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CropWatch Online Resources: The data and charts of this report are available at http://cloud.cropwatch.com.cn/.

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⓿ *NOTE:* CROPWATCH RESOURCES, BACKGROUND MATERIALS AND ADDITIONAL DATA ARE AVAILABLE ONLINE AT WWW.CROPWATCH.COM.CN.

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Abbreviations

5YA	Five-year average, the average for the four-month period from October of the previous year to January of the current year for 2018-2022; one of the standard reference periods.
15YA	Fifteen-year average, the average for the four-month period from October of the previous year to January of the current year 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
CPI	Crop Production Index

Bulletin overview and reporting period

This CropWatch bulletin presents a global overview of crop stage and condition between October 2022 and January 2023, a period referred to in this bulletin as the ONDJ (October, November, December and January) period or just the "reporting period." The bulletin is the 128th 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 the actual crop production and stresses experienced during the monitoring period. (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, 45 major agricultural countries, and 228 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	44 key countries (main producers and exporters) and 221 AEZs	As above, plus NDVI, GVG survey, and CPI
Chapter 4	China and seven agro-ecological zones	As above plus high-resolution images; Pest and crops trade prospects
Chapter 5	Production outlook, and updates on disaster events and El Niño.	
Online Resource	http://cloud.cropwatch.com.cn/	

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/**. Additionally, by accessing the website, you can obtain information on methods, overviews of major producing countries, and their trends in the medium and long term.

Executive summary

The current CropWatch bulletin describes world-wide crop conditions and food production as appraised by data up to the end of January 2023. It is prepared by an international team coordinated by the Aerospace Information Research Institute, Chinese Academy of Sciences.

The assessment is based mainly on remotely sensed data. It covers prevailing agri-climatic conditions, including extreme factors, at different spatial scales, starting with global patterns in Chapter 1. Chapter 2 focuses on agroclimatic and agronomic conditions in major production zones in all continents. Chapter 3 covers the major agricultural countries that, 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 October 2022 to January 2023.

Agroclimatic conditions

Globally, 2022 was the sixth warmest year on record since 1880. Temperatures were above average in Europe and Asia, resulting in the second warmest year. A heat wave accompanied by drought reduced autumn grain crop production in most of Europe and Southern China. An early heat wave in northwest India, in which temperatures exceeded 35ºC in March, caused yield losses in wheat at regional scale.

During this monitoring period, a third consecutive year of La Niña conditions has caused a prolonged drought that keeps affecting East Africa. It reduced crop production, and livestock was also decimated due to a lack of water. La Niña also limited crop production in Argentina. Other climatic factors, exacerbated by climate change, have caused a severe rainfall deficit in all regions bordering the Mediterranean Sea. In that region, winter is the season with the highest precipitation. Hence, the drought will not only impact the production of cereals and legumes in the winter months. Low water levels in the reservoirs mean less water will be available for irrigation in the dry summer months. The rainfall situation is grave in the Maghreb, Levant, and the Caucasus, where the deficit exceeded 30%. Conditions were average in Central and Northern Europe and most of Russia’s crop production region. California and the Western states of the USA benefited from above-average rainfall, which helped to restore soil moisture to normal levels. Most of South and South-East Asia, Northern China, Australia, and New Zealand experienced average to above-average rainfall.

Global crop production situation

In the current monitoring period, the Crop Production Index (CPI) for global crop production had declined for the third consecutive year from 1.19 to 1.12, which is the second lowest level in the past 11 years. This is mainly due to heat and drought conditions in key production regions.

Maize: In the Southern Hemisphere, maize planting starts at the beginning of the rainy season in November and December. In Brazil, first season maize was sown in October. Sowing of the more important second season maize is starting in February, after the soybean harvest. Brazil and Argentina are the second and third largest maize exporters. The total maize production in Brazil is expected to reach 93.603 million tonnes, with an increase of 2.5%. In Argentina, rainfall conditions improved in January, and farmers planted a significant area of late-season maize. Its production is expected to be at 55.924 million tonnes, slightly increasing by 1.7%. For southern Africa, which is affected by slight rainfall deficits, production is generally estimated to be reduced by less than 5%, except in Mozambique, where production is estimated to increase by 9.1% due to a larger area planted. In Indonesia, production is forecasted to increase to 19.586 million tonnes (+2.3%).

Rice: Production in most countries in South and Southeast Asia is close to 2022 levels. Conditions were close to normal in most countries, except Cambodia, where a reduction of 2.2% is forecasted due to a lack of water. In the Philippines, an increase of 5.3% is estimated. In most other countries, the changes are less than 2%. Rice yield and cultivation areas in Brazil and Argentina have decreased slightly, with total rice production decreasing by 5.0% and 4.1%, respectively.

Wheat: This is the most important crop grown during the northern hemisphere's winter months. Severe rainfall deficits have affected Kansas and Oklahoma in the USA, the Maghreb, the Levant, Türkiye and the Caucasus. Conditions were generally favorable for sowing and crop establishment in all other major production zones. This covers most of Europe, South Asia and China. Wheat yields in Australia and Brazil benefitted from favorable weather conditions, whereas in Argentina, the drought caused a significant yield reduction.

Soybean: The soybean production of Brazil and Argentina is only second to that of the United States. CropWatch predicts that Brazil's soybean production will reach 105.178 million tonnes (+10.6%) due to an expansion of the cultivated area. The planted area of soybeans in Argentina had also increased, but drought occurred in the main soybean-producing areas, which delayed the soybean sowing period. Although rainfall returned to normal in January 2023 and the growth of late-planted soybeans improved, yields of the late-sown fields will be reduced. The national average soybean yield is expected to decrease by 5.7%, with a total production of 50.022 million tonnes (-3.4%).

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 wad increased by 40 in this bulletin.

1.1 Introduction to CropWatch agroclimatic indicators (CWAIs)

This bulletin describes the agroclimatic conditions and their potential impacts on crops over the period from October 2022 to January 2023, ONDJ, 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 agroclimatic patterns. Refer to able A.1 for 2023 ONDJ 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 biomass production potential inside each area.

We also stress that the reference period, referred to as "average" in this bulletin covers the 15-year period from 2008 to 2022. Although departures from the 2008-2022 are not anomalies (which, strictly, refer to a "normal period" of 30 years), we nevertheless use that terminology. The specific reason why CropWatch refers to the most recent 15 years is our focus on agriculture, as already mentioned in the previous paragraph. 15 years is deemed an acceptable compromise between climatological significance and agricultural significance: agriculture responds much faster to persistent climate variability than 30 years, which is a full generation. For "biological" (agronomic) indicators used in subsequent chapters we adopt an even shorter reference period of 5 years (i.e., 2018-2022). This makes provision for the fast response of markets to changes in supply.

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

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

1.2 Global overview

According to WMO, global average temperatures in 2022 were 1.15ºC above pre-industrial levels. Globally, 2022 was the sixth warmest year on record. According to NOAA, the 10 warmest years in the last 143 years occurred since 2010. Europe and Asia recorded the second warmest years in 2022. Record temperatures during the summer months were accompanied by droughts, such as in most of Europe and Southern China. A heat wave in the northwest of India, in which temperatures exceeded 35ºC in March, caused yield losses in wheat.

1.3 Rainfall

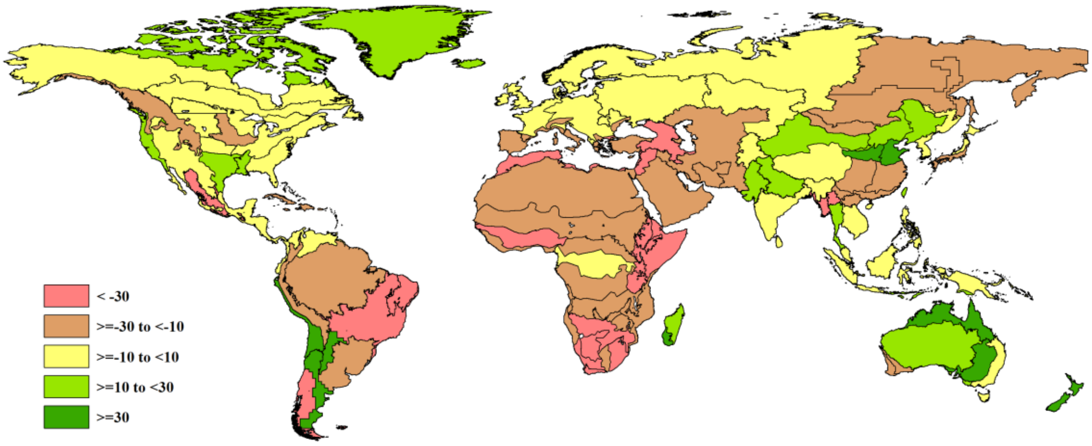


Figure 1.1 Global map of rainfall anomaly (as indicated by the RAIN indicator) by CropWatch Mapping and Reporting Unit: Departure of October 2022 to January 2023 total from 2008-2022 average (15YA), in percent.

A rainfall deficit was recorded for most of South America, Africa, the Middle East and South East China. Conditions were mixed in North America. Only the Sierra Madre in Mexico experienced a deficit that was larger than -30%. Above-average precipitation was recorded for California and the Central South of the USA. All countries bordering the Mediterranean Sea experienced severe deficits. In that region, winter is the period with the highest precipitation. The rainfall situation is grave in the Maghreb and Levant, as well as in the Caucasus, where the deficit exceeded -30%. In Central and Northern Europe, conditions were average as well as in most of Russia's crop production regions. In Africa, a region along the Gulf of Guinea, as well as East and Southern Africa also had a severe rainfall deficit. Most of South and South-East Asia, Northern China as well as Australia and New Zealand experienced average to above average rainfall.

1.4 Temperatures

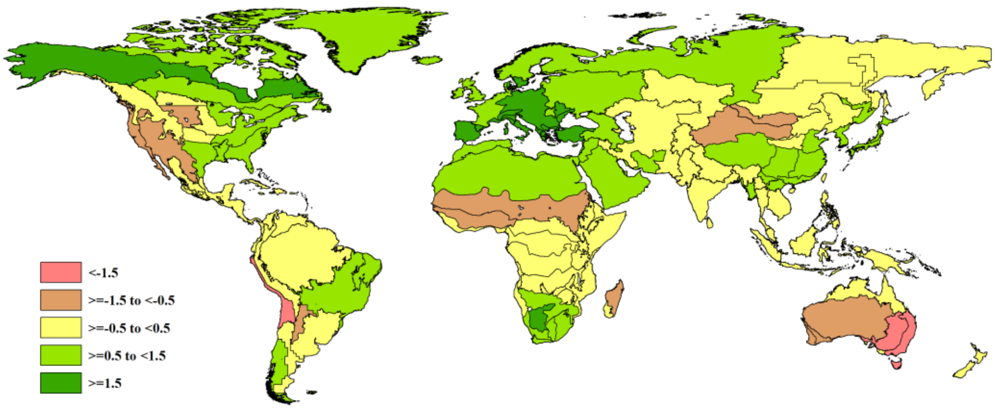


Figure 1.2 Global map of temperature anomaly (as indicated by the TEMP indicator) by CropWatch Mapping and Reporting, Unit: departure of October 2022 to January 2023 average from 2008-2022 average (15YA), in °C.

Temperatures were average in most of South America's crop production regions. In Central and Northeastern Brazil, temperatures were warmer by more than 0.5ºC. The coastline along the Pacific from northern Chile to Ecuador experienced cooler than usual temperatures (<-1.5ºC). The Western USA also experienced cooler than usual temperatures, whereas the south and east were warmer. Temperatures were warmer than usual in all of Europe, northern Africa and the Levant. The Sahel and the south experienced cooler temperatures than usual, whereas the countries in Southern Africa were warmer than usual (>0.5ºC). Most of China, apart from the Northwest, had temperatures that were 0.5 to 1.5ºC above average. Cooler than usual temperatures were recorded for most of Australia. Especially Southeast Australia experienced cooler than usual temperatures (<-1.5ºC).

1.5 RADPAR

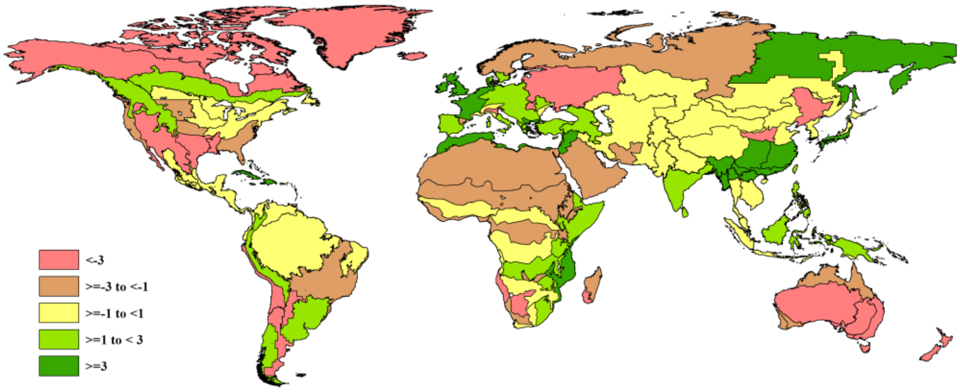


Figure 1.3 Global map of photosynthetically active radiation anomaly (as indicated by the RADPAR indicator) by CropWatch Mapping and Reporting Unit: departure of October 2022 to January 2023 average from 2008-2022 average (15YA), in percent.

Within the important crop production regions, the strongest negative departures (<-3%) in photosynthetically active radiation were observed for the southern USA, Ukraine, Russia west of the Ural, Northeast China, Australia and New Zealand. In the Cerrado of Brazil, solar radiation was below average by -1 to -3%. A similar negative departure from the 15YA was observed for California and the Southeast of the USA, the Sahel region, Central Africa and the Arabian Peninsula. Conditions were average for Central America, northeast of the USA and most of Central Asia. Positive departures in the range of +1 to +3% were recorded for Southern Brazil, the Pampas, the Andes region from Bolivia to Venezuela, Central Europe, Türkiye, the Caucasus region, East and South-East Africa, India and the Philippines. The Maghreb, Western Europe, the Levant as well as South-East China received radiation that was more than 3% above average.

1.6 BIOMSS

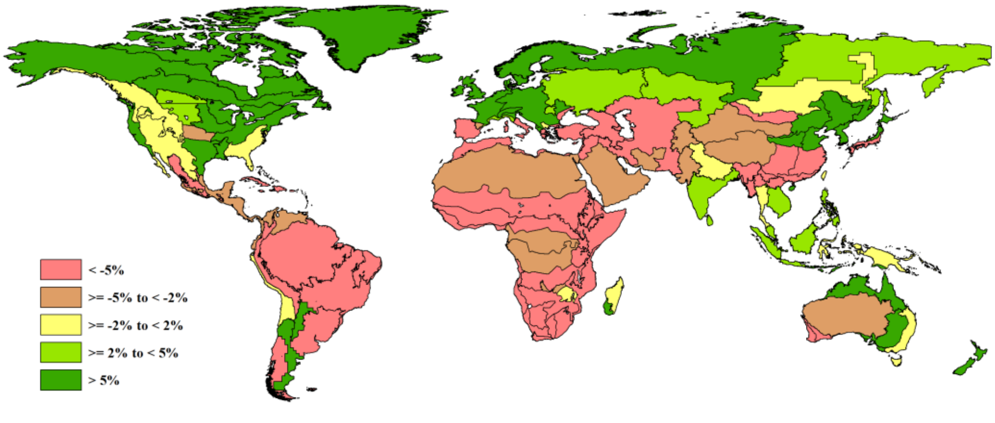


Figure 1.4 Global map of biomass accumulation (as indicated by the BIOMSS indicator) by CropWatch Mapping and Reporting Unit: departure of October 2022 to January 2023 average from 2008-2022 average (15YA), in percent.

Almost all of the relevant crop production regions in South America had a decline in estimated biomass production by more than -5%. The only exception was Central Chile, for which a strong positive departure was estimated. Strong negative departures were observed for the Iberian Peninsula, and most of Africa, with the exception of the Sahel and Central Africa, where the decline ranged between -2 to -5%. The near and Middle East, as well as Southern China, Southern Japan, Myanmar and Southwest Australia also had a decline by more than -5%. Apart from the Rocky Mountain region, biomass production in most of the USA and Canada showed strong positive departures by more than +5%. Positive (+2 to +5%) to strongly positive (>+5%) departures were estimated for Western, Central and Eastern Europe, together with India, Thailand, Vietnam, the Malay Archipelago, the Murray-Darling basin in Eastern 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), and minimum vegetation health index (VHIn)— to describe crop condition in six Major Production Zones (MPZ) across all continents. For more information about these zones and methodologies used, see the quick reference guide in Annex B and 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 (October 2022-January 2023)

	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
West Africa	163	-22	24.5	-0.6	1220	-1	608	-9
North America	301	-1	5.8	0.6	521	-2	479	5
South America	397	-55	23.7	0.6	1343	2	974	-22
S. and SE Asia	294	0	20.5	-0.1	1037	2	616	1
Western Europe	353	-2	7.1	1.6	318	3	577	8
Central Europe and W. Russia	259	1	1.2	1.2	222	-4	374	3

*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 (October of the previous year to January) for 2008-2022.*

Table 2.2 Agronomic indicators by Major Production Zone, current season values and departure from 5YA (October 2022-January 2023)

	CALF (Cropped arable land fraction)		Maximum VCI
	Current	5A Departure (%)	Current
West Africa	95	0	0.89
North America	61	-9	0.72
South America	95	-4	0.80
S. and SE Asia	97	1	0.88
Western Europe	93	1	0.90
Central Europe and W Russia	81	8	0.84

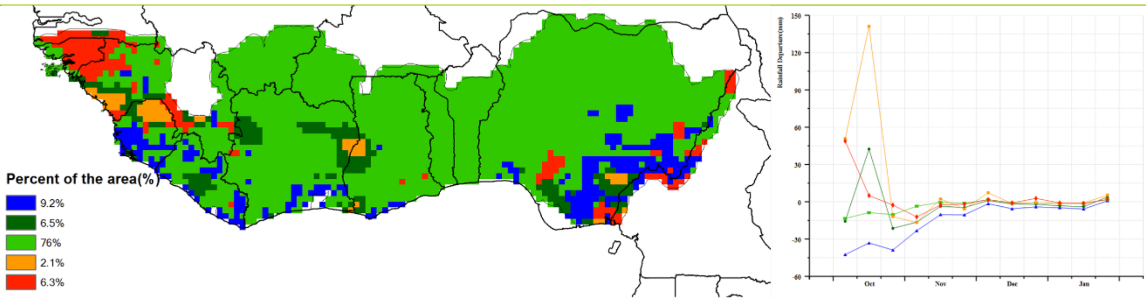
Note: See note for Table 2.1, with reference value R defined as the five-year average (5YA) for the same period (October of the previous year to January) for 2018-2022.

2.2 West Africa

This reporting period covers the harvesting period in this major production zone (MPZ). In the coastal regions, the harvest of the second season tuber crop, cassava, started in January. In the rest of the region, harvesting of rice, millet and sorghum crops was underway and concluded in January 2023. The MPZ relies significantly on imports of cereals, mostly of wheat and rice, to cover its domestic requirements. For Nigeria, cereal imports are forecasted at a near-average level of 8.1 million tonnes.

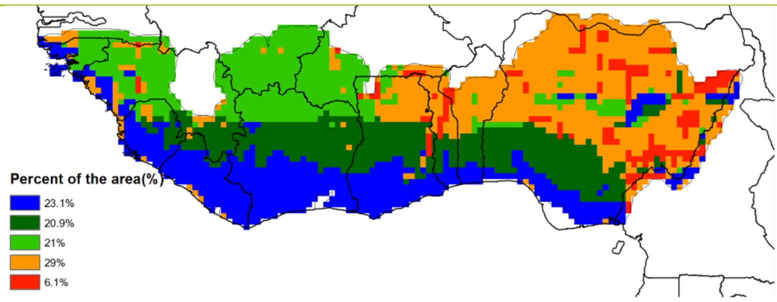
With respect to the climatic indicators for the region, the estimated average rainfall was 163 mm (-22%). At the country level, rainfall deficits were observed for Liberia (416 mm -13%), Sierra Leone (380 mm -7%), Equatorial Guinea (1,434 mm +9%), Togo (57 mm -40%), Burkina Faso (6 mm -77%), Nigeria (125 mm -33%), Ghana (125 mm -35%), Côte d'Ivoire (195 mm -24%) and Guinea (210 mm +6%). Based on the Vegetative Health Index (VHI), localized areas of severe to moderate drought stress were observed, mainly in Nigeria. The average temperature of the MPZ varied from 22.8°C (Equatorial Guinea) to 25.9°C (Guinea Bissau) with an estimated regional average of 24.5°C (-0.6°C) and solar radiation was 1,220 MJ/m2 (-1%) while the regional accumulated biomass production potential decreased by 9%. The cultivated arable cropped area (CALF) for the region was 95% (-0.2%), with Nigeria at 89% (+4%). As an indication of good crop conditions, the regional maximum vegetation condition index (VCIx) attained a favourable value of 0.89. These CropWatch indicators showed stable, but slightly drier-than-usual climatic conditions. In general, conditions were close to normal.

Figure 2.1 West Africa MPZ: Agroclimatic and agronomic indicators, October 2022- January 2023.

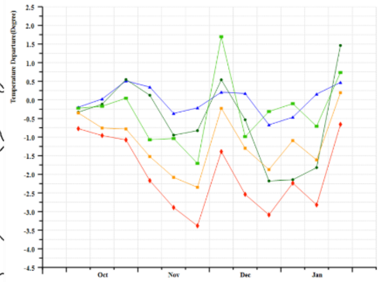


a. Spatial distribution of rainfall profiles

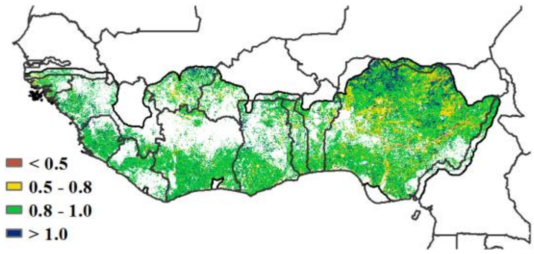
b. Profiles of rainfall departure from average (mm)



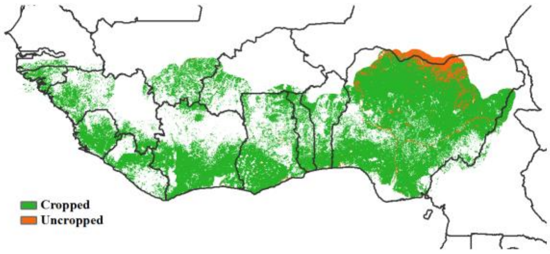
c. Spatial distribution of temperature profiles



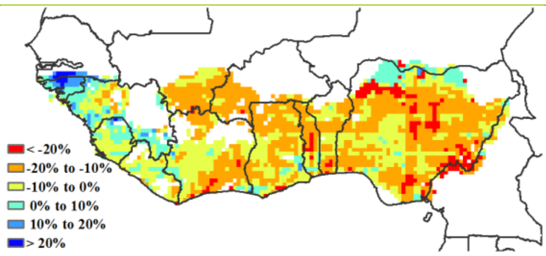
d. Profiles of temperature departure from average (mm)



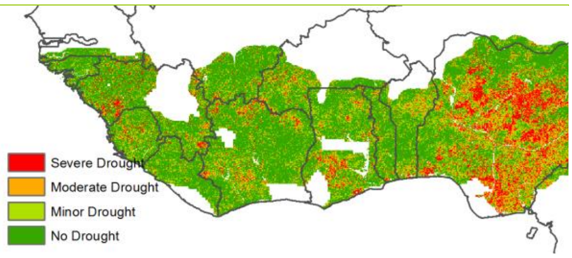
e. Maximum VCI



f. Cropped arable land



g. Biomass accumulation potential departure



h. VHI minimum

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

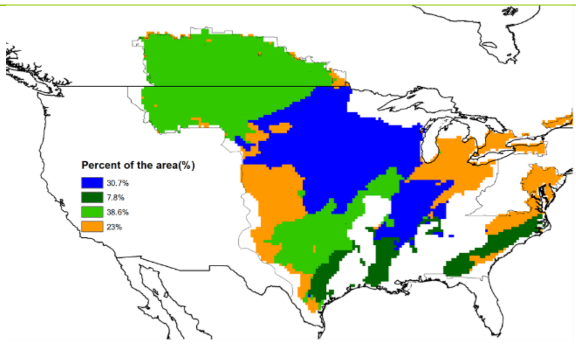
2.3 North America

During the October 2022 to January 2023 reporting period, the harvests of maize and soybean were completed, and winter wheat was sown. Overall, crop conditions for winter wheat were below average.

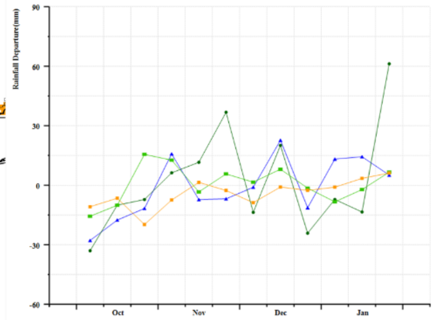
North America has experienced close to average conditions, with below average rainfall (-1%) and RADPAR (-2%), and above average temperature (+0.6°C), while potential biomass was 5% above average. During the previous monitoring period, severe drought conditions affected the region from the Canadian Prairies to the Southern Plains. Although drought conditions have improved in these areas during the current observation period, the minimum Vegetation Health Index (VHIm) indicates that drought conditions still exist, particularly in North Texas and Kansas. The negative deviation in potential biomass (<-20%) also confirms the negative impact of drought on crops in these areas. Poor crop conditions are reflected in Kansas with a VCIx below 0.5. Conditions in other regions were close to average. The maximum Vegetation Condition Index (VCIx) reached 0.72, but the Cropped Arable Land Fraction (CALF) for the whole region was significantly below average (-9%). It is still too early to predict the variation of winter crop yields.

In summary, crop conditions for winter wheat in North America were below average due to persistent drought conditions in North Texas and Kansas.

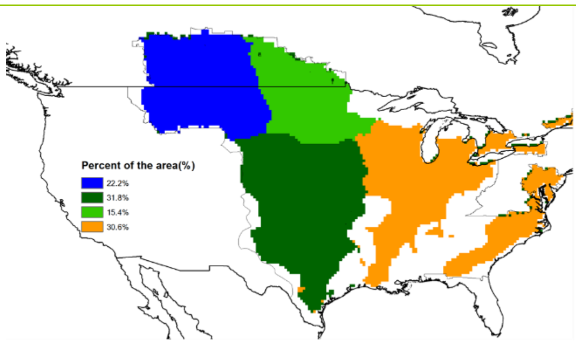
Figure 2.2 North America MPZ: Agroclimatic and agronomic indicators, October 2022-January 2023.



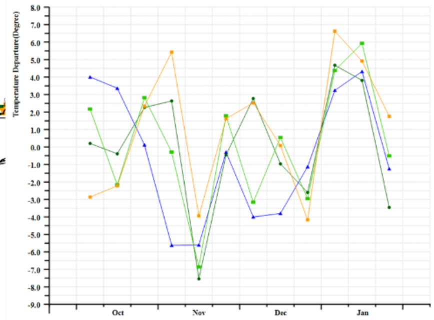
a. Spatial distribution of rainfall profiles



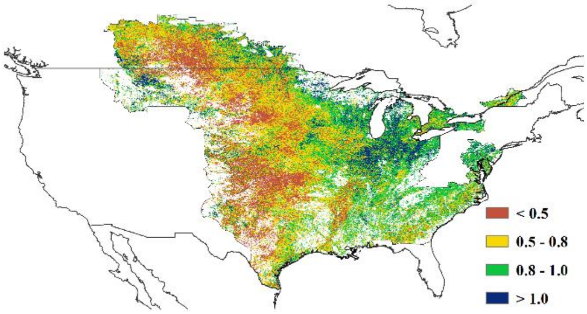
b. Profiles of rainfall departure from average (mm)



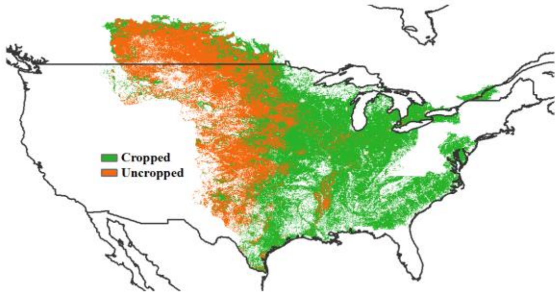
c. Spatial distribution of temperature profiles



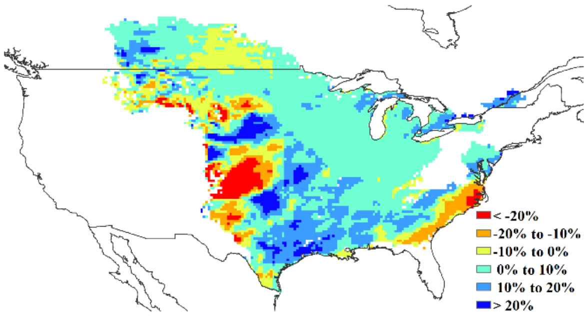
d. Profiles of temperature departure from average (mm)



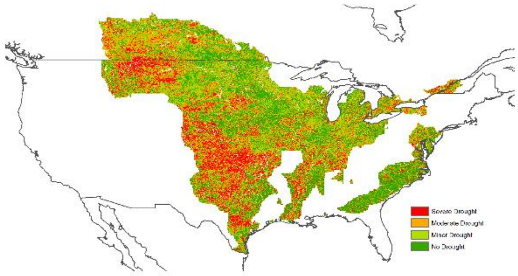
e. Maximum VCI



f. Cropped arable land



g. Biomass accumulation potential departure



h. VHI minimum

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

2.4 South America

This reporting period covers the main growing stages for early maize, early soybean and rice, planting of late maize and late soybean and the harvesting of wheat. The situation in South America is variable. Only TEMP showed in general near average values. Agronomic and drought indicators showed poor conditions, in particular in North-East Pampas in Argentina and in the north of the Brazilian agricultural area.

Spatial distribution of rainfall profiles showed five different patterns. The blue profile showed the most negative anomalies and was located in the North of Brazilian agricultural area in the states of Mato Grosso, Goiás and Minas Gerais. The observed negative anomalies throughout the monitoring period ranged from -30 to -100 mm. The orange profile, located in the west of Mato Grosso, Mato Grosso do Sul, San Pablo and part of Rio Grande do Sul state, showed negative anomalies of near -60 mm during most of the period, except at the beginning of October and mid-December when it showed only slight negative anomalies. The red profile was observed in the west of Mato Grosso do Sul, Parana and Santa Catarina states in Brazil, East Paraguay and North Mesopotamia in Argentina and showed high variability, with positive anomalies in mid-October, mid-December and end-January, and negative anomalies during November and end-December. A dark green profile was observed in most of Chaco, Pampas and South Mesopotamia in Argentina, Uruguay and South of Rio Grande do Sul state in Brazil. It showed a quite stable pattern with near no anomalies along the reporting period. Finally, a light green profile was identified in small areas like in Subtropical Highlands and North-West Pampas in Argentina and East Santa Catarina state in Brazil. It showed high positive anomalies during November, December and January, with high peaks (more than 90 mm) at beginning of December and at the end of January.

Temperature profiles showed five homogeneous patterns. These profiles had some similarities among them, with reductions at the beginning of November (except for the blue profile), increases at the beginning of December, reductions at the end of December and increases again during January. Variation among profiles was mostly observed in the magnitude of the anomalies. The orange profile showed in general the most negative values and was observed in West Paraguay, North Mesopotamia in Argentina and Paraná and Santa Catarina states in Brazil. The light green profile, located in Chaco and North Pampas in Argentina, North and East Uruguay and Rio Grande do Sul, Mato Grosso do Sul and San Pablo sates in Brazil, showed less negative anomalies and higher positive anomalies. The blue profile showed also less negative anomalies and high positive anomalies and was observed in East Pampas, South-West Uruguay and West of Mato Grosso in Brazil. The dark green profile, located in South and West Pampas showed values in between the light green and blue profiles. Finally, the red profile showed in general the highest positive anomalies and almost no negative anomalies and was located in Mato Groso do Sul, Goiás and Minas Gerais states in Brazil.

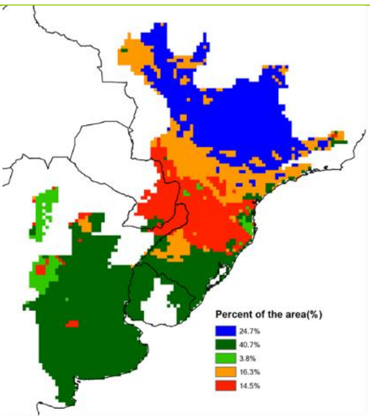
The CALF map showed uncropped areas in Argentina, in Center-East and South-West Pampas, Chaco and Subtropical Highlands. BIOMSS showed the poorest conditions with strong negative anomalies in Mato Grosso, Mato Grosso do Sul, Goiás, San Pablo and South of Rio Grande do Sul in Brazil, as well as in Chaco, South Mesopotamia and Center East Pampas in Argentina and in East Uruguay. Good conditions with positive anomalies were observed in East Paraguay, Paraná and Santa Catarina states in Brazil, and West Pampas and Subtropical Highlands in Argentina.

Surface soil moisture showed low values (less than 30%) in most of agricultural areas of Brazil and Argentina. Intermediate soil moisture values were observed in Paraguay and Mato Gross and Mato Grosso do Sul in Brazil. SPI showed severe to extreme conditions in Goiás and Minas Gerais states in Brazil. Moderate to severe drought conditions were observed in Center-East Pampas and South Mesopotamia in Argentina, Uruguay and Rio Grande do Sul in Brazil. The poor conditions in the drought stricken areas may have affected wheat production and corn and soybean development, and may also have affected or delayed the planting of summer crops in Argentina, where the CALF showed some uncropped areas. Wet conditions were observed in North-West Pampas and

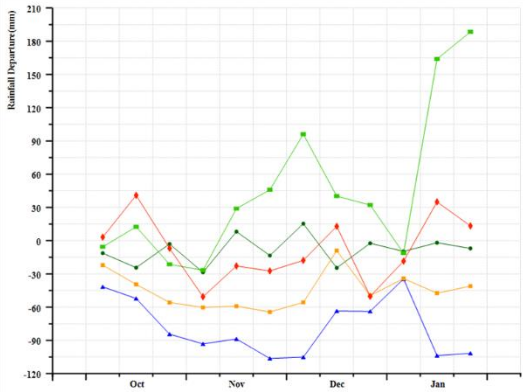
Subtropical Highlands in Argentina. The rest of Brazil and Argentina and Paraguay showed normal conditions.

VCIx showed good conditions in Paraguay and most of Brazil (with values higher than 0.8), except for Río Grande do Sul state where poor conditions were observed. The worst conditions were observed in Argentina, with values of VCIx less than 0.5 in North and Center-East Pampas, Chaco, East Subtropical Highlands and South Mesopotamia. Good conditions in Argentina were only observed in part of West and South Pampas and South-West Subtropical Highlands.

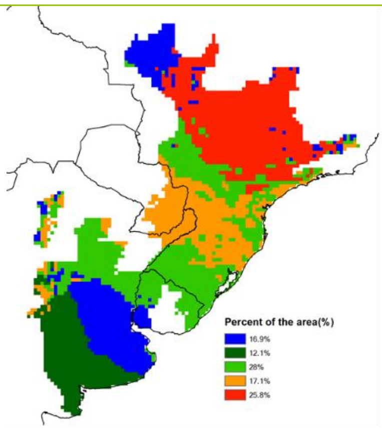
Figure 2.3 South America MPZ: Agroclimatic and agronomic indicators, October 2022 to January 2023.



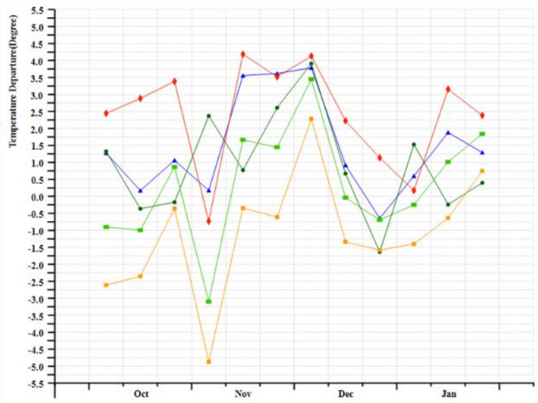
a. Spatial distribution of rainfall profiles



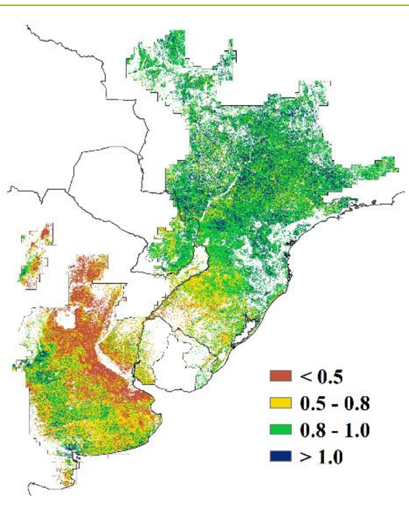
b. Profiles of rainfall departure from average (mm)



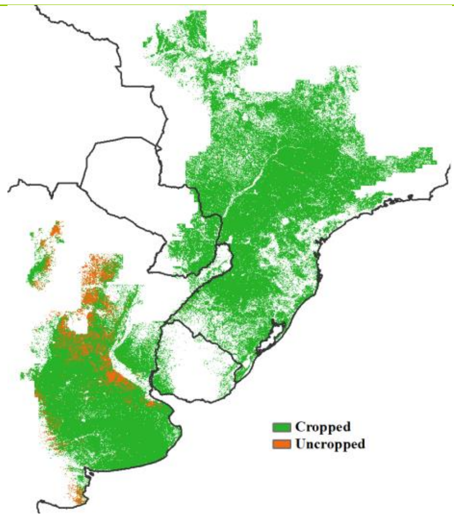
c. Spatial distribution of temperature profiles



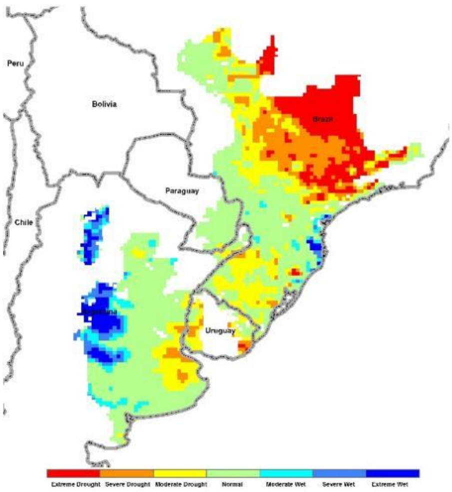
d. Profiles of temperature departure from average (mm)



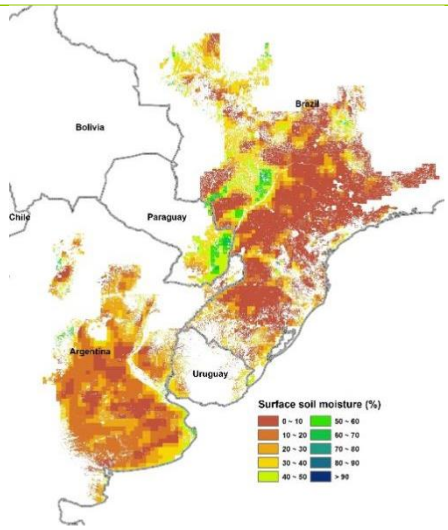
e. Maximum VCI



f. Cropped arable land



g. Biomass accumulation potential departure



h. Soil Mositure (0-10cm)

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

2.5 South and Southeast Asia

The South and Southeast Asia MPZ includes India, Bangladesh, Cambodia, Myanmar, Nepal, Thailand, Laos, and Vietnam. This monitoring period covers the harvesting period of autumn crops (rice, corn, and sugarcane) and the sowing as well as the growing period of winter crops (wheat) in the region.

The accumulated precipitation was unchanged compared with the 15YA, while the temperature was slightly below the 15YA (TEMP -0.1℃) and the RADPAR (+2%) was above the 15YA, resulting in an estimated biomass increase (BIOMSS +1%). Compared with the 5YA, the CALF increased by 1% to 97%. The VCIx of the MPZ was 0.88, indicating that the crops were growing well.

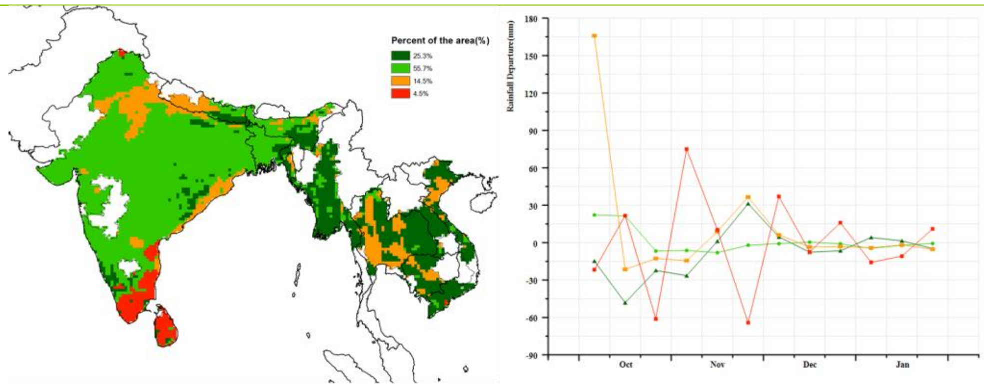
Based on the spatial distribution of rainfall profiles, 14.5% of the MPZ (northern and southeastern India, Nepal, Thailand, Cambodia, and northern Vietnam) experienced higher precipitation levels in early October compared to the 15YA. They dropped sharply to the average level in the middle of October. Between October and early November, the precipitation for 25.3% of the MPZ was lower than the average, which occurred in eastern India, Myanmar, Laos, Cambodia, and Vietnam. However, heavy precipitation occurred in late November, leading to flooding disasters in central Vietnam. The precipitation for 4.5% of the MPZ (southern India, Sri Lanka) fluctuated around the 15YA. After the middle of December, precipitation levels for all cultivated land in the MPZ returned to levels close to the 15YA. According to the spatial distribution of temperature profiles, during the whole monitoring period, 1% of the MPZ (northern India and central Nepal) recorded significantly higher temperature departures than the 15YA, and 12% of the areas (northern and eastern India, Nepal and Myanmar) had slightly higher temperature departures than the 15YA. 67.4% of the MPZ (India and Bangladesh) had negative temperature departures t from October to late November. 19.6% of the MPZ (Thailand, Laos, Cambodia, and Vietnam) had strong temperature fluctuations, with temperatures higher than the average from the middle of November to early December, and lower than the average most of the time.

The BIOMASS departure map shows that the potential biomass of northwest and southern India was 20% greater than the historical average for the same period, while the potential biomass in northern India, eastern India, Myanmar, and northern Vietnam was below the average. The Maximum VCI shows that the index in northern India and various isolated locations were above

1.0. The VHI Minimum map shows that north and central India, regions in Myanmar, Thailand, and Cambodia experienced periods of severe drought conditions. The CALF map indicates that a significant portion of the region was planted, except for northwest India.

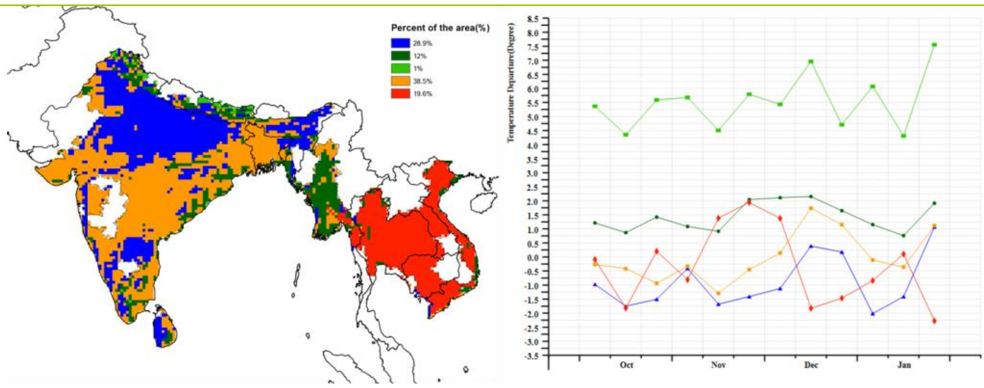
In general, the growth conditions for winter crops in the main production area were close to normal.

Figure 2.4 South and Southeast Asia MPZ: Agroclimatic and agronomic indicators, October 2022 to January 2023.



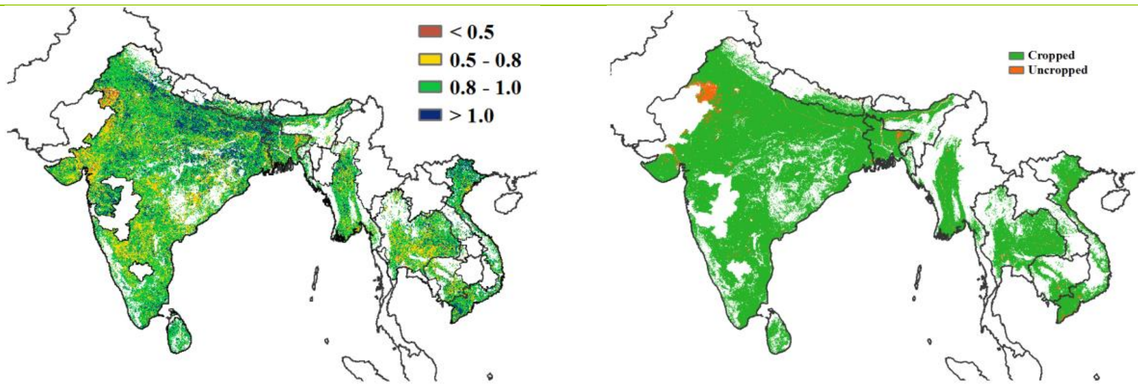
a. Spatial distribution of rainfall profiles

b. Profiles of rainfall departure from average (mm)



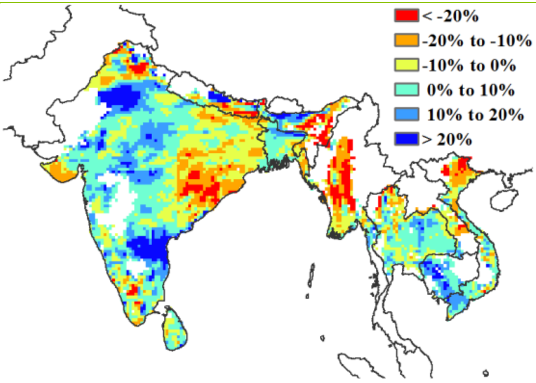
c. Spatial distribution of temperature profiles

d. Profiles of temperature departure from average (mm)

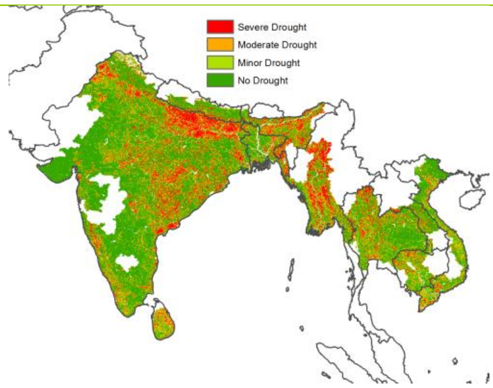


e. Maximum VCI

f. Cropped arable land



g. Biomass accumulation potential departure



h. VHI minimum

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

2.6 Western Europe

This report covers the sowing period of winter crops in the major production zone (MPZ) of Western Europe. In general, crop conditions were above average or close to average in most parts of this region due to favourable sunshine conditions and warmer-than-usual temperatures (Figure 2.5).

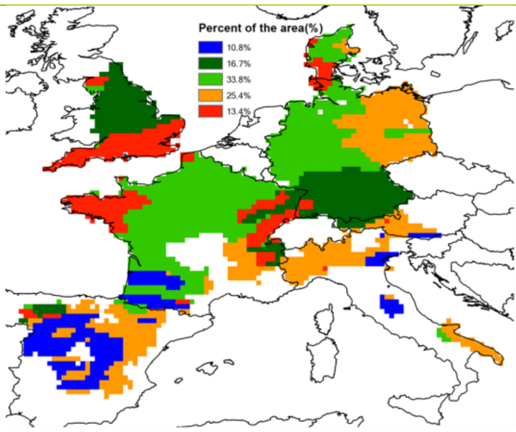
The CropWatch agro-climatic indicators show that the overall rainfall deficit across the MPZ has continued from the last two reports, but the magnitude of the deficit has been significantly reduced, with a deficit of only 2% below average for the whole MPZ for this reporting period. The spatial and temporal distribution of rainfall varies considerably between countries, and rainfall patterns can be characterized as follows: (1) Precipitation was about average in 50.5% of the MPZ (green and dark green areas in Fig. 2.6a), with the exception of late November/early December and late January, when precipitation was well below average, and late December and mid-January, when precipitation was well above average. This includes most of Germany, most of France and central and northern UK; (2) Precipitation was below average in 25.4% of the MPZ (yellow areas in Fig. 2.6a), with the exception of slightly above average precipitation in early and mid-December and mid-January. It mainly affected eastern and northeastern Spain, southeastern France (Auvergne Rhone-Alpes), northern and southeastern Italy and eastern and northeastern Germany (Saxony, Brandenburg, Saxony-Anhalt, Mecklenburg-Western Pomerania); (3) With the exception of mid-November, late December and late January, 10.8% of the MPZ (the blue area in Fig. 2.6a) received above-average precipitation during the observation period, with particular peaks of significantly above-average precipitation in early December. It mainly affected parts of central Italy, west-central Spain, south-western France (south of Aquitaine Limousin Poitou-Charentes, south-west of Languedoc-Roussillon Midi-Pyrenees); (4) above-average precipitation occurred in western France (Bretagne) and eastern France (eastern Auvergne Rhone-Alpes, eastern Bourgogne Franche-Comte, central Alsace Champagne-Ardenne Lorraine), southern, eastern and western UK (red areas in Fig. 2.6a), with the exception of early October, early December and late January. The countries with the most severe precipitation deficits were Germany (RAIN -12%), Italy (RAIN -9%), and France (RAIN -7%). The rainfall deficits in October have favoured the harvesting of autumn crops, but may also have delayed the germination of winter crops in northern Italy, northern Germany, and south-eastern Spain.

CropWatch agroclimatic indicators show that the MPZ experienced relatively mild weather (TEMP +1.6°C) with good light conditions (RADPAR +3%). As shown in the spatial distribution of temperature profiles, except for early and mid-December and late January, temperatures were above average in almost all the MPZ during the monitoring period, particularly in mid and late October and in late December and early January, when temperatures were significantly above average. The relatively mild weather in the MPZ has resulted in very limited winter frost damage to winter crops, but at the same time, the lack of frost conditions may increase pest and disease pressure later in the season.

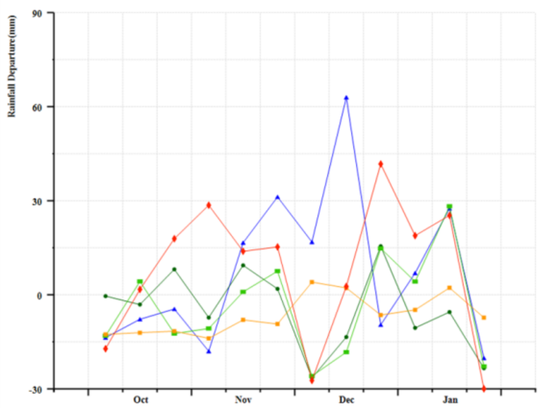
Due to favourable solar radiation and warmer-than-usual temperatures, the potential BIOMSS was 8% above average. Significant BIOMSS departures (-20% and less) occurred in the Northwest and Southeast of Italy, northeast Germany, east and northeast Spain, which was consistent with the above description of areas where precipitation deficits occurred. The average maximum VCI for the MPZ was only 0.90. The lowest VCI values also occurred in areas for which negative BIOMSS departures (-20% and less) were observed. More than 93% of arable land was cropped, which was 1% above the recent five-year average. Most uncropped arable land was concentrated in Spain and northwestern Italy, with patchy distribution in south-eastern and south-western France, and other countries. The VHI minimum map shows that north-west Italy, south-western France, east and northeast Spain were most affected by drought conditions, which is consistent with continuous rainfall deficits in these countries during the monitoring period.

Generally, crop conditions were above average or close to average in most parts of this MPZ.

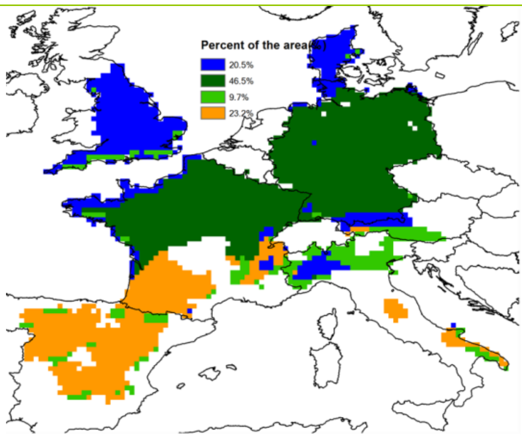
Figure 2.5 Western Europe MPZ: Agroclimatic and agronomic indicators, October 2022-January 2023.



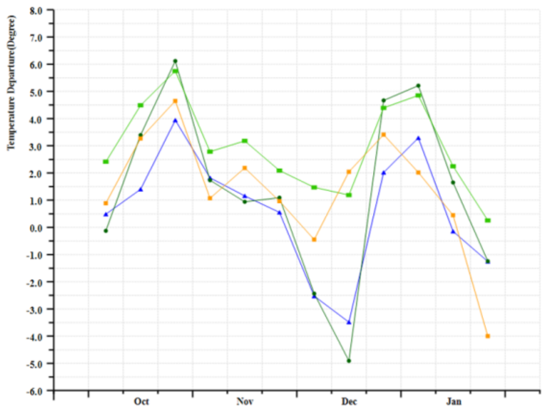
a. Spatial distribution of rainfall profiles



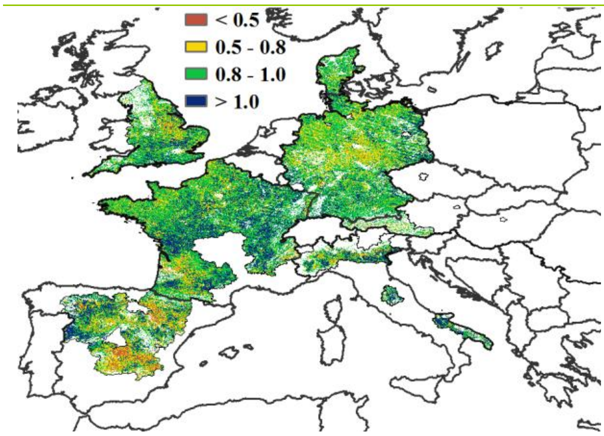
b. Profiles of rainfall departure from average (mm)



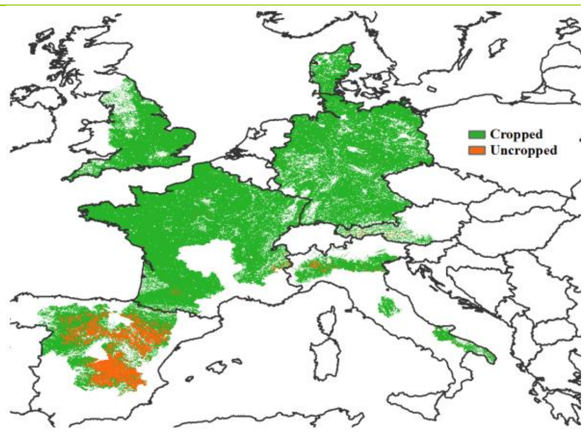
c. Spatial distribution of temperature profiles



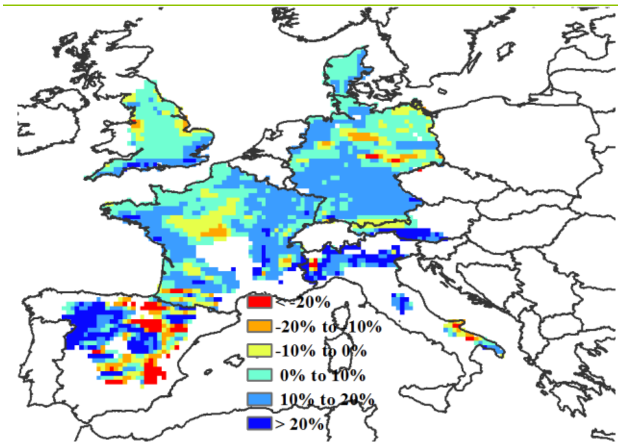
d. Profiles of temperature departure from average (mm)



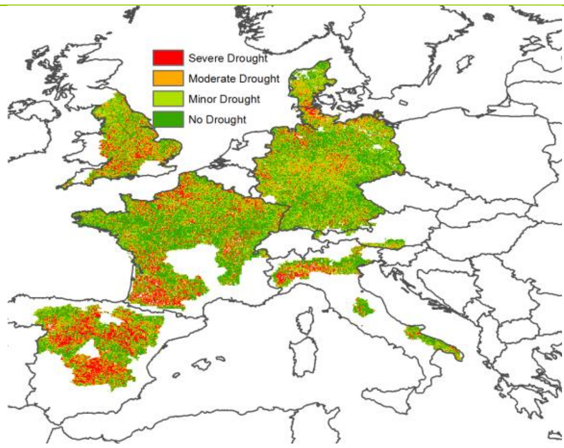
e. Maximum VCI



f. Cropped arable land



g. Biomass accumulation potential departure



h. VHI minimum

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

2.7 Central Europe to Western Russia

This monitoring period covers the sowing and the growing period of winter crops. In general, the agroclimatic indicators in this MPZ were close to average, with higher precipitation (+1%), higher temperature (+1.2°C), and lower RADPAR (-4%), as compared to the 15YA.

According to the spatial distribution map of rainfall departure, precipitation was close to the 15 year average value and the range of fluctuation was relatively small. The specific spatial and temporal distribution characteristics were as follows: (1) In October, 43.4% of the region (the west, south and northeast of the MPZ) received below-average precipitation. The reduction of precipitation provided favorable conditions for the harvest of autumn crops and the sowing of winter crops, but may also have delayed the germination and early development of winter crops; (2) In the middle of November, 68% of the regions (the southwest, central and eastern parts of the MPZ) received above-average precipitation, and the precipitation in other areas was close to the average, which helped alleviate the negative impact of insufficient precipitation in some areas in October; (3) In the middle of December, the precipitation in all areas of the MPZ exceeded the average value; (4) From late December to the end of the monitoring period, the precipitation in 88.4% of the MPZ (the northwest, central and eastern parts of the MPZ) showed a small downward trend and remained below average until the end of January.

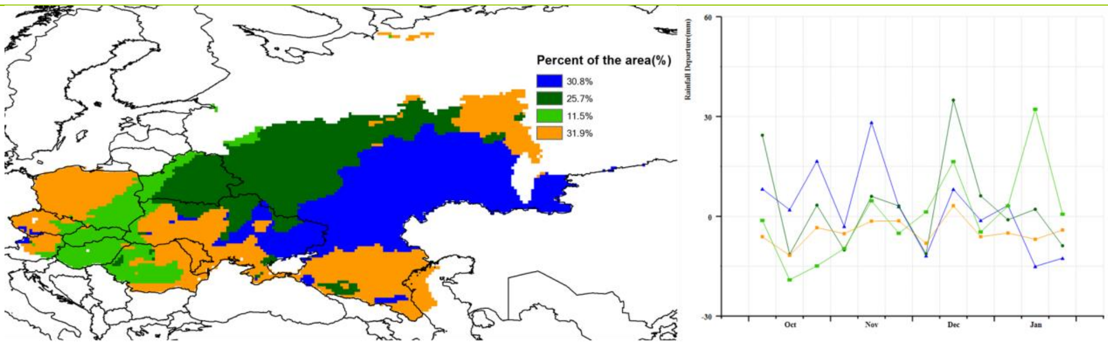
The spatial distribution of the temperature profiles shows that temperature fluctuated greatly in most areas of the MPZ. The specific spatial and temporal distribution characteristics were as follows: (1) In October, the average temperature in the MPZ trended higher than the average value. Only in the middle of October, the temperature in 38.2% of the MPZ (southwest Russia and eastern Ukraine) was slightly below-average; (2) In early December, the temperature in 63.4% of the MPZ was significantly below-average, mainly distributed in western Russia and eastern Ukraine; (3) In early and middle January, the average temperature of 36.5% of the western region in the MPZ was significantly higher than the average value of the same period in the past; (4) In late January, the average temperature of all regions in the MPZ was higher than the average.

On average, the potential biomass in the MPZ was higher than the 5YA (3%). The areas with a 20% lower potential biomass were mainly located in southern Romania and southern Russia; the areas with a 10% higher potential biomass were mainly located in the south-western part of the MPZ, including eastern Poland, southwestern Belarus, western and southeastern Ukraine, Slovakia, southwestern Czechia, eastern Austria, western Hungary, and western Romania.

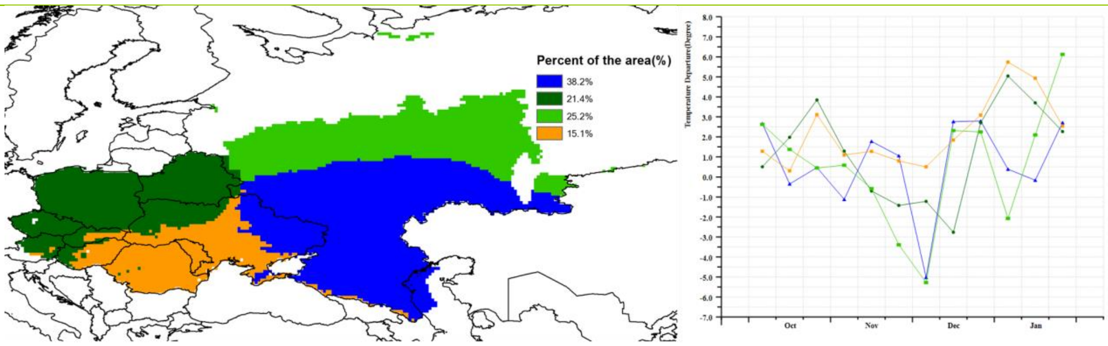
During this monitoring period, most of the arable land in MPZ was cultivated, with a CALF value of 81% (+8%). The VCIx showed a significant spatial variation, with an average value of 0.84. The regions below 0.5 were mainly in southern Ukraine, southeastern Romania, and southwestern Russia, which was consistent with the uncropped arable land map.

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

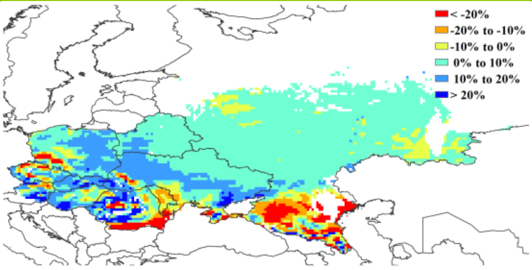
Figure 2.6 Central Europe to Western Russia MPZ: Agroclimatic and agronomic indicators, October 2022 to January 2023.



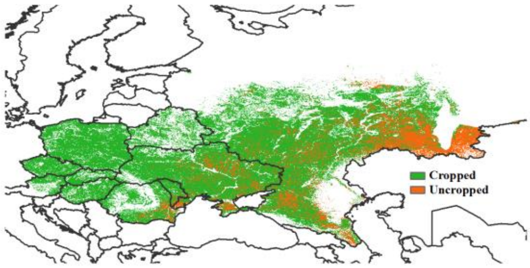
a. Spatial distribution of rainfall profiles b. Profiles of rainfall departure from average (mm)



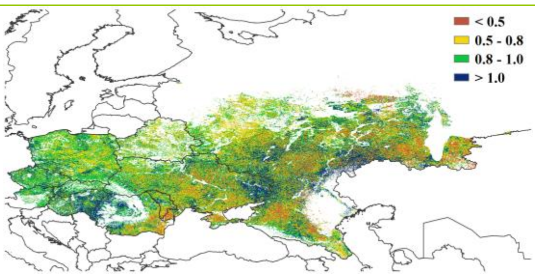
c. Spatial distribution of temperature profiles d. Profiles of temperature departure from average (℃)



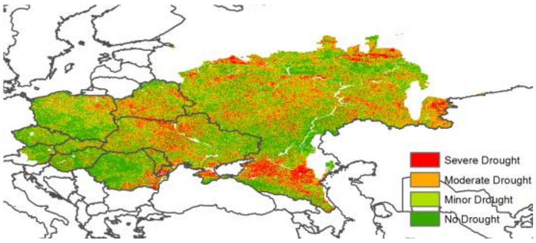
e. Biomass accumulation potential departure



f. Cropped arable land



g. Maximum VCI



h. VHI minimum

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

Chapter 3. Core countries

3.1 Overview

Chapter 1 has focused on large climate anomalies that sometimes reach the size of continents and beyond. The present section offers a closer look at individual countries, including the 44 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.

3.1.1 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 patterns 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.

3.1.2 Overview of weather conditions in major agricultural exporting countries

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

Maize: Harvest in the Northern Hemisphere was completed by last November. In the USA, conditions were favorable in the corn belt, but drought conditions in the south caused yield reductions. In Europe, the summer of 2022 was marked by record heat and extended periods of droughts, which caused a decline in yield. In China, conditions for maize production were generally favorable. In the Southern Hemisphere, maize planting started at the beginning of the rainy season in November and December. In Brazil, most maize is sown as a second crop towards the end of the rainy season, after soybean harvest in February. First season maize was sown in October in Brazil. In Argentina, maize production was affected by severe drought conditions. Similarly, maize production in Eastern Africa, especially in Kenya and Tanzania is suffering from the prolonged, multi-year drought. In southern Africa, conditions for maize planting were close to normal. Similarly, conditions were quite favorable in Bangladesh and other countries in South and South-East Asia, where maize is grown under irrigation in the dry winter months.

Rice: Harvest of rainfed rice in China, Pakistan, India, Bangladesh and South-East Asia was completed by November. The conditions during the monsoon season had been quite favorable for high production levels, apart from Pakistan, where flooding destroyed a substantial part of the rice crop. Production was also reduced in Myanmar, where a rainfall deficit and internal conflicts combined with high input costs caused a yield reduction. In the other countries of South-East Asia, conditions were favorable for rice production. Production in the other parts of the world is minor in relation to Asia. It is expected to remain stable in Nigeria and West Africa as a whole, although rainfall had stayed below average and was erratic during the rainy season. Conditions for rice in Argentina, predominantly sown in Mesopotamia, were poor due to the severe rainfall deficit.

Wheat: Wheat harvest in Argentina took place in December. Severe drought and untimely frost curbed production almost by half, as compared to last year. In Brazil, on the contrary, conditions were favorable. In South Africa, conditions were unfavorable in the Western Cape, but they were much better in the other regions, i.e., Free State, Limpopo and Northern Cape. All in all, production in South Africa is close to normal. Australia benefitted from above-average rainfall, which ensured favorable conditions for wheat production. In the USA, Europe, Russia and China, winter wheat sowing was mostly completed by the end of October. In most regions, moisture conditions have been favorable, apart from Kansas and Oklahoma, where dry conditions persisted. Türkiye, the Maghreb and the Levant are also suffering from severe rainfall deficits, which most likely will cause poor yields. In South Asia, conditions for wheat sowing were favorable. Pakistan is still recovering from the floods, but the planting of wheat was close to average.

Soybean: Brazil and the USA are the dominant exporters of soybean. Together, they account for more than 80% of global exports. Soybean production in Brazil has benefitted from generally favorable conditions. Rainfall was below average, but still sufficient to ensure high production. In Argentina, the drought is causing a major reduction in yields.

3.1.3. Weather anomalies and biomass production potential changes

3.1.3.1 Rainfall

In South America, rainfall was far below average in most countries. The only exception was the Dry Pampas and the foothills of the Andes in Argentina. However, the wheat and soybean-producing regions of Argentina were severely affected by the drought conditions. Conditions were drier than normal in Brazil as well. However, in Brazil rainfall levels are generally much higher than in Argentina. Hence, rainfall was still sufficient to ensure high levels of production in that country. Mexico, which entered the drier winter months, also suffered from a rainfall deficit. In the USA and Canada, rainfall was generally near average. California and the Western States benefitted from above-average rainfall, which helped restore water levels in the reservoirs to normal levels. In Africa, rainfall was generally below average. It limited the production of wheat in the Maghreb and maize in East Africa. Conditions are also drier than usual in southern Africa, where the rainy season started during this monitoring period. In Europe, rainfall conditions were generally close to average. However, wheat production in Türkiye and the Near and Middle East will suffer from the precipitation deficit. Hardly any crops are grown in Southern China during this monitoring period, where rainfall was also below average. Myanmar’s crop production was negatively impacted by the rainfall deficit. Wheat in Australia benefitted from above-average rainfall.

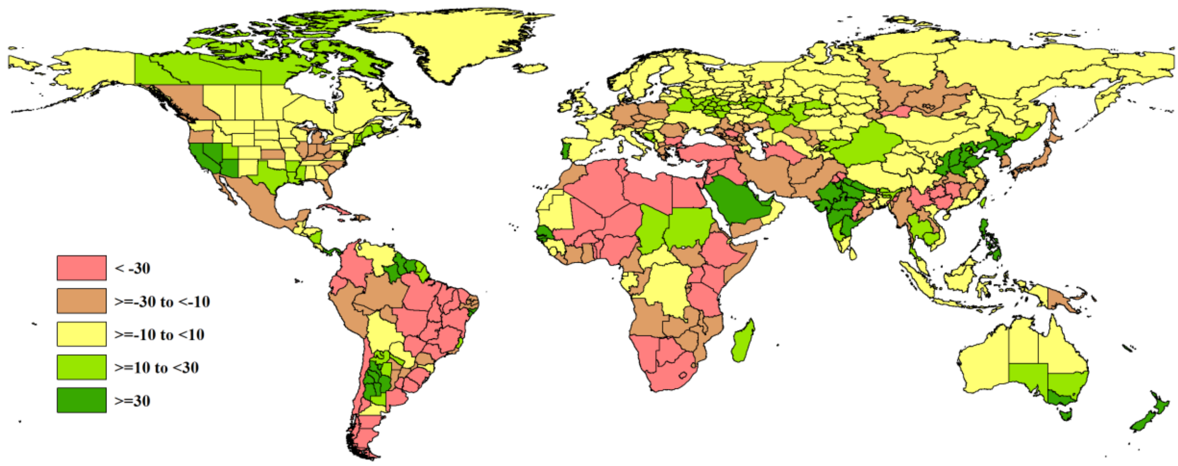


Figure 3.1 National and subnational rainfall anomaly (as indicated by the RAIN indicator) of October 2022 to January 2023 total relative to the 2008-2022 average (15YA), in percent

3.1.3.2 Temperatures

The temperature profile tends to show opposite trends as compared to rainfall. Regions with above-average rainfall experienced relatively cooler conditions, whereas, in dryer-than-usual regions, temperatures were above average. Temperatures in most of South America were above average. In the USA, temperatures were below average in the western states and above average in the eastern states. In Africa, temperatures were close to average. Almost all of Europe experienced above-average temperatures. Together with favorable rainfall, they helped wheat get well established. The same pattern was observed for the North China Plain. In Australia, temperatures were cooler than normal.

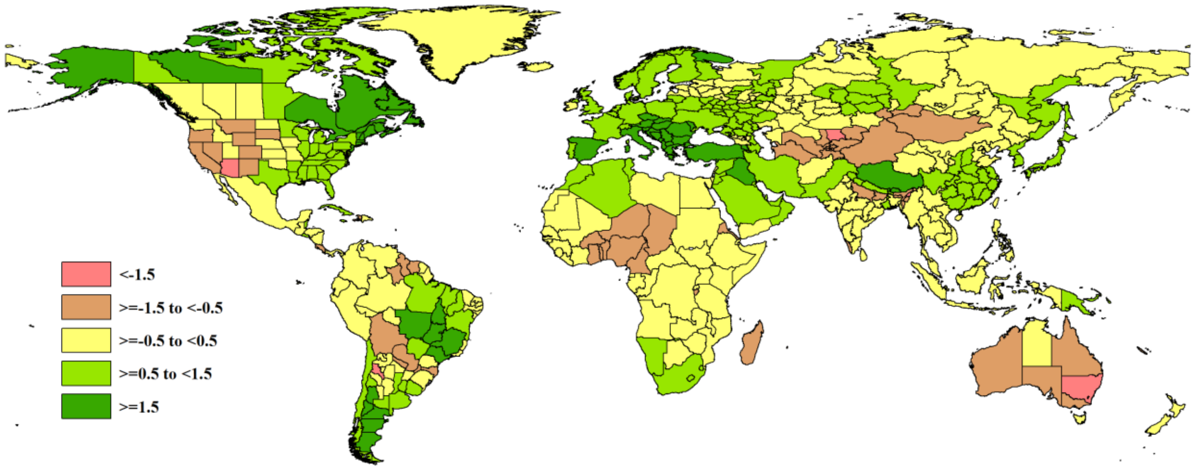


Figure 3.2 National and subnational temperature anomaly (as indicated by the TEMP indicator) of October 2022 to January 2023 average relative to the 2008-2022 average (15YA), in °C

3.1.3.3 Solar radiation

In Argentina and Brazil, conditions were heterogeneous. Below-average solar radiation was observed for Central and Eastern Brazil, as well as the province of Buenos Aires and the provinces to its west in Argentina. Above-average solar radiation was observed for the Northwest of South America and most of Central America. In the USA, solar radiation was generally below average. In South-East Africa, solar radiation was above average. The Levant also experienced average to above-average solar radiation levels. A strong positive departure was observed for Western Europe, whereas in Russia west of the Ural, solar radiation levels were far below average. Most of South and Southeast Asia received more sunshine than usual. Australia, which was more humid than usual, had below-average solar radiation.

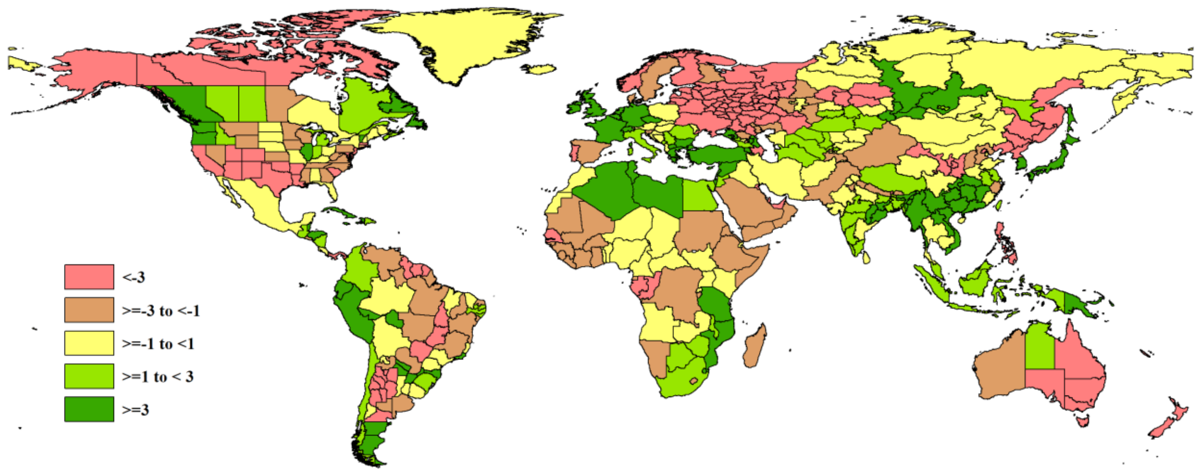


Figure 3.3 National and subnational sunshine anomaly (as indicated by the RADPAR indicator) of October 2022 to January 2023 total relative to the 2008-2022 average (15YA), in percent

3.1.3.4 Biomass production

The BIOMSS indicator is controlled by temperature, rainfall, and solar radiation. In some regions, rainfall is more limiting, whereas in other ones, mainly tropical ones, solar radiation tends to be the limiting factor. For high-latitude regions, the temperature may also limit biomass production. In the crop production regions of Argentina and Brazil, the estimated biomass production was mostly below or even far below average (<-10%). The same conditions apply to Mexico. In the USA and Canada, biomass production ranged from average to far above average. The countries bordering the southern and eastern coast of the Mediterranean Sea had far below biomass production, due to the drought conditions. In East and southern Africa, biomass production was also far below average. Similarly, conditions were not conducive for biomass production in Central Asia, Myanmar, Southern China and Western Australia. In India, the North China Plain and New Zealand, conditions for biomass production were favorable.

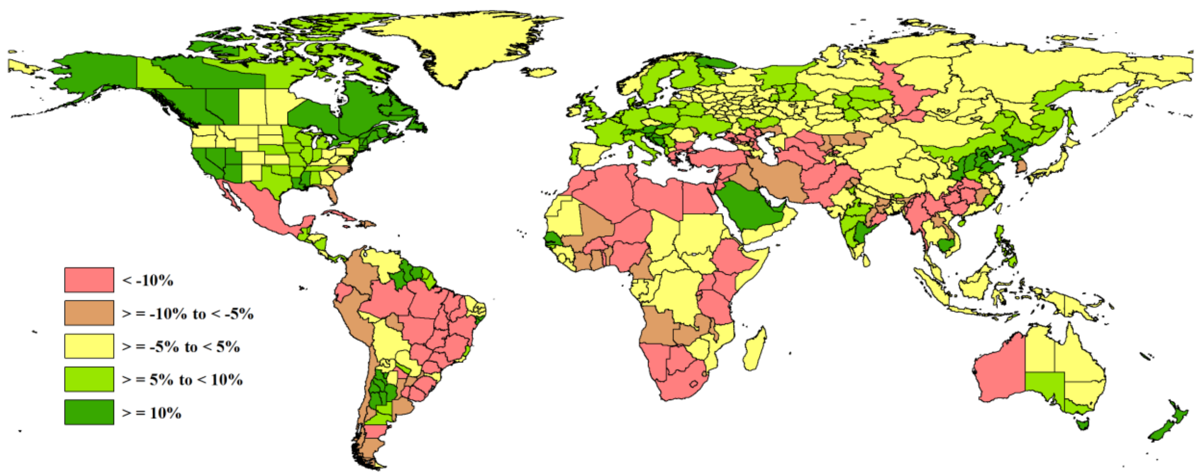


Figure 3.4 National and subnational biomass production potential anomaly (as indicated by the BIOMSS indicator) of October 2022 to January 2023 total relative to the 2008-2022 average (15YA), in percent

Table 3.1 October 2022 to January 2023 agro-climatic and Agronomic indicators by country, current value and departure from average.

Code		Agro-climatic indicators				Agronomic indicators	
	Country	Departure from 15YA (2005-2020)				Departure from 5YA (2015-2020)	Current
		RAIN (%)	TEMP(°C)	PAR(%)	BIOMSS (%)	CALF (%)	VCIx
AFG	Afghanistan	-28	0.0	0	-16	3	0.47
DZA	Algeria	-55	1.4	9	-33	-24	0.53
AGO	Angola	-25	0.1	0	-8	3	0.87
ARG	Argentina	-3	0.5	-1	-1	-12	0.61
AUS	Australia	17	-1.4	-5	2	45	1.08
BGD	Bangladesh	-1	0.2	3	-1	0	0.90
BLR	Belarus	20	1.1	-15	7	-1	0.80
BRA	Brazil	-49	1.0	-1	-23	1	0.93
KHM	Cambodia	22	-0.5	0	10	-1	0.85
CAN	Canada	-6	1.2	2	11	-4	0.74
CHN	China	-14	0.6	5	-6	-6	0.82
EGY	Egypt	-30	0.2	3	-13	0	0.73
ETH	Ethiopia	-33	0.0	-1	-14	2	0.93
FRA	France	-7	1.5	4	8	1	0.92
DEU	Germany	-12	1.3	7	7	0	0.88
HUN	Hungary	0	2.1	-1	10	10	0.99
IND	India	4	-0.2	2	1	1	0.88
IDN	Indonesia	-2	0.0	2	2	0	0.93
IRN	Iran	-19	0.6	0	-9	-5	0.53
ITA	Italy	-9	2.1	2	6	5	0.94
KAZ	Kazakhstan	4	0.0	0	1	-48	0.65
KEN	Kenya	-30	0.1	0	-14	-6	0.75
KGZ	Kyrgyzstan	12	-1.5	0	-2	-38	0.71
MEX	Mexico	-19	0.2	0	-13	4	0.85
MNG	Mongolia	-4	-0.5	0	-3	-69	0.66
MAR	Morocco	-28	1.0	0	-19	-17	0.60
MOZ	Mozambique	-12	0.1	3	-3	2	0.90
MMR	Myanmar	-28	0.4	5	-14	0	0.88
NGA	Nigeria	-32	-0.9	0	-13	4	0.89
PAK	Pakistan	-17	0.6	-1	-14	4	0.98
PHL	Philippines	31	0.0	-4	6	0	0.94
POL	Poland	-15	1.2	1	6	0	0.86
ROU	Romania	-14	2.5	2	-1	6	0.88
RUS	Russia	3	0.5	-5	1	-4	0.79
ZAF	South Africa	-41	1.1	2	-15	16	0.88
LKA	Sri_Lanka	-9	-0.3	1	3	0	0.94
SYR	Syria	-54	1.2	4	-29	-23	0.45
THA	Thailand	23	-0.3	0	3	-1	0.86
TUR	Türkiye	-46	1.6	4	-23	-3	0.75
UKR	Ukraine	-1	1.4	-7	7	13	0.83
GBR	United Kingdom	-2	0.8	9	6	0	0.90
USA	United States	1	0.5	-2	6	-6	0.75
UZB	Uzbekistan	-5	-1.1	2	-13	29	0.86
VNM	Vietnam	-6	0.2	6	-2	0	0.93
ZMB	Zambia	-18	-0.1	0	-6	0	0.90

3.2 Country analysis

This section presents CropWatch analyses for each of 44 key countries (China is addressed in Chapter 4). The maps and graphs refer to crop growing areas only: (a) Phenology of major crops; (b) Crop condition development based on NDVI over crop areas at the national scale, comparing the October 2022 - January 2023 period to the previous season and the five-year average (5YA) and maximum; (c) Maximum Vegetation Condition Index over arable land (VCIx) for October 2022 - January 2023 by pixel; (d) Spatial NDVI patterns up to October 2022 - January 2023 according to local cropping patterns and compared to the 5YA; and (e) NDVI profiles associated with the spatial pattern under (d). Next, separate graphs (labeled as figures (f), (g), and subsequent letters) are included to illustrate crop condition development graphs based on NDVI average over crop areas for different agro-ecological zones (AEZ) within a country, again comparing the October 2022 - January 2023 period to the previous season and the five-year average (5YA) and maximum.

Refer to Annex A, Table A.1-A.11 for additional information about indicator values by country. Country agricultural profiles can be explored using the CropWatch Explore module on the **cloud.cropwatch.com.cn** website. CropWatch provides open access to the module.

Figures 3.5 - 3.48; Crop condition for individual countries ([AFG] Afghanistan to [ZMB] Zambia) including agro-ecological zones (AEZ) from October 2022 - January 2023.

[AFG] Afghanistan

Winter wheat and rice are the main cereals that are grown in Afghanistan. Winter wheat was sown in October and November. Rice was harvested in October and November.

The agro-climatic conditions showed that RAIN decreased by 28%. TEMP and RADPAR were at the average level. BIOMSS decreased by 16%. The CALF was only 3%, increased by 3%, and the VCIx was only 0.25.

According to the last CropWatch bulletin, it was found that heavy rains and floods occurred in Parwan and Nangarhar provinces in August. After August, there was a drought. The drought situation was particularly severe in northern Afghanistan. According to the crop condition development graph based on NDVI, the NDVI was close to the average level between October and December and was lower than that of last year and the 5-year average in January.

The spatial distribution of the NDVI profiles shows that 39.9% 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 44% of the total cropped areas was negative in January, mainly in the north of Afghanistan. This may be caused by extremely cold weather and snow. These areas are experiencing the coldest winter in the past 15 years, with the lowest temperature reaching minus 34º C. Many parts of Afghanistan were completely covered by snow. About 16.2% of total cropped areas were below average levels, mainly distributed in northern Afghanistan. Maximum VCI shows similar results. In addition, the CPI of Afghanistan was 0.98, which indicates a poor overall agricultural production situation.

Overall, the multi-year drought and cold winter cause challenges for the country's food security.

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).

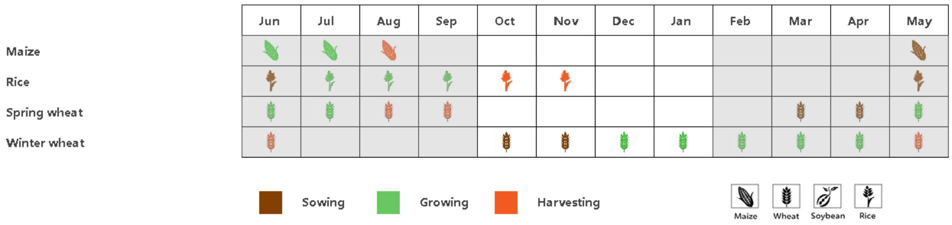
The RAIN in the Central region with sparse vegetation was 79 mm (-29%). The TEMP was 1.5°C (+1.4°C). The RADPAR was 808 MJ/m2, at an average level. According to the NDVI-based crop condition development graph, the NDVI was at the average level between October and January. BIOMSS decreased by 5%, CALF had decreased by 44% and VCIx was 0.44. Except for January, crop conditions in this region were near average.

The Dry region recorded 68 mm of rainfall (RAIN -24%), TEMP was higher than average at 7.9°C, and RADPAR was 854 MJ/m2. According to the NDVI-based development graph, crop conditions were close to the five-year average from October to December and were below the average level in January. CALF in this region was only 2% and VCIx was 0.28.

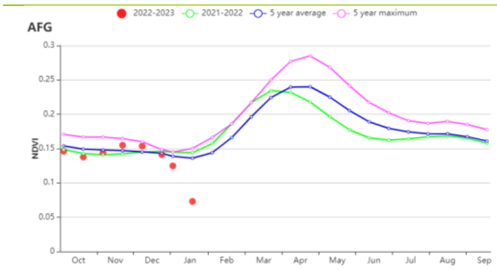
In the Mixed dry farming and irrigated cultivation region, the following indicator values were observed: RAIN 139 mm (-26%); TEMP 2.5°C (-0.5°C); RADPAR 723 MJ/m2 (+1%). BIOMSS decreased by 16% and CALF was 4% above average. According to the NDVI-based crop condition development graph, NDVI was close to the average level and VCIx was 0.65. The crop condition is at the average level.

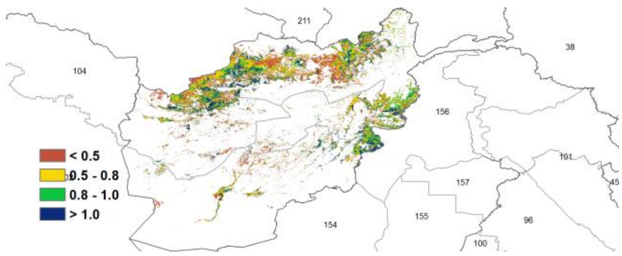
The Mixed dry farming and grazing region recorded 54 mm of rainfall (RAIN -47%). TEMP was 5.4°C (-0.2°C) and RADPAR was 783 MJ/m2, near average levels. CALF was 0%. VCIx was 0.41 and BIOMSS decreased by 28%. According to the crop condition development graph, the NDVI was much lower than the 5YA since December, indicating poor conditions.

Figure 3.5 Afghanistan's crop condition, October 2022 - January 2023

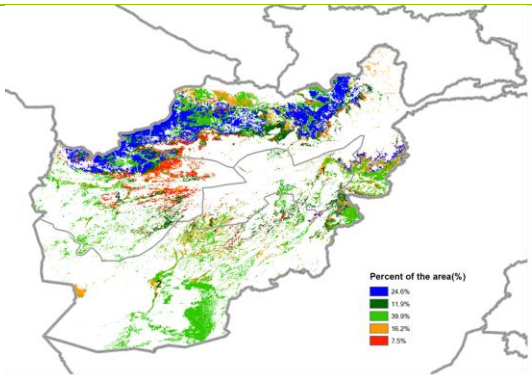


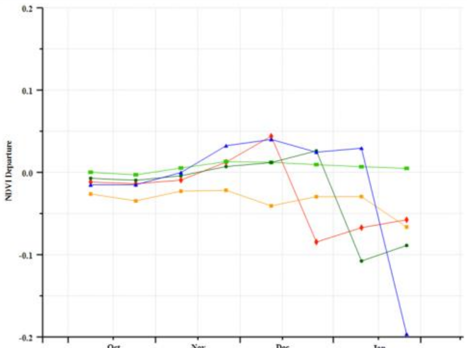
(a). Phenology of major crops



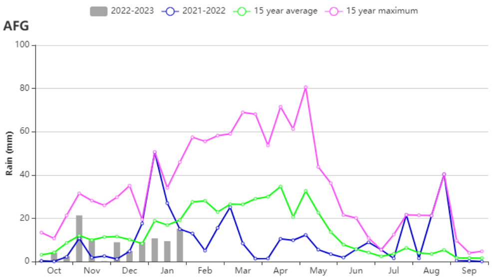


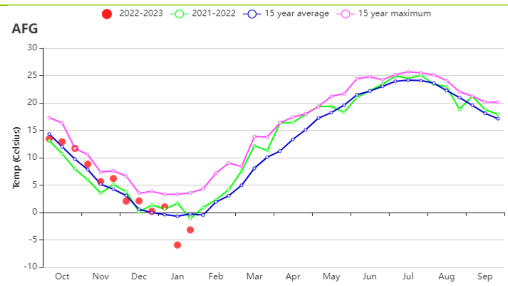
(b) Crop condition development graph based on NDVI (c) Maximum VCI



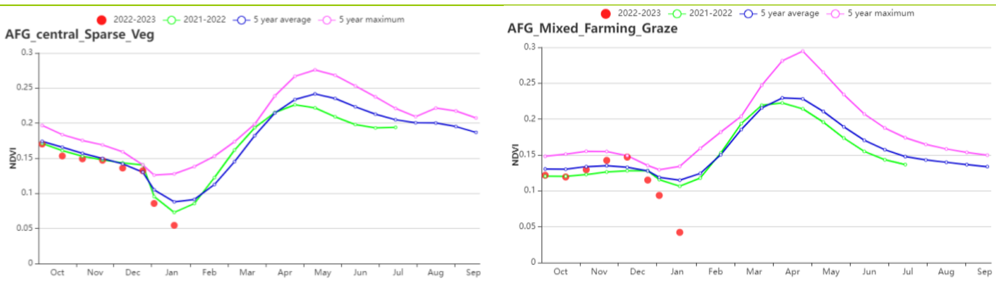


(d) Spatial NDVI patterns compared to 5YA (e) NDVI profiles

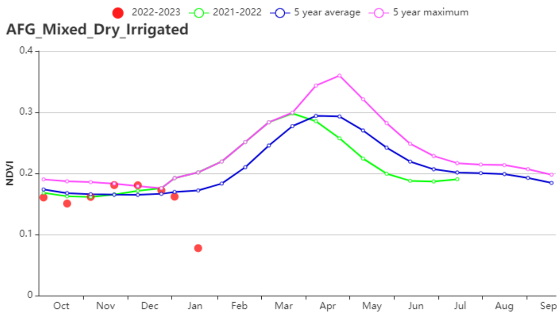


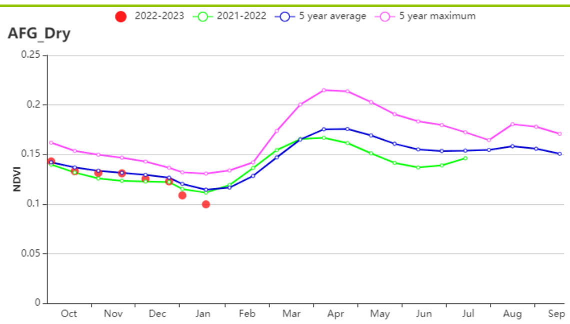


(f) Rainfall profiles (g) Temperature profiles



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





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

Table 3.2 Afghanistan's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, October 2022 - January 2023

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Central region	79	-29	1.5	1.4	808	0	254	-5
Dry region	68	-24	7.9	0.6	854	-1	257	-7
Dry and irrigated cultivation region	139	-26	2.5	-0.5	723	1	289	-16
Dry and grazing region	54	-47	5.4	-0.2	783	0	220	-28

Table 3.3 Afghanistan's agronomic indicators by sub-national regions, current season's values and departure from 5YA, October 2022 - January 2023

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Central region	1	-44	0.44
Dry region	2	15	0.28
Dry and irrigated cultivation region	6	4	0.65
Dry and grazing region	0	12	0.41

[AGO] Angola

The October 2022 - January 2023 monitoring period covers the growing period of rice and maize, while the harvest of wheat concluded in October. Based on NDVI, the crop conditions in Angola were below the average of the past 5 years during most of the monitoring period. These conditions can be attributed to below-average rainfall (663 mm), which was 25% lower than the 15YA. Although the temperature recorded a slightly positive change (TEMP +0.1ºC) and the photosynthetic active radiation was near the average of the past fifteen years, the estimated biomass production decreased by 8%. The decrease in biomass production may have been caused by the rainfall deficit, which, even though it occurred across most of the country, was more severe in the coastal strip and lower southern regions.

The effects of the rainfall deficit are also revealed when analyzing the NDVI departure clustering map, which indicates below-average crop conditions in 62.5% of the cropped area during the entire monitoring period. The regions with relatively poor crop conditions include the provinces of Cunene, Namibe, Huíla, Benguela, and Huambo. Despite these poor conditions, 17.6% of the cropped area across the country registered above-average crop conditions, especially in the provinces of Zaire, Bengo, and Cuanza Norte. While the mean vegetation condition index (VCIx) was 0.87, the cropped arable land fraction (CALF) increased by 3%. The cropping production index (CPI) was 1.12. Mostly depending on the rainfall, the crop conditions across the country were generally close to favorable, apart from the drier Semi-arid zone and Central Plateau.

Regional analysis

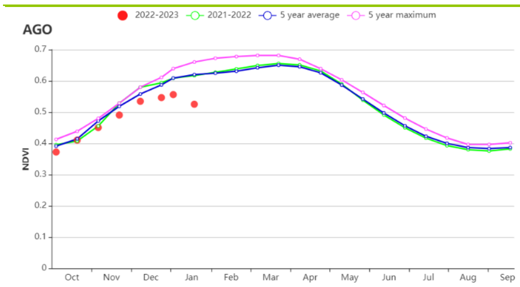
Considering the cropping systems, climate zones and topographic conditions, CropWatch has divided Angola into five agroecological zones (AEZs), including the **Arid zone** (5), **Central Plateau** (6), **Humid zone** (7), **Semi-arid zone** (8), and **Sub-humid zone** (9).

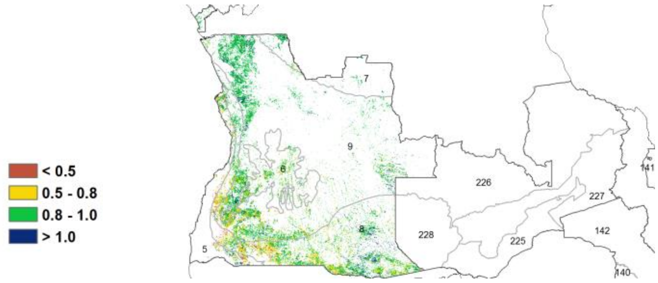
During the monitoring period, compared to the 15-year average, cumulative rainfall in the country's agroecological regions decreased. These decreases were 36% in the Semi-arid zone, 32% in the Central Plateau, 24% in the Semi-humid zone, 16% in the Arid zone, and 5% in the Humid zones. Positive temperature anomalies were recorded especially in the Semi-arid zone (TEMP +0.4ºC). The RADPAR had a slight increase of 1% in the Humid zone and a negative anomaly of 2% in the Arid zone. These elements negatively impacted the total biomass production, which, except for the Humid zone (BIOMSS 0%), decreased in the Semi-arid zone (-12%), Arid zone (-9%), Sub-humid zone (-6%), and Central Plateau zone (-5%).

Based on NDVI crop development profiles, crop conditions were slightly unfavorable in most agroecological zones during the monitoring period. In the Semi-arid zone, better crop conditions (above average) were observed from early October to late November. Subsequently, they decreased. The CALF had a positive anomaly in all agroecological zones, except for the Humid zone while the maximum vegetation condition index (VCIx) was situated between 0.80 and 0.95. The positive changes in CALF were recorded in the Arid zone (+24%), Central Plateau (+4%), Semi-arid zone (2%), and Sub-humid zone (3%).

Figure 3.6. Angola's crop condition, October 2022 – January 2023

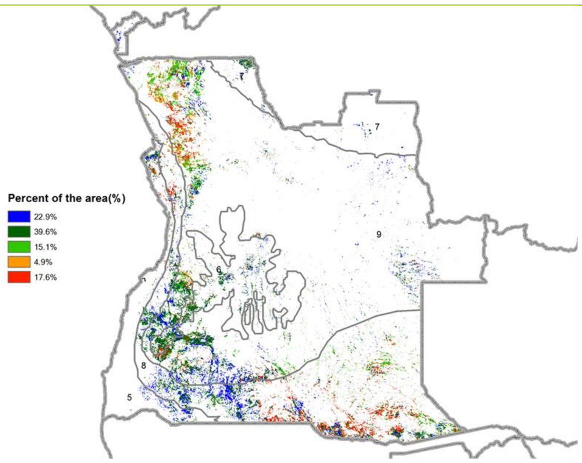
(a) Phenology of major crops

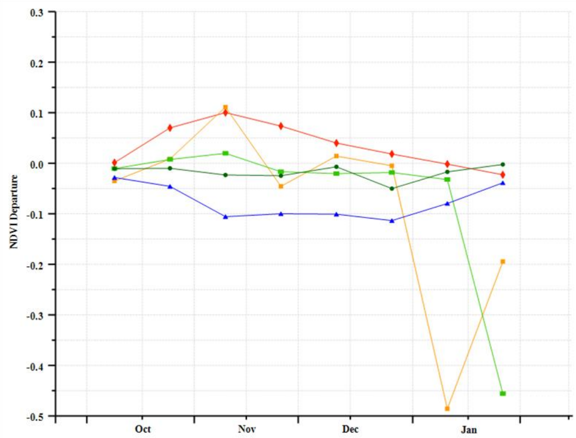




(b) Crop condition development graph based on NDVI

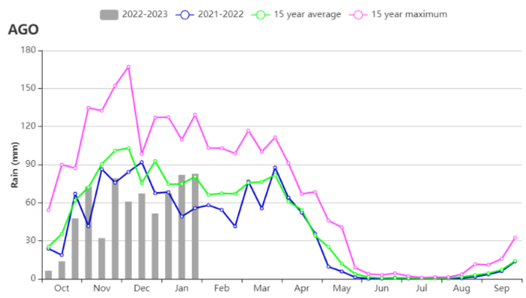
(c) Maximum VCI

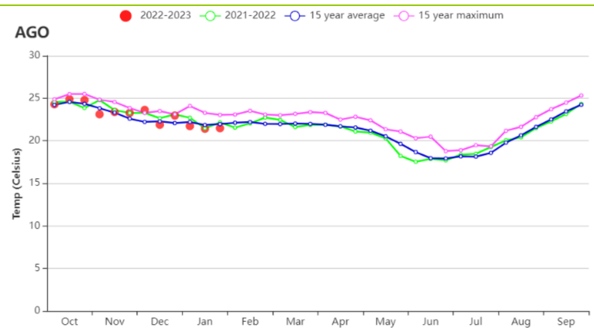




(d) Spatial NDVI patterns compared to 5YA

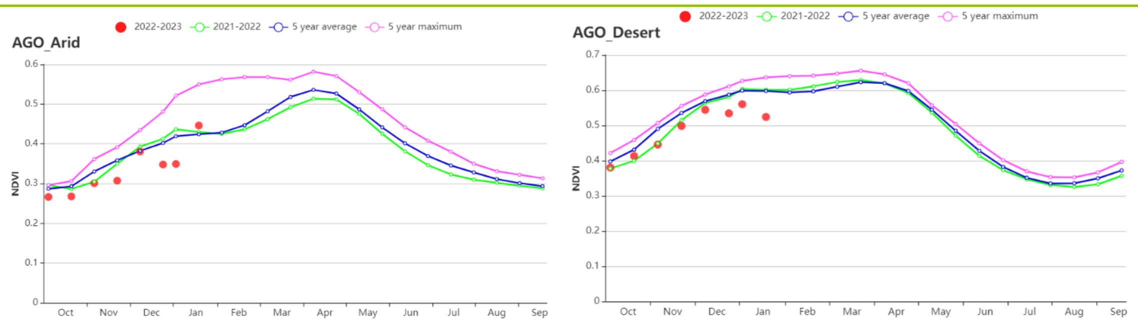
(e) NDVI profiles



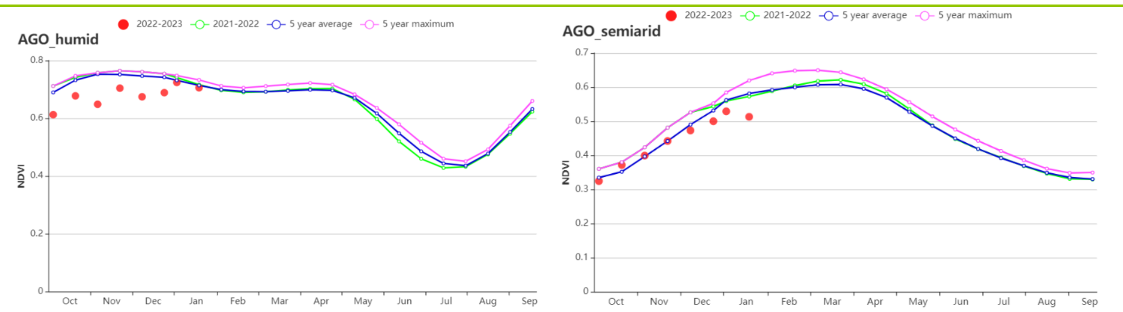


(f) National time-series rainfall profiles

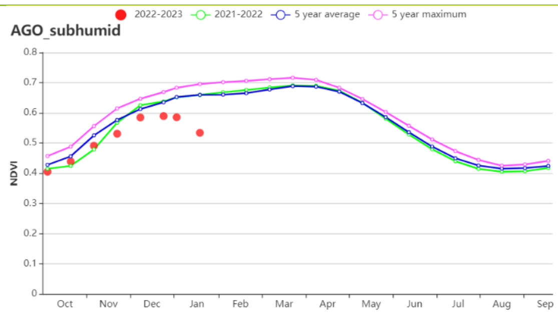
(g) National time-series temperature profiles



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



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



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

Table 3.4. Angolas's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, October 2022 – January 2023

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m2)	Current (mm)	Departure (%)	Current (°C)
Arid Zone	342	-16	24.9	0.1	1341	-2	948	-9
Central Plateau	730	-32	19.4	0.1	1183	0	1204	-5
Humid zone	1240	-5	22.1	0.0	1186	1	1509	0
Semi-Arid Zone	407	-36	24.5	0.4	1319	0	1024	-12
Sub-humid zone	773	-24	22.2	0.0	1202	0	1243	-6

Table 3.5. Angolas's agronomic indicators by sub-national regions, current season's values and departure from 5YA, October 2022 – January 2023

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Arid region	58	24	0.80
Central Plateau	93	4	0.85
Humid zone	100	0	0.95
Semi-Arid Zone	90	2	0.84
Sub-humid zone	97	3	0.89

[ARG] Argentina

The reporting period covers the main growth stages for early maize, early soybean, and rice, the planting of late maize and late soybean and the harvesting of wheat. Several indices show poor conditions for Argentina: negative anomalies of NDVI all along the period were observed in main AEZs, as well as generally low values of VCIx and surface soil moisture, and the lowest CPI values in the last ten years. In addition, a reduction of planted area (CALF) is observed in several AEZs.

For the whole country, three indices showed low variation compared to the 15 year average: rainfall showed a slight negative anomaly of -3 %, TEMP showed a slight positive anomaly of +0.5°, BIOMSS showed a -1 % negative anomaly. The other two indices showed strong reductions: CALF showed a -12 % negative anomaly and VCIx showed a value of 0.61. CPI for the country was 0.74, the lowest value in the last ten years.

For the whole country, the crop condition development graph based on NDVI showed NDVI values below the five years average during the entire reporting period. Values were lower than in the 2021-2022 growing season. In all AEZs, observed values were below average throughout the monitoring period. In particular, in Mesopotamia, the differences to the average values became larger during December and January. For the whole country, rainfall showed negative anomalies only during short periods, like at the beginning and end November and mid-December. Temperature showed variation between negative and positive anomalies, with the dominance of positive anomalies such as from mid-November to the beginning of December and at the end of January.

Spatial distribution of NDVI profiles allowed for the clustering of the area into five classes. Three profiles showed a tendency of reduced NDVI along the reporting period. The orange profile showed near no anomaly during October and November and negative anomalies between -0.5 and -0.1 during December and January. This profile was observed in Center, South-West and North-West Pampas. The dark green profile showed negative anomalies around -0.1 during October and November, which were reduced by up to -0.15 in January. This profile was mainly located in West Pampas and East Subtropical Highlands. The red profile showed slight negative anomalies at the beginning of the reporting period and showed a strong reduction up to January where values near -0.3 were observed. This profile was located in Mesopotamia and North-West Humid Pampas. A stable profile with negative anomalies around -0.2 (light green) was observed in Center-East and North-East Pampas and Chaco. Finally, a profile with a positive tendency, showing values near -0.15 during October and the beginning of November and with nearly no anomaly in January (blue) was observed in South-East and Center-West Pampas.

VCIx showed very low values (lower than 0.5) in North and North-East Pampas, Chaco, East Subtropical Highlands and South Mesopotamia. Good conditions were only observed in part of West and South Pampas and South-West Subtropical Highlands.

Surface soil moisture showed quite low values (less than 30 %) for almost all the agricultural areas of the country. Lower values were observed in Center and North-East Pampas, South Mesopotamia and South Subtropical Highlands. SPI index showed normal conditions for most of the Argentine agricultural area, with cases of moderate to severe drought in Center East Pampas and South Mesopotamia. Wet conditions based on SPI were observed in North-West Pampas and Subtropical Highlands.

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.

In Chaco and Subtropical Highlands main crops are soybean and maize. Main crops in Pampas and South Mesopotamia are soybean, maize and wheat, while in North Mesopotamia the main crop is rice.

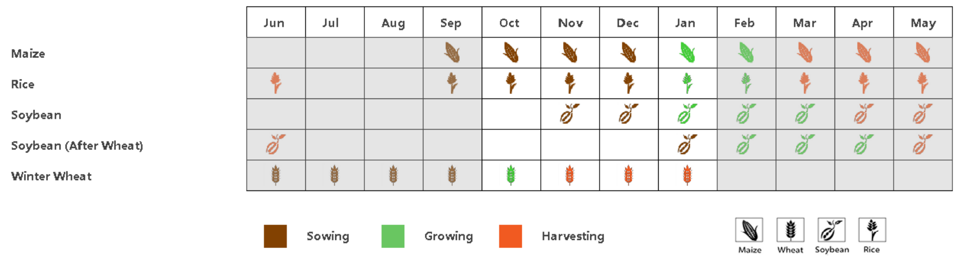
Three of the AEZs showed negative anomalies in RAIN: Mesopotamia (-30 %), Chaco (-11%) and Pampas (-6%), while Subtropical Highlands showed a positive anomaly of +45 %. TEMP showed positive anomalies in Humid Pampas (+1.2°) and Mesopotamia (+0.1°) and negative anomalies in Subtropical Highlands (-0.4°) and Chaco (-0.3°). RADPAR showed negative anomalies in Subtropical Highlands (-4%) and Pampas (-1%), and positive anomalies in Mesopotamia (+2%) and Chaco (+1%).

BIOMSS showed negative anomalies in Mesopotamia (-11%), Chaco (-4%) and Humid Pampas (-2%), and positive anomalies in Subtropical Highlands (+5%). CALF showed negative anomalies in the four AEZs: Chaco (-31%), Subtropical Highlands (-25%), Humid Pampas (-9%) and Mesopotamia (-1%). VCIx showed poor conditions for all AEZs: Chaco (0.43), Subtropical Highlands (0.56), Humid Pampas (0.63) and Mesopotamia (0.62). For all AEZs also the CPI values for 2023 were the lowest in the last ten years. In particular, Chaco and Humid Pampas showed quite lower values than in other years.

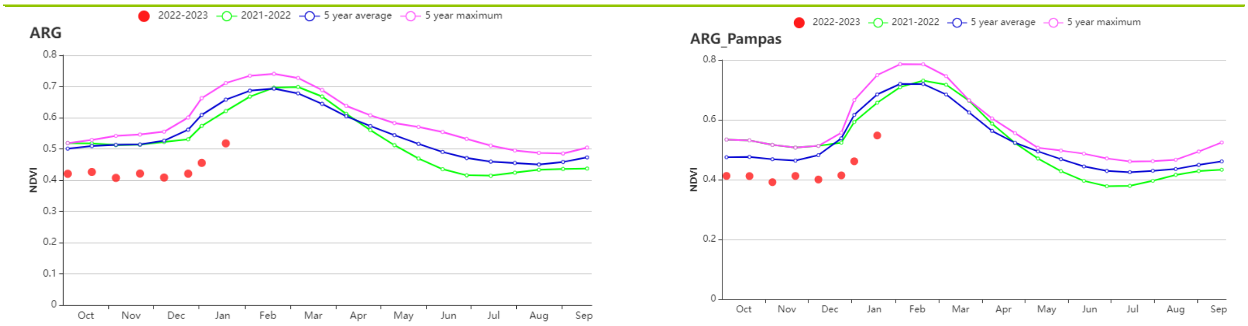
Summary

Poor crop conditions have been observed in Argentina. The persistence of these conditions is reflected in some indices, such as negative anomalies in NDVI, low VCIx and low CALF, which were also observed during the last reporting period. These could have affected the final stages of wheat, where yield is defined, as well as the development of early maize, early soybean and rice. The observed drought conditions may have delayed the planting of soybean, rice and late maize, which may partially explain the negative NDVI anomalies. The return to normal rainfall conditions observed at the end of the period may improve conditions for late planted summer crops.

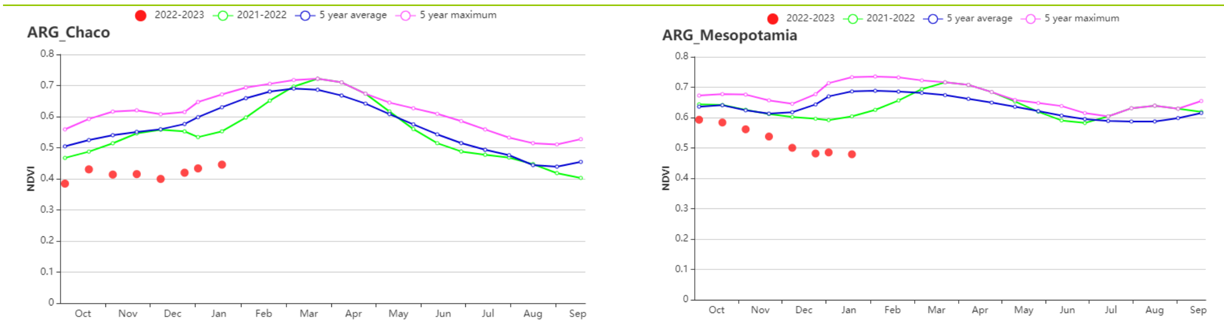
Figure 3.7 Argentina's crop condition, October 2022-January 2023



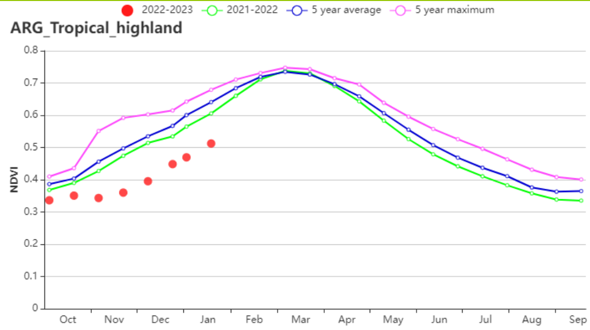
(a). Phenology of major crops

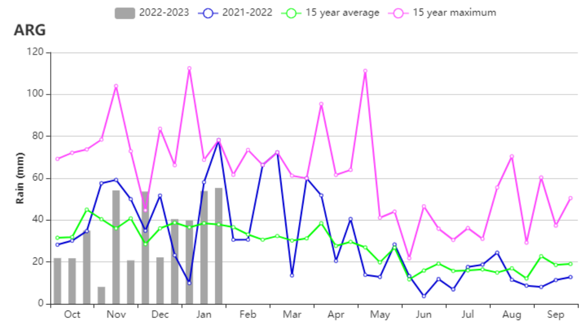


(b) Crop condition development graph based on NDVI (Argentina) (c) Crop condition development graph based on NDVI (Pampas)

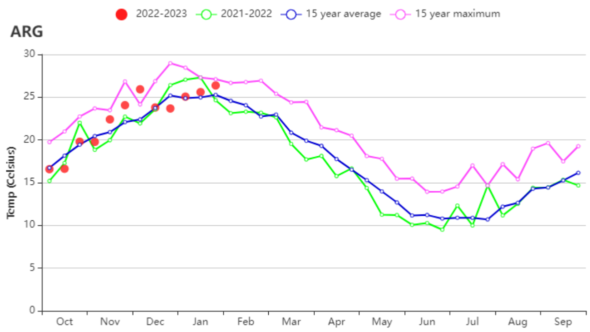


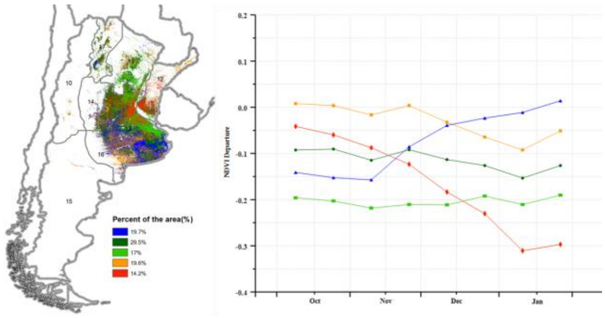
(d) Crop condition development graph based on NDVI (Chaco) (e) Crop condition development graph based on NDVI (Mesopotamia)



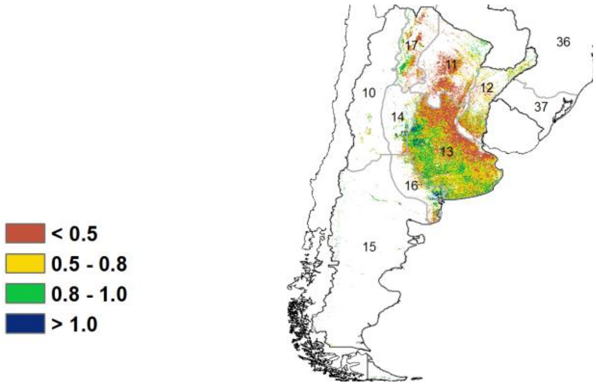


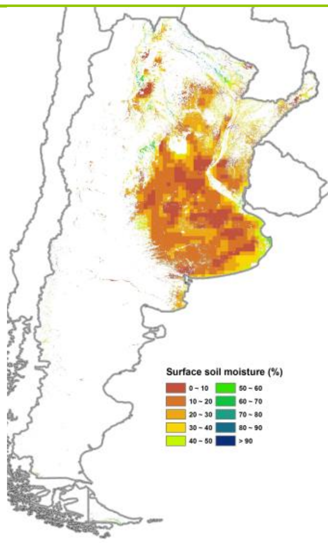
(f) Crop condition development graph based on NDVI (Subtropical Highlands) (g) Time series of rainfall profile (Argentina)



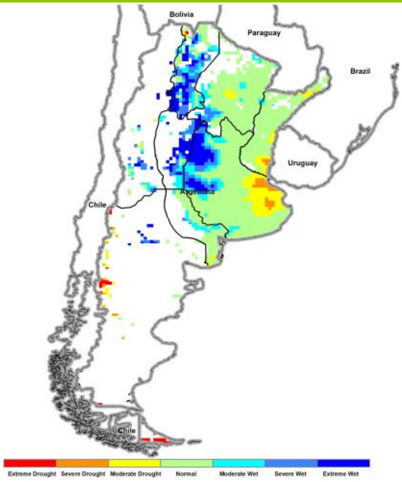


(h) Time series of temperature profile (Argentina) (i) Spatial distribution of NDVI profiles





(j) Maximum VCI (k) Surface soil moisture



(l) SPI

Table 3.6 Argentina's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, October 2022 – January 2023

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Chaco	474	-11	24.7	-0.3	1385	1	1128	-4
Mesopotamia	406	-30	23.1	0.1	1455	2	1052	-11
Humid Pampas	274	-6	22.5	1.2	1491	-1	904	-2
Subtropical highlands	1110	45	21.3	-0.4	1287	-4	1235	5

Table 3.7 Argentina's agronomic indicators by sub-national regions, current season's values and departure from 5YA, October 2022 – January 2023

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Chaco	66	-31	0.43
Mesopotamia	99	-1	0.62
Humid Pampas	90	-9	0.63
Subtropical highlands	68	-25	0.56

[AUS] Australia

According to the phenology calendar, the current period covers the harvest of crops in Australia. Compared to the 15-year average, the rainfall increased by 17%, to 324 mm. Precipitation was above average mostly in October. The temperature was 19.7 °C (-1.4 °C), while the radiation was 1393 MJ/m^2 (-5%). As a result, the potential accumulated biomass was slightly above average (+2%). The CALF increased by 45% compared to the 5YA, and VCI was 1.08. Conditions for cereal production remained favorable through this monitoring period.

The NDVI profiles also showed continued favorable conditions, as the crop conditions were around the maximum of the last 5 years, especially in October and November. The spatial NDVI clustering map also showed good conditions, where more than 90% of areas had mostly positive departures. The only constraint was flooding, which had occurred in New South Wales and Victoria in October.

In general, the crop conditions in the current period were favorable. Drier weather after October improved conditions for wheat harvest. With a CPI of 1.83, above-average production can be expected for Australia.

Regional analysis

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

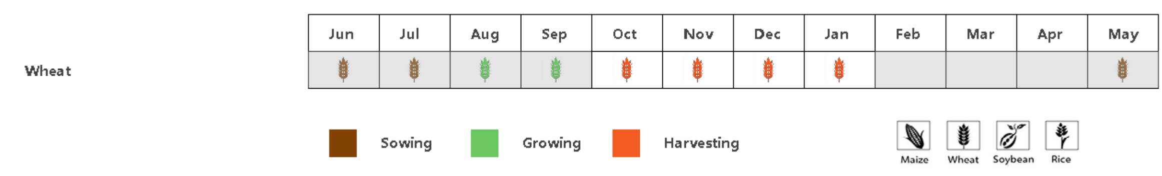
The Southeastern Wheat Zone was affected by flooding in October, which was caused by above-average rainfall (+40%). The temperature (-1.6°C) and radiation (-7%) were both below average. The biomass was positive (+7%). 96% of cropland in the AEZ was cultivated, and the VCIx was 1.15. The NDVI was mostly greater than the 5-year maximum. All indicators were favorable.

The Subhumid Subtropical Zone had average rainfall, but largely cooler temperature (-2.1°C) and slightly below average radiation (-3%). The biomass was generally average (+1%). The CALF was greatly increased by 134%, to 85%, and the VCIx was 1.15. The NDVI profile showed that the crop conditions were good, especially in October and November were above the 5-year maximum. The crop conditions in this zone were favorable.

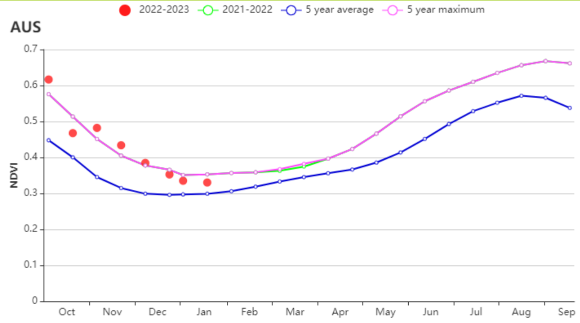
The Southwestern Wheat Zone was slightly drier and cooler than normal. The rainfall (-17%), temperature (-1.2 °C) and radiation (-3%) were all below average, which led to a below-average estimate for biomass (-13%). Though the CALF was increased (+30%), the VCIx was still less than 1 (0.99). The NDVI was generally above average. The conditions were optimal for the harvest of the cereal crops.

The conditions in the Wet Temperate and Subtropical Zone were similar to the Southeastern Wheat Zone, with above-average rainfall (+20%), below-average temperature (-1.1°C) and radiation (-6%). The biomass was also above average (+3%). The cropland was 100% cultivated, but VCIx was 0.93. The NDVI profiles showed that the NDVI reached maximum levels from October to November, and then approached average levels. The crop conditions in this zone were also favorable.

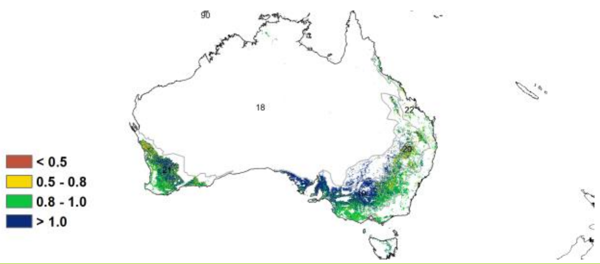
Figure 3.8 Australia's crop condition, October 2022 – January 2023



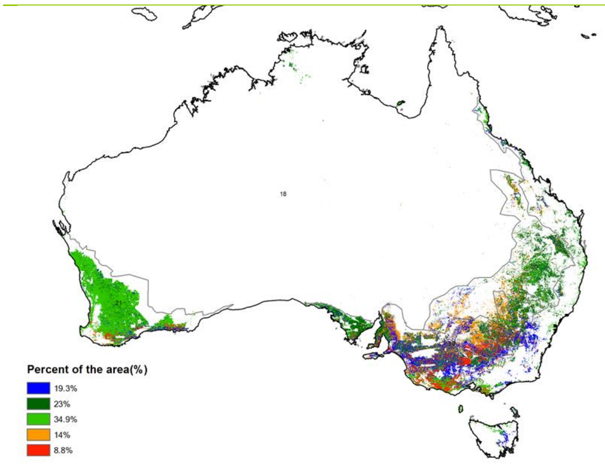
(a). Phenology of major crops



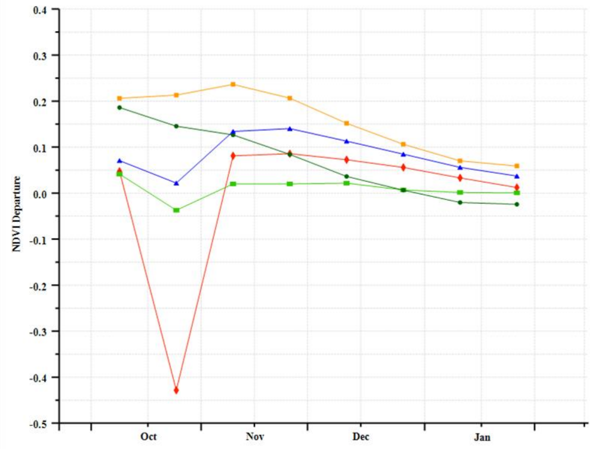
(b) Crop condition development graph based on NDVI



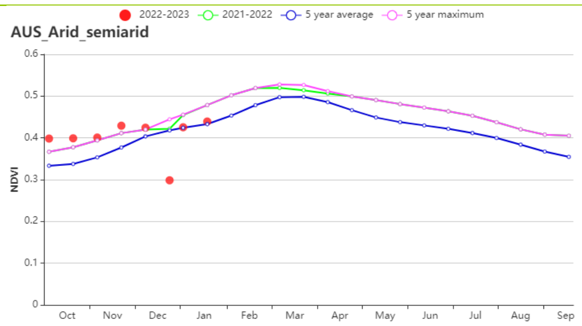
(c) Maximum VCI

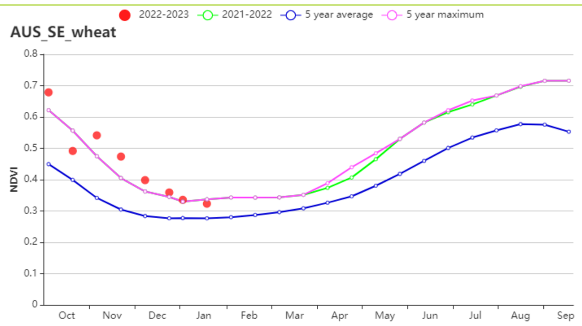


(d) Spatial NDVI patterns compared to 5YA

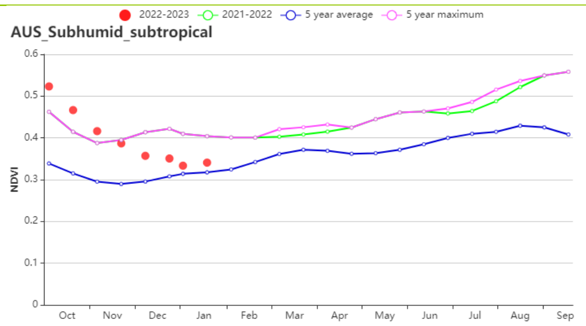


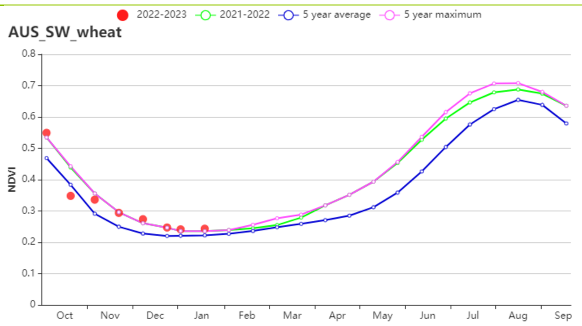
(e) NDVI profiles



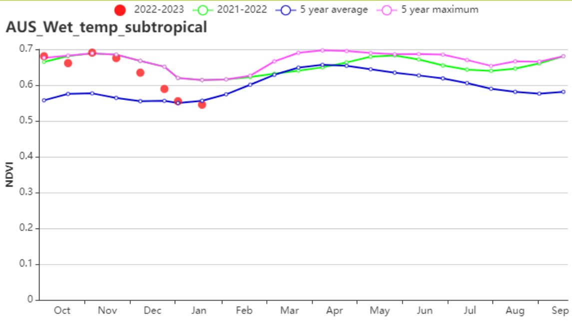


(f) Crop condition development graph based on NDVI (Arid and semiarid zone (left) and Southeastern wheat area (right))

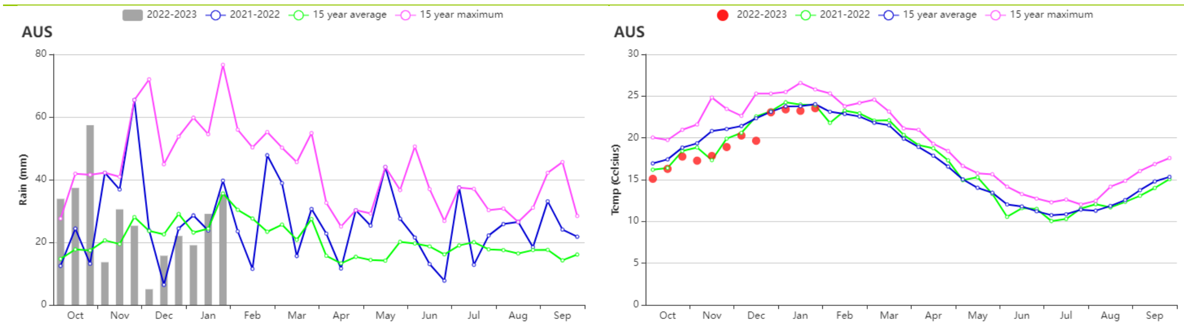




(g) Crop condition development graph based on NDVI (Subhumid subtropical zone (left) and Southwestern wheat area (right))



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



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

Table 3.8 Australia's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, October 2022 – January 2023

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Arid and semiarid zone	719	24	26.8	-0.3	1386	-2	1014	6
Southeastern wheat area	283	40	18.5	-1.6	1369	-7	828	7
Subhumid subtropical zone	271	0	21.9	-2.1	1457	-3	919	1
Southwestern wheat area	88	-17	18.4	-1.2	1485	-3	555	-13
Wet temperate and subtropical zone	450	20	18.3	-1.1	1326	-6	950	3

Table 3.9 Australia's agronomic indicators by sub-national regions, current season's values and departure from 5YA, October 2022 – January 2023

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Arid and semiarid zone	69	17	1.01
Southeastern wheat area	96	48	1.15
Subhumid subtropical zone	85	134	1.15
Southwestern wheat area	77	30	0.99
Wet temperate and subtropical zone	100	6	0.93

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

[BGD] Bangladesh

During the reporting period, the growing and harvesting of Aman rice, and the sowing of Boro rice and wheat were the main farming activities. For the whole nation, RAIN (-1%) was slightly below average. Both TEMP (+0.2℃) and RADPAR (+3%) were above average. After October, the fine weather facilitated the completion of rice harvest and the sowing of wheat and maize. BIOMSS (-1%) was slightly below average. The national NDVI development graph shows that overall crop conditions were near the 5-year average in October and early November and then returned to below the 5-year average from November to January. According to the spatial NDVI pattern, slightly poorer crop conditions were observed for most of the country's arable land area during the entire reporting period. Only 9.6% showed unfavorable conditions in early October scattered throughout the country. The low values might be an artifact caused by cloud cover. The maximum Vegetation Condition Index (VCIx) was 0.90, with most areas showing values higher than 0.8 except for the parts of the northeast, where rainfall was lower. CALF was close to average. Overall, the CropWatch indicators as well as the VCIx map indicate average crop conditions in Bangladesh as CPI (1.09) showed.

Regional analysis

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

In the Coastal region, both RAIN and TEMP were above average (+3% and +0.7℃, respectively). RADPAR was also above average (+3%). BIOMSS was above average (+1%). The crop condition development graph based on NDVI shows that crop conditions trended slightly below the 5-year average. Average conditions were found in the middle and end of November due to the sufficient rainfall in early November. CALF was 93% (+1%) and VCIx was 0.85. CPI was 1.04. Overall, crop conditions were close to the average for this zone.

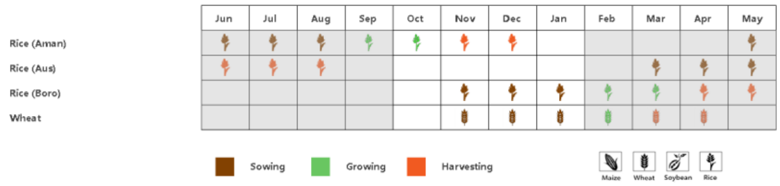
In the Coastal region, both RAIN and TEMP were above average (+3% and +0.7℃, respectively). RADPAR was also above average (+3%). BIOMSS was above average (+1%). The crop condition development graph based on NDVI shows that crop conditions trended slightly below the 5-year average. Average conditions were found in the middle and end of November due to the sufficient rainfall in early November. CALF was 93% (+1%) and VCIx was 0.85. CPI was 1.04. Overall, crop conditions were close to the average for this zone.

In the Gangetic Plain, the agroclimatic indicators show that the accumulated rainfall, temperature and radiation were all above average (RAIN +4%, TEMP +0.2℃, RADPAR +1%), which resulted in near-average biomass production potential (BIOMASS +1%). The crop condition development graph based on NDVI shows that crop conditions were close to the 5-year average before the end of November and then slightly below average. During the monitoring period, CALF (97%) was close to average, VCIx was 0.94, and CPI was 1.13. Favourable crop conditions were expected in this region.

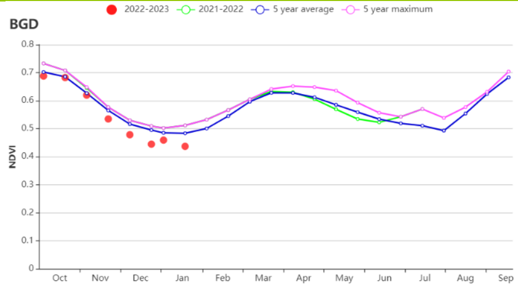
For the Hills, both TEMP (+0.3℃)and RADPAR (+4%) were above average. But this region experienced the largest deficit in rainfall (-21%). BIOMASS was below average (-11%). During the monitoring period, the crop condition development graph based on NDVI shows that crop conditions were close to average in October and then slightly below. CALF was 98% and VCIx was 0.90, CPI was 1.08 for this region, indicating average crop conditions.

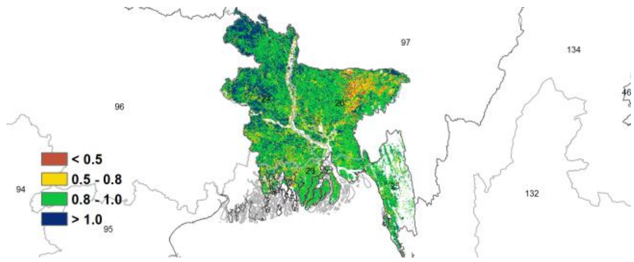
In the Sylhet basin, above-average rainfall (+8%) and cooler temperatures (-0.2℃) were recorded. RADPAR was above average (+2%). BIOMSS was estimated 4% higher than the 15YA. The crop condition development graph based on NDVI shows that crop conditions were above the 5-year average at the end of October and then decreased to below average from November to January. For the Sylhet basin, CALF was 90% (-2%) and VCIx was 0.87. CPI was 1.05. Based on the above information, crop conditions were close to the average for this zone.

Figure 3.9 Bangladesh's crop condition, October 2022- January 2023



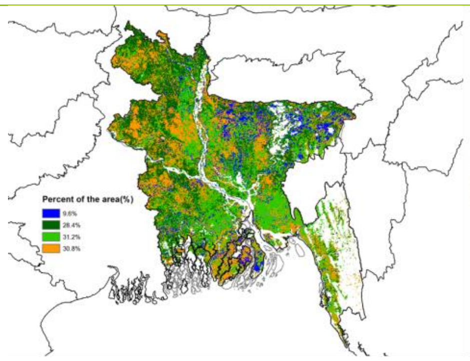
(a). Phenology of major crops

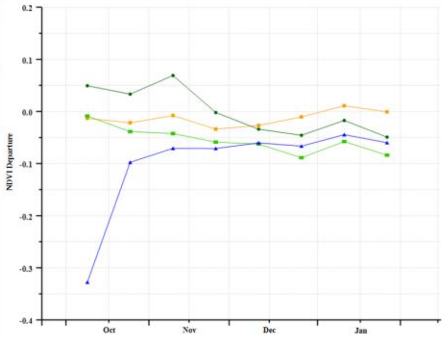




(b) Crop condition development graph based on NDVI

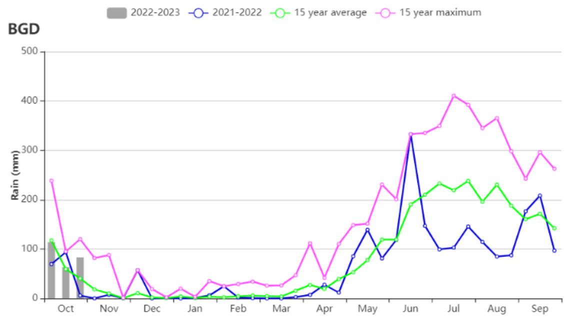
(c) Maximum VCI

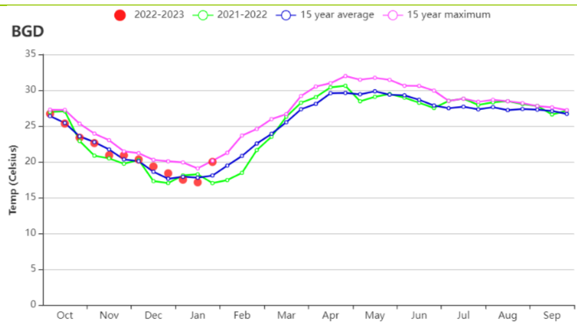




(d) Spatial NDVI patterns compared to 5YA

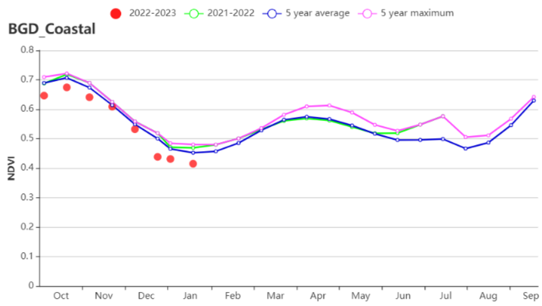
(e) NDVI profiles

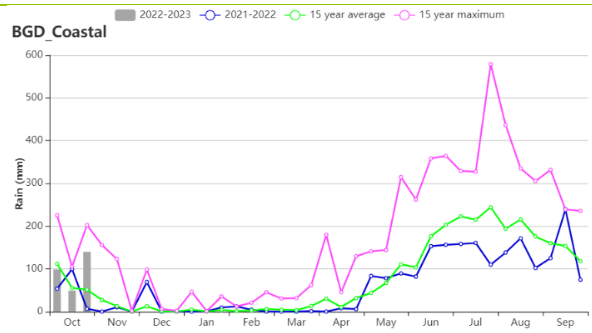




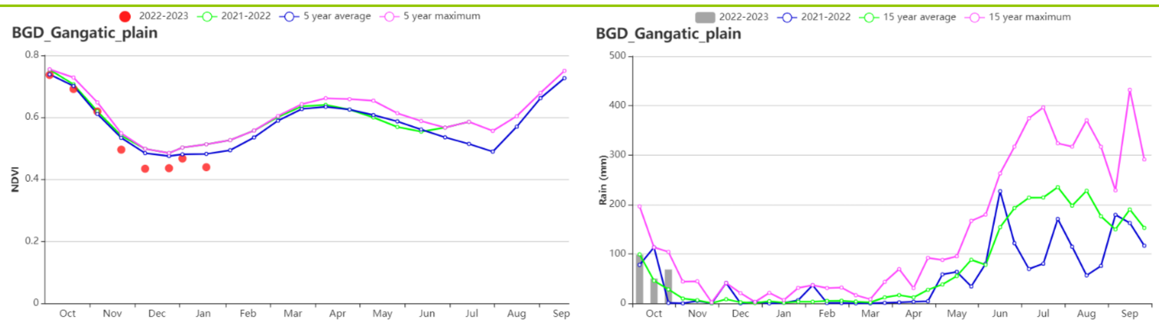
(f) Rainfall profiles

(g) Temperature profiles

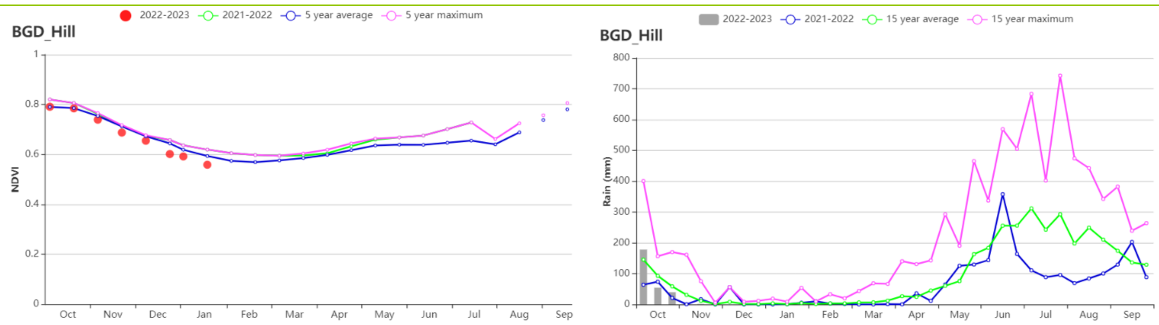




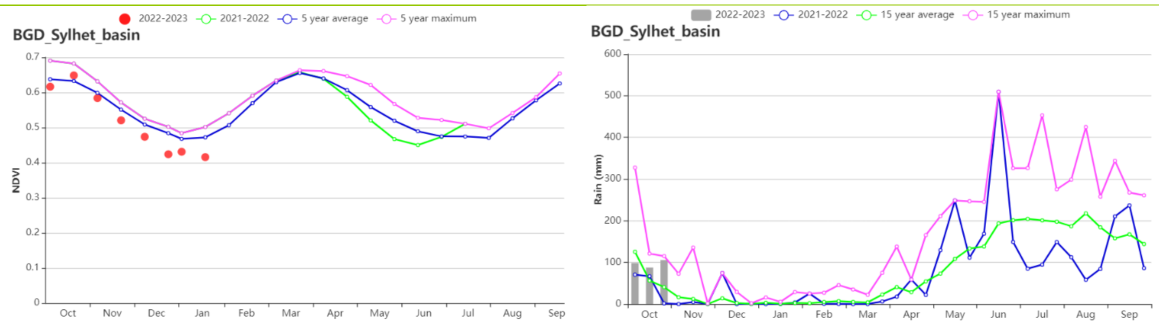
(h) Crop condition development graph based on NDVI (left) and rainfall profile (right) of Coastal region



(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, October 2022- January 2023

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Coastal region	290	3	22.6	0.7	1054	3	641	1
Gangetic plain	217	4	21.0	0.2	984	2	545	1
Hills	283	-21	21.0	0.3	1061	4	598	-11
Sylhet basin	295	8	20.5	-0.2	984	2	590	4

Table 3.11 Bangladesh's agronomic indicators by sub-national regions, current season's values and departure from 5YA, October 2022- January 2023

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Coastal region	93	1	0.85
Gangetic plain	97	0	0.94
Hills	98	0	0.90
Sylhet basin	90	-2	0.87

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

[BLR] Belarus

Winter wheat, which was sown in October, is the major crop in the field during this monitoring period. The nationwide rainfall had increased compared to 15YA average (RAIN 338 mm or 20%). The temperature (TEMP 1.9°C or 1.1°C above average) increased but radiation (RADPAR 136 MJ/m^2 or -15%) decreased. Nearly all the arable land was cropped (CALF at about 99%) and the maximum vegetation condition index (VCIx) was good (0.80). Weather based projected potential biomass was above average (7%).

At the national level, NDVI was below average in October, and then close to the 5YA in November but declined in December. Crop condition in about 81.4% cropped area was above or close to the 5-year average, in agreement with the national VCIx map. According to the spatial distribution maps, although VCIx was satisfactory in most areas of the country (>0.8), there was an apparent drop of NDVI profiles in many areas from December to January. Most likely, this artifact was caused by snow cover. The crop production index (CPI) was 0.95 and not far from 1.0, and it might indicate a good prospect considering the sufficient rainfall during the past few months of this period.

Regional analysis

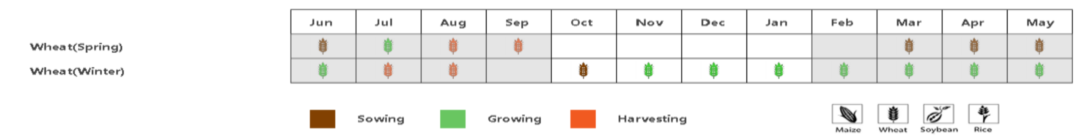
Based on cropping system, climatic zones and topographic conditions, regional analyses for three agro-ecological zones (AEZ) are provided, including Northern Belarus (028, Vitebsk, the northern area of Grodno, Minsk and Mogilev), Central Belarus (027, Grodno, Minsk and Mogilev and Southern Belarus (029)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

Northern Belarus (Vitebsk, northern area of Grodno, Minsk and Mogilev) had more rainfall (27%) and slightly increased temperature (+1.0°C) than average, but radiation had decreased (-19%). The BIOMSS is projected to increase by 6%. Agronomic indicators showed satisfactory values: 99% for CALF and 0.79 for VCIx. CPI value was 0.93. Crop condition is good.

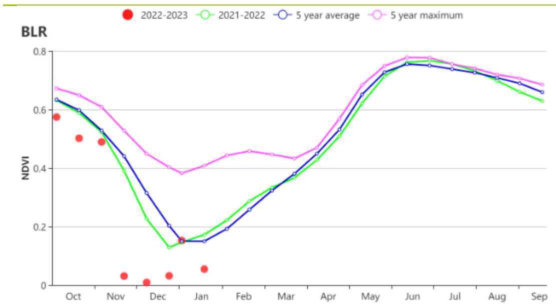
In **Central Belarus**, the regions of Grodno, Minsk and Mogilev recorded higher rainfall (16%), slightly higher temperature (+1.2°C) and below average radiation (-14%). The BIOMSS is projected to increase by 8%. Nearly full cropped arable land (CALF at 98%) and a VCIx value of 0.81 with an CPI of 0.96 were observed. The overall situation was favorable for winter crops.

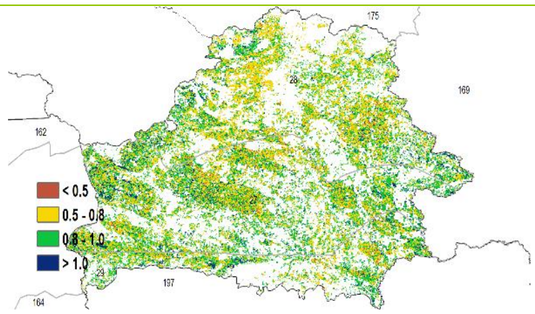
The **Southern Belarus** (southern halves of Brest and Gomel regions) experienced the same agro-climatic condition as Central area. Higher rainfall (12%), higher temperature (+1.0°C) and lower radiation (-12%) were recorded. The BIOMSS is projected to increase by 8%. Favorable agronomic indicators (CALF 98%, VCIx 0.82) were observed. CPI value was 0.93. The conditions for winter wheat were favorable.

Figure 3.10 Belarus's crop condition, October 2022- January 2023.

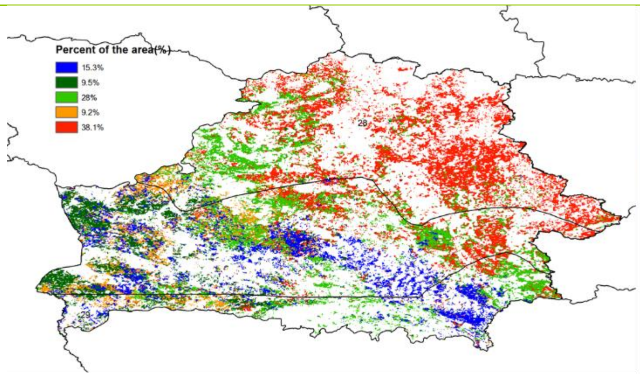


(a). Phenology of major crops

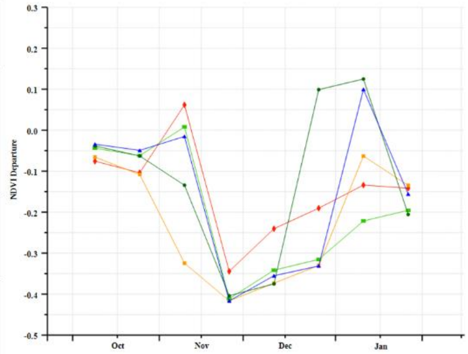




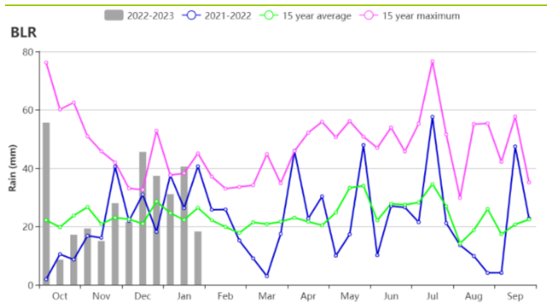
(b) Crop condition development graph based on NDVI



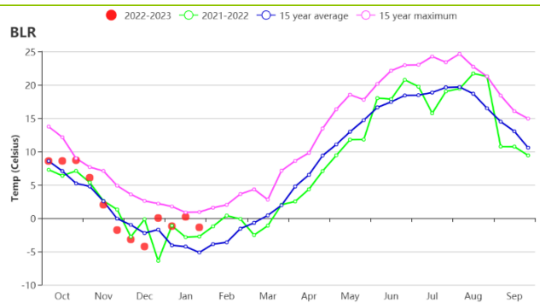
(c) Maximum VCI



(d) Spatial NDVI patterns compared to 5YA

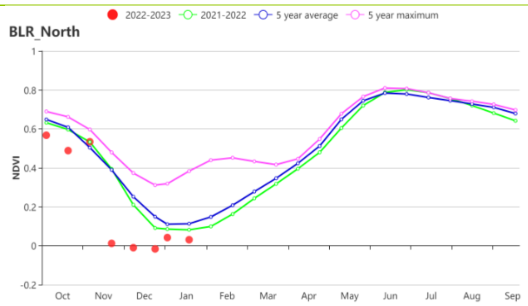


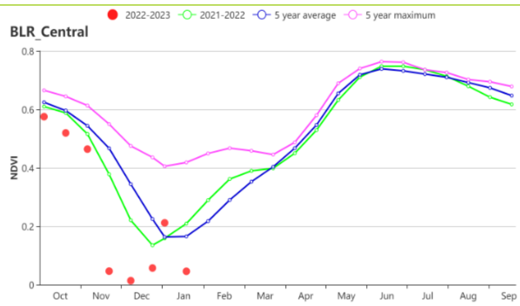
(e) NDVI profiles



(f)Rainfall time series

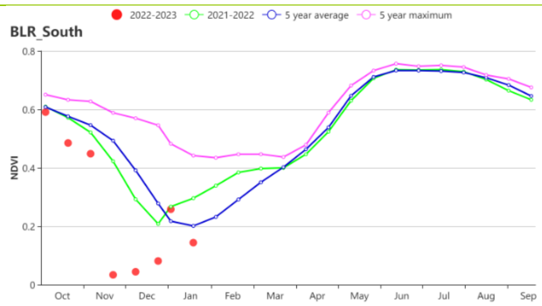
(g) Temperature time series





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

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



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

Table 3.12 Belarus's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, October 2022- January 2023.

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Center	323	16	2.3	1.2	144	-14	426	8
North	370	27	1.1	1.0	117	-19	382	6
South-west	296	12	2.6	1.0	166	-12	436	8

Table 3.13 Belarus's agronomic indicators by sub-national regions, current season's values and departure from 5YA, October 2022- January 2023.

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Center	98	-1	0.81
North	99	-1	0.79
South-west	98	-1	0.82

[BRA] Brazil

During the period from October 2022 to January 2023, the wheat harvest was completed. Soybean, first-season maize, and rice in central-southern Brazil reached peak vegetation cover by the end of the monitoring period. Rice planting began in northern Brazil at the end of January.

Only 12% of Brazil's cropland is irrigated, and agroclimatic conditions play a critical role in the growth of most crops. Overall, Brazil's prolonged dry and warmer-than-normal weather hampered the development of the 2022-2023 summer crop, resulting in slightly below-average crop conditions, particularly for the first season of maize. During the observation period, Brazil received an average rainfall of 464 mm, almost 50% below the 15YA, the largest negative departure in the last three years. Rainfall profiles showed that precipitation was below 2021-2022 and the 15YA throughout the four-month period. Although radiation was at close to average levels (1% below average), the significant below-average rainfall combined with 1.0°C higher temperature adversely affected crops as reflected by the 23% below average BIOMSS indicator. Spatially, most regions in central and southern Brazil had below-average BIOMSS, which was consistent with the map of the three-month composite SPI during November 2022 to January 2023. In contrast, BIOMSS was above average in the eastern coastal regions, northern Brazil and eastern Santa Catarina. Among the nine main agricultural producing states, only Santa Catarina received 5% above average rainfall, while all the other eight states suffered from a rainfall deficit with a more than 28% negative rainfall deviation from the 15YA. Temperature was slightly below average in three southern Brazilian states (Parana, Rio Grande Do Sul and Santa Catarina), but above average in the other six major agricultural producing states. Radiation was generally close to average, ranging from 5% below average in Goias to 4% above in Santa Catarina. Unfavorable weather conditions resulted in below average BIOMSS in all nine major agricultural producing states.

Significant water deficit affected crop growth, resulting in slightly below-average NDVI values since October 2022, as shown in the crop condition evolution graph. The spatial distribution of the NDVI deviation from 5YA and the corresponding profiles further illustrated the variable crop condition across Brazil. Crops with above-average condition were mostly observed along the Parana River Basin, covering western Parana, southwestern Sao Paulo, and southeastern Mato Grosso do Sul, where second season maize and soybean are dominant crops. Southern Brazil, including Rio Grande Do Sul and southern Santa Catarina, had a below-average NDVI, where rice and first-season maize dominate agricultural practices. Accordingly, the VCIx map also shows low values (< 0.8) in southern Brazil and high values (close to or above 1.0) along the Parana River basin. Although rainfall was well below average in the Parana River Basin in Brazil, crops showed above average conditions due to favorable soil moisture, which could be attributed to irrigation infrastructure and water accessibility. Conditions in other major agricultural regions were mixed but generally close to average. At the national level, the VCIx was 0.93. CALF was 1% above the 5YA, indicating an overall limited impact of the dry weather on crop planting.

In general, crop conditions in Brazil at the end of the observation period were slightly below average, but with great spatial and temporal variability. The Crop Production Index (CPI) in Brazil is 1.12, reflecting an overall above-average crop outlook. First-season maize production is forecast to be below average. Production of second season maize and soybean is forecast to be above average due to an increase in planted area.

Regional analysis

Eight agro-ecological zones (AEZ) are identified for Brazil, taking into account differences in cropping systems, climatic zones and topographic conditions. This Bulletin focuses on the Central Savanna (31), the East Coast (32), the Mato Grosso Zone (34), the Nordeste (35), the Parana River (36), and the Southern Subtropical Rangelands (37). All AEZs received significantly below-average precipitation (-13% to -81%) and above-average temperature. In the Central Savanna, temperature was 2.7°C above 15YA, the largest temperature anomaly among the AEZs. PAR was generally close to average, ranging from 4% below to 3% above average. The generally dry and warm weather for the AEZs resulted in below average BIOMSS (-5% to -45%), except for the East Coast where BIOMSS was 4% above 15YA.

Among the AEZs, crop condition in Southern Subtropical Rangelands was well below average with the lowest CPI (0.9) and VCIx (0.74) values compared to other AEZs. According to NDVI profiles, crop growth conditions in

Southern Subtropical Rangelands were below average throughout the monitoring period. Rainfall deficits resulted in unfavorable soil moisture for crops, which reduced rice and soybean yields in the region.

The East Coast AEZ also showed below-average crop conditions, as reflected in the NDVI-based crop development profile. From an agroclimatic perspective, conditions were unfavorable due to a lack of rainfall (-13%) and above-average temperatures. However, the total area planted in the region was 3% above average according to the CALF indicator. Overall, the production outlook for the AEZ is above average with a CPI value of 1.17.

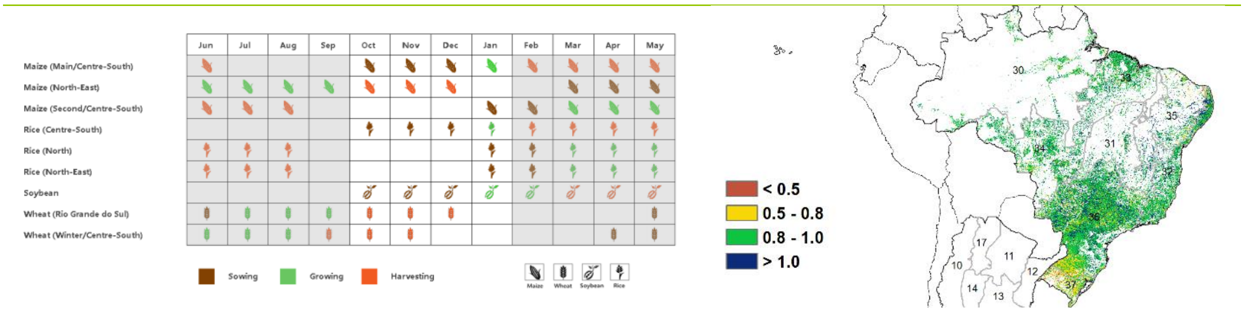
Mato Grosso, as the main maize and soybean producing zone, experienced significant negative rainfall departures, especially in November to early December 2022. Although the dry and hot weather resulted in unfavorable crop growth conditions as presented in the NDVI-based crop development profile, the spatial differences exist due to the variation in cropping practices and management. The northern part of the AEZ showed favorable soil moisture and above average crop conditions, while the southeastern part had poor surface soil moisture and below average conditions. The average VCIx was 0.94 and the CPI was 1.15, reflecting an overall favorable outlook for summer crops. This can be attributed to partial irrigation and near average rainfall in late December 2022 to early January 2023, which alleviated water stress.

The Central Savanna and the Parana Basin are the main production areas for maize and soybeans. Although below-average rainfall was observed in both regions, overall crop condition was close to or above average by the end of the monitoring period, as indicated by the VCIx map. The average VCIx for the two AEZs was 0.96 and 0.92, respectively. According to the NDVI-based crop development profiles, crop conditions were below average before mid-December 2022, but caught up to average conditions thereafter. While rainfall was all below average, soil moisture was normal and replenished by irrigation, which benefited crops, especially second maize and soybeans. The CPI values for the two AEZs were 1.20 and 1.11, respectively, confirming favorable prospects for summer crop production.

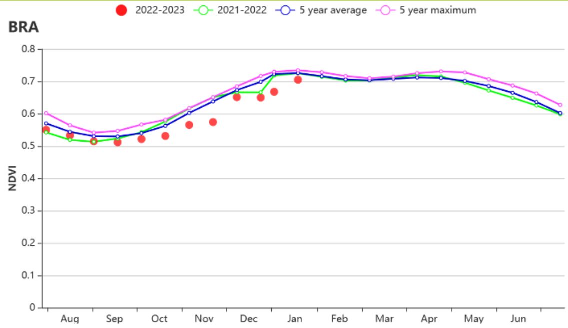
Similar to other AEZs, the Nordeste is dominated by dry and hot weather. Being a semi-arid climate zone, it received the lowest rainfall of the eight zones, only 128 mm. Nevertheless, the NDVI-based crop development profiles show above-average growth conditions, making it the only AEZ with above-average conditions throughout the monitoring period. Comparing the SPI map and soil moisture, regions suffering from meteorological drought with low SPI values were observed with high surface soil moisture. This indicates that most crops are irrigated. Irrigation resulted in the highest VCIx values for this zone compared to others. CALF reached 97%, which is 18% above the 5YA. Overall, the CPI value of the AEZ was 1.39, indicating a favorable production outlook.

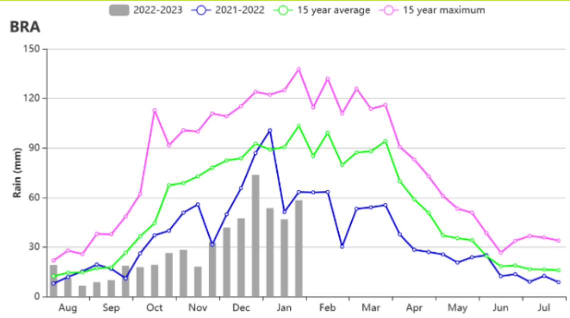
For more indicators and detailed information, please visit CropWatch Explore (http://cropwatch.com.cn/newcropwatch/main.htm).

Figure 3.11 Brazil's crop condition, October 2022 – January 2023

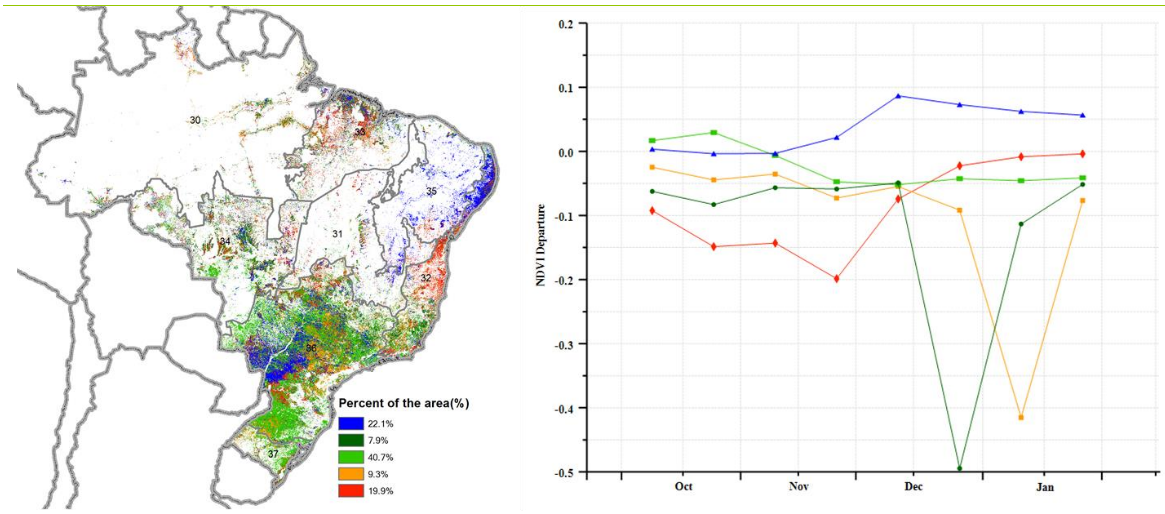


(a) Phenology of major crops (b) Maximum VCI

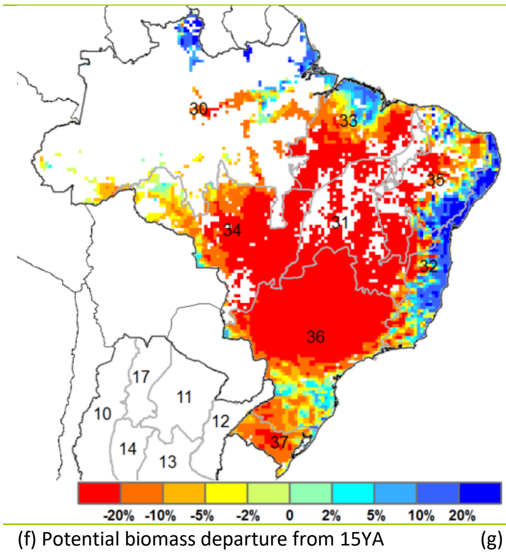


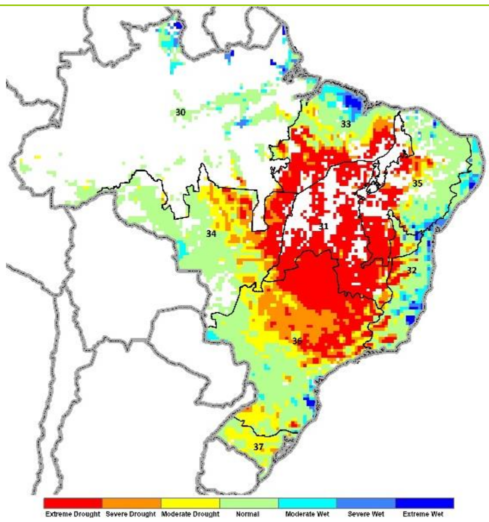


(c) Crop condition development graph based on NDVI of Brazil (d) Time series rainfall profile of Brazil

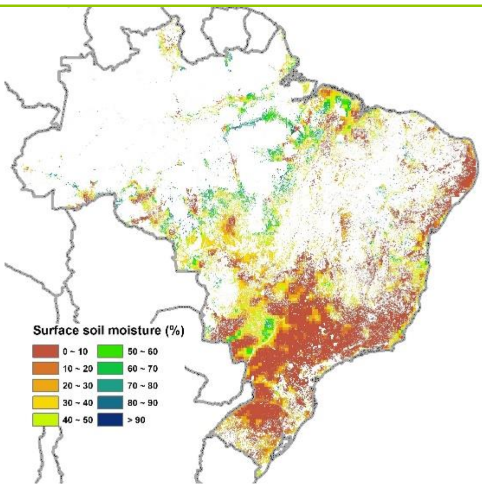


(e) Spatial distribution of NDVI departure from 5YA and NDVI departure profiles corresponding to the clusters

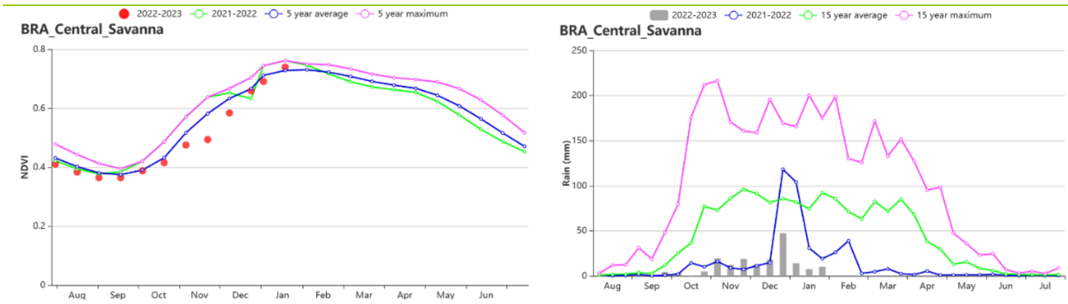




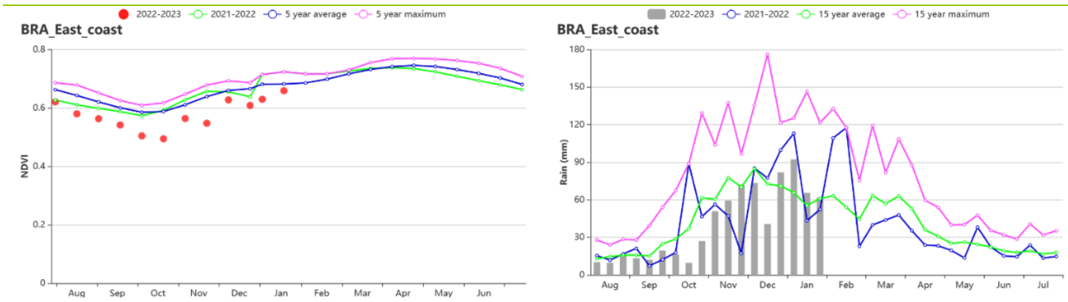
(f) Potential biomass departure from 15YA (g) Meteorological drought measured by standard precipitation index



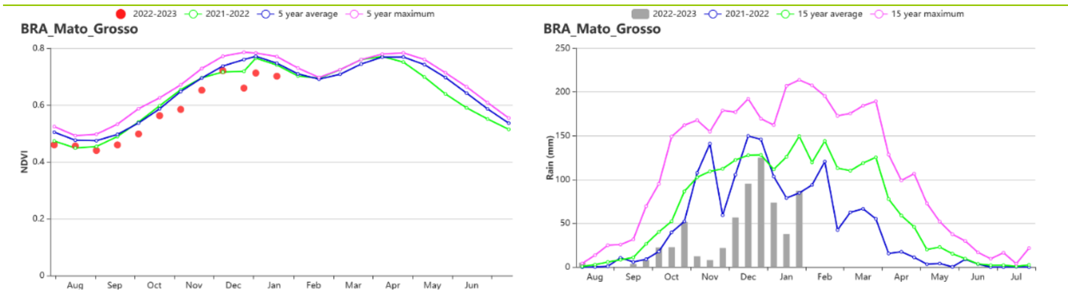
(h) Surface (0-5cm) soil moisture at 10th February, 2023



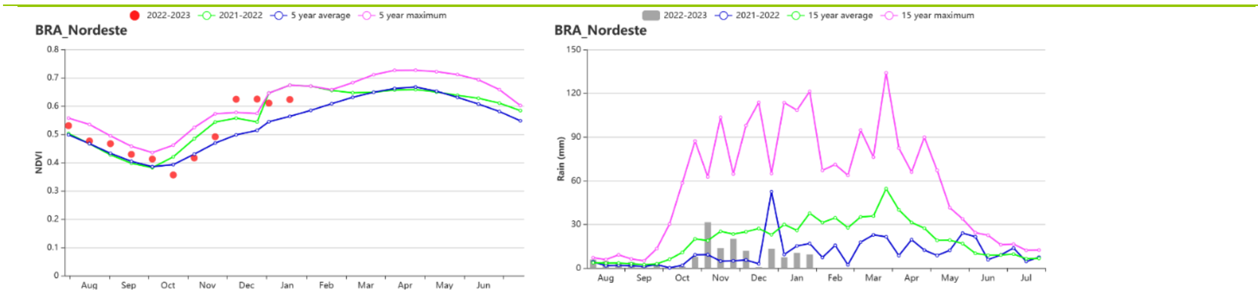
(j) Crop condition development graph based on NDVI (left) and rainfall profile (right) of Central Savanna



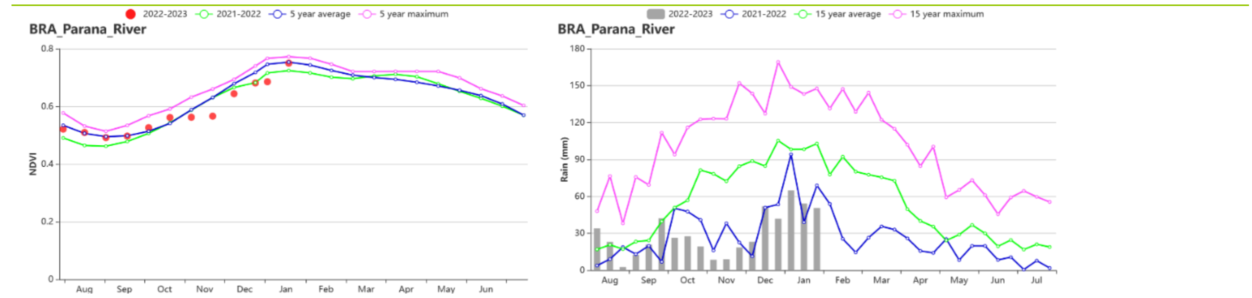
(k) Crop condition development graph based on NDVI (left) and rainfall profile (right) of Coast zone



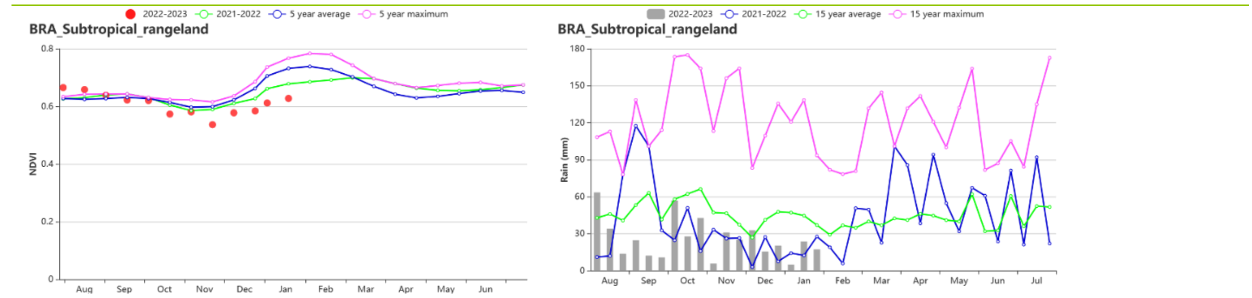
(L) Crop condition development graph based on NDVI (left) and rainfall profile (right) of Mato Grosso



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



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



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

Table 3.14 Brazil's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, October 2022 – January 2023

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m²)	Departure from 15YA (%)	Current (gDM/m²)	Departure from 15YA (%)
Amazonas	776	-19	26.3	0.1	1172	0	1329	-5
Central Savanna	168	-81	27.5	2.7	1220	-4	715	-45
Coast	651	-13	23.6	0.6	1299	3	1198	4
Northeastern mixed forest and farmland	468	-36	27.4	0.8	1205	-1	1071	-19
Mato Grosso	614	-52	26.6	1.2	1154	0	1136	-25
Nordeste	128	-53	27.1	0.8	1323	-2	680	-17
Parana basin	397	-60	24.1	1.1	1287	-2	961	-32
Southern subtropical rangelands	305	-46	21.9	0.2	1430	2	999	-13

Table 3.15 Brazil's agronomic indicators by sub-national regions, current season's values and departure from 5YA, October 2022 – January 2023

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure from 5YA (%)	Current
Amazonas	100	0	0.92
Central Savanna	100	1	0.96
Coast	99	3	0.95
Northeastern mixed forest and farmland	100	0	0.94
Mato Grosso	100	0	0.94
Nordeste	97	18	0.96
Parana basin	100	0	0.92
Southern subtropical rangelands	99	0	0.74

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

[CAN] Canada

During this monitoring period, the harvest of summer crops was completed in Canada. Sowing of winter wheat was completed in October. It reached the hibernation stage in December.

There were few crops in the field except for some winter crops, such as winter wheat and canola. Compared to the 15-year average, below average rainfall (RAIN: -6%), above average radiation (RADPAR +2%) and temperature (TEMP +1.2°C) were captured by CropWatch agroclimatic indicators, which resulted in an increase in potential biomass (BIOMSS +11%). Winter wheat is mainly grown in Ontario and Quebec. Some winter wheat is grown in the Saskatchewan, Alberta, and Manitoba provinces as well. According to the rainfall profile, rainfall was near average most of the time. The crop production index (CPI) was 0.92. Conditions for winter wheat were average according to the NDVI development graph, but winter crop yields will depend largely on agroclimatic conditions in the next monitoring period.

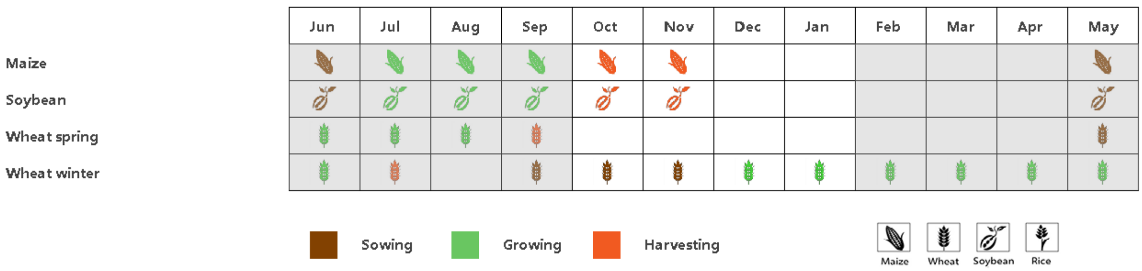
Regional analysis

The Prairies (the area identified as 53 in the NDVI clustering map) and the St. Lawrence Basin (49, covering Ontario and Quebec) are the main agricultural areas.

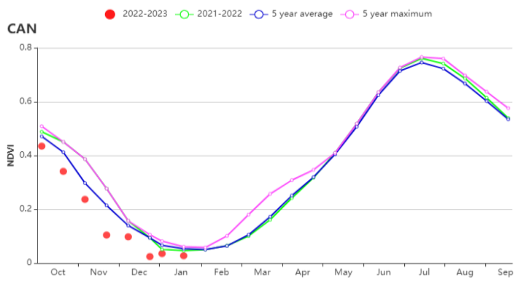
The Prairies is the main crop production area in Canada. It grows mainly summer crops. In this reporting period, the rainfall was close to average while radiation (RADPAR +1%) and temperature (TEMP +0.2°C) were slightly above average, leading to a slightly increased potential biomass production (BIOMSS +5%).

The Saint Lawrence basin is the main winter wheat production region. The temperature (TEMP +2.3°C) was significantly above average while radiation (RADPAR +2%) and rainfall (RAIN -2%) were near average, leading to a slightly increased potential production (BIOMSS +16%). According to the NDVI development graph, the crop conditions trended around the average. The negative departures can be attributed to cloud cover in the satellite images or snow on the ground. Considering that cropped arable land fraction was close to average (CALF 0%), the situation of crops was assessed as normal.

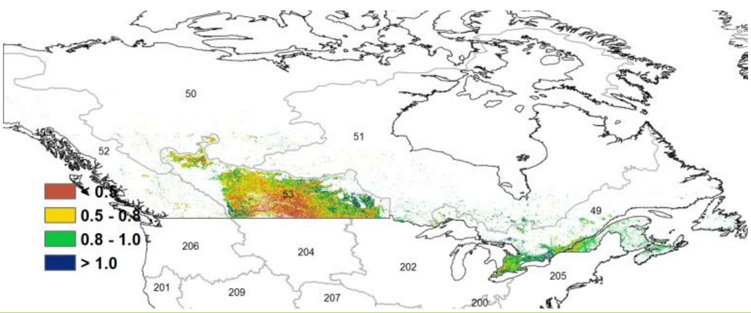
Figure 3.12 Canada's crop condition, October 2022 - January 2023



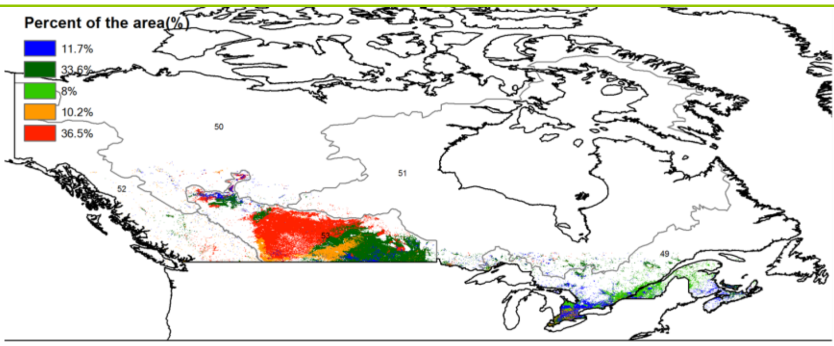
(a) Phenology of major crops

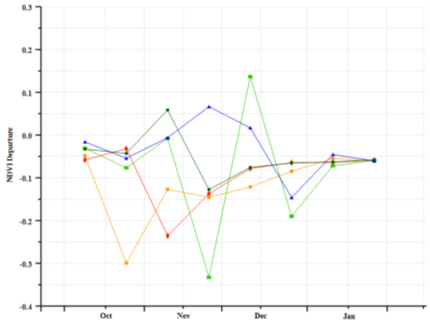


(b) Crop condition development graph based on NDVI



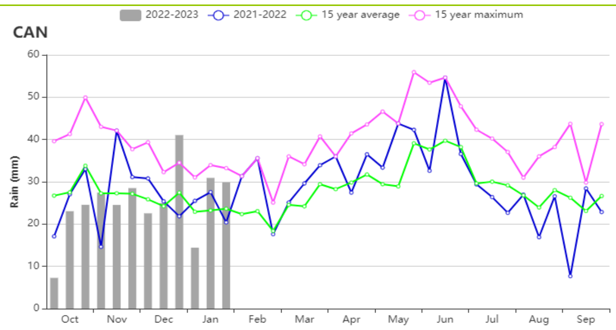
(c) Maximum VCI

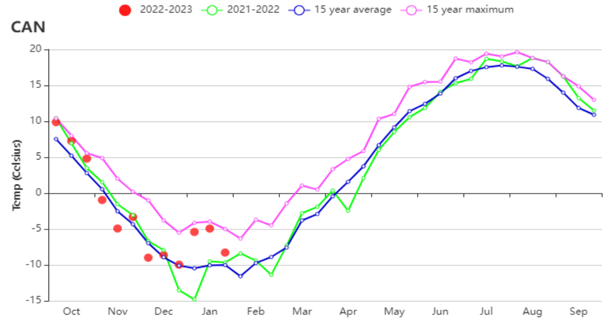




(d) Spatial NDVI patterns compared to 5YA

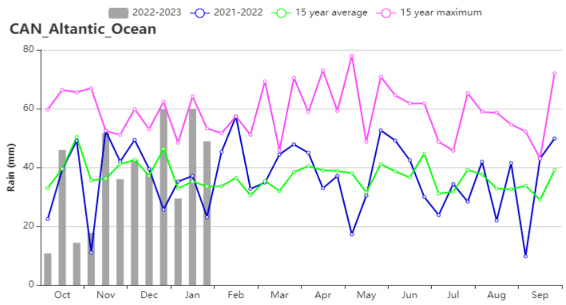
(e) NDVI profiles

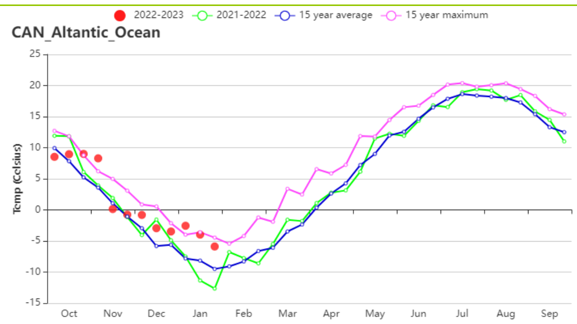




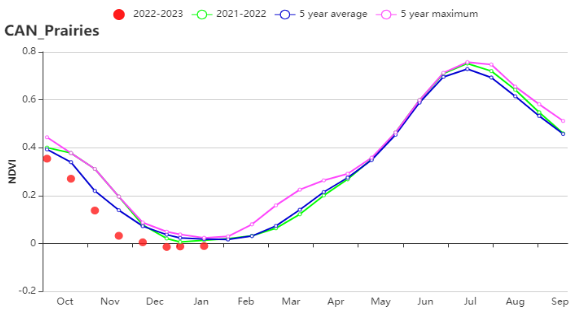
(f) Rainfall profiles

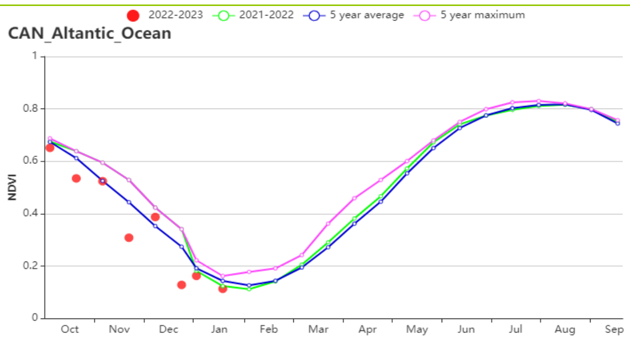
(g) Temperature profiles





(h) Rainfall (left) and temperature (Right) profiles for Saint Lawrence basin





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

Table 3.16 Canada's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, October 2022 - January 2023

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Saint Lawrence basin	455	-2	1.2	2.3	324	2	407	16
Prairies	161	0	-4.7	0.2	293	1	272	5

Table 3.17 Canada's agronomic indicators by sub-national regions, current season's values and departure from 5YA, October 2022 - January 2023

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Saint Lawrence basin	98	0	0.89
Prairies	33	-9	0.69

[DEU] Germany

This monitoring period covers the late stages of sugar beets, which got harvested in October and November, and the sowing period of winter cereals which started in September. Adequate soil moisture, neither too wet nor too dry, is crucial for the germination and early establishment of the winter cereals, mostly wheat, barley and triticale. Based on the agroclimatic and agronomic indicators, the crop conditions in Germany were generally near average in most regions.

CropWatch agroclimatic indicators show that total precipitation was below average (RAIN, -12%), while both temperature (TEMP, +1.3°C) and radiation (RADPAR, +7%) were above the average of the past 15 years. As can be seen from the time series of the rainfall profile, Germany experienced below-average precipitation except for late December and mid-January. Most of the country experienced warmer conditions during the monitoring period, except for early and mid December, which were cooler than average. Late January was also slightly below average. Due to favorable light conditions and warmer-than-usual temperatures, the biomass accumulation potential (BIOMSS) increased by 7% at the nationwide level as compared to the 15YA. The precipitation deficit in October and November was good for summer crop harvesting in Germany, while the germination of the winter cereals may have been delayed in some parts of the country.

CropWatch agronomic indicators based on NDVI development graph at the national scale show that NDVI values were slightly below average in October and near the 5-year maximum level in early November. Subsequent drops in NDVI can be attributed to either fog, cloud cover or snow on the ground in December and Januray. These factors also caused large negative departures in the spatial NDVI profiles. These observations were also confirmed by VCI values in the spatial distribution of maximum VCI map. It reached 0.88 at the national scale. Crop production index (CPI) was 1.05, slightly higher than 1, further suggesting average crop conditions.

Overall, the agronomic and agroclimatic indicators show average conditions for most winter 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).

The large negative NDVI departures that were observed for all regions from November 2022 to January 2023 are artifacts, due to cloud cover, fog or snow.

Schleswig-Holstein and the Baltic coast is the major winter wheat zone of Germany. Compared to the past 15 years' average, the CropWatch agroclimatic indicators RAIN (-10%) was below average, while temperature (TEMP, +1.1°C) and radiation (RADPAR, +10%) were above average. Due to favorable precipitation and temperature during the germination of wheat, biomass (BIOMSS) was increased by 4%. As shown in the crop condition development graph based on NDVI, the values were below average except for early-November which was close to the 5-year average. The area had a high CALF (100%) as well as a favorable VCIx (0.87) indicating favorable crop prospects. CPI was 1.03. The crop production in this region is expected to be above average.

Wheat and sugar-beets are major crops in the **Mixed wheat and sugar-beets zone of the north-west**. RAIN (-13%) was significantly below average, while radiation (RADPAR, +14%) and temperature (TEMP, +1.2°C) were above average. Due to favorable precipitation and temperature during the germination of wheat, biomass (BIOMSS) was 6% above average. As shown in the crop condition development graph based on NDVI, the values were below average except for early-November which was close to the 5-year average. The area had a high CALF (100%) as well as a favorable VCIx (0.84). CPI was 0.99. The crop production in this region is expected to be below average.

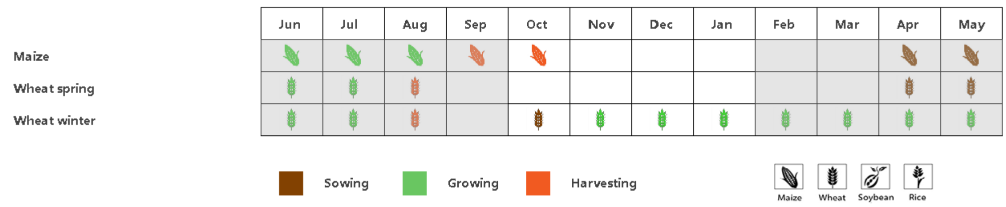
The **Central wheat zone of Saxony and Thuringia** is another major winter wheat zone; The CropWatch agroclimatic indicators show that this region experienced a precipitation deficit (-19%) with warmer weather (TEMP, +1.3°C) and radiation above average (RADPAR, +8%) which led to above average biomass (BIOMSS, +4%). As shown in the crop condition development graph based on NDVI, the values were below average except in early-November and early-December. The area has a high CALF (100%) as well as a favorable VCIx (0.82). CPI was 0.95. The crop production in this region is expected to be slightly below average.

In the **East-German Lake and Heathland Sparse Crop Area**, significantly below-average precipitation was recorded (RAIN, -24%). Temperatures and radiation were both higher than average (TEMP, +1.2°C; RADPAR, +8%). As a result, BIOMSS is expected to increase by 4% as compared to the average. As shown in the crop condition development graph based on NDVI, the values were below average except in early November and late December. The area has a high CALF (100%) and the VCIx was 0.93 for this region. CPI was 1.12. The crop production in this region is expected to be above average.

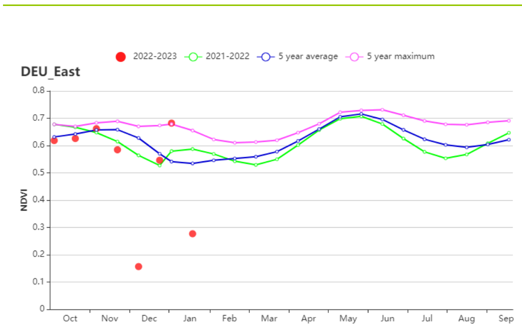
The cropland in the **Western sparse crop area of the Rhenish massif** experienced below average rainfall (RAIN -1%) , while temperature (TEMP +1.5°C) and radiation (RADPAR, +8%) were above average, which led to a biomass (BIOMSS) increase by 13%. As shown in the crop condition development graph based on NDVI, the NDVI values and crop conditions were close to the 5-year average in October, then above 5-year maximum in early November, below average from mid-November to late January. The area had high CALF (100%) and a high VCIx (0.87). CPI was 1.03. The crop production in this region is expected to be above average.

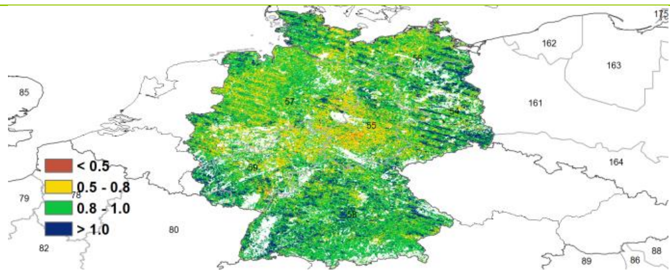
A significant reduction in rainfall was recorded for the **Bavarian Plateau** (RAIN -11%), with above-average temperature (+1.5°C) and above-average radiation (RADPAR +8%). Compared to the fifteen-year average, BIOMSS increased by 13%. As shown in the crop condition development graph based on NDVI, the values were below average from mid-November to early December and late January, close to average from late September to October and close to 5-year maximum in early November. The area had a high CALF (100%) as well as a favorable VCIx (0.92). CPI was 1.09. The crop production in this region is expected to be above average.

Figure 3.13 Germany's crop condition, October 2022 - January 2023



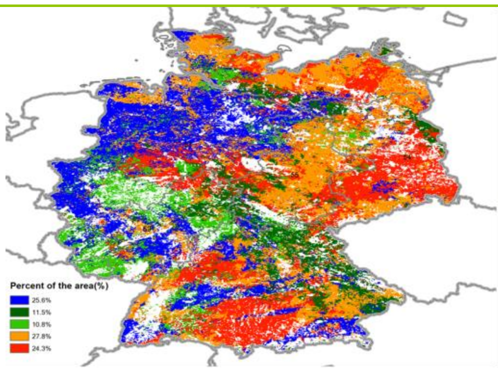
(a) Phenology of major crops

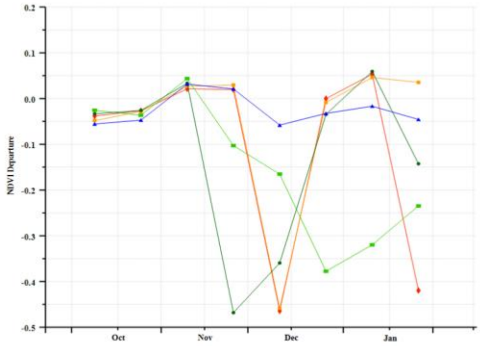




(b) Crop condition development graph based on NDVI

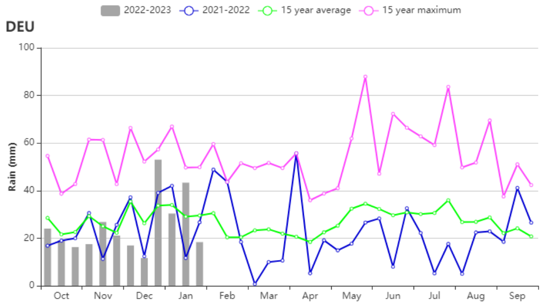
(c) Maximum VCI

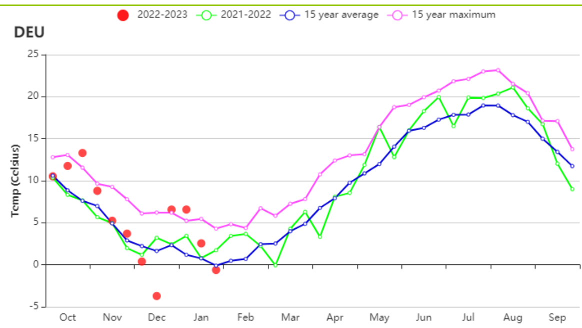




(d) Spatial NDVI patterns compared to 5YA

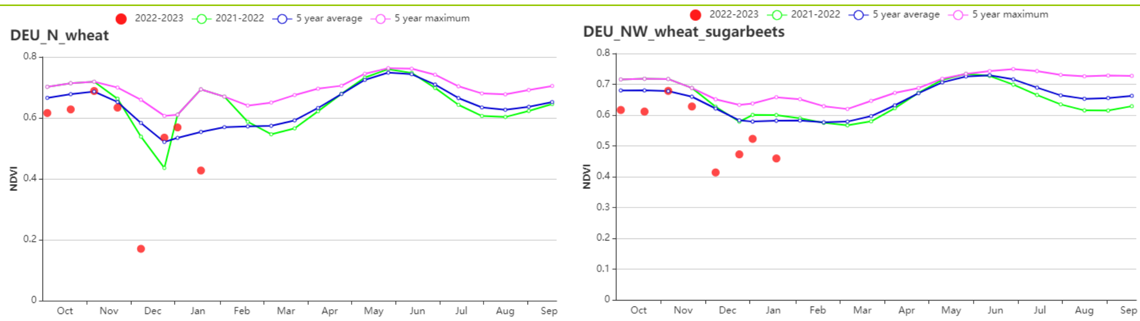
(e) NDVI profiles



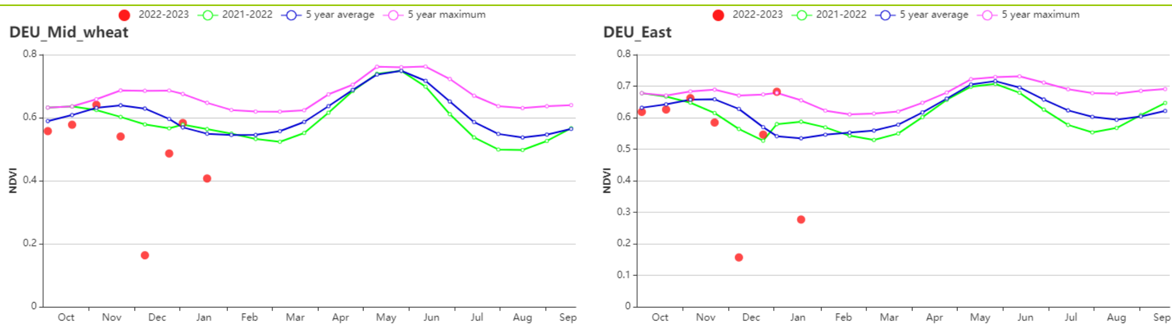


(f) Rainfall profiles

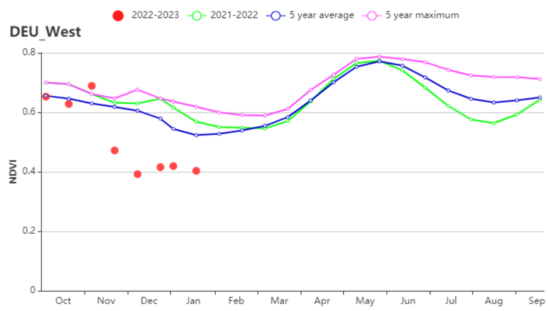
(g) Temperature profiles

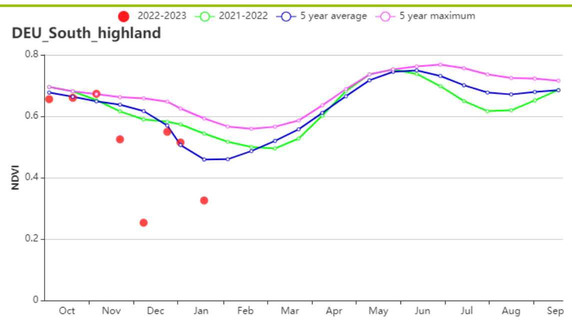


(h) Crop condition development graph based on NDVI (Wheat zone of Schleswig-Holstein and the Baltic coast (left) and Mixed wheat and sugar beets zone of the north-west(right))



(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, October 2022 - January 2023

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	308	-10	6.4	1.1	189	10	556	4
Mixed wheat and sugarbeets zone of the north-west	294	-13	6.4	1.2	224	14	564	6
Central wheat zone of Saxony and Thuringia	230	-19	5.2	1.3	231	8	496	4
East-German lake and Heathland sparse crop area	215	-24	5.2	1.2	228	8	500	3
Western sparse crop area of the Rhenish massif	316	-1	5.6	1.5	241	8	553	13
Bavarian Plateau	336	-11	4.3	1.3	291	3	510	12

Table 3.19 Germany's agronomic indicators by sub-national regions, current season's values and departure from 5YA, October 2022 - January 2023

Region	Cropped arable land fraction		Maximum VCI	Crop Production Index(CPI)
	Current (%)	Departure (%)	Current	Current
Wheat zone of Schleswig-Holstein and the Baltic coast	100	0	0.87	1.03
Mixed wheat and sugarbeets zone of the north-west	100	0	0.84	0.99
Central wheat zone of Saxony and Thuringia	100	0	0.82	0.95
East-German lake and Heathland sparse crop area	100	0	0.93	1.12

Region	Cropped arable land fraction		Maximum VCI	Crop Production Index(CPI)
	Current (%)	Departure (%)	Current	Current
Western sparse crop area of the Rhenish massif	100	1	0.87	1.03
Bavarian Plateau	100	0	0.92	1.09

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

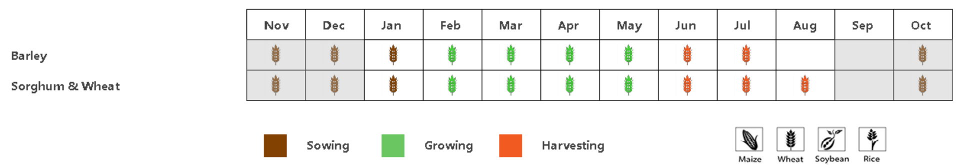
[DZA] Algeria

In October, at the beginning of this reporting period potato production in the regions of Mostaganem, El Oued, Ain defla and Relizane had started, whereas the production in the Mostagnem region (located in the western part of the country) started in January. The establishment of the cereal crops suffered from a serious precipitation deficit. Based on the crop condition development graph, NDVI values were similar to those of 2021-2022 in October to November, lower than those of 2021-2022 in December and slightly below those of 2021-2022 in late January. The NDVI remained far below average throughout the monitoring period. Crop conditions can be assessed as poor due to severe drought conditions.

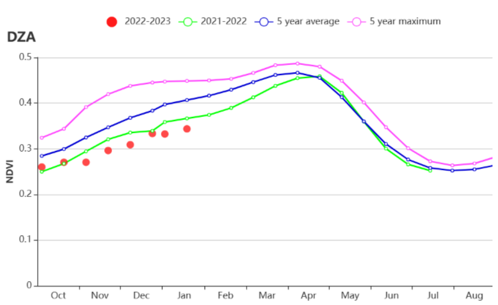
Compared to the average of the last 15 years, rainfall was significantly lower by 55% while both radiation and temperature were above average (RADPAR +9%, TEMP +1.4°C). The estimated biomass for the country was 33% below the 15YA. The cropped arable land fraction (CALF) was below average by 24% and the national average VCIx was 0.53.

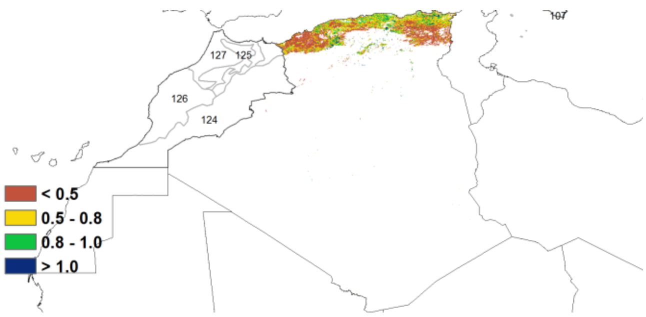
The NDVI departure cluster profiles indicate that: (1) 47.2% of arable land experienced below-average crop conditions, scattered around the central region of the country, the high plateaus, some areas in the sub-Sahara, and the western region. (2) 25.3% of arable land has slightly above-average crop conditions, scattered around the highlands and eastern country. (3) 14.8% of arable land, mainly in the western part of the country and some central regions, had below-average crop conditions before a marked dropdown from November to late January. (4) 12.7% of arable land experienced below-average crop conditions from October to late November before a marked drop in late November, mainly in eastern countries and slightly marked by an increase from December, indicating below-average crop conditions. Dry conditions in October and November may have delayed the establishment of cereal crops and the crop production index (CPI) was 0.77 according to the CPI time series from 2013 to 2023. Crop conditions were unfavorable due to below-average precipitation. However, the heavy rains in January may not help alleviate the production conditions for cereal crops. Indeed, supplemental irrigation is a practical way for farmers to salvage this crop.

Figure 3.14 Algeria's crop condition, October 2022 - January 2023



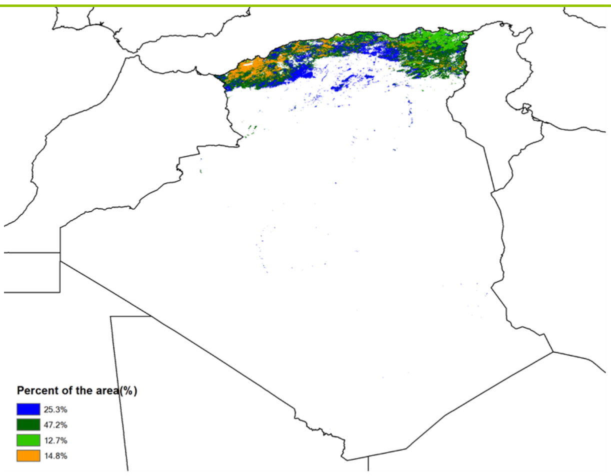
(a) Phenology of major crops

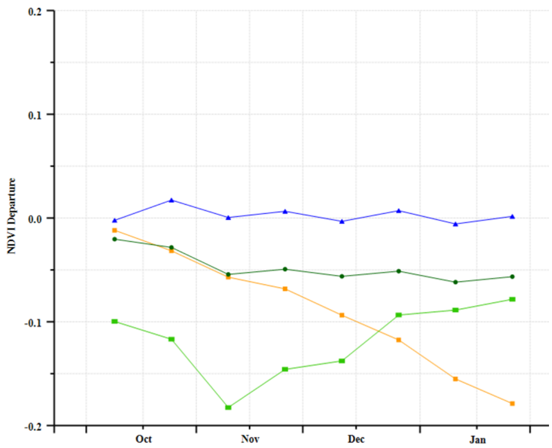




(b) Crop condition development graph based on NDVI

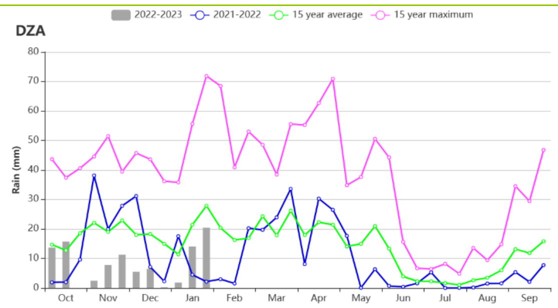
(c) Maximum VCI

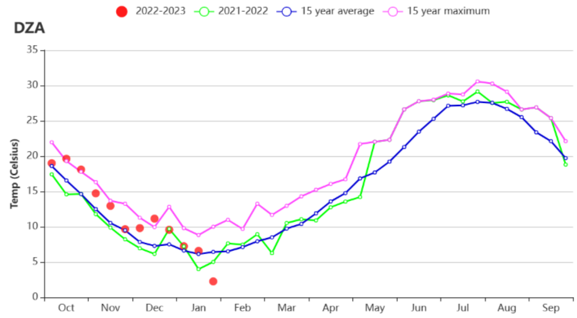




(d) Spatial NDVI patterns compared to 5YA

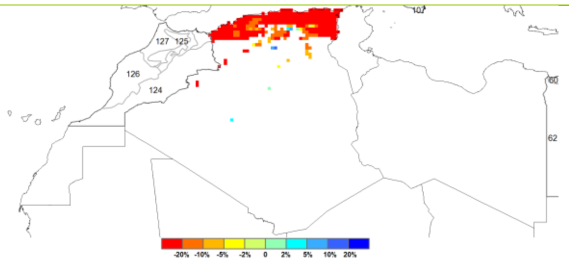
(e) NDVI profiles

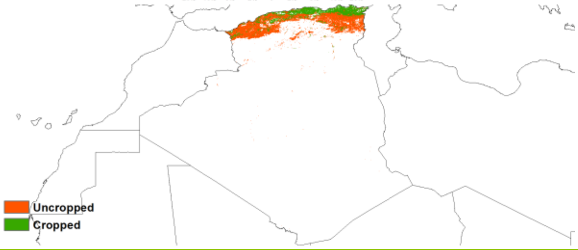




(f) Rainfall profiles

(g) Temperature profiles





(h) Biomass departure

(i)Cropped arable land classification (CALF)

Table 3.20 Algeria's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, October 2022 - January 2023

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Algeria	99	-55	11.7	1.4	717	9	326	-33

Table 3.21 Algeria's agronomic indicators by sub-national regions, current season's values and departure from 5YA, October 2022 - January 2023

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Algeria	29	-24	0.53

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[EGY] Egypt

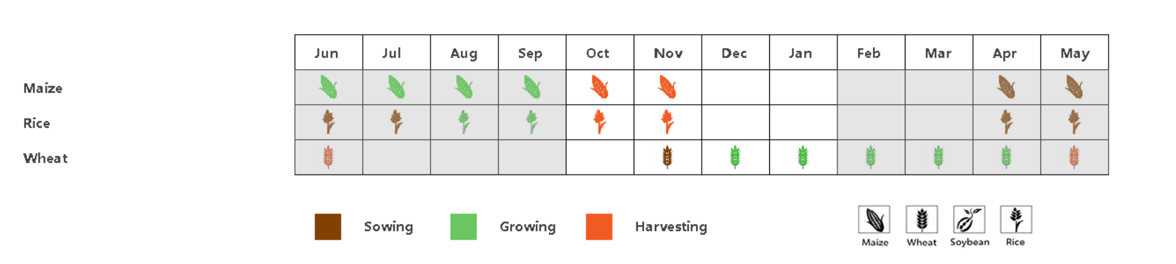
During this reporting period, the summer crops such as maize and rice were harvested, followed by the sowing of winter wheat in November. The CropWatch agro-climatic indicators showed that rain was 30% below the 15-year (15YA) average. According to the rainfall profile, high rainfall >10 mm, fell in late December and first January. The temperature was only 0.2°C above the 15YA. The temperature profile fluctuated around 15YA. The RADPAR was 2.9% above the 15YA while the BIOMSS was 13% below the 15YA. The nationwide NDVI profile trended below the 5YA crop conditions. The NDVI spatial pattern shows that only 10.6% of the cultivated area was above the 5YA across the study period, 41.3% fluctuated around 5YA, and 48.2% was below the 5YA. For the whole country, the VCIx value was 0.73, and the CALF was at 5YA, indicating reasonable crop conditions. The nationwide crop production index (CPI) was at 1.01 implying normal crop production situation.

Regional Analysis

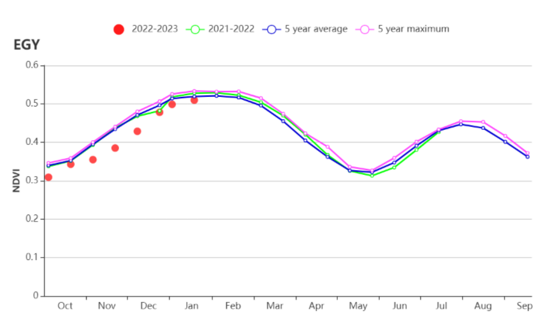
Egypt can be subdivided into three agroecological zones (AEZs) based on cropping systems, climatic zones, and topographic conditions. Only two are relevant for crops: 1) the Nile Delta and the Mediterranean coastal strip and 2) the Nile Valley.

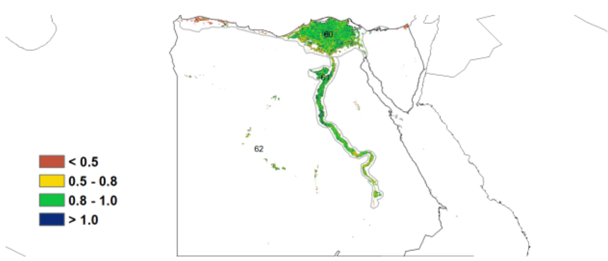
All agro-climatic indicators for these two AEZs are consistent with the national trend. Rainfall was 32%, 40% below the 15YA in both zones. The temperature was only 0.1°C above the 15YA in the first zone and at the 15YA in the second zone. The RADPAR was 3.4% and 0.4 above the 15YA in the first and second zones, respectively. The Biomass was 8% and 35% below the 15YA in both zones. The NDVI-based crop condition development graphs in both zones were similar to the nationwide NDVI profile. Since most of the agricultural land in Egypt is irrigated, the rainfall had little impact on the production levels of maize and rice. However, additional water usually has a beneficial effect. The nationwide crop production index (CPI) was at 1.05 and 1.08 for both zones, respectively, implying above normal crop production situation following the nationwide CPI. CALF was at the 5YA, while the VCIx was 0.75 and 0.81 in both zones. The conditions for winter wheat have been favorable.

Figure 3.15 Egypt's crop condition, October 2022 - January 2023



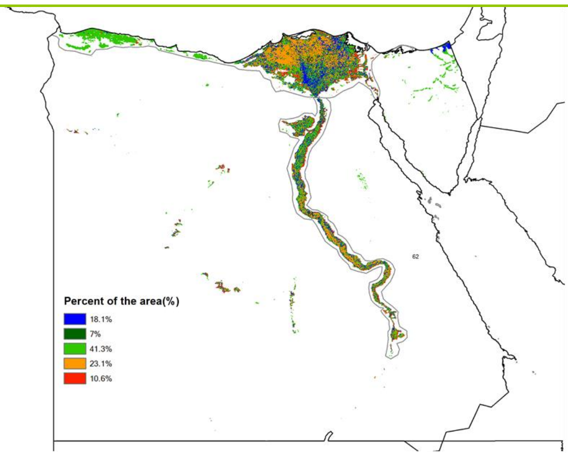
(a) Phenology of major crops



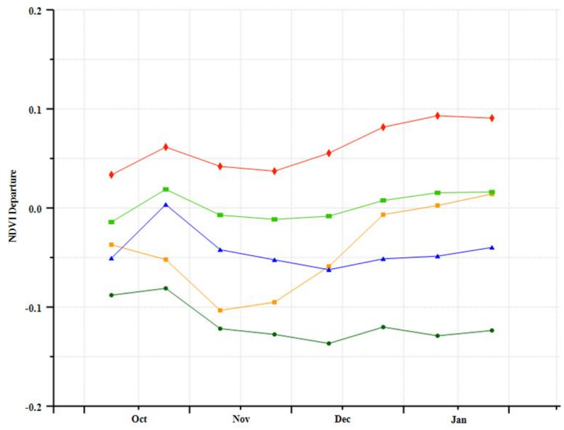


(b) Crop condition development graph based on NDVI

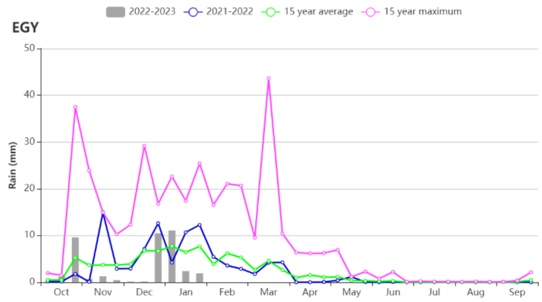
(c) Maximum VCI



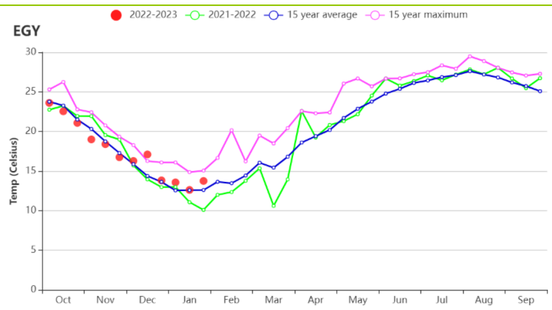
(d) Spatial NDVI patterns compared to 5YA



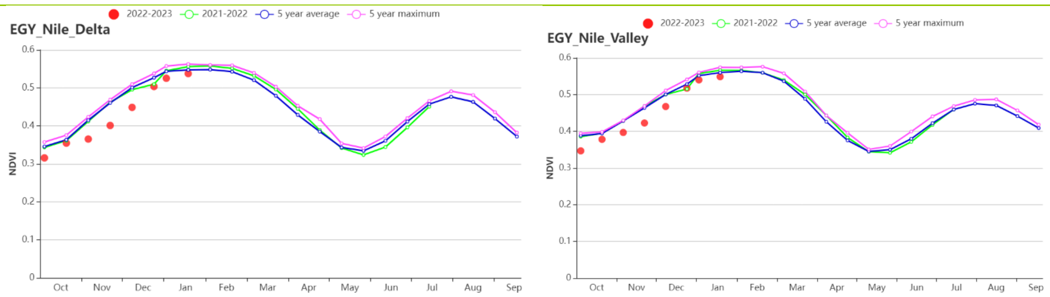
(e) NDVI profiles



(f) Time series 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, October 2022 - January 2023

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Nile Delta and Mediterranean coastal strip	42	-32	17.4	0.1	785	3.4	282	-8
Nile Valley	8	-40	17.0	0.0	870	0.4	128	-35

Table 3.23 Egypt's agronomic indicators by sub-national regions, current season's values and departure from 5YA, October 2022 - January 2023

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Nile Delta and Mediterranean coastal strip	70	0	0.75
Nile Valley	80	0	0.81

[ETH] Ethiopia

In Ethiopia, the primary food crops are teff, wheat, barley, and maize. This monitoring period covers the harvest season for grains, from October 2022 to January 2023.

In the primary agricultural production regions, the persistent drought influenced by the La Niña phenomenon has continued. Nationally, cumulative precipitation has decreased by an average of 33% compared to the 15YA. Meanwhile, average temperature (TEMP 0.0°C) and photosynthetically active radiation (RADPAR -1%) have remained mostly unchanged. Crops had been sown late due to the delayed start of the rainy season. They therefore senesced later than usual. This explains as to why the NDVI curve approached average levels in November and December, despite of lower maximum values which had been observed during the previous monitoring period. Maximum VCI was 0.93. The crop production index (CPI) was 1.18. However, this doesn't necessarily mean that yields have returned to average levels. The estimated biomass (BIOMSS) was 14% lower than the 15YA due to the continued moisture stress throughout the entire 2022 main production season. Additionally, only 4.9% of Ethiopia's farmland is irrigated, making it less resilient to natural hazards, indicating that the 2022 cereal yields were below average.

In summary, the combination of poor rainfall, conflict, and poor macroeconomic conditions has led to below-average crop production in Ethiopia in 2022. Food insecurity is prevalent across the country, with the north, south, and southeast being particularly affected.

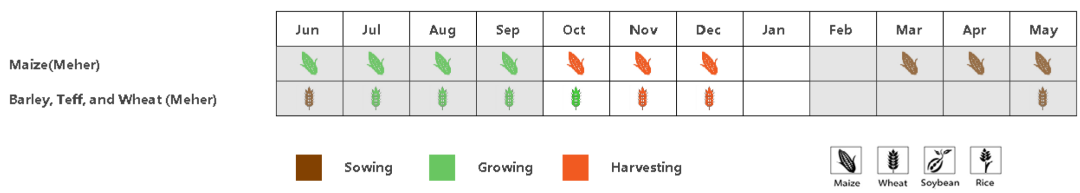
Regional Analysis

This regional analysis focuses on five major cereal production regions: **Central-northern maize-teff highlands (63)**, **Western mixed maize zone (74)**, **Great Rift region (65)**, **South-eastern Mendebo highlands (71)**, and **South-western coffee-enset highlands (73)**.

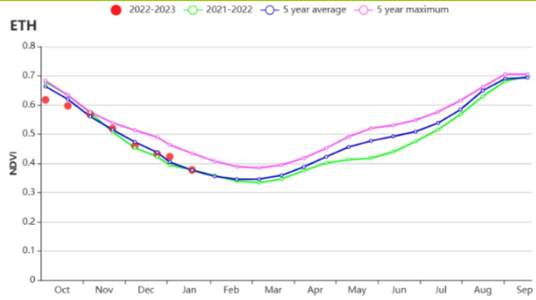
The agroclimatic conditions of **Central-northern maize-teff highlands (63)**, **Western mixed maize zone (74)**, and **South-eastern Mendebo highlands (71)** are similar, with cumulative precipitation below the average levels (RAIN -33%, -22%, and -30%). Biomass also decreased compared to 15YA (BIOMSS -15%, -14% and 14%). The NDVI showed an average trend. Cropped arable land fraction and cropping intensity did not change much. Due to the drought, crop production conditions were below average levels.

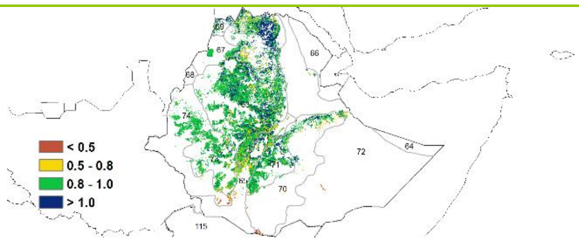
The **Great Rift region (65)** and the **South-western coffee-enset highlands (73)** were even more severely affected by the drought. Precipitation was almost half compared to the 15YA (RAIN -46%, -46%). Biomass was estimated to be below average (BIOMSS -16%, -20%). Cropped arable land fraction and cropping intensity have remained mostly unchanged. Crop production regions in these two regions were below average.

Figure 3.16 Ethiopia's crop condition, October 2022 - January 2023



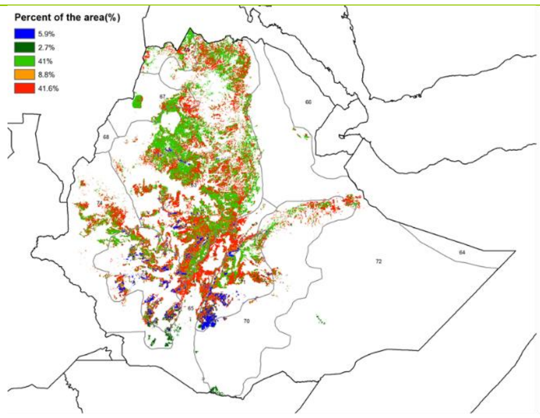
(a) Phenology of major crops

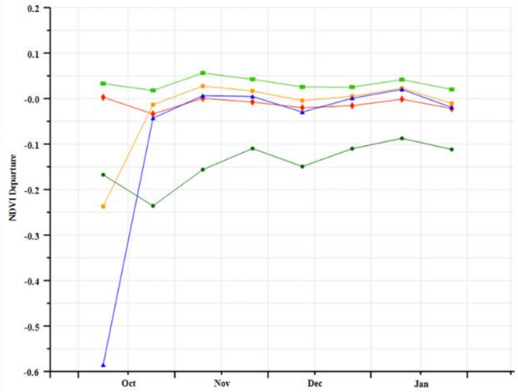




(b) Crop condition development graph based on NDVI

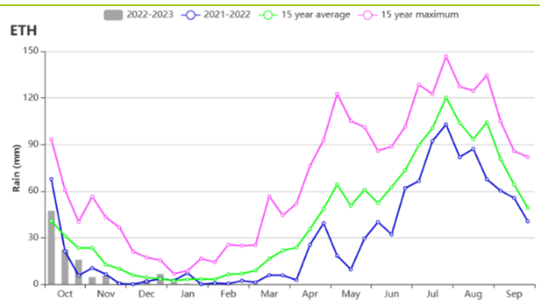
(c) Maximum VCI

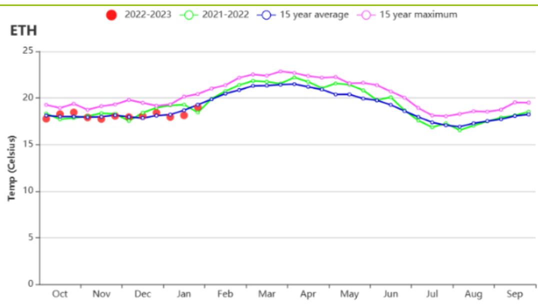




(d) Spatial NDVI patterns compared to 5YA

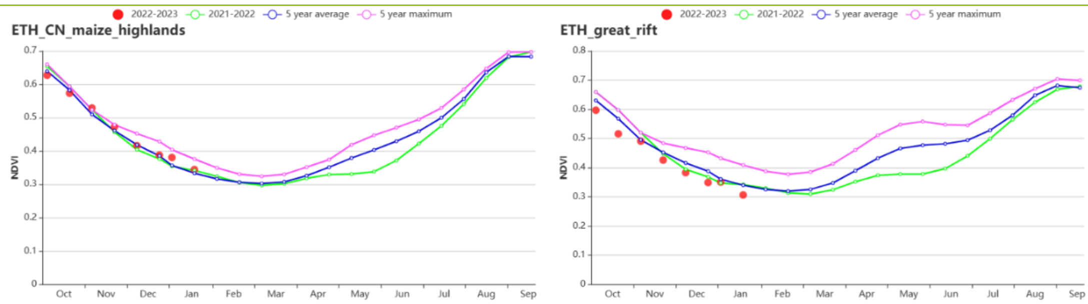
(e) NDVI profiles



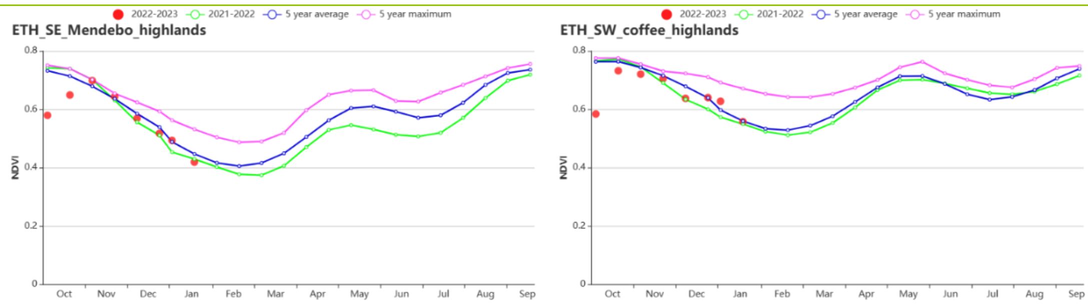


(f) Time series profile of rainfall

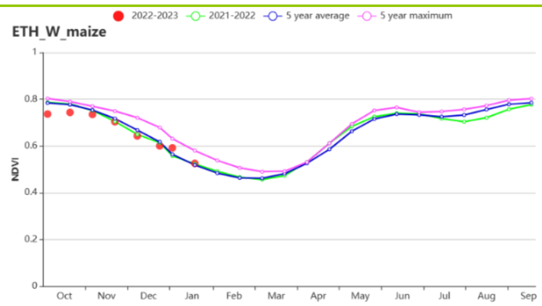
(g) Time series profile of temperature



(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, October 2022 - January 2023

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m^2)	Departure (%)	Current (gDM/m^2)	Departure (%)
Central-northern maize-teff highlands	59	-33	17.1	-0.1	1334	-2	353	-15
Great Rift region	49	-46	18.1	0.0	1315	-3	390	-16
South-eastern Mendebo highlands	94	-22	14.6	-0.2	1264	-3	399	-14
South-western coffee-enset highlands	185	-46	18.4	0.3	1304	0	595	-20
Western mixed maize zone	240	-30	21.3	-0.3	1280	2	666	-14

Table 3.25 Ethiopia's agronomic indicators by sub-national regions, current season's values and departure from 5YA, October 2022 - January 2023

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Central-northern maize-teff highlands	96	4	0.96
Great Rift region	97	1	0.87
South-eastern Mendebo highlands	100	0	0.94
South-western coffee-enset highlands	100	0	0.90
Western mixed maize zone	98	-2	0.88

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

[FRA] France

This monitoring period covers the harvest of maize as well as sowing and the early growth period of winter wheat. CropWatch agro-climatic indicators show that the temperatures were above the average over most of the monitoring period (TEMP +1.5°C), but lower than average in early December and late January. There was a cold spell in January, when the average temperature hovered around 1°C. Snow fell in many places of France. RAIN was 8% below average, while sunshine (RADPAR) was 4% above. Due to favorable temperature and sunshine conditions, the biomass production potential (BIOMSS) is estimated to have increased by 8% nationwide compared to the 15-year average. The national-scale NDVI development graph shows that the NDVI values were overall below the 5-year average. Only in early November were they above average. The sharp drops in NDVI were most likely due to cloud cover, fog, or snow on the ground. The cropped arable land fraction (CALF) departure value was above average by 1%. The spatial distribution of maximum VCI (VCIx) across the country also reached a range of 0.82-0.96. Overall, the precipitation deficit caused slightly unfavorable growth conditions for some 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 weather was observed (TEMP +1.1°C) while RADPAR was above average (+10%) but RAIN was below average (-6%). The potential BIOMSS increased by 6% when compared to the 15-year average. The CALF was higher than the average (+1%), and VCIx was 0.89. Crop condition development based on NDVI for this region was below the 5-year average for most of the monitoring period, especially in December, but higher than average in early November and January.

In the Mixed maize/barley and rapeseed zone from the Center to the Atlantic Ocean, warmer (TEMP +1.3°C) and drier (RAIN -9%) conditions were observed and RADPAR was above average by 3%. Potential BIOMSS was above average by 6% while the overall NDVI profile showed the regional crop conditions were higher than average levels, being below average in mid-October and mid-December only. The CALF was increased by 2%, and VCIx was relatively high, at 0.96.

In the Maize-barley and livestock zone along the English Channel, RADPAR and TEMP were above average by 6% and 0.8°C. RAIN was also higher than the average (+7%). Potential BIOMSS increased by 8%. CALF was average and VCIx was recorded at 0.87. The NDVI profile trended close to the average, except for mid-October and late December, when RADPAR was below average.

In the Rapeseed zone of eastern France, RAIN in this monitoring period was 5% lower than the 15-year average, while TEMP increased by 1.5°C and RADPAR was increased by 5%. BIOMSS was about 12% higher than average with a high VCIx level (0.96). CALF was above average by 1%. The NDVI profile showed great fluctuation during the monitoring period. It was above average in October and then below average in November to January.

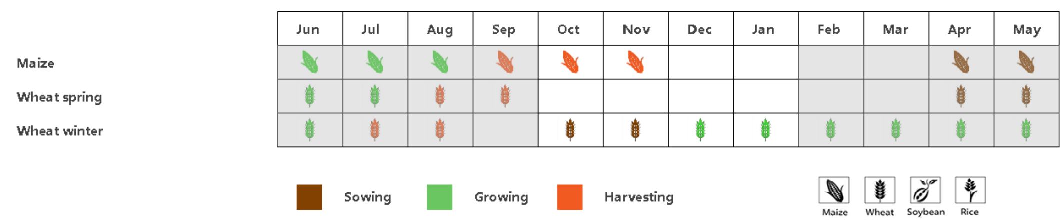
In the Massif Central dry zone, TEMP and RADPAR were 1.4°C and 3% higher than the average, respectively, while RAIN decreased by 12%. The VCIx was 0.96 and potential BIOMSS increased by 10%. CALF was average. Crop conditions based on the NDVI profile indicated that growth conditions were above average before November and below average after November, especially in January when the cold spell hit France.

The Southwestern maize zone is one of the major irrigated regions in France. The regional NDVI profile presented a below average trend, but it was close to the average in mid-November and early December. The VCIx recorded moderate levels (0.90) and potential BIOMSS was 7% higher than average. RAIN in the period was 8% lower than average. TEMP was 1.2°C higher, while RADPAR increased by 1%. CALF was above average by 1%.

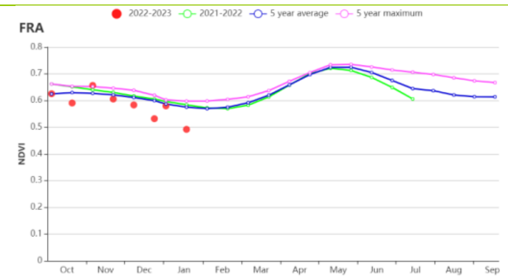
In the Eastern Alpes region, crop conditions presented a slightly above average trend except in January. RADPAR and TEMP in the region were 4% and 1.7°C higher than average, while RAIN was 7% below the average. Potential BIOMSS was also higher than the 15-year average (+14%). VCIx for the region was recorded at 0.94. CALF increased by 1%.

In the Mediterranean zone, NDVI recorded a below-average trend. The region recorded a relatively low VCIx level (0.82). RADPAR and TEMP were above the average (2% and +2.7°C, respectively), while RAIN was significantly lower than average by 24%. CALF also increased by 1%. Potential BIOMSS was above average by 5%.

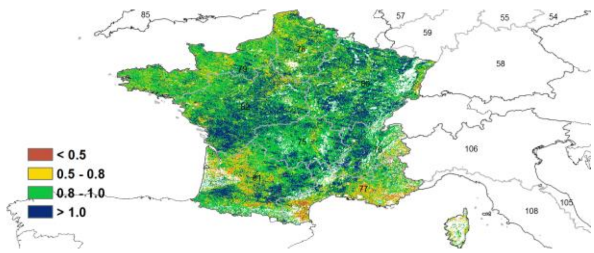
Figure 3.17 France's crop condition, October 2022 - January 2023



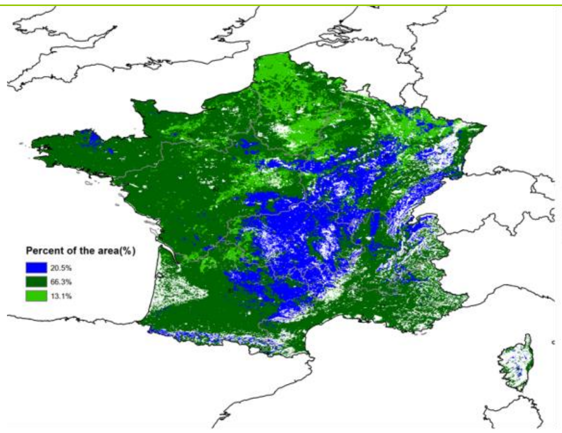
(a) Phenology of major crops



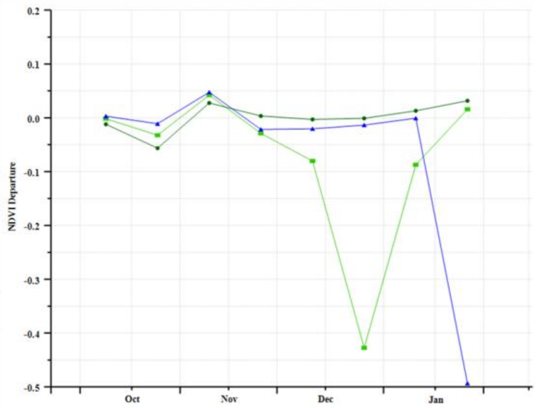
(b) Crop condition development graph based on NDVI



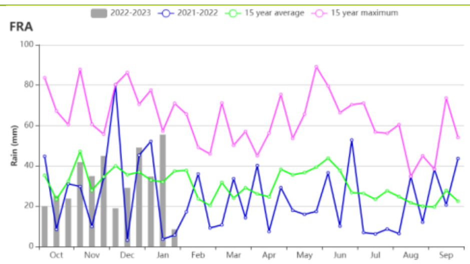
(c) Maximum VCI



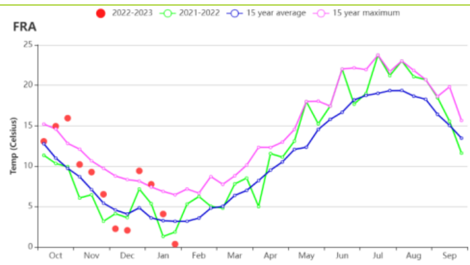
(d) Spatial NDVI patterns compared to 5YA



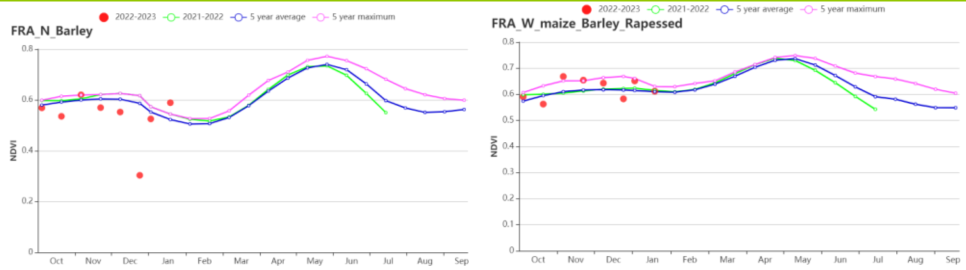
(e) NDVI profiles



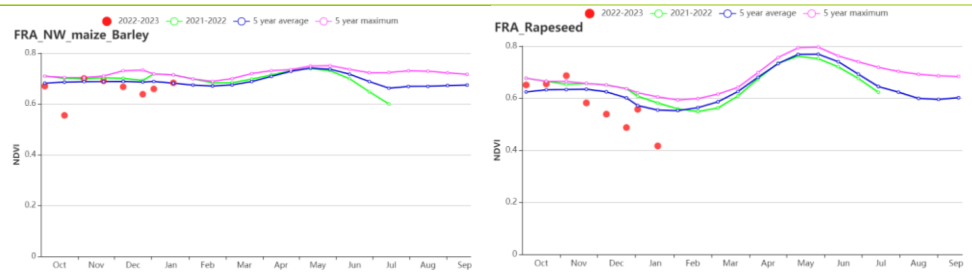
(f) Rainfall profiles



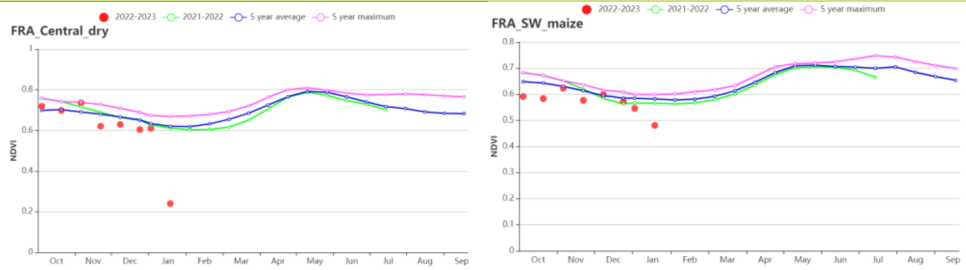
(g) Temperature profiles



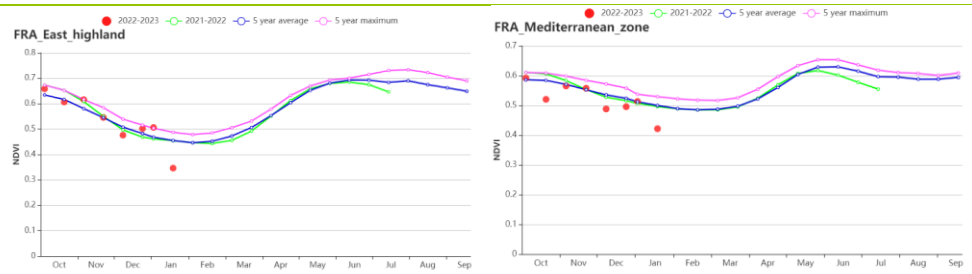
(h) Crop condition development graph based on NDVI (Northern barley region (left) and Mixed maize, Barley and Rapeseed zone (right))



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



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



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

Table 3.26 France's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, October 2022 - January 2023

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Northern Barley zone	332	-6	7.8	1.1	265	10	628	6
Mixed maize/barley and rapessed zone from the Centre to the Atlantic Ocean	331	-9	9.3	1.3	320	3	670	6
Maize barley and livestock	431	7	9	0.8	281	6	702	8

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
zone along the English Channel								
Rapeseed zone of eastern France	394	-5	6.7	1.5	298	5	602	12
Massif Central Dry zone	351	-12	6.9	1.4	357	3	605	10
Southwest maize zone	423	-8	8.6	1.2	401	1	650	7
Alpes region	481	-7	5.5	1.7	397	4	549	14
Mediterranean zone	322	-24	9	2.7	462	2	569	5

Table 3.27 France's agronomic indicators by sub-national regions, current season's values and departure from 5YA, October 2022 - January 2023

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Northern Barley zone	100	1	0.89
Mixed maize/barley and rapessed zone from the Centre to the Atlantic Ocean	100	2	0.96
Maize barley and livestock zone along the English Channel	100	0	0.87
Rapeseed zone of eastern France	100	1	0.96
Massif Central Dry zone	100	0	0.96
Southwest maize zone	99	1	0.90
Alpes region	95	1	0.94
Mediterranean zone	94	1	0.82

[GBR] Kingdom

The planting of winter wheat, winter barley and rapeseed took place between September and November. The NDVI development curves were below the 5-year average during this monitoring period, which may have been caused by clouds or snow. Rainfall for the country was near average (RAIN -2%), while temperature (TEMP +0.8°C) and radiation (RADPAR +9%) were significantly above average. The favorable conditions resulted in above-average biomass (BIOMSS +6%). The seasonal RAIN profile shows that the rainfall was fluctuating during this monitoring period. The TEMP profile shows that temperature was overall above average except in early December, mid-December, and mid-January.

The national average VCIx was 0.90. CALF (100%) was unchanged compared to its five-year average. Crop production index was 1.08. The NDVI departure cluster profiles indicate that: (1) 69.5% of arable land (blue line and red line) experienced average crop conditions, mainly the South and East of England. (2) 30.5% of arable land (yellow line, green line and dark green line), mainly in Scotland, Wales and North-east England, had average crop conditions during most of the monitoring period. Most likely, the large drops of NDVI can be attributed to cloud cover in the satellite images and snow. Altogether, the conditions for winter wheat in the UK are assessed as above average.

Regional analysis

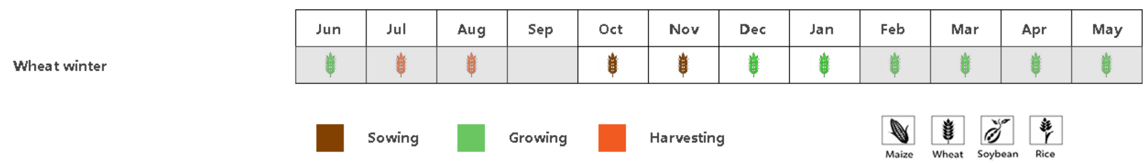
Based on cropping systems, climatic zones, and topographic conditions, three sub-national regions are described below: the **Northern barley region (84)**, **Central sparse crop region (83)** and **Southern mixed wheat and barley region (85)**. All three sub-regions are characterized by an unchanged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

In the **Northern barley region**, NDVI was below average. Rainfall (RAIN -1%) and radiation (RADPAR -7%) were below average, and temperature (TEMP +0.7°C) was above average. Biomass was above average (BIOMSS +6%). The VCIx was 0.91. Crop production index was 1.09. Overall, the conditions were above average.

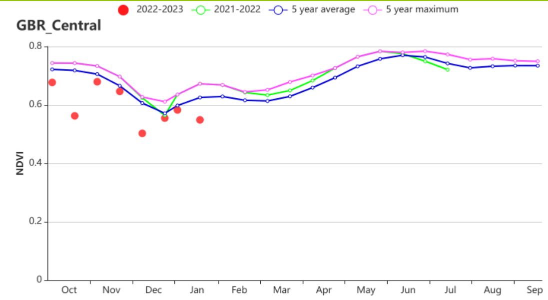
The **Central sparse crop region** is one of the country's major regions for crop production. NDVI was below average, similar to the Northern barley region. Rainfall (RAIN -13%) was significantly below average, while temperatures (TEMP +0.6°C) and radiation (RADPAR +10%) were above average. Biomass（BIOMSS +4%）was above average. The VCIx was 0.89. Crop production index was 1.07. Overall, the conditions were above average.

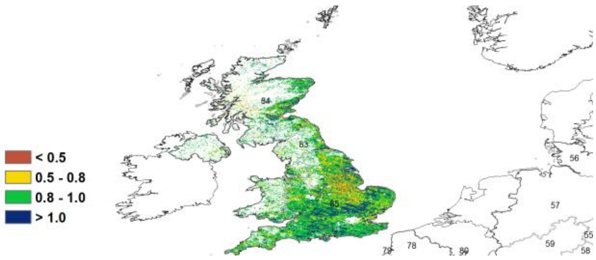
In the **Southern mixed wheat and barley zone**, NDVI was below or close to average. Rainfall (RAIN +5%), temperatures (TEMP +0.9°C) and radiation (RADPAR +15%) were significantly above average. Agro-climate conditions resulted in above-average biomass (BIOMSS +7%). The VCIx was 0.90. Crop production index was 1.07. Overall, the conditions were above average.

Figure 3.18 United Kingdom's crop condition, October 2022 - January 2023

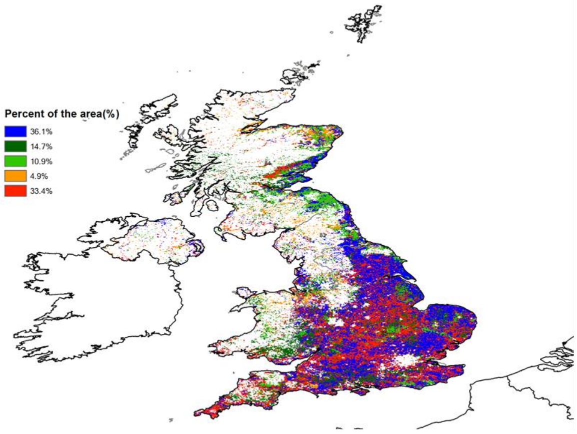


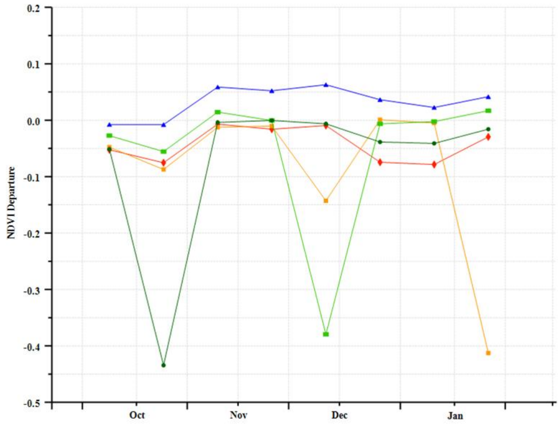
(a) Phenology of major crops



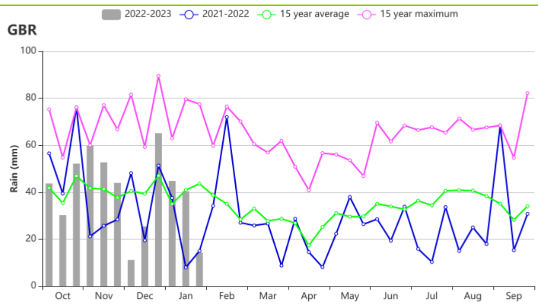


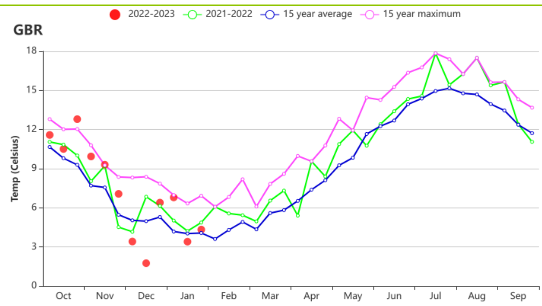
(b) Crop condition development graph based on NDVI (c) Maximum VCI



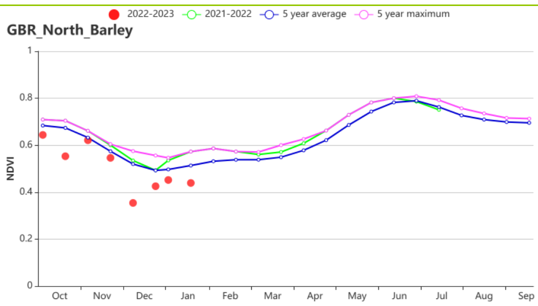


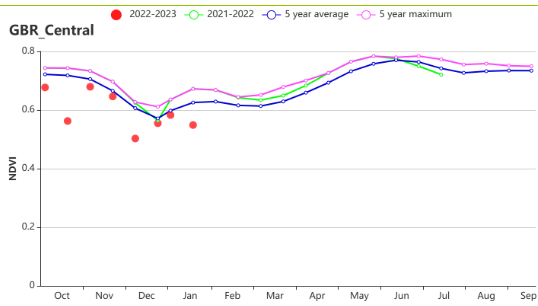
(d) Spatial NDVI patterns compared to 5YA (e) NDVI profiles



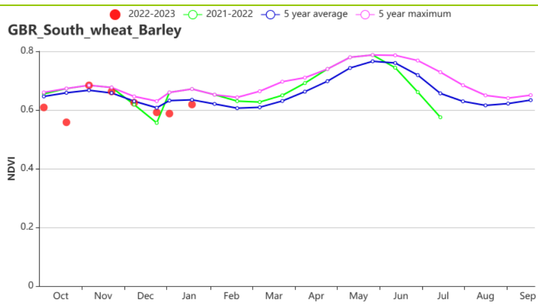


(f) Rainfall profiles (g) Temperature profiles





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



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

Table 3.28 United Kingdom's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, October 2022 - January 2023

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Northern Barley region (UK)	597	-1	6.1	0.7	123	-7	564	6
Central sparse crop region (UK)	451	-13	7.0	0.6	182	10	599	4
Southern mixed wheat and Barley zone (UK)	398	5	8.1	0.9	226	15	646	7

Table 3.29 United Kingdom's agronomic indicators by sub-national regions, current season's values and departure from 5YA, October 2022 - January 2023

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Northern Barley region (UK)	99	0	0.91
Central sparse crop region (UK)	100	0	0.89
Southern mixed wheat and Barley zone (UK)	100	0	0.90

[HUN] Hungary

In Hungary, winter wheat sowing ended in October. NDVI values were below average in mid-October and subsequently stayed above average. Agro-climatic indicators reveal that the area experienced average rainfall, above-average temperatures (+2.1°C), and below-average radiation (-1%). This resulted in a 10% increase in BIOMSS.

The Crop Production Index (CPI) in Hungary was 1.30. The national average VCIx was 0.99. Cropped arable land fraction (CALF) (90%) was higher by 10% as compared to its 5YA. The NDVI departure cluster profiles indicate that: (1) 33.2% of arable land experienced above-average crop conditions, scattered around Western Hungary, middle Hungary and Eastern Hungary. (2) 39.9% of arable land experienced above-average crop conditions in early October and late January but was below average otherwise. It was scattered around all of Hungary. (3) 10% of arable land, mainly in middle Hungary and Eastern Hungary, had above-average crop conditions from November to January. The large drop in October might have been due to cloud cover in the satellite image. (4) 9.5% of arable land experienced below-average crop conditions from mid-November to January. (5) The NDVI of 7.3% of arable land fluctuated around the average. Altogether, the conditions for winter wheat in this period are assessed as slightly above average.

Regional analysis

Based on cropping system, 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. A sizable share of winter wheat, maize and sunflower is planted in this region. According to the NDVI development graphs, NDVI values were below average in late October, early November and early December. In other periods, NDVI values were above average. Agro-climatic indicators show that rainfall (RAIN -8%) was below average. Temperature (TEMP +2.2°C) was above average. Radiation was average. BIOMSS had a 4% increase due to the adequate rainfall during this period. The VCIx was 1.05. Cropped arable land fraction (CALF) experienced a 6% increase compared to the 5YA. The CPI index was 1.30. The crop conditions in this region are slightly above 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 graph, crop conditions were above average throughout the monitoring period. Despite a 7% below-average rainfall, the area experienced an increase in temperature of 2.3°C and above-average radiation of 1%, contributing to a 6% increase in biomass production. The maximum VCI was 1.01. CALF experienced a 17% increase compared to the 5YA. The CPI index was 1.38. The crop conditions in this region are slightly above average.

Northern Hungary (88) is a significant area for winter wheat production. According to the NDVI development graphs, NDVI values were below average in mid-October and mid-November. In other periods, NDVI values were above average. Agro-climatic indicators show that the rainfall was below average (-2%). The temperature was above average (TEMP +2.1°C), whereas radiation was below (RADPAR -1%), which resulted in above-average biomass (BIOMSS +7%). The maximum VCI was 1.04. CALF experienced a 10% increase compared to 5YA. The CPI index was 1.36. The crop conditions in this region are above average.

Southern Transdanubia (89) cultivates winter wheat, maize, and sunflower, mostly in Somogy and Tolna counties. Crop conditions were below average throughout the monitoring period. Rainfall and temperature were above average (RAIN +7%, TEMP +2.0°C), whereas solar radiation was below average (RADPAR -2%) and biomass was above average (BIOMSS +15%). The maximum VCI was favorable at 0.94. CALF experienced a 4% increase compared to the 5YA. The CPI index was 1.15. The crop conditions in this region are above average.

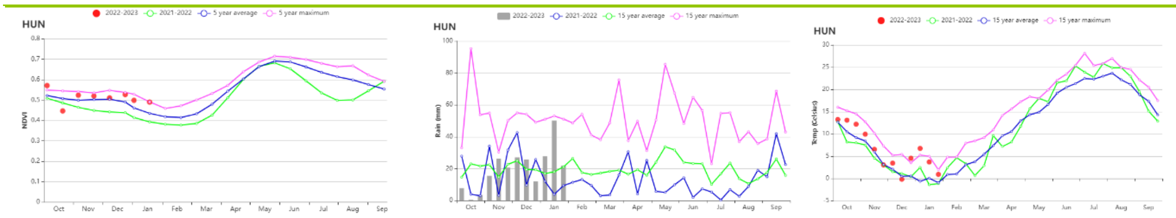
Figure 3.19 Hungary's crop condition, October 2022-January 2023

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

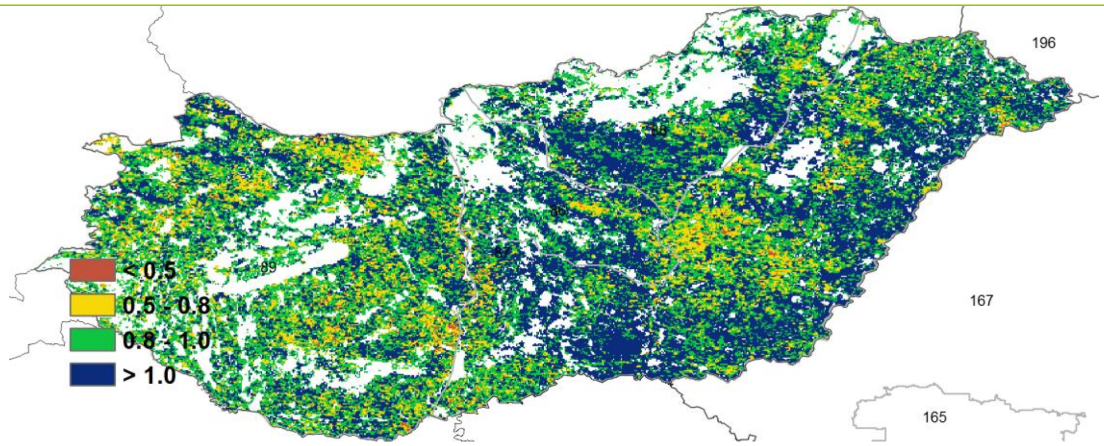
Sowing Growing Harvesting

Maize Wheat Soybean Rice

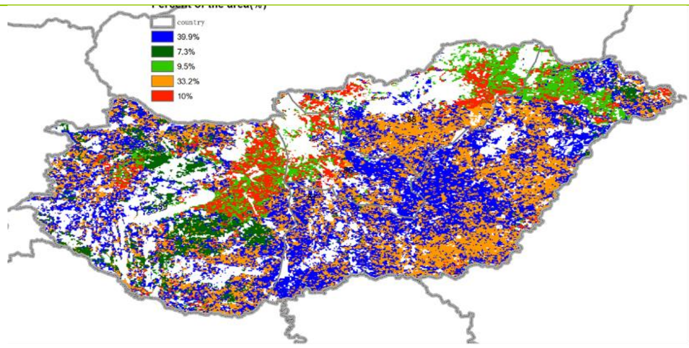
(a). Phenology of major crops

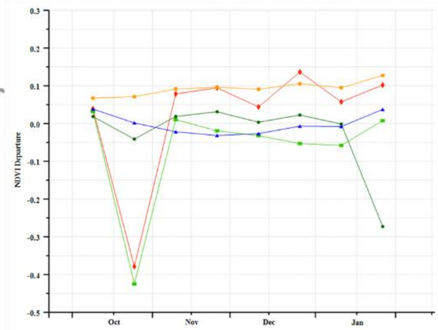


(b) Crop condition development graph based on NDVI, RAIN and TEMP



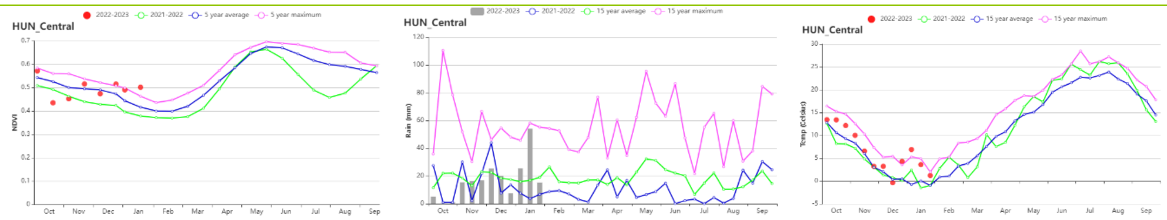
(c) Maximum VCI



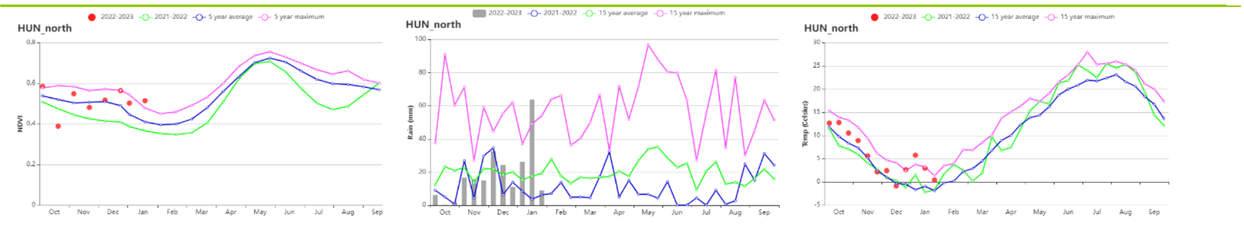


(d) Spatial NDVI patterns compared to 5YA

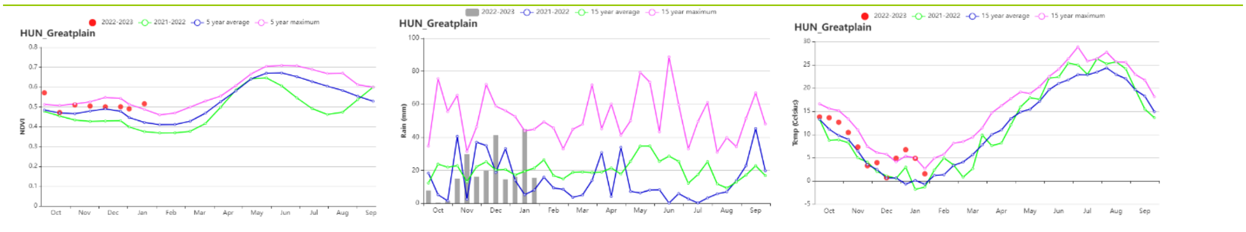
(e) NDVI profiles



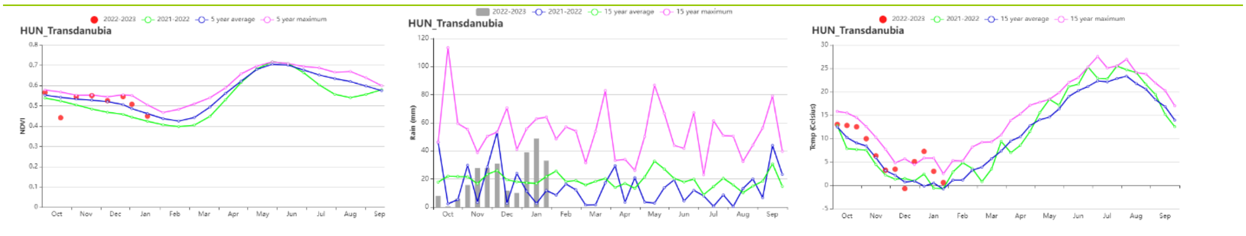
(f) Crop condition development graph based on NDVI, RAIN and TEMP (Central Hungary)



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



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



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

Table 3.30 Hungary's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, October 2022-January 2023

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Central Hungary	203	-8	6.5	2.2	335	0	481	4
Puszta	222	-7	7.0	2.3	342	1	506	6
North Hungary	222	-2	5.5	2.1	308	-1	477	7
Transdanubia	258	7	6.4	2.0	342	-2	553	15

Table 3.31 Hungary's agronomic indicators by sub-national regions, current season's values and departure from 5YA, October 2022-January 2023

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current (%)
Central Hungary	99	6	1.05
Puszta	99	17	1.01
North Hungary	100	10	1.04
Transdanubia	99	4	0.94

[IDN] Indonesia

During the monitoring period, the second-season rice in Java and the dry-season corn had been harvested. The rainy season corn in Java and Sumatra and the main season rice had been sown in November.

CropWatch agroclimatic indicators showed that temperatures were close to the 15YA (TEMP +0.0°C), precipitation was below the average (RAIN -2%), but radiation was above the 15YA (RADPAR +2%), which resulted in above-average potential biomass production (BIOMSS +2%).

According to the regional NDVI development graph, crop conditions were below the 5YA in the whole monitoring period. Flooding occurred in Indonesia between December 2022 and January 2023, which caused a drop in NDVI in some parts. The NDVI departure cluster profiles indicate that 31.3% of arable land was close to or below the average, mainly distributed in Sumatra, Kalimantan, Sulawesi, and Irian. On the remaining 68.7%, located in Java, Kalimantan, and Sumatra, the conditions looked less favorable. However, this might be an artifact due to frequent cloud cover in the satellite images, which causes low NDVI values. The area of cropped arable land (CALF 99%) in Indonesia was close to the 5YA and the VCIx value was 0.92. The CPI index of all regions in Indonesia is greater than 1. In general, crop conditions can be anticipated as normal.

Regional analysis

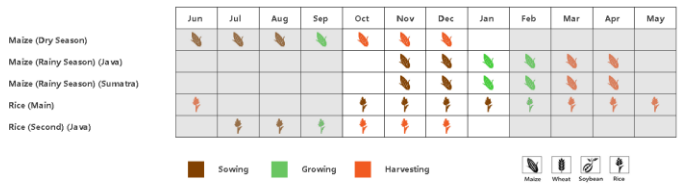
This analysis focuses on four agro-ecological zones in Indonesia: **Sumatra** (92), **Java** (90, the main agricultural region in Indonesia), **Kalimantan and Sulawesi** (91), and **West Papua** (93), among which the first three are the most relevant for crop cultivation. The numbers correspond to the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

On **Java**, the temperature was below the average (TEMP -0.4°C), while precipitation and radiation were above the 15YA (RAIN +16%, RADPAR +1%), resulting in the potential biomass production increase (BIOMSS +7%). According to the NDVI development graphs, crop conditions were close to the 5YA in the early stage of the monitoring period, but they were below average in December and January. The Crop Production Index (CPI) in **Java** was 1, which indicates normal conditions. Overall, crop conditions can be assessed as normal in **Java**.

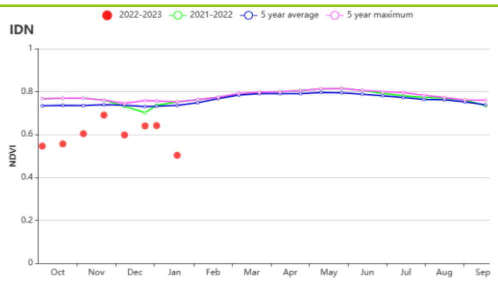
On **Kalimantan and Sulawesi**, precipitation was below the average (RAIN -2%). whereas temperature and radiation were above the 15YA (TEMP +0.1°C, RADPAR +2%), which brought an increase in the potential biomass production (BIOMSS +3%). As shown in the NDVI development graphs, crop conditions were significantly below the 5YA. This can be partly attributed to the floods that occurred in this region in January. The Crop Production Index (CPI) in **Kalimantan and Sulawesi** was 1. The crop conditions can be assessed as normal.

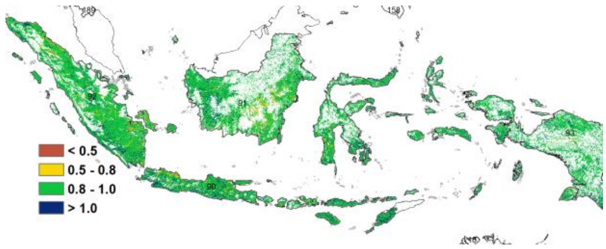
According to the agroclimatic conditions of **Sumatra**, radiation was close to the 15YA (RADPAR +0%), precipitation and temperature were below average (RAIN -4%, TEMP -0.1°C) and the potential biomass production was above average (BIOMSS +1%). NDVI development graphs show that crop conditions were below the 5YA. However, cloud cover in the satellite images caused some outliers, and thus the spatial distribution map needs to be interpreted with care and has limited value. The Crop Production Index (CPI) in **Sumatra** was 1, and the crop conditions can be assessed as normal.

Figure 3.20 Indonesia's crop condition, October 2022 – January 2023

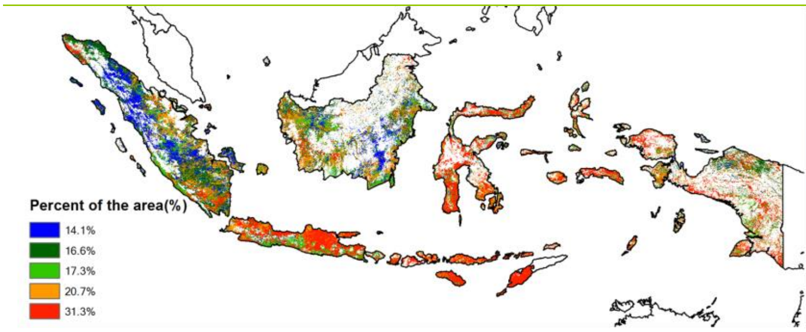


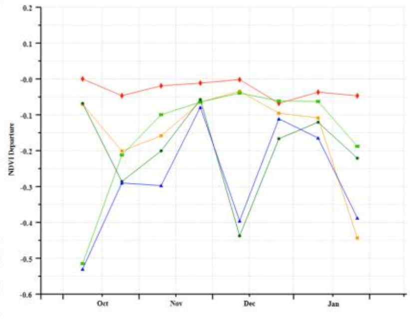
(a) Phenology of major crops



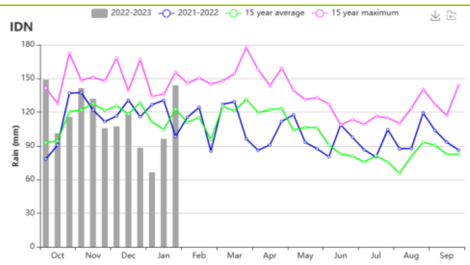


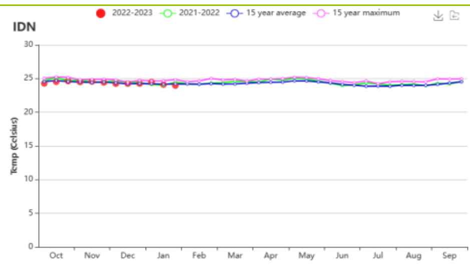
(b) Crop condition development graph based on NDVI (c) Maximum VCI



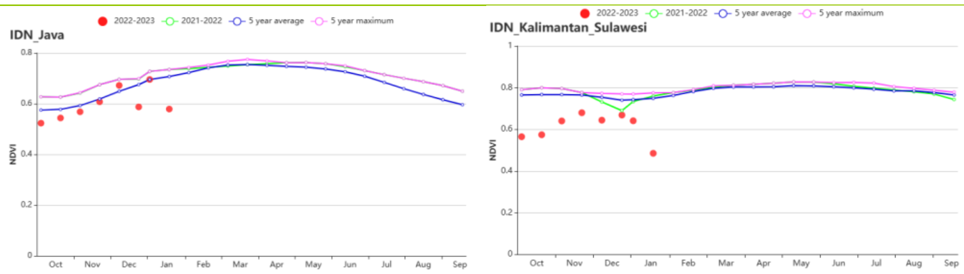


(d) Spatial NDVI patterns compared to 5YA (e) NDVI profiles

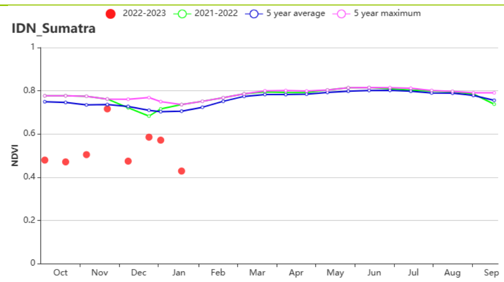




(f) Rainfall profiles (g) Temperature profiles



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



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

Table 3.32 Indonesia's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, October 2022 – January 2023

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m^2)	Departure (%)	Current (gDM/m^2)	Departure (%)
Java	1360	16	25.2	-0.4	1279	1	1495	7
Kalimantan and Sulawesi	1255	-2	24.7	0.1	1185	2	1515	3
Sumatra	1392	-4	24.2	-0.1	1076	0	1501	1
West Papua	1545	-5	23.7	0.1	1075	2	1411	0

Table 3.33 Indonesia's agronomic indicators by sub-national regions, current season's values and departure from 5YA, October 2022 – January 2023

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Java	99	1	0.94
Kalimantan and Sulawesi	99	0	0.93
Sumatra	99	0	0.91
West Papua	100	0	0.95

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[IND] India

The current monitoring period covers the end of the grainfilling stage and harvest of Kharif (summer) maize, rice and soybean, and the planting and early growth of Rabi (winter) rice and wheat. The graph of NDVI development shows that the crop conditions were below average in general, and close to average after December.

The CropWatch agroclimatic indicators show that nationwide, RAIN and RADPAR were above average (+4% and +2% respectively), whereas TEMP was slightly below the 15YA (-0.2°C). The increased RAIN and RADPAR compensated for the lower temperatures, resulting in a slight BIOMSS increase by 1% compared with the 15YA. The overall VCIx was high, with a value of 0.88. 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 northern and central regions showed close to and above-average crop conditions while the conditions were slightly below average in the eastern regions. The spatial distribution of NDVI profiles shows that 56.8% of the areas had below-average crop conditions in the eastern and southern regions throughout the monitoring period. From late November to January, 43.2% of the areas showed above-average crop conditions in northern and central regions. CALF increased by 1% compared to the 5YA. The CPI was 1.05 indicating that the agroclimatic indicators were generally normal.

Regional analysis

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

The three agro-ecological zones of the Deccan Plateau, the Gangetic plain and the Agriculture areas in Rajastan and Gujarat showed similar trends in agricultural indices. Compared to the same period of previous years, RAIN was above average, especially in the agriculture areas in Rajastan and Gujarat (+45%), and RADPAR was slightly above average, but the TEMP was slightly below average. BIOMSS was above the 15-year average benefitting from the abundant rainfall. CALF was average in all of the three regions. The graph of NDVI development shows that the crop growth was close to or above the 5-year average in most of the period. The CPI was above 1.00 indicating that the crop production situation was expected to be near average.

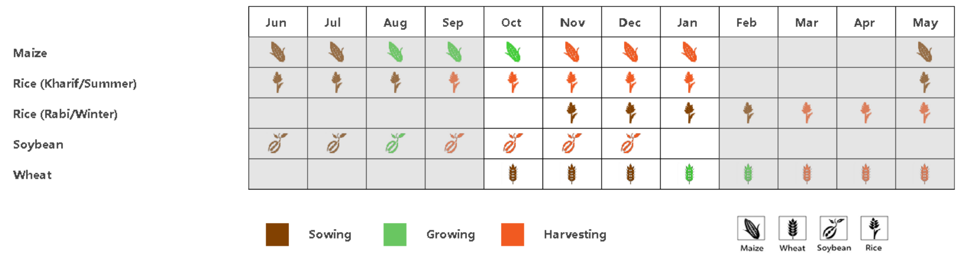
The North-western dry region and the Western Himalayan region showed similar trends in agricultural indices. Compared to the same period of previous years, RAIN and TEMP were above average, but RADPAR was below average. The BIOMSS was below the 15-year average due to the low sunshine. CALF was above average. The graph of NDVI development shows that the crop growth of the two regions was close to the 5-year average in most of the period. The CPI was above 1.01 indicating that the crop production situation was near average.

The Eastern coastal region recorded 366 mm of RAIN, which was slightly above average (+3%). TEMP was close to average (+0.2°C), and RADPAR was above the 15YA (+1%). BIOMSS was above the 15YA (+4%) benefiting from abundant rainfall and sunshine. CALF was 99% which was higher than the 5-year average, and VCIx was 0.86. The graph of NDVI development shows that the crop growth of this region during the monitoring period was close to the 5-year average in most of the period. Cloud cover in the satellite images caused the sharp drop in December. The CPI was 1.09, indicating that the crop production situation was expected to be near average.

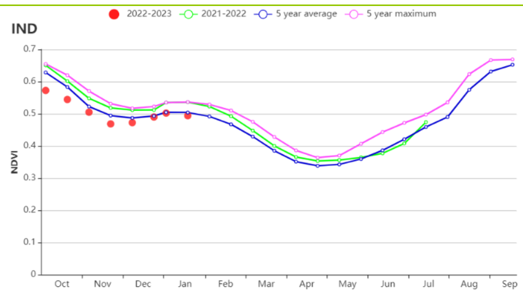
The Assam and north-eastern regions recorded 323 mm of RAIN, which was below average (-3%). TEMP was below average (-0.5°C), and RADPAR was above the 15YA (+5%). BIOMSS was significantly below the 15YA (-9%) due to the low rainfall and temperature. CALF was 96% which was on average, and VCIx was 0.88. The graph of NDVI development shows that the crop growth of this region during the monitoring period was below the 5-year average in most months indicating that the crop production situation was slightly unfavorable.

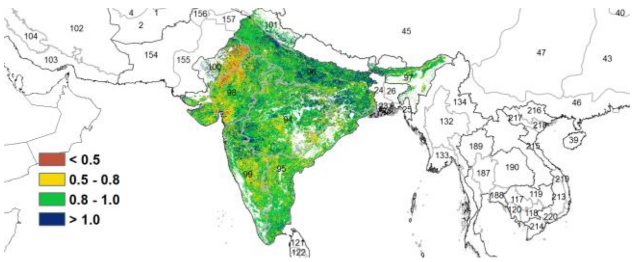
The Western coastal region recorded 342 mm of RAIN, which was slightly below average (-2%), and TEMP was slightly below average (-0.4°C), whereas the RADPAR was slightly above average (+1%). BIOMSS was above the 15YA (+3%) benefitting from the above average sunshine. CALF was 99% which was above the 5-year average (+3%), and VCIx was 0.86. 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. Cloud cover in the satellite images caused a sharp drop in December. The CPI was 1.09 indicating that the crop production situation was expected to be close to average.

Figure 3.21 India's crop condition, October 2022 - January 2023



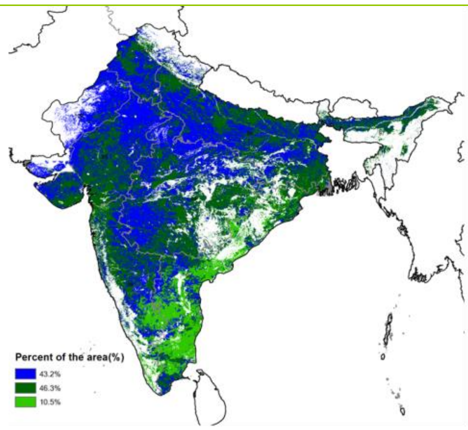
(a) Phenology of major crops

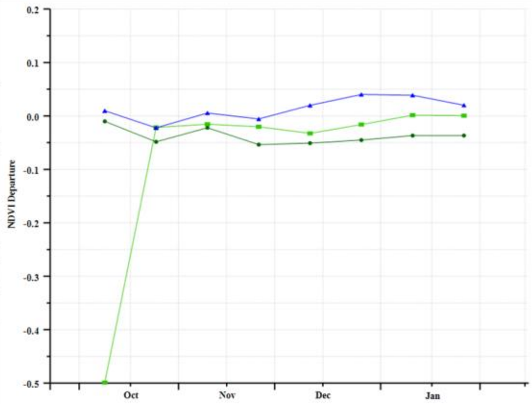




(b) Crop condition development graph based on NDVI

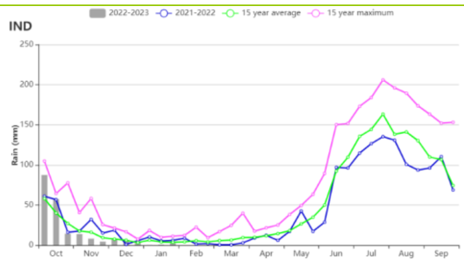
(c) Maximum VCI

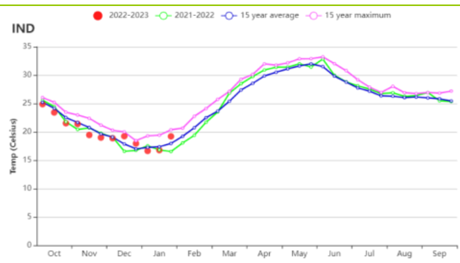




(d) Spatial NDVI patterns compared to 5YA

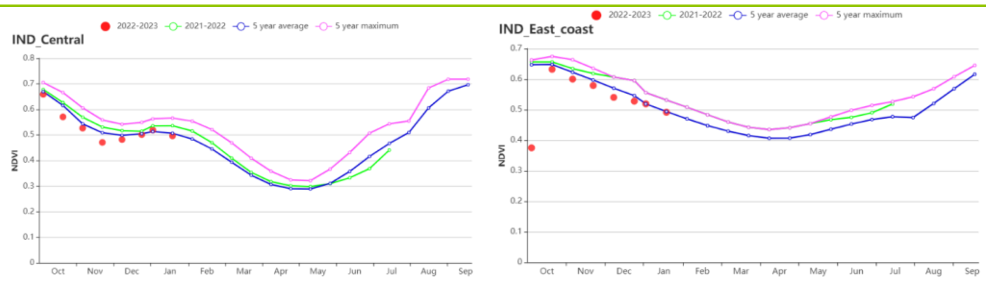
(e) NDVI profiles



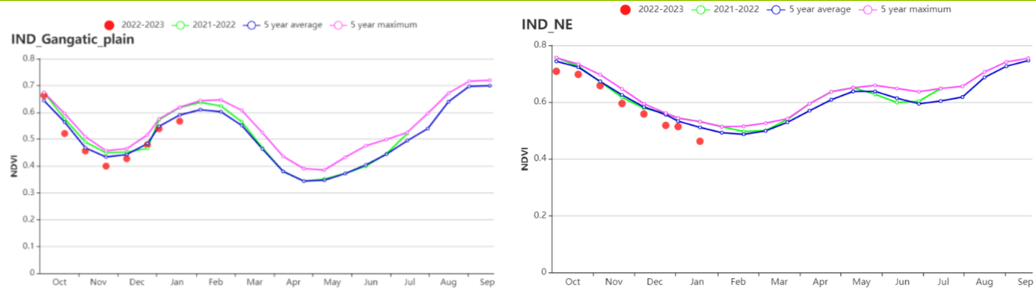


(f) Rainfall profiles

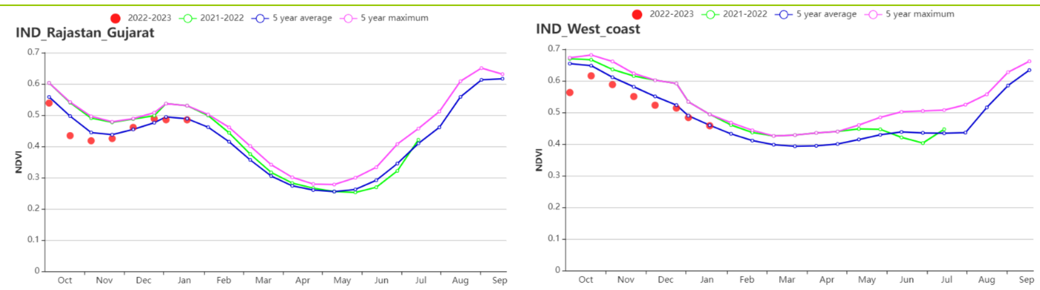
(g) Temperature profiles



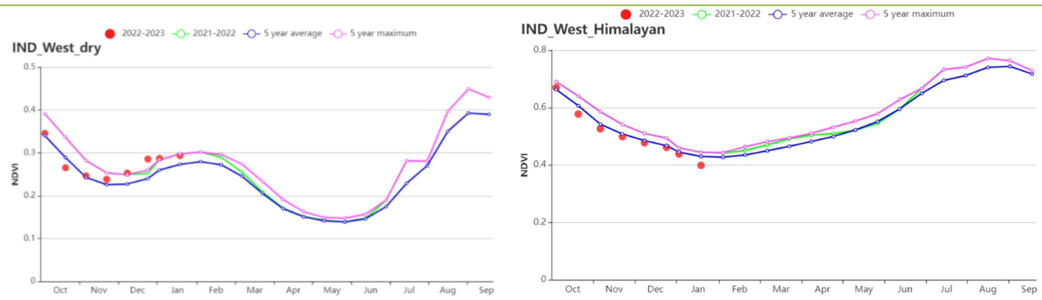
(h) Crop condition development graph based on NDVI (Deccan Plateau (left) and Eastern Coastal Region (right))



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



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



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

Table 3.34 India's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, October 2022 - January 2023

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Deccan Plateau	108	7	20.0	-0.2	1098	3	461	2
Eastern coastal region	366	3	22.5	0.2	1103	1	797	4
Gangatic plain	117	12	18.2	-0.3	971	1	377	-1
Assam and north-eastern regions	323	-3	16.3	-0.5	945	5	510	-9
Agriculture areas in Rajastan and Gujarat	67	45	21.2	-0.3	1048	0	391	6

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m^2)	Departure (%)	Current (gDM/m^2)	Departure (%)
Western coastal region	342	-2	22.9	-0.4	1152	1	757	3
North-western dry region	30	57	21.4	0.2	995	-1	286	-7
Western Himalayan region	176	12	8.8	0.8	874	-2	304	-2

Table 3.35 India's agronomic indicators by sub-national regions, current season's values and departure from 5YA, October 2022 - January 2023

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Deccan Plateau	99	0	0.89
Eastern coastal region	99	1	0.86
Gangatic plain	98	0	0.94
Assam and north-eastern regions	96	0	0.88
Agriculture areas in Rajastan and Gujarat	89	1	0.82
Western coastal region	99	3	0.86
North-western dry region	30	5	0.80
Western Himalayan region	94	0	0.91

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[IRN] Iran

Crop conditions trended slightly below average throughout the monitoring period according to the crop condition development graph based on NDVI. The sowing of winter wheat was completed in October. The temperature was above average (TEMP +0.4°C), radiation was average and rainfall was below average (RAIN -19%) as compared to the 15YA. The lack of rainfall resulted in a slight decrease in the BIOMSS index by 9% as compared to the 15YA. The Cropped Arable Land Fraction (CALF) decreased by 5% compared to the recent five-year average and the national average of maximum VCI index was 0.53. The national Crop Production Index (CPI) was 0.89, indicating a relatively lower-than-normal crop production condition.

According to the spatial distribution of NDVI profiles, approximately 12.6% of the cropland (marked in blue) had above-average crop conditions during the whole monitoring period. The crop conditions of 41.1% of the croplands, marked in red, were near average. 11.3% of the cropland (marked in orange) had below-average crop conditions, mainly distributed in the northern parts of East Azarbaijan and Ardebil, and the province of Mazadaran. Crop conditions in the rest of the cultivated areas (marked in light and dark green) all had near-average to above-average crop conditions at first and then dropped to below-average at the end of the monitoring period, mainly in the provinces of Zanjan, Kordestan, Gilan, Hamadan, Kermanshah, Qazvin, Ilam, Lorestan, and Markazi. The spatial pattern of maximum Vegetation Condition Index (VCIx) was in accord with the spatial distribution of the NDVI profiles. The drop in NDVI in January can be attributed to cloud or snow cover. Overall, the crop conditions for winter crops were slightly below average.

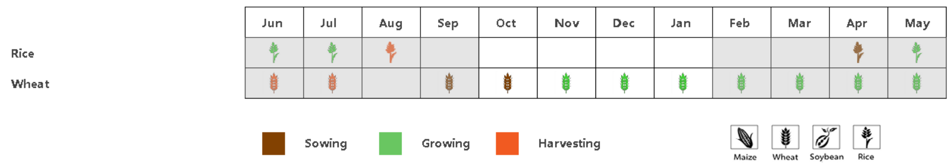
Regional analysis

Based on cropping systems, climatic zones, and topographic conditions, three sub-national agro-ecological regions can be distinguished for Iran, among which two are relevant for crop cultivation. The two regions are referred to as the Semi-arid to sub-tropical hills of the west and north, and the Arid Red Sea coastal low hills and plains.

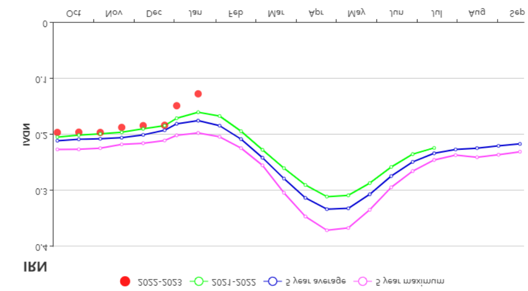
In the **Semi-arid to sub-tropical hills of the west and north region**, crop conditions were slightly below average during the whole monitoring period. This AEZ is a mountainous, relatively high-altitude region. Snow cover is common, and thus the low NDVI values observed for January are not representative. Temperature was 0.6°C above average, the accumulated rainfall was 159 mm (21% below average), and radiation was slightly above average (RADPAR +1%). The unfavorable weather conditions resulted in a decrease of BIOMSS by 13% compared to the recent 15-year average. The CALF decreased by 11%, and the average VCIx (0.54) was rather low. Crop conditions were slightly unfavorable.

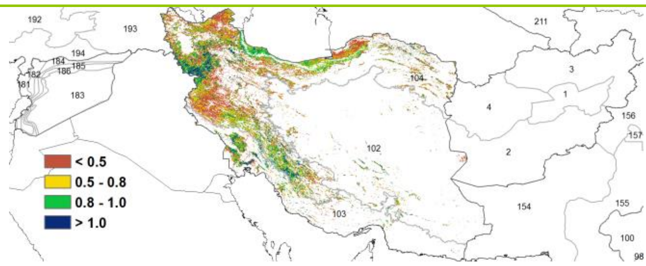
The **Arid Red Sea coastal low hills and plains region** had below average crop conditions during the whole monitoring period except for late January. This AEZ received 169 mm rainfall during the reporting period, 12% below the 15YA average (RAIN -12%). Temperature was 1.5°C above average (TEMP +1.5°C), and radiation was 3% below average (RADPAR -3%). BIOMSS was above average (+13%) as a result of relatively agreeable hydrothermal conditions. The CALF increased by 22% compared to the 5YA, reflecting that more land was cultivated. The average VCIx of this region was 0.64. Crop conditions were assessed as fair.

Figure 3.22 Iran's crop condition, October 2022 - January 2023



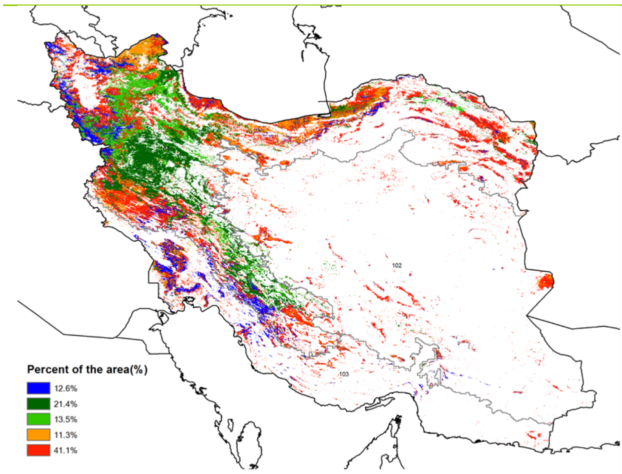
(a) Phenology of major crops

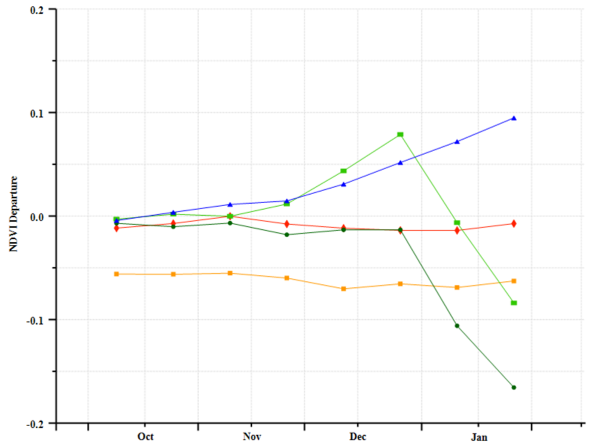




(b) Crop condition development graph based on NDVI

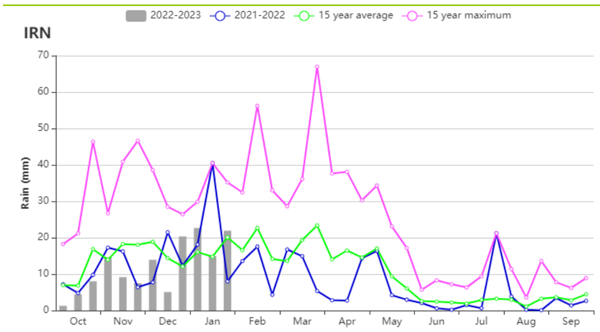
(c) Maximum VCI

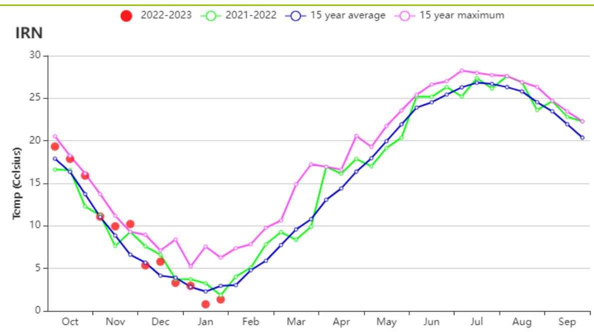




(d) Spatial NDVI patterns compared to 5YA

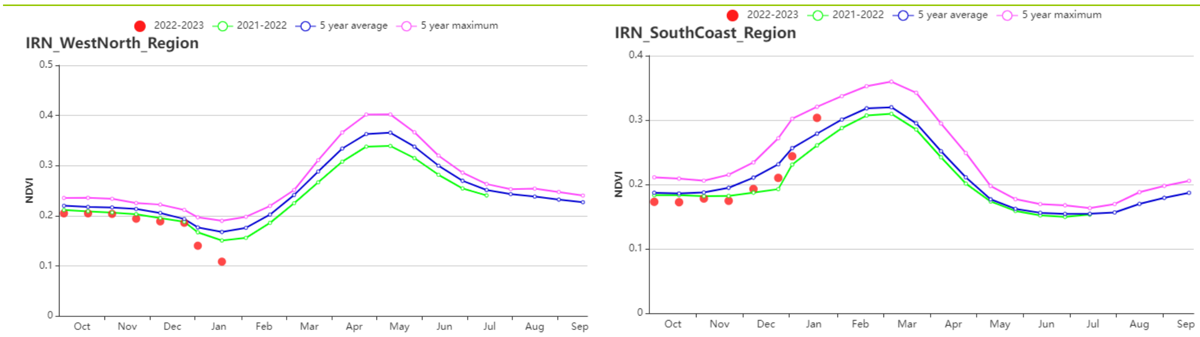
(e) NDVI profiles





(f) Rainfall profiles

(g) Temperature profiles



(h) Crop condition development graph based on NDVI (Semi-arid to sub-tropical hills of the west and north region (left) and Arid Red Sea coastal low hills and plains region (right))

Table 3.36 Iran's agroclimatic indicators by sub-national regions, current season's values, and departure from 15YA, October 2022 - January 2023

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Arid Red Sea coastal low hills and plains	169	12	19.4	1.5	831	-3	507	12
Semi-arid to sub-tropical western and northern hills	159	-21	7.0	0.6	740	1	336	-13

Table 3.37 Iran's agronomic indicators by sub-national regions, current season's values, and departure from 5YA, October 2022 - January 2023

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Arid Red Sea coastal low hills and plains	25	22	0.64
Semi-arid to sub-tropical western and northern hills	9	-11	0.54

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[ITA] Italy

This report covers the sowing of winter wheat in October and November. According to the crop condition development graph, NDVI values were below average from October to early November, above average in mid-November, below average between late November and December, and above average in January. In this period, the overall rainfall (RAIN -9%) was below the 15YA. Temperature (TEMP, +2.1°C) and PADPAR (+2%) were above average. The combined effect of the three weather parameters led to a 6% increase in estimated BIOMSS.

The national average VCIx was 0.94. CALF (97%) was above 5% compared to its five-year average. CPI was 1.23. The NDVI departure cluster profiles indicate that: (1) 24.4% of arable land experienced above-average crop conditions, mainly in Sardegna, Piemonte, Sicily and Apulia. (2) 19.0% of arable land experienced slightly below-average crop conditions, mainly in Lombardia, Toscana, Marche and Sicily. (3) 11.7% of arable land, mainly in Ancona, Pesaro, Arezzo and Parma, was slightly below average from October to the middle of November. However, in early December, NDVI rose above average. The drop from mid-December to early January can most likely be attributed to cloud cover in the satellite images. Starting from mid-January NDVI was again above average. (4) 42% of arable land was hovering around average in October and early November, and above average from mid-November to January. CropWatch estimates that crop conditions were close to the average for this monitoring period.

Regional analysis

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

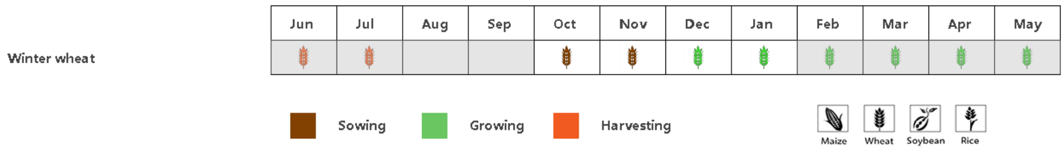
On the **East coast** (108), rainfall was lower by 14%, while temperature and RADPAR were higher by 1.4°C and 7% respectively and potential biomass was 2% lower than the average of the last 15 years. Higher rainfall mainly occurred in November and mid-January, while the NDVI was below average from October to mid-November, and above average in late November and January. VCIx in the subregion reached 0.98. CPI was 1.57. CALF was 97%. It was 14% higher than the average of the last 5 years. In general, crop growth was fair.

In **Po Valley** (105), rainfall and RADPAR were below average by 14% and 5%, while the temperature was higher (+2.4°C) and potential biomass was 20% higher than the average of the last 15 years. Higher rainfall mainly occurred in December and January. Whereas the NDVI was below average in October and late December, average from November to mid-December and above average in January. VCIx in the subregion reached 0.91. CPI was 1.18. CALF experienced a 6% increase compared to the 5YA. Overall, agronomic conditions were near average.

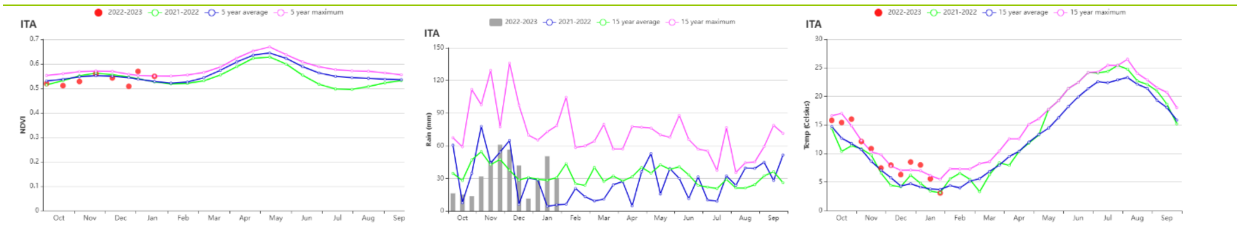
Compared to the average of the last 15 years, rainfall on the **Islands** (107) was lower by 18%, temperature and RADPAR were higher by 1.7°C and 6%, respectively. Lower precipitation during the growing season was negative for the crops, which resulted in a 10% decrease in BIOMSS. NDVI was below average in October and November, above average in December and January. VCIx in the subregion reached 0.95. CPI was 1.20. CALF was 100%. During this monitoring period, agronomic conditions were below but close to average for the islands.

In **Western Italy** (106), rainfall was lower by 3%, while temperature and RADPAR were higher by 2.1°C and 5% respectively and potential biomass was 7% higher than the average of the last 15 years. Higher rainfall mainly occurred in early December and late December of growing season, while the NDVI was above average in early October, mid-November and early January, below but close to average in the rest of monitoring period. VCIx in the subregion reached 0.93. CPI was 1.20. CALF was 100%. Overall, agronomic conditions were close to average for crop growth in this area.

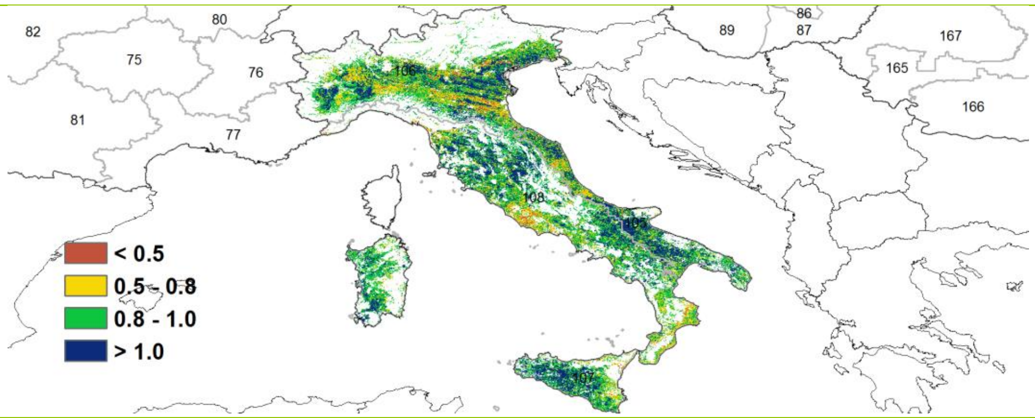
Figure 3.23 Italy's crop condition, October 2022 - January 2023



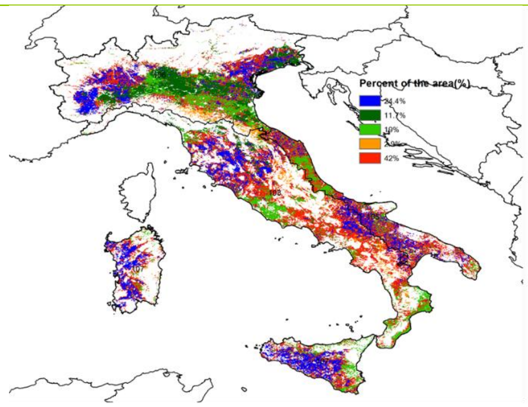
(a) Phenology of major crops



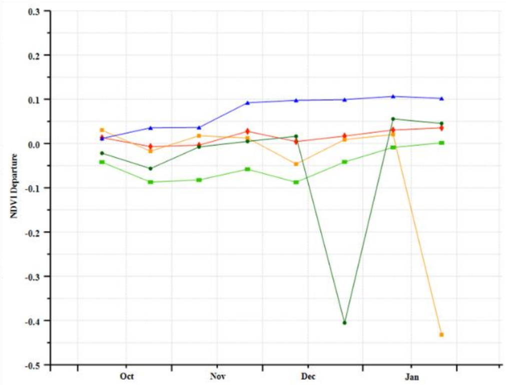
(b) Crop condition development graph based on NDVI, RAIN and TEMP (Italy)



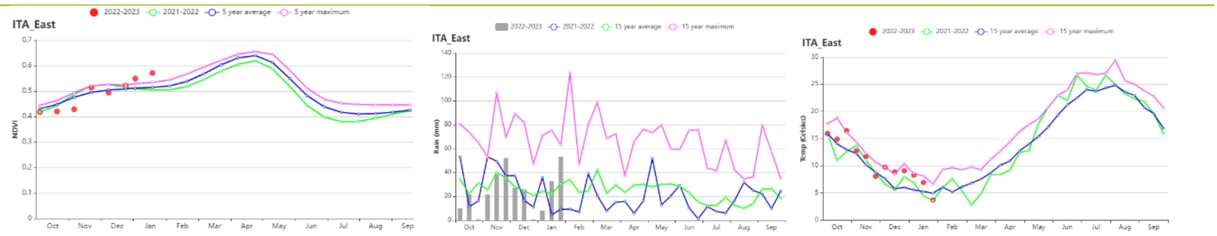
(c) Maximum VCI



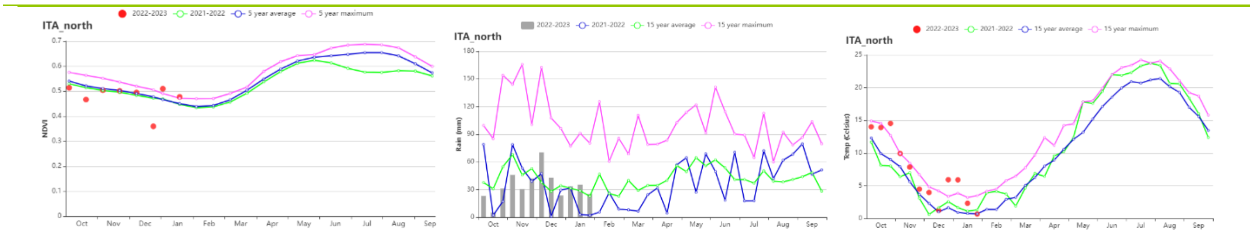
(d) Spatial NDVI patterns compared to 5YA



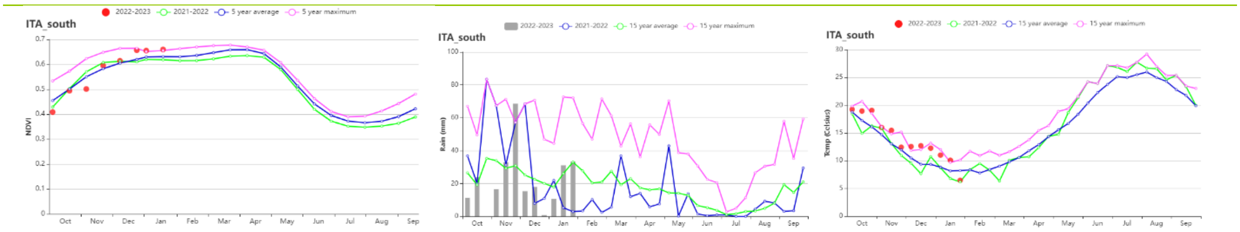
(e) NDVI profiles



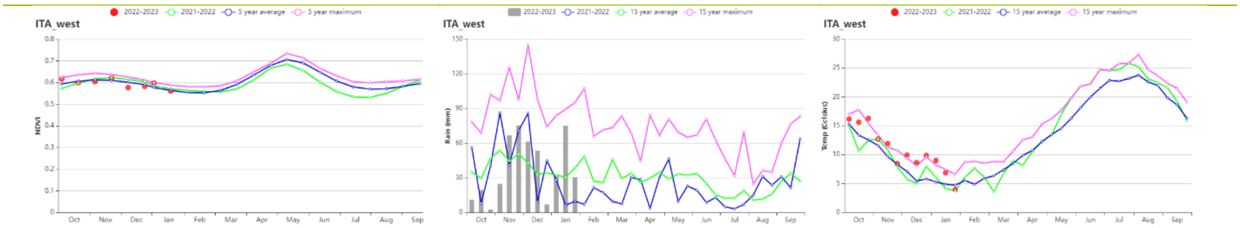
(f) Crop condition development graph based on NDVI, RAIN and TEMP (East Italy)



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



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



(i) 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, October 2022-January 2023

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
East coast	291	-14	10.5	1.4	510	7	583	-2
Po Valley	409	-14	7.1	2.4	373	-5	576	20
Islands	262	-18	13.9	1.7	615	6	590	-10
Western Italy	460	-3	10.8	2.1	489	5	707	7

Table 3.39 Italy's agronomic indicators by sub-national regions, current season's values and departure from 5YA, October 2022-January 2023

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current (%)
East coast	97	14	0.98
Po Valley	94	6	0.91
Islands	100	2	0.95
Western Italy	100	2	0.93

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[KAZ] Kazakhstan

No crops were cultivated in most of the country during this monitoring period, except for some minor winter crops planted in the southern regions. Crop production in Kazakhstan is mostly rainfed, as only 3% of the cropland is under irrigation. According to the NDVI profiles, the national average NDVI values were lower than 0.2 starting from late October because of fallow or freezing conditions.

Compared to the 15-year average, accumulated precipitation was above average (RAIN +4%), while temperature and radiation was close to average. The dekadal precipitation was above the 15-year average from late October to late November and exceeded the 15-year maximum in early January. The dekadal temperature fluctuated along the average level except for the period of late November, early and late December. The agro-climatic conditions resulted in a normal potential biomass (BIOMSS +1%).

Overall, agro-climate conditions were favorable in the monitoring period. Favorable precipitation will create good conditions for the planting of spring wheat.

Regional analysis

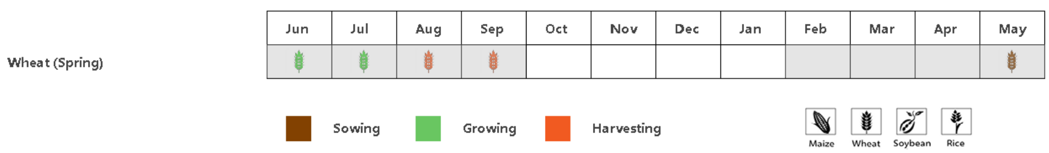
Based on cropping systems, climatic zones and topographic conditions, four sub-national agro-ecological regions can be distinguished for Kazakhstan, among which three are relevant for crop cultivation: the Northern region (112), the Eastern plateau and southeastern region (111) and the South region (110).

In the **Northern region**, the accumulated precipitation (RAIN +8%) and temperature (TEMP +0.4°C) were above average, while RADPAR was at average. The favorable weather conditions resulted in an increase of the BIOMSS index by 4%.

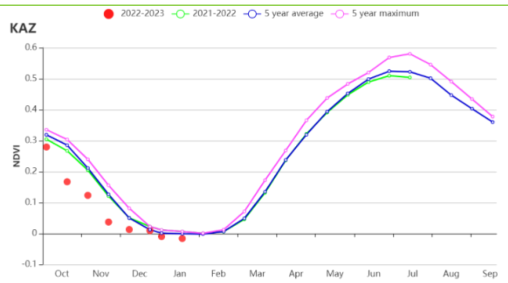
In the **Eastern plateau and southeastern region**, the accumulated precipitation and radiation were close to average, while the temperature (TEMP -0.9°C) was below average. The potential biomass decreased by 4% (BIOMSS, -4%).

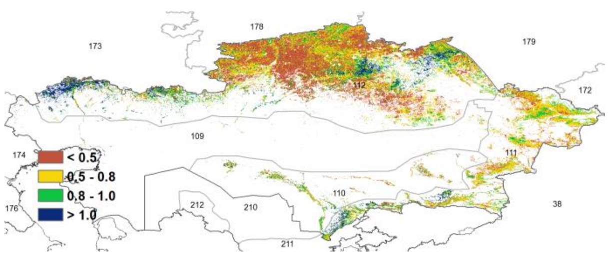
The **South region** received 131 mm of rainfall, which was the lowest amount among the three regions. Due to the deficit of precipitation and lower temperature (RAIN -6%, TEMP -0.8°C), the potential biomass decreased by 9%. The agro-climate conditions were slightly unfavorable in the monitoring period.

Figure 3.24 Kazakhstan's crop condition, October 2022 – January 2023



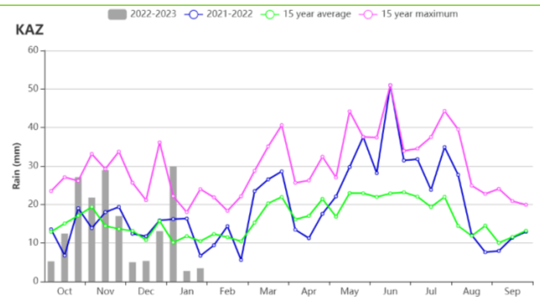
(a). Phenology of major crops



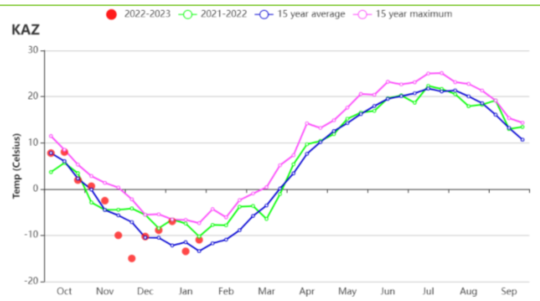


(b) Crop condition development graph based on NDVI

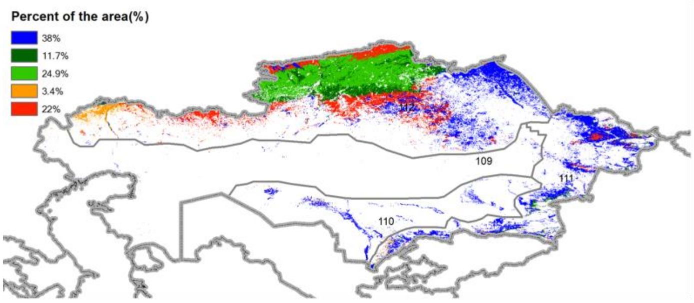
(c) Maximum VCI



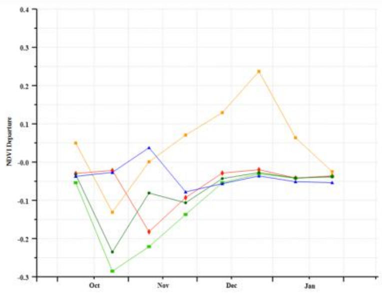
(d) Rainfall Index



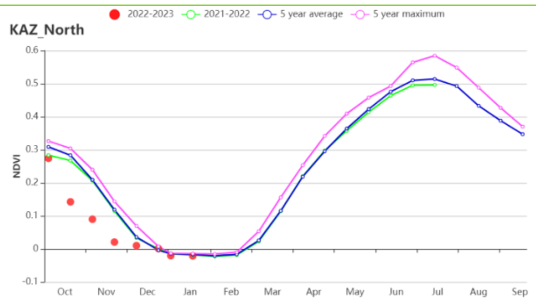
(e) Temperature Index



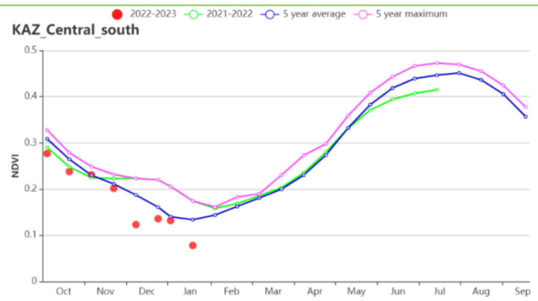
(f) Spatial NDVI patterns compared to 5YA



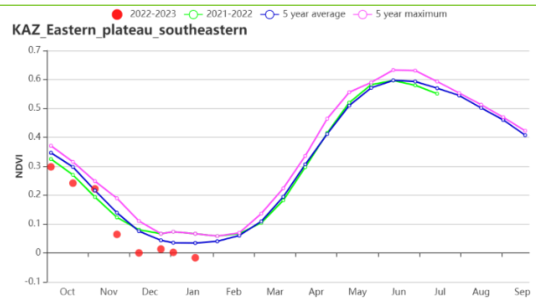
(g) NDVI profiles



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



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



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

Table 3.40 Kazakhstan agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, October 2022 - January 2023

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Northern region	157	8	-5.7	0.4	284	-1	251	4
Eastern plateau and	217	0	-4.5	-0.9	471	1	246	-4

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m^2)	Departure (%)	Current (gDM/m^2)	Departure (%)
southeastern region								
South region	131	-6	0.7	-0.8	500	2	286	-9

Table 3.41 Kazakhstan, agronomic indicators by sub-national regions, current season's values and departure from 5YA, October 2022 - January 2023

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Northern region	5	-51	0.63
Eastern plateau and southeastern region	10	-46	0.68
South region	6	-11	0.70

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[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 October 2022 to January 2023 covers the short rain season and the harvest of wheat and long rain maize.

At the national scale, Kenya is in drought. The precipitation was 281 mm, 30% below average. According to the national rainfall profiles, the 10-day cumulative rainfall was below the 15YA in almost all decades, apart from late November and early December. When looking into sub-national level, all regions received less rainfall, and the Southwest region had the largest negative departure in rainfall compared with the 15YA (RAIN -82%). Due to this condition, the BIOMSS was 14% lower than average and maximum VCI was only 0.75.

The NDVI development graph at the national level shows that NDVI values were all below 5YA, especially in late October and early November. It can be noticed that the sowing of maize in the short rainy season was delayed. Based on the NDVI clusters and the corresponding NDVI departure profiles, the western and central parts of Kenya (red area), which account for 45.1% of the country's cultivated land, has near-average NDVI values, while other areas show significant deviations in crop growth. This is consistent with the maximum VCI map, which shows a relatively low VCI of less than 0.5 (red area) in the southern region. In general, all crops in Kenya were affected by the drought, although to a slightly lesser extent in western and central 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).

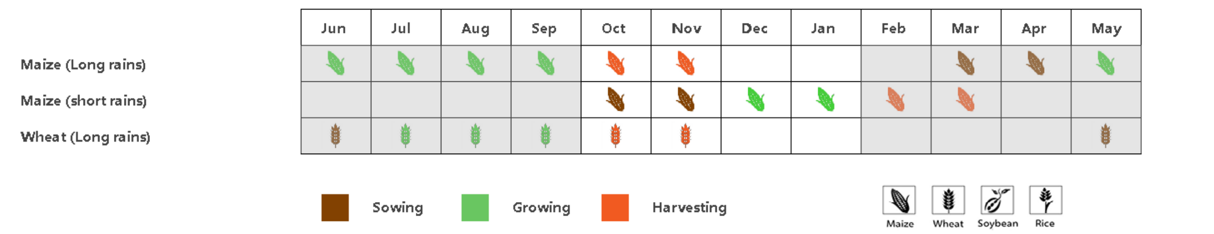
The **Eastern coastal region** had the minimum negative deviation in rainfall (-21%), 0.1°C below average temperature and 2% above average RADPAR. The Crop Production Index was 0.61 and the maximum VCIx value is 0.59. The poor CPI and VCIx indicate poor crop growth in this region during monitoring period. Lack of rainfall resulted in a 6% decrease in BIOMSS and a significant decrease in NDVI from October to January compared to the 5YA. This means that the poor crop growth is the result of delayed sowing of maize in the short rainy season. Overall, the crop condition was unfavorable in the coastal area with poor prospect for livestock and crop production.

The **Highland agriculture zone** recorded 305 mm of rain, which was below the 15YA by 24%. The low precipitation resulted in significant reductions in biomass (-12%). The maximum VCI value recorded was 0.76. The NDVI was below the 5YA, especially in November. And the CALF was reduced to 93% (-5%). This means that the sowing of short rain maize was affected. Overall, crop growth has been severely affected by drought conditions, especially in November.

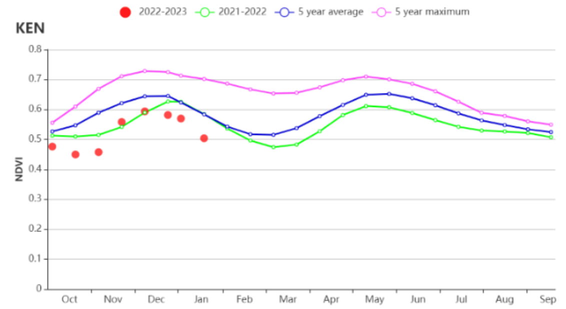
In the **Northern region**, the precipitation was much lower than average at 262 mm, a reduction of 28%. Temperature was close to the 15YA (+0.3°C), whereas RADPAR was lightly above average (+1%), BIOMSS was below average (-8%). The maximum VCIx value (0.53) is the lowest in four AEZs in Kenya and the Crop Production Index was 0.61. The low values of these two indices indicate that the crops in the area are not growing well. In addition, the NDVI development graph shows that the NDVI values were significantly below average, especially in October. This illustrates that the short rainy season maize sowing received a drought impact. Furthermore, the CALF was reduced to 60% (-29%). All in all, the situation of crop growth in this area was unfavorable.

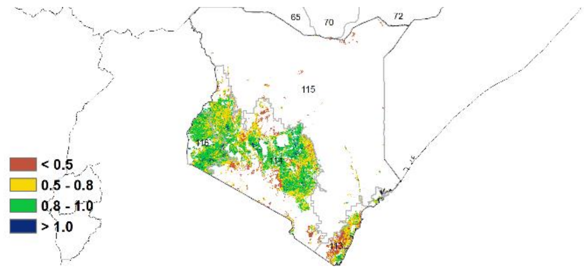
The **Southwest region** includes the districts Narok, Kajiado, Kisumu, Nakuru, and Embu, which has the largest negative departure in RAIN (-82%). The following indicator values were observed: TEMP 20.6°C (+0.4°C); RADPAR (-3%); CPI (1.00) and BIOMSS (-44%). Despite the large variation in precipitation, its CALF and was unchanged and the NDVI values were close to the 5YA. The VCIx value was 0.85, which is the highest in four AEZs in Kenya. In conclusion, despite the severe drought in the area, the vegetation growth has not been seriously affected thanks to advanced agricultural techniques.

Figure 3.25 Kenya's crop condition, October 2022-January 2023

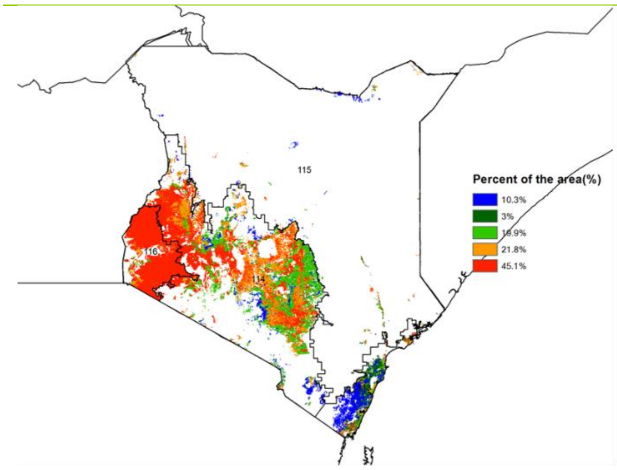


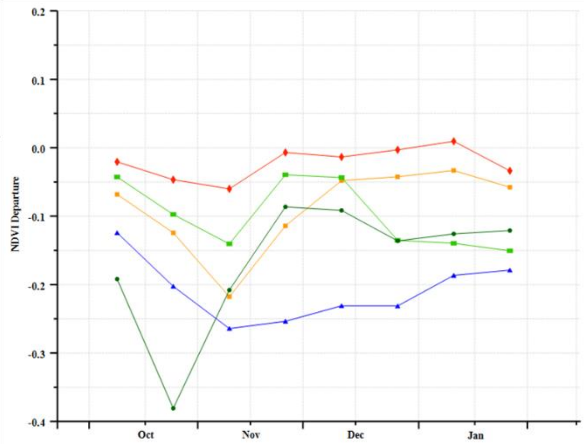
(a). Phenology of major crops



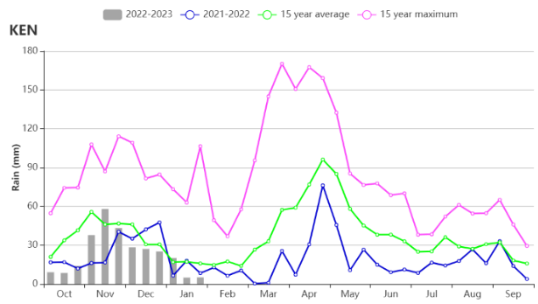


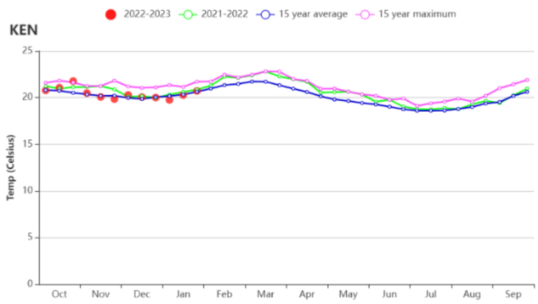
(b) Crop condition development graph based on NDVI (c) Maximum VCI



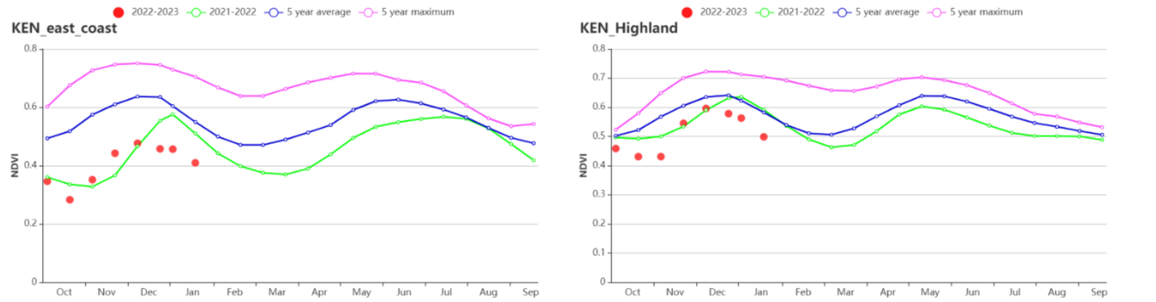


(d) Spatial NDVI patterns compared to 5YA (e) NDVI profiles

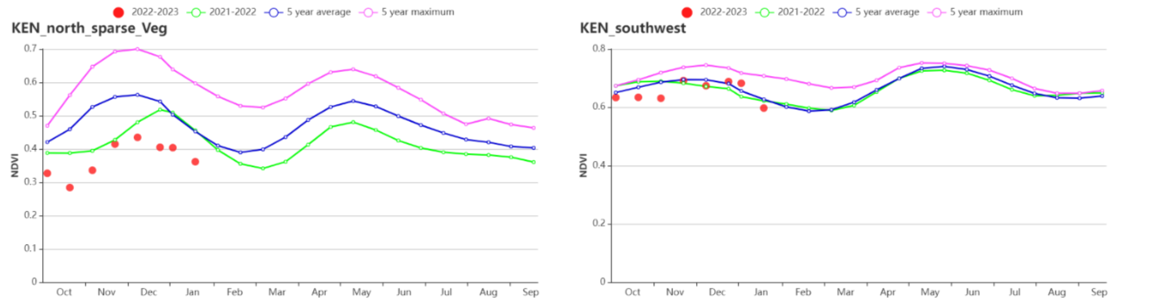




(f) Time series rainfall (g) Time series temperature



(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, October 2022-January 2023

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m2)	Departure (%)	Current (gDM/m2)	Departure (%)
Coast	398	-21	26.0	0.1	1455	2	1175	-6
Highland agriculture zone	305	-24	19.0	0.1	1271	0	713	-12
nothern rangelands	262	-28	23.4	0.3	1353	1	841	-8
South-west	76	-82	20.6	0.4	1254	-3	504	-44

Table 3.43 Kenya's agronomic indicators by sub-national regions, current season's values and departure, October 2022-January 2023

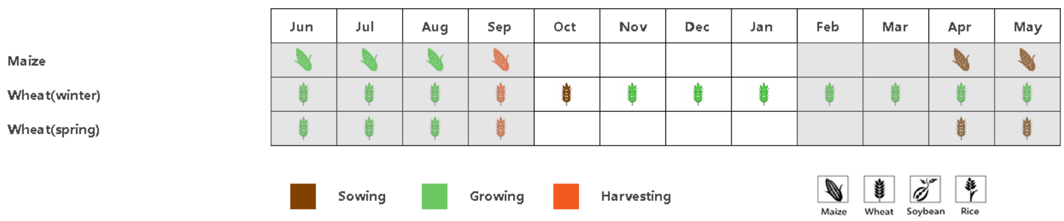
Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Coast	74	-22	0.59
Highland agriculture zone	93	-5	0.76
northern rangelands	60	-29	0.53
South-west	100	0	0.85

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

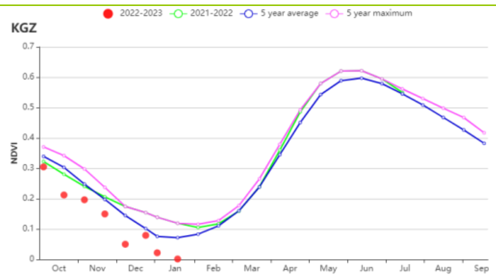
[KGZ] Kyrgyzstan

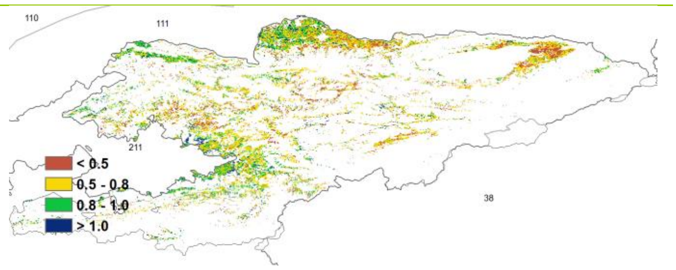
The sowing of winter wheat in Kyrgyzstan was completed in October. During the months of October to January, the CropWatch agro-climatic indicator RAIN (+12%) was slightly above average, RADPAR was average, and TEMP was below average (-1.5℃). The combination of these factors resulted in a decreased estimate for BIOMSS (-2%) compared to the fifteen-year average. As shown by the NDVI development graph, the vegetation conditions were below average throughout the whole monitoring period, which might have been due to the freezing temperatures and snow cover, which started in November. In terms of the spatial NDVI clustering profile, 26.2% of the cultivated area (marked in orange) had near-average crop conditions. Other clustered regions experienced some fluctuations in crop conditions. 25.3% of the cultivated area (marked in dark green), mainly dispersedly distributed in Naryn, Jalal-Abad and Osh, showed great negative NDVI departures, presumably due to cloud cover and snow on the ground. The same conditions prevailed in the light green, blue and red marked regions in late November and early December, causing a negative NDVI departure by 0.2 units. The spatial pattern of maximum Vegetation Condition Index (VCIx) was in accord with the spatial distribution of the NDVI profiles. The national average VCIx was 0.71. Agro-climatic and agronomic conditions were mixed with CALF at 9%, 38% below average, indicating less land was cultivated. The national Crop Production Index was 0.68, indicating an unpromising crop production outlook. The great negative temperature in early January might have caused damage to winter wheat in some areas. Overall, the crop conditions in Kyrgyzstan can be assessed as close-to-average thanks to above-average precipitation.

Figure 3.26 Kyrgyzstan's crop condition, October 2022 - January 2023

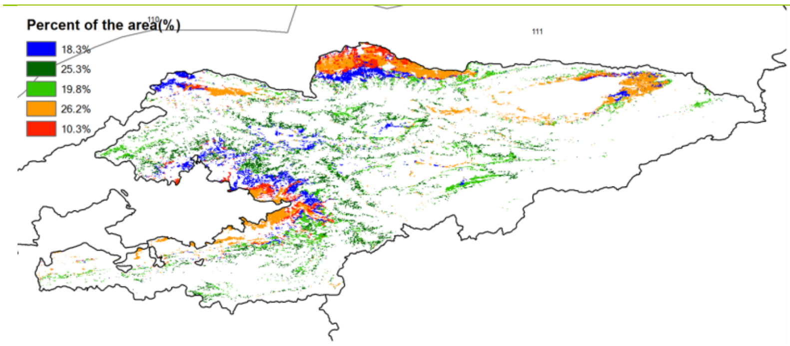


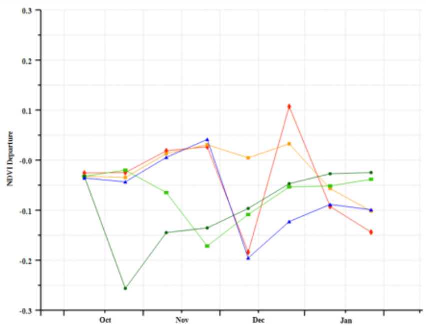
(a) Phenology of major crops



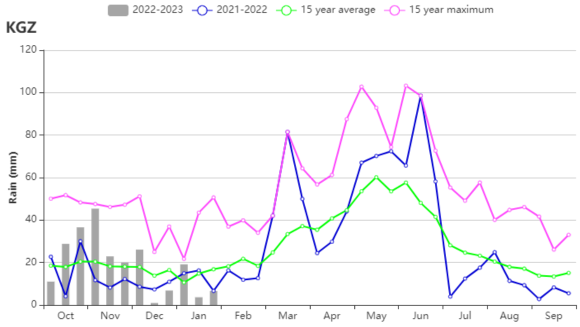


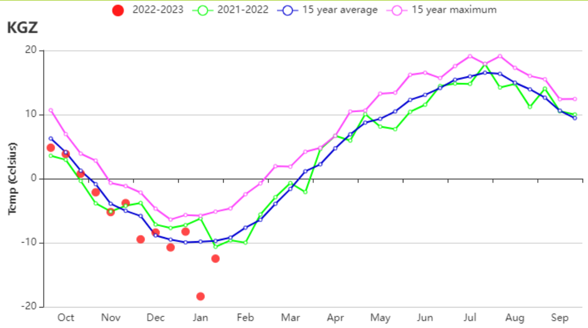
(b) Crop condition development graph based on NDVI (c) Maximum VCI





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





(f) Rainfall profiles

(g) Temperature profiles

Table 3.44 Kyrgyzstan's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, October 2022 - January 2023

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Kyrgyzstan	228	12	-5.8	-1.5	596	0	227	-2

Table 3.45 Kyrgyzstan's agronomic indicators by sub-national regions, current season's values and departure from 5YA, October 2022 - January 2023

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Kyrgyzstan	9	-38	0.71

[KHM] Cambodia

The monitoring period covers the transition from the rainy to the dry season in Cambodia. Rainy season early rice was in the harvesting period. Sowing of dry season early rice, dry season maize and soybean gradually started in November. Medium rice, late rice and floating rice gradually entered the harvesting stage in January.

During this monitoring period, the rainy season in Cambodia retreated relatively late and weather conditions were wetter than before. Compared to the 15YA average, rainfall (RAIN) in Cambodia was 22% higher, while temperature (TEMP) was 0.5℃ lower and radiation (RADPAR) was near average. The wetter weather favored the growth of medium and late rice, resulting in a potential biomass (BIOMASS) about 10% higher than average. The crop production index (CPI) was at 1.06. However, the excessive rainfall in October and November was not only unfavorable for the rainy season early rice and rainy season maize harvests, but also likely delayed the sowing of dry season rice, dry season maize and soybean, resulting in below average NDVI values in the NDVI time series curve. Meanwhile, the maximum VCI map shows that the VCIx value of crops in most areas was above 0.8, indicating normal growing conditions. However, there were also some areas where crops were growing poorly. The NDVI spatial clustering map also shows that 1) the condition of about 6% of the cultivated area (red colour) has been significantly below average since October, indicating that crop growth in these areas has been severely affected. These areas are mainly scattered in the north-west and south-east of the Tonle Sap Lake. 2) Approximately 43.4% of the cultivated area (blue colour) had a crop NDVI that was close to average, indicating normal crop conditions. These areas are mainly located in the eastern shore of Tonle Sap Lake, the plain area of the lower Mekong Valley, and the southwestern shore area of Tonle Sap Lake. 3) The remaining cultivated areas (dark green, light green and orange colour) showed a similar NDVI pattern, all of which showed a significant decrease in October. However, these declines all recovered quickly to slightly below average, suggesting that crop condition in these areas may be slightly below average. And these sharp declines in NDVI were probably caused by cloud cover.

In summary, a combination of several agro-climatic indicators showed that crop growth in Cambodia was slightly below average during this monitoring period.

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 with 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 agro-climatic indicators, rainfall in the **Tonle-sap region** (agro-ecological subzone 117) was 34% higher than average, while temperature decreased by about 0.7°C, radiation was near average, and potential biomass was 13% higher. The crop condition index (CPI) was at 1.03. Due to the influence of cloud cover on satellite imagery, the synthetic NDVI in this area was well below average in early October and then recovered. However, it was still slightly below average, indicating that overall crop growth in this area was slightly below average.

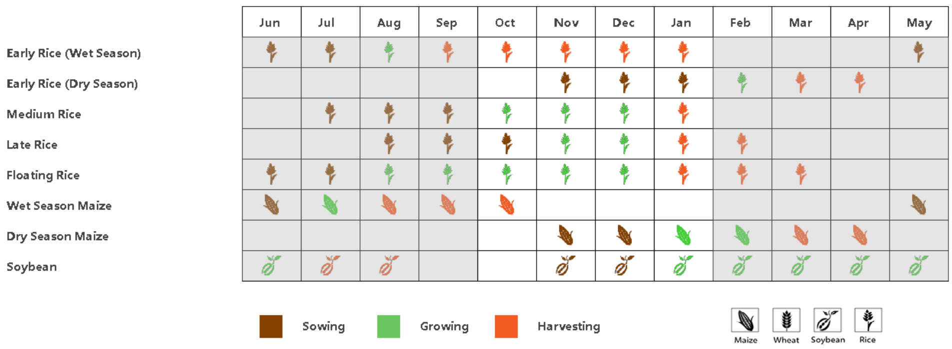
The **Mekong Valley region** (agro-ecological subzone 118) is the main agricultural area in Cambodia. Rainfall in this region was significantly higher by 24% (RAIN), temperature was lower by 0.3°C (TEMP), radiation (RADPAR) was around average and potential biomass (BIOMASS) was higher by 12%. As shown in the NDVI spatial clustering map, most areas in this region (orange, light green and dark green colour) were affected by cloud and rain cover in October, resulting in a significantly below average crop NDVI. Subsequently, NDVI levels gradually recovered but were still slightly below average, possibly due to the delay in planting medium and late rice. In summary, crop growth in the region was slightly below average though the crop production index (CPI) was at 1.06.

For the **Northern Plain and Northeast region** (agro-ecological subzone 119), the region had 9% higher rainfall (RAIN), 0.4°C lower temperature (TEMP), average radiation (RADPAR) and 7% higher potential biomass (BIOMASS). The crop condition index (CPI) was at 1.08. The NDVI time series curve of the crop in this zone was always slightly below average until January, indicating slightly below average crop growth in this zone.

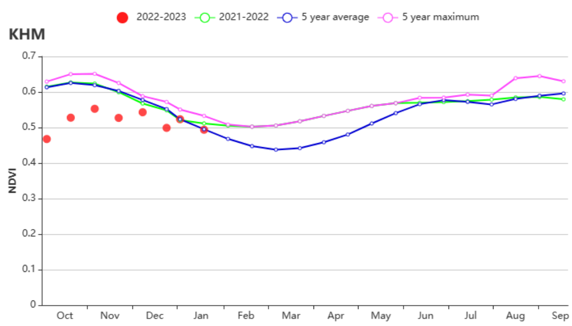
In the **Southwest Hilly region** (agro-ecological subzone 120), rainfall was 35% above average (RAIN), temperature was about 0.7°C lower (TEMP), radiation was near average (RADPAR) and potential biomass was about 12% higher

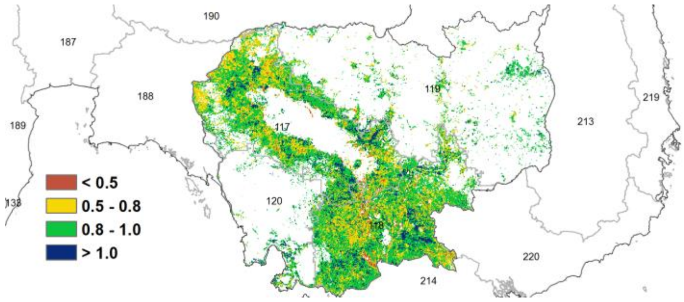
(BIOMASS). Although the VCIx index of the region was as high as 0.91 and the crop production index was at 1.17, the NDVI time series curve of the crop remained slightly below average until January, indicating that crop growth in this zone was also slightly subpar.

Figure 3.27 Cambodia's crop condition, October 2022 - January 2023



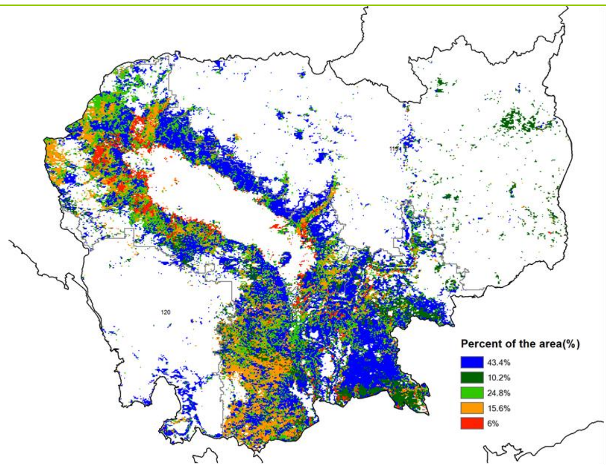
(a) Phenology of major crops

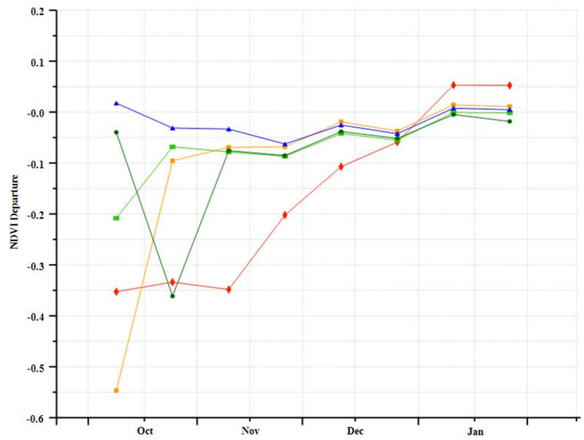




(b) Crop condition development graph based on NDVI

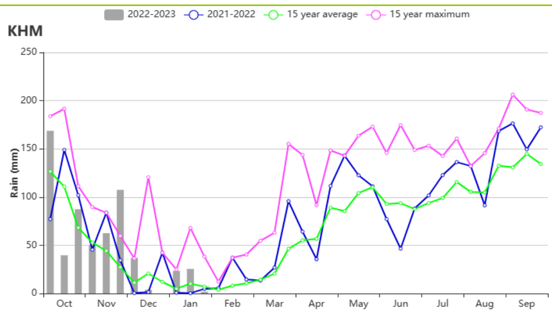
(c) Maximum VCI

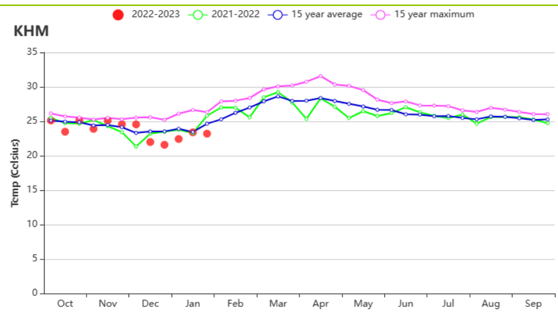




(d) Spatial NDVI patterns compared to 5YA

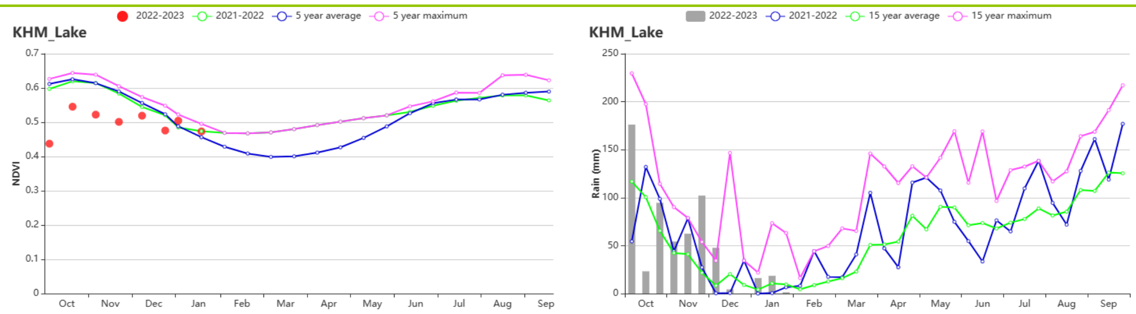
(e) NDVI profiles



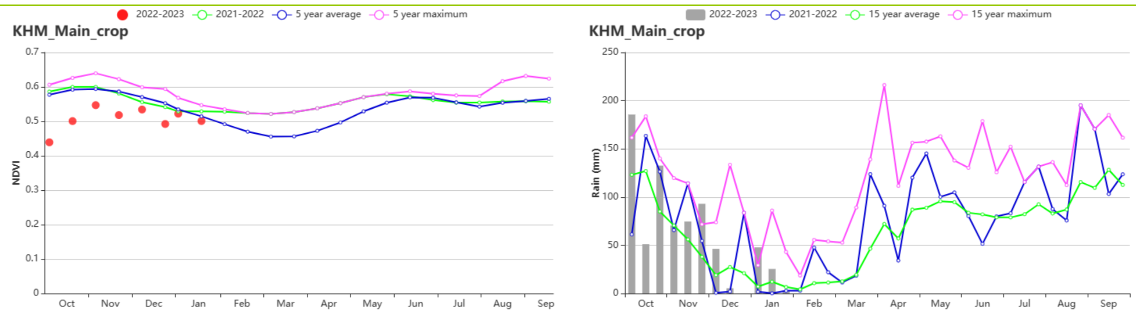


(f) Rainfall profiles

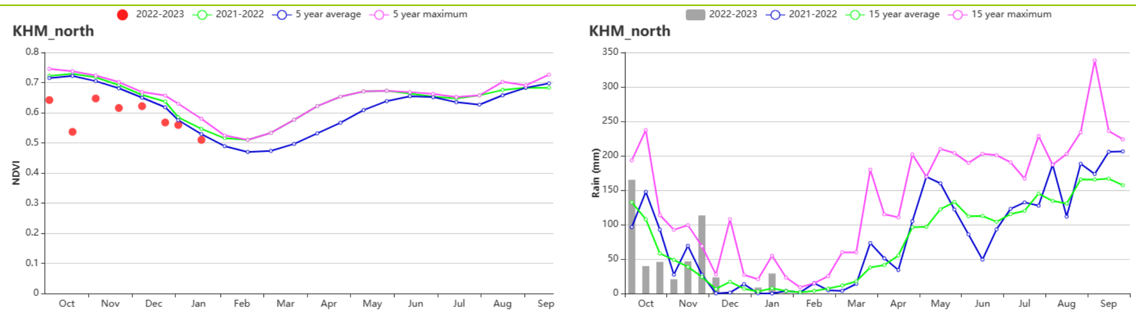
(g) Temperature profiles



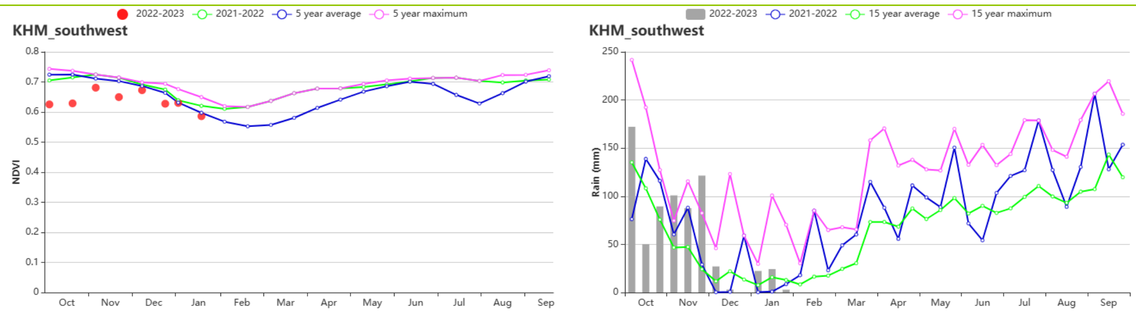
(h) Crop condition development graph based on NDVI (left) and time series rainfall profile (right) in Tonle Sap Lake region



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



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



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

Table 3.46 Cambodia's agroclimatic indicators by sub-national regions, current season's values, and departure from 15YA, October 2022 - January 2023

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Tonle-sap region	601	34	23.4	-0.7	1062	0	1042	13
Mekong valley	735	24	24.6	-0.3	1091	0	1222	12
Northern Plain and Northeast region	495	9	23.6	-0.4	1062	0	951	7
Southwest Hilly region	701	35	22.3	-0.7	1068	-1	1142	12

Table 3.47 Cambodia's agronomic indicators by sub-national regions, current season's values, and departure from 5YA, October 2022 - January 2023

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Tonle-sap region	98	-1	0.84
Mekong valley	96	-1	0.85
Northern Plain and Northeast region	99	0	0.87
Southwest Hilly region	100	0	0.91

[LKA] Sri Lanka

This report covers the main Maha cropping seasons of Sri Lanka. The sowing of main season crops (maize and wheat) started in October. According to the CropWatch monitoring results, crop conditions were assessed as below average for the monitoring period.

During this period, the country mainly experienced the Southwest-Monsoon season, during which the warm season is eased away by the windy weather and rains can be expected. At the national level, precipitation was below the 15YA (RAIN -9%), as well as the temperature (TEMP -0.3°C), while the radiation (RADPAR 1%) was slightly above the average. The fraction of cropped arable land (CALF) was similar to the 5YA and BIOMSS was up by 3% compared to the 15YA. As shown in the NDVI development graph, NDVI was below-average during most of the period. The maximum VCI for the whole country was 0.94. The CPI was 1.13.

As shown by the NDVI clustering map and profiles, almost all of the country's cropland showed below-average crop conditions during the period. However, the sharp drops of the NDVI values were mainly caused by cloud cover in the satellite images. The maximum VCI showed high values almost all over the country except for some clustered areas in the east.

Regional analysis

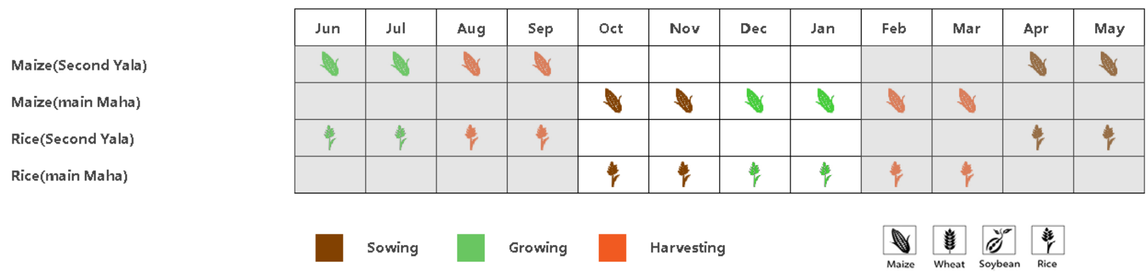
Based on the cropping system, climatic zones and topographic conditions, three sub-national agroecological regions can be distinguished for Sri Lanka. They are the Dry zone (121), the Wet zone (123), and the Intermediate zone (122).

In the **Dry zone**, the recorded RAIN (861 mm) was 12% below average. TEMP was average and RADPAR was 1% above average. BIOMSS increased by 3% as compared to the 15YA. CALF was comparable to the 5YA level with 99% of cropland utilized. NDVI was similar to that of the whole country. The VCIx for the zone was 0.93, The CPI was 1.12. Overall, crop conditions were slightly below average for this zone.

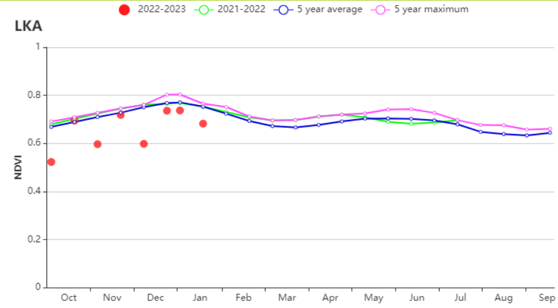
For the **Wet zone**, RAIN (1494 mm) was 6% below average as compared to the 15YA. TEMP and RADPAR decreased by 0.8°C and 1% respectively. BIOMSS was 2% above the 15YA and cropland was fully utilized. NDVI values showed apparent negative deviation from average, especially in October and November. The VCIx value for the zone was 0.94. The CPI was 1.14. Crop conditions were slightly below average for this zone.

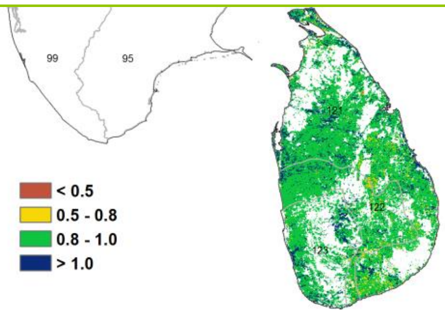
The **Intermediate zone** also experienced sufficient rain (1103 mm) with an 18% decrease from the 15YA. TEMP was average and RADPAR was 4% up compared to the 15YA. With full use of cropland, BIOMSS was comparable to the average. The NDVI values were similar to the whole country and the VCIx value for this zone was 0.94. The CPI was 1.13. Conditions of the crops were slightly below average.

Figure 3.28 Sri Lanka's crop condition, October 2022 - January 2023

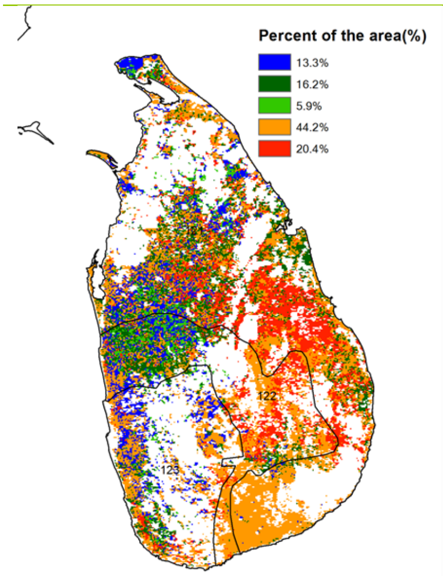


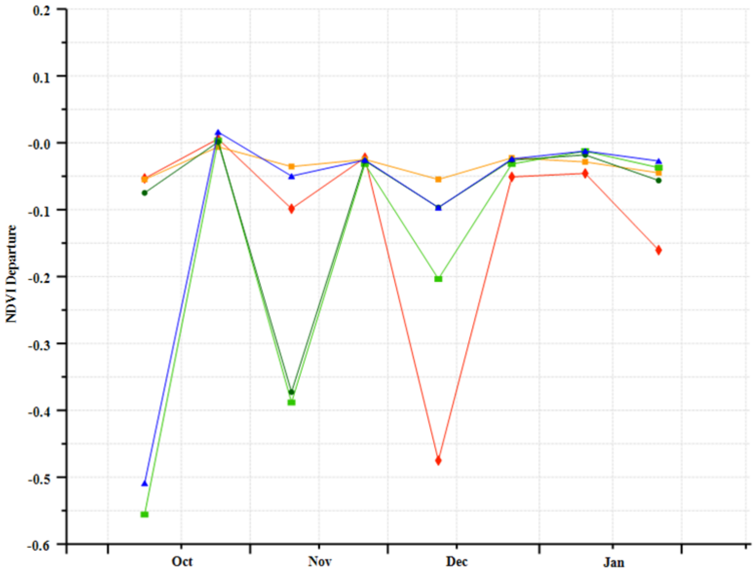
(a) Phenology of major crops



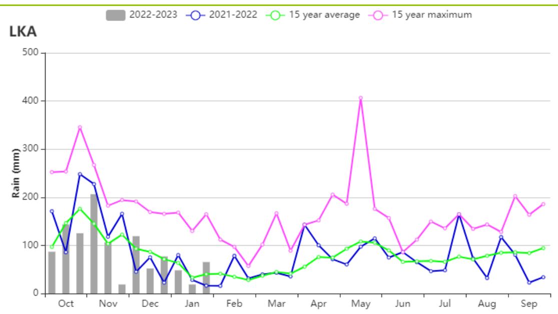


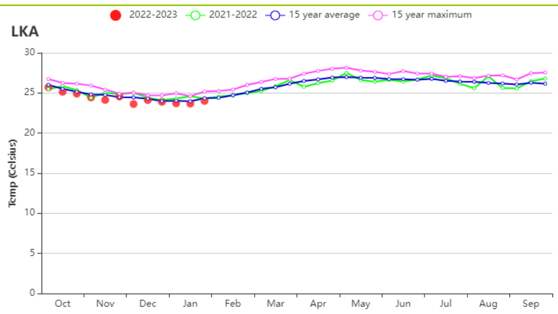
(b) Crop condition development graph based on NDVI (c) Maximum VCI



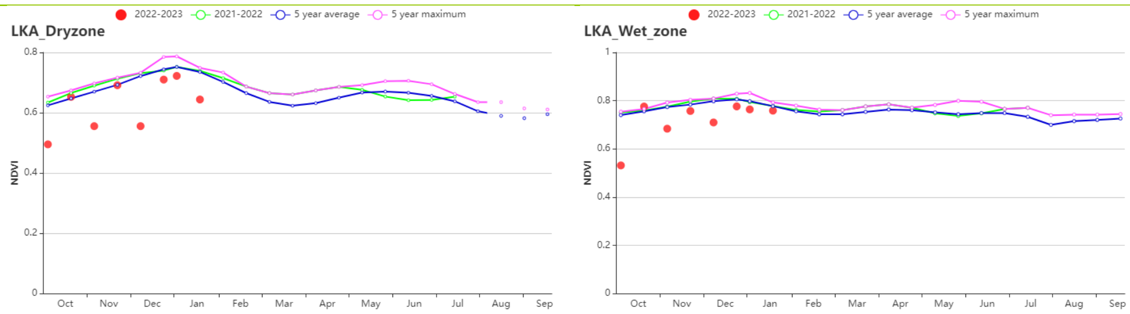


(d) Spatial NDVI patterns compared to 5YA (e) NDVI profiles

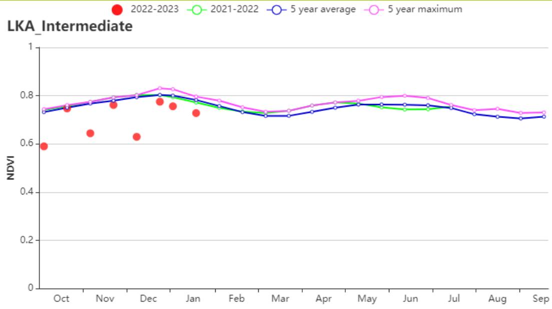




(f) Rainfall profiles (g) Temperature profiles



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



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

Table 3.48 Sri Lanka's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, October 2022 - January 2023

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Dry zone	861	-12	25.0	0.0	1132	1	1409	3
Intermediate zone	1103	-18	23.3	0.0	1072	4	1332	0
Wet zone	1494	-6	23.2	-0.8	1057	-1	1440	2

Table 3.49 Sri Lanka's agronomic indicators by sub-national regions, current season's values and departure from 5YA, October 2022 - January 2023

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Dry zone	99	0	0.93
Intermediate zone	100	0	0.94
Wet zone	100	0	0.96

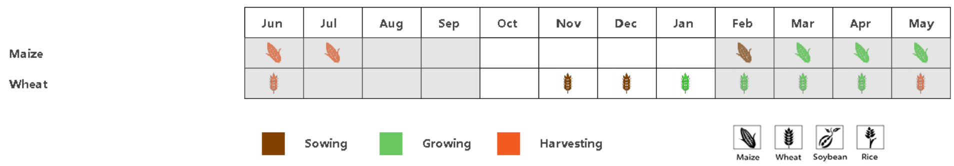
[MAR] Morocco

During this monitoring period, winter wheat, barley, and legumes are Morocco's main crops. Winter wheat sowing started in November and was completed in December. The CropWatch agro-climatic indicators showed that rain was 28% below the 15-year (15YA) average. According to the rainfall profile, high rainfall >20 mm, fell in early and mid-Decemper. The temperature was 1°C above the 15YA. The RADPAR was only 0.3% above the 15YA while the BIOMSS was 19% below the 15YA. The nationwide NDVI profile was below last year's and the 5YA across the study period. It trended even below last year's curve. It had surpassed it only in late January. Generally, the NDVI spatial pattern shows that only 13.1% of the cultivated area was above the 5YA across the study period and the rest (86.9%) was below the 5YA. Cereal production in Morocco is heavily dependent on rainfall since only 15% of the country's cropland is irrigated. The nationwide crop production index (CPI) was at 0.88 implying below normal crop production situation. The country's VCIx value was 0.60, and the CALF was below the 5YA by 17%. Generally, crop conditions were poor due to the severe rainfall deficit.

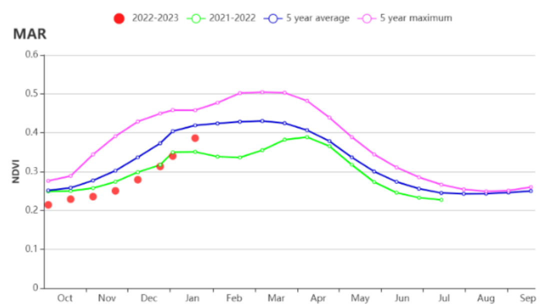
Regional analysis

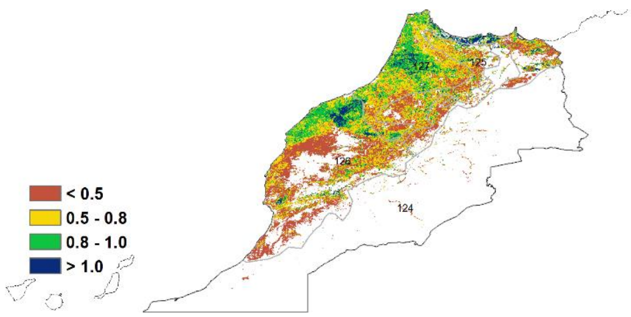
CropWatch adopts three agroecological zones (AEZs) relevant to crop production in Morocco: The Sub-humid northern highlands, the Warm semiarid zone, and the Warm sub-humid zone. All agro-climatic indicators measured for these three AEZs show nearly the same patterns. The rainfall for the three zones was 22%, 39%, and 23% below the 15YA. The temperature was 0.8°C above the 15YA for the first zone and 0.9°C above for the second and third zones. The RADPAR was above the 15YA by 1% in the first and second zones while it was at the 15YA in the third zone. The BIOMSS was below the 15YA by 15%, 20%, and 16% for the three zones. In the three zones, the crop conditions based on the NDVI graph trended below the 5YA following the nationwide NDVI profile. In three zones, the CPI was at 0.57, 0.89, and 1.03, respectively, implying below normal crop production situation in the first and second zones and normal crop production situation in the third zone. The CALF was below the 5YA by 30%, 18%, and 13%, and the maximum VCI was at 0.59, 0.53, and 0.70 in the three zones.

Figure 3.29 Morocco's crop condition, October 2022 - January 2023



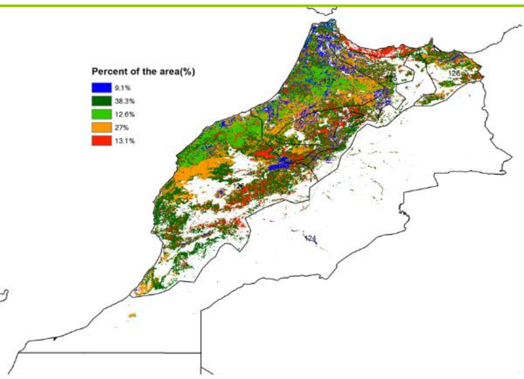
(a) Phenology of major crops

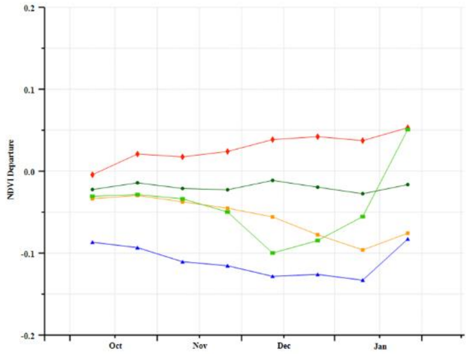




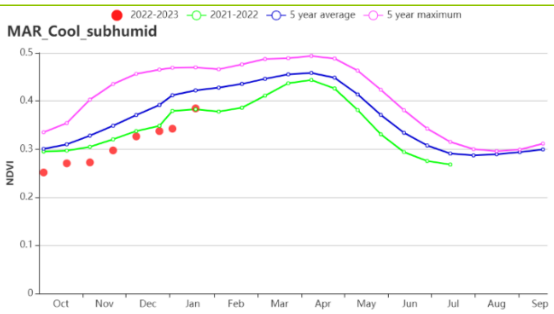
(b) Crop condition development graph based on NDVI

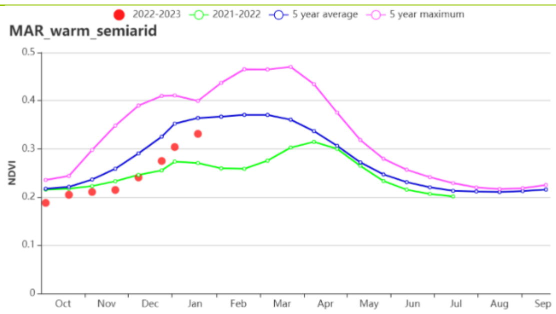
(c) Maximum VCI



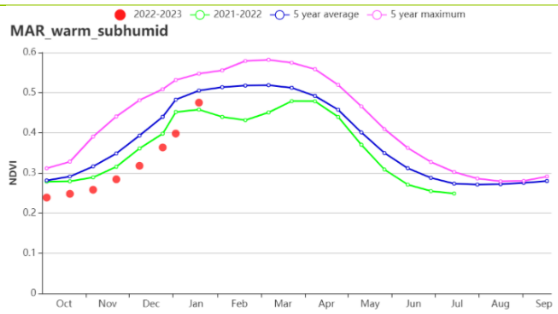


(d) Spatial NDVI patterns compared to 5YA (e) NDVI profiles

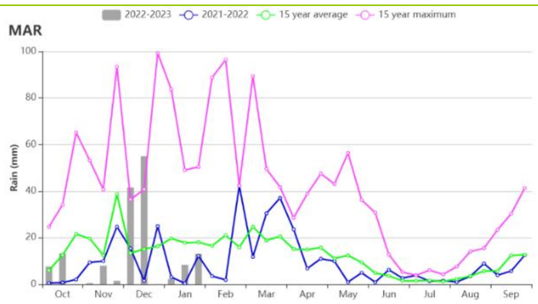




(f) crop condition development graph based on NDVI, Sub-humid northern highlands, and (g) Warm semiarid zones



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



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

Table 3.50 Morocco's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, October 2022 - January 2023

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Sub-humid	218	-22	11.0	0.8	736	1	456	-15

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m^2)	Departure (%)	Current (gDM/m^2)	Departure (%)
northern highlands								
Warm semi-arid zones	85	-39	13.7	0.9	820	1	318	-20
Warm sub-humid zones	208	-23	12.2	0.9	729	0	454	-16

Table 3.51 Morocco's agronomic indicators by sub-national regions, current season's values and departure from 5YA, October 2022 - January 2023

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Buzi basin	30	-30	0.59
Northern high-altitude areas	24	-18	0.53
Southern g region	60	-13	0.70

[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. Sowing of irrigated maize started in September. Its main production region is in the Northwest. Winter wheat sowing began in November. Both soybean and rice reached maturity by the end of this reporting period.

Agro-climatic conditions showed that RAIN decreased by 19%, TEMP increased by 0.2°C, RADPAR was at the average level and BIOMSS decreased by 13%. The Cropped Arable Land Fraction (CALF) increased by 4%. According to the spatial distribution of NDVI profiles, overall crop growth in Mexico was slightly below average.

As shown in the spatial NDVI profiles and distribution map, the growth of crops on 22.6% of the cropland area was lower than the average level and mainly distributed in western Mexico. In October, about 1.8% of total cropped areas were far below the average level, mainly distributed in the eastern coastal areas, especially in Veracruz. This was mainly due to Hurricane "Roslin", which hit parts of the Pacific coast of Mexico. Although the intensity of the landing was reduced from level 4 to level 3, the storm still caused floods. Additionally, about 53.4% of total cropped areas were on average, mainly distributed in eastern Mexico. Only 20.1% of the total cropped areas were above average during the entire monitoring period, mainly in Sonora and Chihuahua.

In general, the agricultural situation in Mexico is close to the average level. However, due to the impact of the slight precipitation deficit, the conditions are less favorable than a year ago.

Regional analysis

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

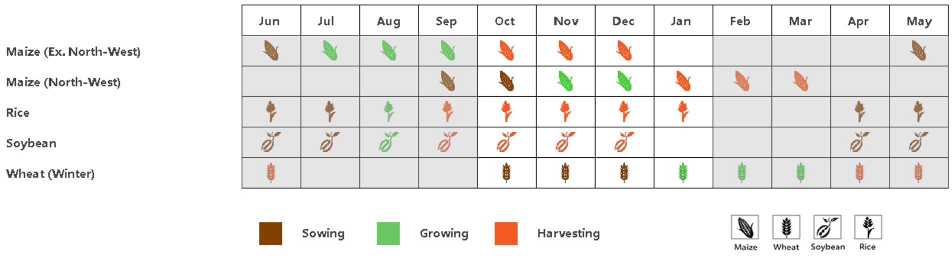
The Arid and semi-arid region, located in northern and central Mexico, accounts for about half of planted areas in the country. The agro-climatic condition showed that RAIN decreased by 38%, TEMP decreased by 0.2°C and RADPAR decreased by 2%. According to the NDVI development graph, crop condition in this region was close to the average. CALF increased by 13% compared with the 5YA. The Arid and semi-arid region was one of the most drought affected regions and the VCIx was 0.81.

The region of Humid tropics with summer rainfall is located in southeastern Mexico. RAIN was near average, TEMP was 0.6℃ warmer, RADPAR increased by 2% and BIOMSS increased by 3%. CALF was 100%. According to the NDVI-based crop condition development graph from October to January, NDVI was below but close to the average level, and VCIx was 0.89.

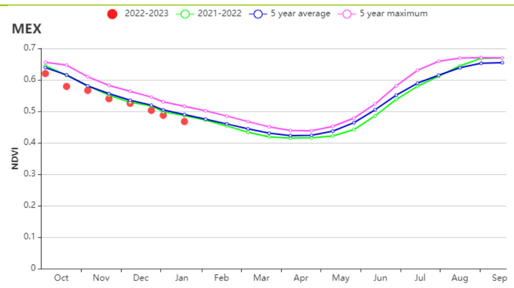
The Sub-humid temperate region with summer rains is situated in central Mexico. According to the NDVI development graph, crop conditions were below the average level. RAIN decreased by 47%, TEMP increased by 0.6°C, and RADPAR increased by 1% compared to the 15YA. BIOMSS decreased by 21% and CALF was 94%. High CALF made VCIx reach 0.88.

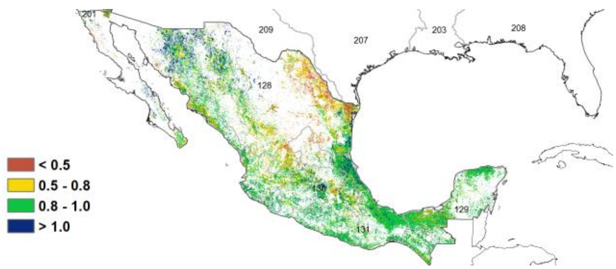
The region called Sub-humid hot tropics with summer rains is located in southern Mexico. During the monitoring period, crop conditions were slightly lower than the average in the four months as shown by the NDVI time profiles. The agro-climatic conditions show that RAIN (-22%), TEMP (+0.4℃) and RADPAR (0%). CALF was 97% The VCIx for the region was 0.88.

Figure 3.30 Mexico's crop condition, October 2022 - January 2023



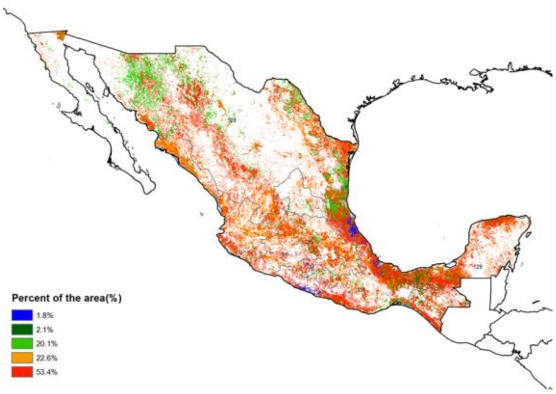
(a). Phenology of major crops

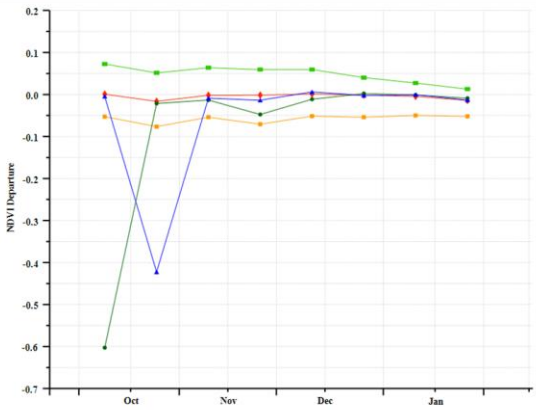




(b) Crop condition development graph based on NDVI

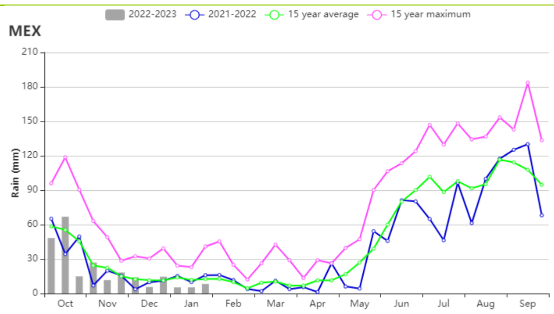
(c) Maximum VCI

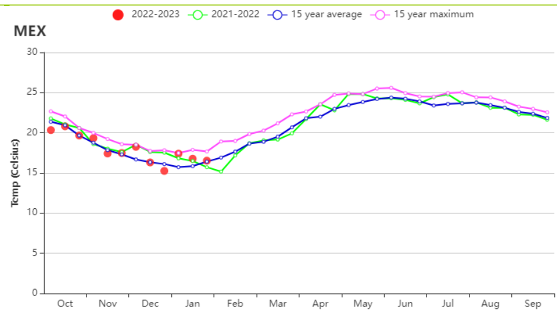




(d) Spatial NDVI patterns compared to 5YA

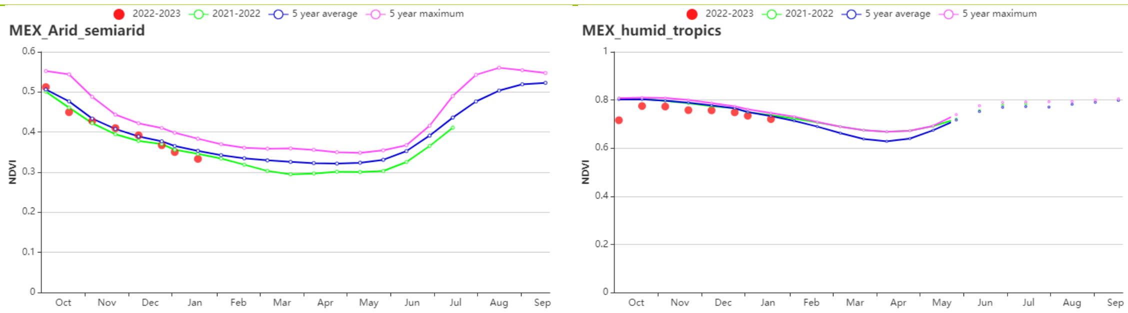
(e) NDVI profiles



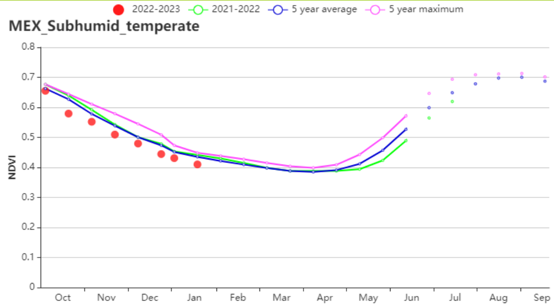


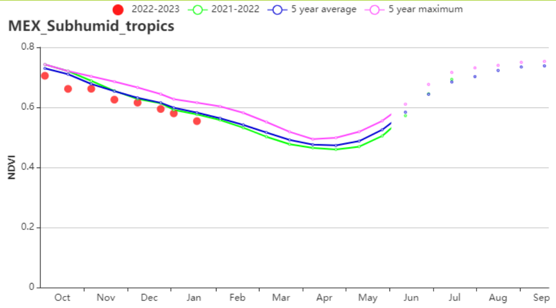
(f) Rainfall profiles

(g) Temperature profiles



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





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

Table 3.52 Mexico's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, October 2022 - January 2023

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Arid and semi-arid region	80	-38	14.7	-0.2	952	-2	335	-19
Humid tropics with summer rainfall	564	0	22.5	0.6	991	2	981	3
Sub-humid temperate region with summer rains	149	-47	16.7	0.6	1093	1	466	-21
Sub-humid hot tropics with summer rains	252	-22	19.5	0.4	1028	0	556	-15

Table 3.53 Mexico's agronomic indicators by sub-national regions, current season's values and departure from 5YA, October 2022 - January 2023

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Arid and semi-arid region	77	13	0.81
Humid tropics with summer rainfall	100	0	0.89
Sub-humid temperate region with summer rains	94	-1	0.88
Sub-humid hot tropics with summer rains	97	0	0.88

[MMR] Myanmar

During this reporting period, the sowing of maize continued until December. Harvest of maize that was sown in September started in January. The main rice was also harvested during this period, whereas the second rice was sown from November to December. Sowing of wheat also took place during this monitoring period.

According to the agroclimatic indicators from the last few periods, as well as this one, the weather in Myanmar tended to be drier than the 15YA. Compared to the 15YA, RAIN was lower (-28%) while TEMP was higher (+0.4ºC) and RADPAR was up by 5%. As a result of the rainfall deficit, BIOMSS was markedly below the average (-14%). The cropland was near fully utilized, unchanged from the 5YA. NDVI values were slightly below-average during the whole monitoring period. The maximum VCI during this period was 0.88. The CPI value was 1.06, which represents a slightly below-average agricultural production situation.

As shown by the NDVI clusters map and profiles, the crop conditions across the country ranged from average to below average. More than 50% of the country's cropland showed near-average crop conditions during the whole period. It was mainly distributed in the Central Plain and some clustered areas throughout the country. Another 11.5% of the cropland, located in Bago, Yangon and Ayeyarwady, showed negative NDVI departure values in October and November, but was slightly above-average thereafter. 29.9% of the country's cropland, which was distributed around the Central Plain, was below average during the entire period. The maximum VCI map showed similar distribution as the NDVI cluster map. According to the CropWatch monitoring results, crop conditions were slightly below average.

Regional analysis

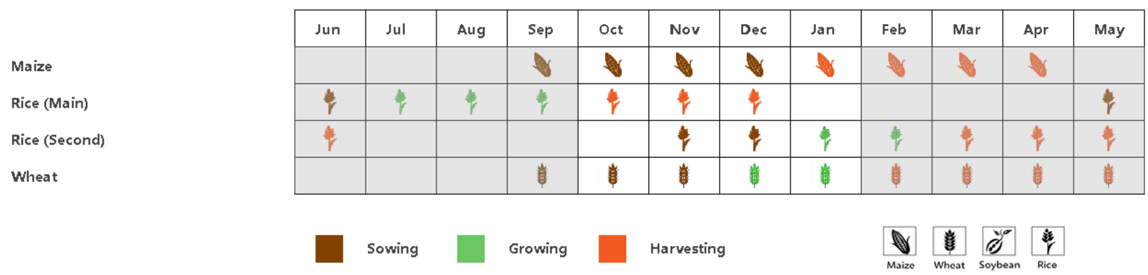
Three sub-national agro-ecological zones (AEZ) can be distinguished for Myanmar based on the cropping system, climatic zones and topographic conditions. They are the Central plain (132), the Hills (134) and the Delta and Southern Coast regions (133).

The **Central Plain** had a marked rainfall deficit (RAIN -45%), and RADPAR and TEMP were up by 6% and 0.9ºC compared to the 15YA. BIOMSS was 20% lower than the 15YA. CALF showed that 98% of the cropland was fully utilized. NDVI was near the level of the 5YA for the period. The VCIx was 0.89. The CPI was 1.14. Crop conditions for this region were slightly below average.

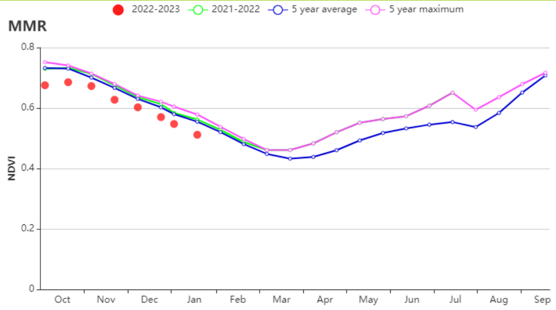
The **Hills region** also had below-average rainfall (RAIN -29%). RADPAR and TEMP increased by 7% and 0.2ºC. BIOMSS was 17% lower than the 15YA. The cropland was almost fully utilized (CALF 98%). The NDVI values were similar to that of the whole country. The VCIx was 0.88. The CPI was 1.05. Crop conditions are assessed as below the 5YA level.

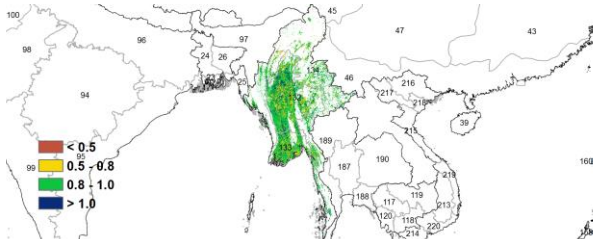
The **Delta and Southern Coast region** had the highest RAIN compared with the other two sub-national regions, though it was also below the 15YA (-10%). RADPAR and TEMP were 1% and 0.1ºC above average. BIOMSS was almost comparable to the 15YA. The cropland was also close to fully utilized (CALF 98%). The NDVI values were apparently below the 5YA during October and November, and on average in December and January. VCIx was 0.88. The CPI was 1.06. Crop conditions in this region were below average.

Figure 3.31 Myanmar's crop condition, October 2022 - January 2023

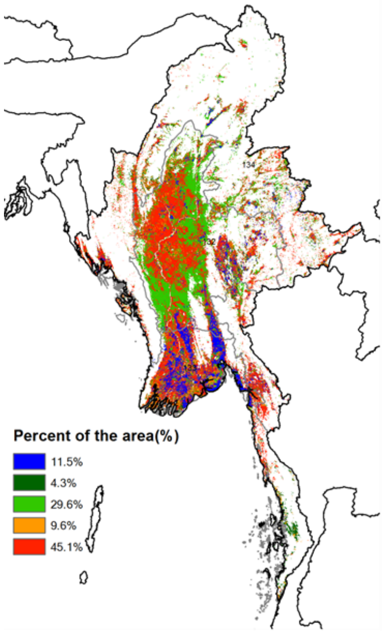


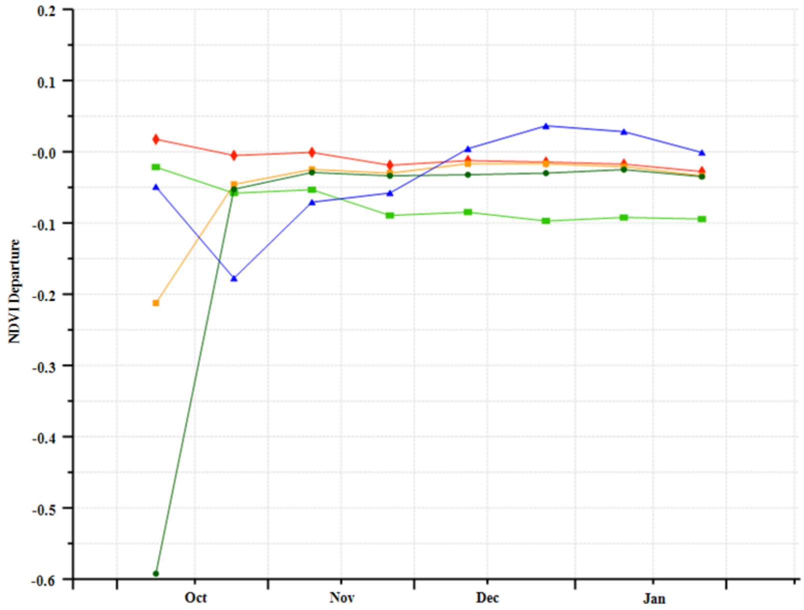
(a) Phenology of major crops



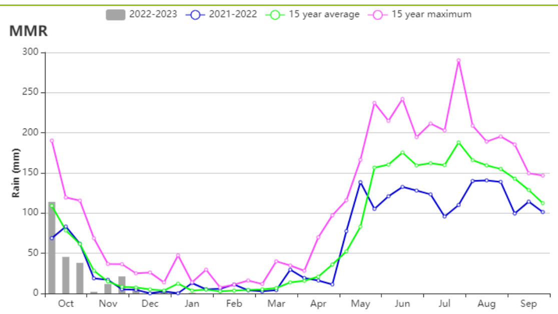


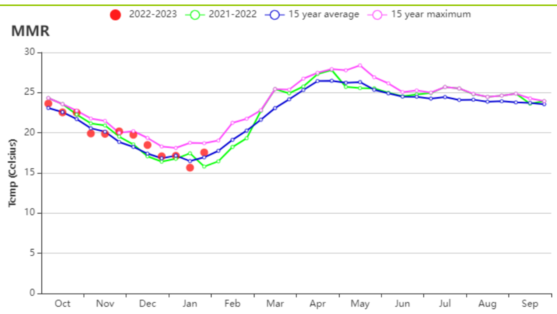
(b) Crop condition development graph based on NDVI (c) Maximum VCI



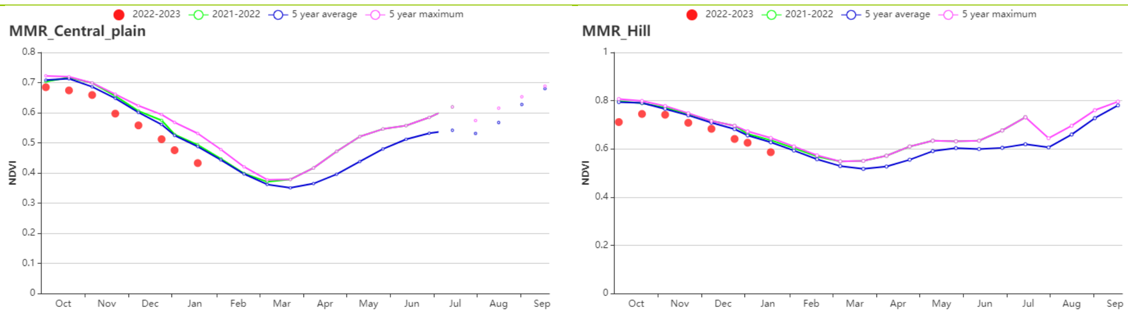


(d) Spatial NDVI patterns compared to 5YA (e) NDVI profiles

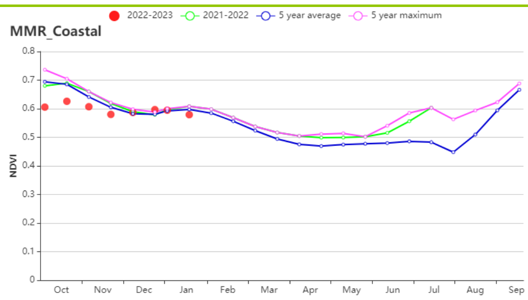




(f) Rainfall profiles (g) Temperature profiles



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



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

Table 3.54 Myanmar's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, October 2022 - January 2023

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Central plain	166	-45	20.1	0.9	1081	6	516	-20
Delta and southern-coast	340	-10	24.6	0.1	1128	1	824	-1
Hills region	245	-29	17.3	0.2	1046	7	534	-17

Table 3.55 Myanmar's agronomic indicators by sub-national regions, current season's values and departure from 5YA, October 2022 - January 2023

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Central plain	98	0	0.89
Delta and southern-coast	98	0	0.88
Hills region	99	0	0.88

[MNG] Mongolia

No crops were grown in Mongolia during the monitoring period from October 2022 to January 2023, as the country only grows summer crops from May to September. With only 2.9% of arable land under irrigation, crop growth is highly dependent on rainfall. Therefore, the accumulation of snow and soil moisture during the winter months is important for the successful production of summer crops. Of the CropWatch agroclimatic indicators, precipitation and temperatures were slightly below the 15-year average (RAIN -4%, TEMP -0.5°C), while solar radiation was close to average (RADPAR +0%). The national average VCIx was 0.66, significantly lower than the same period last year (0.93). The Crop Production Index (CPI) was only 0.21, also much lower than last year (0.84). Additionally, the NDVI was significantly below the five-year average during the monitoring period.

The poor vegetation conditions in Mongolia during the monitoring period were largely due to an extreme cold wave, which caused over 70% of the country to be covered in snow and ice (source: **https://www.imsilkroad.com/news/p/498360.html**). The temperature profile shows that Mongolia was cooler than usual from late November to mid-December, which coincides with the occurrence of the extreme cold wave. The extreme cold wave in Mongolia led to an unusual amount of snow cover, resulting in a decline in NDVI.

However, with wheat planting in Mongolia only starting three months later (in May), the impact of the current extreme weather on future crop production is still uncertain and requires further monitoring.

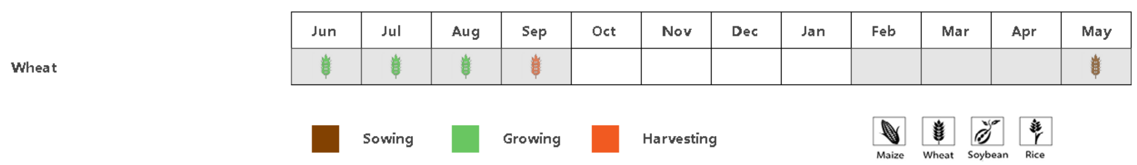
Regional analysis

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

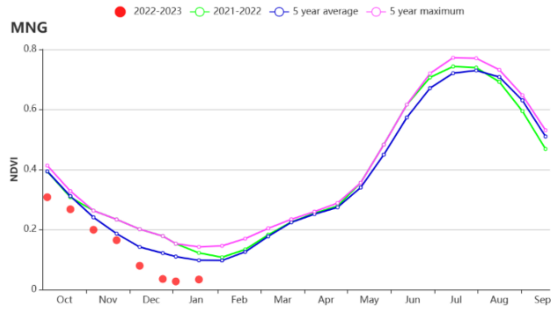
The **Hangai Khuvsgul region** is in the northwest of Mongolia, and the **Selenge-Onon region** is in the central north of Mongolia. These two regions have been affected by extremely cold weather, so their agroclimatic conditions are similar to the overall situation in the country. Precipitation decreased by 8% and 4% respectively, temperatures decreased by 0.9° C and 0.5° C respectively, while solar radiation was equal to the 15-year average. The VCIx values were 0.60 and 0.68, respectively. The **Central and Eastern Steppe region** was slightly less affected by the extreme cold compared to the above two regions, with an 11% increase in precipitation, a 0.3° C decrease in temperature and a 1% decrease in solar radiation, while the VCIx was 0.72.

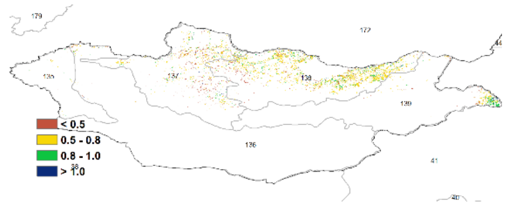
The extreme cold weather and high snowfall may have negatively impacted the production of livestock.

Figure 3.32 Mongolia's crop condition, October 2022 - January 2023

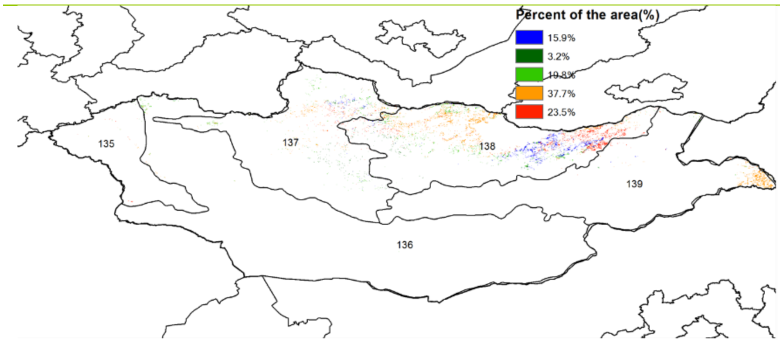


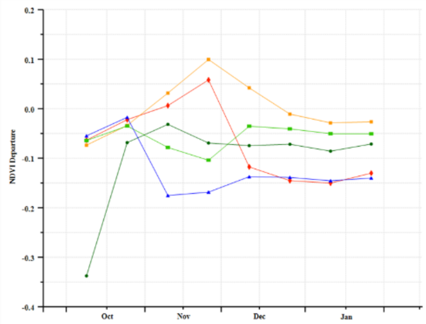
(a). Phenology of major crops



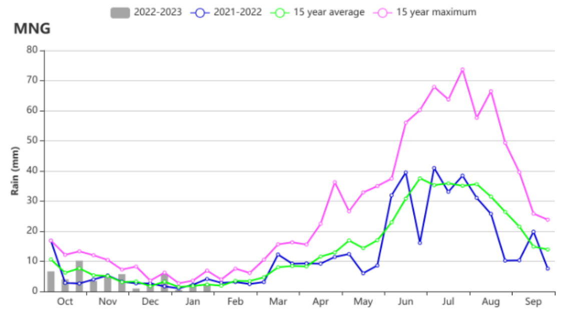


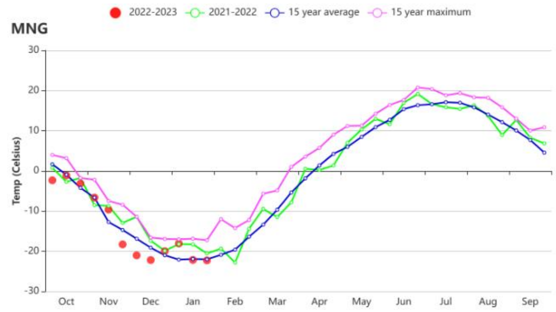
(b) Crop condition development graph based on NDVI (c) Maximum VCI



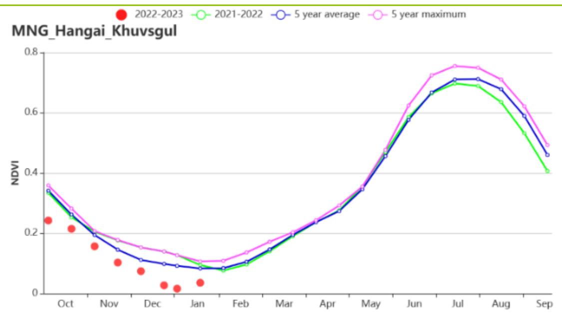


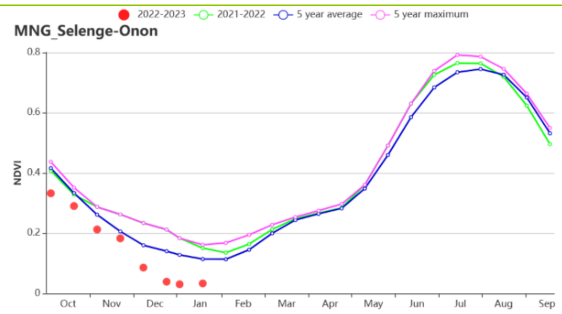
(d) Spatial NDVI patterns compared to 5YA (e) NDVI profiles



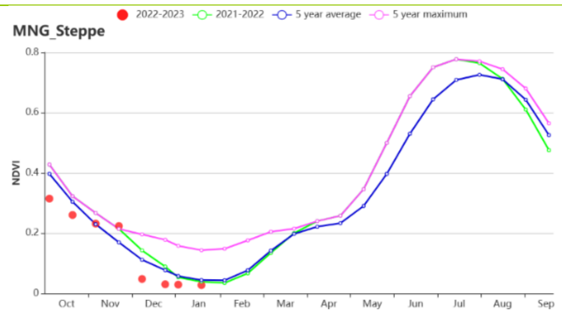


(f) Rainfall profiles (g) Temperature profiles





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



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

Table 3.56 Mongolia's agroclimatic indicators by sub-national regions, current season's values, and departure from 15YA, October 2022 - January 2023

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m2)	Departure (%)	Current (gDM/m2)	Departure (%)
Hangai Khuvsgul Region	42	-8	-15.6	-0.9	455	0	88	-11
Selenge-Onon Region	49	-4	-13.3	-0.5	447	0	124	0
Central and Eastern Steppe Region	70	11	-12.9	-0.3	451	-1	140	-1
Altai Region	39	-51	-14.1	-0.9	435	5	101	-9
Gobi Desert Region	27	-45	-11.8	0.5	422	4	78	-18

Table 3.57 Mongolia's agronomic indicators by sub-national regions, current season's values, and departure from 5YA, October 2022 - January 2023

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Hangai Khuvsgul Region	2	-76	0.60
Selenge-Onon Region	11	-67	0.68
Central and Eastern Steppe Region	0	-98	0.72
Altai Region	0	-92	0.57
Gobi Desert Region	6	-39	0.57

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

[MOZ] Mozambique

In Mozambique, agriculture is mostly practised under rainfed conditions. Coinciding with the firsth half of the rainy season, this reporting period covers the sowing and vegetative growth stages of maize and rice. The wheat sowing started in January and is expected to last until late February. During this period, agroclimatic indicators reveal a 12% drop in cumulative rainfall compared to the past 15 years average, while both temperature and photosynthetic active radiation were close to average (TEMP 25.4ºC and RADPAR 1123.5 MJ/m2). As a result of the decrease in rainfall, the total biomass production nationwide decreased by 3%. The slight drop in total biomass production is confirmed by crop conditions development based on NDVI, which indicates close to average crop conditions during almost the entire monitoring period. However, they reached average levels at the end of this monitoring period.

The NDVI spatial patterns show that 39.2% of the total arable land had crop conditions below the average of the past 5 years, with most of these regions located in the provinces of Tete, Nampula, Niassa, and Cabo Delgado. Above-average crop conditions were observed in the central and southern areas of the country (i.e., in the provinces of Gaza, Inhambane, Manica, Sola, and Maputo), representing 27% of the total cropped arable land. Some regions in the provinces of Nampula and Zambezia recorded below-average crop conditions starting from early October until November. They recovered in December, remaining above average during the remaining period. The reported below-average conditions, especially in the northern regions, can be attributed to the delays in rainfall and the low amount of rain recorded in these regions, which led farmers to delay sowing activity until early December and, in some cases, until late December.

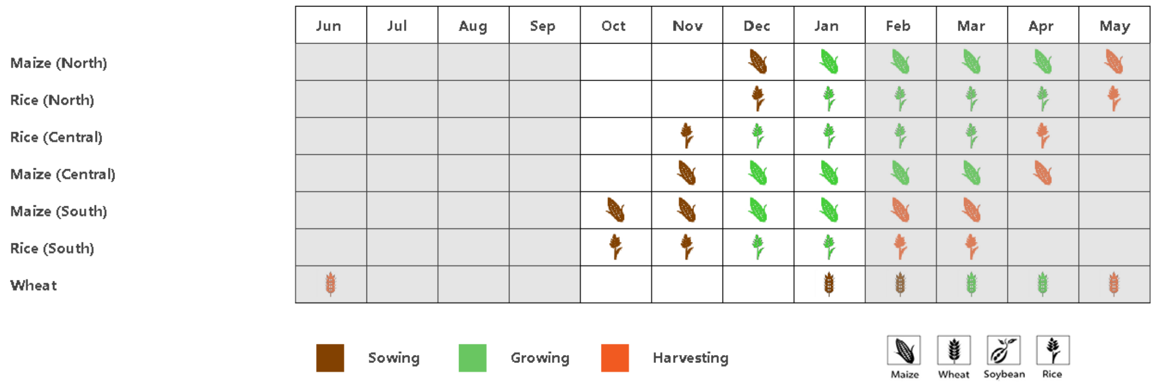
Regional analysis

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).

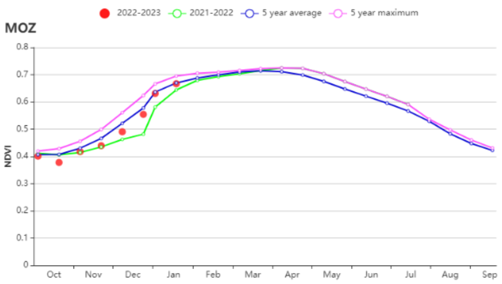
At the regional level, agroclimatic indicators revealed drops in rainfall in the Buzi basin (26%), Southern region (20%), Low Zambezia river basin (15%), Northern high-altitude area (11%), and Northern coast (1%). The temperature decreased in the Northern high-altitude areas (-1ºC) and Northern coast (-0.3ºC) and increased in the Southern region (+0.7ºC), Buzi basin (+0.6ºC), and Low Zambezia river basin (+0.1ºC). With the RADPAR increasing in all the agroecological regions, the total biomass production at the regional level recorded variations, with increases verified in the Buzi basin (+1%) and decreases recorded in the Northern high-altitude area (-8%), Northern coast, and Low Zambezia river basin (-3%). BIOMSS in the southern region was about average.

The regional crop development graphs based on NDVI indicated favourable crop conditions during the entire monitoring period in the Buzi basin and southern regions. In the Northern high-altitude areas and Low Zambezia river basin, crop conditions were below the past 5-year average. On the Northern coast, the crop conditions recovered from late December until the end of the monitoring period. Except for the Buzi basin and the Low Zambezia river basin, the CALF increased in the remaining agroecological zones, by 3% on the Northern coast, 2% in the southern region, and 1% in the Northern high-altitude areas. The maximum VCIx varied from 0.89 to 0.92, and the CPI was between 1.02 and 1.13.

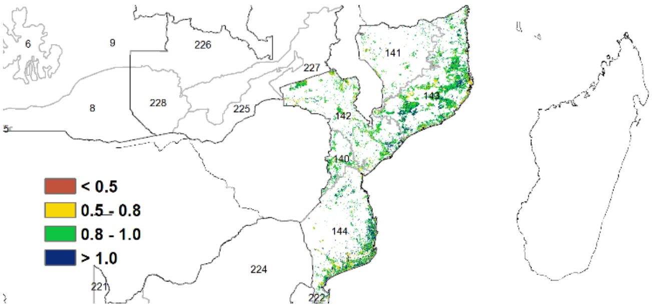
Figure 3.33 Mozambique's crop condition, October 2022 - January 2023



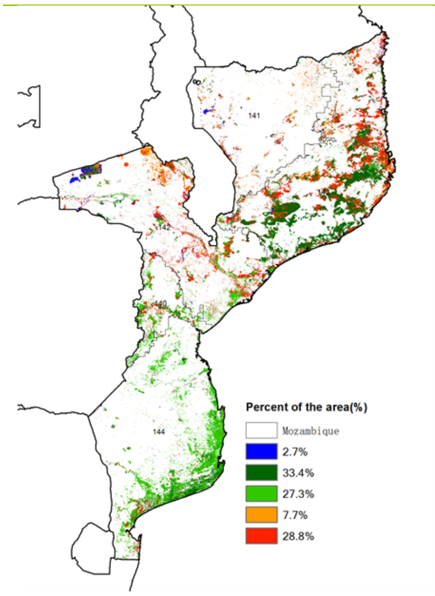
(a) Phenology of major crops

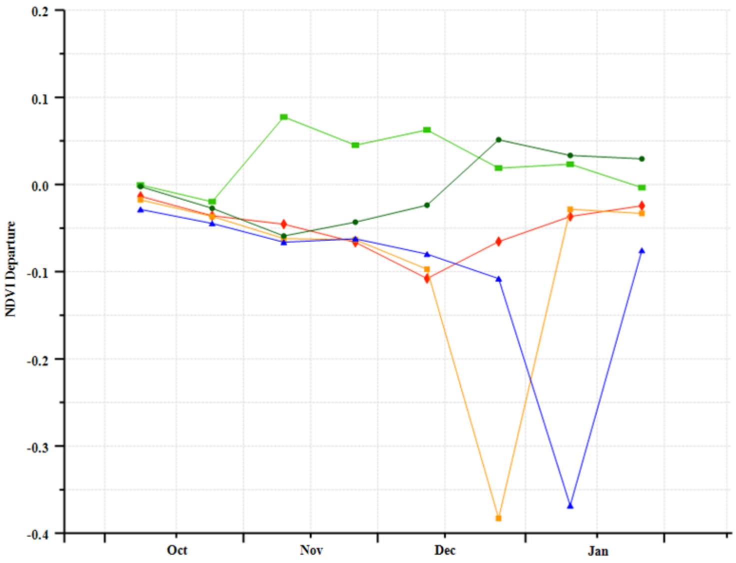


(b) Crop condition development graph based on NDVI



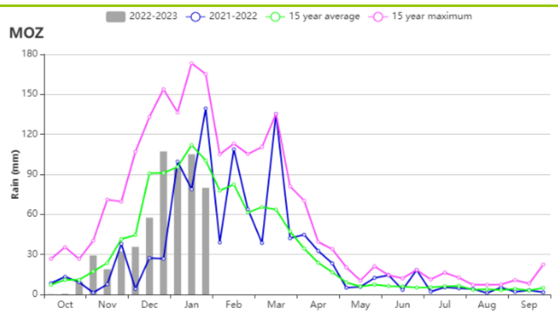
(c) Maximum VCI

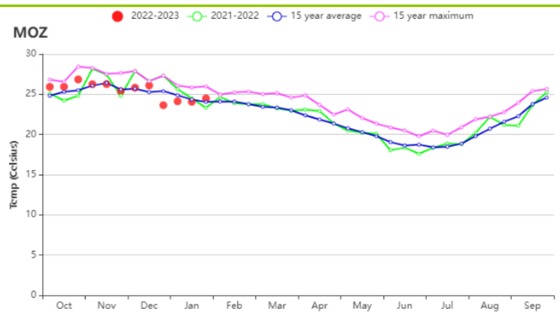




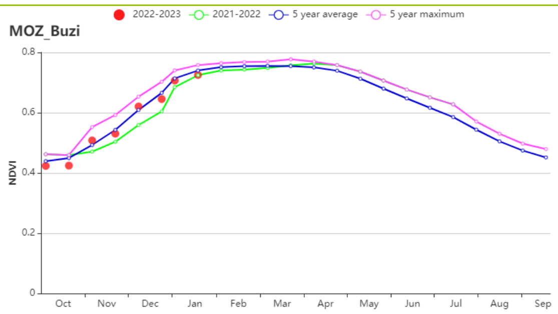
(d) Spatial NDVI patterns compared to 5YA

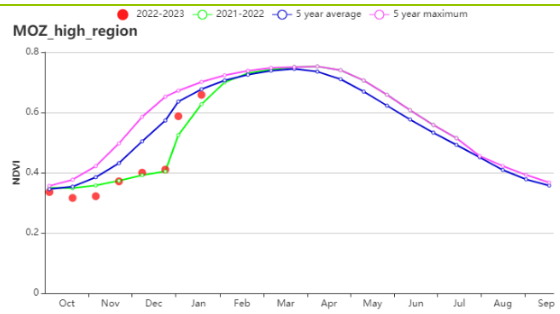
(e) NDVI profiles



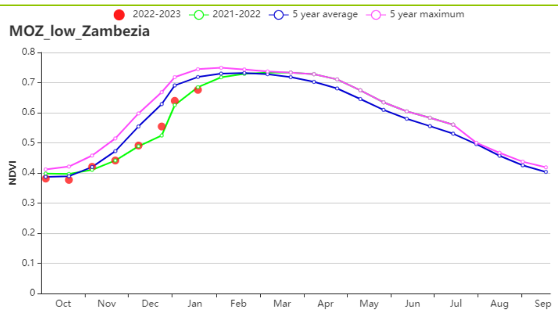


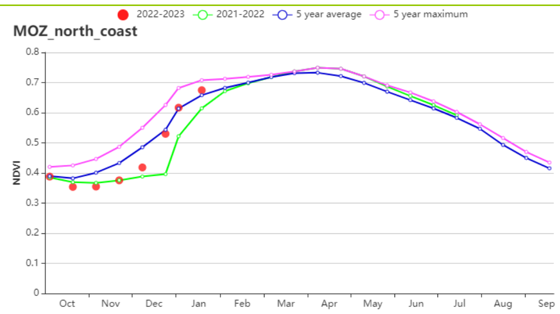
(f) Rainfall profiles (g) Temperature profiles



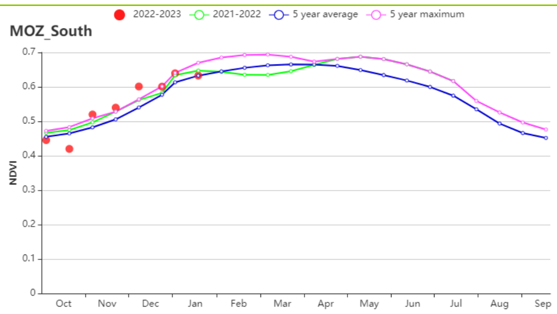


(h) Crop condition development graph based on NDVI-Buzi basin (left), and Northern high-altitude areas (right)





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



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

Table 3.58 Mozambique's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, October 2022 - January 2023

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m^2)	Departure (%)	Current (gDM/m^2)	Departure (%)
Buzi basin	560	-26	23.9	0.6	1436	4	1206	1
Northern high-	691	-11	24.1	-0.1	1345	4	1101	-8

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m^2)	Departure (%)	Current (gDM/m^2)	Departure (%)
altitude areas								
Low Zambezia River basin	605	-15	25.8	0.1	1362	1	1146	-3
Northern coast	618	-1	25.6	-0.3	1361	3	1129	-4
Southern g region	389	-20	26.1	0.7	1390	5	1098	0

Table 3.59 Mozambique's agronomic indicators by sub-national regions, current season's values and departure from 5YA, October 2022 - January 2023

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Buzi basin	100	0	0.90
Northern high-altitude areas	99	1	0.89
Low Zambezia River basin	99	0	0.89
Northern coast	99	3	0.91
Southern g region	98	2	0.92

[NGA] Nigeria

This report covers crop conditions for maize, wheat, soybean and rice between the months of October 2022 to January 2023 in Nigeria, when the country entered the dry season. Rice, millet, and sorghum were harvested in November and December. Harvest of second season maize was completed in January.

Rainfall recorded for the country during this period was -32% below the 15YA. The temperature recorded was -0.9ºC below the 15YA. Solar radiation did not deviate from the 15YA. As a result of these factors, the BIOMSS also fell below the 15YA by -13%. The CALF was above the 15YA at 4% while the observed maximum vegetation condition index (VCI) was 0.89.

The crop condition development graph based on NDVI shows that the NDVI was mostly below the 5YA throughout the reporting period until January, when it levelled off and approached the 5YA. The Crop Production Index (CPI) for the country was at 1 which indicates normal conditions.

As shown in the spatial NDVI profiles and distribution map, 48.2% of the country covering the middle belt and parts of the north were mostly below the 15YA throughout the period, while 32% covering the northern part of the country were above the 15YA. It was observed that a portion of 7.8% and 7.4% dropped far below the 15YA in early October, but by mid-October, was back to near the average for the rest of the monitoring period. The same applies to a portion of 4.6% predominant along the Niger and Benue River as well as the southern part of the country which also fell far below the average in October, but began to rise towards the average in December, but by January, it rose slightly above average. Most likely, the sharp negative departures were artifacts, caused by cloud cover in the satellite images. Overall, the rainfall deficit caused favorable conditions for harvest, but it may have negatively impacted the yield of some late sown crops. Conditions can be assessed as close to normal.

Regional Analysis

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

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

In the **Sahel Savanah zone**, the agro-climatic conditions showed that the region experienced the highest decrease in rainfall at -93% and the average temperature was -1.4°C below the 15YA. The radiation decreased by -1%. The drastic decrease in rainfall caused a reduction in BIOMSS by -6%. However, CALF in this area was 6% above the 5YA and the maximum VCI was 0.97.

In the **Sudan Savannah**, the agro-climatic condition also showed a drastic decline in rainfall at -55% and the average temperature was -1.2°C below the 15YA. The radiation decreased by -1%. And as expected, there was also a significant decrease in the BIOMSS which stood at -17%. However, CALF increased by 7% and the maximum VCI was 0.91.

The **Guinea savannah** zone, which is predominantly located in the central region also recorded a high decrease in rainfall by -52%, temperature was at -1°C below the 15YA, while radiation was at 0%, and BIOMSS dropped by -13%. The CALF was lower by -1% and the maximum VCI was 0.84.

The **Mountain Forest** which covers a very small portion in the central part of the country, recorded a rainfall of -47%, temperature was at -1.2°C, while radiation increased to 1%, and BIOMSS dropped down to -20%. The CALF was on average and the maximum VCI was 0.88.

The **Jos Plateau** which is also located in the central region recorded rainfall of -65%, temperature was lower than the 15YA at -0.7°C, while there was no change in radiation (0%), and BIOMSS was down to -18%. The CALF was unchanged and the maximum VCI was 0.89.

The **Derived Savanah** region recorded rainfall of -32%, the temperature was at -0.5°C, the radiation was slightly above the 15YA at 1% with a recorded BIOMSS of -11% and a CALF of -1%. The maximum VCI was at 0.86.

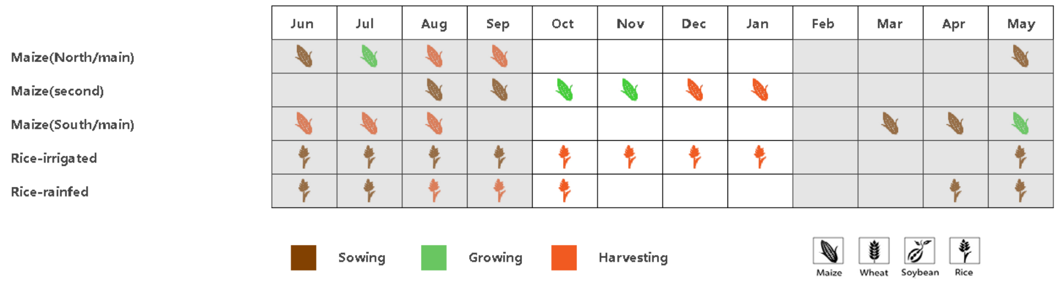
The **Lowland Rain Forest** also recorded a decrease in rainfall at -22%, and temperature was at -0.3°C. The radiation was at 0% and the BIOMSS was also low at -12%. The CALF was levelled on the 5YA at 0% and the maximum VCI was 0.89.

The **Fresh Water Swamp Forest** is located in the southern region of the country and does not cover a large area. Rainfall in this area was also at -22%, temperature was -1°C, while radiation fell to -1%, and BIOMSS dropped down to -10%. The CALF was lower by -1% and the maximum VCI was 0.86.

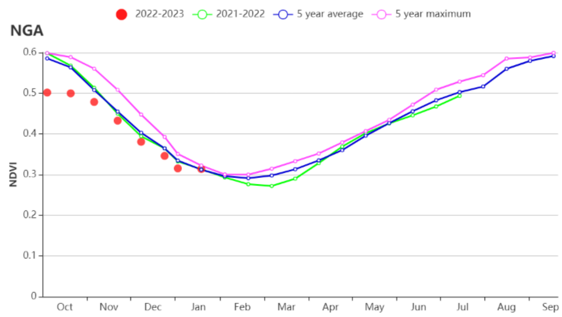
The **Mangroove Forest,** also located in the southern region of the country recorded rainfall of -16%, temperature of -0.2°C, a decreased radiation of -1%, and BIOMSS of -8%. With CALF on the average at 0% and the maximum VCI was 0.85.

The Crop Production Index (CPI) recorded for most of the agro ecological zones was at 1 which indicates normal production index, except for the Fresh Water Swamp Forest, Mangroove Forest and Mountain Forest.

Figure 3.34 Nigeria's crop condition, October 2022-January 2023

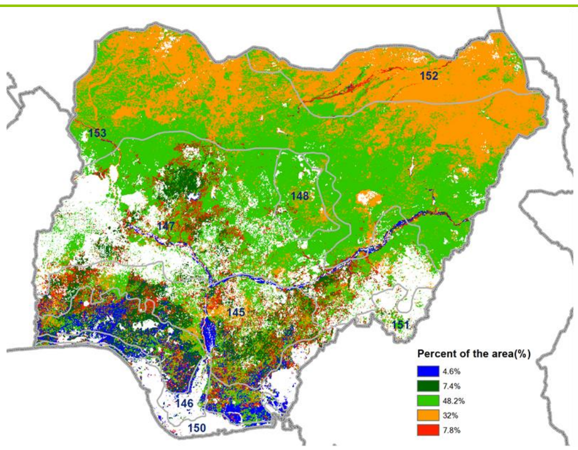


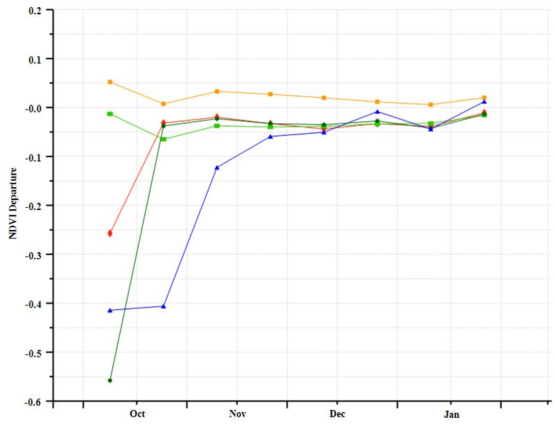
(a) Phenology of major crops



(b) Crop condition development graph based on NDVI

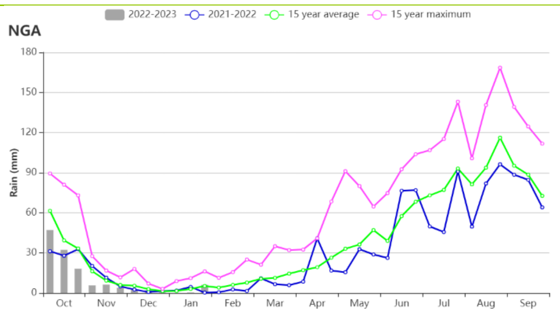
(c) Maximum VCI

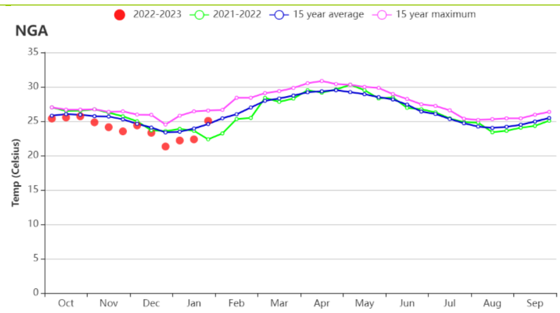




(d) Spatial NDVI patterns compared to 5YA

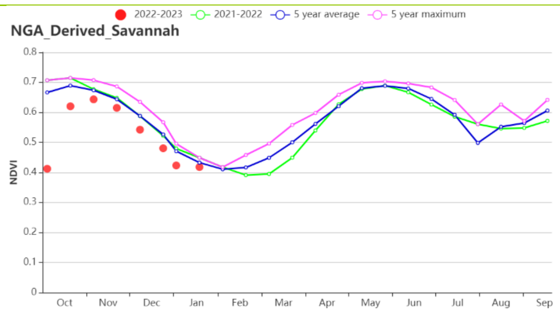
(e) NDVI profiles

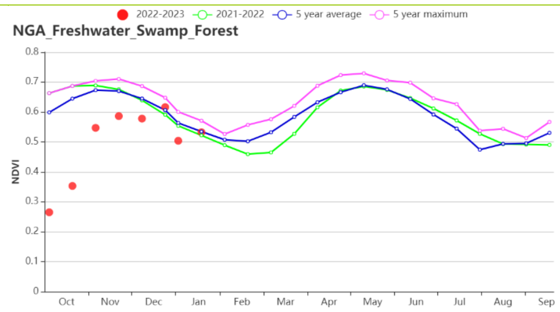




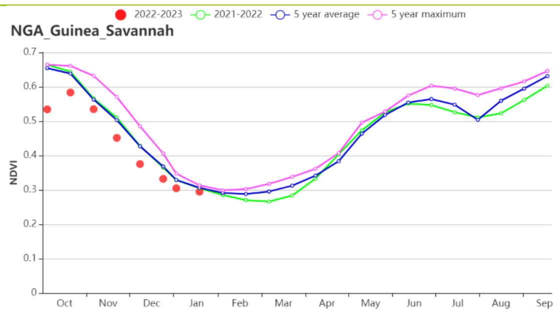
(f) Rainfall profiles

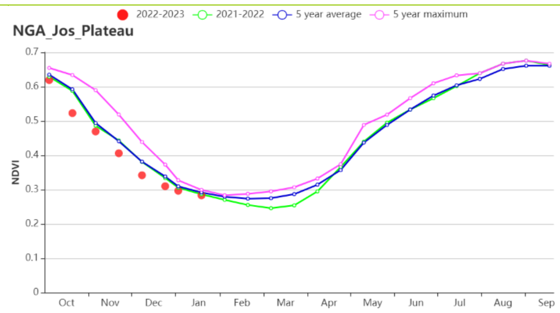
(g) Temperature profiles



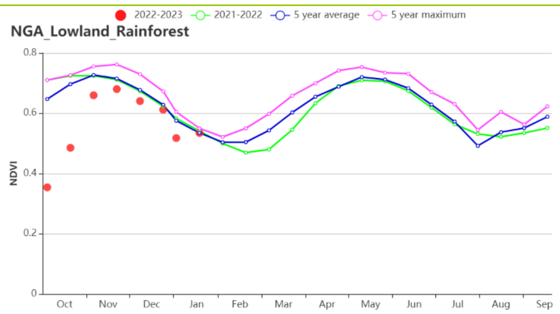


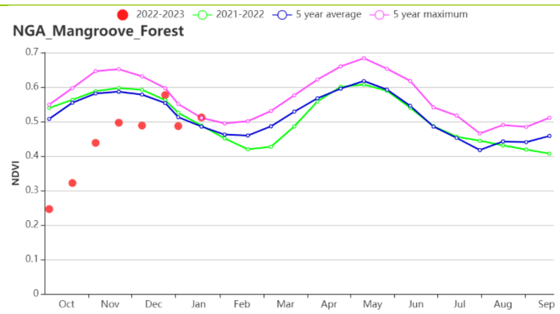
(h) Crop condition development graph based on NDVI(Left:Derived Savannah (146), Right: Freshwater Swamp Forest(147))



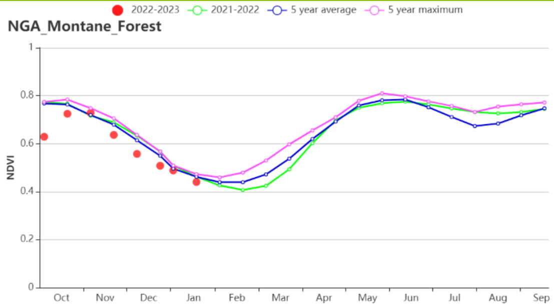


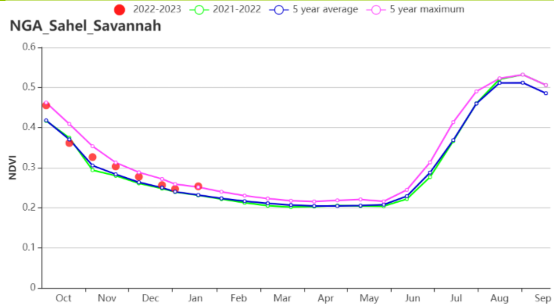
(i) Crop condition development graph based on NDVI(Left:Guinea Savannah (148), Right: Jos Plateau(149))



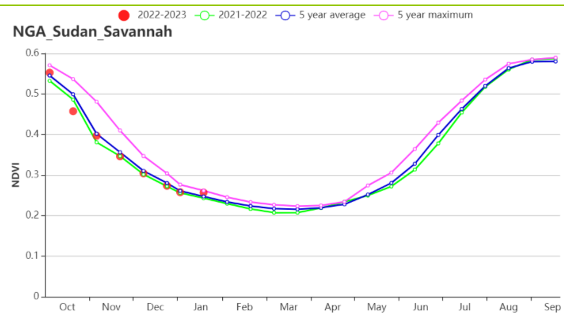


(j) Crop condition development graph based on NDVI(Left:Lowland Rainforest (150), Right: Mangroove Forest (151))





(k) Crop condition development graph based on NDVI(Left:Mountain Forest(152), Right: Sahel Savannah(153))



(l) Crop condition development graph based on NDVI(Sudan Savannah(154))

Table 3.60 Nigeria's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, October 2022 - January 2023

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Derived Savannah	159	-32	25.5	-0.5	1221	1	645	-11
Freshwater Swamp Forest	467	-22	26.0	-0.1	1169	-1	1011	-10
Guinea Savannah	48	-52	23.9	-1.0	1280	0	496	-13
Jos Plateau	33	-65	21.1	-0.7	1324	0	435	-18
Lowland Rainforest	381	-22	25.4	-0.3	1189	0	854	-12
Mangroove Forest	662	-16	25.8	-0.2	1187	-1	1137	-8
Montane Forest	184	-47	20.2	-1.2	1323	1	571	-20
Sahel Savannah	1	-93	22.8	-1.4	1219	-1	355	-6
Sudan Savannah	23	-55	23.0	-1.2	1264	-1	385	-17

Table 3.61 Nigeria's agronomic indicators by sub-national regions, current season's values and departure from 5YA, October 2022 - January 2023

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Derived Savannah	98	-1	0.86
Freshwater Swamp Forest	96	-1	0.86
Guinea Savannah	97	-1	0.84
Jos Plateau	99	0	0.89
Lowland Rainforest	99	0	0.89

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Mangroove Forest	93	0	0.85
Montane Forest	100	0	0.88
Sahel Savannah	57	60	0.97
Sudan Savannah	88	7	0.91

[PAK] Pakistan

This reporting period includes the planting and vegetative growth of winter wheat, as well as the harvest of maize and rice in October. Crop conditions were close to average from October 2022 to January 2023.

Nationwide, RAIN (-17%) and RADPAR (-1%) were below average, whereas TEMP was above (+0.6℃) compared to the 15YA. Rainfall was below average in the Lower Indus river basin in south Punjab and Sind (-80%), Northern highland (-15%) and Northern Punjab (-54%). Temperatures were above average in first two regions mentioned above. The combination of all the agro-climatic indicators resulted in a BIOMSS decrease by 14% compared to the 15YA.

At the national level, heavy monsoon rains had caused flooding conditions during the previous monitoring period. NDVI of the flood affected crops was below average in October, when harvest of most of the summer crops started. NDVI of the wheat crop, which was sown in November, developed favorably. Most of the Punjab and the lower Indus river basin, the two major wheat producing areas, had above-average conditions according to the spatial NDVI patterns and profiles from November. The drop in NDVI observed in January is probably an artifact, due to fog or cloud cover in the satellite images. The national average of VCIx was 0.98 and CALF increased by 4%. The Crop Production Index (CPI) in Pakistan is 0.99, reflecting an overall average crop outlook in this period.

Regional analysis

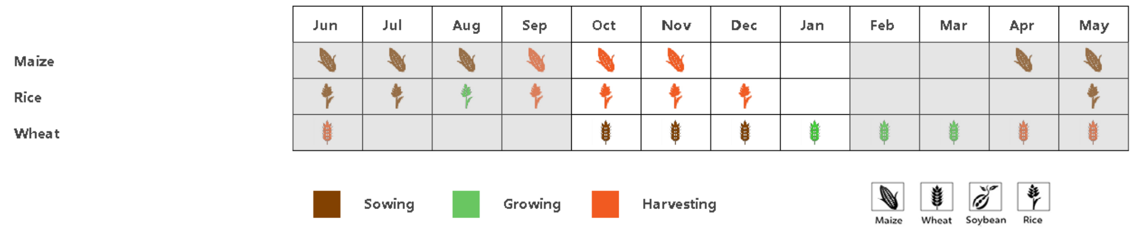
For a more detailed spatial analysis, CropWatch subdivides Pakistan into three agro-ecological regions based on geography and agro-climatic conditions: the **Lower Indus river basin in South Punjab and Sind (155)**, the **Northern highland (156)** and the **Northern Punjab (157)** region.

RAIN was sharply below average by 80%, while TEMP was above average by 0.3℃ and RADPAR was on average in the **Lower Indus river basin in south Punjab and Sin**d. BIOMSS was down by 26% as compared to the fifteen-year average. Heavy monsoon rains and flooding in July and August resulted in poor crop conditions from October to November. During early stages of winter wheat growth, crop conditions based on NDVI development profiles were above average and exceeded the maximum value in December. VCIx was lower than 0.5 in some of areas. CALF was 70%, similar to the average of the previous five years. The Crop Production Index (CPI) was 0.95. Crop conditions for winter wheat were average.

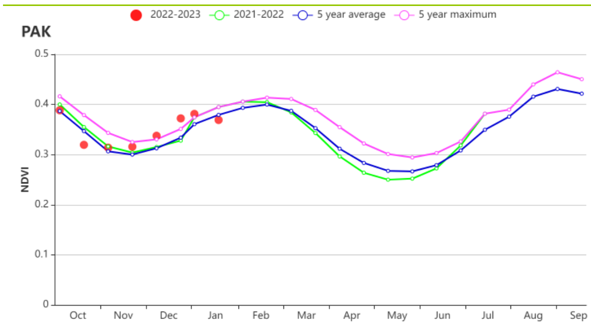
In the **Northern highland** region, RAIN (-15%) was below average, together with lower RADPAR (-2%) and higher TEMP (+0.9℃). As a result, estimated BIOMSS decreased by 6%. The NDVI development graph showed above-average crop conditions starting in November. VCIx was high at 0.93. CALF was at 53%, an increase over the five-year average by 13%. Crop prospects are good.

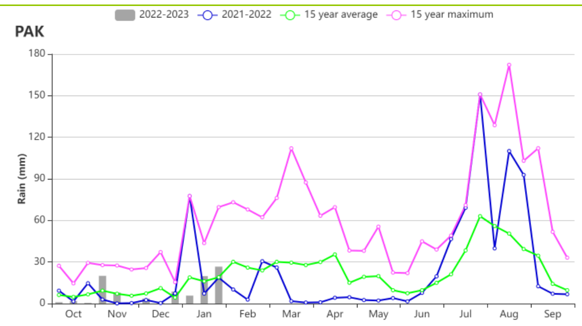
Northern Punjab is the main agricultural region in Pakistan. It recorded a below-average RAIN (-54%). TEMP departure was -0.1℃, and RADPAR was below average by 1%. The resulting BIOMSS decreased by 21% in this region. Crop condition assessed through NDVI based crop development profiles showed below average values in October due to heavy rainfall from July to August. It subsequently increased to above average in November, and above the maximum value in December. VCIx was high at 0.89. The CALF reached 85%, which was 2% above the five-year average. Overall, the winter wheat production potential for the region is high, evidenced by a high CPI of 1.11.

Figure 3.35 Pakistan crop condition, October 2022 - January 2023



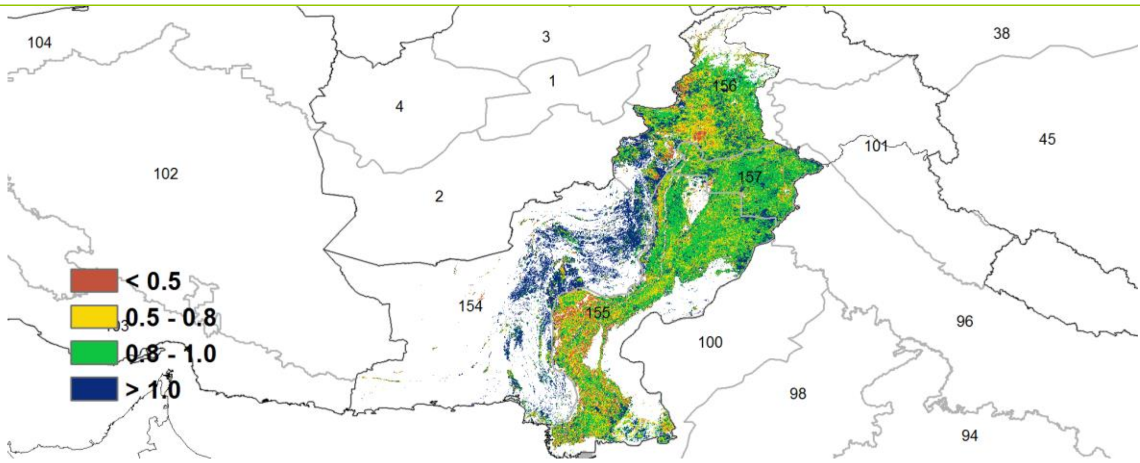
(a). Phenology of major crops



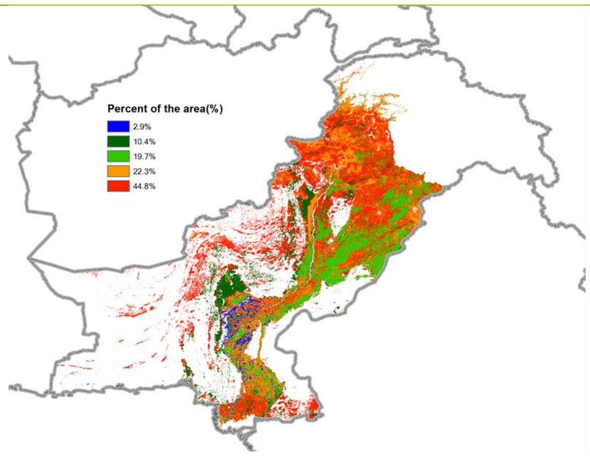


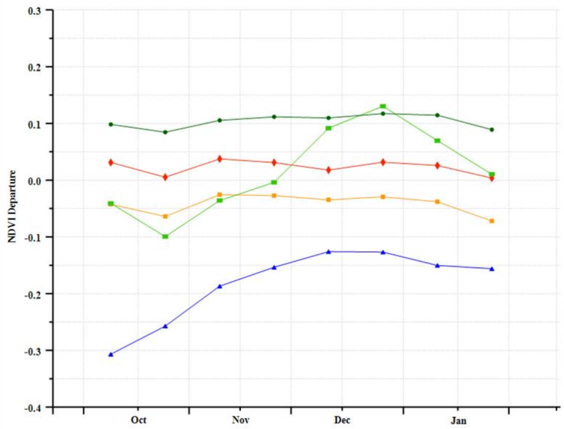
(b) Crop condition development graph based on NDVI

(c) Time series precipitation profile



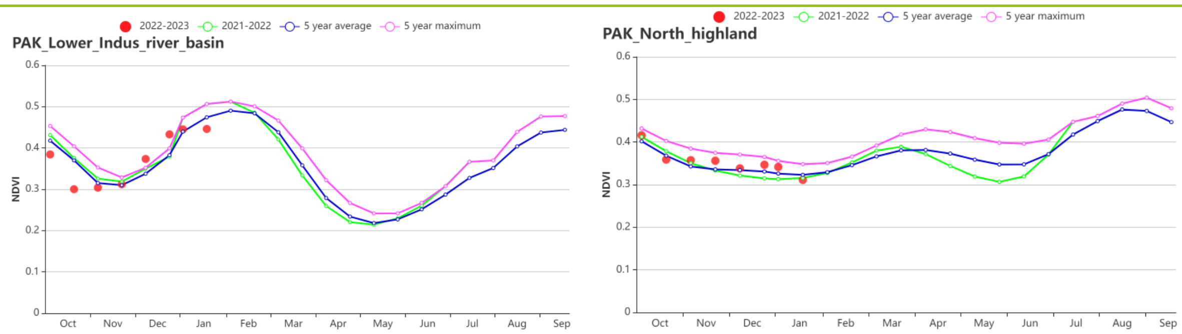
(d) Maximum VCI



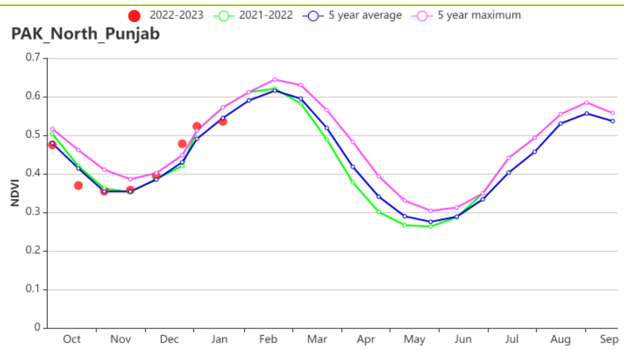


(e) Spatial NDVI patterns compared to 5YA

(f) NDVI profiles



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



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

Table 3.62 Pakistan's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, October 2022- January 2023

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (℃)	Departure (℃)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Lower Indus river basin	4	-80	20.5	0.3	953	0	220	-26
Northern highlands	139	-15	8.5	0.9	785	-2	288	-6
Northern Punjab	33	-54	16.8	-0.1	816	-1	250	-21

Table 3.63 Pakistan's agronomic indicators by sub-national regions, current season's values and departure from 5YA, October 2022- January 2023

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Lower Indus river basin	70	-1	0.83
Northern highlands	53	13	0.93
Northern Punjab	85	2	0.89

[PHL] Philippines

During this monitoring period, both second season maize and second season rice were sown in the Philippines starting in October, while the main season rice harvest was completed by the end of December. The weather in the Philippines was more humid than usual. Compared to the same period in the past 15 years, precipitation (RAIN) was significantly higher by about 31%, radiation (RADPAR) was lower by about 4%, and temperature (TEMP) remained near average. The abundant rainfall was generally favourable for crop growth, resulting in a potential biomass (BIOMASS) bias of about 6%. The NDVI development curves showed several sharp drops. The drops presumeably are artifacts, caused by cloud cover in the satellite images. However, flooding can also cause a drop in NDVI. The persistent high precipitation in January may have affected the second season rice harvest and the growth of secondary maize. The spatial NDVI clustering map shows that about 34% of the cropped area (light green and orange colour) may have been adversely affected by the excessive rainfall in January. Crop NDVI in this area was well below normal in January. The remaining cropland (blue, dark green and orange colour) also have experienced a sudden drop in NDVI, but it quickly returned to normal levels. Overall crop growth in the Philippines was likely to be normal for this period.

Regional analysis

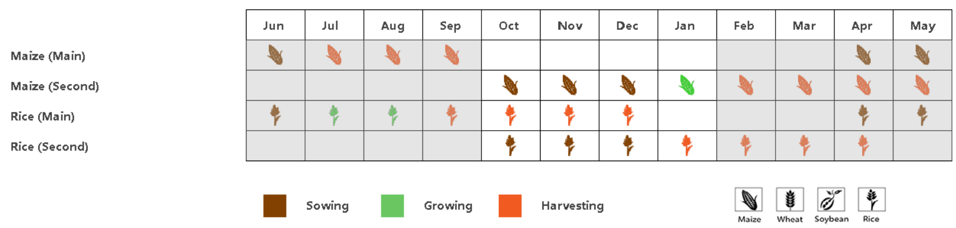
Based on the cropping systems, climatic zones, and topographic conditions, three main agro-ecological regions can be distinguished for the Philippines. They are **the Lowlands region** (northern islands), **the Hilly region** (Island of Bohol, Sebu, and Negros), and **the Forest region** (mostly southern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

The **Lowland region** (agroecological subzone 155) had about 26% (RAIN) higher precipitation, 0.1°C lower temperature (TEMP), 4% lower radiation (RADPAR), and about 5% higher potential biomass (BIOMASS). The proportion of cultivated land was 100%. Despite the high VCIx index of 0.94 and the high CPI index of 1.15. Overall crop growth in this region was close to average.

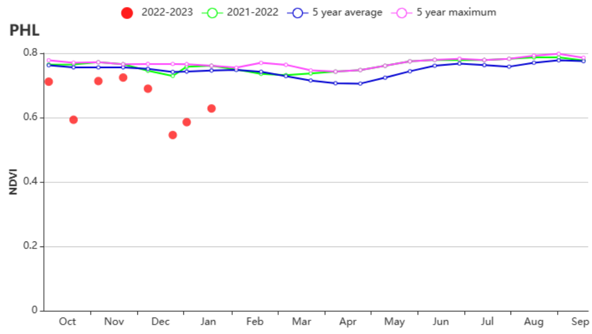
In **Hilly region** (agroecological subzone 154), the precipitation was 47% (RAIN) above the average of the last 15 years. The temperature was 0.4°C (TEMP) lower and radiation was lower by 6% (RADPAR). The potential biomass was 9% (BIOMASS) above average and all the cultivated land was planted. The VCIx index was as high as 0.93 and the CPI index was 1.11, indicating average conditions.

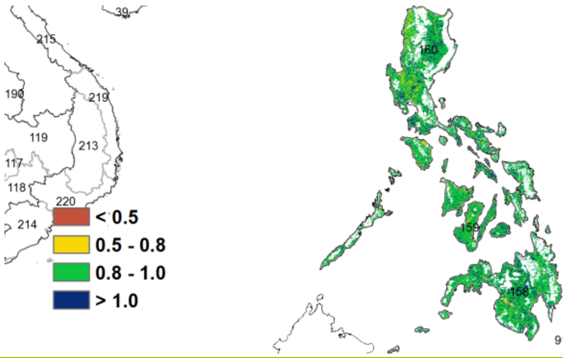
The precipitation in the **Forest region** (agroecological subzone 153) was also more than adequate (1661 mm). Precipitation was 33% (RAIN) higher than the average of the last 15 years, with a higher temperature (TEMP, 0.1°C) and lower radiation (RADPAR, -3%). The potential biomass (BIOMASS) was 5% higher and the arable land was fully utilised. The high VCIx index of 0.95 and high CPI index of 1.15 indiciate normal conditions.

Figure 3.36 Philippines' crop condition, October 2022 - January 2023



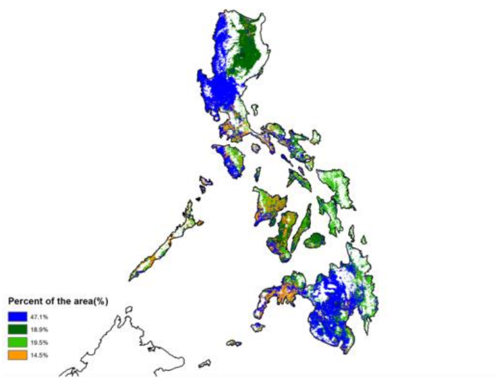
(a) Phenology of major crops

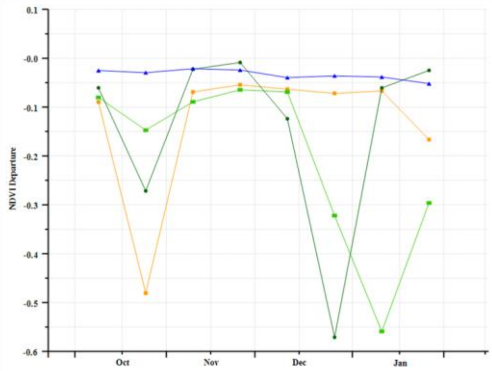




(b) Crop condition development graph based on NDVI

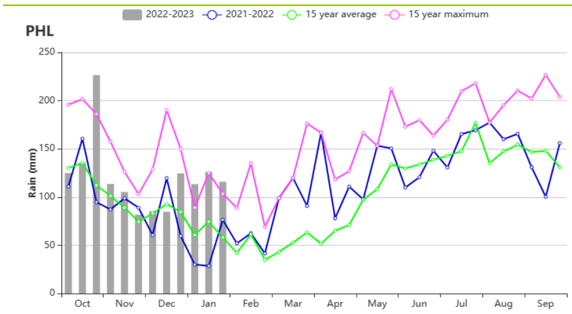
(c) Maximum VCI

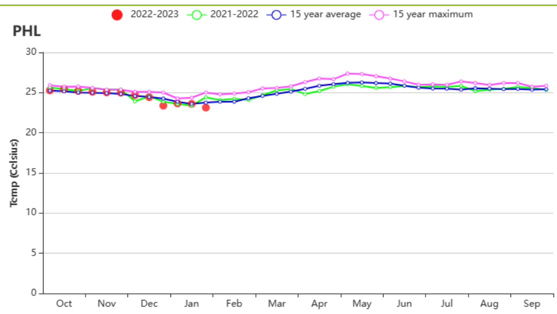




(d) Spatial NDVI patterns compared to 5YA

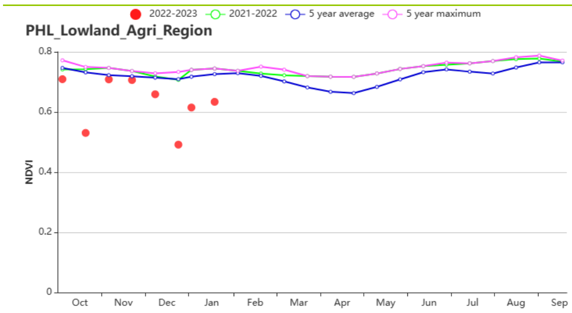
(e) NDVI profiles

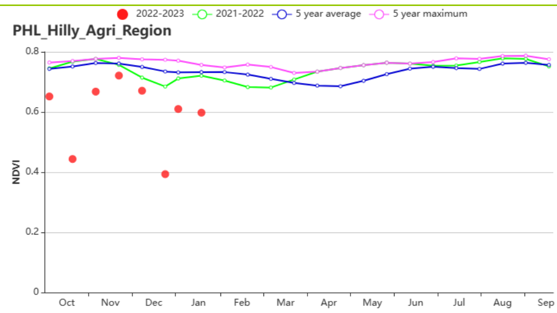




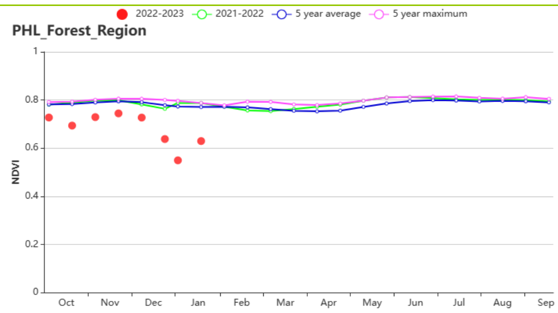
(f) Rainfall profiles

(g) Temperature profiles





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



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

Table 3.64 Philippines' agroclimatic indicators by sub-national regions, current season's values, and departure from 15YA, October 2022 - January 2023

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Lowland Region	1661	33	24.8	0.1	1053	-3	1494	5
Hilly region	1748	47	25.9	-0.4	1063	-6	1595	9
Forest region	1160	26	24.0	-0.1	920	-4	1255	5

Table 3.65 Philippines' agronomic indicators by sub-national regions, current season's values, and departure from 5YA, October 2022 - January 2023

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Lowland Region	100	0	0.95
Hilly region	100	0	0.93
Forest region	100	0	0.94

[POL] Poland

This monitoring period covers the maize harvest in October and the sowing as well as the growing period of winter wheat. Compared to the average of the last 15 years, RAIN was lower by 15%, TEMP was higher by 1.2°C and RADPAR was higher by 1%, resulting in a higher potential BIOMSS (+6%). Cropwatch's last monitoring results indicated that winter crop planting was favorable. The sharp drop in temperatures in mid-December may have had a negative impact on winter crops, but growing conditions improved with above-average temperatures and precipitation in January. NDVI in most periods of this monitoring was significantly lower, which was related to the ground covered by snow.

CALF was close to 100% and VCIx reached 0.86. Nearly all regions had VCIx values above 0.5. CPI was 0.98 indicating a normal crop growth outlook.

In general, the agrometeorological and agronomic parameters indicate favorable conditions for the growth of winter crops in Poland during this monitoring period.

Regional analysis

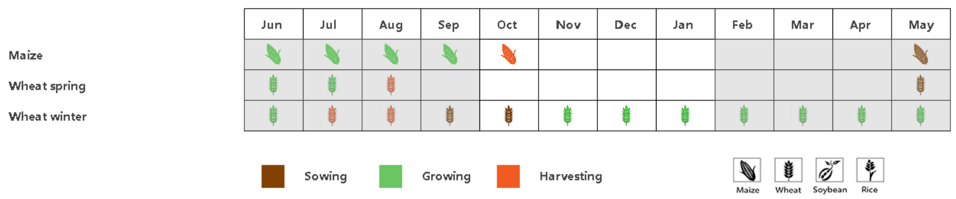
Four agro-ecological zones (AEZ) are examined more closely below. They include the **Northern oats and potatoes areas** (the northern half of west Pomerania, eastern Pomerania and Warmia-Masuria), the **Northern-central wheat and sugar-beet area** (Kuyavia-Pomerania to the Baltic Sea), the **Central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

Compared to the average of the same period of the last 15 years, RAIN and RADPAR were both lower in **Northern oats and potatoes areas** (RAIN -21%; RADPAR -6%) and **Northern-central wheat and sugar-beet area** (RAIN -22%; RADPAR -4%). However, with the higher TEMP (+1.2°C and +1.2°C), resulting in the higher estimated potential BIOMSS (+8% and +6%). CALF in the two zones were both close to 100% and VCIx reached 0.85. CPI were 1.00 and 1.02 respectively. Overall, crop conditions in these two regions were favorable.

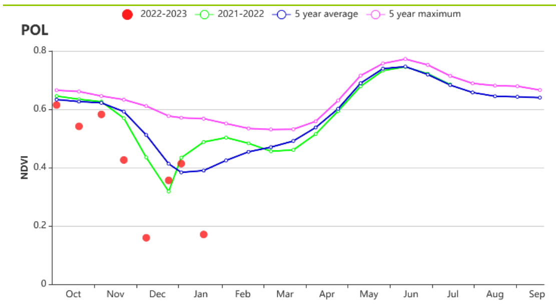
In Central rye and potatoes area, RAIN was below average by 14%, TEMP was higher by 1.2°C, and RADPAR was close to the 15-year average (+1%), which resulted in higher potential BIOMSS (+5%). In addition, CALF was near 100%, and VCIx reached 0.85. CPI was 0.98. In general, crop growth conditions were normal.

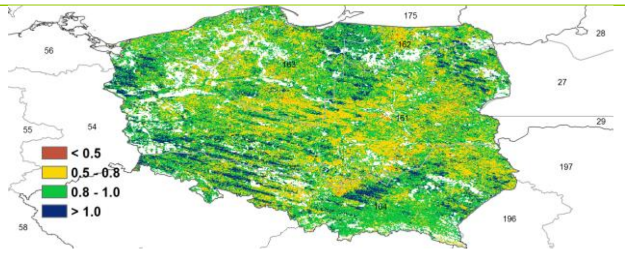
Compared with the average of the last 15 years, RAIN was lower by 9% in Southern wheat and sugar-beet area, combined with higher TEMP (+1.2°C) and RADPAR (+9%). The resulting potential BIOMSS was above average by 6%. In this zone, CALF was 100% and VCIx was 0.88. CPI was 1.01. Crop conditions were favorable.

Figure 3.37 Poland's crop condition, October 2022 – January 2023



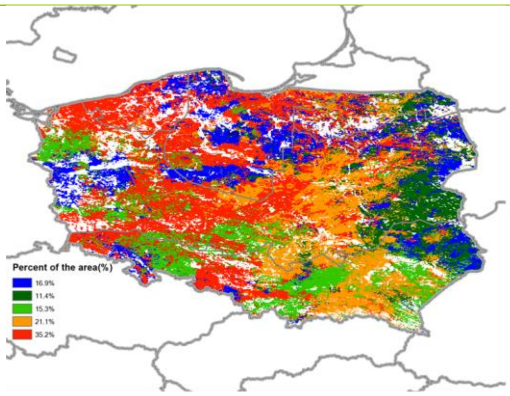
(a). Phenology of major crops

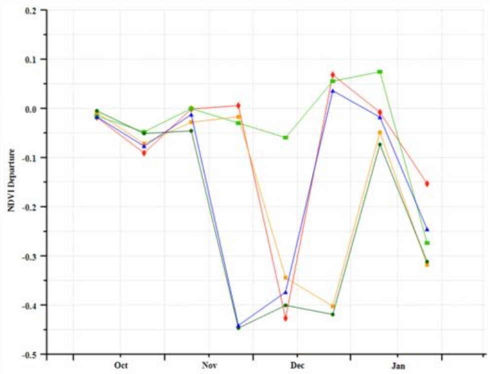




(b) Crop condition development graph based on NDVI

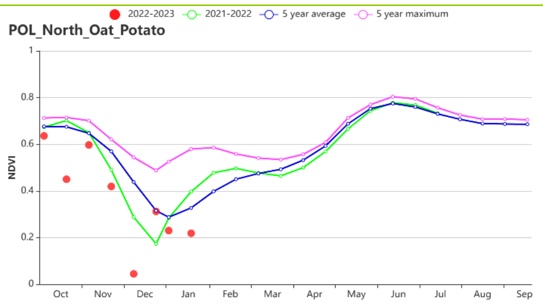
(c) Maximum VCI

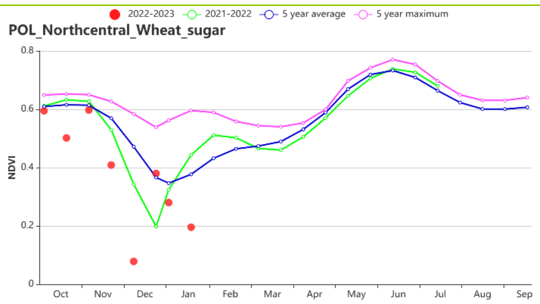




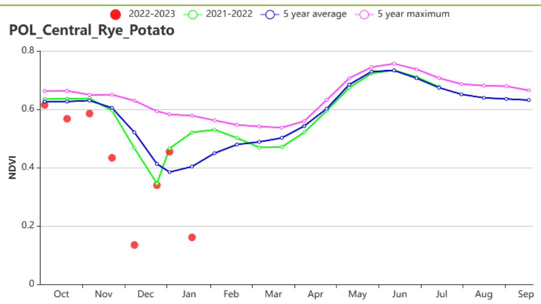
(d) Spatial NDVI patterns compared to 5YA

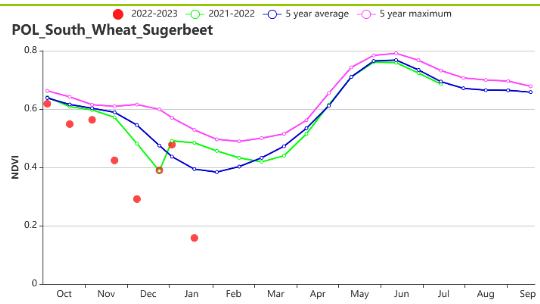
(e) NDVI profiles



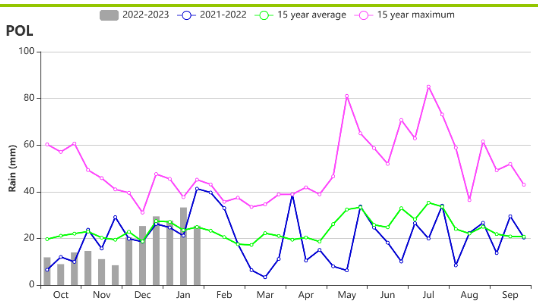


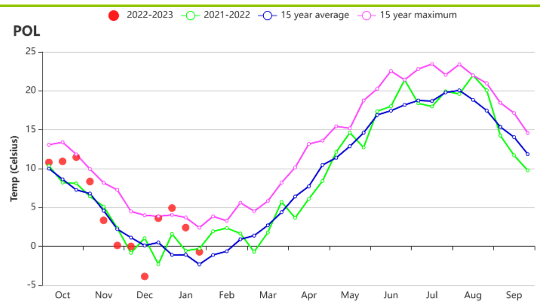
(f) Crop condition development graph based on NDVI, Northern oats and potatoes area (left) and Northern-central wheat and sugar beet area (right).





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





(h) Rainfall index

(i) Temperature Index

Table 3.66 Poland's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, October 2022 - January 2023

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m^2)	Departure (%)	Current (gDM/m^2)	Departure (%)
Northern oats and potatoes areas	240	-21	4.1	1.2	155	-6	487	8
Northern-central wheat and sugarbeet area	214	-22	4.6	1.2	171	-4	492	6
Central rye and potatoes area	228	-14	4.6	1.2	197	1	483	5
Southern wheat and sugarbeet area	235	-9	3.8	1.2	258	4	458	6

Table 3.67 Poland's agronomic indicators by sub-national regions, current season's values and departure from 5YA, October 2022 - January 2023

Region	Cropped arable land fraction		Maximum VCI
	Current	Departure (%)	Current
Northern oats and potatoes areas	100	0	0.85
Northern-central wheat and sugarbeet area	100	0	0.85
Central rye and potatoes area	100	0	0.85
Southern wheat and sugarbeet area	100	0	0.88

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

[ROU] Romania

The reporting period includes the harvest of the 2022 maize and sugar beet crops and the sowing of the 2022-2023 winter wheat, which started in September. The agroclimatic indicators show that rainfall was 14% lower than average; TEMP was 2.5℃ higher than average. RADPAR was 2% higher than average and biomass was 1% lower than average. The nationwide NDVI profile shows that crop conditions were above average during most of the reporting period and above the 15 years maximum in early December. A rainfall deficit was observed in October. The moisture conditions started to improve in mid November, when rainfall surpassed the 15YA. According to the spatial pattern of NDVI in Romania, the west region and east region marked with blue and light green has a fluent and high crop condition, which takes up most of Romania and for some areas marked with yellow and red, there is a sharp drop of NDVI in December, which may be results of snow cover. The CPI of Romania was above 1. All in all, conditions in Romania were close to average.

Regional analysis

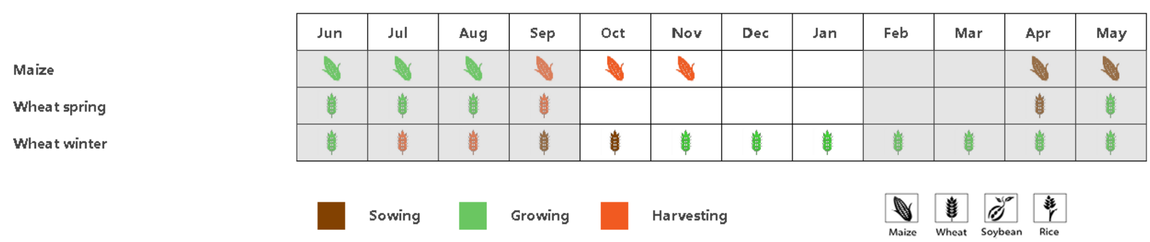
More spatial detail is provided below for the three main agro-ecological zones: the Central mixed farming and pasture Carpathian hills, the Eastern and southern maize, wheat and sugar beet plains and the Western and central maize, wheat and sugar beet plateau.

For the Central mixed farming and pasture Carpathian hills, compared to the 15YA, radiation increased by 1%, rainfall decreased by 4% while temperature increased 2.6℃ and BIOMSS increased by 15%. According to the NDVI development graph, crop conditions were around average until late December and rose to the 15 years maximum in January due to relatively warm weather. The regional average maximum VCI was at 1.00. Regional CALF was 100% and 4% higher than average. The NDVI spatial distribution shows that NDVI was fair throughout the reporting period (light green). The CPI of this region is 1.33. However, this zone occupies only a small fraction of cropland in Romania.

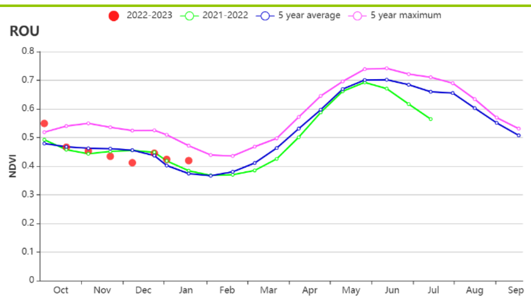
For the Eastern and Southern maize, wheat and sugar beet plains, rainfall decreased by 24%, temperature increased by 3.8℃, radiation increased by 2% and biomass decreased by 9% as compared to the 15YA. The NDVI development graph shows that crop conditions were below average starting in November. Regional CALF was only 81% and 5% lower than average. Maximum VCI value of this region was 0.80 and according to the distribution map, VCI values were below 0.80 in the southeast area of this sub-region (counties of Tulcea and Constanta), representing about 14.3% of the national cropland. The CPI of this region is 0.99. All in all, crop conditions can be assessed as slightly below average.

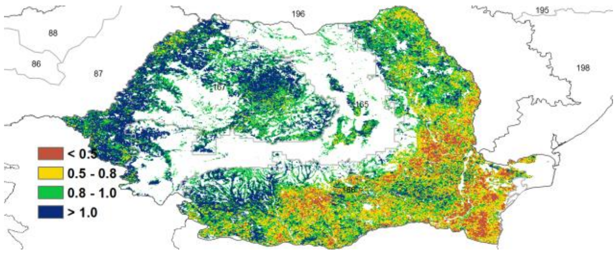
For the Western and central maize, wheat and sugar beet plateau, radiation was higher than average by 4%, temperature was 2.2℃ higher and rainfall was 4% lower and biomass increased by 8%. Spatial NDVI profiles show that crop conditions were above average throughout the reporting period. Regional CALF was 100%, 8% higher than average. Maximum VCI of this region was 1.04, and the spatial distribution was between 0.8 and 1.0 in most of the areas. The CPI of this region is 1.37. Crop conditions can be assessed as favorable.

Figure 3.38 Romania's crop condition, October 2022 - January 2023

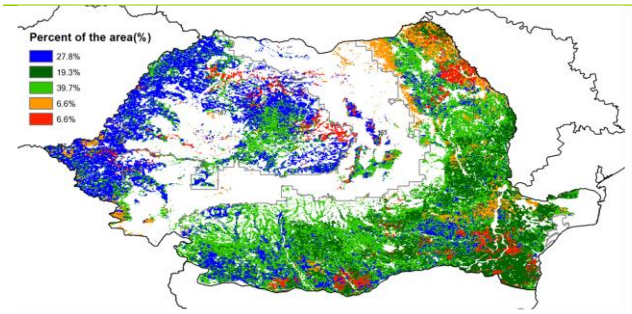


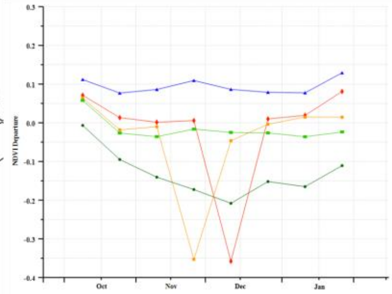
(a) Phenology of major crops



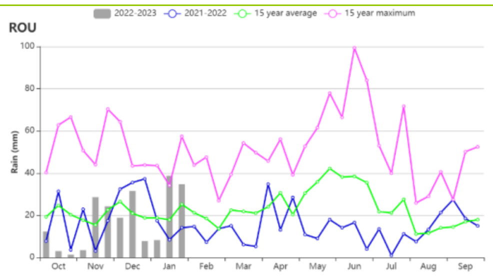


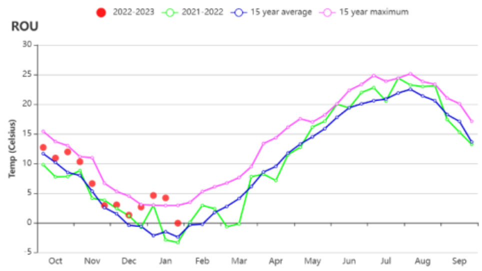
(b) Crop condition development graph based on NDVI (c) Maximum VCI



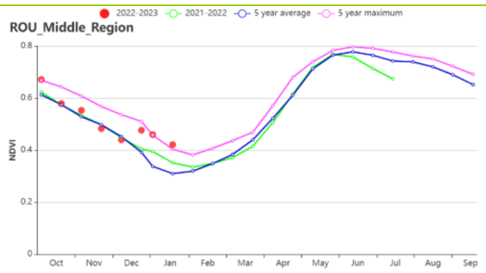


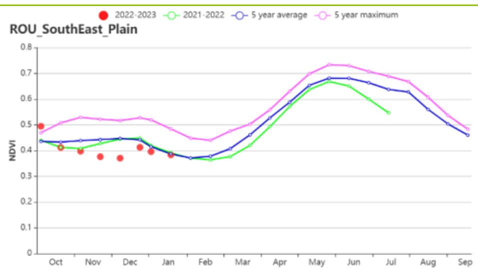
(d) Spatial NDVI patterns compared to 5YA (e) NDVI profiles



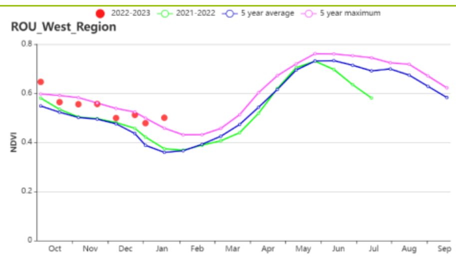


(f) Rainfall profiles (g) Temperature profiles





(h) Crop condition development graph based on NDVI (Central mixed farming and pasture Carpathian hills (left) and Eastern and southern maize, wheat and sugarbeet 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, October 2022 - January 2023

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m^2)	Departure (%)	Current (gDM/m^2)	Departure (%)
Central mixed farming and pasture Carpathian hills	251	-4	4.6	2.6	380	1	466	15
Eastern and southern maize wheat and sugarbeet plains	183	-24	6.7	2.8	391	2	418	-9
Western and central maize wheat and sugarbeet plateau	240	-4	5.5	2.2	380	4	477	8

Table 3.69 Romania's agronomic indicators by sub-national regions, current season's values and departure from 5YA, October 2022 - January 2023

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Central mixed farming and pasture Carpathian hills	100	4	1
Eastern and southern maize wheat and sugarbeet plains	81	5	0.8
Western and central maize wheat and sugarbeet plateau	100	8	1.04

[RUS] Russia

This monitoring period covers the completion of the sowing of winter crops in October followed by early vegetative growth and a subsequent dormancy period over the winter.

At the national level, data showed that NDVI before the snow cover establishment was mainly below the 5-year average, which indicates that winter crop status before the winter was slightly subpar.

Precipitation in October was above the level of the previous year. In the middle of November and December, it was above the 15-year maximum. Till the middle of January, the amount of precipitation was close to the 15-year average and then it dropped below the level of the previous year.

Temperature from October till November was at the level of last year and the 15-year average. In November it dropped below the level of the last year. In December and January, temperatures were above the 15YA.

Among the major winter crop production regions, Northern part of South Caucasus, North Caucasus, south-eastern part of Central Black Soil region as well as south of Middle Volga region showed positive NDVI departure through the whole monitoring period with maximum VCI near 0.8. Central region, the rest of South Caucasus and Central Black Soil region showed positive NDVI departure only in November with maximum VCI mainly up to 0.8. Ural and Western Volga region as well as the rest of Middle Volga region showed negative NDVI departure with maximum VCI mainly up to 0.8.

Agroclimatic conditions varied in major regions of winter crop production. In South Caucasus and North Caucasus regions, there was a lack of snow cover which in combination with fluctuating from positive to negative temperatures, poses a risk of winter crop damage. In Central and Central black soils regions the main concern is also temperature fluctuations which can adversely affect the state of winter crops under the snow cover.

Regional analysis

South Caucasus

Rainfall in the South Caucasus was 24% below the 15-year average. Temperature was 0.6°C higher than the 15-year average. RADPAR increased slightly (-1%) compared to the 15-year average. BIOMSS was down by 13% from the 15-year average. Cropped area increased by 10% compared to the 5-year average. Maximum VCI was 0.79. CPI was 1.09.

NDVI was mainly close to the 5-year average. Only in the middle of December and January it was below the 5-year average.

Due to the lack of snow cover, there is a risk of winter crop damage.

North Caucasus

In the North Caucasus, precipitation was lower by 19% compared to the 15-year average. Temperature was higher by 0.9°C compared to the 15-year average. The RADPAR value was 5% lower than the 15-year average. The BIOMSS value decreased by 6%. Cropped area increased by 35% compared to the 5-year average. Maximum VCI value was 0.86. CPI was 1.21.

NDVI value was mainly above the level of the previous year and the 5-year average except in the middle of October when it was below these two levels and January when it was close to them.

Due to the lack of snow cover, there is a risk of winter crop damage.

Central Russia

In Central Russia, temperature was higher by 0.6°C compared to the 15-year average, and rainfall was higher by 13% compared to the 15-year average. RADPAR decreased by 16%. BIOMSS decreased by 2% relative to the 15-year average. Cropped area was 2% below the 5-year average. Maximum VCI was 0.79. CPI was 0.99.

NDVI was mainly below 5-year average and the level of the previous year.

Overall, winter crops status was below average in this region before the establishment of snow cover.

Central black soil area

In Central Black Earth Region, temperature was higher by 0.7°C compared to the 15-year average. The amount of precipitation was 23% above the 15-year average, and RADPAR was lower by 16%. The amount of BIOMSS was 3% above the 15-year average. Cropped area increased by 17% relative to the 5-year average. Maximum VCI was 0.86. CPI was 1.33.

At the beginning of October NDVI was above the 5-year maximum. Then due to the early establishment of snow cover it dropped below the 5-year average and the level of the previous year till the end of December when NDVI reached the 5-year average and in January it exceeded the 5-year maximum.

Overall, the conditions for winter crops were favorable in this region, and its status is likely to be close to normal.

Middle Volga

In Middle Volga region, the amount of precipitation and temperature was higher than the 15-year average by 8%. and by 0.4°C correspondingly. RADPAR decreased by 10% compared to the 15-year average. BIOMSS increased by 3% compared to the 15-year average. The cropped area was 2% lower than the 5-year average. Maximum VCI was 0.83. CPI was 1.09.

NDVI was mainly below the 5-year average and the value of the previous year mainly due to the early snow cover establishment and the decrease in the sowing area.

Overall, the conditions for winter crops were favorable in this region, and its status is likely to be better than normal.

Ural and western Volga

In the Ural and the Western Volga region, the amount of precipitation was at the level of the 15-year average. Temperature increased by 0.4°C compared to the 15-year average. RADPAR was 2% below the 15-year average. BIOMSS was 3% higher than the 15-year average. Cropped area was 17% lower than the 5-year average. Maximum VCI was 0.74. CPI was 0.71.

NDVI was mainly below the 5-year average and the level of the previous year.

Conditions for winter crops and their status were below average for this region.

Eastern Siberia

In Eastern Siberia, the amount of precipitation was 12% below the 15-year average. The temperature was higher than the 15-year average by 0.9°C. RADPAR was lower by 3% compared to the 15-year average. BIOMSS was higher by 7% compared to the 15-year average. Cropped area was 2% lower than the 5-year average. Maximum VCI was 0.84. CPI was 0.65.

Till December, NDVI was below the 5-year average, then it reached the level of the previous year.

The area of winter crops is insignificant in this region, therefore its agroclimatic conditions will not affect winter crop production in the Russian Federation.

Middle Siberia

In Middle Siberia, rainfall and temperature decreased compared to the 15-year average by 15%, and by 0.1°C correspondingly. RADPAR increased by 2% above the 15-year average. BIOMSS was 2% lower than the 15-year average. Cropped area was 36% lower than the 5-year average. Maximum VCI was 0.67. CPI was 0.75.

NDVI was below the level of the previous year and the 5-year average.

The area of winter crops is insignificant in this region, therefore its agroclimatic conditions will not affect winter crop production in the Russian Federation.

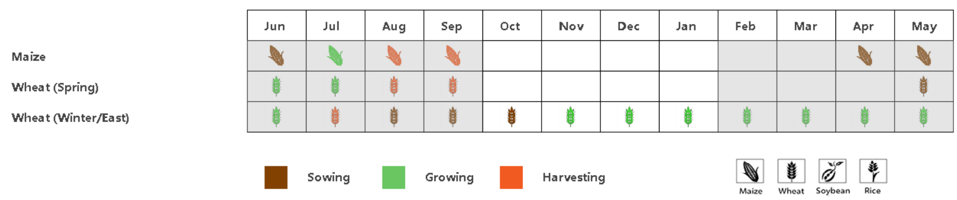
Western Siberia

In Western Siberia, rainfall was at the level of the 15-year average. Air temperature increased by 0.6°C relative to the 15-year average. The RADPAR was 2% lower than the 15-year average. BIOMSS increased by 4% compared to 15-year average. Cropped area decreased by 33% compared to the 5-year average. Maximum VCI was 0.74. CPI was 0.64.

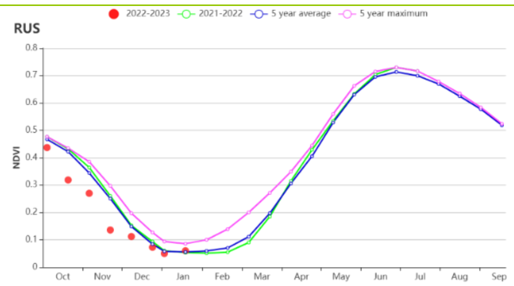
NDVI was mainly below the level of the previous year and below the 5-year average except in the middle of November when it reached the 5-year maximum.

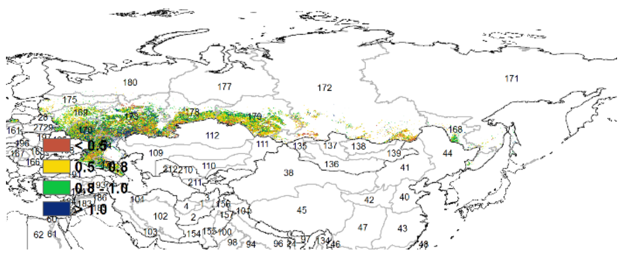
The area of winter crops is insignificant in this region, therefore its agroclimatic conditions will not affect winter crop production in the Russian Federation.

Figure 3.39 Russia's crop condition, October 2022 – January 2023

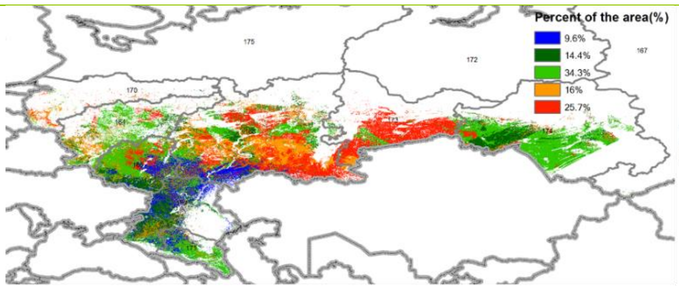


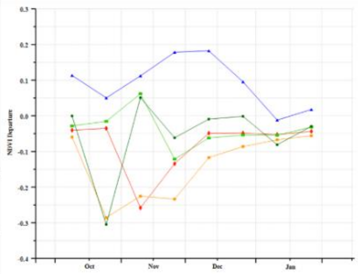
(a) Phenology of major crops



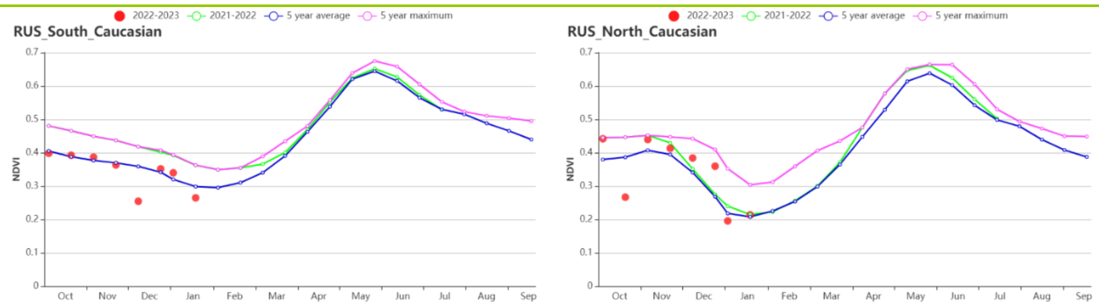


(b) Crop condition development graph based on NDVI (c) Maximum VCI

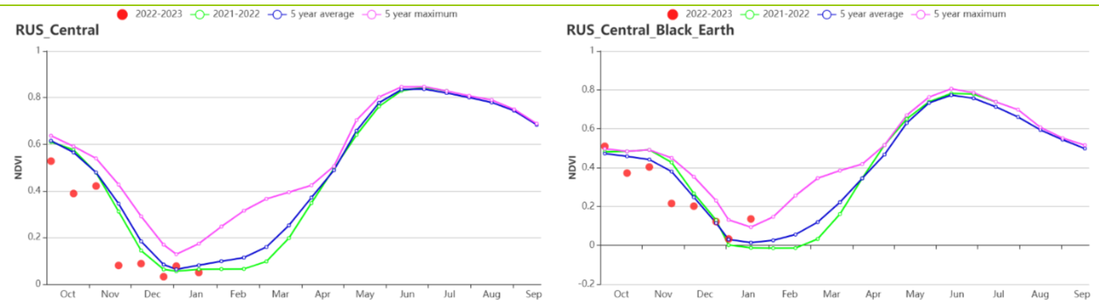




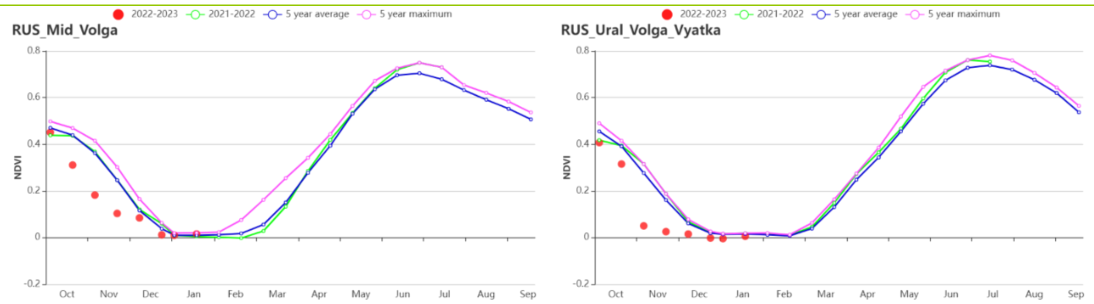
(d) Spatial NDVI patterns compared to 5YA (e) NDVI profiles



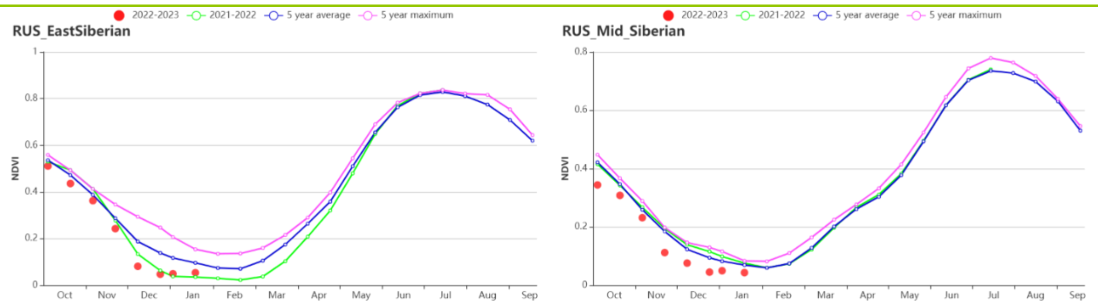
(f) Crop condition development graph based on NDVI, Southern Caucasus (left) and Northen Caucasus (right).



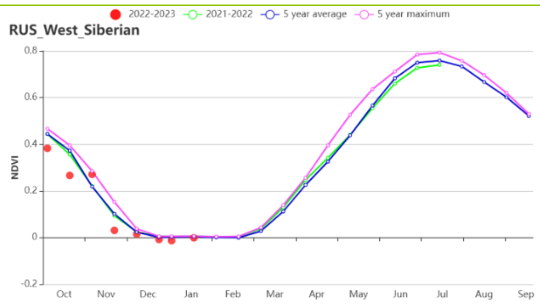
(g) Crop condition development graph based on NDVI, Central Russia (left) and Central black soils area (right).



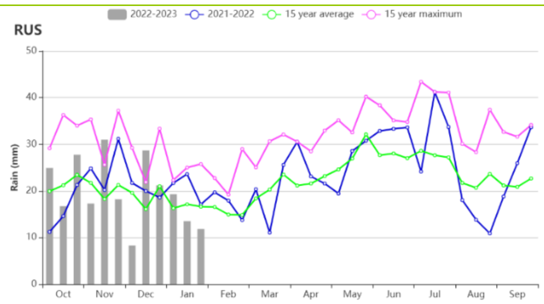
(h) Crop condition development graph based on NDVI, Middle Volga (left) and Ural and western Volga region (right).



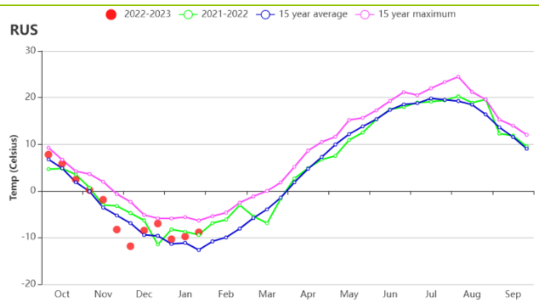
(i) Crop condition development graph based on NDVI, Eastern Siberia (left) and Middle Siberia (right).



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



(k) Rainfall index



(l) Temperature Index

Table 3.70 Russia's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, October 2022 – January 2023

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Central Russia	334	13	-1.2	0.6	111	-16	317	2
Central black soils area	319	23	-0.3	0.7	165	-16	350	3
Eastern Siberia	194	-12	-8.9	0.9	341	-3	213	7
Middle Siberia	106	-15	-12.5	-0.1	322	2	127	-2
Middle Volga	277	8	-3.8	0.4	160	-10	272	3
Northern Caucasus	197	-19	3.3	0.9	314	-5	400	-6
Southern Caucasus	179	-24	3.1	0.6	431	1	346	-13
Ural and western Volga region	180	0	-6.7	0.4	174	-2	220	3
Western Siberia	222	0	-7.5	0.6	203	-2	209	4

Table 3.71 Russia's agronomic indicators by sub-national regions, current season's values and departure from 5YA, October 2022 – January 2023

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Central Russia	97	-2	0.79
Central black soils area	86	17	0.86
Eastern Siberia	85	-2	0.84
Middle Siberia	27	-36	0.67
Middle Volga	63	-2	0.83
Northern Caucasus	74	35	0.86
Southern Caucasus	65	10	0.79
Ural and western Volga region	52	-17	0.74
Western Siberia	39	-33	0.74

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

[SYR] SYRIA

Apart from legumes, barley and wheat are the main crops in Syria. Planting of the cereals starts in November, as soon as soil moisture conditions become favorable. The proportion of irrigated cropland in Syria is about 44%. Cereal production depends on sufficient rainfall.

Compared to the 15-year average, accumulated rainfall was far less than average (RAIN, -54%), while radiation was above average (RADPAR, +4%). The temperature was above average (TEMP, +1.2°C). The average temperature value for the reporting period was 13.9° C. The precipitation was generally below average except in late Nov and late Dec. The temperature was generally above average. It is notable that temperatures rose above 20°C in late October and remained above average throughout this monitoring period. The drought conditions resulted in a decrease of estimated BIOMSS by 29%. According to the NDVI profiles, the national average NDVI values were far below the 5YA during the sowing period of barley and wheat. The national average VCIx was 0.45 and CALF was below average by 23%. Conditions for cereal production in Syria were poor due to the ongoing (CPI=0.80, significantly lower than 1.0), multiyear drought. However, they were slightly better than last year (CPI=0.54).

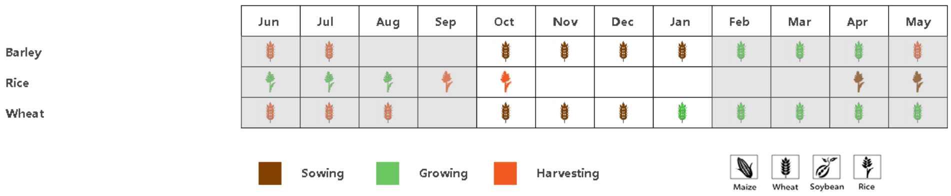
Regional analysis:

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

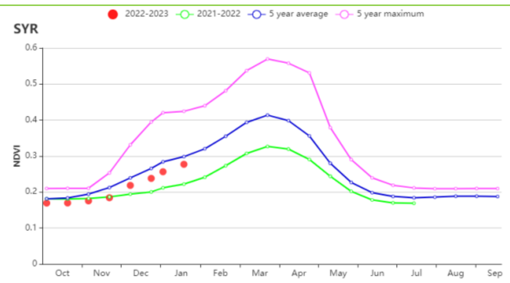
In the first two regions (a and b), the accumulated precipitation was below average, and the temperature was almost close to average, also the RADPAR was close to average. The hot and dry weather resulted in a decrease of BIOMSS by 28% to 32%. The national average VCIx values were not higher than 0.81 for the two regions. Compared to the other regions, the higher CALF values indicated more agricultural activities in this region, they were above their 5YA by 4% and 2% respectively. According to NDVI profiles of the two regions, crop conditions were mostly below the 5YA. But they surpassed it by the end of this monitoring period (Jan) for b zone. The severe drought limited crop growth. The conditions for barley and wheat sowing and growing were not favorable.

Agro-climatic conditions in the second, third and fourth region were also unfavorable. The rainfall was below average by more than 56%, whereas the temperature and RADPAR were above average. The low rainfall led to a decrease of potential biomass by at least 30%. The CALF values in the three regions decreased significantly by more than 26%. The average VCIx value in the second region, the third region and the fourth region was 0.36, 0.31 and 0.30. According to NDVI profiles of three regions, crop conditions were below the 5YA, particularly from Nov to Jan. Due to the severe rainfall deficit and high temperature in the main sowing period, the growth of wheat and barley in the second region are estimated to be below average, and the conditions for barley grown in the third and fourth region were not favorable either.

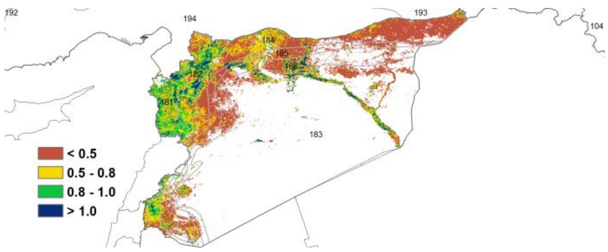
Figure 3.40 Syria's crop condition, October 2022 - January 2023



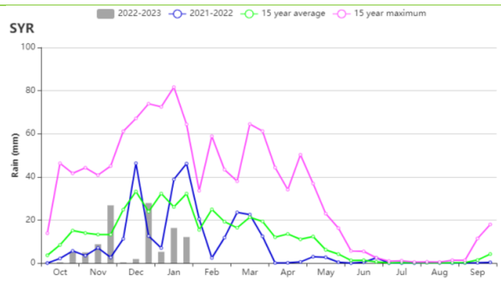
(a). Phenology of major crops



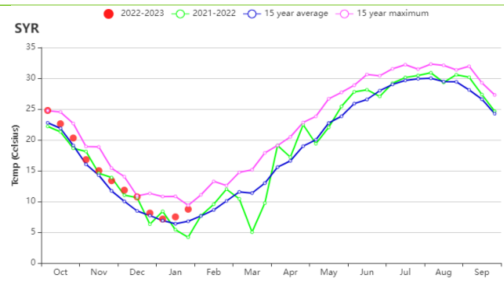
(b) Crop condition development graph based on NDVI



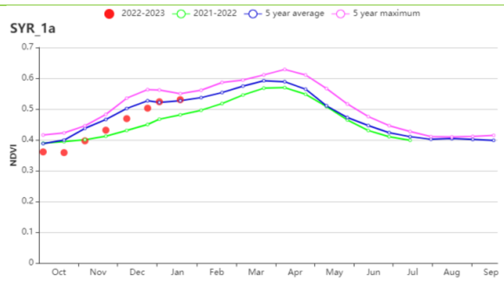
(c) Maximum VCI



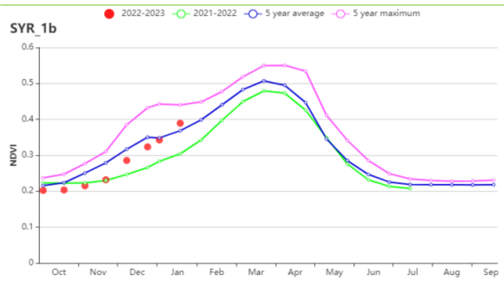
(d) Rainfall profiles



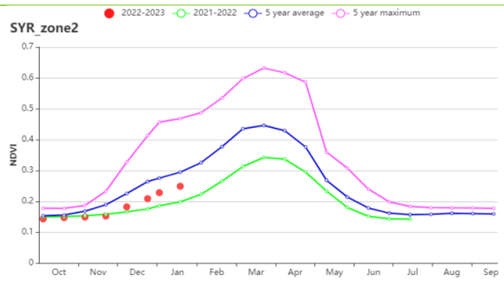
(e) Temperature profiles



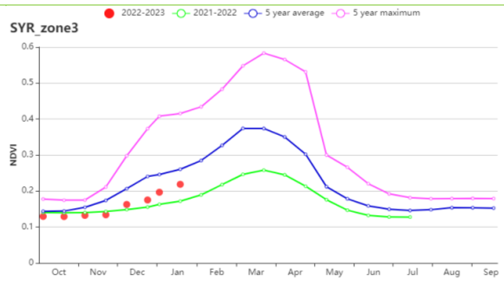
(f) Crop condition development graph based on NDVI (The first(a) region)



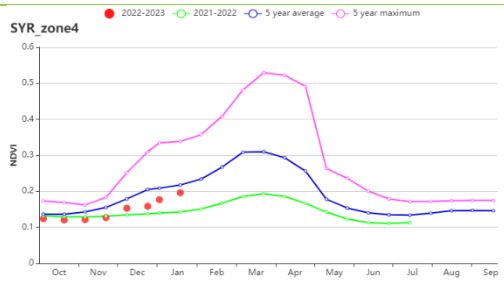
(g) Crop condition development graph based on NDVI (The first (b) region)



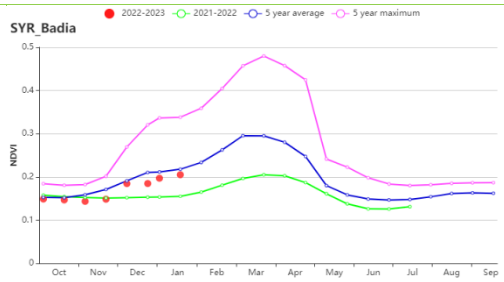
(h) Crop condition development graph based on NDVI (The second region)



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



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



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

Table 3.72 Syria agro climatic indicators by sub-national regions, current season's values and departure from October 2022 - January 2023

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
First (a) region	183	-53	14.6	0.0	732	4	498	-28
First (b) region	145	-59	13.3	1.1	722	6	417	-32
Second region	107	-53	13.5	1.6	702	5	349	-30
Third region	88	-56	13.4	1.2	725	5	322	-33
Forth region	78	-56	13.7	1.4	719	4	307	-33
Badia	64	-53	14.0	1.3	724	2	283	-28

Table 3.73 Syria, agronomic indicators by sub-national regions, current season's values and departure from 5YA, - October 2022 - January 2023

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
First (a) region	89	4	0.81
First (b) region	29	2	0.75
Second region	2	-84	0.36
Third region	3	-76	0.31
Forth region	4	-26	0.30
Badia	5	-10	0.39

[THA] Thailand

This monitoring period covers the harvest of the main rice crop as well as the planting of second season rice (dry season). According to the agroclimatic indicators, Thailand experienced wetter and cooler weather than usual in this monitoring period with above-average rainfall (RAIN +23%), slightly below average temperature (TEMP -0.3°C) and average radiation (RADPAR 0%). As a result of these indicators, a slight increase in crop biomass production potential was estimated (BIOMSS +3%). The ratio of irrigated cropland in Thailand is approximately 22.5%. It is located in the central region of Thailand. Therefore, rainfall is important for crop growth.

The NDVI development graph demonstrates that the crop conditions were generally below the 5-year average during the whole monitoring period. The large negative departures are artifacts, caused by cloud cover in the satellite images. The temperature was mainly below the 15-year average although the temperature from November to December was slightly higher than unusual. The rainfall was high at the beginning of October and at end of the November 2022, when it reached levels close to the 15-year maximum. Subsequently, it followed the 15YA. According to the NDVI departure clustering and the corresponding profiles, crop conditions were generally close to average on 65.5% of total arable land, located in the northeast, eastern, central, and some areas in the northern region. In the other regions, cloud cover in the satellite images affected the trends.

At the national level, most of the arable land was cropped during the season (CALF 99%). VCIx values were around 0.86. The Crop Production Index (CPI) in Thailand was 1.05. 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 (187)**, the **South-eastern horticulture area (188)**, the **Western and southern hill areas (189)**, and the **Single-cropped rice north-eastern region (190)**.

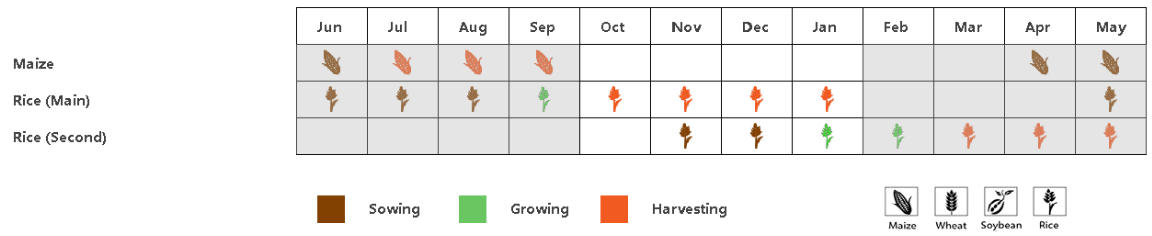
Compared to the 15YA, the **Central double and triple-cropped rice lowlands** experienced cooler and wetter conditions. Radiation (RADPAR +3%) was above average accompanied by lower temperatures (TEMP -0.3°C) and higher rainfall (RAIN +30%). These conditions led to a slightly above-average estimate for BIOMSS (BIOMSS +1%). The NDVI development graph shows that crop conditions were below the five-year average for most of the monitoring period except for January, as was the moderate VCIx value of 0.83. Overall, conditions were slightly below average.

Indicators for the **South-eastern horticulture area** show that temperature (TEMP -0.7°C) and radiation (RADPAR -2%) were below average accompanied by higher rainfall (RAIN +21%). This led to a slightly above-average estimate for BIOMSS (BIOMSS +2%). According to the NDVI development graph, however, the crop conditions were slightly below average during this monitoring period except in early January. The VCIx was at 0.85. All in all, conditions were slightly below average.

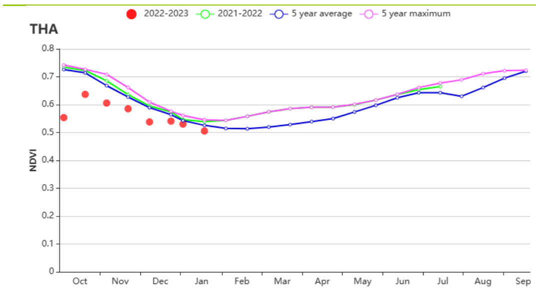
Agroclimatic indicators show that the conditions in the **Western and Southern Hills** were slightly below average: radiation (RADPAR -2%) and temperature (TEMP -0.1°C) were below average, while the rainfall (RAIN, +29%) was above average. The average weather conditions led to a 3% increase in BIOMSS. According to the NDVI development graph, the crop conditions were significantly below average. According to the VCIx value of 0.89, crop conditions were assessed as below average.

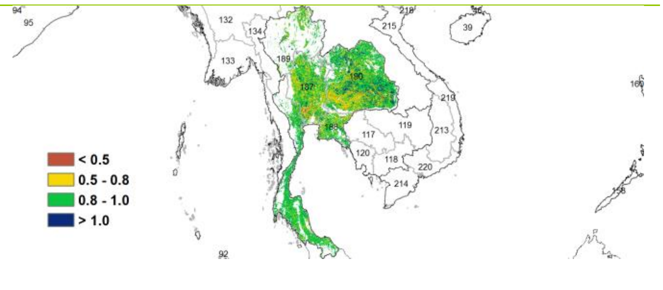
In the **Single-cropped rice north-eastern region**, the temperature was below average (TEMP -0.5°C), while radiation (RADPAR +3%) and rainfall (RAIN, +7%) were above average. All these agroclimatic indicators led to an increase in potential biomass (BIOMSS +3%). According to the NDVI development graph, the crop conditions were close to average. Considering the moderate VCIx value of 0.86, the crop conditions are considered normal.

Figure 3.41 Thailand's crop condition, October 2022- January 2023



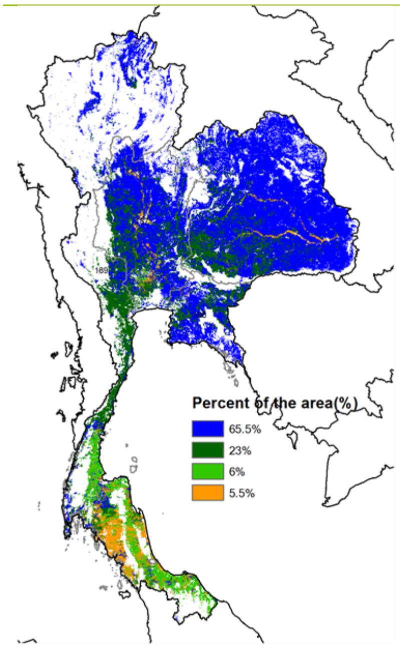
(a) Phenology of major crops

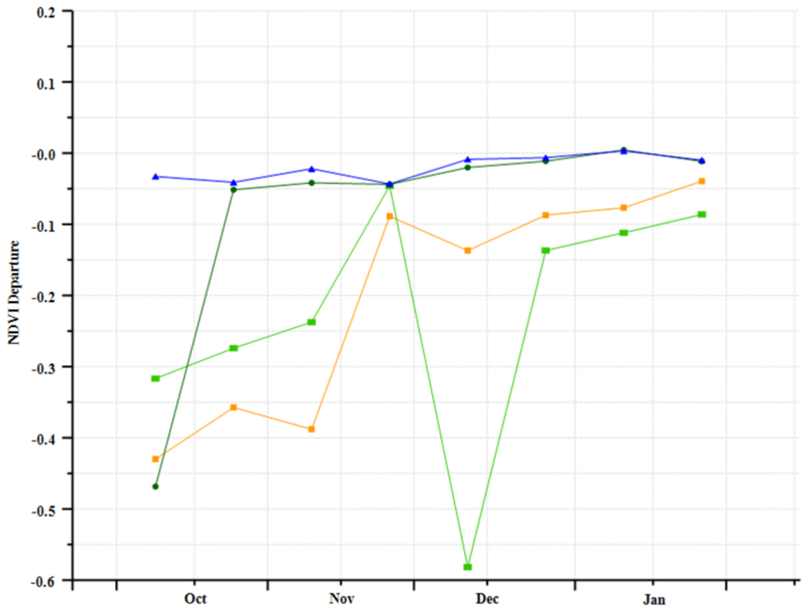




(b) Crop condition development graph based on NDVI

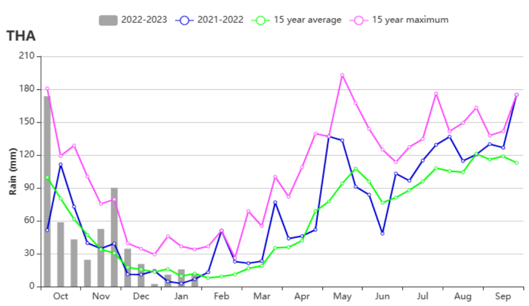
(c) Maximum VCI



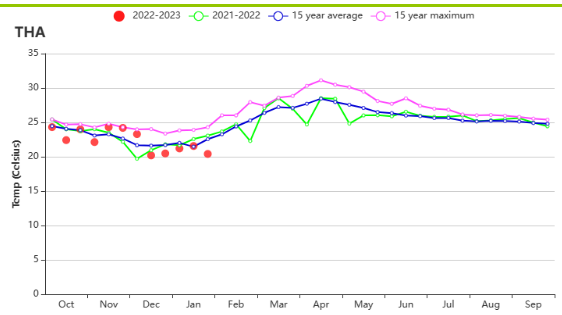


(d) Spatial NDVI patterns compared to 5YA

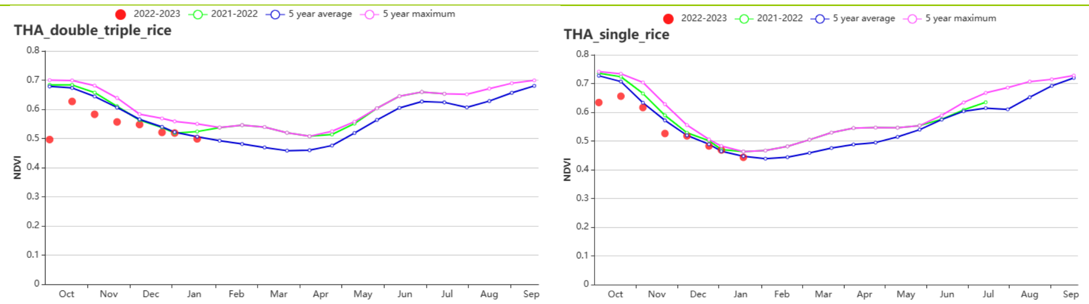
(e) NDVI profiles



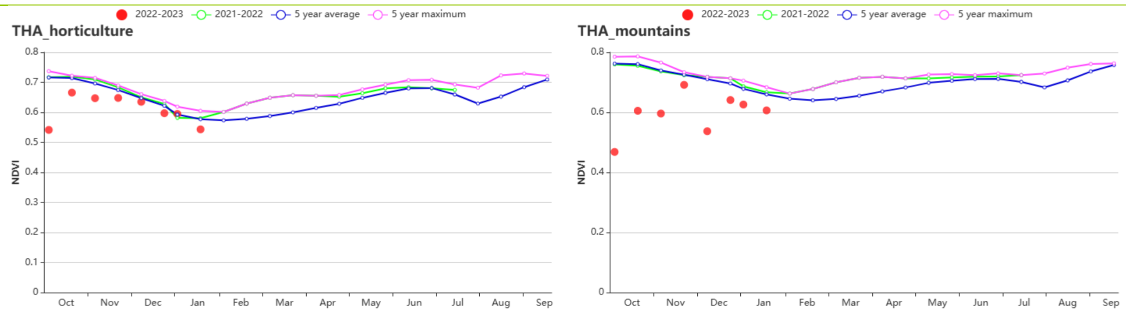
(f) Rainfall profiles



(g) Temperature profiles



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



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

Table 3.74 Thailand's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA,October 2022- January 2023.

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Central double and triple-cropped rice lowlands	500	30	22.9	-0.3	1083	3	826	1
South-eastern horticulture area	493	21	23.9	-0.7	1056	-2	909	2
Western and southern hill areas	730	29	22.2	-0.1	1052	-2	983	3
Single-cropped rice north-eastern region	306	7	22.0	-0.5	1068	3	726	3

Table 3.75 Thailand's agronomic indicators by sub-national regions, current season's values and departure,October 2022- January 2023.

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Central double and triple-cropped rice lowlands	98	-1	0.83
South-eastern horticulture area	99	0	0.85
Western and southern hill areas	100	0	0.89
Single-cropped rice north-eastern region	99	-1	0.86

[TUR] Türkiye

October is the harvesting season for maize and rice in Türkiye. Wheat planting also starts in October and is completed in November. During the observation period, NDVI trended below the 5YA, although it increased to above-average levels in January. The country has experienced a prolonged, multi-year period with severe precipitation deficits and reservoirs around the country's major cities have reached record-low levels. The great earthquake in Türkiye occurred after this monitoring period, and the impact of the earthquake will be the focus of the next monitoring period.

ationally, the average temperature (TEMP +1.6ºC) and photosynthetically active radiation (PADPAR +4%) were above the 15YA. The potential cumulative biomass (BIOMSS) was 23% lower due to low rainfall. The Cropped Arable Land Fraction (CALF) was 3% below average, and the country's Optimum Vegetation Condition Index (VCI) was 0.75. The country's Crop Production Index (CPI) was 1.02, which was about average.

The spatial distribution map of NDVI is similar to that of VCI, with NDVI close to or slightly above average in 16.3% of the cultivated area (marked by the blue line), mainly in the eastern region. The NDVI was below average (marked by the yellow line) in 40.4% of the areas, mainly in the central region. It is worth noting that the NDVI trend line at the national level showed a clear upward trend in January compared to the average level. However, this may be due to the fact that in other years, wheat may have entered winter dormancy due to freezing conditions. However, this January was milder than usual. Overall, the large precipitation deficit indicates unfavorable prospects for winter wheat production.

Regional analysis

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

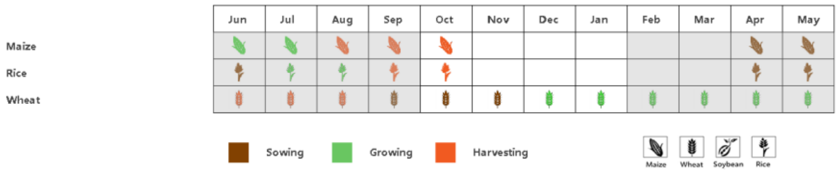
NDVI in the Black Sea region was below average in November and December and above average in January. Photosynthetically Active Radiation (PADPAR) was 2% above average, mean temperature (TEMP) was 0.3°C higher, precipitation (RAIN) was 41% lower and final potential biomass (BIOMSS) was 20% lower. The Optimum Vegetation Condition Index (VCI) was 0.91, the Cropped Arable Land Fraction (CALF) was 3% higher than average and the Crop Production Index (CPI) was 1.18, indicating slightly higher than average crop production potential in the region.

NDVI in **the Central Anatolia region** was below average in the early part of the observation period and significantly above average in January, even reaching a 5-year maximum. Photosynthetically Active Radiation (PADPAR) was 3% higher, mean temperature (TEMP) 1.4°C higher, rainfall (RAIN) 47% lower and potential biomass (BIOMSS) 25% lower than the regional average. Cultivated Land Area (CLAF) was 3% higher, Optimum Vegetation Condition Index (VCI) was 0.71 and Crop Production Index (CPI) was 1.03. The precipitation deficit indicates that conditions were unfavorable.

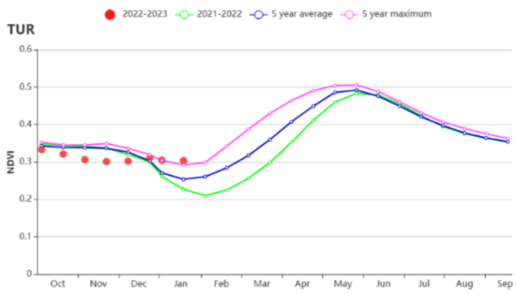
Crop growth in **the Eastern Anatolia region** was below average in October and November and well above average in January, reaching a 5-year maximum. Regional rainfall (RAIN) was 56% lower, mean temperature (TEMP) 1.9°C higher, photosynthetically active radiation (PADPAR) 5% higher and potential biomass (BIOMSS) 22% lower than average. The Cropped Arable Land Fraction (CLAF) was significantly lower (-17%), the Optimum Vegetation Condition Index (VCI) was 0.76 and the Crop Production Index (CPI) was 0.98. Similar to Central Anatolia, the large precipitation deficit indicates that prospects for winter wheat are rather unfavorable.

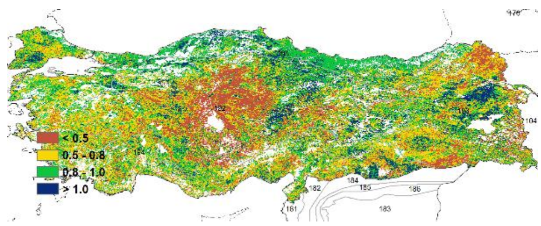
The NDVI in **the Marmara, Aegean and Mediterranean regions** was slightly below average throughout the observation period, but close to average in January. Precipitation (RAIN) was 43% below average, photosynthetically active radiation (PADPAR) was 5% above average, mean temperature (TEMP) was 2.1°C higher and potential biomass (BIOMSS) was 22% lower. The Cropped Arable Land Fraction (CALF) was 4% lower. The optimum vegetation condition index (VCI) was 0.76 and the crop production index (CPI) was 1.02, and the crop production situation was expected to be below average.

Figure 3.42 Türkiye's crop condition, October 2022 - January 2023



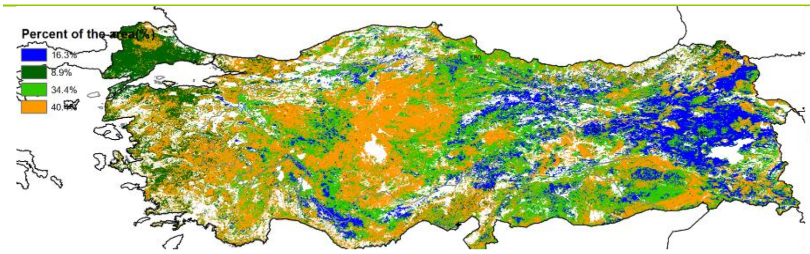
(a). Phenology of major crops

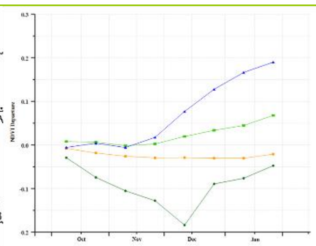




(b) Crop condition development graph based on NDVI

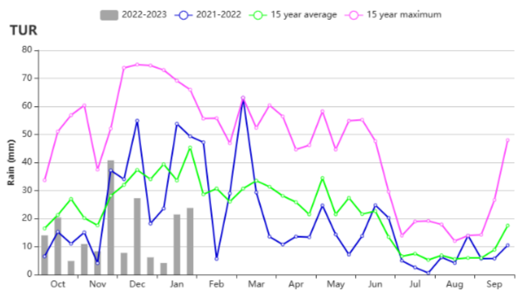
(c) Maximum VCI

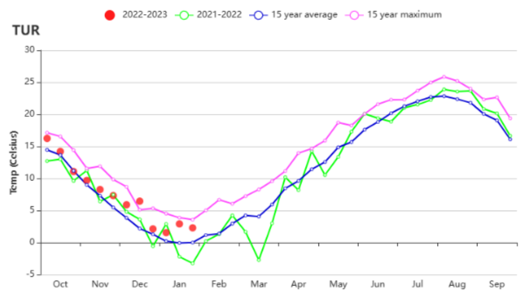




(d) Spatial NDVI patterns compared to 5YA

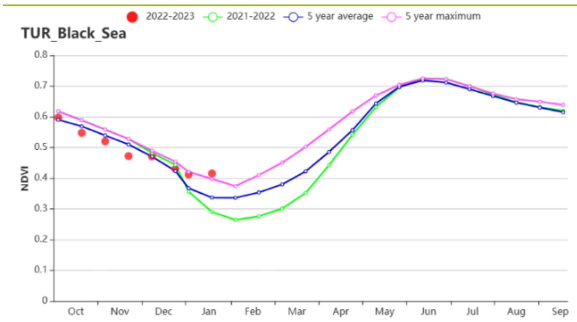
(e) NDVI profiles

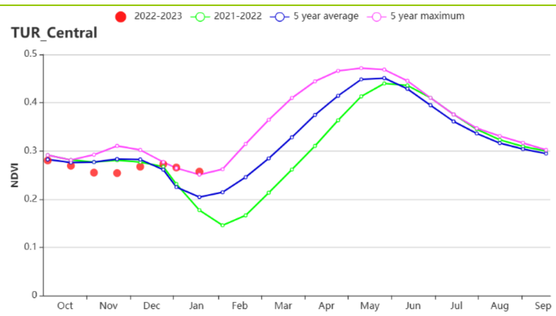




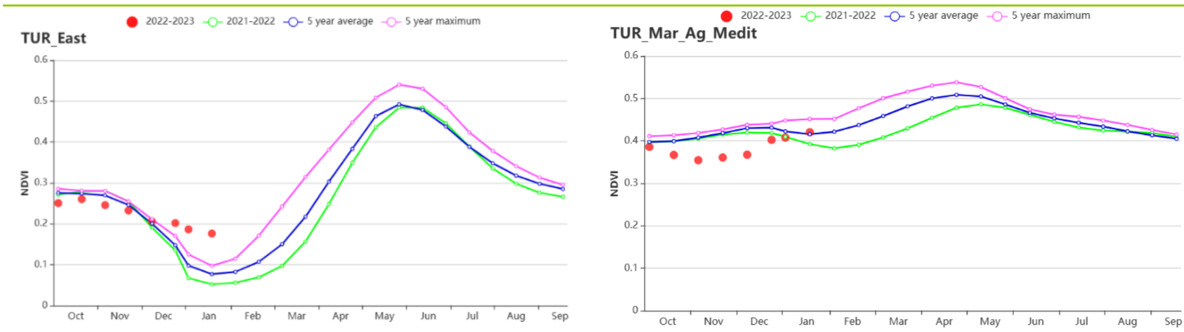
(f) Time series rainfall profile

(g) Time series temperature profile





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



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

Table 3.76 Türkiye's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, October 2022 - January 2023

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current(°C)	Departure (°C)	Current(MJ/m2)	Departure (%)	Current(gDM/m2)	Departure (%)
Black Sea region	247	-41	4.3	0.3	492	2	403	-20
Central Anatolia region	143	-47	5.8	1.4	600	3	357	-25
Eastern Anatolia region	148	-56	4.1	1.9	633	5	336	-22
Marmara Aegean Mediterranean lowland region	235	-43	11.1	2.1	612	5	493	-22

Table 3.77 Türkiye's agronomic indicators by sub-national regions, current season's values and departure from 5YA, October 2022 - January 2023

Region	CALF		Maximum VCI
	Current(%)	Departure (%)	Current
Black Sea region	79	3	0.91
Central Anatolia region	18	3	0.71
Eastern Anatolia region	11	-17	0.76
Marmara Aegean Mediterranean lowland region	61	-4	0.76

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

[UKR] Ukraine

Spring barley, winter wheat and maize are major grain crops in Ukraine. During this monitoring period, maize was harvested in October and November. Winter wheat sowing was completed in October.

Ukraine experienced slightly milder temperatures than usual. The average temperature reached 3.6°C, which was 1.4°C above 15 YA. The rainfall was average (RAIN 229 mm, -1%) while the solar radiation (RADPAR, 252 MJ/m2) decreased by 7%. As a result of these favorable conditions, the potential biomass was estimated to increase by 7% above the 15YA (BIOMSS, 444 gDM/m2).

Despite of the ongoing war, the agronomic indicators suggested that crop growth was generally favorable during this monitoring period. 84% of the arable land (CALF) is cropped, which is 13% higher than the 5 YA. The maximum vegetation condition index (VCIx) also reached a fair value of 0.83. The remote sensing-based crop development graph showed average crop conditions throughout this period except for sudden drops in November, which may be attributed to snow or cloud cover in the satellite images. The NDVI spatial distribution map showed that, although there were some fluctuations in November, NDVI of about 78% of the cropped area reached the 5YA level by the end of this monitoring period. The remaining 22% are concentrated in the northwest, where snow on the ground may have caused low NDVI readings. As shown by the VCIx map, crop conditions were poorer in the southern Ukraine. VCIx was below 0.5 in the war-torn Kherson, Odessa and Zaporizhia oblasts. VCIx was poor in Crimea as well. The best crop condition area was the Russian-occupied area in eastern Ukraine, such as Dunbas. In general, the conditions for winter wheat have been favorable so far. Crop production index (CPI) at both national and agro-ecological zones attained the value above 1, which confirmed the favorable conditions.

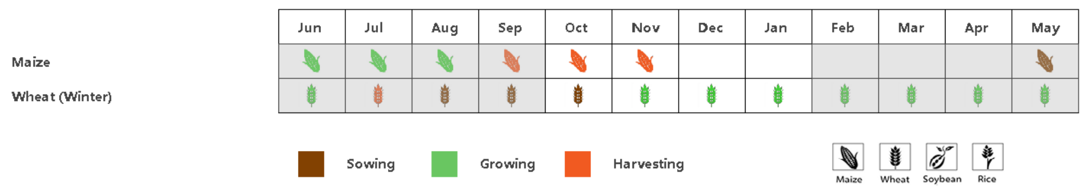
Regional analysis

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

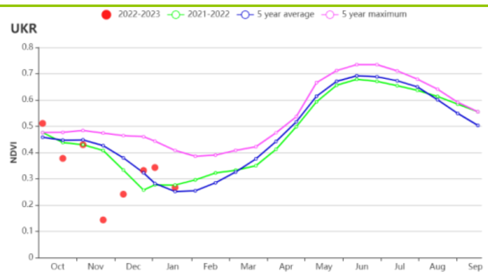
The AEZs of **central wheat area, northern wheat area** and **southern wheat and maize area** shared similar patterns of agroclimatic and agronomic indicators. All these AEZs experienced a warmer winter, with positive temperature departures ranging from +1.2 to +1.9°C, with normal rainfall (rainfall departures ranging from -1 to 2%) and less sunshine (radiation departures ranging from -7 to -11%), resulting in a 6 to 9% higher biomass production potential. These areas also attained a relatively high CALF (0.79 to 0.91) and VCIx (0.79 to 0.85), NDVI based development curves recovered to close to or above average levels by the end of January. All in all, crop prospects are favorable.

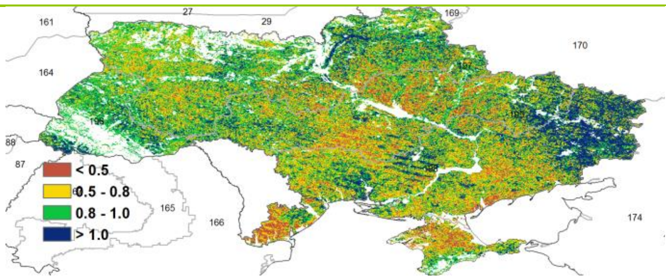
Eastern Carpathian hills received 11% less rainfall. But temperatures were higher and radiation was normal. Weather based projected biomass was 8% higher than the 15YA. Agronomic indicators showed very good CALF (0.99) and VCIx (0.9). The NDVI curve also reached above average levels. All in all, conditions are favorable in this region.

Figure 3.43 Ukraine's crop condition, October 2022 – January 2023



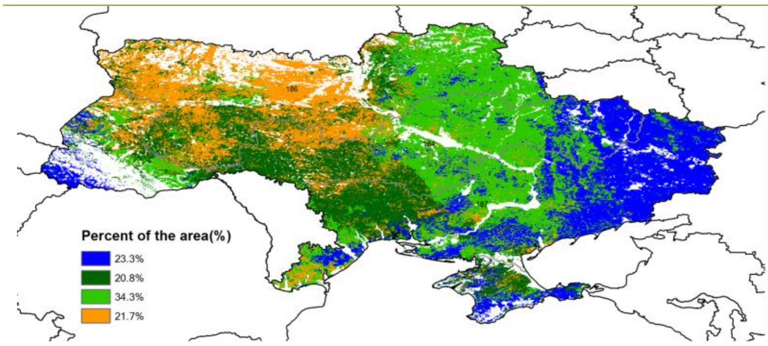
(a). Phenology of major crops

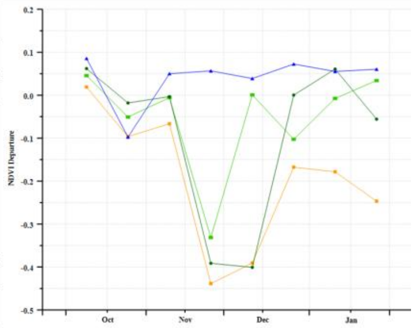




(b) Crop condition development graph based on NDVI

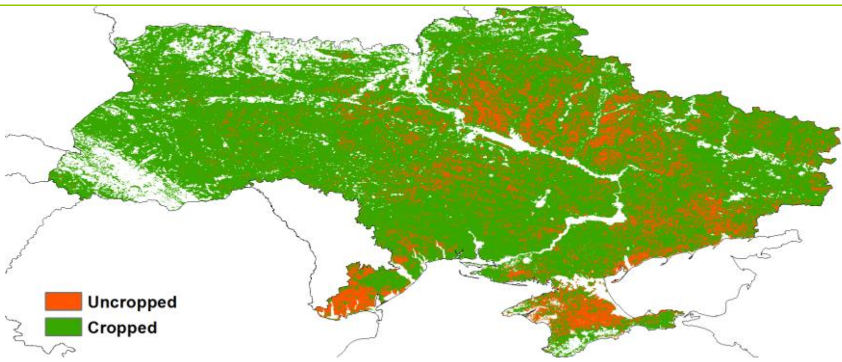
(c) Maximum VCI



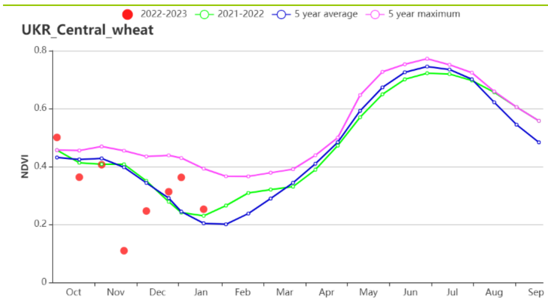


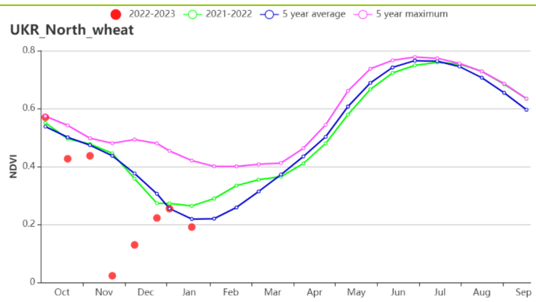
(d) Spatial NDVI patterns compared to 5YA

(e) NDVI profiles

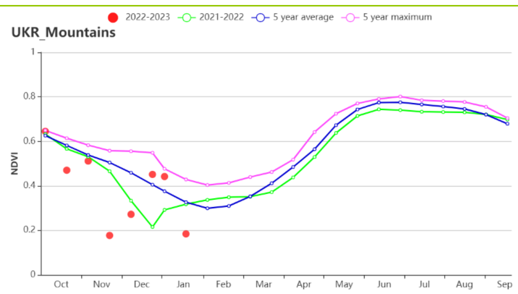


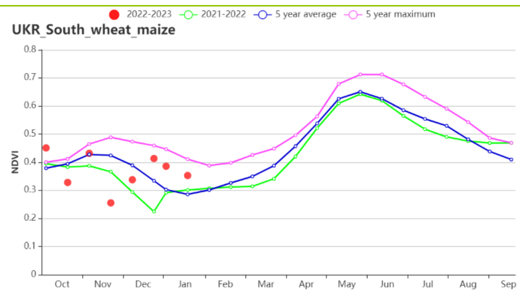
(f) Cropped arable land



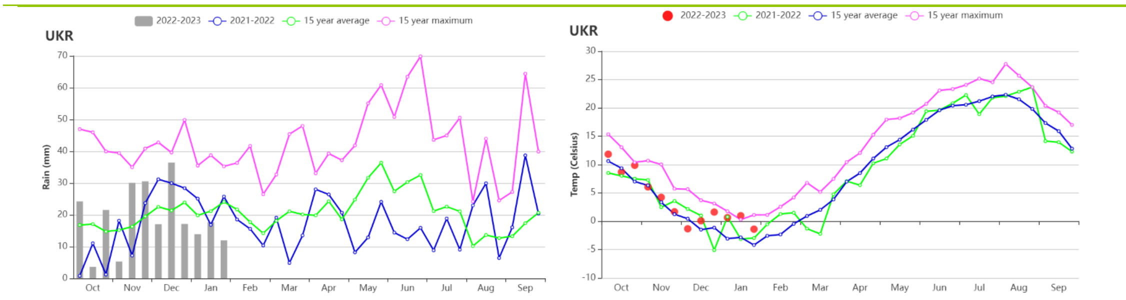


(e) Crop condition development graph based on NDVI (Central wheat area(left) Northern wheat area(right))





(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 3.78 Ukraine's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, October 2022 – January 2023

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Central wheat area	229	2	2.8	1.2	236	-11	437	8
Eastern Carpathian hills	226	-11	3.7	1.9	288	-1	443	8
Northern wheat area	242	-1	2.7	1.2	204	-10	436	9
Southern wheat and maize area	217	1	4.6	1.7	288	-7	457	6

Table 3.79 Ukraine's agronomic indicators by sub-national regions, current season's values and departure from 5YA, October 2022 – January 2023

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Central wheat area	79	14	0.79
Eastern Carpathian hills	99	1	0.90
Northern wheat area	91	3	0.84
Southern wheat and maize area	81	29	0.85

[USA] United States

During the reporting period of October 2022 to January 2023, CropWatch focused on changes in agro-climatic and agronomic information in the winter wheat producing zones. Winter wheat was predominantly sown in September and October. In the colder regions, such as in Kansas, wheat usually goes dormant in December, whereas in Texas, it stays green. Overall, crop conditions for the winter crop were below average.

The US experienced a relatively warm winter with above-average temperatures (TEMP +0.5°C), close to average RAIN (+1%) and RADPAR(-2%), resulting in 6% above 15YA potential biomass. This monitoring period covers the early growing stage of winter crops, which was accompanied by low temperatures, resulting in a low demand for water by crops. The above-average precipitation was recorded after the sowing of winter crops, which could create a good environment for the germination and establishment of the winter crops.

The marked heterogeneity of agro-climatic conditions and phenology led to significant differences in crop growing conditions between regions. In the national scale, the NDVI profile shows below average crop conditions. The VCIx of 0.75 was close to average. The strong heterogeneity of crop conditions was captured by NDVI deviation clusters. Below average crop condition occurred in the Northwest and at the northern half of the Southern Plains, while average crop conditions occurred in California and in the southern half of the Southern Plains. If the favorable moisture conditions prevail, above-average yield could be expected in California.

The overall crop production index (0.95) indicates below-average crop conditions. In summary, winter crop conditions were below average during this reporting period. In the next monitoring period, the winter crop will enter the jointing, heading, and flowering stages in the Southern Plain and Northwest regions, and the water demand will significantly increase.

Regional Analysis

Southern Plain (207), Northwest (206), and California (201) are the major winter crops producing regions. The winter crops entered into the sowing, tillering and overwintering stages in the Southern Plain and Northwest. The winter crops in California entered into jointing and heading stage.

(1) California (201)

California is the most important region for fruit and vegetable production in the USA, and it is also a major producer of winter wheat. According to the NDVI profile, the crop condition was close to average at the end of January. The region has a Mediterranean climate with wet and warm winters, and during the reporting period, wet weather dominated in California with significantly above average rainfall (+49%), below average temperature (-0.8°C), and below average RADPAR (-4%). The significantly above average precipitation has provided abundant soil moisture for crop growth, resulting in an increase in potential biomass (+19%). The cropped arable land fraction (CALF, +7%) was above average. The VCIx reached 0.75, which is close to the average. The favorable soil moisture conditions are expected to result in above average yield levels.

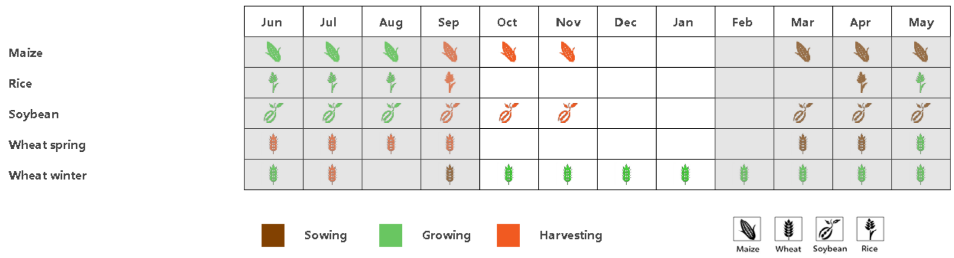
(2) Northwest (206)

The Northwest is another significant winter wheat growing region. It covers the states of Washington and Oregon. The NDVI profile indicated poor crop conditions in this region. The Northwest has experienced relatively dry weather with below-average precipitation (-11%), temperature (-0.5℃), and RADPAR (+4%), resulting in average potential biomass (0%). Rainfall was unevenly distributed. Nevertheless, total precipitation (400 mm) was sufficient to ensure a good establishment of winter wheat. CALF is close to the average (-1%), and VCIx was (0.7). Conditions for winter wheat can be assessed as normal.

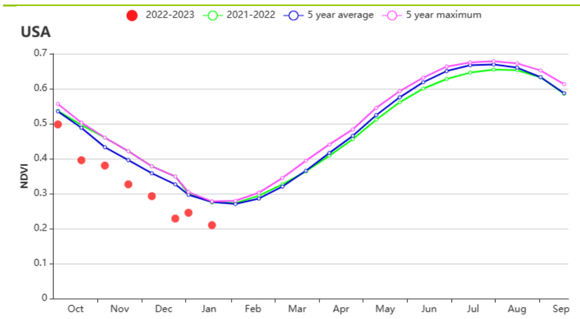
(3) Southern Plains (207)

The Southern Plains is the most important winter wheat producing region in the United States, including the states of Kansas, Oklahoma, and Texas. On average, the Southern Plains experienced wet and warm weather, characterized by above average rainfall (+8%) and temperature (0.4℃), and low RADPAR (-5%), resulting in above average biomass (+5%). However, as mentioned above, within the Southern Plains, the conditions varied greatly: Dry weather was observed for Kansas, the most important winter wheat producing state, with below average precipitation (-13%) and above average temperatures (0.2℃). Oklahoma has experienced agri-climatic conditions close to average, while more favorable weather conditions occurred in Texas. For the entire AEZ, below average CALF (-21%), low VCIx (0.60), and CPI (0.61) were observed. However, crop conditions in the northern part were less favorable than in Texas, where conditions were average.

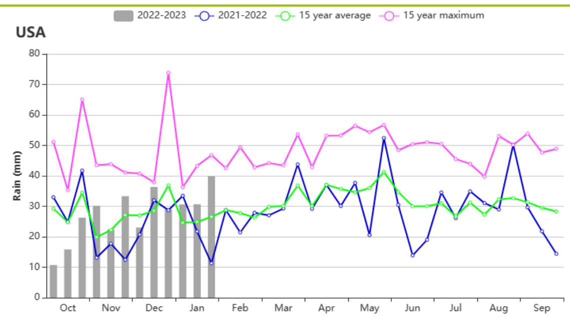
Figure 3.44 United States crop condition, October 2022-January 2023



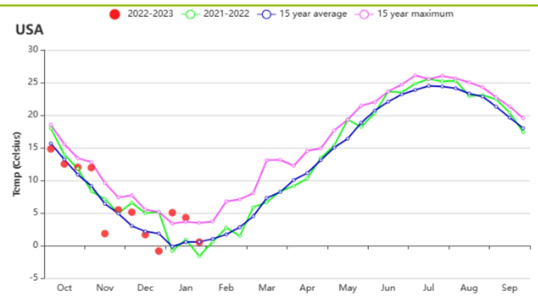
(a). Phenology of United States from October 2022 to January 2023



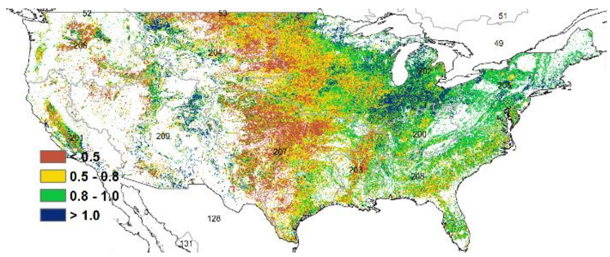
(b). Crop condition development graph based on NDVI



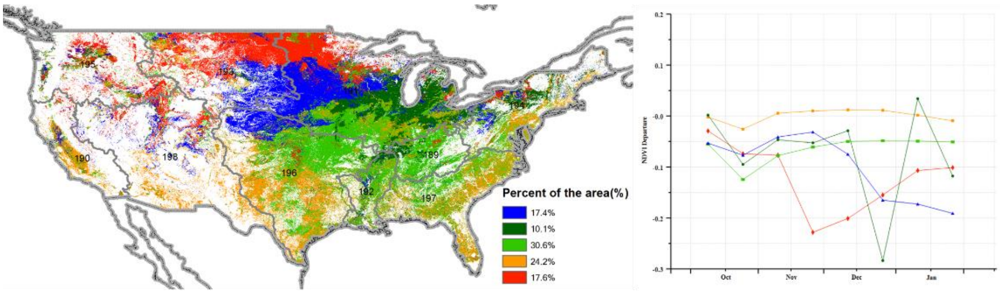
(c). Time series rainfall profile



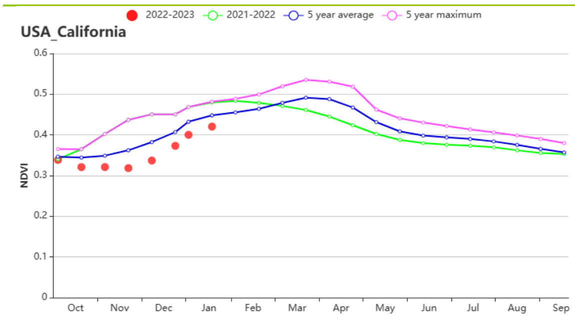
(d). Time series temperature profile



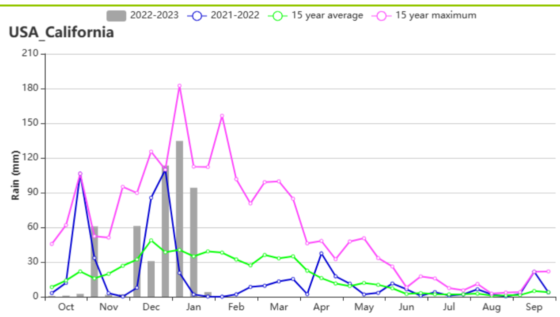
(e). Maximum VCI



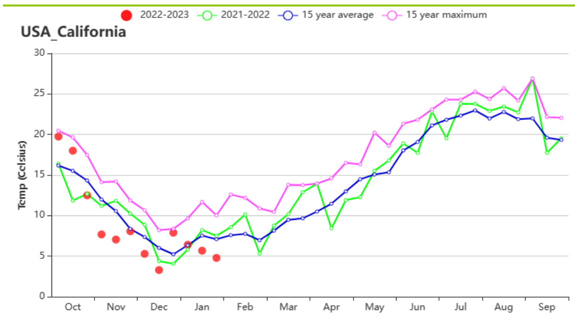
(f). Spatial distribution of NDVI profiles



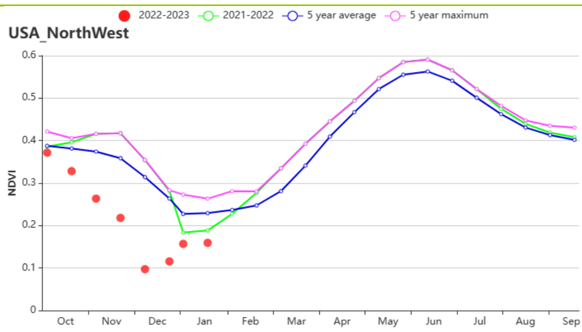
(g). Crop condition development graph based on NDVI for the California from October 2022 to January 2023



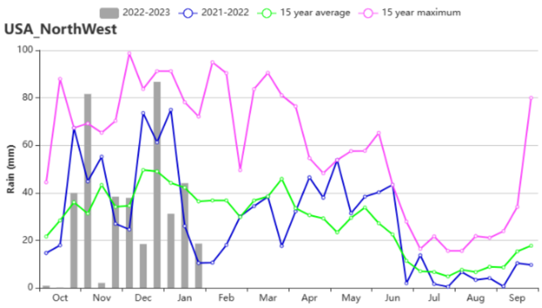
(h). Time series rainfall profile for the California from October 2022 to January 2023



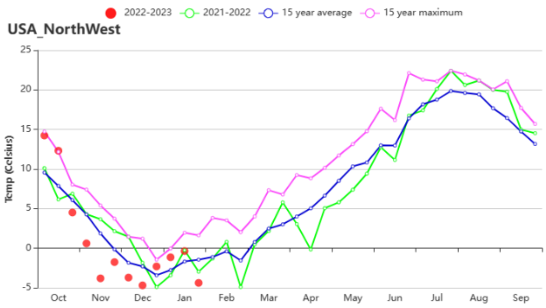
(i). Time series temperature profile for the California from October 2022 to January 2023



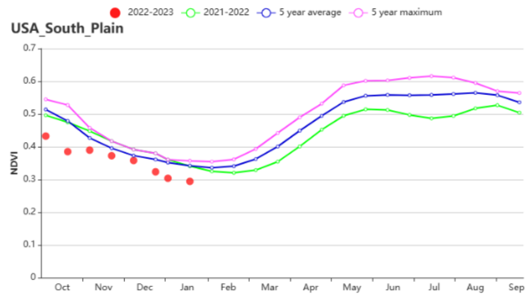
(j). Crop condition development graph based on NDVI for the Northwest from October 2022 to January 2023



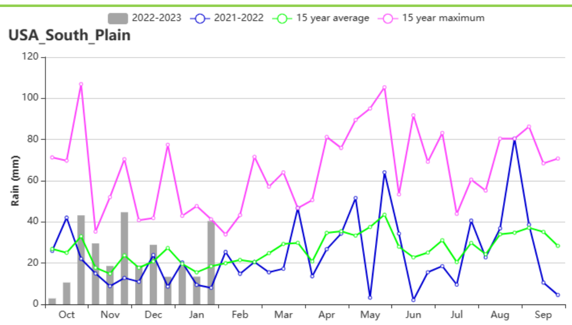
(k). Time series rainfall profile for the Northwest from October 2022 to January 2023



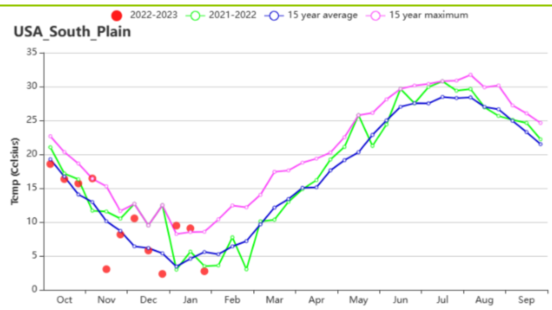
(l). Time series temperature profile for the Northwest from October 2022 to January 2023



(m). Crop condition development graph based on NDVI for the Southern Plains from October 2022 to January 2023



(n). Time series rainfall profile for the Southern Plains from October 2022 to January 2023



(o). Time series temperature profile for the Southern Plains from October 2022 to January 2023

Table 3.80.United States' agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, October 2022-January 2023

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Corn Belt	255	-12	2.2	0.7	447	0	445	6
Lower Mississippi	555	16	12.4	1.1	603	-4	859	10
Northern Plains	163	4	-1.6	-0.8	470	-1	320	1
North-eastern areas	412	2	4.7	1.4	442	-1	530	9
Northwest	400	-11	0.8	-0.5	420	4	394	0
Southern Plains	283	8	9.9	0.4	635	-5	510	5
Southeast	363	-8	13.4	1.1	659	-2	727	0
Southwest	190	22	4.4	-0.6	705	-5	368	8
Blue Grass region	433	-2	7.5	0.7	547	-1	668	5
California	507	49	8.9	-0.8	620	-4	570	19

Table 3.81. United States'agronomic indicators by sub-national regions, current season's values and departure, October 2022-January 2023

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Corn Belt	78	-2	0.80
Lower Mississippi	81	-10	0.69

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Northern Plains	15	-43	0.66
North-eastern areas	100	0	0.93
Northwest	41	-1	0.70
Southern Plains	53	-21	0.60
Southeast	100	0	0.81
Southwest	29	23	0.81
Blue Grass region	99	0	0.86
California	68	7	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 SYR THA TUR UKR USA **UZB** VNM ZAF ZMB

[UZB] Uzbekistan

The monitoring period from October 2022 to January 2023 covers the sowing and early growth stages of winter wheat in Uzbekistan. Among the CropWatch agroclimatic indicators, the radiation (RADPAR) was slightly above average (+2%), while temperature (TEMP) and rainfall (RAIN) were below average (-1.1°C and -5%) compared to the 15-year average (15YA). From mid-October to the beginning of November, the precipitation was above average. However, the precipitation was significantly below average afterward, except for the beginning of January. The temperature in October and November was close to the 15YA, but was below the 15YA in December and January. The biomass accumulation (BIOMSS) decreased by 13%, and the NDVI development graph indicates that crop conditions were slightly below the five-year average in October, surpassed the five-year maximum in November, and remained close to the five-year average until the beginning of January.

The maximum Vegetation Condition Index (VCIx) was 0.86. The cropped arable land fraction (CALF, 24%) increased by 29% compared to its five-year average. The NDVI departure cluster profiles indicate that: (1) 41.1% of arable land experienced average crop conditions (light green), mainly in the west and south of the country. (2) 40.1% of arable land (red and dark green), mainly in the central area of the Eastern hilly cereals zone, had average crop conditions in October, and had better crop conditions than average in November and December before a marked drop at the end of January. (3) 11.1% of arable land (orange) showed unfavorable conditions in October, early December and January, mainly in the east of the Eastern hilly cereals zone. Most likely, the large drops of NDVI can be attributed to cloud cover in the satellite images and snow. Overall, conditions for wheat production can be assessed as average.

Regional analysis

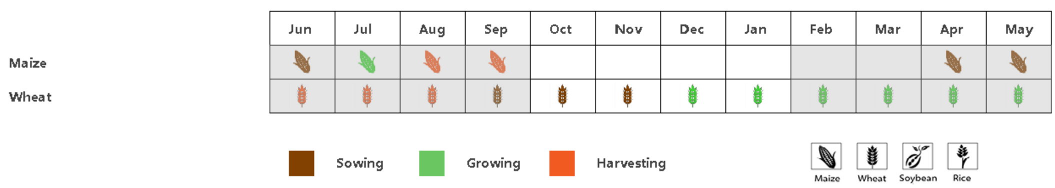
Based on cropping systems, climatic zones and topographic conditions, three sub-national agro-ecological regions (AEZ) can be distinguished for Uzbekistan: **Central region with sparse crops (210)**, **Eastern hilly cereals zone (211)**, and **Aral Sea cotton zone (212)**.

In the **Central region with sparse crops**, the NDVI development graph shows that the crop conditions were generally below average, except for the beginning of October and the beginning of November. RAIN and TEMP were below average (-43% and -0.7°C), while RADPAR was slightly above average (+4%). Consequently, BIOMSS decreased by 36% compared to the 15YA. The agro-climatic conditions of this region were unfavorable.

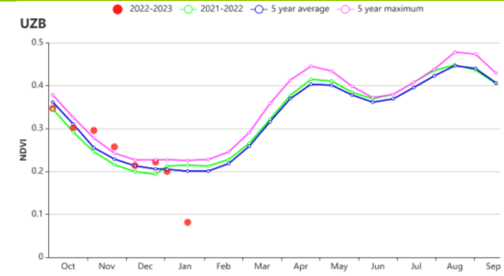
In the **Eastern hilly cereals zone**, RAIN and TEMP were slightly below average (-2% and -1.1°C), while RADPAR was slightly above average (+2%). The CALF was 27%. It had increased by 22% compared to the 5YA and the maximum VCI index was 0.87. The NDVI-based crop condition development graph shows a consistent pattern as the national average state, namely slightly below average in October, above five-year maximum in November, and close to average until the beginning of January. The NDVI values were lower than 0.1 at the end of January, probably due to the cloud or snow. The BIOMSS decreased slightly by 9%.

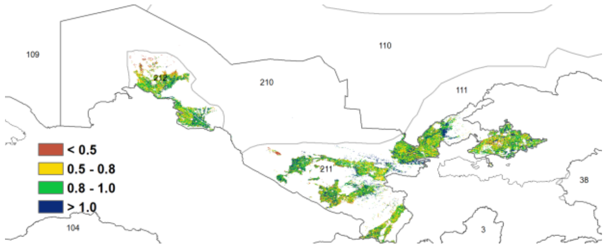
In the **Aral Sea cotton zone**, RAIN and TEMP were below average (-65% and -0.9°C), while RADPAR was slightly above average (+5%). These factors resulted in a decrease in BIOMSS (-45%). The CALF(17%) and VCIx (0.82) were the lowest among the three sub-national crop regions, although the CALF increased by 152% compared to the 5YA. The agro-climatic conditions of this region were unfavorable.

Figure 3.45 Uzbekistan's crop condition, October 2022 - January 2023



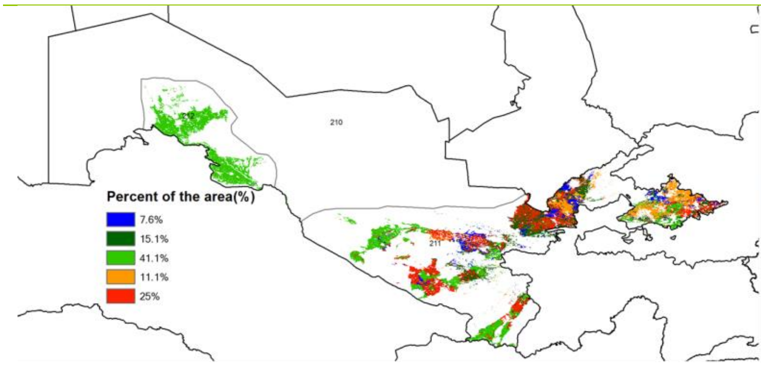
(a) Phenology of major crops

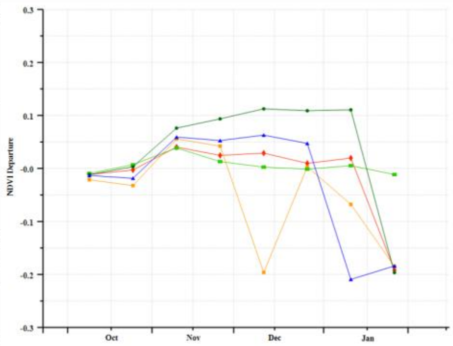




(b) Crop condition development graph based on NDVI

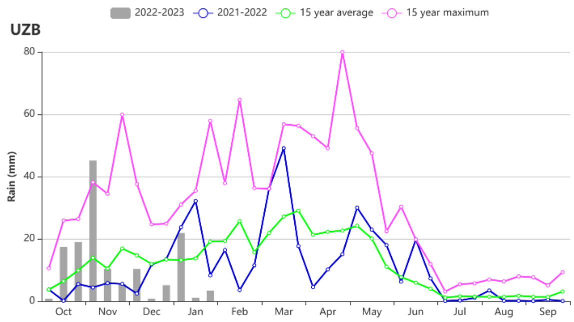
(c) Maximum VCI

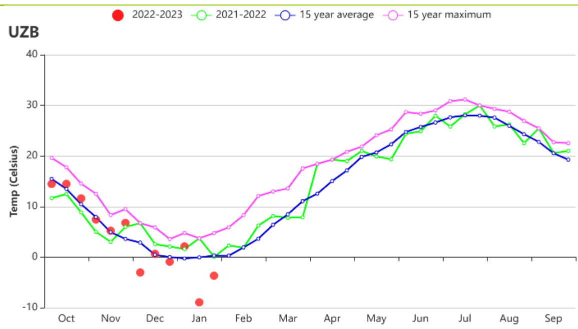




(d) Spatial NDVI patterns compared to 5YA

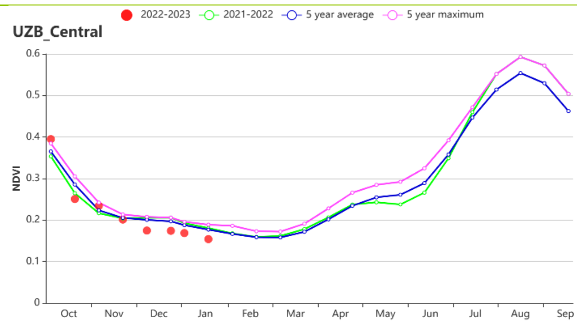
(e) NDVI profiles

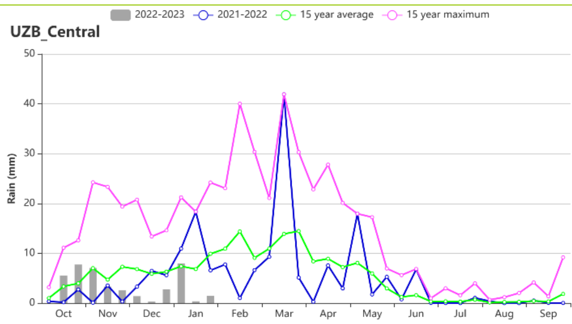




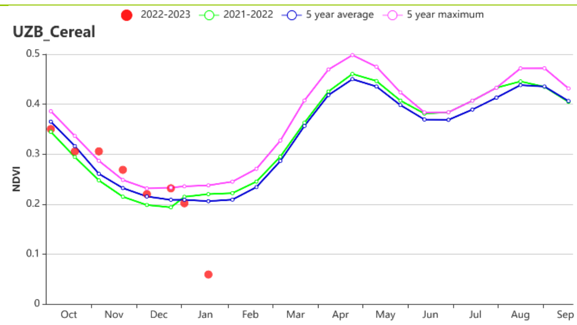
(f) Rainfall profiles

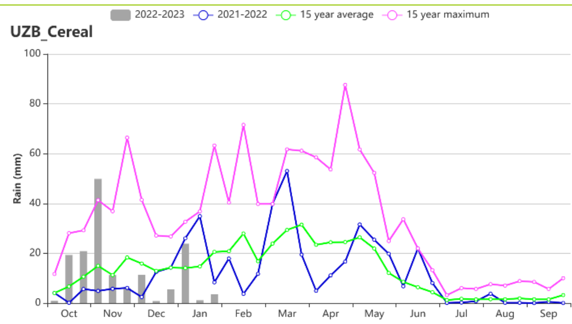
(g) Temperature profiles



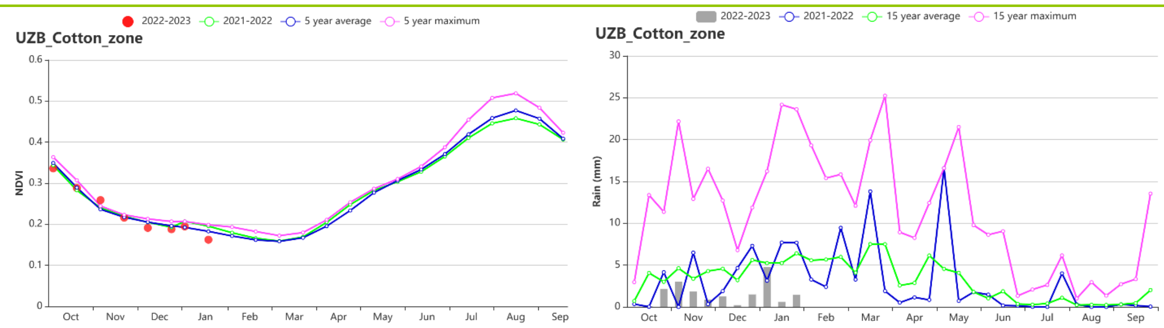


(h) Crop condition development graph based on NDVI (left) and rainfall profile (right) of Central region with sparse crops





(i) Crop condition development graph based on NDVI (left) and rainfall profile (right) of Eastern hilly cereals region



(j) Crop condition development graph based on NDVI (left) and rainfall profile (right) of Aral Sea cotton region

Table 3.82 Uzbekistan's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, October 2022 - January 2023

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Central region with sparse crops	40	-43	4.2	-0.7	606	4	136	-36
Eastern hilly cereals zone	154	-2	4.0	-1.1	626	2	298	-9
Aral Sea cotton zone	18	-65	2.7	-0.9	574	5	102	-45

Table 3.83 Uzbekistan's agronomic indicators by sub-national regions, current season's values and departure from 5YA, October 2022 - January 2023

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Central region with sparse crops	55	179	0.92
Eastern hilly cereals zone	27	22	0.87
Aral Sea cotton zone	12	152	0.82

[VNM] Vietnam

This monitoring period covers the harvest of the rainy season rice in North and Central Vietnam, as well as the planting of winter and winter-spring rice. The winter-spring rice in the Mekong Delta and Southeast Vietnam will be harvested in February.

The proportion of irrigated cropland in Vietnam is 32%. Therefore, precipitation plays an important role in crop production. The agro-climatic condition showed TEMP (19.6°C, +0.2°C) was close to the 15YA and the RADPAR (1170 MJ/m2, +6%) was above the average. Although there was a lower RADPAR, BIOMSS (910 gDM/m2, -2%) was below the 15YA due to the below-average RAIN (563 mm, -6%). The VCIx was 0.95, and the CALF (96%, 0%) was at the 5YA. The CPI in this monitoring period was 1.13 which represents a normal crop production situation.

Based on the NDVI development graph, the crop conditions were below the 5YA throughout the whole monitoring period except at the beginning of January. In the middle of October and December, the precipitation was below average. In most of November and January, the precipitation surpassed the 15YA. The temperature was at the 15YA in the whole monitoring period except for mid November. The spatial distribution of the NDVI profiles shows that the crop conditions in most of the country were below average during the whole monitoring period. But 11.9% of the country exceeded the average in December and January. The drops in NDVI are most likely artifacts, caused by cloud cover in the satellite images. The peaks in all clusters were close to the average. Therefore, crop conditions can be assessed as normal.

Regional analysis

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

In the Central Highlands, although the TEMP (20.5°C, -0.3°C), the RADPAR (905 MJ/m^2, -2%) and the RAIN (592 mm, -5%) were all below the average, the estimated BIOMSS still increased by 6%. The crop condition development graph showed that the NDVI was near the 5YA in most of the monitoring period, but there was a sharp drop in mid-November, which may have been due to cloud cover in the satellite images. The CPI was 1.13, which indicates that the crop production situation was normal. The CALF was 99% and VCIx was 0.93. The crop conditions in this region are expected to be near the average.

In the Mekong River Delta region, the TEMP (25.5°C, -0.4°C) and the RADPAR (1079 MJ/m^2 -2%) were both below the average.The above average RAIN (875 mm, +16%) in this region has resulted in an increase of BIOMSS (1375 gDM/m^2, +10%), which was 10% higher than the 15YA. The VCIx was 0.91 and the CALF was 92%. The CPI was 1.14, which implies that the crop production was at a normal level. The crop condition development graph showed that NDVI steadily increased from far below average levels and reached close to average levels in January. The crop conditions in this monitoring period improved to close to average.

In the North Central Coast, the TEMP (17.8°C, -0.1°C) was at an average level. Although the RADPAR (724 MJ/m^2, +7%) was above the average, the BIOMSS (882 gDM/m^2, -3%) also had a slight drop, this condition can be attributed to the decrease of RAIN, which had a decrease of 7%. The VCIx was 0.92 and CALF was 94%. According to the crop condition development graph, the NDVI had a wide fluctuation range. The minimum was lower than 0.4 in the beginning of October, while the maximum was close to the maximum of past 5 years in January. The CPI was 1.06. The crop conditions were close to the average.

In the North East region, although the TEMP increased by 0.7°C and the RADPAR (787 MJ/m^2, +17%) showed a significant increase compared to the 5YA, the BIOMSS (615 gDM/m^2, -18%) also declined. This was caused by a precipitation deficit (RAIN -26%). The VCIx was 0.98 and CALF was 100%. According to the crop condition development graph, the NDVI was close to the 5YA from October to December except for late November, when it dropped sharply. It subsequently surpassed the average in January. The CPI was 1.18.The crop conditions in this region were average.

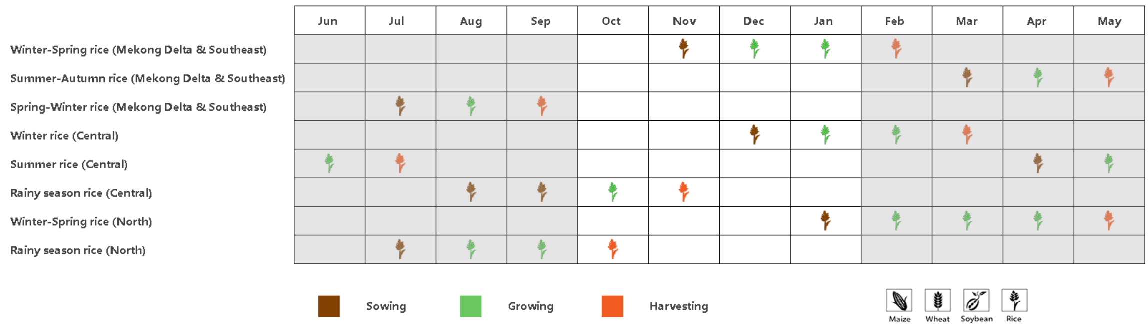
In the North West region, the TEMP (15.8°C, +0.4°C) was above average. Although the RADPAR increased by 12%, the BIOMSS still dropped by 22%, which may have been caused by the decrease of RAIN (197 mm, -35%). The VCIx was 0.96, the CALF was 100%. The CPI was 1.15, indicating normal crop conditions. The crop condition development graph showed that NDVI was close to or surpassed the 5YA throughout the whole monitoring period, especially in December and January. The crop conditions in this region are expected to be normal, despite of the precipitation deficit.

In the region of the Red River Delta, the RAIN increased by 2%. The TEMP (19.4°C, +0.5°C) and the RADPAR (759 MJ/m^2, +17%) were both higher than the average. But the BIOMSS had a decrease of 11%. The VCIx was 0.89 and the CALF increased by 2%. As shown by the crop condition development graph, the NDVI was close to or surpassed the 5YA throughout the whole monitoring period, except in the beginning of October and December, when it decreased. The CPI was 1.1. The crop conditions in this region were estimated to be above average.

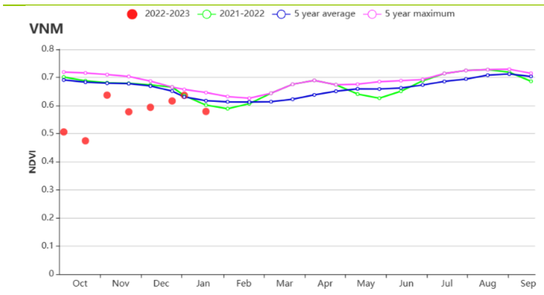
In the South Central Coast, the RAIN (1080 mm, -5%) was lower than the 15YA. With the increased TEMP (20.2°C, +0.4°C) and RADPAR (706 MJ/m^2, +1%), the BIOMSS showed an slight increase by 3%. The VCIx was 0.88 and the CALF dropped by 2%. The CPI was 0.98. According to the NDVI development graph, crop conditions fluctuated greatly. In mid-October, December and January, the NDVI was far below average, but was near or above the average otherwise. Overall, the crop conditions in this region were normal.

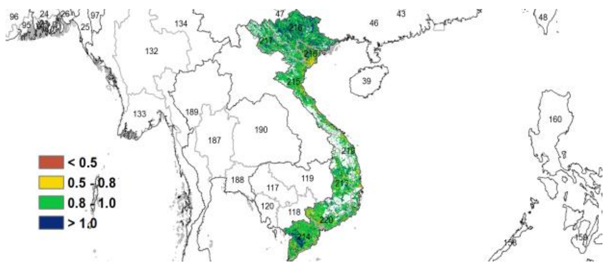
In the South East region, the TEMP (24.3°C, -0.1°C) and the RADPAR (1096 MJ/m^2, +1%) were close to the 15YA. The RAIN (673 mm, -2%) was lower than the average. But the BIOMSS increased by 6%. The VCIx was 0.89 and the CALF was 96%. The CPI was 1.11, which indicates that the crop conditions were normal. The crop condition development graph showed that NDVI was slightly below the 5YA throughout the whole monitoring period, but in October, its value was far below average. The crop conditions in this region were near average.

Figure 3.46 Vietnam's crop conditions, October 2022 - January 2023



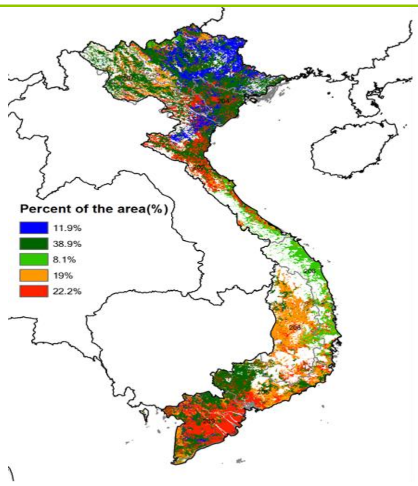
(a) Phenology of major crops

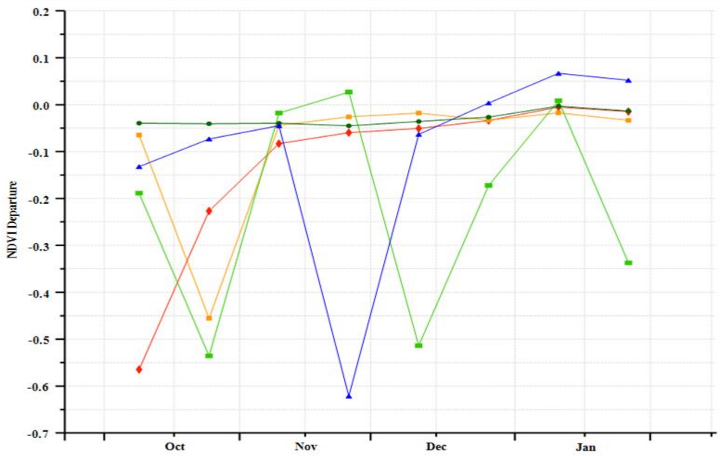




(b) Crop condition development graph based on NDVI

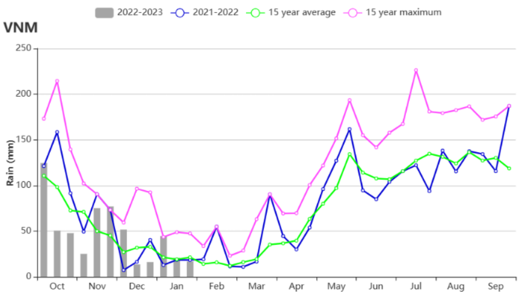
(c) Maximum VCI

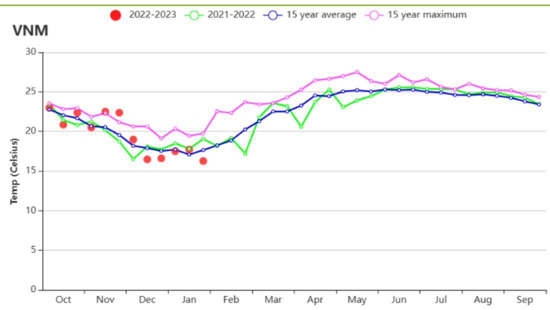




(d) Spatial NDVI patterns compared to 5YA

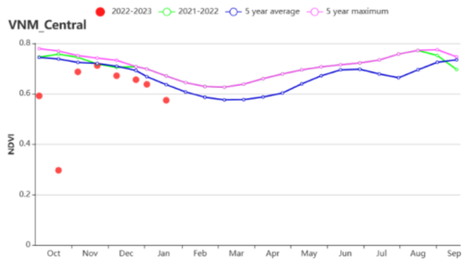
(e) NDVI profiles

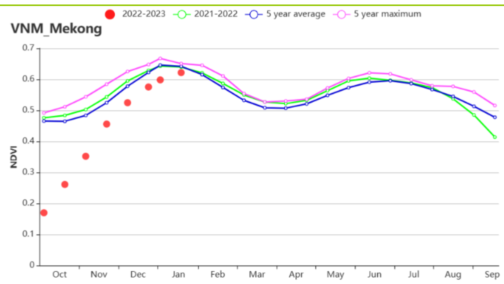




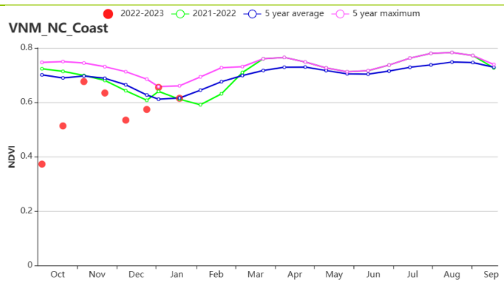
(f) Rainfall profiles

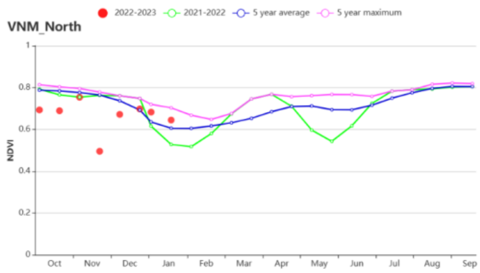
(g) Temperature profiles



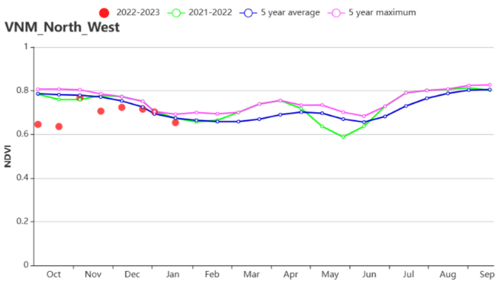


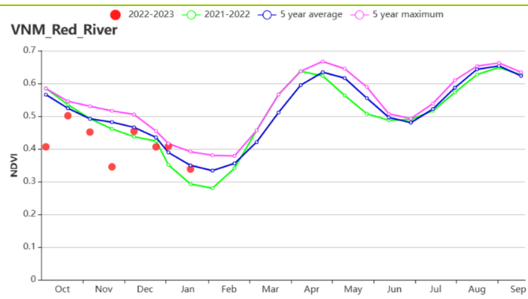
(h) Crop condition development graph based on NDVI (central Highlands Vietnam (left) and Mekong River Delta(right))



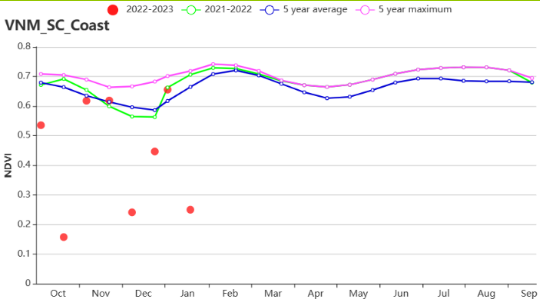


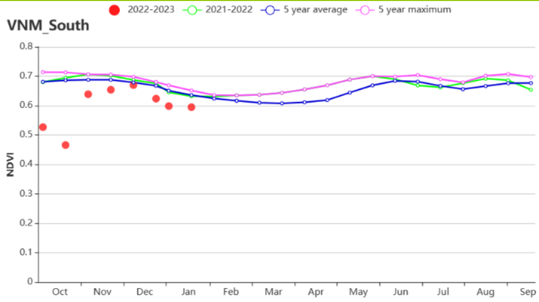
(i)Crop condition development graph based on NDVI North Central Coast Vietnam (left), and North East Vietnam (right)





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





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

Table 3.84 Vietnam's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, October 2022 - January 2023

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Central Highlands	592	-5	20.5	-0.3	905	-2	987	6
Mekong River Delta	875	16	25.5	-0.4	1079	-2	1375	10
North Central Coast	643	-7	17.8	-0.1	724	7	882	-3
North East	293	-26	16.7	0.7	787	18	615	-18
North West	197	-35	15.8	0.4	858	12	504	-22
Red River Delta	482	2	19.4	0.5	759	17	738	-11
South Central Coast	1080	-5	20.2	0.4	706	1	1181	3
South East	673	-4	24.3	-0.1	1096	1	1172	6

Table 3.85 Vietnam's agronomic indicators by sub-national regions, current season's values and departure from 5YA, October 2022 - January 2023

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Central Highlands	99	0	0.93
Mekong River Delta	92	0	0.91
North Central Coast	94	0	0.92
North East	100	0	0.98
North West	100	0	0.96
Red River Delta	93	2	0.89
South Central Coast	94	-2	0.88
South East	96	0	0.89

[ZAF] South Africa

In South Africa, wheat is the main crop harvested during this monitoring period. Maize sowing started in October for the east and in December for the west. Soybean planting also started in October. 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. Based on the NDVI development graph, the crop conditions were near or above the 5-year max until the end of December. In January, they dropped to below-average conditions, due to the precipitation deficit. At the national level, the CropWatch agroclimatic indicators show that TEMP and RADPAR were above the 15-year average (+1.1°C, +2%). Due to a rainfall deficit (-41%), the BIOMSS decreased significantly by 15% compared to the 15-year average. The VCIx was 0.88. CALF increased significantly (+16%) compared with the last 5 years, indicating good progress with sowing and establishment of the new crops. As to the spatial distribution of NDVI profiles, crop conditions on about 86.9% of the cropland were close to and above average mainly in the central and eastern parts, and on about 13.1%, they were below average. The areas with negative departures were mainly in the western region, located in Gauteng, Mpumalanga, North West and Orange Free State Province. Overall, crop conditions in South Africa were generally favorable, but the rainfall deficit started to impact growth in January, when NDVI levels dropped to below-average levels.

Regional analysis

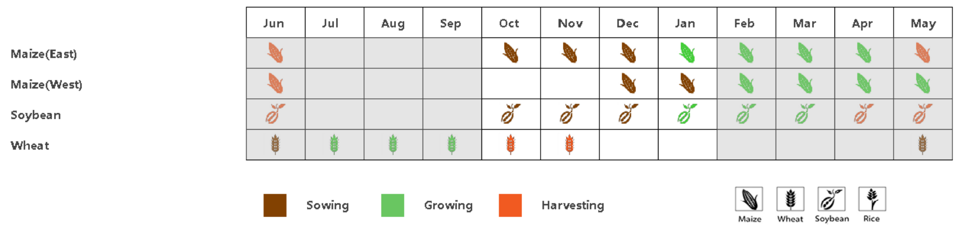
In the Arid and desert zones (221), RAIN (81 mm) was significantly below average (-36%) and RADPAR was slightly below average (-1%), whereas TEMP was above average (+1.3°C). BIOMSS decreased by 9% due to the low rainfall. CALF increased (+52%) and VCIx was 0.86. The crop condition development graph based 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 (222), the TEMP (+1.3°C) and RADPAR (+4%) were above average. Due to insufficient rainfall (288 mm, -26%), BIOMSS was below the 15-year average (-9%). CALF was 97% and VCIx was 0.92. The crop condition development graph based on NDVI also indicates favorable crop conditions, but the large rainfall deficit started to impact growth in January, when NDVI levels dropped to below-average levels.

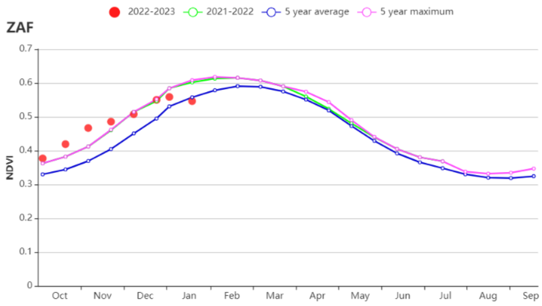
In the Mediterranean zone (223), the TEMP was close to average (0.7°C). Rainfall dropped to 73 mm (RAIN -40%) and RADPAR was as average. The BIOMSS was significantly decreased by 12% due to the insufficient rainfall. CALF decreased slightly (56%, -4%) and VCIx was 0.68. According to the crop condition development graph, the NDVI was below the 5-year average for most of the period, the CPI was 0.77, indicating that crop conditions were generally unfavorable.

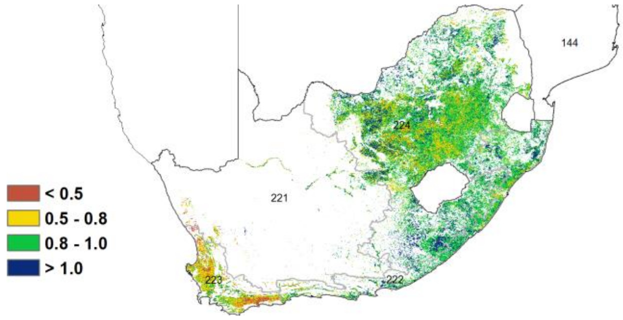
In the Dry Highveld and Bushveld maize areas (224), RAIN (147 mm, -46%) was significantly below the 15-year average, whereas TEMP and RADPAR were above average (+1.1°C, +3%). The BIOMSS was decreased by 17% due to the insufficient rainfall. CALF increased significantly (95%, +19%) and VCIx was 0.90. The crop condition development graph based on NDVI shows that the NDVI was above the 5-year max for most of the period, and the CPI was 1.18. All in all, the crop conditions were favorable, but the large rainfall deficit started to impact growth in January, when NDVI levels dropped to below-average levels.

Figure 3.47 South Africa's crop condition, October 2022 - January 2023



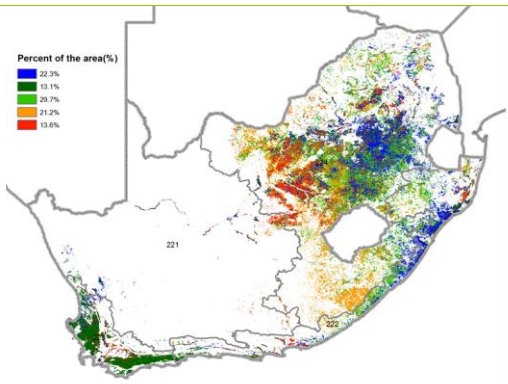
(a) Phenology of major crops

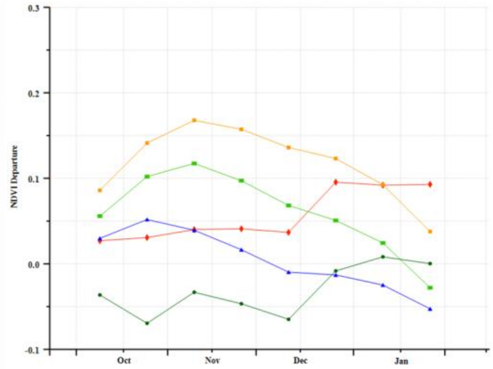




(b) Crop condition development graph based on NDVI

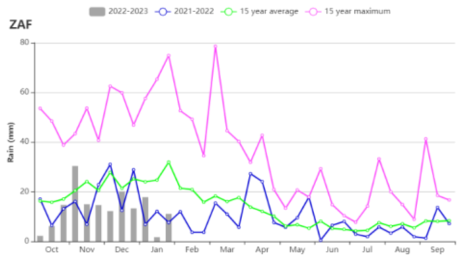
(c) Maximum VCI

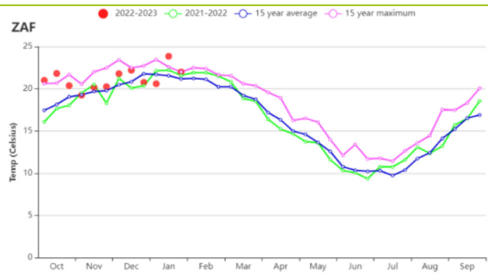




(d) Spatial NDVI patterns compared to 5YA

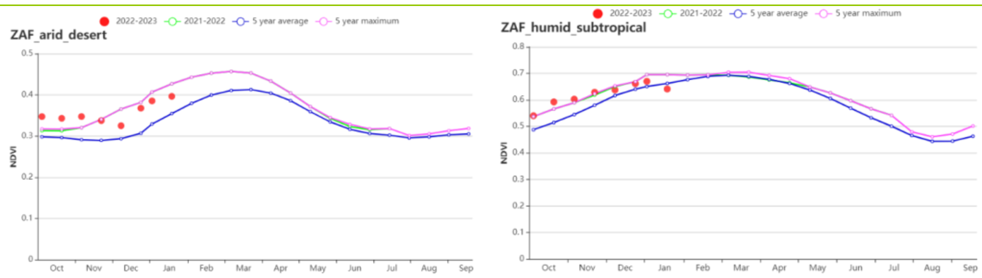
(e) NDVI profiles



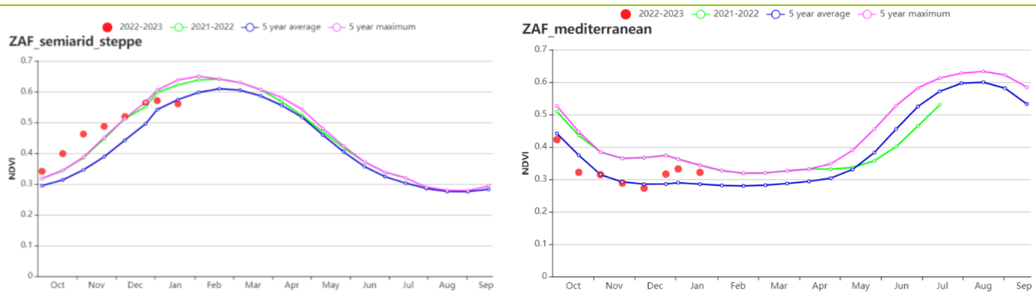


(f) Rainfall profiles

(g) Temperature profiles



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



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

Table 3.86 South Africa's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, October 2022 - January 2023

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m^2)	Departure (%)	Current (gDM/m^2)	Departure (%)
Arid and desert zones	81	-36	21.8	1.3	1592	-1	626	-9
Humid Cape Fold mountains	288	-26	20.5	1.3	1320	4	891	-9
Mediterranean zone	73	-40	19.0	0.7	1575	0	563	-12
Dry Highveld and Bushveld maize areas	147	-46	21.5	1.1	1511	3	728	-17

Table 3.87 South Africa's agronomic indicators by sub-national regions, current season's values and departure from 5YA, October 2022 - January 2023

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Arid and desert zones	47	52	0.86
Humid Cape Fold mountains	97	3	0.92
Mediterranean zone	56	-4	0.68
Dry Highveld and Bushveld maize areas	95	19	0.90

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

[ZMB]Zambia

The reporting period covers the onset and establishment of the rainy season, characterized by agricultural activities of the land preparation and planting of rainfed cereal crops and legumes/pulses. The early part of the reported period also included the harvested of irrigated wheat grown mainly under center pivot systems. This monitoring period recorded a below-average rainfall of 723 mm (RAIN -18%), an average temperature of 23.4°C (-0.1°C) and an average radiation of 1316 MJ/m2 (+0%), resulting in potential biomass production reduction of 1147 gDM/m2, -6%). The cropped arable land fraction (CALF) was 98% (+0%), and the VCIx was 0.90. The crop condition based on the NDVI indicates a significant decline in January. The reduced NDVI can be partly attributed to the above-normal rainfall in January, resulting in a prolonged flooding of cropped fields. Cloud cover in the satellite images may also have contributed to the sharp drops in NDVI. Countrywide, climatic indicators generally showed average conditions for early crop establishment for the main cereals (maize, sorghum, and millet) and pulses/legumes (soybean, groundnuts, cowpeas, sunflower, beans, pumpkins, and other minor crops).

Regional analysis

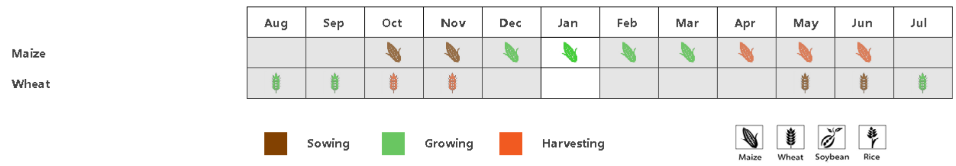
Zambia is classified into four major agroecological zones (AEZs), primarily based on rainfall amount but also incorporating soils and other climatic characteristics. These AEZs include: Luangwa-Zambezi Rift Valley (225), covering the major river valleys with rainfall less than 400-800 mm per year; Northern high rainfall zone (226); Central-Eastern and Southern Plateau (227), with relatively fertile soils; Western Semi-Arid Plain (228), dominated by relatively poor sandy soils.

The analyses of the agroecological regions show that the rainfall was below-average in all regions. The reduction in rainfall ranged from -30% (Western Semi-arid Plateau) to -10% (Central-Eastern and Southern Plateau). However, average rainfall levels were still rather high, with the total exceeding 550 mm. Hence, rainfall was probably not limiting crop production in most regions. The average temperature varied from 21.9°C (Northern High Rainfall Zone) to 24.6°C (Luangwa Zambezi Rift Valleys) with negative departure (-0.2°C to -0.1°C) from the 15YA, respectively. The radiation in all agroecological zones was above 1280 MJ/m2. Negative departures in radiation were observed for the Luangwa Zambezi Rift Valley (-2%) and Central Eastern and Southern Plateau (-1%). The interplay of rainfall, temperature and solar radiation led to a reduction in potential biomass production (-7% to - 6%) in all three regions.

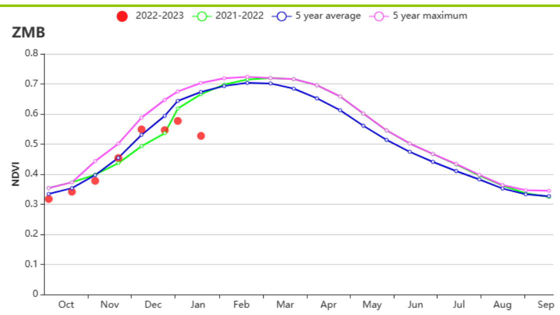
The observed Cropped Arable Land Fraction (CALF) was above 96% in all the regions; however, the crop condition based on NDVI showed reduced values during January across all the areas due to flooding and effects of cloud cover on NDVI, as mentioned above. The maximum vegetation health index (VCIx) was the lowest in Central-Eastern Southern Plateau region (0.87) and Western Semi-Arid Areas (0.89), while Northern High Rainfall Zone and Western semi-arid and Luangwa-Zambezi Rift Valleys were above 0.90.

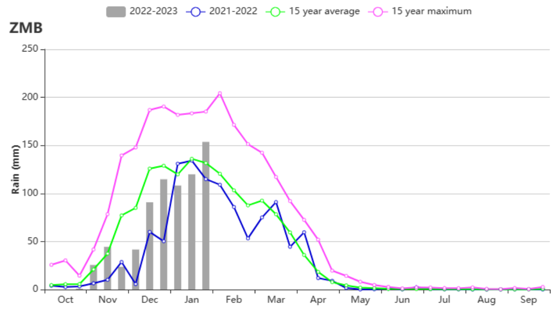
In general, the traditionally low rainfall regions experienced increased rainfall, hence favorable conditions for crop production; however, excessive rainfall and prolonged flooding in January would negatively impact the expected crop yields in limited areas. All in all, prospects for crop production are fair.

Figure 3.48 Zambia's crop condition, October 2022 - January 2023



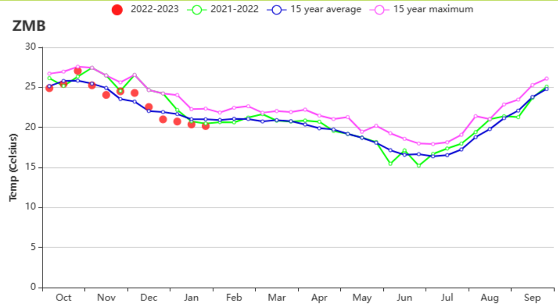
(a) Phenology of major crops

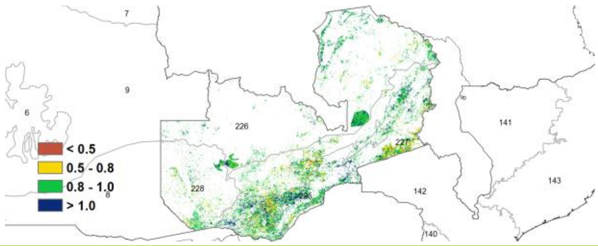




(b) Crop condition development graph based on NDVI

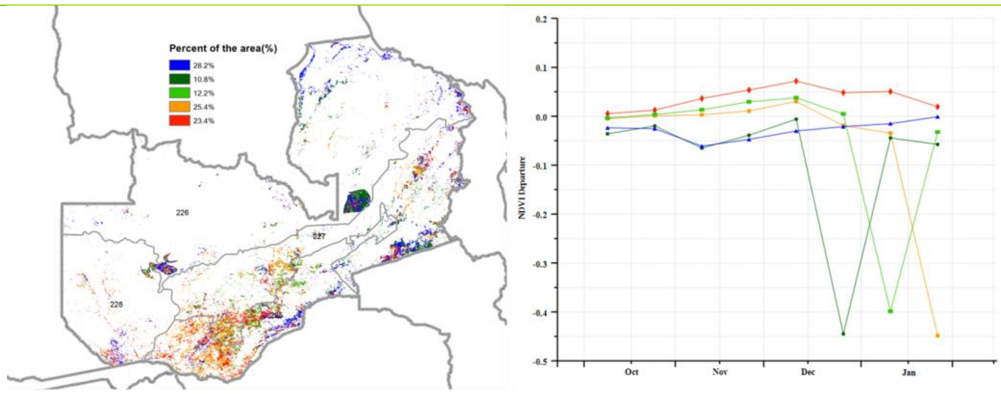
(c) Time series rainfall profile





(d)Time series temperature profile

(e) Maximum VCI



(f)Spatial distribution of NDVI profiles

Table 3.88 Zambia's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, October 2022 - January 2023

Region	RAIN Current (mm)	RAIN Departure (%)	TEMP Current (°C)	TEMP Departure (°C)	RADPAR Current (MJ/m²)	RADPAR Departure (%)	BIOMSS Current (gDM/m²)	BIOMSS Departure (%)
Luangwa-Zambezi rift valley	651	-20	24.6	-0.2	1361	-2	1126	-6
Western semi-arid plain	788	-20	21.9	-0.1	1286	2	1176	-8
Central-eastern and southern plateau	741	-10	23.7	-0.1	1314	-1	1130	-6
Northern high rainfall zone	586	-30	24.5	-0.2	1319	0	1193	-7

Table 3.89 Zambia's agronomic indicators by sub-national regions, current season's values and departure from 5YA, October 2022 - January 2023

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Luangwa-Zambezi rift valley	99	1	0.93
Western semi-arid plain	100	0	0.92
Central-eastern and southern plateau	96	-1	0.87
Northern high rainfall zone	100	0	0.89

Chapter 4. China

This chapter starts with a brief overview of the agro-climatic and agronomic conditions in China over the reporting period (section 4.1). Next it describes the situation by region, focusing on the seven most productive agro-ecological regions of the east and south: Northeast China, Inner Mongolia, Huanghuaihai, Loess region, Lower Yangtze, Southwest China, and Southern China (4.2). Additional information on the agroclimatic indicators for agriculturally important Chinese provinces are listed in table A.11 in Annex A.

4.1 Overview

Agro-climatic conditions were quite fair in China from October 2022 to January 2023. Winter wheat sowing was completed in late October. The crop reached the hibernation stage in December. Spring green-up is starting in February. Radiation and temperature had increased by 5% and 0.6°C over the 15YA, respectively. Rainfall was 14% below the 15YA. The lack of rainfall resulted in the below-average potential biomass (-6%). National average of maximum Vegetation Condition Index (VCIx) and Crop Production Index (CPI) is 0.82 and 0.97.

Temperatures in seven of the agroecological zones (AEZs) of China were above average, ranging from 0.1°C (Inner Mongolia) to +1.0°C (Lower Yangtze region). Four of the AEZs received above-average rainfall, the positive rainfall departure ranging from +15% (Inner Mongolia) to +47% (Huang Huaihai), while the remaining three AEZs had below-average precipitation. The potential biomass (BIOMSS) indicator takes rainfall, radiation, and temperature into consideration. In China, rainfall tends to be the most important factor controlling crop growth. Hence, the potential biomass estimates followed the rainfall patterns: Huanghuaihai (+14%), Inner Mongolia (+12%), Loess region (+13%) and Northeast China (+13%) had above-average potential biomass, while the rest of AEZs had below-average potential biomass.

The spatial distribution of the rainfall indicated that 68.3% of the agricultural area (marked in dark green) had near-average rainfall, which was widely distributed across China. Other regions in China went through some fluctuations in rainfall. Excessive rainfall (more than +90 mm/dekad) occurred mainly in early October in southern part of Huang Huaihai and northeastern part of South West China (light green marked regions). Areas marked in blue, located mainly in southeastern part of Lower Yangtze region and eastern part of Southern China, also received largely above-average rainfall (almost +90 mm/dekad) in late November, mainly in some parts of Zhejiang, Fujian, Jiangxi, Hunan, Guangdong, and Guangxi. The temperature profiles indicated that the region marked in dark green, located mainly in the Northeast, had the largest departures from the 15YA, with the biggest positive departure (more than +4.0℃) in middle of November and the biggest negative departure (almost -3.5℃) in early October. However, the summer crops had reached maturity by then and no winter crops are grown in that region.

At the provincial level, only 8 provinces had positive rainfall anomalies, ranging from +10% (Heilongjiang) to +62% (Shaanxi). The negative temperature anomalies were only recorded in Ningxia (-0.1°C). The wet conditions in early October might have caused a delay in winter wheat planting, especially in the Loess and Huang Huaihai regions. Subsequently, conditions were rather favorable and the crops got well established, as can be seen in the above average CALF for Huanghuaihai. Overall, conditions for winter wheat are normal.

Table 4.1 CropWatch agroclimatic and agronomic indicators for China, October 2022 - January 2023, departure from 5YA and 15YA

Region	Agroclimatic indicators				Agronomic indicators	
	Departure from 15YA				Departure from 5YA	Current period
	RAIN (%)	TEMP (°C)	RADPAR (%)	BIOMSS (%)	CALF (%)	Maximum VCI
Huanghuaihai	47	0.5	0	14	10	0.86
Inner Mongolia	15	0.1	-1	12	/	/
Loess region	31	0.5	-3	13	1	0.86
Lower Yangtze	-19	1.0	7	-10	-4	0.84
Northeast China	28	0.3	-3	13	/	/
Southern China	-24	0.6	9	-17	0	0.91
Southwest China	-26	0.7	10	-15	0	0.89

Figure 4.1 China crop calendar

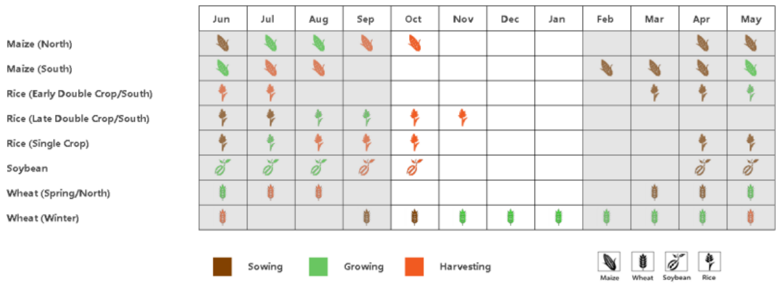


Figure 4.2 China spatial distribution of rainfall profiles, Oct 2022 to Jan 2023

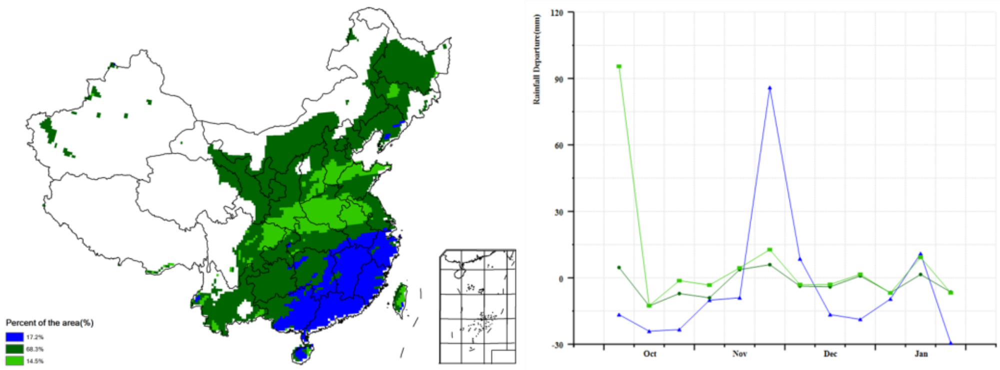


Figure 4.3 China spatial distribution of temperature profiles, Oct 2022 to Jan 2023

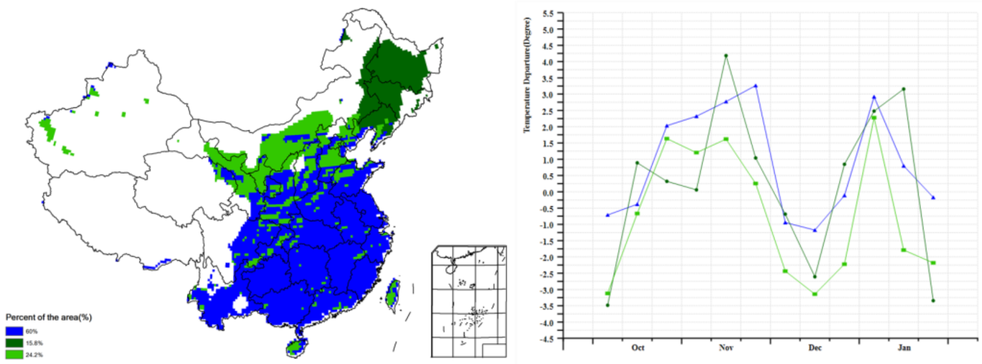
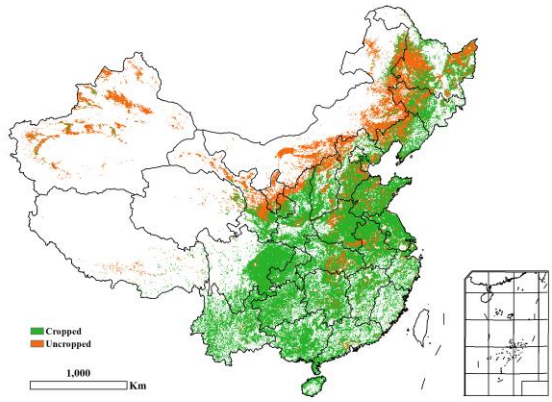


Figure 4.4 China cropped and uncropped arable land, by pixel, Oct 2022 to Jan 2023

Figure 4.5 China maximum Vegetation Condition Index (VCIx), by pixel, Oct 2022 to Jan 2023



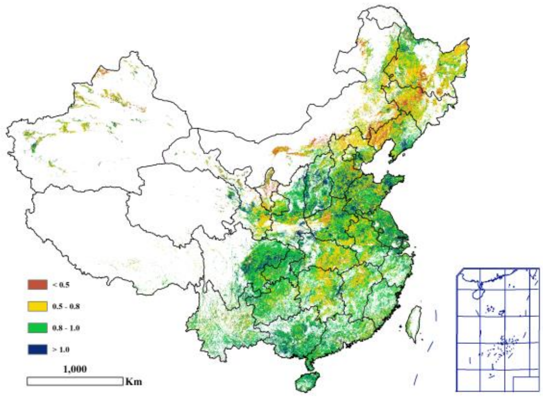
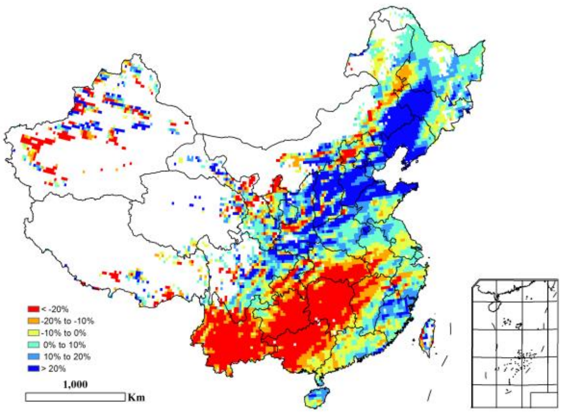


Figure 4.6 China biomass departure map from 15YA, by pixel, Oct 2022 to Jan 2023



4.2 Regional analysis

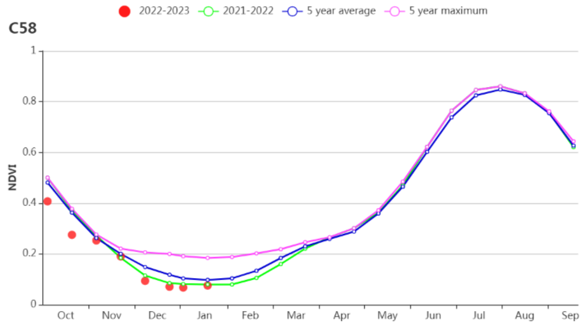
Figures 4.7 through 4.13 present crop condition information for each of China's seven agricultural regions. The provided information is as follows: (a) Phenology of major crops; (b) Crop condition development graph based on NDVI, comparing the current season from October 2022 to January 2023 to the previous season, to the five-year average (5YA), and to the five-year maximum; (c) Spatial NDVI patterns for October 2022 to January 2023 (compared to the (5YA)); (d) NDVI profiles associated with the spatial patterns under (c); (e) maximum VCI (over arable land mask); and (f) biomass for October 2022 to January 2023. Additional information about agro-climatic indicators and BIOMSS for China is provided in Annex A.

Northeast region

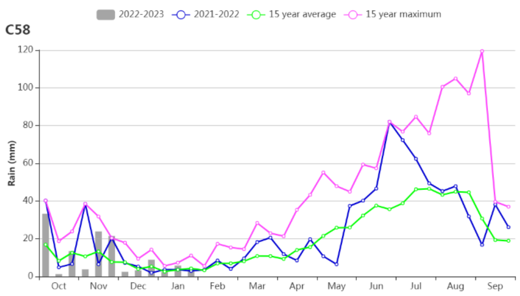
Due to the freezing conditions, no crops were growing in the northeast of China during this monitoring season. CropWatch Agroclimatic Indicators (CWAIs) showed that the overall precipitation increased by 28%, and it was significantly above the 15YA in mid-November, late-December and mid-January. The photosynthetically active radiation decreased by 3%, and the temperature increased by about 0.3°C.

In general, the above-average precipitation in the current monitoring season can be expected to have a positive impact on spring sowing. Adequate soil moisture, together with normal temperature and radiation will benefit the emergence and early growth of crops in the spring.

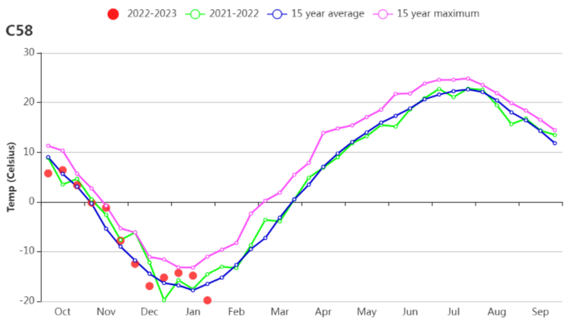
Figure 4. 7 Crop condition China Northeast region, October 2022 - January 2023



(a) Crop condition development graph based on NDVI



(b)Time series rainfall profile

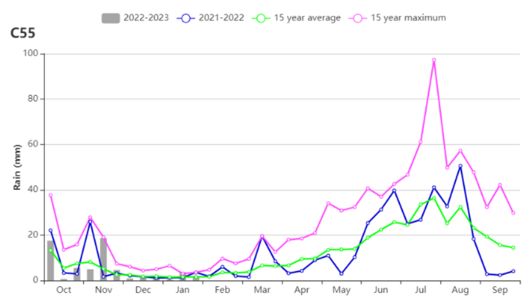


(c)Time series temperature profile

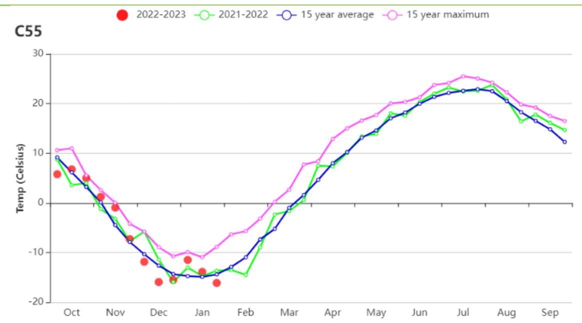
Inner Mongolia

Due to seasonal low temperatures, no winter were crops grown in Inner Mongolia during this monitoring period. The weather conditions in this period were favorable, rainfall (+15%) was above average. It will provide adequate soil moisture for the preparation and establishment of the spring crops. CropWatch Agroclimatic Indicators showed TEMP (+0.1°C) was slightly above average, while RADPAR (-1%) was below average. Potential biomass was above the average level (BIOMASS +12%). Conditions in the next reporting period will be more critical for the 2023 production.

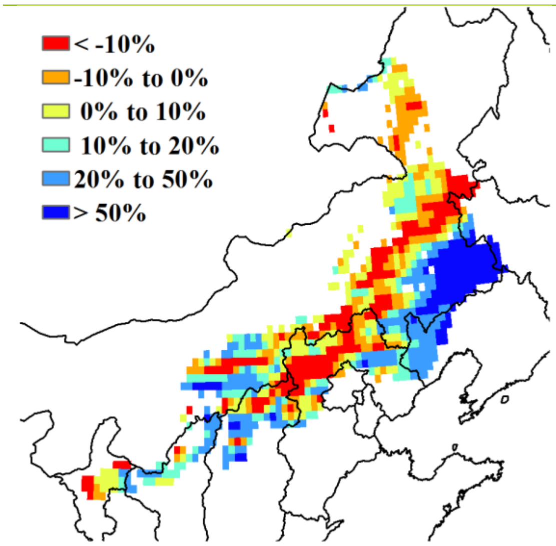
Figure 4.8 Crop condition Inner Mongolia, October 2022 - January 2023



(a)Time series rainfall profile



(b)Time series temperature profile



(c) Biomass departure

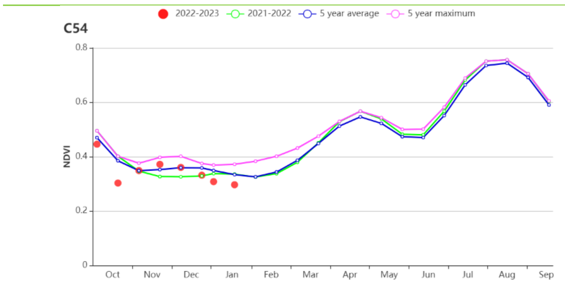
Huanghuaihai

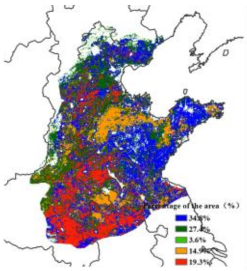
The monitoring period (October 2022 to January 2023) covers the planting and early growth stages of winter wheat in Huanghuaihai. Agro-climatic indicators showed that precipitation (+47%) and temperature (+0.5°C) in this area were above the 15YA, but radiation was unchanged, which resulted in above-average biomass production potential (BIOMSS +14%). The CALF exceeded the 5YA by 10%, indicating an increase in summer grain planting area in the MPZ. Below-average BIOMSS was located in southern Anyang, Henan, northern Xinxiang, Henan and southeastern Shandong.

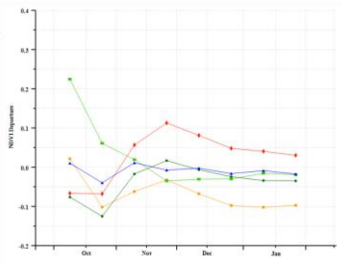
According to the NDVI development graph, rainfall profile, and temperature profile, crop growth conditions were favorable due to sufficient rainfall, supplementary irrigation and above-average temperatures. Cold temperatures caused a drop in NDVI starting in December. As the NDVI departure clustering map shows, 19.3% of the cropland was slightly above average after November, mainly located in eastern Henan, northern Anhui, southwestern Shandong, and middle-eastern Hebei. 14.9% of the cropped area in northern Suzhou, Anhui, southeastern Shangqiu, Henan, and northern Shandong (yellow colors in the NDVI departure clustering map) indicate slightly less favorable conditions.

The maximum VCI value was 0.86, and the Crop Production Index (CPI) is 1.17. In general, crop conditions in this region were average.

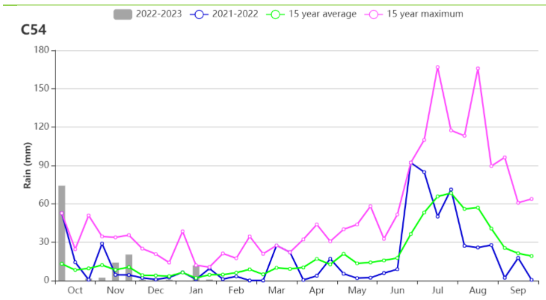
Figure 4. 9 Crop condition China Huanghuaihai, October 2022 - January 2023

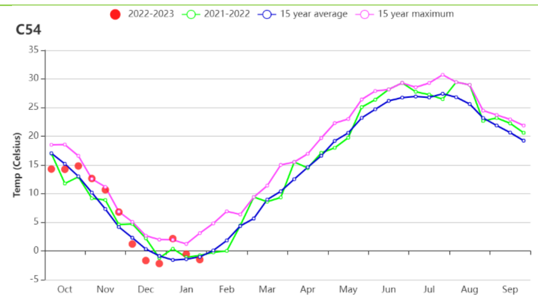






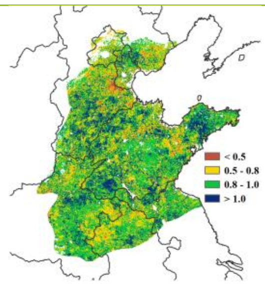
(a) Crop condition development graph based on NDVI (b) Spatial NDVI patterns compared to 5YA (c) NDVI profiles

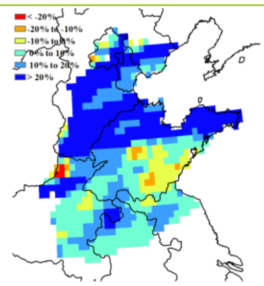




(d)Time series rainfall profile

(e)Time series temperature profile





(f) Maximum VCI

(g) Biomass departure

Loess region

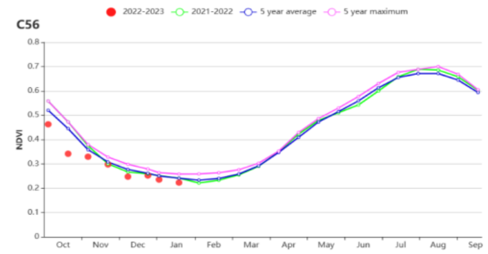
Winter wheat is the predominant crop that is grown during this monitoring period. Sowing started in September and was completed in October.

The CropWatch Agroclimatic Indicators (CWAIs) in the Loess Region show that although radiation was below average (RADPAR -3%), accumulated rainfall and temperature were above average (RAIN +31%, TEMP +0.5℃), which resulted in above-average biomass production potential compared to the 15YA (BIOMSS +13%). During the monitoring period, rainfall was significantly above average in early October, but then returned to close to the 15YA in the subsequent periods.

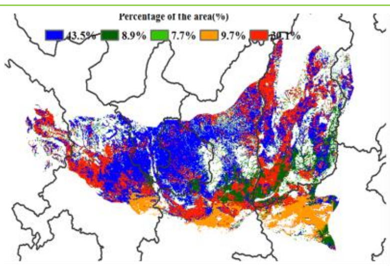
According to the regional NDVI development map, the overall crop condition in the Loess region was close to the 5YA, but below average in October. The NDVI departure cluster profiles indicate that about 53.2% of the areas were below average from October to mid-November, mainly distributed in most of the region. In addition, about 7.7% of the areas were above average by mid-November, mainly in central Henan, southwestern Shanxi, and southeastern Shaanxi Province. The majority of arable land had high VCIx values, with a regional average of 0.86, and the fraction of cropped arable land under cultivation is 78% , which is 1% above the 5YA. The CPIx in the region is greater than 1.

In conclusion, the CropWatch indicators point to normal conditions for this region.

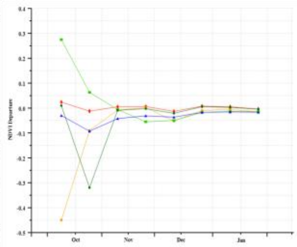
Figure 4. 10 Crop condition China Loess region, October 2022 - January 2023



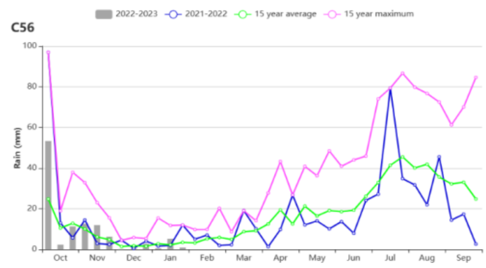
(a) Crop condition development graph based on NDVI



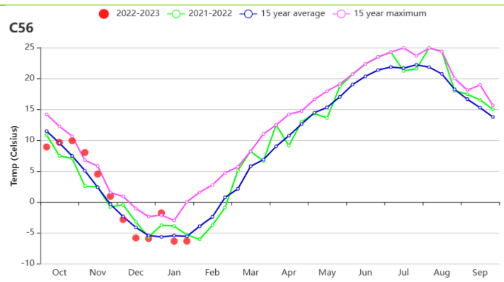
(b) Spatial NDVI patterns compared to 5YA



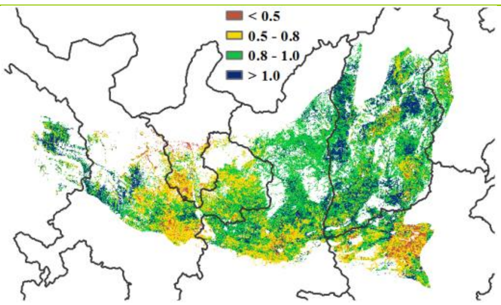
(c) NDVI profiles



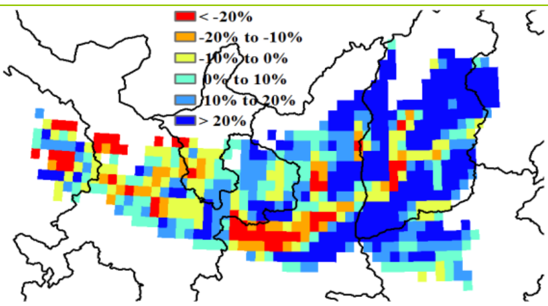
(d)Time series rainfall profile



(e)Time series temperature profile



(f) Maximum VCI



(g) Biomass departure

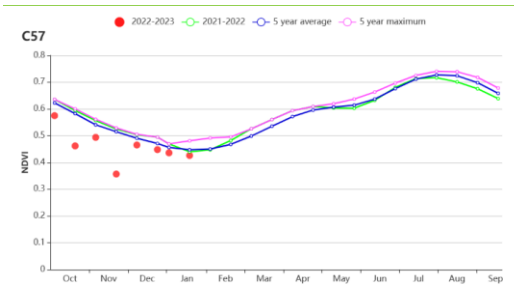
Lower Yangtze region

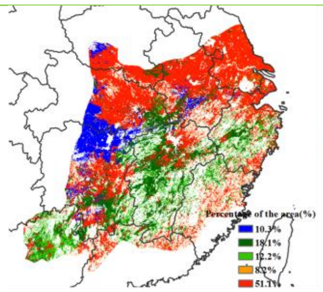
During this monitoring period, only winter crops like wheat and rapeseed were in the field, mostly in the north of the region, including parts of Hubei, Henan, Anhui and Jiangsu provinces. Limited winter crops were planted in Fujian, the southern Jiangxi and Hunan provinces.

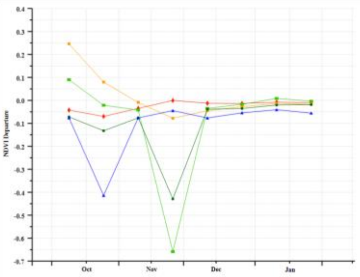
The accumulated precipitation was 19% below the average. Temperature and photosynthetically active radiation were 1.0℃ and 7% higher than the 15-year averages, respectively. The drought conditions caused a negative departure of the biomass production potential by 10%. The rainfall profile indicates that the precipitation in late November exceeded the maximum in 15 years, but the precipitation in other periods was mostly lower than the average. As shown in the NDVI development graph, crop conditions were below the 5-year average throughout this period. 51.1% of the region, mainly in the northern part, including Jiangsu, Anhui, Henan, northern Jiangxi and northern Hubei, had slightly below-average crop growth until late November, after which the crops improved to average. The potential biomass departure in this part had values between -20% and +20%. Crop growth in the rest of the region also started to improve in December and gradually approached the average level. The average VCIx of this region was 0.84. Most of Jiangsu had VCIx values ranging from 0.8 to 1, the other parts had VCIx values ranging from 0.5 to 1.

In general, the crop conditions in the Lower Yangtze region were close to average.

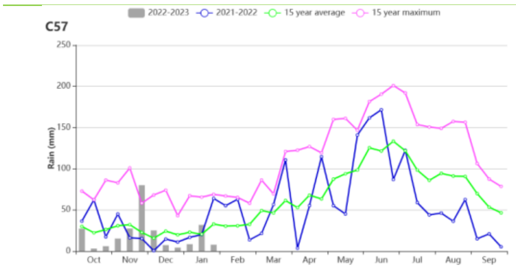
Figure 4. 11 Crop condition China Lower Yangtze region, October 2022 – January 2023

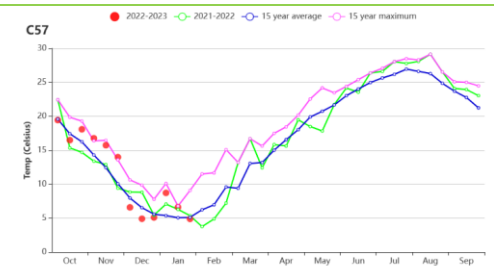




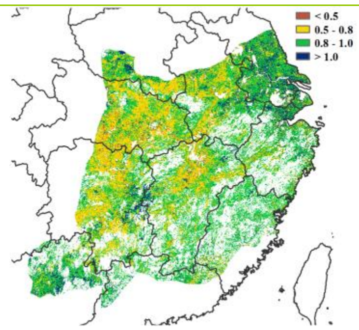


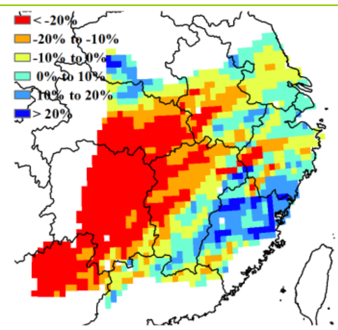
(a) Crop condition development graph based on NDVI (b) Spatial NDVI patterns compared to 5YA(c) NDVI profiles





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





(f) Maximum VCI (g) Biomass departure

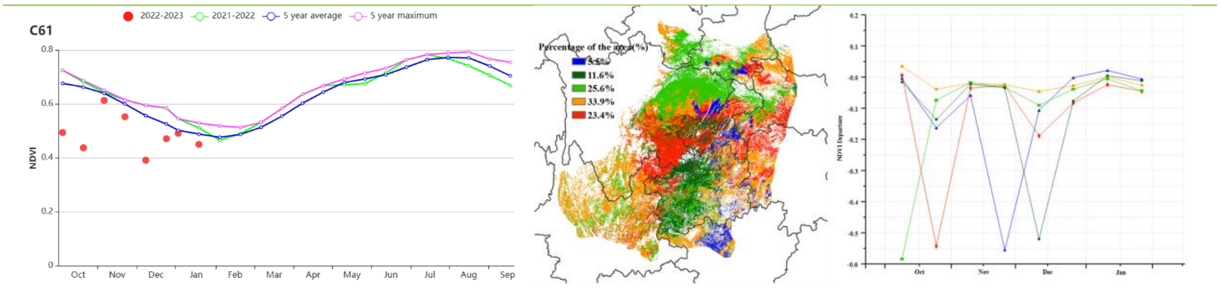
Southwest region

The reporting period covers the planting and establishment of winter wheat in southwest China. However, this region is only a minor producer of wheat in China.

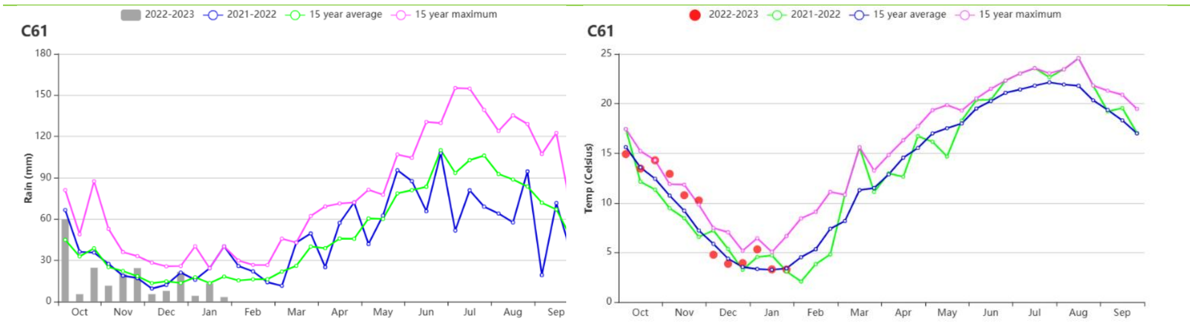
During this monitoring period, agroclimatic indicators showed that the RAIN in this region was 202 mm, 26% below the 15-year average, and the TEMP was 8.4℃, 0.7℃ above the 15-year average. The decrease in rainy weather also led to a small increase in RADPAR (+10%). Overall low precipitation resulted in a 15% lower BIOMSS than the 15YA. The VCIx in the area was 0.89 and the arable land was almost fully utilized, and CALF is the same as in previous years.

The potential biomass map shows a significantly drop in production in the southern part of this region. However, in this region, most of the winter wheat is grown in Sichuan, where conditions were more favorable. VCIx values in some areas are greater than 1.0, indicating that overwintering crop growth exceeds the best conditions of the last 5 years. Overall across the region,, the crop conditions were slightly below average, due to a rainfall deficit.

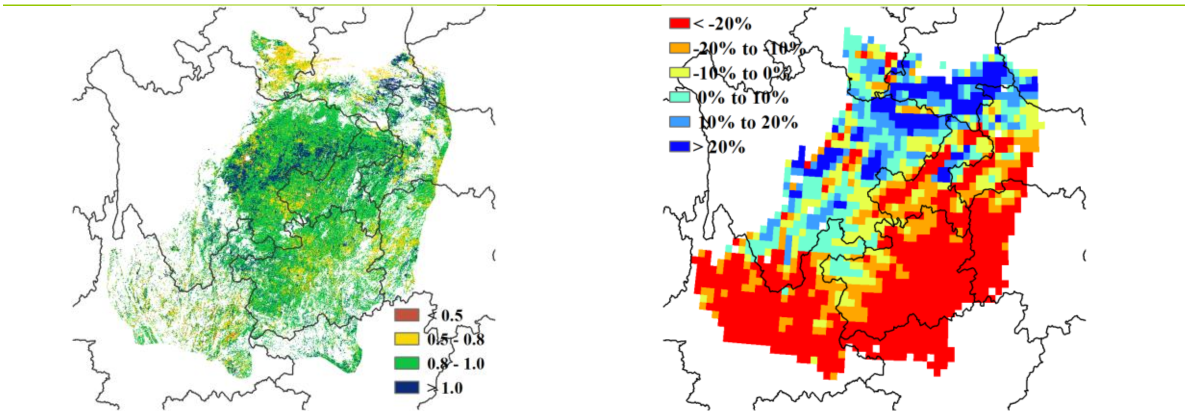
Figure 4. 12 Crop condition China Southwest region, October 2022 - January 2023



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



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



(f) Maximum VCI (g) Biomass departure

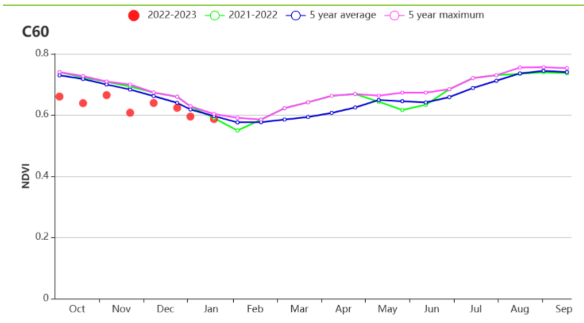
Southern China

The reporting period covers the harvest period of late rice in Southern China. As presented by the agro-climate indicators, the temperature (+0.6°C) and radiation (+9%) in this area were above the 15YA, but precipitation was below (-24%), which resulted in a below-average biomass production potential (BIOMSS -17%). Based on the potential biomass departure map, BIOMSS in most of Southern China was significantly below average.

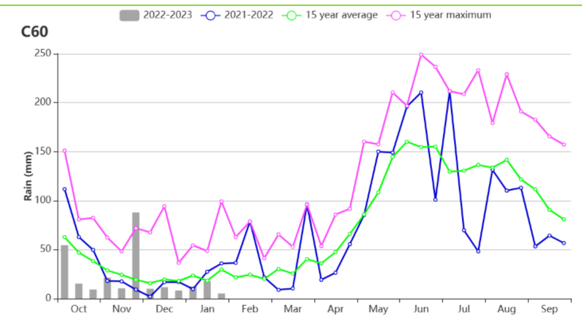
The NDVI development graph also showed below average conditions during the harvest period of late rice in October and early November. Rainfall was generally below average, apart from late November, when the crops had been harvested already.

All in all, crop conditions were close to normal.

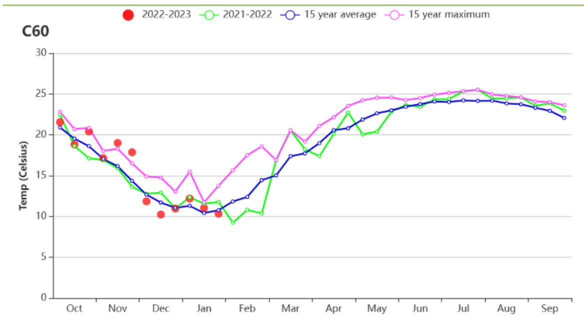
Figure 4. 13 Crop condition Southern China, October 2022 - January 2023



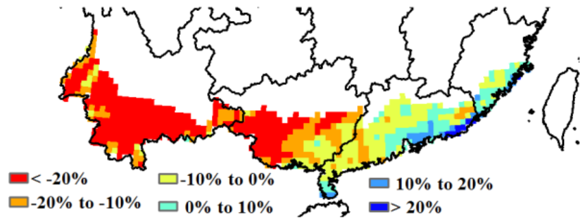
(a) Crop condition development graph based on NDVI



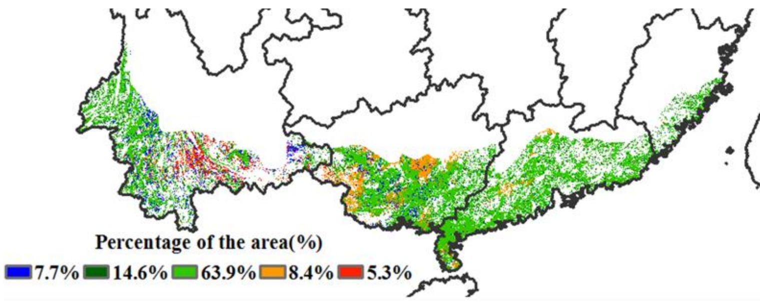
(b)Time series rainfall profile



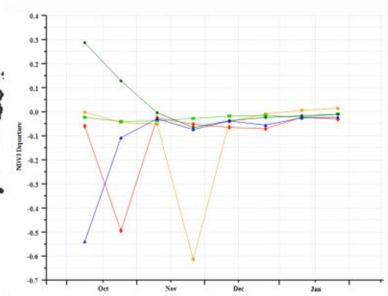
(c)Time series temperature profile



(d) Biomass departure



(b) Spatial NDVI patterns compared to 5YA



(c) NDVI profiles

Chapter 5. Focus and perspectives

Building on the CropWatch analyses presented in chapters 1 through 4, this chapter presents first the global crop production index as of January 2023 (section 5.1), early outlook of crop production for 2023 (section 5.2), sections on recent regional conflict and disaster events (section 5.3), and an update on El Niño (section 5.4).

5.1 Global Crop Production Index

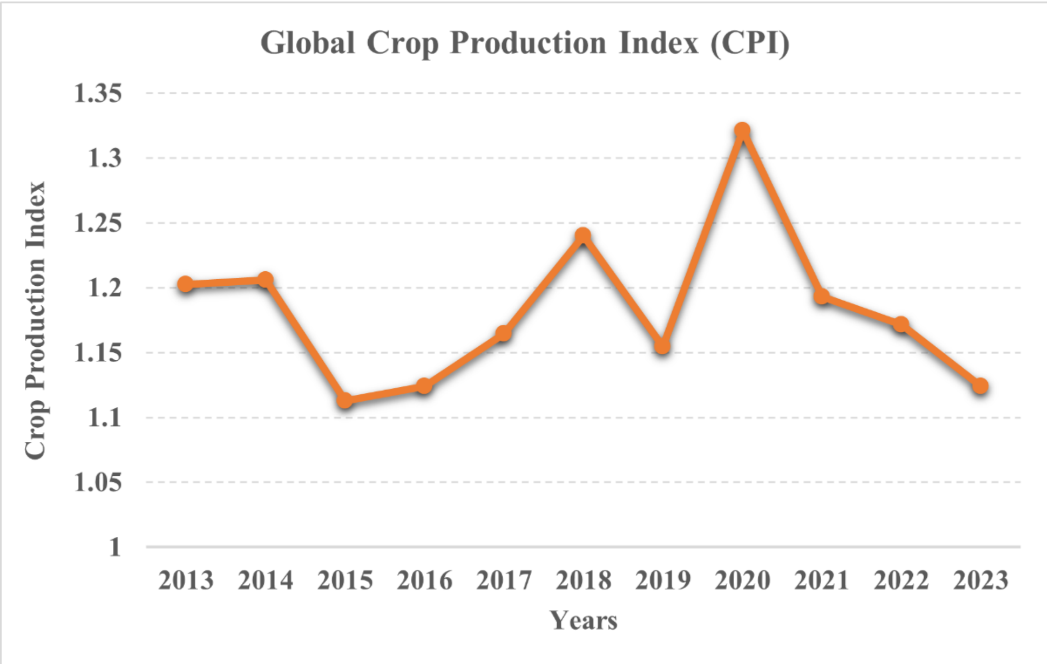


Figure 5.1 Global CPI for the past 11 years during the current monitoring period (from October of the previous year to January of the current year).

For the current monitoring period, the Crop Production Index (CPI) for global crop production reached its highest level in almost 11 years in 2020. However, from 2021 onwards, the global CPI declines for three consecutive years, from 1.19 to 1.12 in 2023, which is close to the lowest level in the past 11 years (i.e. 1.11 in 2015) and the second lowest level in nearly 11 years. The downward trend in the CPI over the past three years indicates that global agricultural production is facing severe challenges, which are expected to continue in 2023. The causes of this trend are complex, but climate change and extreme weather events appear to be key factors. Effective strategies are needed to mitigate the impact of these factors and ensure sustainable agricultural production to meet the growing global demand for food.

The Crop Production Index (CPI) is an indicator proposed by CropWatch 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.

5.2 CropWatch food production estimates

Production estimates

In order to ensure the accuracy of crop yield forecasting, this bulletin focuses on the major food producing countries in the equatorial region and the southern hemisphere, as well as forecasts the summer crop yields of a few countries in the northern hemisphere (e.g., Pakistan and India).

The CropWatch system for estimating crop yields mainly uses remote sensing data as the primary data source for agricultural producing countries, and combines ground-based measurement, crop masks, and statistical data from some foreign countries. The calibration of the yield prediction model is carried out separately for different crops (Table 5.1). Based on vegetation indices and cultivated land ratios of different crop masks, the system monitors the annual variations in crop yield and cultivated area, and predicts the yield for the current year by combining with the previous year's production.

Table 5.1 2023 cereal and soybean production estimates in thousand tonnes. Δ is the percentage of change of 2023 production when compared with corresponding 2022 values.

	Maize		Rice		Wheat		Soybean	
	2023	Δ%	2023	Δ%	2023	Δ%	2023	Δ%
Africa								
Angola	2,672	-2	36	-27				
Egypt					11,330	1		
Kenya	1,808	-7						
Morocco					7,917	31		
Mozambique	2,405	9	422	6				
Nigeria	11,377	-4						
South Africa	3,571	0						
Zambia	2,672	-2	36	-27				
Asia								
Bangladesh	3,713	0	45,839	-5				
Cambodia			9,575	-2				
India					92,557	-1		
Indonesia	19,586	2	66,538	2				
Myanmar			24,198	-2				
Pakistan					24,746	-3		
Philippines			22,407	5				
Sri Lanka			2,500	1				
Thailand			39,084	1				
Vietnam			46,895	0				
America								
Argentina	55,924	2	1,771	-4			50,022	-3

	Maize		Rice		Wheat		Soybean	
	2023	Δ%	2023	Δ%	2023	Δ%	2023	Δ%
Brazil	93,603	3	10,788	-5			105,178	11
Mexico	21,577	-7			4,138	3		

Maize

The predicted maize production of 10 major producing countries is listed in Table 5.1, including the second and third largest exporters (i.e., Brazil and Argentina). The total maize production of these 10 countries accounts for approximately 20% of global production. Due to the impact of persistent drought, the first maize production in central and southern Brazil has been reduced to 22.169 million tonnes by 3.5% on the basis of the 2021-2022. The second maize received rainfall close to the average in crop growth period, and irrigation in some areas ensured an increase of 4.5% second maize production. The total maize production in Brazil is expected to reach 93.603 million tonnes with an increase of 2.5%. In Argentina, continuous dry weather in the past four months has led to delayed sowing of autumn crops and poor growth conditions of early-planted maize. Some farmers are still rushing to plant maize since the significant increase in rainfall since January 2023. The improvement in rainfall will be favorable for the growth and development of late-planted maize. The maize production in Argentina is expected to be 55.924 million tonnes with a slight increase of 1.7%.

Drought has also spread to the major maize-producing countries in Africa. Among them, South Africa is the most severely affected by the drought, with rainfall in its maize-producing areas more than 40% below normal, resulting in a decrease in both maize yield and planting area, and a 4.1% decrease in total maize production. Kenya and Angola experienced continuous drought before and after maize planting, resulting in a 6.5% and 2.4% decrease in production, respectively. Slight drought also occurred in Mozambique's main maize-producing areas, resulting in a slight decrease in maize yield, but the increase in maize cultivation area offset the impact of the decrease in yield, resulting in a significant increase of 9.1% in total maize production. Indonesia had sufficient rainfall, providing adequate moisture for maize production, and total maize production increased to 19.586 million tonnes (+2.3%). Despite some areas alleviating the impact of drought through irrigation, the total maize production in Mexico's main maize-producing areas in the northwest was still 6.8% lower than in 2021-2022 due to persistent low rainfall. Maize production in Bangladesh and Zambia remained similar to the previous year.

Rice

The rice production forecast in this bulletin mainly covers the major rice-producing countries in South and Southeast Asia, including 12 major rice-producing countries. The rice production of the monitored countries accounts for 35% of the global production, and the overall production is expected to decrease slightly by 0.1%. Rice production in most countries in South and Southeast Asia is close to 2022. The rice cultivation area in Bangladesh has decreased compared to the 2021-2022, resulting in a 4.5% decrease in total rice production, while the agro-climatic conditions in the Philippines are generally better than last year, and rice production is expected to increase by 5.3%. There are significant differences in the growth conditions of drought-season rice in the Mekong sub-region countries. Cambodia is expected to experience a significant decline in drought-season rice production, with a decrease of 2.2% in whole country, while Thailand is expected to experience a slight increase in drought-season rice production, with a total rice production increase of 0.6%. The changes in rice production in Indonesia, Myanmar, Sri Lanka, and Vietnam are all less than 2%. Rice yield and cultivation area in Brazil and Argentina have both decreased slightly, with total rice production decreasing by 5.0% and 4.1%, respectively.

Wheat

Wheat completed harvesting in Argentina, Australia, Brazil, Ethiopia, South Africa, and Zambia in the southern hemisphere in 2022. This bulletin focuses on wheat-producing countries in tropical and subtropical regions, including Egypt, Morocco, India, Pakistan, and Mexico. Compared to 2021-2022, agro-climatic conditions in Morocco have improved significantly, leading to a recovery in both wheat yield and cultivation area, and total production has increased significantly to 7.917 million tonnes (+30.9%), but still significantly lower than the high-yield year in 2020-2021. The agro-climatic conditions in the wheat production areas in northern Mexico are better than the national average, with an increase in wheat planting area, leading to a 3.1% increase in wheat production. Wheat planting mostly adopts irrigation measures in Egypt, India, and Pakistan, with relatively small changes in wheat yield. Remote sensing data shows that the wheat planting area has decreased slightly in India and Pakistan, while that in Egypt has increased, and it is expected that wheat production in Pakistan and India will decrease by 3.2% and 0.7%, respectively, and wheat production in Egypt will increase by 0.8%.

Soybean

The soybean production of Brazil and Argentina is only second to that of the United States. CropWatch predicts that Brazil's soybean production will increase significantly to reach 105.178 million tonnes (+ 10.6%), with the main reason being the expansion of soybean cultivation area. The planted area of soybeans in Argentina has also increased, but drought occurred in the main soybean producing areas, which led to a delay in the soybean sowing period. Although rainfall returned to normal in January 2023 and the growth of late-planted soybeans improved, the delay in the phenological period will affect the yield of late-planted soybeans, and it is expected that the national average soybean yield will decrease by 5.7%, with a total production decrease to 50.022 million tonnes (-3.4%).

5.3 Conflicts and Disaster events

This section covers the October 2022 - January 2023 disaster events worldwide. Apart from floods, cyclones and droughts, this section also highlights the current situation of the Desert locust across the globe.

Russia-Ukraine conflict

The large-scale conflict between Russia and Ukraine, which broke out on February 24, 2022, continues to devastate the region. As the conflict approaches its first anniversary, there appears to be no end in sight. The conflict has also had far-reaching impacts, disrupting the global agricultural system, which is struggling to cope with the adverse effects of climate change and the COVID-19 pandemic. The impact of the crisis is alarming, not only threatening supply chains but also posing significant food production and trade risks.

As the conflict's first anniversary approaches, some positive developments occurred in agriculture of Ukraine, such as the national cropped arable land fraction, which according to the Remote Sensing CropWatch monitoring system, has increased by 13% from October 2022-January 2023 compared to the average of the past five years. The Southern wheat and winter crops area have seen an increase by 29%, while in the Central wheat area, it has increased by 14%, which could lead to an increase in total grain production. However, these developments must be viewed in the context of the ongoing conflict, as reports indicate that global market conditions might not provide short-term relief, leading to more pain for communities that are already suffering from hunger.

Flood and Landslide

During the initial week of 2023, 18 floods and 6 landslides impacted Indonesia and the Philippines. As per reports from the Badan Nasional Penanggulangan Bencana (BNPB), Banten, West Java, Central Java, East Java, East Nusa Tenggara, West Sulawesi, and South Sulawesi areas were affected by floods, landslides, and wind-related disasters that were triggered by moderate to heavy rainfall, overflowing rivers, and strong winds. In early October, Costa Rica was overwhelmed by Cyclone Julia which brought together rains which exceeded 200 mm, causing rivers and streams to overflow.

THE PHILIPPINES: Starting around December 23, 2022, a combination of a Shear Line storm and a trough of low pressure caused extensive damage, including floods and landslides, throughout the Philippines. The calamity initially impacted around 200,000 people and resulted in 17 fatalities as of December 27, 2022. However, only four days later on January 1, 2023, the number of affected people skyrocketed to nearly 600,000, and the fatality count rose by over 100% to 51. As of January 8, 2023, the number of dead reached 52, with 18 people still missing and 16 injured. Over 600,000 people were affected. Additionally, a separate incident involving a Low-Pressure system caused flooding due to continuous light to moderate heavy rains in various municipalities in MIMAROPA as of January 4, 2023. This episode affected a total of 3,275 people across 18 flooded areas.

Fire

RECORD BURNING IN THE AMAZON RAINFOREST: The role played by the Amazon rainforest in regulating the Earth's climate is crucial, making it one of the most significant ecosystems on the planet. Regrettably, in recent years, there has been an unprecedented surge in forest fires, with 2022 experiencing a notable increase.

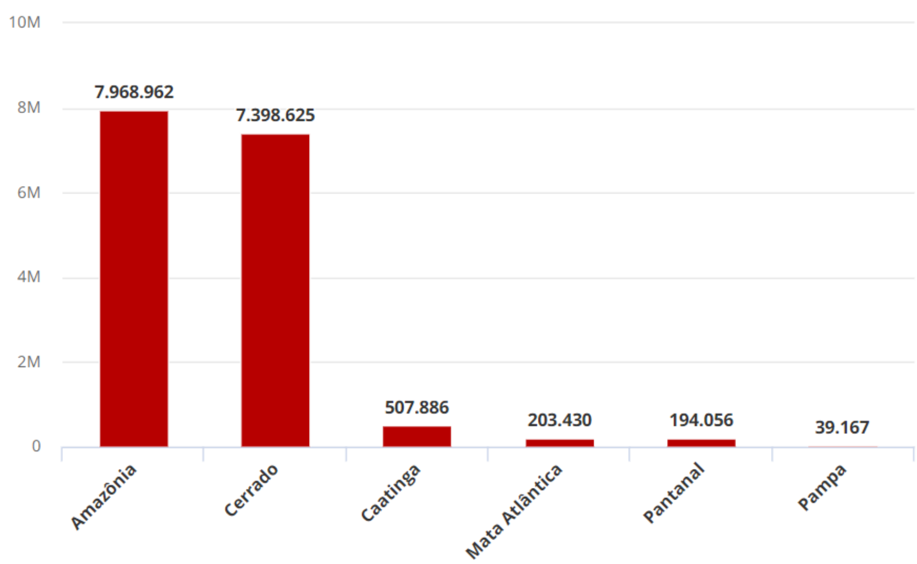


Figure 5.2 Territories most affected by wildfires (in hectares) (Source: https://g1.globo.com/meio-ambiente/noticia/2023/01/31/area-de-florestas-queimadas-quase-dobra-em-1-ano-diz-mapbiomas.ghtml).

In 2022, there were high levels of fires in the Amazon. The Instituto Nacional de Pesquisas Espaciais's (INPE) Fire Program registered almost 115,000 fire outbreaks, the highest number since 2010 and a 53% increase from 2021.

In December alone, there were 2,743 fire outbreaks in the Amazon rainforest, which is an unusual situation for the period as it is typically marked by rainfall and low number of fires. This represents a 73% increase from the same period the previous year when 1,584 fire outbreaks were identified. Fires are not a natural occurrence in the humid, tropical Amazon rainforest. Instead, farmers resort to deforestation and burning of trees to clear land, and on occasion, these fires spiral out of control. Although fires may lead to deforestation in the Amazon rainforest, which alters the climate patterns, the newly created agricultural fields may, at some point, lead to increases in grain production, at least in the short term. This could potentially alleviate global food insecurity through grain exports. However, in the long run crop production will drop and become erratic, because of a reduction in rainfall and prolonged droughts.

Drought

EAST AFRICA: As of October 2022, the drought situation in East Africa was in watch condition due to the deficit in rainfall with warning conditions in Ethiopia, Somalia, Kenya, and Uganda. The indicator showed a drought alert situation in Northwestern Tanzania and across Kenya, while the other regions were on watch. The watch situation prevailed over the region by the end of January with some warning conditions scattered across Kenya, Somalia, and Ethiopia.

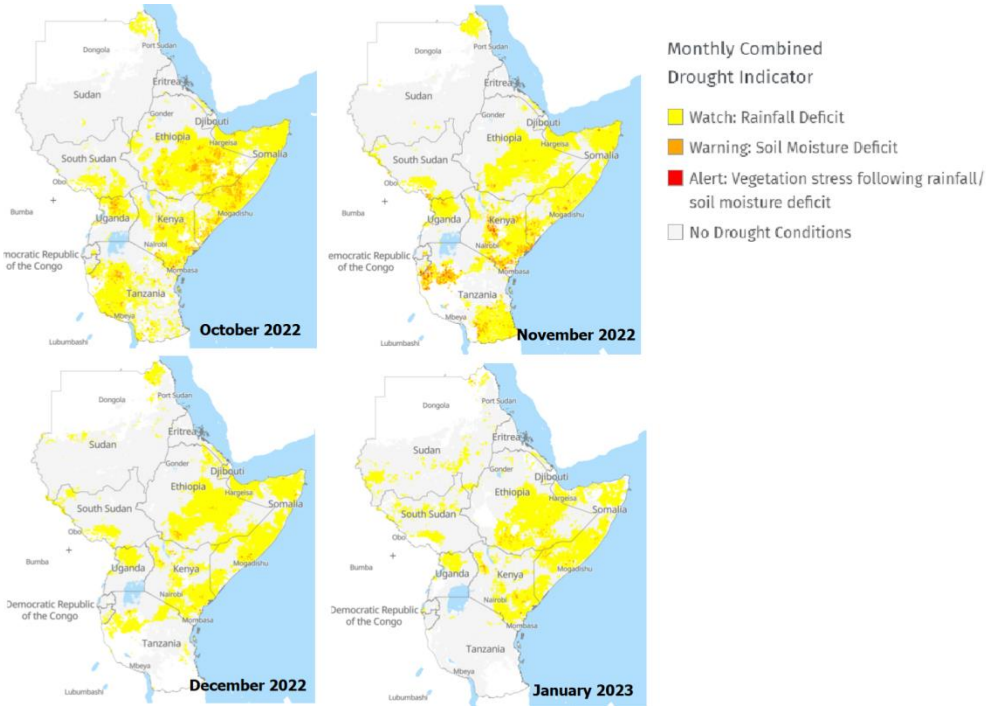


Figure 5.3 Monthly combined drought indicator for west Africa from October 2022-January 2023 (Source: https://droughtwatch.icpac.net/mapviewer/)

As of December 2022, many areas in the Horn of Africa have experienced their fifth consecutive failed rainy season, resulting in the most prolonged and severe drought that the region has encountered in recent history. This drought surpasses that of 2010-2011 and 2016-17. It was projected that about 21 million people could face acute food insecurity between October and

December 2022, and over 8.9 million livestock have died across the region. Furthermore, pastoralists are reportedly traveling further to find food and water for their livestock, which often leads to an increase in conflicts between communities. In some areas, agro-pastoralists and agriculturalists are experiencing poor crop yields due to prolonged crop moisture stress, resulting in a reduction of up to 70% in crop yields during the 2022 long rains season.

URUGUAY: The country has been facing severe droughts in its agricultural areas since 2018, which have led to reduced rainfall and increased temperatures during the summer seasons. According to reports, 60% of the country's territory is experiencing extreme or severe drought. Over 75,000 people have been affected by the emergency, with the lack of access to safe water being a pressing concern. To address the situation, the national government declared a state of agricultural emergency until the end of April 2023. The emergency declaration includes livestock, dairy, fruit, horticulture, agriculture, poultry, beekeeping, and forestry. Reports indicate that droughts are affecting the country, with 20.51% of the territory experiencing extreme drought. The situation remains a concern for the country's food security and rural development.

ARGENTINA: Since 2019, several parts of Argentina and neighboring countries have been experiencing drought conditions. During the months of September, October, November, and December 2022, the precipitation levels were below half of the average, marking the lowest rainfall in 35 years. The combination of low precipitation and high temperatures (with the country experiencing its warmest November-January) has led to widespread crop failure. Consequently, the country, which is one of the major wheat exporters, expects a 28% drop in total exports compared to the 2022 levels.

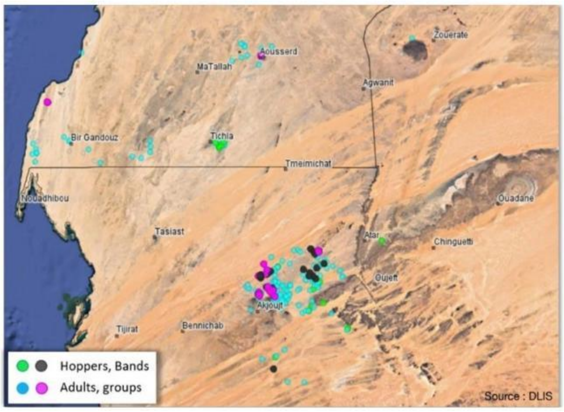
PERU: As of November 2022, Peru's government declared a state of emergency aimed at the drought situation in the country, which according to the national weather service, Senamhi, is one of the worst when compared to the past half century, which is exacerbated by the offshore La Nina weather phenomenon. The drought in the Peruvian Andes has ravaged alpaca flocks and withered potato crops. Also, the Andean hamlets for Quechua- and Aymara-speaking indigenous groups have faced critical losses of crops and livestock herds.

Türkiye: As of December 2021, the country experienced its warmest December in nearly 52 years, leading to a drastic decrease in rainfall and exacerbating the drought situation in Türkiye, particularly in many of its agricultural areas. The critically low dam levels resulting from the drought could negatively impact the country's agricultural output. The lack of snow and rain during winter worsens the drought conditions, putting many parts of the country at risk of further suffering. As the drought persists, the production of fruits and vegetables will most certainly be negatively affected, which will not only impact the agricultural sector but also put significant strain on the country's economy and food security. The great earthquake in Türkiye occurred after this monitoring period, and the impact of the earthquake will be the focus of the next monitoring period.

Desert locust

According to the FAO's reports, the Desert Locust situation in October 2022 was calm, with only low numbers of solitarious adults and hoppers observed in certain areas. In northwest Mauritania, a few copulating adults and transients' hoppers were treated in an area of 213 ha, while a group of adults was sighted in Sudan. Light rain fell intermittently along the Red Sea coast of Yemen, and rain had started in some parts of the coast of Sudan, Eritrea, and Saudi Arabia. No locusts or rain were reported in Southeast Asia during this period.

In November 2022, the CASEarth working group on Monitoring and assessment of desert locusts in Asia and Africa reported that suitable conditions for the survival and reproduction of the desert locust were observed in northwestern Somalia due to increased rainfall and vegetation. A total of 54.7 thousand hectares of vegetation were damaged during this period, including 0.2 thousand hectares of cropland, 2.1 thousand hectares of grassland, and 52.4 thousand hectares of shrub, which account for 2.06%, 0.5%, and 1.1% of the total country's area of cropland, grassland, and shrub, respectively. The north-West province had the largest damaged area of 23.3 thousand hectares, followed by Togdheer with 17.5 thousand hectares, and Sanaag and Awdal with 8.9 and 5.0 thousand hectares of affected areas, respectively. During the same period, the western coast of the Red Sea in Yemen reported the presence of Desert Locust due to the combination of low rainfall and sufficient vegetation, which creates favourable conditions for their survival and reproduction. The total vegetation damage in the region was about 64.4 thousand hectares, with 8.2 thousand hectares of grassland and 56.2 thousand hectares of shrub, accounting for 2.85% and 1.40% of the total area of grassland and shrub in Yemen, respectively. In December 2022, a very small outbreak continued in northwest Mauritania and low numbers of locust adults were observed in the southern Western Sahara of Morocco.



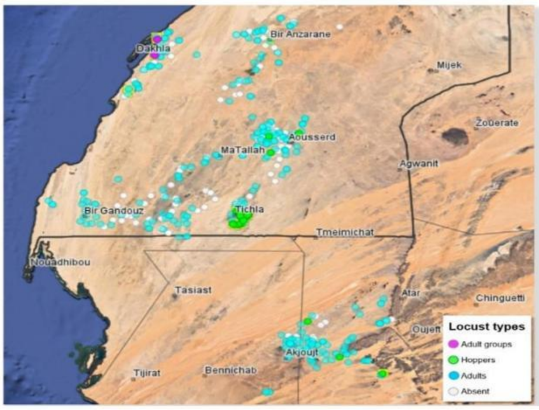


Figure 5.4 Desert locust situation as for December 2022, on the left (Source: http://desertlocust-crc.org/Pages/NewsDetails.aspx?lang=EN&Cat=2&I=0&DId=0&CId=0&CMSId=800362&id=2407045) and January 2023, on the right (Source: https://www.fao.org/ag/locusts/en/info/info/index.html)

In January 2023, scattered hoppers and adults with a few adult groups were present in the southern Western Sahara of Morocco. On the Red Sea coast, hoppers and adults were present in Sudan and low numbers of adults were present on the coast of Yemen, Saudi Arabia, Eritrea, and northwest Somalia.

5.4 Update on El Niño

According to the Australian Government Bureau of Meteorology, the La Niña event in the tropical Pacific Ocean is ongoing, and while oceanic indicators like sea surface temperatures have weakened to ENSO-neutral values, the atmosphere remains La Niña-like. Despite the weakening, La Niña can continue to impact global weather and climate. Forecasts suggest that sea surface temperatures in the central Pacific Ocean will warm further, but remain at neutral levels until at least mid-autumn.

Figure 5.4 depicts the standard Southern Oscillation Index (SOI) behavior from January 2022 to January 2023. The SOI has been positive and high (greater than +7) for the past four months, with the exception of November 2022. However, there has been a recent weakening trend, with the SOI declining from 20 in 2022 to 11.8 in 2023. This suggests a weakening of La Niña's influence, despite its continued presence during the monitoring period.

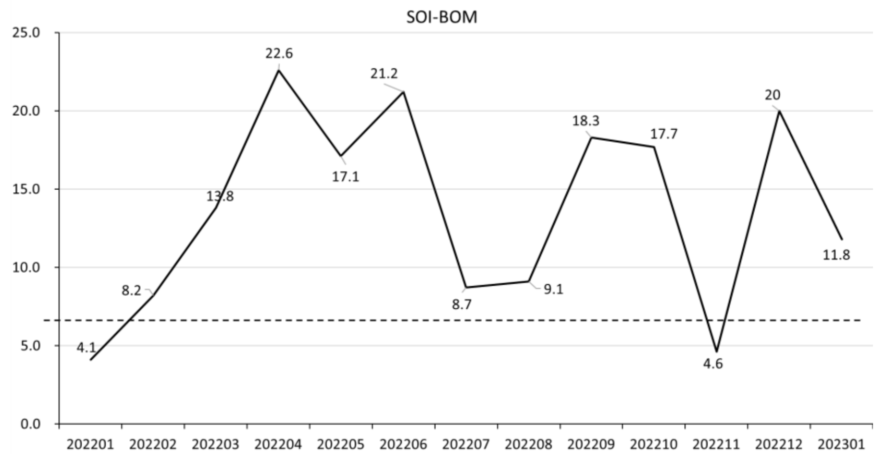


Figure 5.5 Monthly SOI-BOM time series from January 2022 to January 2023 (Source: http://www.bom.gov.au/climate/enso/soi/)

The Oceanic Niño Index (ONI) is another widely-used measure of El Niño. Figure 5.5 displays several ONIs and their respective locations. A quick analysis of Table 5.2 reveals that all three regions (NINO3, NINO3.4, and NINO4) had negative values throughout the four-month period, with the values for NINO3 and NINO3.4 regions consistently negative and of similar magnitude. The NINO4 region exhibited consistently negative values of less than -5 ° C, which is indicative of cooler-than-average sea surface temperatures and consistent with a La Niña event. It's worth noting that the negative values in the NINO indices suggest the persistence of La Niña conditions in the tropical Pacific Ocean during this period. However, the values for January 2023 were less negative than those of the previous three months, indicating a possible weakening or transition to neutral conditions.

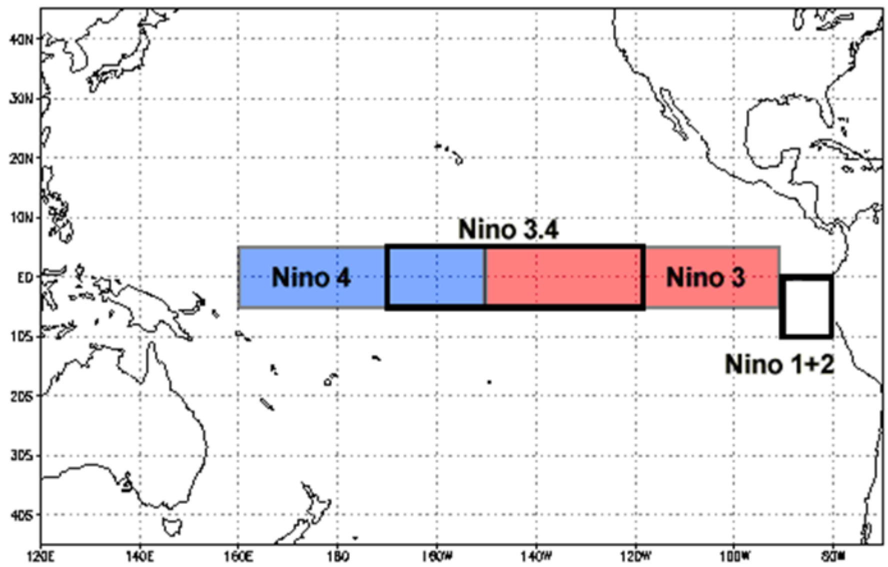


Figure 5.6 Map of NINO Region(Source: https://www.ncdc.noaa.gov/teleconnections/enso/sst)

Table 5.2 Anomalies of ONIs (°C), October 2022 to January 2023(Source: https://www.cpc.ncep.noaa.gov/data/indices/sstoi.indices)

Year	Month	NINO3	NINO3.4	NINO4
2022	10	-0.92	-0.85	-1.08
2022	11	-0.89	-0.93	-0.90
2022	12	-0.78	-0.84	-0.73
2023	1	-0.50	-0.69	-0.60

Sea surface temperature (SSTs) (Figure 5.5) for January 2023 were cooler than average across the central tropical Pacific Ocean, extending from around 170° E to around 100° W, although anomalies were generally less than 1 degree cooler than average. Warm anomalies up to 2 degrees above average were observed in a band across the South Pacific stretching from the South American coast around 40° S towards the Coral Sea, while weaker warm anomalies were present across much of the Maritime Continent. Warm SST anomalies also continue to the south of Australia, especially around Tasmania and in waters close to New Zealand.

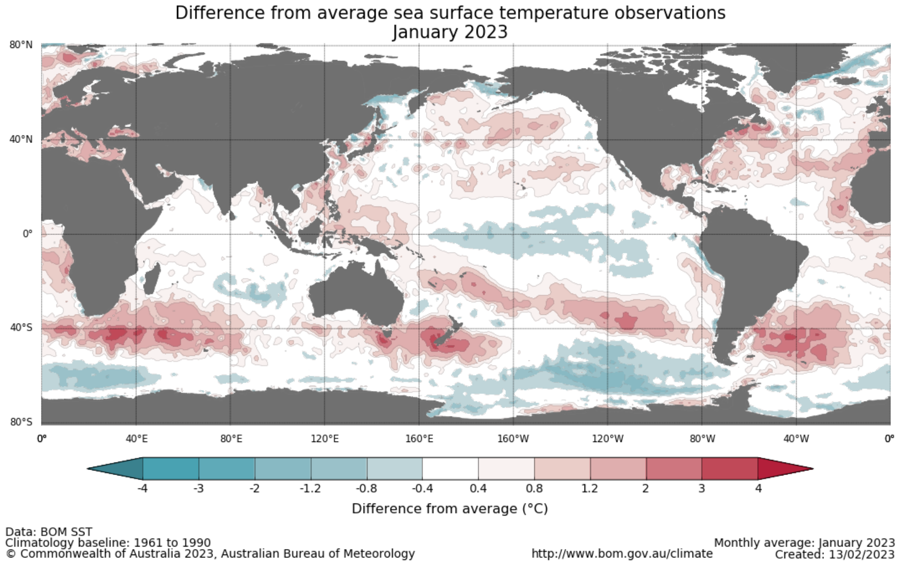


Figure 5.7 Monthly temperature anomalies for January 2023(Source: http://www.bom.gov.au/climate/enso/index.shtml#tabs=Pacific-Ocean)

La Niña has affected different regions in different ways, including more frequent and intense tropical cyclones in the western Pacific, increased rainfall in parts of Southeast Asia, Australia, and South America, drier conditions in parts of Indonesia, Malaysia, and the Philippines, and colder temperatures in some parts of North America. These effects are ongoing, but are expected to ease in the coming months.

***East* Africa**

The Horn of Africa is currently facing its worst drought in over 40 years, with Ethiopia, Kenya, and Somalia experiencing persistent and widespread drought, particularly in the eastern coastal regions. The cause of this drought can be attributed to the jet stream, which is diverting moisture away from the region to areas with lower atmospheric pressure. Unfortunately, the drought is ongoing and is expected to likely continue through the summer of 2023. Urgent humanitarian aid is required on the ground to address the situation [2].

South America

This current La Niña event has persisted for an unusually long period of time and is the primary cause of the devastating drought that has been impacting central South America. The region has been experiencing drought since 2019, with Uruguay declaring an agricultural emergency in October of last year. In addition, the central region of Argentina has experienced its driest year since 1960, resulting in widespread crop failures (figure 5.7). The southern region of Brazil, including Rio Grande do Sul, has also been affected by the drought.

In summary, La Niña has continued to prevail over the past four months, but has begun to weaken. The impacts of La Niña on global weather and climate are ongoing, but it is difficult to predict specific climate events or disasters that may occur in a particular location during a specific time frame.

Figure 5.8 A general view of a farm shows corn and cotton that was planted where corn was ruined by the weather, in Tostado, northern Santa Fe Argentina in February 8, 2023.

Annex A. Agroclimatic indicators and BIOMSS

Table A.1 October 2022 - January 2023 agroclimatic indicators and biomass by global Monitoring and Reporting Unit (MRU)

105 Global MRUs		RAIN Current(mm)	RAIN 15YA dep.(%)	TEMP Current(°C)	TEMP 15YA dep.(°C)	RADPAR Current (MJ/m2)	RADPAR 15YA dep.(%)	BIOMSS Current (gDM/m2)	BIOMSS 15YA dep.(%)
C01	Equatorial central Africa_zone1 (Cameron, Central African Republic, and South Sudan)	322	-17	23.4	-0.3	1274	0	1398	-3
C02	Equatorial central Africa_zone2 (North DRC, Equatorial Guinea, Uganda, Republic of Congo)	870	-4	22.9	-0.4	1141	-3	1336	-7
C03	Equatorial central Africa_zone3 (South DRC, Rwanda, Burundi, Gabon)	969	-15	22.3	-0.2	1181	0	857	-12
C04	Equatorial central Africa_zone4 (Angola, Zambia, and Malawi)	703	-24	22.1	0.1	1299	3	407	-13
C05	East African highlands	150	-34	18.1	0.0	1297	-1	795	-12
C06	Gulf of Guinea zone1 (Nigeria, Benin, Togo, Ghana, Cote d'Ivoire, Guinea, and Guinea_Bissau)	92	-30	24.6	-0.6	1236	-1	1213	-7
C07	Gulf of Guinea zone2 (South Nigeria, Liberia, Sierra Leone, south Ghana, south Cote d'Ivoire, and west Genua)	377	-14	24.8	-0.3	1168	-2	1353	-8
C08	Horn of Africa	243	-34	21.7	0.2	1322	3	534	-13
C09	Madagascar(main)	966	13	22.3	-0.7	1333	-1	622	-1
C10	SW Madagascar	550	57	25.7	-0.4	1364	-5	430	-4
C11	North Africa Mediterranean	108	-46	13.0	1.1	746	4	533	-8
C12	Sahel	54	-13	24.7	-0.6	1231	-1	1146	9
C13	Southern Africa_zone1 (West Angolan coast)	581	-19	23.6	-0.3	1246	0	555	-10
C14	Southern Africa_zone10 (Middle part of South Africa)	126	-16	22.7	0.9	1584	0	318	-8
C15	Southern Africa_zone2 (southeastern Kenya, East Tanzania, and Mozambique)	557	-14	25.2	0.1	1379	4	488	-9
C16	Southern Africa_zone3 (South Zambia)	680	-19	24.1	-0.2	1325	-2	379	-11
C17	Southern Africa_zone4 (Zimbabwe)	539	-19	23.6	0.1	1392	1	378	-7
C18	Southern Africa_zone5 (Northeast of Namibia, Botswana, and south Zimbabwe and Mozambique)	246	-44	25.1	0.6	1393	1	404	-3
C19	Southern Africa_zone6 (West Namibia coast)	223	-21	24.4	0.2	1397	-5	415	0
C20	Southern Africa_zone7 (Southeast Namibia, Southwest Botswana, and northeast of South Africa)	32	-41	25.6	1.6	1671	-4	288	-1
C21	Southern Africa_zone8 (South Africa and southwest Namibia)	32	-53	20.1	0.9	1652	-1	336	-26

C22	Southern Africa_zone9 (western part of South Africa, Lesotho, and Eswatini)	176	-43	20.8	1.2	1470	3	384	-12
C23	S. Africa Western Cape	93	-38	18.9	0.9	1530	0	424	-26
C24	British Columbia To Colorado	315	-11	-2.5	-0.3	448	1	552	-12
C25	America northern great plains_canada	159	9	-4.1	0.0	321	0	547	-15
C26	America northeastern great plains	217	-10	2.0	0.3	483	0	689	-17
C27	America northwestern great plains	153	6	-1.0	-0.8	464	-2	574	-17
C28	Nnorth of high plain	150	-10	6.1	0.1	630	-2	709	-19
C29	America corn belt	383	-3	3.5	1.3	423	0	851	-4
C30	America cotton belt_Mexican coastal plain	315	12	12.9	0.5	664	-7	870	-9
C31	America cotton belt_lower Mississippi	565	17	12.7	1.2	606	-4	1033	-7
C32	America cotton belt_high plain	366	-6	11.8	1.1	625	-2	1033	-4
C33	Sub_boreal North America	211	-3	-5.2	1.2	247	2	619	-14
C34	America West Coast	570	11	7.2	-0.9	520	-1	476	-11
C35	Sierra Madre	165	-33	15.4	0.0	1050	0	1113	-8
C36	SW Mexico and N. Mexico highlands	144	5	8.0	-0.5	760	-3	743	-3
C37	Northern South and Central America	640	-9	22.3	0.0	1048	0	1358	-2
C38	Caribbean	269	-29	24.1	0.4	1060	3	1336	-3
C39	Central_Northern Andes	523	45	15.2	-1.8	1323	-5	257	-28
C40	Central_Northern Andes	699	-26	15.4	0.1	1170	3	537	-15
C41	Brazil Nordeste	154	-43	26.8	0.8	1332	-1	567	-2
C42	Central_Eastern Brazil	400	-57	26.0	1.4	1239	-2	572	-21
C43	Amazon	765	-27	25.7	0.4	1162	0	815	-14
C44	Central_North Argentina	761	39	23.6	-0.6	1331	-4	485	-5
C45	SE Brazil_Concepcion_Bahia Blanca	419	-24	22.2	0.1	1430	1	689	-9
C46	SW Southern Cone	196	-33	13.6	1.1	1519	2	535	-4
C47	Semi_arid Southern Cone	447	150	18.6	0.2	1536	-6	364	7
C48	Caucasus	192	-35	5.4	1.0	573	2	535	-12
C49	Central Asia Pamir mountains	186	-3	2.6	-0.1	714	-1	552	6
C50	Western Asia (Kazakhstan,Uzbekistan,Turkmenistan,Iran et.al)	113	-16	6.9	0.4	662	0	551	15
C51	Western Asia(Syrian, Jordan,Israel, et.al)	116	-53	13.7	1.3	710	4	489	-6
C52	Gansu-Xinjiang (China)	87	16	-5.0	-1.3	589	-1	528	-5
C53	Hainan (China)	552	-5	20.3	-0.4	757	0	1525	2
C54	Huanghuaihai (China)	127	47	5.9	0.5	650	0	877	-4
C55	Inner Mongolia (China)	61	15	-6.2	0.1	578	-1	647	-5
C56	Loess region (China)	108	31	1.1	0.5	678	-3	784	-4

C57	Lower Yangtze (China)	243	-19	11.4	1.0	682	7	983	-20
C58	Northeast China	124	28	-7.3	0.3	468	-3	859	9
C59	Qinghai-Tibet (China)	205	-2	1.5	1.0	881	1	755	2
C60	Southern China	264	-24	15.1	0.6	805	9	1280	-8
C61	Southwest China	202	-26	8.4	0.7	651	10	1054	-8
C62	Taiwan (China)	361	11	19.9	-0.4	824	1	1134	-2
C63	East Asia	296	-8	-0.4	0.6	502	1	1021	5
C64	Southern Himalayas_zone111 (Vietnam, Laos, Myanmar)	261	-22	16.6	0.5	855	13	1415	-1
C65	Southern Himalayas_zone112 (Myanmar)	169	-44	16.0	0.4	1065	8	1365	0
C66	Southern Himalayas_zone12 (India, Myanmar, Bangladesh,Bhutan)	309	-9	16.0	-0.2	966	6	1390	0
C67	Southern Himalayas_zone222 (Nepal, India)	121	18	16.1	0.0	972	1	1260	5
C68	Southern Asia	299	0	22.0	-0.1	1106	2	1425	6
C69	Southern Japan and Korea	353	-25	10.0	1.2	610	5	1238	0
C70	Mongolia region (Western of Mongolia)	39	-22	-14.0	-0.5	472	1	417	-9
C71	S. Asia Punjab to Gujarat	53	10	20.1	-0.1	982	0	1187	25
C72	SE Asia islands_zone1 (Indonesia, Malaysia)	1445	2	24.2	-0.2	1088	0	1424	10
C73	SE Asia islands_zone2 (Indonesia, Malaysia)	1370	4	24.4	0.1	1101	2	1560	6
C74	SE Asia islands_zone3 (Indonesia, Papua New Guinea)	1404	-6	23.9	0.2	1135	2	1367	8
C75	SE Asia mainland_zone1 (Myanmar, Bangladesh)	198	-36	22.9	0.8	1103	4	1464	-5
C76	SE Asia mainland_zone2 (Thailand, Myanmar, Laos)	637	24	22.5	-0.2	1068	0	1515	3
C77	SE Asia mainland_zone3 (Cambodia, Vietnam, Thailand, Laos)	525	6	22.0	-0.4	1001	1	1565	3
C78	Eastern Siberia	191	-21	-9.1	0.5	284	4	810	6
C79	Eastern Central Asia (Eastern of Mongolia)	67	-12	-13.7	0.0	375	1	658	0
C80	North Australia_zone1 (Timor_Leste, Indonesia, Papua New Guinea)	1066	12	26.4	-0.1	1391	0	1018	27
C81	North Australia_zone2 (Northern Australia)	764	31	26.4	0.0	1367	-3	635	24
C82	Australia Queensland to Victoria _zone1 (Southeast Australia_coast)	352	7	17.8	-1.5	1346	-5	789	32
C83	Australia Queensland to Victoria _zone21 (Southeast Australia Marrin Darling)	257	34	21.0	-1.9	1433	-6	728	46
C84	Australia Queensland to Victoria _zone22 (Southeast Australia Adeleid)	234	24	16.5	-0.4	1265	-6	786	10
C85	Australia Nullarbor_Darling_zone1 (Southwest Australia)	85	-17	18.8	-1.4	1480	-3	572	10
C86	Australia Nullarbor_Darling_zone2 (Southwest Australia)	86	-19	18.3	-0.9	1496	-2	696	2
C87	New Zealand	540	67	13.5	0.1	1163	-10	700	7
C88	Boreal Eurasia	361	-4	-2.5	0.6	122	-2	692	-4
C89	Ukraine to URAL Mountains	290	7	-0.1	0.8	167	-11	707	4

C90	Mediterranean Europe and Türkiye	332	-13	10.0	1.6	544	1	579	-5
C91	W. Europe _zone1 (Germany, Poland, Switzerland, Czechia, Hungary, Austria, and Balkans countries)	290	-10	5.3	1.7	291	2	655	-12
C92	W. Europe_ zone10 (Northwestern Greece and southwestern of Albania)	689	-3	10.4	1.7	536	3	747	-7
C93	W. Europe_zone2 (Southeastern of Romania, Moldova, and southwestern Urania)	166	-29	7.2	2.5	364	1	501	-18
C94	W. Europe__zone3 (Ebro River, Zaragoza, Spain)	168	-16	9.1	1.8	518	-3	568	-2
C95	W. Europe_zone4 (Northeastern of Italy and southwestern coast of France)	351	-18	10.5	2.9	441	0	794	5
C96	W. Europe_zone5 (North Italy)	417	-9	8.6	2.0	367	-6	928	5
C97	W. Europe_zone6 (Switzerland, North Italy and west Austria)	386	-20	2.1	1.9	399	-1	856	7
C98	W. Europe_zone7 (Ireland, United Kingdom, France, Belgium, Netherland)	410	-5	7.6	1.1	273	6	725	-8
C99	W. Europe_zone8 (Northwest of Türkiye and northeast of Greece)	202	-51	11.3	3.3	489	5	604	-13
C100	W. Europe_zone9 (North Greece and North Macedonia)	281	-22	9.0	2.9	513	5	713	-8
C101	Boreal North America	414	3	-4.7	1.8	128	-7	634	-1
C102	URAL to Altai Mountains	195	3	-6.5	0.2	270	-1	645	6
C103	Australian Desert (Central Australia)	120	12	21.6	-1.1	1545	-3	508	14
C104	Old World Deserts	52	-15	17.4	0.7	927	-1	534	24
C105	Sub Arctic America (IceLand)	128	14	-18.4	0.8	39	-6	315	5

Table A.2 October 2022 - January 2023 agroclimatic indicators and biomass by country

Country code	Country name	RAIN Current (mm)	RAIN 15YA Departure (%)	TEMP Current (°C)	TEMP 15YA Departure(°C)	RADPAR Current (MJ/m²)	RADPAR 15YA Departure (%)	BIOMSS Current (gDM/m²)	BIOMSS 15YA Departure (%)
AFG	Argentina	427	-3	22.5	0.5	1443	-1	992	-1
AUS	Australia	324	17	19.7	-1.4	1393	-5	832	2
BGD	Bangladesh	264	-1	21.0	0.2	1008	3	580	-1
BRA	Brazil	464	-49	25.6	1.0	1242	-1	1007	-23
KHM	Cambodia	607	22	23.7	-0.5	1068	0	1066	10
CAN	Canada	299	-6	-2.8	1.2	290	2	287	11
CHN	China	195	-14	6.4	0.6	665	5	345	-6
EGY	Egypt	39	-30	17.4	0.2	794	3	221	-13
ETH	Ethiopia	109	-33	18.1	0.0	1307	-1	445	-14
FRA	France	386	-7	8.0	1.5	346	4	626	8
DEU	Germany	298	-12	5.4	1.3	245	7	531	7
IND	India	206	4	19.9	-0.2	1049	2	516	1
IDN	Indonesia	1367	-2	24.4	0.0	1142	2	1490	2
IRN	Iran	144	-19	8.7	0.6	765	0	334	-9
KAZ	Kazakhstan	172	4	-5.0	0.0	349	0	252	1
MEX	Mexico	240	-19	18.0	0.2	1000	0	493	-13
MMR	Myanmar	244	-28	19.5	0.4	1073	5	582	-14
NGA	Nigeria	125	-32	24.0	-0.9	1249	0	513	-13
PAK	Pakistan	96	-17	12.4	0.6	857	-1	258	-14

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 (%)
PHL	Philippines	1437	31	24.5	0.0	992	-4	1398	6
POL	Poland	230	-15	4.3	1.2	208	1	479	6
ROU	Romania	213	-14	5.9	2.5	385	2	443	-1
RUS	Russia	239	3	-4.2	0.5	211	-5	254	1
SYR	Syria	159	-41	21.2	1.1	1493	2	726	-15
ZAF	South Africa	538	23	22.4	-0.3	1061	0	870	3
THA	Thailand	190	-46	7.3	1.6	598	4	406	-23
TUR	Türkiye	483	-2	7.3	0.8	183	9	612	6
GBR	United Kingdom	229	-1	3.6	1.4	252	-7	444	7
UKR	Ukraine	328	1	6.2	0.5	539	-2	477	6
USA	United States	141	-5	3.8	-1.1	621	2	258	-13
UZB	Uzbekistan	563	-6	19.6	0.2	864	6	910	-2
VNM	Vietnam	96	-28	4.6	0.0	780	0	258	-16
AFG	Afghanistan	663	-25	23.1	0.1	1245	0	1159	-8
AGO	Angola	338	20	1.9	1.1	136	-15	409	7
BLR	Belarus	238	0	6.4	2.1	336	-1	520	10
HUN	Hungary	402	-9	9.8	2.1	464	2	629	6
ITA	Italy	281	-30	20.4	0.1	1298	0	759	-14
KEN	Kenya	1067	-9	24.3	-0.3	1106	1	1416	3
LKA	Sri_Lanka	151	-28	12.7	1.0	772	0	364	-19
MAR	Morocco	50	-4	-13.9	-0.5	447	0	112	-3
MNG	Mongolia	571	-12	25.4	0.1	1371	3	1123	-3
MOZ	Mozambique	723	-18	23.4	-0.1	1316	0	1147	-6
ZMB	Zambia	228	12	-5.8	-1.5	596	0	227	-2
KGZ	Kyrgyzstan	110	-54	13.9	1.2	711	4	345	-29

*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 October 2022 - January 2023 agroclimatic indicators and biomass (by province)

	RAIN Current (mm)	RAIN 15YA Departure (%)	TEMP Current (°C)	TEMP 15YA Departure(°C)	RADPAR Current (MJ/m²)	RADPAR 15YA Departure (%)	BIOMSS Current (gDM/m²)	BIOMSS 15YA Departure (%)
Buenos Aires	178	-33	21.6	1.4	1505	-1	789	-9
Chaco	435	-24	24.7	-0.3	1392	4	1085	-11
Cordoba	500	74	23.0	0.3	1462	-3	1129	19
Corrientes	462	-25	23.5	-0.2	1442	3	1155	-6
Entre Rios	206	-50	23.4	1.0	1470	0	860	-19
La Pampa	271	14	22.9	1.2	1538	-2	950	8
Misiones	663	-12	21.8	-1.2	1456	4	1268	-7
Santiago Del Estero	618	19	24.5	-0.2	1322	-4	1166	0
San Luis	432	83	21.7	0.0	1488	-4	1103	24
Salta	1130	24	21.2	-0.1	1281	-1	1246	0
Santa Fe	340	-22	24.4	0.7	1452	0	1002	-8
Tucuman	1171	101	19.7	-0.4	1277	-9	1249	16

Table A.4 October 2022 - January 2023 agroclimatic indicators and biomass (by state)

	RAIN Current (mm)	RAIN 15YA Departure (%)	TEMP Current (°C)	TEMP 15YA Departure(°C)	RADPAR Current (MJ/m²)	RADPAR 15YA Departure (%)	BIOMSS Current (gDM/m²)	BIOMSS 15YA Departure (%)
New South Wales	324	13	19.2	-2.3	1431	-4	921	5
South Australia	181	29	18.7	-0.8	1373	-6	719	6
Victoria	345	39	16.5	-1.1	1271	-9	843	8
W. Australia	158	2	19.5	-1.1	1485	-2	594	-10

Table A.5 October 2022 - January 2023 agroclimatic indicators and biomass (by state)

	RAIN Current (mm)	RAIN 15YA Departure (%)	TEMP Current (°C)	TEMP 15YA Departure (°C)	RADPAR Current (MJ/m²)	RADPAR 15YA Departure (%)	BIOMSS Current (gDM/m²)	BIOMSS 15YA Departure (%)
Ceara	133	-37	27.9	0.2	1363	-1	723	-3
Goias	150	-86	27.6	3.1	1219	-5	674	-54
Mato Grosso Do Sul	323	-64	26.8	0.9	1272	-4	946	-34
Mato Grosso	535	-57	26.8	1.5	1154	-1	1066	-29
Minas Gerais	384	-65	24.6	2.0	1239	-3	940	-32
Parana	638	-28	21.6	-0.2	1336	1	1178	-16
Rio Grande Do Sul	383	-37	21.1	-0.2	1430	3	1057	-12
Santa Catarina	848	5	18.7	-0.6	1317	4	1281	-1
Sao Paulo	328	-70	24.6	1.5	1282	0	895	-38

Table A.6 Canada, October 2022 - January 2023 agroclimatic indicators and biomass (by province)

	RAIN Current (mm)	RAIN 15YA Departure (%)	TEMP Current (°C)	TEMP 15YA Departure (°C)	RADPAR Current (MJ/m²)	RADPAR 15YA Departure (%)	BIOMSS Current (gDM/m²)	BIOMSS 15YA Departure (%)
Alberta	139	-9	-4.7	0.3	279	2	273	11
Manitoba	200	4	-4.9	0.7	280	-2	258	1
Saskatchewan	159	2	-5.1	0.1	296	2	263	3

Table A.7 India, October 2022 - January 2023 agroclimatic indicators and biomass (by state)

	RAIN Current (mm)	RAIN 15YA Departure (%)	TEMP Current (°C)	TEMP 15YA Departure (°C)	RADPAR Current (MJ/m²)	RADPAR 15YA Departure (%)	BIOMSS Current (gDM/m²)	BIOMSS 15YA Departure (%)
Andhra Pradesh	338	44	22.6	-0.1	1110	0	783	12
Assam	387	13	16.5	-0.9	909	4	548	-6
Bihar	115	-4	18.5	-0.6	989	3	387	-5
Chhattisgarh	77	-34	19.6	0.0	1116	4	431	-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 (%)
Daman and Diu	27	-37	26.1	0.0	1147	0	449	-6
Delhi	168	198	17.0	-0.8	892	-3	393	27
Gujarat	49	32	24.0	-0.1	1097	0	404	-3
Goa	269	10	25.8	-0.1	1202	2	772	5
Himachal Pradesh	101	-36	9.4	0.6	884	0	301	-9
Haryana	87	63	17.2	-0.4	884	-2	330	9
Jharkhand	116	-12	18.4	0.0	1055	3	427	-6
Kerala	660	-10	23.9	-0.5	1137	2	1076	-2
Karnataka	336	15	22.1	-0.5	1148	1	779	5
Meghalaya	430	19	16.9	-0.8	924	3	573	-3
Maharashtra	181	49	22.3	-0.3	1144	2	578	6
Manipur	191	-49	13.1	-0.9	998	10	446	-25
Madhya Pradesh	88	50	19.1	-0.3	1065	3	404	6
Mizoram	328	-12	15.7	-1.0	1046	7	508	-17
Nagaland	349	-21	12.1	-1.6	929	11	504	-21
Orissa	158	-19	20.5	0.3	1107	3	482	-14
Puducherry	544	-2	26.0	0.4	1146	0	1103	3
Punjab	56	-33	16.6	-0.3	850	0	304	-7
Rajasthan	61	110	19.6	-0.2	993	0	321	4
Sikkim	46	-33	12.2	2.7	1006	-4	234	-6
Tamil Nadu	653	-2	23.9	0.2	1094	2	1104	3
Tripura	231	-37	19.1	-0.1	1002	5	563	-8
Uttarakhand	154	91	12.0	1.1	921	-2	278	2
Uttar Pradesh	125	83	17.6	-0.6	956	0	356	4
West Bengal	172	-4	20.9	0.5	1017	2	501	-4

Table A.8 Kazakhstan, October 2022 - January 2023 agroclimatic indicators and biomass (by oblast)

	RAIN Current (mm)	RAIN 15YA Departure (%)	TEMP Current (°C)	TEMP 15YA Departure (°C)	RADPAR Current (MJ/m²)	RADPAR 15YA Departure (%)	BIOMSS Current (gDM/m²)	BIOMSS 15YA Departure (%)
Akmolinskaya	144	-1	-6.4	0.4	305	2	238	4
Karagandinskaya	117	-7	-6.9	0.0	376	3	228	1
Kustanayskaya	170	15	-5.7	0.4	264	-3	248	3
Pavlodarskaya	125	-3	-6.5	0.6	280	1	240	6
Severo kazachstanskaya	179	13	-6.6	0.5	232	1	228	3
Vostochno kazachstanskaya	203	-4	-6.5	0.0	400	2	232	2
Zapadno kazachstanskaya	191	6	-1.6	0.6	263	-9	341	8

Table A.9 Russia, October 2022 - January 2023 agroclimatic indicators and biomass (by oblast, kray and republic)

	RAIN Current (mm)	RAIN 15YA Departure (%)	TEMP Current (°C)	TEMP 15YA Departure (°C)	RADPAR Current (MJ/m²)	RADPAR 15YA Departure (%)	BIOMSS Current (gDM/m²)	BIOMSS 15YA Departure (%)
Bashkortostan Rep.	245	-1	-5.7	0.2	187	-3	234	1
Chelyabinskaya Oblast	171	8	-6.4	0.3	217	-1	225	2

	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 (%)
Gorodovikovsk	131	-42	4.7	1.1	332	-4	366	-23
Krasnodarskiy Kray	201	-27	-1.2	0.7	310	3	285	-11
Kurganskaya Oblast	168	-1	-6.6	0.4	182	-2	223	3
Kirovskaya Oblast	330	6	-4.3	0.6	92	-17	251	5
Kurskaya Oblast	318	16	0.4	0.8	168	-16	367	3
Lipetskaya Oblast	326	26	-0.5	0.7	162	-16	346	3
Mordoviya Rep.	312	16	-2.3	0.5	141	-16	302	3
Novosibirskaya Oblast	230	4	-7.7	0.7	177	-5	207	5
Nizhegorodskaya O.	307	6	-2.7	0.4	115	-14	289	3
Orenburgskaya Oblast	230	10	-4.5	0.2	242	-5	267	1
Omskaya Oblast	204	5	-7.2	0.8	164	-7	216	7
Permskaya Oblast	272	-8	-5.9	0.5	115	-6	226	5
Penzenskaya Oblast	294	10	-2.1	0.5	158	-15	307	3
Rostovskaya Oblast	194	-18	3.2	1.2	288	-8	426	-1
Ryazanskaya Oblast	324	18	-1.2	0.6	131	-19	325	2
Stavropolskiy Kray	162	-30	4.5	0.9	367	-2	402	-13
Sverdlovskaya Oblast	190	-8	-6.8	0.4	141	-1	216	5
Samarskaya Oblast	283	16	-3.2	0.4	182	-11	292	3
Saratovskaya Oblast	251	7	-1.6	0.6	206	-14	332	4
Tambovskaya Oblast	323	22	-0.9	0.7	163	-17	337	3
Tyumenskaya Oblast	191	-5	-7.1	0.6	146	-6	214	5
Tatarstan Rep.	298	12	-3.8	0.5	136	-12	268	3
Ulyanovskaya Oblast	278	14	-2.8	0.6	157	-15	294	4
Udmurtiya Rep.	315	7	-4.7	0.7	110	-12	248	6
Volgogradskaya O.	214	1	0.4	0.8	248	-13	386	6
Voronezhskaya Oblast	319	30	0.1	0.7	204	-14	368	3

Table A.10 United States, October 2022 - January 2023 agroclimatic indicators and biomass (by state)

	RAIN Current (mm)	RAIN 15YA Departure (%)	TEMP Current (°C)	TEMP 15YA Departure (°C)	RADPAR Current (MJ/m²)	RADPAR 15YA Departure (%)	BIOMSS Current (gDM/m²)	BIOMSS 15YA Departure (%)
Arkansas	519	13	10.1	0.9	570	-5	790	10
California	514	53	9.1	-0.9	626	-4	566	19
Idaho	310	-6	-1.1	-0.4	465	2	356	1
Indiana	286	-28	5.4	1.0	482	2	575	6

	RAIN Current (mm)	RAIN 15YA Departure (%)	TEMP Current (°C)	TEMP 15YA Departure (°C)	RADPAR Current (MJ/m²)	RADPAR 15YA Departure (%)	BIOMSS Current (gDM/m²)	BIOMSS 15YA Departure (%)
Illinois	304	-15	5.0	0.8	501	3	567	6
Iowa	244	-5	1.9	0.4	467	-2	461	6
Kansas	155	-14	6.2	0.2	616	-2	378	-3
Michigan	293	-16	2.3	1.1	356	2	446	7
Minnesota	229	-2	-1.6	0.9	367	-2	346	6
Missouri	331	1	6.2	0.5	554	0	611	9
Montana	183	-1	-2.4	-1.0	427	-1	314	-1
Nebraska	148	-2	2.5	-0.3	561	-1	384	7
North Dakota	161	1	-2.9	-0.4	392	-1	313	4
Ohio	289	-24	5.0	0.9	454	1	553	5
Oklahoma	258	2	9.5	0.4	623	-6	543	9
Oregon	433	-16	3.0	-0.9	434	5	447	-3
South Dakota	149	-8	-0.2	-0.5	482	0	349	2
Texas	293	12	13.5	0.5	674	-7	551	6
Washington	513	-9	2.5	-0.4	346	6	444	2
Wisconsin	295	4	0.2	1.2	377	-3	393	7

Table A.11 China, October 2022 - January 2023 agroclimatic indicators and biomass (by province)

	RAIN Current (mm)	RAIN 15YA Departure (%)	TEMP Current (°C)	TEMP 15YA Departure (°C)	RADPAR Current (MJ/m²)	RADPAR 15YA Departure (%)	BIOMSS Current (gDM/m²)	BIOMSS 15YA Departure (%)
Anhui	208	-5	9.2	0.6	659	2	458	-3
Chongqing	202	-28	9.3	0.7	609	11	479	-13
Fujian	375	-5	13.5	1.1	637	1	732	9
Gansu	105	-6	-0.5	0.3	675	-5	248	2
Guangdong	371	-5	16.4	0.5	757	4	675	-2
Guangxi	205	-45	14.8	0.9	751	15	518	-26
Guizhou	181	-49	9.5	0.8	610	24	486	-26
Hebei	78	43	-0.4	0.2	614	-1	195	15
Heilongjiang	109	10	-9.2	0.4	423	-3	194	7
Henan	164	42	7.4	0.7	666	0	331	9
Hubei	164	-28	8.9	0.9	679	6	404	-15
Hunan	162	-50	11.1	1.3	724	19	433	-29
Jiangsu	189	-2	9.4	0.6	660	2	457	2
Jiangxi	280	-21	11.9	1.0	691	9	573	-8
Jilin	147	41	-6.3	0.3	504	-4	234	15
Liaoning	137	54	-2.4	0.1	555	-3	280	31
Inner Mongolia	57	7	-8.3	0.0	537	0	151	9
Ningxia	57	-2	-1.3	-0.1	696	-3	174	-4
Shaanxi	190	62	3.2	0.5	648	-4	320	16
Shandong	114	47	5.8	0.5	657	0	274	13
Shanxi	96	50	-0.4	0.5	653	-2	235	23
Sichuan	260	0	7.0	0.7	615	1	468	0
Yunnan	172	-43	10.4	0.4	830	12	435	-26
Zhejiang	332	-12	10.7	0.8	599	-2	673	2

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**.**

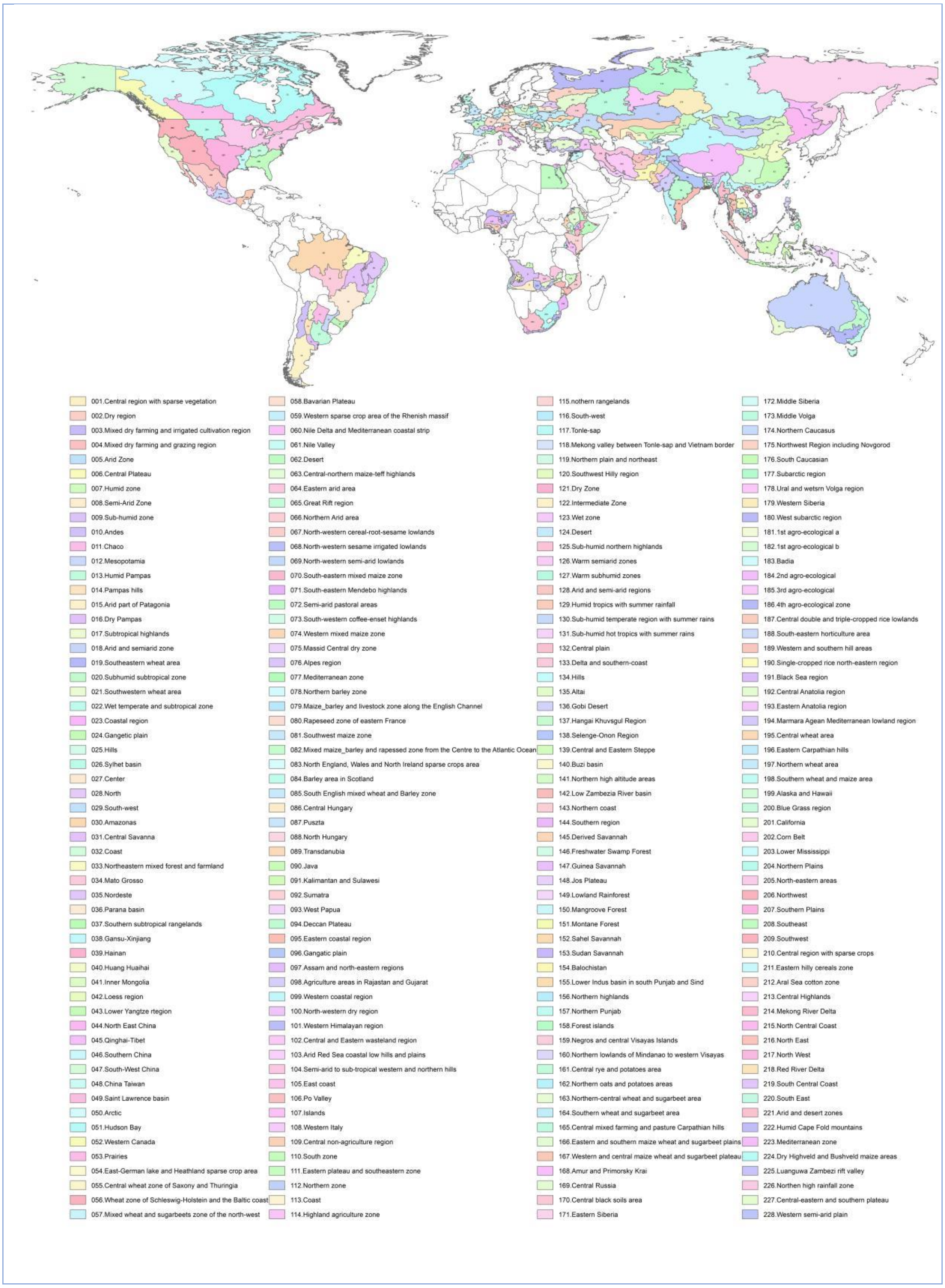
Agroecological zones for 45 key countries

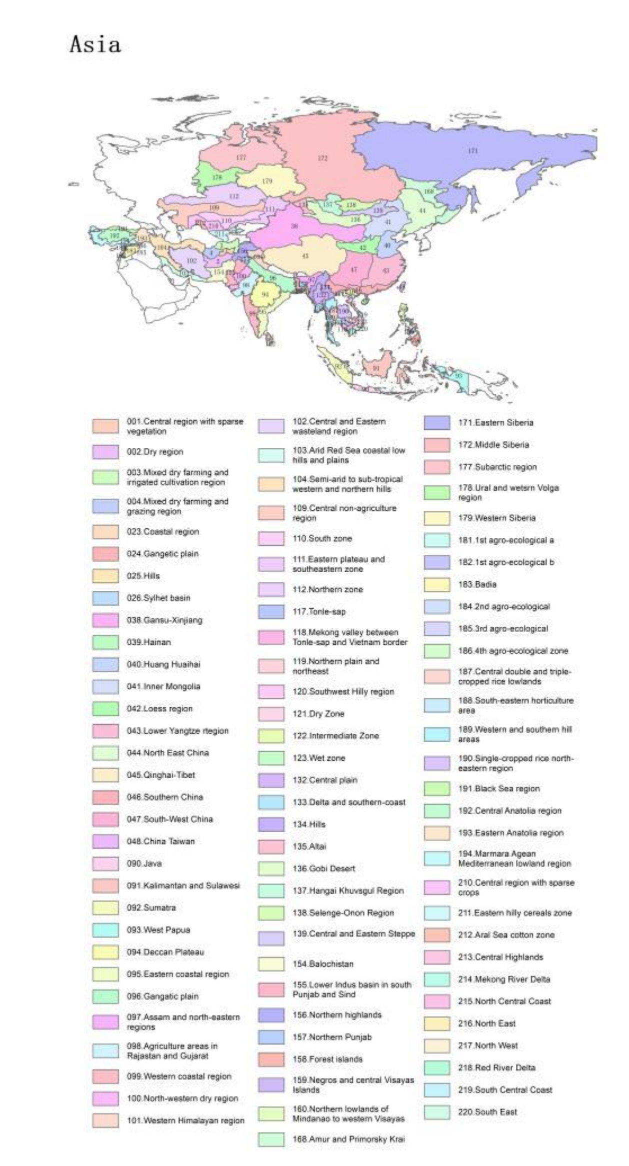
Overview

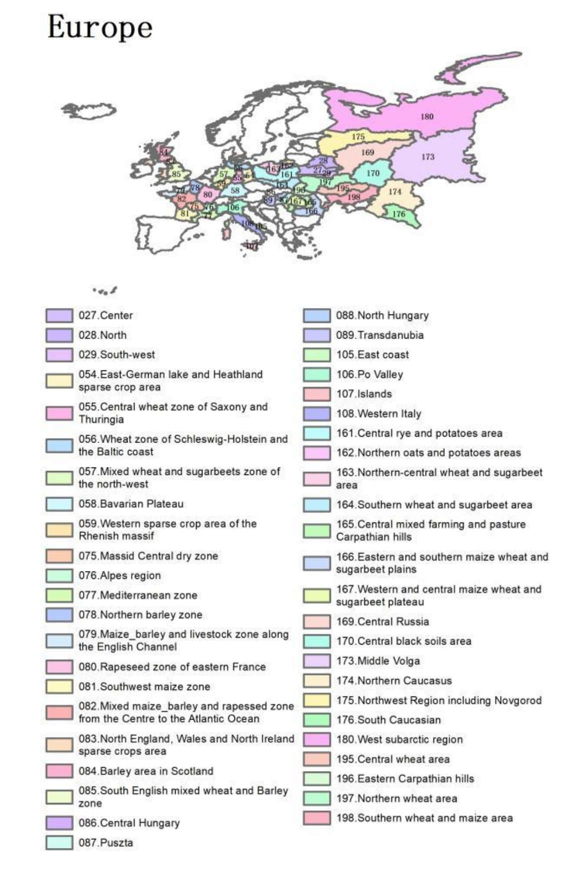
228 agroecological zones for the 45 key countries across the globe

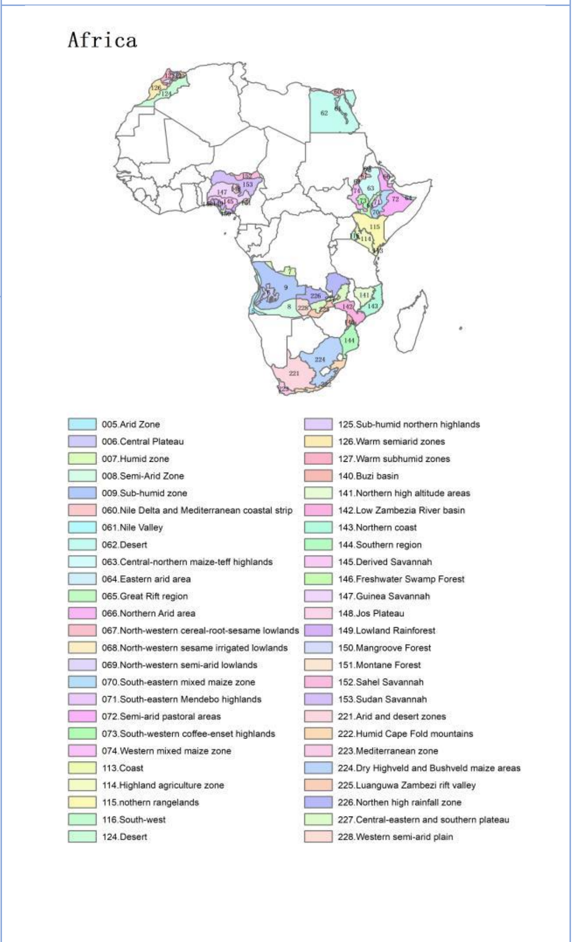
Description

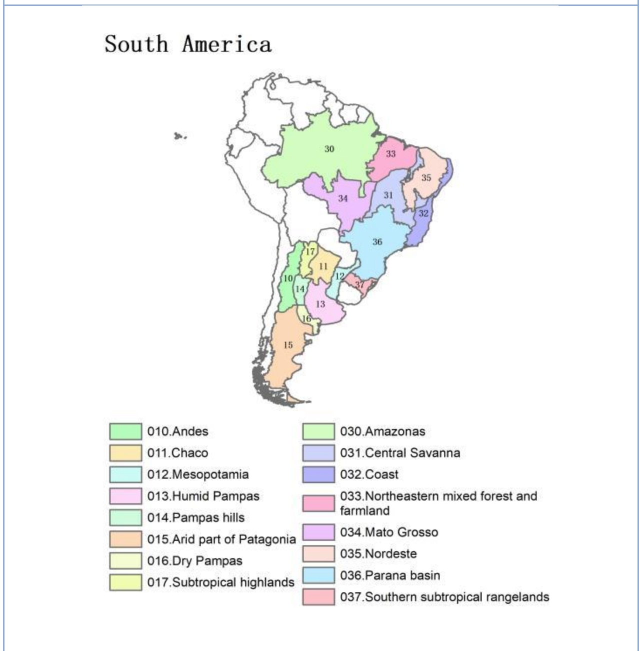
45 key agricultural countries are divided into 228 agro-ecological zones based on cropping systems, climatic zones, and topographic conditions. Each country is considered separately. A limited number of regions (e.g., region 001, region 027, and region 127) are not relevant for the crops currently monitored by CropWatch but are included to allow for more complete coverage of the 45 key countries. Some regions are more relevant for rangeland and livestock monitoring, which is also essential for food security.

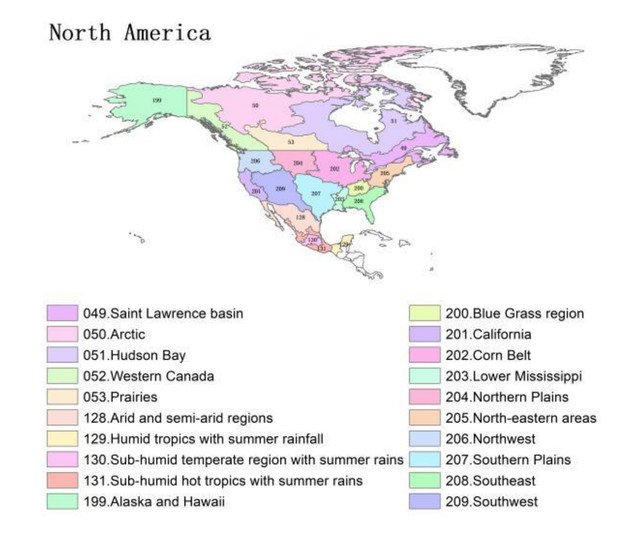

001.Central region with sparse vegetation
002.Dry region
003.Mixed dry farming and irrigated cultivation region
004.Mixed dry farming and grazing region
005.Arid Zone
006.Central Plateau
007.Humid zone
008.Semi-Arid Zone
009.Sub-humid zone
010.Andes
011.Chaco
012.Mesopotamia
013.Humid Pampas
014.Pampas hills
015.Arid part of Patagonia
016.Dry Pampas
017.Subtropical highlands
018.Arid and semiarid zone
019.Southeastern wheat area
020.Subhumid subtropical zone
021.Southwestern wheat area
022.Wet temperate and subtropical zone
023.Coastal region
024.Gangetic plain
025.Hills
026.Sylhet basin
027.Center
028.North
029.South-west
030.Amazonas
031.Central Savanna
032.Coast
033.Northeastern mixed forest and farmland
034.Mato Grosso
035.Nordeste
036.Parana basin
037.Southern subtropical rangelands
038.Gansu-Xinjiang
039.Hainan
040.Huang Huaihai
041.Inner Mongolia
042.Loess region
043.Lower Yangtze rtegion
044.North East China
045.Qinghai-Tibet
046.Southern China
047.South-West China
048.China Taiwan
049.Saint Lawrence basin
050.Arctic
051.Hudson Bay
052.Western Canada
053.Prairies
054.East-German lake and Heathland sparse crop area
055.Central wheat zone of Saxony and Thuringia
056.Wheat zone of Schleswig-Holstein and the Baltic coast
057.Mixed wheat and sugarbeets zone of the north-west
058.Bavarian Plateau
059.Western sparse crop area of the Rhenish massif
060.Nile Delta and Mediterranean coastal strip
061.Nile Valley
062.Desert
063.Central-northern maize-teff highlands
064.Eastern arid area
065.Great Rift region
066.Northern Arid area
067.North-western cereal-root-sesame lowlands
068.North-western sesame irrigated lowlands
069.North-western semi-arid lowlands
070.South-eastern mixed maize zone
071.South-eastern Mendebo highlands
072.Semi-arid pastoral areas
073.South-western coffee-enset highlands
074.Western mixed maize zone
075.Massid Central dry zone
076.Alpes region
077.Mediterranean zone
078.Northern barley zone
079.Maize_barley and livestock zone along the English Channel
080.Rapeseed zone of eastern France
081.Southwest maize zone
082.Mixed maize_barley and rapessed zone from the Centre to the Atlantic Ocean
083.North England, Wales and North Ireland sparse crops area
084.Barley area in Scotland
085.South English mixed wheat and Barley zone
086.Central Hungary
087.Puszta
088.North Hungary
089.Transdanubia
090.Java
091.Kalimantan and Sulawesi
092.Sumatra
093.West Papua
094.Deccan Plateau
095.Eastern coastal region
096.Gangatic plain
097.Assam and north-eastern regions
098.Agriculture areas in Rajastan and Gujarat
099.Western coastal region
100.North-western dry region
101.Western Himalayan region
102.Central and Eastern wasteland region
103.Arid Red Sea coastal low hills and plains
104.Semi-arid to sub-tropical western and northern hills
105.East coast
106.Po Valley
107.Islands
108.Western Italy
109.Central non-agriculture region
110.South zone
111.Eastern plateau and southeastern zone
112.Northern zone
113.Coast
114.Highland agriculture zone
115.nothern rangelands
116.South-west
117.Tonle-sap
118.Mekong valley between Tonle-sap and Vietnam border
119.Northern plain and northeast
120.Southwest Hilly region
121.Dry Zone
122.Intermediate Zone
123.Wet zone
124.Desert
125.Sub-humid northern highlands
126.Warm semiarid zones
127.Warm subhumid zones
128.Arid and semi-arid regions
129.Humid tropics with summer rainfall
130.Sub-humid temperate region with summer rains
131.Sub-humid hot tropics with summer rains
132.Central plain
133.Delta and southern-coast
134.Hills
135.Altai
136.Gobi Desert
137.Hangai Khuvsgul Region
138.Selenge-Onon Region
139.Central and Eastern Steppe
140.Buzi basin
141.Northern high altitude areas
142.Low Zambezia River basin
143.Northern coast
144.Southern region
145.Derived Savannah
146.Freshwater Swamp Forest
147.Guinea Savannah
148.Jos Plateau
149.Lowland Rainforest
150.Mangroove Forest
151.Montane Forest
152.Sahel Savannah
153.Sudan Savannah
154.Balochistan
155.Lower Indus basin in south Punjab and Sind
156.Northern highlands
157.Northern Punjab
158.Forest islands
159.Negros and central Visayas Islands
160.Northern lowlands of Mindanao to western Visayas
161.Central rye and potatoes area
162.Northern oats and potatoes areas
163.Northern-central wheat and sugarbeet area
164.Southern wheat and sugarbeet area
165.Central mixed farming and pasture Carpathian hills
166.Eastern and southern maize wheat and sugarbeet plains
167.Western and central maize wheat and sugarbeet plateau
168.Amur and Primorsky Krai
169.Central Russia
170.Central black soils area
171.Eastern Siberia
172.Middle Siberia
173.Middle Volga
174.Northern Caucasus
175.Northwest Region including Novgorod
176.South Caucasian
177.Subarctic region
178.Ural and wetsrn Volga region
179.Western Siberia
180.West subarctic region
181.1st agro-ecological a
182.1st agro-ecological b
183.Badia
184.2nd agro-ecological
185.3rd agro-ecological
186.4th agro-ecological zone
187.Central double and triple-cropped rice lowlands
188.South-eastern horticulture area
189.Western and southern hill areas
190.Single-cropped rice north-eastern region
191.Black Sea region
192.Central Anatolia region
193.Eastern Anatolia region
194.Marmara Agean Mediterranean lowland region
195.Central wheat area
196.Eastern Carpathian hills
197.Northern wheat area
198.Southern wheat and maize area
199.Alaska and Hawaii
200.Blue Grass region
201.California
202.Corn Belt
203.Lower Mississippi
204.Northern Plains
205.North-eastern areas
206.Northwest
207.Southern Plains
208.Southeast
209.Southwest
210.Central region with sparse crops
211.Eastern hilly cereals zone
212.Aral Sea cotton zone
213.Central Highlands
214.Mekong River Delta
215.North Central Coast
216.North East
217.North West
218.Red River Delta
219.South Central Coast
220.South East
221.Arid and desert zones
222.Humid Cape Fold mountains
223.Mediterranean zone
224.Dry Highveld and Bushveld maize areas
225.Luanguwa Zambezi rift valley
226.Northen high rainfall zone
227.Central-eastern and southern plateau
228.Western semi-arid plain

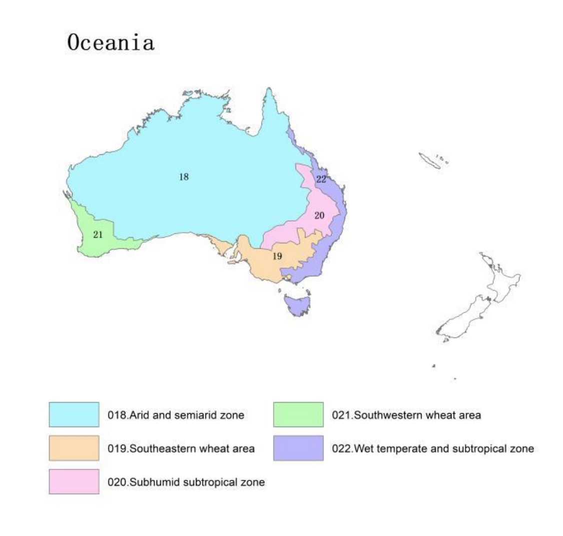

Asia
001.Central region with sparse vegetation
002.Dry region
003.Mixed dry farming and irrigated cultivation region
004.Mixed dry farming and grazing region
023.Coastal region
024.Gangetic plain
025.Hills
026.Sylhet basin
038.Gansu-Xinjiang
039.Hainan
040.Huang Huaihai
041.Inner Mongolia
042.Loess region
043.Lower Yangtze rtegion
044.North East China
045.Qinghai-Tibet
046.Southern China
047.South-West China
048.China Taiwan
090.Java
091.Kalimantan and Sulawesi
092.Sumatra
093.West Papua
094.Deccan Plateau
095.Eastern coastal region
096.Gangatic plain
097.Assam and north-eastern regions
098.Agriculture areas in Rajastan and Gujarat
099.Western coastal region
100.North-western dry region
101.Western Himalayan region
102.Central and Eastern wasteland region
103.Arid Red Sea coastal low hills and plains
104.Semi-arid to sub-tropical western and northern hills
109.Central non-agriculture region
110.South zone
111.Eastern plateau and southeastern zone
112.Northern zone
117.Tonle-sap
118.Mekong valley between Tonle-sap and Vietnam border
119.Northern plain and northeast
120.Southwest Hilly region
121.Dry Zone
122.Intermediate Zone
123.Wet zone
132.Central plain
133.Delta and southern-coast
134.Hills
135.Altai
136.Gobi Desert
137.Hangai Khuvsgul Region
138.Selenge-Onon Region
139.Central and Eastern Steppe
154.Balochistan
155.Lower Indus basin in south Punjab and Sind
156.Northern highlands
157.Northern Punjab
158.Forest islands
159.Negros and central Visayas Islands
160.Northern lowlands of Mindanao to western Visayas
168.Amur and Primorsky Krai
171.Eastern Siberia
172.Middle Siberia
177.Subarctic region
178.Ural and wetern Volga region
179.Western Siberia
181.1st agro-ecological a
182.1st agro-ecological b
183.Badia
184.2nd agro-ecological
185.3rd agro-ecological
186.4th agro-ecological zone
187.Central double and triple-cropped rice lowlands
188.South-eastern horticulture area
189.Western and southern hill areas
190.Single-cropped rice north-eastern region
191.Black Sea region
192.Central Anatolia region
193.Eastern Anatolia region
194.Marmara Agean Mediterranean lowland region
210.Central region with sparse crops
211.Eastern hilly cereals zone
212.Aral Sea cotton zone
213.Central Highlands
214.Mekong River Delta
215.North Central Coast
216.North East
217.North West
218.Red River Delta
219.South Central Coast
220.South East


Europe
027.Center
028.North
029.South-west
054.East-German lake and Heathland sparse crop area
055.Central wheat zone of Saxony and Thuringia
056.Wheat zone of Schleswig-Holstein and the Baltic coast
057.Mixed wheat and sugarbeets zone of the north-west
058.Bavarian Plateau
059.Western sparse crop area of the Rhenish massif
075.Massid Central dry zone
076.Alpes region
077.Mediterranean zone
078.Northern barley zone
079.Maize_barley and livestock zone along the English Channel
080.Rapeseed zone of eastern France
081.Southwest maize zone
082.Mixed maize_barley and rapessed zone from the Centre to the Atlantic Ocean
083.North England, Wales and North Ireland sparse crops area
084.Barley area in Scotland
085.South English mixed wheat and Barley zone
086.Central Hungary
087.Puszta
088.North Hungary
089.Transdanubia
105.East coast
106.Po Valley
107.Islands
108.Western Italy
161.Central rye and potatoes area
162.Northern oats and potatoes areas
163.Northern-central wheat and sugarbeet area
164.Southern wheat and sugarbeet area
165.Central mixed farming and pasture Carpathian hills
166.Eastern and southern maize wheat and sugarbeet plains
167.Western and central maize wheat and sugarbeet plateau
169.Central Russia
170.Central black soils area
173.Middle Volga
174.Northern Caucasus
175.Northwest Region including Novgorod
176.South Caucasian
180.West subarctic region
195.Central wheat area
196.Eastern Carpathian hills
197.Northern wheat area
198.Southern wheat and maize area


Africa
005.Arid Zone
006.Central Plateau
007.Humid zone
008.Semi-Arid Zone
009.Sub-humid zone
060.Nile Delta and Mediterranean coastal strip
061.Nile Valley
062.Desert
063.Central-northern maize-teff highlands
064.Eastern arid area
065.Great Rift region
066.Northern Arid area
067.North-western cereal-root-sesame lowlands
068.North-western sesame irrigated lowlands
069.North-western semi-arid lowlands
070.South-eastern mixed maize zone
071.South-eastern Mendebo highlands
072.Semi-arid pastoral areas
073.South-western coffee-enset highlands
074.Western mixed maize zone
113.Coast
114.Highland agriculture zone
115.nothern rangelands
116.South-west
124.Desert
125.Sub-humid northern highlands
126.Warm semiarid zones
127.Warm subhumid zones
140.Buzi basin
141.Northern high altitude areas
142.Low Zambezia River basin
143.Northern coast
144.Southern region
145.Derived Savannah
146.Freshwater Swamp Forest
147.Guinea Savannah
148.Jos Plateau
149.Lowland Rainforest
150.Mangroove Forest
151.Montane Forest
152.Sahel Savannah
153.Sudan Savannah
221.Arid and desert zones
222.Humid Cape Fold mountains
223.Mediterranean zone
224.Dry Highveld and Bushveld maize areas
225.Luanguwa Zambezi rift valley
226.Northen high rainfall zone
227.Central-eastern and southern plateau
228.Western semi-arid plain


South America
010.Andes
011.Chaco
012.Mesopotamia
013.Humid Pampas
014.Pampas hills
015.Arid part of Patagonia
016.Dry Pampas
017.Subtropical highlands
030.Amazonas
031.Central Savanna
032.Coast
033.Northeastern mixed forest and farmland
034.Mato Grosso
035.Nordeste
036.Parana basin
037.Southern subtropical rangelands





CropWatch indicators

The CropWatch indicators are designed to assess the condition of crops and the environment in which they grow and develop; the indicators—RAIN (for rainfall), TEMP (temperature), and RADPAR (photosynthetically active radiation, PAR)—are not identical to the weather variables, but instead are value-added indicators computed only over crop growing areas (thus for example excluding deserts and rangelands) and spatially weighted according to the agricultural production potential, with marginal areas receiving less weight than productive ones. The indicators are expressed using the usual physical units (e.g., mm for rainfall) and were thoroughly tested for their coherence over space and time. CWSU are the CropWatch Spatial Units, including MRUs, MPZ, and countries (including first-level administrative districts in select large countries). For all indicators, high values indicate "good" or "positive."

INDICATOR			
BIOMSS			
Biomass accumulation potential			
Crop/ satellite	Grams dry matter/m^2, pixel or CWSU	An estimate of biomass that could potentially be accumulated over the reference period given the prevailing rainfall and temperature conditions.	Biomass is presented as maps by pixels, maps showing average pixels values over CropWatch spatial units (CWSU), or tables giving average values for the CWSU. Values are compared to the average value for the recent fifteen years (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	Cropping intensity index describes the extent to which arable land is used over	Cropping intensity is presented as maps by pixels or spatial average pixels values for MPZs, 45

INDICATOR			
	crops growing over a year for each pixel	a year. It is the ratio of the total crop area of all planting seasons in a year to the total area of arable land.	countries, and 7 regions for China. Values are compared to the average of the previous five years, with departures expressed in percentage.
NDVI			
Normalized Difference Vegetation Index			
Crop/ Satellite	[0.12-0.90] number, pixel or CWSU average	An estimate of the density of living green biomass.	NDVI is shown as average profiles over time at the national level (cropland only) in crop condition development graphs, compared with previous year and recent five-year average (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/m^2, CWSU	The spatial average (for a CWSU) of PAR accumulation over agricultural pixels, weighted by the production potential.	RADPAR is shown as the percent departure of the RADPAR value for the reporting period compared to the recent fifteen-year average (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/m^2, CWSU	The spatial average (for a CWSU) of rainfall accumulation over agricultural pixels, weighted by the production potential.	RAIN is shown as the percent departure of the RAIN value for the reporting period, compared to the recent fifteen-year average (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			

INDICATOR			
Crop/ Satellite	Number, pixel to CWSU	The average of VCI and the temperature condition index (TCI), with TCI defined like VCI but for temperature. VHI is based on the assumption that "high temperature is bad" (due to moisture stress), but ignores the fact that low temperature may be equally "bad" (crops develop and grow slowly, or even suffer from frost).	Low VHI values indicate unusually poor crop condition, but high values, when due to low temperature, may be difficult to interpret. VHI is shown as typical time profiles over Major Production Zones (MPZ), where they occur, and the percentage of pixels concerned by each profile.
VHIn			
Minimum Vegetation health index			
Crop/ Satellite	Number, pixel to CWSU	VHIn is the lowest VHI value for every pixel over the reporting period. Values usually are [0, 100]. Normally, values lower than 35 indicate poor crop condition.	Low VHIn values indicate the occurrence of water stress in the monitoring period, often combined with lower than average rainfall. The spatial/time resolution of CropWatch VHIn is 16km/week for MPZs and 1km/dekad for China.
CPI			
Crop Production Index			
Crop/ Satellite	Number, pixel to CWSU	The average crop production situation for the same period in the past five years was used as a benchmark to make an overall estimate of the current season's agricultural production situation.	Based on the VCIx, CALF, land productivity and area of irrigated and rainfed cropland in the current monitoring period and the same period in the past five years for the spatial unit, a mathematical model proposed by CropWatch is used to calculate the index expressed as a normalized value. A value of 1.0 represents the basic normal crop production situation in the current period for the spatial unit, and the higher the value, the better the crop production situation in the current period. Conversely, the lower the value, the worse the crop production situation for the spatial unit in the current period.

Note: Type is either "Weather" or "Crop"; source specifies if the indicator is obtained from ground data, satellite readings, or a combination; units: in the case of ratios, no unit is used; scale is either pixels or large scale CropWatch spatial units (CWSU). Many indicators are computed for pixels but represented in the CropWatch bulletin at the CWSU scale.

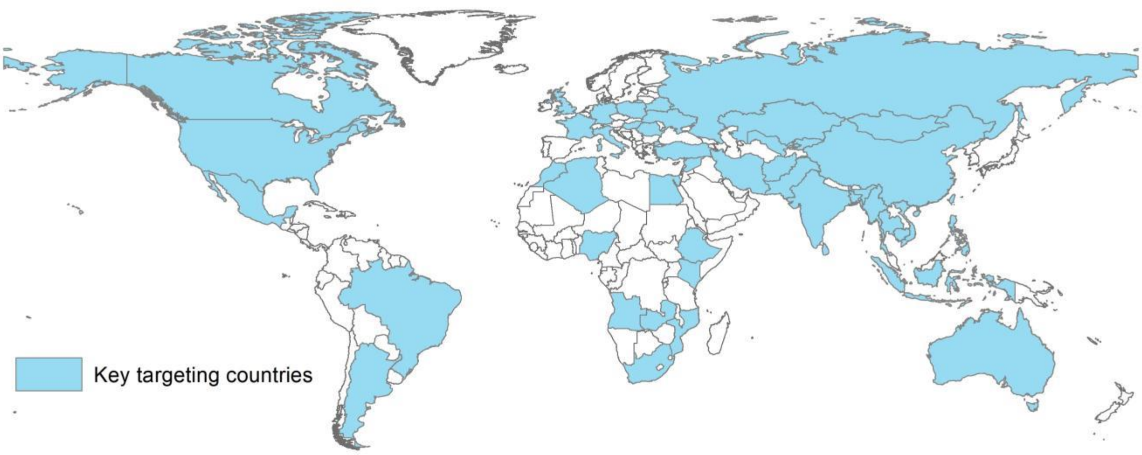
CropWatch spatial units (CWSU)

CropWatch analyses are applied to four kinds of CropWatch spatial units (CWSU): Countries, China, Major Production Zones (MPZ), and global crop Monitoring and Reporting Units (MRU). The tables below summarize the key aspects of each spatial unit and show their relation to each other. For more details about these spatial units and their boundaries, see the CropWatch bulletin online resources.

SPATIAL LUNITS	
CHINA	
Overview	*Description*
Seven monitoring regions	The seven regions in China are agro-economic/agro-ecological regions that together cover the bulk of national maize, rice, wheat, and soybean production. Provinces that are entirely or partially included in one of the monitoring regions are indicated in color on the map below.


Heilongjiang
North East China
Inner Mongolia
Jilin
Inner Mongolia
Liaoning
Gansu
Ningxia
Shanxi
Hebei
Loess region
Shandong
Huang Huaihai
Shaanxi
Jiangsu
Anhui
Sichuan
Hubei
Chongqing
Zhejiang
South-West China
Lower Yangtze
Jiangxi
Guizhou
Hunan
Fujian
Yunnan
Guangxi
Guangdong
Southern China

Countries (and first-level administrative districts, e.g., states and provinces)	
Overview	*Description*
"Forty four 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 "44 + 1," referring to 44 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 45 countries monitored by CropWatch, yield variation for each crop is calibrated against NDVI time series, using the following equation:

$$\Delta Yield_i = f(NDVI_i, NDVI_{i-1})$$

Where $NDVI_i$ and $NDVI_{i-1}$ are taken from the time series of the spatial average of NDVI over the crop specific mask for the current year and the previous year. For NDVI values that correspond to periods after the current monitoring period, average NDVI values of the previous five years are used as an average expectation. $\Delta Yield_i$ is calculated by regression against average or peak NDVI (whichever yields the best regression), considering the crop phenology of each crop for each individual country.

A different method is used for areas. For China, CropWatch combines remote-sensing based estimates of the crop planting proportion (cropped area to arable land) with a crop type proportion (specific type area to total cropped area). The planting proportion is estimated based on an unsupervised classification of high resolution satellite images from HJ-1 CCD and GF-1 images. The crop-type proportion for China is obtained by the GVG instrument from field transects. The area of a specific crop is computed by multiplying farmland area, planting proportion, and crop-type proportion of the crop.

To estimate crop area for wheat, soybean, maize, and rice outside China, CropWatch relies on the regression of crop area against cropped arable land fraction of each individual country (paying due attention to phenology):

$$Area_i = a + b * CALF_i$$

Where, a and b are the coefficients generated by linear regression with area from FAOSTAT or national sources and CALF (Cropped Arable Land Fraction) from CropWatch estimates

Data notes and bibliography

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Home | Famine Early Warning Systems Network (fews.net)

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Online resources

Online Resources posted on **www.cropwatch.com.cn** , **http://cloud.cropwatch.com.cn/**

This bulletin is only part of the CropWatch resources available. Visit **www.cropwatch.com.cn** for access to additional resources, including the methods behind CropWatch, country profiles, and other CropWatch publications. For additional information or to access specific data or high-resolution graphs, simply contact the CropWatch team at **cropwatch@radi.ac.cn**.

CropWatch bulletins introduce the use of several new and experimental indicators. We would be very interested in receiving feedback about their performance in other countries. With feedback on the contents of this report and the applicability of the new indicators to global areas, please contact:

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