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CropWatch

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

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Abbreviations

5YA	Five-year average, the average for the four-month period from July to October for 2017-2021; one of the standard reference periods.
15YA	Fifteen-year average, the average for the four-month period from July to October for 2007-2021; one of the standard reference periods and typically referred to as "average".
AEZ	Agro-Ecological Zone
BIOMSS	CropWatch agroclimatic indicator for biomass production potential
BOM	Australian Bureau of Meteorology
CALF	Cropped Arable Land Fraction
CAS	Chinese Academy of Sciences
CPI	Crop Production Index
CWAI	CropWatch Agroclimatic Indicator
CWSU	CropWatch Spatial Units
DM	Dry matter
EC/JRC	European Commission Joint Research Centre
ENSO	El Niño Southern Oscillation
FAO	Food and Agriculture Organization of the United Nations
GAUL	Global Administrative Units Layer
GVG	GPS, Video, and GIS data
Ha	hectare
Kcal	kilocalorie
MPZ	Major Production Zone
MRU	Mapping and Reporting Unit
NDVI	Normalized Difference Vegetation Index
OISST	Optimum Interpolation Sea Surface Temperature
PAR	Photosynthetically active radiation
PET	Potential Evapotranspiration
AIR	CAS Aerospace Information Research Institute
RADPAR	CropWatch PAR agroclimatic indicator
RAIN	CropWatch rainfall agroclimatic indicator
SOI	Southern Oscillation Index
TEMP	CropWatch air temperature agroclimatic indicator
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 2022, a period referred to in this bulletin as the JASO (July, August, September and October) period or just the "reporting period." The bulletin is the 127th 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, 44 major agricultural countries, and 223 Agro-Ecological Zones (AEZs).

This bulletin is organized as follows:

Chapter	Spatial coverage	Key indicators
Chapter 1	World, using Mapping and Reporting Units (MRU), 105 large, agro-ecologically homogeneous units covering the globe	RAIN, TEMP, RADPAR, BIOMSS
Chapter 2	Major Production Zones (MPZ), six regions that contribute most to global food production	As above, plus CALF, VCIx, and VHIn
Chapter 3	43 key countries (main producers and exporters) and 216AEZs	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 **http://cloud.cropwatch.com.cn/**

Executive summary

The current CropWatch bulletin describes world-wide crop condition and food production as appraised by data up to the end of October 2022. It is prepared by an international team coordinated by the Aerospace Information Research Institute, Chinese Academy of Sciences.

The assessment is based mainly on remotely sensed data. It covers prevailing 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, together, make up at least 80% of production and exports (the "core countries") while chapter 4 zooms into China. Special attention is paid to the production outlook of main crop producing and exporting countries where major cereal and oil crops (maize, rice, wheat and soybean) are harvested this year or currently still in the field. Subsequent sections of Chapter 5 describe the global disasters that occurred from July to October 2022.

Agroclimatic conditions and global warming

Temperatures keep setting new records. During this monitoring period, Europe experienced the hottest summer and autumn on record, accompanied by a prolonged drought. The Yangtze river basin in China also experienced an extremely hot and dry summer and autumn. Extreme rainfall anomalies were recorded as well in other parts of the world: Pakistan suffered from devastating floods, while the South of the USA, Argentina, southern Africa and the Horn of Africa were affected by severe droughts. These conditions are partly due to La Niña, which is entering a rare 3rd consecutive northern winter. Thus, the outlook for the upcoming months is rather dire for some regions.

In many regions of the world, rainfall is the main limiting factor for crop production. The largest rainfall deficits, exceeding more than -30%, as compared to the 15-year average, were observed for Central-Eastern Brazil, the Central-Northern Andes, California, the northern Plains of the United States, the coast of North African and Middle Asia region, the Caucasus region, Africa south of the equator, Tibet and South-East China. Rainfall deficits in the range of -10 to -30% were observed for the Pampas of Argentina, southern and north-eastern Brazil, the Amazon basin, the Mexican Highlands, most of Canada's crop production regions, most of Europe and Türkiye, Central Africa and Gulf of Guinea, northwest India, the North China Plain and Southern China. Only few summer crop production regions in the northern hemisphere received above average rainfall. In Pakistan, torrential rainfalls caused prolonged floods in Sindh and Baluchistan provinces. In the southern hemisphere, the Malay Archipelago, as well as Australia and New Zealand experienced above average rainfall conditions.

Global crop production situation

During the monitoring period from July to October, the global crop production index (CPI) was at the lowest level (CPI=1.15) in the same period of nearly 10 years, which was equivalent to that in 2018. Although the crop production situation in this monitoring period is worse than that in previous years, a CPI greater than 1 indicates that global crop production is stable on the whole, and there will be no significant reduction in production.

Estimates of global crop production

The global production of majors crops for 2022 is expected to be 2859.86 million tonnes with a decrease by 44.10 million tonnes (-1.5%) from 2021. Maize production is expected to be 1045.17 million tonnes with a decrease of 32.01 million tonnes (-3.0%), which is the largest reduction in the past five years. Rice production is expected to be 754.57 million tonnes with a decrease of 9.45 million tonnes (-1.2%) from 2021. Wheat production is expected to be 740.07 million tonnes, a reduction of 2.32 million tonnes, a drop by 0.3% from 2021. Soybean production is expected to be 320.05 million tonnes with a decrease of 0.32 million tonnes (-0.1%) from the previous year.

Outlook

In October, the prolonged drought negatively impacted the sowing of winter wheat in the High Plains of the USA and the planting of maize and soybeans in Argentina. In Brazil, conditions for sowing of maize and soybean were close to normal. Planting of winter wheat in Europe and China benefitted from generally favorable moisture conditions, although dry conditions persisted in the Caucasus region of Russia.

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 to October 2022, 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 2022 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 2007 to 2021. Although departures from the 2007-2021 are not anomalies (which, strictly, refer to a "normal period" of 30 years), we nevertheless use that terminology. The specific reason why CropWatch refers to the most recent 15 years is our focus on agriculture, as already mentioned in the previous paragraph. 15 years is deemed an acceptable compromise between climatological significance and agricultural significance: agriculture responds much faster to persistent climate variability than 30 years, which is a full generation. For "biological" (agronomic) indicators used in subsequent chapters we adopt an even shorter reference period of 5 years (i.e., 2017-2021). This makes provision for the fast response of markets to changes in supply.

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

Considering the size of the areas covered in this section, even small departures may have dramatic effects on vegetation and agriculture due to the within-zone spatial variability of weather. It is important to note that we have adopted an improved calculation procedure of the biomass production potential in the bulletin based on previous evaluation.

1.2 Global overview

Temperatures keep setting new records. During this monitoring period, Europe experienced the hottest summer on record, accompanied by a prolonged drought. The Yangtze river basin in China also experienced an extremely hot and dry summer. Extreme rainfall anomalies were recorded as well in other parts of the world: Pakistan experienced devastating floods, while the South of the USA, Argentina, southern Africa and the Horn of Africa were affected by severe droughts. These conditions can be partly blamed on La Niña, which is entering a rare 3rd consecutive northern winter. Thus, the outlook for the upcoming months is rather dire for some regions.

1.3 Rainfall

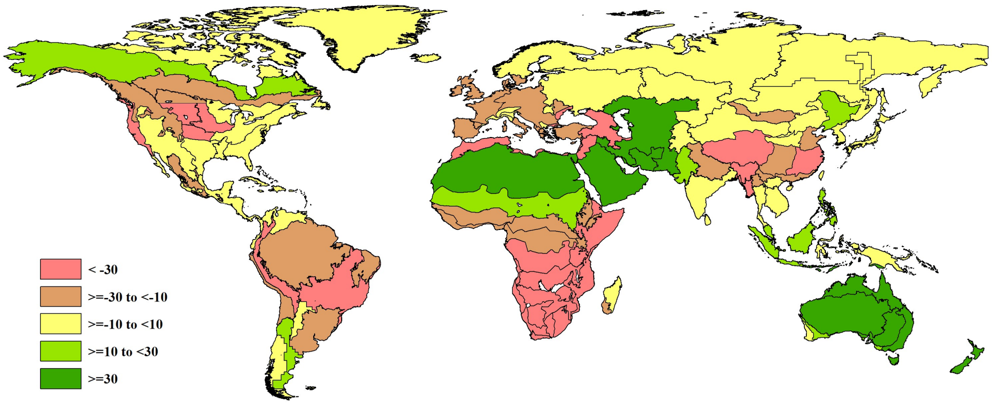


Figure 1.1 Global map of rainfall anomaly (as indicated by the RAIN indicator) by CropWatch Mapping and Reporting Unit: departure of July to October 2021 total from 2007-2021 average (15YA), in percent.

The rainfall departure map continues to reflect the current La Niña conditions. The largest rainfall deficits, exceeding more than -30%, as compared to the 15YA, were observed for Central-Eastern Brazil, the Central-Northern Andes, California, the northern Plains, Southern and eastern Mediterranean area, the Caucasus region, Africa south of the equator, Tibet and South-East China. Rainfall deficits in the range of -10 to -30% were observed for the Pampas, southern and north-east of Brazil, the Amazon basin, the Mexican Highlands, most of Canada's crop production regions, most of Europe and Türkiye, Central Africa and Gulf of Guinea, northwest India, the North China Plain and Southern China. Only few summer crop production regions in the northern hemisphere received above average rainfall. These were most of Iran and Central Asia, Arabian Peninsula, Sahara, Pakistan and the North-East of China. In the southern hemisphere, the Malay Archipelago, as well as Australia and New Zealand experienced above average rainfall conditions.

1.4 Temperatures

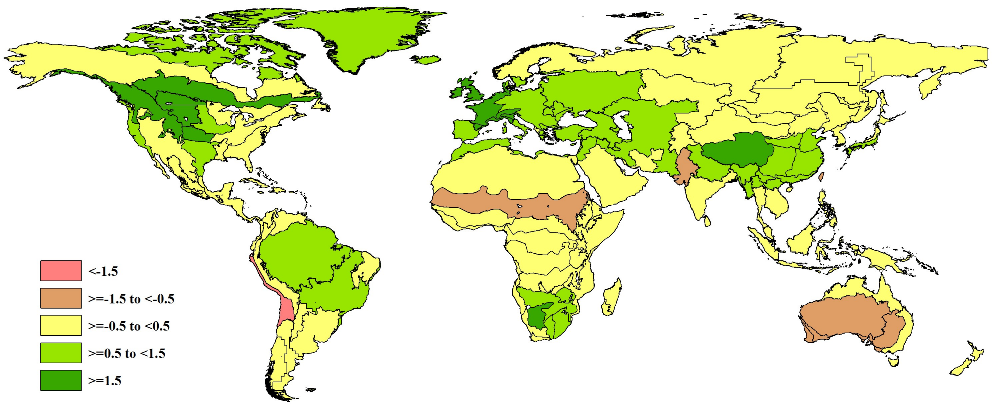


Figure 1.2 Global map of temperature anomaly (as indicated by the TEMP indicator) by CropWatch Mapping and Reporting Unit: departure of July to October 2021 average from 2007-2021 average (15YA), in °C.

Cooler temperatures, exceeding the 15YA by more than -1.5ºC were observed along the coast of northern Chile and Peru. The Sahel, Pakistan and most of Australia experienced temperatures that were 0.5 to 1.5ºC below average. The Cerrados, Pantanal and Amazon basin in Brazil, the Southern Plains, California, Maghreb, Central and Eastern Europe, the Middle East, north of India and most of China south of Beijing experienced temperatures that were 0.5 to 1.5ºC above average. The strongest positive departures (greater than +1.5ºC) were recorded for the Northern Plains, most of Canada's crop production region, Western Europe, the Tibetan Plateau and Southern Africa.

1.5 RADPAR

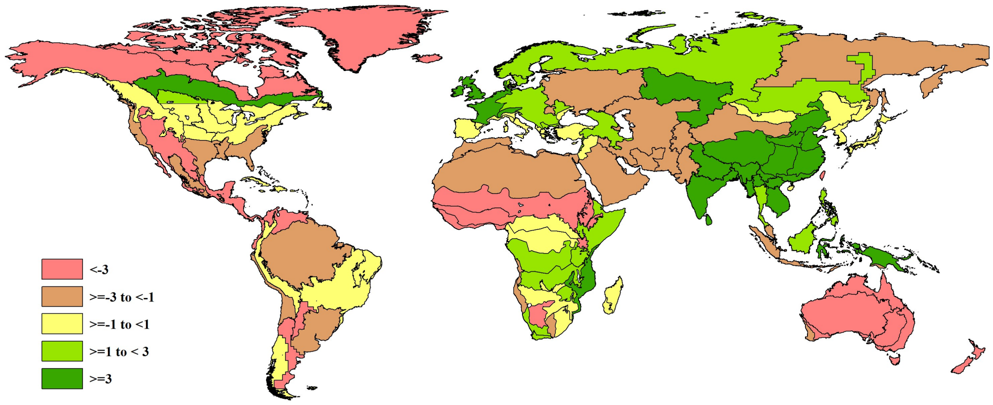


Figure 1.3 Global map of photosynthetically active radiation anomaly (as indicated by the RADPAR indicator) by CropWatch Mapping and Reporting Unit: departure of departure of July to October 2021 total from 2007-2021 average (15YA), in percent.

The strongest negative departures (<-3%) in solar radiation were observed for the northwest and southeast of Argentina, Central America, the Rocky Mountains, the Sahel and Western Africa, as well as Australia. The Pampas, southern Brazil, the Amazon basin, the Pacific coast of South America, California, South of the USA, Africa north of the Sahel, Middle East and Central Asia, Eastern Europe as well as Indonesia had below average solar radiation, in the range of -1% to -3% below average. Above average solar radiation was recorded for parts of southern and eastern Africa and Central Europe. A stretch ranging from the Canadian Prairies to its East Coast recorded strong positive departures exceeding +3%. Similarly, Western Europe, Mozambique, South- and Southeast Asia as well as most of China experienced much sunnier conditions than usual.

1.6 BIOMSS

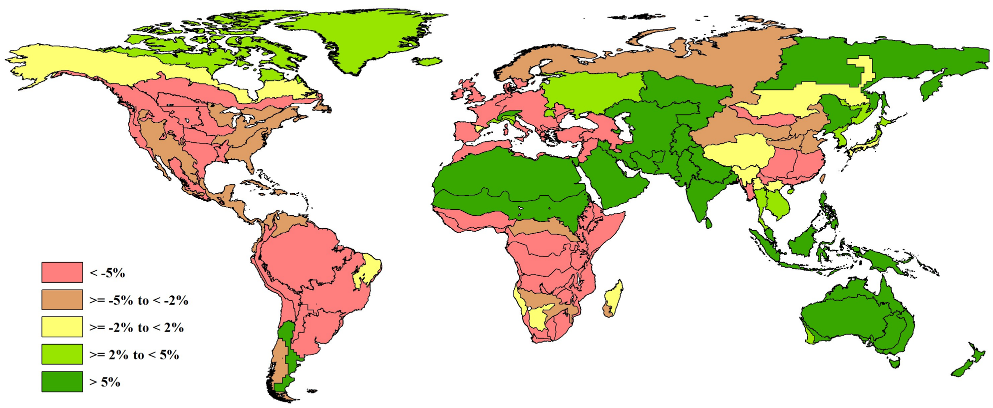


Figure 1.4 Global map of biomass accumulation (as indicated by the BIOMSS indicator) by CropWatch Mapping and Reporting Unit: departure of July to October 2021 from 2007-2021 average (15YA), in percent.

In the Americas, potential biomass production, which is calculated by taking rainfall, temperature and solar radiation into account, was above average only in Central Chile and the south-east coast of Argentina. In the other parts of the Americas, it was strongly or slightly below average. A similar situation was observed for Western Africa and most of Africa south of the Equator. The Maghreb and Europe, apart from Russia and the Alps also had a strong negative departure. Most of China, apart from its Northeast, had below average biomass production. Conditions were more favorable for Central and South Asia, the Malay Archipelago, Australia and New Zealand.

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), minimum vegetation health index (VHIn) and cropping intensity (CI)— 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 2022)

	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m^2)	Departure (%)	Current (gDM/m^2)	Departure (%)
West Africa	792	-16	24.7	-0.1	1045	-4	1212	-7
North America	300	-15	20.9	0.5	1134	0	758	-11
South America	226	-34	19.1	-0.6	999	-3	603	-18
S. and SE Asia	1223	-10	25.6	0.2	1136	6	1417	5
Western Europe	248	-19	17.4	1.8	1015	6	693	-7
Central Europe and W. Russia	250	-1	15.9	0.7	875	-1	680	1

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

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

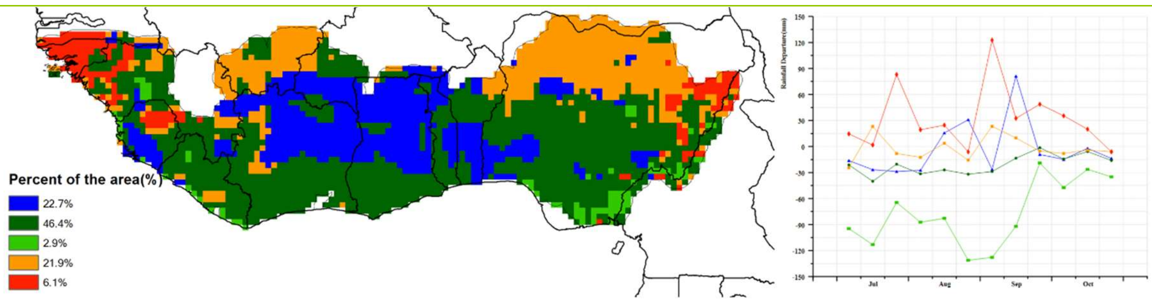
	CALF (Cropped arable land fraction)		Maximum VCI	Cropping Intensity	
	Current	5A Departure (%)	Current	Current	5A Departure (%)
West Africa	97	0	0.92	128	-1
North America	91	-3	0.84	112	10
South America	82	-9	0.72	131	4
S. and SE Asia	97	1	0.92	157	17
Western Europe	88	-3	0.75	109	-1
Central Europe and W Russia	97	2	0.87	103	-1

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 2017-2021.

2.2 West Africa

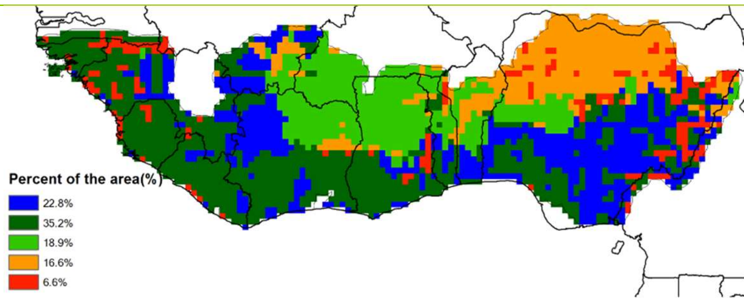
The reporting period covers the end of the main rainy season in the northern Sahelian areas and the onset of the main rainy season throughout the region's south. The main agricultural activities include sowing cereals (maize, sorghum, millet, and rice) under both rainfed and irrigated conditions. Tuber crops such as yam were being harvested, while rice harvest is expected to extend into December and January. The first maize crop in southern Nigeria with bimodal rainfall was harvested in October while cassava was still growing, contributing to the cropped arable land as reflected by the CALF (97%, +0%). The agroclimatic indicators show below-average rainfall (RAIN 792 mm, -16%), average temperature (TEMP 24.7°C, down 0.1°C), and sunshine (RADPAR 1045 MJ/m2, - 4%), resulting in a decrease in biomass production potential (BIOMSS 1212 g DM/m2, -7%) with generally negative departures in indicators observed throughout the MPZ. The estimated regional average maximum VCI was 0.92, indicating generally moderate favorable crop growth conditions, with minimum VHI indicating moderate to severe drought stress throughout the region. The average cropping intensity index observed in the MPZ was at 128, down 1% (CI = 200 in the coastal area and CI=100 in the northern region). These CropWatch indicators show stable climatic conditions for the MPZ and favorable prospects for 2022 crops.

Figure 2.1 West Africa MPZ: Agroclimatic and agronomic indicators, July– October 2022.

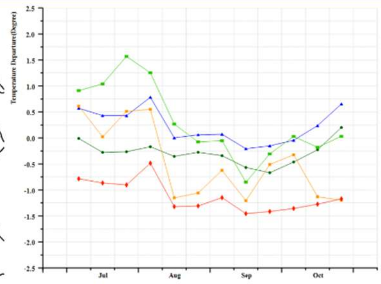


a. Spatial distribution of rainfall profiles

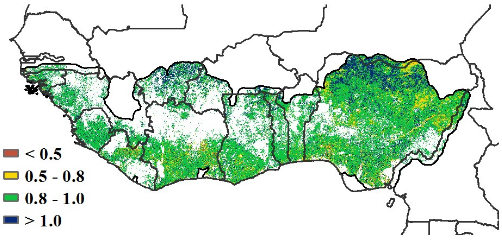
b. Profiles of rainfall departure from average (mm)



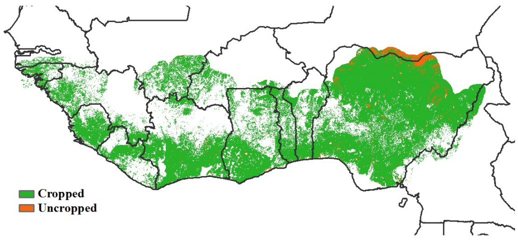
c. Spatial distribution of temperature profiles



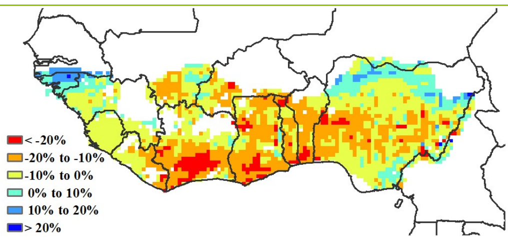
d. Profiles of temperature departure from average (mm)



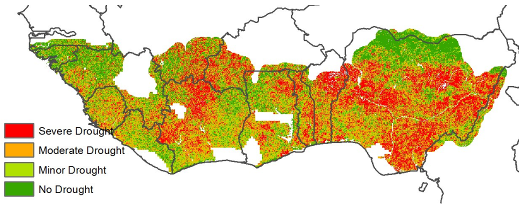
e. Maximum VCI



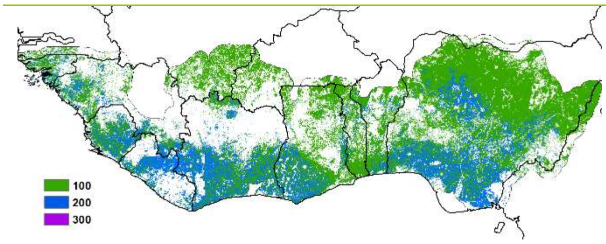
f. Cropped arable land



g. Biomass accumulation potential departure



h. VHI minimum



i. cropping intensity

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

2.3 North America

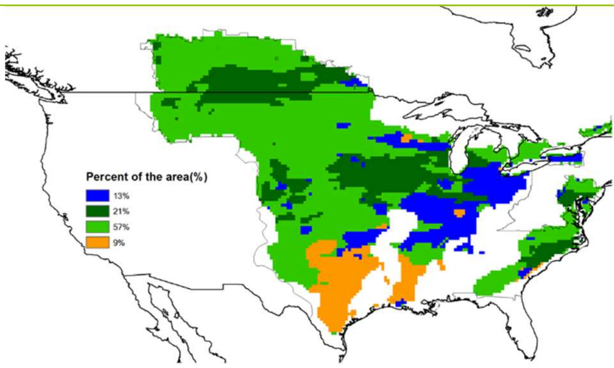
This reporting period covers the flowering, grain filling and maturity of maize and soybean. Spring wheat was harvested in August in the northern states of the USA and in Canada. In general, conditions were unusually dry and hot in the central, whereas the conditions were more favorable in the eastern regions.

As a whole, dry and warm weather was prevalent in the North American production zone, with a significantly below-the-15-year-average (15YA) precipitation (Rain -15%), an above-the-15YA temperature (+0.5°C), and average RADPAR. A significant deficit of precipitation and warming trend accelerated soil moisture loss and resulted in below-average potential biomass (BIOMSS -11%). However, the agri-climatic parameters showed a strong spatial heterogeneity. The western Corn Belt and the area from the Canadian Prairies to the Northern 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%). Agri-climatic conditions were favorable in the eastern part of the Corn Belt. Abundant precipitation from July to August effectively replenished soil moisture for corn and soybean at the flowering and filling stages and facilitated yield formation. After August, corn and soybeans entered the maturity and harvest stage, and the slightly below-the-15YA precipitation created good conditions for harvest.

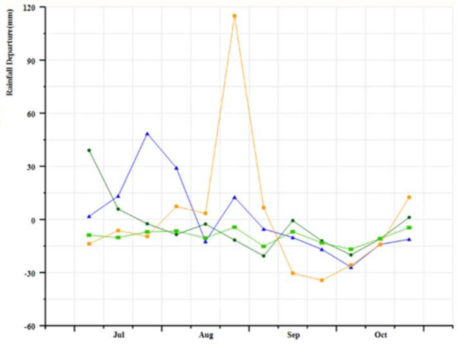
The minimum vegetation health index (VHIm) indicates the drought conditions that occurred from the Canadian Prairies to the Southern Plains in the reporting period. The maximum vegetation condition index (VCIx) reached 0.84, with poor crop conditions observed in the area from the Northern to Southern Plains, while favorable conditions were observed across most areas of the Canadian Prairies and the Corn Belt. Compared to the 5-year average, below average (-3%) cropped arable land fraction (CALF) was observed for the whole region.

In short, the CropWatch assessment indicates poor crop conditions in the Plains and acceptable crop conditions in the Corn Belt.

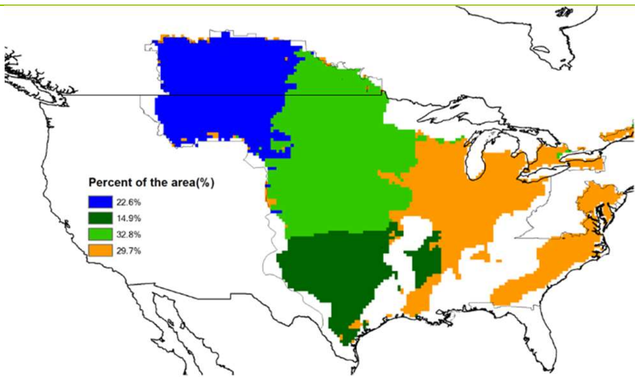
Figure 2.2 North America MPZ: Agroclimatic and agronomic indicators, July to October 2022.



a. Spatial distribution of rainfall profiles

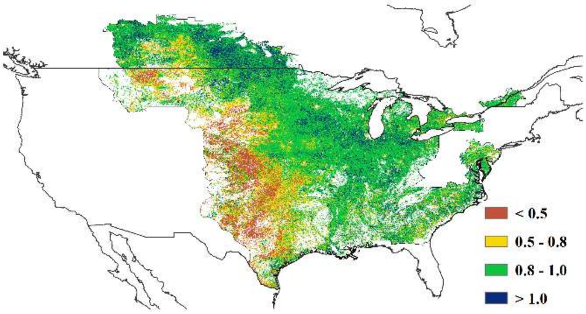


b. Profiles of rainfall departure from average (mm)

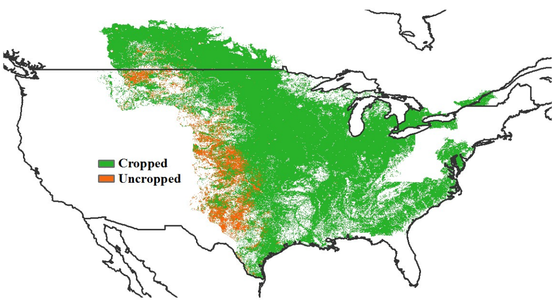


c. Spatial distribution of temperature profiles

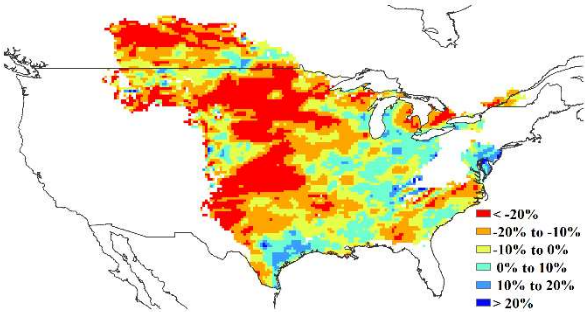
d. Profiles of temperature departure from average (mm)



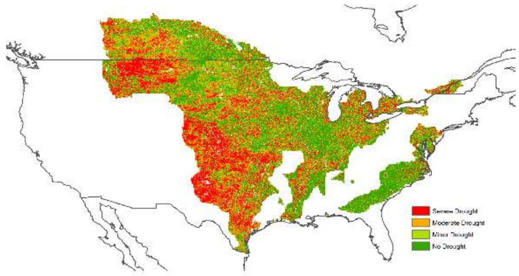
e. Maximum VCI



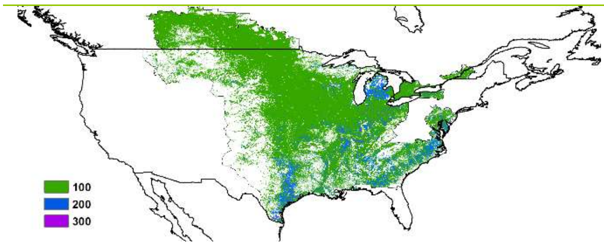
f. Cropped arable land



g. Biomass accumulation potential departure



h. VHI minimum



i. Cropping intensity (2021)

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

2.4 South America

The reporting period covers the main growing period of winter crops and the planting of early maize and rice. The situation in South America is variable, with adverse conditions mainly in Argentina and in the north of MPZ, and near normal conditions for the rest of the MPZ.

Spatial distribution of rainfall profiles showed five different patterns. Center and South of Argentina showed no anomalies at the beginning of the reporting period and negative anomalies at the end (light green profile). The north of the MPZ, including states of Mato Grosso, Mato Grosso do Sul, Goias, Minas Gerais and Sao Paulo in Brazil, showed also no anomalies at the beginning, and stronger negative anomalies at the end (red profile). This pattern was also found in North Chaco in Argentina and part of Rio Grande do Sul in Brazil. A pattern with strong positive anomalies in mid-July and beginning of August and slight negative anomalies since mid-August was observed in South Mesopotamia in Argentina, North of Uruguay and South of Rio Grande do Sul in Brazil (orange profile). A pattern with high variation in anomalies, presenting negative anomalies during July, end of August and end of October, and positive anomalies at the beginning of July and end of September, was observed in North Mesopotamia in Argentina and Santa Catarina and Paraná states in Brazil. Lastly, a pattern located in East Paraguay and West of Paraná state in Brazil (dark green profile) showed negative anomalies during July and positive anomalies during August, September and October.

Temperature profiles showed five homogeneous patterns located in a North South gradient. The north of the MPZ, including the sates of Mato Grosso, Goias and Minas Gerais in Brazil showed positive anomalies during July and beginning of August and since September. The dark green profile, located mostly in Mato Grosso do Sul and Sao Paulo in Brazil showed positive anomalies during July and beginning of August, negative anomalies in mid-August and September and again positive anomalies at the end of October. The orange profile was observed for East Paraguay, North Mesopotamia in Argentina and in Paraná State, Santa Catarina and Rio Grande do Sul in Brazil. It showed positive anomalies during July and negative anomalies during the rest of the period, with stronger values in September and October. The light green profile was observed in

North Pampas, Subtropical Highlands, Chaco and South Mesopotamia in Argentina, Uruguay and South Rio Grande do Sul in Brazil. It showed high variability, with positive values at the beginning and end of July and negative values at mid-July, and during the rest of the reporting period. Lastly, Center and South Pampas showed a pattern with periods of positive and no anomalies, with stronger positive anomalies at the end of July, mid-September and beginning of October.

BIOMSS showed strong negative anomalies in most of the region, mainly in Mato Grosso, Mato Grosso do Sul, Goias, Minas Gerais Sao Paulo and Rio Grande do Sul states in Brazil, and in North Subtropical Highlands, Chaco and most of Pampas in Argentina. Slight negative and positive anomalies were observed in Mesopotamia in Argentina, East Paraguay and Santa Catarina and Paraná states in Brazil and most of Uruguay. It generally coincided with rainfall departure patterns.

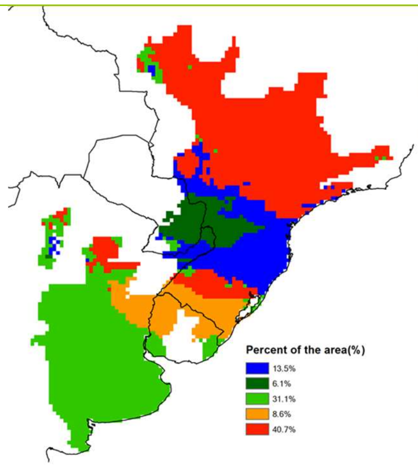
CALF index was at 82%, 9% lower than 5YA. The CALF map showed several uncropped areas in East Subtropical Highlands, West Chaco and Center and West Pampas in Argentina, probably due to a delay in planting of summer crops. The north of the MPZ (Mato Grosso and Goias states in Brazil) showed also uncropped areas but in a much lower magnitude.

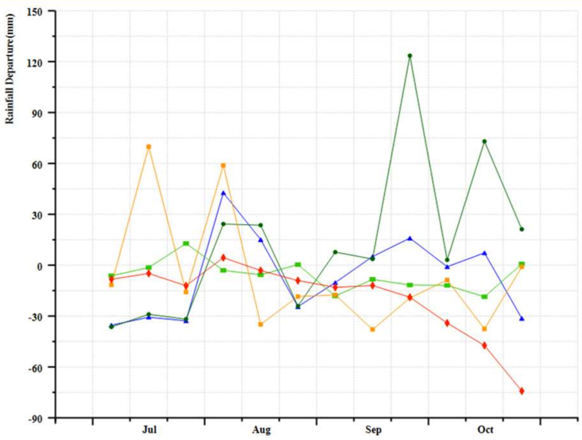
Maximum VCI was at 0.72, and the VCIx map showed poor conditions in most of Argentina: Humid Pampas, Chaco and Subtropical Highlands where sowing of summer crops were delayed due to the below-average rainfall. The north of Brazilian agricultural area (Mato Grosso and Goias states) showed also poor VCIx value as suffering from drought. The regions from Parana to Rio Grande Do Sul received above-average rainfall, benefitting early stage of summer crops. VCIx map showed those regions at good conditions with values in general higher than 0.8, especially for the Panara River Basin where water can be easily accessed for irrigation.

Cropping intensity value for the whole MPZ was 131, four percent higher than the 5YA. The Cropping intensity map showed areas with only one crop per year in West Pampas, West Chaco and Subtropical Highlands in Argentina, as well as in East Paraguay, and West Mato Groso de Sul, Sao Paulo, South of Minas Gerais and South of Rio Grande do Sul states in Brazil. The rest of the area showed an intensity of two crops per year.

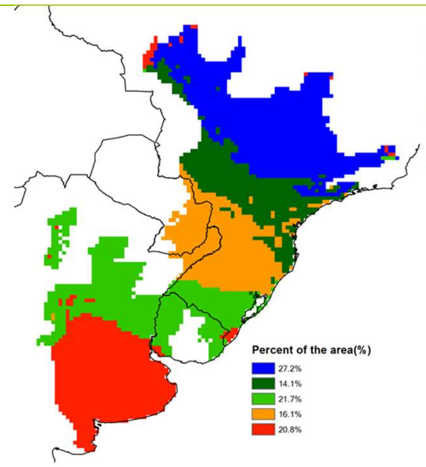
In summary, several indices showed poor conditions for most of Argentina (Pampas, Chaco and Subtropical Highlands), showing low values for BIOMSS, VCIx and CALF, and drought conditions considering VHI minimum. The north of the Brazilian agricultural area, mainly Mato Grosso and Goias showed in a lesser extent poor conditions for several of these indices.

Figure 2.3 South America MPZ: Agroclimatic and agronomic indicators, July-October 2022

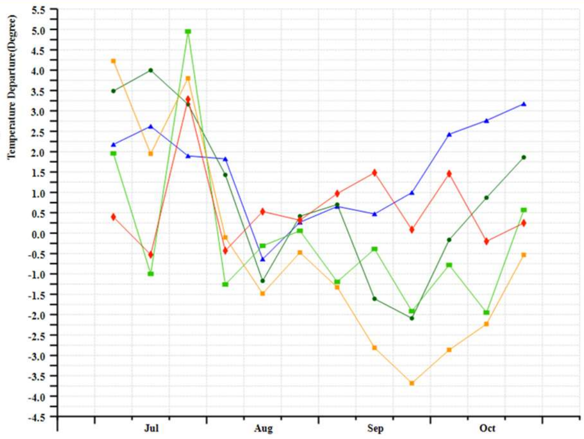




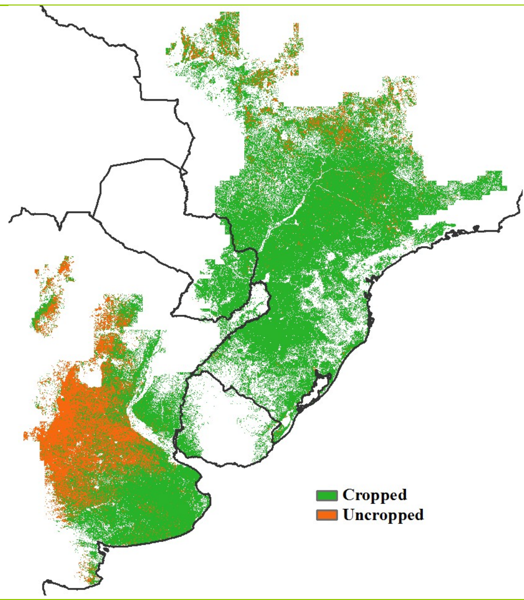
a. Spatial distribution of rainfall profiles | b. Profiles of rainfall departure from average (mm)



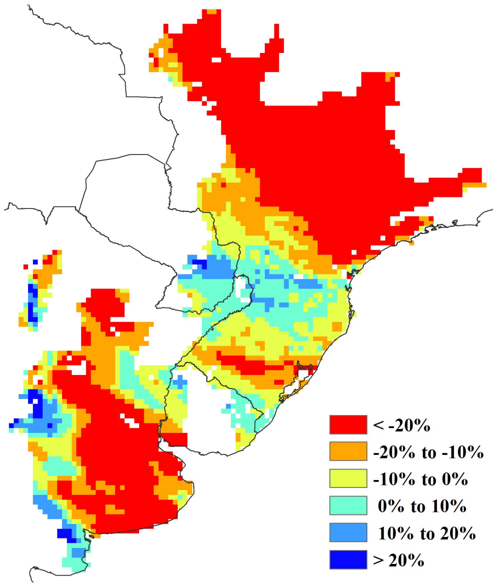
c. Spatial distribution of temperature profiles



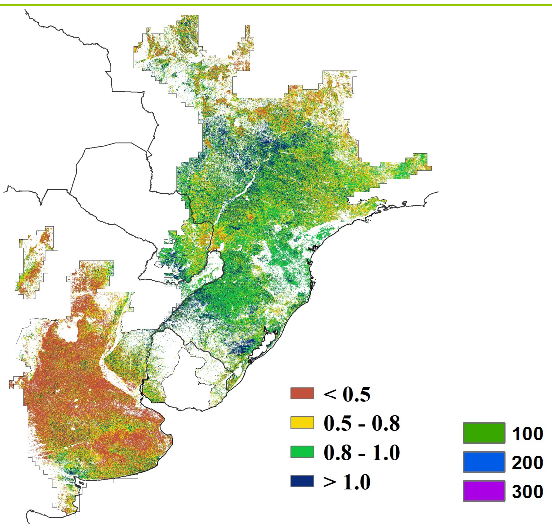
d. Profiles of temperature departure from average (°C)



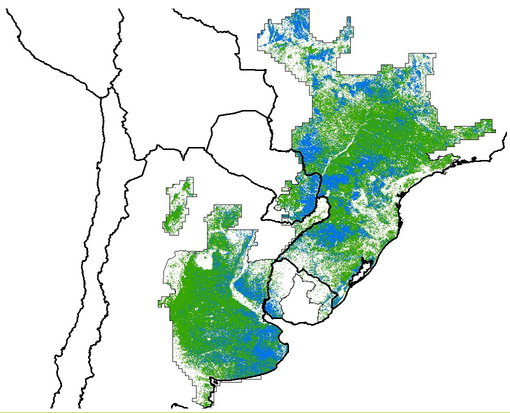
e. Cropped and uncropped arable land



f. Potential biomass departure from 15YA



g. Maximum VCI



h. Cropping intensity

2.5 South and Southeast Asia

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

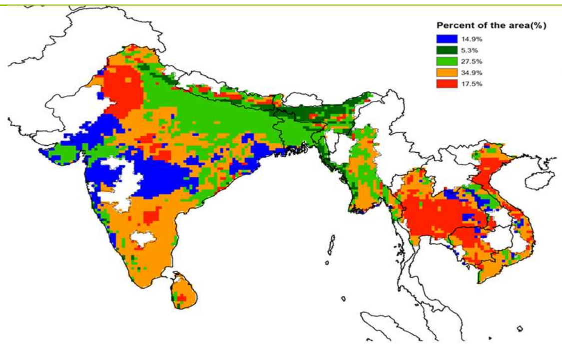
According to the CropWatch agroclimatic indicators, RAIN was below the 15YA (RAIN -10%), whereas the temperature and the RADPAR were above the 15YA (TEMP +0.2%, RADPAR +6%), which resulted in an increase of estimated biomass (BIOMSS +5%). CALF was increased by 1% compared with the 5YA, reaching 97% and the VCIx of the MPZ was 0.92.

According to the spatial distribution of rainfall profiles, the precipitation for 17.5% of the MPZ (southwestern India, Thailand, northern Cambodia, and northern Vietnam) was above the average from July to early October and reached the highest values in late September, which affected the summer rice, soybean and corn harvests. The precipitation for 14.9% of the MPZ in Central India had strong fluctuations in late September and reverted to average in early October. Heavy rainfall had caused floods in southern India, northwestern Nepal, central Bangladesh and Thailand. The precipitation for 27.5% of the MPZ (north and western India, Bangladesh, central Myanmar, and southern Laos) was below the average from July to early September and reverted to the average in late September. This negatively affected the planting of the main rice crop. The precipitation for 5.3% of the MPZ (northern India and southern Nepal) showed small negative departures from July to September and close-to-average values in October. The growing season of summer rice in southern India had been affected by drought in July. The spatial distribution of temperature profiles showed that the temperature for 13.4% of the MPZ was below the average in July, August, and October, mostly located in western India. The temperature for 13.6% of the MPZ was above the average from July to October, mainly located in central India, southern India, eastern Nepal, and central Myanmar. The temperature for 2.5% of the MPZ showed higher positive departures during this period, mainly located in northern India, Nepal, central Myanmar, and southern Sri Lanka.

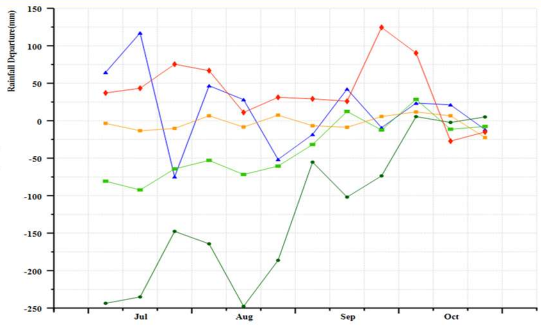
The BIOMSS departure map reveals that the potential biomass in western India and eastern Sri Lanka was 20% higher than the average level, while the potential biomass in most of India, central Myanmar and western Sri Lanka were estimated to be below average. The Maximum VCI map shows that the index was higher than 1.0 in some scattered areas. Based on the VHI Minimum map, summer rice, soybean, and maize growth suffered from severe drought that was experienced from July to October, mainly in western and northern India, eastern Bangladesh, southern Nepal, central Myanmar, western Thailand, southern and northern Vietnam, and Cambodia. The CALF map indicates that most of the regions were planted except for scattered areas in India and Bangladesh. The CPI is 1.0, and the crop production situation is normal. The cropping intensity is 100 in India, Nepal, central Myanmar, Thailand, Cambodia, southern Laos, and central Vietnam. The Cropping intensity of 200 was observed form southern and northern India, southern Myanmar, central Thailand, and northern and southern Vietnam.

Overall, the crop conditions in the MPZ were generally favorable, except for areas affected by severe drought and heavy rainfall.

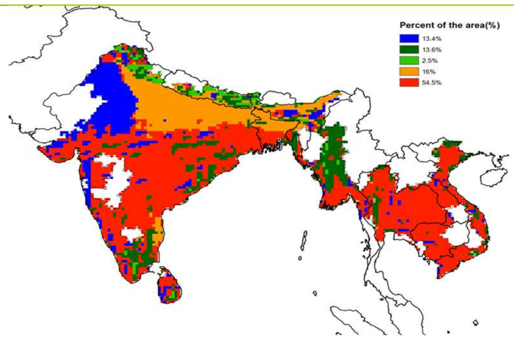
Figure 2.4 South and Southeast Asia MPZ: Agroclimatic and agronomic indicators, July to October 2022.



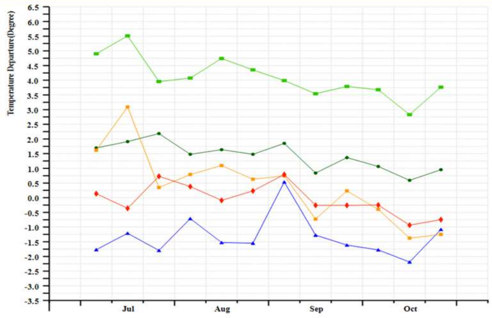
a. Spatial distribution of rainfall profiles



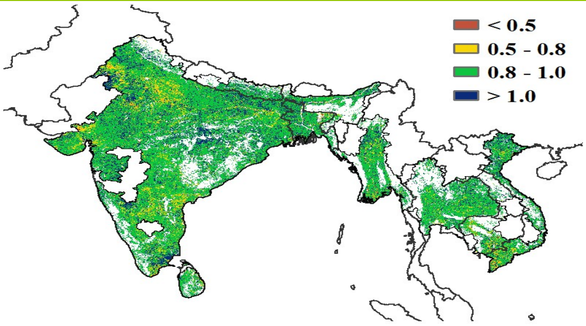
b. Profiles of rainfall departure from average (mm)



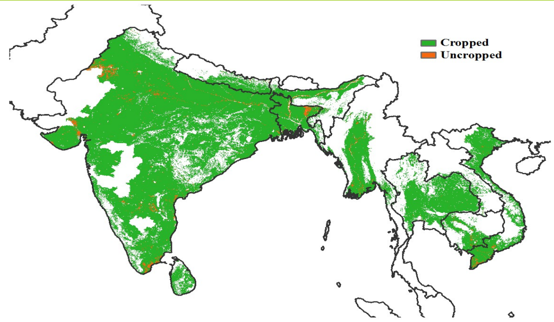
c. Spatial distribution of temperature profiles



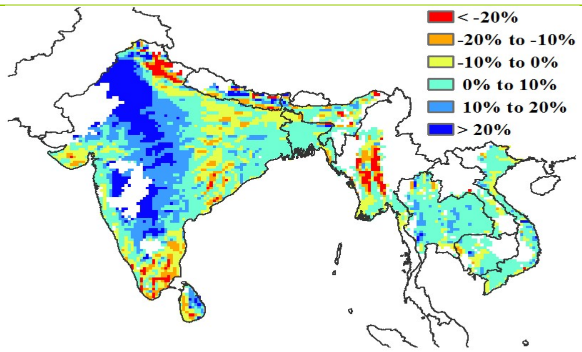
d. Profiles of temperature departure from average (mm)



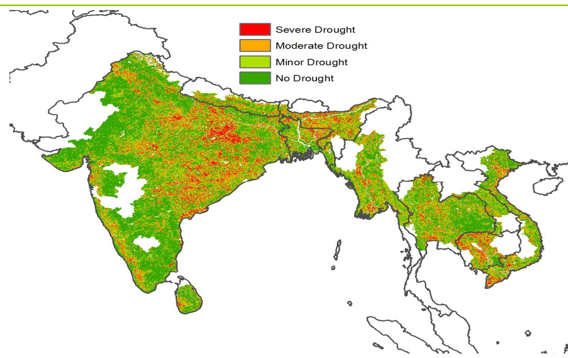
e. Maximum VCI



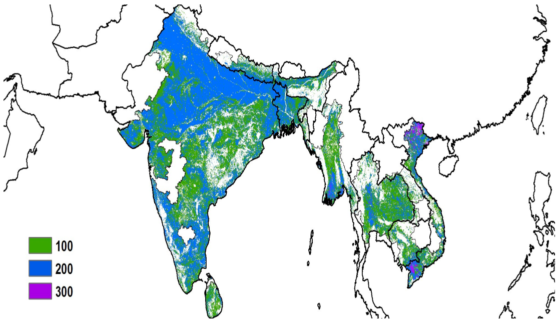
f. Cropped arable land



g. Biomass accumulation potential departure



h. VHI minimum



i.Cropping intensity (2022)

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

2.6 Western Europe

This report covers the vegetative and reproductive periods of summer crops and the sowing of winter crops in the major production zone (MPZ) of Western Europe. Generally, crop conditions were below average in most parts of this region due to persistent dry and hot weather conditions (Figure 2.6).

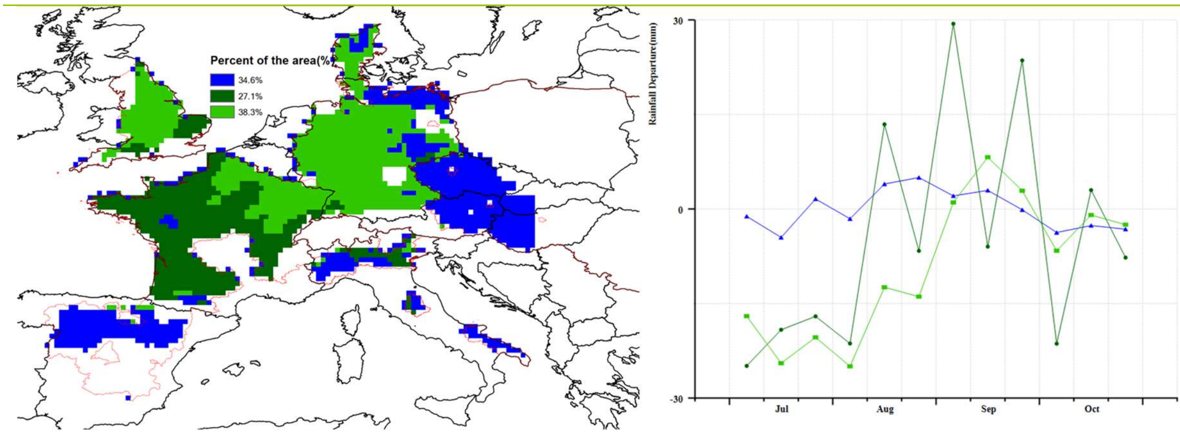
CropWatch agroclimatic indicators show that the whole MPZ had a significant deficit in RAIN (19% below average), which had persisted since spring. Rainfall patterns can be characterized as follows: (1) precipitation hovered around the average in 34.6 percent of the MPZ areas throughout the entire monitoring period. This includes most parts of Spain, north-west, central and south-east Italy and north-east Germany (Mecklenburg-Vorpommern State); (2) precipitation was below average from early-July to late October, with the exception of September, in 38.3% of the MPZ. The largest negative departures were observed between in July and August, the most critical months for the summer crops. It predominantly affected parts of United Kingdom and Germany, northern and north-eastern France (Picardy, Lorraine, Alsace, Champagne-Ardenne, Burgundy); (3) precipitation in Eastern England (Norfolk, Suffolk) & South West England (Dorset, Somerset, Wiltshire), most of France and northern Italy was significantly below average during the monitoring period, except for mid-August, as well as early and late September when it was significantly above average, and in mid-October when it was slightly above average. Countries with the most severe precipitation departures included Spain (RAIN -51%), France (RAIN -37%), Germany (RAIN -28%), United Kingdom (RAIN -27%) and Italy (RAIN -21%). Due to persistent and significant precipitation deficit in July and August, flowering and grain filling for the summer crops in those countries were negatively impacted. In addition, there was a lack of water for irrigation, due to the prolonged drought, which had started in this MPZ in February. Therefore, yield losses for the summer crops occurred. Meanwhile, relatively normal autumn weather conditions in October favoured the harvesting of the summer crops and the planting of winter crops.

CropWatch agroclimatic indicators also show that both temperature (TEMP +1.8°C) and sunshine (RADPAR +6%) for the MPZ as a whole were above average. As shown in the spatial distribution of temperature profiles, 78.9 percent of the MPZ areas (France, Germany, United Kingdom and northern Italy) experienced warmer-than-usual conditions throughout the monitoring period, except for mid-September and late September; 21.1 percent of the MPZ areas (central and south-eastern Italy) experienced temperatures hovering around the average throughout the monitoring period. The spatial distribution of temperature profiles indicates that there were three periods of hot weather in July, early August and mid-October, especially in France, Germany, United Kingdom and northern Italy.

Due to the persistent significantly below-average precipitation and unfavorable crop conditions, the potential BIOMSS was 7% below average. Significant BIOMSS departures (-20% and less) occurred in north-west Germany, west and central east of England, south-west France and north-east Spain. The average maximum VCI for the MPZ was only 0.75. The lowest VCI values occurred in areas for which negative BIOMSS departures (-20% and less) were observed as well. More than 88% of arable land was cropped, which was 3% below the recent five-year average. Most uncropped arable land was concentrated in Spain and southeastern Italy, with patchy distribution in central France, south-west France, north-west Italy and other countries. The VHI minimum map shows that France, Germany, Italy, Spain and United Kingdom were most affected by severe drought conditions, which is consistent with continuous precipitation deficits in these countries during the monitoring period. Cropping intensity reached 109%, which was down by 1% compared to the five-year-average across the MPZ.

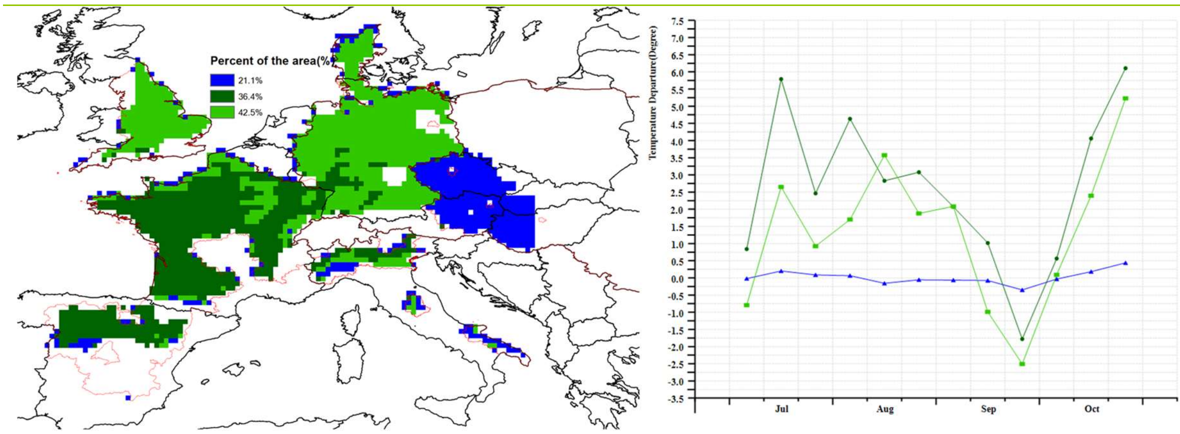
Generally, crop conditions were below average in most parts of this MPZ. Crop yields have been negatively affected in most countries and need to be paid attention to due to persistent and significant precipitation deficits in the first half of the monitoring period affecting the flowering and grain filling of the summer crops.

Figure 2.5 Western Europe MPZ: Agroclimatic and agronomic indicators, July-October 2022.



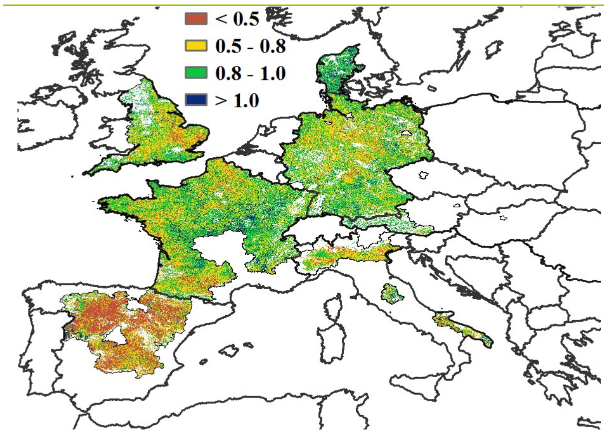
a. Spatial distribution of rainfall profiles

b. Profiles of rainfall departure from average (mm)

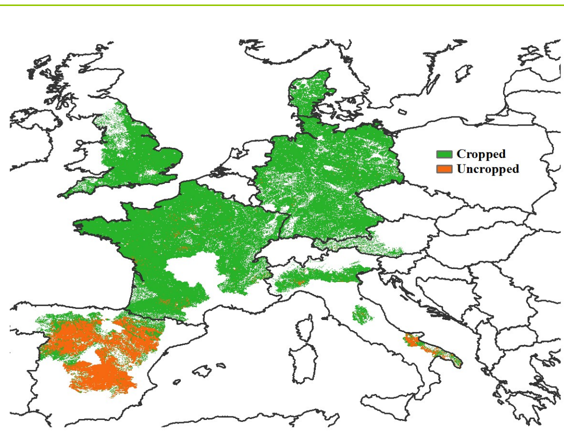


c. Spatial distribution of temperature profiles

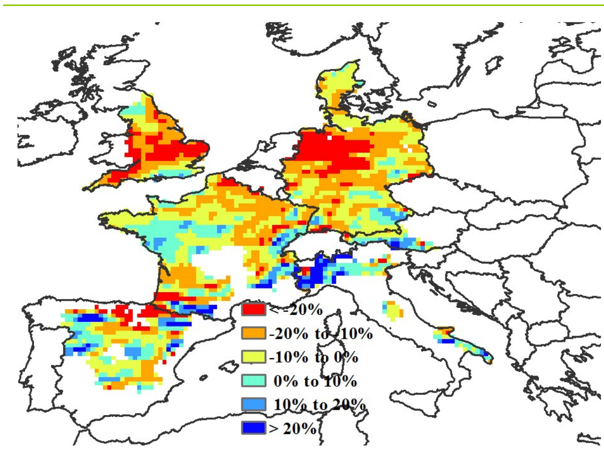
d. Profiles of temperature departure from average (mm)



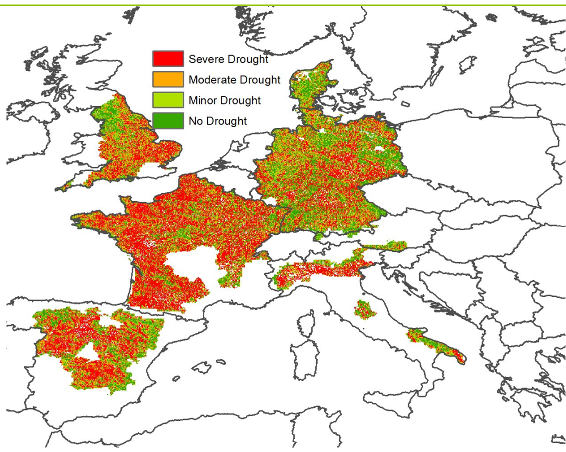
e. Maximum VCI



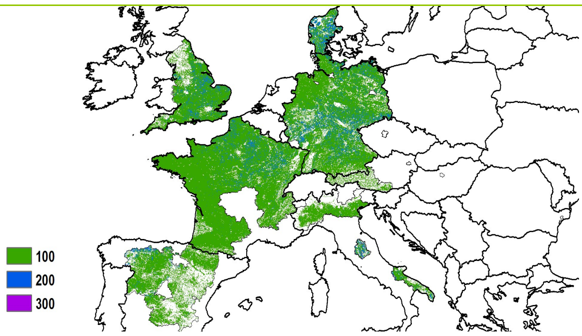
f. Cropped arable land



g. Biomass accumulation potential departure



h. VHI minimum



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 (-1%), higher temperature (+0.7°C), and lower RADPAR (-1%), as compared to the 15YA.

According to the spatial distribution map of rainfall departure, the precipitation in most areas of the MPZ fluctuated around the mean during the monitoring period. The spatial and temporal distribution characteristics were as follows: （1） In early July, precipitation within the MPZ was below average; in mid-July, 48.4% of the MPZ received significantly above-average precipitation, and 3.3% of the MPZ reached the highest distance level (+135mm). (2) From early August to early September, 48.4% of the MPZ received below-average precipitation, mainly in the northern and northeastern parts of the MPZ and in parts of southern Russia. (3) Above-average precipitation was observed in Russia, Belarus, northern Ukraine, and eastern Poland (71.1% of the MPZ) from early September to early October. (4) Southern and eastern Russia, southern Ukraine, Moldova, Romania, and Poland (28.9% of the MPZ) received below-average precipitation in early July to early August and late September to late October.

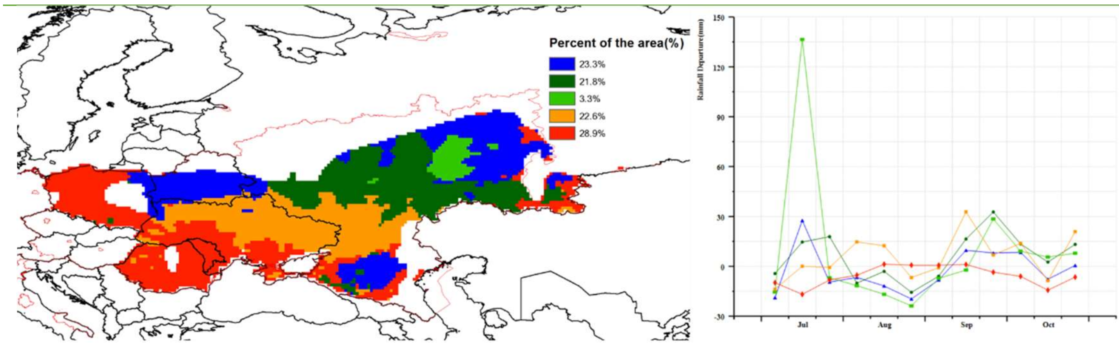
According to the average temperature departure map, temperatures in the MPZ varied significantly during this monitoring period. The specific spatial and temporal characteristics are as follows: (1) Between mid-July and early August, 33.9% of the MPZ had below-average temperatures, mainly in western Ukraine, Belarus, eastern Poland, northern Moldova, northwestern Russia, and parts of Romania. (2) Between mid-September and early October, 56.3% of the MPZ had above-average temperatures, mainly in the eastern part of the MPZ. (3) Temperatures in the MPZ were above average and reached a maximum departure of +6.0°C in late August, but were below average in early September.

The CropWatch agronomic indicators show that most of the arable land in the MPZ was planted, with a CALF value of 97%. The potential biomass in the MPZ was higher than the average of the last 5 years (1%). The areas with a 10% higher potential biomass were mainly located in most parts of Russia and eastern Ukraine. Affected by the persistent lack of precipitation since April and the high temperatures from June to August, areas with more than 20% lower potential biomass were mainly located in the south-western part of the MPZ, including Moldova, Romania, Hungary, Slovakia, the Czech Republic, and eastern Austria.

The VCIx showed a significant spatial difference in the MPZ, with an average value of 0.87. The regions below 0.8 were mainly located in south-eastern Russia, southern Ukraine, Moldova, eastern Romania, Hungary, Slovakia, and parts of Poland. The VHI minimum map shows that the severe drought areas were mainly in Southern Russia and southwestern part of the MPZ, where precipitation has been below average since April. Cropping intensity was 103%, which was 1% lower as compared to the five-year average across the MPZ.

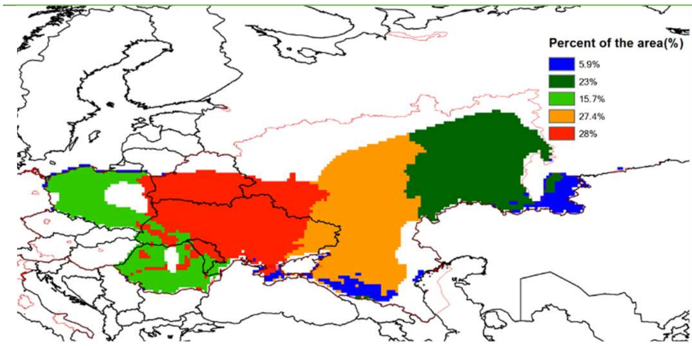
Overall, CropWatch agroclimatic and agronomic indicators indicate that crop growth was expected to be slightly above average during this monitoring period.

Figure 2.6 Central Europe to Western Russia MPZ: Agroclimatic and agronomic indicators, July to October 2022

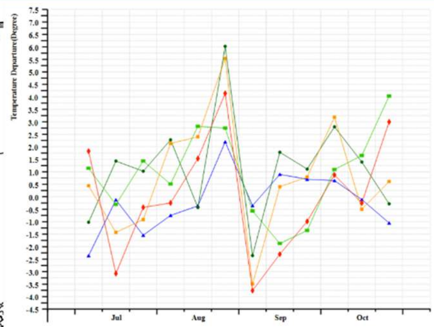


a. Spatial distribution of rainfall profiles

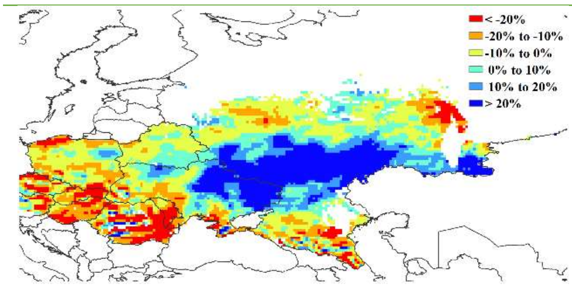
b. Profiles of rainfall departure from average (mm)



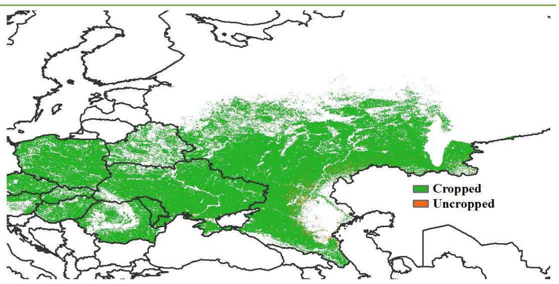
c. Spatial distribution of temperature profiles



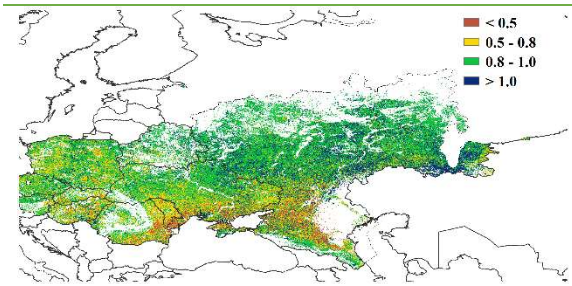
d. Profiles of temperature departure from average (°C)



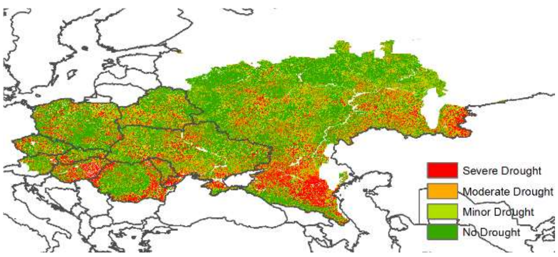
e. Biomass accumulation potential departure



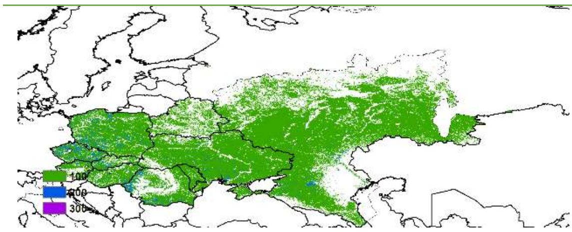
f. Cropped arable land



g. Maximum VCI



h. VHI minimum



i. Cropping intensity

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 43 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.

Introduction

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

In many cases, the situations listed below are also mentioned in the section on disasters (chapter 5.2) although extreme events tend to be limited spatially, so that the statistical abnormality is not necessarily reflected in the climate statistics that include larger areas. No attempts are normally made, in this chapter, to identify global patterns that were already covered in Chapter 1. The focus is on 166 individual countries and sometimes their subdivisions for the largest ones. Some of them are relatively minor agricultural producers at the global scale, but their national production is nevertheless crucial for their population, and conditions may be more extreme than among the large producers.

Overview of weather conditions in major agricultural exporting countries

The current section provides a short overview of prevailing conditions among the major exporters of maize, rice, wheat, and soybeans, conventionally taken as the countries that export at least one million tons of the covered commodities. There are only 20 countries that rank among the top ten exporters of maize, rice, wheat, and soybeans respectively. The United States and Argentina rank among the top ten of all four crops, whereas Brazil, Ukraine and Russia rank among the top ten of three crops.

Maize: Maize exports have been dominated by few countries. In 2021, the share of the USA was roughly one third of total maize exports, followed by Argentina (18%) the Ukraine (11%) and Brazil 8%). In Brazil, the sowing of maize had started in September. The area for the first maize crop is much smaller than for the second crop, which is grown after soybean harvest in January and February. The share of the first crop is about one third. Conditions for maize planting were mixed, some regions suffering from excessive soil moisture (Northern Rio Grande do Sul and Santa Catarina) and other ones from dry conditions (Minas Gerais and Southern Rio Grande do Sul). Conditions were favorable for Parana. All in all, conditions were more favorable than last year. Unusually dry conditions in Argentina delayed the start of the planting season, except for Mesopotamia, where conditions were a bit more favorable. In the USA, maize planting had been delayed in some regions due to lack of soil moisture in the spring. These late sown crops were subsequently more exposed to the relatively dry weather conditions during the grainfilling phase in August and September. Hence, conditions were less favorable than in 2021. Maize production in the Horn of Africa was hampered by the prolonged drought, whereas in Western Africa, irregular rains and local flooding caused yield losses. In the Ukraine, the ongoing crisis, as well as below average precipitation have caused unfavorable conditions for maize production. Drought and heat impacted maize production in other European countries as well, such as in France, Germany, Italy, Hungary and Romania. In China, conditions for maize production were generally favorable, although extremely high temperatures exceeding 35ºC during the silking stage caused some yield losses.

Rice: Four out of the 5 top rice exporting countries are located in South and Southeast Asia: India supplies about 1/3 of the rice that is internationally traded, followed by Thailand with 1/5. The USA, number 3, supplies less than 10%. Vietnam contributes about 7% and Pakistan close to 6%. California, a main producer of rice in the USA, has been plagued by a prolonged drought, which has caused a lack of water for irrigation. Thus, rice production in that state is lower than in previous years. In India, rainfall during the monsoon season was irregular, causing a slight reduction in yield. In Pakistan, large areas got flooded in the provinces of Sindh and Baluchistan. The flooding conditions prevailed for a long period, causing significant yield losses in those provinces. In China, the grainfilling period of the late rice crop in the south was affected by extremely high temperatures, accompanied by drought conditions. However, yields of the early and main rice crops were normal. In Southeast Asia, rainfall was generally favorable in all rice producing countries, apart from Myanmar, where dry spells and internal conflicts hampered production. In Nigeria, floods along its major rivers have caused a reduction in rice production.

Wheat: Timely rain and irrigation helped sustain the growth of wheat in Brazil, where conditions were generally favorable. In Argentina, to the contrary, a severe drought caused by La Niña substantially reduced yields. The situation was similar in South Africa, where wheat yields also suffered from a lack of water. In the USA, drought continued to plague production of wheat in the High Plains, which reached maturity in July and August. Conditions were more favorable for winter wheat grown in the Pacific North West, as well as for spring wheat in the Canadian Prairies, where regular rainfall during the peak growing season helped sustain growth. This report covers the grainfilling and maturity phases of wheat grown in Europe, where excessive heat and drought hampered production. Conditions were better in North-eastern Europe, which had received relatively more rainfall and temperatures were not as extreme. Ample rainfall in Australia sustained favorable conditions and good yield can be expected. The sowing of winter wheat had started in September in the USA and Europe. Continuous dry conditions in Kansas and Oklahoma hampered the sowing and germination of winter wheat. In Europe, most regions had received sufficient rainfall to ensure germination and early establishment of the crop in October. However, soil moisture levels are still generally low and ample precipitation will be needed to replenish soil moisture.

Soybean: Brazil and the USA are the dominant exporters of soybean. Together, they account for more than 80% of global exports. In the USA, drought conditions in Nebraska and Kansas caused a reduction in overall production, as the yields and acreages in the other states had remained similar to last year's conditions. Conditions for soybean production were challenging in the Ukraine due to the crisis and a rainfall deficit. China, on the other hand, had substantially increased its acreage and thanks to rather favorable conditions, production had increased substantially over the previous years. Conditions for soybean planting in Brazil have been relatively favorable in September and October. However, in Argentina planting was delayed due to the drought conditions.

Weather anomalies and biomass production potential changes

(1) Rainfall

In South America, a severe rainfall deficit by more than -30% had been observed for the Pampas, an important region for Argentina's wheat production. Conditions in the south of Brazil, another important region for wheat production, were more favorable. In Argentina, the dry conditions also threatened the sowing of the summer crops, such as maize and soybean. In Brazil, rains were more favorable in October. Central America experienced above average rainfall in the range of 10 to 30%, which provided good conditions for its important maize production. In Mexico, rainfall was below average by more than 10%. In the USA, a severe rainfall deficit for the Pacific Northwest, Upper Midwest, High Plains and the Western corn belt was observed. Rainfall was average in the eastern half of the corn belt, covering Illinois, Indiana, Michigan and Ohio. In Canada, the Prairies also experienced a deficit by more than 30%, whereas the conditions in Quebec were average. Rainfall in the Sahel was average or above average, whereas a rainfall deficit was observed for the West African countries bordering the Gulf of Guinea. The rainfall deficit in Africa south of the Equator had little impact on food production, because it fell into the generally dry winter months. Rainfall was below average for almost all of Europe and the Middle East. Conditions were more favorable in Central Asia and the Volga region in Russia, which is important for its wheat production. Pakistan experienced excessive rainfall, causing a prolonged flood. Most of China south of Beijing experienced a rainfall deficit. Conditions were above average in its Northeast, an important region for crop production. South-East Asia and Australia experienced above average rainfall.

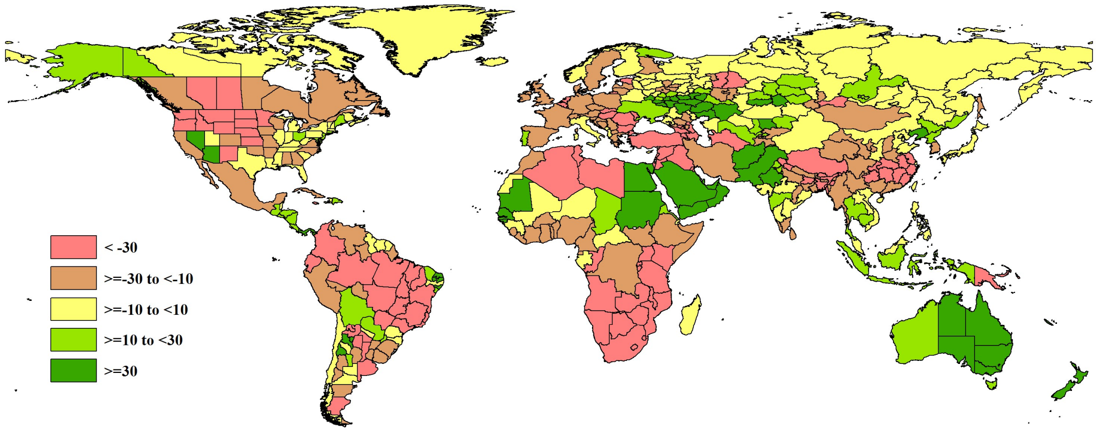


Figure 3.1 National and subnational rainfall anomaly (as indicated by the RAIN indicator) of July to October 2022 total relative to the 2007-2021 average (15YA), in percent

(2) Temperature anomalies

Average and warmer than average temperatures were recorded for almost all regions in the Americas. The Western halves of the USA and Canada, as well as Most of Brazil experienced above average temperatures. The only exception are Arizona and the northern Appalachians. Temperatures departures exceeded +1.5ºC for most of Western Europe. In the other regions of Europe and near East, temperatures were average or above average. Slightly cooler temperatures had been observed for the Sahel region and central northern Pakistan, as well as the north-east of China and Western and Southern Australia. Apart from the north-east, temperatures were above average by 0.5ºC to 1.5ºC in China. Southern Africa also experienced a similar departure in average temperatures.

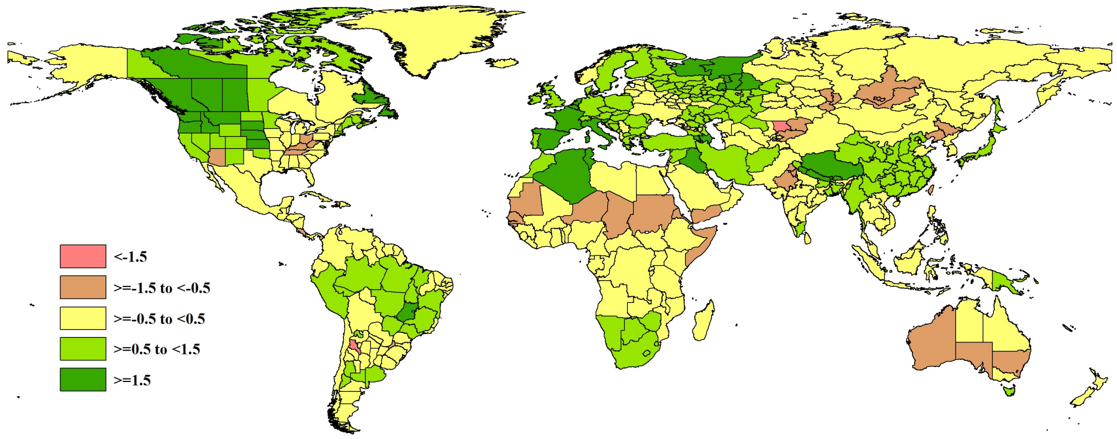


Figure 3.2 National and subnational sunshine anomaly (as indicated by the TEMP indicator) of July to October 2022 total relative to the 2007-2021 average (15YA), in °C

(3) RADPAR anomalies

In Argentina and Brazil, conditions were heterogenous. Average to above solar radiation was observed for central and eastern Brazil, as well as the province of Buenos Aires in Argentina. In Central America, which had received above average rainfall, solar radiation was below average by more than 3%. Mexico and the southwest of the USA, the states bordering the Great Lakes and the eastern USA had less solar radiation than usual. Conditions were sunnier in the Central North of the USA and in all crop production regions of Canada. The weather was sunnier in most of Europe, for which solar radiation had departed by more than 3%. The Ukraine had received below average solar radiation with a departure by more than 3%, so did the Volga region, which is important for the Russian wheat production. West Africa, the Sahel and East Africa also received less solar radiation than usual. Most of South, Southeast and East Asia experienced a strong increase in solar radiation by more than 3%. In Australia, which experienced a wetter than normal winter, solar radiation was below average by more than 3%.

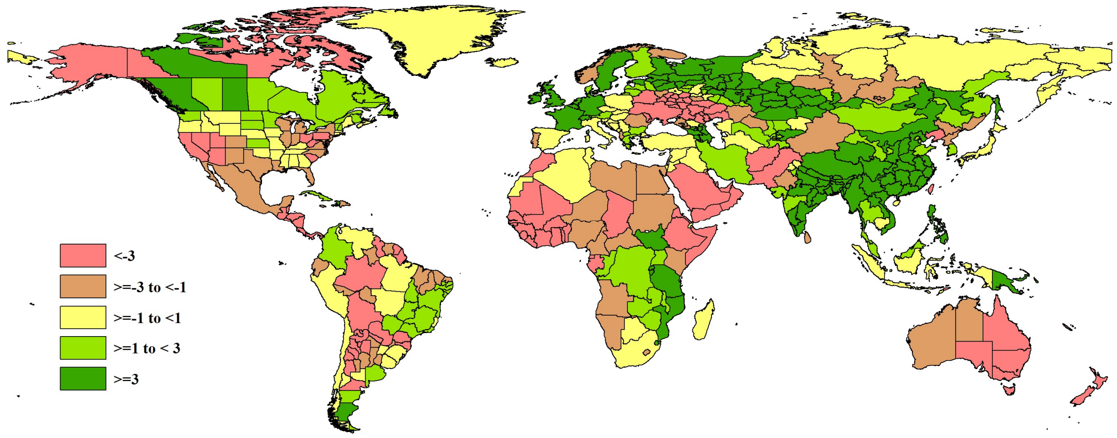


Figure 3.3 National and subnational sunshine anomaly (as indicated by the RADPAR indicator) of July to October 2022 total relative to the 2007-2021 average (15YA), in percent

(4) Biomass accumulation potential

The BIOMSS indicator is controlled by temperature, rainfall, and solar radiation. In some regions, rainfall is more limiting, whereas in other ones, mainly the tropical ones, solar radiation tends to be the limiting factor. For high latitude regions, temperature may also become the most critical limiting factor. In the crop production regions of Argentina and Brazil, the estimated biomass production was mostly far below average (<-10%). The situation was similar in North America. Only the Southwest and most of the Eastern regions of the USA had average to above average biomass production. Production was also below average for Central and Southeastern Europe, Türkiye, Syria and Iraq. In the Sahel region, average to above average biomass production was estimated, as well as for the western half of India and Pakistan. Above average production was estimated for the winter wheat production regions of Russia, and north-eastern China. Strong positive departures were estimated for Indonesia and most of Australia.

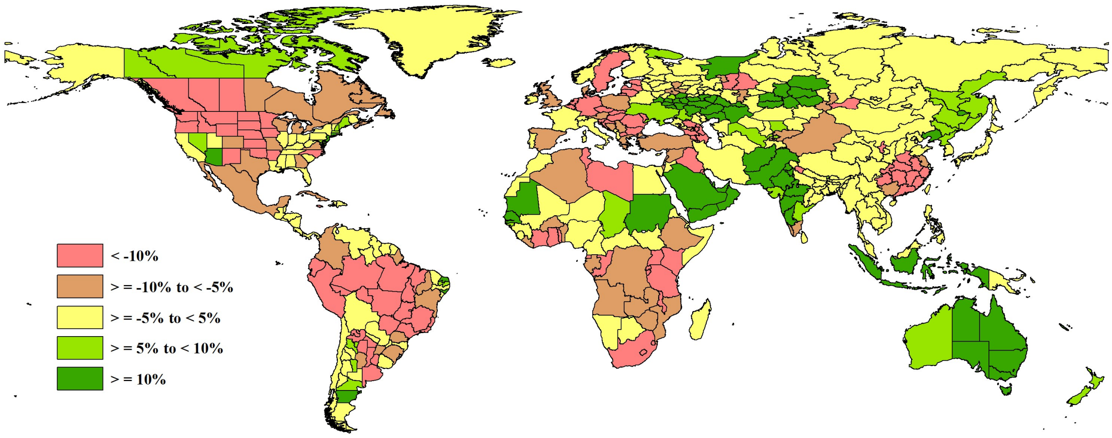


Figure 3.4 National and subnational biomass production potential anomaly (as indicated by the BIOMSS indicator) of July to October total relative to the 2007-2021 average (15YA), in percent

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

Code	Country	Agro-climatic indicators				Agronomic indicators	
		Departure from 15YA (2006-2021)				Departure from 5YA (2015-2020)	Current
		RAIN (%)	TEMP(°C)	PAR(%)	BIOMSS (%)	CALF (%)	VCIx
AFG	Afghanistan	147	0.5	-3	21	14	0.25
DZA	Algeria	-50	1.6	0	-10	-23	0.54
AGO	Angola	-39	0.1	-1	-9	-1	0.78
ARG	Argentina	-24	0.1	-2	-12	-22	0.53
AUS	Australia	76	-0.6	-12	30	15	0.95
BGD	Bangladesh	-32	0.5	12	1	0	0.90
BLR	Belarus	3	0.2	-3	-1	0	0.92
BRA	Brazil	-44	0.8	0	-18	-1	0.84
KHM	Cambodia	14	-0.2	0	1	0	0.88
CAN	Canada	-21	1.3	3	-11	1	0.93
CHN	China	-27	0.8	9	-7	0	0.92
EGY	Egypt	61	0.2	-1	0	2	0.71
ETH	Ethiopia	-19	-0.1	-7	-9	0	0.94
FRA	France	-20	2.4	9	-4	-1	0.80
DEU	Germany	-27	1.3	6	-12	0	0.80
HUN	Hungary	-37	1.2	0	-17	-1	0.77
IND	India	-11	0.1	6	8	3	0.93
IDN	Indonesia	19	0.1	0	12	0	0.94
IRN	Iran	-13	0.8	1	-1	-2	0.47
ITA	Italy	-4	1.6	0	1	-2	0.75
KAZ	Kazakhstan	20	0.2	3	10	-9	0.73
KEN	Kenya	-47	0.2	-2	-19	-17	0.68

KGZ	Kyrgyzstan	-25	-0.5	5	-6	2	0.86
MEX	Mexico	-12	0.0	-3	-7	1	0.88
MNG	Mongolia	-11	-0.4	2	-4	0	0.92
MAR	Morocco	-26	1.0	-5	-4	-40	0.43
MOZ	Mozambique	-43	0.3	4	-9	4	0.93
MMR	Myanmar	-23	0.7	13	-3	1	0.94
NGA	Nigeria	-20	-0.2	-2	-4	1	0.91
PAK	Pakistan	72	-0.2	-6	37	12	1.02
PHL	Philippines	9	0.1	3	2	0	0.95
POL	Poland	-21	0.5	1	-8	0	0.84
ROU	Romania	-35	1.0	-1	-17	-3	0.75
RUS	Russia	4	0.5	2	4	1	0.91
ZAF	South Africa	-39	1.1	0	-13	65	1.23
LKA	Sri_Lanka	-13	-0.1	-1	1	1	0.92
THA	Thailand	19	0.0	3	4	0	0.93
TUR	Türkiye	-30	0.6	1	-8	3	0.76
UKR	Ukraine	10	0.1	-7	6	1	0.82
GBR	United Kingdom	-22	1.4	9	-8	0	0.80
USA	United States	-9	0.4	-1	-7	-2	0.83
UZB	Uzbekistan	23	0.2	1	5	0	0.77
VNM	Vietnam	-2	0.2	6	2	0	0.93
ZMB	Zambia	-88	0.3	1	-9	21	0.89

3.2 Country analysis

This section presents CropWatch analyses for each of 42 key countries (China is addressed in Chapter 4). The maps refer to crop growing areas only and include several graphs: (a) Phenology of major crops; (b) Crop condition development based on NDVI over crop areas at national scale, comparing the July - October 2022 period to the previous season and the five-year average (5YA) and maximum; (c) Maximum VCI (over arable land) for July - October 2022 by pixel; (d) Spatial NDVI patterns up to July - October 2022 according to local cropping patterns and compared to the 5YA; and (e) NDVI profiles associated with the spatial pattern under (d). Next, separate graphs (labeled as figures (f), (g), and subsequent letters) are included to illustrate crop condition development graphs based on NDVI average over crop areas for different regions within the country, again comparing the July - October 2022 period to the previous season and the five-year average (5YA) and maximum.

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

Figures 3.5 - 3.46 are Crop condition for individual countries ([AFG] Afghanistan - [ZMB] Zambia) including sub-national regions during July – October 2022.

[AFG] Afghanistan

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

The agro-climatic conditions showed that RAIN increased by 147%, TEMP increased by 0.5°C, RADPAR decreased by 3% and BIOMSS increased by 21%. The CALF was only 7%, increased by 14%.

According to the last CropWatch bulletin, it was found that there was continuous drought from March to May, whereas some areas in the south had suffered from floods in July. During the monitoring period of this bulletin, heavy rains and floods occurred in Parwan and Nangarhar provinces in August. Thereafter, the dry conditions continued. The drought situation was particularly severe in northern Afghanistan. Due to the impact of extreme weather, the growth of crops was worse than in previous years. According to the crop condition development graph based on NDVI, the NDVI was lower than that of last year and the 5-year average. Although the CALF was increased, the VCIx was only 0.25.

The spatial distribution of NDVI profiles show that 35% of the total cropped areas were close to the average level during the whole monitoring period. These areas are mainly distributed in the south and southeast of Afghanistan. The NDVI departure in 6% of the total cropped areas was positive, mainly distributed in the east of Afghanistan. About 57.4% of total cropped areas were slightly below average levels, mainly distributed in northern Afghanistan. Maximum VCI shows similar results.

Overall, the Cropping Intensity had increased and overall agricultural production was slightly improving, although conditions continued to stay precarious exacerbating the conditions of famine.

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).

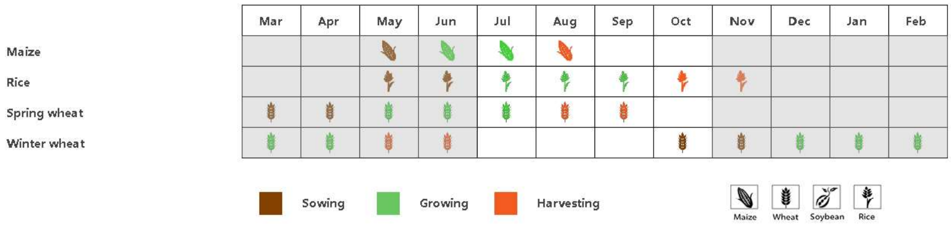
The RAIN in the **Central region with sparse vegetation** was 100 mm (+272%). The TEMP was 16.4°C (+1.4°C), and the RADPAR was 1396 MJ/m2 (-4%). BIOMSS decreased by 45%. According to the NDVI-based crop condition development graph, the NDVI was lower than the 5-year average level during the entire monitoring period. CALF had increased by 8%, and the Cropping Intensity was 114. VCIx was 0.38.

The **Dry region** recorded 183 mm of RAIN (+661%), 22.6°C for TEMP (+1.1°C), 1372 MJ/m2 for RADPAR (-8%), and 625 gDM/m2 for BIOMSS (+62%). According to the NDVI-based development graph, crop conditions were lower than the 5YA during the monitoring period. CALF in this region was only 5% and VCIx was 0.24. The Cropping Intensity of this region was 122.

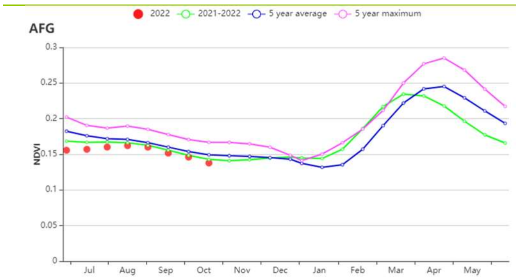
In the **Mixed dry farming and irrigated cultivation region**, the CropWatch agroclimatic indicators show that RAIN increased by 26%, RADPAR decreased by 1%, and BIOMSS increased by 4% compared to the 15YA. CALF was 10% above average. According to the NDVI-based crop condition development graph, NDVI was below the average level. The Cropping Intensity and VCIx in this region were 116 and 0.32, respectively.

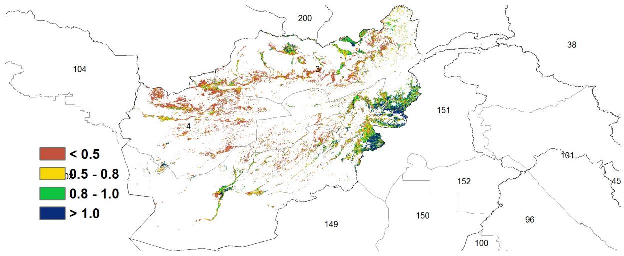
The **Mixed dry farming and grazing region** recorded 2 mm of rainfall (RAIN -75%). TEMP was 20.7°C (+0.5°C) and RADPAR was 1461 MJ/m2 (-1%). CALF was 0%, it had decreased by 16% compared to the 5YA. According to the crop condition development graph, the NDVI was lower than the 5YA throughout the monitoring period, but above last year. The Cropping Intensity of this region was 104. Crop conditions in this region were below average, and VCIx was 0.13.

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

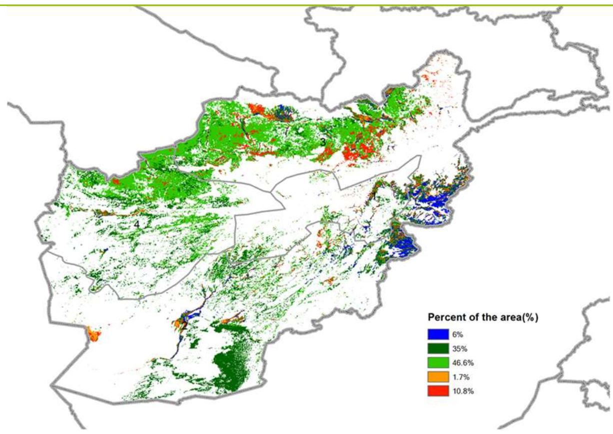


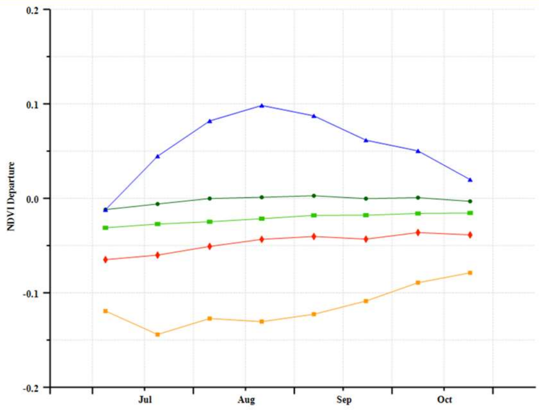
(a). Phenology of major crops



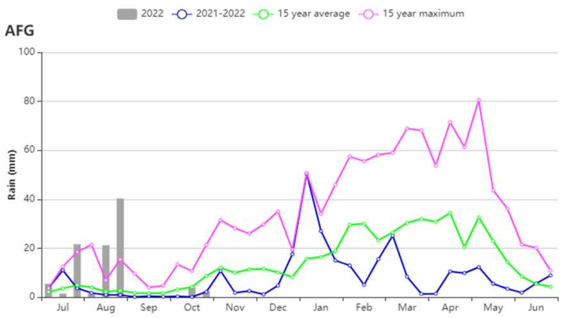


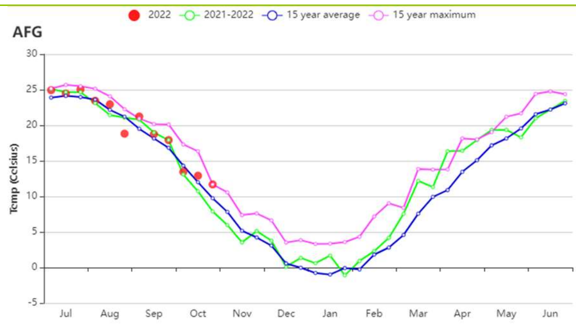
(b) Crop condition development graph based on NDVI (c) Maximum VCI



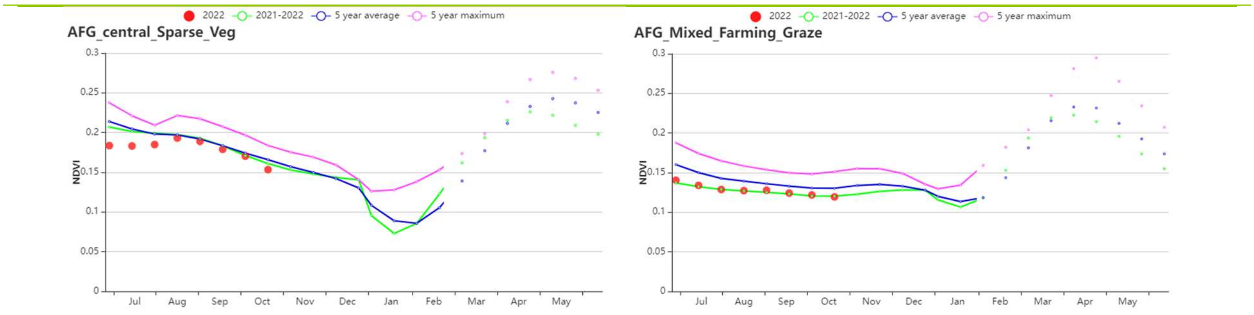


(d) Spatial NDVI patterns compared to 5YA (e) NDVI profiles

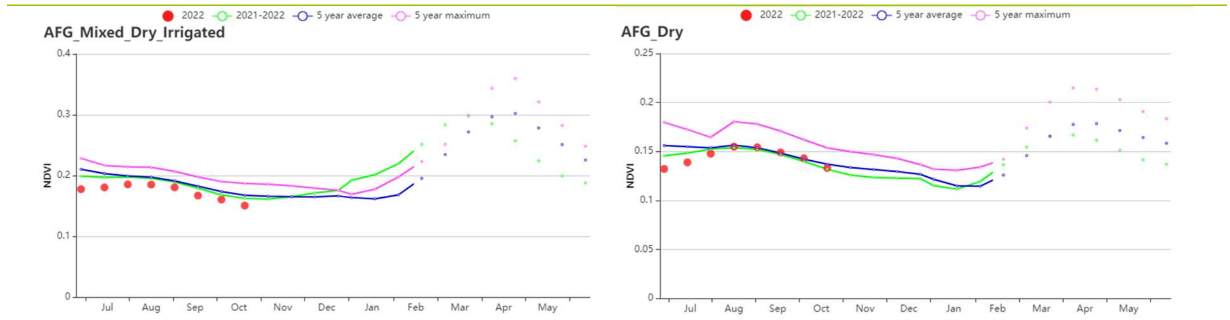




(f) Rainfall profiles (g) Temperature profiles



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



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

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

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Central region	100	272	16.4	1.4	1396	-4	458	45
Dry region	183	661	22.6	1.1	1372	-8	625	62
Dry and irrigated cultivation region	87	26	17.6	0	1412	-1	443	4
Dry and grazing region	2	-75	20.7	0.5	1461	-1	296	-18

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

Region	Cropped arable land fraction		Cropping intensity		Maximum VCI
	Current (%)	Departure (%)	Current (%)	Departure (%)	Current
Central region	8	8	114	8	0.38
Dry region	5	33	122	8	0.24
Dry and irrigated cultivation region	12	10	116	7	0.32
Dry and grazing region	0	-16	104	0	0.13

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

[AGO] Angola

National Analysis

During the July-October monitoring period, winter wheat had reached maturity in September and harvest was concluded in October. With the rainy season starting in late September, the sowing of maize and rice took place from September to October all over the country. During this period, all the national agroclimatic indicators revealed drops (RAIN -39%, RADPAR -1% and BIOMSS -9%), except for temperature, which recorded an increase of 0.1ºC. The drops in the agroclimatic indicators had a severe influence on crop conditions during the reporting period. The national crop development profile based on NDVI indicates that crop conditions were unfavourable from early July to the third week of October when the NDVI started to indicate favourable crop conditions, which may have affected the wheat which was in the growing stages during this period.

The NDVI departure cluster profiles indicate that: (1) 52.6% of arable land, mainly in the provinces of Zaire, Huíla and Cuando Cubango, experienced close to the average crop conditions during the entire monitoring period; (2) 3.6% of the arable land, particularly in the provinces of Zaire and Bengo had unfavourable crop conditions starting in early July. However, conditions in these regions improved and became better when compared to the average of the past five years. The crops are mostly rainfed in Angola and, with a small area under irrigation, the agroclimatic indicators had a significant effect on the crop development, leading therefore to the reported poor crop conditions. The cropped arable land fraction for the country was 52%, a drop of 1% compared to the 5YA. A slight change in the cropping intensity (+1%) was observed and the maximum VCIx was 0.79.

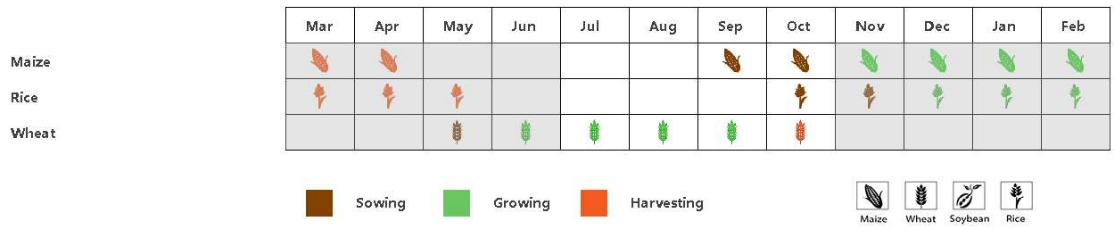
Regional analysis

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

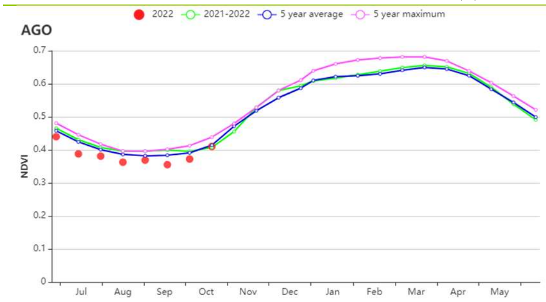
At the regional level, the agroclimatic indicators show decreases by more than 30% in rainfall in all agroecological regions when compared to the average of the past fifteen years. For the same period, temperature also increased in all the agroecological zones, with the Humid zone and Semi-arid zone recording increases of about 0.2ºC. Except for the Humid zone, which registered an increase (RADPAR +1%), the photosynthetic active radiation decreased in all regions. The declines varied from 1% to 2%. Together, these conditions led to decreases in the total biomass production in all the agroecological regions: Arid zone (BIOMSS -10%), Central Plateau (BIOMSS -13%), Humid zone (BIOMSS -8%), Semi-Arid Zone (BIOMSS -6%) and Sub-humid zone (BIOMSS -11%).

In addition, the agronomic indicators reveal significant drops in the cultivated arable land fraction of about 25% in the Humid zone and 4% in both the Central plateau and Sub-humid zone. The Simi-arid zone recorded increases in CALF by 8% while in the Humid zone it was near the average of the past five years. Cropping intensity increased by 11% in this region. Increases by 1% and 5% in cropping intensity were observed in the Sub-humid zone and Humid zone, respectively, while decreases of 1% and 3% were observed in the Semi-arid zone and Central Plateau, respectively. With the VCIx varying from 0.56 (in the Arid zone) to 0.89 (in the Humid zone), the crop development based on NDVI graphs indicates below-average crop conditions during the entire monitoring period in all the agroecological regions.

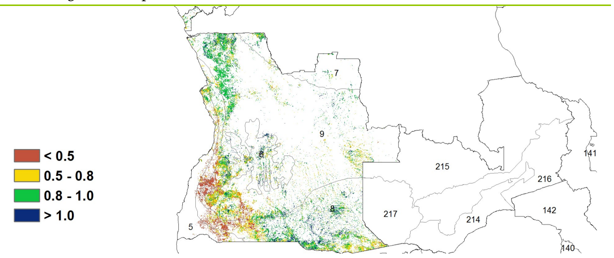
Figure 3.6 Angola's crop condition, April–July 2022



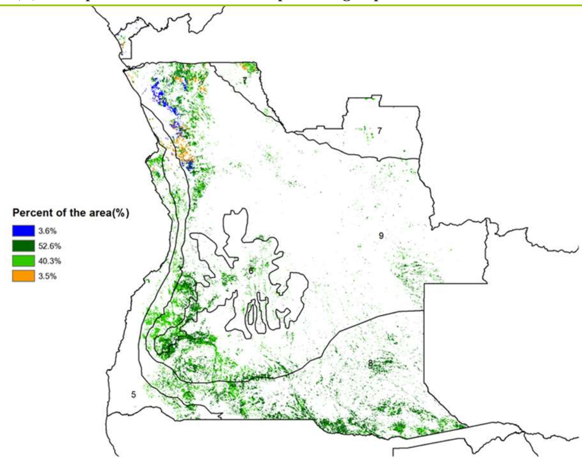
(a) Phenology of major crops



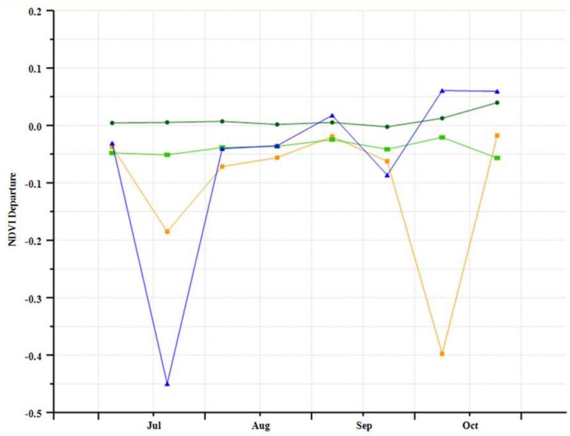
(b) Crop condition development graph based on NDVI



(c) Maximum VCI

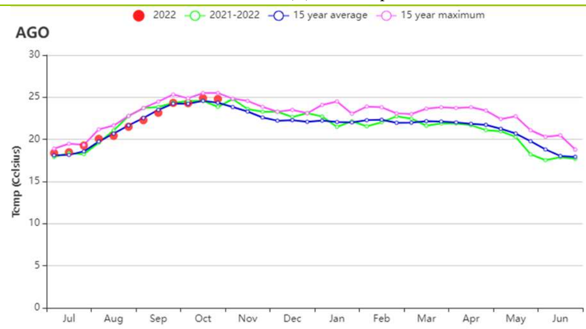


(d) Spatial NDVI patterns compared to 5YA

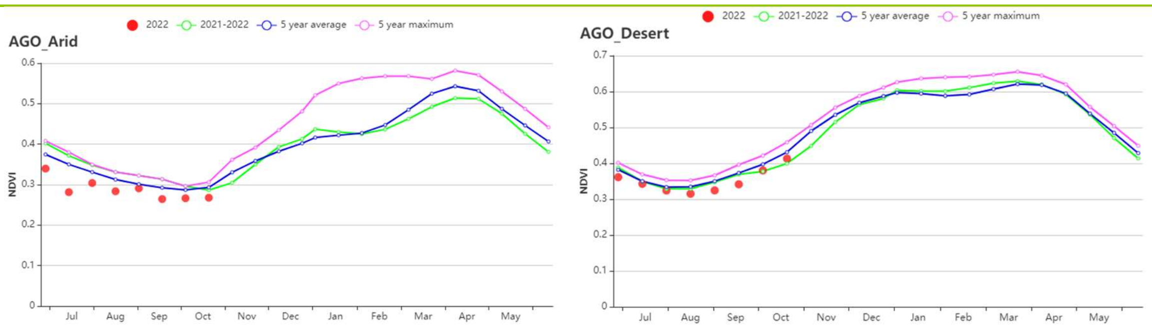


(e) NDVI profiles

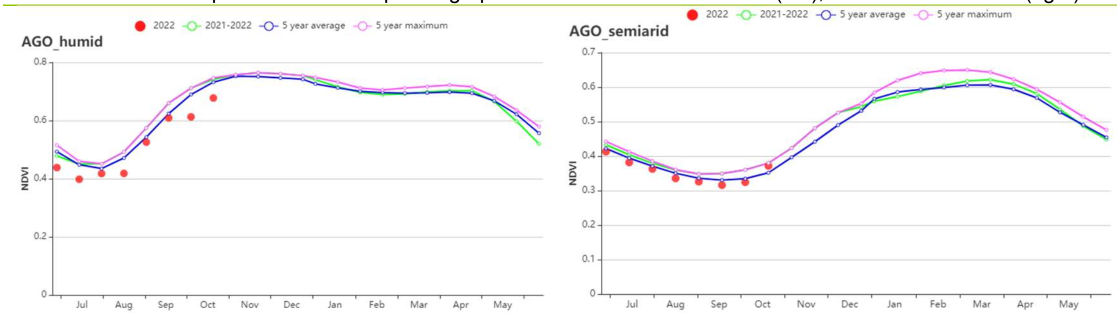
(f) rainfall profiles



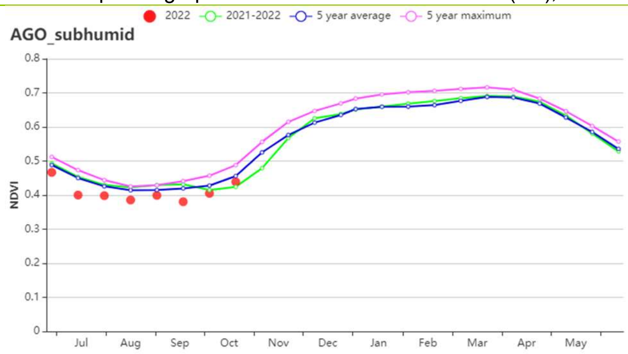
(g) temperature profiles



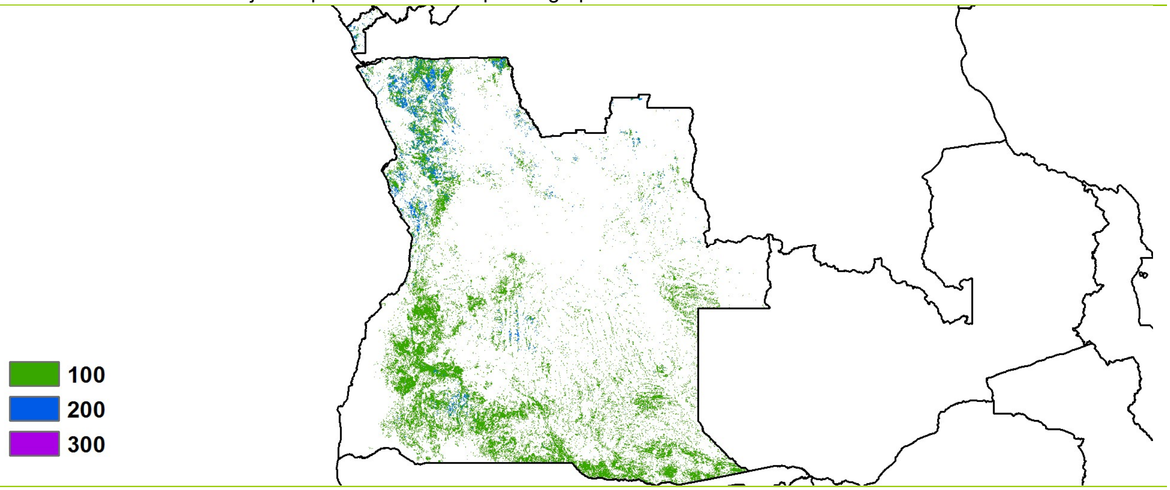
（h）Crop condition development graph based on NDVI - Arid zone (left), and Central Plateau (right)



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



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



(k) National Cropping intensity

Table 3.4 Angola's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, April – July 2021

Region	RAIN	TEMP	RADPAR	BIOMASS

	Current (mm)	Departure from 15YA (%)	Current (℃)	Departure from 15YA (℃)	Current (MJ/m2)	Departure from 15YA (%)	Current (gDM/m^2)	Departure from 15YA (%)
Arid Zone	49	-43	21.9	0.1	1321	-1	502	-10
Central Plateau	87	-39	19.1	0	1345	-2	468	-13
Humid zone	357	-32	24.1	0.2	1282	1	944	-8
Semi-Arid Zone	20	-49	21.5	0.2	1367	-1	440	-6
Sub-humid zone	118	-40	21.8	0	1296	-1	553	-11

Table 3.5 Angola's agronomic indicators by sub-national regions, current season's values and departure from 5YA, April – July 2021

Region	CALF		Cropping Intensity		Maximum VCI
	Current(%)	Departure from 5YA (%)	Current(%)	Departure from 5YA (%)	Current
Arid Zone	17	-26	118	11	0.56
Central Plateau	41	-4	101	-3	0.81
Humid zone	99	0	138	5	0.89
Semi-Arid Zone	40	8	101	-1	0.78
Sub-humid zone	60	-4	107	1	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 LKA MAR MEX MMR MNG MOZ NGA PAK PHL POL ROU RUS THA TUR UKR USA UZB VNM ZAF ZMB

[ARG] Argentina

The reporting period covers the main growing period of winter crops and the sowing of early maize and rice. In some parts, this is the fallow period between summer crops. Observed crop conditions in Argentina were poor for most of the country. Conditions were worst in the Humid Pampas which is the main agricultural area.

For the whole country, rainfall showed a strong negative anomaly (-24%), TEMP showed a slight positive anomaly (+0.1°), RADPAR showed a positive anomaly of +2% and BIOMSS, like RAIN, showed a negative anomaly (-12%).

Regional analysis

CropWatch subdivides Argentina into eight agro-ecological zones (AEZ) based on cropping systems, climatic zones, and topography; they are identified by numbers on the NDVI departure cluster map. During this monitoring period, most crops were grown in the following four agro-ecological zones: **Chaco** (11), **Mesopotamia** (12), **Humid Pampas** (13), and **Subtropical Highlands** (17). The other agro-ecological zones are less relevant for this period. Wheat and maize are planted in the four AEZs, and rice is planted in Mesopotamia and East Chaco.

The following four AEZs showed negative anomalies in RAIN: Humid Pampas (-37%), Chaco (-30%), Subtropical Highlands (-23%) and Mesopotamia (-14%). TEMP showed positive anomaly for Humid Pampas (+0.6°) and negative anomalies of -0.3° for Chaco, Mesopotamia and Subtropical Highlands. RADPAR showed no anomaly for Humid Pampas and negative anomalies for Subtropical Highlands (-5%), Chaco (-3%) and Mesopotamia (-2%). Related to the poor conditions observed in RAIN, BIOMSS showed also negative anomalies in the four AEZs: Humid Pampas (-20%), Chaco (-14%), Subtropical Highlands (-7%) and Mesopotamia (-7%). Cropping intensity showed positive anomalies for Mesopotamia (+10%), Chaco (+7%) and Pampas (+1%), and negative anomalies for Subtropical Highlands (-4%).

CALF showed low values for Subtropical Highlands (48%), Humid Pampas (58%) and Chaco (68%). In Mesopotamia, it was 97%. These values represent negative anomalies for Subtropical Highlands (-28%), Humid Pampas (-26%) and Chaco (-21%), and were also lower than those observed for November 2021 bulletin, suggesting a delay in the sowing date of summer crops or reduction in planted area of winter crops due to rainfall deficits. Maximum VCI showed quite low values for Humid Pampas (0.46), Chaco (0.58) and Subtropical Highlands (0.6), and good conditions in Mesopotamia (0.80). Crop condition index was quite low for whole Argentina (0.61), and particularly low for Chaco (0.47), Humid Pampas (0.54) and Subtropical Highlands (0.54). The index was near normal for Mesopotamia (0.89).

Spatial distribution of NDVI profiles allowed for the clustering of the area in five classes. Two profiles showed positive anomalies during part of the reporting period (blue and orange profiles) and three profiles showed negative anomalies during all the reporting period (dark green, light green and red profiles). A profile with positive anomalies during July and August and negative anomalies since September was observed in most of Mesopotamia, North East Chaco and West Subtropical Highlands (blue profile). Another profile with negative anomalies during July and positive anomalies since August was observed in a small area in South West Pampas. Dark green profile showed slight and stable negative anomalies during the reporting period and was located in the West and Center Pampas. Red profile showed stronger negative anomalies and was located mainly in South East and West Pampas, South Chaco and West Subtropical Highlands. Light green profile showed the strongest negative anomalies, in particular at the end of the reporting period, and was observed in North East Pampas and South Chaco.

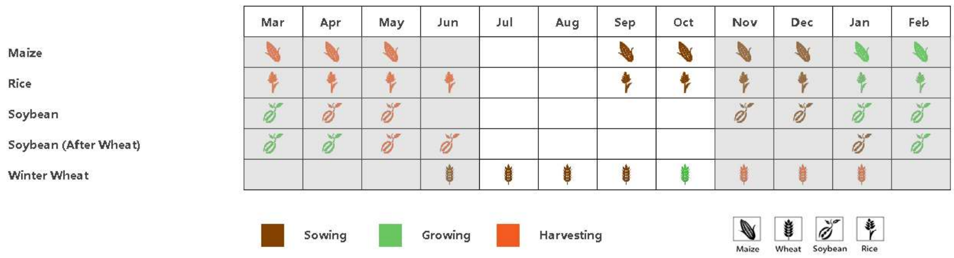
For the whole country, crop condition development graph based on NDVI showed negative anomalies throughout the reporting period. Mesopotamia showed a profile with changes between negative anomalies (at beginning July and since the end of September) and positive anomalies (during August). Chaco and Subtropical Highlands showed almost no anomalies during July and August and negative anomalies since September. On the contrary, Pampas showed negative anomalies all along the reporting period.

Rainfall profile for Argentina showed negative anomalies since August. Differences were observed in rain profiles among the AEZs. Pampas and Chaco showed stronger negative anomalies than Subtropical Highlands and Mesopotamia. For Chaco, negative anomalies were observed in July, August and the beginning of September. In Pampas, stronger negative anomalies were observed during September and October. Temperature profile showed during most of the period no anomalies, excepting for the beginning and end of July with positive anomalies, and the end of September and mid-October with negative anomalies.

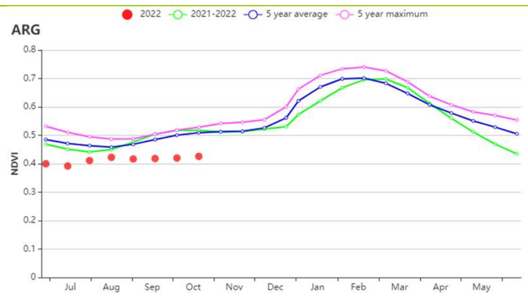
Maximum VCI showed in general poor conditions, with a dominance of cases with values lower than 0.5. Good conditions were only observed in North Mesopotamia, North East Chaco and a small area in South West Pampas. Crop condition classification based on Vegetation Health Index showed an increment in moderate and severe drought conditions at the end of the reporting period.

Several indicators showed below average conditions (RAIN, BIOMSS) for the whole country. VCIx showed a generalized pattern with low values in most of the Argentine agricultural area. Worst conditions with strong negative anomalies in RAIN and NDVI were observed in Humid Pampas, the main planting area for wheat. These conditions could have delayed the planting of summer crops and affected wheat yield, which at the end of the period was in heading stage. Cropped area of wheat could also have been reduced due to drought conditions observed already in the previous monitoring report. Normal conditions were observed in Mesopotamia and North East Chaco.

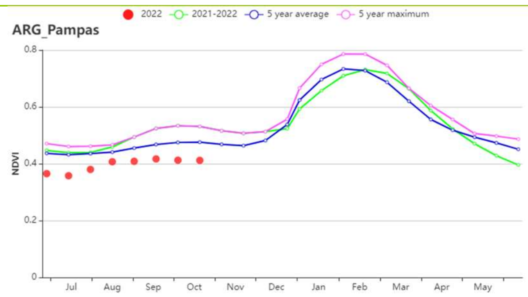
Figure 3.7 Argentina's crop condition, July - October 2022



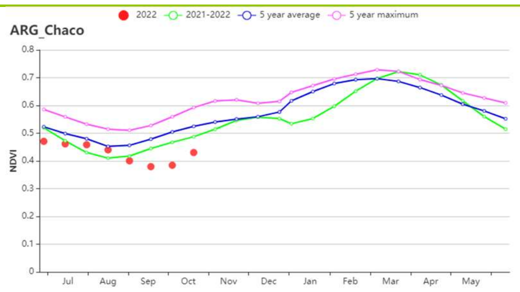
(a). Phenology of major crops



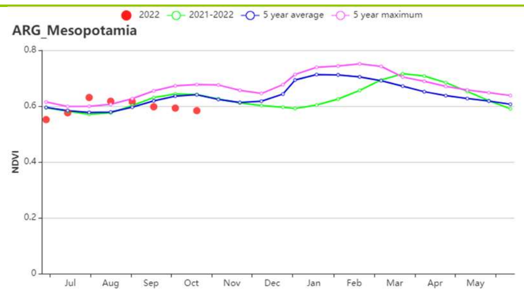
(b) Crop condition development graph based on NDVI(Argentina)



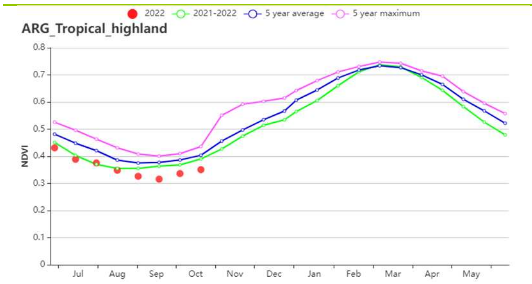
(c). Crop condition development graph based on NDVI (Humid Pampas)



(d). Crop condition development graph based on NDVI (Chaco)

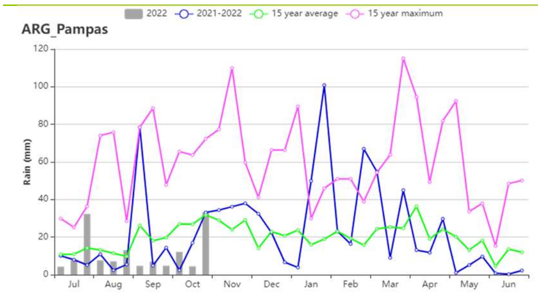


(e). Crop condition development graph based on NDVI (Mesopotamia)

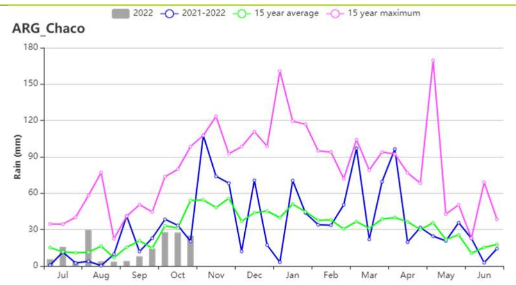


(f).Crop condition development graph based on NDVI (Subtropical Highlands)

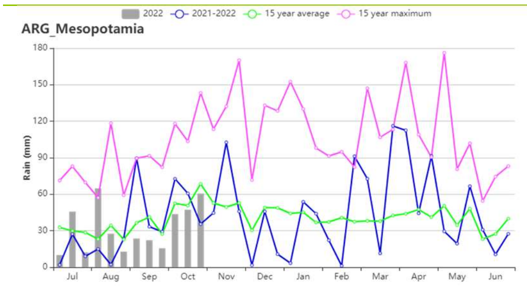
(g). Time series rainfall pofile (Argentina)



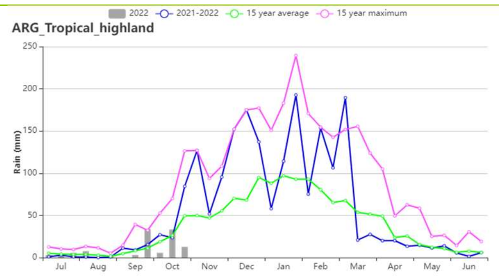
(h). Time series rainfall pofile (Humid Pampas)



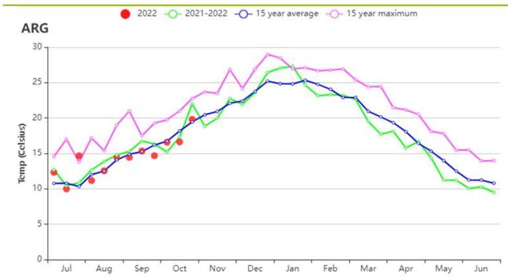
(i). Time series rainfall pofile (Chaco)



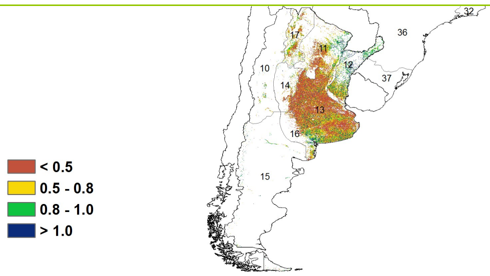
(j).Time series rainfall pofile (Mesopotamia)



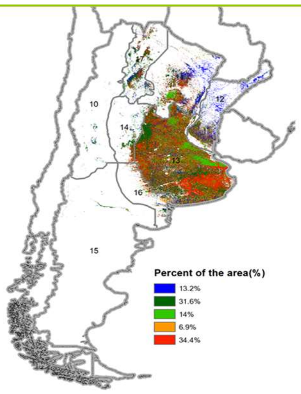
(k). Time series rainfall pofile (Subtropical Highlands)

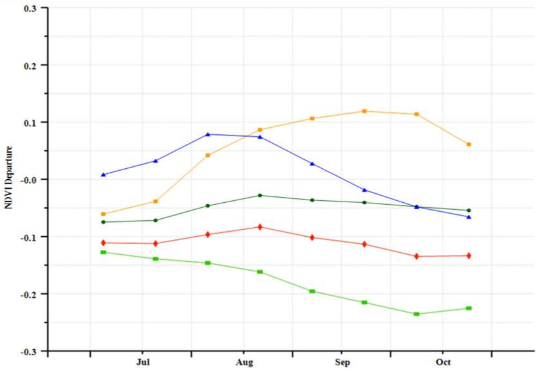


(l). Time series temperature pofile (Argentina)



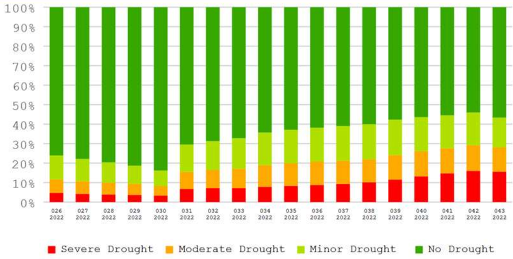
(m). Maximum VCI





(n) Spatial NDVI patterns compared to 5YA

(o) NDVI profiles



(p). Crop condition classification based on Vegetation Health Index

Table 3.6 Argentina's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, July - October 2022

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Chaco	169	-30	17.5	-0.3	908	-3	539	12
Mesopotamia	386	-14	15.5	-0.3	848	-2	768	13
Humid Pampas	138	-37	13.2	0.6	894	0	442	27
Subtropical Highlands	108	-23	15.5	-0.3	1065	-5	437	0

Table 3.7 Argentina's agronomic indicators by sub-national regions, current season's values and departure from 5YA, July - October 2022

Region	Cropped arable land fraction		Cropping intensity		Maximum VCI
	Current (%)	Departure (%)	Current (%)	Departure (%)	Current
Chaco	68	-21	0.58	117	7
Mesopotamia	97	-1	0.8	129	10
Humid Pampas	58	-26	0.46	114	1
Subtropical Highlands	48	-28	0.6	100	-4

[AUS] Australia

The current monitoring period covers the end of the late sowing, main growth and early harvest periods of wheat and barley in Australia. The national NDVI profile was close to the maximum of the last 5 years.

In the current period, rainfall was largely higher than the 15-year average (RAIN +76%, equal to 351 mm). The average temperature was slightly lower (TEMP -1.0°C) while the sunshine was below average (RADPAR -12%). Abundant rainfall led to an increasing biomass (BIOMSS +30%). The positive agronomic indicators, with a VCIx of 0.95, an increased CALF (+15%) and CI (+5%) also showed good crop conditions.

The conditions in the four main wheat production states (New South Wales, South Australia, Victoria, and Western Australia) were generally similar, with above-average rainfall (ranging from +15% to +133%), slightly cooler temperatures (ranging from -0.4°C to -0.9°C), below-average sunshine (ranging from -3% to -17%). These conditions led to an increase in estimated biomass production, ranging from 6% to 54% above average. Abundant rainfall, especially in New South Wales, contributed to the above-average yield prospects for Australia. However, flooding in early July caused some local damage. High rainfall during wheat harvest, which started in October, may reduce wheat quality.

Spatially, the VCI map shows that the overall conditions in Australia were favorable, and low values only appeared in Southeast Australia. The spatial NDVI profiles show the same pattern. Overall, the crop conditions for Australia were very favorable.

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.

During the current period, the four main AEZs had agro-climatic and agronomic indicator departures in the same direction, but with large variations. The conditions in these regions were all favorable.

The **Southeastern wheat area** and **Wet temperate and subtropical zone** had the same departure features. Rainfalls was largely above average (+80%, +85%), the temperatures were slightly below average (-0.6°C, -0.1°C), while the radiation was below average (-16%, -14%). Due to the sufficient rainfall, the biomass was also largely above average (+35%, +30%). The slightly increased CALFs (+9%, +6%), CIs of greater than 100 (111%, 103%) and VCIx of greater than or equal to 0.9 (0.97, 0.90) all indicate favorable crop condition in these two zones.

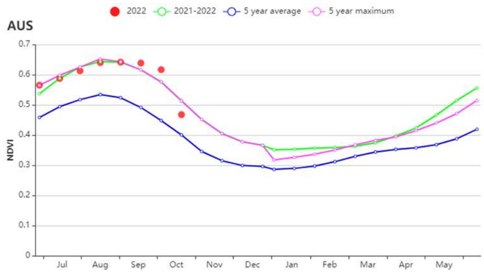
The **Subhumid subtropical zone** reported greatly above average rainfall (+124%), which encouraged the farmers to cultivate more farmland, resulting in CALF of 89% (increased by 74%) and a CI of 120% (increased by 14%). Also, due to the heavy rains, the temperature and radiation were both below average (-1.1°C, -13%). Considering abundant rainfall and positive farming works, the biomass was largely increased by 51%. The VCIx in this zone was even great than 1, which meant the crop conditions were highly favorable.

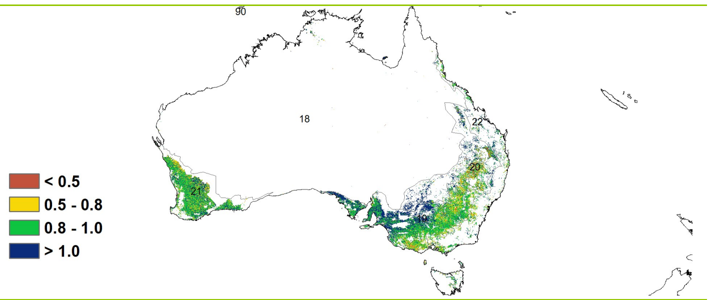
Positive rainfall departure was observed in the **Southwestern wheat area** (+14%) as well, along with lower temperatures (-0.9°C) and less sunshine (-3%). Consequently, the biomass was slightly increased by 6%. The CALF was slightly increased (+7%), but the CI was average. The VCIx was 0.9, which indicated the crop condition was adequate.

Overall, combining the agro-climatic and agronomic indicators, the crop conditions in the JASO period were favorable, and an above-average production is estimated.

Figure 3.8 Australia's crop condition, July – October 2022

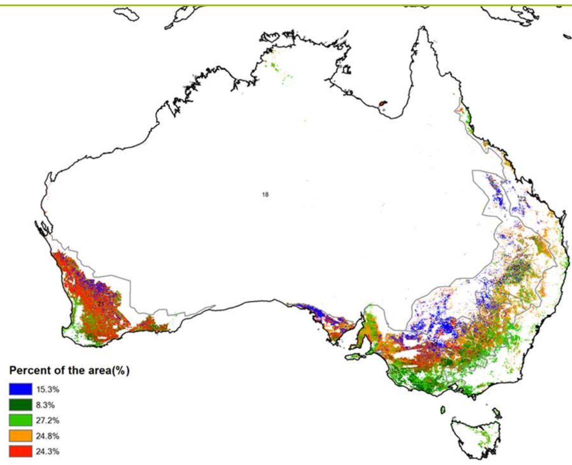
(a). Phenology of major crops

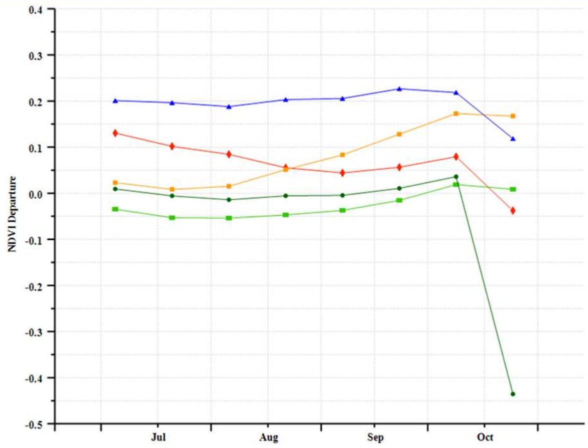




(b) Crop condition development graph based on NDVI

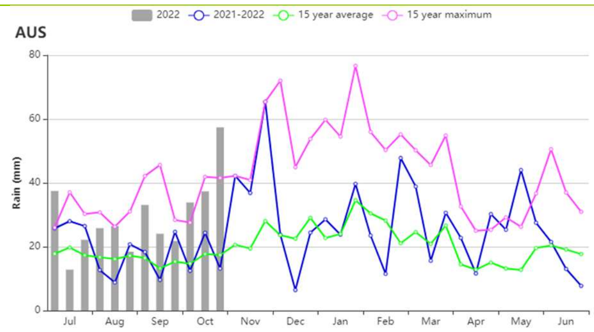
(c) Maximum VCI

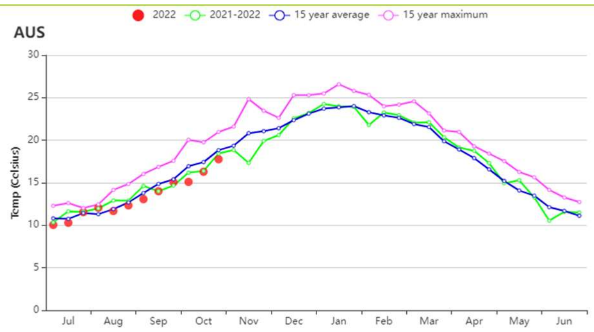




(d) Spatial NDVI patterns compared to 5YA

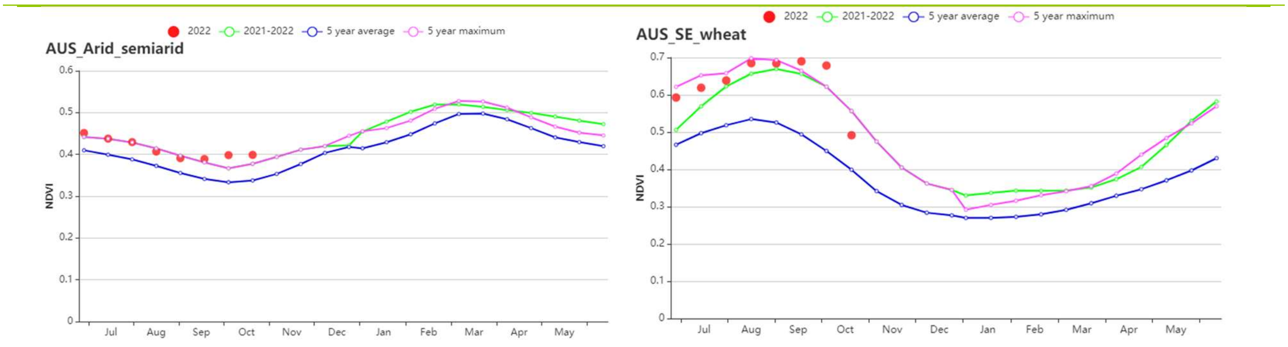
(e) NDVI profiles



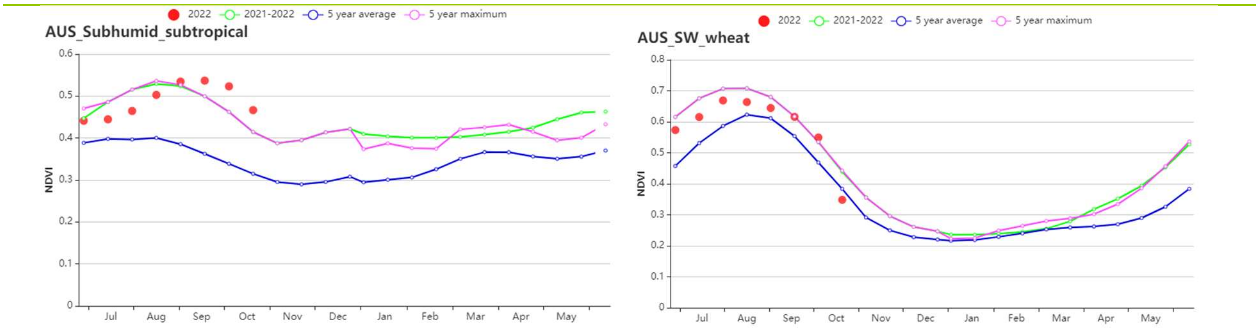


(f) Rainfall profiles

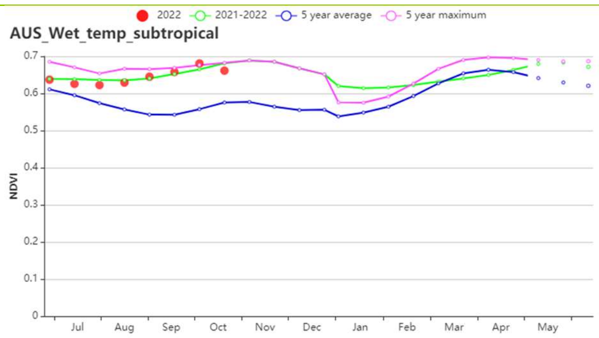
(g) Temperature profiles



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



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



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

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

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Arid and semiarid zone	121	81	22.6	0.1	1193	-4	571	18
Southeastern wheat area	386	80	11.3	-0.6	700	-16	740	35
Subhumid subtropical zone	339	124	14.1	-1.1	928	-13	759	51
Southwestern wheat area	274	14	12.1	-0.9	827	-3	636	6
Wet temperate and subtropical zone	426	85	12.9	-0.1	812	-14	765	30

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

Region	Cropped arable land fraction	Cropping intensity	Maximum VCI

	Current (%)	Departure (%)	Current (%)	Departure (%)	Current
Arid and semiarid zone	68	31	100	-1	0.96
Southeastern wheat area	99	9	111	8	0.97
Subhumid subtropical zone	89	74	120	14	1.03
Southwestern wheat area	96	7	100	0	0.90
Wet temperate and subtropical zone	100	6	103	-1	0.90

[BGD] Bangladesh

During the reporting period, the harvest of the Aus rice crop was completed in July. The planting of the main rice crop (Aman) had started in June already and was completed in July. For the whole reporting period, rainfall was below average (-32%) and TEMP was above average (+0.5℃). Both RADPAR and BIOMSS were above the 15-year average (+12% and +1%, respectively). The national NDVI development graph showed that overall crop conditions were slightly below the 5-year average in July and August except well above the 5 year maximum at the end of July and returned to the 5-year average in September and October. But excessive rainfall at the end of September slightly affected the NDVI values, presumeably due to flooding. The spatial NDVI pattern showed that over 80% of the cultivated area was close to average, but 18.9% had a big drop in early August and 15.1% in September due to cloud cover in the satellite images. The rest (18.7%) of the area was below average during the whole period, mainly distributed in the Sylhet basin. The maximum Vegetation Condition Index (VCIx) was 0.90, with most areas showing values higher than 0.8 and CALF was close to the 5YA (93%). The Cropping intensity was 161% (-7%) and Crop Production Index (CPI) was 1.14. Overall, the crop conditions in most parts of Bangladesh were below but close to average

Regional analysis

Bangladesh can be divided into four agro-ecological zones (AEZ): **the Coastal region**(23), **the Gangetic Plain**(24), **the Hills**(25), and **the Sylhet basin**(26).

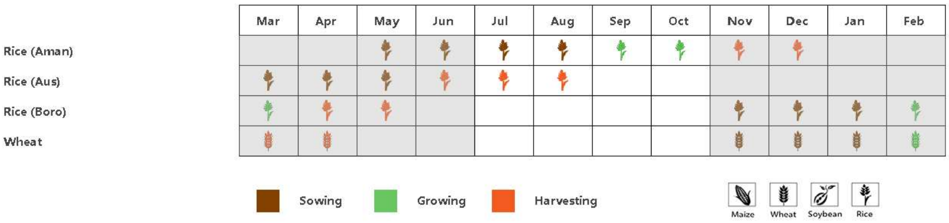
In **the Coastal region**, RAIN was below average (-19%) while both TEMP and RADPAR were above average (+0.4°C and +8%). The potential biomass was slightly above average (+2%). The crop condition development graph based on NDVI shows that crop conditions were above the 5-year average in July and early August, but they were below average at the end of September and in October. Below average rainfall in the first two month affected the growth of Aman rice. Cropping intensity (CI 138%) was lower than the 5YA by 11%. CALF was 93% and VCIx was 0.90, Crop Production Index (CPI) was 1.13. Overall, crop conditions were below but close to average for this zone.

RAIN was greatly below average (-37%) in **the Gangetic Plain**. Both TEMP and RADPAR were above average (+0.5°C and +10%, 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 the end of July and returned to the 5-year average in October. During the monitoring period, CALF (97%) was above average (+1%) while CI was below the 5YA (-3%). VCIx was 0.95 and the Crop Production Index (CPI) was 1.17. Crop conditions of this region were close to the average.

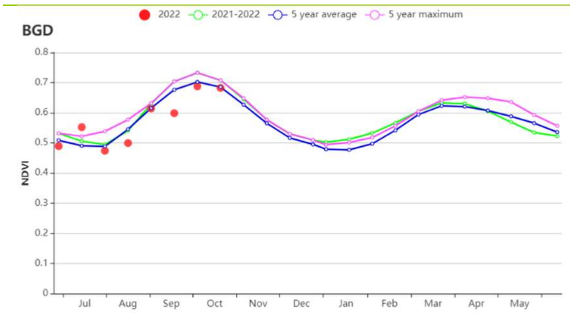
The Hills recorded less rainfall (-47%). Warmer temperature (+0.5℃) and more sunshine (+17%) were also recorded. Potential biomass for the Hills was estimated 2% lower than the 15YA average. The crop conditions experienced a deterioration from above average to near average. Insufficient rainfall affected the sowing of Aman rice and Cropping intensity was below the 5YA (-12%). CALF was 98% and VCIx was 0.90, Crop Production Index (CPI) was 1.14. Overall, crop conditions were close to the average.

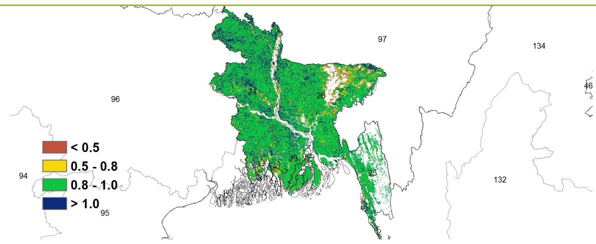
The Sylhet basin also had less rainfall (-27%). Both TEMP and RADPAR were above the 15YA (+0.6℃ and +14%, respectively). Potential biomass for the Hills was estimated 3% higher than the 15YA. CALF and CI were lower than the 5YA by 2% and 8% (86% and 155%, respectively) and VCIx was 0.95 for the area. Crop development based on NDVI was near or slightly below average in this period except at the end of July. Crop Production Index (CPI) was 1.08. 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 2022



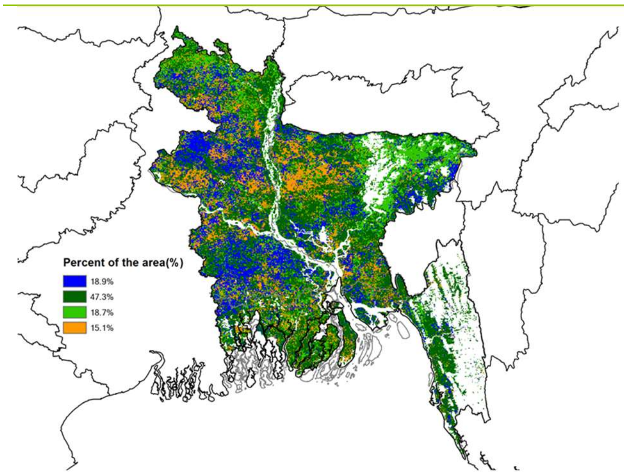
(a). Phenology of major crops

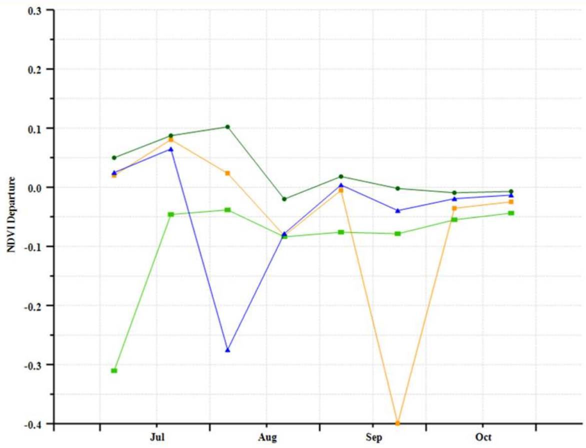




(b) Crop condition development graph based on NDVI

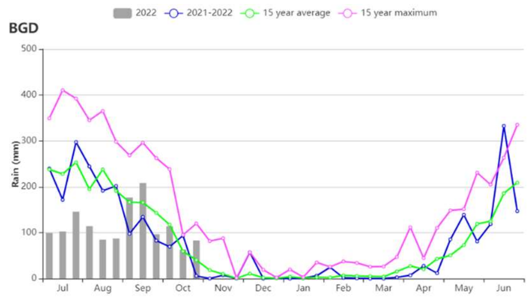
(c) Maximum VCI

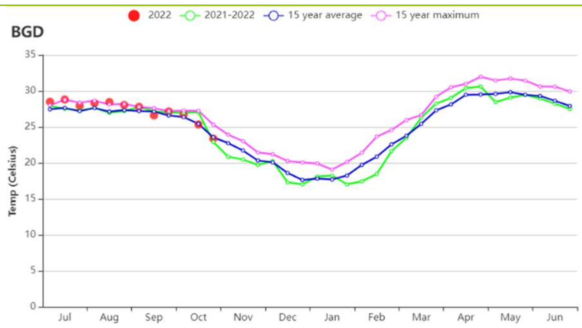




(d) Spatial NDVI patterns compared to 5YA

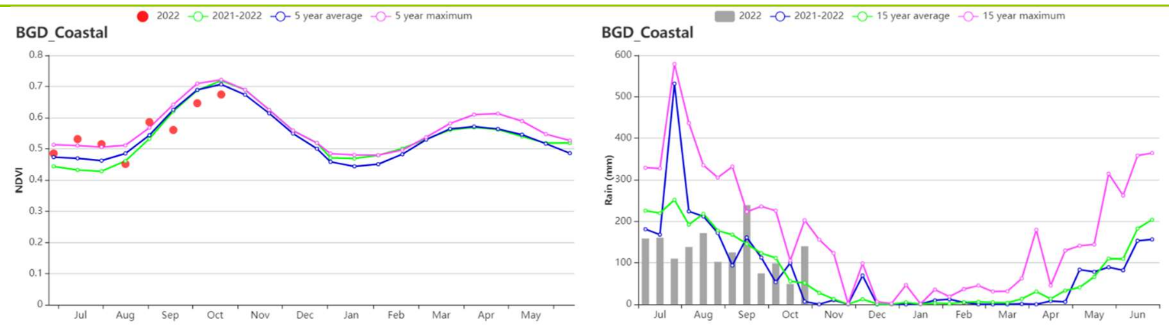
(e) NDVI profiles



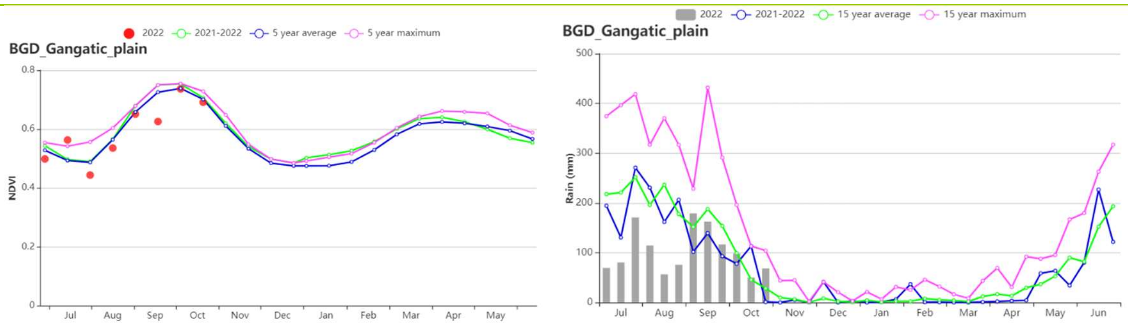


(f) Rainfall profiles

(g) Temperature profiles

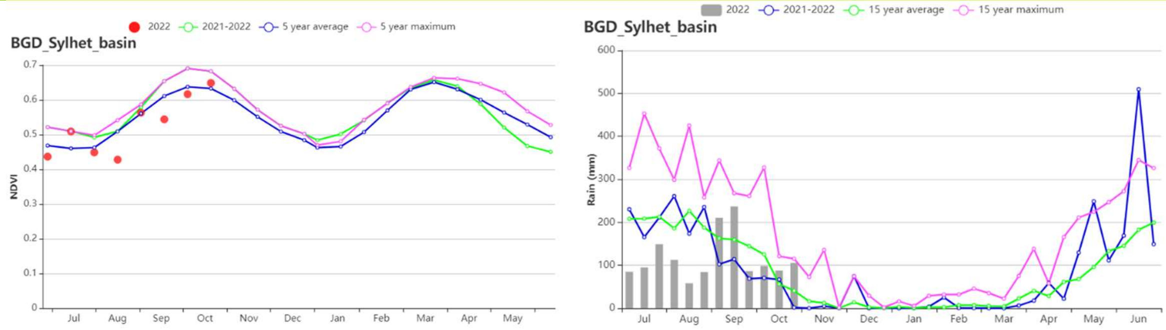


(h) Crop condition development graph based on NDVI (left) and rainfall profile (right) of Coastal region



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

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



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

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

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Coastal region	**1567**	**-19**	**27.8**	**0.4**	**1268**	**8**	**1724**	**2**
Gangetic plain	**1242**	**-37**	**27.4**	**0.5**	**1193**	**10**	**1625**	**1**
Hills	**1240**	**-47**	**26.5**	**0.5**	**1254**	**17**	**1610**	**-2**
Sylhet basin	**1408**	**-27**	**27.2**	**0.6**	**1192**	**14**	**1638**	**3**

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

Region	Cropped arable land fraction		Cropping intensity		Maximum VCI
	Current (%)	Departure(%)	Current (%)	Departure (%)	Current
Coastal region	93	2	138	-11	0.90
Gangetic plain	97	1	180	-3	0.95
Hills	98	1	115	-12	0.95
Sylhet basin	86	-2	155	-8	0.95

[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 283 mm, 3% above the 15YA average. Temperature increased slightly (14°C, 0.2°C) while solar radiation was somewhat below average (RADPAR, 766 MJ/m², -3%). The potential biomass was below average (-1%). Agronomic conditions were generally favorable: good values of VCIx (0.92), cropping intensity (CI, 98%) and cropped arable land fraction (CALF, 100%) were observed. However, due to the decrease of solar radiation in north and central Belarus during the period of winter wheat sowing, crop prospects for the next season in these areas might be affected.

The NDVI development graph indicates that crop condition had gradually recovered closely to the level of the 5-year average starting in August. The national VCIx map shows that crop condition in about 67.4% cropped area was 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 scattered in the southern area. The agricultural production index was above 1.0 (CPI, 1.16), indicating a good prospect.

Regional analysis

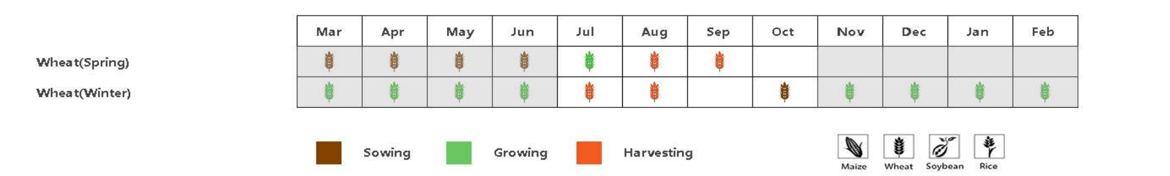
Regional analyses are provided for three agro-ecological zones (AEZ) defined by their cropping systems, climatic zones, and topographic conditions, including Northern Belarus (028, Vitebsk, the northern area of Grodno, Minsk and Mogilev), Central Belarus (027, Grodno, Minsk and Mogilev and Southern Belarus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

North Belarus recorded a radiation decrease (-1%) combined with slightly higher temperatures (+0.3°C) and rainfall (+5%). And potential biomass decreased by 3% below average. The VCIx had reached 0.95, and CALF had reached 100%, with an CPI of 1.19. The NDVI development curve was generally near average level. Winter wheat may grow normally based on agro-climatic indicators in this area but the impact of less radiation in this period on winter wheat germination and early establishment requires attention.

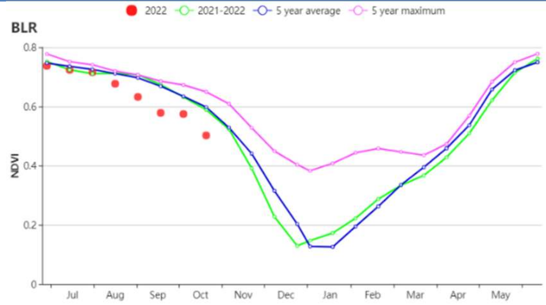
Central Belarus also experienced less radiation (-4%) and slightly higher temperature (+0.3°C) and decreased rainfall (-2%). Similar to northern Belarus, high CALF (100%), VCIx (0.90) and CPI (1.15) were also recorded were also recorded. The NDVI growth curve was generally near the average trend from July to October. The potential biomass decreased by about 2%, therefore winter wheat conditions in this area might also need close monitoring.

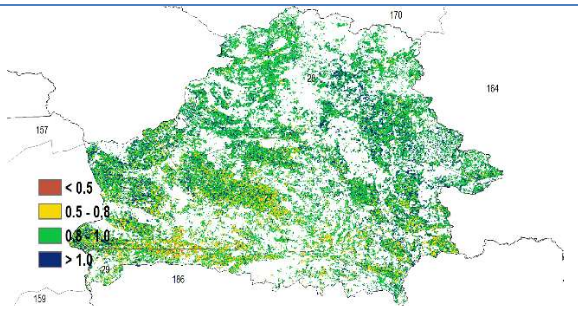
Precipitation in **Southern Belarus** was above the 15YA average level (+11%), and the temperature was slightly lower by -0.1°C and radiation was decrease by -8%. Potential biomass was expected to increase by 5%. The CALF and the VCIx were 100% and 0.88 respectively, with an CPI of 0.99. The water shortage in the previous period didn't impact on the production of spring wheat.

Figure 3.10 Belarus's crop condition, July - October 2022.

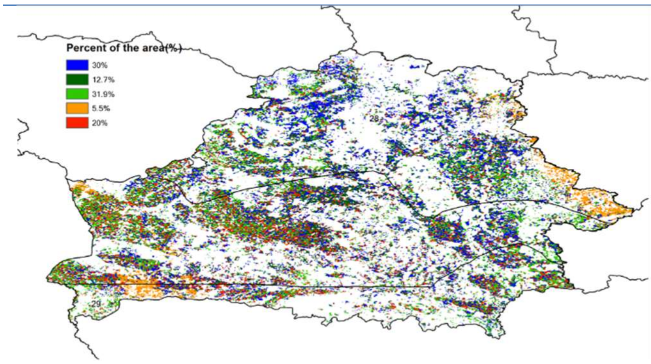


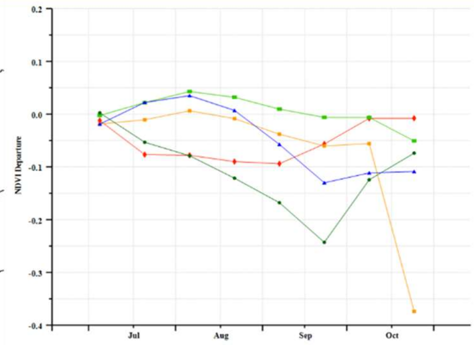
(a). Phenology of major crops



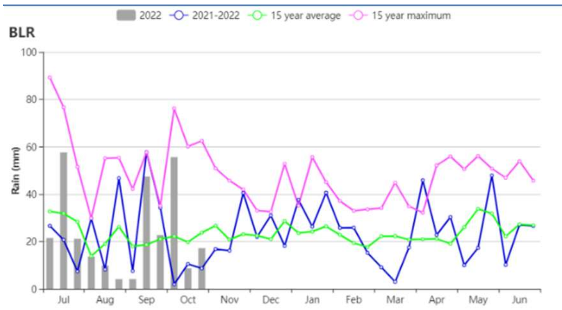


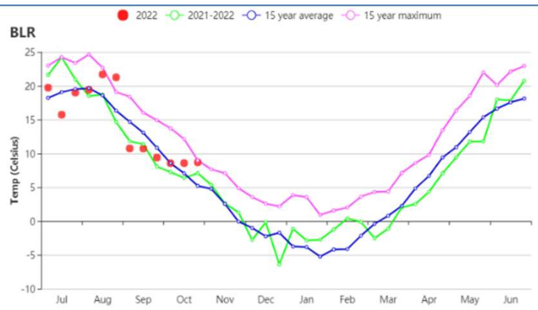
(b) Crop condition development graph based on NDVI (c) Maximum VCI



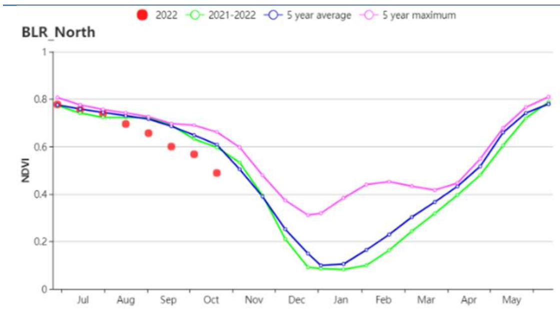


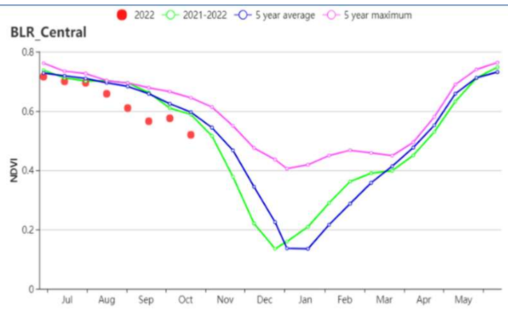
(d) Spatial NDVI patterns compared to 5YA (e) NDVI profiles



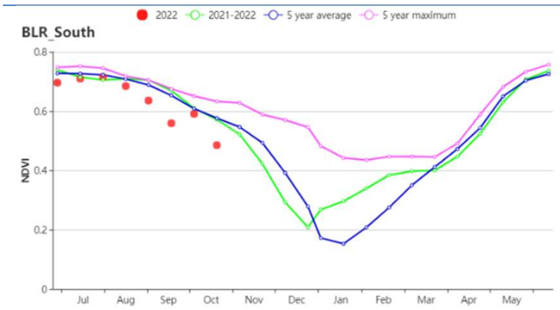


(f)Rainfall time series (g) Temperature time series





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



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

Table 3.12 Belarus's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, July - October 2022.

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Center	261	-2	15	0.3	776	-4	669	-2
North	309	5	14	0.3	752	-1	705	-3
South-west	268	11	15	-0.1	777	-8	683	5

Table 3.13 Belarus's agronomic indicators by sub-national regions, current season's values and departure from 5YA, July - October 2022.

Region	Cropped arable land fraction		Cropping Intensity		Maximum VCI
	Current (%)	Departure (%)	Current (%)	Departure (%)	Current
Center	100	0	101	1	0.90
North	100	0	93	-7	0.95
South-west	100	0	100	-1	0.88

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

[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 the summer crops (maize, soybean, and rice) in Central and Southern Brazil just started in early October.

Brazil has experienced prolonged dry and warmer-than-usual weather for more than two years since mid-2020. CropWatch Agro-climatic Indicators (CWAIs) present below-average conditions with 44% lower rainfall, 0.8°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 18% reduction of potential biomass. Dry and warm weather conditions were widespread across almost the whole country except for a few states on the northeast coast. The extreme dry weather was observed in most of the major agricultural producing states in Central Brazil such as Goias, Sao Paulo, Mato Grosso, Mato Grosso Do Sul and Minas Gerais with larger than 50% negative rainfall anomalies. Above-average temperature and radiation were also observed in those five states except for PAR in Mato Grosso (-1%). As affected by the extremely low rainfall, the BIOMSS was in general well below average on the BIOMSS departure map.

According to the 15YA precipitation profile, 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 as well as below last year's levels. Moreover, the start of the wet season was delayed not only in comparison to the long-term average, but to last year's conditions as well. The dry weather together with the late start of the wet season affected the sowing, emergence and early development of summer crops. It was estimated that the sowing progress of first season maize and the soybean in Brazil was slower by 5 percentage point and 7 percentage point respectively.

The water stress negatively affected crop development, resulting in below-average NDVI values throughout the monitoring period. Crop conditions varied, especially since August. Both the proportions of above-average and below-average crop condition categories increased gradually. Spatially, crops in the northeast coast and Parana River Basin presented above-average NDVI as they benefited from the normal or above-average rainfall while NDVI in most other regions stayed at or below average according to the NDVI departure clustering maps and profiles. Poor crop conditions were observed in central Brazil where negative NDVI departures from average exceeded 0.1 mainly due to the extreme dry conditions (dark green color in figure f). 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 0.84 and CALF was 1% below the 5YA. On an annual basis, cropping intensity increased by 3% indicating that the soybean – maize double cropping system was still expanding even under prolonged dry weather conditions.

All in all, crop conditions in Brazil were 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 1.05 reflecting an overall above-average crop prospect. The main reason is wheat production in Parana and Rio Grande Do Sul which was less affected by dry weather. Wheat production is expected to be above average level. Currently, it is still at the sowing and early stages of the summer crops, the outputs for 2022-2023 summer season crops will depend on the future weather conditions.

Regional analysis

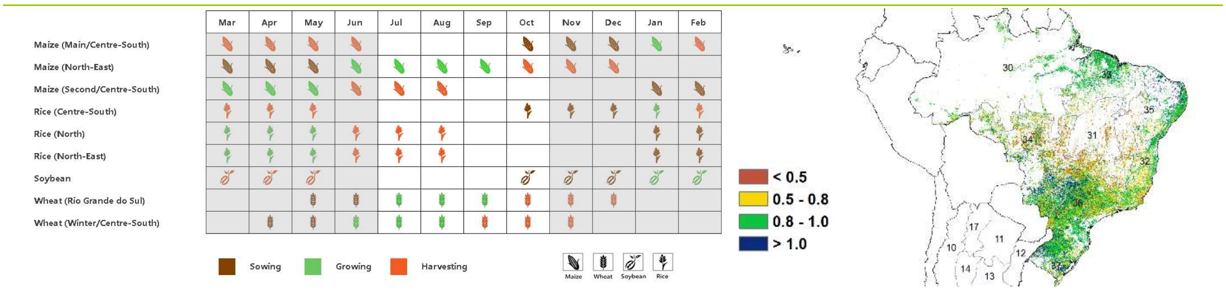
Considering the differences in cropping systems, climatic zones and topographic conditions, eight agro-ecological zones (AEZ) are identified for Brazil. Considering the current agriculture practices, this bulletin focus on **Central Savanna** (31), **the East coast** (32), **Mato Grosso zone** (34), **Parana River** (36), and **Southern subtropical rangelands** (37). All the AEZs received significantly below-average rainfall (-27% to -89%) and above-average temperature (0.4 ºC to 1.3 ºC) except for southern subtropical rangelands (0.1 ºC lower than 15YA). In Central Savanna, the total precipitation was 18 mm during the last four months, the lowest rainfall among the AEZs. PAR was in general close to average. The overall dry and hot weather for the AEZs resulted in below-average BIOMSS (-3% to -25%).

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 422 mm, but still 31% below average. Great temporal differences were observed during the last four months with large negative departures from the 15YA in late August to late September, while rainfall was above or close to average in other months. In general, the crops were less affected by the below average rainfall as reflected by the highest VCIx values at 0.95 among the AEZs. CALF in the region was 1% above the 5YA, and the CI was at an average level. Wheat production was still at above-average levels estimated by CropWatch with crop production index (CPI) value at 1.20, the highest among the AEZs in Brazil. For **Parana basin**, rainfall was 44% below average resulting in a 22% drop in BIOMSS. Thanks to the accessibility of water and irrigation facilities, crop condition was at the 5YA level and above 2021 according to the NDVI-based crop development profile. During the wheat growing period, CALF was just 1% lower compared with the 5YA and CI was 133%, 3% above the 5YA. Average VCIx value in the region was 0.85. CropWatch puts the wheat production in the region at an above-average level with crop production index (CPI) at 1.07.

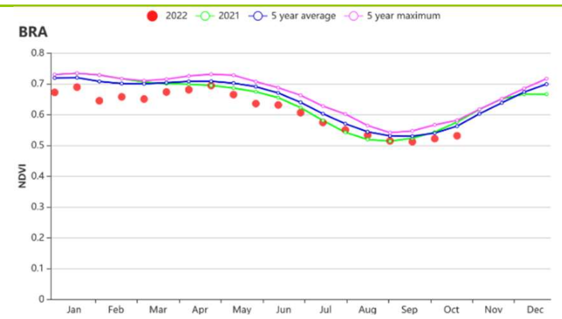
Dry and hot weather resulted in continuous below-average crop conditions in **Central Savanna**, the Coast, and **Mato Grosso zones** as shown in NDVI-based crop development profiles. CALF in Central Savanna, and Mato Grosso zones was 10% and 7% below average reflecting a delayed sowing on summer crops. CALF in the coast zone was at the average level. VCIx values in **Central Savanna**, and **Mato Grosso zones** were also the lowest among the AEZs. Accordingly, CPI values in the two regions were 0.68 and 0.88 respectively, ranking as the lowest two AEZs values in Brazil.

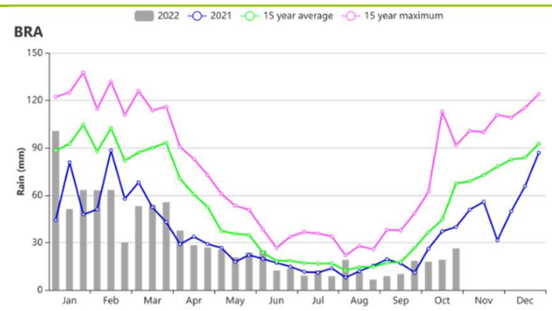
For more indicators and detailed information, it is recommended to visit CropWatch Explore (http://cropwatch.com.cn/newcropwatch/main.htm).

Figure 3.11 Brazil's crop condition, July - October 2022



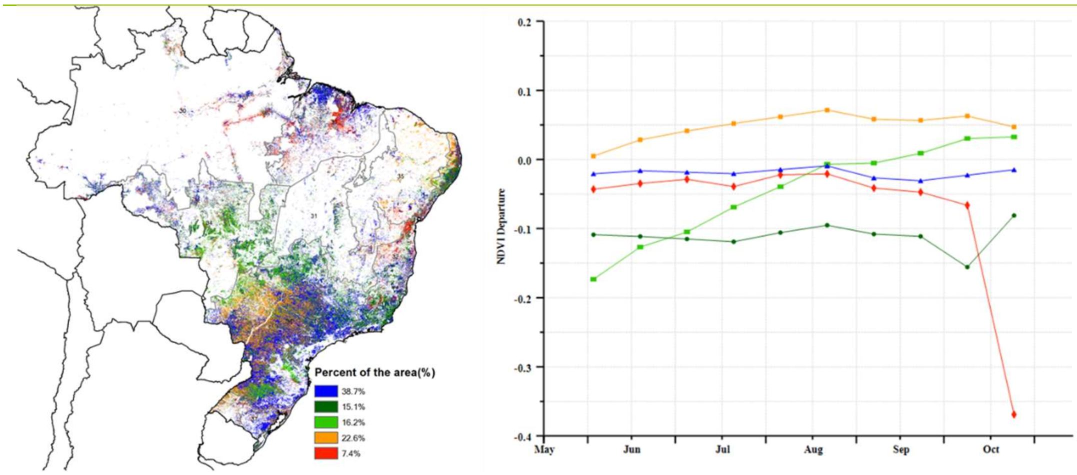
(a) Phenology of major crops (b) Maximum VCI



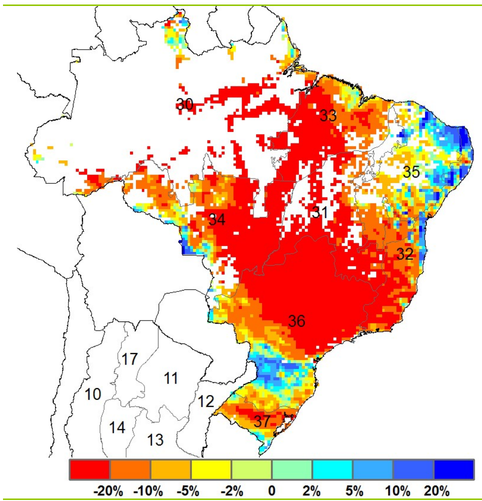


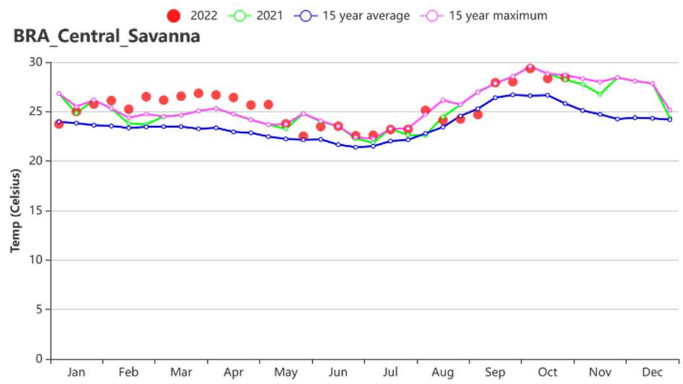
(c) Crop condition development graph based on NDVI of Brazil

(d) Time series rainfall profile of Brazil



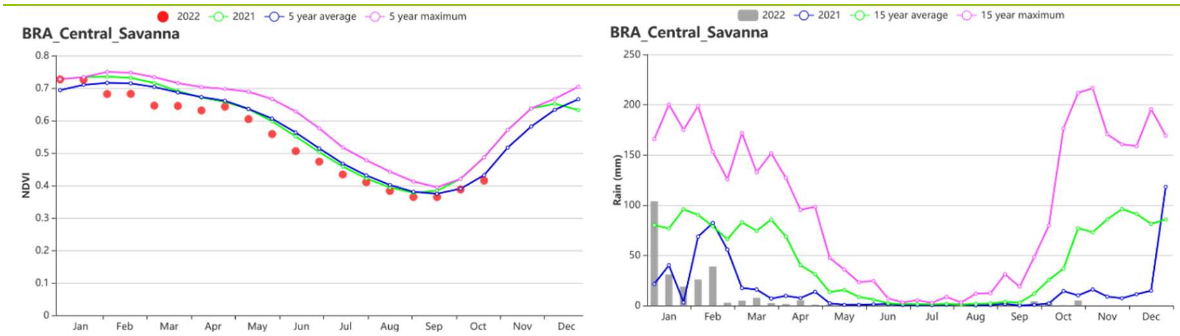
(e) Spatial distribution of NDVI departure from 5YA and NDVI departure profiles corresponding to the clusters



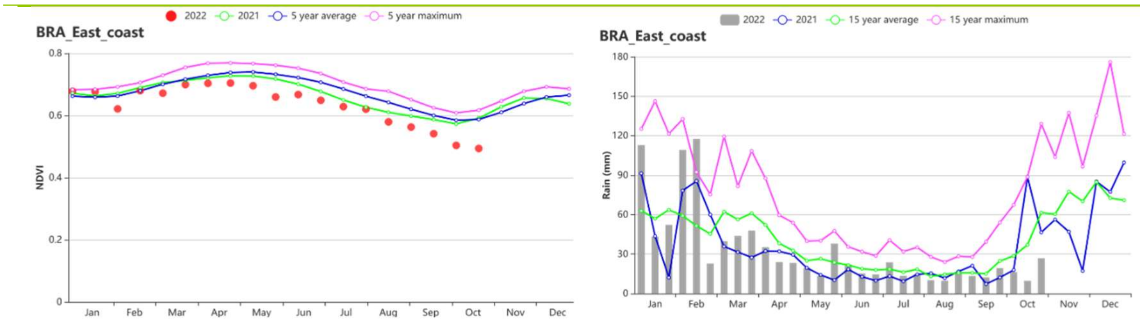


(e) Potential biomass departure from 15YA

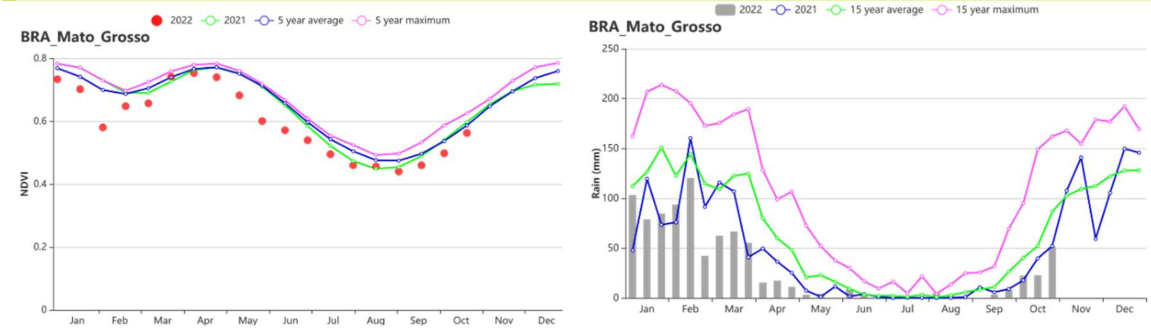
(f) Air temperature profile of Central Savanna



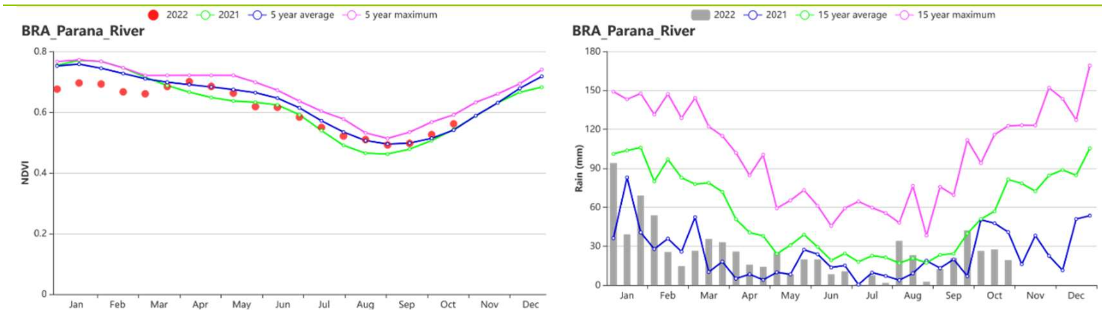
(g) Crop condition development graph based on NDVI (left) and rainfall profile (right) of Central Savanna



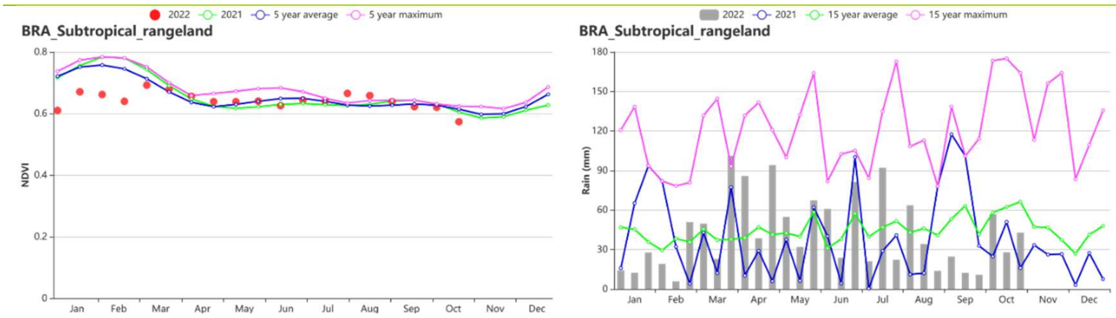
(h) Crop condition development graph based on NDVI (left) and rainfall profile (right) of Coast zone



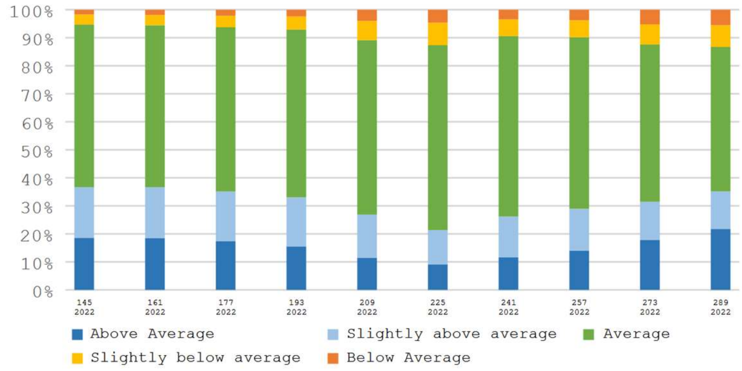
(i) Crop condition development graph based on NDVI (left) and rainfall profile (right) of Mato Grosso



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



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



(L) Proportion of different crop condition categories, July - October 2022

Table 3.14 Brazil's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, July - October 2022

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Central Savanna	18	-89	25.8	1.3	1255	1	458	-25
Coast	186	-33	21.4	0.6	1040	3	663	-11
Mato Grosso	116	-52	27.0	0.8	1153	-1	577	-21
Parana basin	219	-44	21.2	0.9	1060	0	635	-22
Southern subtropical rangelands	422	-31	15.1	-0.1	833	1	869	-10

Table 3.15 Brazil's agronomic indicators by sub-national regions, current season's values and departure from 5YA, July - October 2022

Region	Cropped arable land fraction		Cropping intensity		Maximum VCI
	Current (%)	Departure (%)	Current (%)	Departure (%)	Current
Central Savanna	64	-10	0.68	122	6
Coast	99	0	0.82	117	4
Mato Grosso	84	-7	0.75	157	2
Parana basin	95	-1	0.85	133	3
Southern subtropical rangelands	98	1	0.95	127	0

[CAN] Canada

The period from July to October covers the harvest of wheat in August. The harvest of soybean and maize started in September in the Saint Lawrence Basin. The sowing of winter wheat started in September. According to agroclimatic indicators, Canada experienced warmer weather in this period. The overall conditions in this region were close to the five-year average.

The temperature and radiation were above the 15-year average by 1.3°C and 3%, respectively. Nevertheless, the reduction of rainfall (RAIN -21%) led to a decrease in potential biomass (BIOMSS -11%). According to the rainfall profile, the deficit of precipitation mainly occurred at the beginning of September and October. At that time, wheat and canola in the Prairies had already reached maturity. Maize in the Saint Lawrence basin was close to maturity as well. Hence, these rainfall deficits, accompanied by a drop to below the 5YA of NDVI, had no negative impact on crop yields. The temperature profile indicates that the temperature was mostly above average and even reached the 15-year maximum in September and October.

According to the NDVI cluster map, the crop condition was close to average but gradually dropped below average in October, which accounted for 40.1% of cropped land and mostly located in the south of Ontario and patches in Saskatchewan. For 31.4% of total cropped land (marked as yellow and blue), located in the south of Saskatchewan and Alberta, the crops were below average after August. In regions accounting for 20% of the total cropped area, the crop condition was above average but deteriorated to below average in October, mainly in the south of Saskatchewan. For the rest of the regions, accounting for 8.5% of the total cropped area, crop conditions were above average during the beginning of August and the end of September. For the whole year, the crop intensity is 100%, with a decrease of 1% when compared with the 5YA. The national maximum VCI value was 0.93, while CALF was slightly above average (CALF +1%). Considering the crop production index (CPI) was 1.15 during this monitoring period and the fact that the rainfall deficit occurred after most crops had reached maturity, the overall conditions of the summer crops in Canada are assessed as slightly above average.

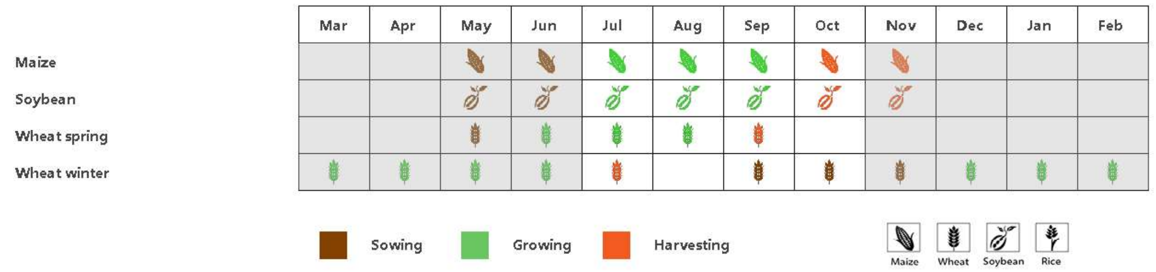
Regional analysis

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

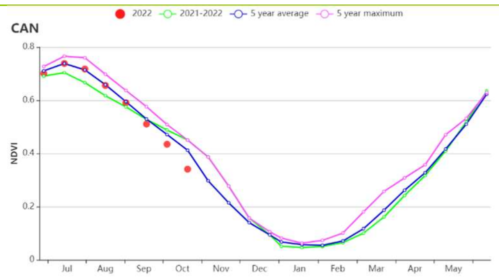
The **Prairies** are the main food production area in Canada. The major crops in this region are winter wheat and spring wheat, as well as canola and sunflowers. The weather was drier and warmer than the 15YA. The rainfall was significantly below average (RAIN 170 mm, -30%), while the temperature and radiation were slightly above average (TEMP +1.9℃; RADPAR +3%). According to the rainfall profile in the Prairies, rainfall was significantly below average across the whole monitoring period except for the beginning of July, middle of September and end of October. The deficit of rainfall led to a below-average potential production (BIOMSS -15%). However, the total amount of rainfall was still 170 mm, which basically could meet crop water requirements. In addition, rainfall had been above average in the previous monitoring period (April to July). The below-average crop conditions in late September had no impact on crop yields, as crops had reached maturity by then. All in all, crop production can be assessed as slightly above average in this region.

The conditions in the **Saint Lawrence basin** were significantly warmer (TEMP +2.2°C) and drier (RAIN -26%) than the 15YA, while radiation was slightly above average (RADPAR +6%) and the potential BIOMSS suffered a 10% reduction. However, the deficit of rainfall occurred in July, the start of September, and October. The rainfall basically met crop water requirements during the major growing season. According to the NDVI development graph, crop conditions had reached average levels in August and September. Accordingly, production is estimated as average as well.

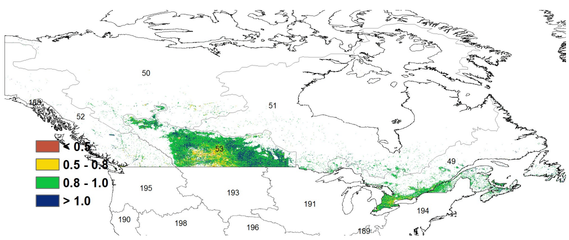
Figure 3.12 Canada's crop condition, July - October 2022



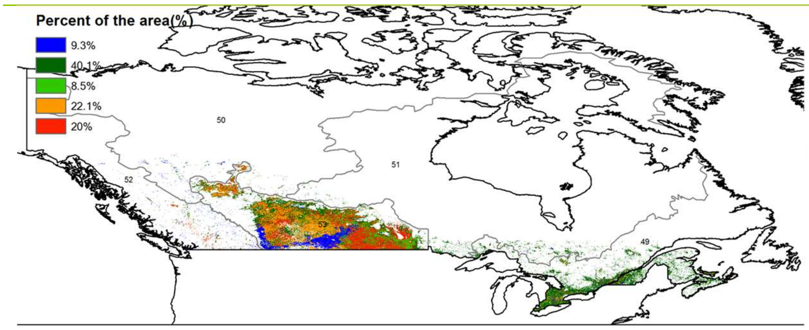
(a). Phenology of major crops



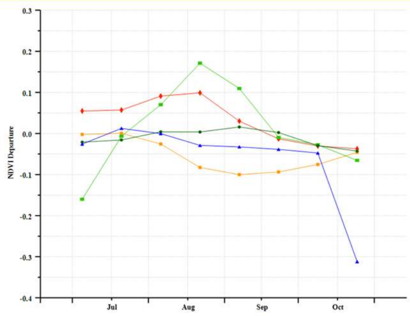
(b) Crop condition development graph based on NDVI



(c) Maximum VCI

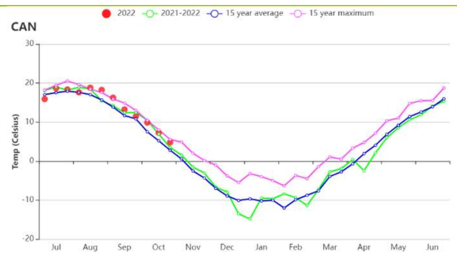


(d) Spatial NDVI patterns compared to 5YA

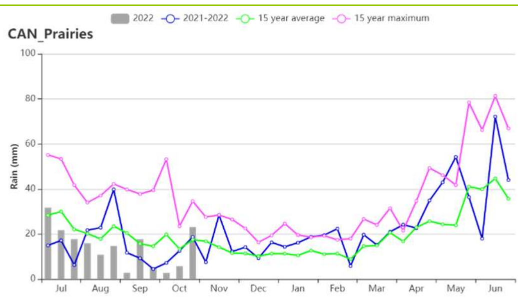


(e) NDVI profiles

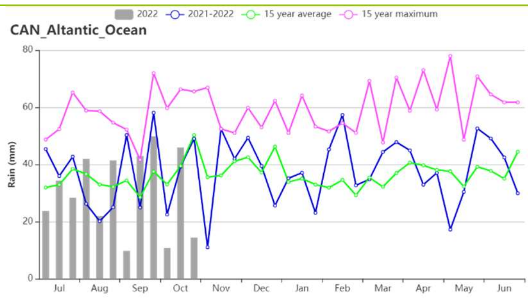
(f) Rainfall profiles



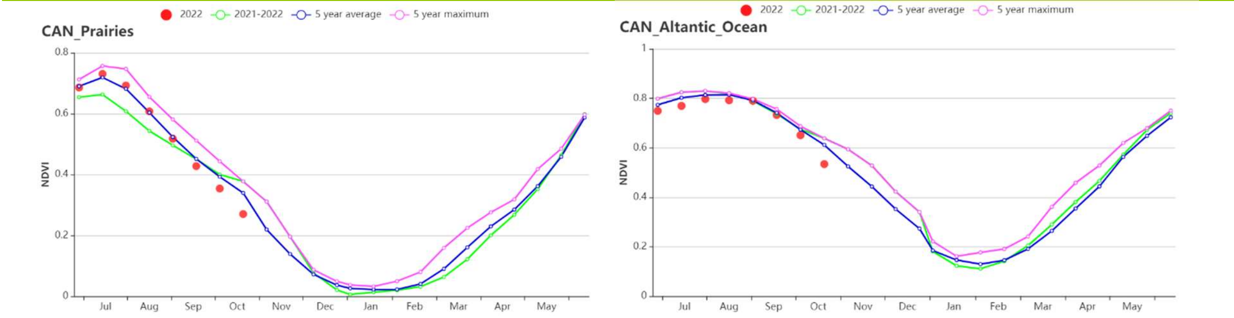
(g) Temperature profiles



(h) Time-series rainfall profile in Prairies



(i) Time-series rainfall profile in Saint Lawrence basin



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

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

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Saint Lawrence basin	283	26	11.9	2.2	981	6	584	-10
Prairies	170	-30	15.1	1.9	994	3	555	-15

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

Region	Cropped arable land fraction		Cropping intensity		Maximum VCI
	Current (%)	Departure (%)	Current (%)	Departure (%)	Current
Saint Lawrence basin	98	-	92	-9	0.82
Prairies	98	1	99	-1	0.76

[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 below average in most regions.

According to the CropWatch agroclimatic indicators, total precipitation at the national level was significantly below average (RAIN -27%), temperature was above average (TEMP +1.3°C) and radiation was also above average (RADPAR +6%). As shown in the time series rainfall profile for Germany, precipitation was overall below average, but significantly above average in mid-September and close to average in late September. Most of the country experienced warmer-than-usual conditions during this reporting period, except for early July and September. Due to the persistent precipitation deficits combined with warmer-than-usual temperatures, the biomass production potential (BIOMSS) was estimated to decrease by 12% 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. These observations are confirmed by the clustered NDVI profiles: all regional NDVI values were below average from July to early September and over half of the regional NDVI values were below average from late September to October. These observations are confirmed by lower VCI values shown in the maximum VCI map. These negative departures were due to below-average rainfall. Overall VCIx for Germany was 0.80. CALF during the reporting period was close to the recent five-year average.

In Germany, crops are mainly rainfed and irrigation rates are relatively low (7.2%). However, the prolonged drought, which had started in the spring, caused a lack of irrigation water. The precipitation stayed below average until September and the drought conditions reduced crop production in all regions of Germany. Crop production index (CPI) was 0.96, less than 1, further suggesting poor crop conditions.

Overall, the agronomic and agroclimatic indicators show below-average conditions for most summer crops in Germany.

Regional analysis

Based on cropping systems, climatic zones, and topographic conditions, six sub-national agro-ecological regions are adopted for Germany. They include: the Wheat Zone of **Schleswig-Holstein and the Baltic coast** (56), **Mixed Wheat and Sugar beet Zone of the Northwest** (57), **Central Wheat Zone of Saxony and Thuringia** (55), **Sparse Crop Area of the East-German Lake and Heathland area** (54), **Western Sparse Crop Area of the Rhenish Massif** (59) and the **Bavarian Plateau** (58).

Schleswig-Holstein and the Baltic Coast are among the major winter wheat zones of Germany. Temperature fluctuated above and below the average value in this region, but total precipitation was below average (RAIN -23%) and radiation was above average (RADPAR +1%). As a result, BIOMSS is expected to decrease by 10% as compared to the average. As shown in the crop condition development graph (NDVI), the values were below average. The area has a high CALF (100%) as well as a favorable VCIx (0.9), indicating a large cropping area. The cropping intensity increased by 10% 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, temperatures and radiation were both higher than average (TEMP +1.4°C; RADPAR +9%), but rainfall was significantly below average (RAIN -42%), which led to a decrease in BIOMSS by 23%. As shown in the crop condition development graph based on NDVI, the values were below average,which is consistent with the crop condition reflected by the crop production index (CPI) of only 0.91. The area has a high CALF (100%), and the cropping intensity decreased by 4% as compared to the average.

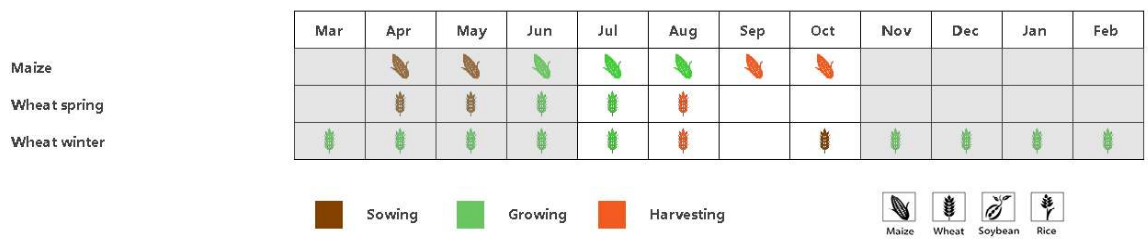
Central Wheat Zone of Saxony and Thuringia is another major winter wheat zone. Temperatures and radiation were both higher than average (TEMP +1.2°C; RADPAR +4%), but rainfall was significantly below average (RAIN -29%), which led to a decrease in BIOMSS by 14%. As shown in the crop condition development graph based on NDVI, the values were below average. Similarly, the crop production index (CPI) was relatively low, with a CPI value of only 0.93. The area has a high CALF (99%) and the VCIx was 0.91 for this region. The cropping intensity decreased by 5% as compared to the average.

In the **East-German Lake and Heathland Sparse Crop Area**, significantly below-average precipitation was recorded (RAIN -22%). Temperatures and radiation were both higher than average (TEMP +0.9°C; RADPAR +1%). As a result, BIOMSS is expected to decrease by 10% as compared to the average. As shown in the crop condition development graph based on NDVI, the values were below average from July to early September, and close to average from later September to October. The area has a high CALF (100%) and the VCIx was 0.93 for this region. The cropping intensity decreased by 5% as compared to the average.

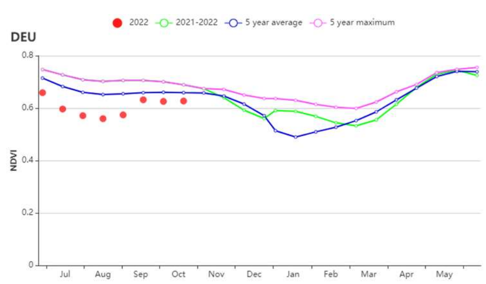
In the **Western Sparse Crop Area of the Rhenish Massif**, significantly below-average precipitation was also recorded (RAIN -34%) with above-average temperature and solar radiation (TEMP +1.9°C; RADPAR +10%). The biomass potential (BIOMSS) decreased by 15% compared to the 15YA. As shown in the crop condition development graph based on NDVI, the values were below average from July to early September, and close to average from late September to October. The crop production index (CPI) was only 0.91. The CALF was 100% for the regions. The VCIx value was 1.01 for the western areas. The cropping intensity decreased by 1% as compared to the average.

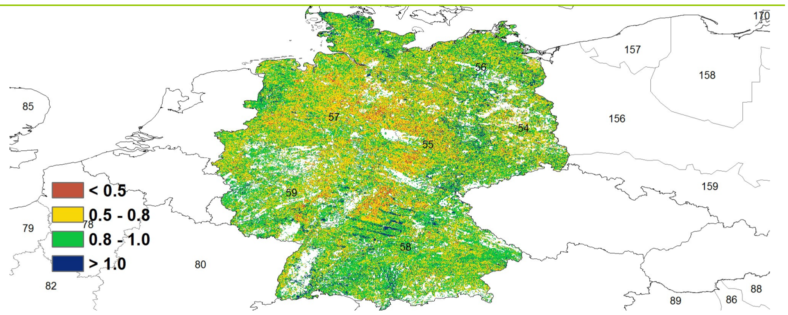
A significant reduction in rainfall was recorded for the **Bavarian Plateau** (RAIN -20%), with above-average temperature (+1.2°C) and above-average radiation (RADPAR +6%). Compared to the fifteen-year average, BIOMSS decreased by 6%. As shown in the crop condition development graph based on NDVI, the values were below average from July to early September, and close to average from late September to October. The area had a high CALF (100%) as well as a favorable VCIx (0.95). The cropping intensity decreased by 5% as compared to the average.

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



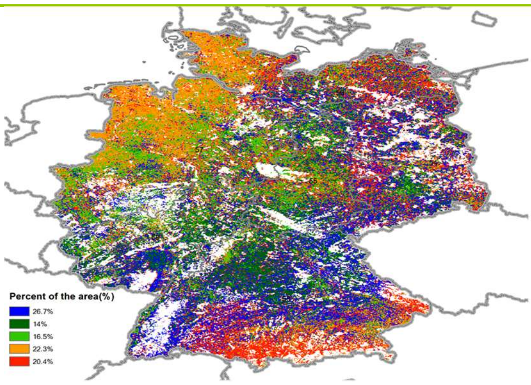
(a). Phenology of major crops



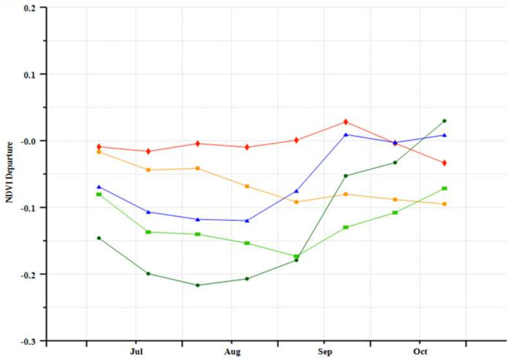


(b) Crop condition development graph based on NDVI

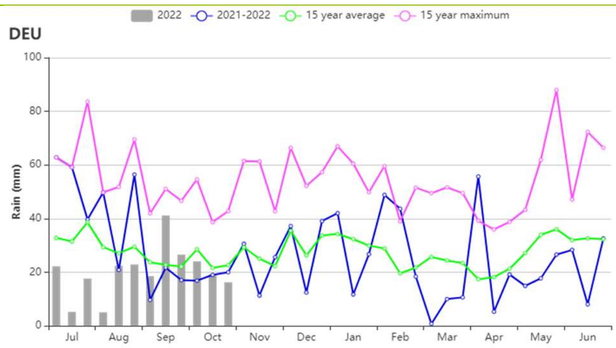
(c) Maximum VCI



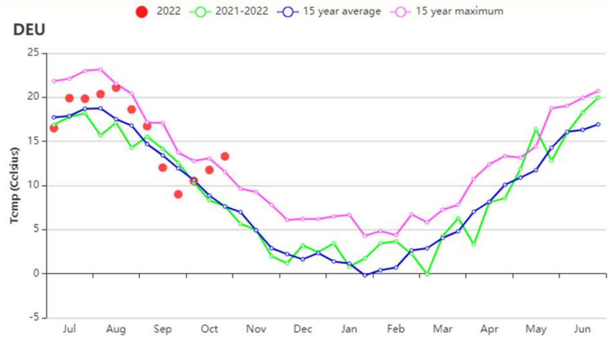
(d) Spatial NDVI patterns compared to 5YA



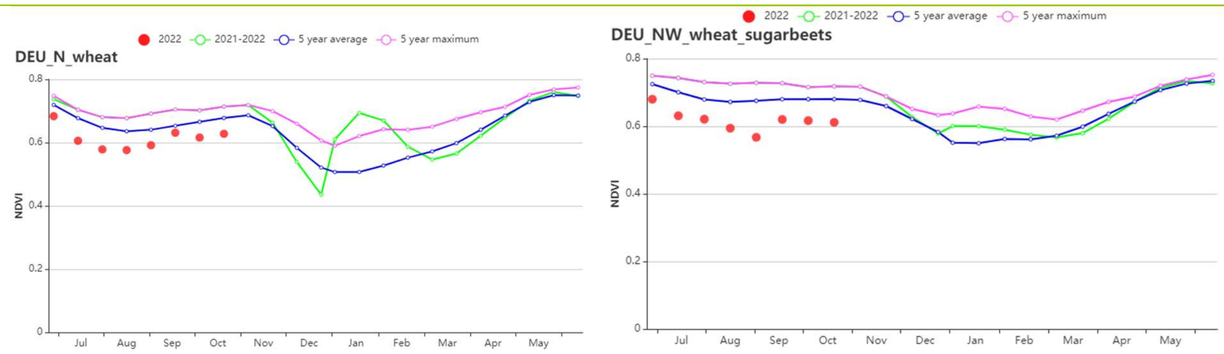
(e) NDVI profiles



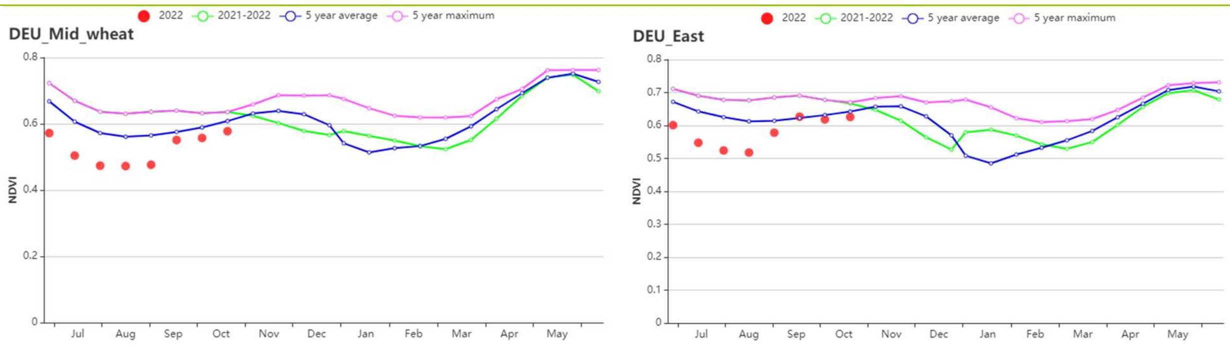
(f) Rainfall profiles



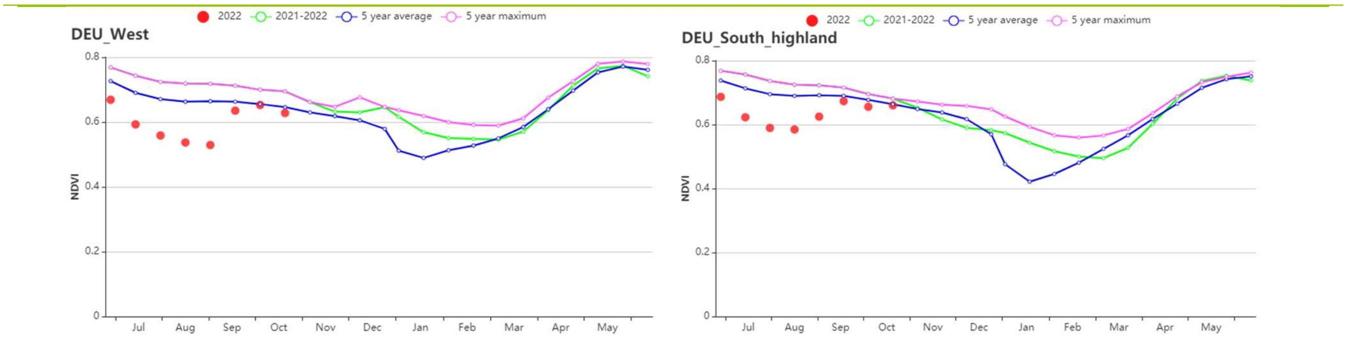
(g) Temperature profiles



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



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



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

Table 3.18 Germany's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, July-October 2022

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m^2)	Departure (%)	Current (gDM/m^2)	Departure (%)
Wheat zone of Schleswig-Holstein and the Baltic coast	261	-23	16.1	0.9	801	1	717	-10
Mixed wheat and sugarbeets zone of the north-west	178	-42	16.2	1.4	881	9	587	-23
Central wheat zone of Saxony and Thuringia	197	-29	15.9	1.2	896	4	618	-14
East-German lake and Heathland sparse crop area	231	-22	16.0	0.9	864	1	665	-10
Western sparse crop area of the Rhenish massif	178	-34	16.1	1.9	969	10	606	-15
Bavarian Plateau	315	-20	15.1	1.2	991	6	776	-6

Table 3.19 Germany's agronomic indicators by sub-national regions, current season's values and departure from 5YA, July-October 2022

Region	Cropped arable land fraction		Maximum VCI	Cropping Intensity	
	Current (%)	Departure (%)	Current	Current	Departure (%)
Wheat zone of	100	0	1.01	122	10

Region	Cropped arable land fraction		Maximum VCI	Cropping Intensity	
	Current (%)	Departure (%)	Current	Current	Departure (%)
Schleswig-Holstein and the Baltic coast					
Mixed wheat and sugarbeets zone of the north-west	100	0	0.98	110	-4
Central wheat zone of Saxony and Thuringia	99	0	0.91	108	-5
East-German lake and Heathland sparse crop area	100	0	0.93	111	-5
Western sparse crop area of the Rhenish massif	100	0	1.01	108	-1
Bavarian Plateau	100	0	0.95	102	-5

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

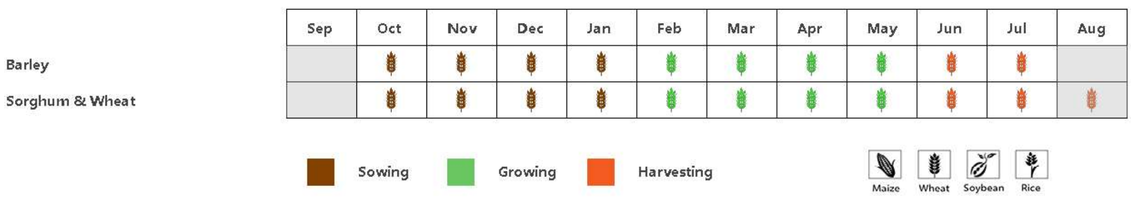
[DZA] Algeria

The monitoring period for this report covers July to October. In Algeria, the harvest of wheat, barley and sorghum ended in July. The sowing of potatoes and some irrigated crops like artichoke, tomato and cauliflower started in August. Potatoes are mostly grown in the regions of Mostaganem and El Oued.

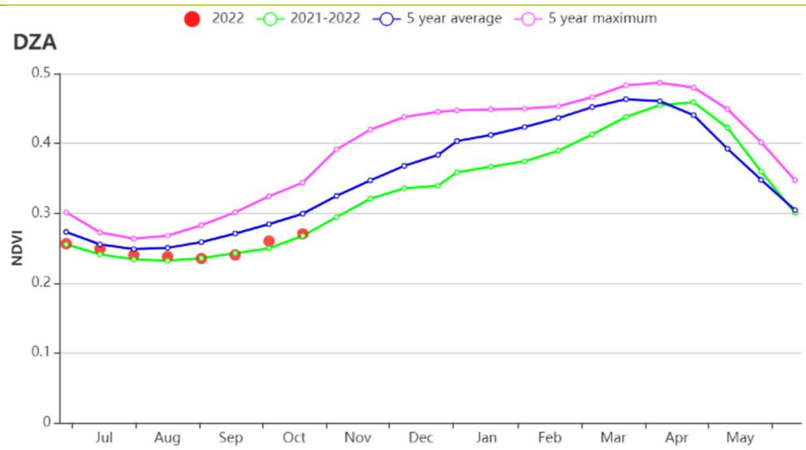
The proportion of irrigated cropland in Algeria is only 3% and rainfall plays an utmost role in the growth of most crops. CropWatch agro-climatic indicators show that when compared to the 15YA, RAIN was 50% lower, and sunshine temperature were average. Due to the large rainfall deficit, the biomass production potential (BIOMSS) is estimated to have decreased by 10% at the national level compared to the 15-year average. The national-scale NDVI development graph shows that the NDVI values were generally lower as compared to the 5YA, but close to that of the corresponding season in 2021. The crop conditions were different from the 5-year average from January to March. This is also partly reflected by the spatial distribution of maximum VCI (VCIx) in the most of country, which reached an average of 0.54. Overall, below-average rainfall starting in mid-January to February caused unfavorable growth conditions for the wheat crops. It is the time when the cereal crop needs water, that is why i mentioned the period between January and March as the critical stages of cereal crops in the Algeria according to the low precipitation.

The VCIx map shows relatively low values (<0.5) distributed across the whole country. The national average VCIx was 0.54, indicating unfavorable crop conditions. The cropped arable land fraction represented 14% and the crop production index (CPI) was 0.66. Crop conditions were unfavorable due to below-average precipitation.

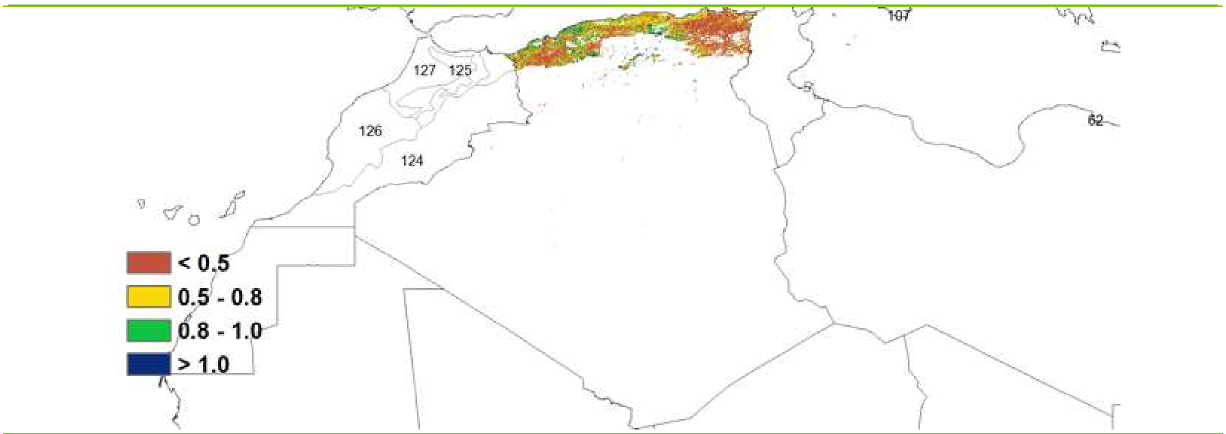
Figure 3.14 Algeria's crop condition, July - October 2022



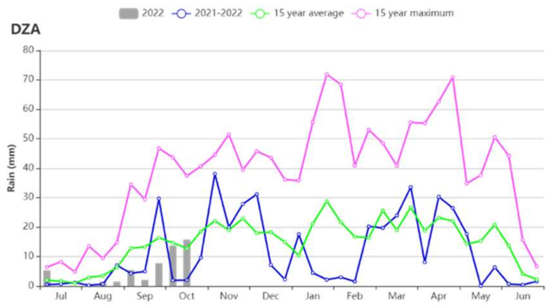
(a). Phenology of major crops

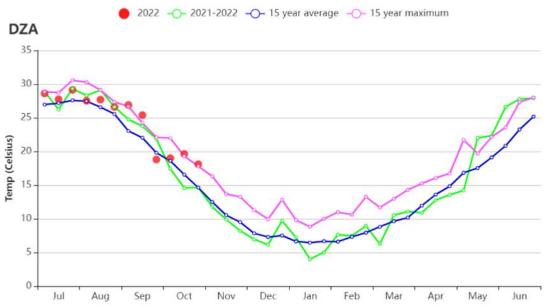


(b) Crop condition development graph based on NDVI

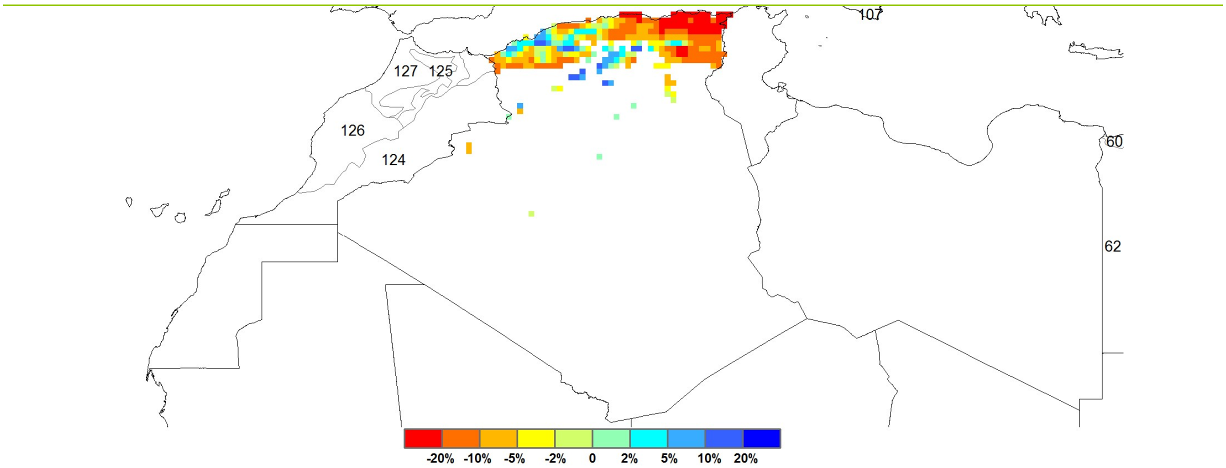


(c) Maximum VCI

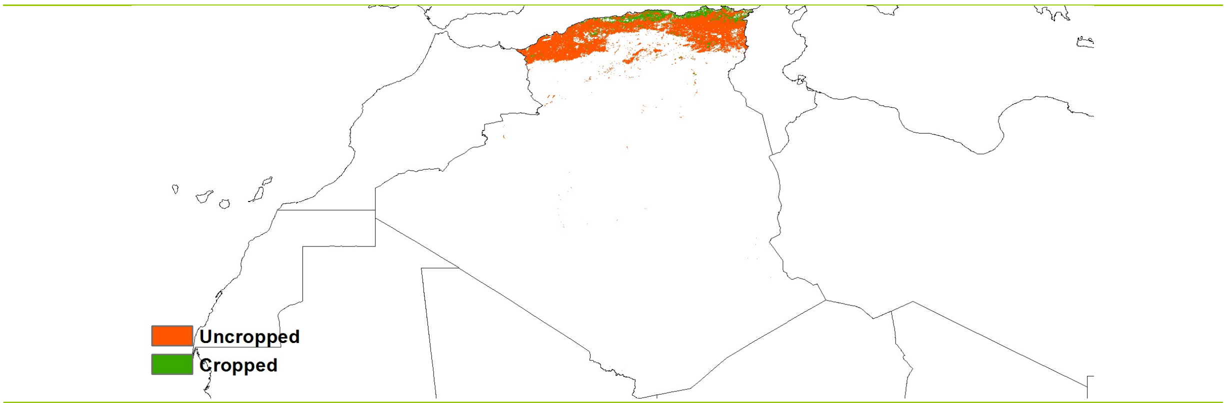




(d) Rainfall profiles (e) Temperature profiles



(f) Biomas departure



(g) CALF

Table 3.20 Algeria's agroclimatic indicators, current season's values, and departure from 15YA, July - October 2022

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m2)	Departure (%)	Current (gDM/m2)	Departure (%)
Algeria	53	-50	24.6	1.6	1309	0	556	-10

Table 3.21 Algeria's agronomic indicators, current season's values, and departure from 5YA, July - October 2022

Region	Cropped arable land fraction		Cropping intensity		Maximum VCI
	Current (%)	Departure (%)	Current (%)	Departure (%)	Current
Algeria	14	-23	104	2	0.54

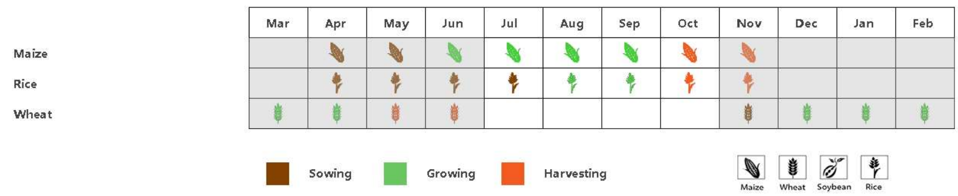
[EGY] Egypt

The reporting period (July-October) covers the growth and harvest of the main summer crops: maize and rice. Winter wheat sowing is about to start in early November. The average rainfall was 11mm which is 61% higher than the 15-year average (15YA). The rainfall profile shows that the rainfall did not exceed 10mm and it rained mainly at the end of October. The average temperature was higher than the 15YA by 0.2°C .The temperature profile shows that the temperature fluctuated around the 15YA. The RADPAR was lower than the 15YA by 1.3% , while the BIOMSS was at the 15YA. The nationwide NDVI profile was below the 5-year average (5YA) except for August, which was at the 5YA. The NDVI spatial pattern shows that 12.6% of the cultivated area was above the 5YA, 57.5% fluctuated around the 5YA, and 29.9% was below the 5YA. The Maximum Vegetation Condition Index (VCIx) map shows that the condition of the current crops was near average where the dominant VCIx values ranged between 0.50 and 1. This finding agrees with the whole country's VCIx value of 0.71. CALF was higher than the 5YA by only 2%. The nationwide crop production index (CPI)was at 1.13 implying an above-normal crop production situation. In general, the crop conditions were favorable.

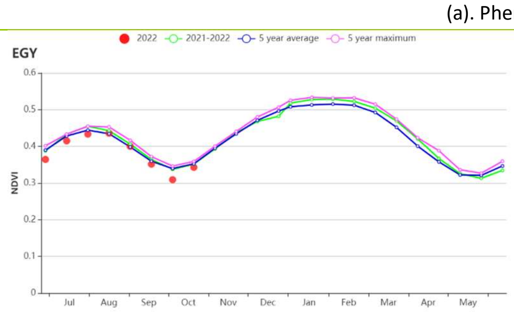
Regional analysis

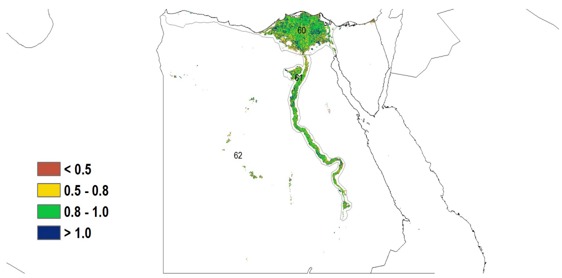
Based on crop planting systems, climate zones, and topographical conditions, Egypt can be divided into three agro-ecological zones (AEZs), two of which are suitable for crop cultivation. These are the Nile Delta and the southern coast of the Mediterranean and the Nile Valley. The average rainfall was 13mm (+67%) in the Nile Delta and Mediterranean coast, while the Nile Valley recorded 3mm(+292%) . Since virtually all crops in Egypt are irrigated, the impact of precipitation on crop yield is limited, but additional rainfall is nevertheless always beneficial. The temperature was higher than the 15YA by 0.2℃ in the first zone while it was lower than the 15YA by 0.1℃ in the second zone. In both zones, the RADPAR was lower than the 15YA by 1% while the BIOMSS was higher than the 15YA by 4% and 7% in the Nile Delta and Nile Valley, respectively. The NDVI development graph was below the 5YA except for August in the first zone where it was slightly above the 5YA. In both zones, CALF exceeded the 5YA by 2%. They also registered good VCIx values at 0.80 and 0.82 for the Nile Delta and Nile Valley, respectively, confirming favorable crop conditions. Cropping Intensity estimates were 186% and 163% for the Nile Delta and Nile Valley, respectively, indicating both regions had a mixture of single and double cropping during the reporting period. In both zones, the CPI was at 1.15 and 1.10, respectively, implying above normal crop production situation following the nationwide CPI.

Figure 3.15 Egypt's crop condition, July - October 2022

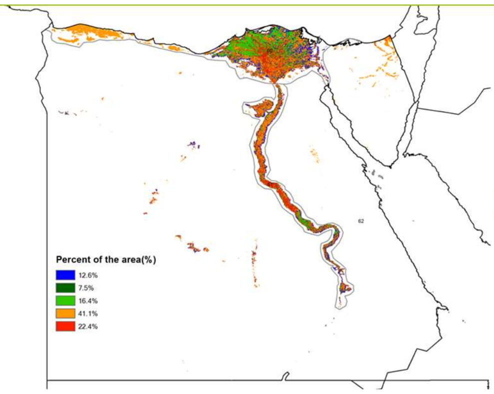


(a). Phenology of major crops

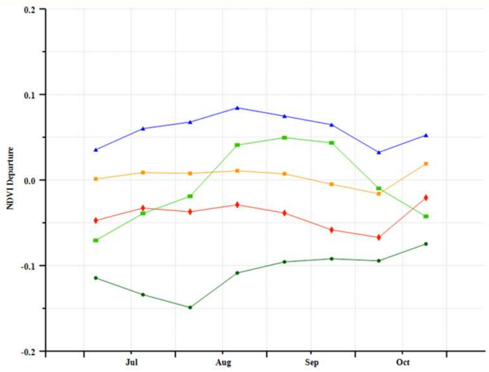




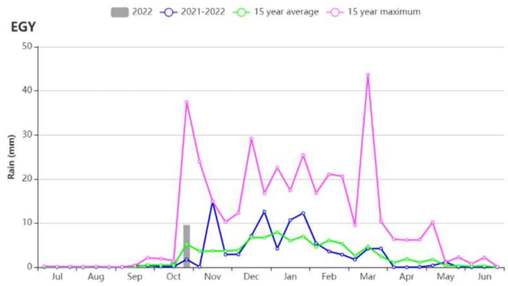
(b) Crop condition development graph based on NDVI



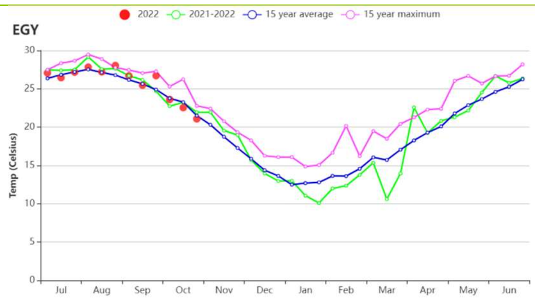
(c) Maximum VCI



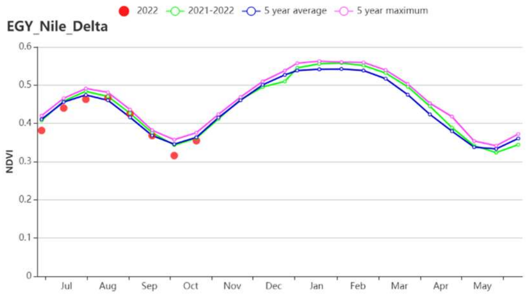
(d) Spatial NDVI patterns compared to 5YA



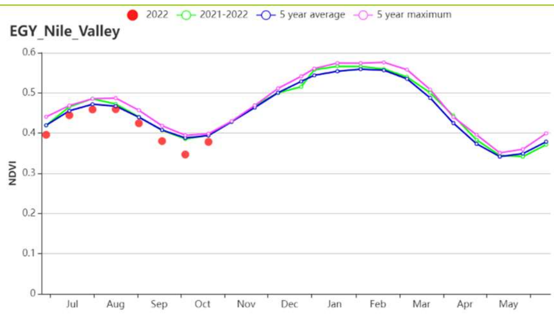
(e) NDVI profiles



(f) Time series profile of rainfall



(g) Time series profile of temperature



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

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

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Nile Delta and Mediterranean coastal strip	13	67	25.8	0.2	1366	-1.0	498	4
Nile Valley	3	292	27.7	-0.1	1419	-1.0	253	7

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

Region	Cropped arable land fraction		Cropping intensity		Maximum VCI
	Current (%)	Departure (%)	Current (%)	Departure (%)	Current
Nile Delta and Mediterranean coastal strip	65	2	186	17	0.80

Region	Cropped arable land fraction		Cropping intensity		Maximum VCI
	Current (%)	Departure (%)	Current (%)	Departure (%)	Current
Nile Valley	71	2	163	13	0.82

[ETH] Ethiopia

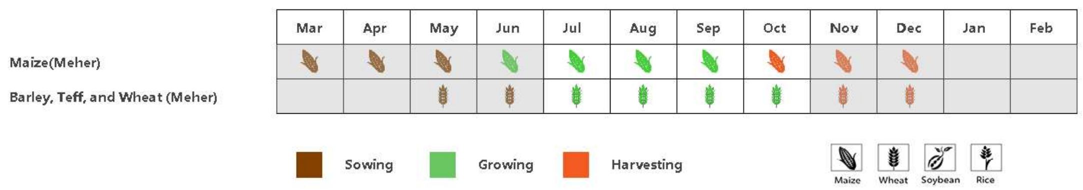
The main food crops in Ethiopia are teff, wheat, barley, and maize. The monitoring period is from July to October and encompasses the main growing and developmental seasons of all Meher crops. In the previous report, it was noted that crop cultivation and development were negatively affected by low precipitation, with the east and north of the country being the most affected by drought. In this report, the overall negative impact of drought has diminished, mainly as a result of higher, yet still below average, precipitation.

Cumulative precipitation had dropped by 19% compared to the 15YA (34% in the previous monitoring period), and both average temperature (-0.1°C) and photosynthetically active radiation (-7%) were slightly lower than the 15YA. Precipitation deficit resulted in a slight 9% decrease in biomass compared to the 15YA. The crop condition development graph based on NDVI for Ethiopia shows average values after September as a result of the rains. The NDVI departure clustering map shows a good crop development recovery in most of the regions, except for the negative departure pattern in the southern region. The mean maximum VCI for Ethiopia is 0.93. The Maximum VCI graph shows the same pattern as the NDVI departure clustering map. The cropped arable land fraction decreased by 4% compared to 5YA. In conclusion, the crop conditions were generally still below average levels.

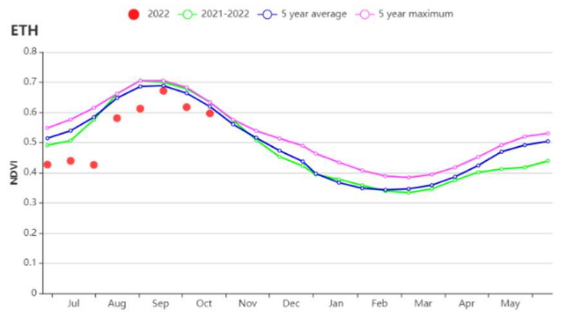
Regional analysis

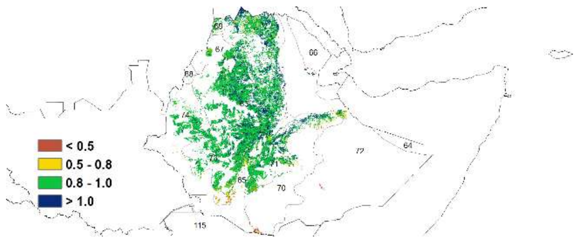
The agroclimatic indicators are similar in **Central-northern maize-teff highlands (63) and Western mixed maize zone (74)**, with cumulative precipitation reaching close to average levels (RAIN -15% and -12% respectively). This resulted in a slight decrease in BIOMSS by 7% and 9%, respectively, compared to the 15YA. NDVI showed decreasing and then increasing trends, reaching close to average levels. Cropped arable land fraction and cropping intensity did not change much. The crop production index was 1.18 and 1.14. Crop yields in these two areas can be assessed as close to average. However, in the southern region including **Great Rift region (65)**, **South-eastern Mendebo highlands (71),** and **South-western coffee-enset highlands (73)**, the negative impact of drought is more long-term. Cumulative precipitation (-39%, -25%, and -50%) and photosynthetically active radiation (-7%, -7%, and -8%) were significantly reduced in all three regions, resulting in less cumulative biomass (-19%, -15%, and -17%). Cropped arable land fraction remained essentially unchanged while cropping intensity decreased by 9%, 3%, and 7%. In summary, crop yield projections for 2022 are slightly below average in these southern agricultural regions.

Figure 3.16 Ethiopia's crop condition, July - October 2022



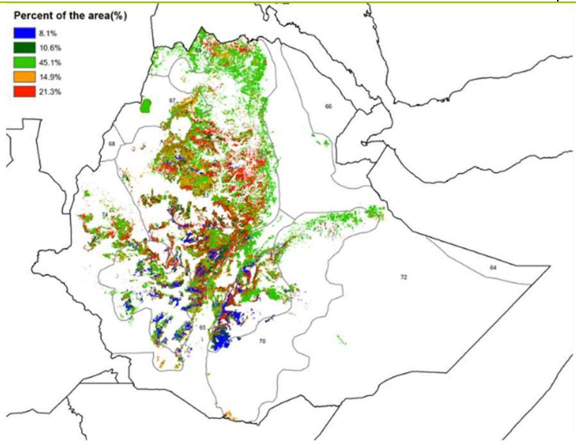
(a) Phenology of major crops

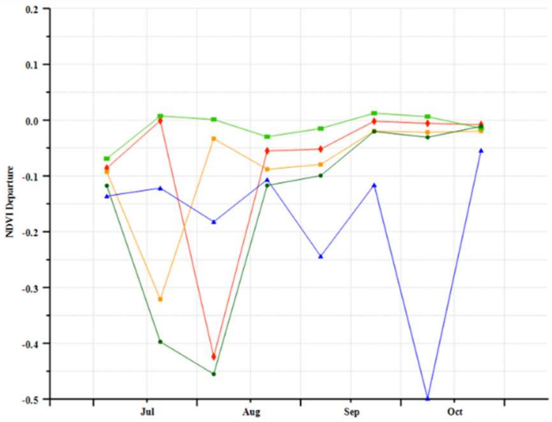




(b) Crop condition development graph based on NDVI

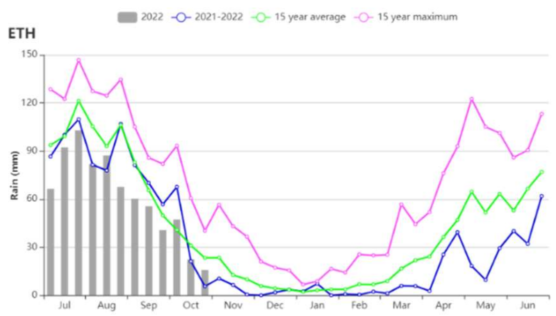
(c) Maximum VCI

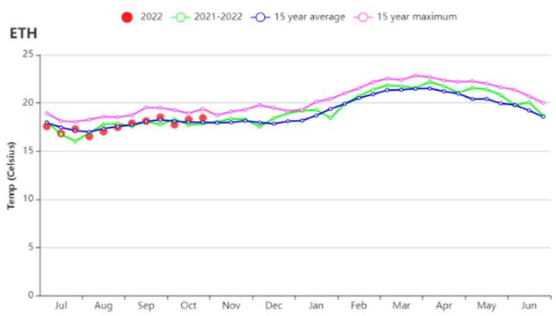




(d) Spatial NDVI patterns compared to 5YA

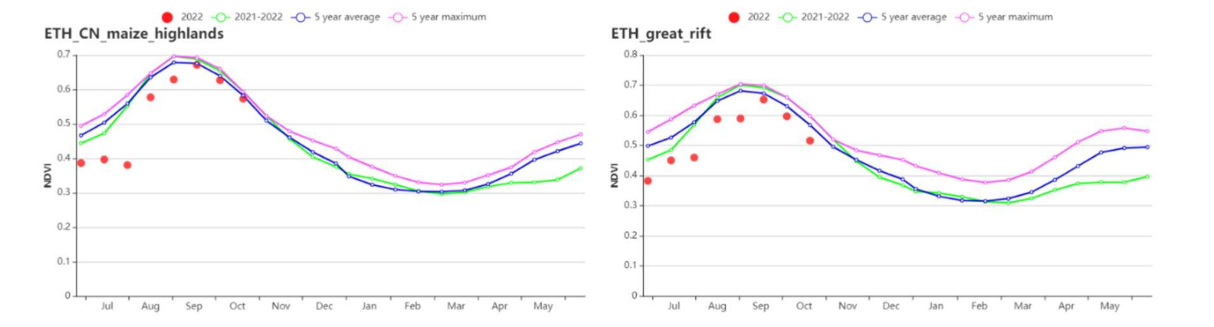
(e) NDVI profiles



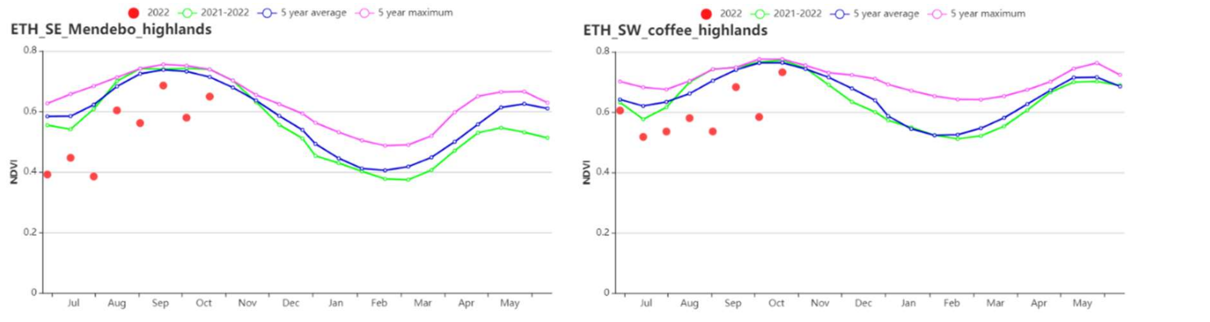


(f) Rainfall profiles

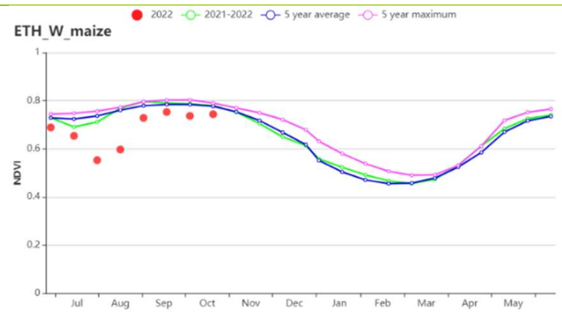
(g) Temperature profiles



(h) Crop condition development graph based on NDVI (Central-northern maize-teff highlands (left) Great Rift region (right))



(i) Crop condition development graph based on NDVI (South-eastern Mendebo highlands (left) and South-western coffee-enset highlands (right))



(j) Crop condition development graph based on NDVI (Western mixed maize zone)

Table 3.24 Ethiopia's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, July-October 2022

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	826	-15	17.0	0.0	1136	-8	892	-7
Great Rift region	213	-39	18.3	0.1	1160	-7	578	-19
South-eastern Mendebo highlands	365	-25	14.8	0.0	1046	-7	678	-15
South-western coffee-enset highlands	486	-50	17.4	0.3	1003	-8	864	-17
Western mixed maize zone	1170	-12	19.4	-0.3	1055	-3	1110	-9

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

Region	Cropped arable land fraction		Cropping intensity		Maximum VCI
	Current (%)	Departure (%)	Current (%)	Departure (%)	Current
Central-northern maize-teff highlands	100	1	107	-3	0.84
Great Rift region	98	-2	108	-9	0.93
South-eastern Mendebo highlands	100	0	123	-3	0.88
South-western coffee-enset highlands	100	0	138	-7	0.93
Western mixed maize zone	99	-1	126	3	0.67

[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 +2.4°C). Temperatures surpassed the 15-year maximum during several periods execpt in late September. RAIN was significantly lower than the average (RAIN -19%), especially in July and early August, which continued the trend of below-average precipitation observed during of the previous monitoring period. Sunshine was higher than the average (RADPAR +9%). Due to unfavorable rainfall and the relatively warm temperature conditions, the biomass production potential (BIOMSS) is estimated to have decreased by 4% nationwide compared to the 15-year average. Cropping intensity was slightly below average by 1%. The national-scale NDVI development graph shows that the NDVI values were also significantly below the trend of the 5-year average, but reached close to average values in early October. The spatial distribution of maximum VCI (VCIx) across the country reached 0.80. CALF decreased by 1%. Overall, persistent drought and warmer-than-usual temperatures during the summer season caused unfavorable growth conditions for all of 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: (78) **Northern barley region**, (82) **Mixed maize/barley and rapeseed zone from the Center to the Atlantic Ocean**, (79) **Maize-barley and livestock zone along the English Channel**, (80) **Rapeseed zone of eastern France**, (75) **Massif Central dry zone**, (81) **Southwestern maize zone**, (76) **Eastern Alpes region** and (77) **the Mediterranean zone**.

In the **Northern barley region**, warmer (TEMP +2.2°C) and sunnier (RADPAR +14%) weather was observed while RAIN was far below average (RAIN -31%) over the monitoring period. The BIOMSS also decreased by 11% when compared to the 15-year average. The CALF was at the average level, and VCIx was relatively low at 0.73. Cropping intensity increased by 4%. Crop condition development based on NDVI for this region was below the 5-year average, only close to the average level in early October.

In the **Mixed maize/barley and rapeseed zone from the Center to the Atlantic Ocean**, warmer (TEMP +2.6°C), sunnier (RADPAR +10%) but drier (RAIN -18%) conditions were observed during the monitoring period. BIOMSS was at the average level, but the NDVI profile showed the regional crop conditions were lower than average levels except in early October, when it was above the average. Cropping intensity was higher than the average level by 4%. The CALF decreased by 1%, and VCIx was 0.80.

In the **Maize-barley and livestock zone along the English Channel**, TEMP and RADPAR were above average by 2.3°C and 12%. RAIN was lower than the average (-15%). BIOMSS decreased by 4%. Cropping intensity increased by 8%. CALF was average and VCIx was 0.80. The regional NDVI profile also presented an overall lower-than-average trend, but was close to average levels in early 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 August and then above average in September and October. Overall, RAIN in this period was 27% lower than the 15-year average, while TEMP increased by 2.2°C and RADPAR by 13%. BIOMSS was about 9% lower than average, while CALF was at the average level, and VCIx was 0.87. Cropping intensity was lower than the average level by 1%.

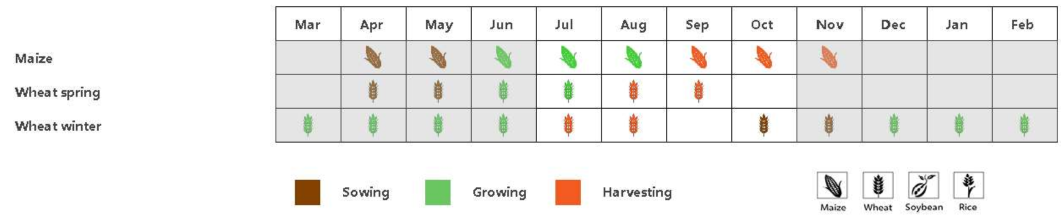
In the **Massif Central dry zone**, TEMP and RADPAR were 2.3°C and 10% higher than the average, respectively, while RAIN decreased by 19%. CALF was at the average level. Cropping intensity decreased by 3%. The VCIx was relatively high at 0.88 and BIOMSS decreased by 4%. Crop conditions of this region based on the NDVI profile were close to the average trend in July and dropped to below-average levels in August, but improved to average levels in September and October.

The **Southwestern maize zone** is one of the major irrigated regions in France. The regional NDVI profile presented a below-average trend during the whole monitoring period. The VCIx was low (0.75). BIOMSS was 8% lower than average. CALF had decreased by 2%. Cropping intensity was below the average by 10%. RAIN in the period was below average (RAIN -24%), while TEMP was 2.4°C higher than average, and RADPAR increased by 6%.

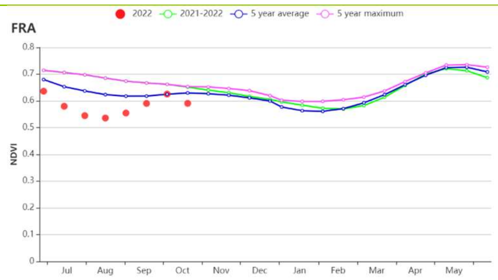
In the **Eastern Alpes region**, the NDVI profile presented a below-average and then above- average trend. RAIN in the region was 10% lower than average, while TEMP was higher than average (+2.1°C) and RADPAR was 7% higher than the 15YA. BIOMSS was at the 15-year average. Cropping intensity was 5% lower than average. VCIx for the region was recorded at 0.83 and CALF was at the average level.

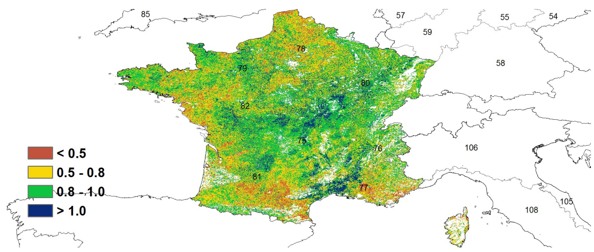
The **Mediterranean zone** also indicated an overall below-average NDVI profile, but it improved to average levels in late September and early October. The region recorded a relatively low VCIx (0.75). RADPAR (+ 2%) and TEMP (+3°C) were above average, while RAIN was lower than average (-11%). Cropping intensity decreased by 6%. BIOMSS increased by 5% and CALF slightly decreased by 1%.

Figure 3.17 France's crop condition, July - October 2022



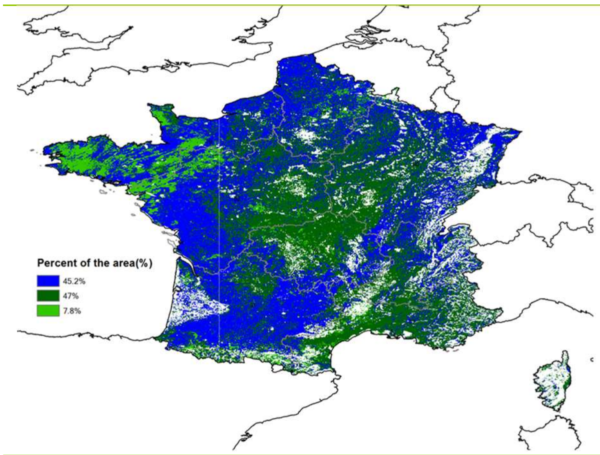
(a). Phenology of major crops

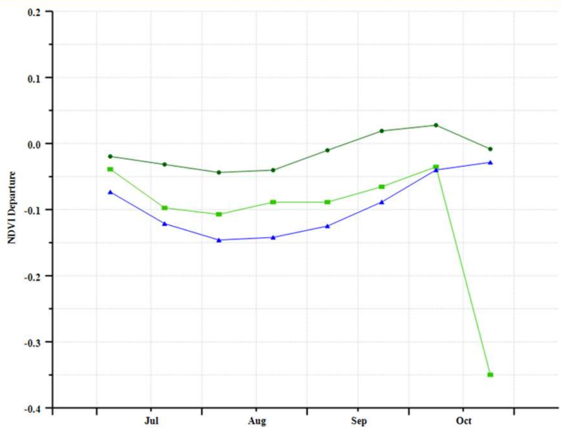




(b) Crop condition development graph based on NDVI

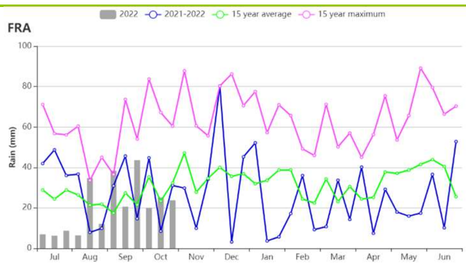
(c) Maximum VCI



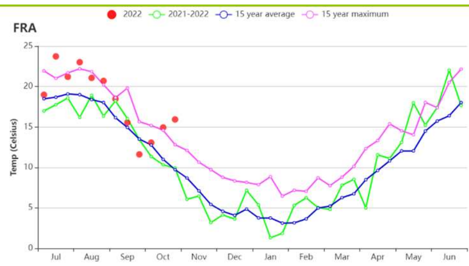


(d) Spatial NDVI patterns compared to 5YA

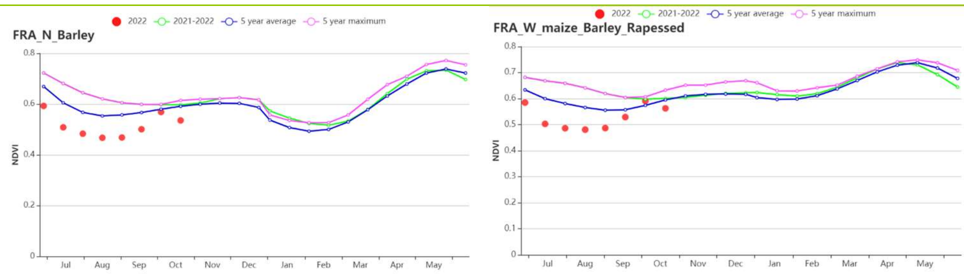
(e) NDVI profiles



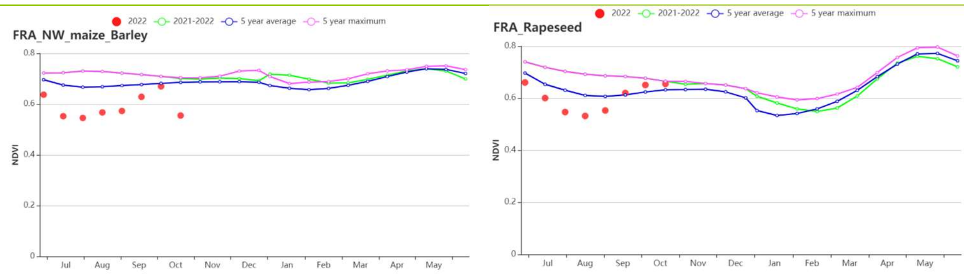
(f) Rainfall profiles



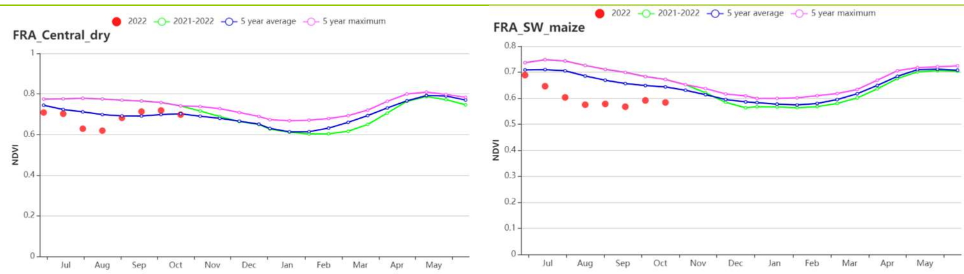
(g) Temperature profiles



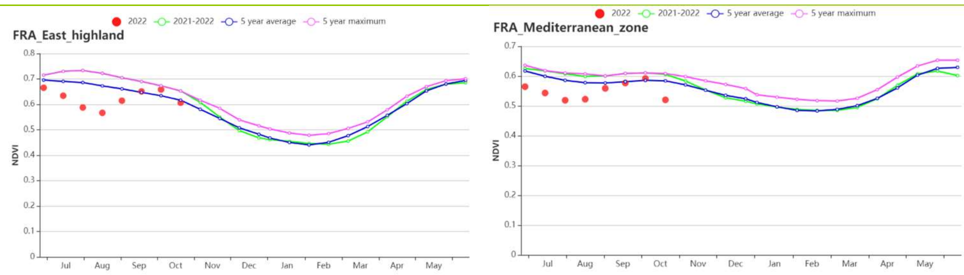
(h) Crop condition development graph based on NDVI (Northern barley region (left) and Mixed maize, Barley and Rapeseed zone (right))



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



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



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

Table 3.26 France's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, July - October 2022

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Northern Barley zone	199	-31	17.7	2.2	976	14	663	-11
Mixed	206	-18	19.2	2.6	1044	10	706	0

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m^2)	Departure (%)	Current (gDM/m^2)	Departure (%)
maize/barley and rapessed zone from the Centre to the Atlantic Ocean								
Maize barley and livestock zone along the English Channel	229	-15	17.7	2.3	971	12	685	-4
Rapeseed zone of eastern France	262	-27	17.3	2.2	1059	13	731	-9
Massif Central Dry zone	255	-19	17.3	2.3	1127	10	763	-4
Southwest maize zone	227	-24	19.1	2.4	1133	6	724	-8
Alpes region	391	-10	16.5	2.1	1148	7	851	0
Mediterranean zone	258	-11	19.6	3.0	1182	2	762	5

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

Region	Cropped arable land fraction		Cropping intensity		Maximum VCI
	Current (%)	Departure (%)	Current (%)	Departure (%)	Current
Northern Barley zone	99	0	117	4	0.73
Mixed maize/barley and rapessed zone from the Centre to the Atlantic Ocean	98	-1	109	4	0.80
Maize barley and livestock zone along the English Channel	100	0	125	8	0.80
Rapeseed zone of eastern France	100	0	105	-1	0.87
Massif Central Dry zone	100	0	101	-3	0.88
Southwest maize zone	98	-2	95	-10	0.75
Alpes region	98	0	100	-5	0.83
Mediterranean zone	93	-1	106	-6	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 LKA MAR MEX MMR MNG MOZ NGA PAK PHL POL ROU RUS 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 wheat had started. According to the crop condition development graph, crops experienced unfavorable conditions. NDVI values were below average in the monitoring period. Agro-climatic indicators show that rainfall was below average (RAIN, -22%), while the temperature and radiation were significantly above average (TEMP +1.4℃, RADPAR +9%). The seasonal RAIN profile shows that the rainfall was below average until early September. The temperature was above or close to the 15YA. The below-average rainfall caused a below-average BIOMSS (-8%).

The national average VCIx was 0.80. It was lower than during the corresponding period in 2021. Crop production index was 0.9, slightly below average. CALF (100%) was unchanged compared to its five-year average. The NDVI departure cluster profiles indicate that: (1) 24.8% of arable land experienced average crop conditions, scattered over the whole UK. (2) 24.3% of arable land experienced below-average crop conditions, mainly in the south of the UK. （3）The other areas experienced fluctuating crop conditions. The marked drop in September and October in some areas can be attributed to cloud cover in the satellite images or foggy conditions. Altogether, the conditions in the UK are assessed as below-average.

Regional analysis

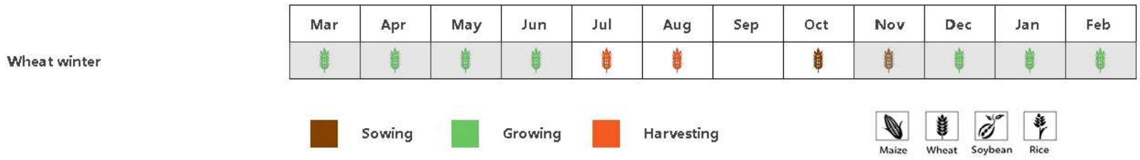
Based on cropping systems, climatic zones, and topographic conditions, three sub-national regions are described below: **Northern barley region （84）**, **Central sparse crop region （83）** and **Southern mixed wheat and barley region （85）**. All three sub-regions are characterized by an unchanged fraction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

In the **northern barley region**, NDVI was below average. Rainfall was below average (RAIN -16%), while temperature (TEMP +0.9℃) and radiation (RADPAR +3%) were above average. Estimated biomass was near average. This region is cultivated with a mixture of single and double cropping systems, and the CI (-1%) was slightly below average, while the VCIx was at 0.91. Crop production index was 1.1. Conditions were near average.

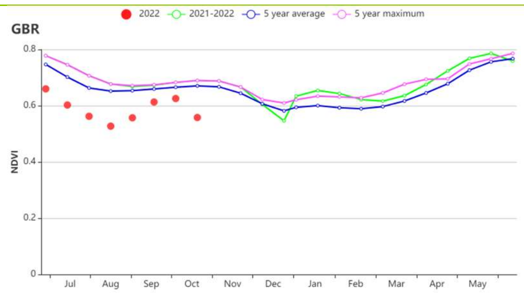
The **Central sparse crop region** is one of the country's major agricultural regions for crop production. The crop condition development graph based on NDVI was similar to the northern barley region. Rainfall was significantly below average (RAIN -26%), temperature (TEMP +1.3℃) and radiation (RADPAR +9%) were above average. The unfavourable crop conditions and below-average rainfall resulted in below-average biomass（BIOMSS -9%). This region is cultivated with a mixture of single and double cropping systems, and the CI was below average (-5%), while the VCIx was at 0.88. Crop production index was 1.0. Overall, the situation was below average.

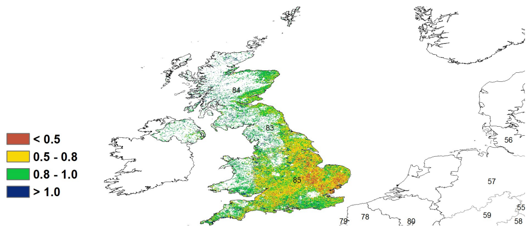
In the **Southern mixed wheat and barley zone**, NDVI was also below average. This region experienced the largest rainfall deficit (RAIN -28%), whereas temperature (TEMP +1.8°C) and radiation (RADPAR +13%) were significantly above average. The below-average rainfall resulted in the markedly below-average biomass (BIOMSS -15%). This region is cultivated with a mixture of single and double cropping systems, and the CI was close to average, while the VCIx was at 0.75. Crop production index was 0.9. Overall, the conditions were below average.

Figure 3.18 United Kingdom's crop condition, July - October 2022



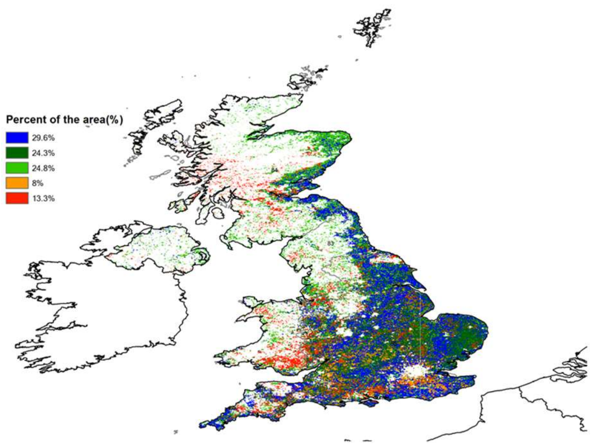
(a). Phenology of major crops

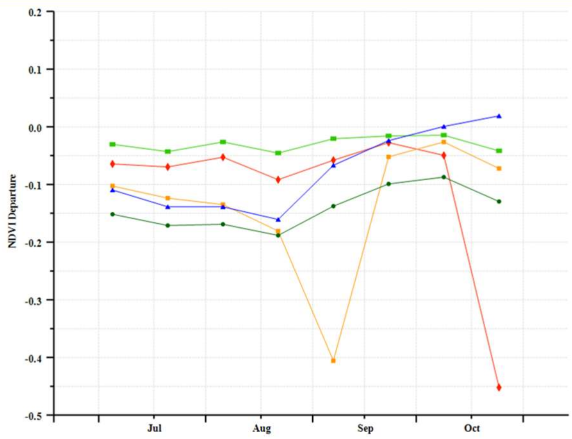




(b) Crop condition development graph based on NDVI

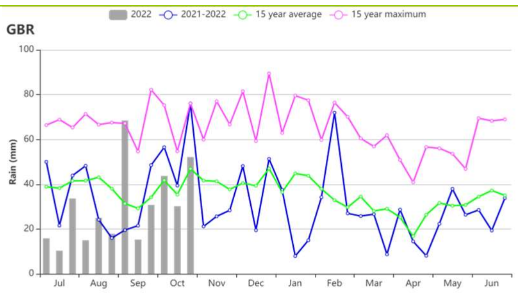
(c) Maximum VCI





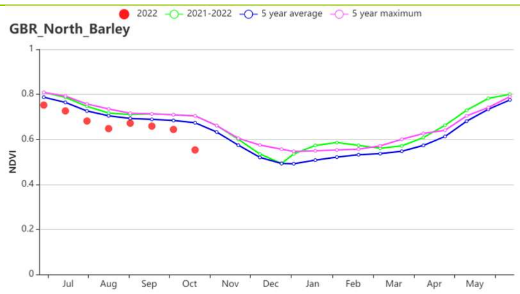
(d) Spatial NDVI patterns compared to 5YA

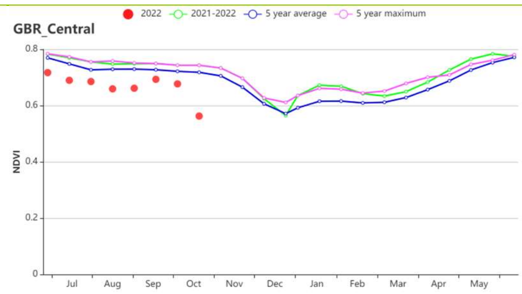
(e) NDVI profiles



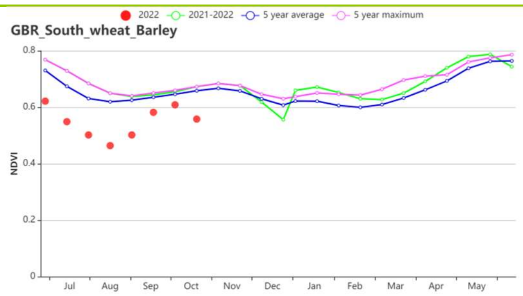
(f) Rainfall profiles

(g) Temperature profiles





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



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

Table 3.28 United Kingdom's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, July - October 2022

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m^2)	Departure (%)	Current (gDM/m^2)	Departure (%)
Northern Barley region(UK)	485	-16	12.2	0.9	600	3	826	0
Central sparse crop region (UK)	360	-26	13.9	1.3	688	9	787	-9
Southern mixed wheat and Barley zone (UK)	252	-28	15.9	1.8	811	13	665	-15

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

Region	Cropped arable land fraction		Cropping intensity		Maximum VCI
	Current (%)	Departure (%)	Current (%)	Departure (%)	Current
Northern Barley region(UK)	100	0	106	-1	0.91
Central sparse crop region (UK)	100	0	113	-5	0.88
Southern mixed wheat and Barley zone (UK)	100	0	120	0	0.75

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

[HUN] Hungary

During this 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.

At the national level, accumulated rainfall was below average (RAIN -37%), temperature increased by 1.2°C, and radiation was average. BIOMSS was below average (BIOMSS -17%) due to lower rainfall from July to mid-August as compared to the 15YA. According to the national NDVI development graphs, crop conditions were below average from July to mid-September, which were mainly due to lower rainfall during this period. However, drought conditions in Hungary had already started in May. Conditions improved in October. The maximum VCI value reached 0.77 at the national level and the cropped arable land fraction (CALF) was at 99%. Crop Production Index (CPI) was 0.95. Crop production in Hungary is expected to be below average.

Some spatial and temporal detail is provided by the NDVI clusters: All of Hungary was below average from July to early September, the key growing period for summer crops, such as maize. Abundant rainfall in late September improved the situation, which may have helped with the establishment of the new winter wheat crop. However, that increase in rainfall had no effect on the summer crops, as they had already reached maturity by late September.

Regional analysis

Based on cropping systems, climatic zones and topographic conditions, Hungary is divided into four sub-regions: 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 NDVI development graphs, crop conditions were below average from July to mid-September, which was mainly due to below-average rainfall. Agro-climatic conditions include below-average rainfall (RAIN -41%) and radiation (RADPAR -1%), and above-average temperature (TEMP +1.5°C). Biomass was below average (BIOMSS -17%) due to the lower rainfall. The VCIx was 0.76. CALF was 99% (-1%). CPI was 0.90. Cropping intensity was 104% (+1%). The crop production in this region is expected to be below average.

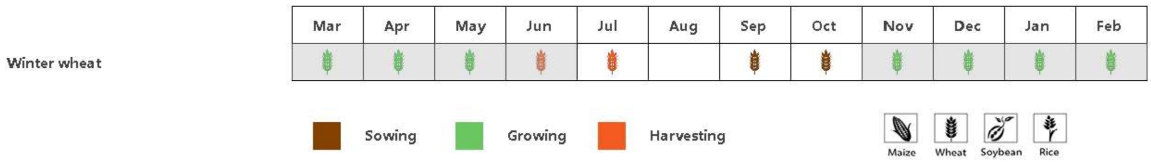
The Puszta (86) region mainly grows winter wheat, maize and sunflower, especially in the counties of Jaz-Nagykum-Szolnok and Bekes. According to the NDVI development graphs, crop conditions were below average from July to mid-September, mainly due to lower rainfall from June to mid-August, above the 5-year maximum in late September and early October, and average in mid to late October. Total rainfall was below average (-37%). Temperature was above average (TEMP +1.1°C) and radiation was average. Biomass was below average (BIOMSS -17%) due to the lower rainfall. The maximum VCI was 0.75. CALF was 99% (-1%). CPI was 0.94. Cropping intensity was 104% (-2%). The crop production in this region is expected to be below average.

Northern Hungary (88) is another important winter wheat region. According to the NDVI development curve, crop conditions were below average from July to mid-September, which was mainly due to low rainfall, which was far below average (RAIN -42%). Temperature was above average (TEMP +1.5°C), and radiation was below average (RADPAR -2%). Estimated biomass decreased (BIOMSS -20%) due to the lower rainfall. The maximum VCI was 0.70. Cropping intensity was 105% (-2%). CALF was 99% (-1%). CPI was 0.98. So the crop production in this region is expected to be below average.

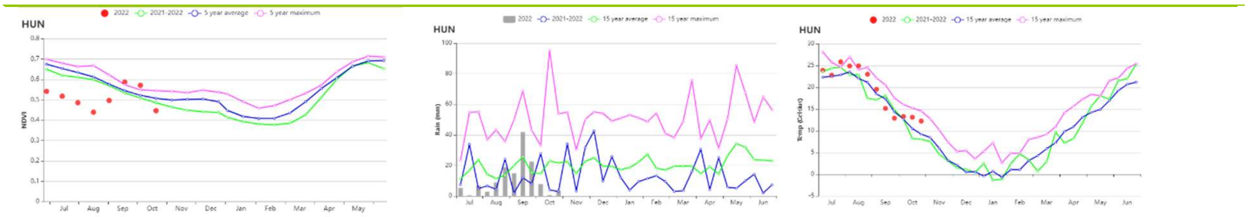
Southern Transdanubia (89) cultivates winter wheat, mostly in Somogy and Tolna counties. Crop conditions were below average from July to mid-September, which was mainly due to lower rainfall from June to mid-August, close to average in late September and early October, and fell to below average in mid to late October. The rainfall was below average (RAIN -36%). Temperature was above average (TEMP

+1.2°C), and radiation was average. Estimated biomass decreased (BIOMSS -16%) due to the lower rainfall. The maximum VCI was 0.77. Cropping intensity was 104% (-4%). CALF was 100%. CPI was 0.99. The crop production in this region is expected to be below average.

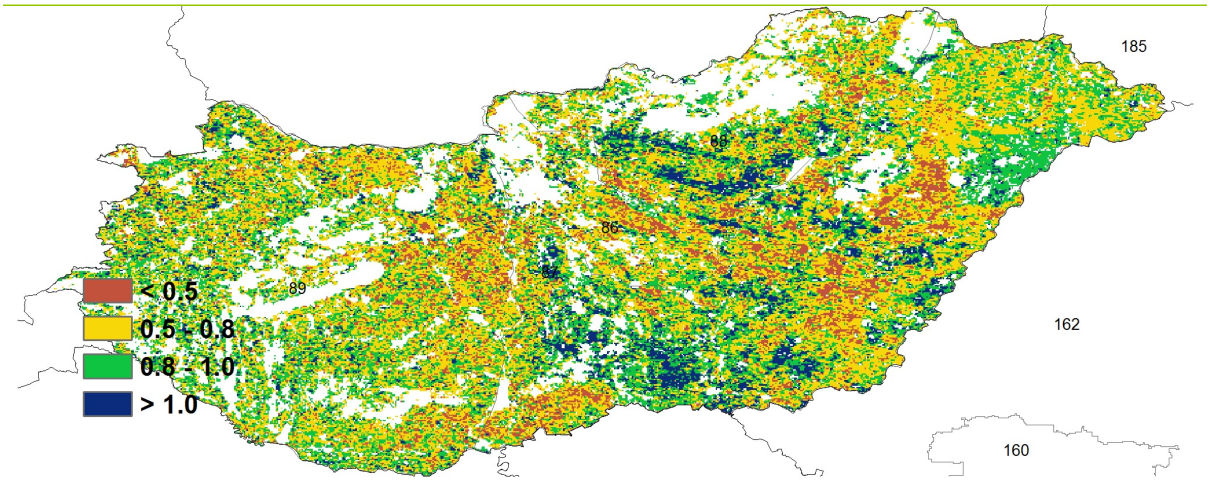
Figure 3.19 Hungary's crop condition, July -October 2022



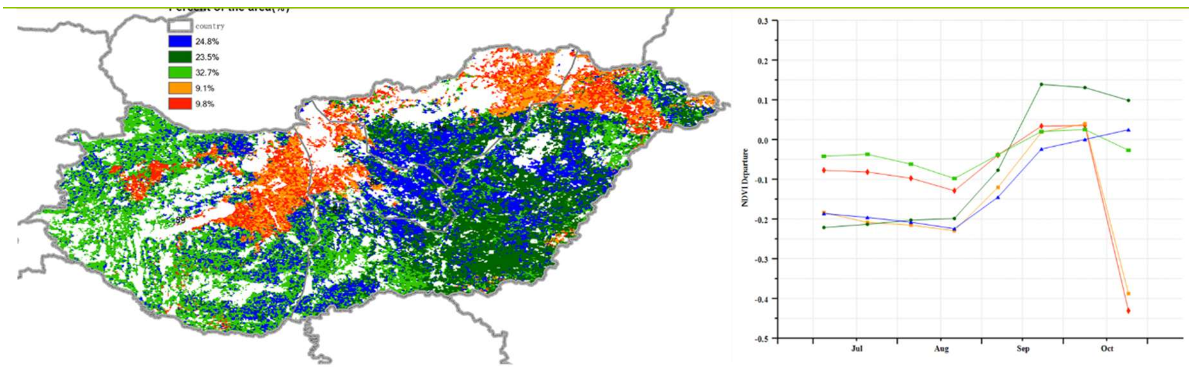
(a). Phenology of major crops



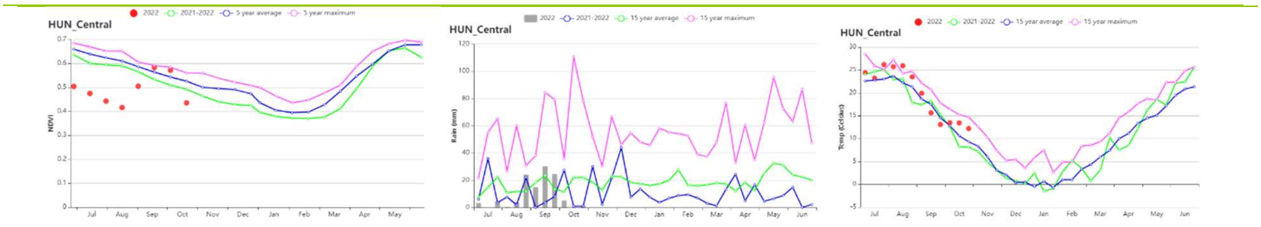
(b) Crop condition development graph based on NDVI, RAIN and TEMP



(c) Maximum VCI

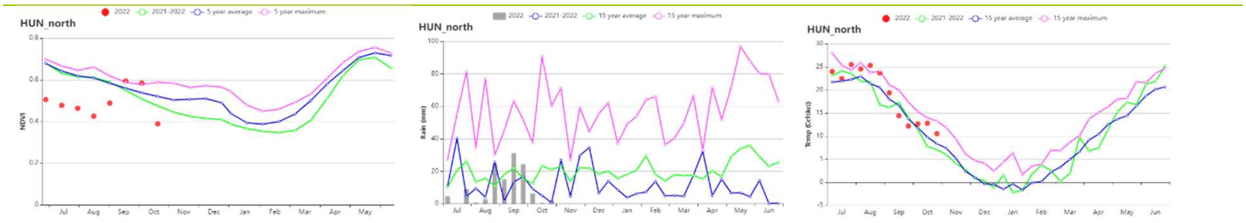


(d) Spatial distribution of NDVI profiles.

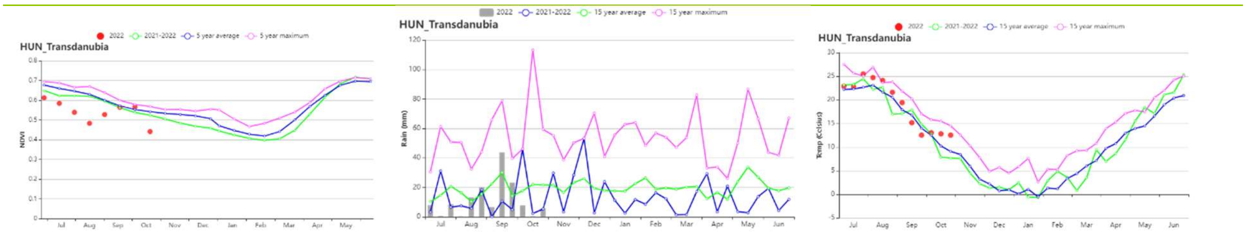


(e) Crop condition development graph based on NDVI, RAIN and TEMP

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



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



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

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

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Central region	112	-41	19.7	1.5	1025	-1	525	-17
North Hungary	120	-42	19.0	1.5	982	-2	517	-20
Puszta	130	-37	19.8	1.1	1033	0	555	-17
Transdanubia	138	-36	18.9	1.2	1039	0	562	-16

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

Region	Cropped arable land fraction		Cropping Intensity		Maximum VCI
	Current (%)	Departure (%)	Current (%)	Departure (%)	Current (%)
Central region	**99**	**-1**	**104**	**1**	**0.76**
North Hungary	**99**	**-1**	**105**	**-2**	**0.70**
Puszta	**99**	**-1**	**104**	**-2**	**0.75**

Region	Cropped arable land fraction		Cropping Intensity		Maximum VCI
	Current (%)	Departure (%)	Current (%)	Departure (%)	Current (%)
Transdanubia	100	0	104	-4	0.77

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[IDN] Indonesia

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

CropWatch agroclimatic indicators show that precipitation and temperature were above the 15YA (RAIN +19%, TEMP +0.1°C), and radiation was close to average (RADPAR 0%), which resulted in an estimate of potential biomass production that was above the average (BIOMASS +12%).

According to the national NDVI development graph, crop conditions were below average over the reporting period, however, there were large differences among the regions. NDVI clusters and profiles showed that 35.2% of arable land, located in Semarang, Java, Madura, Nusa Tenggara Barat, Nusa Tenggara Timur, Kupang, and Sulawesi were close to or below average. About 64.8% of arable land, located in Kalimantan, Sumatra, Medan, and Palembang, was below average in late August and late September, but returned to normal in October.

The area of cropped arable land (CALF 100%) in Indonesia was comparable to the 5YA and the VCIx was 0.94. Cropping intensity (CI -5%) was below the five-years-average. The Crop Production Index (CPI) in this country was 1, while the crop production situation was normal. The national production was anticipated to be above the average, mainly due to the favorable conditions on Java island.

Regional analysis

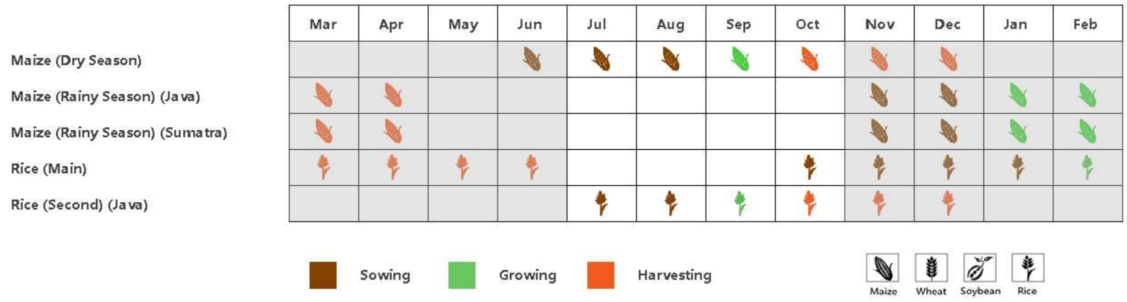
CropWatch focuses on four agro-ecological zones, namely **Sumatra** (92), **Java** (90), **Kalimantan and Sulawesi** (91), and **West Papua** (93), among which the former three are the most relevant for crop cultivation. **Java** is the main agricultural region in this country. The numbers of the zones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

Java experienced rainy conditions in this monitoring period. Radiation (RADPAR -2%) was below the 15YA, whereas temperature and precipitation were above the 15YA (TEMP +0.1° C, RAIN +99%). The increase of rainfall brought an increase in the potential biomass production (BIOMASS +37%). According to the NDVI development graph, crop conditions were close to or slightly above the 5YA. However, due to the influence of clouds in the satellite images, crop conditions were shown as below the five-years-average in October, which was an artifact. Cropping intensity (CI 0%) was close to the five-years-average. The Crop Production Index (CPI) in Java was 1, which indicates normal conditions. Overall, crop conditions in Java were expected to be above the average.

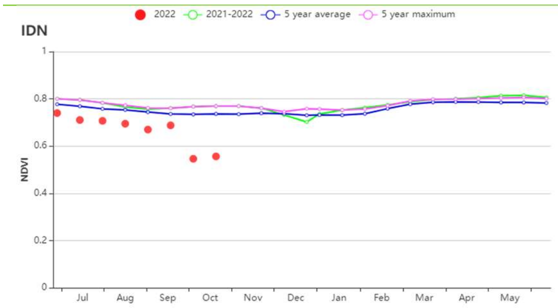
In the **Kalimantan and Sulawesi** region, radiation was below the average (RADPAR -1%), but precipitation and temperature were above the average (RAIN +26%, TEMP +0.1°C). Adequate rainfall resulted in a potential biomass production increase (BIOMSS +12%). The NDVI development graphs show that crop conditions were below the 5YA. The sharp drop in October was presumably due to cloud cover in the satellite images or flooding conditions. Cropping intensity (CI -4%) was below the five-years-average. The Crop Production Index (CPI) in **Kalimantan and Sulawesi** was 1, and the crop production situation was normal. Crop conditions in this region were assessed as average.

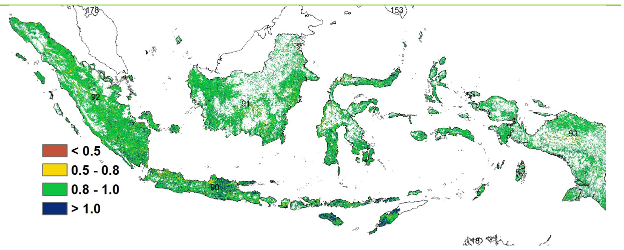
In **Sumatra**, radiation was below the average (RADPAR -2%), and temperature was close to average (TEMP 0°C), while precipitation was above the average (RAIN +11%). Rainy conditions led to the increase of the potential biomass production (BIOMSS +7%). As shown in NDVI development graphs, crop conditions were below the average. However, due to the influence of clouds, crop conditions were below the 5YA in October. Cropping intensity was below the five-years-average (CI -13%). The Crop Production Index (CPI) in **Sumatra** was 1, the crop production situation was normal. Crop conditions in **Sumatra** were anticipated to be average.

Figure 3.20 Indonesia's crop condition, July – October 2022



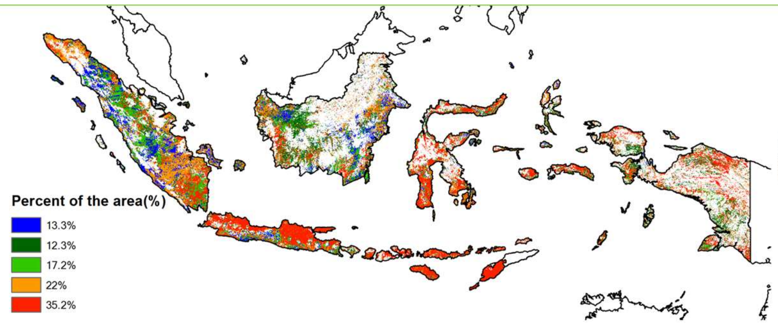
(a). Phenology of major crops

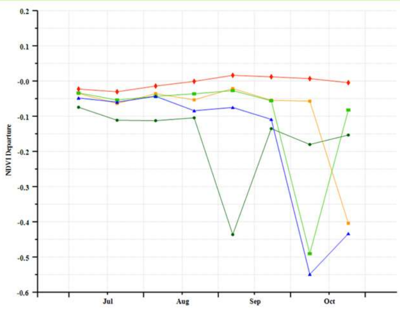




(b) Crop condition development graph based on NDVI

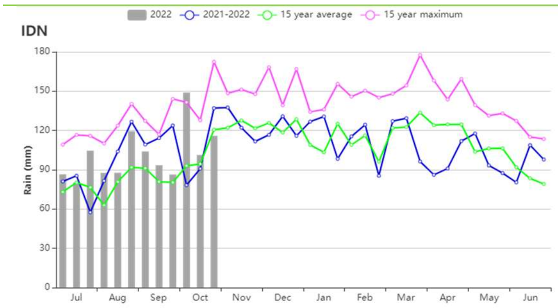
(c) Maximum VCI

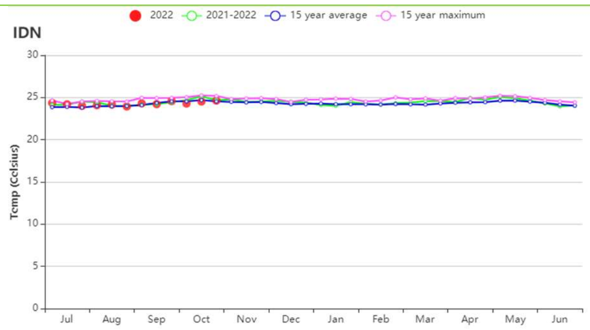




(d) Spatial NDVI patterns compared to 5YA

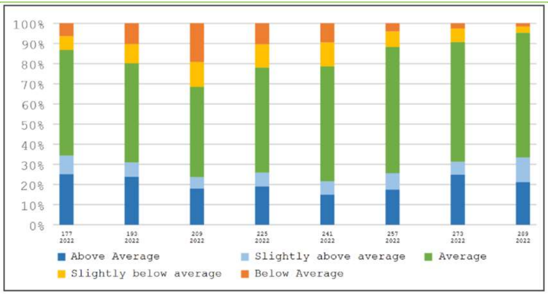
(e) NDVI profiles



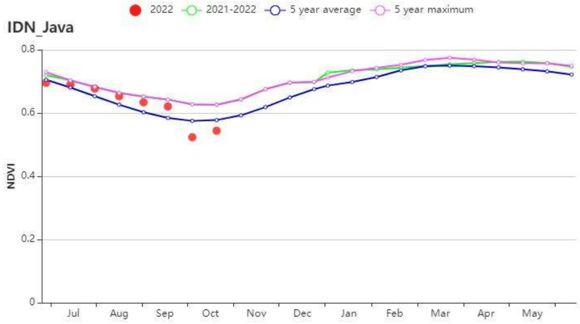


(f)Rainfall profiles

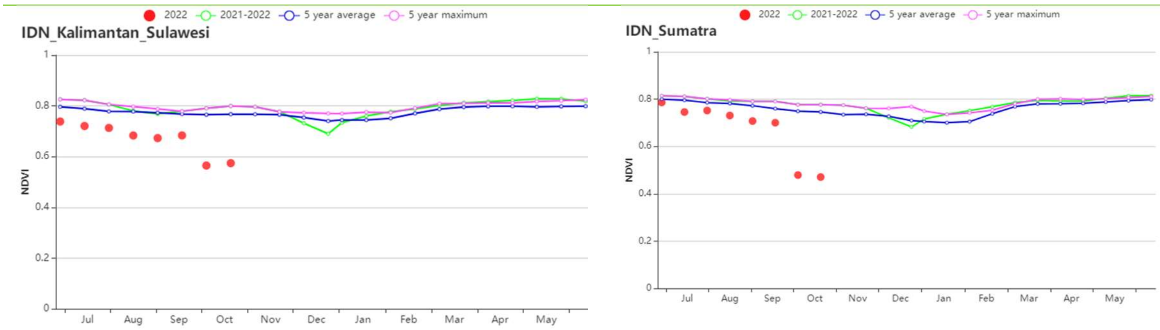
(g)Temperature profiles



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



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



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

Table 3.32 Indonesia's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, July – October 2022

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure from 15YA(%)	Current (°C)	Departure from 15YA(°C)	Current (MJ/m²)	Departure from 15YA(%)	Current (gDM/m²)	Departure from 15YA(%)
Java	658	99	24.9	0.1	1259	-2	1106	37
Kalimantan and Sulawesi	1225	26	24.5	0.1	1191	-1	1500	12
Sumatra	1051	11	24.6	0.0	1166	-2	1451	7
West Papua	1641	6	23.3	0.4	1021	5	1390	7

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

Region	Cropped arable land fraction		Cropping Intensity		Maximum VCI
	Current (%)	Departure from 5YA(%)	Current (%)	Departure from 5YA(%)	Current
Java	99	1	123	0	0.95
Kalimantan and Sulawesi	100	0	128	-4	0.94
Sumatra	100	0	114	-13	0.93
West Papua	100	0	131	0	0.94

[IND] India

The current monitoring period covers the monsoon season, during which the main rice crop (Kharif) is grown. It is planted at the beginning of monsoon in June and harvested in October. Other major crops grown during this monitoring period are maize and soybean. Rabi wheat sowing started in late October. The graph of NDVI development shows that the crop conditions were below average in general, except in August.

The CropWatch agroclimatic indicators show that nationwide, TEMP and RADPAR were above average (+0.1°C and +6% respectively), whereas RAIN was slightly below the 15YA (-11%). The increased TEMP and RADPAR compensated for the low rainfall, resulting in a BIOMSS increase by 8% compared with the 15YA. The overall VCIx was high, with a value of 0.93. As can be seen from the spatial distribution, only the Northwestern region recorded values below 0.80 and most of India had high VCIx values. These spatial patterns of VCIx were thus generally consistent with those of NDVI. The southern and northern regions showed above-average crop conditions while the conditions were slightly below average in the central regions. The spatial distribution of NDVI profiles shows that 21.4% of the areas showed below-average crop conditions in the central regions throughout the monitoring period. From late July to early September, 78.6% of the areas showed average or above-average crop conditions in northern and southern regions. CALF increased by 1% compared to the 5YA. The CPI was 1.11 indicating that the agroclimatic indicators were generally favorable.

Regional analysis

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

The three agro-ecological zones of the **Eastern coastal region**, **the Gangetic plain and Assam** and **north-eastern regions** showed similar trends in agricultural indices. Compared to the same period of previous years, RAIN was below average, especially in the Gangetic plain (-38%), but the TEMP and RADPAR were above average, resulting in a BIOMSS that was above the 15-year average. CALF was above average in all of the three regions. The cropping intensity was average, indicating cropland utilization rate was normal. The graph of NDVI development shows that the crop growth was close to or above the 5-year average in most of the period. It is worth noting that the sharp drop in October in the Eastern coastal region was caused by cloud cover in the satellite images. The CPI was above 1.10 indicating that the crop production situation was expected to be near average.

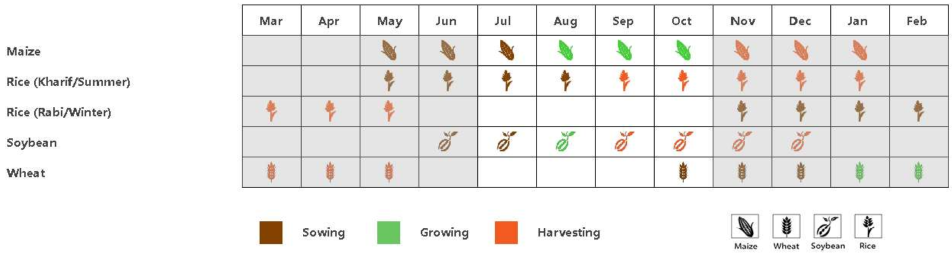
The **Deccan Plateau** and the **Agriculture areas in Rajasthan and Gujarat regions** showed similar trends in agricultural indices. Compared to the same period of previous years, RAIN and RADPAR were slightly above average, but TEMP was slightly below average. The BIOMSS was above the 15-year average benefitting from abundant rainfall. CALF was above average. The cropping intensity was average, indicating cropland utilization rate was normal. The graph of NDVI development shows that the crop growth of the two regions was close to or above the 5-year average in most of the period. It is worth noting that the sharp drop in July in these two regions was caused by cloud cover in the satellite images. The CPI was above 1.10 indicating that the crop production situation was near average.

The **Western coastal region** recorded 1392 mm of RAIN, which was slightly below average. TEMP was close average (-0.3°C), and RADPAR was above the 15YA (+4%). BIOMSS was above the 15YA (+8%) benefit from abundant sunshine. CALF was 99% which was higher than the 5-year average, and VCIx was 0.93. The cropping intensity was average, indicating cropland utilization rate was normal. The graph of NDVI development shows that the crop growth of this region during the monitoring period was below the 5-year average in most of the period. Cloud cover in the satellite images caused the sharp drop in July. The CPI was 1.14 indicated that the crop production situation was expected to be below average.

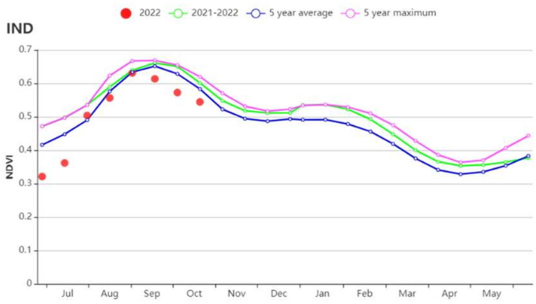
The **North-western dry region** recorded 807 mm of RAIN, which was significantly above the average (+108%). TEMP was significantly below average (-1.6°C), and RADPAR was slightly below the 15YA (-5%). BIOMSS was significantly above the 15YA (+41%) benefitting from abundant rainfall. CALF was 67% which was a significant increase over the 5-year average (+57%), and VCIx was 1.06. The cropping intensity was average, indicating cropland utilization rate was normal. The graph of NDVI development shows that the crop growth of this region during the monitoring period was above the 5-year average in most months, and even above 5-year maximum in August and September. The CPI was 1.47 indicating that the crop production situation was expected to be above average.

The **Western Himalayan region** recorded 537 mm of RAIN, which was significantly below average (-41%), whereas TEMP and RADPAR were above average (+1.5°C, +2%). BIOMSS was significantly below the 15YA (-7%) due to the low rainfall. CALF was 99% which was the same as the 5-year average, and VCIx was 0.95. The cropping intensity was average, indicating cropland utilization rate was normal. The graph of NDVI development shows that the crop growth of this region during the monitoring period was close to or below the 5-year average. The CPI was 1.13 indicating that the crop production situation was expected to be close to average.

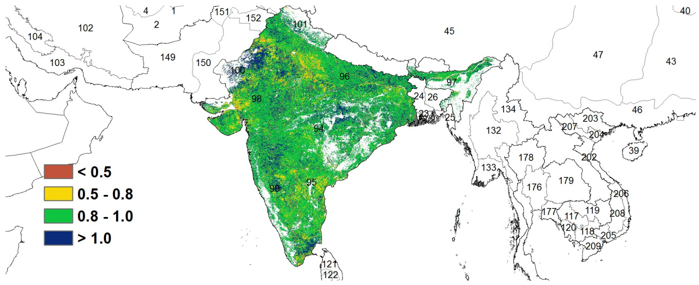
Figure 3.21 India's crop condition, July - October 2022



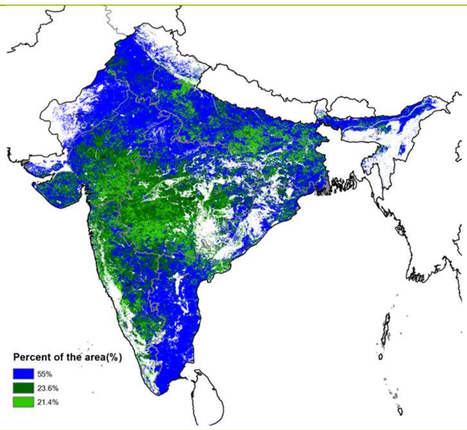
(a). Phenology of major crops



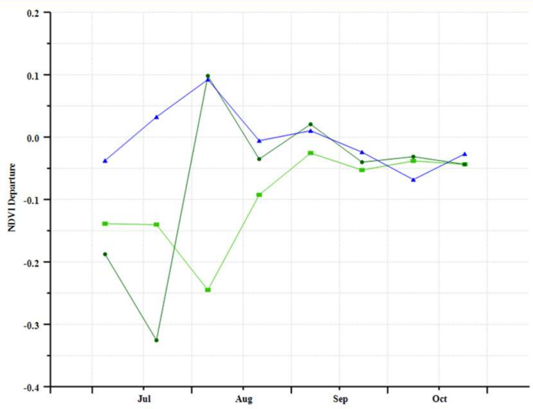
(b) Crop condition development graph based on NDVI



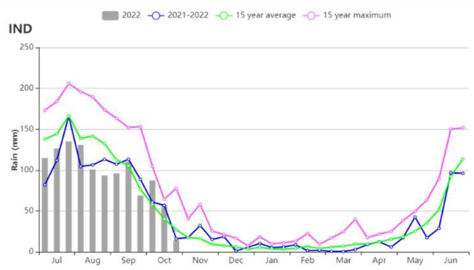
(c) Maximum VCI



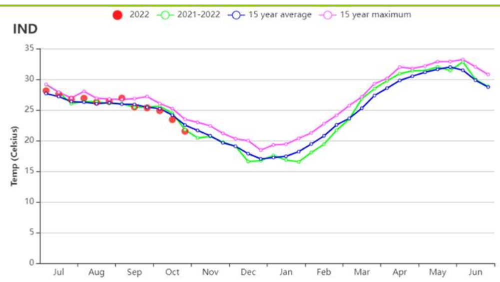
(d) Spatial NDVI patterns compared to 5YA



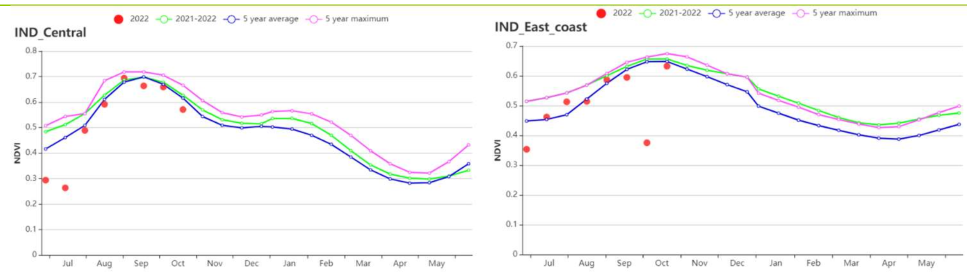
(e) NDVI profiles



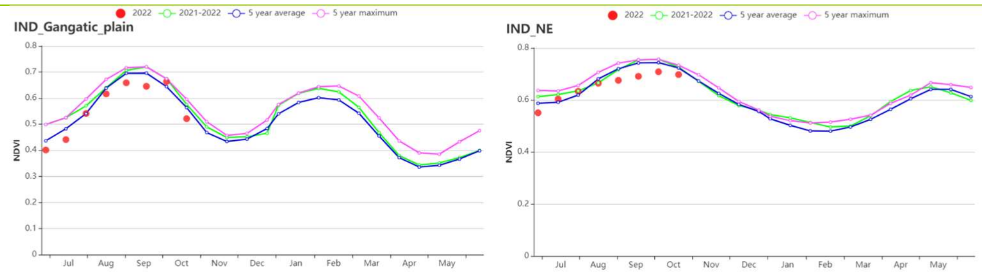
(f) Rainfall profiles



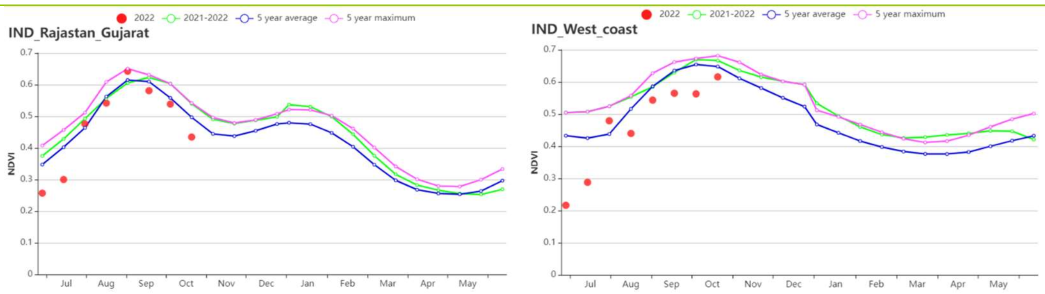
(g) Temperature profiles



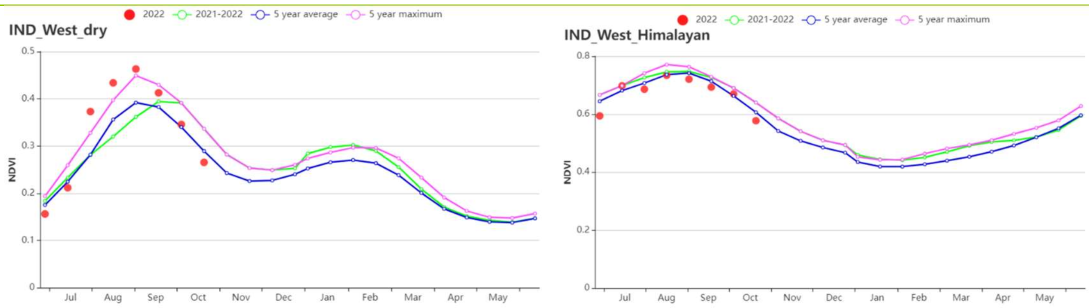
(h) Crop condition development graph based on NDVI (Deccan Plateau (left) and Eastern Coastal Region (right))



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



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



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

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

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Deccan Plateau	1179	7	25.3	-0.1	1109	5	1466	12

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m^2)	Departure (%)	Current (gDM/m^2)	Departure (%)
Eastern coastal region	987	-6	26.8	0.4	1164	5	1362	2
Gangatic plain	951	-18	27.5	0.2	1181	5	1383	5
Assam and north-eastern regions	1537	-38	24.4	0.6	1108	21	1444	1
Agriculture areas in Rajastan and Gujarat	1080	9	26.6	-0.8	1093	2	1328	15
Western coastal region	1392	-2	23.7	-0.3	1008	4	1369	8
North-western dry region	807	108	29.1	-1.6	1158	-5	1145	41
Western Himalayan region	537	-41	20.1	1.5	1233	2	824	-7

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

Region	Cropped arable land fraction		Cropping intensity		Maximum VCI
	Current (%)	Departure (%)	Current (%)	Departure (%)	Current
Deccan Plateau	99	0	132	8	0.93
Eastern coastal region	96	3	124	11	0.90
Gangatic plain	98	1	197	14	0.92
Assam and north-eastern regions	96	1	143	1	0.93
Agriculture areas in Rajastan and Gujarat	97	3	147	12	0.91
Western coastal region	99	3	127	19	0.93
North-western dry region	67	57	137	6	1.06
Western Himalayan region	99	0	130	13	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 LKA MAR MEX MMR MNG MOZ NGA PAK PHL POL ROU RUS THA TUR UKR USA UZB VNM ZAF ZMB

[IRN] Iran

The harvest of summer crops (irrigated potatoes and rice) was almost over by the end of August, while winter crops (wheat and barley) started to be sown in September. According to the NDVI-based crop condition development graph, the crop conditions in Iran during this whole monitoring period were worse than the 5-year average. The accumulative rainfall was down by 13%. The photosynthetically active radiation was 1% above average, whereas the average temperature was 0.8℃ above average. The potential biomass was 1% smaller than the 15-year average. The national maximum vegetation condition index (VCIx) was 0.47, while the cropped arable land fraction (CALF) was 2% smaller than the average of the past 5-years. The national average Crop Production Index (CPI) was 0.92, indicating an unfavorable crop production status.

The NDVI spatial patterns show that from July to October, 24% (marked in blue) and 4% (marked in dark green) of the cropped area had average or slightly above the 5-year average crop conditions throughout the whole monitoring period. The remaining cropped area experienced below-average crop conditions. 3.6% of the cropped area (marked in orange) had the worst below-average crop conditions, mainly located in some parts of Khuzestan and Ardebil. The spatial pattern of maximum Vegetation Condition Index (VCIx) was in accord with the spatial distribution of the NDVI profiles. Although crop production during this period relied on irrigation, the generally drier-than-usual conditions had a negative impact on production. 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.

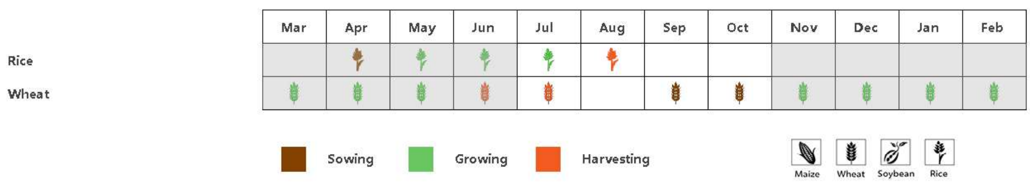
Regional analysis

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** and the **coastal lowland in the arid red sea plain area**.

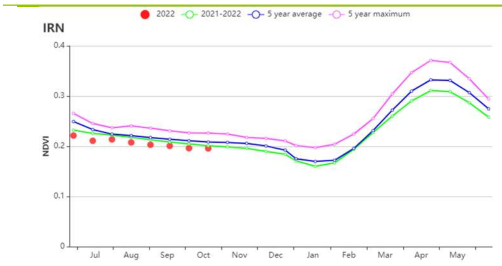
In the **semi-arid to the subtropical hilly region in the west and the north**, the cumulative precipitation during the monitoring period was 49 mm, 28% below average. Temperature was 0.9℃ above average and photosynthetically active radiation was slightly above the 15YA (+2%). The potential biomass was 6% lower than average. Crop conditions were below the 5-year average. The proportion of cultivated land was 12%, which was 1% smaller than the 5YA. Cropping intensity (CI) was slightly above the 5YA (+3%). The average VCIx for this region was 0.5, indicating an unfavorable crop prospect.

In the **coastal lowland in the arid red sea plain area**, the temperature was 0.7℃ above average. Although the accumulated precipitation was 376% above average, the total was just 61 mm. The photosynthetically active radiation was 2% below average. The potential biomass was 22% higher than the 15-year average. Crop conditions were generally below-average to average compared with 5YA. During the monitoring period, CALF was 10% below the 5YA, while CI was 103% (2% below the 5YA). The value of VCIx was 0.45, also indicating unfavorable crop prospects.

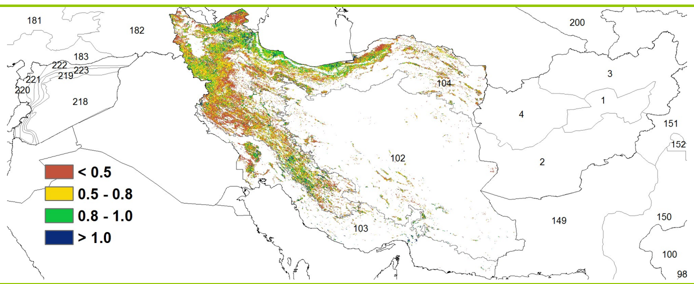
Figure 3.22 Iran's crop condition, July - October 2022



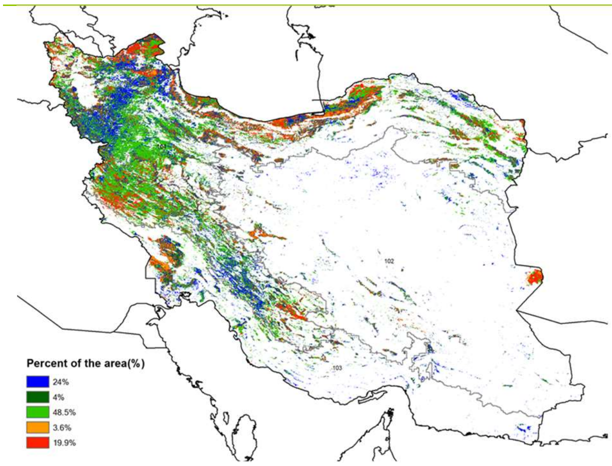
(a). Phenology of major crops



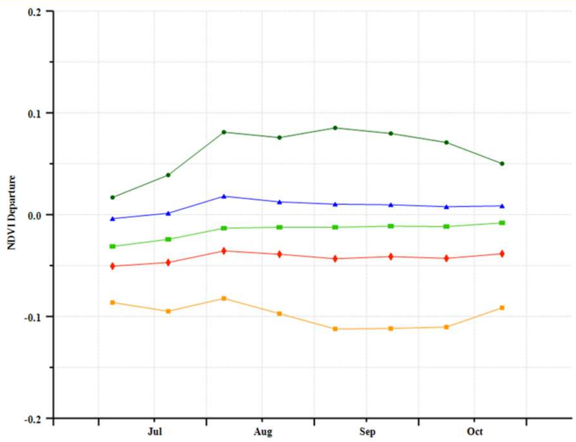
(b) Crop condition development graph based on NDVI



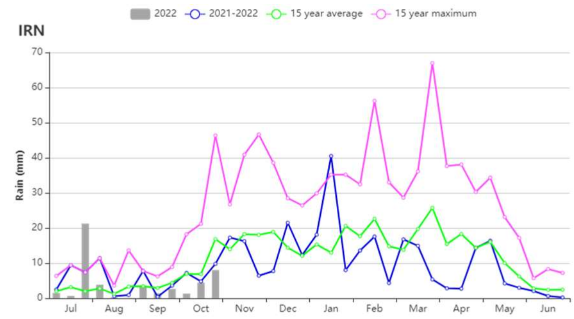
(c) Maximum VCI



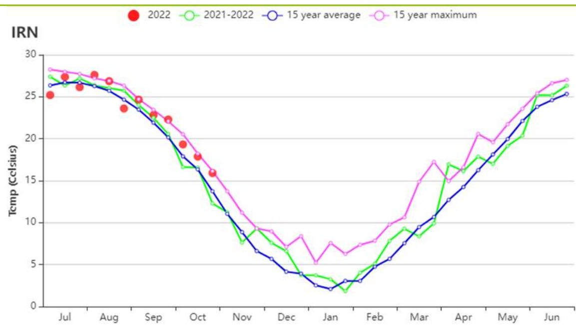
(d) Spatial NDVI patterns compared to 5YA



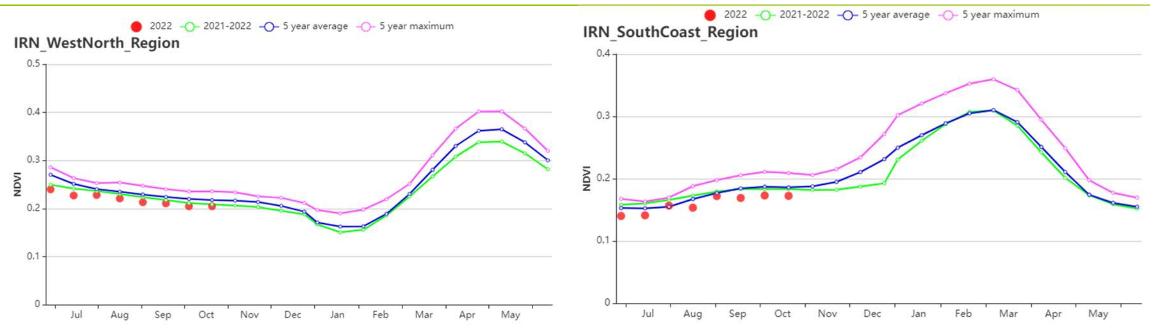
(e) NDVI profiles



(f) Rainfall profiles



(g) Temperature profiles



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

Table 3.36 Iran's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, July - October 2022

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
semi-arid to the subtropical hilly region in the	49	-28	21.7	0.9	1431	2	439	-6

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m^2)	Departure (%)	Current (gDM/m^2)	Departure (%)
west and the north								
coastal lowland in the arid red sea plain area	61	376	33.6	0.7	1439	-2	521	22

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

Region	Cropped arable land fraction		Cropping intensity		Maximum VCI
	Current (%)	Departure (%)	Current (%)	Departure (%)	Current
semi-arid to the subtropical hilly region in the west and the north	12	-1	106	3	0.5
coastal lowland in the arid red sea plain area	7	-10	103	-2	0.45

[ITA] Italy

During this reporting period, winter wheat harvest was completed in July. The new crop was sown in October. Based on the agroclimatic and agronomic indicators, the crop conditions in Italy were below the 5-year average during this reporting period.

At the national level, rainfall was below the 15YA (-4%). The radiation and temperature were unchanged. Potential biomass production was 1% above average. CALF was 85%. The national VCIx was 0.75. The crop condition development graph indicates that NDVI was below average in July and August, and near the 5YA in September and October. In summary, the overall crop conditions were far below average in July and August.

About 18.6% of the crops (areas in red color), mainly located in the north Italy (Piemonte and Lombardia), showed a positive departure from the 5YA from September to October. 11.0% of arable land experienced below-average crop conditions (areas in light green color), scattered in Umbria, Molise and Marche. About 21.4% (areas in green color) of arable land, mainly in Lombardia, Lazio and Sardegna, experienced below-average crop conditions between July and August, above-average conditions between September and October. On about 20.0% (areas in yellow color) of arable land, NDVI was near average. For the remaining 19.1% (areas in blue color) of arable land, NDVI remained above average. The crop production index was 0.91.

Regional analysis

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

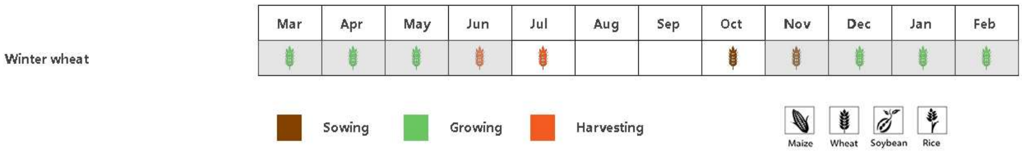
East coast (mainly in Puglia, Marche and Abruzzi) experienced below-average rainfall (RAIN -20%), above-average temperature (TEMP +1%) and solar radiation (RADPAR +1%). The precipitation was above average in early August and September, but below average in July and October. The potential biomass production showed a decrease (BIOMSS -3%). VCIx was 0.73. The Cropping Intensity was 104%, cropped arable land fraction was 58%, and crop production index was 0.87. The crop condition development graph indicates that NDVI was below average in July and August and conditions were generally below average.

Crop production in the **Po Valley** (mainly in Piemonte, Lombardia and Veneto) was affected by slightly higher rainfall (RAIN +8%) and temperature (TEMP +2%). The solar radiation was unchanged. BIOMSS was above the 15YA by 10% and VCIx was 0.70. The Cropping Intensity was 101%, Cropped arable land fraction was 97%, crop production index was 0.84. The crop condition development graph indicates that the crop condition was far below average in July and August. According to the agro-climatic indicators, a below-average output can be expected, especially due to the poor conditions in July and August and conditions were generally below average.

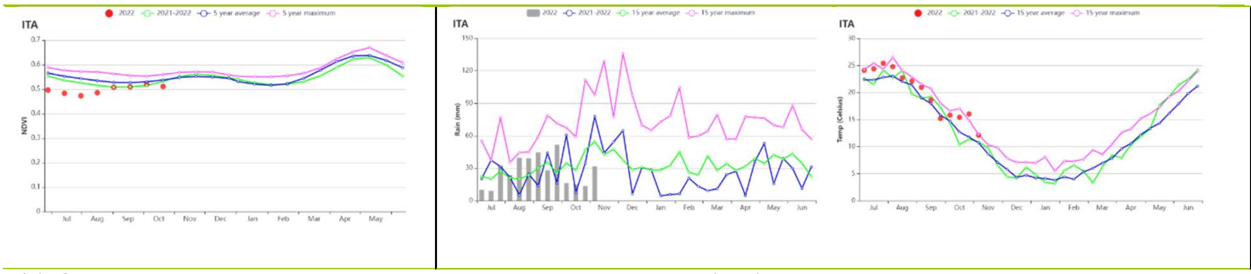
The Islands recorded below-average precipitation (RAIN -40%) and slightly above-average temperature (TEMP +2°C). RADPAR was slightly below average (-1%). BIOMSS decreased by 11% compared with the 15YA. The maximum VCI was only 0.68, which is the lowest among the four AEZs in Italy. And the Cropping Intensity is the lowest in the four regions. Crop production index reached 1.14, the highest in the AEZs. NDVI was very close to average throughout the monitoring period. The crop production in this region is expected to be slightly below average.

In **Western Italy**, RAIN was below average (-15%) and TEMP was above average (+2%). The RADPAR was unchanged. The precipitation was below average in July and August, and the biomass production potential decreased in this region by 4%. The Cropping Intensity was 125%, which is the highest in the four AEZs. The NDVI was slightly below average in July and August. VCIx was 0.69. CropWatch expects a significant below-average production.

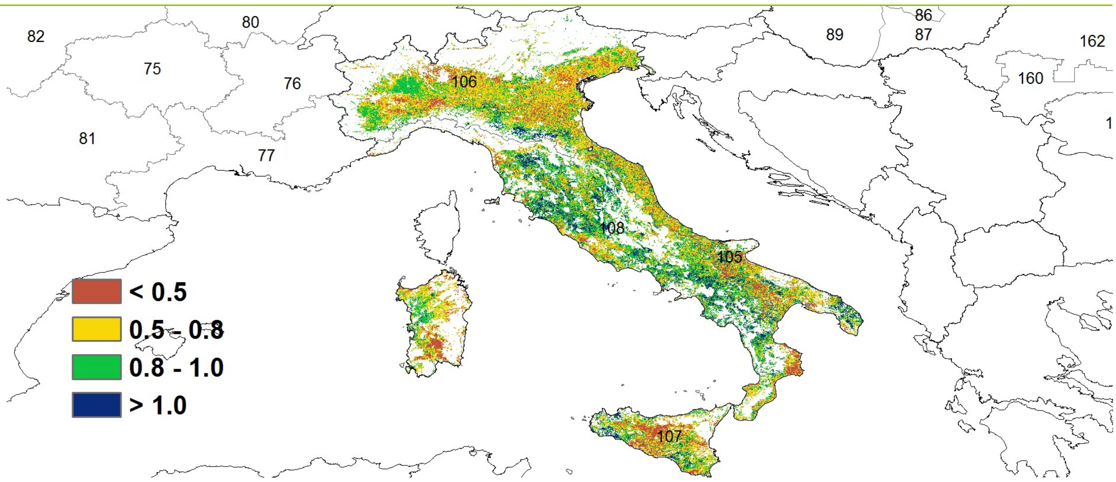
Figure 3.23 Italy's crop condition, July 2022- October 2022



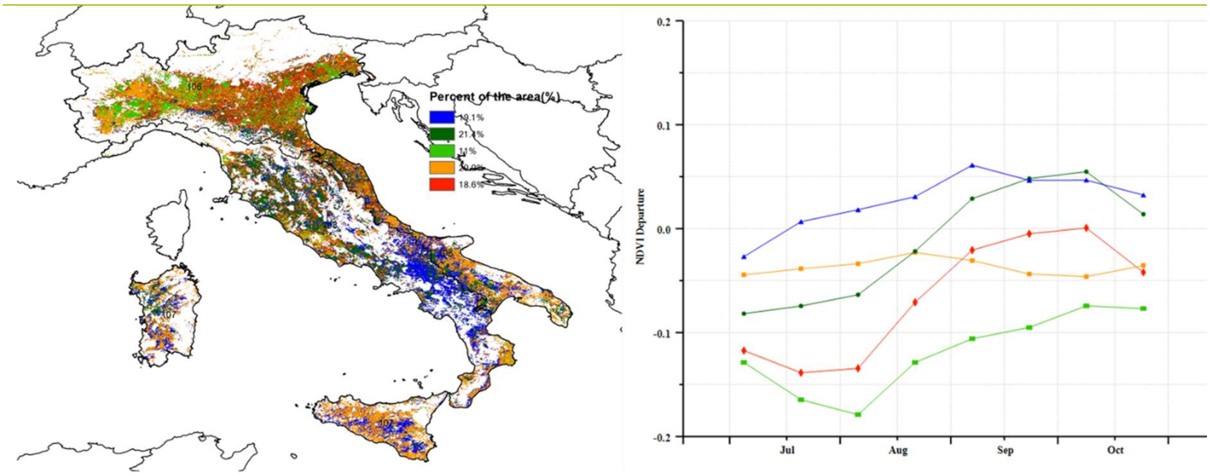
(a) Phenology of major crops



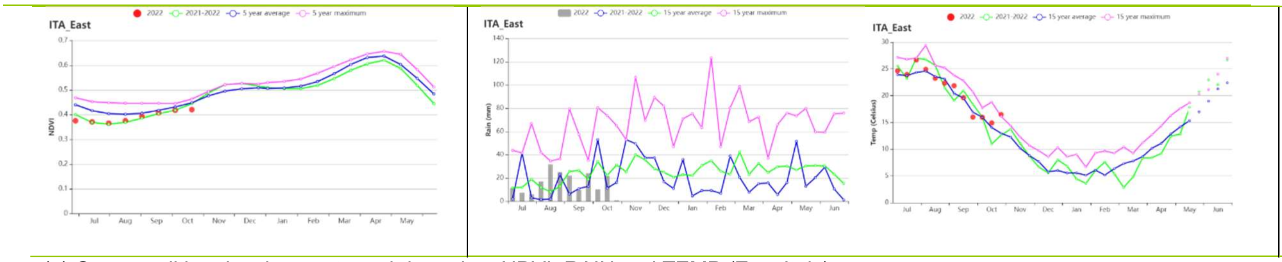
(b) Crop condition development graph based on NDVI, RAIN and TEMP (Italy).



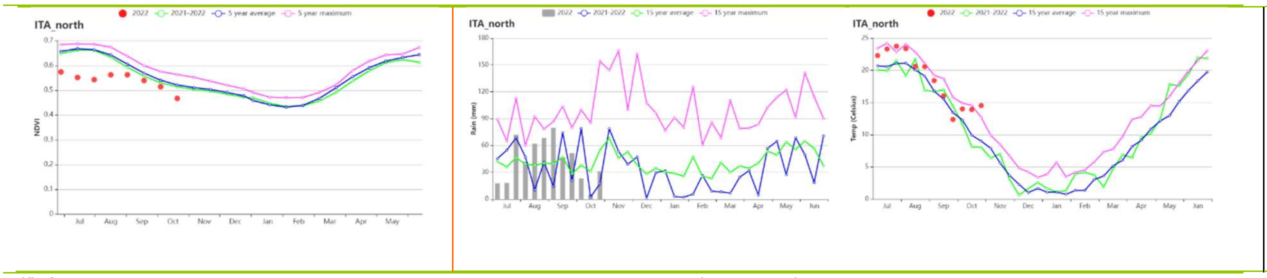
(c) Maximum VCI



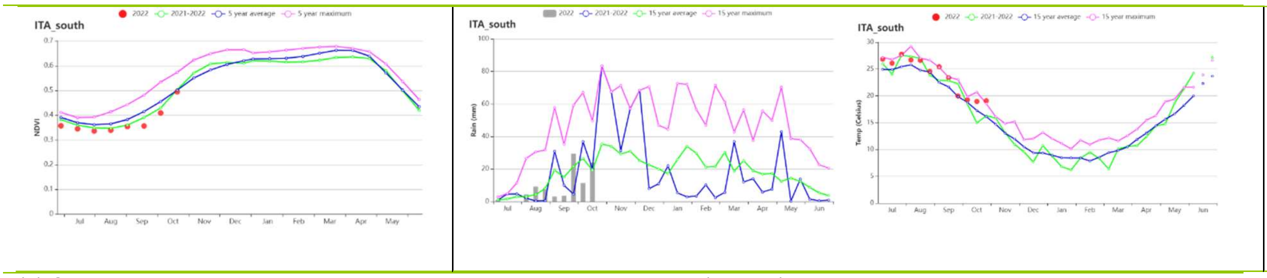
(d)Spatial distribution of NDVI profiles.



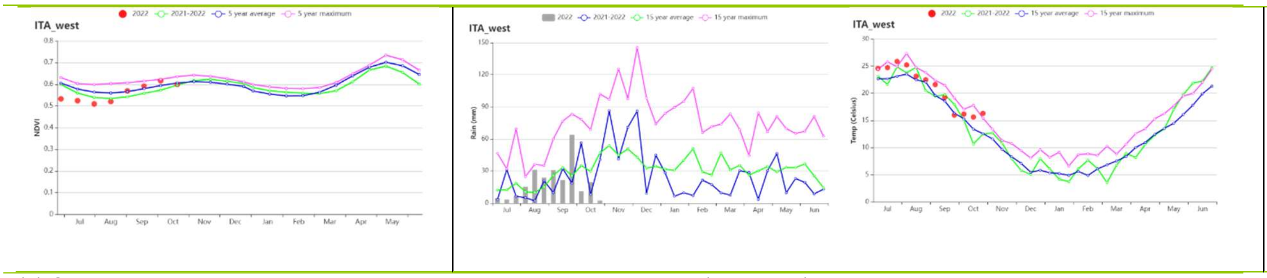
(e) Crop condition development graph based on NDVI, RAIN and TEMP (East Italy).



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



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



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

Table 3.38 Italy's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, April 2022-July 2022

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
East Coast	186	-20	21	1	1177	1	714	-3
Po Valley	517	8	19	2	1084	0	945	10
Islands	94	-40	24	2	1269	-1	599	-11
Western Italy	234	-15	21	2	1171	0	737	-4

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

Region	Cropped arable land fraction		Maximum VCI	Cropping Intensity	
	Current (%)	Departure (%)	Current	Current (%)	Departure (%)
East Coast	58	-6	0.73	104	-3

Region	Cropped arable land fraction		Maximum VCI	Cropping Intensity	
	Current (%)	Departure (%)	Current	Current (%)	Departure (%)
Po Valley	97	-3	0.70	101	-3
Islands	64	3	0.68	90	-12
Western Italy	91	-4	0.69	125	4

[KAZ] Kazakhstan

This report covers the growth and harvest of spring wheat In Kazakhstan. Crop production in Kazakhstan is mostly rainfed, as only 3% of the cropland is under irrigation. Compared to the last year's level, the crop conditions were generally favorable.

Compared to the 15-year average, accumulated rainfall, temperature and radiation were above average (RAIN +20%, TEMP +0.2°C, RADPAR +3%). The dekadal precipitation was above average from July to mid-August and exceeded the 15-year maximum in late October. The dekadal temperature fluctuated along the average level and reached the 15-year maximum in early and late September and mid-October.

The favorable weather conditions resulted in an increase of the BIOMSS index by 10%.

However, the national average maximum VCI index was 0.73 and the Cropped Arable Land Fraction (CALF) was below average by 9%. The cropping intensity was close to average. The spatial VCIx map mostly matched well with the national crop condition development graphs. About 64.9% of croplands, which were distributed in most areas of the central north region, experienced below-average crop conditions from August to October. However, during that period the harvest of wheat had already started. The crop conditions in 35% of the cropland were above average from August to September in most Aktube state in the northwest region, and some areas of Kostanay, Soltustik kazakstan, Akmola and Shyghys states in the northern region.

According to the agro-climate and agronomic indicators of CropWatch, the output of spring wheat in this season is estimated to be below 5-year average, but higher than last year's average, despite of a relatively low crop production index (CPI, 0.92).

Regional analysis

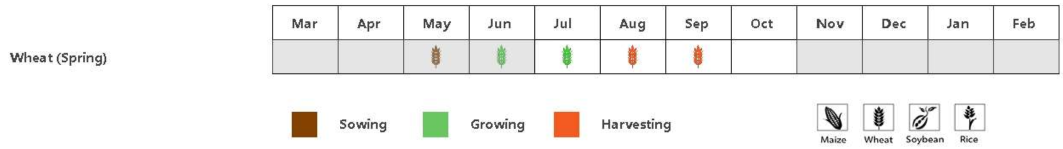
Based on cropping systems, climatic zones and topographic conditions, four sub-national agro-ecological regions can be distinguished for Kazakhstan, among which three are relevant for crop cultivation: the Northern region (112), the Eastern plateau and southeastern region (111) and the South region (110).

The **Northern region** is the main spring wheat production area. The accumulated precipitation, temperature and RADPAR were above average (RAIN +24%, TEMP +0.5°C, RADPAR +4%). The rainy and warm sunny weather resulted in an increase of BIOMSS by 14%. According to the NDVI profiles, crop conditions were above or close to last year's level from July to August. The average VCIx for this region was 0.73, and the proportion of cultivated land was 9% lower than the average. The cropping intensity was slightly below average by 1%. The CPI is 0.92. The spring wheat production is estimated to be higher than last year.

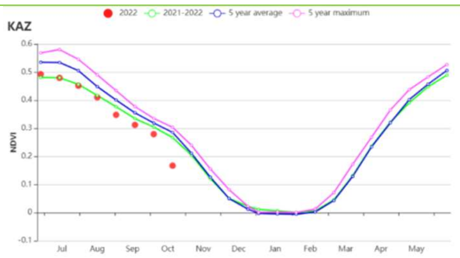
In the **Eastern plateau and southeastern region**, the average rainfall and RADPAR were above average (RAIN +14%, RADPAR +2%), while temperature was below average (TEMP -0.6°C). Crop conditions, as indicated by the NDVI were slightly below average and last year's level during the monitoring period. The average VCIx for this region was 0.76, and CALF was below average by 7%. Output for spring wheat is estimated to be near average.

Although the **South region** had the lowest precipitation (60mm) among the three regions, the rainfall was above average by 11%. The temperature was above average (TEMP +0.9°C), while the solar radiation was close to average. The combination of agro-climatic indicators resulted in a slight increase of the BIOMSS index by 4%. The average VCIx for this region was 0.65 and CALF was below average by 21%. The NDVI profiles show below-average conditions during the growth period of spring wheat.

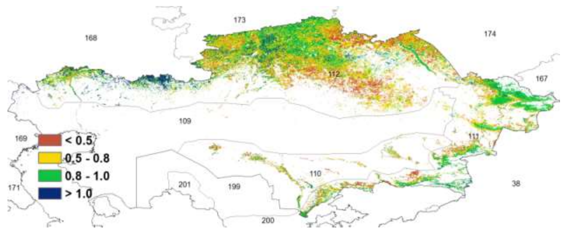
Figure 3.24 Kazakhstan's crop condition, July– October 2022



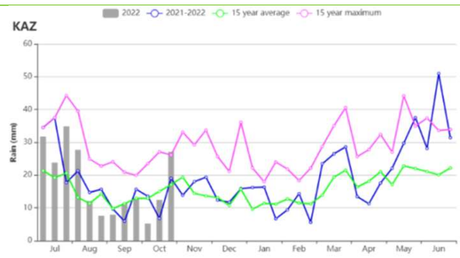
(a). Phenology of major crops



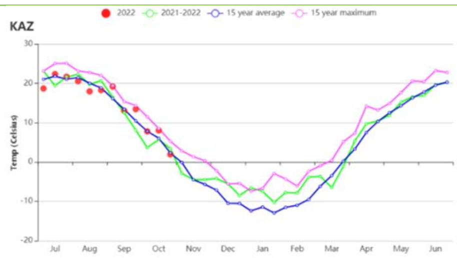
(b) Crop condition development graph based on NDVI



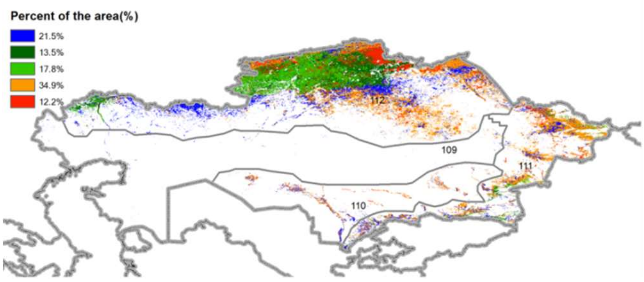
(c) Maximum VCI



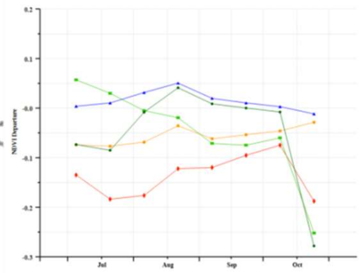
(d) Rainfall profiles



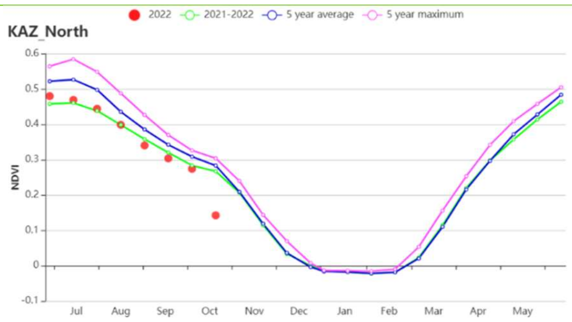
(e) Temperature profiles



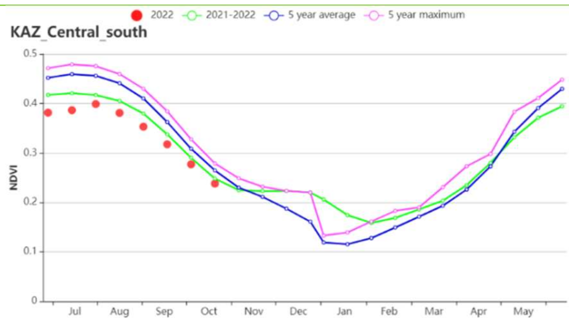
(f) Spatial NDVI patterns compared to 5YA



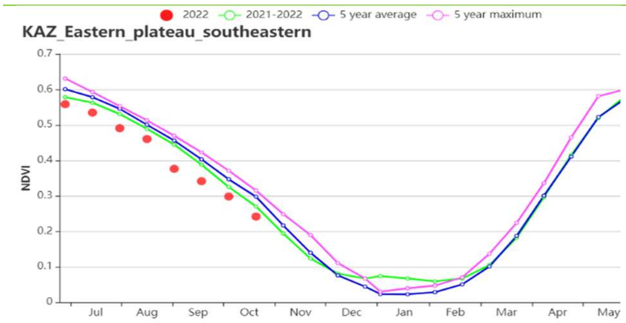
(g) NDVI profiles



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



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



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

Table 3.40 Kazakhstan agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, July – October 2022

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Northern region	206	24	15.1	0.5	970	4	615	14
Eastern plateau and southeastern region	267	14	14.2	-0.6	1180	2	594	1
South region	60	11	22.4	0.9	1255	0	491	4

Table 3.41 Kazakhstan, agronomic indicators by sub-national regions, current season's values and departure from 5YA, July – October 2022

Region	Cropped arable land fraction		Cropping Intensity		Maximum VCI
	Current (%)	Departure (%)	Current (%)	Departure (%)	Current
Northern region	68	-9	99	-1	0.73
Eastern plateau and southeastern region	75	-7	100	0	0.76
South region	45	-21	101	1	0.65

[KEN] Kenya

Kenya experiences two rainy seasons. The long rains last from March to late May and the short rains from late October to December. Maize is sown during long and short rains, while wheat is sown only during long rains. This report for the monitoring period from July to October 2022 covers the main growing period and harvesting stage of wheat.

At the national scale, Kenya is in severe drought. The precipitation was 183 mm, 47% below average. According to the national rainfall profiles, the 10-day cumulative rainfall was below the 15YA in almost all decades, apart from mid August and early September. At the sub-national level, all regions received less rainfall, and the Southwest region had the largest negative departure in rainfall compared with the 15YA (RAIN -66%). Due to this condition, the BIOMSS was 19% lower than average and maximum VCI was only 0.68. The NDVI development graph at the national level shows that the NDVI values were below the 5YA throughout this monitoring period.

According to the NDVI clusters and the corresponding NDVI departure profiles, the western and eastern parts of the Highland agriculture zone accounting for 57.7% of national cropland (areas in light green color) had NDVI values that were slightly below the 5YA, while other areas showed significant deviations in crop growth. However, this agreed with the maximum VCI graph which shows VCIx higher than 0.8 in the western regions, but VCIx values were much lower in the eastern Highland agriculture zone. In general, all crops in Kenya were affected by the drought, although to a slightly lesser extent in western Kenya.

Regional analysis

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

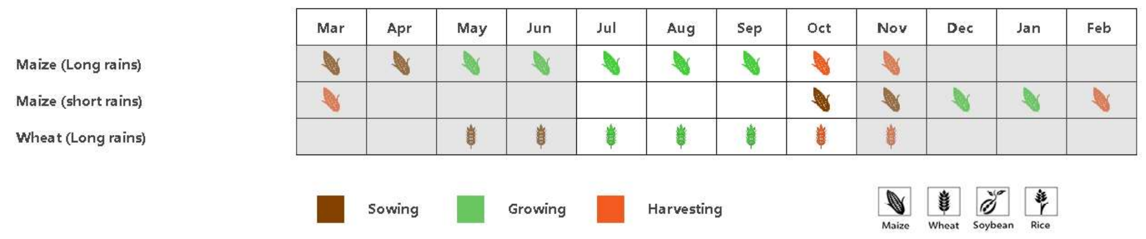
The **Eastern coastal region** had the minimum negative deviation in rainfall (-29%), 0.1°C below average temperature and unchanged RADPAR. The shortage of rainfall resulted in a significant drop of NDVI compared with the 5YA and BIOMSS was 7% below average. The maximum VCI was 0.71. The Cropping Intensity was 163%. In general, the crop condition was unfavorable in the coastal area with poor prospect for livestock and crop production.

The **Highland agriculture zone** recorded 195 mm of rain, which was below the 15YA by 46%. The low precipitation resulted in significant reductions in biomass (-19%). The maximum VCI value recorded was 0.64. The CALF was reduced to 63% (-23%). The Cropping Intensity was 148% and crop production index was 0.90. The NDVI was slightly below the 5YA, especially in late July. This means that the growth of long rain crops wheat and maize was affected. Overall, crop growth has been severely affected by drought conditions in the upland agricultural areas where rainfall was below average.

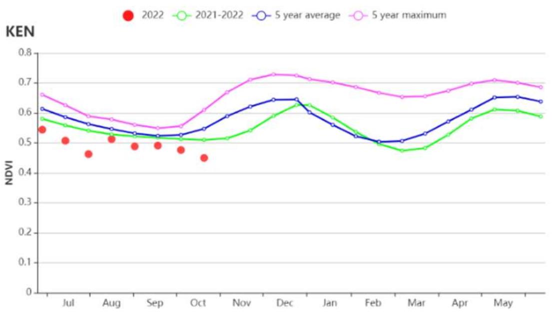
In **Northern rangelands region**, the precipitation was significantly below average at 133 mm, decreasing by 49%. Temperature was above the 15YA (+0.3°C), whereas RADPAR was below average (-3%), BIOMSS was below average (-18%). The NDVI development graph shows that the NDVI values were below average, especially in October. Furthermore, the CALF was reduced to 38% (-41%). The Cropping Intensity was 142%. All in all, the situation of crop growth in this area was unfavorable.

The **Southwest region** includes the districts Narok, Kajiado, Kisumu, Nakuru, and Embu, which has the largest negative departure in RAIN (-66%). The following indicator values were observed: TEMP 19.7°C (+0.6°C); RADPAR (-6%) and BIOMSS (-37%). And the NDVI curve was close to the 5YA with a VCIx value of 0.82. The Cropping Intensity was 141%, a drop by 4% from the 5YA, which is the lowest in the four AEZs. This indicates poor crop growth in this region.

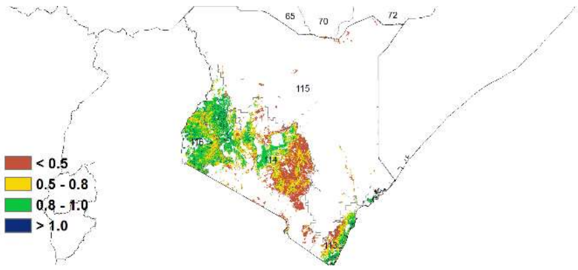
Figure 3.25 Kenya's crop condition, July-October 2022



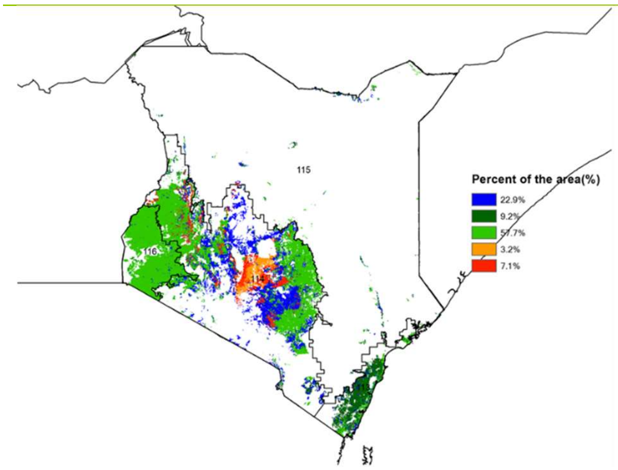
(a) Phenology of major crops



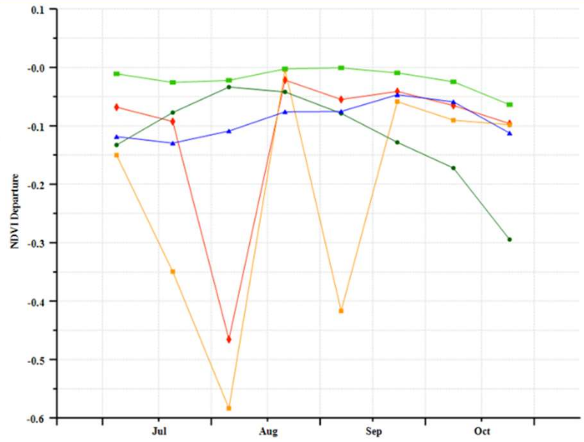
(b) Crop condition development graph based on NDVI



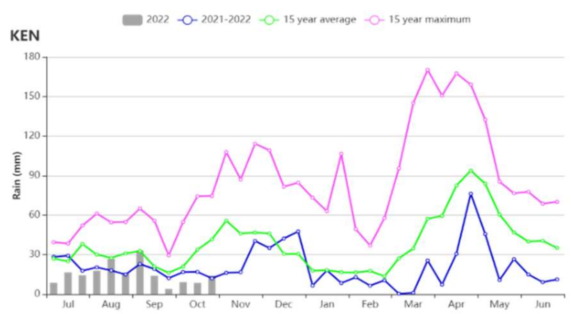
(c) Maximum VCI



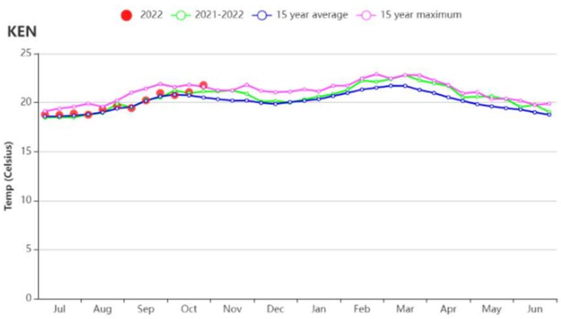
(d) Spatial NDVI patterns compared to 5YA



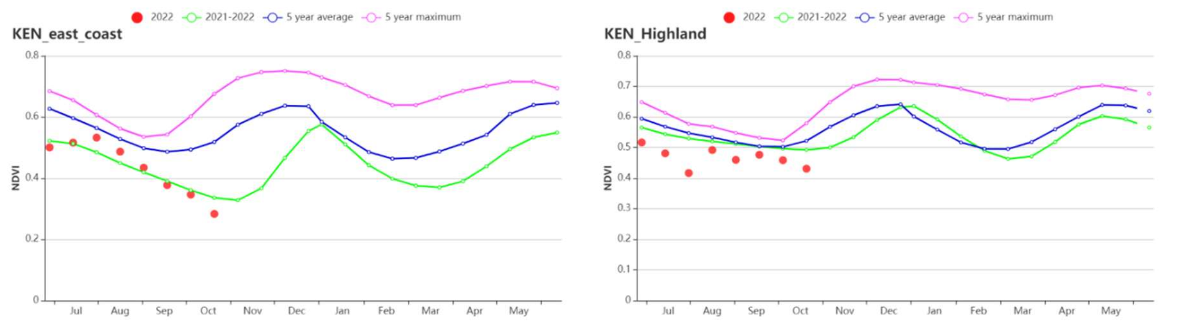
(e) NDVI profiles



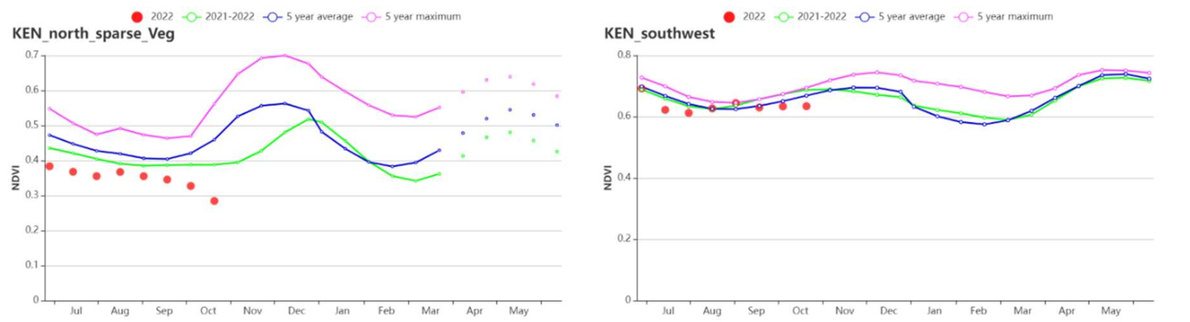
(f) Time series rainfall



(g) Time series temperature



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



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

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

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m2)	Departure (%)	Current (gDM/m2)	Departure (%)
Coast	168	-29	24.3	-0.1	1218	0	785	-7
Highland agriculture zone	195	-46	18.6	0.2	1125	-1	564	-19
nothern rangelands	133	-49	23.0	0.3	1211	-3	607	-18
South-west	180	-66	19.7	0.6	1151	-6	622	-37

Table 3.43 Kenya's agronomic indicators by sub-national regions, current season's values and departure, July - October 2022

Region	Cropped arable land fraction		Maximum VCI	Cropping Intensity CI	
	Current (%)	Departure (%)	Current	Current (%)	Departure (%)
Coast	78	-16	0.71	163	11
Highland agriculture zone	63	-23	0.64	148	11
northern	38	-41	0.48	142	-1

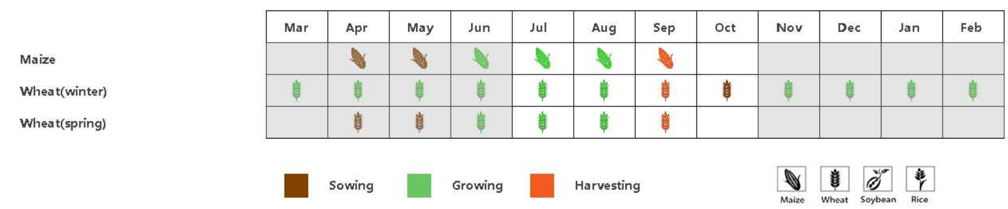
rangelands					
South-west	100	0	0.82	141	-4

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

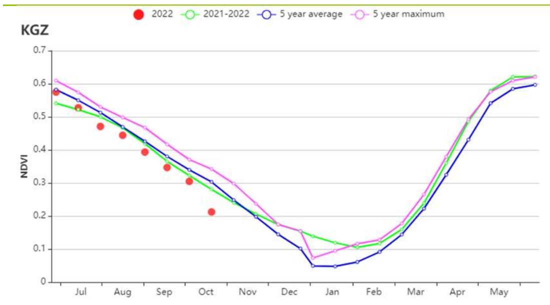
[KGZ] Kyrgyzstan

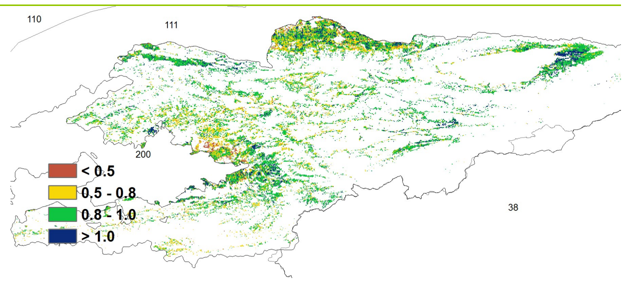
The reporting period covers the growth and harvest of wheat and maize. On the whole, crop conditions were below the 5-year average throughout the whole monitoring period. Among the CropWatch agro-climatic indicators, RAIN decreased largely (-25%), TEMP was below average (-0.5 ℃), while RADPAR was slightly above average (+5%). The combination of these factors resulted in the below-average BIOMSS (-6%) as compared to the 15YA. The time series precipitation profile shows that precipitation was higher than average in early August, early and middle October. The temperature profile indicates that temperatures were only a bit higher than the 15-year average in late July, early and late September. Below-average rainfall from July to September limited the growth of maize. The spatial NDVI clustering profile shows that only 43.7% of the cultivated area (marked in orange and red) had average or above-average crop conditions, the remaining cultivated area all had below-average crop conditions. 17.2% of the cultivated area (marked in blue) had average to slightly above-average crop conditions at the beginning of the monitoring period and then dropped to below-average crop conditions, mainly located in northwestern part of Issyk-Kul and northern part of Osh. The remaining cultivated regions had below-average crop conditions throughout the monitoring period, widely dispersed over the country. The spatial pattern of maximum Vegetation Condition Index (VCIx) was in accord with the spatial distribution of the NDVI profiles. CALF increased by 2% and the nationwide VCIx average was 0.86. Cropping intensity was 100%. Crop conditions in Kyrgyzstan can be assessed as close to average, and the crop prospect is fair.

Figure 3.26 Kyrgyzstan's crop condition, July-October 2022



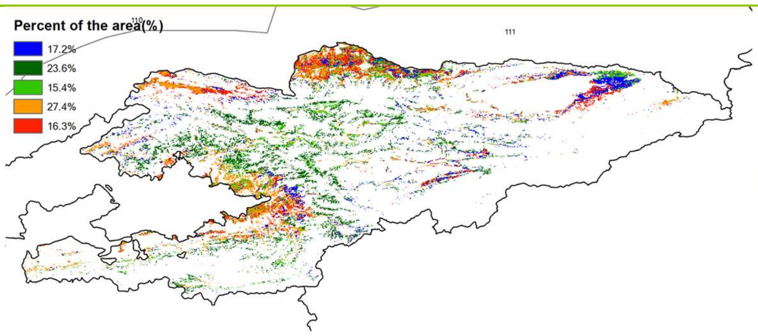
(a). Phenology of major crops

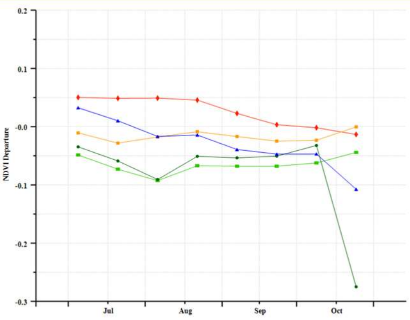




(b) Crop condition development graph based on NDVI

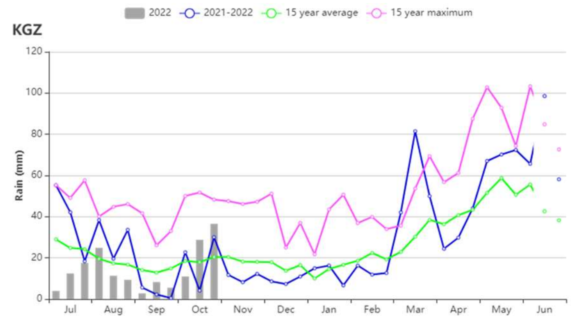
(c) Maximum VCI

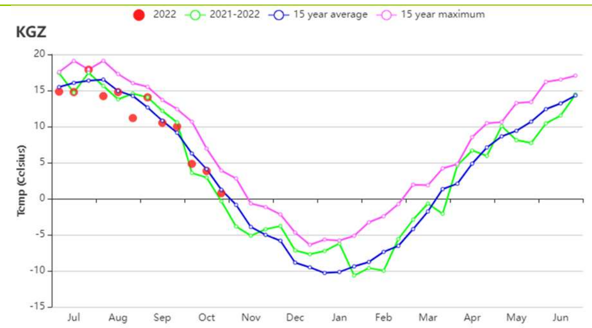




(d) Spatial NDVI patterns compared to 5YA

(e) NDVI profiles





(f) Rainfall profiles

(g) Temperature profiles

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

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Kyrgyzstan	172	-25	11.0	-0.5	1353	5	486	-6

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

Region	Cropped arable land fraction		Cropping intensity		Maximum VCI
	Current (%)	Departure (%)	Current (%)	Departure (%)	Current
Kyrgyzstan	89	2	100	0	0.86

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[KHM] Cambodia

The period from July to October is the rainy season in Cambodia. The floating rice, medium rice and late rice were sown in July. The soybeans began to mature in early July as well and the harvest of rainy-season maize and rainfed rice began in August and September, respectively.

The weather in Cambodia during this monitoring period was wetter than in the past. The precipitation (RAIN) in Cambodia was 14% higher, while average temperature (TEMP) and radiation (RADPAR) were close to average. The wetter weather was generally favorable for crop growth and thus potential biomass (BIOMSS) was about 1% higher than average. However, the stronger rainy season posed difficulties for crop growth monitoring based on satellite remote sensing, as manifested by cloud cover obscuring satellite images. It introduced excessive noise into the synthetic NDVI time series curves, thus affecting the determination of crop growth. However, with the help of the maximum vegetation condition index distribution map, it can be found that the VCIx value is higher than 0.8 in most areas, which indicates that the crop growth is normal in general, and only some areas have poor crop growth. The NDVI spatial clustering map also shows that the crop condition of about 7.8% of the cultivated land (orange areas) has been deteriorating since mid-July, mainly in Banteay Meanchey and Siem Reap provinces on the north side of Tonle Sap Lake and Kampong Thom and Kampong Cham provinces in the east. About 27.8% of the cultivated land (red areas) had poor crop growth in July, which gradually returned to normal after August. These areas are mainly concentrated in Prey Veng, Svay Rieng and Kampong Cham provinces in the lower Mekong River. In the rest of the cultivated land (light green, dark green and blue), the NDVI of the crops remained around the average level and the crop growth was normal.

In conclusion, a combination of various agroclimatic indicators shows that the crop growth in Cambodia during this monitoring period was normal.

Regional analysis

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

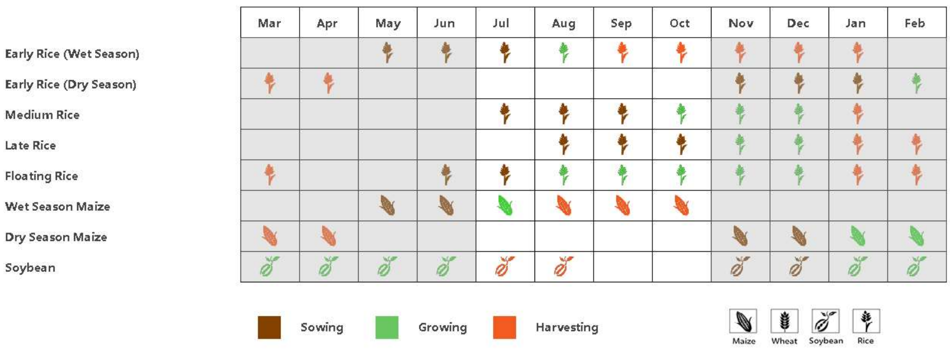
According to agroclimatic indicators, the precipitation (RAIN) in the Tonle-Sap region (agroecological subzone 117) was significantly higher by 20% than the average, while the temperature (TEMP) decreased by about 0.3°C, radiation (RADPAR) decreased by about 3%, and potential biomass (BIOMSS) was 1% higher. The synthetic NDVI time series curves in this area were more volatile and overall lower than average due to the influence of cloud cover on the satellite images, but this does not reflect the true crop growth. According to the distribution map of the maximum vegetation condition index, the VCIx value was higher than 0.8 in all areas of the district, except for some areas in the north and west, where the crop growth was poor, indicating that the overall crop growth in the district was normal.

The **Mekong Valley region** (agroecological subzone 118) is the main agricultural area in Cambodia. The precipitation (RAIN) in this region was significantly higher by 20%, temperature (TEMP) was lower by 0.1°C, and both radiation (RADPAR) and potential biomass (BIOMSS) were higher by 2%. According to the precipitation time series figure, the above-average precipitation was mainly concentrated in mid- and late July, late August, and early October, and this almost coincided with the occurrence of the minimal value points of the NDVI time series curve, indicating that precipitation and cloud cover limited the remote sensing monitoring of crop growth in the region. Although the distribution map of the VCIx shows that many areas in the region had crop VCIx less than 0.8, the spatial clustering map of the distance level shows that the NDVI of cropland crops in the central and western parts of the region (light green and blue areas) remained basically at the average level. While the NDVI of crops in the eastern region (red area) was below the average level until August, it gradually recovered afterwards. The NDVI of crops in only some areas in the northeast (orange area) kept decreasing, but the area was not large. Therefore, the crop growth in the region was basically normal or slightly below average.

For the Northern Plain and Northeast region (agroecological subzone 119), the region had a 7% higher precipitation (RAIN), 0.1°C lower temperature (TEMP), 3% higher radiation (RADPAR), and 1% higher potential biomass (BIOMSS). Although the NDVI time series curves of crops in this area remained consistently below average, the VCIx value of this region was as high as 0.92, and the spatial distribution of VCIx also shows that the VCIx in most areas of this region was higher than 0.8, indicating that the crops in this area were basically growing normally.

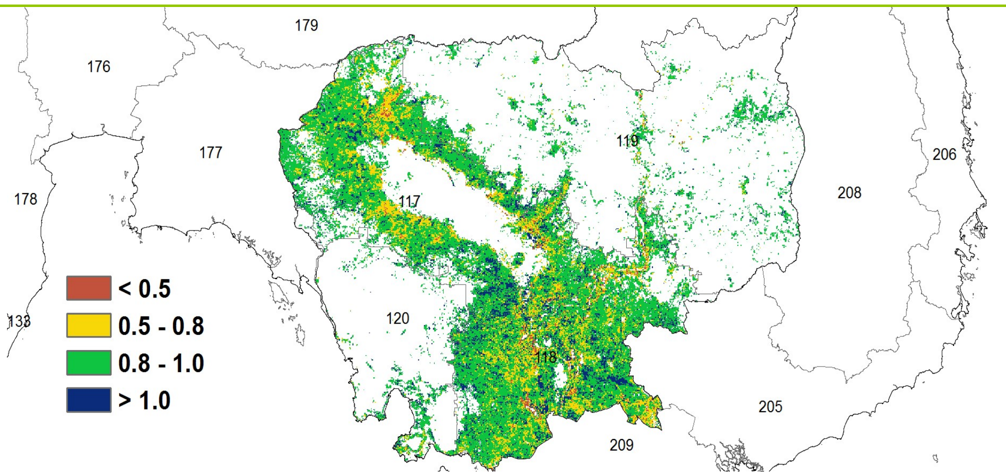
The precipitation (RAIN) in the **southwestern Hilly region** (agroecological subzone 120) was significantly higher than the average by 25%, the temperature (TEMP) was lower by about 0.5°C, the radiation (RADPAR) was significantly lower by 8%, and the potential biomass (BIOMSS) was lower by about 2%. The VCIx index of the region was as high as 0.91, and the spatial distribution of the VCIx also indicates that the crop growth in the region was basically normal.

Figure 3.27 Cambodia's crop condition, July -October 2022

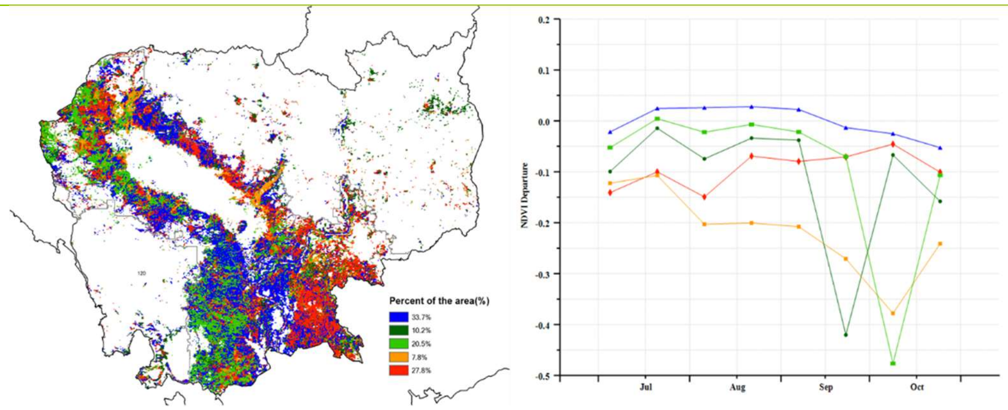


(a). Phenology of major crops

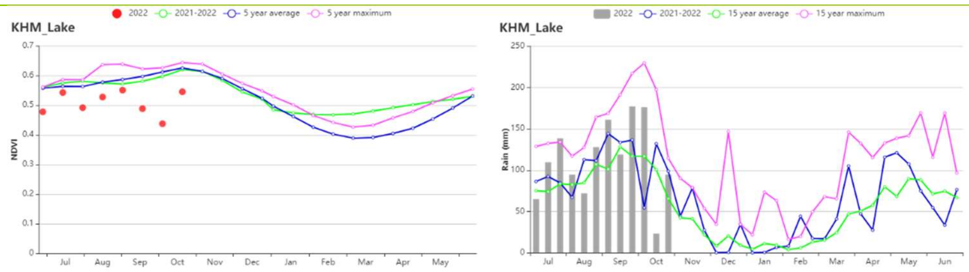
(b) Crop condition development graph based on NDVI, RAIN and TEMP



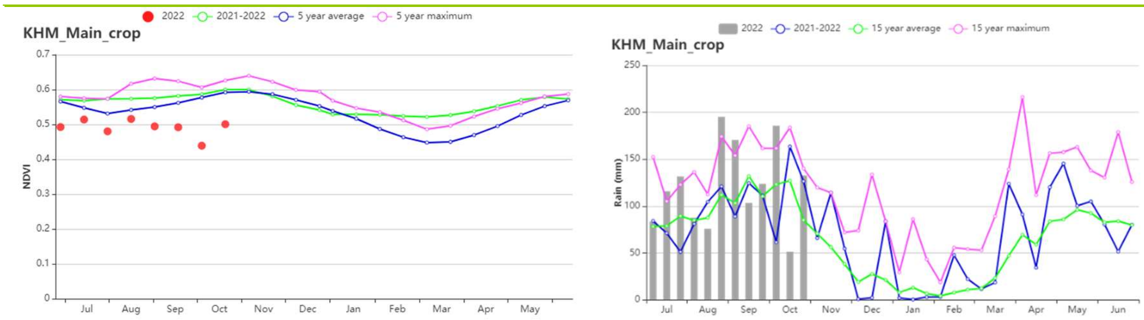
(c) Maximum VCI



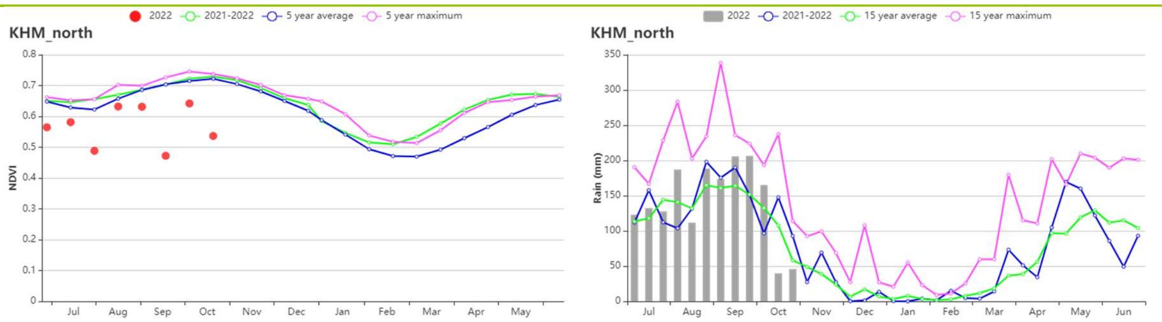
(d) Spatial distribution of NDVI profiles.



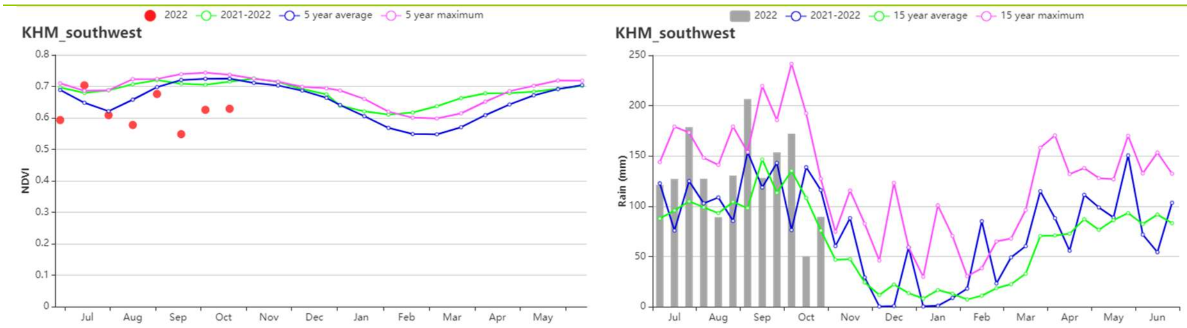
(e) Crop condition development graph based on NDVI (left) and time series rainfall profile (right) in Tonle Sap Lake region



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



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



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

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

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Tonle-sap	1358	20	25.3	-0.3	1070	-3	1566	1
Mekong valley	1455	20	25.8	-0.1	1139	2	1635	2
Northern plain and northeast	1706	7	25.1	-0.1	1095	3	1617	1
Southwest Hilly region	1573	25	23.9	-0.5	1004	-8	1518	-2

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

Region	Cropped arable land fraction		Cropping Intensity		Maximum VCI
	Current (%)	Departure (%)	Current (%)	Departure (%)	Current (%)
Tonle-sap	97	-1	108	-6	0.89
Mekong valley	95	0	116	-6	0.87
Northern plain and northeast	99	0	97	-15	0.92
Southwest Hilly region	99	0	99	-21	0.97

[LKA] Sri Lanka

This report covers both the main Maha and the second Yala cropping seasons of Sri Lanka. The Yala season crops were harvested in August and September. The sowing of main season crops (maize and wheat) started in October. Sri Lanka had abruptly switched to organic farming in 2021 and banned the import of chemical fertilizers. The ensuing lack of nutrients for the crops has reduced productivity. According to the CropWatch monitoring results, crop conditions were assessed as slightly below average for the monitoring period.

During this period, the country mainly experienced the Southwest-Monsoon Season, which is accompanied by windy weather and rains. However, at the national level, precipitation was markedly below the 15YA (RAIN -13%), while temperature and radiation were slightly below the average (TEMP -0.1°C, RADPAR -1%) . The fraction of cropped arable land (CALF) increased by 1% and BIOMSS was up by 1% compared to the 15YA. As shown in the NDVI development graph, NDVI was average during most of the period. The maximum VCI for the whole country was 0.92.

As shown by the NDVI clustering map and profiles, near half of country's cropland showed average and above-average crop conditions during August and September. These croplands were mainly located in the east, but there were also some clustered areas throughout the country. The abnormal NDVI departure values in early September and early October were mainly caused by cloud cover in the satellite images. The maximum VCI showed high values almost all over the country except for east coast.

Regional analysis

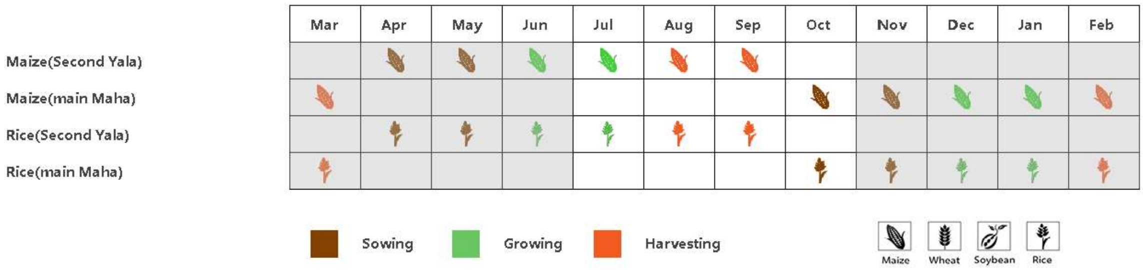
Based on the cropping system, climatic zones and topographic conditions, three sub-national agroecological regions can be distinguished for Sri Lanka. They are the Dry zone, the Wet zone, and the Intermediate zone.

In the **Dry zone**, the recorded RAIN (556 mm) was 8% below average. TEMP was 0.2°C above average and RADPAR was average. BIOMSS increased by 5% as compared to the 15YA. CALF was up by 1% as compared to the 5YA level with 98% of cropland utilized. NDVI was similar to that of the whole country. The VCIx for the zone was 0.93. Overall, crop conditions were near average for this zone.

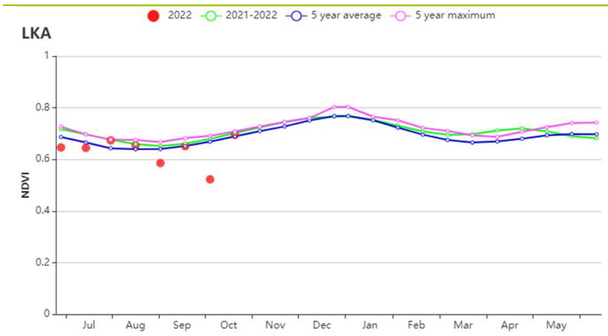
For the **Wet zone**, RAIN (1855 mm) was 16% below average as compared to the 15YA. TEMP and RADPAR decreased by 0.5°C and 3% respectively. BIOMSS was 4% below the 15YA and cropland was fully utilized. NDVI values showed negative deviation from average. The VCIx value for the zone was 0.97. Crop conditions were below average for this zone.

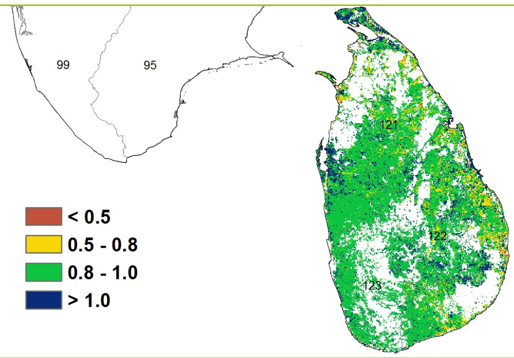
The **Intermediate zone** also experienced sufficient rain (945 mm) but with an 18% decrease from the 15YA. TEMP was 0.3°C above average and RADPAR was average compared to the 15YA. With full use of cropland, BIOMSS was comparable to the average. The NDVI values were similar to the whole country and the VCIx value for this zone was 0.96. Conditions of the crops were below average.

Figure 3.28 Sri Lanka's crop condition, July - October 2022



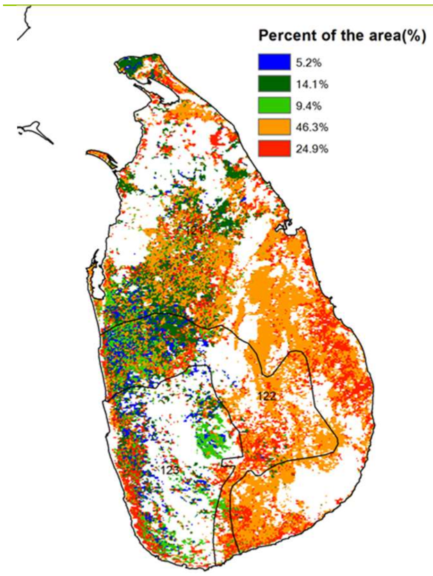
(a). Phenology of major crops

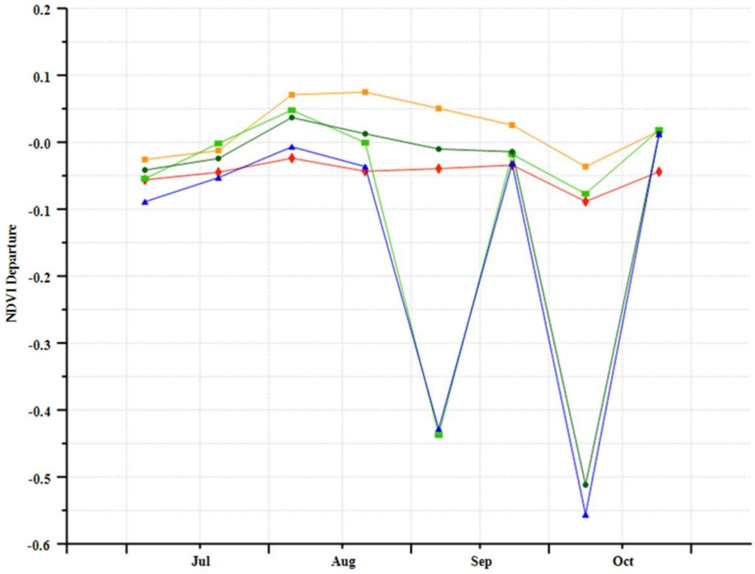




(b) Crop condition development graph based on NDVI

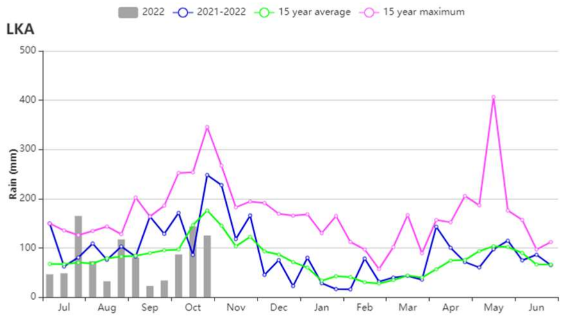
(c) Maximum VCI

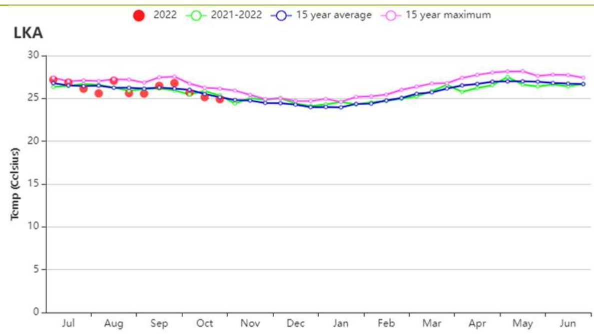




(d) Spatial NDVI patterns compared to 5YA

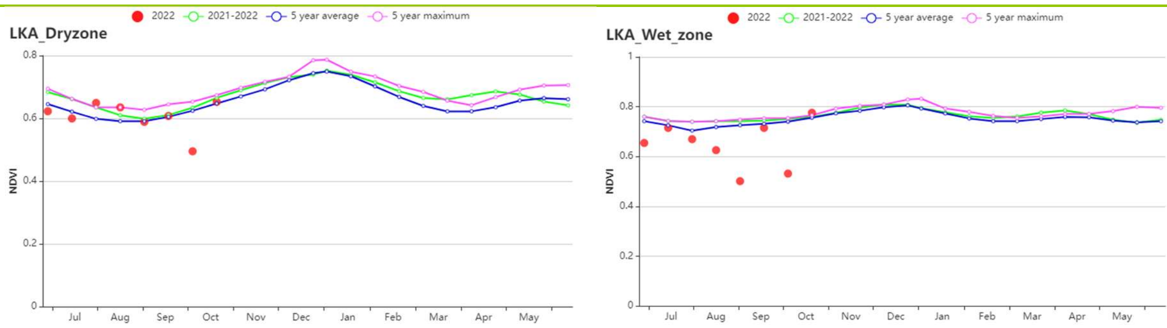
(e) NDVI profiles



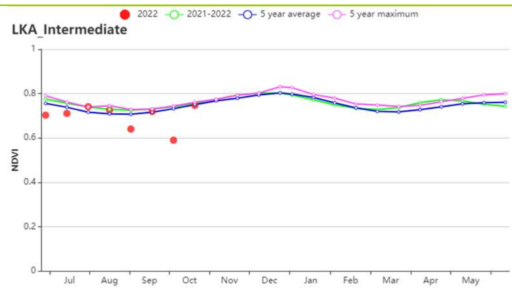


(f) Rainfall profiles

(g) Temperature profiles



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



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

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

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Dry zone	556	-8	27.4	0.2	1260	0	1175	5
Wet zone	1855	-16	23.6	-0.5	1130	-3	1490	-4
Intermediate zone	945	-18	24.9	0.3	1159	0	1236	-1

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

Region	Cropped arable land fraction		Cropping intensity		Maximum VCI
	Current (%)	Departure (%)	Current (%)	Departure (%)	Current
Dry zone	98	1	128	-9	0.93
Wet zone	100	0	111	-3	0.97
Intermediate zone	100	0	134	-5	0.96

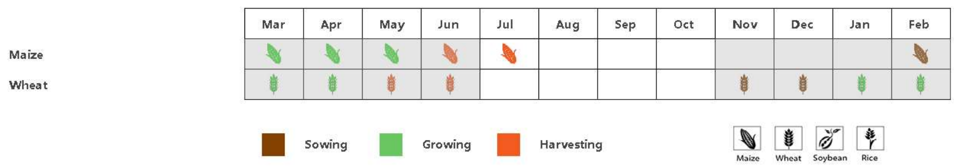
[MAR] Morocco

The reporting period (July - October) covers the last part of irrigated maize season only. Maize was harvested in July. Otherwise, no cereal crops are grown during this monitoring period. The sowing of winter wheat will start in November. The cumulative rainfall was lower than the 15-year average (15YA) by 26%. The rainfall profile shows that the rainfall did not exceed 20 mm and it rained mainly from mid-August to mid-October. The average temperature was higher than the 15YA by 1.0°C. The temperature profile shows that the temperature fluctuated around the average. Both RADPAR and BIOMSS were lower than the 15YA, by 4.7% and 4%, respectively. The nationwide NDVI profile was below the 5-year average (5YA) during the reporting period. The NDVI spatial pattern shows that only 11.6% of the cultivated area was above the 5YA while the rest was below. The national VCIx value was at 0.43. CALF was lower than the 5YA by 40%. The nationwide crop production index (CPI) was at 0.60, implying a below-normal crop production situation. In general, the crop conditions were unfavorable and low soil moisture content will hamper land preparation for the upcoming wheat planting period.

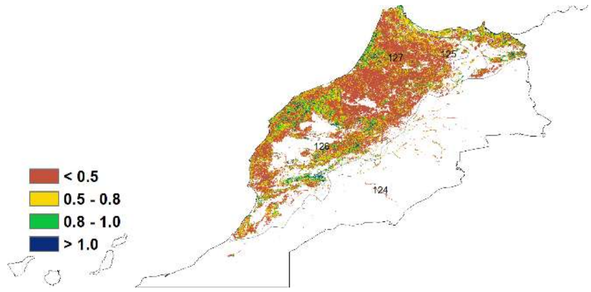
Regional analysis

CropWatch adopts three agro-ecological zones (AEZs) relevant to crop production in Morocco: the Sub-humid northern highlands, the Warm semi-arid zone, and the Warm sub-humid zone. For the three zones in their respective order, rainfall was below the 15YA by 17%, 28% and 20% while the temperature was higher than the 15YA by 0.7°C, 1.0°C and 0.8°C. Both RADPAR and BIOMSS were below the 15YA, by 6%, 4% and 5% for RADPAR, and 3%, 5% and 3% for BIOMSS, for the three zones respectively. The NDVI development graph shows that crop conditions were below the average in the three zones following the nationwide NDVI profile. The cropped arable land fraction (CALF) was below the 5YA by 39%, 44% and 40%. The Maximum VCI value was 0.60 and 0.67 for the first and third zones, implying near-average conditions while it was 0.35 in the second zone which implies below-average crop conditions. Cropping Intensity estimates were at 103%, 101% and 105% for the three zones, indicating all regions were dominated by single cropping during the investigation period. In the three zones, the CPI was at 0.47, 0.60 and 0.56, respectively, implying a below-normal crop production situation.

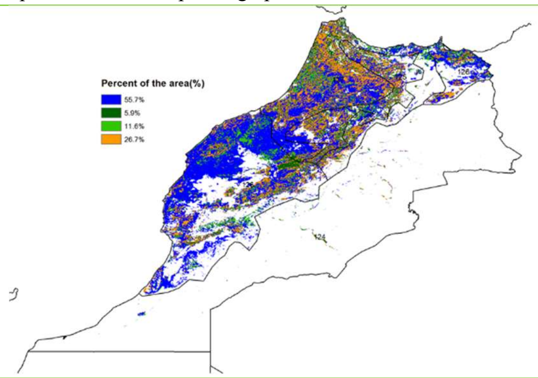
Figure 3.29 Morocco's crop condition, July– October 2022

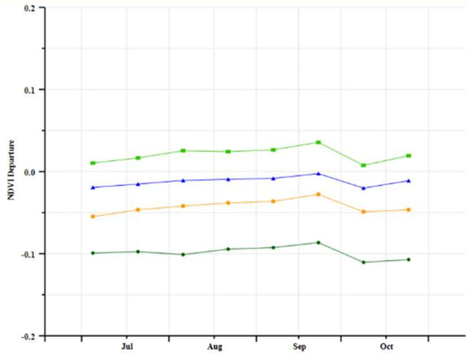


(a). Phenology of major crops

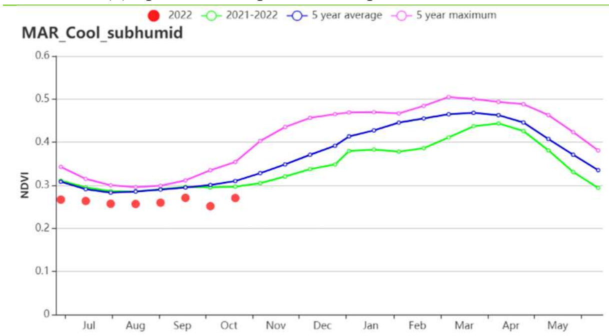


(b) Crop condition development graph based on NDVI (c) Maximum VCI

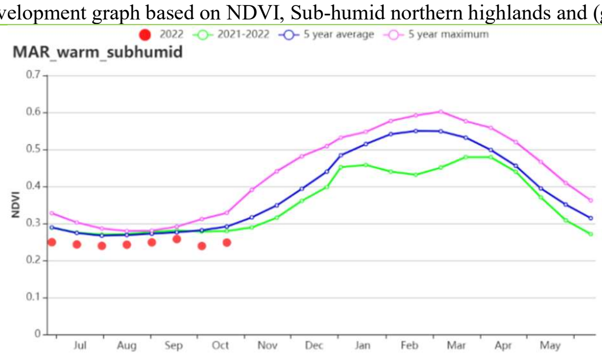




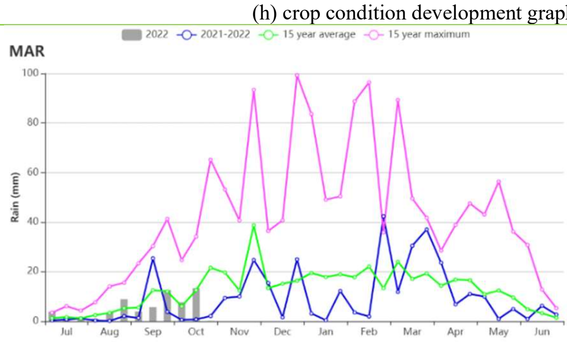
(d) Spatial NDVI patterns compared to 5YA (e) NDVI profiles

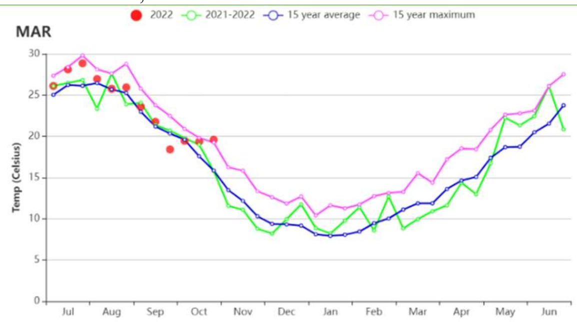


(f) crop condition development graph based on NDVI, Sub-humid northern highlands and (g) Warm semiarid zones



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





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

Table 3.50 Morocco's agroclimatic indicators by sub-national regions, current season's values, and departure from 15YA, July 2022 – October 2022

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m2))	Departure from 15YA (%)	Current (gDM/m2)	Departure from 15YA (%)
Sub-humid northern highlands	87	-17	23.0	0.7	1285	-6	588	-3
Warm semi-arid zones	49	-28	24.0	1.0	1316	-4	534	-5
Warm sub-humid zones	80	-20	23.0	0.8	1284	-5	580	-3

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

Region	CALF		Cropping Intensity		Maximum VCI
	Current (%)	Departure from 5YA (%)	Current (%)	Departure from 5YA (%)	Current
Sub-humid northern highlands	11	-39	103	0	0.60
Warm semi-arid zones	1	-44	101	0	0.35
Warm sub-humid zones	8	-4	105	3	0.67

[MEX] Mexico

Maize is the most important crop grown in Mexico. In the rainfed production regions of the country, maize reached maturity in September and October. The sowing of irrigated maize started in September. Its main production region is in Sinaloa, in the northwest. Winter wheat sowing begins in November. Both soybean and rice reached maturity by the end of this reporting period.

The CropWatch agroclimatic indicators show that RAIN (-12%) and RADPAR (-3%) were below average, and TEMP was normal, compared with the 15-year average. Accordingly, BIOMSS decreased by 7%. CALF was 91% and had increased by 1%. The VCIx was 0.88.

The RAIN in July was significantly less than the average, and more than half of Mexico was still in a drought state. The northern state of Nuevo León was experiencing a severe water shortage and was the most seriously affected state. After August, the RAIN reached average levels. As shown in the spatial NDVI profiles and distribution map, only 13.1% of the total cropped areas were above average during the entire monitoring period, mainly distributed in the Northwest region, including Sonora. 13.7% of the cropped areas were significantly below average, mainly distributed in the Northeast region. The crop growth in about half of the cropped areas was at an average level. Additionally, the NDVI departure in 21.8% of the total cropped areas changed from negative to positive during the monitoring period. The Crop Production Index was 1.15.

According to the VCIx spatial patterns, very high values (greater than 1.0) occurred mainly in northwestern Mexico. Extremely low values (less than 0.5) occurred in the northeastern Mexico, mainly in Nuevo León and Tamaulipas.

In addition, although the drought situation has eased since August, the Cropping Intensity had declined. This maybe due to the previous drought, since only 34.9% of the cropland are under irrigation. Thus, the crop conditions were not as favorable as last year. The crop condition development graph based on NDVI also confirmed this.

Regional analysis

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

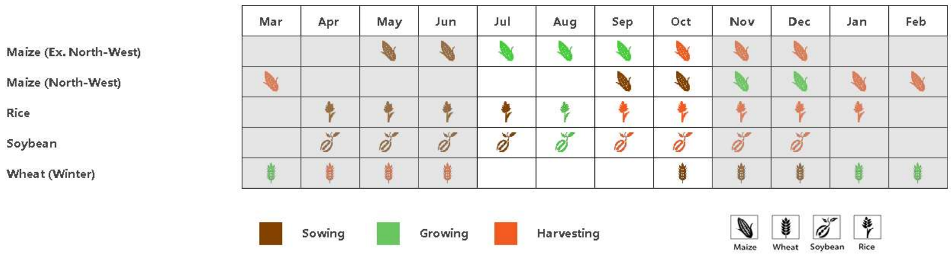
The Arid and semi-arid region, located in northern and central Mexico, accounts for about half of the cropped areas in the country. The agro-climatic condition showed that RAIN decreased by 18%, TEMP decreased by 0.1 °C and RADPAR decreased by 4%. According to the NDVI development graph, crop condition in this zone was worse than last year in July and August and was above average after August. CALF increased by 4% compared with the 5YA. This region was most severely affected by the drought in Mexico. VCIx was only 0.85. The Cropping Intensity of this region was 103.

The region of Humid tropics with summer rainfall is located in southeastern Mexico. RAIN was above average (+5%). TEMP (-0.3 °C), RADPAR (-5%) and BIOMSS (-1%) were below the 15 year average. As shown in the NDVI development graph, crop conditions were slightly below average. CALF was 100%. The increased RAIN brought some relief from the drought. The VCIx (0.91) confirms that crops grew better in this zone than in other regions. The Cropping Intensity of this zone was 107.

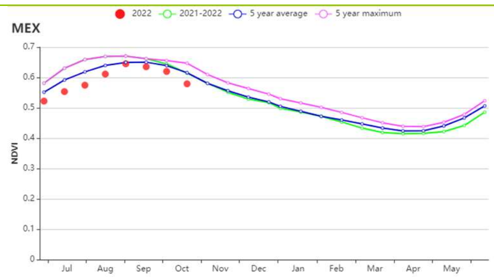
The Sub-humid temperate region with summer rains is situated in central Mexico. According to the NDVI development graph, the crop condition has been below the average level during the monitoring period. The CropWatch agroclimatic indicators show that RAIN decreased by 32%, TEMP increased by 0.5 °C, RADPAR increased by 1%, and BIOMSS decreased by 10% compared to the 15YA. CALF was 97%, and VCIx for this zone was 0.87. The Cropping Intensity of this region was 106.

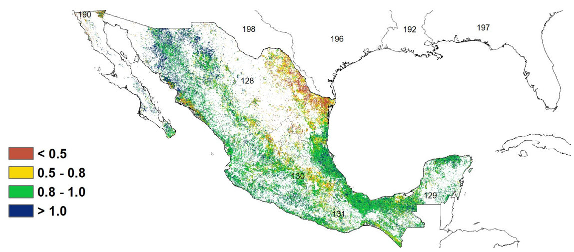
The region called Sub-humid hot tropics with summer rains is located in southern Mexico. During the monitoring period, crop conditions were below average as shown by the NDVI time profiles. Agro-climatic conditions were below average levels, including RAIN (-12%), RADPAR (-1%) and BIOMSS (-6%). CALF was 96%. The Cropping Intensity and VCIx for the zone were 110 and 0.91, respectively.

Figure 3.30 Mexico's crop condition, July - October 2022



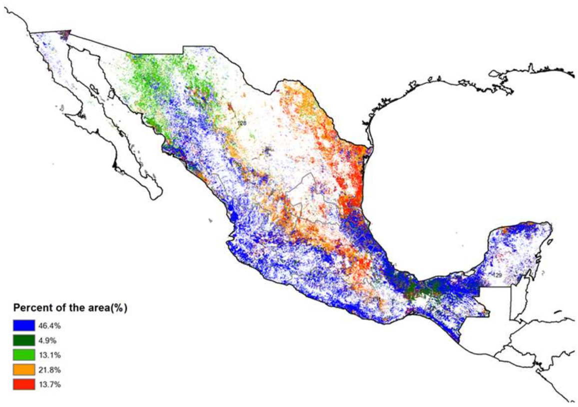
(a). Phenology of major crops

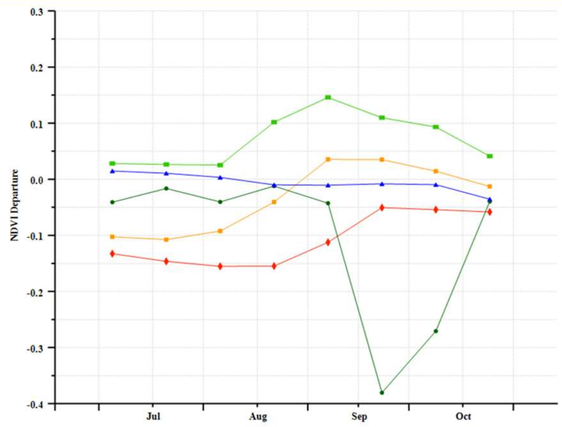




(b) Crop condition development graph based on NDVI

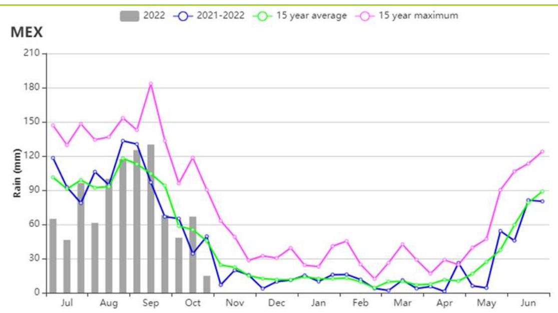
(c) Maximum VCI

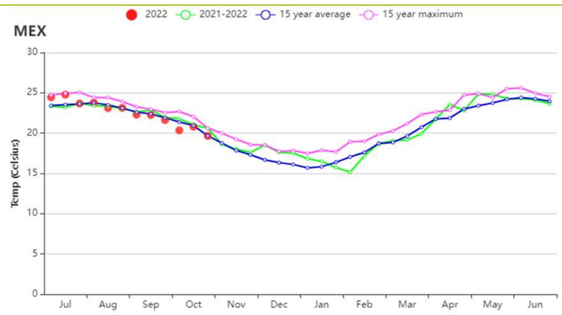




(d) Spatial NDVI patterns compared to 5YA

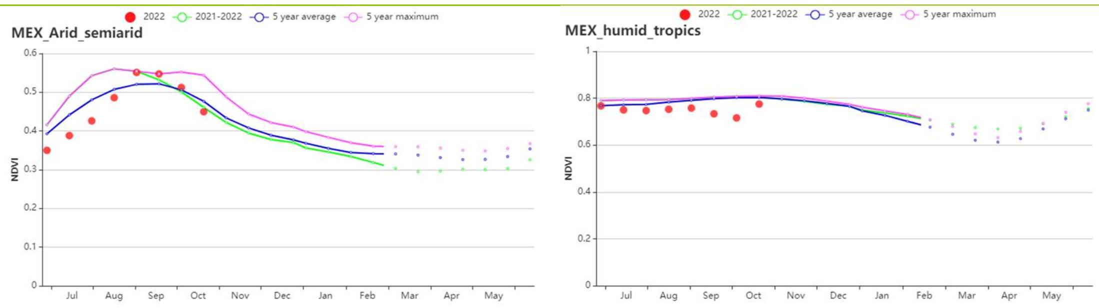
(e) NDVI profiles



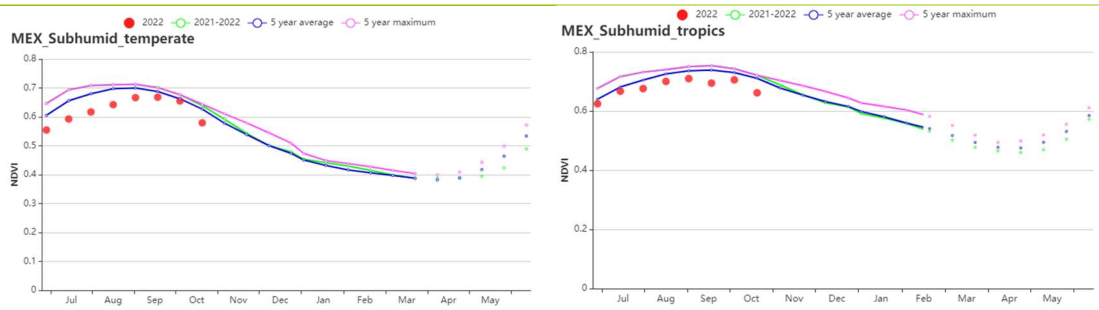


(f) Rainfall profiles

(g) Temperature profiles



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



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

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

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Arid and semi-arid region	600	-18	22.5	-0.1	1250	-4	978	-9
Humid tropics with summer rainfall	1345	5	24.5	-0.3	1202	-5	1439	-1
Sub-humid temperate region with summer rains	840	-32	19.2	0.5	1232	1	1053	-10
Sub-humid hot tropics with summer rains	1089	-12	22.5	0.2	1216	-1	1221	-6

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

Region	Cropped arable land fraction		Cropping intensity		Maximum VCI
	Current (%)	Departure (%)	Current (%)	Departure (%)	Current
Arid and semi-arid region	83	4	103	-1	0.85
Humid tropics with summer rainfall	100	0	107	-4	0.91
Sub-humid temperate region with summer rains	97	-1	106	0	0.87
Sub-humid hot tropics with summer rains	96	0	110	-1	0.91

[MMR] Myammar

During this reporting period, the sowing of maize and wheat was underway during September and October, whereas the main rice was growing from July to September and was harvested in October. Macroeconomic difficulties, due to the political instability, have caused widespread loss of income and livelihoods due to internal displacements, accompanied by a sharp increase in fertilizer costs by 75 to 90% as compared to last year. According to the CropWatch monitoring results, crop conditions were below average for the monitoring period.

According to the agroclimatic indicators from the last few periods, the weather in Myanmar was drier than usual in general. Compared to the 15YA, RAIN was lower (-23%) while TEMP was higher (+0.7ºC) and RADPAR was up by 13%. As a result of insufficient of rainfall, BIOMSS was below the average (-3%). Compared to the 5YA, the utilization of cropland had slightly increased by 1%. NDVI values were below average during most of the monitoring period, except for mid-July, early August and early September. The maximum VCI during this period was 0.94.

As shown by the NDVI clusters map and profiles, the crop conditions across the country were heterogeneous. More than 60% of the country's cropland showed above-average crop conditions during July and August. It was mainly distributed in Southern Sagaing Region, Ayeyarwady Region, Yangon Region, Bago Region, and throughout the Hills region. The remaining cropland was average and below average during the whole period, including the sowing season for maize and wheat during September and October. The high VCI values were observed throughout the country, and only some small parts in Central Plain and southern region showed lower VCI values.

Regional analysis

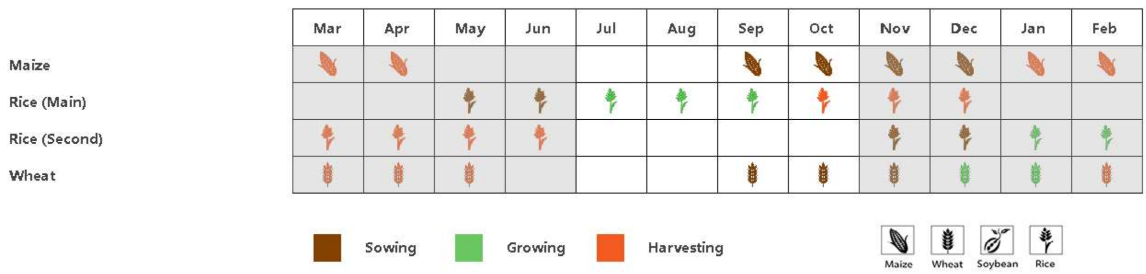
Three sub-national agro-ecological zones (AEZ) can be distinguished for Myanmar based on the cropping system, climatic zones and topographic conditions. They are the Central plain (132), the Hills (134) and the Delta and Southern Coast regions (133).

The **Central Plain** had a marked rainfall deficit (RAIN -31%), and RADPAR and TEMP were up by 15% and 1.3ºC compared to the 15YA. BIOMSS was 7% lower than the 15YA. CALF showed that 98% of the cropland was fully utilized. NDVI was average and above average during July and August. The VCIx was 0.91. Crop conditions for this region were slightly below average.

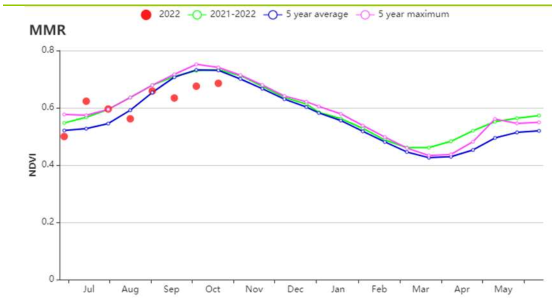
The **Hills region** also had below-average rainfall (RAIN -26%). RADPAR and TEMP increased by 18% and 0.6ºC. BIOMSS was equal to the 15YA. The cropland was almost fully utilized (CALF 99%). The NDVI values were similar to that of the Central Plain and the whole country. The VCIx was 0.93. Crop conditions are assessed as below the 5YA level.

The **Delta and Southern Coast region** had the highest RAIN compared with the other two sub-national regions, though it was also below the 15YA (-13%). RADPAR and TEMP were 2% and 0.1ºC above average. BIOMSS was almost comparable to the 15YA. The cropland was also almost fully utilized (CALF 96%). VCIx was 0.92. The NDVI values were below the 5YA during most of the period, especially in September and October. Crop conditions in this region were below average.

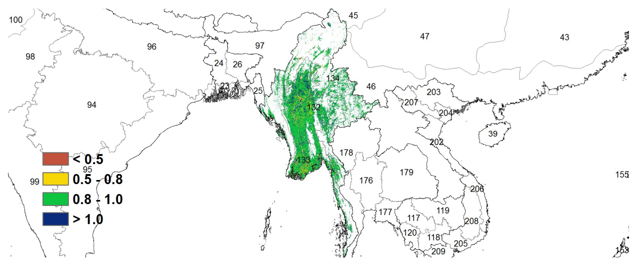
Figure 3.31 Myammar's crop condition, July - October 2022



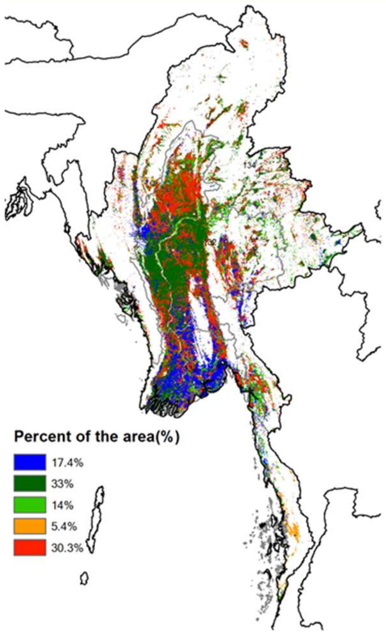
(a). Phenology of major crops

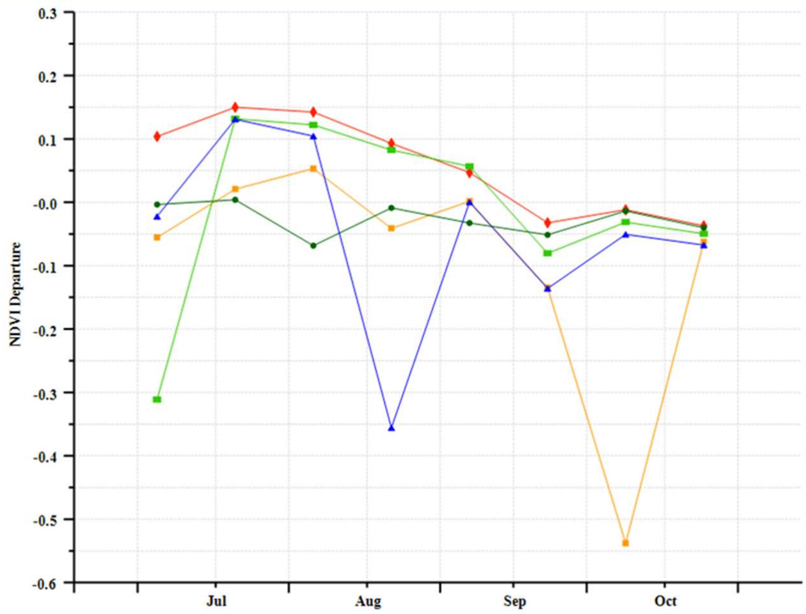


(b) Crop condition development graph based on NDVI



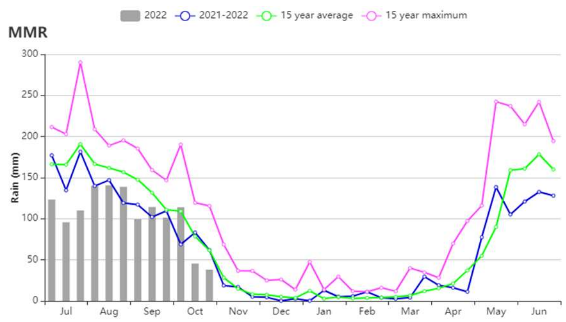
(c) Maximum VCI

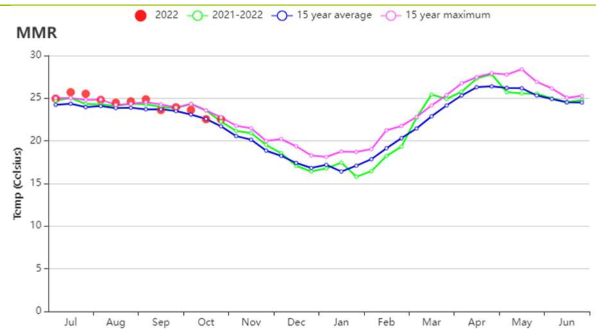




(d) Spatial NDVI patterns compared to 5YA

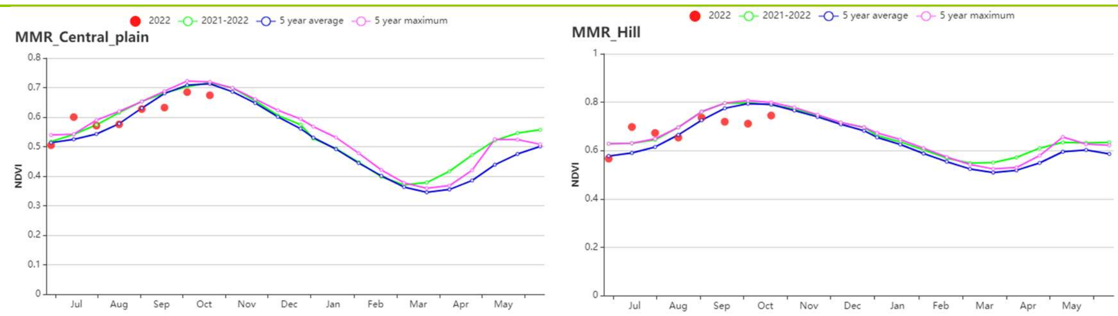
(e) NDVI profiles



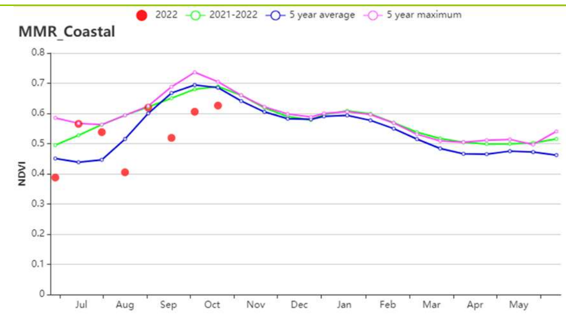


(f) Rainfall profiles

(g) Temperature profiles



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



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

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

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Central plain	786	-31	25.4	1.3	1209	15	1320	-7
Hills region	1337	-26	23.1	0.6	1132	18	1407	0
Delta and southern-coast	1732	-13	25.8	0.1	1107	2	1594	-1

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

Region	Cropped arable land fraction		Cropping intensity		Maximum VCI
	Current (%)	Departure (%)	Current (%)	Departure (%)	Current
Central plain	98	1	91	-12	0.91
Hills region	99	0	97	-10	0.93
Delta and southern-coast	96	2	118	-4	0.92

[MNG] Mongolia

This reporting period from July to October covers the humid summer and autumn seasons in Mongolia which correspond to the main growth period and harvesting stage of wheat in September. Wheat is the main cereal crop grown in that country. The proportion of irrigated cropland in Mongolia is only 2.9% and crop growth is mainly limited by rainfall. As compared to the fifteen-year average, TEMP was slightly below average (-0.4°C), and the TEMP of each month was normal. RAIN decreased by 11% during the whole monitoring period. RAIN from July to early August was normal. Below-average RAIN was mainly observed from late August to September, when the wheat was harvested. The monitoring results reported in the last bulletin showed that the RAIN from April to June was normal, so the decreased RAIN in this monitoring period had little impact on the production of spring wheat. RADPAR was slightly above average by 2%, while BIOMSS was below average by 4%.

According to the crop condition development graph based on NDVI and the spatial distribution of NDVI profiles, only 12.4% cropland of Mongolia had below-average conditions before harvest. CALF was 99%, equal to the 5YA, and Cropping Intensity (CI) increased by 6% to 106%. The national VCIx was 0.92, crop production index (CPI) was 1.15.

Overall, crop conditions in Mongolia were favorable.

Regional analysis

Hangai Khuvsgul region:

Compared to the fifteen-year average, RAIN and TEMP were below average (-21% and -0.3°C), while RADPAR increased by 2% and BIOMSS decreased by 6%. CALF decreased by 1% to 99%, regional VCIx was 0.87, and CI was 103%. According to the crop condition development graph based on NDVI and the spatial distribution of NDVI profiles, the overall crop condition in the region was poor, especially in the north-central and western districts. However, the area of cropland in this region accounts only for a small proportion of the total cropland in Mongolia, so the poor crop conditions had little impact on the crop production in Mongolia.

Selenge-Onon region:

Most of the cropland of Mongolia is concentrated in this region. For the CropWatch agroclimatic indicators, as compared to the fifteen-year average, RAIN and TEMP were below average (-2% and -0.6°C), while RADPAR was above average by 2% and BIOMSS was equal to the 15YA. CALF was 100%, equal to the 5YA. Regional VCIx was 0.93, and CPI was 1.00. CI was 106%, which had increased by 5%, and the CI of some areas in Hentiy province was 200%. According to the crop condition development graph based on NDVI, the NDVI of this region was higher than the 5YA in July and August, and below the 5YA in September and October. Thus, the favorable conditions observed during the previous reporting period continued throughout the main growth period of spring wheat (from June to August). Therefore, crop production conditions in this region are favorable.

Central and Eastern Steppe Region:

As compared to the fifteen-year average, RAIN was significantly below average (-21%), TEMP was slightly below average (-0.3°C), and RADPAR was above average (+3%). These factors lead to a decrease in BIOMSS (-9%). However, the area of cropland in this area is relatively small. It is mainly distributed in the eastern part of Dornod Province, for which the Maximum VCI map showed that the VCIx value was generally above 1.0. The value of CPI was also high for the region (CPI=1.19). CALF increased by 1% to 100%, VCIx was 1.00, and CI was 100%. Overall, crop conditions in this region are favorable.

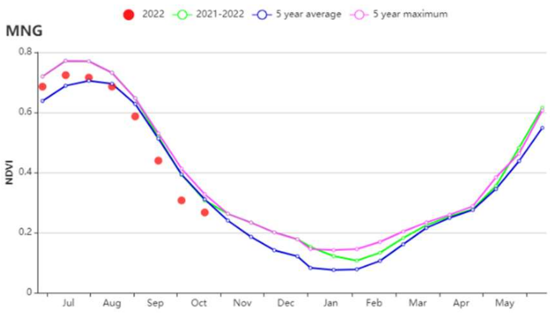
Figure 3.32 Mongolia's crop condition, July - October 2022

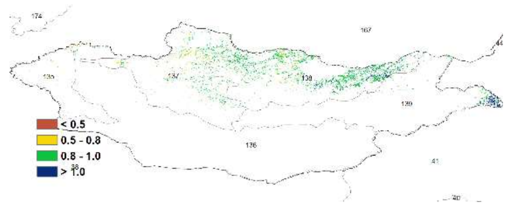
	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
Wheat												

Sowing Growing Harvesting

Maize Wheat Soybean Rice

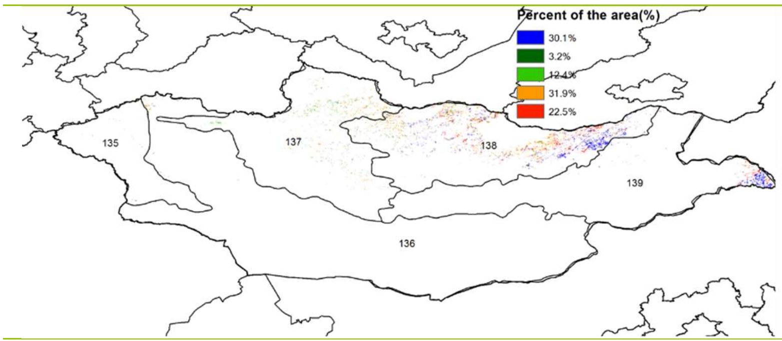
(a). Phenology of major crops

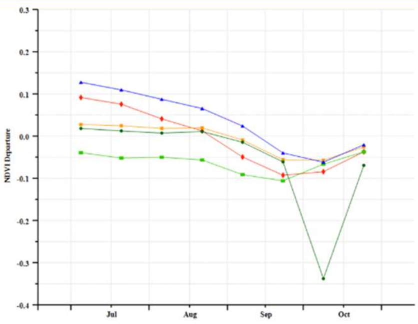




(b) Crop condition development graph based on NDVI

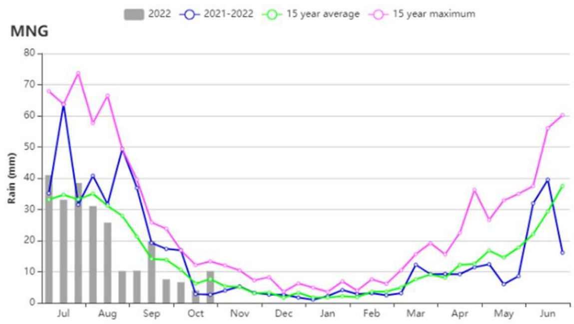
(c) Maximum VCI

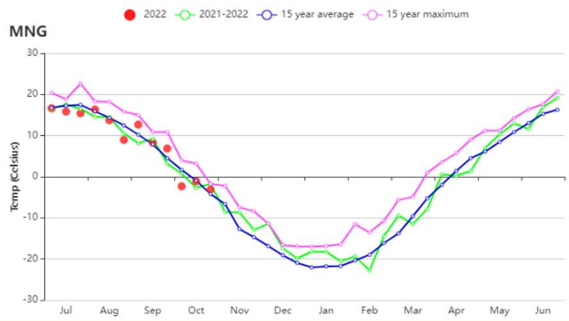




(d) Spatial NDVI patterns compared to 5YA

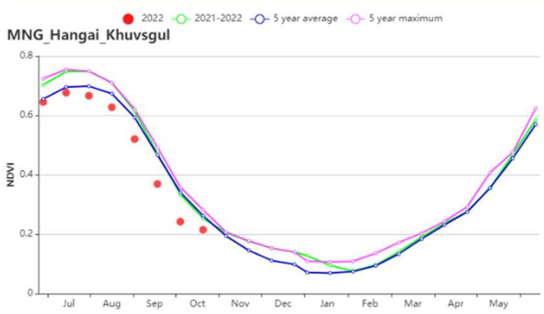
(e) NDVI profiles

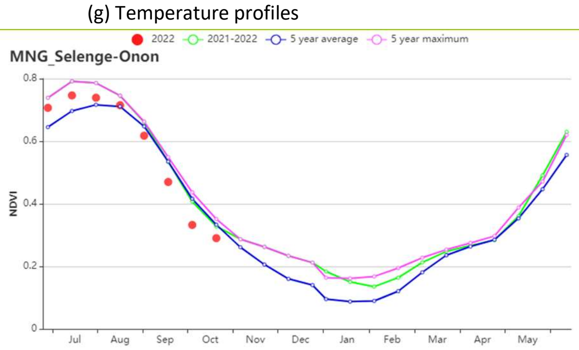




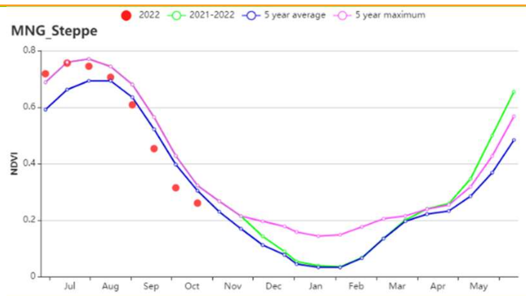
(f) Rainfall profiles

(g) Temperature profiles





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



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

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

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m2)	Departure (%)	Current (gDM/m2)	Departure (%)
Hangai Khuvsgul Region	236	-21	6.5	-0.3	1075	2	558	-6
Selenge-Onon Region	264	-2	9.4	-0.6	1060	2	647	0
Central and Eastern Steppe Region	176	-21	13	-0.3	1062	3	575	-9
Altai Region	139	-63	7.9	1.0	1117	8	401	-26
Gobi Desert Region	88	-56	10.4	0.5	1148	6	335	-31

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

Region	Cropped arable land fraction		Cropping intensity		Maximum VCI
	Current (%)	Departure (%)	Current (%)	Departure (%)	Current
Hangai Khuvsgul Region	99	-1	103	3	0.87
Selenge-Onon Region	100	0	106	5	0.93
Central and Eastern Steppe Region	100	1	100	0	1.00
Altai Region	72	-11	103	3	0.76
Gobi Desert Region	70	-8	99	-1	0.77

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

[MOZ] Mozambique

In Mozambique, crop production is mostly affected by rainfall variability. During this monitoring period (July-October), the sowing of rice and maize for the main agricultural season started in late October. It lasts up to the end of November. Meanwhile, in the central and northern regions, the sowing of major crops is expected to start in November. However, delays in rainfall in these regions may lead to delays in sowing which will have direct impacts on the total grain production. Compared to the average of the past fifteen years, the national agroclimatic indicators show that the total recorded rainfall decreased by 43% while temperature increased by about 0.3ºC. The recorded Photosynthetic Active Radiation was 1273 MJ/m2, an increase of 4% compared to the past fifteen years' average. The drops in rainfall and the increases in temperature influenced the total biomass production, which decreased by about 9% compared to the average of the past fifteen years.

Even with the above-reported agroclimatic indicators, the national crop development profile based on NDVI reveals better crop conditions as compared to the same period in 2021 and the average of the past five years, with values of vegetation conditions index close to 1, particularly in the province of Zambezia, Inhambane, Gaza and Tete. These conditions are also indicated by the NDVI clusters in which, only 10% of the country area recorded below-average crop conditions compared to the past five years. The areas with unfavourable crop conditions are centred in the province of Cabo Delgado, which may have been caused by the military conflicts in the region, because farmers had to leave their fields. Despite of the military conflicts in Cabo Delgado, the total cropped arable land fraction increased by 4%, with an about-average cropping intensity. For this period, the maximum recorded VCIx was 0.93.

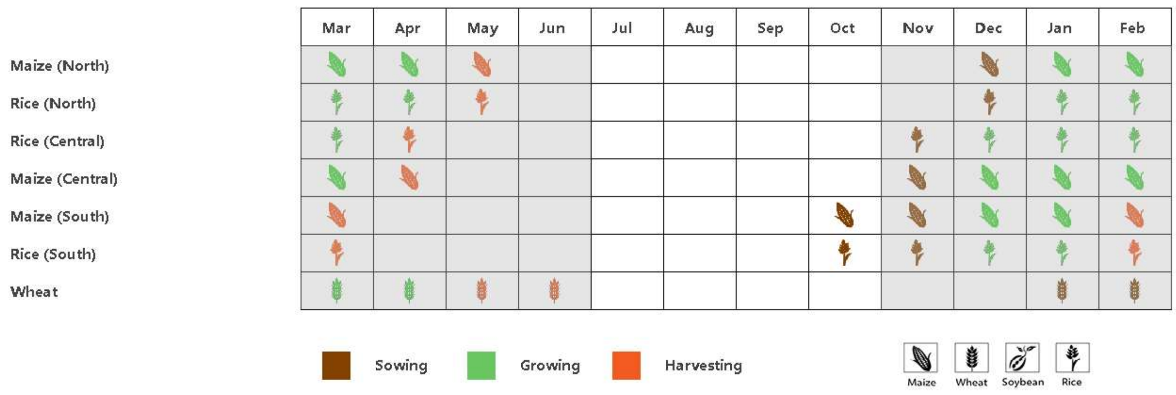
Regional analysis

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).

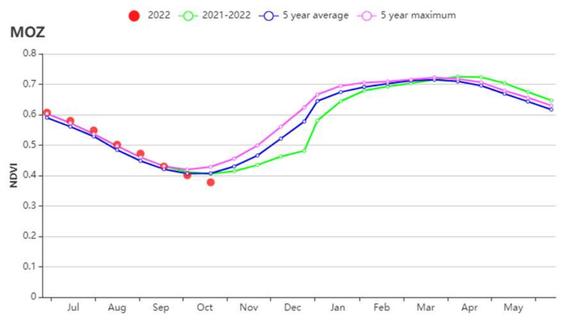
Regionally, similar patterns were observed in all the agroecological zones, in which the agroclimatic indicators reveal decreases in rainfall in all regions, with the Northern high-altitude areas, Buzi basin and the Lower Zambezi River basin recording decreases above 50% (RAIN -69%, -66% and -58%, respectively) when compared to the departures from the fifteen years' average. Except for the Northern coast, where the temperature decreased by 0.1ºC, all the zones recorded increases on this indicator, with the temperature in the Buzi basin increasing by 1ºC. In all regions, RADPAR increased. These increases vary from 3% on the Northern coast to 6% in the Southern region. The total biomass dropped in all the agroecological regions, with drops by more than 10% being observed in the Low Zambezi River basin and Northern-high altitude area (both with a 12% drop) and the Buzi basin (with a 14% drop).

Compared to the average of the past five years, the regional crop conditions development graph based on NDVI indicates favourable crop conditions in all agroecological zones during almost the entire reporting period, with drops in crop conditions being verified in late October. For all the agroecological regions, the cropped arable land fraction recorded increases. The highest increases in CALF were observed in the Northern-high altitude areas, Low Zambezi River Basin and the Southern Region with increases of 11%, 9% and 6% respectively. The cropping intensity decreased by 2% and 1% in the Buzi basin and Northern high-altitude areas it increased by 2% and 1% in the Low Zambezia River basin and Southern Region. On the Northern coast, the cropping intensity was near the average of the past five years.

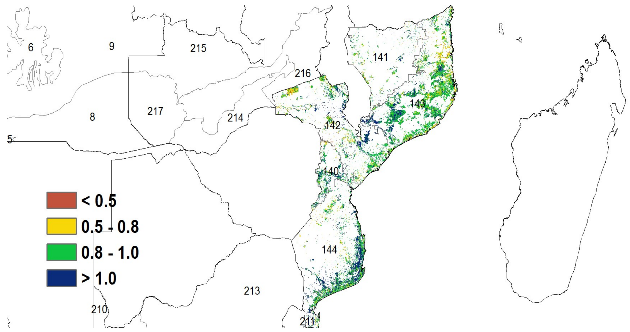
Figure 3.33 Mozambique's crop condition, July-October 2022



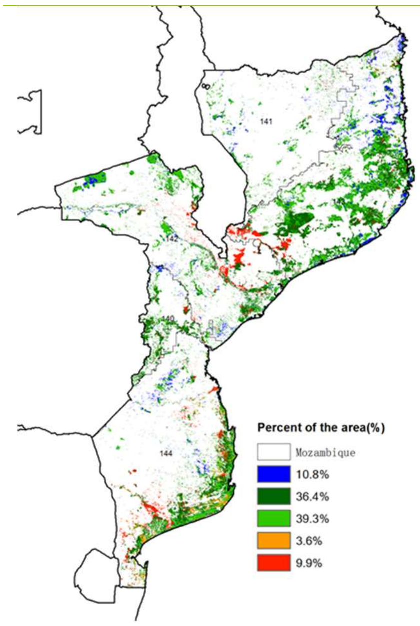
(a) Phenology of major crops

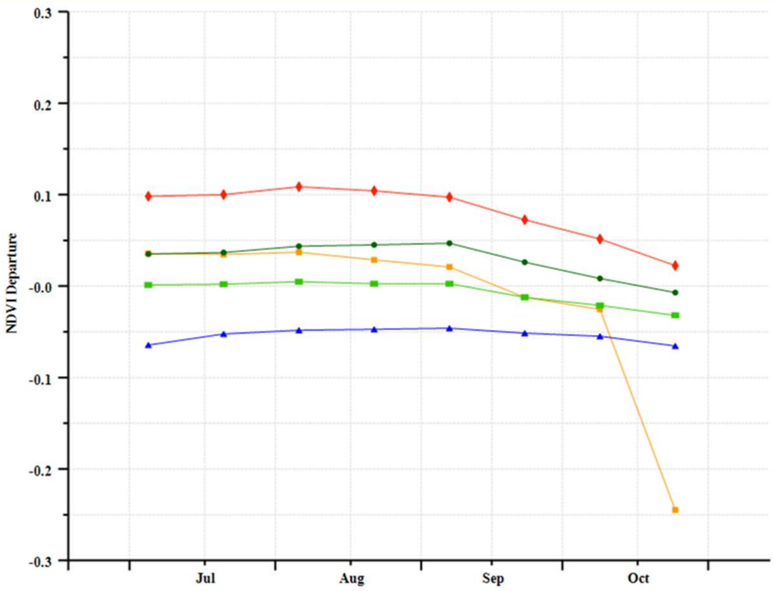


(b) Crop condition development graph based on NDVI



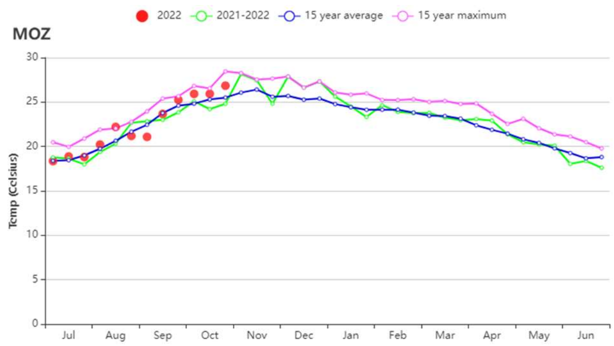
(c) Maximum VCI





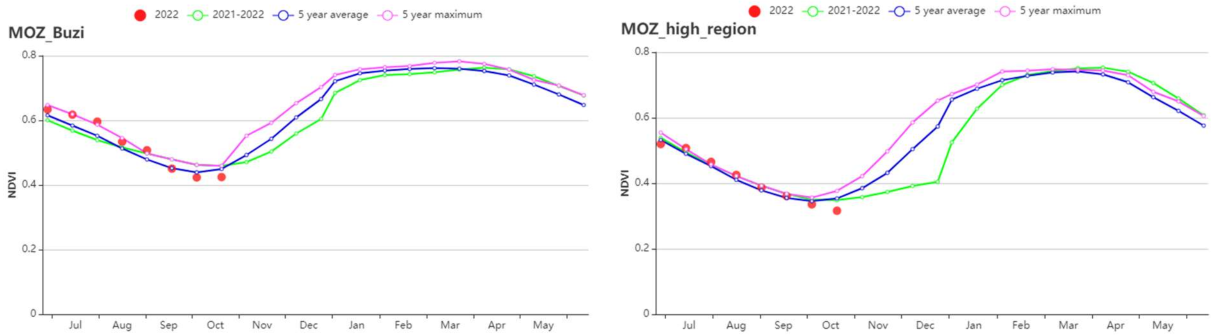
(d) Spatial NDVI patterns compared to 5YA

(e) NDVI profiles

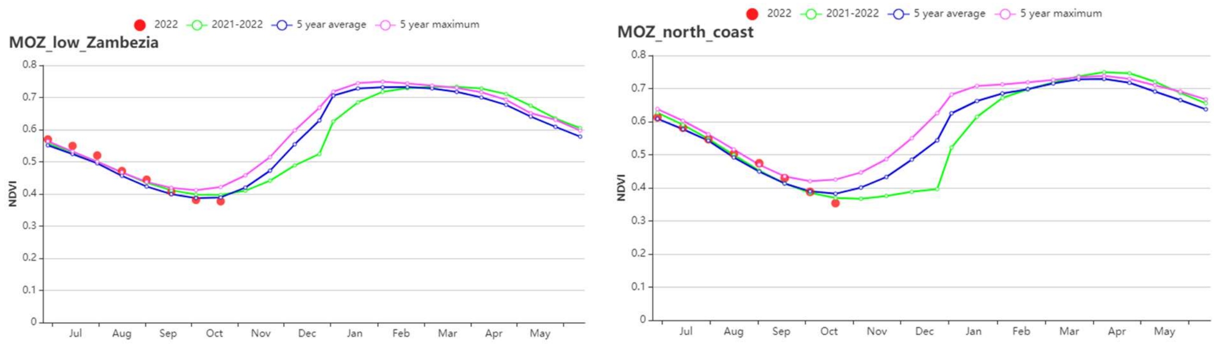


(f) National time-series temperature profiles

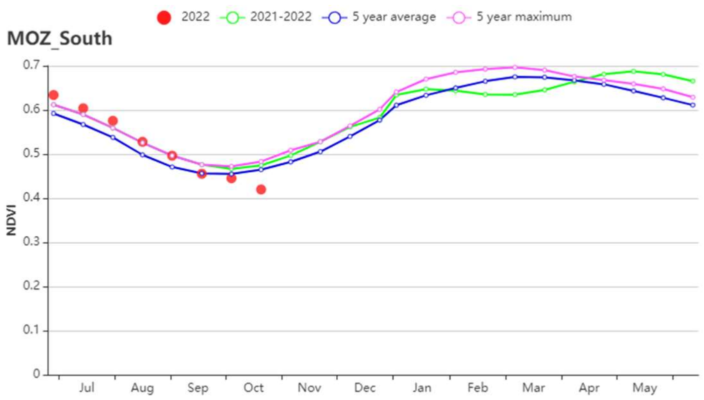
(g) National time-series rainfall profiles



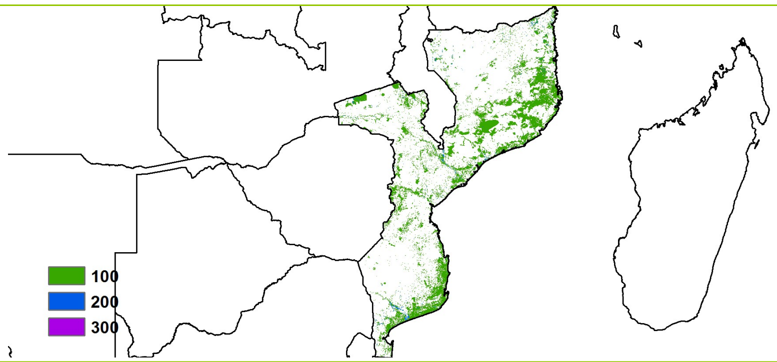
(h) Crop condition development graph based on NDVI-Buzi basin (left), and Northern high-altitude areas (right)



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



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



k) National Cropping Intensity

Table 3.58 Mozambique's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, July - October 2022

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Buzi basin	24	-66	20.6	1.0	1273	4	415	-14
Northern high-altitude areas	14	-69	21.7	0.0	1244	4	403	-12
Low Zambezia River basin	28	-58	22.6	0.4	1242	3	448	-12
Northern coast	43	-43	22.8	-0.1	1213	4	488	-10
Southern region	75	-19	22.6	0.9	1125	6	511	-3

Table 3.59 Mozambique's agronomic indicators by sub-national regions, current season's values and departure from 5YA, July - October 2022

Region	Cropped arable land fraction		Cropping Intensity		Maximum VCI
	Current (%)	Departure (%)	Current (%)	Departure from 5YA (%)	Current
Buzi basin	97	1	100	-2	0.95
Northern high-altitude areas	91	11	100	-1	0.90
Low Zambezia River basin	80	9	103	2	0.91
Northern coast	98	1	100	0	0.90
Southern region	98	6	101	1	0.99

[NGA] Nigeria

This report covers crop conditions for maize, wheat, soybean and rice between the months of July to October 2022 in Nigeria. In the northern region, maize and soybean sowing started in April/May, while in the south, it began in March/April depending on the start of rainfall. After 3 to 4 months, the early maturing crops reached maturity in July/August. Planting of rainfed rice started in April, followed by irrigated rice a month later. The harvesting of the 2022 main season crops, mainly maize, was completed in August in the south. In the rest of the country, rice, millet, and sorghum harvesting were expected to conclude in January 2023.

This monitoring period, which coincides with the peak of the rainfall season, recorded the maximum rainfall of 100 mm in a dekade in mid-August. Rainfall was generally consistent throughout the period. It was near the 15-year average. Early July and early August recorded a drop in rainfall. On average, rainfall was 20% below the 15YA. The average temperature was also lower than the 15YA (-0.2°C). The recorded radiation decreased by 2%. As a result of these factors, the BIOMSS also fell below the 15-year average by 4%. The observed maximum vegetation condition index (VCIx) was 0.79 and the CALF was lower than the 15-year average (- 4%). The crop condition development graph based on NDVI shows that the NDVI was mostly below the 15-year average through out the reporting period.

The Crop Condition Index (CPI) was generally normal through out the country. As shown in the spatial NDVI profiles and distribution map, 50% of the country, predominantly in the northern part, were slightly below the 15-year average throughout the July to October period. About 16.7% of the total cropped areas were far below the 15-year average in early August, but returned to near average before the end of August and maintained that level for the rest of the period. Only a portion of 10.4% rose above the 15-year average for a very short period before dropping far below. Overall, the crop conditions in most parts of the country were near average and slightly better in the northern part of the country.

The southern part of the country experienced much more rainfall than usual during this period. This led to an increase in water levels. In addition, the release of excess water from Ladgo dam in the neighbouring Cameroon, together with the already increased water levels, led to flooding. It greatly affected lives and farming activities in the region. In addition, cereal production was affected by high production costs and conflicts.

Regional Analysis

The analysis focuses on four major agro-ecological zones in the country, i.e., **Derived savanna zone** (146) within the central region, **Guinea savanna zone** (147) and **Humid Forest zone** (148) situated in the southern region and **Sudan-Sahel savanna zone** (149) across the northern region.

The Derived savanna region is a transition zone between the Guinea savanna and Humid Forest zones. The rainfall decreased by 26% below the 15-year average. The temperature was average. The radiation was unchanged and the BIOMSS fell below the 15-year average at -10%. The CALF was unchanged and the maximum VCI was 0.91. The CPI was normal at 1. According to the NDVI development graph, crop conditions trended below average, but were approaching average levels at the end of this monitoring period.

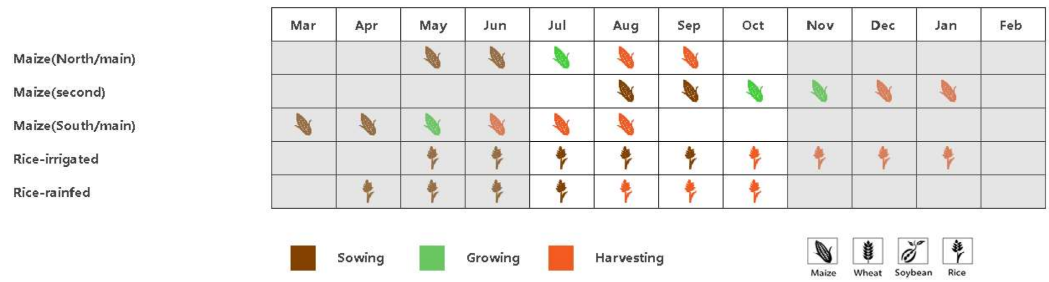
The Guinea savanna zone is predominantly located in the central region of the country. Rainfall decreased by 14%, temperature was lower by 0.2°C, while radiation was 3% lower, and BIOMSS was down by 6%.

The CALF was lower by 1% and the maximum VCI was 0.90. The CPI was at 1, which indicates normal conditions.

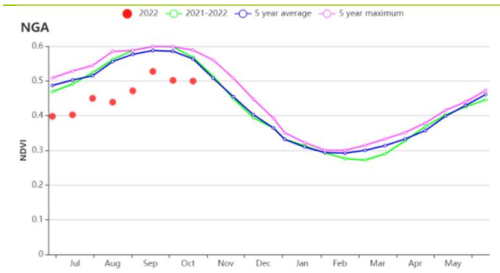
In the Humid Forest, the rainfall is rather high as compared to other regions, however it was below the 15-year average (-28%) and temperature was close to the 15-year average. The radiation decreased by 1% and the BIOMSS decreased by 4%. The CALF was near the 5-year average at -1% and the maximum VCI was 0.87. The CPI at 1 indicates that the crop conditions were normal. The NDVI development graph trended below average, partly due to flooding.

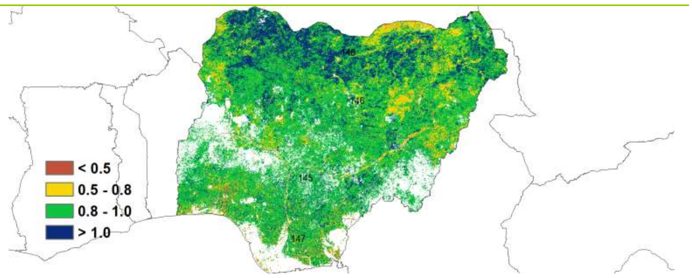
In the Sudan-Sahel zone, the agro-climatic conditions showed that rainfall increased by 15% and the average temperature was 0.7°C below the 15-year average. The radiation decreased by 3%. The increase in rainfall and the decrease in temperature led to an increase in the BIOMSS which stood at +6%. However, CALF increased by 4% and the maximum VCI was 0.94, while CPI was also normal at 1. According to the NDVI development graph, crop conditions were average almost throughout the period with a slight drop occurring only in early August.

Figure 3.34 Nigeria's crop condition, July-October 2022

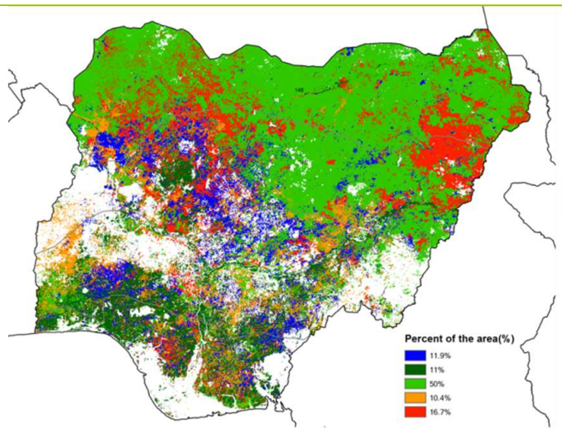


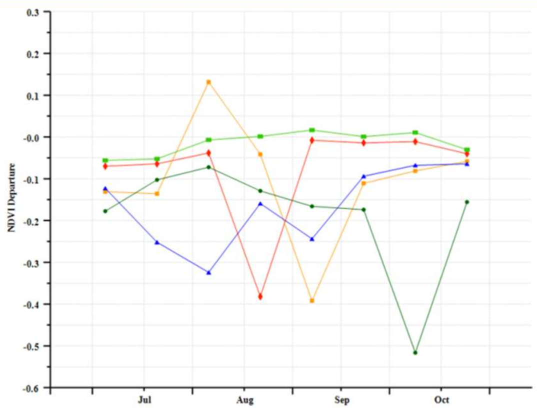
(a). Phenology of major crops



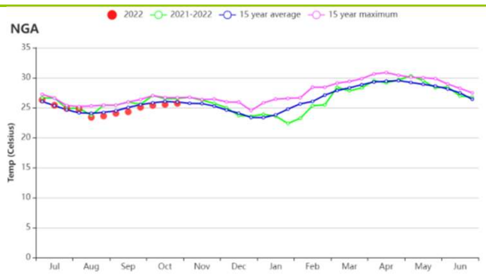


(b) Crop condition development graph based on NDVI (c) Maximum VCI

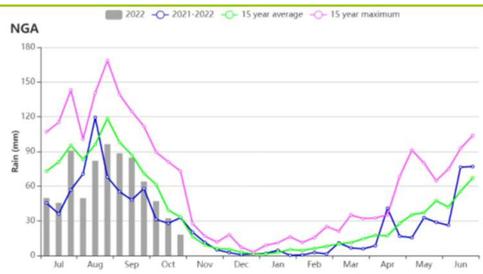




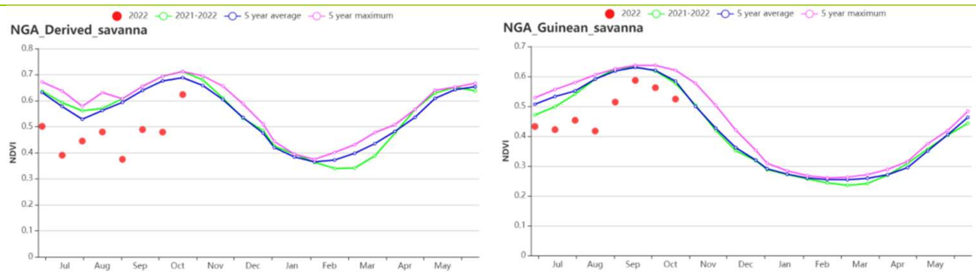
(d) Spatial NDVI patterns compared to 5YA (e) NDVI profiles



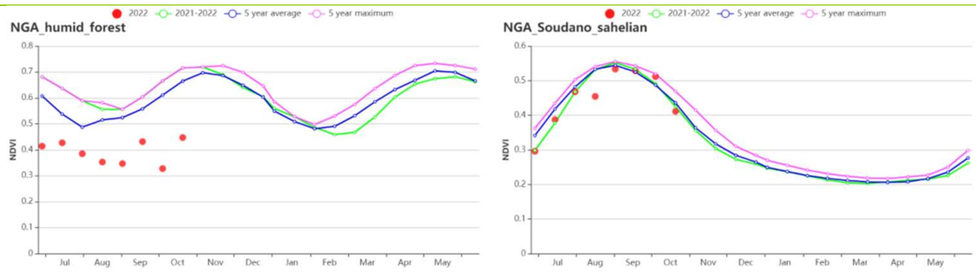
(f) Time series temperature profile



(g) Time series rainfall profile



(h) Crop condition development graph based on NDVI (Left:Derived-savanna (146), Right: Guinean-savanna (147))



(i) Crop condition development graph based on NDVI(Left: Right:Humid-forest (148), Right: Sudan-sahel (149))

Table 3.60 Nigeria's agro-climatic indicators by sub-national regions, current season's values and departure from 15YA. July-October 2022

region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Derived savanna zone	770	-26	24.2	0.0	1058	0.0	1260	-10
Guinean savanna	663	-14	24.5	-0.2	1122	-3	1187	-6
Humid forest zone	1141	-28	24.1	0.0	941	-1	1449	-4
Soudano-Sahelian zone	509	15	27.0	-0.7	1162	-3	1035	6

Table 3.61 Nigeria's agro-climatic indicators by sub-national regions, current season's values and departure from 5YA. July-October 2022

region	CALF		Cropping Intensity		Maximum VCI
	Current (%)	Departure (%)	Current (%)	Departure (%)	Current
Derived savanna zone	99	0	150	-7	0.91

Guinean savanna	98	-1	107	0.2	0.90
Humid forest zone	97	-1	176	-2	0.87
Soudano-Sahelian zone	88	4	99	-2	0.94

[PAK] Pakistan

This reporting period covers the production period for main maize and rice, which were harvested in October. It also covers the sowing of winter barley and wheat.

RAIN was sharply above average (+72%), together with lower TEMP and RADPAR (-0.2℃ and -6% respectively), which resulted in a significant increase of estimated BIOMSS (+37%). The dekad rainfall was above average for most dekads from July to August, except for first dekad in August, but it still exceeded last year's level. The significantly heavy monsoon rains influenced crops growing in many areas and caused flooding conditions, mainly in the provinces of Sindh, Balochistan and Khyber Pakhtunkhwa. The fraction of cropped arable land (CALF) increased by 12% compared with the 5YA. However, that index takes are based on the maximum CALF value observed during the July to October period. It therefore does not account for the effects of the floods. According to CropWatch, about 8.6% of the country's rice fields were inundated causing a decrease of rice production by 9.6% as compared with 2021.

As shown by the nationwide NDVI development graph, crop conditions were below average in the first dekad of July, then reached average levels in later dekads. Further, according to the spatial NDVI patterns and profiles, 17.0% of the cropped areas presented continuously below-average conditions during the reporting period, which were mostly distributed in the Sindh, southern Punjab and along the Lower Indus River. About 2.9% of cropland, concentrated in Sukkur and northern Sindh, presented largely below-average conditions after July. Since late August, an additional 26.9% of cropland in Punjab and southern Khyber Pakhtunkhwa presented below-average conditions. The continuous floods had a serious impact on crop growth in Sindh and parts of Punjab, where the maximum VCI was lower than 0.5. At the annual scale, cropping intensity increased by 14% indicating that the total cultivated crop area was at an above-average level. All in all, crop production estimates for the summer crops are below average.

Regional analysis

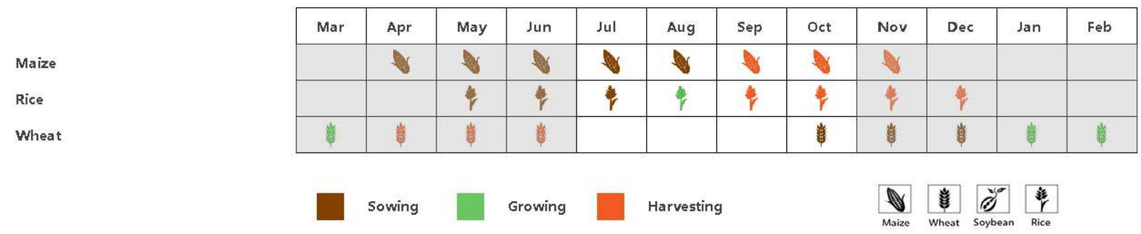
For a more detailed spatial analysis, CropWatch subdivides Pakistan into three agro-ecological regions based essentially on geography and agro-climatic conditions: the Lower Indus basin(150), the Northern highlands(151), and the Northern Punjab(152) region.

Compared to average, RAIN recorded above-average values (+411%) and TEMP was below average by 2.4℃ in the Lower Indus basin. The estimated BIOMSS was 61% above average. NDVI was below average in early July, and later recovered to above maximum level. Since late August, the crop conditions were consistently below average mainly due to heavy rainfall and floods, distributed by northern Sindh and along Lower Indus basin. The CALF value of 66% exceeds the average by 9% and the VCIx was 0.87. Overall, summer crops production is expected to be below average.

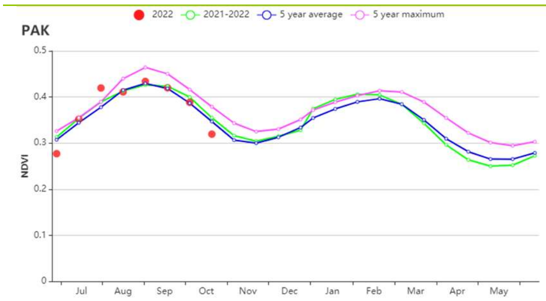
In **Northern highland** region, RAIN decreased by 15%, RADPAR and TEMP were above average (+5% and +1.0℃ respectively). BIOMSS decreased by 3%. The region showed a low CALF of 70%, but it was higher than the 5YA by 19%. The NDVI profile stayed above average during late July and early October and exceeded the maximum in August. The VCIx was high with 1.02. In short, the situation for the region is assessed as above average.

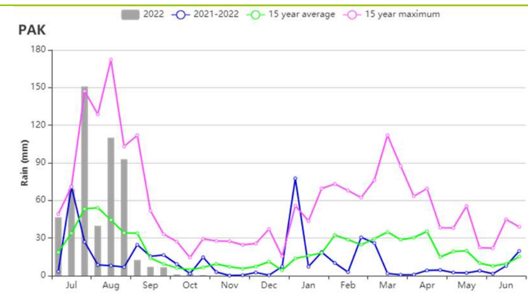
In **Northern Punjab** region, which is the main agricultural region of Pakistan, RAIN increased by 28%. TEMP and RADPAR were below average (-0.9℃ and -3% respectively). The resulting BIOMSS was above average by 18%. The NDVI profile presented above average conditions during late July and late August due to abundant monsoon rains. Subsequently the crop conditions were slightly below average. In addition, CALF in this area reached 87%, which was up by 7% compared to the 5YA, and the VCIx was at 0.92. Overall, the summer crops production potential for the region are assessed as average.

Figure 3.35 Pakistan crop condition, July-October, 2022



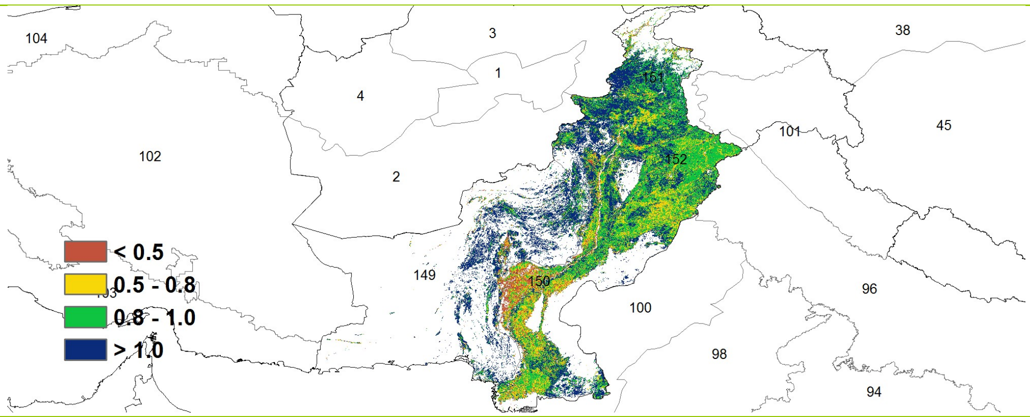
(a). Phenology of major crops



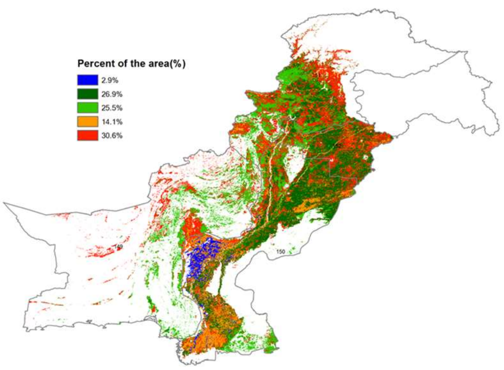


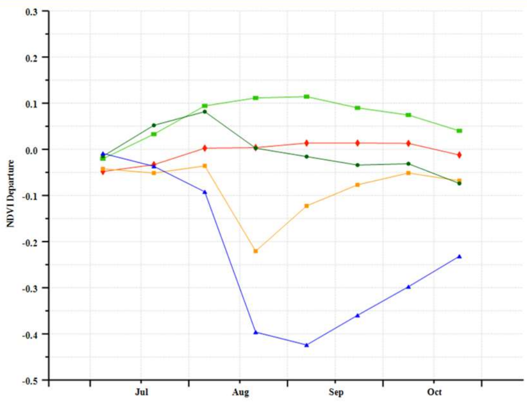
(b) Crop condition development graph based on NDVI

(c) Time series precipitation profile



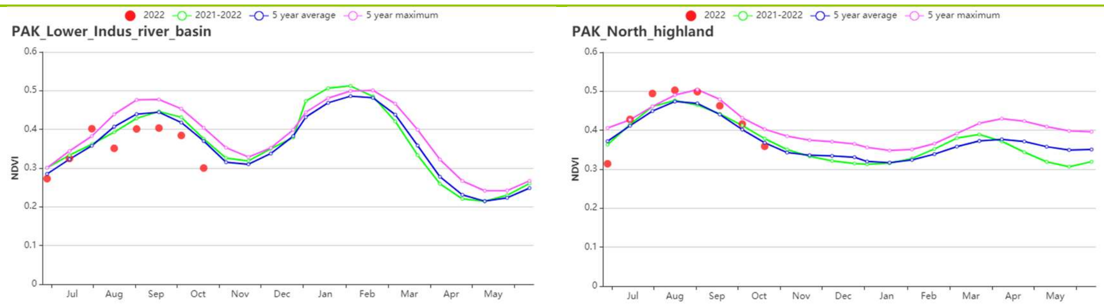
(d) Maximum VCI



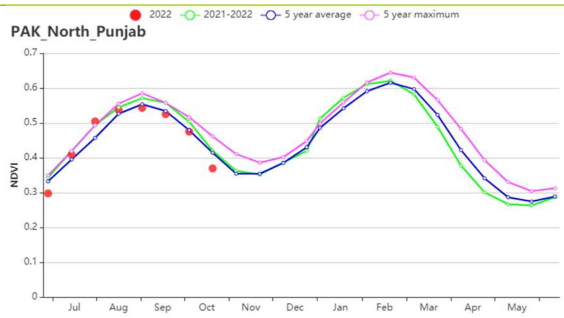


(e) Spatial NDVI patterns compared to 5YA

(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 3.62 Pakistan's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, July-October 2022

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (℃)	Departure (℃)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Lower Indus river basin	850	411	30.4	-2.4	1206	-8	1072	61
Northern highlands	307	-15	22.4	1.0	1307	-5	712	-3
Northern Punjab	475	28	29.9	-0.9	1225	-3	995	18

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

Region	Cropped arable land fraction		Cropping Intensity		Maximum VCI
	Current (%)	Departure (%)	Current (%)	Departure (%)	Current
Lower Indus river basin	66	9	175	13	0.87
Northern highlands	70	19	139	9	1.08
Northern Punjab	87	7	206	20	0.92

[PHL] Philippines

During this monitoring period, the harvest of main-season maize and rice in the Philippines started in July and September, respectively, while both second-season maize and second-season rice started to be planted in October. The weather in the Philippines was more humid than usual during the monitoring period. The precipitation (RAIN) and radiation (RADPAR) were about 9% and 3% higher, respectively, compared to the same period in the past 15 years, while the temperatures (TEMP) remained around average. The abundant precipitation was generally favorable for crop growth, resulting in a positive departure of potential biomass by about 2% (BIOMSS). The NDVI time series graph also indicates that the crop growth was consistently below average during the monitoring period. According to the NDVI trend line, there was a significant drop in NDVI in late October, and this was associated with Tropical Storm Nalgae. It made landfall in the Philippines in late October and not only brought record daily rainfall but also caused extensive flooding in Maguindanao province (Maguindanao) on Mindanao Island. Although the intense rainfall in late October may have delayed or disrupted the sowing of second-season corn and second-season rice, its consequences were not evident during this monitoring period. According to the spatial distribution map of VCIx, the VCIx in almost all areas was higher than 0.8. According to the spatial NDVI pattern map, the NDVI in almost all cultivated areas remained near the average level, except for a sudden drop in NDVI due to cloud and rain cover in some areas, indicating generally normal crop growth.

Regional analysis

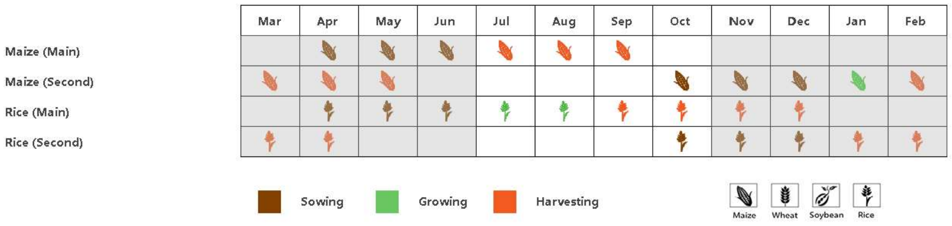
Based on the cropping systems, climatic zones, and topographic conditions, three main agro-ecological regions can be distinguished for the Philippines. They are **the Lowlands region** (northern islands), **the Hilly region** (Island of Bohol, Sebu and Negros), and **the Forest region** (mostly southern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

The **Lowland region** (agroecological subzone 155) had higher precipitation (RAIN +7%), near average temperature (TEMP), higher radiation (RADPAR +3%), and higher potential biomass (BIOMSS +3%). The proportion of cultivated land was 100%. The NDVI in general stayed slightly below average during the monitoring period. The VCIx index for the subzone was 0.95 and the CI index was 134. Overall, crop growth in the subzone was generally normal.

In the **Hilly region** (agroecological subzone 154), the precipitation was above the average of the last 15 years (RAIN +15%). The temperature was lower (TEMP -0.2ºC) and radiation was higher (RADPAR +3%). The potential biomass was higher than the average (BIOMSS +1%) and all cultivated land was planted. NDVI values were significantly lower in early July and September. The VCIx index for this subzone was 0.93. The results indicated that crop growth in this subzone was normal.

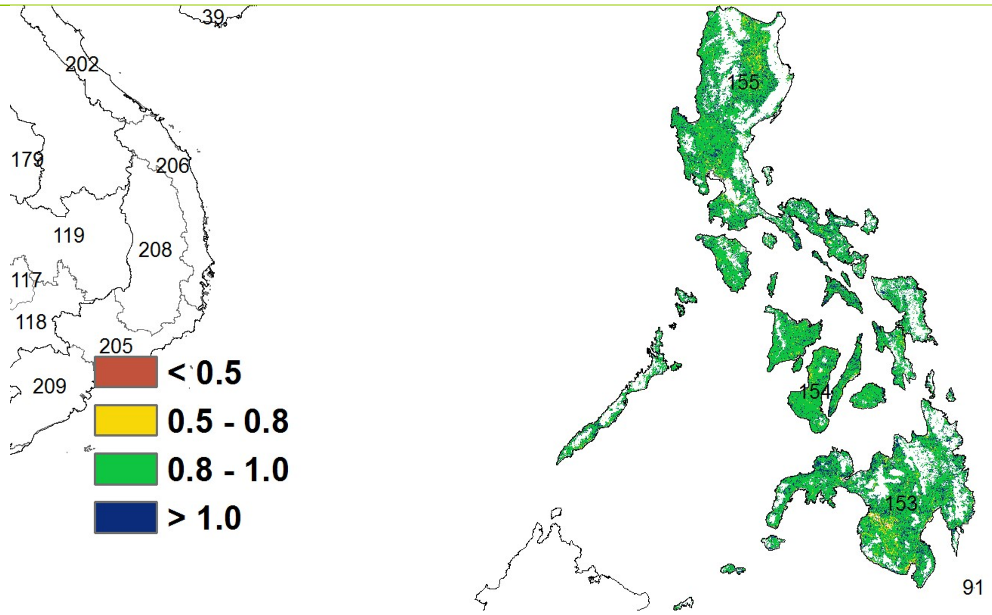
The precipitation in the **Forest region** (agroecological subzone 153) was also more than adequate at 1644 mm. It was higher than the average of the last 15 years (RAIN +12%), with a higher temperature (TEMP +0.3ºC) and radiation (RADPAR +4%). The potential biomass was higher (BIOMSS +2%) and the arable land was fully utilized. The NDVI was always slightly below average and the VCIx index was 0.95. Crop growth in this subzone was generally normal.

Figure 3.36 Philippines' crop condition, July -October 2022

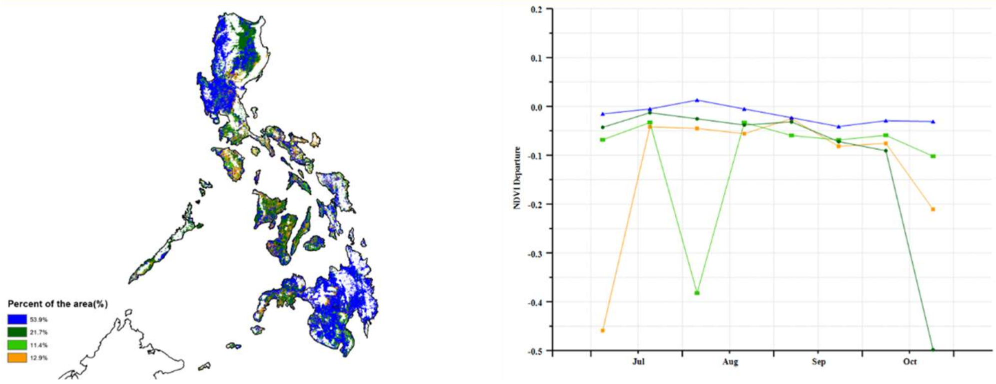


(a). Phenology of major crops

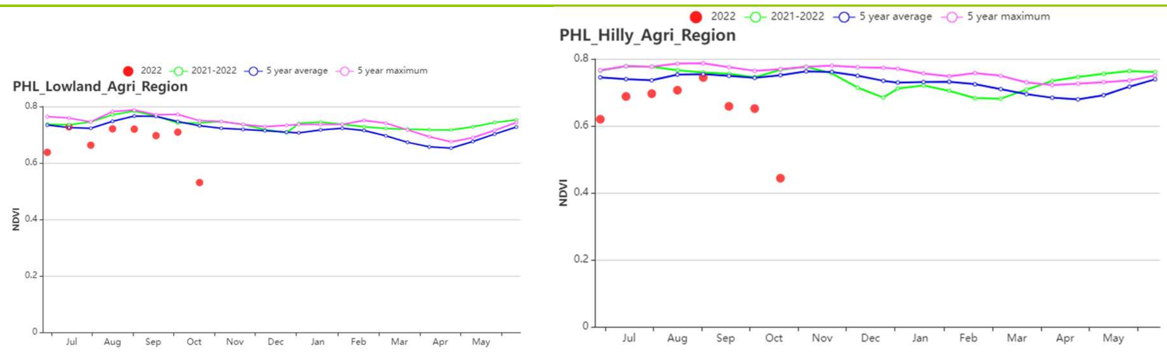
(b) Crop condition development graph based on NDVI, RAIN and TEMP



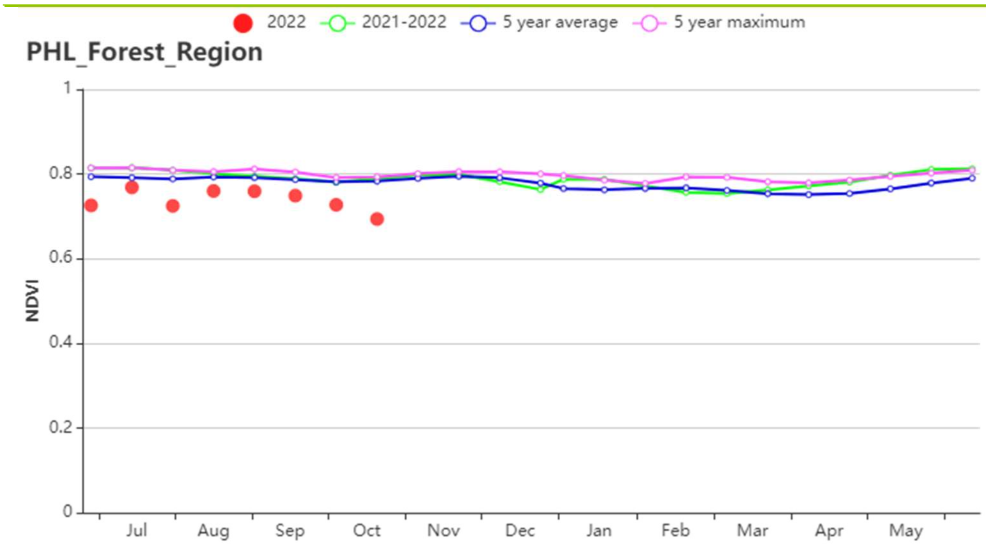
(c) Maximum VCI



(d) Spatial distribution of NDVI profiles.



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



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

Table 3.64 Philippines' agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, July -October 2022

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m^2)	Departure (%)	Current (gDM/m^2)	Departure (%)
Forest region	1644	12	25.5	0.3	1274	4	1564	2
Hilly region	1929	15	26.5	-0.2	1287	3	1644	1
Lowlands region	2028	7	25.4	0.0	1206	3	1619	3

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

Region	Cropped arable land fraction		Cropping Intensity		Maximum VCI
	Current (%)	Departure (%)	Current (%)	Departure (%)	Current (%)
Forest region	100	0	145	3	0.95
Hilly region	100	0	119	-5	0.93
Lowlands region	100	0	134	-10	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 October. Winter wheat sowing started in September and was completed in October.

Compared to the average for the same period of the last 15 years, Poland experienced drier and warmer weather. Temperature (TEMP +0.5°C) and radiation (RADPAR +1%) were above average from July to October, but significantly lower rainfall (RAIN -21%) resulted in a below-average biomass production potential (BIOMSS -8%).

The main grain crops were adversely affected during the flowering and grain filling periods due to the high temperature and drought conditions during the previous monitoring period. Although rainfall in July improved soil moisture conditions, a rainfall deficit and record high temperatures in early August continued to cause unfavorable conditions. This is also reflected in the crop condition development graph based on NDVI, where NDVI was lower than the average of the last 5 years throughout the monitoring period. Warm weather in October caused favorable conditions for germination of winter wheat, but rainfall was below average.

The crop growth clustering map shows that only about 32.2% of the arable land planted (marked in blue) had above-average crop growth, mainly located in the central region, where VCIx was above 0.8. CALF at the national level was 100% and VCIx was 0.84, while dry soil conditions have affected the replanting of cropland, as CI was only 99%, 8% below the average of the last 5 years.

Overall, crop growth in Poland seems to be slightly below average. Sowing conditions for winter wheat were close to normal.

Regional analysis

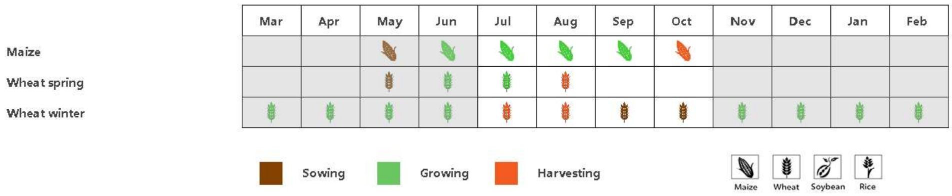
CropWatch sub-divides Poland into four zones according to the agro-ecological and farming characteristics, including: (a) the **Northern oats and potatoes area** covering the northern half of West Pomerania, eastern Pomerania and Warmia-Masuria; (b) the **Northern-central wheat and sugar-beet area** (Kuyavia-Pomerania to the Baltic Sea); (c) the **Central rye and potatoes area** (Lubusz to South Podlaskie and northern Lublin), and (d) the **Southern wheat and sugar-beet area** (Southern Lower Silesia to southern Lublin and Sub-carpathia along the Czech and Slovak borders).

In the **Northern oats and potatoes area** and **Southern wheat and sugar-beet area**, above-average temperature (TEMP +0.8°C and +0.2°C, respectively), average radiation, significantly lower precipitation (RAIN -31% and -22%, respectively) resulted in below-average potential biomass (BIOMSS -15% and -11%, respectively). NDVI in both subregions were below the average of the last 5 years during entire monitoring period. CALF in both zones reached 100% and VCIx was 0.92 and 0.96, respectively. CI was below the 5-year average in both areas (-5% and -9%, respectively) due to low precipitation at key times throughout this period. CPI were 1.03 and 1.01, respectively. Crop conditions were below average in both subregions.

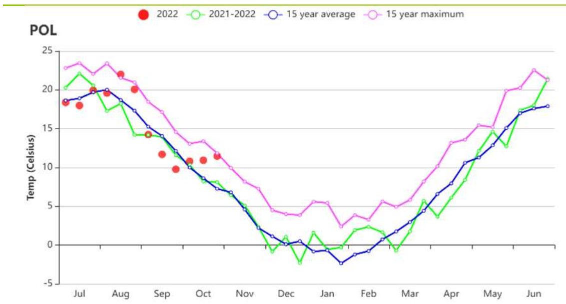
Compared to the average of the last 15 years, the **Northern-central wheat and sugar-beet area** experienced below-average precipitation (RAIN -19%), above-average temperature (TEMP +0.9°C) and radiation (RADPAR +2%), resulting in a below-average potential biomass (BIOMSS -7%). NDVI in this subregion was close to the average in July and September, and significantly below average in August because of drought stress. CALF was near 100% and CI was 105%, both of which were close to the average of the last 5 years. VCIx was 0.89 and CPI was 1.04, indicating normal crop conditions in this zone.

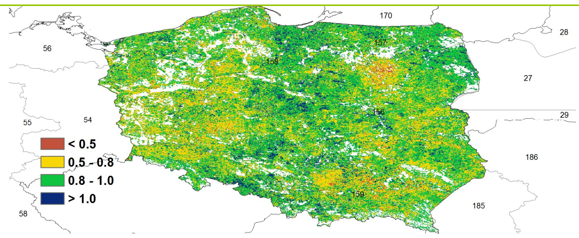
Similar to the Northern-central wheat and sugar-beet area, the **Central rye and potatoes area** experienced below-average rainfall (RAIN -16%), above-average temperature (TEMP +0.6°C) and radiation (RADPAR +1%). Potential cumulative biomass was below the 15-year average by 6% due to the dry and hot weather. NDVI in this subregion was close to the 5-year average only in early September and early October, and below average in the rest of the period. CALF was 100%. CI was 103%, 5% lower than 5-year average. With VCIx of 0.96 and CPI of 1.02, crop yields in this zone are likely to be slightly below or close to normal.

Figure 3.37 Poland's crop condition, July - October 2022



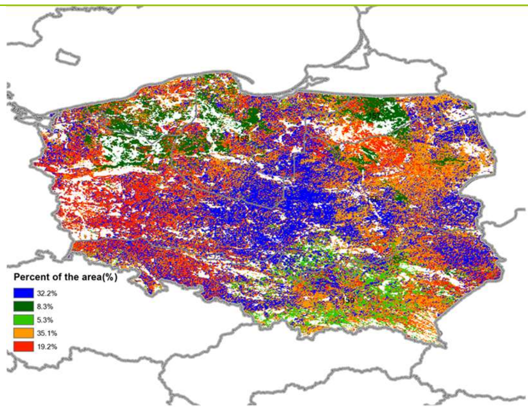
(a). Phenology of major crops

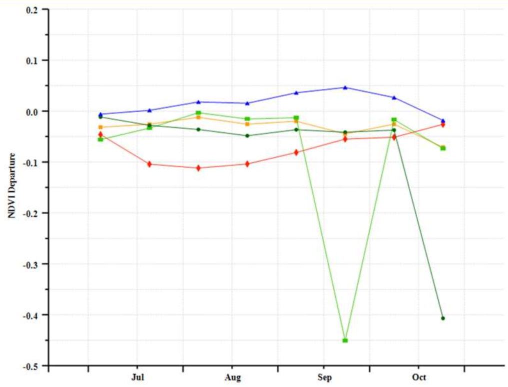




(b) Crop condition development graph based on NDVI

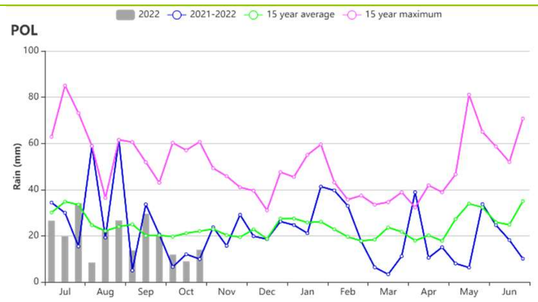
(c) Maximum VCI





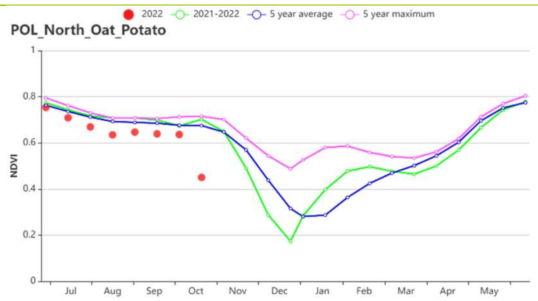
(d) Spatial NDVI patterns compared to 5YA

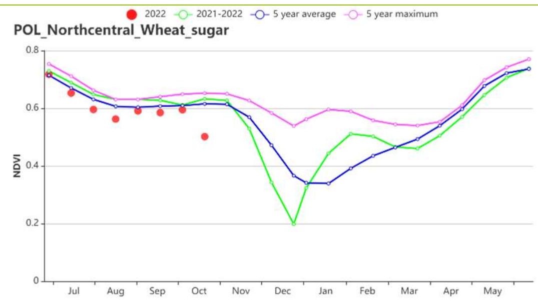
(e) NDVI profiles



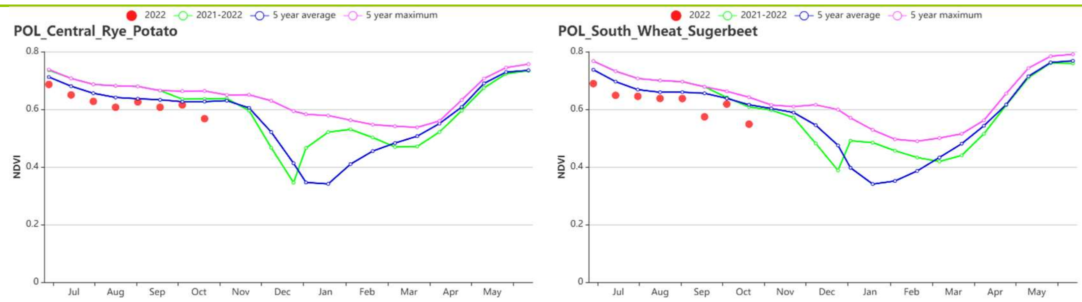
(f) Rainfall profiles

(g) Temperature profiles





(h) Crop condition development graph based on NDVI (Northern oats and potatoes area (left) and Northern-central wheat and sugarbeet area (right))



(i) Crop condition development graph based on NDVI (Central rye and potatoes area (left) and Southern wheat and sugarbeet area (right))

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

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Northern oats and potatoes area	224	-31	15.4	0.8	795	0	661	-15
Northern-central wheat and sugarbeet area	232	-19	15.9	0.9	826	2	682	-7
Central rye and potatoes area	236	-16	16	0.6	848	1	685	-6
Southern wheat and sugarbeet area	240	-22	15	0.2	899	0	668	-11

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

Region	Cropped arable land fraction		Cropping intensity		Maximum VCI
	Current (%)	Departure (%)	Current (%)	Departure (%)	Current
Northern oats and potatoes area	100	0	96	-5	0.92
Northern-central wheat and sugarbeet area	100	0	105	0	0.89
Central rye and potatoes area	100	0	103	-5	0.96
Southern wheat and sugarbeet area	100	0	102	-9	0.96

[ROU] Romania

The reporting period includes the harvest of wheat (which started in July), the sowing of the 2021-22 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 35% lower than average; TEMP was above the 15YA (+1°C) , whereas RADPAR was a bit lower than average (-1%) and BIOMSS was below average (-17%). The nationwide NDVI profile shows that crop conditions were a bit lower than average from July to August and above average in September. The temperature fluctuated around above-average levels and rainfall was below average in July. The southeast suffered from low crop condition. The CALF of Romania during the reporting period was 95%, 3% lower than average and the maximum VCI was 0.75, which was a bit low. According to the spatial distribution of VCIx, the eastern subregion has higher values (0.8-1.0) than the western and central subregion (0.5-0.8). The NDVI pattern profile shows that nearly all regions experienced a sharp decrease in September and October. NDVI was also far below average in the eastern and southern maize, wheat and sugar beet plains, shown in light green and red. Hence, production prospects for this important region of Romania are unfavorable. The CPI of Romania was 0.98.

Regional analysis

More spatial detail is provided below for three main agro-ecological zones: the Central mixed farming and pasture Carpathian hills (104), the Eastern and southern maize, wheat and sugar beet plains (105), and the Western and central maize, wheat and sugar beet plateau (106).

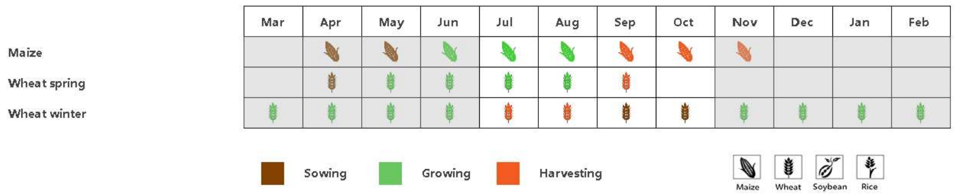
For the Central mixed farming and pasture Carpathian hills, rainfall decreased by as much as 29% below average while temperature increased by 1.1℃ and radiation decreased by 1%, and BIOMSS decreased by 13%. The maximum VCI map shows values above 0.8, with the regional average at 0.84. The NDVI spatial distribution shows that NDVI was below average from July to August. 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 104, 2% higher than last year.

For the Eastern and Southern maize, wheat and sugar beet plains, rainfall decreased by 48%, temperature increased by 1.4℃, radiation decreased by 1% and biomass decreased by 22%. The NDVI development graph shows that crop conditions were largely lower than average. The decrease of precipitation in this period caused drought conditions. VCIx value of this region was only 0.70 and according to the distribution map, VCIx values were between 0.5 and 0.8 in most of the central and middle region (counties of Tulcea and Constanta), representing about 14.3% of national cropland. The cropping intensity was 106, 6% lower than last year.

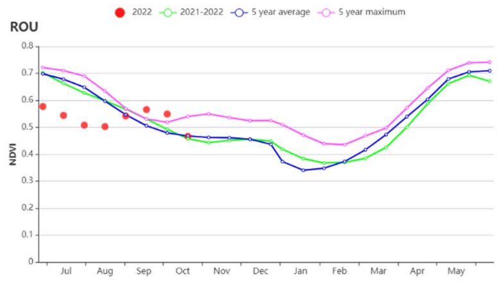
For the Western and central maize, wheat and sugar beet plateau, rainfall was lower than average by 23%, temperature was average (+0.5℃) and radiation was a bit lower (RADPAR -1%), and biomass decreased by 12%, due to a decrease in rainfall. Spatial NDVI profiles show that crop condition was worse than average during July to August, covering the growing periods of maize and spring wheat. Maximum VCI of this region was 0.84, the highest among three sub regions. The VCI spatial distribution was between 0.5 and 1.0. Also, the NDVI development decreased from July to August, consistent with the VCI values. The cropping intensity is 104% and remained unchanged from last year.

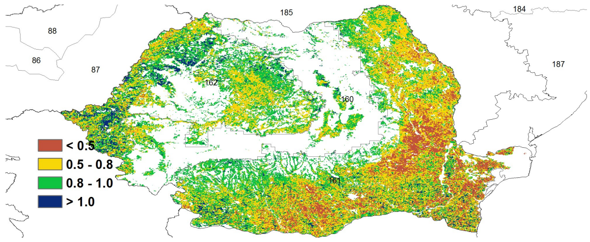
Overall, the widespread lack of rainfall has made a negative impact on crop conditions and the production prospect is unfavorable.

Figure 3.38 Romania's crop condition, July - October 2022



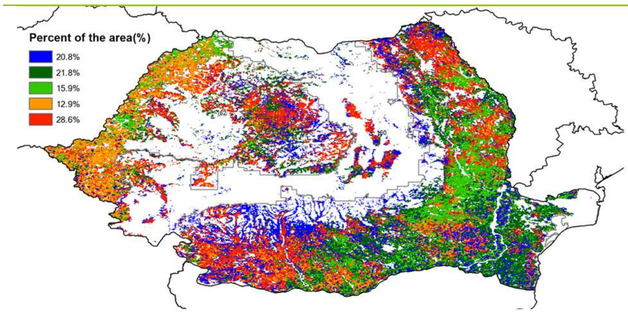
(a). Phenology of major crops

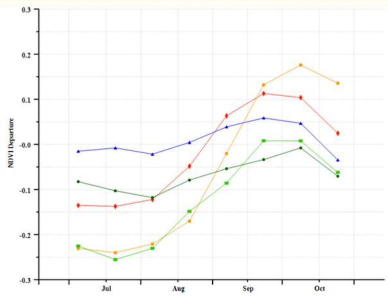




(b) Crop condition development graph based on NDVI

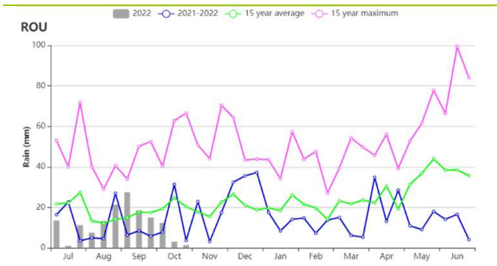
(c) Maximum VCI

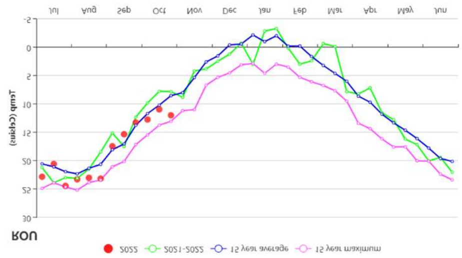




(d) Spatial NDVI patterns compared to 5YA

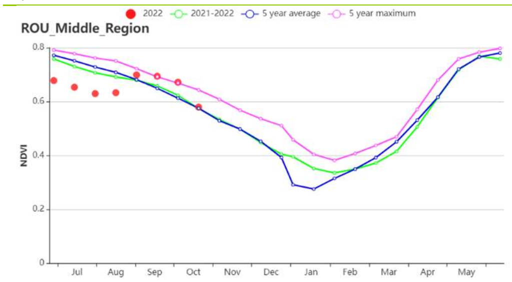
(e) NDVI profiles

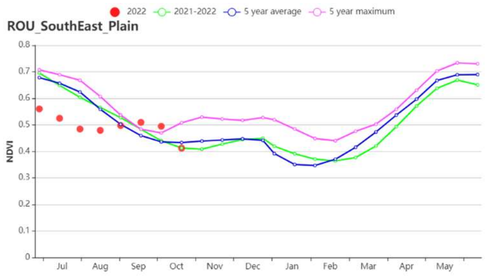




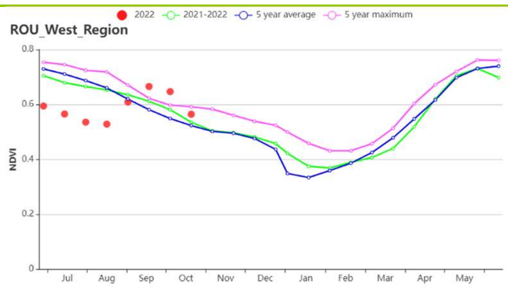
(f) Rainfall profiles

(g) Temperature profiles





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



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

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

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Central mixed farming and pasture Carpathian hills	184	-29	16	1.1	1041	-1	597	-13
Eastern and southern maize wheat and sugarbeet plains	108	-48	19.7	1.4	1058	-1	514	-22
Western and central maize wheat and sugarbeet plateau	175	-23	17.2	0.5	1044	-1	587	-12

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

Region	Cropped arable land fraction		Cropping intensity		Maximum VCI
	Current (%)	Departure (%)	Current (%)	Departure (%)	Current
Central mixed farming and pasture Carpathian hills	100	0	104	2	0.84
Eastern and southern maize wheat and sugarbeet plains	93	-5	106	-6	0.7
Western and central maize wheat and sugarbeet plateau	100	0	104	0	0.84

[RUS] Russia

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

During the analyzed period, rainfall was mainly above the 15YA, sometimes reaching the 15-year maximum, except for August and the beginning of September, when precipitation was below 15YA and the level of the previous year.

Temperatures in Russia from July to August were mainly close to the 15YA and last year's value.

According to the national CropWatch data, NDVI during the monitoring period was mainly below both the 5YA and the level of the previous year, except for July when it was close to these levels.

According to VHIn data category “no drought” prevailed during the analyzed period followed by the category “minor drought” compared to the 5YA. Their combined share was more than 85%. Among NDVI anomaly categories, “average” had prevailed with a proportion of about 60%.

Crop conditions with VCIx above 0.8 are observed in Central and Black soil region. VCIx in South and North Caucasus regions ranges from <0.5 to 0.8. Spring crop producing regions (Volga, Urals, Siberia) showed VCIx ranging from 0.5 to 1. NDVI departure was mainly negative or close to 0. Only 9.8% of the territory (mainly located in Middle Volga region) showed clear positive NDVI departure.

In Middle Volga the crop yield is expected to be above or at the level of the previous year. In South and North Caucasus regions the yield of winter crops is likely to be lower than in the previous year. In Central and Black soil regions the yield of winter crops should be close to the 5YA. In spring crop producing regions the yield of spring crops is expected to be close to the 5YA or slightly below it.

Regional analysis

More spatial detail is provided below for nine main agro-ecological zones: South Caucasus (171), North Caucasus (169), Central Russia (164), Central black soils area (165), Middle Volga (168), Ural and western Volga (173), Western Siberia (174), Middle Siberia (167), and Eastern Siberia (166).

South Caucasus

Rainfall was 30% below the 15YA. Temperature and RADPAR were above the 15YA by 0.4°C and 2%, respectively. BIOMSS showed a negative deviation of 11% relative to the 15YA. The CALF was similar to the 5YA. Cropping intensity was by 19% above the 5YA. The VCIx was 0.75. Crop production index was 1.0 meaning that crop production situation was normal.

NDVI was mainly below the 5YA. Only in October it reached the level of the previous year. Judging by the index values, the 2021/2022 winter wheat harvest was lower than last year and 5YA as well as the harvest of summer crops.

North Caucasus

Rainfall was above the 15YA by 3% and temperature was above by 0.7°C. RADPAR decreased by 4% relative to the 15YA, and BIOMSS increased by 5% relative to the 15YA. CALF increased by 7% relative to the 5YA. Cropping intensity was by 16% above the 5YA. The VCIx was 0.79. Crop production index was 1.1.

During the monitoring period, NDVI was mainly below the 5YA and the level of the previous year. At the beginning of September, it reached 5-year maximum and then dropped back below the level of the previous year. It is likely that summer crop yield was lower than last year, and the sowing and status of 2022/2023 winter crop at the end of analyzed period was worse than in the previous year.

Central Russia

Rainfall was down by 3% relative to the 15YA. Temperature increased by 0.7°C relative to the 15YA.

RADPAR was similar to the 15YA. BIOMSS decreased by 1% relative to the 15YA. CALF was equal to the 5YA. Cropping intensity was 4% below the 5YA. VCIx was 0.96. Crop production index was 1.2.

In July, NDVI was close to the last year's average and the 5YA, then it dropped below the level of the previous year and stayed there till the end of the analyzed period. The yield of 2021/2022 winter crops should be close to last year values, and below average, while the yield of spring and summer crops should be below the 5YA. The sowing campaign of 2022/2023 winter crops is likely to be worse than normal.

Central black soils area

Rainfall and temperature were above the 15YA by 47% and by 0.3°C respectively. RADPAR decreased by 8% relative to the 15YA. BIOMSS increased by 25% relative to the 15YA. The CALF and Cropping intensity were similar to the 5YA. VCIx was 0.93. Crop production index was 1.1.

From July through mid-August, the NDVI was close to the 5YA, till October when it first reached the 5-year maximum and then dropped below 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 the 5YA. Summer crop yield should be also close to the average. The sowing campaign of 2022/2023 winter crop was delayed because of excessive rainfall.

Middle Volga

Rainfall, temperature and RADPAR increased by 10% relative to the 15YA, 1.0°C and 3% respectively. BIOMSS increased by 7% relative to the 15YA. CALF increased by 5% relative to the 5YA. Cropping intensity was 3% below the 5YA. The VCIx was 0.96. Crop production index was 1.3.

Until the middle of August, NDVI was close to the 5YA. Then it dropped to the level of the previous year until October when it decreased below this level. The yield of winter, spring, and summer crop is expected to be close to the last year and 5YA.

Ural and western Volga

In the Ural and western Volga, rainfall was down by 20% relative to the 15YA, while temperature increased by 0.9°C. RADPAR increased by 13% relative to the 15YA. Biomass decreased by 10% relative to the 15YA. CALF increased by 1% relative to the 5YA. Cropping intensity was by 1% below the 5YA. VCI was 0.92. Crop production index was 1.1.

Throughout the monitoring period, NDVI was below the 5YA and the last year's value. At the end of October, NDVI was equal to the 5YA. The yield of winter, spring, and summer crops is expected to be below the last year and the 5YA. The 2022/2023 sowing campaign is likely to be close to normal.

Western Siberia

In Western Siberia, rainfall increased by 15% over the 15YA. Temperature was down by 0.2°C relative to the 15YA. RADPAR and BIOMSS increased relative to the 15YA by 4% and 10% respectively. CALF was down by 2% relative to the 5YA. Cropping intensity was 1% below the 5YA. The VCIx was 0.87. Crop production index was 1.0.

The NDVI in Western Siberia was below last year's value and the 5YA. 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 5YA and below the level of the previous year.

Middle Siberia

In Middle Siberia, rainfall decreased by 2% and temperatures decreased by 0.6°C relative to the 15YA. RADPAR increased by 2% while BIOMSS decreased by 1% relative to the 15YA. CALF decreased by 4% relative to the 5YA. Cropping intensity was 4% above the 5YA. VCIx was 0.89. Crop production index was 1.1.

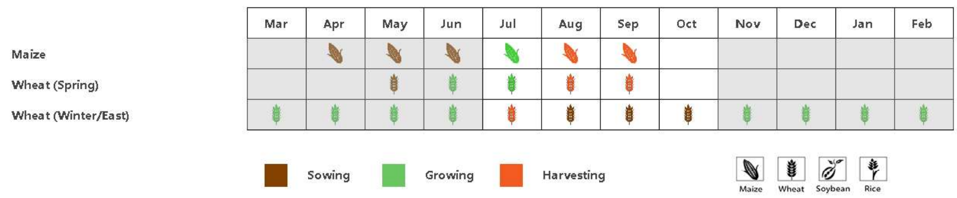
In Middle Siberia, NDVI from July to August was at the level of the previous year and the 5YA, and from September to October was below these two levels. According to the charts, the yield of spring, and summer crops is expected to be close to the 5YA and the level of the previous year.

Eastern Siberia

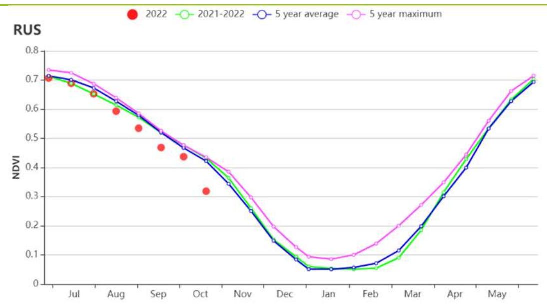
In Eastern Siberia, rainfall increased by 4% compared to the 15YA, while temperature increased by 0.4°C. RADPAR and BIOMSS also increased relative to the 15YA by 3% and by 7% respectively. The CALF was similar to the 5YA. Cropping intensity was 4% below the 5YA. The VCIx was 0.96. Crop production index was 1.2.

NDVI was close to the 5YA and the last year's value. According to the graphs, the spring, and summer crops yield is expected to be close to the 5YA.

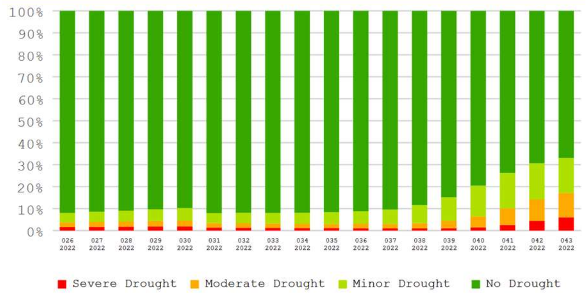
Figure 3.39 Russia's crop condition, July - October 2022



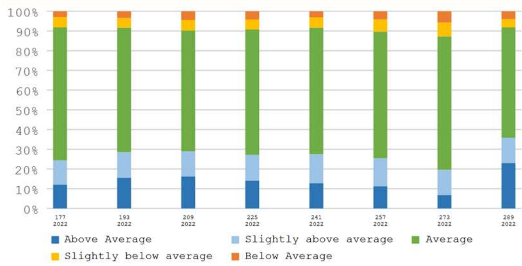
(a). Phenology of major crops

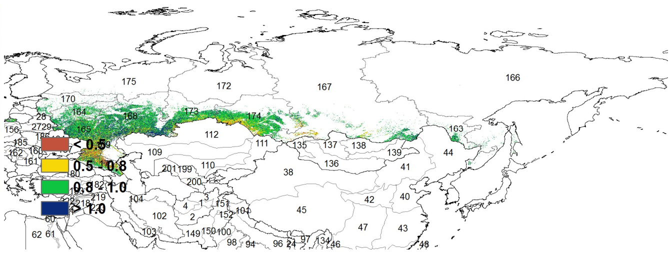


(b) Crop condition development graph based on NDVI

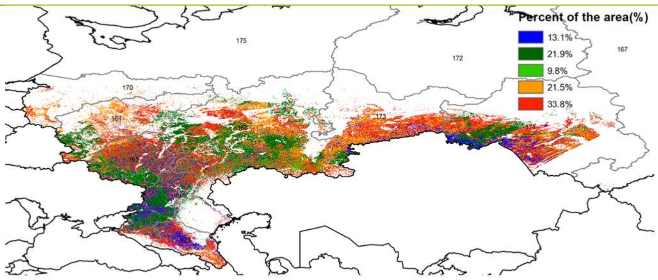


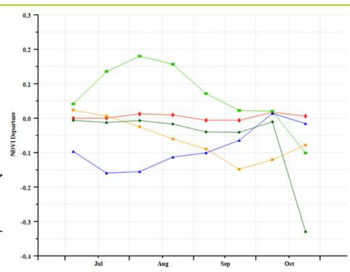
(c) Proportion of VHIm categories compared with 5YA



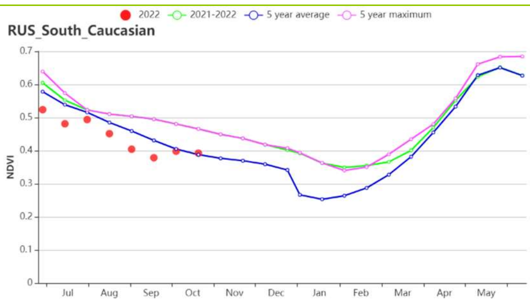


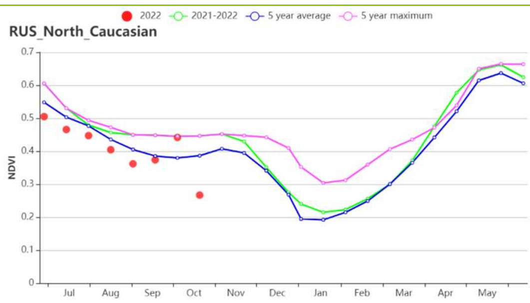
(d) Proportion of NDVI anomaly categories compared with 5YA (e) Maximum VCI



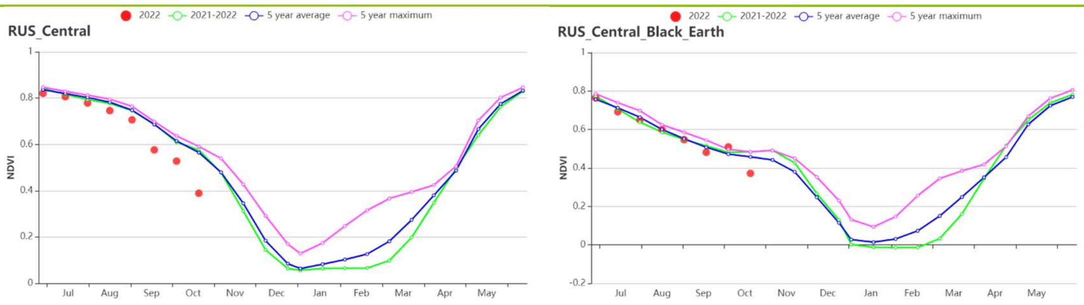


(f) Spatial NDVI patterns compared to 5YA (g) NDVI profiles

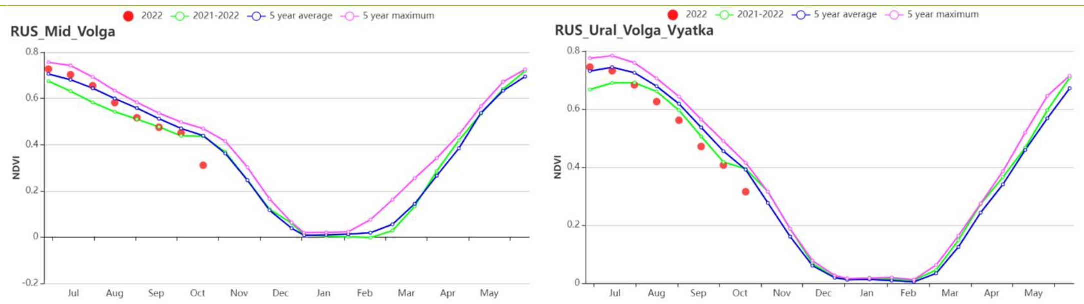




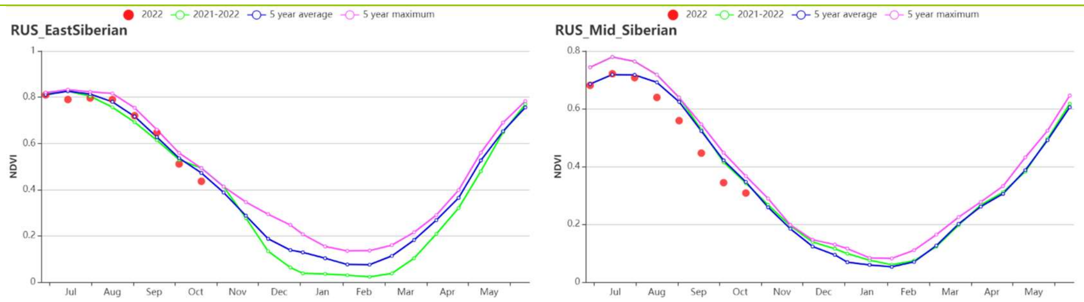
(h) Crop condition development graph based on NDVI (Southern Caucasus and Northern Caucasus)



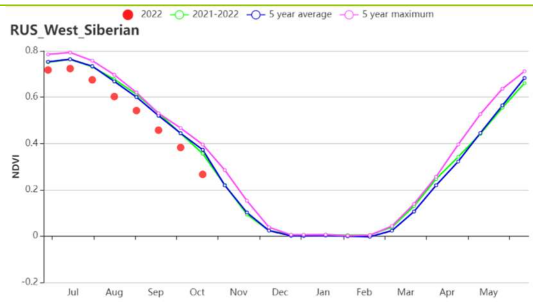
(i) Crop condition development graph based on NDVI (Central Russia and Central Chernozemic region)



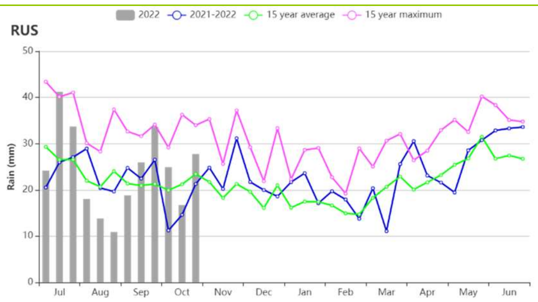
(j) Crop condition development graph based on NDVI (Middle Volga and Ural and western Volga region)



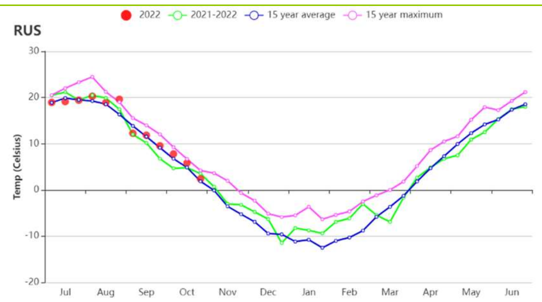
(k) Crop condition development graph based on NDVI (Eastern Siberia and Middle Siberia)



(l) Crop condition development graph based on NDVI (Western Siberia)



(m) Rainfall index



(n) Temperature index

Table 3.70 Russia's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, July - October 2022

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m2)	Departure (%)	Current (gDM/m2)	Departure (%)
Central Russia	295	-3	13.7	0.7	733	0	722	-1
Central black soils area	329	47	15.3	0.3	786	-8	788	25
Eastern Siberia	512	4	13.6	0.4	883	3	947	7
Middle Siberia	282	-2	8.9	-0.6	935	2	637	-1
Middle Volga	289	10	14.6	1.0	831	3	717	7
Northern Caucasus	204	3	19.6	0.7	1003	-4	662	5
Southern Caucasus	234	-30	17.4	0.4	1099	2	660	-11
Ural and western Volga region	205	-20	13.1	0.9	852	13	582	-10
Western Siberia	311	15	11.8	-0.2	840	4	744	10

Table 3.71 Russia's agronomic indicators by sub-national regions, current season's values and departure from 5YA, July – October 2022

Region	Cropped arable land fraction		Cropping Intensity		Maximum VCI
	Current (%)	Departure (%)	Current (%)	Departure (%)	Current
Central Russia	100	0	95	-4	0.96
Central black soils area	100	0	100	0	0.93
Eastern Siberia	100	0	98	-4	0.96
Middle Siberia	95	-4	105	4	0.89
Middle Volga	99	5	96	-3	0.96
Northern Caucasus	89	7	121	16	0.79
Southern Caucasus	77	0	123	19	0.75
Ural and western Volga region	100	1	99	-1	0.92
Western Siberia	98	-2	99	-1	0.87

[THA] Thailand

This monitoring period covers most of the growth cycle of main rice and the harvest of maize. According to the agroclimatic indicators, Thailand experienced wetter and warmer weather than usual in this monitoring period with above-average rainfall (RAIN +19%), radiation (RADPAR +3%), and average temperature (TEMP, 0°C) from July to October. All these indicators led to a favorable biomass production potential (BIOMSS +4%). The proportion of irrigated cropland in Thailand is 22.5%, and therefore, regular rainfall is important to sustain crop growth.

The NDVI development graph shows that the crop conditions were generally lower than the 5YA during the whole monitoring period except for mid-July. Particularly from mid-September to mid-October, the NDVI showed a sharp drop which may have been mainly due to cloud cover in the satellite images and flooding conditions caused by typhoon Noru on September 29. The temperature was around average but reached a 15-year maximum in early-September. And the rainfall was obviously higher than average throughout the whole monitoring period except for mid-to-late October, and its trend was increased and higher than 15 years maximum in mid of September.

According to the NDVI departure clusters and the corresponding profiles, crop conditions were generally close to average on 41.9% of total arable land, located in the central and some cultivated areas in the northeastern region. In the center of these areas, especially in the Chao Phraya River basin, crop conditions were impacted minimally by floods due to early completed rice harvest before late-September, when typhoon Noru hit the country. In an area accounting for 25.9% of total cropped area, mostly located in central and southern parts, crop conditions were close to average but deteriorated significantly to below average after early-September, presumably due to cloud cover in the satellite images. A similar sharp drop in late September was observed for 14.4% of the cropped area. Those areas, predominantly located in the eastern part of Thailand, were hit by typhoon Noru, resulting in flooding and crop rice losses in the Chao Phraya, Chi and Mun river basins. For the remaining 17.9%, located in the central and eastern part of Thailand, a sharp negative departure was observed in early July, 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 -2%), and had favorable VCIx values of around 0.93. The Crop Production Index (CPI) in Thailand is 1.14. CropWatch estimates that the crop conditions were close to average.

Regional analysis

The regional analysis below focuses on some of the already mentioned agro-ecological zones of Thailand, which are mostly defined by the rice cultivation typology. Agro-ecological zones include **Central double and triple-cropped rice lowlands (176)**, **South-eastern horticulture area (177)**, **Western and southern hill areas (178)**, and the **Single-cropped rice north-eastern region (179)**.

For the **Central double and triple-cropped rice lowlands**, the agroclimatic indicators show that the accumulated rainfall and radiation were above average (RAIN +42%, RADPAR +4%), and temperature was near average (TEMP +0ºC), which resulted in above-average biomass production potential (BIOMSS +6%). According to the NDVI development graph, NDVI at the beginning of July was around 0.6 and suddenly decreased two weeks later with the NDVI of 0.55. Then, the NDVI increased with similar values at the beginning of the period and was steady until September. The NDVI proved the dropping value again in mid-October 2022 caused by severe storms from typhoon Noru; then, the NDVI increased and was observable a few higher than before. Considering the favorable VCIx value of 0.92, the situation is assessed as near average.

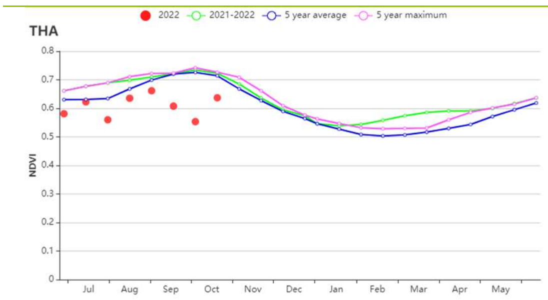
According to agroclimatic indicators for the **South-eastern horticulture area**, temperature was near average (TEMP +0ºC), the accumulated rainfall was above average (RAIN +20%), while solar radiation was slightly below average (RADPAR -3%), the resulting biomass production potential stayed unchanged (BIOMSS +0%). The NDVI is 0.5 in June and then increases in July with a difference of approximately 0.15. Then, the NDVI decreased in mid of July and abruptly increased from August to September. The NDVI dropped again the mid-September and tends to rise in October. According to the NDVI development graph as well as a VCIx of 0.92, the crop condition is close to the average of the recent 5 years after removing the effect of cloud contamination in the satellite images.

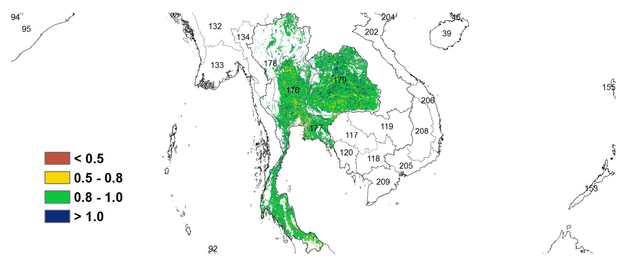
Agroclimatic indicators show that the conditions in the **Western and southern hills** were slightly below average: accumulated rainfall and radiation were above average (RAIN +13%, RADPAR +2%), and temperature was near average (TEMP +0ºC), resulting in an increase of biomass production potential (BIOMSS +2%). The NDVI from the beginning of July until September shows high values with a range of 0.65-0.70. Oppositely, the NDVI immediately decreased in the mid of September (0.45) and suddenly increased in October with an NDVI of nearly 0.6. As shown in NDVI development graph, the crop conditions were markedly below average, and VCIx was at 0.93. Overall, crop conditions were below normal.

Indicators for the **Single-cropped rice north-eastern region** show that rainfall and radiation were above average (RAIN +19%, RADPAR +5%), and temperature was near average (TEMP +0ºC), resulting in an increased biomass production potential (BIOMSS +5%). As depicted in the NDVI development graph, the crop conditions were below average except for mid-July, when a sharp drop was observed due to cloud cover. Subsequently, conditions gradually improved to near average levels but then crop conditions dropped below average again. The dropping of NDVI may be from severe storms in the northeastern part, which may impact the NDVI of crops during the wet season. According to the satisfactory VCIx value of 0.93, and the NDVI curve, the crop conditions were below average.

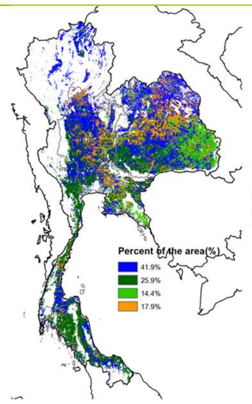
Figure 3.40 Thailand's crop condition, crop calendar from July-October 2022

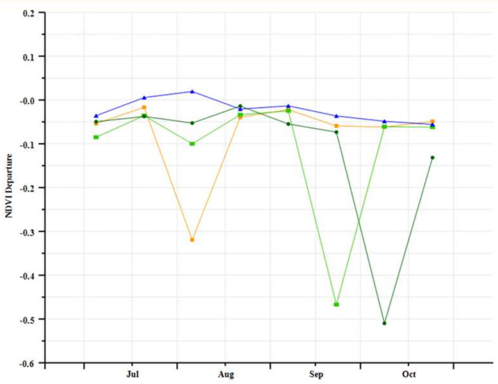
(a) Crop phenology map of major crops



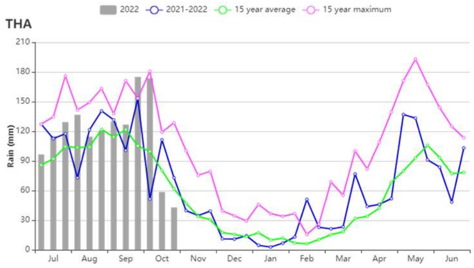


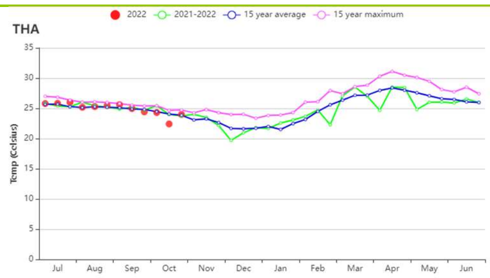
(b) Crop condition development graph based on NDVI (c) Maximum VCI



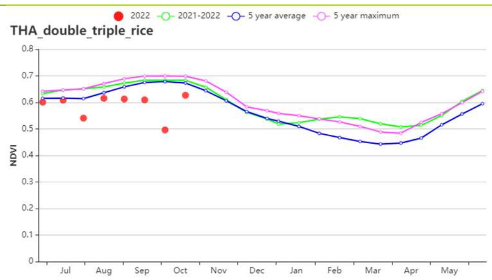


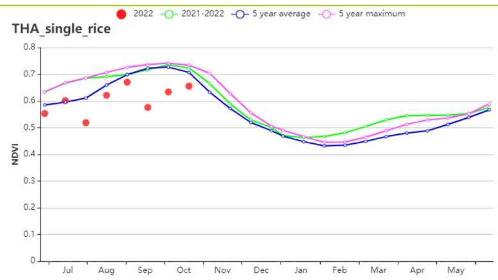
(d) Spatial NDVI patterns compared to 5YA (e) NDVI profiles



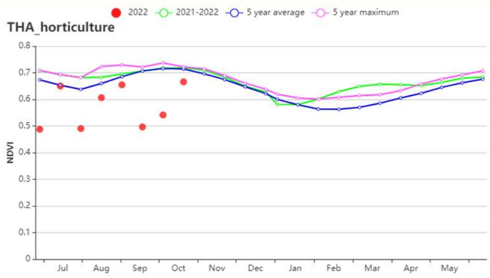


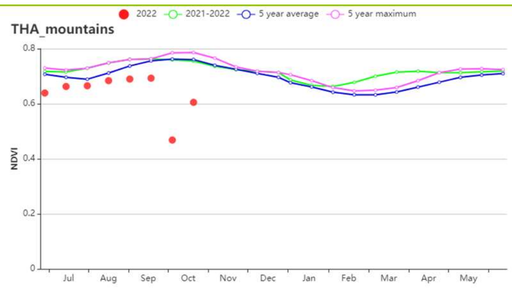
(f) Rainfall profiles (g) Temperature profiles





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

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Central double and triple-cropped rice lowlands	1598	42	25.4	0	1111	4	1584	6
South-eastern horticulture area	1616	20	25.5	0	1092	-3	1583	0
Western and southern hill areas	1243	13	24.4	0	1131	2	1490	3
Single-cropped rice north-eastern region	1570	19	25.2	0	1150	5	1611	5

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

Region	Cropped arable land fraction		Cropping intensity		Maximum VCI
	Current (%)	Departure (%)	Current (%)	Departure (%)	Current
Central double and triple-cropped rice lowlands	100	0	130	2	0.92
South-eastern horticulture area	99	0	114	-12	0.92
Western and southern hill areas	100	0	116	-8	0.93
Single-cropped rice north-eastern region	100	0	109	-1	0.93

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

[TUR] Türkiye

This monitoring period covers the growing and harvesting periods of maize and rice, as well as the harvesting period of wheat. sowing of winter wheat for the next season starts in October. The annual percentage of irrigated farmland in Türkiye is 19.8% and agrometeorological conditions play a role in crop growth. During the monitoring period, rainfall (RAIN) was 30% lower, average temperature (TEMP) was 0.6°C higher, PAR agroclimatic indicator (PADPAR) was 0.8% higher, and overall, potential biomass (BIOMASS) was 8% lower. During the monitoring period, especially in late July, when the crops were in their growth period, low precipitation led to poor crop growth and consequently low BIOMASS.

The NDVI-based crop growth process lines show that crop growth was slightly below average overall during the monitored period. The maximum vegetation condition index (VCIx) for the whole country was 0.76, while the maximum vegetation condition index (VCIx) for most of the Black Sea region was close to 1.0, indicating good crop growth in this region, and the maximum vegetation condition index (VCIx) for the eastern Anatolia region and some parts of the Marmara, Aegean, and Mediterranean regions was below 0.5, indicating poor crop growth.

The NDVI process line results were consistent with the results of the NDVI distance level spatial clustering map monitoring. The vegetation health index map showed that the drought conditions eased in June and July, but further worsened after August, which coincided with the precipitation time course line. Overall, drought conditions since April have eased, but still exist, and crop growth is slightly below average.

Regional analysis

The regional analysis includes four agro −ecological zones (AEZ): **the Black Sea region(180), Central Anatolia(181), Eastern Anatolia(182) and Marmara Aegean Mediterranean lowland zone(183).**

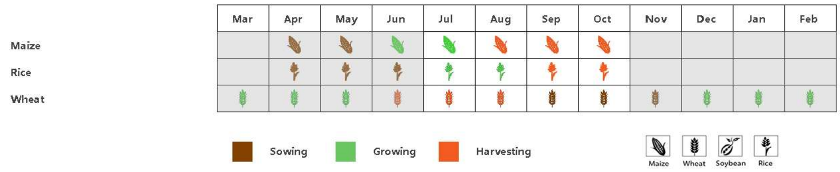
Crop growth in the **Black Sea region** was close to average, rainfall (RAIN) was 23% lower compared to average, average temperature (TEMP) was 0.1°C lower, and light and PADPAR was at the same level as average. Cropped arable land fraction (CALF) was 95%, which was 1% higher compared to the average. the VCIx value was 0.89, which was the highest among the four sub-districts. The cropping Intensity (CI) was 119, which was 15% higher than the average. The crop production index (CPI) was 1.1, indicating good crop growth. Overall, crop growth was generally close to the average.

Rainfall (RAIN) was 13% lower compared to the average, mean temperature (TEMP) was 0.5°C higher, photosynthetically active radiation (PADPAR) was close to the average, maximum vegetation condition index (VCIx) was 0.78, and cropped arable land fraction (CALF) was 38%, 11% higher compared to the average in **the Central Anatolian region**. The Cropping Intensity (CI) was 109, which was 6% higher than the average, and the potential biomass of crops (BIOMSS) was 2% lower under the above agronomic conditions. The crop production index (CPI) was 1.1, indicating good crop growth. Overall, regional crop growth was on par with the average.

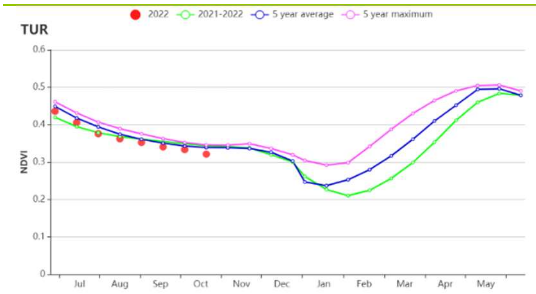
The Eastern Anatolia region had 67% lower rainfall (RAIN) compared to the average, 1.7°C higher mean temperature (TEMP), 5% higher photosynthetically active radiation (PADPAR) than average, and 18% lower potential biomass (BIOMSS) affected by low precipitation, the lowest of the four divisions. The cropped arable land fraction (CALF) was 48%, which was 7% higher. The maximum vegetation condition index (VCIx) value was 0.74, and the Cropping Intensity (CI) was 104, which was the same as the average. The crop prodcution index (CPI) was 1.1, indicating good crop growth. Overall, crop growth was below average.

The overall crop growth in the Marmara, Aegean and Mediterranean lowland regions was below average, with a 5% biomass potential (BIOMSS) bias, a 21% rainfall (RAIN) bias, a 0.6 mean temperature (TEMP) bias and a photosynthetically active radiation (PADPAR) at the same level as the average. The maximum Vegetation Condition Index (VCIx) value was 0.71 and the cropped arable land fraction (CALF) was 4% lower, reaching 55%. The Cropping Intensity (CI) was 115, which was 8% higher. The crop production index (CPI) was 0.99, indicating average crop growth. Crop growth in the region is expected to be slightly below average.

Figure 3.41 Türkiye's crop condition, July-October 2022

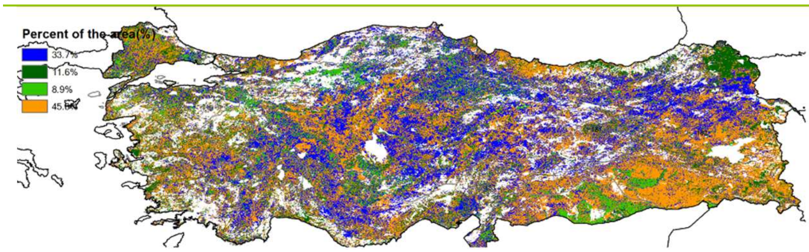


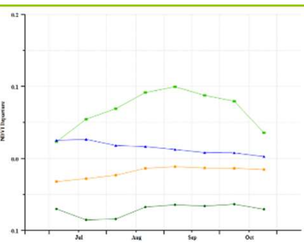
(a). Phenology of major crops



(b) Crop condition development graph based on NDVI

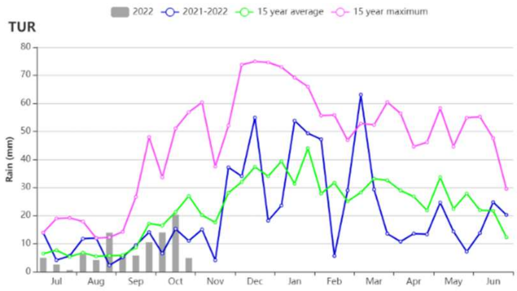
(c) Maximum VCI

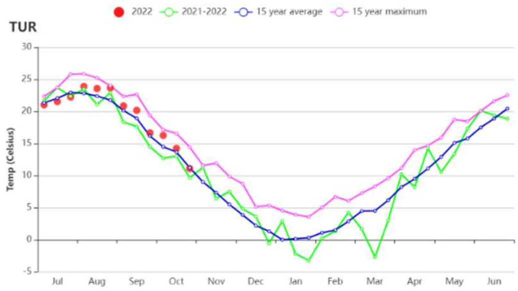




(d) Spatial NDVI patterns compared to 5YA

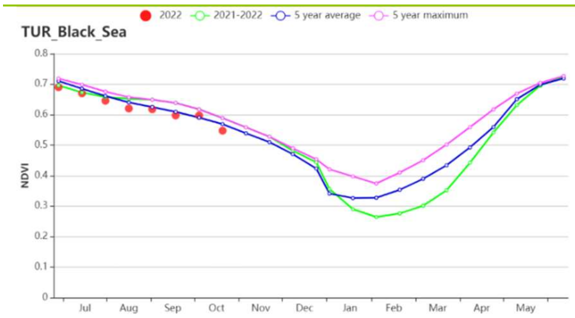
(e) NDVI profiles

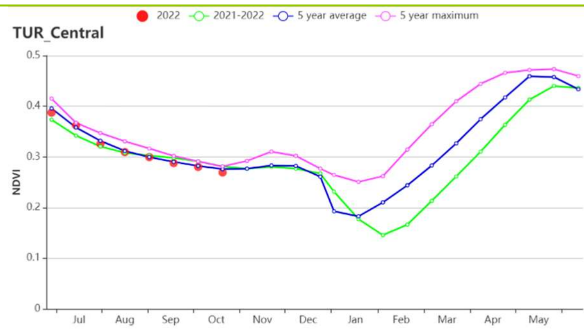




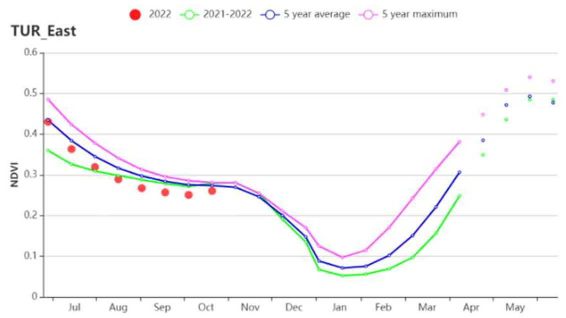
(f) Time series rainfall profile

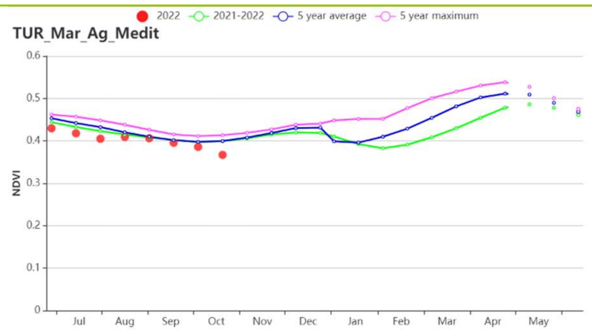
(g) Time series temperature profile



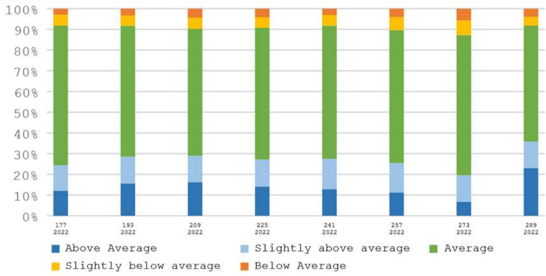


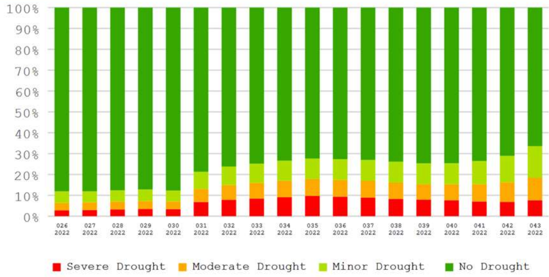
(h) Crop condition development graph based on NDVI (Black Sea region (left) and Central Anatolia region (right))





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





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

(k) Proportion of VHIm categories compared with 5YA

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

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m2)	Departure from 15YA (%)	Current (gDM/m2)	Departure from 15YA (%)
Black Sea region	218	-23	14.9	-0.3	1106	0	625	-9
Central Anatolia region	88	-13	18.3	0.5	1282	0	492	-2
Eastern Anatolia region	48	-67	19.1	1.7	1380	5	445	-18
Marmara Agean Mediterranean lowland region	89	-21	22.2	0.6	1320	0	556	-5

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

Region	CALF		Cropping Intensity		Maximum VCI
	Current(%)	Departure from 5YA (%)	Current(%)	Departure from 5YA (%)	Current
Black Sea region	95	1	119	15	0.89
Central Anatolia region	38	11	109	6	0.78
Eastern Anatolia region	48	7	104	0	0.74
Marmara Agean Mediterranean lowland region	55	-4	115	8	0.71

[UKR] Ukraine

This monitoring period covers the main growth period of maize and sunflowers and their harvest in September and October. Harvesting of winter wheat ended in July and sowing started in September.

According to the agroclimatic and agronomic indicators of CropWatch, this season in Ukraine was more humid than usual, both rainfall and temperature were above the 15YA (RAIN +10%, TEMP +0.1℃) , but sunshine was below average (RADPAR -7%). CropWatch predicted that the potential biomass was above the 15YA (+6%). Most cropland was cultivated (CALF 96%, +1%), and cropping intensity was 105% (-2%). Maximum vegetation condition index (VCIx) was 0.82 and Crop Production Index (CPI) was 1.04.

During this period, the crop conditions at the national level experienced an increase from below average to above average in the reporting period, but it was below average at the end of October. As shown in the spatial NDVI patterns, NDVI in about 87% area of cropland went from below average to above average from July to early October, but an obvious depression of NDVI was observed in middle October, which could be attributed to cloud cover or fog. Additionally, the ongoing war continues to negatively impact crop production, which led to the unfavorable crop conditions in southern Ukraine, as shown by the spatial VCIx pattern. VCIx was below 0.8 in that region. Overall, the situation was assessed as average except for the southern Ukraine, where conditions were unfavorable.

Regional analysis

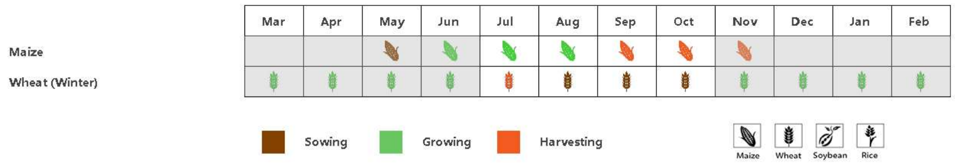
Regional analyses are provided for four agro-ecological zones (AEZ) defined by their cropping systems, climatic zones and topographic conditions. They are referred to as **Central wheat area** (184) with the Poltava, Cherkasy, Dnipropetrovsk and Kirovohrad Oblasts; **Eastern Carpathian hills** (185)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

More rainfall and less sunshine than usual were recorded in the **Central wheat area** (RAIN +26%, RADPAR -9%) and **Northern wheat area** (RAIN +13%, RADPAR -14%). Temperature was close to average in the Central wheat area and it was slightly below average in **Northern wheat area** (-0.1℃). Potential biomass showed an above-average level in the **Central wheat area** (BIOMSS +14%) and **Northern wheat area** (BIOMSS +6%). According to the NDVI development graph, crop conditions returned to the average in September and early October. Agronomic indicators also suggest the crop conditions were favorable in **Central wheat area** (CALF 100%, VCIx 0.85, CI +8%) and **Northern wheat area** (CALF 100%, VCIx 0.85, CI -1%). Overall, near-average or slightly above-average prospects can be expected.

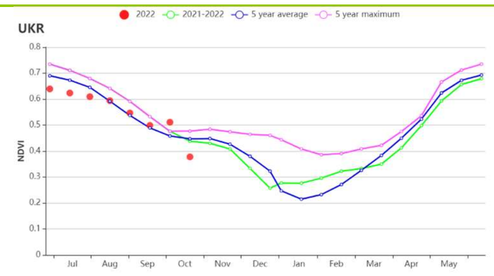
In **Southern wheat and maize area**, both rainfall and temperature were above average (+14%, +0.4℃). Sunshine was below average (RADPAR -4%). Potential biomass was above average (+8%). However, due to the war, CALF (91%), VCIx (0.73) and CI (-5%) were unfavorable. Considering the CPI value of 0.84, the situation is assessed as below average.

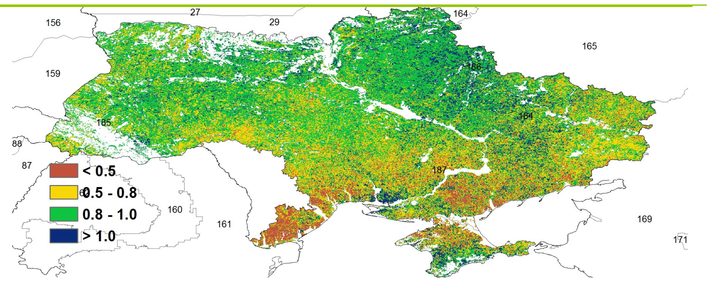
Eastern Carpathian hills recorded less rainfall (-14%), higher temperature (+0.3°C) and less sunshine (-5%). The potential biomass was below average (-7%). Crop condition development graph based on NDVI showed below-average crop conditions during the whole period. Although CALF (100%) and VCIx (0.85) were high, a low cropping index was also recorded (-16%). CPI (1.03) indicated a near or slightly below-average prospect.

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

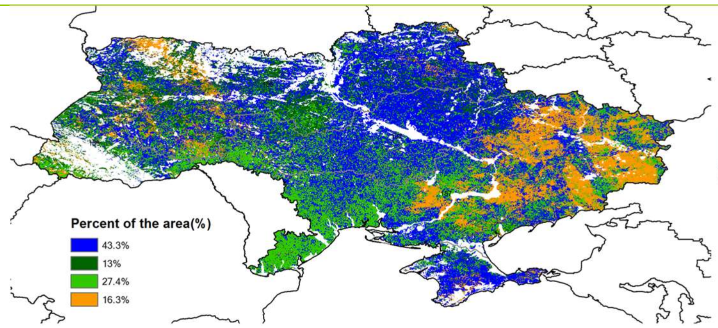


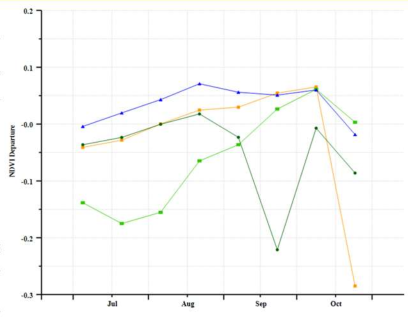
(a). Phenology of major crops



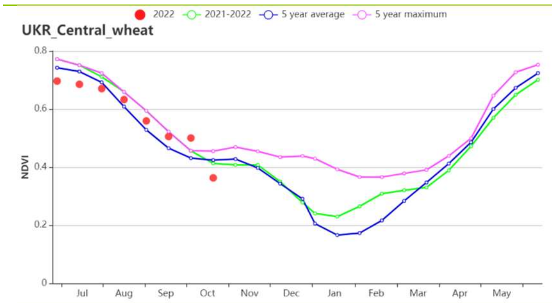


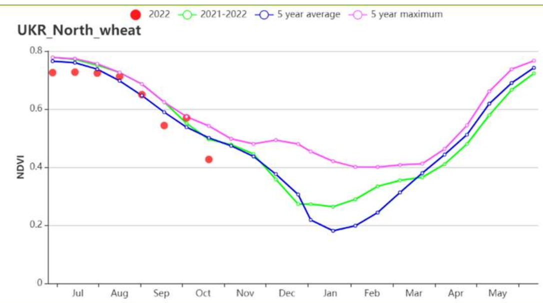
(b) Crop condition development graph based on NDVI (c) Maximum VCI



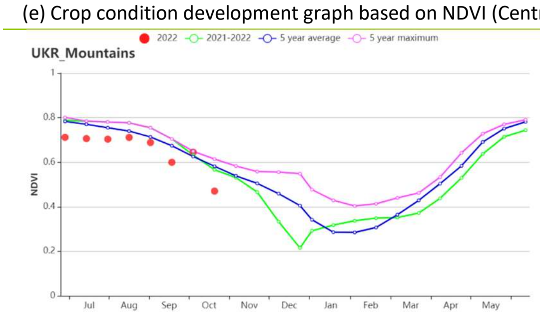


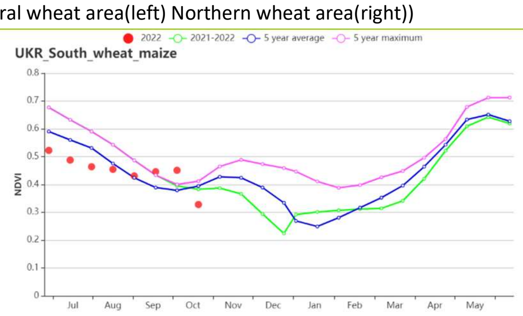
(d) Spatial NDVI patterns compared to 5YA (e) NDVI profiles



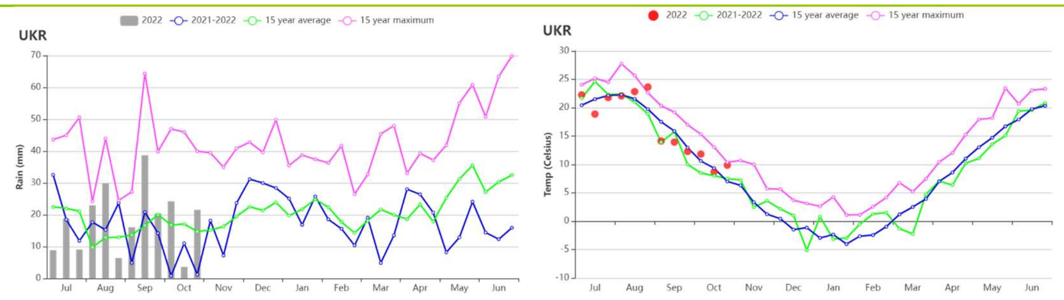


(e) Crop condition development graph based on NDVI (Central wheat area(left) Northern wheat area(right))





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



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

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

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Central wheat area	230	26	16.8	0.0	867	-9	678	14
Eastern Carpathian hills	236	-14	15.2	0.3	909	-5	654	-7
Northern wheat area	252	13	15.4	-0.1	799	-11	670	6
Southern wheat and maize area	181	14	18.9	0.4	981	-4	638	8

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

Region	Cropped arable land fraction		Crop Intensity		Maximum VCI
	Current (%)	Departure (%)	Current	Departure (%)	Current
Central wheat area	100	0	113	8	0.78
Eastern Carpathian hills	100	0	88	-16	0.88
Northern wheat area	100	0	103	-1	0.84
Southern wheat and maize area	91	0	107	-5	0.69

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

[USA] United States

This reporting period from July to October 2022 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 below average.

At the national level, the agro-climatic indicators show below-average rainfall (RAIN -9%) and radiation (RADPAR -1%), above-average temperature (TEMP +0.4ºC), which resulted in below-average potential biomass (BIOMASS +7%). Dry and warm weather was prevalent in the high plains and western Corn Belt. In particular, severe rainfall deficits occurred in the area from the Northern Plains to the Northwest Pacific, including Kansas (-55%), Oregon (-52%), North Dakota (-49%), Washington (-45%), Nebraska (-45%), Minnesota (-40%), Montana (-38%), Iowa (-27%), and Oklahoma (-28%). The temperatures in these rainfall-deficient areas were at least 0.4°C warmer than the 15-year average. Better agroclimatic conditions were widespread in the eastern Corn Belt, with near-average precipitation in Indiana (+6%), Illinois (-7%), Ohio (15%), and Michigan (-8%).

Spatial differences in agro-climatic conditions lead to diverse agronomic conditions. Poor crop conditions were prevalent in some areas of the Southern and Northern Plains (VCIx < 0.5), and acceptable crop conditions were prevalent in other areas (VCIx > 0.8). Nationally, below average (-2%) cropped arable land fraction (CALF) occurred, in particular, the CALF in the Southern Plain was dramatically below average (-15%). NDVI deviation clusters and their curves also indicated a strong spatial variability in crop conditions. Good crop conditions prevailed in the eastern Corn Belt. Low rainfall caused below average conditions in the in the Southern Plain, western Corn Belt and some areas of the Northern Plains. In the major rice-producing area, below-average crop conditions were observed in the lower Mississippi River.

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

Regional Analysis

The crop condition of the Corn Belt (191), Northern Plains (193), Lower Mississippi (192), Northwest (195), Southern Plains (196), and Southeast region (197) are summarized below.

(1) Corn Belt (191)

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, dry and warm weather prevailed in the western Corn Belt, with below-average rainfall (-20%) and above-average temperatures (+0.3°C). The rainfall deficit occurred from late August to October that covers the maturity and harvest stages of soybean and maize. As mentioned above, extremely dry and hot agri-climatic conditions occurred in the western part of the Corn Belt but normal agri-climatic conditions were prevalent in the eastern part of the Corn Belt. Crop conditions were below average in July, then bounced close to the maximum of last 5 years in August, and finally dropped to average in September. VCIx reached 0.92 which suggested that the rainfall deficit from late August to October had little impact on the crop condition of the entire region. The Crop Production Index (CPI = 1.06) and above average cropping intensity (+6%) also indicated the acceptable crop condition. In short, CropWatch assessed that an average crop production could be expected.

(2) Northern Plains (193)

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 extremely dry and hot weather, with precipitation 45% below average and temperatures 1.7°C warmer than the 15YA. The rainfall profile indicated a significant water deficit throughout the entire reporting stage, and the significant drought impacted the grain filling and yield formation. However, according to the NDVI development curve, conditions were better than last year and started to drop in August only, when spring wheat approched maturity. CALF (-1%), VCIx (0.75) and crop production index (0.98) reflected better than last year's and close to average conditions.

(3) Lower Mississippi (192)

It is the biggest rice-producing area and an important soybean producing zone in the United States. It includes Arkansas, Louisiana, Mississippi, and Missouri. Average agri-climatic conditions occurred in Lower Mississippi. The slightly below-average rainfall (-6%) and RADPAR (-1%) and average temperature resulted in slightly below average potential biomass (-7%). The rainfall deficit occurred in Septermber and early October which has little effect on crops at the harvest stage.The average VCIx was 0.88 and the cropping intensity (10%) was above than average, while the NDVI profile showed that the crop growth reached the average level only from late August to early September during the monitoring period and was below average for the rest of the period. In short, CropWatch assessed that the crop production was not reached the average level.

(4) Northwest (195)

Northwest is an important spring wheat-producing area. During the monitoring period, spring wheat reached maturity and most of it was harvested by August. The NDVI profile indicated an average crop production situation in the region. Dry and hot weather prevailed during the monitoring period, with a significant rainfall deficit (-46%) and warmer than average temperatures (+1.8℃), and average RADAR, which resulted in a lower-than-average potential biomass (-15%). The water deficit which started in August had little impact on grain yield. Significantly above average CALF (+9%), crop production index (1.26) and VCIx (0.88) also indicated good crop conditions. In short, CropWatch assessed that average crop production could be expected.

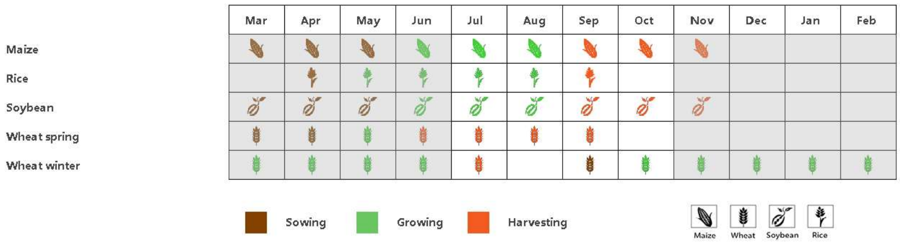
(5) Southern Plains (196)

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 and radiation (RAIN -13%, RADPAR -1%) and above-average temperatures (TEMP +0.8°C), which resulted in below average biomass production potential (BIOMSS -11%). According to the NDVI development map, crop conditions were poor and below the 5-year average for the entire monitoring period. CALF during the monitoring period was only 72% which is 15% lower than the 5YA. The crop production index (0.72) and VCIx (0.64) are far below the national average, indicating poor crop conditions. In short, CropWatch assessed that crop production in the Southern Plains as below average.

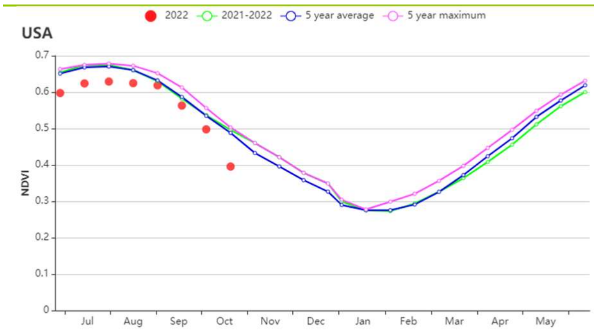
(6) Southeast region (197)

The Southeast is an important cotton and corn-producing region. It includes the states of Georgia, Alabama, and North Carolina. Below-average rainfall (-6%), temperature (-0.4℃), and RADPAR (-1%) occurred in the reporting period, which resulted in below-average potential biomass (BIOMSS -6%). According to the NDVI development profile, crop conditions were close to the 5-year average. The VCIx (0.88), crop production index(1.11) and significantly above-average cropping intensity (+13%) also indicated acceptable crop growth conditions in the Southeast. In short, CropWatch assessed that average crop production could be expected in this region.

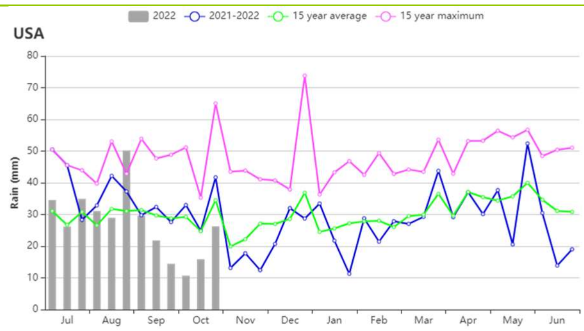
Figure 3.43 United States crop condition, July to October 2022



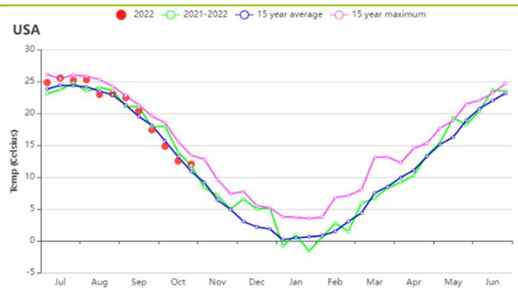
(a). Phenology of United States from July to October 2022



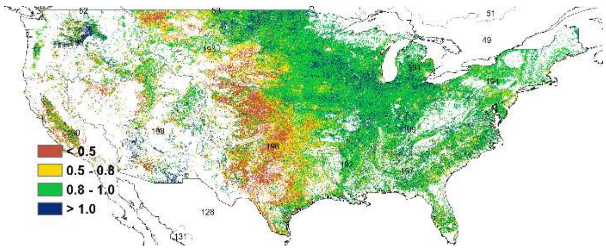
(b). Crop condition development graph based on NDVI



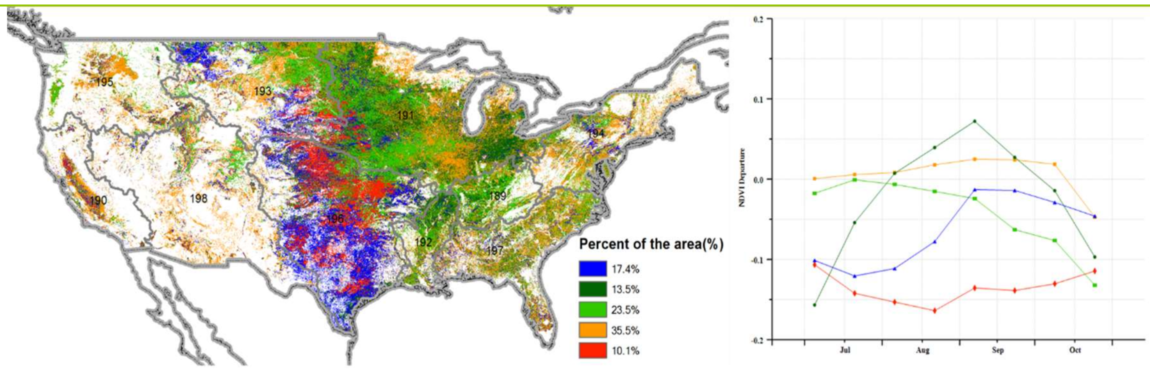
(c). Time series rainfall profile



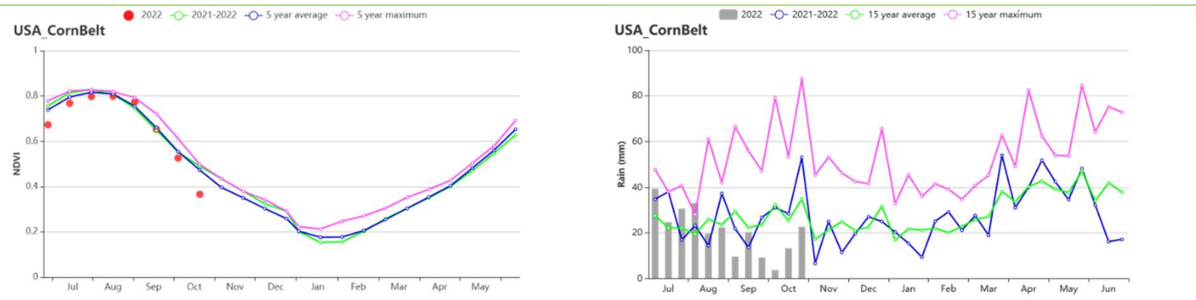
(d). Time series temperature profile



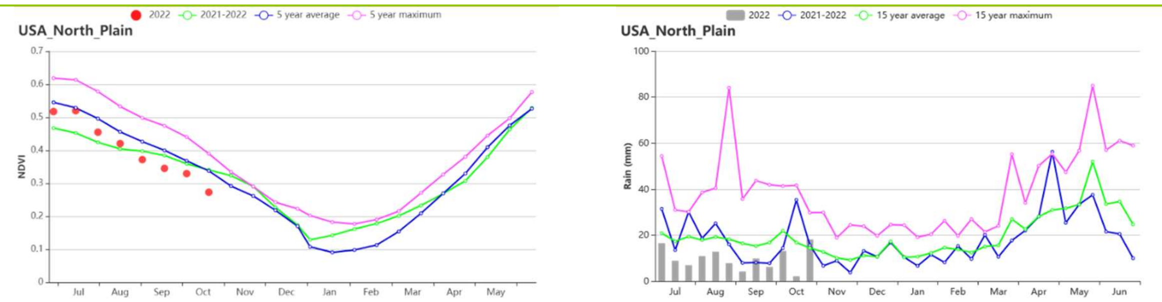
(e). Maximum VCI



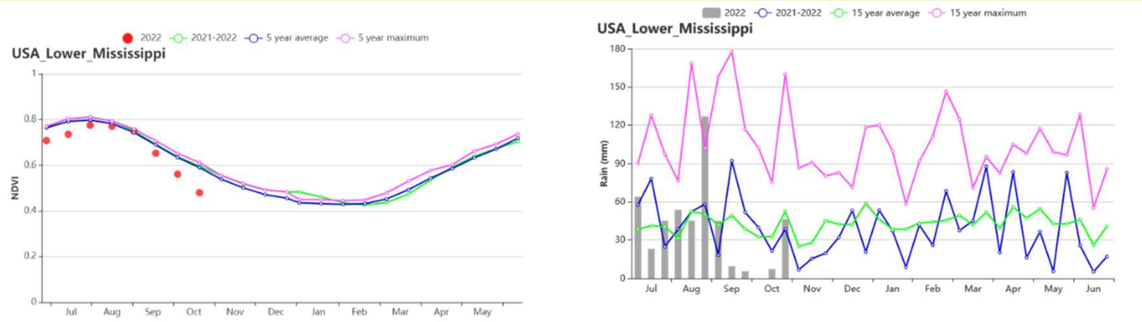
(f). Spatial distribution of NDVI profiles



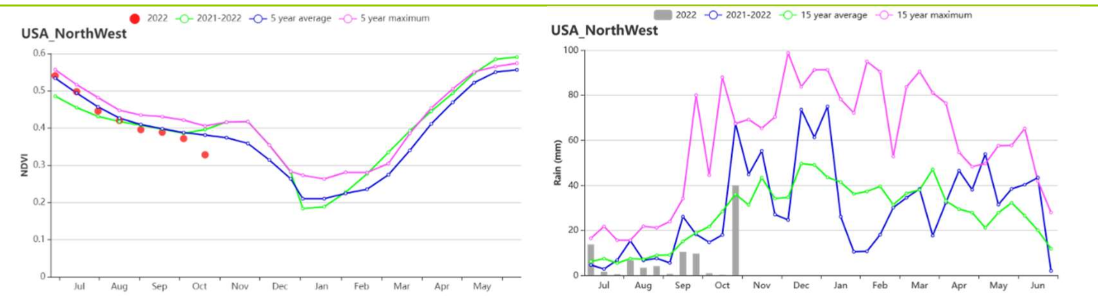
(g). Crop condition development graph based on NDVI and time series rainfall profile for the Corn Belt from July to October



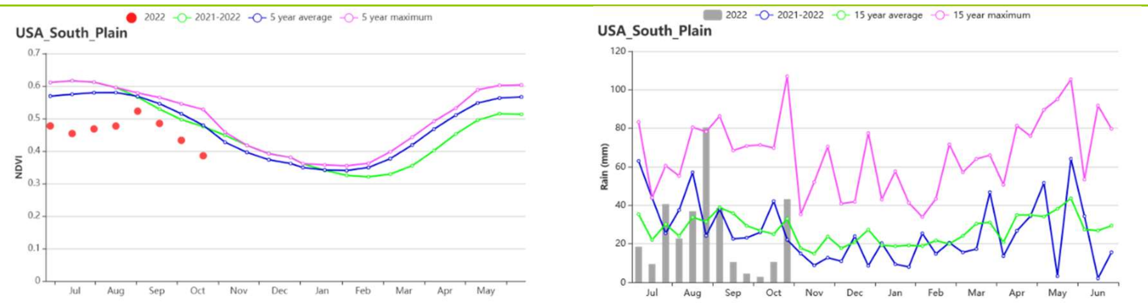
(h). Crop condition development graph based on NDVI and time series rainfall profile for the Northern Plains from July to October



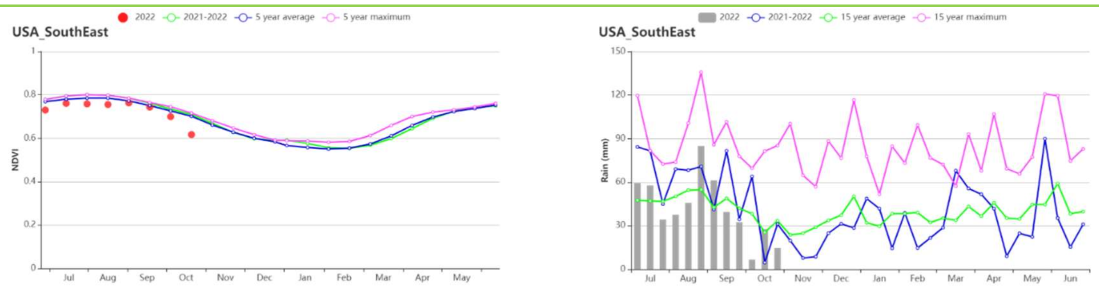
(i) Crop condition development graph based on NDVI and time series rainfall profile for the Lower Mississippi from July to October



(j). Crop condition development graph based on NDVI and time series rainfall profile for the Northwest from July to October



(k). Crop condition development graph based on NDVI and time series rainfall profile for the Southern Plains from July to October



(l). Crop condition development graph based on NDVI and time series rainfall profile for the Southeast region from July to October

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

Region	RAIN		TEMP		RADPAR		BIOMASS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Corn Belt	248	-20	18.8	0.3	1086	0	730	-11
Northern Plains	118	-45	18.6	1.8	1169	1	554	-18
Lower Mississippi	472	-6	24.3	0.0	1170	-1	1021	-7
Southeast	501	-6	23.6	-0.2	1185	-1	1079	-6
Southern Plains	319	-13	24.6	0.8	1215	-1	811	-12
North-eastern areas	397	4	17.8	-0.1	1029	-2	946	2
Northwest	91	-47	16.8	1.8	1191	0	451	-15
Southwest	294	10	20.0	0.5	1263	-4	736	2
Blue Grass region	345	-2	19.9	-0.8	1160	0	921	0
California	48	-27	20.9	0.9	1325	-5	480	-1

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

Region	Cropped arable land fraction		Cropping intensity		Maximum VCI
	Current (%)	Departure (%)	Current (%)	Departure (%)	Current
Corn Belt	100	0	106	6	0.93
Northern Plains	80	1	101	0	0.76
Lower Mississippi	100	0	110	10	0.90
Southeast	100	0	115	13	0.89
Southern Plains	73	-15	114	9	0.65
North-eastern areas	100	0	103	2	0.90
Northwest	75	9	101	-3	0.88
Southwest	45	11	105	0	0.80
Blue Grass region	100	0	107	6	0.93
California	41	-6	104	0	0.66

[UZB] Uzbekistan

This monitoring period from July to October covers the growing and harvesting stages of maize. Winter wheat was harvested from June to August. The sowing of winter wheat, to be harvested next year, started in September and October. The proportion of irrigated cropland in Uzbekistan is 30% and regular rainfall is crucial to sustaining the growth of most crops. Among the CropWatch agroclimatic indicators, RAIN increased by 23%, and TEMP, RADPAR, and BIOMSS were slightly above average (+0.2° C, +1%, and +5%). Although total precipitation was above average, most of it fell in October, which helps with the germination and establishment of winter wheat.

The national average VCIx was only 0.77, CALF was equal to the 5YA. Cropping Intensity (CI) was slightly above average (119%, +3%), and the crop production index (CPI) was 0.96. According to the crop condition development graph based on NDVI and the spatial distribution of NDVI profiles, crop condition was slightly below average since late August. More than 37.3% of the cropland of Uzbekistan had below-average crop conditions during the whole monitoring period, and these areas were mainly in the north of Kashkadarya state, the south of Samarkand state, and the middle of The Autonomous Republic of Karakalpakstan. The maximum VCI map shows that the middle and eastern of the Eastern hilly cereals zone and the northwest of the Aral Sea cotton zone had low values of VCIx.

Overall, the prospects for crop production in Uzbekistan were slightly unfavorable.

Regional analysis

Based on cropping systems, climatic zones, and topographic conditions, Uzbekistan can be divided into three agro-ecological zones (AEZ): **Central region with sparse crops (199), Eastern hilly cereals zone (200), and Aral Sea cotton zone (201)**.

Central region with sparse crops

According to the crop condition development graph based on NDVI, the crop condition in the region was above average from August to early October. As for the agroclimatic indicators, RAIN increased by 20%, TEMP increased by 0.8° C and RADPAR was equal to the 15YA. BIOMSS increased by 2%. Both CALF and CI were equal to the 5YA. The regional average VCIx was 0.84. Crop prospects for this region were normal. However, the area of cropland in this region is very small.

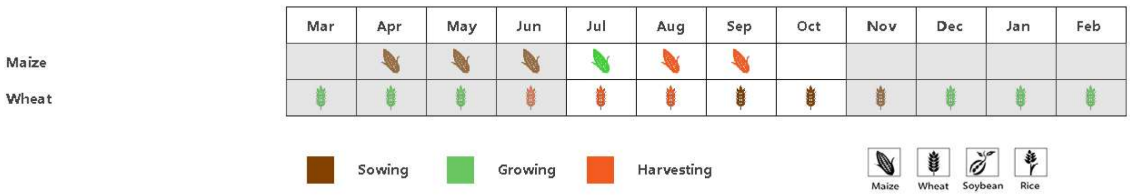
Eastern hilly cereals zone

Since most of the cropland of Uzbekistan is concentrated in this region (more than 70%), the trend of the NDVI development graph of this region is similar to the national level, which was slightly below average since late August. Among the CropWatch agroclimatic indicators, RAIN increased by 26%, and TEMP, RADPAR, and BIOMSS were slightly above average (+0.2° C, +1%, and +6%). CALF increased by 6%, CI increased by 2%, regional VCIx was 0.79, and CPI was 1.01. Overall, the prospects for crop production in Uzbekistan are expected to be normal.

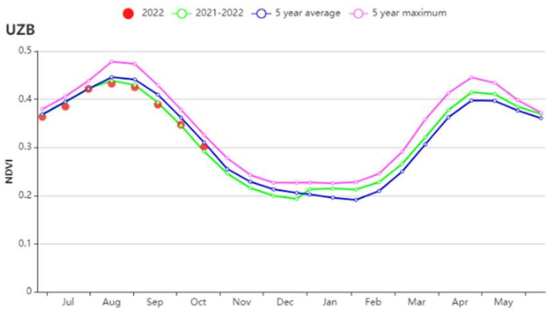
Aral Sea cotton zone

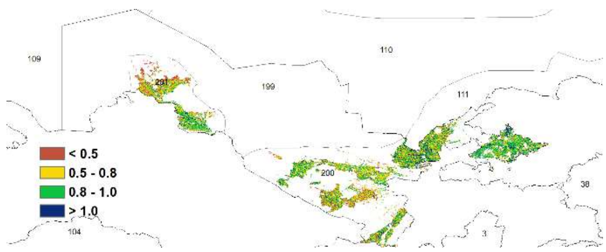
Compared to the 15YA, RAIN had a large decrease by 45%, while TEMP increased by 0.9° C. RADPAR and BIOMSS were equal to average. According to the crop condition development graph, crop conditions were below the five-year average during the whole monitoring period. CALF decreased by 18%, CI increased by 2%, regional VCIx was only 0.69, and the CPI was only 0.79. Therefore, the prospects for crop production in this region were slightly unfavorable.

Figure 3.44 Uzbekistan's crop condition, July - October 2022



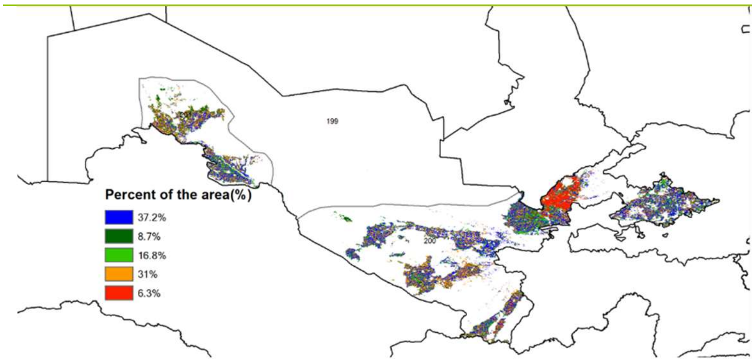
(a). Phenology of major crops

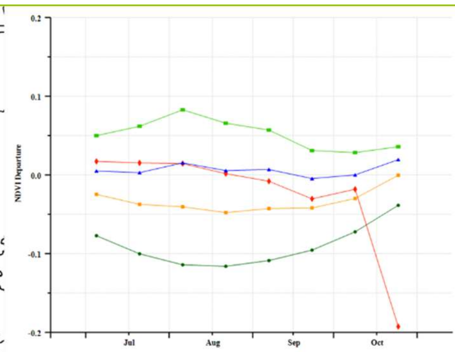




(b) Crop condition development graph based on NDVI

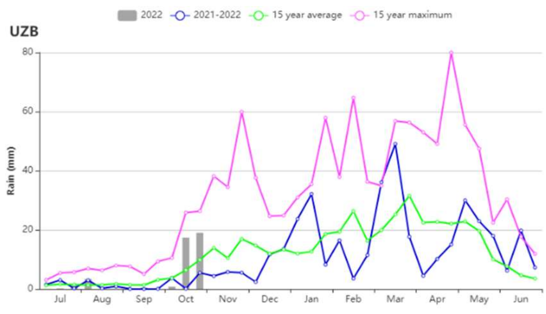
(c) Maximum VCI

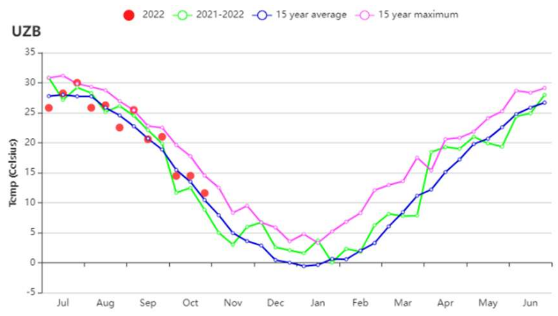




(d) Spatial NDVI patterns compared to 5YA

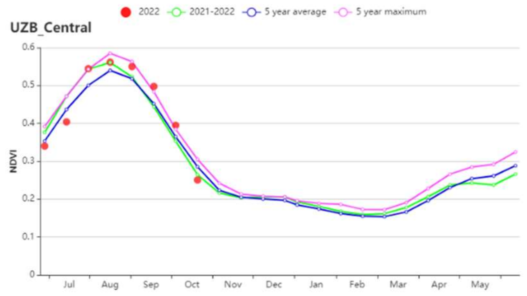
(e) NDVI profiles

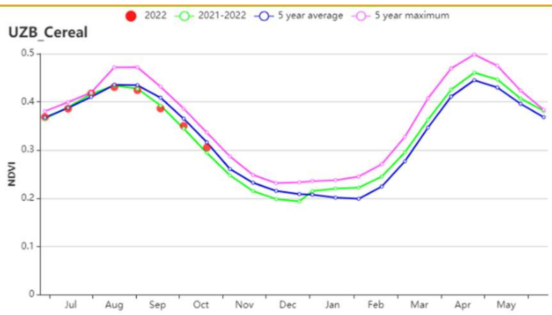




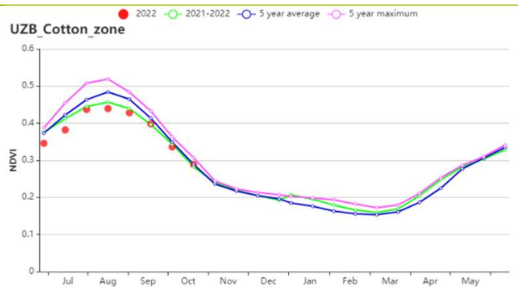
(f) Rainfall profiles

(g) Temperature profiles





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



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

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

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m2)	Departure (%)	Current (gDM/m2)	Departure (%)
Central region with sparse crops	15	20	24.5	0.8	1341	0	470	2
Eastern hilly cereals zone	47	26	22.0	0.2	1392	1	504	6
Aral Sea cotton zone	7	-45	24.1	0.9	1296	0	443	0

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

Region	Cropped arable land fraction		Cropping intensity		Maximum VCI
	Current (%)	Departure (%)	Current (%)	Departure (%)	Current
Central region with sparse crops	77	0	100	0	0.84
Eastern hilly cereals zone	61	6	123	3	0.79
Aral Sea cotton zone	56	-18	102	2	0.69

[VNM] Viet Nam

This monitoring period covers the entire span 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 precipitation (1382 mm, -2%) and increased TEMP (24.1°C, +0.2°C) compared to the 15-year average. With the decreased precipitation, the BIOMSS (1508 gDM/m^2, +2%) was higher mainly due to the significant increase in RADPAR (1170 MJ/m^2, +6%). The VCIx was 0.93 and the CALF (97%, +0%) was at the 5YA. The cropping intensity was well above the 5YA (154%, +11%). The crop production index in this monitoring period was 1.16, which represented a favorable crop production situation.

Based on the NDVI development graph, the crop conditions were below the 5-year average throughout the whole monitoring period except for mid-July. Particularly in October, the NDVI showed a sharp drop which may have been caused by cloud cover in the satellite images. From July to early October, precipitation was generally near the 15YA and even surpassed the average in late September. But in mid-to-late October, the precipitation dropped to lower values. The temperature was above the 15-year average except for mid-October. As to the spatial distribution of NDVI profiles, crop conditions on about 37.4% of the country were close to the average, located mainly in Tuyen Quang, Cao Bang, Thai Binh, Thanh Hoa and Nam Dinh provinces.

Regional analysis

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

In the **Central Highlands**, the precipitation (1555 mm, 0%) and the temperature (22.5°C, -0.1°C) was near average. Because of the increased RADPAR (1081 MJ/m^2, +5%), the BIOMSS also had a slight increase (1477 gDM/m^2, +2%). The cropping intensity (98%) showed a sharp decrease of 22%. CALF was 100% and VCIx was 0.95. The crop condition development graph based on the NDVI indicates that the crop conditions fluctuated around the 5YA from July to August. In September and October, the NDVI was significantly below the 5YA. The crop conditions were expected to be close to the average.

In the **Mekong River Delta**, the TEMP was near the average (26.6°C, -0.1°C). Increased precipitation (1364 mm, 2%) and RADPAR (1234 MJ/m^2, 2%) both resulted in a slight increase of BIOMSS. The cropping intensity was higher than the 5YA (179%, +3%). The CALF was 89% and the VCIx was 0.85. According to the NDVI-based development graph, the crop conditions were below the 5YA during the whole monitoring period. The crop conditions were expected to be slightly below average.

In the **North Central Coast**, due to decreased TEMP (23.6°C, -0.5°C), significantly increased RAIN (1546 mm, +10%) and RADPAR (1139 MJ/m^2, +7%), the BIOMSS showed an increase compared to the 15YA (1482 gDM/m^2, +2%). VCIx was 0.96 and CALF was 98%. The cropping intensity (140%) increased by 8%. According to the NDVI-based development graph, the crop conditions were simlar to the Central Highlands. During the early monitoring period, the NDVI was close to the 5YA, but it also dropped sharply in October which may have been caused by cloud cover in the satellite images. Crop production was expected to be close to the average.

In the **North East**, TEMP and RADPAR were both above the average (24.1°C, +0.7°C; 1180 MJ/m^2, +7%). Although RAIN decreased (1360 mm, -11%), BIOMSS was still close to the average (1491 gDM/m^2, +1%). The cropping intensity was higher than the 5YA (193%, +42%). CALF was 100% and VCIx was 0.97. According to the NDVI-based development graph, the NDVI was below the 5YA during the whole monitoring period. Overall, the crop conditions were estimated to be below the average.

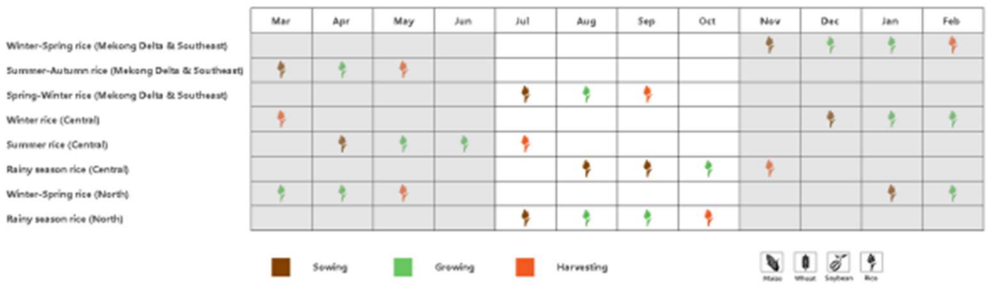
In the **North West**, TEMP was above average (22.3°C, +0.5°C). Although the RADPAR (1179 MJ/m^2) increased by 10%, the BIOMSS (1342 gDM/m^2) was still lower by 2% because of decreased precipitation (1142 mm, -9%). The cropping intensity (149%) was increased by 22% and the CALF was 100%, the VCIx was 0.97. According to the agroclimatic indicators, crop conditions in this region were generally below the 5YA. At the Initial Stage of the monitoring, the NDVI was near the average level, but from August to October, the crop conditions were all below the 5YA. Overall, crop conditions in this region were below the average.

In the **Red River Delta**, due to an increased precipitation (1735 mm, +16%) and a high RADPAR (1222 MJ/m2, +6%), the BIOMSS (1635 gDM/m^2) showed an increase of 2%. The TEMP was at an average level (26.5°C, +0.2°C). The CALF was 96% and the VCIx was 0.90. The region showed a high cropping intensity of 171, increased by 11% compared to the 5YA. According to the crop condition development graph, the NDVI was below the 5YA during the whole monitoring period. Based on the agroclimatic indicators, the crop conditions in this region were below the average.

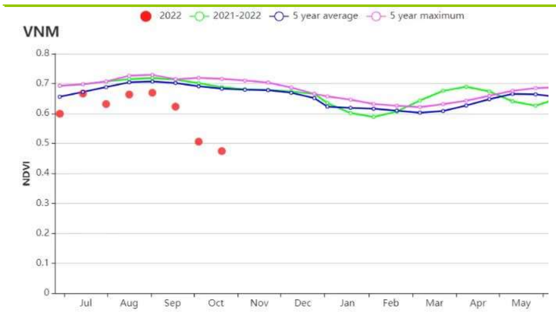
In the **South Central Coast**, TEMP was above average (23.6°C, +0.3°C). Because of the increased RAIN (1408 mm, +7%) and RADPAR (1131 MJ/m^2, +6%), the BIOMSS (1477 gDM/m^2) increased by 7%. CALF was 97% and VCIx was 0.92. The cropping intensity was 128%, with a drop of 8%. According to the crop condition development graph, the NDVI was above the 5YA from July to August. The crop conditions showed a declining trend in the late monitoring period, particularly in October, the NDVI dropped sharply which may have been caused by cloud cover in the satellite images. Crop conditions were expected to be favorable.

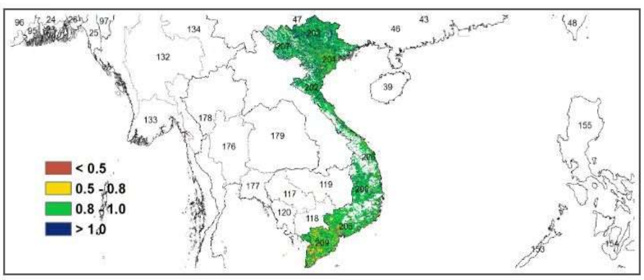
In **South East,** increased TEMP (25.3°C, 0.2°C), sharply decreased RAIN (1432 mm, -10%), increased RADPAR (1215 MJ/m^2, +5%) all resulted in increased BIOMSS (1560 gDM/m^2, +1%). CALF was 96% and VCIx was 0.90. The cropping intensity (122%) decreased by 4%. According to the crop condition development graph, the NDVI was below the 5YA because of the influence of the clouds in the satellite images. Crop production in this region was slightly below the average.

Figure 3.45 Vietnam's crop conditions, July – October 2022



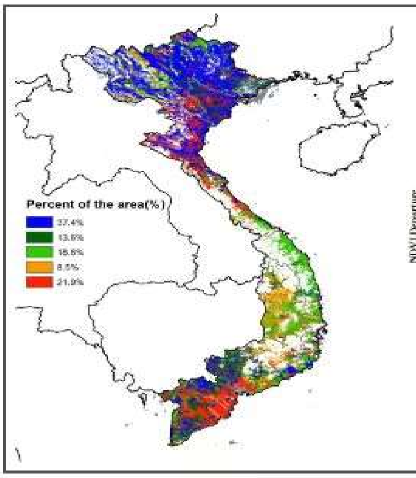
(a). Phenology of major crops

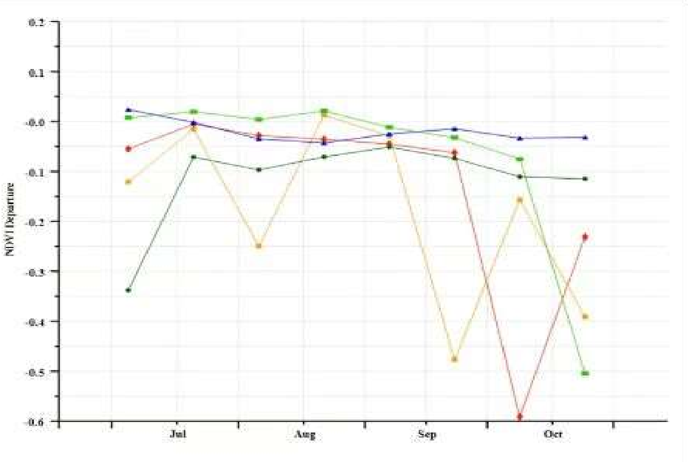




(b) Crop condition development graph based on NDVI

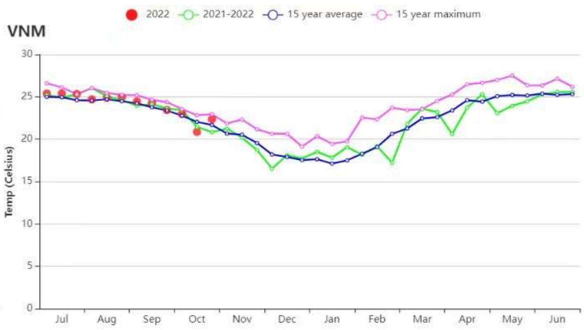
(c) Maximum VCI





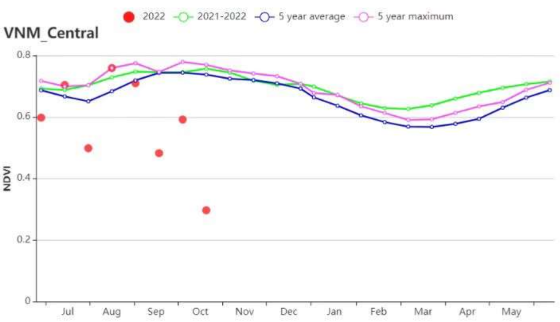
(d) Spatial NDVI patterns compared to 5YA

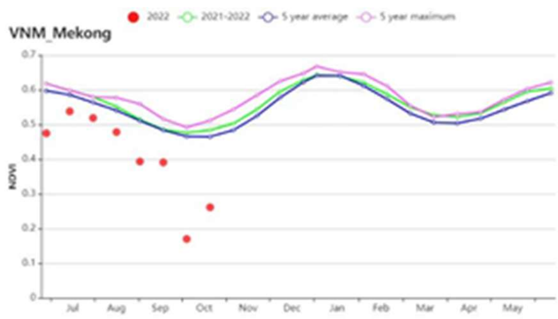
(e) NDVI profiles



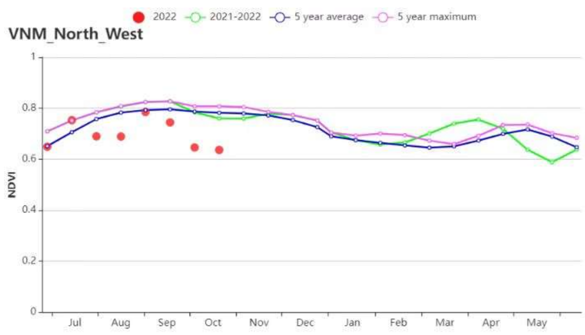
(f) Rainfall profiles

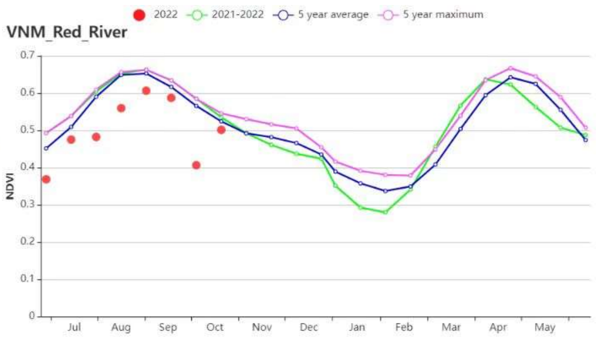
(g) Temperature profiles



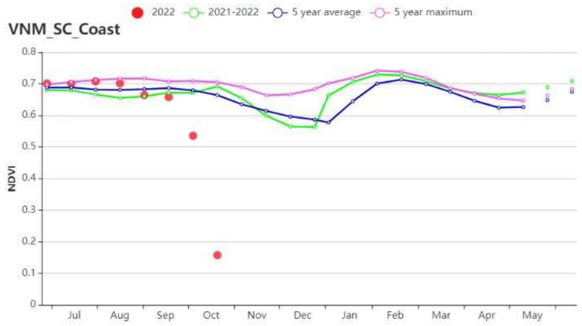


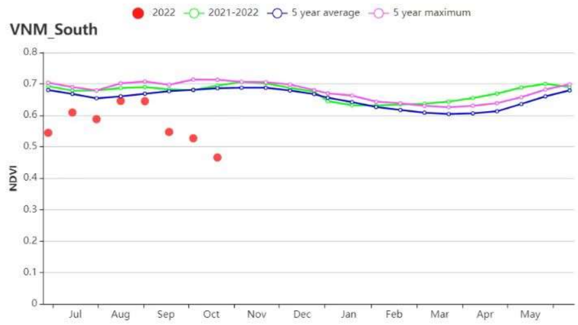
(h) Crop condition development graph based on NDVI Central Highlands Vietnam (left), and Mekong River Delta (right).



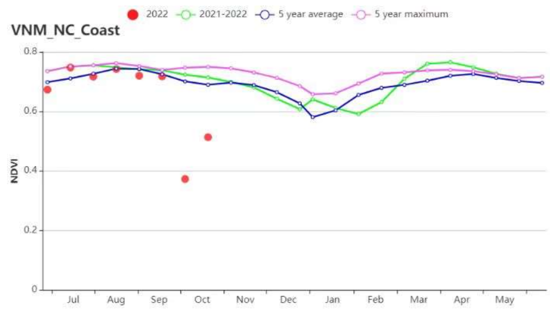


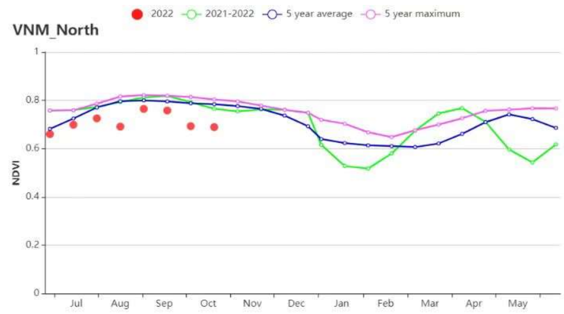
(i) Crop condition development graph based on NDVI North Central Coast Vietnam (left), and North East Vietnam (right).



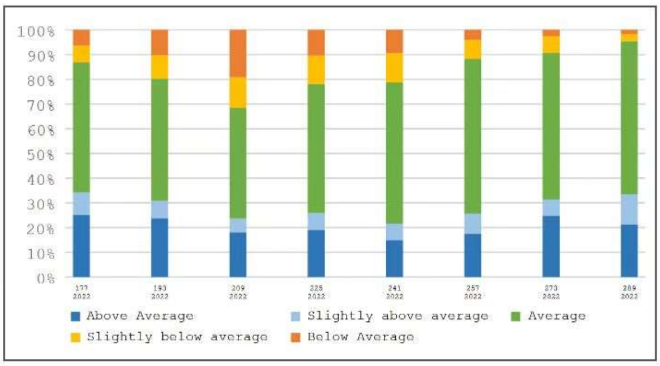


(j) Crop condition development graph based on NDVI North West Vietnam (left), and Red River Delta (right).

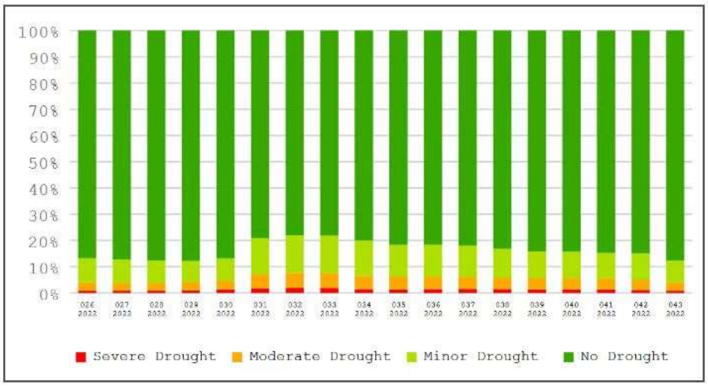




(k) Crop condition development graph based on NDVI South Central Coast Vietnam (left), and South East Vietnam (right).



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



(m) Proportion of VHIm categories compared with 5YA

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

	RAIN		TEMP		RADPAR		BIOMSS	
Region	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (%)	Current (MJ/m²)	Departure from 15YA (%)	Current (gDM/m²)	Departure from 15YA (%)
Central Highlands	1555	0	22.5	-0.1	1081	5	1477	2
Mekong River Delta	1364	2	26.6	-0.1	1234	2	1706	1
North Central Coast	1546	10	23.6	0.0	1139	7	1482	2
North East	1360	-11	24.1	0.7	1180	7	1491	1
North West	1142	-9	22.3	0.5	1179	10	1342	-2
Red River Delta	1735	16	26.5	0.2	1222	6	1635	2
South Central Coast	1408	7	23.6	0.3	1131	6	1477	7
South East	1432	-10	25.3	0.2	1215	5	1560	1

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

Region	CALF		Cropping Intensity		Maximum VCI
	Current(%)	Departure from 5YA (%)	Current(%)	Departure from 5YA (%)	Current
Central Highlands	100	0	98	-22	0.95
Mekong River Delta	89	0	179	3	0.85
North Central Coast	98	0	140	8	0.96
North East	100	0	193	42	0.97
North West	100	0	149	22	0.97
Red River Delta	96	0	171	11	0.90
South Central Coast	97	0	128	-8	0.92
South East	96	0	122	-4	0.90

[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. Based on the NDVI development graph, the development of summer crops was advanced compared with 5YA, while the crop condition was in general below the 5-year average and well below 2021 during the monitoring period.

At the national level, the CropWatch agroclimatic indicators show that RADPAR was at average and TEMP was above the 15-year average (+1.1°C). Due to a significantly decreased rainfall (-39%), the BIOMSS decreased by 13% compared to the 15-year average. The VCIx was 1.23, while that of the Mediterranean zone where wheat is an important crop was only 0.79, much less than other regions. CALF increased significantly (+65%) compared with the last 5 years, indicating the advanced sowing progress and the early development of summer crops. As to the spatial distribution of NDVI profiles, crop conditions on about 94.1% of the cropland were close to and above average mainly in the central and eastern parts, and on about 5.9% were below average mainly in the western regions during the whole monitoring period. The areas with negative departures were mainly in the western region, most located in Gauteng, Mpumalanga, North West and Orange Free State Province. Water is generally limiting crop production in South Africa. Its government has developed several large water facilities, which have increased the irrigated area of the country by 40%, and the yield of crops has generally increased in recent years. Overall, favorable agro-climatic conditions in South Africa benefitted summer crops sowing and early development, while crop condition in wheat growing regions was unfavorable with reduced production.

Regional analysis

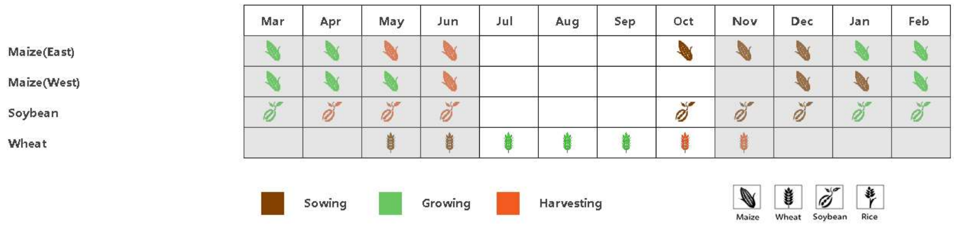
In the **Arid and desert zones**, RAIN was significantly below average (-47%) and RADPAR was slightly below average (-2%), whereas TEMP was above average (+1.3°C). BIOMSS decreased significantly by 18% due to the low rainfall. CALF increased significantly (+56%) and VCIx was 1.14. The cropping intensity was average (112%, +4%), 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 above the 5-year maximum in most months. Crop production is expected to be favorable.

In the **Humid Cape Fold mountains**, the TEMP (+1.1°C) and RADPAR (+2%) were above average. Due to insufficient rainfall (-28%), BIOMSS was significantly below the 15-year average (-11%). CALF was 94% and VCIx was 1.05. The cropping intensity was average (102%, -2%), indicating cropland utilization rate was normal. The crop condition development graph based on NDVI also indicates favorable crop conditions.

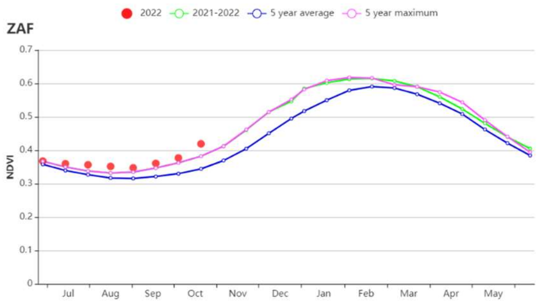
In the **Mediterranean zone**, the TEMP was close to average (-0.2°C), while RAIN witnessed a significant decrease (-45%) and RADPAR was slightly above average (+2%). The BIOMSS was significantly decreased by 27% due to the insufficient rainfall. CALF decreased slightly (83%, -2%) and VCIx was 0.79. The cropping intensity was average (107%, +7%), indicating cropland utilization rate was normal. According to the crop condition development graph, the NDVI was close to or below the 5-year average for most of the period, crop conditions generally were unfavorable and wheat production reduced from 2021.

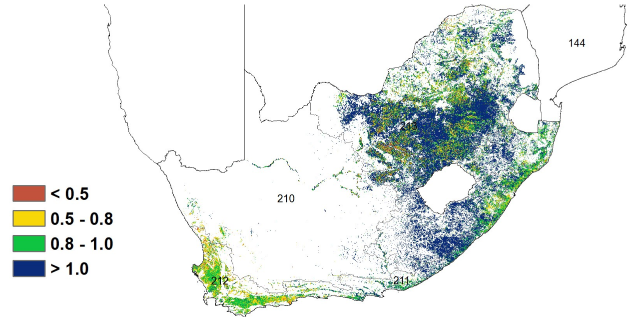
In the **Dry Highveld and Bushveld maize areas**, RAIN (-43%) was significantly below the 15-year average, whereas TEMP was above average (+1.3°C). RADPAR was as average. The BIOMSS was decreased by 11% due to the insufficient rainfall. CALF increased significantly (33%, +162%) and VCIx was 1.31. The cropping intensity was average (102%, +2%), indicating cropland utilization rate was normal. The crop condition development graph based on NDVI shows that the NDVI was above the 5-year average for most of the period. In all, the crop conditions were favorable.

Figure 3.46 South Africa's crop condition, July - October 2022



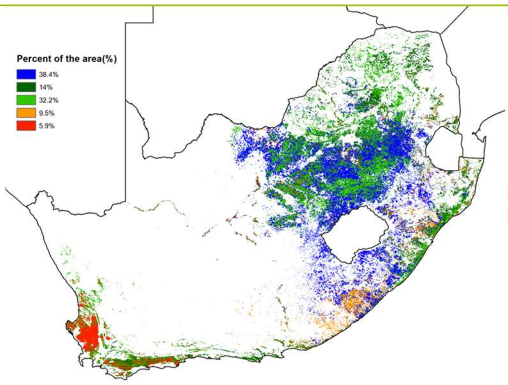
(a). Phenology of major crops

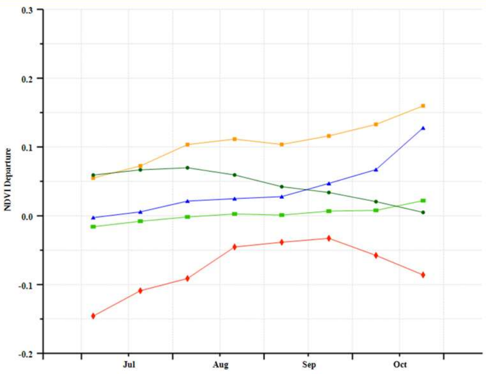




(b) Crop condition development graph based on NDVI

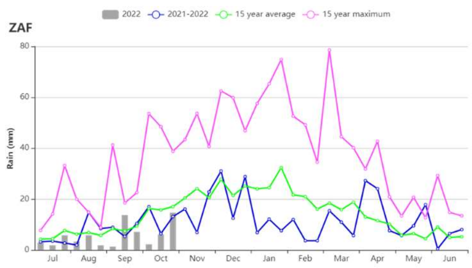
(c) Maximum VCI

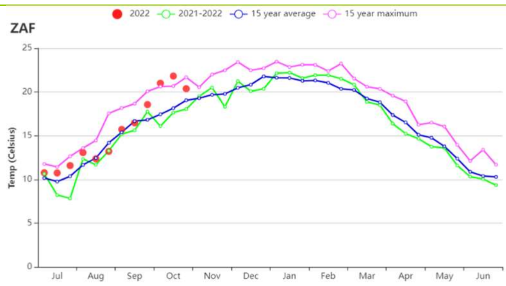




(d) Spatial NDVI patterns compared to 5YA

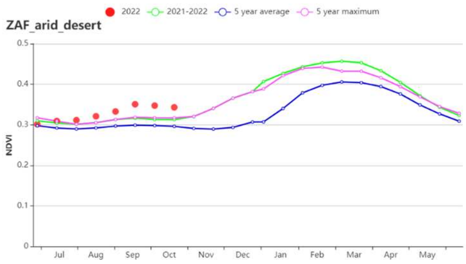
(e) NDVI profiles

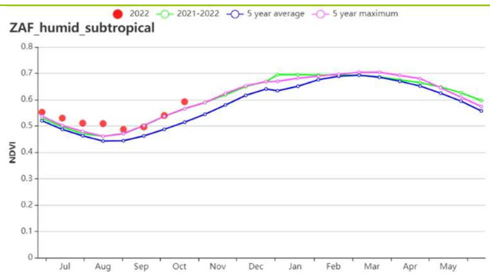




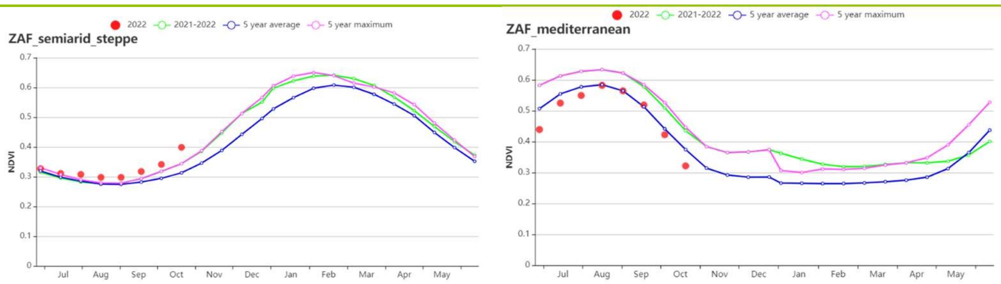
(f) Rainfall profiles

(g) Temperature profiles





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



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

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

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Arid and desert zones	42	-47	14.5	1.3	1091	-2	304	-18
Humid Cape Fold mountains	143	-28	16.3	1.1	983	2	522	-11
Mediterranean zone	123	-45	12.4	-0.2	977	2	421	-27
Dry Highveld and Bushveld maize areas	49	-43	15.7	1.3	1172	0	351	-11

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

Region	Cropped arable land fraction		Cropping intensity		Maximum VCI
	Current (%)	Departure (%)	Current (%)	Departure (%)	Current
Arid and desert zones	30	56	112	4	1.14
Humid Cape Fold mountains	94	23	102	-2	1.05
Mediterranean zone	83	-2	107	7	0.79
Dry Highveld and Bushveld maize areas	33	162	102	2	1.31

[ZMB] Zambia

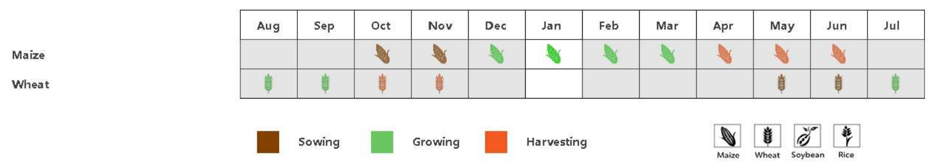
The report covers the irrigated crop production season. The key irrigated crops are wheat, barley, green maize, and vegetables. According to MoA (Zambia) an estimated 2,300,000 MT of cereal production, including irrigated wheat at about 205,000 MT, was harvested in from September into October. Late-onset and reduced seasonal rains in the previous season, particularly in eastern parts, dampened production prospects for 2022 cereal crops. The recorded rainfall for this period was 2 mm (-88%). The temperature was average (21.7℃) and favorable for winter cropping, while average radiation was 1405MJ/m2 (+1.4%). The estimated biomass production was 397 gDM/m2 (-9.1%). CALF was above average (+2.1%) and maximum VCI was 0.88. The rain-fed cropping season begins in November. Thanks to irrigation, crop production levels were average.

Regional analysis

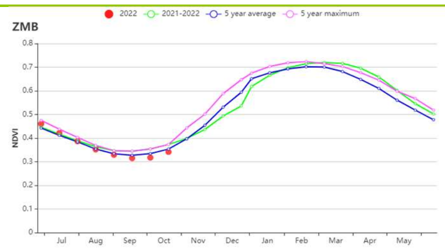
Zambia is classified into three major agroecological zones (AEZs), primarily based on rainfall amount but also incorporating soils and other climatic characteristics. These AEZs include: Luangwa-Zambezi Rift Valley (214), covering the major river valleys with rainfall less than 400-800 mm per year; Central-Eastern and Southern Plateau (216), with relatively fertile soils providing a backbone of agriculture production and Western Semi-Arid Plain (217) dominated by relatively poor sandy soils. The second and third AEZs receive mean annual rainfall of 800 -1000 mm, a growing season of 100 -140 days; and Northern High Rainfall Zone (215) occupying about 41% of the country. It receives mean annual rainfall of 1000-1500 mm, and a growing season of 120-150 days. Generally, in these agroecological zones, cereals (maize, sorghum, millets, and rice), root crops (cassava, sweet potato, and yams), fruits (banana, pineapples, and sugarcane), and several vegetables are the most important crops and they are predominantly under rainfed agriculture and low-input farming systems.

According to the agro-ecological region analysis, all the regions/zones received less than 4 mm rainfall which was less than the 15-year average. The average temperature in the regions varied from 21.0℃ to 22.0℃ with negligible departure (< 0.6℃) from the average. The potential radiation across all three agro-ecological zones was more than 1380 MJ/m2 with the highest value for the Northern High Rainfall Zone (1435 MJ/m2 +2%) and resulted in negative BIOMSS departures in all regions, with Northern High Rainfall Region recording the highest departure (-13%). The Cropped Arable Land Fraction (CALF) was highest for the Northern High Rainfall Zone (81%) and lower values in the three other zones: Luangwa-Zambezi Rift valley (47%), Central-Eastern and Southern Plateau (41%) and Western Semi-Arid Plateau (63%). The cropping intensity is above 99%, with negative departures observed in Central-Eastern & Southern Plateau (-1%) and Luangwa-Zambezi Rift Valley (-3%). The NDVI showed a positive departure from the 5YA, indicating reduced potential agricultural production in the three southern AEZs due mainly to reduced rainfall in these regions.

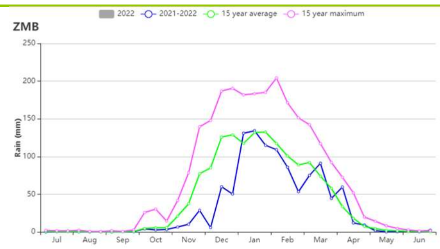
Figure 3.47 Zambia's crop condition, July - October 2022



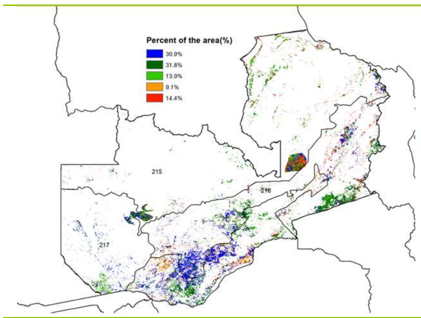
(a). Phenology of major crops



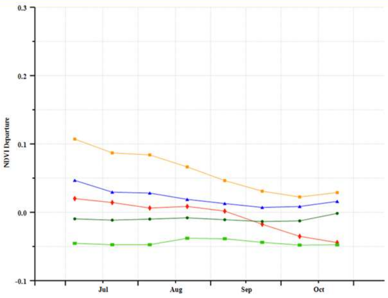
(b)Crop condition development graph based on NDVI



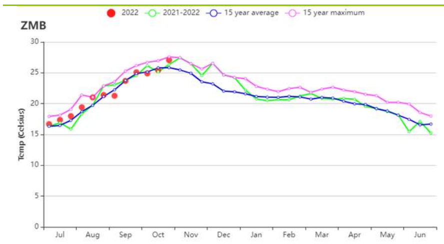
(c) Time series rainfall profile



(d) Spatial NDVI patterns compared to 5YA



(e) NDVI profiles



(f) Figure D: Time series temperature profile

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

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Northern high rainfall zone	4	-89	21.4	0.2	1435	2	401	-13
Central-eastern and southern plateau	1	-88	21.8	0.3	1395	2	385	-8
Western semi-arid plain	2	-81	22.6	0.6	1382	-1	429	-3
Luangwa Zambezi rift valley	1	-87	22	0.5	1387	0	391	-7

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

Region	Cropped arable land fraction		Cropping intensity		Maximum VCI
	Current (%)	Departure (%)	Current (%)	Departure (%)	Current
Northern high rainfall zone	81	1	113	8	0.85
Central-eastern and southern plateau	41	28	99	-1	0.91
Western semi-arid plain	63	12	100	0	0.82
Luangwa Zambezi rift valley	47	52	97	-3	0.91

Chapter 4. China

After a brief overview of the agro-climatic and agronomic conditions in China over the reporting period (section 4.1), Chapter 4 presents an updated estimate of major cereals and soybean production at provincial and national levels as well as summer crops production and total annual outputs (4.2) and describes the situation by region, focusing on the seven most productive agro-ecological regions of China: Northeast China, Inner Mongolia, Huanghuaihai, Loess region, Lower Yangtze, Southwest China, and Southern China (4.3). Section 4.4 describes trade prospects of major cereals and soybean. Additional information on the agro-climatic indicators for agriculturally important Chinese provinces is listed in table A.11 in Annex A.

4.1 Overview

From the perspectives of agroclimatic indicators, the overall conditions were generally normal in China from July to October 2022. The only exception was that the drought and heat affected Lower Yangtze River basin. Temperature and radiation were above average by 0.8°C and 9%, respectively, while rainfall was 27% below average. As a result, the potential biomass was 7% smaller than the 15YA. The maximum Vegetation Condition Index (VCIx) was quite high at 0.92. The national Cropping Intensity (CI) was 5% above the 5YA, but was close to that of 2021. 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) is 1.16, indicating a good crop production status.

Over the entire growing period, all of the main agricultural regions of China except Northeast China (+21%) recorded below-average rainfall, with the largest negative departure occurring in Lower Yangtze region (-47%). According to the spatial distribution of rainfall profiles, blue marked regions (62.6% of the cultivated regions) had slightly above average rainfall during the whole monitoring period, while other cultivated regions had below-average rainfall almost during the whole monitoring period. It is worth noting that 7.7% of the cultivated regions (marked in light green) experienced positive rainfall departure larger than 150 mm/dekad, mainly located in Guangdong and some parts of Hunan, Guangxi, and Fujian.

Six of the main agricultural regions in China recorded above-average temperatures ranging from +0.3℃ (Inner Mongolia) to +1.2℃ (Lower Yangtze region), while only Northeast China recorded below-average temperatures with negative departures of -0.3°C. The map of the spatial distribution of temperature profiles indicates that temperatures fluctuated during the monitoring period as follows: 30.3% of the cultivated regions experienced relatively smoother temperature variation, while other regions had some fluctuations in temperature during certain periods. 34.4% of the cultivated regions suffered from positive temperature departure larger than +3.0℃ in early and middle August, mainly located in northern parts of Lower Yangtze region, Southwest China and some parts of Loess region and Huanghuaihai region. The rest 35.3% of the cultivated regions mainly had below-average temperature during the whole monitoring period, mainly distributed in Northeast China, Inner Mongolia and some parts in Huanghuaihai region.

As for RADPAR, all of the main agricultural regions in China received average or above-average radiation as compared to the 15YA. With respect to BIOMSS, only Northeast China had positive departures of 9% as a result of abundant rainfall, while all the others had negative BIOMSS departure with a range from -20% (Lower Yangtze region) to -4% (Loess region and Huanghuaihai). As can be seen in the spatial distribution of potential biomass departure from the 15YA, most parts of China had negative departures, but there were areas with positive departures, mainly concentrated in some parts in Shandong, Liaoning and Jilin, as confirmed by the statistics at AEZ level.

The VCIx values were all greater than or equal to 0.89 in all of the main producing regions of China, with values between 0.89 (Lower Yangtze region) and 0.96 (Northeast China). Nationally, CALF was average in all AEZs of China as compared to the 5YA. Among them, Inner Mongolia recorded slightly below-average CALF (-1%) 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 (+18%), and CI in Lower Yangtze River, Southwest, Huanghuaihai, and the Loess region presented above 5YA CI but was in general close to that of 2021.VHIn maps show that agricultural drought mainly occurred in Southwest China and Lower Yangtze region, especially in the provinces of Jiangxi, Anhui, Jiangsu, Chongqing, Sichuan, Hubei, and Hunan. The combination of high temperatures and drought caused unfavorable conditions for rice production in these provinces. Regarding CPI values for AEZs, Northeast China had the biggest CPI value at 1.19 under agreeable agroclimatic conditions.

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

Region	Agroclimatic indicators				Agronomic indicators		
	Departure from 15YA (2007-2021)				Departure from 5YA (2017-2021)		Current period
	RAIN (%)	TEMP (°C)	RADPAR (%)	BIOMSS (%)	CALF (%)	Cropping intensity (%)	Maximum VCI
Huanghuaihai	-14	0.8	3	-4	0	8	0.92
Inner Mongolia	-8	0.3	4	-5	-1	1	0.93
Loess region	-10	1	3	-4	0	4	0.93
Lower Yangtze	-47	1.2	13	-20	0	12	0.89
Northeast China	21	-0.3	0	9	0	0	0.96
Southern China	-23	0.7	12	-8	0	11	0.92
Southwest China	-28	1.1	12	-8	0	18	0.93

Figure 4.1 China crop calendar

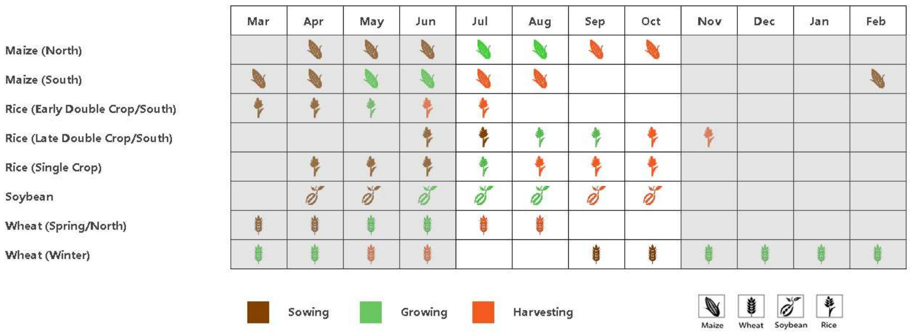
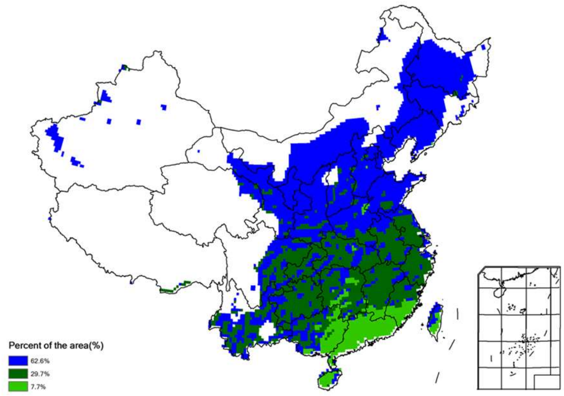


Figure 4.2 China spatial distribution of rainfall profiles, July to Oct 2022



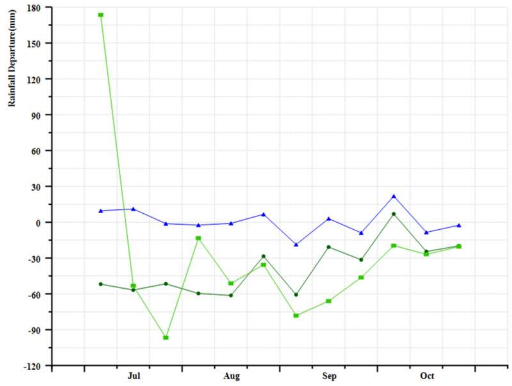


Figure 4.3 China spatial distribution of temperature profiles, July to Oct 2022

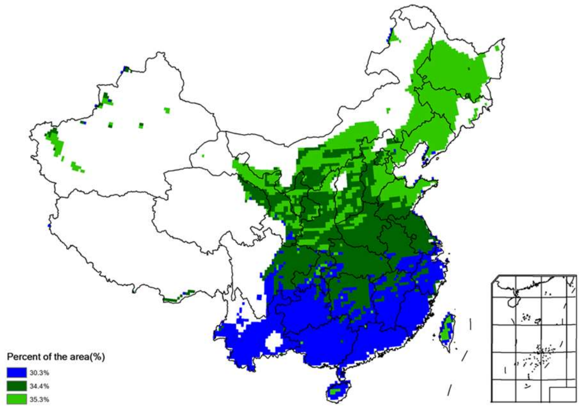
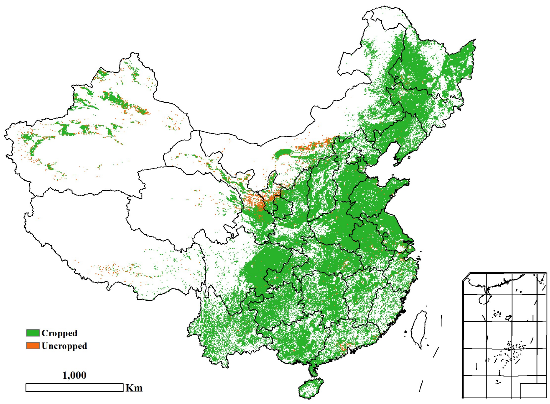


Figure 4.4 China cropped and uncropped arable land, by pixel, July to Oct 2022

Figure 4.5 China maximum Vegetation Condition Index (VCIx), by pixel, July to Oct 2022



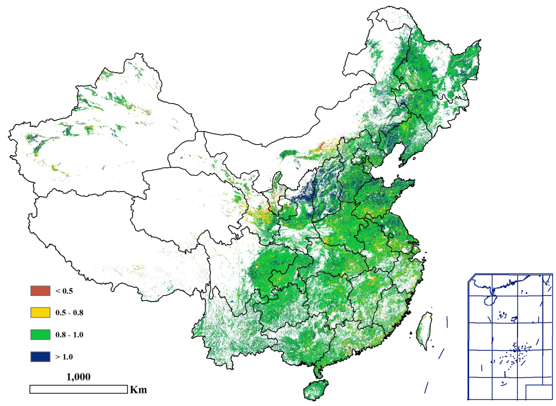
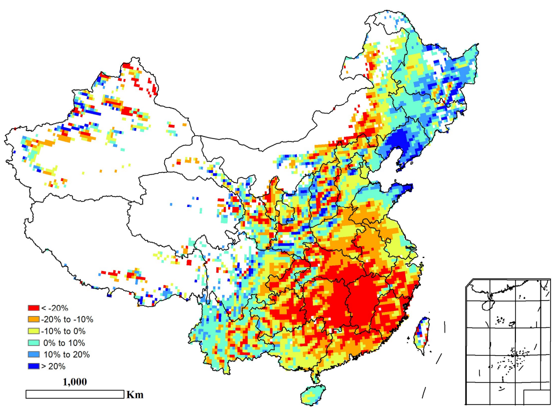


Figure 4.6 China biomass departure map from 15YA, by pixel, July to Oct 2022

Figure 4.7 China minimum Vegetation Health Index (VHIn), by pixel, July to Oct 2022



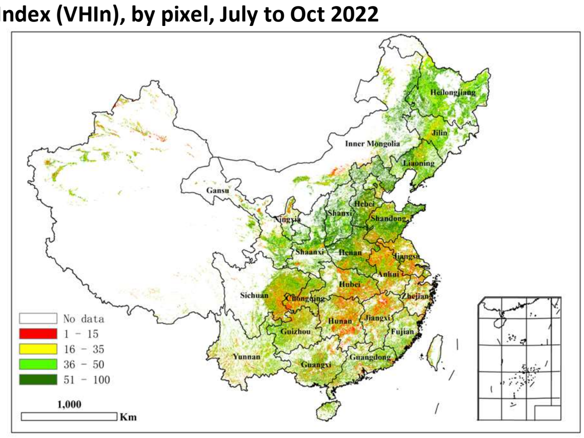
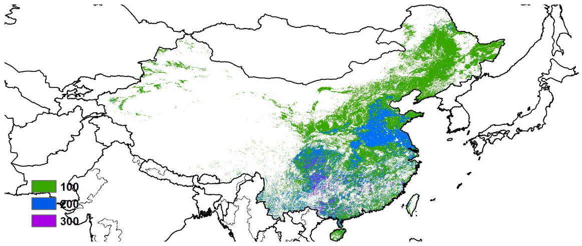


Figure 4.8 China Cropping Intensity (CI), by pixel, 2022



4.2 China's crops production

The agro-climatic conditions during 2022 summer crops growth process, the national agricultural meteorological conditions are generally close to the average conditions, but regional differences, showing a pattern of persistent high temperatures in the south and more rain in the north. since July, the Yangtze River basin has seen persistent high temperatures and less rain, high temperature and dry weather has continued until the first and middle of August, the adverse impact on the growth of crops in this region, resulting in Sichuan, Chongqing, Jiangxi, Hunan and other places. The growth was significantly lower than the average level in the past five years. Northeast China, most of Shandong, Shaanxi and Shanxi had normal temperatures and high precipitation, with generally better-than-average crop growth. The negative impact of local flooding was generally limited, with the disaster-forming effects mainly distributed in parts of southern Gansu.

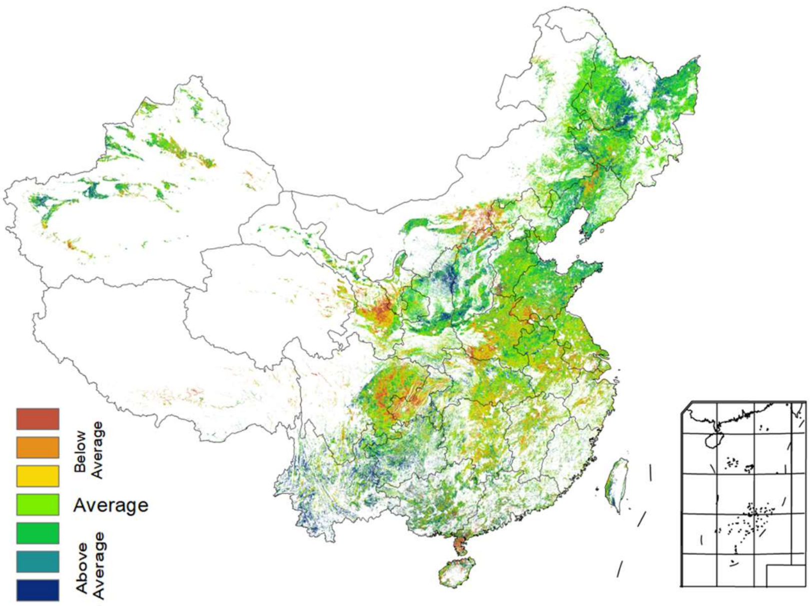


Figure 4.9 Crop growth during the peak growth period of summer crop crops in China in mid-August 2022 (compared with the average of recent 5 years)

China's total crop production in 2022 is 646.74 million tons, a decrease of 5.48 million tons or 0.8% year-on-year. Among them, the total production of staple crops (wheat and rice) is 329.53 million tons, a slight decrease of 1.76 million tons, or 0.5%; As a result of crop type shifting policy, the total production of summer crops (including maize, semi-late rice, late rice, spring wheat, soybeans, legumes and tuber crops) is 476.96 million tons, a decrease of 4.75 million tons, or 1.0%, compared with 2021; the total production of winter crops (winter wheat, rapeseed, and other minor crops) is 142.23 million tons, down 0.98 million tons, or 0.7%. The main reason for the reduction in winter crops production is the year-on-year decline of

1.9% in planted area; total production of early rice was 27.55 million tons, an increase of 0.25 million tons, or 0.9%. As far as the provinces are concerned, most of the provinces in the Yangtze River Basin saw a year-on-year decrease in summer crop production. Among them, Jiangxi (-4.7%), Sichuan (-4.5%), Chongqing (-4.1%), Hubei (-2.3%) and Hunan (-2.2%) had slightly larger reductions in their summer crops. Anhui, Jiangsu and Zhejiang summer crop production also fell slightly. Heilongjiang and Inner Mongolia due to the shrinkage of maize planted area, summer crop production decreased by 5.2% and 2.5% respectively. Summer crop yields increased in Xinjiang (+5.7%), Shanxi (+1.8%), Fujian (+1.8%) and Jilin (+1.7%) due to generally better agro-meteorological conditions than last year. As the summer crops production occupy the majority of annual crops production, the intre-annual variations of annual crops production in the above provinces is in general close to that of summer crops production.

Table 4.2 Summer crop and annual crop production and variation in China in 2022

	Summer crop		Total annual production	
	Production (1000 tonnes)	Variation (%)	Production (1000 tonnes)	Variation (%)
Anhui	20169	-1.4	35888	-2
Chongqing	7862	-4.1	7862	-4.1
Fujian	5190	1.8	6072	1.8
Gansu	6842	-1.3	10405	-0.4
Guangdong	7837	-1.8	11991	-1.7
Guangxi	9391	-0.4	14129	0
Guizhou	12672	-0.9	12672	-0.9
Hebei	21253	0.4	33761	-0.5
Heilongjiang	76543	-5.2	76543	-5.2
Henan	24378	-0.8	57031	-1.3
Hubei	18600	-2.3	25652	-1.9
Hunan	18913	-2.2	27872	-0.6
Inner Mongolia	33402	-2.5	33402	-2.5
Jiangsu	20337	-0.5	34324	-0.2
Jiangxi	9959	-4.7	15822	-2.8
Jilin	40792	1.7	40792	1.7
Liaoning	21323	0.7	21323	0.7
Ningxia	2796	1.3	2796	1.3
Shaanxi	7623	-0.6	11689	-1
Shandong	20511	0.8	47663	0.1
Shanxi	9345	1.8	11684	2.3
Sichuan	26468	-4.5	32424	-3.3
Xinjiang	9988	5.7	15106	4
Yunnan	15343	0.5	15343	0.5
Zhejiang	6292	-1.1	6879	-0.9
subtotal	453829	-1.5	609125	-1.3
China	476959	-1	646736	-0.8

Maize: China's total maize production in 2022 was 227.19 million tons, down 6.65 million tons or 2.8% year-on-year, with the main reason for the decrease being a 3.2% year-on-year reduction in maize planted area. Although some of the main production areas suffered from extreme heat and drought and local flooding disasters and other unfavorable factors, but China's northeast and the Huanghuaihai regions and other areas of the main maize production areas are growing well, yield increased year-on-year. The national average maize yield is expected to be 5,560 kg/ha, a slight increase of 0.4%.

In northeastern China, rainfall was significantly higher than normal, resulting in localized flooding in northwestern Heilongjiang, central Jilin and north-central Liaoning, but sufficient precipitation contributed to generally better crop growth than in 2021. Maize yields increased in Jilin (+1.2%), Liaoning (+1.5%) and Heilongjiang (+2.9%). As China's largest maize-producing regions, northeastern Inner

Mongolia and Heilongjiang saw the most significant shrinkage in maize acreage. This led to a 4.9% and 12.7% year-on-year decline in maize production in two provinces and regions, respectively. Persistent high temperature weather in the Yangtze River basin since July led to severe drought in Chongqing and Sichuan provinces and cities, resulting in maize yield decreases of 6.4% and 9.4%, respectively. Jiangsu maize planted area decreased year-on-year, resulting in a 2.5% reduction in maize production. Maize production increased in Shandong (+0.8%), Shanxi (+1.8%), Yunnan (+3.2%) and Xinjiang (+7.0%), thanks to generally favorable agro-meteorological conditions during the reproductive period.

Soybean: The year 2022 was the largest year for soybean planted in China in 10 years, reaching 9.851 million ha, an increase of 2.043 million ha or 26.2% from the previous year. The national average yield was 1,846 kg/ha, an increase of 0.5% year-over-year. China's soybean production reached 18.19 million tons, an increase of 3.84 million tons or 26.8% year-over-year, the largest increase in 10 years.

The soybean planted area in Heilongjiang Province reached 4.962 million ha, an increase of 1.384 million ha or 38.7% from 3.578 million ha in 2021. Soybean planted area in Inner Mongolia reached 1.486 million ha, an increase of 0.438 million ha, or 41.8%. compared with 1.048 million ha in 2021. The significant expansion of planted area contributed to the increase in soybean production in the two provinces and regions, by 1.98 million tons and 0.5 million tons, an increase of 41.3% and 41.0%, respectively. In addition, soybean production in provinces such as Henan, Hebei, Jiangsu, Shandong and Shanxi also increased to varying degrees. The direct reason for the significant increase in soybean planted area is the increase in soybean planted subsidies. The multi-pronged measures of soybean producer subsidies, arable land rotation subsidies and soybean planted seed subsidies have bridged the income gap between planted soybeans and maize, and all relevant subsidies are directly issued to the actual planted farmers, which has mobilized farmers to plant soybeans.

Table 4.3 production and amplitude of maize, rice, wheat and soybean in China in 2022

	Maize		Rice		Wheat		Soybean	
	Production (1000 tonnes)	Variation (%)	Production (1000 tonnes)	Variation (%)	Production (1000 tonnes)	Variation (%)	Production (1000 tonnes)	Variation (%)
Anhui	3589	1	16087	-2.1	14181	-2	1071	-0.2
Chongqing	1984	-6.4	4624	-3.1				
Fujian			2251	1.8				
Gansu	5497	-1.2			2610	5.2		
Guangdong			10318	-1.6				
Guangxi			9956	0.1				
Guizhou	5147	-0.7	5480	-1.1				
Hebei	19297	0.4			12199	-2	201	2.4
Heilongjiang	43870	-12.7	22774	2			6768	41.3
Henan	15246	-0.7	3701	-2	32508	-1.6	834	3.3
Hubei			14905	-2.3	4470	-0.1		
Hunan			25043	-0.4				
Inner Mongolia	23433	-4.9			1975	0.2	1707	41
Jiangsu	2137	-2.5	16148	-0.6	13574	-0.6	825	7.5
Jiangxi			14602	-2.7				
Jilin	32066	2.1	5889	1.6			720	-12.1
Liaoning	16449	0.6	4645	1.2			431	-1.4
Ningxia	1689	-0.3	481	7.2				
Shaanxi	3807	-0.1	978	-3.3	4003	-1.3		
Shandong	19363	0.8			26909	-0.4	720	0.7
Shanxi	9347	1.8			2264	4.4	166	4.5
Sichuan	6535	-9.4	14855	-2.2	1972	2.7		
Xinjiang	7432	7			5017	1.1		
Yunnan	6629	3.2	5740	-2.6				
Zhejiang			6217	-0.9				

	Maize		Rice		Wheat		Soybean	
	Production (1000 tonnes)	Variation (%)	Production (1000 tonnes)	Variation (%)	Production (1000 tonnes)	Variation (%)	Production (1000 tonnes)	Variation (%)
subtotal	223518	-3	184695	-0.9	121682	-0.8	13443	22.5
China	227191	-2.8	195335	-0.6	134198	-0.5	18185	26.8

Rice: The total national rice production was 195.33 million tons, a decrease of 1.09 million tons or 0.6% year-on-year. Among them, the production of early rice was 27.55 million tons, an increase of 0.25 million tons or 0.9% year-on-year. The production of semi-late rice/single rice was 133.75 million tons, a decrease of 0.39 million tons, or 0.3%. Late rice production was 34.03 million tons, down 0.95 million tons, or 2.7%. Since the sowing of semi-late rice/single rice, generally favorable agrometeorological conditions in the northern single rice producing areas, with single rice production in Liaoning, Jilin and Heilongjiang increasing by 1.2%, 1.6% and 2.0% year-on-year. Persistent extreme heat in the main rice producing areas of the Yangtze River Basin started since the maturity stages of semi-late rice. The impacts of heat and drought on semi-late rice was limited. Hunan (-0.6%), Jiangxi (-1.2%), Anhui (-2.1%), Hubei (-2.1%), Sichuan (-2.2%) and Chongqing (-3.1%) saw slight year-over-year declines in production. The persistent extreme heat and dry weather covered almost the entire fertility period of late rice in the Yangtze River Basin, which was unfavorable to late rice production, resulting in a 2.7% year-on-year decrease in national late rice production. Although persistent hot and dry weather resulted in severe meteorological drought, but the agricultural drought was less severe thanks to the well-developed agricultural infrastructures which compensated for the meteorological drought. Even though, late rice production in Jiangxi (-6.3%), Zhejiang (-4.1%), Hunan (-4.0%), Hubei (-2.9%) and Anhui (-2.0%) all still declined year-over-year. Guangdong and Guangxi late rice production also declined to varying degrees year-on-year. Only Fujian late rice production increased year-on-year by 1.8%.

Table 4.4 Early, semi-late and late rice production and variation (%) by province in China, 2022

	Early rice		Semi-late rice/single rice		Late rice	
	Production (1000 tonnes)	Variation (%)	Production (1000 tonnes)	Variation (%)	Production (1000 tonnes)	Variation (%)
Anhui	1058	-2.2	13467	-2.1	1562	-2
Chongqing			4624	-3.1		
Fujian	881	1.8			1370	1.8
Guangdong	4154	-1.3			6165	-1.8
Guangxi	4738	0.7			5219	-0.4
Guizhou			5480	-1.1		
Heilongjiang			22774	2		
Henan			3701	-2		
Hubei	866	-3.7	10875	-2.1	3164	-2.9
Hunan	8959	3.1	8387	-0.6	7697	-4
Jiangsu			16148	-0.6		
Jiangxi	5863	0.5	2954	-1.2	5785	-6.3
Jilin			5889	1.6		
Liaoning			4645	1.2		
Ningxia			481	7.2		
Shaanxi			978	-3.3		
Sichuan			14855	-2.2		
Yunnan			5740	-2.6		
Zhejiang	587	1.6	4795	-0.6	835	-4.1
subtotal	27106	0.9	125793	-0.7	31797	-3
China	27551	0.9	133749	-0.3	34035	-2.7

4.3 Regional analysis

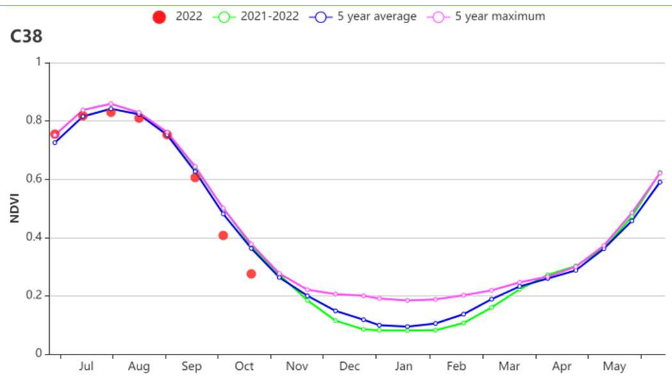
Figures 4.10 through 4.16 present crop condition information for each of China's seven agricultural regions. The provided information is as follows: (a) Phenology of major crops; (b) Crop condition development graph based on NDVI, comparing the current season up to October 2022 to the previous season, to the five-year average (5YA), and to the five-year maximum; (c) Spatial NDVI patterns for July to October 2022 (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 2022. Additional information about agro-climatic indicators and BIOMSS for China is provided in Annex A.

Northeast region

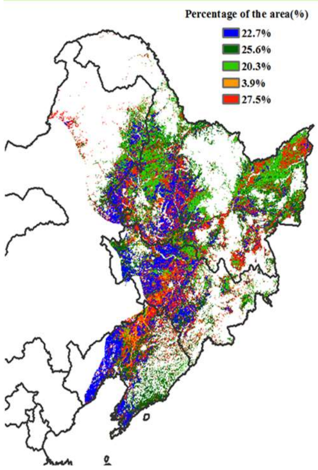
The current monitoring period (July to October) covered the peak of the summer crops in July until the harvest in September and October in northeast China. The crops, including maize, rice and soybeans, reached maturity stage in August to September in Heilongjiang, Jilin and Liaoning provinces, and the harvest was mostly completed by the end of October. Overall, crop growth in northeast China was normal from July to mid-September, but was slightly lower than average after mid-September. Precipitation in northeast China was 21% higher than the average level, the average temperature was 0.3°C lower. Temperatures were close to average during the current monitoring period except in late August and early October. During the monitoring period, the potential biomass in northeast China was 9% above the fifteen-year average. The eastern parts of northeast China were significantly above average, and this could be attributed to the abundant rainfall and moderate temperatures. While biomass estimates for western parts of northeast China were slightly less than average due to excessive precipitation.

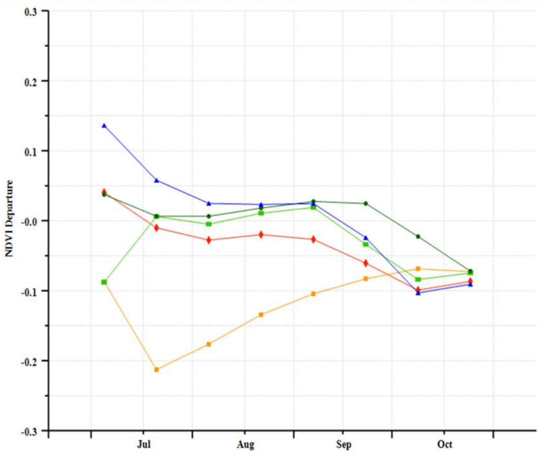
The crop conditions during the monitoring period were in general close to average but spatial variations existed. As shown by NDVI clusters and profiles, 3.9% of cropland over western Liaoning province and Jilin province were observed with negative NDVI departures, indicating that crops in this area were in relatively poor conditions. The spatial distribution map of the VCI shows that the crops in the whole northeast region were in good conditions, with VCIx values higher than 0.8 in almost all areas, except for small parts in the western part in Jilin and Liaoning province. In general, crops in northeast China grow well in 2022, with good prospects for crop yield.

Figure 4.10 Crop condition China Northeast region, July-October 2022

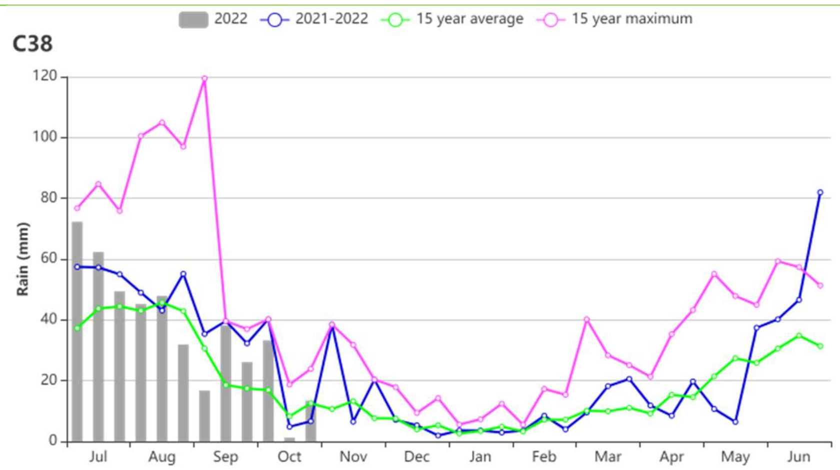


(a) Crop condition development graph based on NDVI

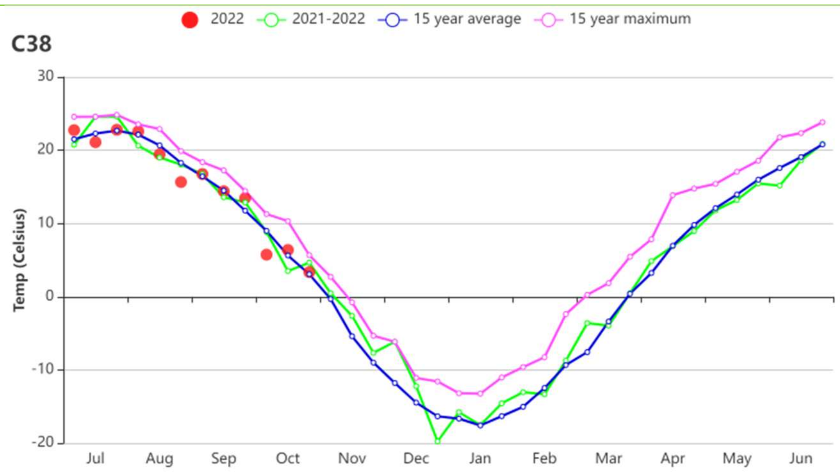




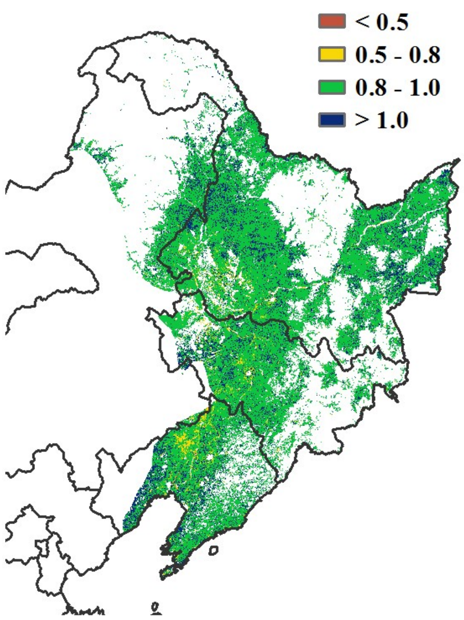
(b) Spatial NDVI patterns compared to 5YA (c) NDVI profiles



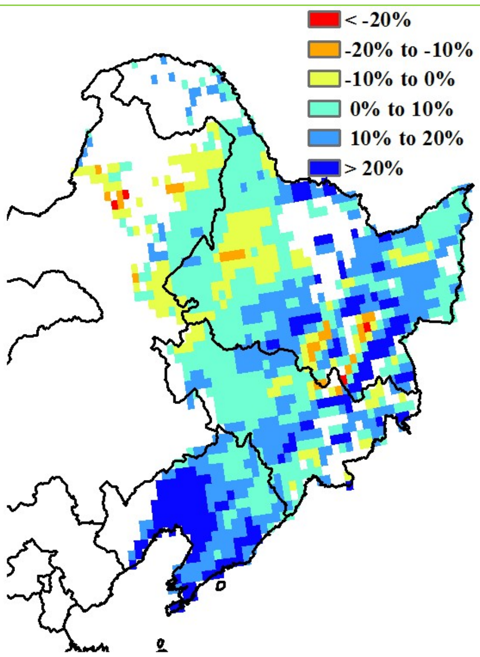
(d) Time series rainfall profile



(e) Time series temperature profile



(f) Maximum VCI



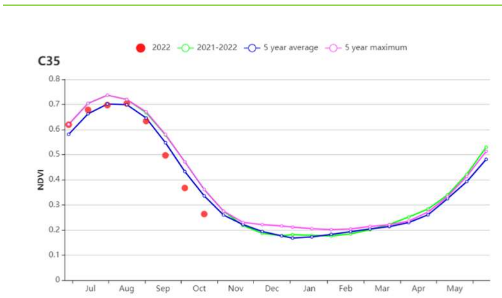
(g) Biomass departure

Inner Mongolia

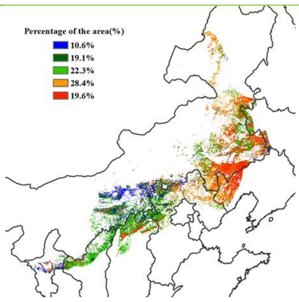
During this monitoring period, maize and soybean are the main summer crops grown in Inner Mongolia.

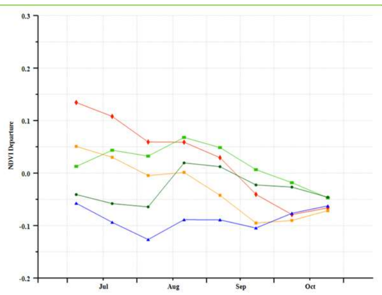
CropWatch Agroclimatic Indicators (CWAIs) show that rainfall was slightly below average (-8%). TEMP and RADPAR were both above average (+0.3°C and +4%, respectively). Insufficient rainfall resulted in a lower-than-average potential BIOMSS estimate (-5%). The NDVI development graph indicates slightly above-average crop conditions during July and August, but conditions then dropped to below the 5YA in September and October. The spatial NDVI patterns show that 29.7% of the crops were below the 5YA, mainly distributed in northern Shanxi and central Inner Mongolia. The rest of the cropped areas showed a continuous deterioration from above average to below average over time, but in general with above average crop condition during peak growing season. The fraction of cropped arable land (CALF) reached 95% and VCIx was above average (0.93). On the whole, Inner Mongolia is expected to have close to average crop production.

Figure 4.11 Crop condition Inner Mongolia, July - October 2022

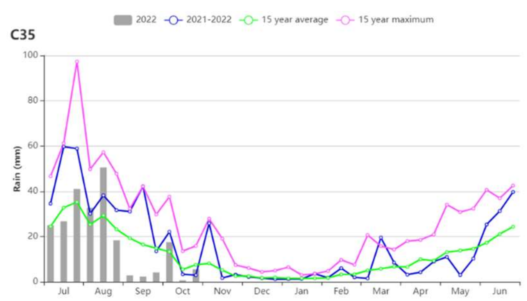


(a) Crop condition development graph based on NDVI

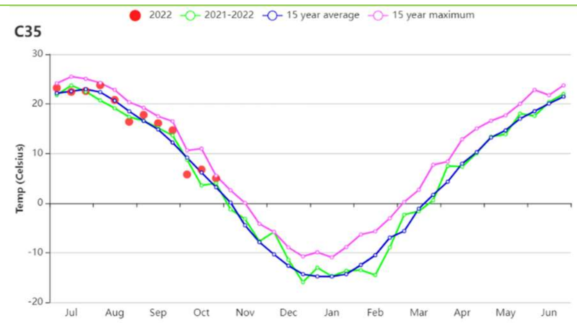




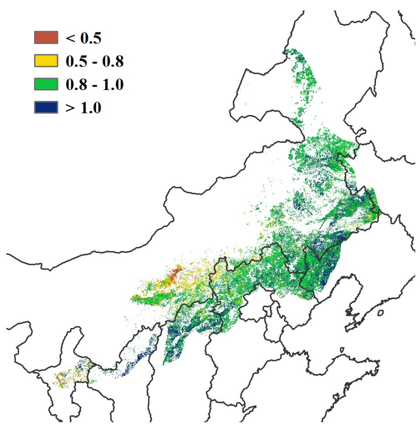
(b) Spatial NDVI patterns compared to 5YA(c) NDVI profiles



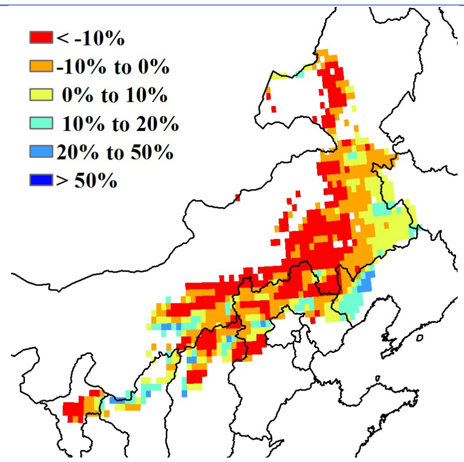
(d)Time series rainfall profile



(e)Time series temperature profile



(f) Maximum VCI



(g) Biomass departure

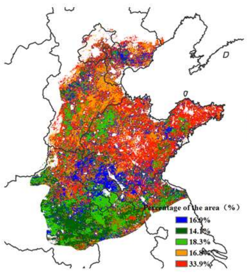
Huanghuaihai

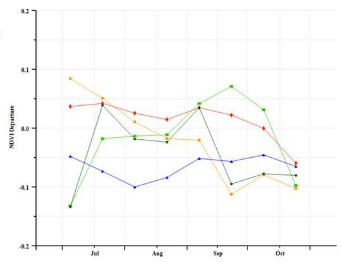
This report covers the main growing period for maize, which reached maturity in late September or early October. The winter wheat sowing started in early October. As presented by the agro-climate indicators, the temperature (+0.8°C) and radiation (+3%) in this area were above the 15YA, but precipitation was below (-14%), which resulted in below-average biomass production potential (BIOMSS -4%). Significantly above-average BIOMSS was located in northern Shandong, southeastern Beijing, and Qinhuangdao.

According to the NDVI development graph, crop conditions were favorable before August due to sufficient rainfall, while a lack of rainfall since August led to a slight deterioration in crop conditions. Significant above average rainfall was observed in early October which improved the soil moisture, benefiting for winter crops emergence and early development. As the NDVI departure clustering map shows, 33.9% of cropland was always slightly above average before mid-October, widely located in Shandong, central Hebei, and northeastern Henan. 16.8% of the cropped area in central Hebei and southwestern Shandong (blue colors in the NDVI departure clustering map) experienced poor crop conditions during the whole monitoring period.

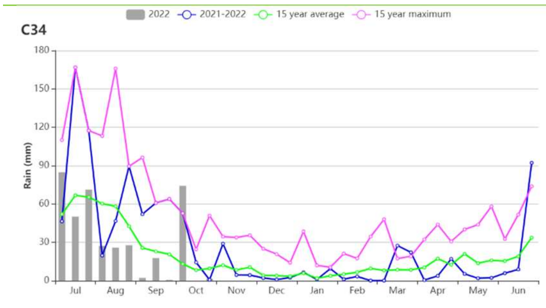
The CALF is similar to the 5YA, and the maximum VCI value was 0.92. The Crop Production Index (CPI) is 1.18. Overall, crop conditions were average during the period.

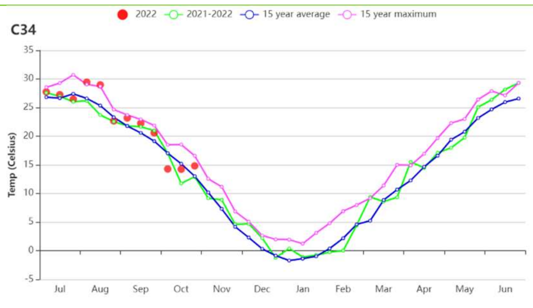
Figure 4.12 Crop condition China Huanghuaihai, July - October 2022



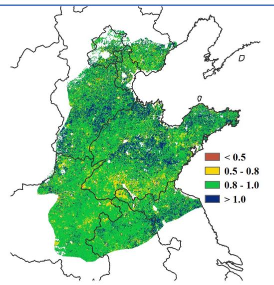


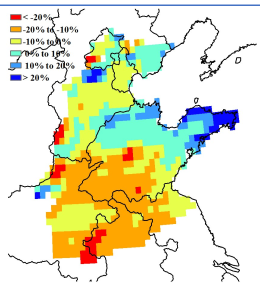
(a) Crop condition development graph based on NDVI (b) Spatial NDVI patterns compared to 5YA(c) NDVI profiles





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





(f) Maximum VCI (g) Biomass departure

Loess region

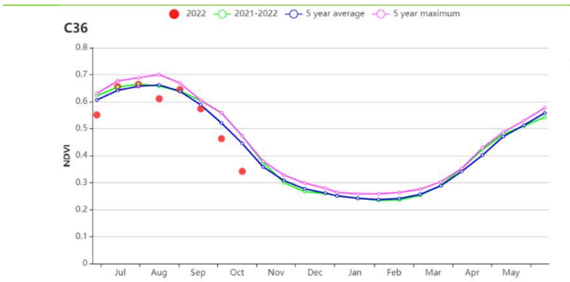
During the reporting period, maize was harvested in late September and early October, and then the sowing of winter wheat was completed.

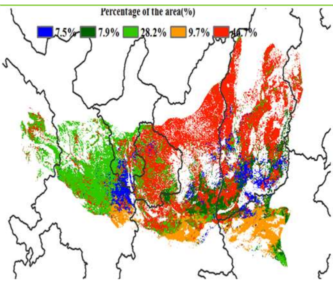
The CropWatch Agro-climatic Indicators (CWAIs) of the Loess Region show that the rainfall was below average (-10%), temperature was 1℃ higher, and radiation was above average by 3%. The combined effect resulted in potential biomass that was 4% below the average compared to the 15YA.

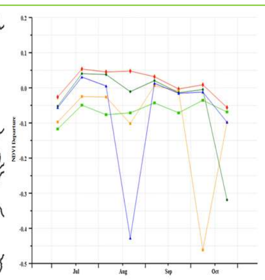
According to the regional NDVI development graph, the crop conditions in the Loess region hovered around the 5YA during the monitoring period except for late August and late September. The NDVI departure cluster profiles indicate that about 37.9% of the crop conditions were below the average throughout the entire monitoring period, mainly in the western and southern Loess Region. Crop conditions in other areas were close to average during the monitoring period. It is noteworthy that crop condition was in general above average during peak growing season. VCIx for the region was 0.93, indicating favorable crop condition during the monitoring period. The fraction of cropped arable land (CALF) in the whole region is as high as 97%, which is comparable to the average.

All in all, the crop conditions in the Loess region were at the average.

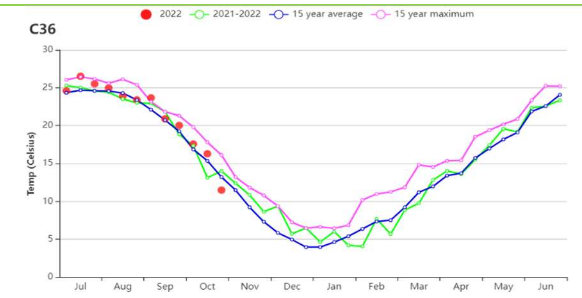
Figure 4.13 Crop condition China Loess region, July - October 2022



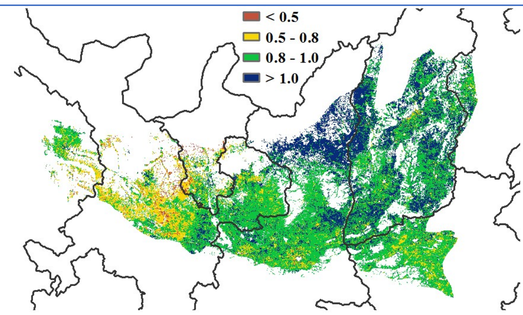


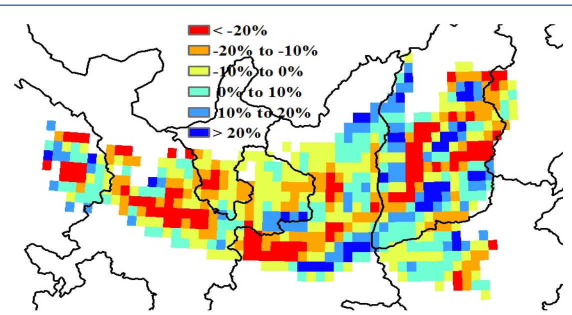


(a) Crop condition development graph based on NDVI (b) Spatial NDVI patterns compared to 5YA(c) NDVI profiles



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





(f) Maximum VCI (g) Biomass departure

Lower Yangtze region

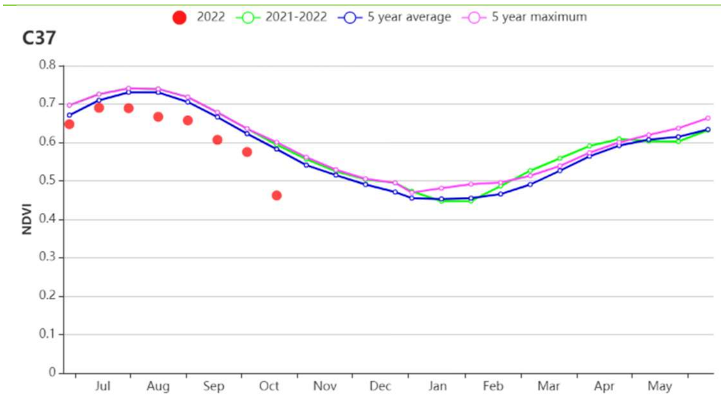
By October, the autumn grain crops such as late rice and maize had been harvested in the Lower Yangtze region.

According to the CropWatch agro-climatic indicators, the accumulated precipitation from July to October was 47% below the average. Temperature and photosynthetically active radiation were 1.2℃ and 13% higher than the 15-year averages, respectively. The rainfall profiles indicate that the decadal precipitation was below average throughout the entire monitoring period. The high temperatures and drought conditions caused a negative departure of the biomass production potential by 20%.

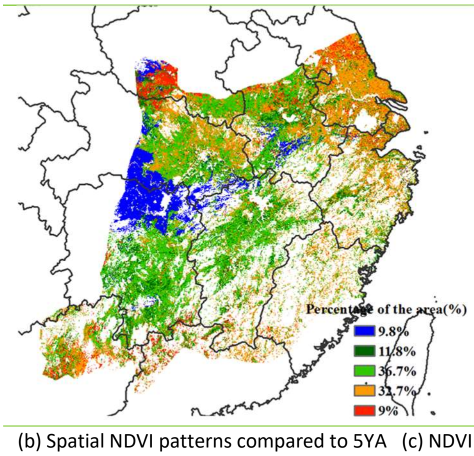
As shown in the NDVI development graph, crop conditions were below the 5-year average throughout this period. Only 32.7% of the region, mainly distributed in Jiangsu and northern Zhejiang, had a slightly lower crop growth than the average, and the potential biomass departure map shows a similar spatial pattern in this part with values between -10% and +10%. Crop growth in the other region was significantly lower than the average of the previous years. The potential biomass departure in most area was 20% below average (red area), the meteorological drought in Hunan, Hubei, Jiangxi was the most serious. However, benefited from good irrigation conditions, the average VCIx of this region was 0.89, and most of the area had VCIx values ranging from 0.8 to 1, indicating that the crop growth is generally normal during the peak growth period, but high temperature and drought during the grain filling period had a certain impact on the yield of late rice.

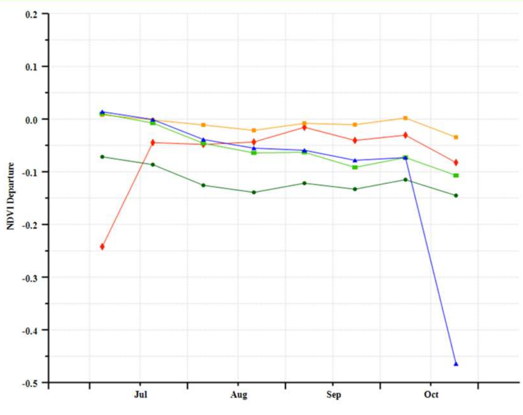
In general, affected by the continuous high temperature and drought during the monitoring period, the crop conditions in the Lower Yangtze region were below average.

Figure 4.14 Crop condition China Lower Yangtze region, July - October 2022

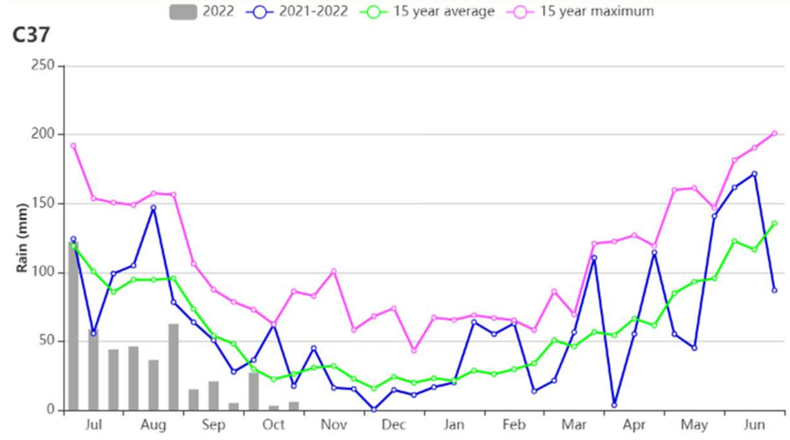


(a) Crop condition development graph based on NDVI

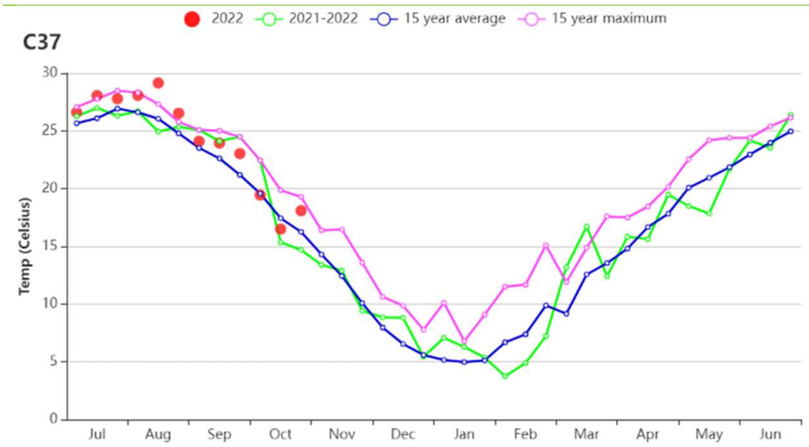




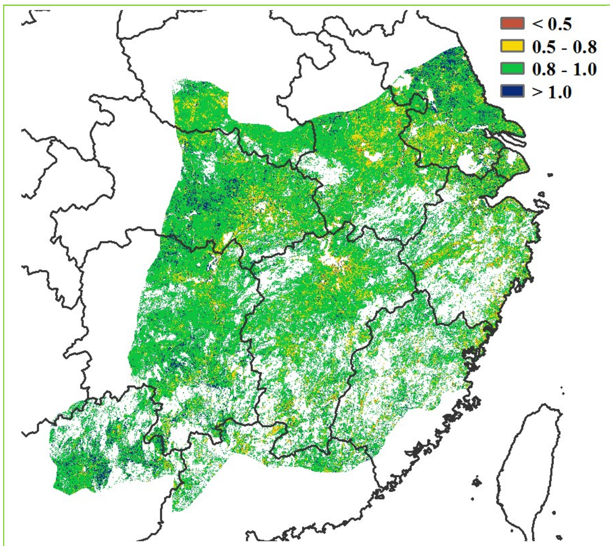
(b) Spatial NDVI patterns compared to 5YA (c) NDVI profiles

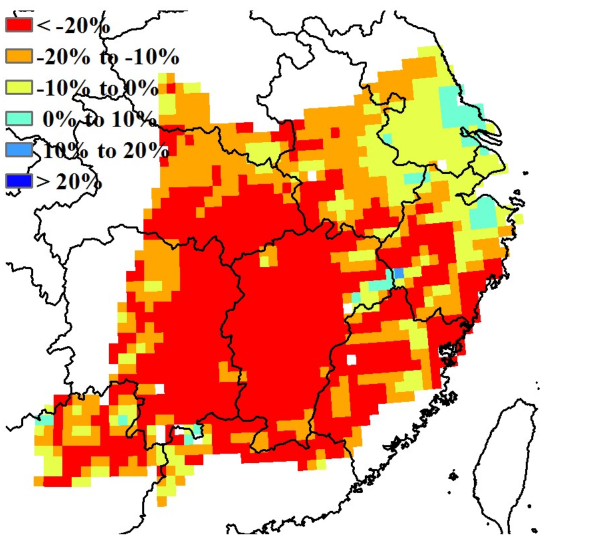


(d)Time series rainfall profile



(e)Time series temperature profile





(f) Maximum VCI (g) Biomass departure

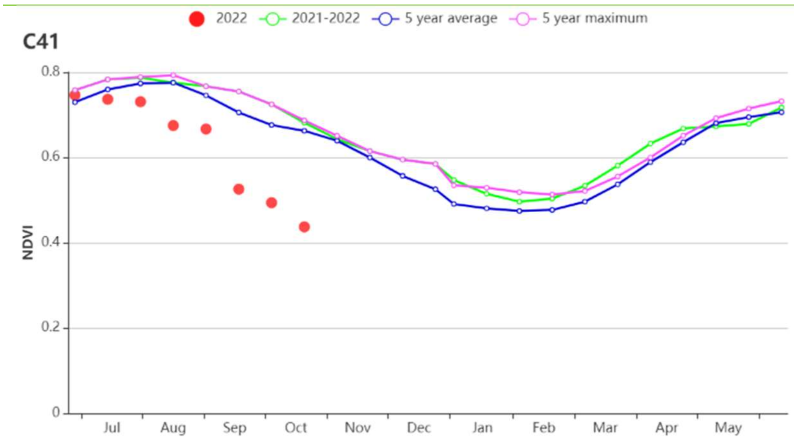
Southwest

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, crop conditions were below the 5-year average because of drought.

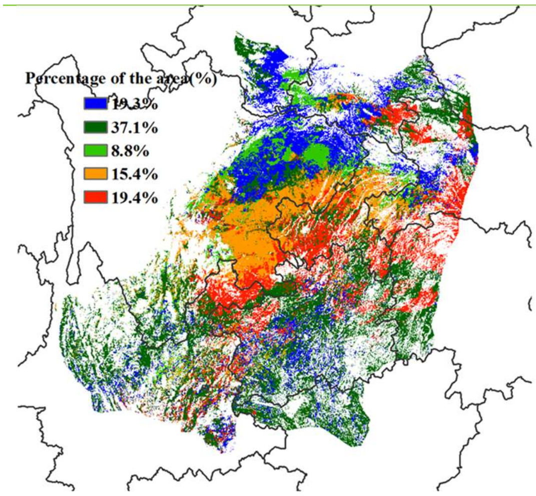
During this reporting period, the region experienced severe heat and drought events. Agroclimatic indicators showed that RAIN in the region was only 635 mm, 28% lower than the 15-year average, while TEMP was 19.8℃, 1.1℃ higher than the 15-year average, and similarly, RADPAR was substantially higher (+12%). High temperature and less rainfall resulted in severe meteorological drought, and the potential biomass was 8% lower than the average. The VCIx of the region was still as high as 0.93, and most areas had high VCIx values. Comparing the VCIx map and the BIOMSS map, the agricultural drought in areas where severe meteorological drought occurred was relatively mild, indicating that irrigation measures in the region played an important role, Which mitigate the drought effects.

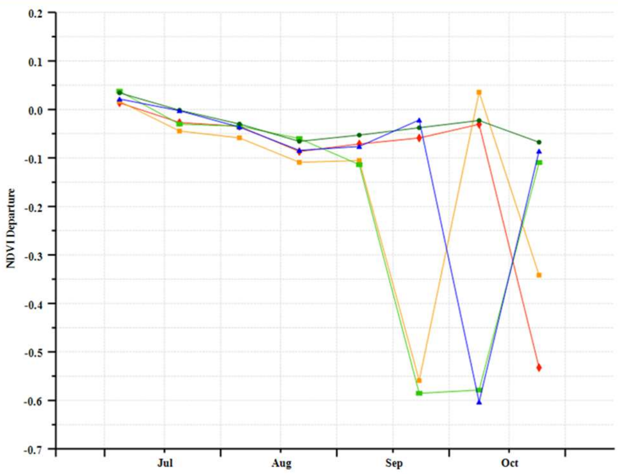
According to the NDVI distance level clustering map, crop conditions in the region were below average, while high precipitation in late August and mid-September contributed to a recovery of crop conditions in the southern part of the main production area in September, but it was still slightly below average. Despite the raging hot and dry weather, the arable land utilization in the region remained good. CALF was 100% and CI was 144%, almost unchanged from last year.

Figure 4.15 Crop condition China Southwest region, July - October 2022

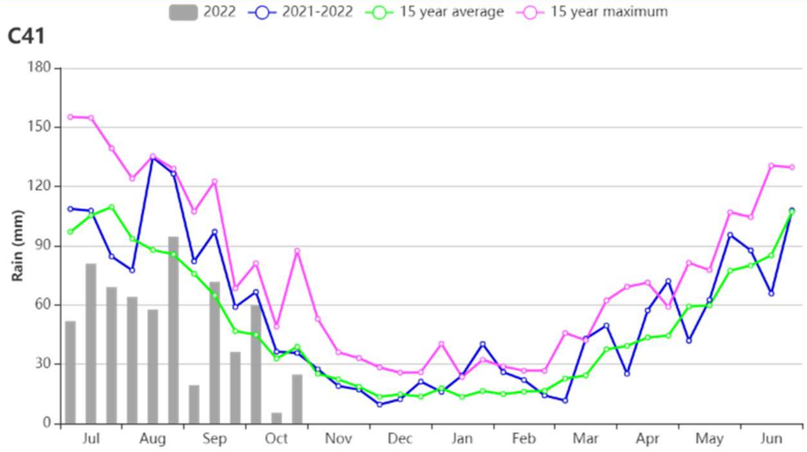


(a) Crop condition development graph based on NDVI

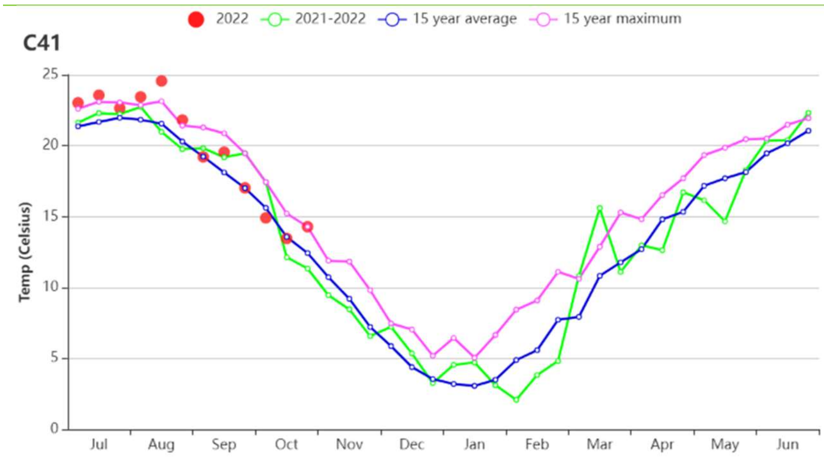




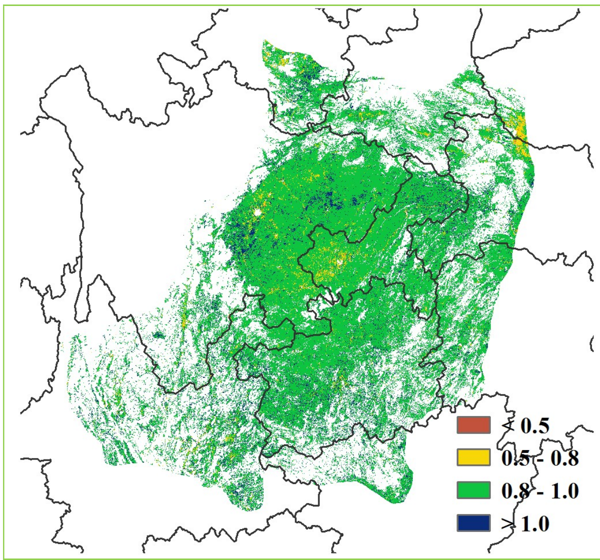
(b) Spatial NDVI patterns compared to 5YA (c) NDVI profiles

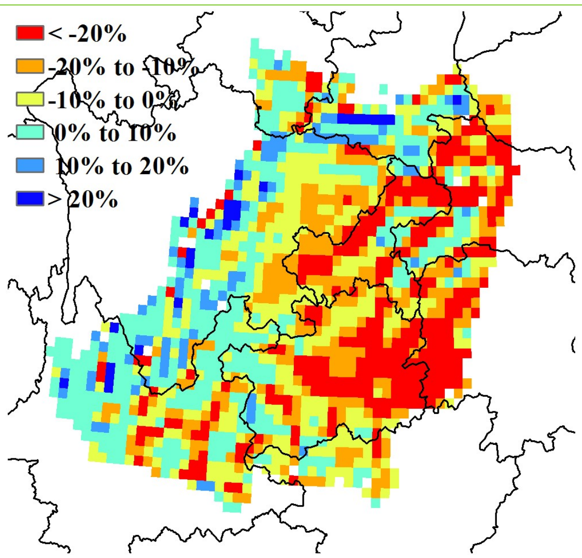


(d)Time series rainfall profile



(e)Time series temperature profile





(f) Maximum VCI

(g) Biomass departure

Southern China

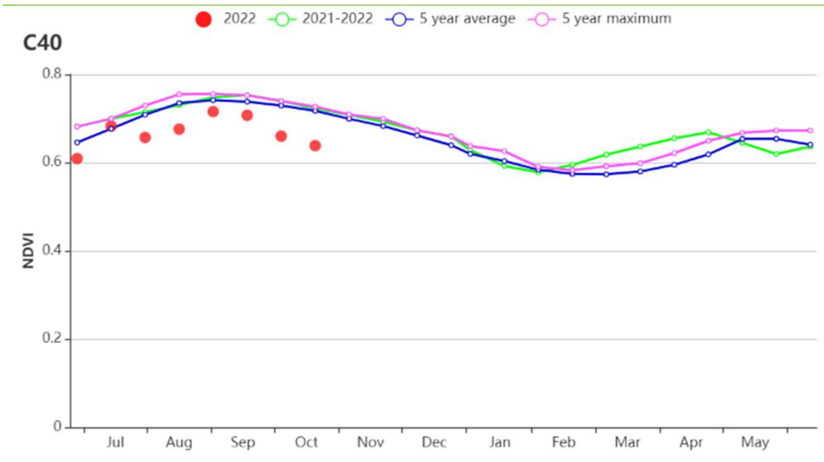
By October, late rice had been maturing and harvested progressively in Southern China. The average VCIx of the Southern China region during the monitoring period was 0.92. According to the regional NDVI profile, crop conditions were slightly below the 5-year average.

During the reporting period, precipitation in Southern China decreased obviously. According to the CropWatch agro-climatic indicators, the accumulated precipitation was 938 mm, 23% lower than average, while temperature and radiation were above average (TEMP +0.7ºC, RADPAR +12%), which resulted in below-average biomass production potential (BIOMSS -8%).

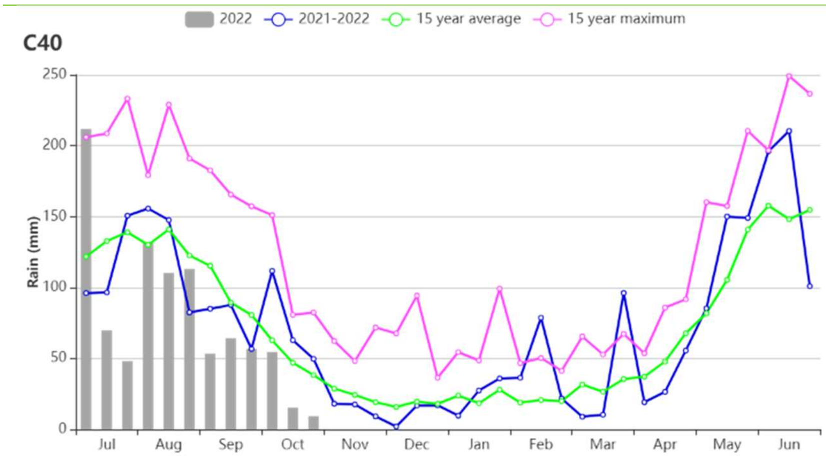
As shown by NDVI clusters and profiles, crop conditions in Yunnan was above average before August, and then fell back to the average due to the lack of precipitation. While, crop conditions in Guangdong, guangxi was below average and reverted to the average at the end of the reporting period. The potential biomass departure map showed a similar spatial pattern. BIOMSS in Yunnan was above average, while BIOMSS in Eastern Guangxi, Guangdong and Fujian was at or slightly below average and varied between -10% and 10%.

Affected by the lack of rainfall, crop conditions in Southern China was slightly below average. The precipitation exceeded 900mm, and the influence of precipitation decrease was unlikely to affect crop conditions in Southern China.

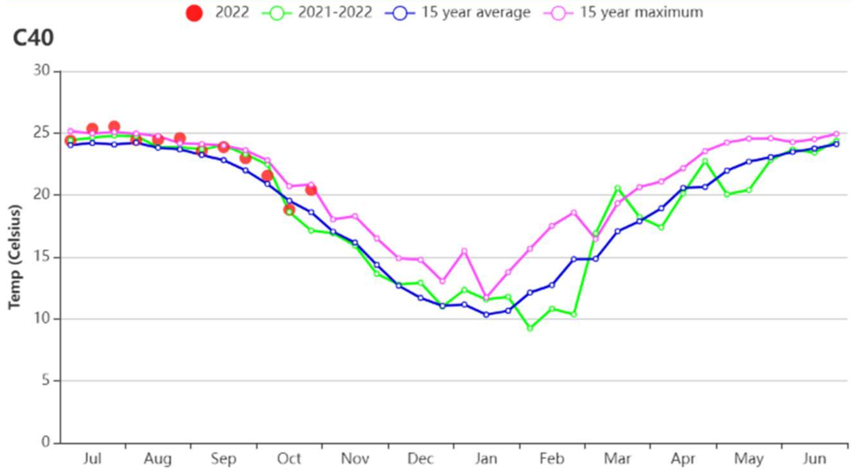
Figure 4.16 Crop condition Southern China, July - October 2022



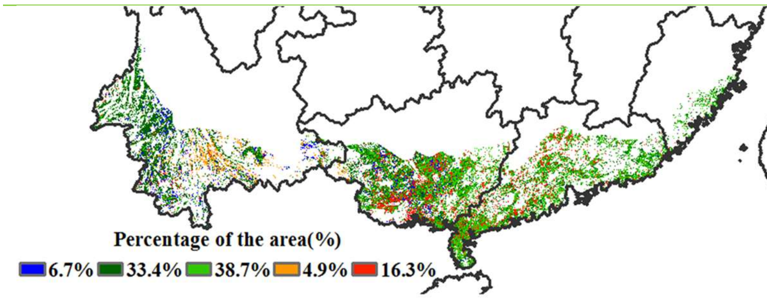
(a) Crop condition development graph based on NDVI

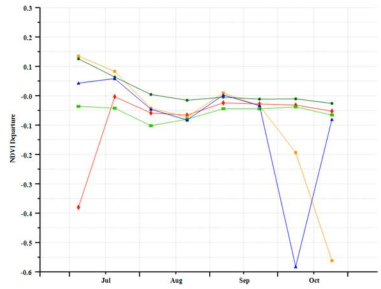


(b) Time series rainfall profile



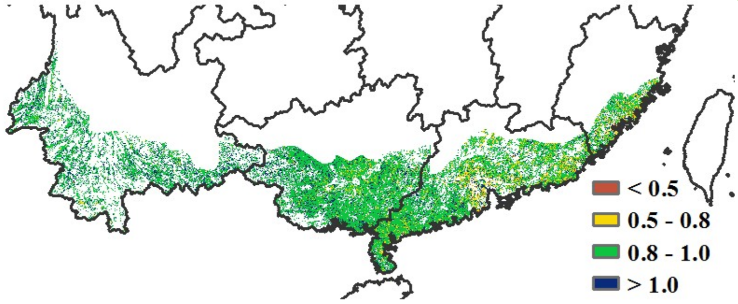
(c)Time series temperature profile



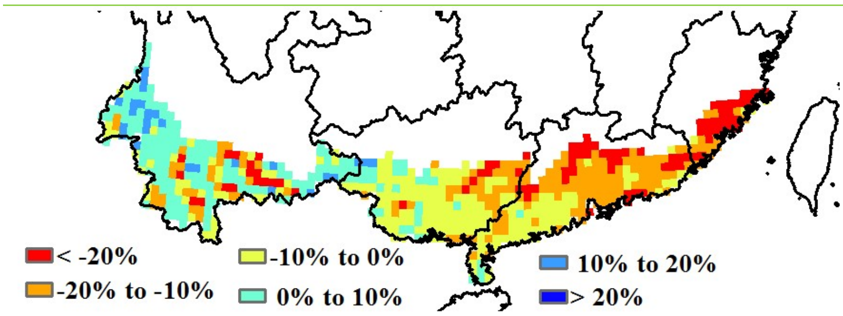


(d) Spatial NDVI patterns compared to 5YA

(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 18.463 million tonnes of maize, a decrease of 25.9% over the previous year. The main import countries were the United States and Ukraine, accounting for 71.8% and 26.6% of the total import, respectively, and the import volume was US $6.253 billion. The export of maize was 900 tonnes, a decrease of 79.9% over the previous year. The export volume was US $1.316 million, mainly to Angola and Tajikistan.

Rice

In the first three quarters, China imported 5.048 million tonnes of rice, an increase of 40.7% over the previous year. The main import source countries were India, Pakistan, Vietnam, Myanmar and Thailand, accounting for 40.6%, 22.1%, 11.7%, 11.0% and 9.6% of the total import, respectively. The import volume was US $2.105 billion. The export of rice was 1.626 million tonnes, a decrease of 12.1% over the previous year, mainly exported to Egypt, Turkiye, Papua New Guinea, South Korea and Sierra Leone, accounting for 24.8%, 10.9%, 8.4%, 8.2% and 7.3% of the total export, respectively, with an export volume of US $748 million.

Wheat

In the first three quarters, China imported 6.622 million tonnes of wheat, a decrease of 12.8% over the previous year. The main import source countries were Australia, France and Canada, accounting for 68.8%, 22.0% and 8.9% of the total import, respectively. The import volume was US $2.472 billion. The wheat export was 107,500 tonnes, an increase of 94.1% over the previous year, and the export volume was US $51.343 million.

Soybean

In the first three quarters, China imported 69.047 million tonnes of soybeans, a decrease of 6.7% over the previous year. The main sources of imports were Brazil and the United States, accounting for 67.3% and 28.0% of the total import, respectively. The import volume was US $46.502 billion. Soybean exports were 78,600 tonnes, an increase of 57.3% over the previous year, mainly exported to South Korea, Japan and North Korea, accounting for 56.8%, 18.7% and 6.4% of the total export, respectively. The export volume was US $94.639 million.

Trade prospects for major cereals and oil crop in China for 2022

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

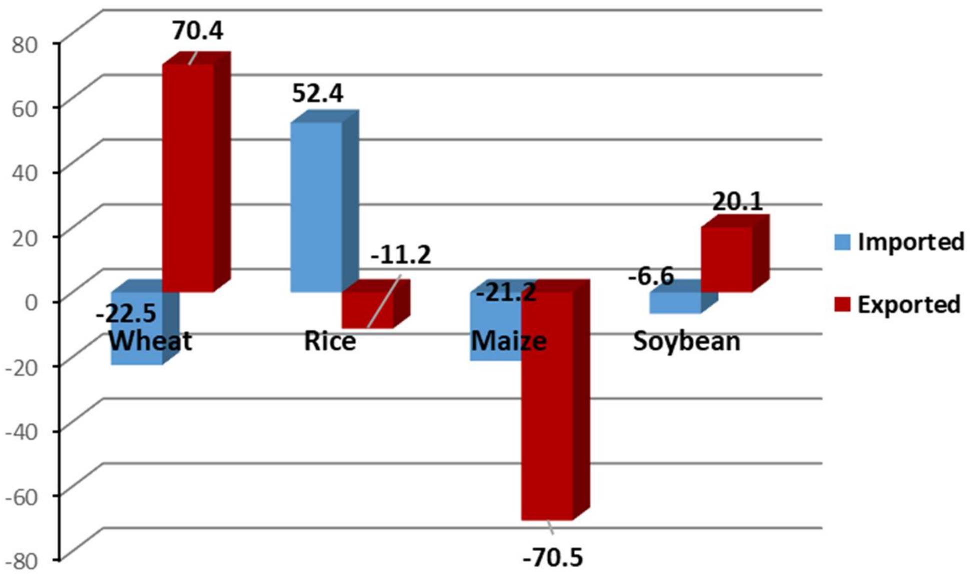
In 2022, China's maize import will decrease significantly in 2022, by 21.2% year on year, and exports by 70.5%. Affected by extreme high temperature and drought, both the EU and the United States will reduce their production. The global maize production will decrease by 3%. The overall maize price is on the rise, especially in the early stage of the crisis in Ukraine. From the domestic perspective, the demand for deep processing of maize has declined, and imports from Ukraine have decreased due to the impact of geopolitical risks. It is expected that China's maize import will decline significantly in 2022.

In 2022, China's rice import will increase by 52.4% and export will decrease by 11.2%. Due to the impact of drought and waterlogging in major producing countries, the global rice production is expected to decrease, but the decrease is not significant. Driven by the price difference of rice at home and abroad, and the strong demand for broken rice for feeding and processing, China's rice import has kept growing, but India's rice export restrictions may lead to a slowdown in imports in the fourth quarter.

In 2022, China's wheat import will decrease by 22.5% and its export will increase by 70.4% in 2022. Since this year, wheat in major producing countries has grown well, and global wheat supply and demand has continued to ease. However, due to the crisis in Ukraine and other factors, wheat prices fluctuate greatly and remain at a high level. It is expected that wheat import will decrease significantly in 2022.

In 2022, China's soybean import will decrease by 6.6% and its export will increase by 20.1% in 2022. Affected by the drought and flood weather at the beginning of the year, the main soybean producing countries in South America have slightly reduced their output, but by a small margin. The global soybean supply prospects are optimistic and remains in tight balance. Due to the comprehensive impact of such factors as the international soybean price hitting a new high, the domestic soybean oil production increase, the decline of feed demand, and the low crushing profit, it is expected that the soybean import will decrease significantly throughout the year.

Figure 4.17 Rate of change of imports and exports for rice, wheat, maize, and soybean in China in 2022 (%)



Chapter 5. Focus and perspectives

Building on the CropWatch analyses presented in chapters 1 through 4, this chapter presents first early outlook of crop production for 2022 (section 5.1), as well as sections on recent disaster events (section 5.2), and an update on El Niño (5.3).

5.1 CropWatch food production estimates

Methodological introduction

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

Global Crop Production Index

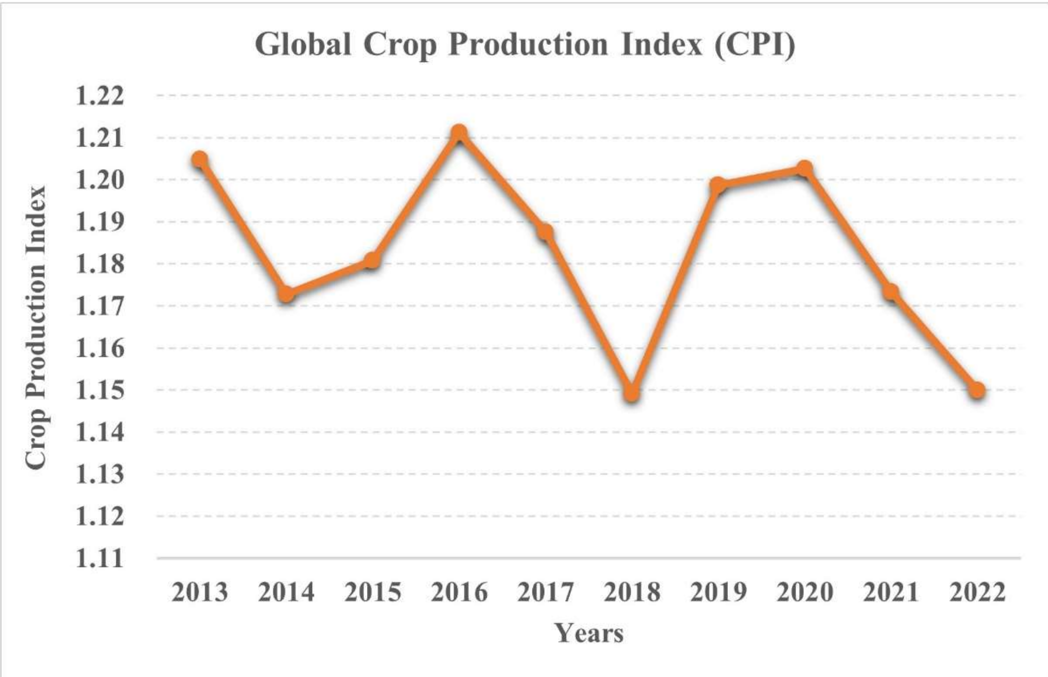


Figure 5.1 Global crop production index from July to October of the past 10 years

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

During the monitoring period from July to October, the global crop production index was at the lowest level (CPI=1.15) in the same period of nearly 10 years, which was equivalent to that in

2018. In the past 10 years, the global crop production index has experienced two significantly continuous declines, one in 2017 and 2018, and the other in 2021 and 2022. Although the crop production situation in this monitoring period is worse than that in previous years, a CPI greater than 1 indicates that global crop production is stable on the whole, and there will be no significant reduction in production.

Production estimates

The year of 2022 has been marked by frequent and extreme weather conditions caused by climate change. Heat waves, droughts, floods, regional conflicts, and the continuing COVID-19 pandemic have increased the uncertainty in global food production(Figure 5.1). Total global production of major cereal and oil crops decreased, challenging the goal of reaching Zero Hunger by 2030.

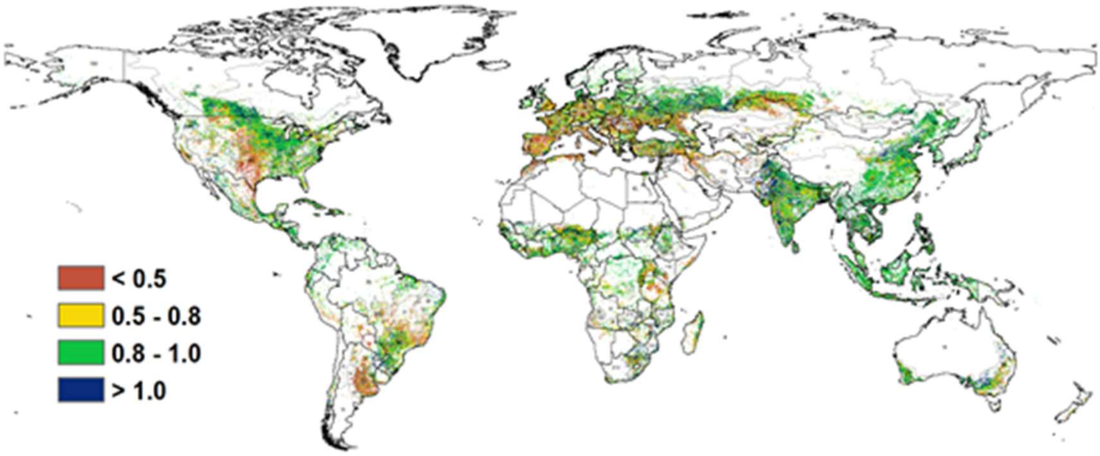


Figure 5.2 Global Maximum Vegetation Condition Index, July-August 2022

The global production of majors crops for 2022 is expected to be 2859.86 million tonnes with a decrease by 44.10 million tonnes (-1.5%) from 2021. Maize production is expected to be 1045.17 million tonnes with a decrease of 32.01 million tonnes (-3.0%), which is the largest reduction in the past five years. Rice production is expected to be 754.57 million tonnes with a decrease of 9.45 million tonnes (-1.2%) from 2021. Wheat production is expected to be 740.07 million tonnes, a reduction of 2.32 million tonnes, a drop by 0.3% from 2021. Soybean production is expected to be 320.05 million tonnes with a decrease of 0.32 million tonnes (-0.1%) from the previous year.

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

	Maize		Rice		Wheat		Soybean	
	2022	Δ%	2022	Δ%	2022	Δ%	2022	Δ%
Afghanistan					3,617	-7		
Angola	273,7	4	49	10				
Argentina	54,971	3	1,846	-3	12,738	-29	51,774	0
Australia					32,205	9		
Bangladesh	3,713	-6	48,006					
Belarus					2,991	-1		
Brazil	91,305	10	11,354	-4	7,751	6	95,137	-1

	Maize		Rice		Wheat		Soybean	
	2022	Δ%	2022	Δ%	2022	Δ%	2022	Δ%
Cambodia			9,791	-1				
Canada	11,608	-4			29,936	4	7,585	-3
China	227,191	-3	195,335	-1	134,198		18,185	27
Egypt	6,058	3	6,583	1	11,240	-2		
Ethiopia	5,720	-15			3,412	-5		
France	12,988	-17			33,361	-6		
Germany	4,377	-12			25,095	-4		
Hungary	4,859	-14%			4,452	-10		
India	18,835	3	176,115	-3	93,244		13,535	4
Indonesia	19,152	14	65,272	-2				
Iran			2,590	6	10,974	-13		
Italy	5,086	-19			7,362	-5		
Kazakhstan					12,953	15		
Kenya	1,935	-15			270	-8		
Kyrgyzstan	773	25			744	41		
Mexico	23,146	-6			4,015	17	789	-11
Mongolia					299	-5		
Morocco					6,050	-33		
Mozambique	2,204	5	400	0				
Myanmar	1,935	2	24,607	-1				
Nigeria	9,553	-8	4,090	-4				
Pakistan	5,751	4	10,275	-10	25,573	-3		
Philippines	7,433	5	21,289	4				
Poland					10,292	-5		
Romania	11,270	-13			6,945	-13		
Russia	13,664	1			86,215	14	3,817	7
South Africa	11,861	4			1,595	-12		
Sri Lanka			2,487	-2				
Thailand	4,299	1	38,839	-4				
Türkiye	6,496	2			16,859			
Ukraine	25,374	-29			21,433	-11		
United Kingdom					12,644	-2		
USA	363,601	-5	10,691	-6	51,572	-1	101,705	-3
Uzbekistan					8,336	11		
Vietnam	5,221	-3	46,695	0				
Zambia	3,556	-1			246	10		
Sub-total	**966,672**	**-3**	**676,314**	**-2**	**678,617**	**-1**	**292,527**	
Others	**78,506**		**78,260**	**3**	**61,451**	**3**	**27,519**	**-2**
Global	**1,045,178**	**-3**	**754,574**	**-1**	**740,068**		**320,046**	

Maize

2022 Maize production is expected to be 1045.17 million tonnes with a decrease of 32.01 million tonnes (-3.0%), which is the largest reduction in the past five years, but with significant variations among countries and regions. The major producers in tropical to subtropical regions in the Northern Hemisphere and those in the Southern Hemisphere had expanded their maize cultivation area and their production increased. Other major producers in the Northern Hemisphere were affected by high temperature and dry weather, causing a decline in both cropping area and yield, with overall productions lower than in 2021 for most countries. In the summer of 2022, extreme heat and dry weather had an adverse impact on agricultural production in Europe, damaging maize production in Germany, Romania, Hungary, France, and Italy, with a larger than 10% yield drop from 2021. The Ukraine crisis, combined with significantly lower rainfall in the mid-west part of the country, resulted in a sharp fall of both maize area and average yield. Maize production in Ukraine declined to 25.37 million tonnes, the largest drop of 10.58 million tonnes (-29.4%) from 2021 in agricultural producing countries. In the Horn of Africa, Kenya and Ethiopia suffered from a severe drought, resulting in decreased maize area and yield. Maize production in both countries decreased by 15.3% from 2021. High temperature, as well as flooding conditions also affected Western African countries such as Nigeria, resulting in a reduction of 7.9% maize production. The United States, as the world's top maize producer, experienced a decline in maize area. The maize production is projected at 363.6 million tonnes, down by 17.50 million tonnes, which is the largest reduction of production among the maize producing countries. Thanks to the increase in area and average yield, Kyrgyzstan maize production is projected to be up by 24.2% from last year, the largest increase in terms of percentage of maize production. Maize production in India, Indonesia, Myanmar, Pakistan and the Philippines were slightly increased with the general favorable agro-climatic conditions.

Rice

Global rice production is expected to be 754.57 million tonnes with a decrease of 9.45 million tonnes (-1.2%) from 2021. Most of Southeast Asia experienced favorable rice growth in the dry season, but with an uneven rainfall distribution in the rainy season. Thailand, Indonesia and Cambodia had significantly higher rainfall and some area suffered from flooding, resulting in a reduction of 3.7%, 1.6% and 1.5% in rice production, respectively; Vietnam and Philippines had normal agro-meteorological conditions, with rice production increased by 0.2% and 3.6%, respectively. In Central and North-central India, rainfall was significantly below average during the growing season, India's rice production is expected to decline by 3.2%. Pakistan had experienced significantly above average rainfall, which caused severe flooding in the Sindh and Balochistan provinces, causing a decrease of rice production by 9.5%. Due to the reduced rice planted area in the United States, rice production declined by 5.7%. Benefiting from irrigation systems, rice production in Egypt and Iran increased by 1.5% and 5.6%, respectively. Nigeria suffered from insecurity and floods, resulting in a reduced rice area and yield compared with those of last year, with a decrease of 4.2% in rice production. Argentina and Brazil are the top rice producers in the Southern Hemisphere. Rice planted area in both countries was reduced from 2021, resulting in rice production decreases by 2.9% and 4.2%, respectively.

Wheat

Wheat production is expected to be 740.07 million tonnes, a reduction of 2.32 million tonnes, a drop by -0.3% from 2021. Global wheat cultivated area in 2022 decreased from the previous year. In addition, drought and extreme heat caused unfavorable conditions in some producing regions. The global wheat production has declined for the last two years, tightening wheat supply situation. In autumn of 2021, Northern Hemisphere winter wheat producers experienced overall poor agro-climatic conditions during the sowing period. Drought and lack of soil moisture in Europe, the Middle East, southern part of North America hampered the sowing of winter wheat, resulting in reduced planted area. The temperature in Western and Central Europe was abnormally higher than average since May, leading to a shorter wheat grain-filling period in most European countries. Wheat production was generally lower than in 2021. As the most severely affected country, Romania’ s wheat production decreased by 13.2%. Due to continued drought, major wheat-producers, such as Afghanistan and Iran saw declines in wheat yield, with production down by 7.4% and 13.4%, respectively. Although wheat planted area in Ukraine increased, the dry weather negatively affected wheat yield. The Ukraine Crisis resulted in the damage of wheat fields and affected the wheat harvest. The total wheat production in Ukraine is expected to be 21.43 million tonnes, down by 11.1%. Thanks to the increased wheat yield and planted area, wheat production in Kazakhstan, Russia and Uzbekistan increased by 15.3%, 13.5% and 11.0%, respectively. Argentina, South Africa and Kenya in Southern Hemisphere experienced serious droughts, resulting in a decline in wheat yields. Wheat production decreased by 28.7%, 12.4% and 7.5%, respectively; Australia and Brazil wheat yields and planted area have increased, prompting wheat production increases by 8.9% and 5.6%, respectively.

Soybean

Soybean production is expected to be 320.05 million tonnes with a decrease of 0.32 million tonnes (-0.1%) from the previous year, under a generally normal situation of soybean supply. The United States is the world's largest soybean exporter. Due to the slight reduction of cultivated area, the low rainfall and high temperature in its main soybean producing areas in June and July, affecting soybean flowering and podding, production of soybean is estimated at 101.71 million tonnes with a decrease of 2.9%. The soybean planted area increased in Brazil but was affected by persistent drought and continued high temperature in the main production areas, which reduced soybean yields for two consecutive years. Production fell to 95.14 million tons, a decrease of 1.2%. Soybean area in Argentina was reduced, but yield increased by 2.1%, offsetting the impact of reduced area. Production is estimated at 51.77 million tonnes, with an increase of 0.16 million tonnes or up by 0.3%. Soybean production in Canada and India decreased by 0.25 million tonnes (-3.2%) and 0.45 million tonnes (-3.5%), respectively, while Russian soybean production increased by 0.24 million tonnes (+6.7%). It is noteworthy that, China, the largest soybean importer, increased its soybean area significantly in 2022, prompting an increase by 3.84 million tonnes. This increase offsets reductions of soybean production in the United States and Brazil.

5.2 Disaster events

Introduction

Large emissions of greenhouse gases, such as carbon dioxide, methane and nitrous oxide have caused a warming of the atmosphere, which in turn leads to the occurrence of extreme climate-related events such as floods, drought, cyclones, fires, pests, and diseases. They threaten the global food security, which so far has mostly affected the people in the Global South. Conflicts are an additional threat to food security.

This section highlights the July-October disaster events across the globe. It covers the Russia-Ukraine conflict, droughts in Europe and China, and floods in Pakistan West and East Africa. It also highlights the current situation of the desert locust, an agricultural pest that impacts food production, especially in Africa.

Russia-Ukraine conflict

The Russia-Ukraine conflict that began on 24 Feb. 2022 has caused extensive damage and loss of life, spread across rural areas, and sparked massive population displacement. More than 3.6 million people have been forced to abandon their homes and flee across borders to safety. Millions more are internally displaced. It is clear that the crisis has resulted in a massive and more deteriorating food insecurity situation, disrupted food production and farmers' livelihoods during the agricultural growing season in the Ukraine, and has also affected global food security. Nearly 50 countries depend on the Russian Federation and Ukraine for at least 30 percent of their wheat import needs. Out of these countries, 26 source over 50 percent of their wheat imports from these two countries. In that context, this crisis keeps disrupting global markets and food supplies. It has caused a challenge to food security in many countries, especially for low-income food import-dependent countries and vulnerable population groups.

The CropWatch system monitored and evaluated the impact of the Russian- Ukrainian conflict on the output of autumn crops in the Ukraine in 2022, by using the monitoring model of crop yield and planting area, multi-source remote sensing data such as Sentinel1, Sentinel2 and Landsat up to the middle of August 2022, together with the latest agrometeorological information.

Remote sensing monitoring shows that the cropped arable land fraction in the main wheat-corn production area in southeast Ukraine is only 70%, a decrease by 25.5% compared with the same period last year due to the conflict. The states of Kherson, Odessa, Nikolayev, Crimea, Zaporoge, Donetsk and Dnipropetrovsk in the southeast of Ukraine have been significantly affected.

Combined with the drought effects, the Russia-Ukraine conflict has reduced the crop production in the Ukraine to a level that is significantly lower than the historical average. Ukraine's corn production will decline significantly to 25.37 million tonnes, a decrease of 29%; The wheat output will dropp to 21.43 million tons, a decrease of 11%. The other autumn grain crops, including sunflowers, also suffered from yield reduction to varying degrees.

Drought

EUROPE: From early May to mid-September, the European continent recorded the worst drought in almost 500 years, a result of a combination of record-breaking temperatures and low rainfall that led rivers to dry out, wildfires to rage and partial crops failures. In combination with the crisis in the Ukraine, this caused a sharp increase in food prices. According to the drought map of the Copernicus Global Drought Observatory, which is based on the soil moisture anomaly average from 1 June to 31 August and using 2021 and 2016 as the reference periods, the most affected countries in Europe were Spain, France, Italy, Germany, the United Kingdom, the Netherlands, Hungary and Romania (Figure 5.2).

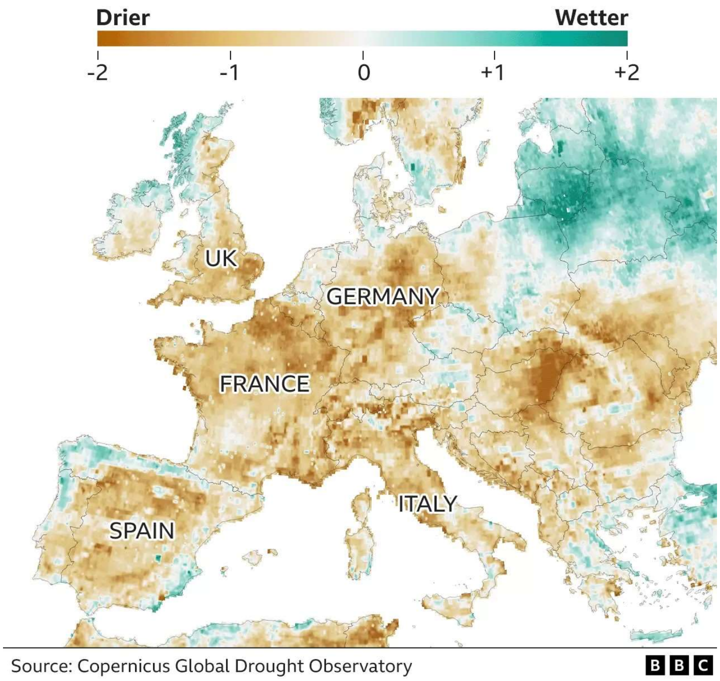


Figure 5.3 Copernicus Global Drought Observatory drought map based on soil moisture anomaly average from 1 June to 31 August. (Source: https://www.bbc.com/news/62751110)

The water and heat stress substantially reduced the yields of summer crops. The most affected crops were maize, soybean and sunflower. Not only the agricultural sector was affected, but also the supply of drinking water was reported as another big issue.

During the first decade of October 2022, the combined drought indicator based on the Standardized Precipitation Index (SPI), Soil Moisture Index (SMI) and Fraction of Absorbed Photosynthetic Active Radiation (fAPAR) shows that 19% of the regions across Europe were in warning conditions, particularly in Spain, France, Germany and the Netherlands and 23% of the continent was in the alert conditions, indicating a deficit in soil moisture and shortage of rainfall, mostly in western France, northern Germany, United Kingdom, Slovenia, Slovakia and Hungary (Figure 5.3).

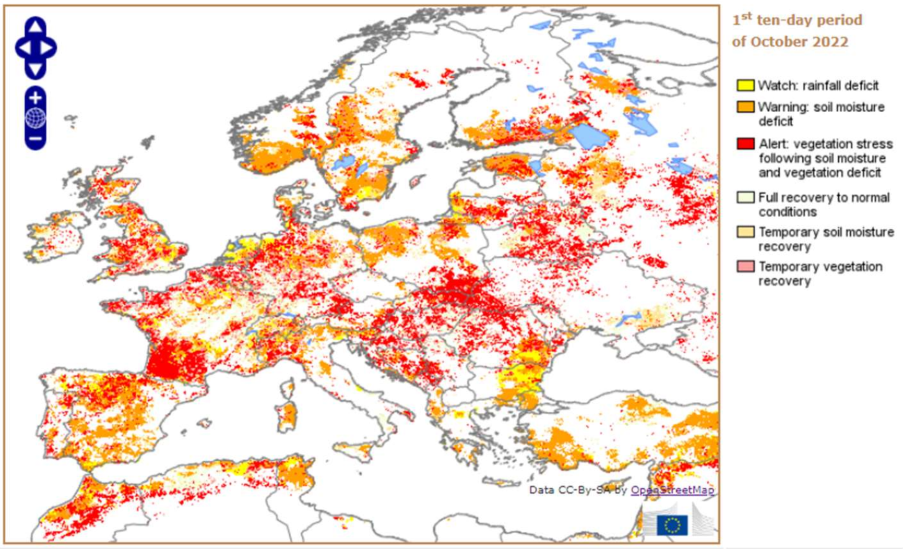


Figure 5.4 Combined drought indicator based on Standardized Precipitation Index (SPI), Soil Moisture Index (SMI) and Fraction of Absorbed Photosynthetic Active Radiation (fAPAR) during the first decade of October 2022. Source: https://edo.jrc.ec.europa.eu/edov2/php/index.php?id=1052

CHINA: Extreme heat and severe lack of rainfall led to a record-breaking drought that caused parts of the Yangtze River, Poyang Lake and Dongting Lake in China to dry up. This affected not only the hydro-power (especially in Sichuan, which receives more than 80% of its energy from hydro-power) and shipping routes but also the drinking water supply. The standardized Drought Severity map for the first decade of August (Figure 5.4) indicates severe to exceptional drought situations across China, especially in the provinces of Hunan, Hubei, Anhui, Sichuan, Shaanxi and Henan.

The heatwave eased in August, but severe drought along the Yangtze River and its tributaries continued in September. During this period, the late-season rice was in the booting stage.

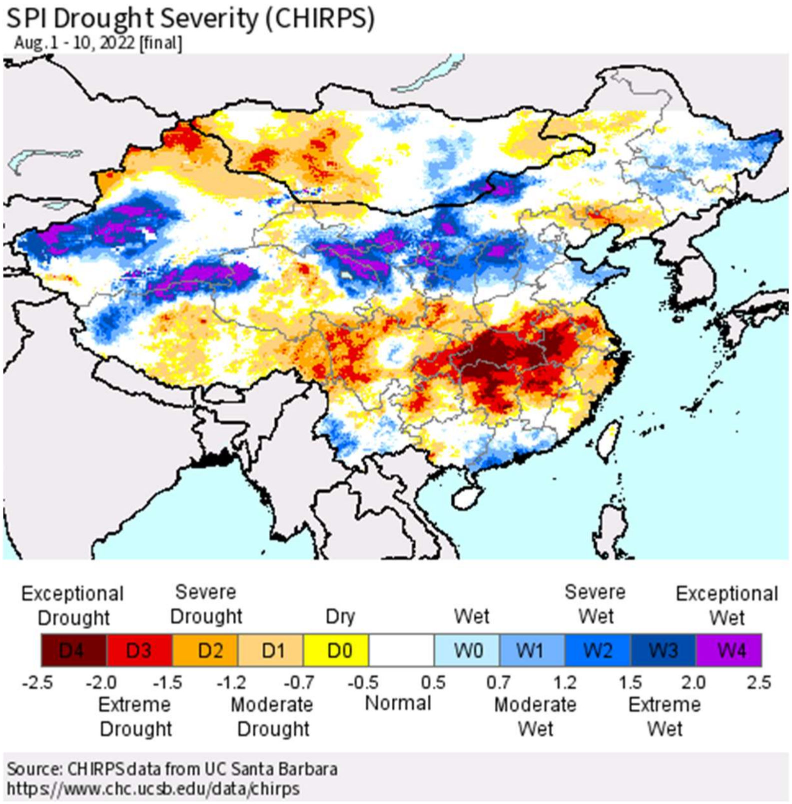


Figure 5.5 Standardized Drought Severity from August 1st to August 10th 2022 in China. (Source: Foreign Agriculture Services, US Department of Agriculture)

UNITED STATES OF AMERICA: In the United States of America, the short-term droughts continued to expand in Ohio, Tennessee, and the central Mississippi Valleys along with parts of the Corn Belt. As the Mississippi river was at its lowest water levels in a decade, it closed off a vital channel to barge traffic at a crucial time of the year for the transport of crops from the nation's heartland. This is due to widespread drought across the Mississippi River basin and its tributaries (the Missouri, Ohio, Tennessee, and Arkansas-White-Red basins) (Figure 5.5).

Figure 5.6 Mississippi river drought. Source: https://www.esquire.com/news-politics/politics/a41806647/mississippi-river-drought/

According to the National Centers for Environmental Information, numerous drought impacts have occurred (Fig 5.6). These impacts include dry soils, low groundwater, dried-out ponds, low or dried-out streams, low or empty reservoirs (especially in the West), and stressed vegetation. In October, dozens of large wildfires were burning in the Pacific Northwest, and several in Oklahoma. According to the **National Interagency Coordination Center**, over 59,000 fires have burned over 7 million acres in the U.S. as of October 28. These are more than the 10-year average.

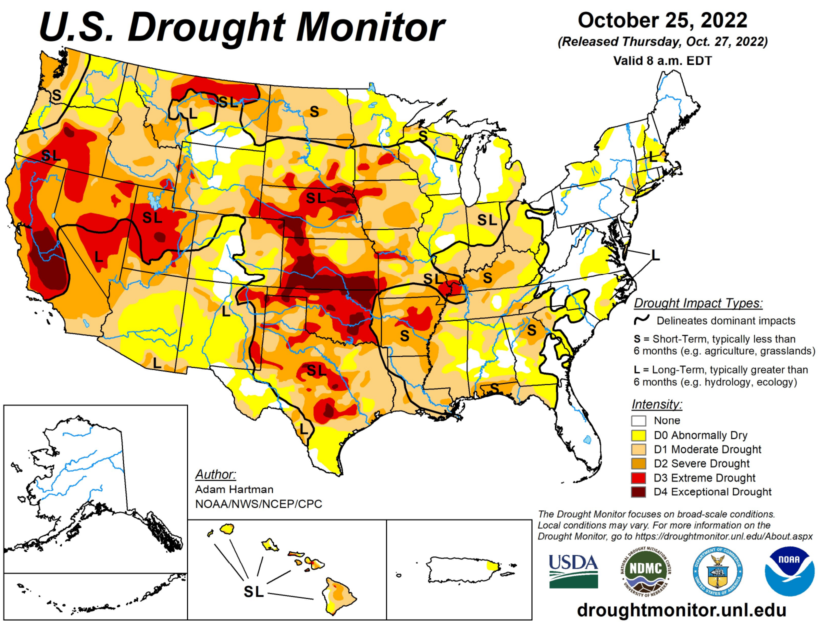


Figure 5.7 US Drought monitoring map (October 25, 2022).
Source: https://droughtmonitor.unl.edu/Summary.aspx

EAST AFRICA: Not only Europe, China and the USA were suffering from severe droughts. The rainy season in Eritrea, Ethiopia, South Sudan and Somalia finished in October. The drought monitoring map (Figure 5.7) indicates the situation in late October. Althought it shows relatively low levels of drought stress, the World Meteorological Organization forecasts high drought conditions for the October-December season. These conditions will worsen the crises that are affecting millions of people in the region. In addition to drought, the conflicts in the region have increased poverty levels and food insecurity, resulting in a weak capacity to cope with the drought crises. According to UN-OCHA, people in need of humanitarian help include 7 million in Ethiopia, 4 million in Kenya, and 5 million in South Sudan.

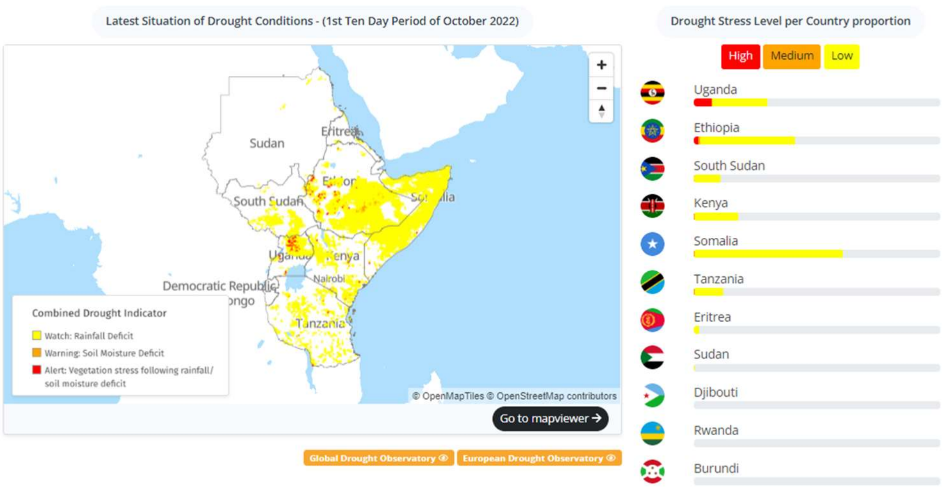


Figure 5.8 Combined Drought Indicator (CDI). Source: https://droughtwatch.icpac.net/

RECORD BURNING OF RAINFOREST IN BRAZIL: With the dry season in the Brazilian Amazon lasting from July through November, a high number of illegal fires had been started. According to the Brazilian Space Agency – INPE, on August 22nd, 2022, about 3358 fires were detected through satellite images in the Brazilian Amazon. This event was considered to be the highest number of recorded fires for any 24 hours since 2007. For the January to August period, the number of fires had increased by 16.7%, as compared to the same period of last year. Apart from storing large amounts of carbon, the Brazilian Amazon Rainforest plays a vital role in regulating and balancing regional and global climate, bringing rains to distant regions. According to the MapBioma – Monitor do Fogo project, a total of 15,203,570 hectares of forest were burned from January to October 2022. The most affected regions were Cerrado and Amazonia (Figure 5.8).

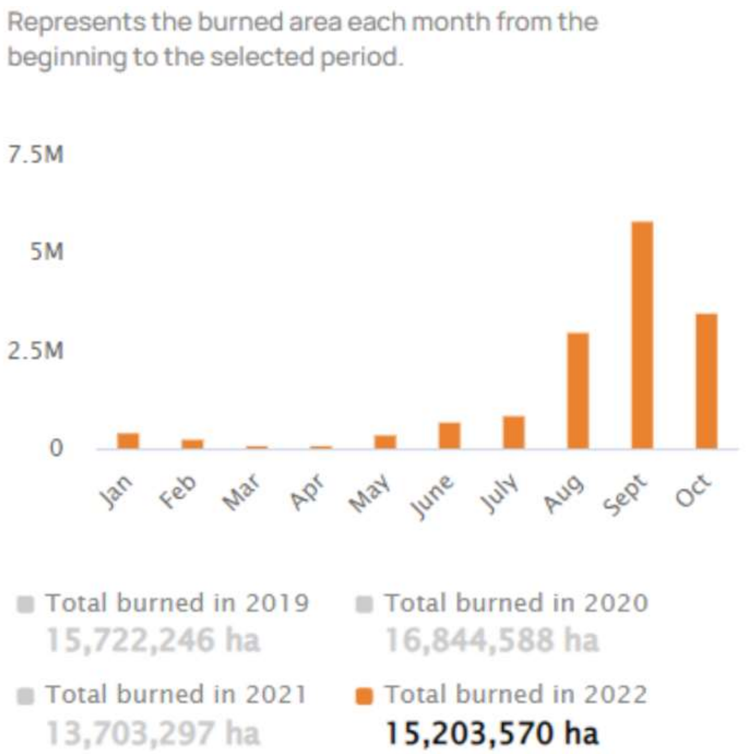


Figure 5.9 Burned area per month in Brazil. Source: https://plataforma.brasil.mapbiomas.org/monitor-do-fogo

Floods and Landslides

PAKISTAN: In Pakistan, the heavy monsoon rains caused flooding on about 10-12% of Pakistan's land. The province of Sindh was most hit. About 33 million people were affected and thousands of hectares of cropland, crops, livestock assets, critical agriculture infrastructure, and households have been destroyed. Following it, acute food security is expected to worsen in many parts of the country.

SUDAN: Reports show that by the first half of August, in 12 provinces, over 8000 houses were destroyed and over 20000 homes were damaged due to floods. In the same period, 52 deaths due to flooding were reported. This situation lasted until September and the number of people affected continued to rise. According to the Government's Humanitarian Aid Commission (HAC), during this period, in 16 of the 18 states, more than three hundred thousand people were affected and 24,860 houses were destroyed. The total number of people affected by the floods has exceeded the number of people affected in 2021 (about 314,500 people).

WEST AFRICA: Food insecurity is a serious, growing problem in Nigeria. In 2021 it was reported that 7 out of 10 Nigerians did not have enough to eat. This problem is worsened by annual flooding. The satellite-based flood analysis detected water in Nigeria using VIIRS between 13 to 17 October 2022 and it was compared to the week before (08 to 12 October 2022). The results from this analysis revealed that on the analyzed cloud-free areas (about 890,000 km^2), approximately 3000 km^2 of land was affected. (Figure 5.9).

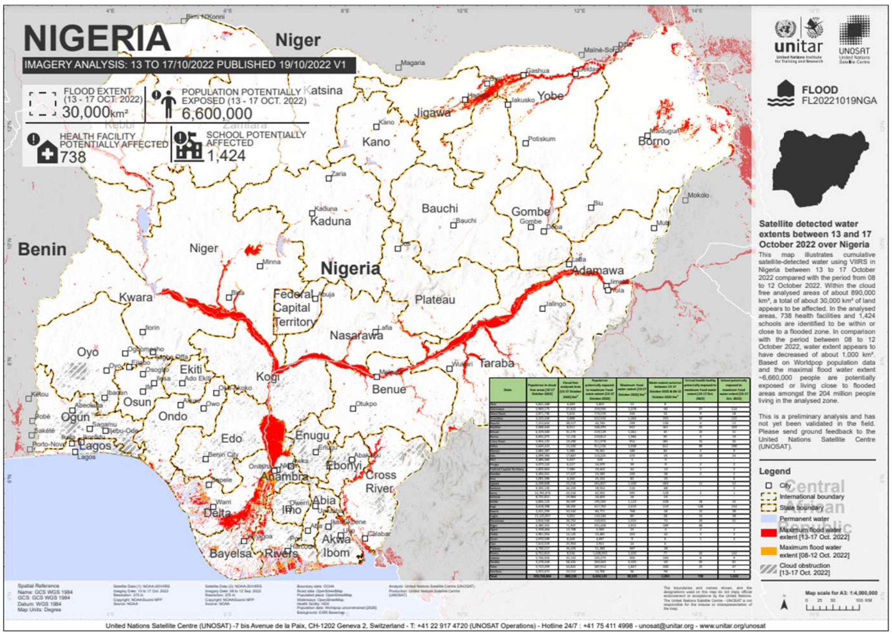


Figure 5.10 Cumulative satellite detected water in Nigeria

This event was considered one of the deadliest events recorded in the region and the worst event in Nigeria in over a decade, killing more than 600 people and displacing more than 1.5 million people as of October 2022. The damages from this event are also measured in terms of lost production area, in which more than 300,000 hectares of cropland were damaged. Other issues related to this flood event are concerns about the increased spread of diseases, and food and fuel supplies have also been disrupted. Food production levels in Nigeria are already below demand, the World Food Programme and the UN's Food and Agriculture Organization reported that Nigeria was among the six countries facing a high risk of catastrophic levels of hunger. To alleviate the impacts, The United Nations released a total of US$ 10.5 million from the Nigeria Humanitarian Fund (NHF) and the Central Emergency Response Fund (CERF) to provide assistance to people affected and left vulnerable by floods across Nigeria.

Desert Locust

Considered the most destructive migratory pest in the world, the Desert Locust (Schistocerca gregaria) situation was calm between July to October 2022, with some isolated cases of scattered immature solitarious adults locusts being reported in Mauritania, Niger, Sudan and Yemen. In addition, during August and September, few hopers were reported in some parts of northwest Mauritania and the red sea coastal plain of Yemen. Although the situation was calm, some control majors were undertaken in Egypt where about 20 ha were treated.

5.3 Update on El Niño or La Niña

According to the Australian Government Bureau of Meteorology, La Niña continues in the tropical Pacific. Atmospheric and oceanic indicators of the El Niño–Southern Oscillation (ENSO) reflect a mature La Niña, including tropical Pacific sea surface temperatures, the Southern Oscillation Index (SOI), and tropical cloud patterns.

Figure 5.10 illustrates the behavior of the standard Southern Oscillation Index (SOI) for the period from October 2021 to October 2022. The SOI has remained positive and high (greater than +7) for the past four months, with a decreasing trend in July and August and a renewed increase in September and October. Much of the persistent positive SOI signal is due to high pressure systems over Tahiti. Overall, the SOI indicates a typical La Niña event during the monitoring period.

Another commonly used measure of El Niño is known as the Oceanic Niño Index (ONI). Figure 5.11 shows several ONIs and their locations. Values of the three key NINO indices for October 2022 were: NINO3 −0.7°C, NINO3.4 −0.7°C, and NINO4 −0.7°C. It implies that the average sea surface temperature in all three regions is significantly lower than the historical average. This indicates that La Niña re-enforces in September and October, consistent with the monthly SOI-BOM time series trend.

Sea surface temperature (SSTs) for October 2022 (Figure 5.12) were cooler than average across the central and eastern tropical Pacific Ocean, extending from around 160°E to the South American coastline and also across a large area south of the equator, particularly in the east of the basin. Warm anomalies extend into the mid-latitudes in the southern Pacific and across the mid to high latitudes in the north—a pattern characteristic of well-developed La Niña.

The southern Pacific Ocean has been locked in its La Niña phase for three winters running which is exceptional and causes extreme drought and flood conditions. It has been recorded just twice before, once in the mid-1970s and again at the turn of the millennium. Its long duration is a problem. The large, persistent mass of cold air and high pressure influences wind patterns known as jetstreams across the Pacific and the Indian Ocean. Where jetstreams that blow over land from the ocean are diverted, that land loses moisture and can suffer from drought. The land to which that jetstream is diverted gets more moisture and can be flooded. Between July and October, La Niña, combined with a warmer planet, causes a series of extreme weather events that vary with geographic region.

North America

The southwestern United States has been in a state of drought for three winters running. The jet stream which blows in from the Pacific, carrying moisture with it, has been forced north by La Niña's high pressure zone in the southern Pacific. That means more rain falls further north too, and less falls in the south. The National Integrated Drought Information System (NIDIS) shows that 70% of Oklahoma is in a state of exceptional or extreme drought, the most serious level that NIDIS reports. September was the driest since 1956, according to Gary McManus, the state's climatologist.

This La Niña-induced drought is stimulating wildfires in Kansas. The state is now so dusty that it is becoming a safety concern for drivers and cattle. The wheat crop is weaker than usual and the state is concerned that it will be too dry for much of it to survive the winter. Losses to cotton crops due to drought in Texas are estimated to be worth some $2bn. The end of La Niña will bring relief. America's National Weather Service's latest prediction gives a 57% likelihood of ENSO returning to its neutral phase between February and April 2023.

Atlantic Hurricanes

While La Nina is a phenomenon of the Pacific, it also impacts hurricanes in the Atlantic during August, September, and October, the heart of storm season. The changing weather patterns cut off a lot of wind shear in the Caribbean Sea and elsewhere across the basin, allowing more Atlantic hurricanes and tropical storms to form and grow stronger.

Australia

La Niña typically increases the chance of above average rainfall for northern and eastern Australia during spring and summer and the chance of warmer days and nights in northern Australia during spring. Torrential rains have inundated large parts of New South Wales, Queensland, and Victoria.

South America

Typically, La Nina leads to hot and dry conditions for Argentina and southern Brazil as well as a shortened wet season in central Brazil. But in this monitor period, the third La Nina is starting a little benign for southern Brazil because fronts have regularly stalled in the region and produced good rainfall. In central Brazil, there has yet to be seen an effect from La Nina. In Argentina, corn is planted in two phases, the first in September and October, and the second in December and January. La Nina pushed a larger portion of the crop into the second phase than normal. Moreover, the drought has caused poor conditions for wheat, which will reach maturity in December.

South Asia

Flooding in Pakistan killed at least 1,700 people during the summer of 2022, and left 7.6 million homeless, according to the UN-monitoring organization, ReliefWeb. The country's climate minister, Sherry Rehman, said that the worst-affected provinces received between five and seven times their average rainfall in August. The Indus river, which runs the length of Pakistan, burst its banks to swamp thousands of square kilometers of land. Shehbaz Sharif, the prime minister, said they were the worst floods in his country's history (Figure 5.13).

La Niña is partially responsible. Just as the colder southern Pacific equilibrium pushes moisture away from the southern United States, it happens to push moisture right on top of Pakistan. But La Niña is not acting alone. A warmer climate, due to humanity's carbon dioxide emissions, also means a more flood-prone Pakistan. In a paper published in September, a group of climate scientists estimated that rainfall over the worst-impacted provinces was 75% more intense than it would have been without the 1.2 ºC of warming to which the planet has already been subjected.

East Africa

One of the regions most affected by La Niña is East Africa, where a prolonged drought has been experienced. At least one million people in Somalia have been displaced by the worst drought in decades due to climate change, which has also affected the wider Horn of Africa, including Ethiopia and Kenya. Between July and October, when staple food crops such as maize are growing and developing in East Africa, widespread drought brings reduced food production and hunger.

As 2022 shifts to 2023, La Niña is weakening. Its end will bring relief to many places with extreme weather. Unfortunately, climate change will continue to exacerbate the effects of ENSO on local weather conditions in vulnerable regions across the globe.

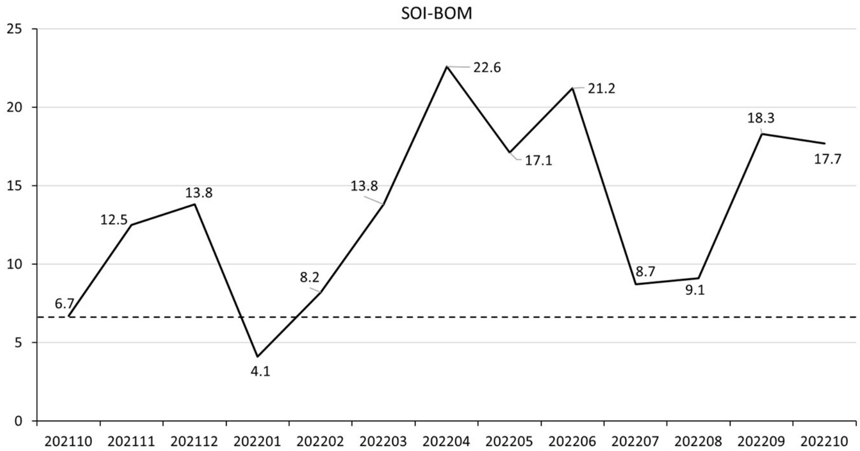


Figure 5.11 Monthly SOI-BOM time series from October 2021 to October 2022

(Source: http://www.bom.gov.au/climate/enso/soi/)

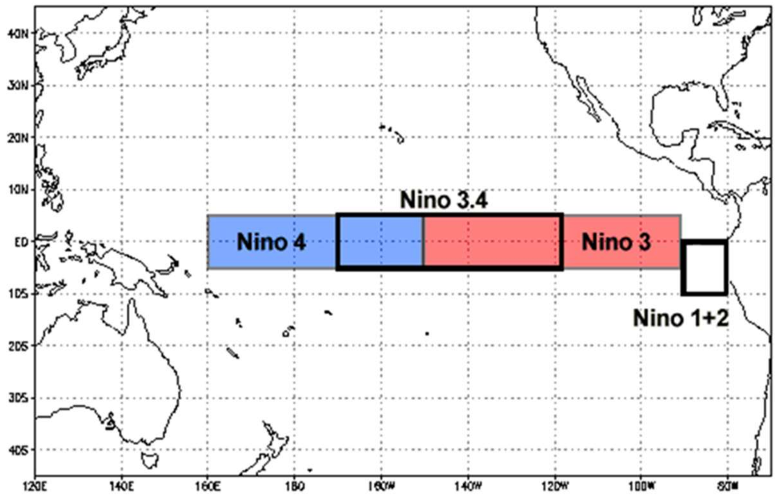


Figure 5.12 Map of NINO Region

(Source: https://www.ncdc.noaa.gov/teleconnections/enso/sst)

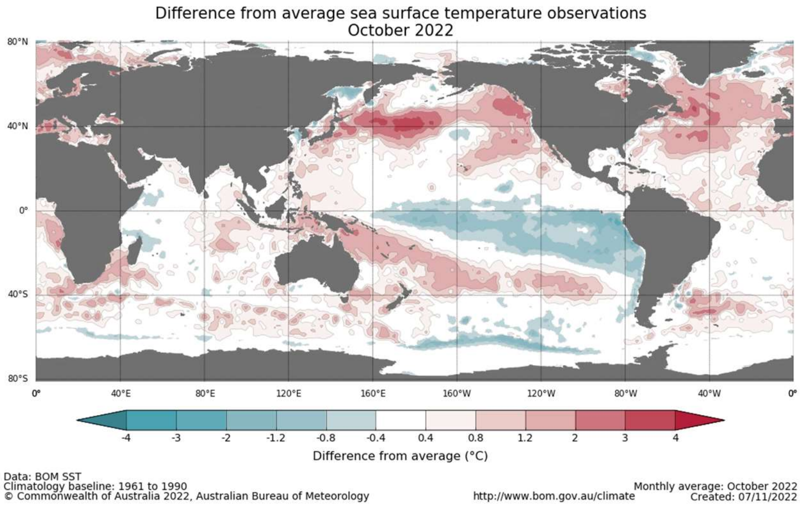


Figure 5.13 Monthly temperature anomalies for October 2022

(Source: http://www.bom.gov.au/climate/enso/index.shtml#tabs=Pacific-Ocean)

Figure 5.14 Heavy monsoon rains flooded residential areas in Dera Allah Yar in Jaffarabad district, Balochistan province, Pakistan, in August.

(source: https://www.bloomberg.com/graphics/2022-la-nina-weather-risk-global-economies/)

Annex A. Agroclimatic indicators and BIOMSS

Table A.1 April 2022 – July 2022 agroclimatic indicators and biomass by global Monitoring and Reporting Unit (MRU)

65 Global MRUs		RAIN Current (mm)	RAIN 15YA dep. (%)	TEMP Current (°C)	TEMP 15YA dep. (°C)	RADPAR Current(MJ/m²)	RADPAR 15YA dep. (%)	BIOMSS Current (gDM/m²)	BIOMSS 15YA dep. (%)
C01	Equatorial central Africa	524	-14	22.3	0.0	1173	2	951	-5
C02	East African highlands	455	-41	19.2	0.4	1235	4	771	-19
C03	Gulf of Guinea	538	-11	27.2	0.1	1181	-1	1061	-5
C04	Horn of Africa	137	-57	21.0	0.5	1213	4	581	-21
C05	Madagascar (main)	294	18	19.4	-0.1	891	-5	716	5
C06	Southwest Madagascar	82	21	21.1	-0.1	960	-2	415	-3
C07	North Africa-Mediterranean	71	-29	21.9	1.2	1551	-1	594	-3
C08	Sahel	346	13	30.0	0.0	1292	-1	848	7
C09	Southern Africa	128	14	17.4	0.0	985	-3	444	6
C10	Western Cape (South Africa)	165	-27	12.1	-1.1	698	2	439	-18
C11	British Columbia to Colorado	343	5	9.3	-0.7	1363	-2	669	-4
C12	Northern Great Plains	364	-3	16.5	-0.1	1321	-2	885	-3
C13	Corn Belt	434	-2	15.9	0.1	1240	0	980	0
C14	Cotton Belt to Mexican Nordeste	385	-15	24.3	1.2	1427	2	1018	-6
C15	Sub-boreal America	429	19	9.2	-1.1	1087	-7	789	0
C16	West Coast (North America)	264	46	14.7	-0.6	1434	-4	632	3
C17	Sierra Madre	530	-29	21.2	0.5	1499	2	884	-11
C18	SW U.S. and N. Mexican highlands	162	-14	20.4	0.4	1584	0	659	-7
C19	Northern South and Central America	1111	2	24.2	-0.1	1247	1	1271	0
C20	Caribbean	607	5	25.7	-0.1	1445	2	1294	5
C21	Central-northern Andes	406	-30	14.0	0.2	1082	3	510	-15
C22	Nordeste (Brazil)	195	-13	24.4	0.6	1085	3	686	-4
C23	Central eastern Brazil	107	-63	22.4	1.3	1054	9	478	-34
C24	Amazon	489	-24	24.3	0.4	1106	4	943	-12
C25	Central-north Argentina	121	-34	15.0	-0.5	732	1	404	-15
C26	Pampas	354	-12	14.3	-0.2	648	1	620	-9
C27	Western Patagonia	821	10	6.5	-0.8	470	0	540	-5

C28	Semi-arid Southern Cone	94	-17	9.3	-0.8	719	1	292	-6
C29	Caucasus	217	-30	16.3	0.0	1485	1	649	-13
C30	Pamir area	250	-30	18.5	1.4	1586	2	669	-9
C31	Western Asia	134	26	23.2	0.5	1547	0	654	2
C32	Gansu-Xinjiang (China)	271	5	16.6	0.4	1424	-1	649	-4
C33	Hainan (China)	988	9	25.6	-1.0	1341	1	1482	7
C34	Huanghuaihai (China)	344	1	22.9	0.9	1361	3	873	-3
C35	Inner Mongolia (China)	230	4	16.5	0.3	1382	0	715	0
C36	Loess region (China)	261	-8	17.9	0.8	1443	6	766	-3
C37	Lower Yangtze (China)	1059	-6	22.1	0.2	1135	5	1300	-3
C38	Northeast China	447	35	15.2	-0.3	1252	-1	923	10
C39	Qinghai-Tibet (China)	974	-14	11.5	1.2	1211	3	717	-2
C40	Southern China	1322	0	22.5	-0.1	1158	3	1393	-2
C41	Southwest China	817	-9	18.6	0.2	1106	4	1153	-1
C42	Taiwan (China)	1116	23	24.3	-1.2	1197	-6	1244	3
C43	East Asia	577	9	14.9	0.5	1212	1	971	4
C44	Southern Himalayas	884	-16	27.2	0.8	1302	5	1072	-3
C45	Southern Asia	681	-15	29.8	0.3	1279	4	1006	-3
C46	Southern Japan and the southern fringe of the Korea peninsula	871	3	19.0	1.2	1210	2	1217	3
C47	Southern Mongolia	152	-24	7.9	-0.1	1488	0	534	-5
C48	Punjab to Gujarat	569	46	32.5	0.2	1434	0	947	17
C49	Maritime Southeast Asia	1206	-2	24.6	0.2	1156	4	1439	3
C50	Mainland Southeast Asia	1112	-4	26.4	-0.3	1269	5	1454	3
C51	Eastern Siberia	353	10	10.0	0.0	1125	-1	783	5
C52	Eastern Central Asia	298	9	11.1	0.3	1309	1	746	6
C53	Northern Australia	504	34	24.0	0.5	1078	1	924	12
C54	Queensland to Victoria	277	39	12.6	0.0	592	-8	575	16
C55	Nullarbor to Darling	244	4	13.8	-0.3	596	-5	585	6
C56	New Zealand	444	21	9.4	0.5	440	0	676	7
C57	Boreal Eurasia	334	-1	9.7	-0.1	1088	1	709	-1
C58	Ukraine to Ural mountains	320	4	13.2	-0.9	1134	-2	821	1
C59	Mediterranean Europe and Türkiye	130	-40	18.0	0.9	1510	3	619	-13
C60	W. Europe (non Mediterranean)	246	-32	15.2	0.8	1276	4	717	-15
C61	Boreal America	317	-9	6.5	0.3	1043	4	601	-1
C62	Ural to Altai mountains	387	37	13.7	0.3	1212	0	842	15

C63	Australian desert	134	-7	14.9	-0.4	668	-2	451	-3
C64	Sahara to Afghan deserts	46	42	28.4	0.5	1618	-1	576	-2
C65	Sub-arctic America	131	4	-3.4	0.3	1196	-2	278	3

Table A.2 April 2022 – July 2022 agroclimatic indicators and biomass by country

Country code	Country name	RAIN Current (mm)	RAIN 15YA Departure (%)	TEMP Current (°C)	TEMP 15YA Departure(°C)	RADPAR Current (MJ/m²)	RADPAR 15YA Departure (%)	BIOMSS Current (gDM/m²)	BIOMSS 15YA Departure (%)
ARG	Argentina	240	-8	12.8	-0.5	632	0	460	-10
AUS	Australia	276	39	13.7	0.0	631	-7	582	15
BGD	Bangladesh	1297	-17	28.9	0.2	1316	5	1449	-1
BRA	Brazil	244	-39	22.6	0.9	1048	6	641	-22
KHM	Cambodia	1161	9	26.3	-0.6	1244	6	1601	5
CAN	Canada	422	9	9.9	-0.7	1141	-3	771	1
CHN	China	797	-4	19.6	0.2	1207	3	1000	-1
EGY	Egypt	2	-75	24.2	0.6	1585	-1	374	-21
ETH	Ethiopia	521	-34	19.9	0.4	1275	4	824	-16
FRA	France	249	-37	16.3	1.8	1372	10	753	-14
DEU	Germany	253	-28	14.3	0.5	1243	4	716	-14
IND	India	702	-14	30.1	0.5	1315	4	985	1
IDN	Indonesia	1146	-2	24.5	0.2	1125	4	1399	4
IRN	Iran	70	-27	21.9	0.5	1644	1	579	-6
KAZ	Kazakhstan	333	38	15.7	0.3	1306	-1	794	14
MEX	Mexico	513	-18	23.9	0.5	1503	2	904	-8
MMR	Myanmar	1079	-22	25.7	0.5	1211	3	1267	-6
NGA	Nigeria	509	-14	27.9	0.2	1207	0	978	-5
PAK	Pakistan	314	18	27.1	1.5	1553	0	792	11
PHL	Philippines	1601	18	25.7	-0.2	1297	0	1560	5
POL	Poland	246	-26	14.2	-0.3	1179	2	733	-14
ROU	Romania	175	-52	16.8	0.6	1361	3	668	-24
RUS	Russia	353	14	12.8	-0.5	1152	-2	835	7
SYR	Syria	10	-86	24.9	1.0	1650	2	559	-13
ZAF	South Africa	117	36	12.3	-0.3	859	-3	380	12
THA	Thailand	1079	14	26.2	-0.5	1255	5	1490	7
TUR	Türkiye	151	-36	16.4	0.1	1518	2	618	-14
GBR	United Kingdom	279	-27	12.1	0.8	994	1	695	-12
UKR	Ukraine	200	-35	15.5	-0.6	1238	0	673	-19
USA	United States	366	-7	19.1	0.5	1370	0	878	-3
UZB	Uzbekistan	135	-3	23.2	0.8	1559	0	667	-2
VNM	Vietnam	1128	0	24.5	-0.4	1263	5	1472	3
AFG	Afghanistan	88	-52	20.7	1.3	1642	2	585	-8
AGO	Angola	171	-10	19.4	-0.3	1207	0	501	-4
BLR	Belarus	338	6	13.2	-1.0	1104	-1	833	-1
HUN	Hungary	116	-55	18.3	0.9	1361	3	592	-27
ITA	Italy	300	-21	18.5	1.6	1450	3	784	-4
KEN	Kenya	272	-57	20.0	0.6	1156	3	710	-22
LKA	Sri_Lanka	1072	15	26.6	-0.2	1244	-3	1244	4
MAR	Morocco	74	-22	21.0	0.9	1557	-2	586	-1
MNG	Mongolia	257	-5	10.7	0.2	1394	2	684	0
MOZ	Mozambique	173	32	19.9	-0.1	933	-4	583	11
ZMB	Zambia	87	24	18.1	0.0	1128	-1	395	3
KGZ	Kyrgyzstan	564	14	10.6	-0.3	1495	2	709	3

Note: Departures are expressed in relative terms (percentage) forall variables, except for temperature, for which absolute departure in degrees Celsius is given. Zero means no change from the average value; relative departures are calculated as

*(C-R)/R*100, with C=current value and R=reference value, which is the fifteen-year average (15YA) for the same period between Oct- Jan.*

Table A.3 Argentina, April 2022 – July 2022 agroclimatic indicators and biomass (by province)

	RAIN Current (mm)	RAIN 15YA Departure (%)	TEMP Current (°C)	TEMP 15YA Departure(°C)	RADPAR Current (MJ/m²)	RADPAR 15YA Departure (%)	BIOMSS Current (gDM/m²)	BIOMSS 15YA Departure (%)
Buenos Aires	138	-36	11.0	-0.5	604	5	371	-24
Chaco	441	41	15.6	-0.9	562	-10	748	12
Cordoba	60	-50	12.6	-0.3	716	5	269	-24
Corrientes	640	37	14.9	-0.7	543	-10	923	14
Entre Rios	322	-5	13.0	-0.8	604	1	587	-7
La Pampa	83	-38	11.0	-0.5	640	7	297	-18
Misiones	542	-11	16.3	-0.1	669	1	927	-1
Santiago Del Estero	140	-19	14.6	-0.9	664	-3	422	-8
San Luis	44	-49	11.0	-0.5	731	5	223	-24
Salta	145	-28	13.7	-0.2	783	-2	452	-10
Santa Fe	211	-15	13.8	-0.8	607	-3	480	-12
Tucuman	93	-21	11.9	-0.3	824	-1	361	-6

Table A.4 Australia, April 2022 – July 2022 agroclimatic indicators and biomass (by state)

	RAIN Current (mm)	RAIN 15YA Departure (%)	TEMP Current (°C)	TEMP 15YA Departure(°C)	RADPAR Current (MJ/m²)	RADPAR 15YA Departure (%)	BIOMSS Current (gDM/m²)	BIOMSS 15YA Departure (%)
New South Wales	272	52	12.0	0.0	613	-9	568	25
South Australia	179	-15	13.3	-0.3	537	-3	477	-11
Victoria	258	-3	10.8	0.0	453	-5	559	-1
W. Australia	226	4	15.0	-0.2	654	-4	579	6

Table A.5 Brazil, April 2022 – July 2022 agroclimatic indicators and biomass (by state)

	RAIN Current (mm)	RAIN 15YA Departure (%)	TEMP Current (°C)	TEMP 15YA Departure (°C)	RADPAR Current (MJ/m²)	RADPAR 15YA Departure (%)	BIOMSS Current (gDM/m²)	BIOMSS 15YA Departure (%)
Ceara	312	-19	25.8	0.5	1147	-1	938	-4
Goias	1	-100	23.7	2.2	1171	9	230	-63
Mato Grosso Do Sul	49	-82	22.1	1.5	981	14	416	-41
Mato Grosso	35	-85	24.4	1.0	1168	8	426	-40
Minas Gerais	36	-83	20.4	1.3	1052	13	356	-41
Parana	199	-61	17.4	0.9	830	11	586	-33
Rio Grande Do Sul	695	21	14.5	-0.3	604	-6	970	10
Santa	436	-26	14.5	0.2	701	2	809	-10

	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 (%)
Catarina								
Sao Paulo	52	-83	20.2	1.6	955	13	370	-48

Table A.6 Canada, April 2022 – July 2022 agroclimatic indicators and biomass (by province)

	RAIN Current (mm)	RAIN 15YA Departure (%)	TEMP Current (°C)	TEMP 15YA Departure (°C)	RADPAR Current (MJ/m²)	RADPAR 15YA Departure (%)	BIOMSS Current (gDM/m²)	BIOMSS 15YA Departure (%)
Alberta	367	6	9.8	-1.0	1215	-4	781	0
Manitoba	586	59	10.4	-1.6	1083	-10	884	5
Saskatchewan	370	11	10.7	-1.3	1177	-5	819	2

Table A.7 India, April 2022 – July 2022 agroclimatic indicators and biomass (by state)

	RAIN Current (mm)	RAIN 15YA Departure (%)	TEMP Current (°C)	TEMP 15YA Departure (°C)	RADPAR Current (MJ/m²)	RADPAR 15YA Departure (%)	BIOMSS Current (gDM/m²)	BIOMSS 15YA Departure (%)
Andhra Pradesh	370	-24	30.9	0.3	1237	2	851	-7
Assam	2160	-12	24.7	-0.1	1076	1	1474	-2
Bihar	453	-46	32.8	1.2	1409	7	966	-10
Chhattisgarh	508	-26	30.7	0.4	1294	5	915	-7
Daman and Diu	996	-6	29.4	0.1	1452	1	1080	-2
Delhi	363	33	33.9	0.6	1478	2	967	16
Gujarat	628	-5	30.9	-0.2	1403	1	980	4
Goa	1471	-30	27.0	0.4	1260	2	1268	2
Himachal Pradesh	231	-62	23.5	2.5	1515	4	671	-23
Haryana	359	46	34.0	0.9	1485	3	914	15
Jharkhand	435	-37	31.3	0.8	1340	6	939	-7
Kerala	1320	-20	25.2	-0.3	1233	4	1392	-5
Karnataka	570	-18	27.2	0.3	1176	4	940	-2
Meghalaya	2249	6	24.3	-0.5	1082	-2	1459	-2
Maharashtra	790	-3	29.9	0.4	1275	2	1007	2
Manipur	1455	-19	22.2	0.2	1156	4	1411	0
Madhya Pradesh	663	5	31.7	0.4	1367	6	1024	10
Mizoram	1514	-6	24.0	-0.4	1243	2	1521	1
Nagaland	2113	4	20.4	-1.2	990	-9	1370	-1
Orissa	576	-22	30.3	0.4	1296	6	972	-8
Puducherry	633	-41	29.5	-0.2	1325	3	1059	-6
Punjab	378	27	34.0	1.5	1495	3	857	2
Rajasthan	681	111	32.9	-0.2	1406	1	990	31
Sikkim	646	-1	21.3	4.1	1435	7	896	8
Tamil Nadu	282	-41	29.1	0.7	1223	1	808	-15
Tripura	1633	-6	27.2	-0.2	1248	2	1622	2
Uttarakhand	103	-82	26.6	3.3	1566	10	632	-25
Uttar Pradesh	378	-29	33.9	1.1	1437	5	907	-1
West Bengal	855	-26	30.7	0.7	1366	7	1174	-5

Table A.8 Kazakhstan, April 2022 – July 2022 agroclimatic indicators and biomass (by oblast)

	RAIN Current (mm)	RAIN 15YA Departure (%)	TEMP Current (°C)	TEMP 15YA Departure (°C)	RADPAR Current (MJ/m²)	RADPAR 15YA Departure (%)	BIOMSS Current (gDM/m²)	BIOMSS 15YA Departure (%)
Akmolinskaya	262	27	15.5	0.7	1283	2	762	12
Karagandinskaya	190	-1	15.6	1.3	1383	3	690	4
Kustanayskaya	316	46	14.8	-0.3	1177	-6	830	19
Pavlodarskaya	308	43	15.8	0.8	1297	3	831	19
Severo kazachstanskaya	321	27	14.4	0.7	1170	0	802	10
Vostochno kazachstanskaya	374	31	14.5	0.8	1426	3	836	14
Zapadno kazachstanskaya	259	36	16.9	-1.1	1229	-8	806	14

Table A.9 Russia, April 2022 – July 2022 agroclimatic indicators and biomass (by oblast, kray and republic)

	RAIN Current (mm)	RAIN 15YA Departure (%)	TEMP Current (°C)	TEMP 15YA Departure (°C)	RADPAR Current (MJ/m²)	RADPAR 15YA Departure (%)	BIOMSS Current (gDM/m²)	BIOMSS 15YA Departure (%)
Bashkortostan Rep.	429	35	11.8	-1.0	1060	-9	893	10
Chelyabinskaya Oblast	376	36	12.3	-0.7	1083	-7	863	14
Gorodovikovsk	174	-40	18.4	-0.2	1283	-4	689	-22
Krasnodarskiy Kray	305	-17	14.4	-0.2	1267	1	799	-6
Kurganskaya Oblast	399	54	12.8	-0.2	1078	-4	889	22
Kirovskaya Oblast	410	31	10.8	-1.0	962	-8	867	11
Kurskaya Oblast	342	16	13.7	-1.0	1149	-3	888	8
Lipetskaya Oblast	341	19	13.6	-1.1	1155	-2	899	12
Mordoviya Rep.	353	13	12.4	-1.3	1052	-8	874	6
Novosibirskaya Oblast	351	22	13.1	0.6	1142	3	839	10
Nizhegorodskaya O.	360	19	11.9	-1.3	1021	-8	883	10
Orenburgskaya Oblast	352	41	14.1	-1.0	1166	-8	884	19
Omskaya Oblast	412	48	13.4	0.8	1081	-1	879	17
Permskaya Oblast	385	19	10.9	-0.7	948	-9	856	8
Penzenskaya Oblast	359	19	13.0	-1.1	1130	-3	901	11
Rostovskaya Oblast	177	-36	17.6	-0.2	1300	-1	691	-18
Ryazanskaya Oblast	367	20	12.9	-1.3	1087	-5	911	11
Stavropolskiy Kray	300	-30	17.0	-0.5	1294	-3	801	-17
Sverdlovskaya Oblast	351	16	11.5	-0.3	1012	-5	844	11
Samarskaya Oblast	453	55	13.5	-1.2	1124	-7	987	22
Saratovskaya Oblast	337	30	14.8	-1.0	1220	-3	893	15

	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 (%)
Tambovskaya Oblast	333	16	13.7	-1.1	1185	-1	883	10
Tyumenskaya Oblast	371	37	12.5	0.3	1032	-3	870	19
Tatarstan Rep.	468	53	12.0	-1.2	1030	-9	927	15
Ulyanovskaya Oblast	418	38	12.9	-1.1	1074	-8	929	14
Udmurtiya Rep.	407	35	11.2	-1.0	961	-10	877	12
Volgogradskaya O.	189	-19	16.6	-0.6	1275	-2	694	-8
Voronezhskaya Oblast	279	-4	14.8	-0.8	1247	1	823	0

Table A.10 United States, April 2022 – July 2022 agroclimatic indicators and biomass (by state)

	RAIN Current (mm)	RAIN 15YA Departure (%)	TEMP Current (°C)	TEMP 15YA Departure (°C)	RADPAR Current (MJ/m²)	RADPAR 15YA Departure (%)	BIOMSS Current (gDM/m²)	BIOMSS 15YA Departure (%)
Arkansas	452	-1	23.5	1.1	1377	0	1038	-7
California	97	1	17.3	0.0	1610	-1	542	-3
Idaho	276	15	10.9	-1.2	1419	-4	653	-3
Indiana	455	-3	18.6	0.2	1290	-2	1117	2
Illinois	482	2	18.9	0.0	1270	-4	1134	3
Iowa	441	1	17.3	-0.2	1254	-3	1042	1
Kansas	327	-9	22.2	1.0	1396	-1	918	-7
Michigan	367	-7	14.0	0.2	1215	-2	909	-2
Minnesota	414	1	14.0	-0.6	1184	-4	937	0
Missouri	459	7	20.7	0.4	1329	-2	1089	2
Montana	294	-12	11.4	-1.1	1368	-1	753	-7
Nebraska	243	-32	19.4	1.1	1420	2	830	-13
North Dakota	412	13	13.3	-1.2	1258	-2	919	4
Ohio	406	-5	17.8	0.3	1275	-1	1051	0
Oklahoma	391	2	24.6	1.6	1398	-1	982	-3
Oregon	352	55	11.7	-1.2	1309	-6	717	13
South Dakota	287	-22	16.7	0.2	1375	2	835	-11
Texas	220	-38	27.0	2.1	1466	2	831	-14
Washington	422	68	11.6	-1.6	1234	-8	766	17
Wisconsin	398	-6	14.4	-0.1	1199	-3	950	-1

Table A.11 China, April 2022 – July 2022 agroclimatic indicators and biomass (by province)

	RAIN Current (mm)	RAIN 15YA Departure (%)	TEMP Current (°C)	TEMP 15YA Departure (°C)	RADPAR Current (MJ/m²)	RADPAR 15YA Departure (%)	BIOMSS Current (gDM/m²)	BIOMSS 15YA Departure (%)
Anhui	636	-18	22.9	0.9	1261	9	1145	-4
Chongqing	718	-19	20.4	0.4	1148	9	1220	-2
Fujian	1287	-2	21.5	0.1	1079	2	1317	-6
Gansu	328	-8	14.4	0.5	1378	5	774	-1
Guangdong	1635	6	24.1	-0.1	1158	2	1471	-4
Guangxi	1435	2	22.8	-0.3	1122	4	1446	-2
Guizhou	838	-23	18.7	-0.2	1002	5	1212	-5
Hebei	233	-4	19.8	0.4	1399	1	777	0

	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 (%)
Heilongjiang	351	10	14.8	-0.3	1260	1	891	7
Henan	352	-11	23.3	1.1	1363	7	907	-6
Hubei	652	-19	21.5	0.7	1243	10	1195	-3
Hunan	1126	-2	21.6	0.1	1080	3	1370	0
Jiangsu	469	-27	23.1	1.4	1303	9	1040	-7
Jiangxi	1203	-8	22.0	-0.2	1061	0	1380	-4
Jilin	535	50	15.5	-0.3	1261	-2	981	11
Liaoning	554	66	16.9	-0.3	1238	-5	961	12
Inner Mongolia	243	9	15.8	0.2	1357	0	723	2
Ningxia	142	-19	17.3	0.5	1500	6	631	-6
Shaanxi	427	-6	18.7	0.8	1391	9	887	1
Shandong	400	23	22.4	0.7	1351	1	861	-5
Shanxi	203	-16	18.2	0.8	1448	5	712	-5
Sichuan	895	5	17.5	0.4	1131	1	1085	1
Yunnan	953	-4	17.9	-0.2	1073	0	1171	0
Zhejiang	849	-22	21.1	0.3	1131	7	1289	-3

Annex B. Quick reference to CropWatch indicators, spatial units and methodologies

The following sections give a brief overview of CropWatch indicators and spatial units, along with a description of the CropWatch production estimation methodology. For more information about CropWatch methodologies, visit CropWatch online at www.cropwatch.com.cn**.**

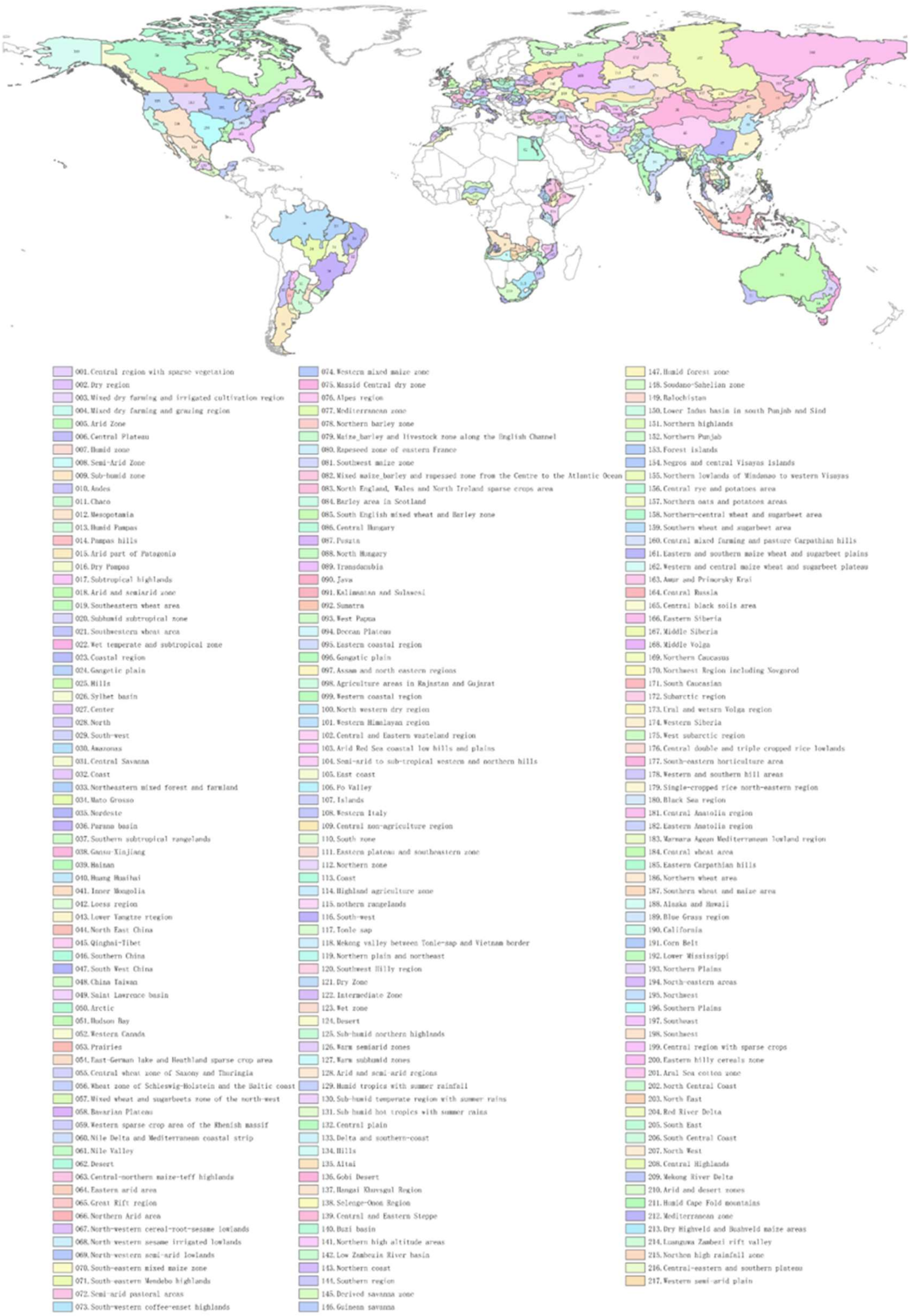
Agroecological zones for 44 key countries

Overview

223 agroecological zones for the 44 key countries across the globe

Description

44 key agricultural countries are divided into 223 agro-ecological zones based on cropping systems, climatic zones, and topographic conditions. Each country is considered separately. A limited number of regions (e.g., region 001, region 027, and region 127) are not relevant for the crops currently monitored by CropWatch but are included to allow for more complete coverage of the 44 key countries. Some regions are more relevant for rangeland and livestock monitoring, which is also essential for food security.



CropWatch indicators

The CropWatch indicators are designed to assess the condition of crops and the environment in which they grow and develop; the indicators—RAIN (for rainfall), TEMP (temperature), and RADPAR (photosynthetically active radiation, PAR)—are not identical to the weather variables, but instead are value-added indicators computed only over crop growing areas (thus for example excluding deserts and rangelands) and spatially weighted according to the agricultural production potential, with marginal areas receiving less weight than productive ones. The indicators are expressed using the usual physical units (e.g., mm for rainfall) and were thoroughly tested for their coherence over space and time. CWSU are the CropWatch Spatial Units, including MRUs, MPZ, and countries (including first-level administrative districts in select large countries). For all indicators, high values indicate "good" or "positive."

INDICATOR			
BIOMSS			
Biomass accumulation potential			
Crop/ 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 (2007-2021), 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 (2017-2021), with departures expressed in percentage.
CROPPING INTENSITY			
Cropping intensity Index			
Crop/ Satellite	0, 1, 2, or 3; Number of crops growing over a year for each pixel	Cropping intensity index describes the extent to which arable land is used over a year. It is the ratio of the total crop area of all planting seasons in a year to the total area of arable land.	Cropping intensity is presented as maps by pixels or spatial average pixels values for MPZs, 44 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 (2017-2021), 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/m², 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 (2007-2021), 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/m², CWSU	The spatial average (for a CWSU) of rainfall accumulation over agricultural	RAIN is shown as the percent departure of the RAIN value for the reporting period, compared to

INDICATOR			
		pixels, weighted by the production potential.	the recent fifteen-year average (2007-2021), 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 (2007-2021), per CWSU. For the MPZs, regular temperature is illustrated as typical time profiles over the spatial unit, with a map showing where the profiles occur and the percentage of pixels concerned by each profile.
VCIx			
Maximum vegetation condition index			
Crop/ Satellite	Number, pixel to CWSU	Vegetation condition of the current season compared with historical data. Values usually are [0, 1], where 0 is "NDVI as bad as the worst recent year" and 1 is "NDVI as good as the best recent year." Values can exceed the range if the current year is the best or the worst.	VCIx is based on NDVI and two VCI values are computed every month. VCIx is the highest VCI value recorded for every pixel over the reporting period. A low value of VCIx means that no VCI value was high over the reporting period. A high value means that at least one VCI value was high. VCI is shown as pixel-based maps and as average value by CWSU.
VHI			
Vegetation health index			
Crop/ Satellite	Number, pixel to CWSU	The average of VCI and the temperature condition index (TCI), with TCI defined like VCI but for temperature. VHI is based on the assumption that "high temperature is bad" (due to moisture stress), but ignores the fact that low temperature may be equally "bad" (crops develop and grow slowly, or even suffer from frost).	Low VHI values indicate unusually poor crop condition, but high values, when due to low temperature, may be difficult to interpret. VHI is shown as typical time profiles over Major Production Zones (MPZ), where they occur, and the percentage of pixels concerned by each profile.
VHIn			
Minimum Vegetation health index			
Crop/ Satellite	Number, pixel to CWSU	VHIn is the lowest VHI value for every pixel over the reporting period. Values usually are [0, 100]. Normally, values lower than 35 indicate poor crop condition.	Low VHIn values indicate the occurrence of water stress in the monitoring period, often combined with lower than average rainfall. The spatial/time resolution of CropWatch VHIn is 16km/week for MPZs and 1km/dekad for China.

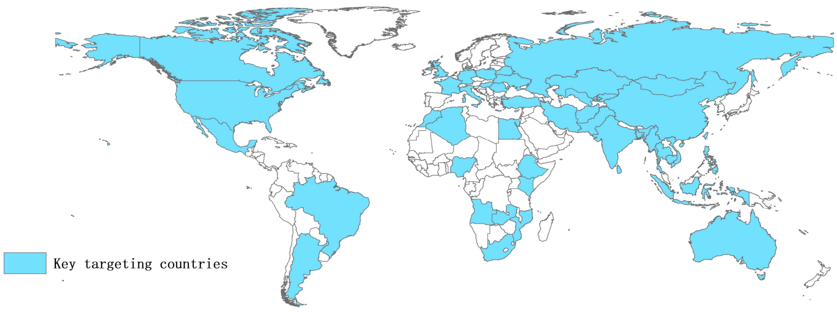
Note: Type is either "Weather" or "Crop"; source specifies if the indicator is obtained from ground data, satellite readings, or a combination; units: in the case of ratios, no unit is used; scale is either pixels or large scale CropWatch spatial units (CWSU). Many indicators are computed for pixels but represented in the CropWatch bulletin at the CWSU scale.

CropWatch spatial units (CWSU)

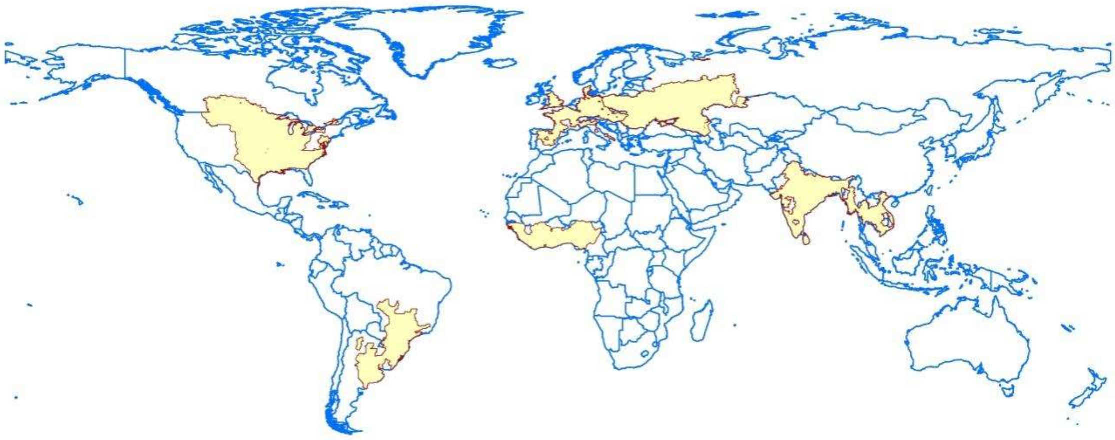
CropWatch analyses are applied to four kinds of CropWatch spatial units (CWSU): Countries, China, Major Production Zones (MPZ), and global crop Monitoring and Reporting Units (MRU). The tables below summarize the key aspects of each spatial unit and show their relation to each other. For more details about these spatial units and their boundaries, see the CropWatch bulletin online resources.

SPATIAL LUNITS	
CHINA	
Overview	*Description*
Seven monitoring regions	The seven regions in China are agro-economic/agro-ecological regions that together cover the bulk of national maize, rice, wheat, and soybean production. Provinces that are entirely or partially included in one of the monitoring regions are indicated in color on the map below.

Countries (and first-level administrative districts, e.g., states and provinces)	
Overview	*Description*
"Forty two plus one" countries to represent main producers/exporters and other key countries.	CropWatch monitored countries together represent more than 80% of the production of maize, rice, wheat and soybean, as well as 80% of exports. Some countries were included in the list based on criteria of proximity to China (Uzbekistan, Cambodia), regional importance, or global geopolitical relevance (e.g., four of five most populous countries in Africa). The total number of countries monitored is "43 + 1," referring to 43 and China itself. For the nine largest countries—, United States, Brazil, Argentina, Russia, Kazakhstan, India, China, and Australia, maps and analyses may also present results for the first-level administrative subdivision. The CropWatch agroclimatic indicators are computed for all countries and included in the analyses when abnormal conditions occur. Background information about the countries' agriculture and trade is available on the CropWatch Website, **www.cropwatch.com.cn**.



Major Production Zones (MPZ)	
Overview	*Description*
Six globally important areas of agricultural production	The six MPZs include West Africa, South America, North America, South and Southeast Asia, Western Europe and Central Europe to Western Russia. The MPZs are not necessarily the main production zones for the four crops (maize, rice, soybean, wheat) currently monitored by CropWatch, but they are globally or regionally important areas of agricultural production. The seven zones were identified based mainly on production statistics and distribution of the combined cultivation area of maize, rice, wheat and soybean.



Global Monitoring and Reporting Unit (MRU)	
Overview	*Description*
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 44 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.

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Online resources

Online Resources posted on **http://cloud.cropwatch.com.cn/**

This bulletin is only part of the CropWatch resources available. Visit **cloud.cropwatch.com.cn** for access to additional resources, including the methods behind CropWatch, country profiles, and other CropWatch publications. For additional information or to access specific data or high-resolution graphs, simply contact the CropWatch team at **cropwatch@radi.ac.cn**.

CropWatch bulletins introduce the use of several new and experimental indicators. We would be very interested in receiving feedback about their performance in other countries. With feedback on the contents of this report and the applicability of the new indicators to global areas, please contact:

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