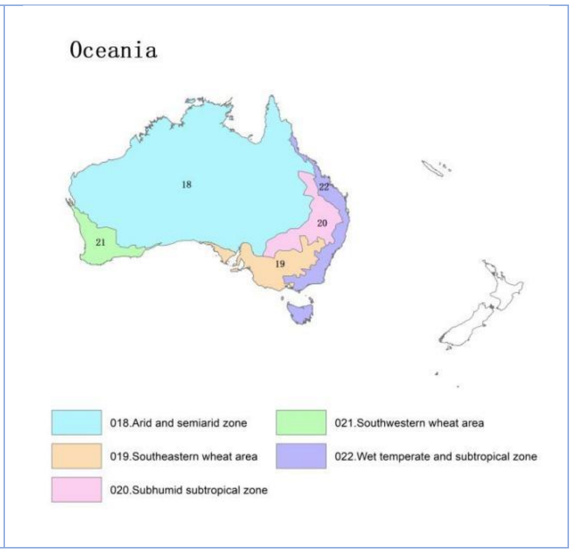


- 005.Arid Zone
- 006.Central Plateau
- 007.Humid zone
- 008.Semi-Arid Zone
- 009.Sub-humid zone
- 060.Nile Delta and Mediterranean coastal strip
- 061.Nile Valley
- 062.Desert
- 063.Central-northern maize-teff highlands
- 064.Eastern arid area
- 065.Great Rift region
- 066.Northern Arid area
- 067.North-western 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
- 113.Coast
- 114.Highland agriculture zone
- 115.nothern rangelands
- 116.South-west
- 124.Desert
- 125.Sub-humid northern highlands
- 126.Warm semiarid zones
- 127.Warm subhumid zones
- 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
- 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
- 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/m², 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.

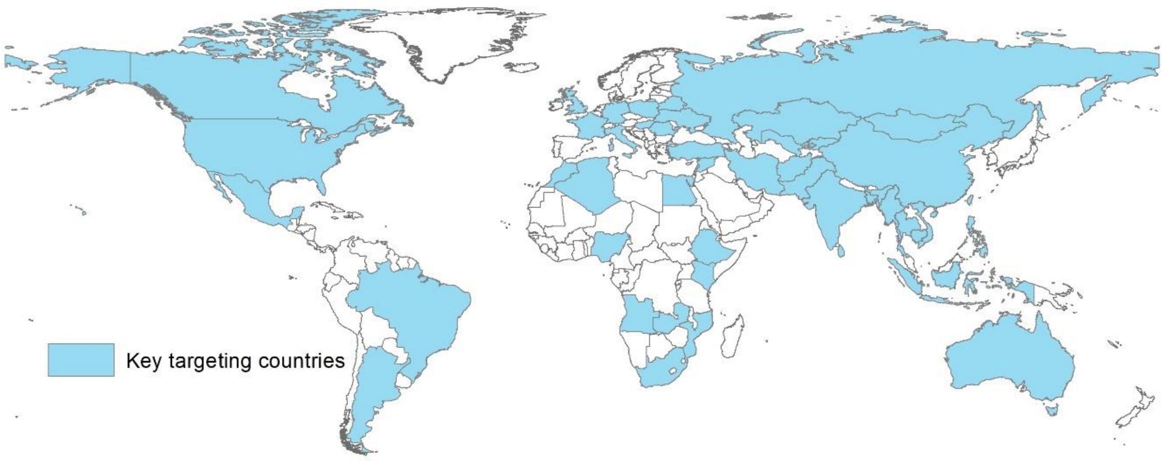
CropWatch spatial units (CWSU)

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.

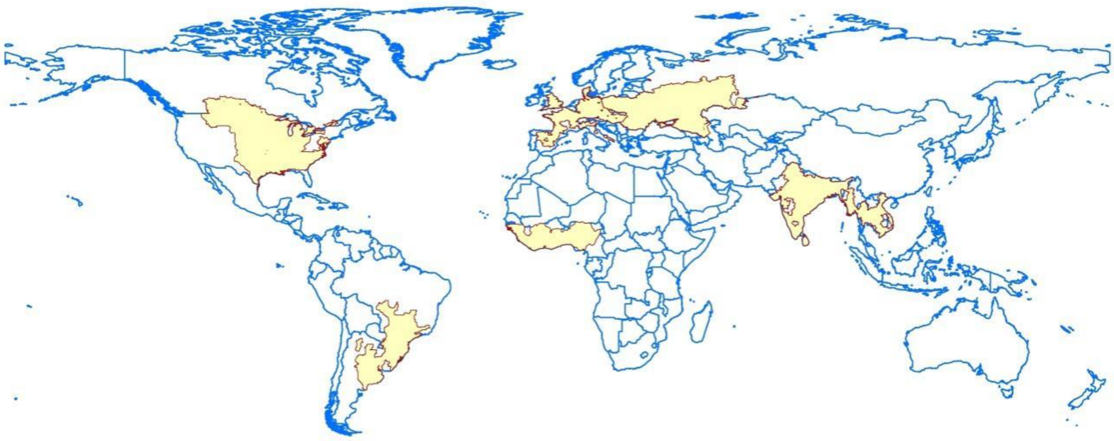
SPATIAL LUNITS	
CHINA	
Overview	*Description*
Seven monitoring regions	The seven regions in China are agro-economic/agro-ecological regions that together cover the bulk of national maize, rice, wheat, and soybean production. Provinces that are entirely or partially included in one of the monitoring regions are indicated in color on the map below.


Heilongjiang
North East China
Inner Mongolia
Jilin
Inner Mongolia
Liaoning
Gansu
Ningxia
Hebei
Shanxi
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

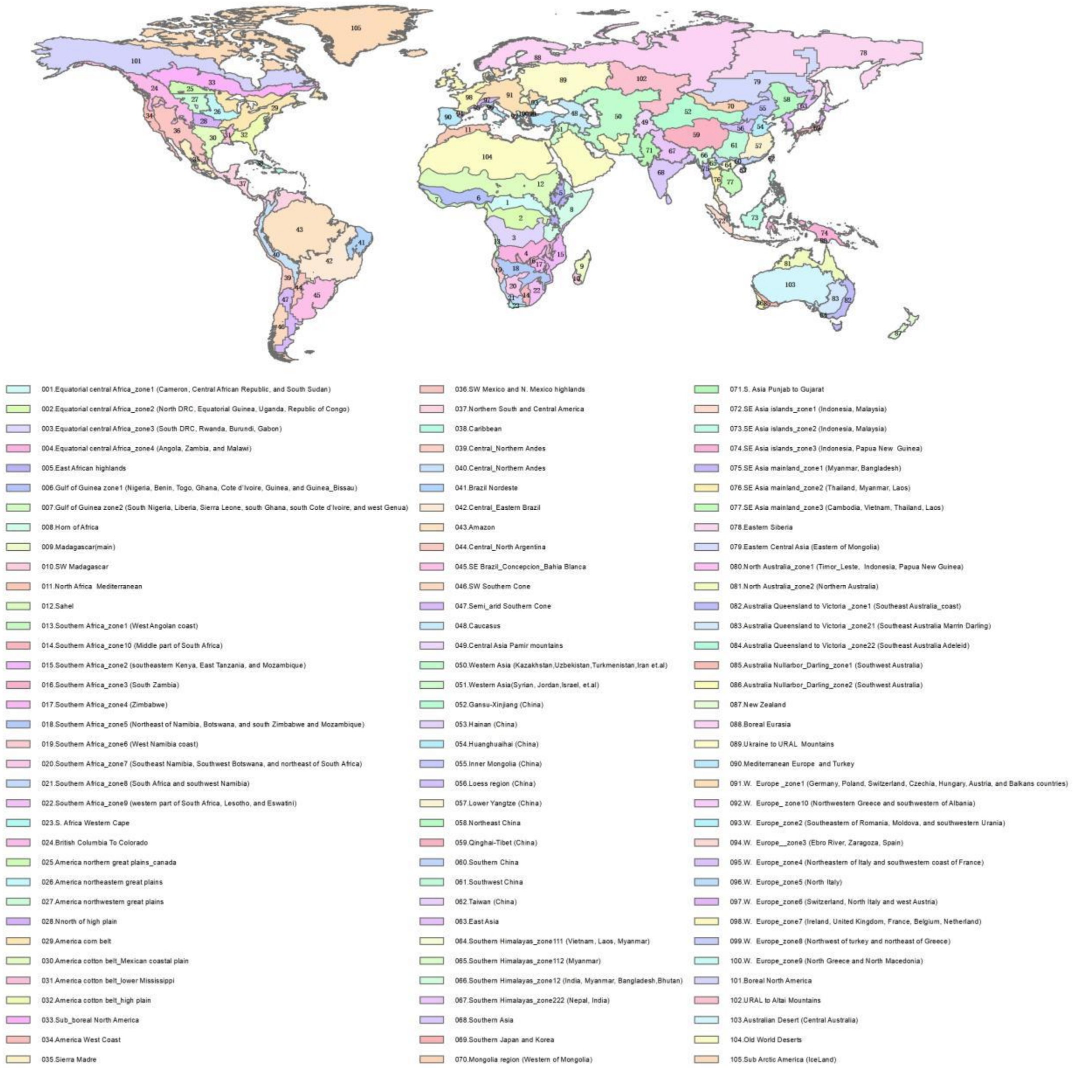
Countries (and first-level administrative districts, e.g., states and provinces)	
Overview	*Description*
"Forty six plus one" countries to represent main producers/exporters and other key countries.	CropWatch monitored 47 countries together represent more than 80% of the production of maize, rice, wheat 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.

References

ACT 2014 Condensed Papers of the First Africa Congress on Conservation Agriculture, 2014, Lusaka. http://www.act-africa.org/lib.php?com=5&com2=20&com3=63&com4=30&res_id=219

Agada O O 2016 Agricultural Water Management in Sub – Sahara Africa: Options for Sustainable Crop Production. Greener Journal of Agricultural Sciences, 6 (4):151-158. https://www.researchgate.net/publication/308208940_Agricultural_Water_Management_in_Sub_-_Sahara_Africa_Options_for_Sustainable_Crop_Production

Akroyd S, L Smith 2007 Public Spending to Agriculture A joint DFID / World Bank study. Main Study & Country Case-Studies. Oxford Policy Management, Oxford, UK. http://www1.worldbank.org/publicsector/pe/pfma07/OPMReview.pdf

ATV 2010 Recommendation report: food for all forever. Danish academy of technical sciences (ATV), Copenhagen.

Bloomberg 2018 South Africa Plans to Declare Drought a National Disaster https://www.bloomberg.com/news/articles/2018-02-08/south-africa-plans-to-declare-drought-a-national-disaster

Buckley L, Chen Ruijian, Yin Yanfei, Zhu Zidong 2017 Chinese agriculture in Africa, Perspectives of Chinese agronomists on agricultural aid. International Institute for Environment and Development IIED and Foreign Economic Cooperation Centre (FECC) of the of the Chinese Ministry of Agriculture, http://pubs.iied.org/pdfs/17603IIED.pdf

Christiaansen L, L Demery 2018 Agriculture in Africa: Telling Myths from Facts. Directions in Development—Agriculture and Rural Development. Washington, DC: World Bank. © World Bank. https://openknowledge.worldbank.org/handle/10986/28543 License: CC BY 3.0 IGO.

CropWatch 2015 New optimism for African agriculture? February 2015 CropWatch bulletin available from http://www.cropwatch.com.cn/htm/en/files/201531010955561.pdf

CropWatch 2017a The specter of famine is back in the Horn of Africa. August 2017 CropWatch bulletin available from http://www.cropwatch.com.cn/htm/en/files/20170805en.pdf

CropWatch 2017b Rangeland management and issues in Africa. July 2017 CropWatch bulletin available from http://www.cropwatch.com.cn/htm/en/files/20170405EN.pdf

Deininger K, D Byerlee 2011 Rising global interest in farmland. Can it yield sustainable equitable benefits. World Bank, Washington http://siteresources.worldbank.org/INTARD/Resources/ESW_Sept7_final_final.pdf

ECA 2009 Agricultural Input Business Development in Africa: Opportunities, Issues and Challenges, Economic Commission for Africa, southern-Africa Office. https://www.uneca.org/sites/default/files/PublicationFiles/sro-sa-agri-iputs-business-opportunities.pdf

FAO. 2011. The state of the world's land and water resources for food and agriculture (SOLAW) – Managing systems at risk. FAO Rome and Earthscan, London. http://www.fao.org/docrep/017/i1688e/i1688e00.htm

Feed Africa 2016 Strategy for agricultural transformation in Africa. African development Bank, Tunis, Tunisia. https://www.afdb.org/fileadmin/uploads/afdb/Documents/Generic-Documents/Feed_Africa-_Strategy_for_Agricultural_Transformation_in_Africa_2016-2025.pdf

Ferguson, R., D. Krishna, Y. Mhango, A. Alexander, R. Kuzviwanza, A. Oliver, O. Mfune,

I. Pretorius & J. Lutzweiler. 2011. African agriculture, this other Eden. Renaissance, Moscow, Russia. 220 pp. http://www.fastestbillion.com/res/Research/This_other_Eden-211111.pdf

Fritz S, L See, I McCallum, Liangzhi You, A Bun and 42 others 2015 Mapping global cropland and field size Global Change Biology 21(5)1980-1992

GrowAfrica 2018 https://www.growafrica.com/

Hopkins R Agriculture in Africa http://ruperthopkins.com/pdf/Agriculture%20in%20Africa%20002.pdf

IRI 2015 2015 El Niño: Notes for the East African Malaria Community.

IFPRI 2016 El Niño and the Outlook for 2016. http://www.foodsecurityportal.org/el-ni%C3%B1o-and-outlook-2016

Livingston G, S Schonberger, S Delaney 2011 Sub-Saharan Africa: The state of smallholders in agriculture, Paper presented at the IFAD Conference on New Directions for Smallholder Agriculture 24-25 January, 2011, IFAD, Rome

Mittal A 2009 The 2008 Food price crisis: rethinking food security policies. G-24 Discussion Paper No. 56.

Nakweya G 2017 Africa needs to invest in agricultural censuses. https://www.scidev.net/sub-saharan-africa/agriculture/news/africa-invest-agricultural-censuses.html#

NEPAD 2013 Agriculture in Africa, Transformation and outlook. https://www.un.org/en/africa/osaa/pdf/pubs/2013africanagricultures.pdf

OECD-FAO 2016 Agricultural Outlook 2016-2025. INCOMPLETE

Peel M C, B L Finlayson, T A McMahon 2007 Updated world map of the Köppen-Geiger climate classification. Hydrol. Earth Syst. Sci., 11, 1633–1644.

Reuters 2018 Commentary: In drought-hit South Africa, the politics of water. https://www.reuters.com/article/us-saundersonmeyer-drought-commentary/commentary-in-drought-hit-south-africa-the-politics-of-water-idUSKBN1FP226

RISCURA 2015 The high-level impact and ongoing effects of El Niño http://www.riscura.com/brightafrica/el-nino/impact-effects/

Siebert S, V Henrich, K Frenken, J Burke 2013 GMIA version 5, Global map or irrigated agriculture. FAO and University of Bonn. http://www.fao.org/nr/water/aquastat/irrigationmap/gmia_v5_highres.pdf

SOLAW 2011. The state of the world's land and water resources for food and agriculture. Managing systems at risk. FAO, Rome. http://www.fao.org/docrep/015/i1688e/i1688e00.pdf

UNEP-UNCTAD 2008 Organic Agriculture and Food Security in Africa, UN New-York and Geneva http://www3.weforum.org/docs/WEF_ACR_2015/Africa_Competitiveness_Report_2015.pdf

Vargas-Hill R 2010 Agricultural insurance in Sub-Saharan Africa: can it work? Paper prepared for the Fourth African Agricultural Markets Program (AAMP) policy symposium, Agricultural Risks Management in Africa: Taking Stock of What Has and Hasn't Worked, organized by the Alliance for Commodity Trade in Eastern and Southern Africa (ACTESA) and by the Common Market for Eastern and Southern Africa (COMESA). Lilongwe, Malawi, September 6-10, 2010. http://www.fsg.afre.msu.edu/aamp/sept_2010/aamp_lilongwe-vargas_hill-agricultural_insurance.pdf

Ward Christopher, R Torquebiau, Hua Xie 2016 Improved Agricultural Water Management for Africa's Drylands. World Bank Studies. Washington, DC: World Bank. doi: 10.1596/978-1-4648-0832-6. License: Creative Commons Attribution CC BY 3.0 IGO

WEC 2015 "Africa competitiveness Report 2015, chapter 2.1 Africa" WEC, Geneva Switzerland http://www3.weforum.org/docs/WEF_ACR_2015/Africa_Competitiveness_Report_2015.pdf

WB 2018 https://data.worldbank.org/indicator/NV.AGR.TOTL.ZS, https://data.worldbank.org/indicator/SL.AGR.EMPL.ZS

WEF 2016 African farmers need investment – but these 6 factors stand in the way. https://www.weforum.org/agenda/2016/05/6-challenges-to-investing-in-african-farmers

WHO 2016 El Niño and health, Global overview. http://www.who.int/hac/crises/el-nino/who_el_nino_and_health_global_report_21jan2016.pdf

World Bank 2009. Awakening Africa's Sleeping Giant. Prospects for Commercial Agriculture in the Guinea Savannah Zone and Beyond. Directions in development, Agriculture and Rural Development. World Bank, Italian Ministry fo Foreign Affairs and FAO, Rome. 219 pp

https://reliefweb.int/report/lesotho/lesotho-key-message-update-november-2017

http://www.bbc.com/news/av/world-africa-42866178/why-cape-town-is-shutting-off-its-water-supply

https://reliefweb.int/report/zimbabwe/zimbabwe-key-message-update-january-2018

https://www.acaps.org/country/dominica/special-reports#container-955

https://en.wikipedia.org/wiki/Hurricane_Irma

https://en.wikipedia.org/wiki/Hurricane_Maria

https://www.acaps.org/country/vietnam/special-reports#container-957

https://en.wikipedia.org/wiki/Hurricane_Nate_(2017)

https://reliefweb.int/report/viet-nam/aha-centre-flash-update-4-typhoon-damrey-28

https://reliefweb.int/sites/reliefweb.int/files/resources/AHA__6_Flash_Update_Typhoon_Damrey.pdf

https://en.wikipedia.org/wiki/Cyclone_Ockhi

https://reliefweb.int/sites/reliefweb.int/files/resources/DSWD%20DROMIC%20Report%20%2310A%20on%20TD%20URDUJA%20as%20of%2020%20December%202117%2C%208AM.pdf

https://reliefweb.int/sites/reliefweb.int/files/resources/Summary%20of%20Response%20Clusters%20SitRep%20No.%2007%20on%20TS%20Urduja.pdf

https://reliefweb.int/report/viet-nam/viet-nam-typhoon-damrey-dref-operation-update-n-1-mdrvn017

https://www.acaps.org/sites/acaps/files/products/files/171228_start_acaps_briefing_note_philippines_tropical_storm.pdf

https://reliefweb.int/sites/reliefweb.int/files/resources/ROSEA_180110_FlashUpdate5_TropicalCyclone_Madagascar.pdf

https://reliefweb.int/sites/reliefweb.int/files/resources/MDRPH026_OU1.pdf

https://reliefweb.int/sites/reliefweb.int/files/resources/171109_flash_update_inundacion_corinto-noviembre_vf.pdf

https://reliefweb.int/sites/reliefweb.int/files/resources/Peru%20deslizamiento%20en%20el%20distrito%20de%20%20Cholon.pdf

https://reliefweb.int/report/colombia/colombia-desplazamiento-masivo-en-alto-baud-choc-flash-update-no-2-15112017

https://reliefweb.int/sites/reliefweb.int/files/resources/MDRPA012dfr.pdf

https://reliefweb.int/sites/reliefweb.int/files/resources/BOLETIN%20INFORMATIVO%20N%20607.pdf

https://ec.europa.eu/jrc/sites/jrcsh/files/jrc-mars-bulletin-vol25-no11.pdf

https://reliefweb.int/sites/reliefweb.int/files/resources/Children-on-the-Move-v.2.pdf

https://reliefweb.int/sites/reliefweb.int/files/resources/55971.pdf

https://reliefweb.int/sites/reliefweb.int/files/resources/WCD_Data_analysis.pdf

https://www.acaps.org/sites/acaps/files/products/files/acaps_humanitarian_overview_analysis_of_key_crises_into_2018.pdf

https://reliefweb.int/report/guatemala/autoridades-atienden-m-s-de-2700-desamparados-por-fr-o-en-guatemala

https://reliefweb.int/sites/reliefweb.int/files/resources/MDRMA009EPOA.pdf

Acknowledgments

This bulletin is produced by the CropWatch research team at Aerospace Information Research Institute, at the Chinese Academy of Sciences in Beijing, China. The team gratefully acknowledges the active support of a range of organizations and individuals, both in China and elsewhere.

Online resources

Online Resources posted on **www.cropwatch.com.cn** , **http://cloud.cropwatch.com.cn/**

This bulletin is only part of the CropWatch resources available. Visit **www.cropwatch.com.cn** for access to additional resources, including the methods behind CropWatch, country profiles, and other CropWatch publications. For additional information or to access specific data or high-resolution graphs, simply contact the CropWatch team at **cropwatch@radi.ac.cn**.

CropWatch bulletins introduce the use of several new and experimental indicators. We would be very interested in receiving feedback about their performance in other countries. With feedback on the contents of this report and the applicability of the new indicators to global areas, please contact:

Professor Bingfang Wu
Institute of Remote Sensing and Digital Earth
Chinese Academy of Sciences, Beijing, China
E-mail: cropwatch@radi.ac.cn, wubf@radi.ac.cn