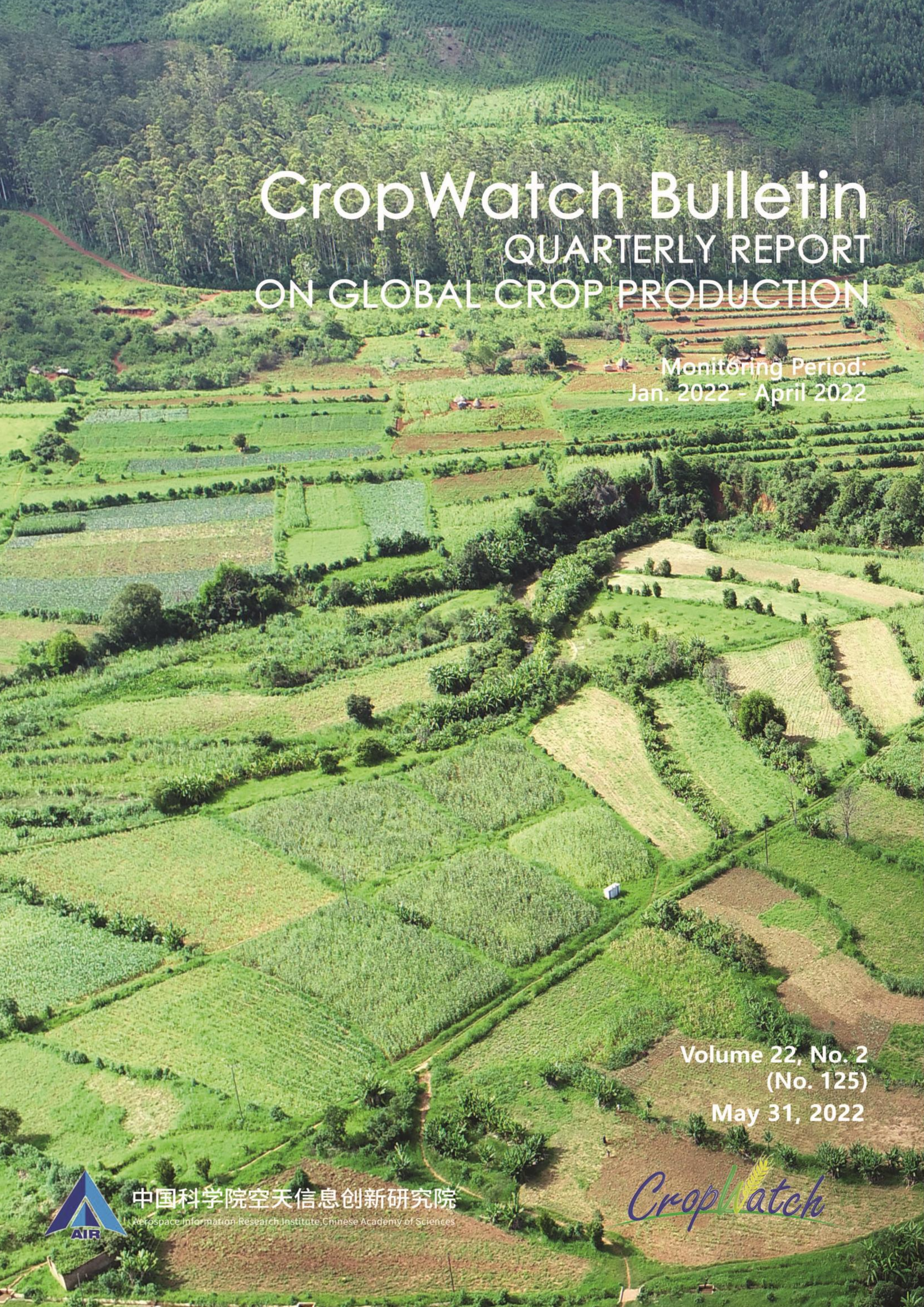

CropWatch Bulletin

QUARTERLY REPORT ON GLOBAL CROP PRODUCTION

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CropWatch

May 2022

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

Contents

LIST OF TABLES

LIST OF FIGURES

Abbreviations

5YA	Five-year average, the average for the four-month period from January to April of for 2017-2021; one of the standard reference periods.
15YA	Fifteen-year average, the average for the four-month period from January to April for 2007-2021; one of the standard reference periods and typically referred to as “average”.
AEZ	Agro-Ecological Zone
BIOMSS	CropWatch agroclimatic indicator for biomass production potential
BOM	Australian Bureau of Meteorology
CALF	Cropped Arable Land Fraction
CAS	Chinese Academy of Sciences
CWAI	CropWatch Agroclimatic Indicator
CWSU	CropWatch Spatial Units
DM	Dry matter
EC/JRC	European Commission Joint Research Centre
ENSO	El Niño Southern Oscillation
FAO	Food and Agriculture Organization of the United Nations
GAUL	Global Administrative Units Layer
GVG	GPS, Video, and GIS data
Ha	hectare
Kcal	kilocalorie
MPZ	Major Production Zone
MRU	Mapping and Reporting Unit
NDVI	Normalized Difference Vegetation Index
OISST	Optimum Interpolation Sea Surface Temperature
PAR	Photosynthetically active radiation
PET	Potential Evapotranspiration
AIR	CAS Aerospace Information Research Institute
RADPAR	CropWatch PAR agroclimatic indicator
RAIN	CropWatch rainfall agroclimatic indicator
SOI	Southern Oscillation Index
TEMP	CropWatch air temperature agroclimatic indicator
Tonne	Thousand kilograms
VCIx	CropWatch maximum Vegetation Condition Index
VHI	CropWatch Vegetation Health Index
VHIn	CropWatch minimum Vegetation Health Index
W/m^2	Watt per square meter

Bulletin overview and reporting period

This CropWatch bulletin presents a global overview of crop stage and condition between January and April 2022, a period referred to in this bulletin as the JFMA (January, February, March and April) period or just the "reporting period." The bulletin is the 125th such publication issued by the CropWatch group at the Aerospace Information Research Institute (AIR) of the Chinese Academy of Sciences, Beijing.

CropWatch indicators

CropWatch analyses are based mostly on several standard as well as new ground-based and remote sensing indicators, following a hierarchical approach.

In parallel to an increasing spatial precision of the analyses, indicators become more focused on agriculture as the analyses zoom in to smaller spatial units. CropWatch uses two sets of indicators: (i) agroclimatic indicators—RAIN, TEMP, RADPAR, and potential BIOMSS, which describe weather factors and its impacts on crops. Importantly, the indicators RAIN, TEMP, RADPAR, and BIOMSS do not directly describe the weather variables rain, temperature, radiation, or biomass, but rather they are spatial averages over agricultural areas, which are weighted according to the local crop production potential; and (ii) agronomic indicators—VHIn, CALF, and VCIx and vegetation indices, describing crop condition and development. (iii) PAY indicators: planted area, yield and production.

For each reporting period, the bulletin reports on the departures for all seven indicators, which (with the exception of TEMP) are expressed in relative terms as a percentage change compared to the average value for that indicator for the last five or fifteen years (depending on the indicator).For more details on the CropWatch indicators and spatial units used for the analysis, please see the quick reference guide in Annex B, as well as online resources and publications posted at www.cropwatch.cn.

CropWatch analysis and indicators

The analyses cover large global zones; major producing countries of maize, rice, wheat, and soybean; and detailed assessments for Chinese regions, 42 major agricultural countries, and 217 Agro-Ecological Zones (AEZs).

This bulletin is organized as follows:

Chapter	Spatial coverage	Key indicators
Chapter 1	World, using Mapping and Reporting Units (MRU), 65 large, agro-ecologically homogeneous units covering the globe	RAIN, TEMP, RADPAR, BIOMSS
Chapter 2	Major Production Zones (MPZ), six regions that contribute most to global food production	As above, plus CALF, VCIx, and VHIn
Chapter 3	42 key countries (main producers and exporters) and 210 AEZs	As above plus NDVI and GVG survey
Chapter 4	China and regions	As above plus high-resolution images; Pest and crops trade prospects
Chapter 5	Production outlook, and updates on disaster events and El Niño.	

Regular updates and online resources

The bulletin is released quarterly in both English and Chinese. E-mail **cropwatch@radi.ac.cn** to sign up for the mailing list or visit CropWatch online at **www.cropwatch.cn**, **http://cloud.cropwatch.cn/**

Executive summary

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

The assessment is based mainly on remotely sensed data. It covers prevailing weather conditions, including extreme factors, at different spatial scales, starting with global patterns in Chapter 1. Chapter 2 focuses on agroclimatic and agronomic conditions in major production zones in all continents. Chapter 3 covers the major agricultural countries that, together, make up at least 80% of production and exports (the "core countries") while chapter 4 zooms into China. Special attention is paid to the production outlook of main crop producing and exporting countries where major cereal and oil crops (maize, rice, wheat and soybean) are harvested this year or currently still in the field. Subsequent sections of Chapter 5 describe the global disasters that occurred from January to April 2022.

Agroclimatic conditions and global warming

Temperatures keep raising, though at a slightly slower pace thanks to La Niña. While the global average increase in March was “only” 0.95ºC over the 20th-century average, it nevertheless caused much larger increases at the regional scale. Temperatures in the northwest of India, as well as in the Punjab of Pakistan were above 35ºC during the grain filling stage of wheat in March. This caused terminal heat stress and a yield reduction by 15-20% in some regions.

Deforestation in the Brazilian Amazon during the first three months of 2022 has increased by 64% compared to the same period last year. The total burned area in 2022 reached 43,000 ha, more than twice the average of the past ten years.

Ukraine, the commodity market and food security

Russia Ukraine conflict brought uncertainties to world food supply. Before the conflict , Ukraine used to export about 27 million tonnes of maize and 21 million tonnes of wheat. This represents a 11 to 13% share of the world market. It also is the second largest exporter of barley and the largest exporter of sunflower oil, with a market share of 40%. As shown in our special section on “The impact of the Russia Ukraine conflict on global food security,” potential production levels for winter wheat are almost unchanged, due to favorable weather conditions – yet the conflict impacts farming operations, logistics and trade, and it is almost impossible to forecast the levels of commodity exports for the coming months. Partly due to the large uncertainties and fueled by speculators, commodity prices have risen sharply.

According to the remote sensing-based estimates, the winter crop area increased 3.8% in Ukraine, the production of winter crops increased 2.1% (520 thousand tonnes). The area increase of winter crops in the Donetsk and Luhansk regions of eastern Ukraine has led to a doubling of production in both regions. However, the conflicts bring uncertain for the coming harvest season.

Agroclimatic conditions and crop production

In the Northern Hemisphere, wheat was the dominant crop that was in the field during this period. It had reached maturity in India and Pakistan by March. In most other production regions, it was still in its vegetative growth phase at that time. The planting of spring wheat, soybean and rice had started or was already in full swing in most northern regions by late April. In South America, maize and soybean were the key crops to be monitored. The harvest of the first crop, mainly soybean, and the subsequent sowing of the second crop in Brazil took place in February, whereas the harvest of the main crop in the other South American countries was well advanced by April. Closer to the Equator, this report covers the end tail of the harvest of the main season rice crop and production of the winter rice crops (Boro/Kharif) in South- and South-east Asia.

Global rainfall patterns were strongly affected by the current La Niña conditions. The largest rainfall deficits, exceeding more than -30%, as compared to the 15 year average, were observed for Central-Eastern Brazil, the West-Coast of North America, the Horn of Africa, as well as Afghanistan. Negative departures of rainfall, in the range of -30 to -10%, were also observed for a large region stretching from Morocco to Afghanistan. Most of the European part of Russia, most of China, as well as South-east Asia and Australia experienced rainfall that was at least 10% above average.

Impact of weather conditions on crops

Maize: Argentina and Brazil contribute about 40% to the maize that is being traded internationally. Conditions in Argentina were favorable. In Brazil, the regular, though below average rainfall ensured favorable conditions for the important second season (safrinha) maize. Hence, CropWatch estimates a production increase by 9% for Brazil and 2.9% for Argentina, amounting to a combined increase by roughly 11 million tonnes. Maize production during the rainy season in Africa south of the equator was negatively impacted by irregular rains, but production levels stayed close to average. However, Kenya was hit by a severe drought, causing a decline in production by 12.9%. Maize production in South and Southeast Asia benefitted from generally favorable conditions. Maize planting started in April in North America and Europe. So far, weather conditions have been favorable, although the weather has been cooler than normal in the USA and drier than normal in most of Western Europe. Total global production is forecasted at 1009 million tonnes (+0.8%).

Wheat: In China, wheat benefitted from favorable weather conditions in recent two months. The crop more than compensated for the delayed sowing in last fall. Nevertheless, there was a slight reduction in area, causing an overall reduction of production by 1.2%. A heat wave hit the northwest of India and the Punjab of Pakistan in mid March. The ensuing terminal heat stress caused a fast brown-down of the crops and shortened the grain-filling period. At the national level, this resulted in wheat production decreases by 4.9% to 25.57 million tonnes in Pakistan and by 2.8% to 93.24 million tonnes in India. Severe yield losses for the rainfed wheat production are forecasted for the drought stricken countries of the Maghreb, Near- and Middle East and Central Asia. Production in Morocco is estimated to have declined by 40%. The south of the USA is also affected by drought conditions. Significant yield reductions are to be expected for Texas, Oklahoma and Kansas. Abundant rain in recent weeks has caused rather favorable conditions for the upcoming planting period of wheat in Argentina, Brazil and Australia. CropWatch estimates a decline in global wheat production by 1% to 713 million tonnes, which continued the wheat decrease since 2021 and world wheat supply is still with tension.

Rice: Conditions for winter (Rabi) season rice production were generally favorable in India, the largest rice exporter. Production is estimated to increase by 1.5% year on year. Conditions were also favorable in Bangladesh (+4.2%) and Vietnam (+1.7%), whereas a slight decrease in production by -0.7% is forecasted for Thailand. Conditions for the other important rice producing countries and regions, such as the Philippines (-0.2%) and Indonesia (+3.1%) were average or above. CropWatch forecasts a slight increase of total global rice production by 0.7% to 769 million tonnes.

Soybean: Argentina, Brazil, Paraguay and Uruguay produce more than half of the world's soybeans traded on the international market. Conditions in Brazil for soybean production were unfavorable due to drought conditions from October to December. CropWatch forecasts a decline by 7.4% to 89 million tonnes, whereas for Argentina, a slight increase by 0.3% to 51 million tonnes is expected. In the USA, Canada and the Ukraine, soybean sowing started at the end of this monitoring period, in late April. Soil moisture conditions are mostly favorable in these countries, but the war causes high uncertainties for the Ukrainian production. Conditions in May will determine the area planted and crop establishment. CropWatch foresees a decline in global soybean production by 3.3% to 310 million tonnes.

Chapter 1. Global agroclimatic patterns

Chapter 1 describes the CropWatch Agroclimatic Indicators (CWAIs) rainfall (RAIN), temperature (TEMP), and radiation (RADPAR), along with the agronomic indicator for potential biomass (BIOMSS) in sixty-five global Monitoring and Reporting Units (MRU). RAIN, TEMP, RADPAR and BIOMSS are compared to their average value for the same period over the last fifteen years (called the "average"). Indicator values for all MRUs are included in Annex A table A.1. For more information about the MRUs and indicators, please see Annex B and online CropWatch resources at **www.cropwatch.cn**.

1.1 Introduction to CropWatch agroclimatic indicators (CWAIs)

This bulletin describes environmental and crop growth conditions over the period from January 2022 to April 2022, JFMA, referred to as "reporting period". In this chapter, we focus on 65 spatial "Mapping and Reporting Units"(MRU) which cover the globe, but CWAIs are averages of climatic variables over agricultural areas only inside each MRU. For instance, in the "Sahara to Afghan desert" MRU, only the Nile Valley and other cropped areas are considered. MRUs are listed in Annex B and serve the purpose of identifying global climatic patterns. Refer to Annex A for definitions and to table A.1 for 2022 JFMA numeric values of CWAIs by MRU. Although they are expressed in the same units as the corresponding climatological variables, CWAIs are spatial averages limited to agricultural land and weighted by the agricultural production potential inside each area.

1.2 Global overview

Temperatures keep raising, though at a slightly slower pace thanks to La Niña. While the global average increase in March was "only" 0.95ºC over the 20th-century average, it nevertheless caused much larger increases at the regional scale. Temperatures in the northwest of India, as well as in the Punjab of Pakistan were close to 40ºC during the grain filling stage of wheat in March. This caused terminal heat stress and a yield reduction by 15-20%. An analysis by the World Weather Attribution (WWA) initiative concluded that the probability of such an event has increased by a factor of about 30 due to climate change. They also warn that "Rising temperatures from more intense and frequent heat waves will render coping mechanisms inadequate as conditions in some regions meet and exceed limits to human survivability." Not only urban dwellers, but farm workers as well are getting more and more exposed to life threatening conditions.

The analysis of the CropWatch Agroclimatic Indicators (CWAIs) at the global level showed that temperatures were 0.26ºC warmer, solar radiation was 0.2% above average, but rainfall was reduced by 1.8% when compared to the 15YA (Fig 1.1).

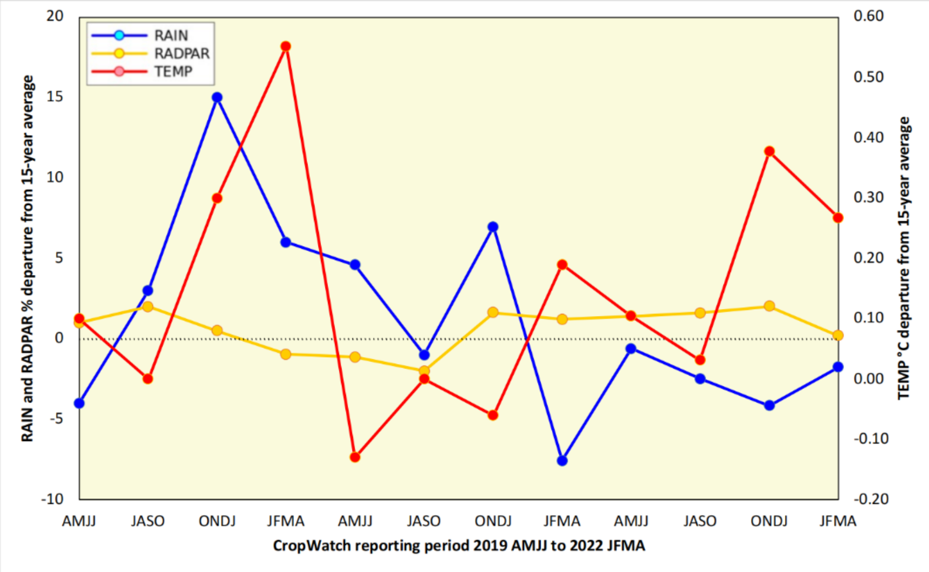

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Figure 1.1 global departure from recent 15-year average of the RAIN, TEMP and RADPAR indicators. The last period covers January to April (JFMA) 2022 (average of 65 MRUs, unweighted).

1.3 Rainfall

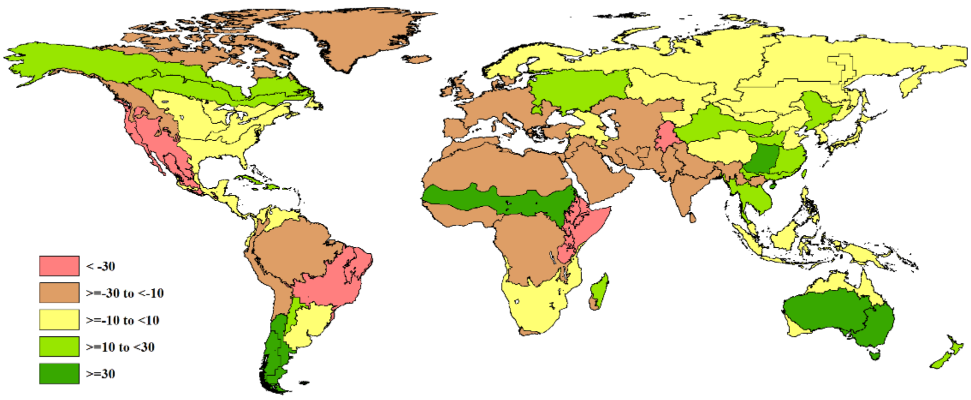

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Figure 1.2 Global map of rainfall anomaly (as indicated by the RAIN indicator) by CropWatch Mapping and Reporting Unit: Departure of January to April 2022 total from 2007-2021 average (15YA), in percent.

The rainfall departure map reflects the current La Niña conditions. The largest rainfall deficits, exceeding more than -30%, as compared to the 15YA, were observed for Central-Eastern Brazil, the West-Coast of North America, the Horn of Africa, as well as Afghanistan. Rainfall deficits ranging between -30% to -10% occurred in the Amazon basin and the adjacent Andean countries, as well as in western Europe. In Africa, the regions north and south of the Sahel were affected to a similar degree, as well as the Middle East, Central and South Asia. Rainfall was average in the eastern half of the USA, Central America, as well as in the south of Brazil, Uruguay and the Pampas in Argentina, southern Africa and most of Siberia. Strong positive departures were observed for the southern tip of South America and a belt just south of the Sahel stretching across all of Africa. Most of the European part of Russia, most of China, as well as South-East Asia and Australia experienced rainfall that was at least 10% above average.

1.4 Temperatures

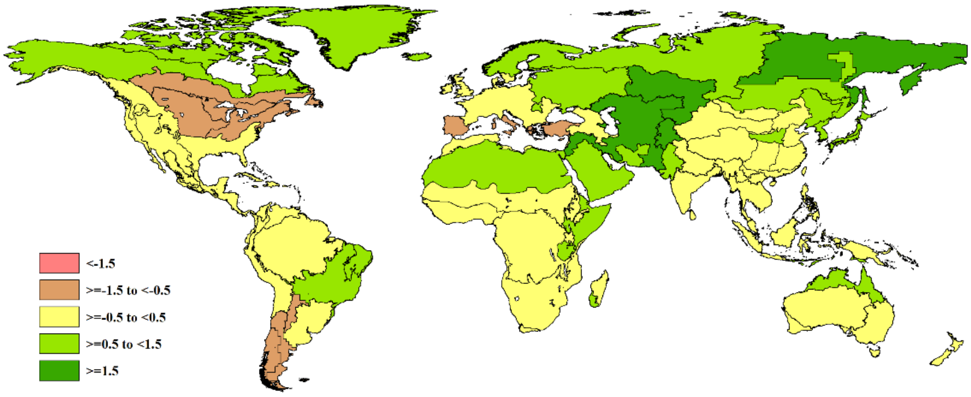


Figure 1.3 Global map of temperature anomaly (as indicated by the TEMP indicator) by CropWatch Mapping and Reporting Unit: departure of January to April 2022 average from 2007-2021 average (15YA), in °C.

Cooler temperatures, in the range of -1.5 to -0.5ºC as compared to the 15YA, were observed near the southern tip of South America, the North of the USA, the Canadian Prairies, the Iberian Peninsula, Italy, Greece and Turkey. Close to average temperatures were recorded for the south and west of the USA, Central America and the north of South America. Temperatures were near average for most of Africa south of the Sahel, except for the Horn of Africa, where temperatures were slightly warmer, western Europe, China, South and South-East Asia as well as most of Australia. Above average temperatures in the range of +0.5 to +1.5ºC were recorded for Mato Grosso, the Cerrados and North-East of Brazil, as well as the Middle East, and most of Russia. Although its region around the Caucasus, as well as Central Asia, Eastern Siberia experienced even warmer temperatures that exceeded the 15YA by more than 1.5ºC.

1.5 RADPAR

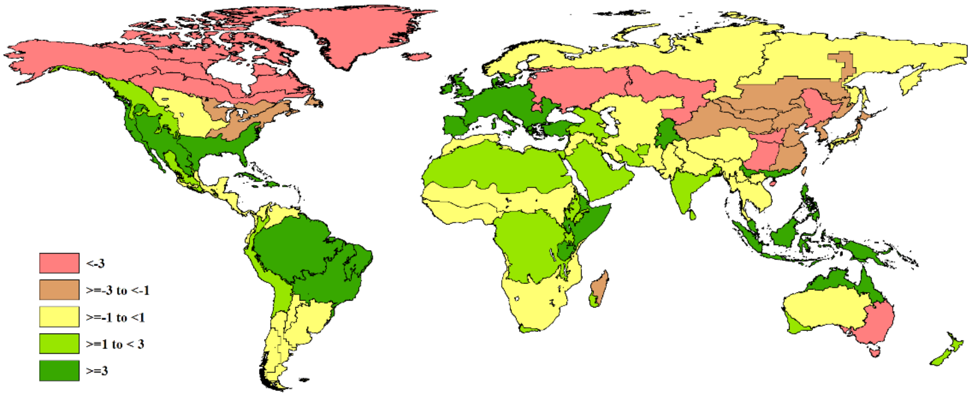


Figure 1.4 Global map of photosynthetically active radiation anomaly (as indicated by the RADPAR indicator) by CropWatch Mapping and Reporting Unit: departure of January to April 2022 total from 2007-2021 average (15YA), in percent.

As for the previous reporting period, solar radiation was above average for most of the Americas. Only the North-East of the USA as well as Ontario in Canada experienced a negative departure by -1 to -3%. Solar radiation was strongly reduced for most of the European part of Russia, southern Siberia and most of China. The Middle and Horn of Africa experienced above average solar radiation. In Western Europe, solar radiation levels exceeded the 15YA by more than 3%.

1.6 BIOMSS

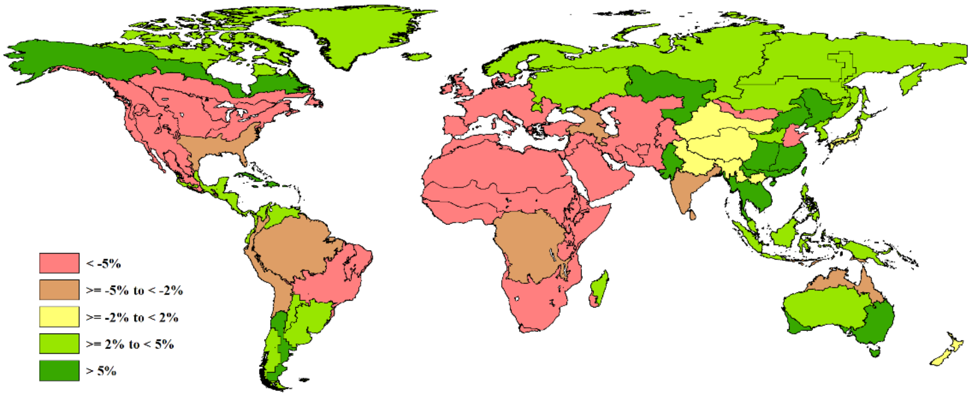


Figure 1.5 Global map of biomass accumulation (as indicated by the BIOMSS indicator) by CropWatch Mapping and Reporting Unit: departure of January to April 2022 total from 2007-2021 average (15YA), in percent.

Potential biomass production, which is calculated by taking rainfall, temperature and solar radiation into account, was more than 5% below the 15YA for most of North America, Mato Grosso, Cerrado, as well as the north-east of Brazil, Western Europe, near and middle East, Central Asia, as well as most of Africa, except for Equatorial Central Africa. The main reason for these departures was the rainfall deficit. For the Caucasus region and Southern India a negative departure by -2% to -5% had been estimated as well. Positive departures were estimated for the south of Brazil, most of Argentina, Central America and most of Russia, as well as most of China, South-East Asia and Australia.

Chapter 2. Crop and environmental conditions in major production zones

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

http://www.cropwatch.com.cn/htm/en/bullAction!showBulletin.action#.

2.1 Overview

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

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

	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
West Africa	112	-13	27	-0.2	1331	1	594	-3
North America	343	-1	4	-0.5	774	2	442	-8
South America	483	-43	23.1	0.5	1193	3	996	-14
S. and SE Asia	144	3	23.5	0	1211	1	582	3
Western Europe	254	-21	5.3	0.4	618	5	497	-6
Central Europe and W. Russia	268	5	0.4	1.2	458	-6	369	-1

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

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

	CALF (Cropped arable land fraction)		Maximum VCI
	Current	**5A Departure (%)**	**Current**
West Africa	54	1	0.86
North America	38	-15	0.71
South America	100	0	0.89
S. and SE Asia	87	13	0.92
Western Europe	94	0	0.88
Central Europe and W Russia	57	-12	0.82

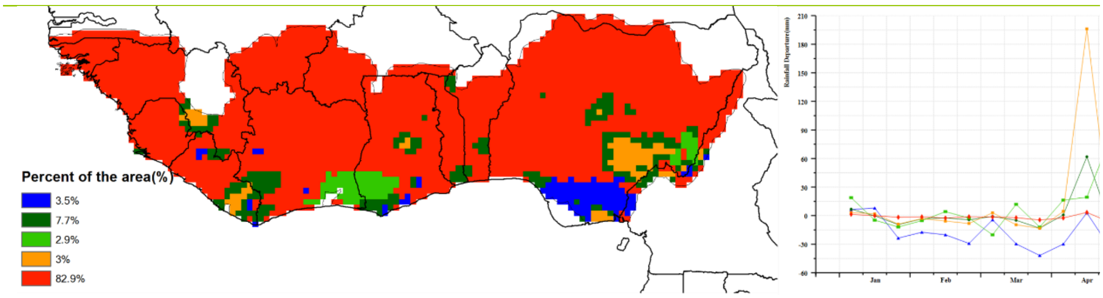
Note: See note for Table 2.1, with reference value R defined as the five-year average (5YA) for the same period (January to April) for 2007-2021.

2.2 West Africa

The report covers the period from January to April which represents the dry season in the MPZ and marks the end of the harvest of the main season crops. Cropping activities are mainly limited to the coastal areas. Northern areas were uncropped. The harvested cereal crops include main crop maize, sorghum, millet and rainfed rice. The crops grown in the coastal region include maize, yam and rice. For Nigeria, the harvesting activities of cereals were finalized by the end of January. This region is dominated by rainfed crops, the agro-meteorological conditions play a decisive role in the growth of crops.

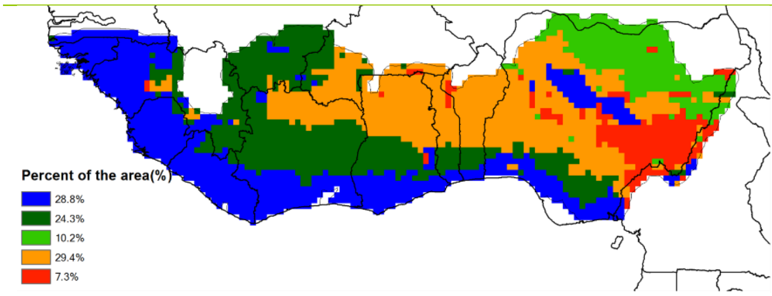
For this region, the climatic indicators showed general decrease in annual rainfall (112mm, -13%) with the highest rainfall observed in Equatorial Guinea (882 mm, -24%), Gabon (837 mm, 24%) and Liberia (393 mm, -1%) while the rest of the region representing 82.9% experienced negative rainfall departures. Based on the vegetative health index (VHI), Nigeria experienced severe drought in both coastal and northern areas of the country. The temperature profiles show that the regional average temperature was 27.1ºC with negligible departure (-0.1ºC). The estimated regional radiation potential was 1331 MJ/m2 (+1%) resulting in observed potential biomass production of 617 gDM/m2 (-5%), located predominantly in the cropped coastal areas of the region. The climatic indicators are indicative of a dry season with reduced agricultural activities as shown by the CALF and rainfall profiles.

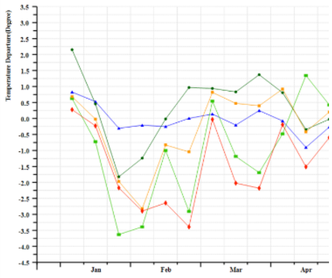
Figure 2.1 West Africa MPZ: Agroclimatic and agronomic indicators, January - April 2022



a. Spatial distribution of rainfall profiles

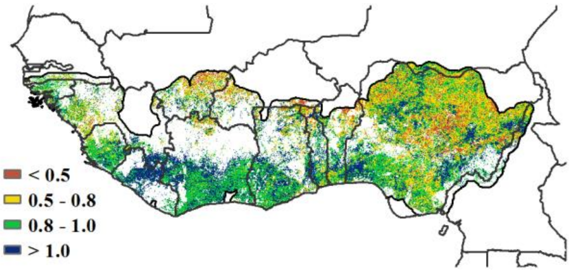
b. Profiles of rainfall departure from average (mm)



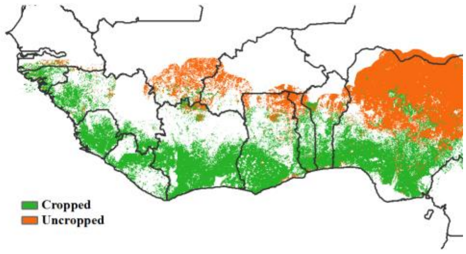


c. Spatial distribution of temperature profiles

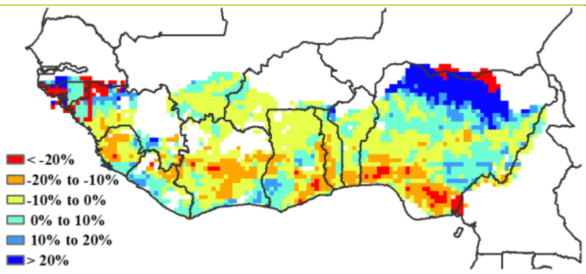
d. Profiles of temperature departure from average (mm)



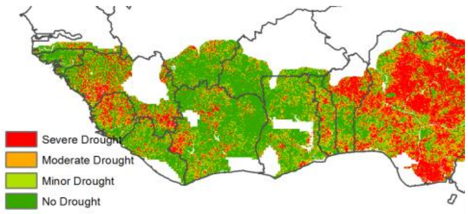
e. Maximum VCI



f. Cropped arable land



g. Biomass accumulation potential departure



h. VHI minimum

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

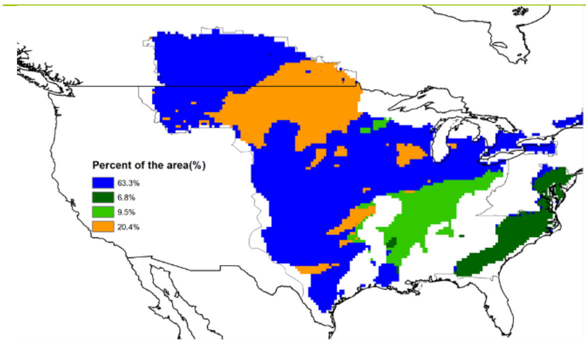
2.3 North America

This reporting period runs from January to April 2022. It covers the growing season for the winter cereals, which includes the green-up, tillering, jointing and heading periods. The major winter wheat growing regions involve Texas, Oklahoma and Kansas. Overall, crop conditions were poor due to drought in the main winter wheat producing areas. Irrigation crops take around one fifth of cropland with the rest under rain-fed, agro-meteorological conditions play an important role in crop growth.

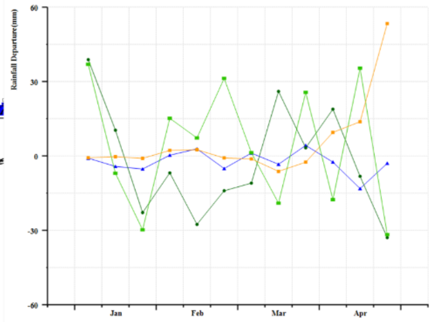
As a whole, agroclimatic conditions were average during this reporting period, with rainfall and temperature 1% and 0.5°C below average, respectively, while radiation was 2% above average. The spatial distribution of rainfall indicates below-average rainfall in the main winter wheat producing areas since late March, while on the contrary, the temperature profiles indicate a significant warming during the same period. March-April is a critical growing period for winter wheat and the crop's water demand increases. Below-average rainfall and warming trends increase soil moisture loss and are detrimental to the growth of winter wheat. The potential biomass is 20% below average in the major winter wheat producing zones. The warming and dry weather led to severe drought in the main winter wheat producing areas, and the minimum vegetation index captured moderate and severe drought in the main winter wheat producing areas. The maximum vegetation index below 0.5 reflects poor crop conditions in the region. Compared to the recent five years, cropped area land fraction is 15% below average.

In short, CropWatch assessed crop growth for this monitoring period as below average. This period is a critical growth stage for winter wheat, below average production could be expected due to drought-reduced acreage.

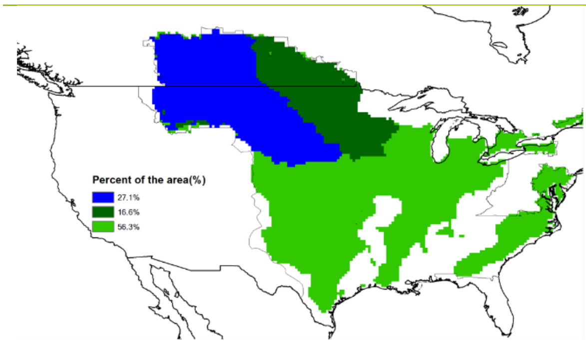
Figure 2.2 West Africa MPZ: Agroclimatic and agronomic indicators, January - April 2022.



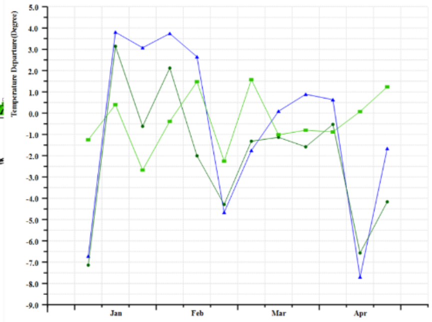
a. Spatial distribution of rainfall profiles



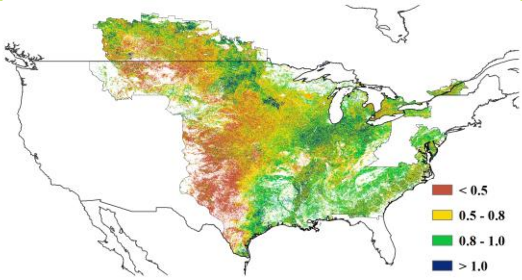
b. Profiles of rainfall departure from average (mm)



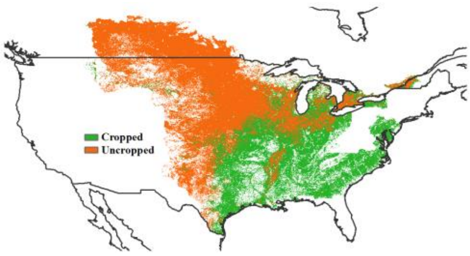
c. Spatial distribution of temperature profiles



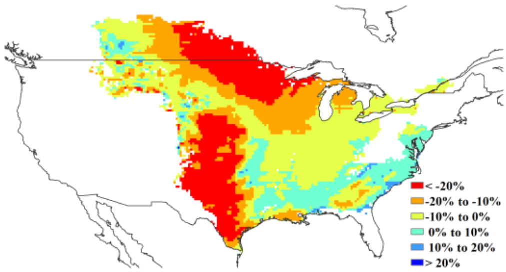
d. Profiles of temperature departure from average (mm)



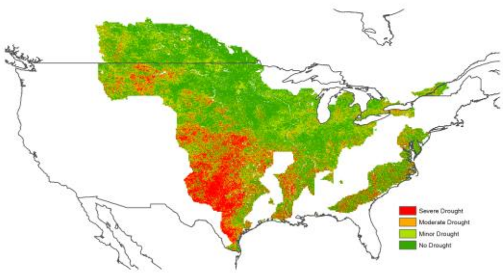
e. Maximum VCI



f. Cropped and uncropped arable land



g. Biomass accumulation potential departure



h. VHI minimum

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

2.4 South America

The reporting period covers the main growing period of summer crops, as well as the harvest of the crops that had been planted at the beginning of the rainy season in October. The situation of South America is contrasting, with poor conditions in the north and good conditions in the south. This regions is dominated by rain fed crops and agro-meteorological conditions play decisive role.

Spatial distribution of rainfall profiles showed three main patterns distributed along a North-South gradient (Figure 2.3 a/b). North of the MPZ showed negative anomalies all along the reporting period (blue areas), with larger negative departures (-90 mm) in January, end of February and March. Southern Paraguay and Mato Grosso do Sul, Sao Pablo and Paraná states in Brazil showed a variable profile with strong negative anomaly values in mid-January and February. Starting from March, it trended near the average (orange areas). Santa Catarina and Rio Grande do Sul states in Brazil, Uruguay and Argentina showed a profile with positive and no anomalies (light and dark green areas). A profile with strong positive anomalies at the end of January, February and beginning of March (dark green) was observed in Subtropical highlands and North Pampas in Argentina and Center Uruguay. The remaining areas (light green profile) showed a quite stable pattern with nearly no anomalies. Lastly, a small portion of the area showed a high variable pattern of strong positive anomalies and moderate negative anomalies (red areas) and was located in part of Minas Gerais state in Brazil.

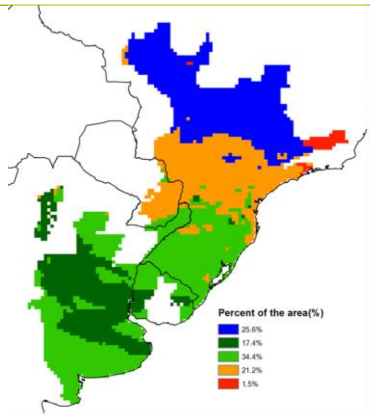
Temperature profiles showed four homogeneous profiles with high temporal variability (Figure 2.3 c/d). North of the MPZ showed two profiles: North Center of the MPZ (orange profile) showed no anomalies at the beginning of the reporting period and strong positive anomalies at the end of January, and from end of February to April. Surrounding this area (at North East and North West of the MPZ), a profile with moderate positive anomalies during January, and from February to April was observed (dark green profile). Southern states of Brazil (Paraná, Santa Catarina and Rio Grande do Sul states), Southern Paraguay, East and North Uruguay, and Mesopotamia and North-East Chaco in Argentina showed a profile with strong positive anomalies in January, end of February and beginning of March and negative anomalies at the beginning of February and from mid-March to mid-April (blue areas). The rest of Argentina sowed a profile with positive anomalies at the beginning of the reporting period and negative anomalies since the end of January (light green areas).

The BIOMSS departure map shows a contrasting pattern with poor conditions in the North of the MPZ and good conditions in most of Argentina (Figure 2.3 f). The center of the MPZ showed intermediate and variable BIOMSS values.

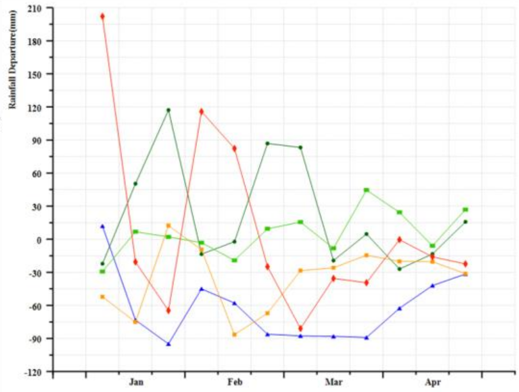
Maximum VCI showed quite good conditions for most of the area, with the exception of West of Rio Grande do Sul state in Brazil that showed low VCIx values mainly due to the prolonged drought. Poor conditions also appeared in a lesser extent in South and North Pampas, South Paraguay and Mato Grosso do Sul state in Brazil. Crop Arable Land Fraction was almost complete, with the exception of a small portion in the South-West Pampas (Figure 2.3 e).

South America showed contrasting conditions for several of the analyzed indices (Figure 2.3 g). In the north of the MPZ (South Brazil) negative anomalies were observed for RAIN and low BIOMSS values, while in the South (most of Argentina) no or positive anomalies in RAIN and high BIOMSS values were observed.

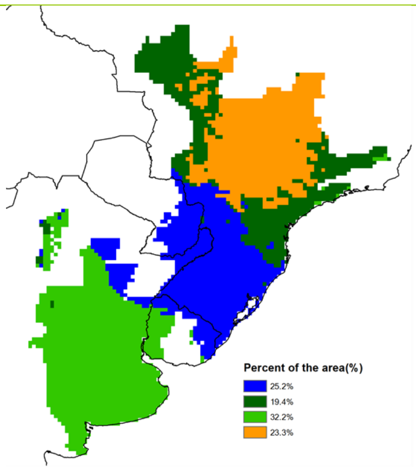
Figure 2.3 South America MPZ: Agroclimatic and agronomic indicators, January - April 2022.



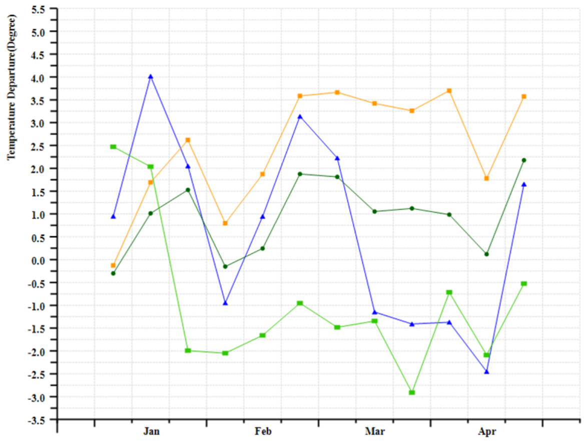
a. Spatial distribution of rainfall profiles



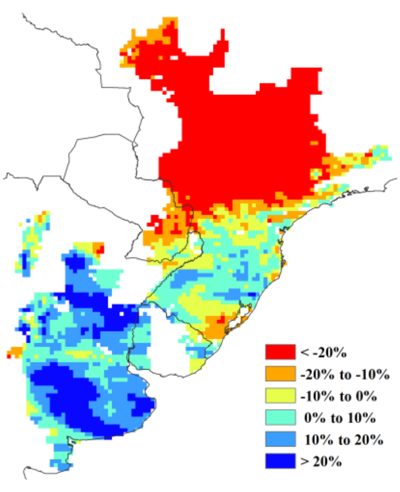
b. Profiles of rainfall departure from average (mm)



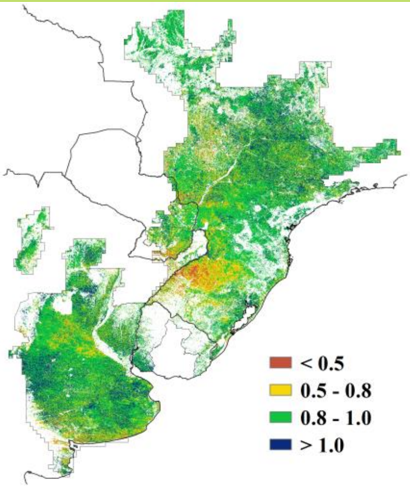
c. Spatial distribution of temperature profiles



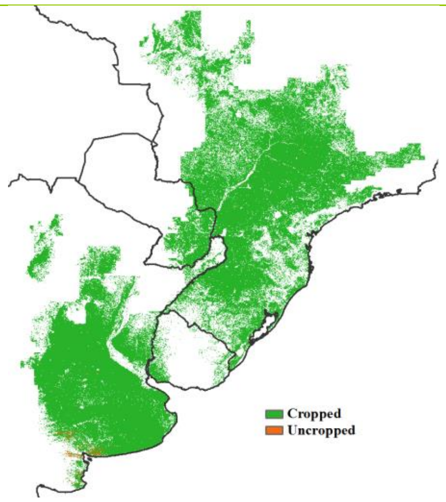
d. Profiles of temperature departure from average (°C)



e. Potential biomass departure from 15YA



f. Maximum VCI



g. Cropped and uncropped arable land

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

2.5 South and Southeast Asia

In this period, the South and Southeast Asia winter crops were in the growing period and earlier planted crops were in the harvest period. The main crops grown in South and Southeast Asia were maize, rice, wheat and soybean. Most of India crops are under irrigation, rainfall plays limited roles on crop conditions. The Southeast Asia is experiencing dry season and most crops are also irrigated.

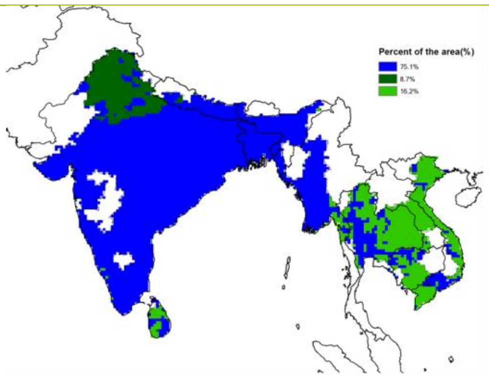
According to the CropWatch agroclimatic indicators, the temperature was unchanged compared with the 15YA. The RADPAR was above the 15YA (RADPAR +1%) and the accumulated precipitation was above the 15YA (RAIN+3%) which led to an increase in the potential biomass (BIOMSS +3%). CALF increased by 13% compared with the 5YA, reaching 87% and VCIx of the MPZ was 0.92.

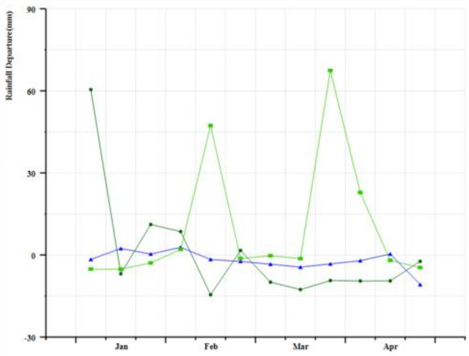
According to the spatial distribution of rainfall profiles, the precipitation for 8.7% of the MPZ showed the highest positive departures in late January, located in northwestern India. The precipitation for 16.2% of the MPZ showed the strongest positive anomaly in mid-February and late March, located in Sri Lanka, eastern Thailand, Laos, Cambodia and Vietnam. The precipitation in other regions was slightly below the average after early January. Southern Asia, southern Thailand and central Vietnam were experiencing drought conditions in late January. According to the spatial distribution temperature profiles, the temperature for 45.3% of the MPZ (Nepal, northwestern India and central Myanmar) gradually rose in February and reached the highest values in mid-March. 1.9% of the area, which included Punjab and Haryana, experienced temperatures that were up to 8ºC higher than the 15 YA starting from mid-March. It caused terminal heat stress in wheat in these two states. In contrast, on 17.4% of the MPZ (Thailand, Laos, Cambodia and northern Vietnam) temperatures dropped in late February and early April. The temperature in other regions fluctuated around the average after January.

The BIOMASS departure map reveals that the potential biomass in Thailand, southern Cambodia and southern Vietnam was 20% higher than the average level, while the potential biomass in southern and eastern India, Nepal, Bangladesh and Myanmar was estimated to be below average. The Maximum VCI map shows that the index in northern, western and southern India and other scattered areas was higher than 1.0. The VHI Minimum map shows severe drought happened in northern India, central India and central Myanmar. CALF map indicates that most of the regions were planted except for western and central India and central Myanmar.

In summary, the crop conditions of winter crops in this MPZ were generally favorable, apart from the extremely high temperatures that affected the northwest of India starting from mid-March. Since this regions mainly grows irrigated crops, and irrigation mitigated the impact of high air temperature, which shorten the duration of grouting period and caused very limited influence on crop condition.

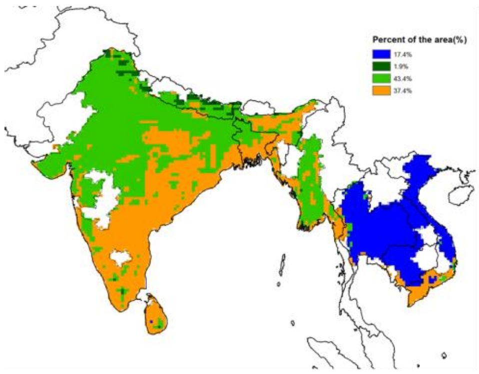
Figure 2.4 South And Southeast MPZ: Agroclimatic and agronomic indicators, January - April 2022.





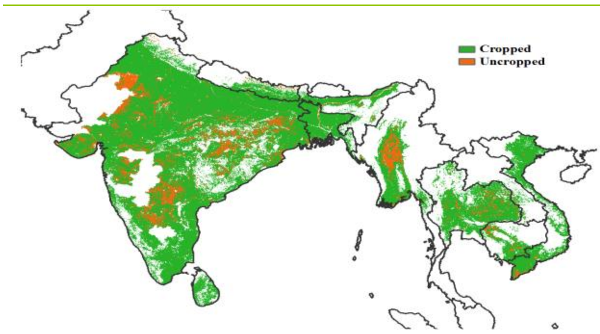
a.Spatial distribution of rainfall profiles

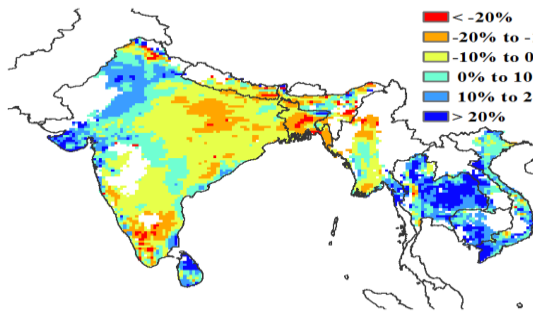
b.Profiles of rainfall departure from average (mm)



c.Spatial distribution of tempreature profiles

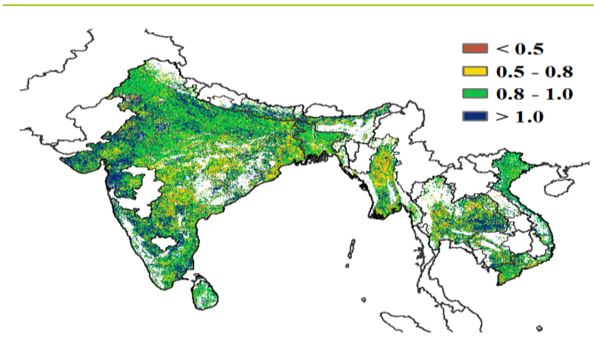
d.Profiles of temperature departure from average (℃)

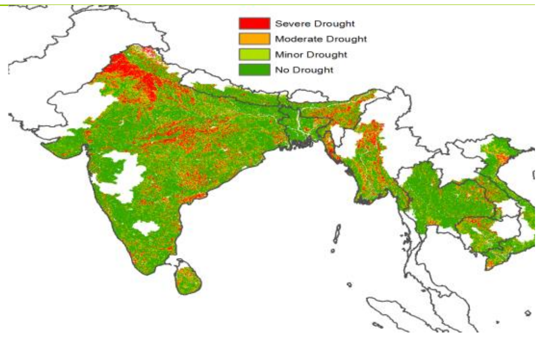




e.Cropped and uncropped arable land

f.Potential biomass departure from 5YA





g.Maximum VCI

h.VHI Minimum

2.6 Western Europe

The reporting period covers the over-wintering and spring green-up periods for the important winter cereals in the Western European Major Production Zone (MPZ). The sowing of summer crops started in March. Overall, crop conditions were average in most parts of the MPZ based on the interpretation of agroclimatic and agronomic indicators (figure 2.5). Crops of this region are mainly rainfed, agro-meteorological conditions play decisive role.

The precipitation deficit that had been observed during the previous monitoring period continued. On average, precipitation was below average (-21%). There were significant spatial and temporal differences in precipitation between the countries: (1) Precipitation in North central Spain, Northwestern and Central-Eastern parts of Italy, most of the Czech Republic, Southwestern Slovakia, Northeastern Austria and Western part of Hungary, covering 28.4% of the MPZ areas, was near or below average, except for mid-March; (2) Precipitation was below average on 30.9% of the MPZ. The affected area covered most of Germany, Denmark and northeastern France. Only in early January, early February, mid-March and early April was precipitation significantly above average; (3) For the rest of the monitoring area (40.8%), covering most parts of UK and France, Northern and Southeastern Italy, precipitation was significantly below average, except for slightly above-average precipitation in early January, early February, mid-March and early April. Almost all western European countries covered by the MPZ had below-average precipitation. The countries with the most severe precipitation departures included Italy (RAIN -51%), Hungary (RAIN -38%), Spain (RAIN -36%), France (RAIN -29%), UK (RAIN -21%), Austria (RAIN -20%) and Slovakia (RAIN -18%). The pronounced and intermittent precipitation deficit in the southern part of the MPZ may have negatively impacted winter crop growth.

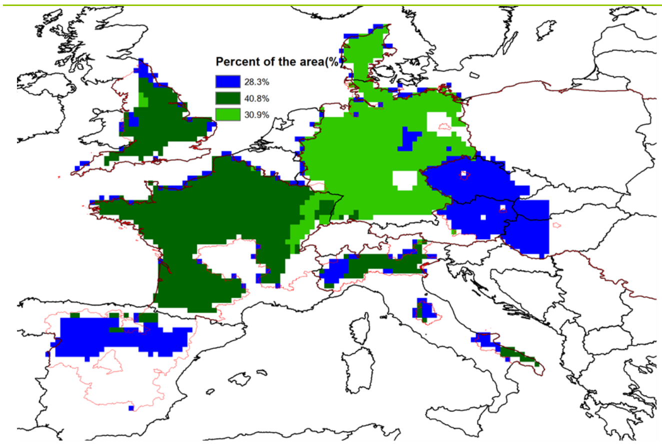
Temperature for the MPZ as a whole was above average (TEMP +0.4%) and radiation was above average with RADPAR at +5%. As shown in the spatial distribution of temperature profiles, 62.4 percent of the MPZ areas (UK, Spain, France, northeastern Italy, most of the Czech Republic, Southwestern Slovakia, Northeastern Austria and Western part of Hungary) experienced warmer-than-usual conditions throughout the monitoring period, except for mid-late-January and early-April; 17.5 percent of the MPZ areas (Northern Germany and Denmark) experienced significant above -average temperatures throughout the monitoring period, except for early March and April; 20.1 percent of the MPZ areas (Southern Germany and Northern, Central and Southeastern Italy) experienced warmer-than-usual conditions during the monitoring period, except for the period in mid-January, late February, mid-early March and April. In addition, cold snaps swept through the MPZ in early March and early April, but had a very limited impact on winter crops, as they were not yet in the frost sensitive flowering period.

Due to the precipitation deficit, the potential BIOMSS was 6% below average. The lowest BIOMSS values (-20% and less) were observed for most parts of Spain and Italy, and the west of France. In contrast, BIOMSS was above average (+10% and more) mainly in Southeastern Spain, Northern UK, Northern Germany and Denmark.

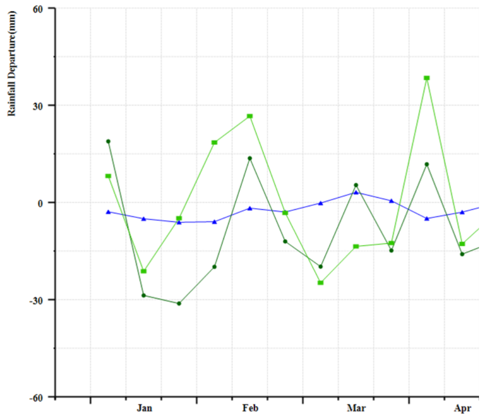
The average maximum VCI for the MPZ reached a value of 0.88 during this reporting period, whichs is at normal level. However, crops in northern area were just sown and waiter for further monitoring. More than 94% of arable land was cropped, which is same as the recent five-year average in the whole MPZ. The uncropped areas of arable land were mainly located in the southern regions of the MPZ, such as Northern Italy, Eastern and Southeastern Spain, Southeastern France and Southwestern Austria, and few pockets in parts of Germany, Northern and Southwestern France and the UK. The VHI minimum map shows that some pockets of France, Germany, Central region of UK, Spain and Italy were affected by short spells of drought conditions.

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

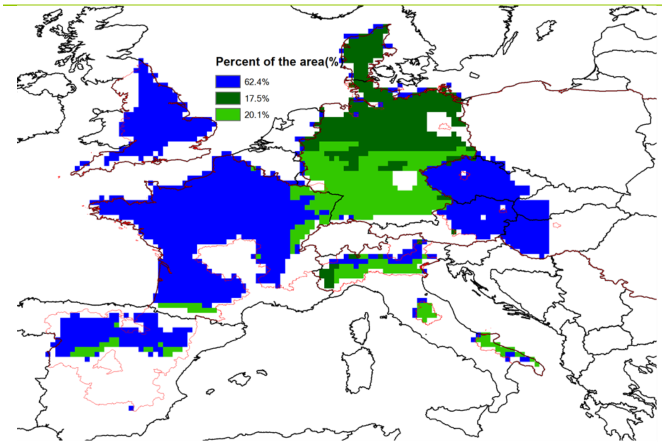
Figure 2.5 Western Europe MPZ: Agroclimatic and agronomic indicators, January - April 2022.



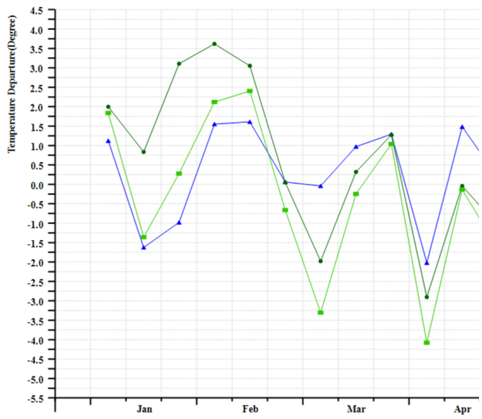
a. Spatial distribution of rainfall profiles



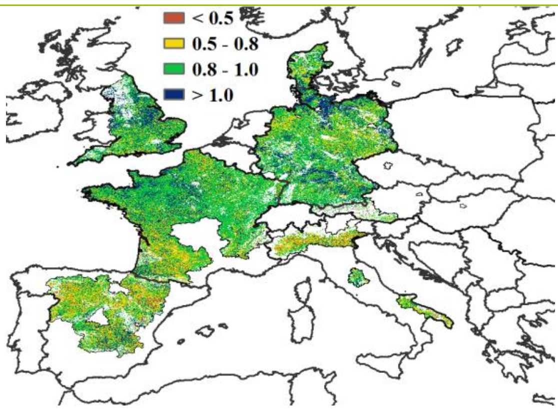
b. Profiles of rainfall departure from average (mm)



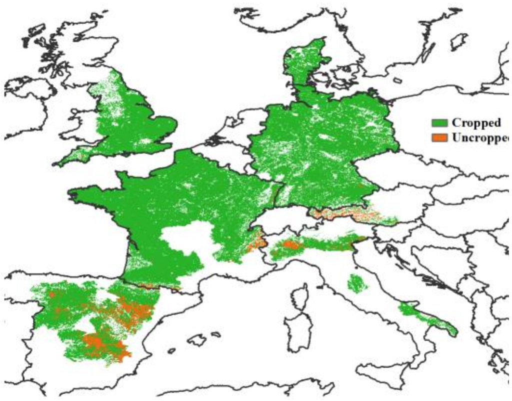
c. Spatial distribution of temperature profiles



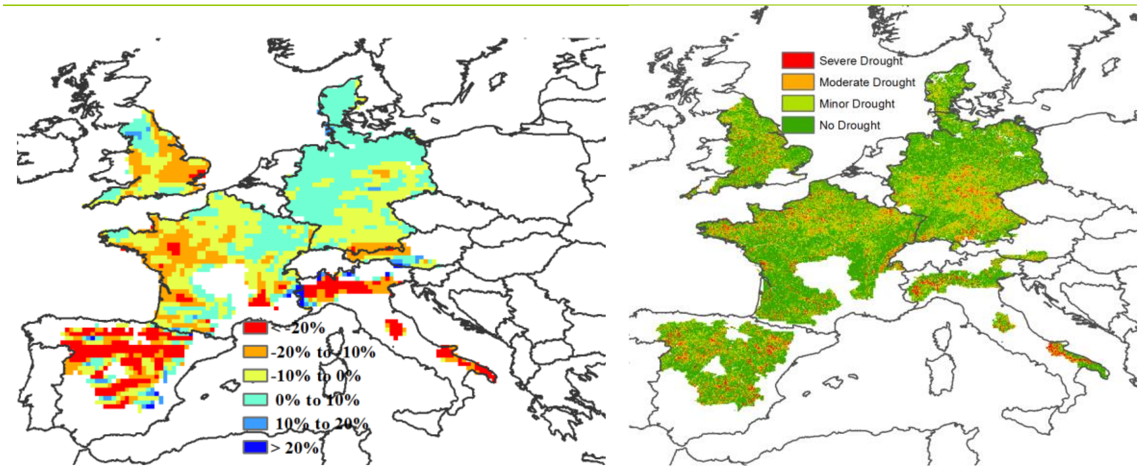
d. Profiles of temperature departure from average (mm)



e. Maximum VCI



f. Cropped arable land



g. Biomass accumulation potential departure

h. VHI minimum

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

2.7 Central Europe to Western Russia

This monitoring period covers the dormant winter season and the spring green-up of winter cereals in Central Europe and western Russia. In general, the agroclimatic indicators in this MPZ were close to average, including 5% higher precipitation, near-average temperature, and 5.9% lower RADPAR, as compared to the 15YA. Crops of this region is mainly rainfed, the agro-meteorological conditions play a decisive role in crop growth.

According to the spatial distribution map of rainfall departure, the precipitation in most areas of the MPZ fluctuated around the mean during the monitoring period. The spatial and temporal distribution characteristics were as follows: (1) From January to February, the precipitation in most of northern and western Russia and parts of Ukraine (43% of the MPZ) was above average. (2) From early February to late March, the precipitation in the MPZ declined to below average. In mid-March, precipitation was below average in all production areas. The largest precipitation deficits were observed in southern Belarus, western Ukraine, northern Moldova, Romania, and parts of Poland (20.1% of the MPZ). (3) From mid-March to mid-April, 38.2% of the MPZ received above-average precipitation, mainly in northern Russia, northeastern Ukraine, northern Belarus and parts of Poland.

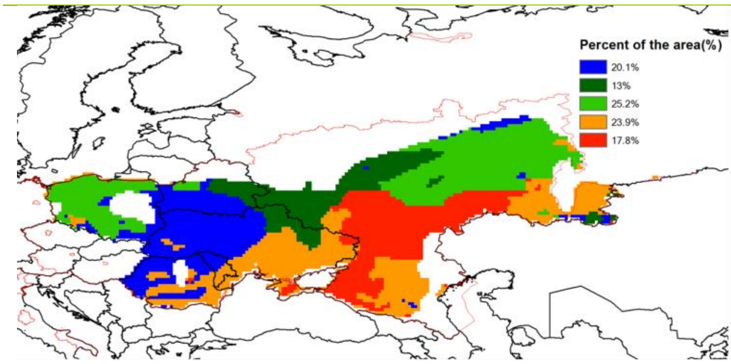
The temperature departure distribution map shows that the temperature departures followed the same trend across the entire MPZ. The specific spatial and temporal distribution characteristics were as follows: (1) From January to February, temperatures were above average in 80.3% of the MPZ, mainly in the eastern and northwestern parts of the MPZ. (2) In early and mid-March, temperatures within the MPZ were below average. (3) In April, 45.7% of the MPZ had above-average temperatures, mainly in Russia and parts of eastern Ukraine.

The potential biomass in the MPZ was 0.5% lower than average. The potential cumulative biomass in the eastern part of the MPZ was more than 10% above average, due to the regional drought; the areas in which with potential cumulative biomass was reduced by more than 20% were mainly located in southern Ukraine, southern Moldova, southeastern Romania and Hungary.

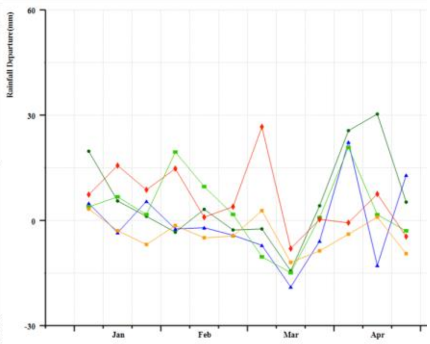
During this monitoring period, more than half of the arable land in the MPZ was cultivated, with a CALF value of 57.3% (-11.6%). The uncultivated arable land was mainly distributed in the northeastern part of Russia, northern Belarus, Ukraine, and Moldova. Russia Ukraine conflict may have contributed to the negative departure with postponed crop sown. The average maximum VCI for the MPZ reached a value of 0.82 during the monitoring period, the regions below 0.8 were mainly in southeastern Russia, Ukraine, and Moldova. The VHI minimum map shows that the eastern part of the main production area, parts of Ukraine, and Moldova were affected by below-average rainfall.

Overall, CropWatch agroclimatic and agronomic indicators show that crop growth was expected to be above average during this monitoring period. However, the impact of the war between Russia and Ukraine has significantly increased the area of uncultivated arable land in the Ukraine, which may lead to lower total food production in the region.

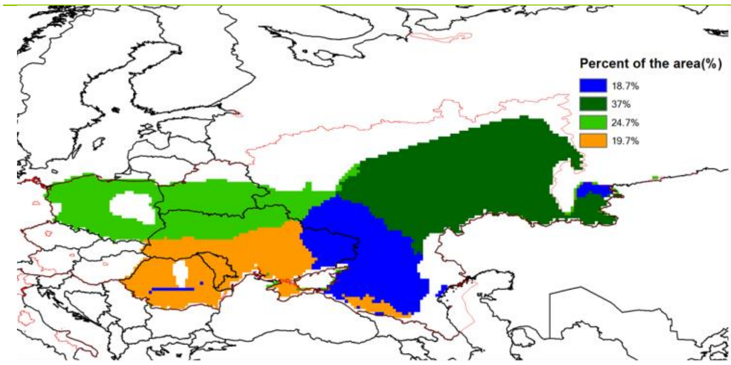
Figure 2.6 Central Europe-Western Russia MPZ: Agroclimatic and agronomic indicators, Juanuary-April 2022.



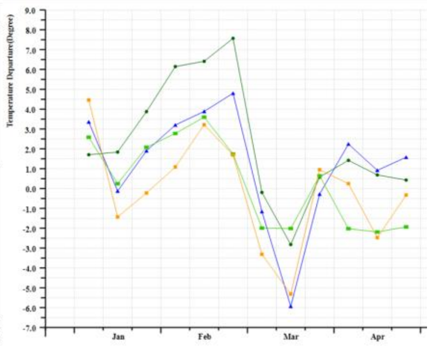
a. Spatial distribution of rainfall profiles



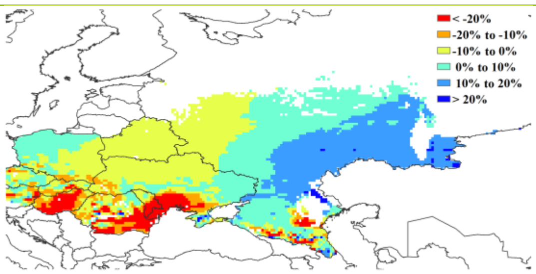
b. Profiles of rainfall departure from average (mm)



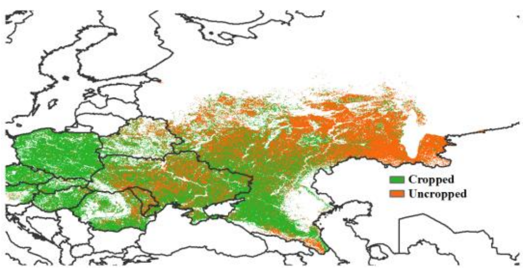
c. Spatial distribution of temperature profiles



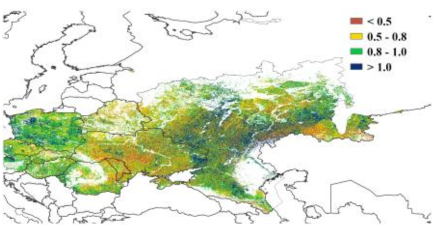
d. Profiles of temperature departure from average (mm)



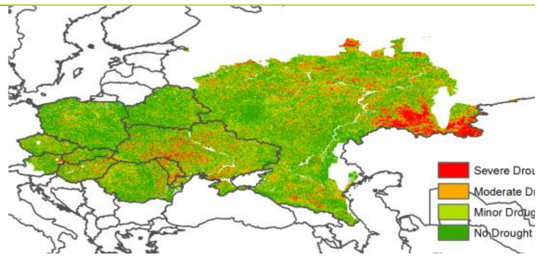
e. Biomass accumulation potential departure



f. Cropped arable land



g. Maximum VCI



h. VHI minimum

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

Chapter 3. Core countries

Chapter 1 has focused on large climate anomalies that sometimes reach the size of continents and beyond. The present section offers a closer look at individual countries, including the 42 countries that together produce and commercialize 80 percent of maize, rice, wheat, and soybean. As evidenced by the data in this section, even countries of minor agricultural or geopolitical relevance are exposed to extreme conditions and deserve mentioning, particularly when they logically fit into larger patterns.

3.1 Overview

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

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

Overview of weather conditions in major agricultural exporting countries

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

Maize: Maize exports have been dominated by just 4 countries: USA, Brazil, Argentina and the Ukraine. Together, they have supplied three quarters of maize being traded internationally. This may change this year due to the war in the Ukraine. During this monitoring period, rainfed maize was produced in the southern hemisphere, whereas in India, Bangladesh and Myanmar maize was grown in the dry winter months under irrigation. Production in these countries, as well as in South Africa and Paraguay is mainly for domestic consumption, with limited exports. After some drier conditions in December, rainfall improved in Argentina and during the January to April period, rainfall was more than 30% above the 15YA. CALF was high, and thus above-average production can be expected. In Brazil, conditions were sub-optimal for the 1st maize, which is mainly grown in the south, due to drought conditions. However, conditions greatly improved thanks to more abundant rainfall for the second maize crop, which is usually sown after soybean. Rainfall was below average during the monitoring period in India. However, rainfall during the dry winter season is generally very low, and farmers rely on irrigation for maize production during the winter months. The main maize production season is during the monsoon (Kharif), and production during the winter months (Rabi) contributes only about 15% to the total production. With temperatures and solar radiation being close to normal, average maize production can be expected for India during the monitoring period. South Africa is the largest maize exporter in Africa. Sowing was delayed because of lack of rainfall, and slightly below average production can be expected. Maize production in Kenya was greatly reduced by the severe drought conditions. Maize planting started in April in North America and Europe. So far, weather conditions have been favorable, although the weather has been cooler than normal in the USA and drier than normal in most of Western Europe. Weather conditions in the Ukraine are rather favorable, but the war causes large uncertainties.

Rice: Conditions for winter (Rabi) season rice production were generally favorable in India, the largest rice exporter. The region of irrigated dry season (Boro) rice production is limited to West Bengal, Telangana, Andhra Pradesh and Assam. However, Boro rice yields are much higher than those obtained in the Kharif (rainy) season. Another region with important dry season rice production is Southeast Asia. Thailand and Vietnam rank in the 2nd and the 3rd position of exporting countries. In these two countries, crop conditions were favorable. Water levels in the Mekong have recovered to average levels, enabling the farmers to irrigate their rice crops during the dry season. Conditions for the other important rice producing countries and regions, such as the Philippines and Indonesia were generally favorable. Hence, all in all, rice production is stable at a global level.

Wheat: Spring wheat sowing in Australia, Canada, Northern USA, Russia and Kazakhstan started in April. Depending on the local conditions, the sowing period lasts until May or early June. So far, soil moisture conditions have been rather favorable in these countries. Wheat tends to be grown in drier regions, where water is the limiting factor, except for the Indo-Gangetic Plain and the North-China Plain, where wheat is irrigated. In these two regions, conditions for wheat production have generally been favorable. Most wheat in India, apart from Punjab and Haryana had been harvested by the time the heat wave hit the country in mid March. In Punjab and Haryana, most fields were hit in the midst of the grain filling period. The terminal heat stress caused a high percentage of shriveled grains and yield reduction by 15-20% in these two states. Winter wheat is an important crop in the drought stricken Maghreb, Near and Middle East. The drought caused significant yield reductions in all countries of these regions, except for Egypt, where all wheat is irrigated with water from the Nile river. The south of the USA is also affected by drought conditions. Significant yield reductions are to be expected for Texas, Oklahoma and Kansas. Abundant rain in recent weeks has caused rather favorable conditions for the upcoming planting period of wheat in Argentina, Brazil and Australia.

Soybean: In the USA, Canada and the Ukraine, soybean sowing started at the end of this monitoring period, in late April. Soil moisture conditions are mostly favorable in these countries, but the war causes high uncertainties for the Ukrainian production. Conditions in May will determine the area planted and crop establishment. Argentina, Brazil, Paraguay and Uruguay produce more than half of the world's soybeans traded on the international market. Conditions in Brazil for soybean production were unfavorable due to drought conditions from October to December. In Argentina, where a high percentage of soybean is sown after the wheat harvest in December, conditions were favorable.

Weather anomalies and biomass production potential changes

(1) Rainfall

Rainfall in Brazil was below average during the previous and remained below average during this monitoring period as well, but rainfall levels were in general sufficient and evenly spread to ensure good conditions for finishing off the first season crop and ensuring good growth for the second season maize crop. In Argentina, rainfall had been below average from mid December to early January. This had a negative impact on crops sown in October. However, soybean, which is usually sown in December and January, benefitted from above average rainfall during the January to April period. Conditions for maize production were generally favorable as well. Below average rainfall caused unfavorable conditions in Peru, Ecuador and Colombia. In Central America, however, rainfall was above average, although this was the dry season. Main crop production will start in May. Conditions in Mexico were near average. In the South-west of the USA and California, the severe drought conditions continued. The important winter wheat production states of Texas and Kansas, Colorado as well as the north-west of Oklahoma were affected by a severe rainfall deficit, ranging between 10 to 30% below average. Rainfall conditions in the more northern states and in the Canadian Prairies were normal to above average, although in some regions, excessive soil moisture causes delays in sowing of the summer crops. In Europe, the UK, France, the Iberian Peninsula, as well as Italy and all countries in the South-East experienced a moderate to severe precipitation deficit. These drought affected countries are important winter cereal producers. Other important winter cereal producers, such as Germany, Poland and the Ukraine experienced close to normal conditions. Russia west of the Urals, as well as Kazakhstan, had average to above average precipitation, creating a favorable environment for wheat production. Conditions for winter cereal production in the Maghreb, the Near and Middle East as well as in Central Asia were highly unfavorable: Wheat yields in countries and regions that rely mostly on rainfed wheat production, such as Morocco and Syria, as well Central and Eastern Anatolia and the Kurdish regions in Turkey, Irak and Iran were reduced due to severe precipitation deficits. The drought conditions in Afghanistan continued, although high rainfall in January had brought some relief. Another region that was affected by drought was the Horn of Africa. Especially in Kenya and Tanzania, crop production was reduced. While conditions were mixed in southern Africa, an uneven distribution of rainfall hampered crop production in most countries of southern Africa. In India and Bangladesh most production of winter wheat is irrigated, hence the drier than usual precipitation had little impact on crop production. Rainfall was above average for China, causing favorable conditions for winter wheat production and land preparation for the upcoming rice growing season. In South-East Asia, above average rainfall generated favorable conditions for rice production, which was aided by normal water flow levels in the Mekong river. In Australia, high rainfall helped establish good moisture conditions for the upcoming wheat growing season.

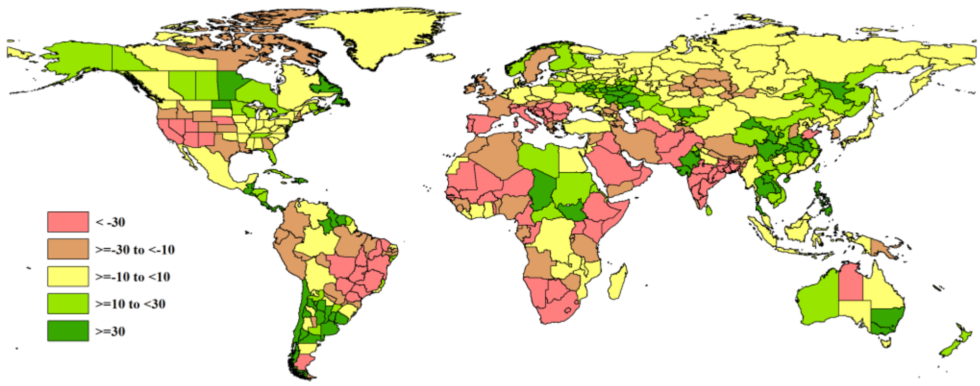


Figure 3.1 National and subnational rainfall anomaly (as indicated by the RAIN indicator) of January to April 2022 total relative to the 2007-2021 average (15YA), in percent

(2) Temperatures

Temperatures are insofar important for crop production, as they control the start of the growing season and early crop growth in temperate regions. For planting of maize and soybean, soil temperatures need to be at least at 10ºC in order to ensure an even germination. Untimely freezing conditions, which usually occur at the beginning and end of the growing season can cause large damage or even kill crops. Among the main crops covered in this report, only wheat can withstand freezing temperatures. Excessive heat with temperatures higher than 32ºC, in combination with dry conditions, can cause yield reductions for wheat due to terminal heat stress, as experienced in Pakistan and the northwest of India in March. Temperatures above 35ºC can cause pollen sterility in maize. Taking these points into consideration, the temperature departures in South America and Africa did not have a big impact on crop production. In North America, the below average temperatures caused a slight delay for planting of maize in the corn belt. The above average temperatures in Russia, which were centered around the Urals, accelerated spring green-up of the winter crops.

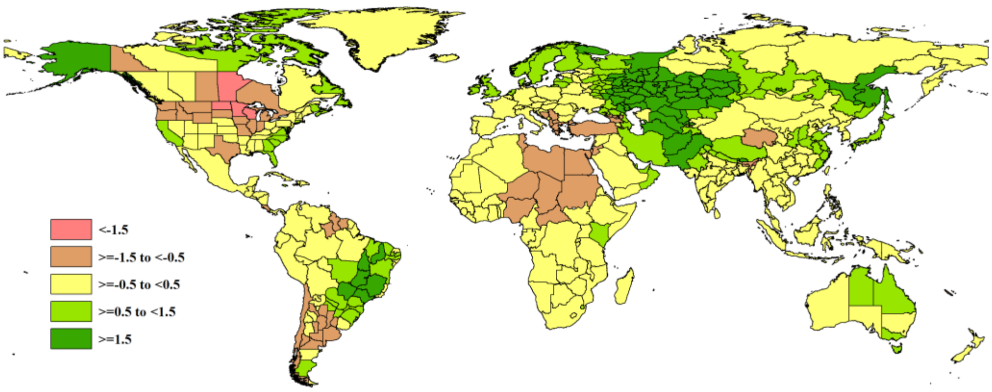


Figure 3.2 National and subnational temperature anomaly (as indicated by the TEMP indicator) of January to April 2022 average relative to the 2007-2021 average (15YA), in °C

(3) RADPAR

The pattern of solar radiation departures tends to mirror the rainfall departures. Rainy conditions are generally accompanied by increased cloud cover and therefore, lower solar radiation. Rainfall deficits tend to go together with clear skies and above average solar radiation. In Argentina, most of the important crop producing provinces had average to slightly below average solar radiation levels. Below average solar radiation levels were also observed for the south of Brazil and Paraguay. Further north, up to the southern corn belt of the USA, radiation levels were mostly above average, especially in the USA. Its northern states, as well as most of Canada, experienced below average radiation levels. All of Europe, apart from Russia and the Ukraine, had sunnier conditions than usual. In Africa, solar radiation was 1 to 3% below average for Tunisia, Egypt, Sudan, Zimbabwe, Mozambique and Madagascar. The largest negative departures were observed for Namibia and Libya. Solar radiation levels were above average in the Near and Middle East, as well as in South Asia. Conditions were more cloudy than usual in China, Myanmar and North Korea. The important rice producing countries Thailand, Vietnam, Laos, the Philippines and Indonesia had average to strongly above average solar radiation levels.

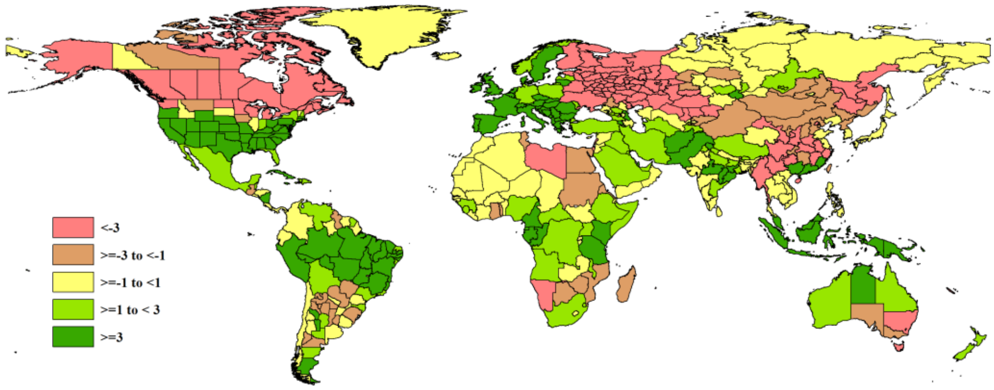


Figure 3.3 National and subnational sunshine anomaly (as indicated by the RADPAR indicator) of January to April 2021 total relative to the 2007-2021 average (15YA), in percent

(4) Biomass accumulation potential

The BIOMSS indicator is controlled by temperature, rainfall and solar radiation. In some regions, rainfall is more limiting, whereas in other ones, mainly the tropical ones, solar radiation tends to be the limiting factor. For high latitude regions, temperature may also become the most critical limiting factor. The strong positive departure (>+10%) for potential biomass production for most of Argentina indicates that conditions were favorable. To the contrary, the important crop production regions in Brazil had a negative departure by more than -10%. Conditions were average for most of the other regions in South and Central America. Mexico, the USA apart from the Southeast and Canada had negative (-5 to -10%) to strongly negative departures. Similarly, most of southern and eastern Europe had a mix of negative to strongly negative departures. Conditions in the north of Europe as well as most of Russia west of the Urals and Kazakhstan had average to strongly above average conditions. In the Near and Middle East, as well as the Maghreb, negative to strongly negative departures dominated. Similarly, the Horn of Africa and southern Africa as well as the West African countries bordering the Sahel had a strong negative departure. Neutral to strongly above average solar radiation levels dominated most of Asia. Only the east coast of India, Bangladesh, Shandong province in China as well as South Korea had a negative departure of potential biomass production. Conditions were strongly above average for Inner Mongolia, and the Loess Plateau in China, as well as Southeast Asia.

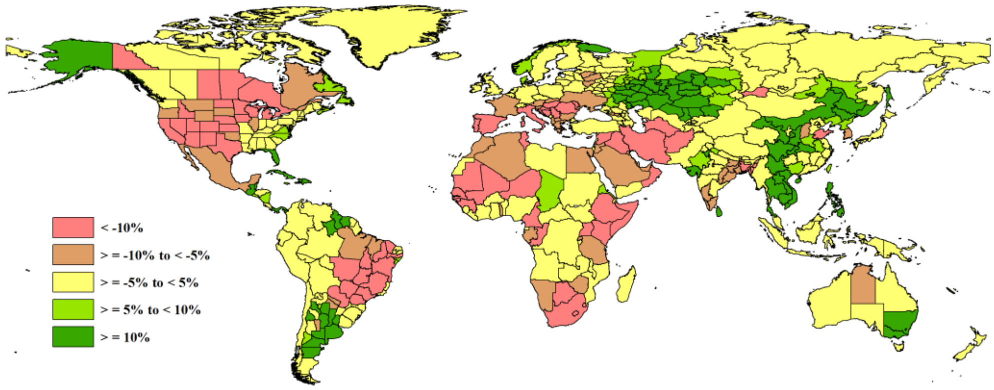


Figure 3.4 National and subnational sunshine anomaly (as indicated by the RADPAR indicator) of January to April 2022 total relative to the 2007-2021 average (15YA), in percent

3.2 Country analysis

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

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

Figures 3.5 - 3.45; Crop condition for individual countries ([AFG] Afghanistan to [ZMB] Zambia) including agro-ecological zones (AEZ) from January to April 2022.

[AFG] Afghanistan

Winter and spring wheat are the main cereals sown in Afghanistan. Most winter wheat is grown in the northern border provinces and is harvested in May. Spring wheat was planted between March and April.

The proportion of irrigated cropland in Afghanistan is 54% and agro-meteorological conditions play an important role in the growth of almost half of the crops. Rainfall is note the major influential factor.

The agro-climatic conditions showed that RAIN decreased by 41%, TEMP increased by 2.2°C and RADPAR increased by 5%. Affected by the decrease of RAIN, BIOMSS decreased by 11%. The CALF decreased by 1%, and VCIx was 0.52.

Last year's drought resulted in a shortage of food and insufficient seed supply. Additionally, the poor economy has limited the farmers' ability to prepare the land and plant the crops. The actual areas of winter wheat are far lower than normal, and a large amount of farmland was left fallow. Short-term heavy rainfall in Kandahar and its north caused a flooding disaster in January. According to meteorological data precipitation was significantly above average and even reached a 15-year maximum in January. According to the spatial distribution of NDVI profiles, the overall crop conditions at the national level in Afghanistan were below average in January. As shown in the spatial NDVI profiles and distribution map, the growth of crops on 34.3% of the crop land area was lower than the average level, mainly distributed in central Afghanistan. Crop conditions in eastern Afghanistan that is under irrigation were also lower than the 5-year average due to the damaged irrigation facilities. 23% of the total cropped areas were positive, mainly in northern Afghanistan. However, 12.3% of the cropped land areas were below average after March due to the continuing drought conditions in March and April. Additionally, about 42.7% of total cropped areas were near average levels, mainly distributed in southern Afghanistan. Maximum VCI shows similar results. Overall, the prolonged drought and conflict led to the poor crop conditions. Prospects for crop production are unfavorable.

Regional analysis

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

The RAIN in the Central region with sparse vegetation was 126 mm (-56%). The TEMP was 3.2°C (+3.3°C), and the RADPAR was 1052 MJ/m2 (+6%). According to the NDVI-based crop condition development graph, the NDVI was lower than the 5-year average level in January and February and then near the average level between March and April. CALF had increased by 7% and VCIx was 0.61.

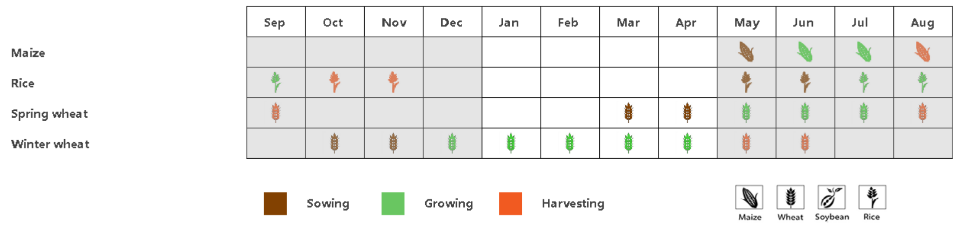
The Dry region recorded 125 mm of rainfall (RAIN -44%), TEMP was higher than average at 11.1°C, RADPAR was 868 MJ/m2, and BIOMSS decreased by 15%. According to the NDVI-based development graph, crop conditions were lower than the 5YA during the monitoring period. CALF in this region was only 4% and VCIx was 0.28.

In the Mixed dry farming and irrigated cultivation region, the following indicator values were observed: RAIN 248 mm (-42%); TEMP 5.2°C (+1.8°C); RADPAR 950 MJ/m2 (+7%); BIOMSS decreased by 8%. CALF was 6% above average. According to the NDVI-based crop condition development graph, NDVI was above the average level in the first three months, but crop conditions were below average after March due to the decreased rainfall, and VCIx was 0.70.

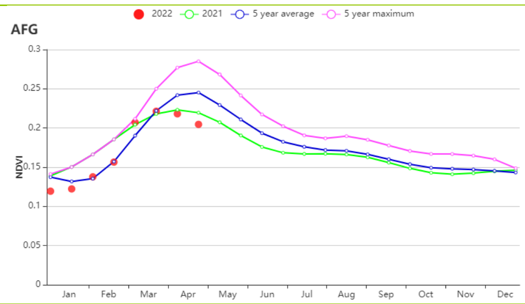
The Mixed dry farming and grazing region recorded 155 mm of rainfall (RAIN -30%). TEMP was 8.5°C (+2.2°C) and RADPAR was 1021 MJ/m2 (+4%). CALF was 8%. It had decreased by 17%

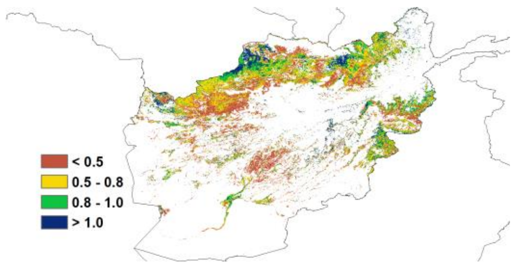
compared to the 5YA. According to the crop condition development graph, the NDVI was much lower than the 5YA throughout the monitoring period. Crop conditions in this region were below average, and VCIx was 0.49.

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

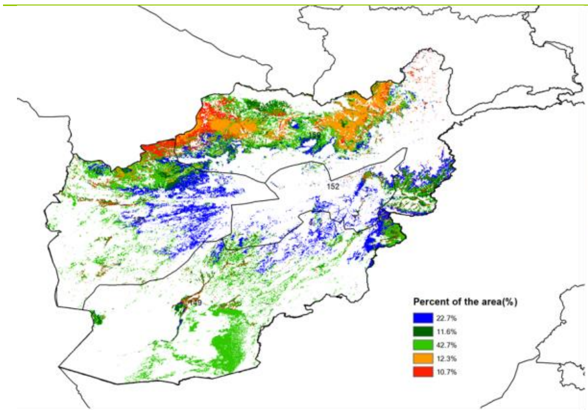


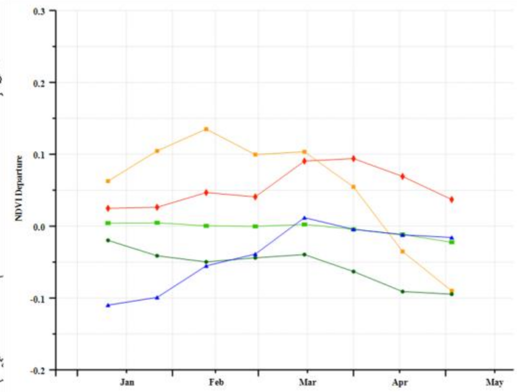
(a). Phenology of major crops



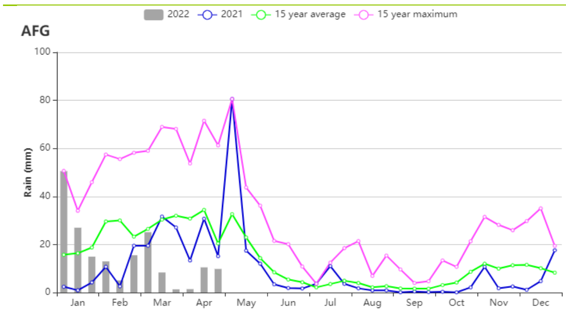


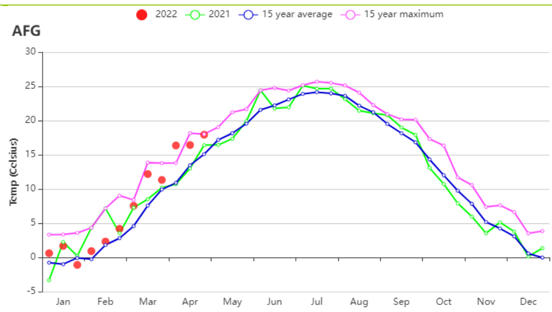
(b) Crop condition development graph based on NDVI (c) Maximum VCI



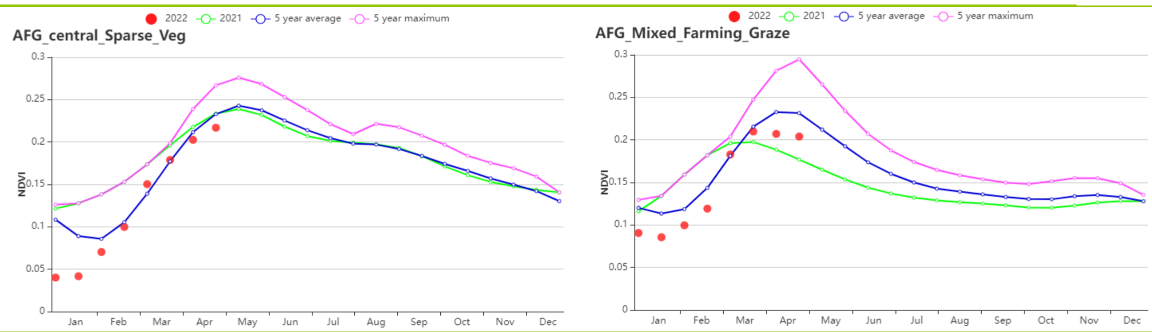


(d) Spatial NDVI patterns compared to 5YA (e) NDVI profiles

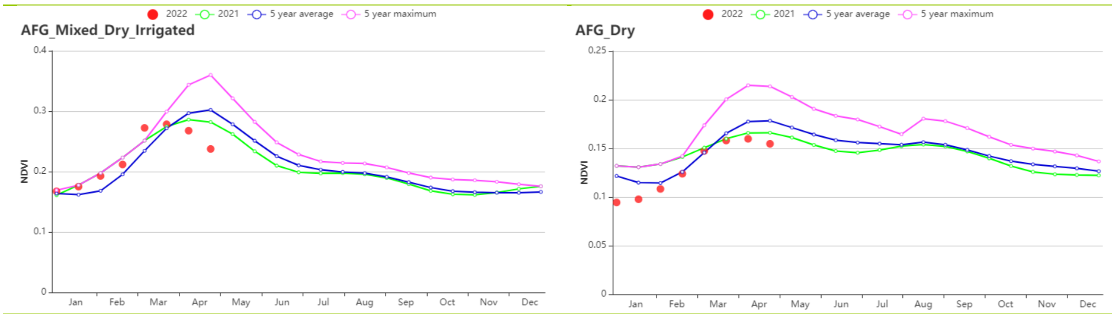




(f) Rainfall profiles (g) Temperature profiles



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



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

Table 3.1 Afghanistan's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, January - April 2022

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m²)	Departure from 15YA (%)	Current (gDM/m²)	Departure from 15YA (%)
Central region with sparse vegetation	126	-56	3.2	3.3	1052	6	349	-8
Dry region	125	-44	11.1	2.6	1103	5	396	-15
Mixed dry farming and irrigated cultivation region	248	-42	5.2	1.8	950	7	448	-8
Mixed dry farming and grazing region	155	-30	8.5	2.2	1021	4	442	-9

Table 3.2 Afghanistan's agronomic indicators by sub-national regions, current season's values and departure from 5YA, January - April 2022

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Central region	7	7	0.61
Dry region	4	-12	0.28
Dry and irrigated cultivation region	20	6	0.70
Dry and grazing region	8	-17	0.49

[AGO] Angola

During the current January-April 2022 monitoring period, maize and rice were at the growing and harvesting stages in Angola. In April, land preparation for wheat planting had started. The proportion of irrigated cropland in Angola is only 2% and agro-meteorological conditions play a decisive role in the growth of crops.

The agroclimatic indicators for this period reveal that the country received less rainfall when compared to the average of the past fifteen years (RAIN -14%). Also, the temperature was slightly below the average (TEM -0.1ºC). The photosynthetic active radiation was 1198 MJ/m2, 2% higher than that of the 15YA. The national potential biomass production decreased by 2%. In general, the nationwide NDVI profile trended below average until early April and recovered to average levels by the end of this reporting period. The NDVI spatial patterns show that 53% of the cultivated area was near the average for the past five years. For the whole country, the VCIx value was 0.88 and the CALF was near average. Conditions were average, except for the arid zone in the south, which was affected by the precipitation deficit.

Regional Analysis

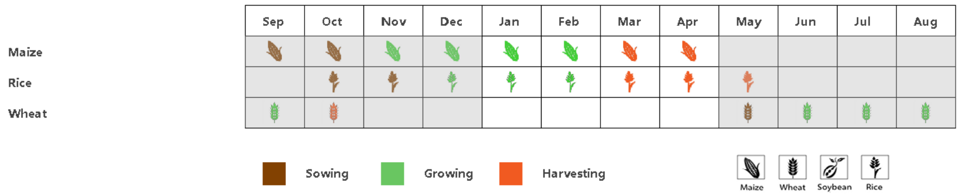
Considering the cropping systems, climate zones and topographic conditions, CropWatch has divided Angola into five agroecological zones (AEZs): the Arid zone (5), Central Plateau (6), Humid zone (7), Semi-arid zone (8) and Sub-humid zone (9).

Depending mostly on precipitation, agriculture in the agroecological regions was affected by the significant decreases recorded in precipitation over all the regions. This indicator decreased by 19% in the Arid zone, 12% in the Central Plateau, 13% in the Humid zone and Sub-humid zone and 16% in the Semi-arid zone. Temperature decreased by 0.2ºC, 0.3ºC and 0.6ºC in the Sub-humid zone, Central Plateau and Arid zone, respectively. Meanwhile, in the Humid and Semi-arid zone, the temperature was near the average of the past fifteen years. In the Humid Zone, rainfall decreased by 13%, whereas RADPAR increased by 8%. Increases in radiation were also observed in Central Plateau (+3%) and the Sub-humid zone (+4%). The regional total biomass production decreased by 1% in the Arid zone, Humid zone and Sub-humid zone, while in the Semi-arid zone it decreased by 2% and in the Central plateau, it increased by 2%.

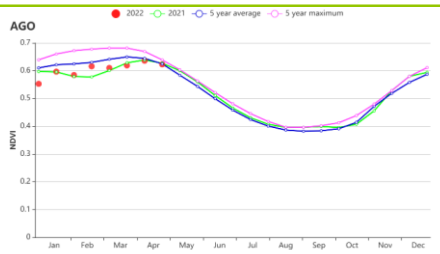
The regional crop conditions development graph based on NDVI reveals that except for the Central plateau, crop conditions were below the average of the past five years from early January to early April (when conditions improved) in all remaining regions. Only the Central plateau experienced near-average crop conditions throughout the monitoring period.

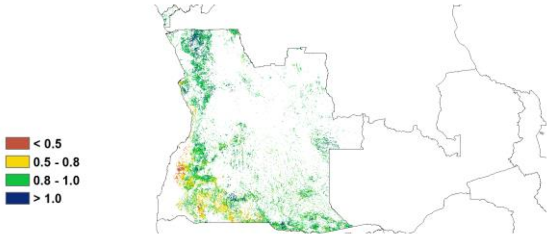
Regarding the agronomic indicators, CALF was near the average for the past five years in the Humid zone, Semi-arid zone and Sub-humid zone. In the Arid zone, the CALF decreased by 1% while in the Central plateau, it increased by 1%. The maximum VCIx in the agroecological regions varied from 0.79 (in the Arid zone) to 0.92 (in the Humid zone).

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

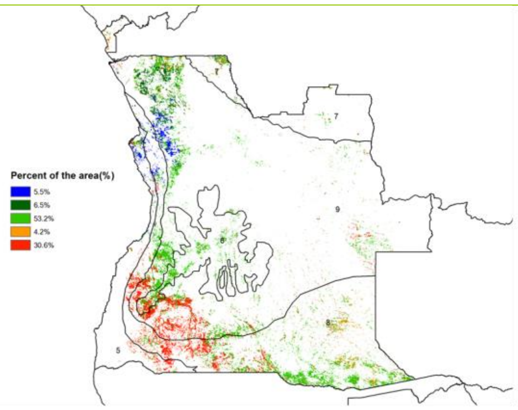


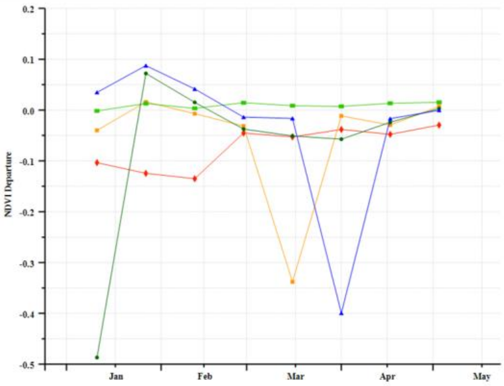
(a). Phenology of major crops



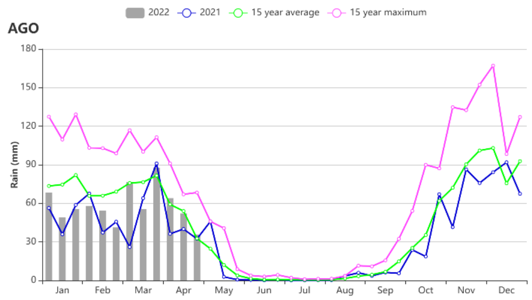


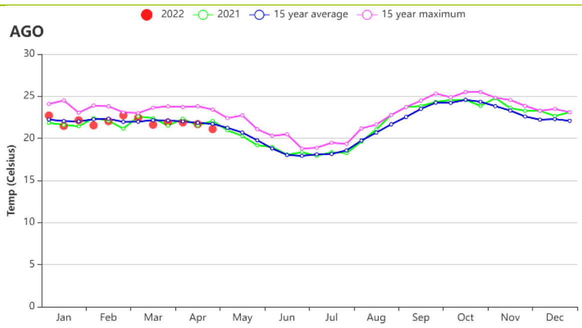
(b) Crop condition development graph based on NDVI (c) Maximum VCI



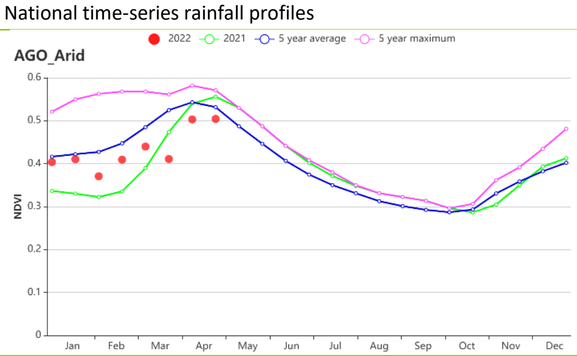


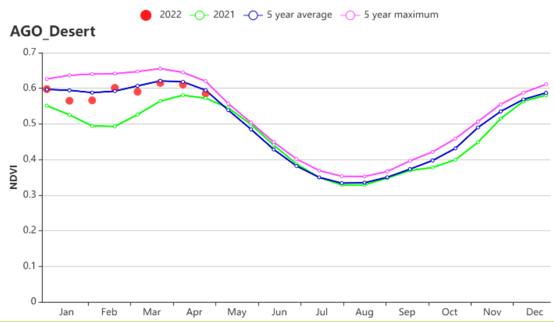
(d) Spatial NDVI patterns compared to 5YA (e) NDVI profiles



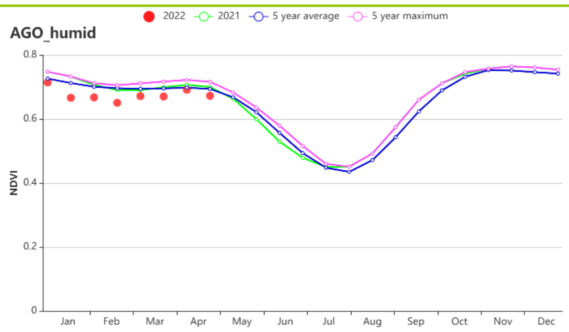


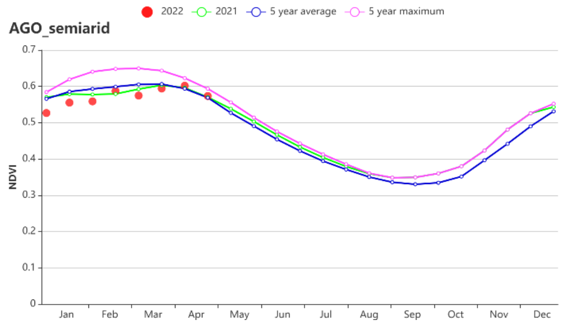
(f) National time-series rainfall profiles (g) National time-series temperature profiles



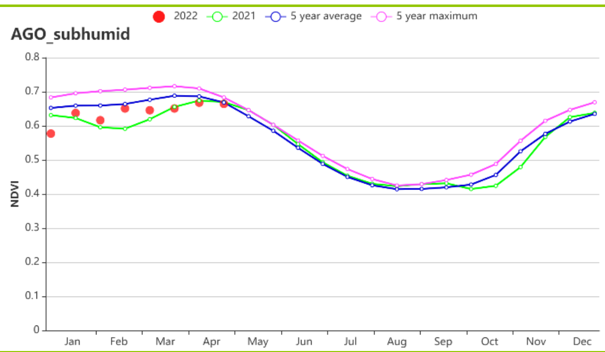


(h) Crop condition development graph based on NDVI - Arid zone (left) and Central Plateau (right)





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



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

Table 3.3 Angolas's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, January – April 2022

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

Table 3.4 Angolas's agronomic indicators by sub-national regions, current season's values and departure from 5YA, January – April 2022

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Arid region	83	-1	0.79
Central Plateau	99	1	0.88
Humid zone	100	0	0.92
Semi-Arid Zone	98	0	0.85

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Sub-humid zone	93	-3	0.87

[ARG] Argentina

The report covers the harvesting period for early soybean, early maize and rice, and the main growing period for late soybean and late maize. The proportion of irrigated cropland in Argentina is only 9% and agro-meteorological conditions play a decisive role in the growth of crops. For the whole country, rainfall showed a positive anomaly of 34%, TEMP showed a slight negative anomaly (-0.5°), RADPAR showed a 0.4% negative anomaly and BIOMSS a 8% positive anomaly. The rainfall profiles showed negative anomalies at the end of December and the beginning of January. They explain the negative NDVI anomalies observed at the beginning of the reporting period. High rainfall observed at the end of January and February could have accelerated the crop development reducing negative anomalies and generating positive anomalies in NDVI at the end of the reporting period. TEMP profile showed quite temporal variability with positive anomalies at the beginning of the reporting period followed by alternating sub-periods with no or negative anomalies. In general, conditions were rather favorable, better than the poor conditions observed at the end of the last reporting period.

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, Mesopotamia, Humid Pampas, and Subtropical Highlands. The other agro-ecological zones were 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, rice is the main crop.

RAIN showed positive anomalies in all the AEZs: Humid Pampas (+57%), Mesopotamia (+35%), Chaco (+26%) and Subtropical Highlands (+26%). TEMP showed a slight positive anomaly in Mesopotamia (+0.2°) and negative anomalies in Humid Pampas (-1°), Subtropical Highlands (-0.5°) and Chaco (-0.1°). RADPAR showed no anomalies in Humid Pampas and slight negative anomalies in Chaco (-2%), Mesopotamia (-1%) and Subtropical Highlands (-1%). BIOMSS showed positive anomalies in all the AEZs: Humid Pampas (+16%), Mesopotamia (+7%), Chaco (+4%) and Subtropical Highlands (+4%).

CALF was complete (100%) and showed no anomalies in Chaco, Mesopotamia and Subtropical Highlands and showed a positive anomaly in Humid Pampas with a current value of 99%. Maximum VCI showed good conditions for the four AEZs: Humid Pampas (0.91), Chaco (0.89), Subtropical Highlands (0.88) and Mesopotamia (0.84).

For the whole country, the crop condition development graph based on NDVI showed negative anomalies during most of the reporting period, except for March, when values were near the 5-year average. Negative anomalies were also observed during December last year. Nevertheless, main agricultural areas showed some improvement in conditions. Chaco and Mesopotamia showed negative anomalies during part of December last year, January and February and no or positive anomalies during March and April. Subtropical Highlands showed no anomalies only in March and negative anomalies during the rest of the period. Humid Pampas showed negative anomalies during January and February (with similar values as last year), positive anomalies during March and no anomalies during April.

Spatial distribution of NDVI profiles showed homogeneous and heterogeneous spatial patterns for the different AEZs. Chaco and Mesopotamia were dominated by two profiles distributed homogeneously (red and light green) with higher presence of red in the North and of the light green profile in the South. Both profiles started with negative anomalies and finished the reporting period with nearly no anomalies. Except for the first period, the light green profile (South of these AEZs) showed higher values than the red profile. Part of Humid Pampas showed a profile with positive anomalies during the end of February and March (dark green), but was also covered by the blue profile with quite stable and near average values. Center and Center West of Humid Pampas showed a NDVI profile with positive anomalies during most of the period and lower values at the beginning and end of the reporting period (orange profile). Subtropical highlands showed a mixture of several profiles (blue, red and light green).

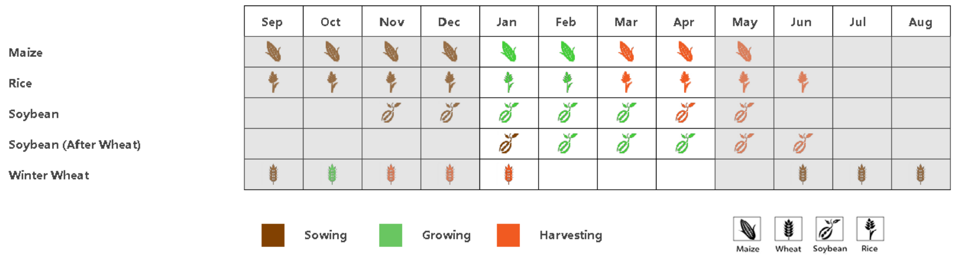
Maximum VCI showed in general good conditions with values higher than 0.8. Some areas showed intermediate values like North and South of Humid Pampas.

Production outlook

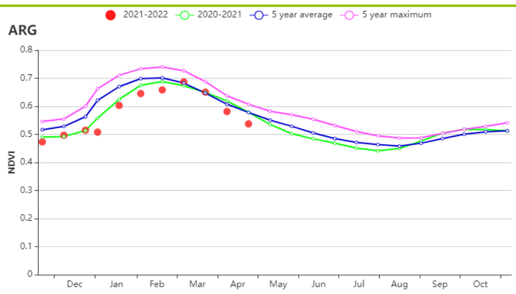
Based on CropWatch area and yield monitoring, Argentina's maize yield increased 1.8%, accompanying a 1.1% expansion of maize area and production increased by 2.9% at 54,971 thousand tonnes. While rice growing area remained as 2021, the yield of rice decreased and production decreased 2.9% at 1,849 thousand tonnes. Soybean increased in yield (+2.1%) while area decreased (-1.8%), the production increased 0.3% at 51,775 thousand tonnes.

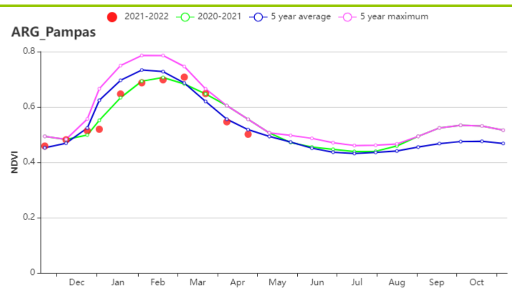
In summary, total rainfall showed positive anomalies. But it was not regularly distributed, showing times of negative anomalies. VCIx and BIOMSS showed good conditions. NDVI profiles started with low values following poor rainfall conditions observed during December and January, but showed a tendency to increase at the end of this reporting period.

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

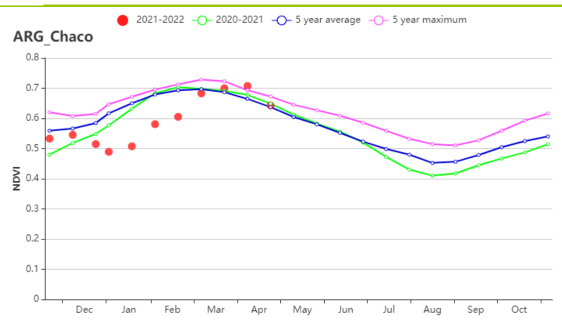


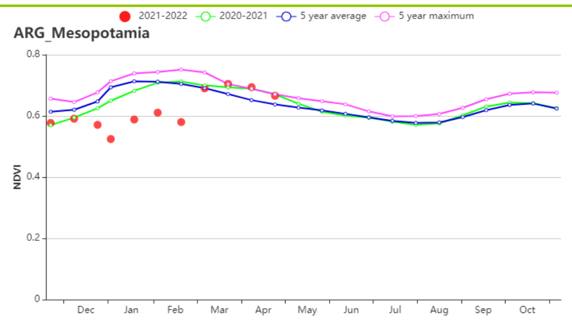
(a). Phenology of major crops



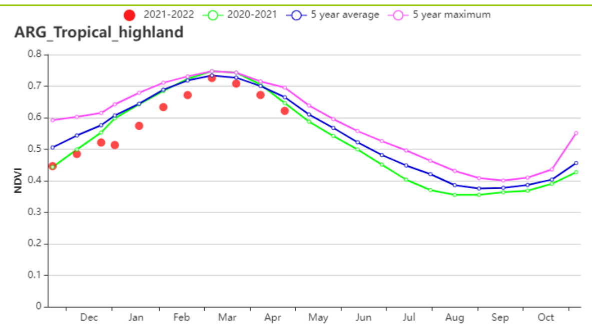


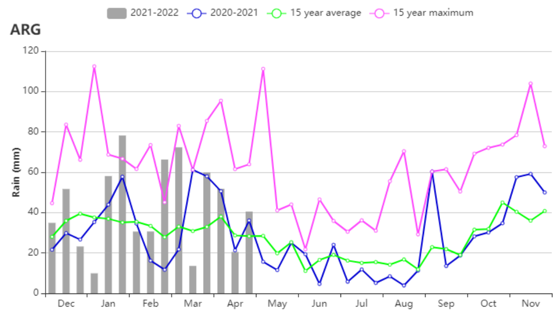
(b) Crop condition development graph based on NDVI (c) Crop condition development graph based on NDVI (Pampas)



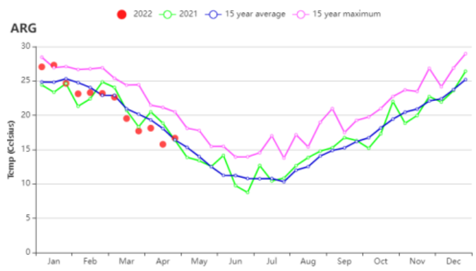


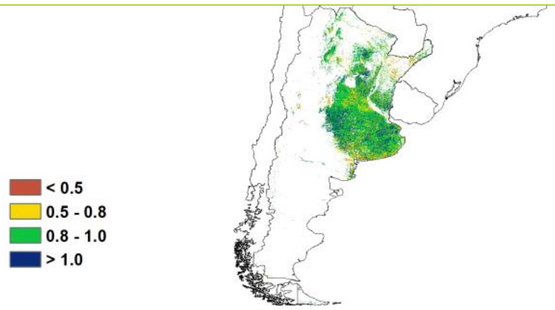
(d) Crop condition development graph based on NDVI (Chaco) (e) Crop condition development graph based on NDVI (Mesopotamia)



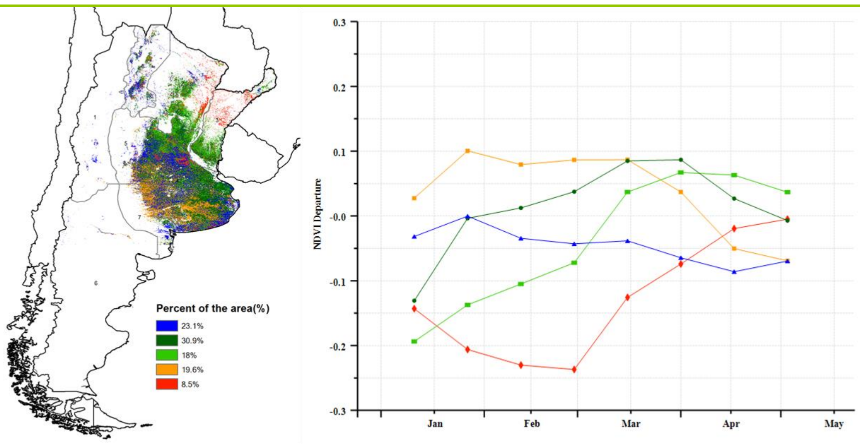


(f) Crop condition development graph based on NDVI (Subtropical Highlands) (g) Time series rainfall pofile (Pampas)





(h) Time series of temperature profile (i) Maximum VCI



(j) Spatial distribution of NDVI profiles

Table 3.5 Argentina's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, January 2022 – April 2022

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m^2)	Departure (%)	Current (gDM/m^2)	Departure (%)
Chaco	572	26	24.6	-0.1	1123	-2	1074	4
Mesopotamia	664	35	23.6	0.2	1174	-1	1112	7
Humid Pampas	424	57	20.6	-1.0	1207	0	929	16
Subtropical highlands	992	26	20.1	-0.5	1085	-1	1141	4

Table 3.6 Argentina's agronomic indicators by sub-national regions, current season's values and departure from 5YA, January 2022 – April 2022

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Chaco	100	0	0.89
Mesopotamia	100	0	0.84
Humid Pampas	99	1	0.91
Subtropical highlands	100	0	0.88

Table 3.7 Argentina's crop production in 2022

	2020-2021	2021-2022			
	Yield (thousand tonnes)	Area change (%)	Yield change (%)	Production (thousand tonnes)	Production change (%)
Maize	53440	1.1	1.8	54971	2.9
Rice	1901	0.0	-2.9	1846	-2.9
Soybean	51608	-1.8	2.1	51775	0.3

[AUS] Australia

In Australia, the harvest of wheat and barley ended in January. The sowing of wheat will start in May. Therefore, the vegetation conditions reported here have limited relevance.

The proportion of irrigated cropland in Australia is only 9% and agro-meteorological conditions play a decisive role in the growth of more than 90% crops. In the current period, Australia had relatively wet weather with abundant rainfall (RAIN, +18%), which will be beneficial for the planting of wheat and barley in the next period. The temperature (TEMP +0) and radiation (RADPAR -2%) were both close to average. Above-average biomass accumulation potential (+10%) was expected. Additionally, CALF increased by 27% compared with the recent five-year average, while the maximum VCI was 0.90.

The conditions in the four main wheat production states were similar. They all received above-average rainfall (New South Wales, +64%; South Australia, +9%; Victoria, +36%; Western Australia, +11%). But only New South Wales (+24%) and Victoria (+36%) had positive biomass estimates.

The NDVI profile was generally close to the maximum levels observed over the past 5 years.

Regional analysis

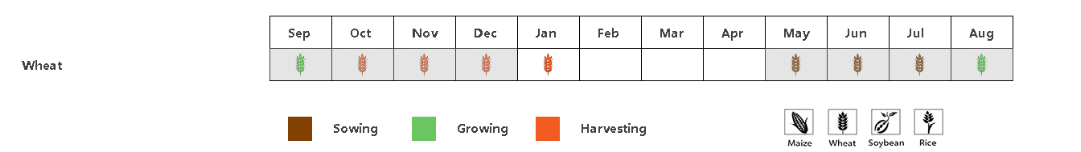
This analysis adopts five agro-ecological zones (AEZs) for Australia, namely the Arid and Semi-arid Zone (marked as 18 in NDVI clustering map), Southeastern Wheat Zone (19), Subhumid Subtropical Zone (20), Southwestern Wheat Zone (21), Wet Temperate and Subtropical Zone (22). The Arid and Semi-arid Zone,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

The three southeast AEZs, including Southeastern wheat zone, Sub-humid subtropical zone, and Wet temperate and subtropical zone, had similar departures of the agro-climatic indicators: abundant rainfall (+47%, +15%, +23%), average temperature (+0.1°C, -0.1 ° C, +0.3°C) and slightly less sunshine (-3%, -3%, -4%). Mainly due to the rainfall, biomass accumulation potential were favorable (+18%, +9%, +10%). The CALF in these three AEZs had increased (+37%, +43%, +4%) and maximum VCI were 0.84, 0.88 and 0.85, respectively. Conditions were favorable in these zones.

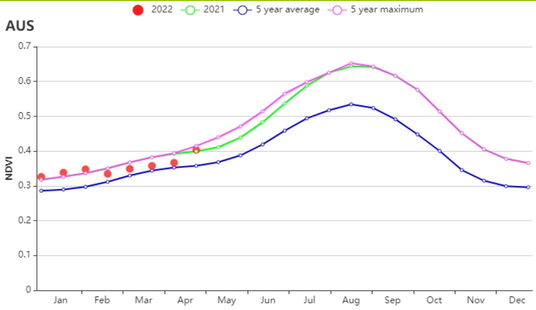
The departures from the 15YA of the agro-climatic indicator in the Southwestern Wheat Zone were relatively small. All indicators were slightly above average (RAIN +5; TEMP +0.2°C; RADPAR +2%; BIOMSS +5%, CALF +29%), while the maximum VCI was 1.06.

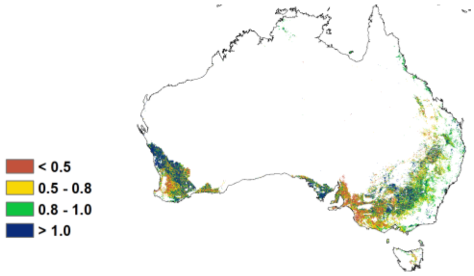
Overall, the agro-climatic indicators in the reporting period, especially rainfall, predict a favorable prospect for the coming wheat planting season in Australia.

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



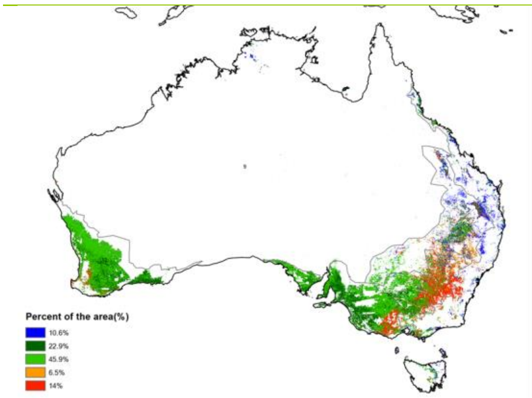
(a). Phenology of major crops

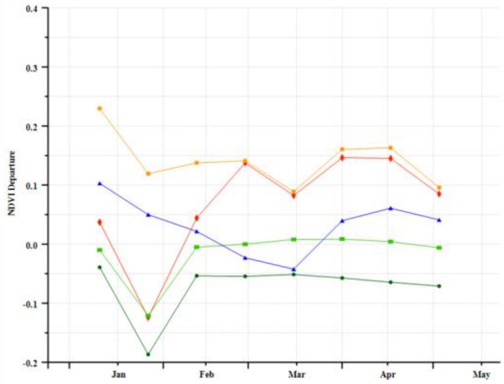




(b) Crop condition development graph based on NDVI

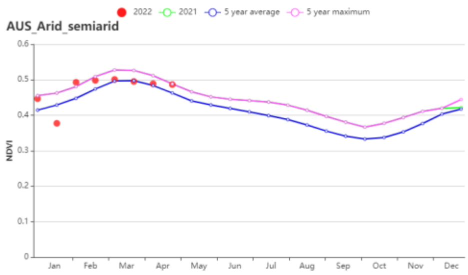
(c) Maximum VCI

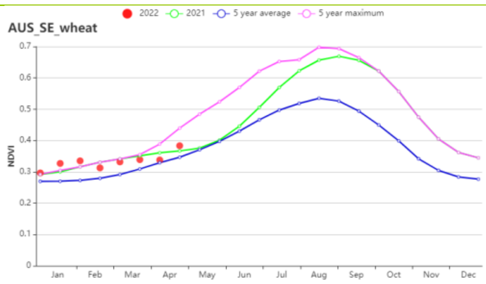




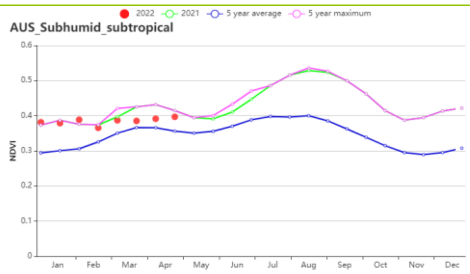
(d) Spatial NDVI patterns compared to 5YA

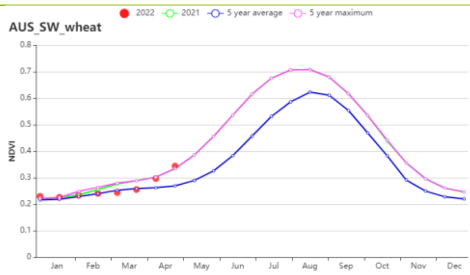
(e) NDVI profiles



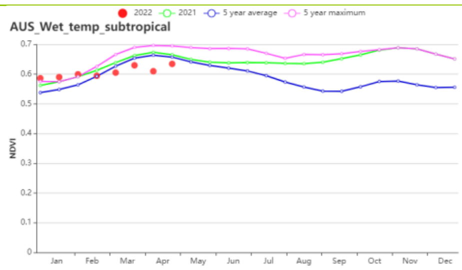


(f) Crop condition development graph based on NDVI (Arid and semiarid zone (left) and Southeastern wheat area (right))

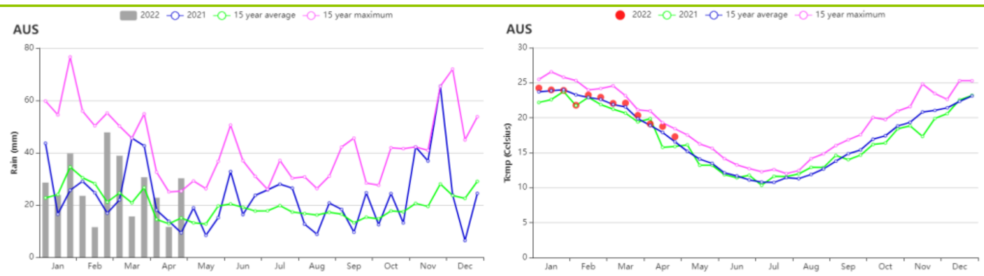




(g) Crop condition development graph based on NDVI (Subhumid subtropical zone (left) and Southwestern wheat area (right))



(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, January - April 2021

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Arid and semiarid zone	624	-17	26.8	0.8	1289	4	967	-4
Southeastern wheat area	233	47	21.0	0.1	1165	-3	752	18
Subhumid subtropical zone	274	15	23.5	-0.1	1208	-3	845	9
Southwestern wheat area	113	5	21.3	0.2	1261	2	615	5
Wet temperate and subtropical zone	497	23	19.9	0.3	1090	-4	932	10

Table 3.9 Australia's agronomic indicators by sub-national regions, current season's values and departure from 5YA, January - April 2021

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Arid and semiarid zone	71	4	0.89
Southeastern wheat area	42	37	0.84
Subhumid subtropical zone	58	43	0.88
Southwestern wheat area	19	29	1.06
Wet temperate and subtropical zone	98	4	0.85

[BGD] Bangladesh

During the previous monitoring period, rainfall was below average in October and early November. This caused a poor establishment of the winter cereals. Winter wheat was the major crop in the field during this monitoring period. The proportion of irrigated cropland is only 53% and agro-meteorological conditions play a decisive role. Rainfall is not the major influential factor.

The sowing of spring wheat started in March. During this monitoring period, rainfall and temperature were above the 15YA (RAIN +15%, TEMP +0.4°C), whereas solar radiation was below average (RADPAR -11%). This resulted in a potential biomass decrease (-4.1%). Agronomic indicators did not show a satisfactory vegetation condition index (VCIx 0.7) while the cropped arable land fraction (CALF) decreased by about 26%. The NDVI profile shows very low values in January and February, presumably due to snow cover. Cooler than normal temperatures in March and April had slowed the development of the crops. The spatial patterns of NDVI profiles shows large fluctuations. In most of the areas VCIx was low during this time. Crop conditions were below average during this monitoring period.

Regional analysis

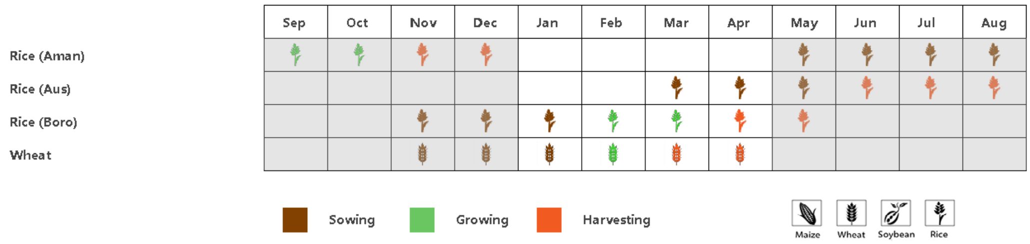
Based on cropping system, climatic zones and topographic conditions, regional analyses are provided for three agro-ecological zones (AEZ): Northern Belarus (028, Vitebsk, northern area of Grodno, Minsk and Mogilev), Central Belarus (027, Grodno, Minsk and Mogilev and Southern Belarus (029) which includes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

Northern Belarus suffered drop in radiation (-11%), while temperature and rainfall were above average (TEMP +0.4°C, RAIN +18%). This condition resulted in a potential biomass decrease by 4%. Agronomic indicators showed that CALF dropped sharply compared to the 5YA level (-43%). VCIx war rather low as well (VCIx 0.67). Starting from January, the regional NDVI development curve was close to but below the long-term average.

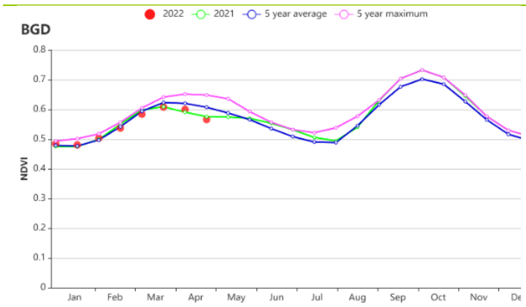
Central Belarus was also affected by low photosynthetically active radiation (RADPAR -11%), while temperature and rainfall were above the 15YA (TEMP +0.3°C, RAIN +16%). The VCIx had a value of 0.76, and CALF was 76%. The potential biomass was also expected to decrease (-4%). Similar to Southern Belarus, the NDVI growth curve started to improve to close to the average trend from January to March, but dropped below the 5YA level in April.

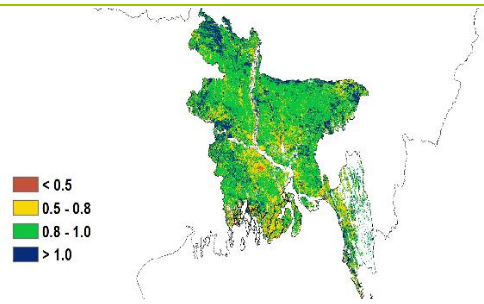
Radiation in Southern Belarus was significantly lower by 13%, while temperature and rainfall were higher by 0.2°C and 9%, respectively. Potential biomass was also estimated to decrease by 4%. And like Central Berlarus, CALF and VCIx were 74% and 0.76 respectively.

Figure 3.9 Bangladesh's crop condition, January -April 2021



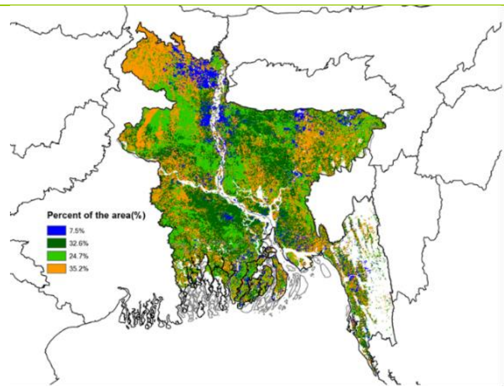
(a). Phenology of major crops

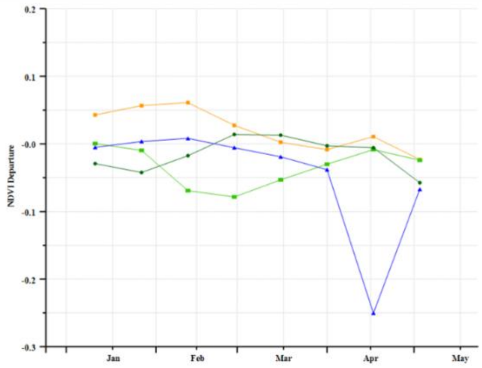




(b) Crop condition development graph based on NDVI

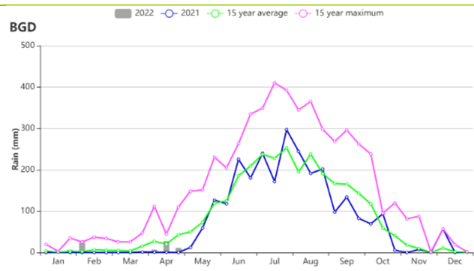
(c) Maximum VCI

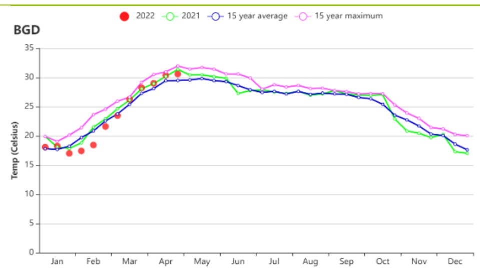




(d) Spatial NDVI patterns compared to 5YA

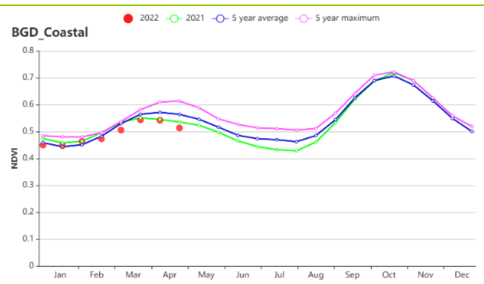
(e) NDVI profiles

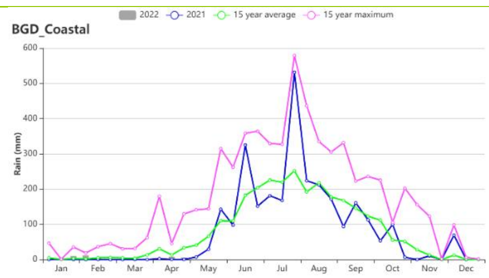




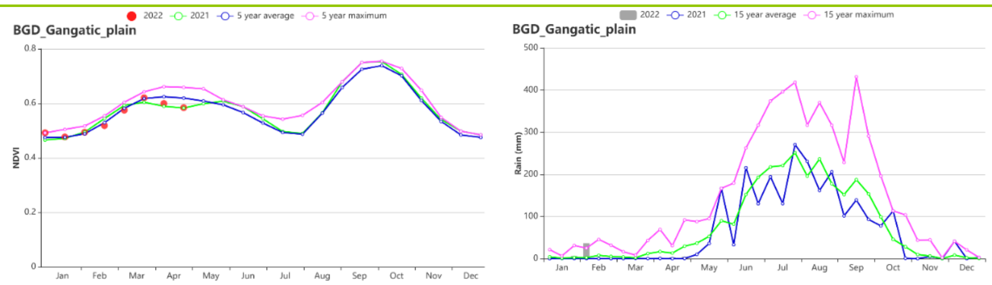
(f) Rainfall profiles

(g) Temperature profiles

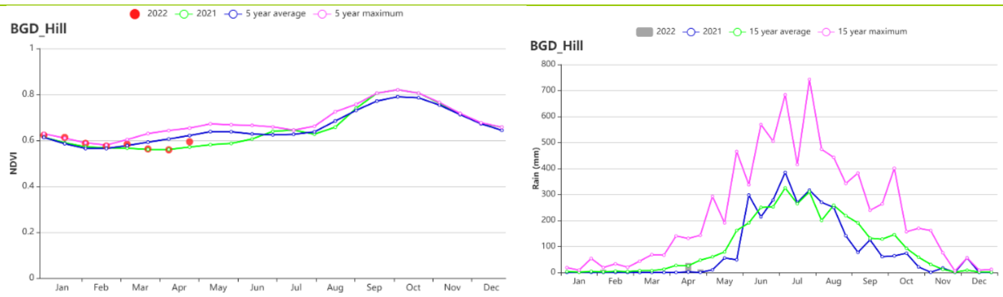




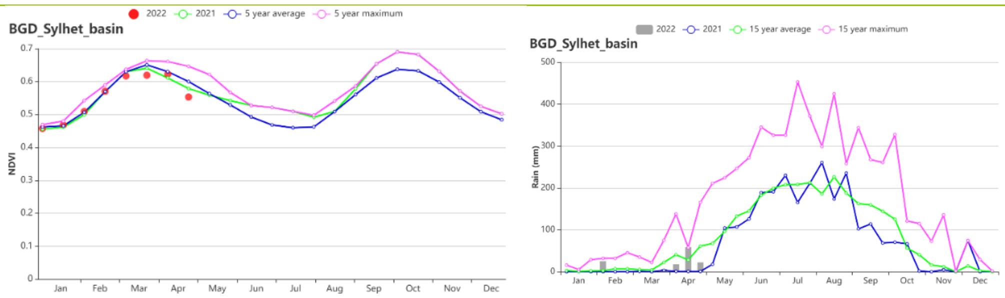
(h) Crop condition development graph based on NDVI (left) and rainfall profile (right) of Coastal region



(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, January-April 2022

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Coastal region	41	-65	24.4	-0.1	1248	2	509	-13
Gangetic plain	56	-45	23.7	0.0	1170	0	493	-11
Hills	69	-52	22.4	-0.1	1246	-1	511	-13
Sylhet basin	135	-27	22.8	-0.2	1143	-2	574	-7

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

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Coastal region	86	1	0.82

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Gangetic plain	97	0	0.9
Hills	97	1	0.88
Sylhet basin	99	0	0.90

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

[BLR] Belarus

Winter wheat was the major crop in the field during this monitoring period. The sowing of spring wheat started in March. The proportion of irrigated cropland in Belarus is only 0.4% and agro-meteorological conditions play a decisive role in the growth of almost all crops. Rainfall and temperature were above the 15YA (RAIN +15%, TEMP +0.4°C), whereas solar radiation was below average (RADPAR -11%). This resulted in a potential biomass decrease (-4.1%). Agronomic indicators did not show a satisfactory vegetation condition index (VCIx 0.7) while the cropped arable land fraction (CALF) largely decreased by about 26%. The NDVI profile shows very low values in January and February, presumably due to snow cover. Cooler than normal temperatures in March and April might slow the development of the crops. The spatial patterns of NDVI profiles show that around 71.5% of cropped areas had approached the 5-year average levels, but they experienced a notable drop from March to April and in most of the areas VCIx was low during this time.

Because ice and snow cover in previous report period might have delayed the sowing and growing of crops, combined with solar radiation deficit and rainy weather in this season, the emergence and growth of plants did not propose a prominent remote sensing signature as usual in this season. This might be the main reason why agronomic indicators (CALF 64%, VCIx 0.72) did not present very favorable conditions for crops during current monitoring period. And more accurate information about crop growth from better observation of CALF and VCIx in the following season is needed.

Regional analysis

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

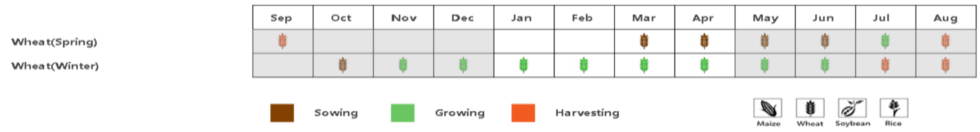
Northern Belarus suffered deficit in radiation (-11%), while temperature and rainfall were above average (TEMP +0.4°C, RAIN +18%). This condition resulted in a potential biomass decrease by 4%. Agronomic indicators showed that CALF dropped a lot compared to the 5YA level (-43%), with a not very high VCIx value (0.67). Starting from January, the regional NDVI development curve was close to but below the long-term average.

Central Belarus was also affected by low photosynthetically active radiation (11% lower), while temperature and rainfall were above the 15YA (TEMP +0.3°C, RAIN +16%). The VCIx had a value of 0.76, and CALF was 76%. The potential biomass was also expected to decrease (-4%). Similar to Southern Belarus, the NDVI growth curve started to improve to close to the average trend from January to March, but dropped below the 5YA level since April.

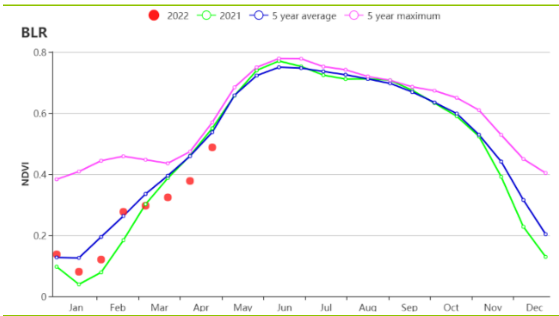
Radiation in **southern Belarus** was significantly lower by 13%, while temperature and rainfall were higher by 0.2°C and 9%, respectively. Potential biomass was also expected to decrease by 4%. And like Central Berlarus, CALF and VCIx were 74% and 0.76 respectively.

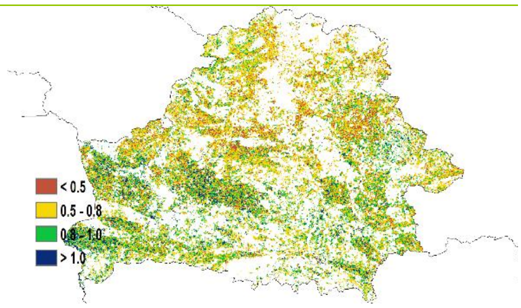
Above all, the three AEZ of Belarus had experienced slow recovery from last season and similar agroclimatic conditions in currentt season, this might have hindered both the sowing and growing progress of crops. Agronomic situation was also not very favorable, therefore crop status in the following season still require further close attention.

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



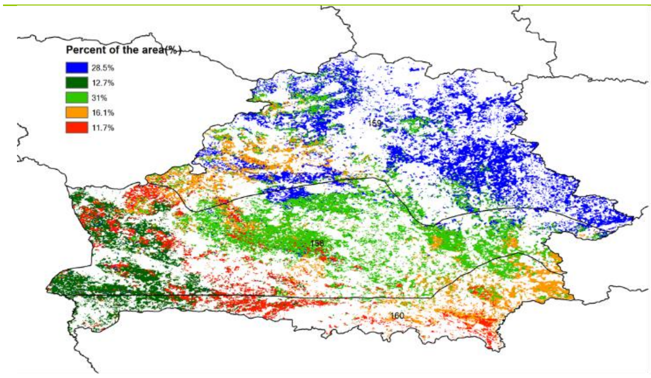
(a). Phenology of major crops

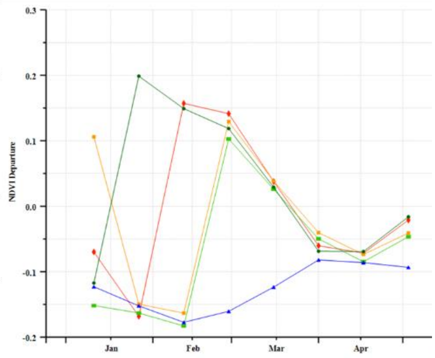




(b) Crop condition development graph based on NDVI

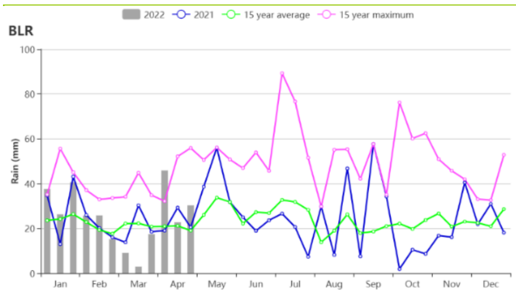
(c) Maximum VCI

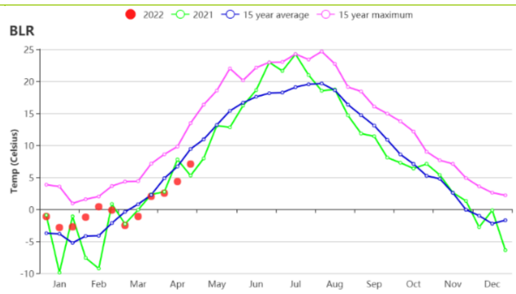




(d) Spatial NDVI patterns compared to 5YA

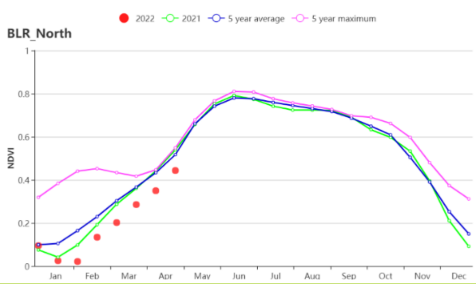
(e) NDVI profiles

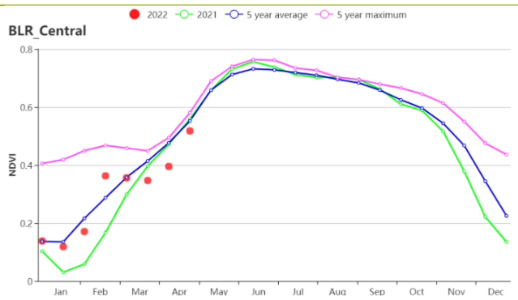




(f)Rainfall time series

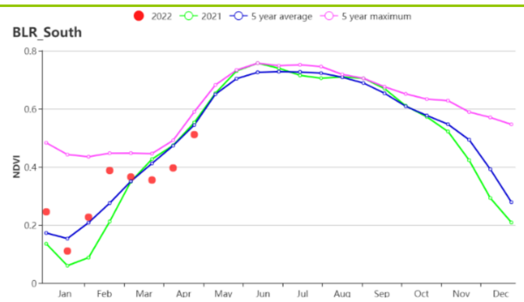
(g) Temperature time series





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

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



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

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

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Center	303	16	0.8	0.3	376	-11	382	-4
North	309	18	-0.4	0.4	355	-11	341	-4
South-west	278	9	1.3	0.2	379	-13	397	-4

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

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Center	76	-15	0.76
North	47	-43	0.67
South-west	74	-18	0.76

[BRA] Brazil

This bulletin covers the main growing period for soybean, rice and main maize in Center-South. The harvest of those crops almost concluded by the end of April. Second season maize, safrinha, mainly cultivated in Centre-South, reached peak growing stage in March and April and the harvest will start in late May. Rice in the North and Northeast reached the peak of its growth in April. The sowing of maize in the Northeast and wheat in Parana and Rio Grande do Sul starts at the end of the monitoring period.

The proportion of irrigated cropland in Brazil is only 12% and agro-meteorological conditions play a decisive role in the growth of most crops. Since the beginning of the rainy season in September 2021, Brazil experienced prolonged drier and warmer-than-usual weather. From January to April, Brazil received 628 mm rainfall on average, 38% below the 15YA. CropWatch Agro-Climatic Indicators (CWAIs) present 1.1°C higher temperatures and 4% above average radiation compared with the 15YA. Above average temperature and radiation further accelerated the soil moisture loss and further exacerbated the drought conditions. Altogether, the adverse weather resulted in a 19% reduction of potential biomass. Most major agricultural states in central and southern Brazil suffered from severe water shortage while few states in the North received well above average rainfall. Among the top eight major agricultural producing states, only Rio Grande Do Sul received average rainfall (+2%) compared with the 15YA. All other major states experienced significantly below average rainfall with warmer temperature and higher radiation. Low rainfall, high temperature and radiation resulted in below average BIOMSS in all major agricultural producing states except for Rio Grande Do Sul (-2%) and Santa Catarina (+2%). It is also noteworthy that although the weather conditions in the Brazilian main producing states are significantly below the 15YA, the situation is still much better than in the same period of 2021, when the drought conditions were more severe. Only two major states, Mato Grosso, and Santa Catarina experienced drier conditions compared to JFMA 2021 according to the RAIN indicator.

Tracing back to the start of the summer season in September-October 2021, the prolonged dry conditions reduced the overall crop vigor as shown by the continuously below-average vegetation greenness in the crop condition development graph based on NDVI. Nevertheless, the amplitude of the negative NDVI anomalies were narrowed since March 2022 and the NDVI recovered to the 5YA in early-May. Similarly, spatial distribution of NDVI departure from the 5YA and the corresponding profiles also presented significantly below-average NDVI in central Mato Grosso, southern Mato Grosso Do Sul, western Parana, and northwestern Rio Grande Do Sul before March, but recovered to average or above-average level at the end of the monitoring period (dark green region). The below average vegetation greenness before March indicates a reduced production of soybean and first season maize. While no evidence shows the weather conditions were getting better after March, satellite images revealed that the overall recovered crop vigor after March was mainly due to the expanded second maize planted area compared with 2021 and the 5YA. It might be driven by the high maize price after Russia's special military operation in Ukraine. March is still a good sowing window for the second maize in Center and South Brazil. Accordingly, the VCIx map also presents scattered high values (> 1.0) in Central Brazil (figure b). Favorable rainfall in East Coast benefitted crop development which also presented above 1.0 values of VCIx while Northwestern Rio Grande Do Sul presented poor crop conditions with VCIx values below 0.5 due to the drought at peak season in February to March. At the national level, VCIx was 0.91 and almost all cropland was cultivated, indicating overall limited effects from the dry weather on the sowing of the crops especially for the second maize producing regions.

In general, while crop conditions in Brazil were slightly below average due to the dry and warm weather, the agroclimatic conditions were still relatively more favorable for second maize compared with the same period in 2021. Also, the expanded second maize planted area compared with 2021 compensated the drought affects, resulting in large increase of second maize production.

Regional analysis

Considering the differences in cropping systems, climatic zones and topographic conditions, eight agro-ecological zones (AEZ) are identified for Brazil. These include the Amazon zone (30), Central Savanna (31), the East coast (32), Northeastern mixed forest and farmland (33), Mato Grosso zone (34), the Nordeste (35), Parana River (36), and Southern subtropical rangelands (37). During this monitoring period, dry and hot weather dominated in most AEZs especially in Center South Brazil which was mainly affected by the La Nina effect since the middle of last year.

Central Savanna (31) and Mato Grosso (34) were the two AEZs hit most hard by the exceptional drought, even worse than 2021 during the same period. Rainfall was 72% below average in Central Savanna which resulted in well below average NDVI as presented in the crop development profiles. The impacts were more complicate in Mato Grosso as the monitoring period covered the growth and harvest of first maize and soybean as well as the sowing and growth of second maize. Drought lowered the outputs for first maize and soybean in the region. For the second maize, the significantly below average rainfall in April hampered the second crops development when crops were in high water demand stages, threatening second maize yield. Rainfall was even 20% below 2021 levels. Fortunately, planted area for second maize increased significantly from 2021 which somehow compensated the lower yield impacts.

Parana Basin (36), another major agricultural producing zone, received less than half of the 15YA rainfall during the monitoring period. Adverse weather resulted in poor crop conditions and lower yield for soybean and first maize. Although rainfall was still less than the 15YA since March, it was much higher than the same period in 2021, bringing a relatively better crops development progress for second crops. NDVI based crop development profiles also confirmed the above 2021 crop condition in the second crops growing season. Second maize yield is projected to be above 2021 for the region.

Southern subtropical rangelands (37) experienced 9% above average rainfall but with an irregular distribution. In January and February when first season crops were at peak growing stage, low rainfall and high temperature resulted in poor soil moisture and crop conditions. Crop vigor is below average as reflected by NDVI profiles. When crops reached maturity, above-average rainfall was observed but it was too late for soybean and first maize. Also, the wet weather was unfavorable for the harvest.

Nordeste (35) is dominated by dry and hot weather. As most crops are irrigated in the zone, the abnormal weather had limited effects on the maize. The irrigation mitigated the drought effect, leading to the above-average condition and the highest VCIx values for this zone, as compared with others. Vegetation greenness became lower than average since March which might be attributed to lower planted area for second crops.

Weather conditions in Coast zone (32) was generally normal resulting in close to average crop conditions. Almost all cropland was cultivated with average VCIx at 0.93. However, as recorded by rainfall profiles, the well below average rainfall since late February slowed down the crop development with slightly below average NDVI after February, indicating less favorable conditions for the second crops.

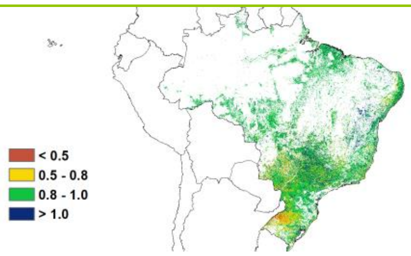
Production outlook

According to CropWatch estimates, the planted area and yield of Brazil's first maize both decreased in 2022, resulted in a decrease of 8.7% in production at 22,589 thousand tonnes. Driven by the increasing maize price, the planted area of second maize expanded by 9.2% from last year; Although dry and warm weather dominated whole Brazil, the agroclimatic conditions were still less adverse compared with 2021 for second maize, resulting in 6.7% increase of yield for second maize. The production of the second maize is projected at 68,298 thousand tonnes, up by 16.5% from 2021. The total maize production reached 90,887 thousand tonnes, 9.0% increase from the last year. Although rice growing area slightly shrank 0.1%, the yield decreased by 9% and production decreased 9.1%. Since soybean yield and growing area both decreased, it's estimated that soybean production will decrease to 89,205 thousand tonnes with 7.4%.

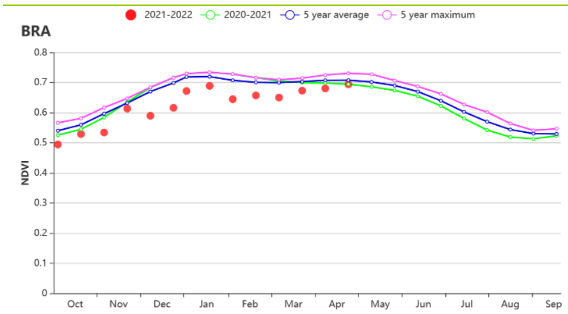
For more indicators and detailed information, it is recommended to visit CropWatch Explore (http://cropwatch.cn/newcropwatch/main.htm).

Figure 3.11 Brazil's crop condition, January - April 2022

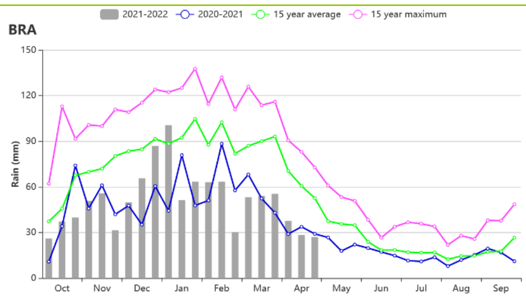
(a) Phenology of major crops



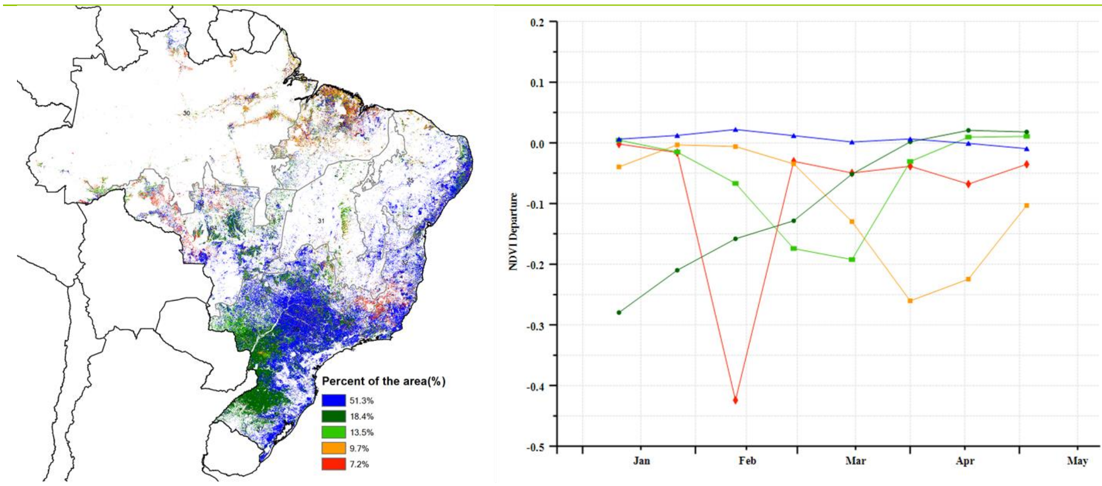
(b) Maximum VCI



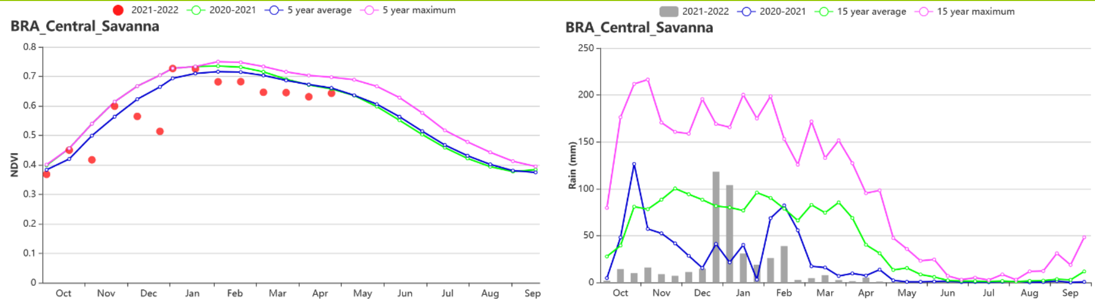
(c) Crop condition development graph based on NDVI of Brazil



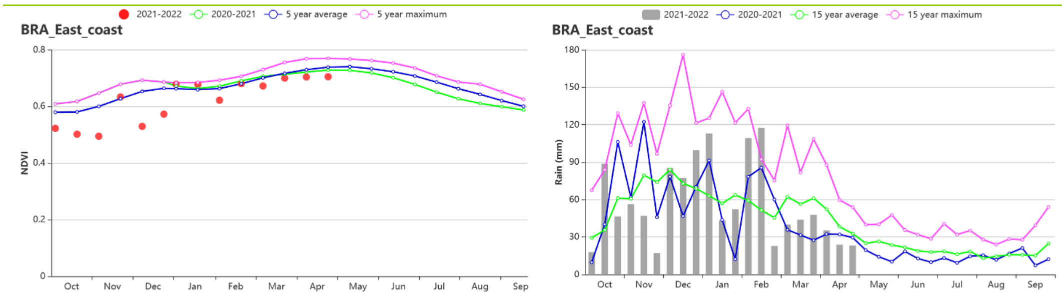
(d) Time series rainfall profile of Brazil



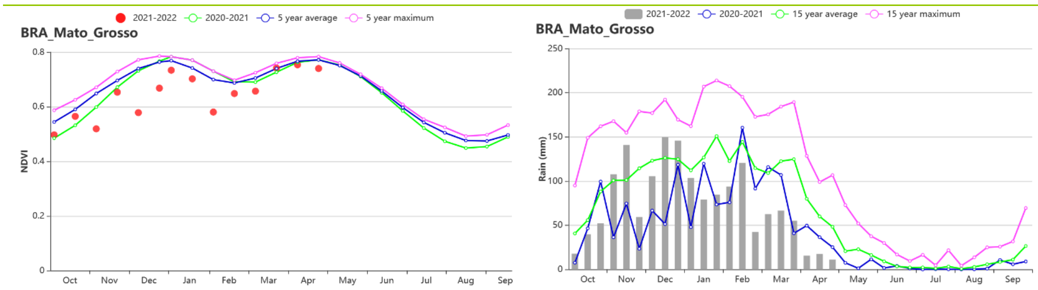
(e) Spatial distribution of NDVI departure from 5YA and NDVI departure profiles corresponding to the clusters



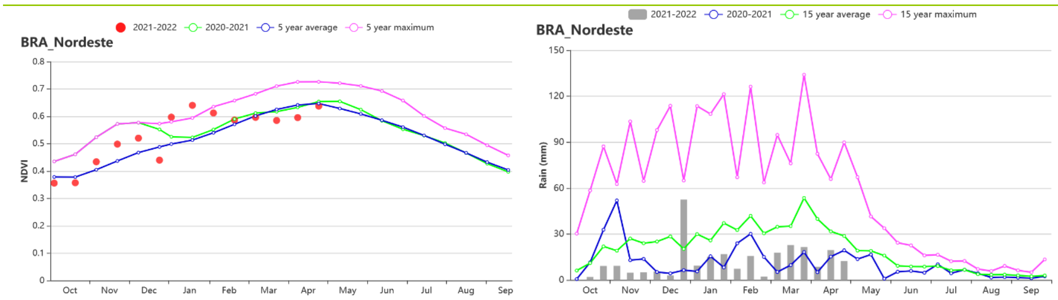
(f) Crop condition development graph based on NDVI (left) and rainfall profile (right) of Central Savanna



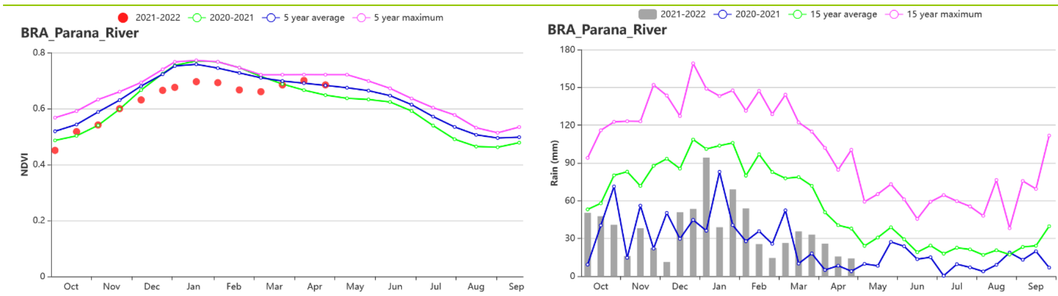
(g) Crop condition development graph based on NDVI (left) and rainfall profile (right) of Coast zone



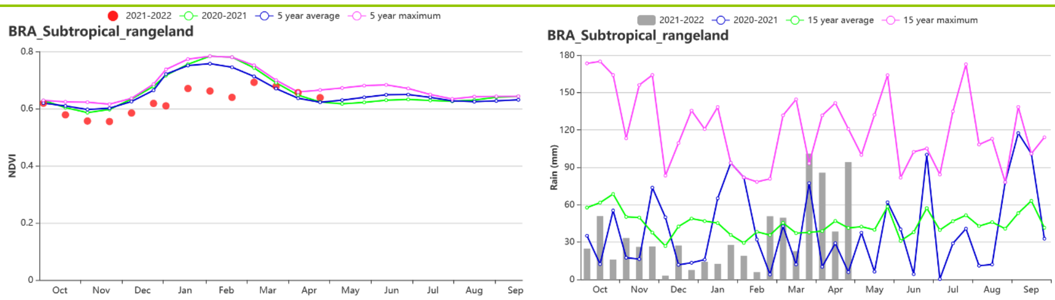
(h) Crop condition development graph based on NDVI (left) and rainfall profile (right) of Mato Grosso



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



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



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

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

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m²)	Departure from 15YA (%)	Current (gDM/m²)	Departure from 15YA (%)
Amazonas	1222	-8	25.0	0.0	1122	5	1507	1
Central Savanna	244	-72	25.9	2.5	1284	4	753	-43
Coast	672	4	23.5	0.3	1310	6	1154	0
Northeastern mixed forest and farmland	872	-34	25.6	0.7	1230	8	1421	-11
Mato Grosso	752	-43	25.0	0.9	1198	9	1235	-18
Nordeste	170	-60	26.8	1.2	1299	4	751	-25
Parana basin	448	-52	23.7	1.6	1192	1	984	-27
Southern subtropical rangelands	522	9	23.1	0.6	1153	-2	1054	0

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

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure from 5YA (%)	Current
Amazonas	100	0	0.94
Central Savanna	100	0	0.92
Coast	100	1	0.93
Northeastern mixed forest and farmland	100	0	0.95
Mato Grosso	100	0	0.94
Nordeste	99	7	0.95
Parana basin	100	0	0.88
Southern subtropical rangelands	100	0	0.83

Table 3.16 Brazil's production outlook in 2022

	2020-2021	2021-2022

	Production	Area change	Yield change	Production	Production change
	（thousand tonnes）	（%）	（%）	（thousand tonnes）	（%）
First season maize	24739	-4.1	-4.8	22589	-8.7
Second season maize	58606	9.2	6.7	68298	16.5
Rice	11851	-0.1	-9	10774	-9.1
Soybean	96300	-2.6	-4.9	89205	-7.4

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

[CAN] Canada

From January to April, winter cereals are the only crops that were grown in Canada. Winter wheat is usually planted in the period of September to November and reaches maturity in July and August. It is mainly grown in Ontario and Quebec. Some winter wheat is grown in the Saskatchewan, Alberta and Manitoba provinces as well. The winter wheat conditions were below the 5-year average according to the NDVI development graph.

The proportion of irrigated cropland in Canada is only 5% and agro-meteorological conditions play a decisive role in the growth of most crops. Below-average temperature and above-average precipitation occurred in Ontario, Quebec, Manitoba and Saskatchewan. According to CropWatch Agroclimatic indicators, the precipitation was above the 15-year average by 15% while temperatures were below average by 0.5 ℃, and radiation was below average by 7%. Above average precipitation created favorable conditions for winter wheat. The sowing of spring wheat crop will start in May. Its success will depend on the soil moisture conditions. Excessive soil moisture will delay timely sowing, whereas dry conditions will cause poor germination.

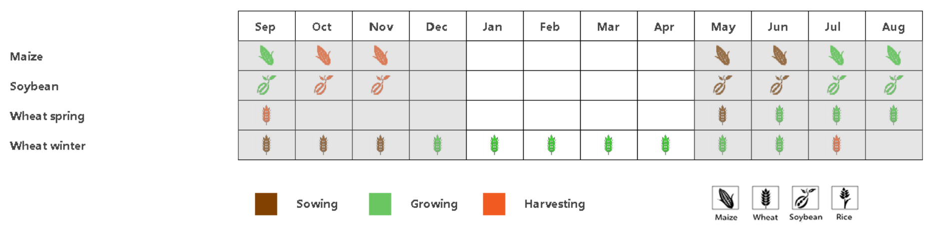
Regional analysis

The Prairies (area identified as 30 in the NDVI clustering map) and Saint Lawrence basin (26, covering Ontario and Quebec) are the major agricultural regions.

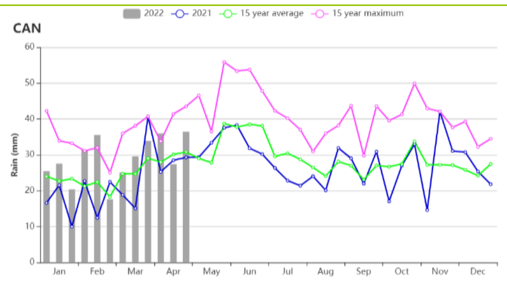
In the **Prairies**, precipitation was above average (RAIN +12%), while the temperature and radiation were lower than the 15-year average (TEMP -0.2°C; RADPAR -7%, respectively). By the end of April, hardly any crops had been sown.

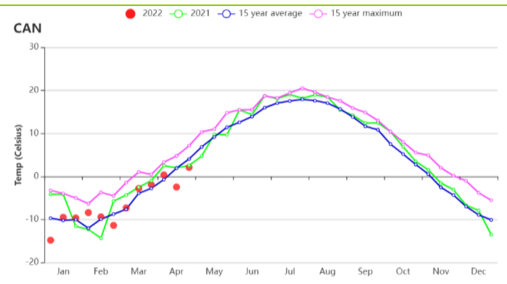
The **Saint Lawrence basin** is the main winter wheat production area in Canada. Most winter wheat is grown in southeastern Ontario, near Toronto and Ottawa. The temperatures and radiation were below the 15-year average (TEMP -0.8℃; RADPAR -7%), and the precipitation was significantly above average (RAIN +29%). Despite the below average trend of NDVI, prospects for winter wheat production are favorable, due to sufficient soil moisture levels.

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



(a). Phenology of major crops





(b) Rainfall profiles

(c) Temperature profiles

Table 3.17 Canada's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, January - April 2022

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Saint Lawrence basin	473	12	-4.7	-0.2	539	-7	253	-3
Prairies	235	29	-6.5	-0.8	538	-7	227	-12

Table 3.18 Canada's agronomic indicators by sub-national regions, current season's values and departure from 5YA, January - April 2022

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Saint Lawrence basin	51	-6	0.77
Prairies	1	-71	0.69

[DEU] Germany

This reporting period covers the overwintering and spring green-up phases of the winter cereals. In late April, winter wheat and barley were at the late vegetative stages, and spring wheat and maize were being planted. Generally, the crop conditions in Germany were near average in most regions based on the agroclimatic and agronomic indicators.

The proportion of irrigated cropland in Germany is only 7% and agro-meteorological conditions play a decisive role in the growth of most crops. At the national level, temperatures and solar radiation were above average (TEMP +0.2°C; RADPAR +1%), whereas total precipitation was below average (RAIN -2%). As can be seen from the time series of the rainfall profile, precipitation was significantly below average during the monitoring period, with the exception of early January, early and mid-February, and early April when precipitation was significantly above average. Most of northern Germany experienced significant above-average temperatures throughout the monitoring period, except for early March and April, while most of southern Germany experienced warmer-than-usual conditions, except for the period in mid-January, late February, mid-early March and April (see Figure 2.5(c) and 2.5(d)). Due to warmer-than-normal temperatures and clear skies, the biomass production potential (BIOMSS) is estimated to increase by 1% nationwide as compared to the average of the past 15 years.

CropWatch agronomic indicators based on NDVI development graph at the national scale show that NDVI values were close to average or below average due to snow cover in January, consistent with the previous monitoring period, and then back up to the average in February. They subsequently dropped to below average due to the precipitation deficit. These observations are confirmed by the clustered NDVI profiles: 28.5% of regional NDVI values were below average in late January. Subsequently, NDVI values were at average levels in almost 100% of the region in February, but then dropped to below average levels from mid-March to late-March. Overall VCIx for Germany was 0.91. CALF during the reporting period was the same as the recent five-year average.

Generally, crop conditions were close to the 5-year average in most parts of Germany. High rainfall in early April helped increase soil moisture, but it is starting to get depleted, because of below-average rainfall in the last 2 decades of April. More rainfall will be needed in May and June to ensure high cereal yields.

Regional analysis

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

Schleswig-Holstein and the Baltic Coast are among the major winter wheat zones of Germany. The region experienced warmer weather (TEMP +0.8°C), above-average radiation (RADPAR +1%) and rainfall (RAIN +11%). As a result, BIOMSS is expected to increase by 5% as compared to the average. As shown in the crop condition development graph (NDVI), the values were significantly above average in the first part of this monitoring period, and then below average from early February to late April. The area has a high CALF (99%) as well as a favorable VCIx (0.97), indicating a large cropping area.

Wheat and sugarbeets are the major crops in **the Mixed Wheat and Sugarbeet Zone of the Northwest**. According to the CropWatch agroclimatic indicators, temperature was higher than average (TEMP +0.6°C), while rainfall and radiation were both above average (RAIN +7%; RADPAR +1%), which led to an increase in BIOMSS by 5%. As shown in the crop condition development graph based on NDVI, the values were below average during the monitoring period, except for near average in early January and mid-February. The area has a high CALF (100%) and crop conditions for the region are favorable according to the high VCIx (0.89).

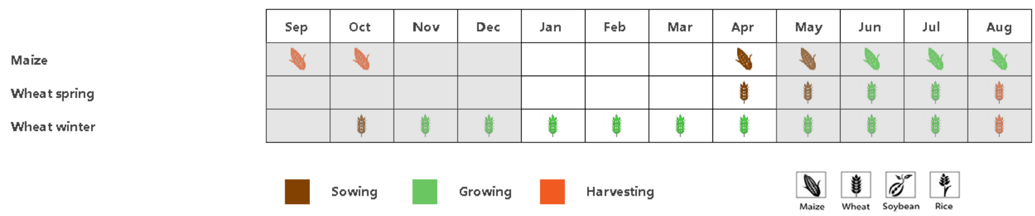
Central Wheat Zone of Saxony and Thuringia is another major winter wheat zone. RAIN was near average, and TEMP was above average (+0.2°C) but RADPAR was below average (-4%). The biomass potential (BIOMSS) was the same as the 15YA. As shown in the crop condition development graph based on NDVI, the values were significantly below average in the first part of this monitoring period and remained below average from mid-March to late April. The area has a high CALF (99%) and the VCIx was 0.85 for this region.

Average to below-average precipitation was recorded in **the East-German Lake and Heathland Sparse Crop Area** (RAIN -4%). TEMP was above average (+0.3°C) but RADPAR was below average (-1%). The biomass potential (BIOMSS) was the same as the 15YA. As shown in the crop condition development graph based on NDVI, the values were close to average in the first part of this monitoring period and were below average from early March to late April. The area has a high CALF (99%) and the VCIx was 0.88 for this region.

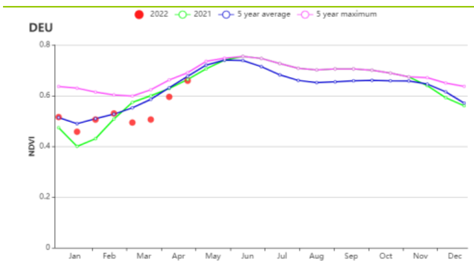
Crop conditions were favorable in **the Western Sparse Crop Area of the Rhenish Massif**. Average to above-average precipitation was recorded in this region (RAIN +4%), with above-average temperature and solar radiation (TEMP +0.3°C; RADPAR +1%). The biomass potential (BIOMSS) increased by 3% compared to the 15YA. As shown in the crop condition development graph based on NDVI, the values were significantly below average in late January, and stayed below average from early March to mid-April. The VCIx value was 0.94 for the western areas. The CALF was 100% for the regions.

On average, a significant reduction in rainfall was recorded for **the Bavarian Plateau** (RAIN -11%), with below-average temperature (-0.3°C) and above-average radiation (RADPAR +3%). Compared to the five-year average, BIOMSS decreased by 3%. As shown in the crop condition development graph based on NDVI, the values were significantly below average in late January, and stayed below average from early March to mid-April. The area had a high CALF (99%) as well as a favorable VCIx (0.93).

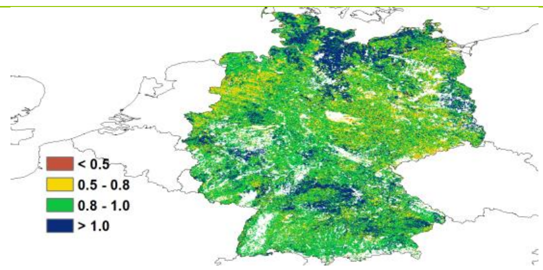
Figure 3.13 Germany's crop condition, January-April 2022



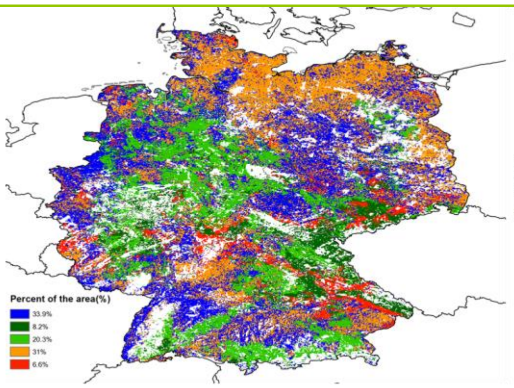
(a). Phenology of major crops

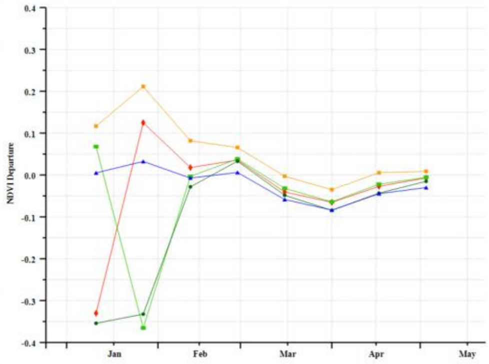


(b) Crop condition development graph based on NDVI



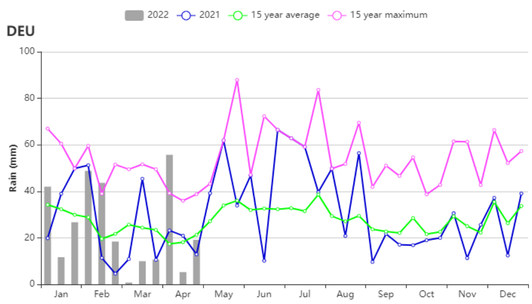
(c) Maximum VCI

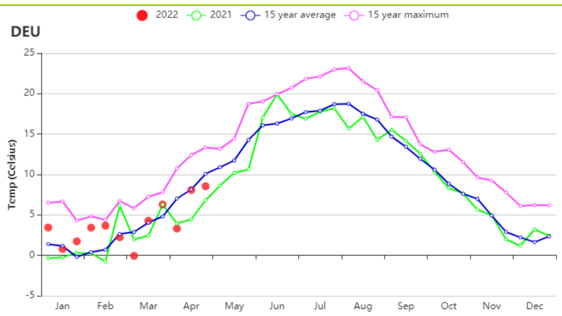




(d) Spatial NDVI patterns compared to 5YA

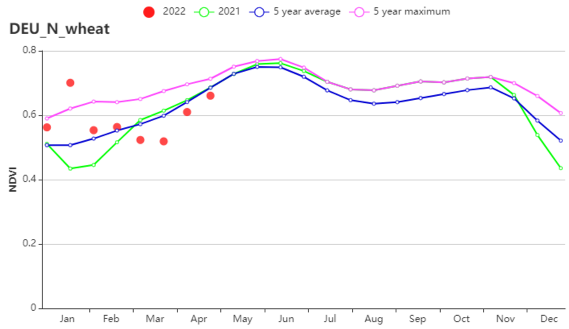
(e) NDVI profiles

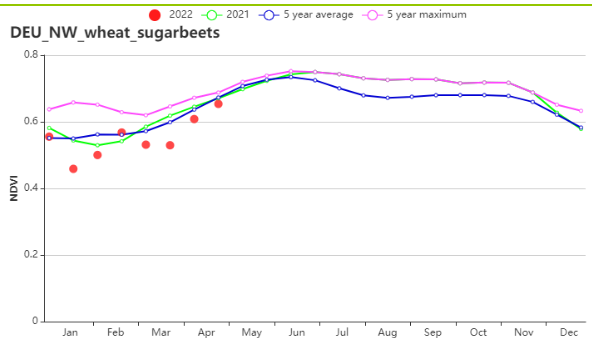




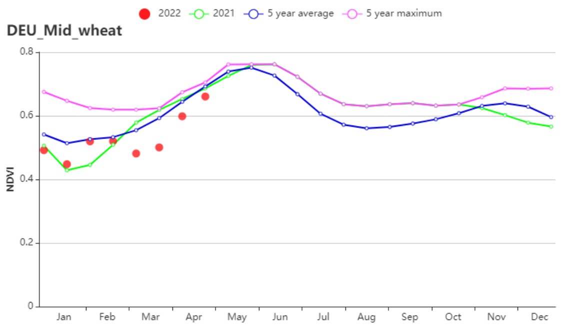
(f) Rainfall profiles

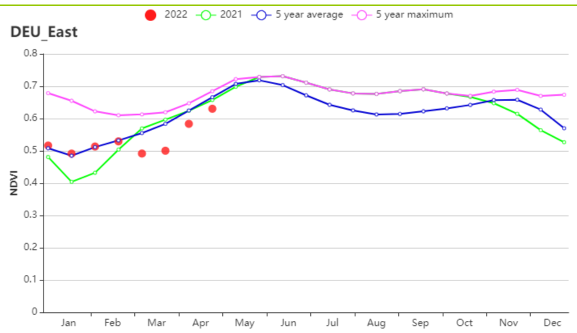
(g) Temperature profiles



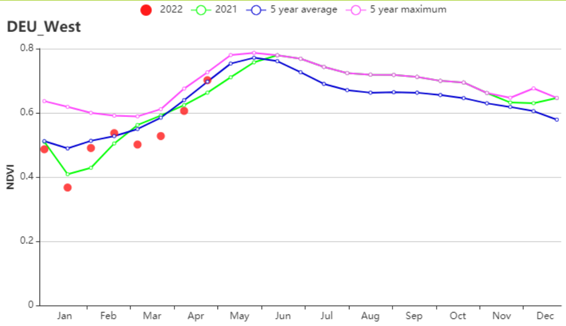


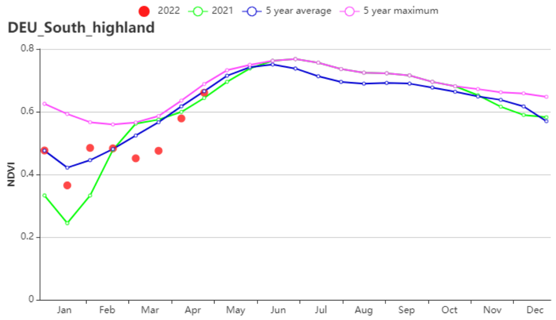
(h) Crop condition development graph based on NDVI (Wheat zone of Schleswig-Holstein and the Baltic coast (left) and Mixed wheat and sugar beets zone of the north-west(right))





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





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

Table 3.19 Germany's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, January-April 2022

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Wheat zone of Schleswig-Holstein and the Baltic coast	298	11	4.9	0.8	474	1	533	5
Mixed wheat and sugarbeets zone of the north-west	306	7	5.0	0.6	492	1	545	5
Central wheat zone of Saxony and Thuringia	244	0	3.5	0.2	488	-4	469	0
East-German lake and Heathland sparse crop area	238	-4	3.7	0.3	494	-1	485	0
Western sparse crop area of the Rhenish massif	291	4	4.0	0.3	524	1	510	3
Bavarian Plateau	318	-11	2.5	-0.3	596	3	457	-3

Table 3.20 Germany's agronomic indicators by sub-national regions, current season's values and departure from 5YA, January-April 2022

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Wheat zone of Schleswig-Holstein and the Baltic coast	99	0	0.97
Mixed wheat and sugarbeets zone of the north-west	100	0	0.89
Central wheat zone of Saxony and Thuringia	99	0	0.85
East-German lake and Heathland sparse crop area	99	0	0.88
Western sparse crop area of the Rhenish massif	100	0	0.94
Bavarian Plateau	99	0	0.93

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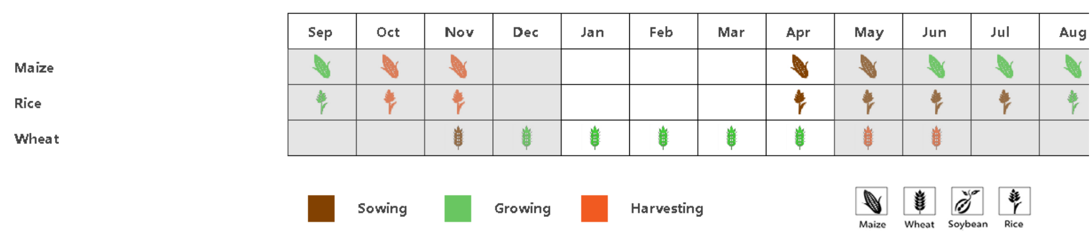
[EGY] Egypt

This report covers the primary growing season of winter wheat and the sowing of maize and rice. Irrigated agriculture is highly developed in Egypt and almost all arable land is irrigated, so rainfall is not the major influential factor. The CropWatch agro-climatic indicators show that the recorded rainfall was 49 mm, 3% less than the average of the last 15-years (15YA). The rainfall index graph shows that most rainfall fell during January and February. The average temperature was 14.6°C, 1.0°C lower than the 15YA. The temperature index graph shows that it was cooler than usual except for late March. Both RADPAR and BIOMSS were lower than the 15YA, respectively, by 2.5% and 8%. The reduction in estimated BIOMSS was presumably due to a decrease in rainfall. The nationwide NDVI development graph shows that the crop conditions fluctuated around the 5-year average (5YA). The NDVI profile map indicates that 33.9% of the cultivated area was above the 5YA, 43% fluctuated around the 5YA, and 23.1% was below the 5YA. The VCIx map indicates that the crop conditions were generally favorable. This finding agrees with the country's VCIx value of 0.82, and the CALF exceeded the 5YA by 2%. Crop conditions for Egypt were average.

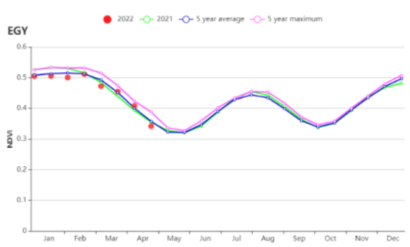
Regional Analysis

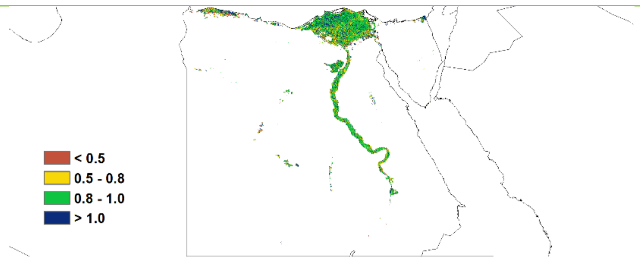
Based on the cropping systems, climatic zones, and topographic conditions, Egypt is subdivided into three agro-ecological zones (AEZ). Only two are relevant for crop production: (1) the Nile Delta and the Mediterranean coastal strip, as well as (2) the Nile Valley. In the Nile Delta and Mediterranean coastal strip, the average rainfall was 53 mm, only 1% above the 15YA while in the Nile Valley zone, it was 13 mm, 25% below the 15YA. The temperature for both zones was above the 15YA by 1.0°C and 1.2°C, respectively. In Egypt, most crops are irrigated, so rainfall has little impact on crop production. RADPAR and BIOMSS both deviated below the 15YA by about 3% and 4% for the first zone and by 0.9% and 17% for the second, respectively. The NDVI-based crop condition development graphs show similar conditions for both zones following the national crop development NDVI graph. The VCIx was 0.86 and 0.82 for the first and second zone, respectively, while the CALF exceeded the 5YA by 2% for both zones, indicating average crop conditions.

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

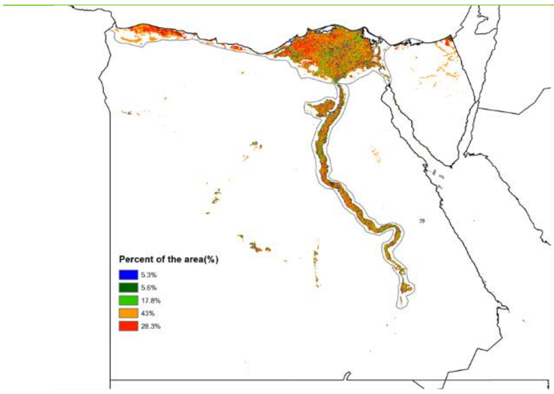


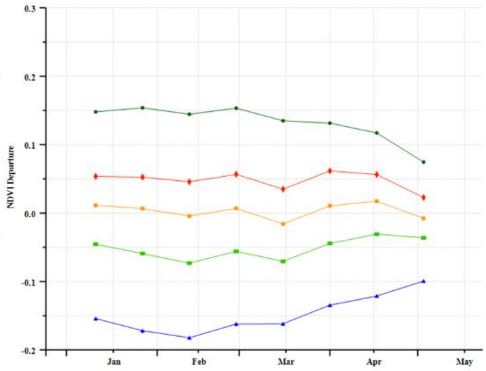
(a). Phenology of major crops



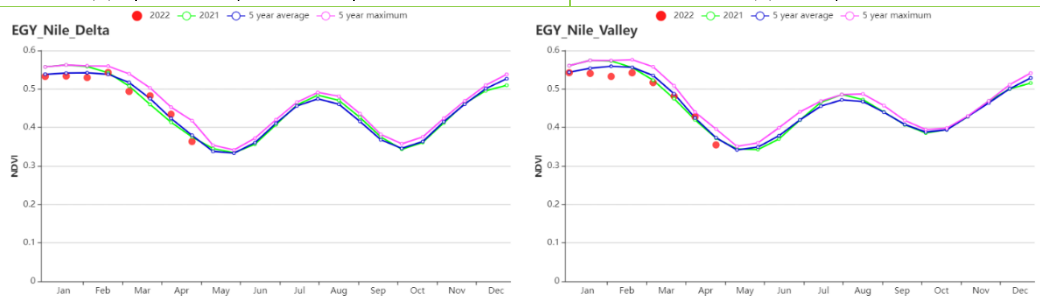


(b). Crop condition development graph based on NDVI	(c). Maximum VCI

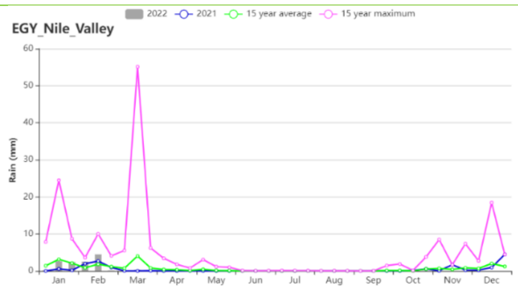


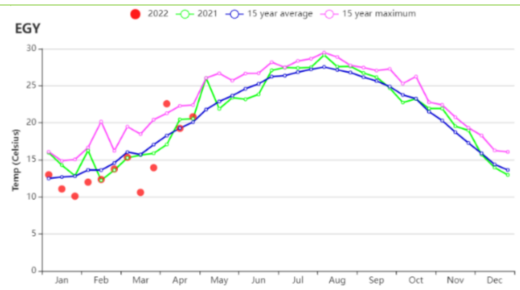


(d). Spatial NDVI patterns compared to 5YA | (e). NDVI profiles



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





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

Table 3.21 Egypt's agroclimatic indicators by sub-national regions, current season's values, and departure from 15YA, January-April 2022

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m2)	Departure from 15YA (%)	Current (gDM/m2)	Departure from 15YA (%)
Nile Delta and Mediterranean coastal strip	53	1	14.5	-1.0	976	-3.0	312	-4
Nile Valley	13	-25	15.1	-1.2	1099	-0.9	212	-17

Table 3.22 Egypt's agronomic indicators by sub-national regions, current season's values, and departure from 5YA, January-April 2022

Region	CALF		Maximum VCI
	Current (%)	Departure from 5YA (%)	Current
Nile Delta and Mediterranean coastal strip	71	2	0.86

Region	CALF		Maximum VCI
	Current (%)	Departure from 5YA (%)	Current
Nile Valley	81	2	0.82

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[ETH] Ethiopia

The monitoring period for this report covers January to April. Harvest of last year's main crops (barely, teff and wheat) was completed in December, amidst drier than usual conditions. In March and April, the planting of maize started. The proportion of irrigated cropland in Ethiopia is only 5% and agro-meteorological conditions play a decisive role in the growth of crops. However, significant rainfall started in mid-April only. Rainfall had dropped by 48% from the 15YA, temperature (+0.3°C) and solar radiation (+2%) were slightly higher than the 15YA. Below-average rainfall resulted in a 17% reduction of potential biomass compared with the 15YA. The drought was most severe in the southern regions of the country. In the South-eastern mixed maize zone rainfall was 22% below average. The crop condition development graph based on NDVI for Ethiopia presents below-average values in March and April mainly due to late planting of maize caused by dry weather in southeastern Ethiopia. The NDVI departure clustering maps show a negative departure in the south. The average Maximum VCI for Ethiopia was 0.69. The Maximum VCI graph shows the same pattern as the NDVI departure clustering map. The cropped arable land fraction decreased by 11% compared to the 5YA. This was due to poor soil moisture conditions. In short, land preparation and maize planting were negatively affected by below-average rainfall in the southern and eastern parts of the country. Crop cultivation in the war-torn northern semi-arid region has been severely impacted.

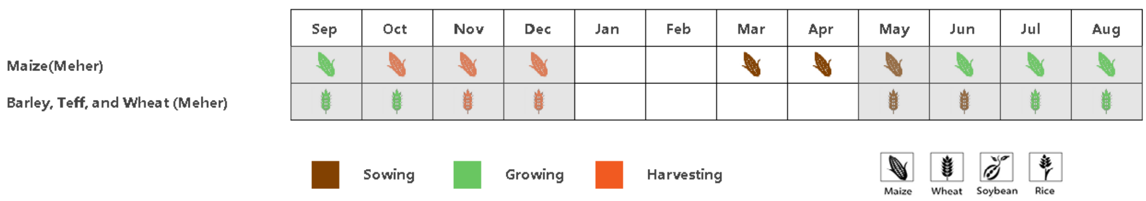
Regional analysis

The agroclimatic conditions in **Semi-arid pastoral areas**, **Southeastern Mendebo highlands zone** and **South-eastern mixed maize zone** as well as the Semi-arid pastoral areas were similar: Low precipitation but average temperature and adequate photosynthetically active radiation. As a result, the estimated cumulative biomass was reduced by 12%, 29% and 22% in the three regions compared to 15YA.The NDVI was also below the average level in March and April, which means that the forage growth and maize sowing were affected by the drought, which also caused a drop in the cropped arable and fraction and the maximum VCI was less than 0.65. In conclusion, the drought impacted forage production and a delay in maize planting in the southeast zone.

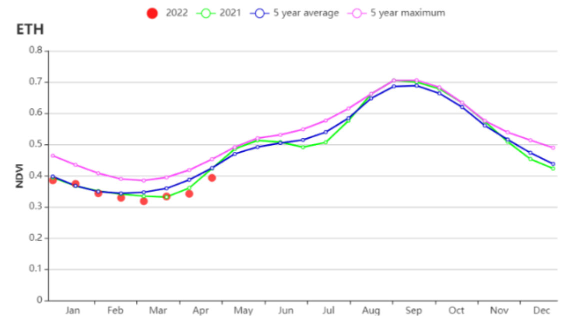
The agroclimatic conditions in **western mixed maize zone** were different. There was a slight decrease in rainfall (-16%), but the effect on cumulative biomass (-4%) was minimal. The cropped arable and fraction did not change much either. The NDVI was near the 15YA and the maximum VCI at 0.85. Conditions for maize cultivation in this region can be assessed as close to normal.

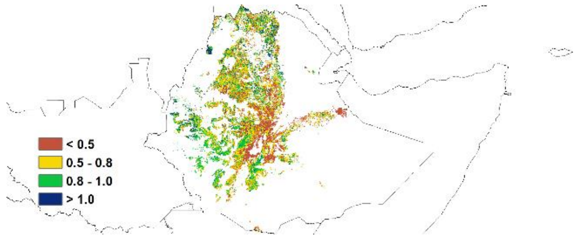
The **northern arid area** is an agricultural area in northern Ethiopia. Due to the war, the cropped arable land fraction was almost zero and the severe food shortage is continuing.

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



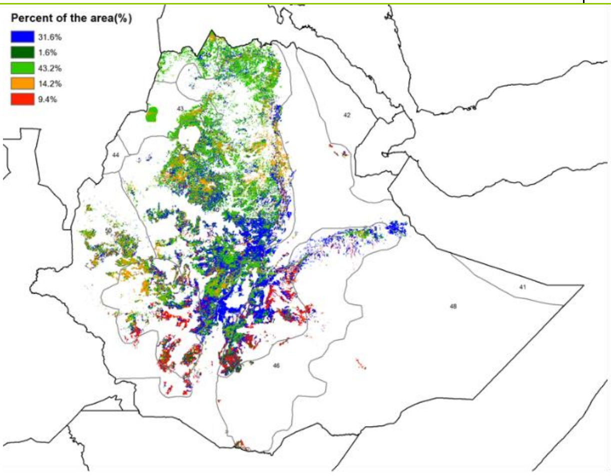
(a) Phenology of major crops

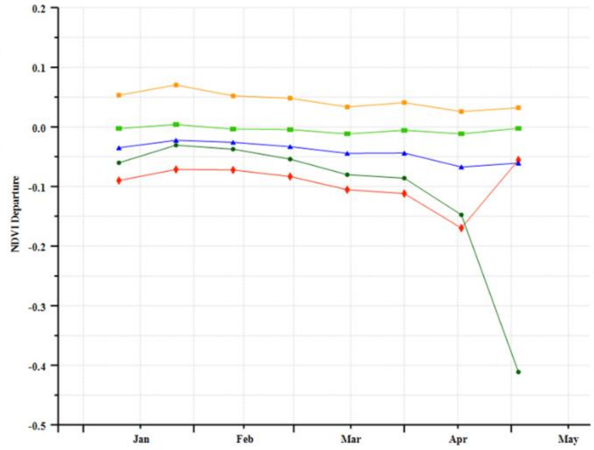




(b) Crop condition development graph based on NDVI

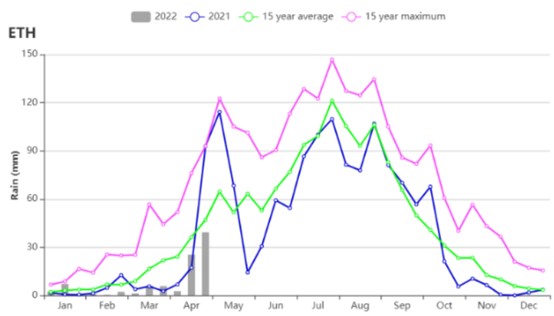
(c) Maximum VCI

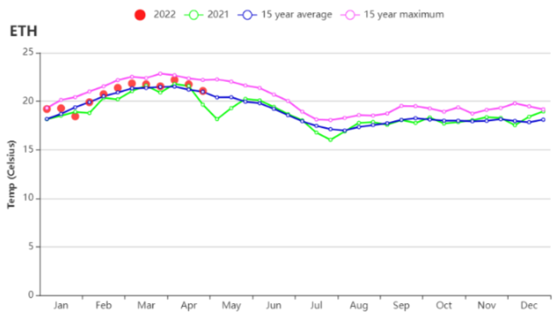




(d) Spatial NDVI patterns compared to 5YA

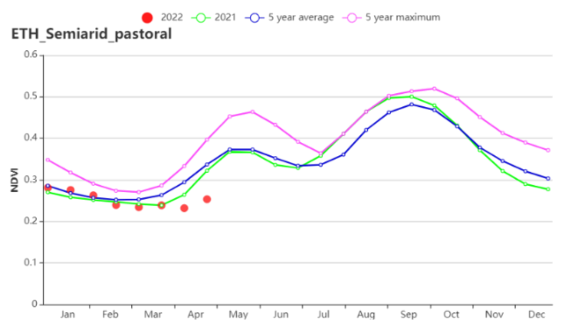
(e) NDVI profiles

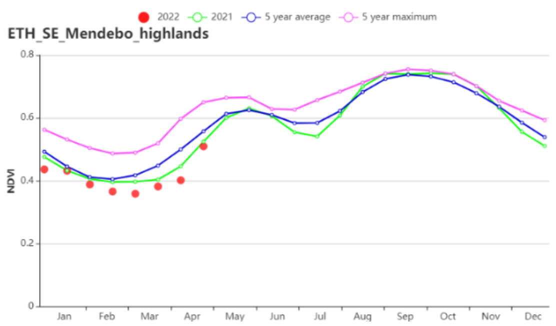




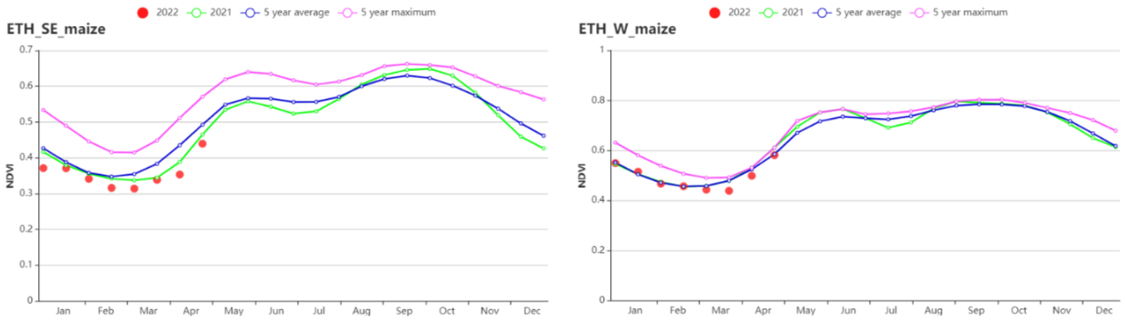
(f) Rainfall profiles

(g) Temperature profiles

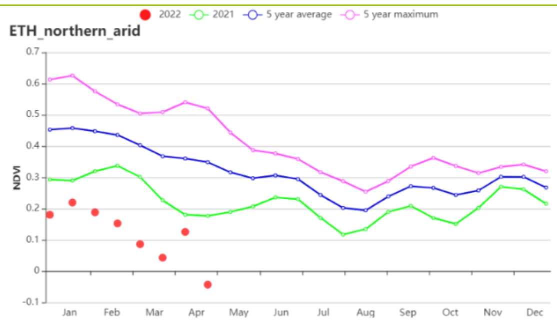




(h) Crop condition development graph based on NDVI (Semi-arid pastoral (left) South-eastern Mendebo highlands (right))



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



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

Table 3.23 Ethiopia's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, January 2022-April 2022

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m2)	Departure (%)	Current (gDM/m2)	Departure (%)
Semi-arid pastoral areas	74	-52	22.8	1.5	1427	3	551	-12
South-eastern Mendebo highlands	70	-68	16.6	0.3	1417	5	402	-29
South-eastern mixed maize zone	78	-68	20.3	1.0	1389	6	495	-22
Western mixed maize zone	168	-16	24.5	0.0	1297	0	650	-4
Northern arid area	64	11	26.1	0.6	1404	3	577	3

Table 3.24 Ethiopia's agronomic indicators by sub-national regions, current season's values and departure from 5YA, January 2022-April 2022

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Semi-arid pastoral areas	14	-32	0.47
South-eastern Mendebo highlands	64	-12	0.65
South-eastern mixed maize zone	50	-24	0.58
Western mixed maize zone	94	-1	0.85
Northern arid area	0	-100	0.32

[FRA] France

This report covers the growing period of winter wheat, as well as the sowing of spring wheat and maize in France. The proportion of irrigated cropland in France is only 9% and agro-meteorological conditions play a decisive role in the growth of most crops. CropWatch agro-climatic indicators, when compared to the 15YA, show that RAIN was 30% lower than average and sunshine was above average (RADPAR +6%). The temperature was at the average level. Due to extremely unfavorable precipitation conditions, the biomass production potential (BIOMSS) is estimated to have decreased by 7% nationwide compared to the 15-year average. The national-scale NDVI development graph shows that the NDVI values were generally lower than in the 2021 season and the 5YA. The crop conditions were close to the 5-year average in January and February. This is also partly reflected by the spatial distribution of maximum VCI (VCIx) across the country, which reached an average of 0.86. Overall, below-average rainfall starting in mid-January caused unfavorable growth conditions for most of France.

Regional analysis

Considering cropping systems, climatic zones and topographic conditions, additional sub-national details are provided for eight agro-ecological zones. They are identified on the maps by the following numbers: (78) **Northern barley region**, (82) **Mixed maize/barley and rapeseed zone from the Center to the Atlantic Ocean**, (79) **Maize-barley and livestock zone along the English Channel**, (80) **Rapeseed zone of eastern France**, (75) **Massif Central dry zone**, (81) **Southwestern maize zone**, (76) **Eastern Alpes region** and (77) **the Mediterranean zone**

In the Northern barley region, RADPAR and TEMP were both above average (+6% and +0.6°C respectively), while RAIN was below average (-19%). The BIOMSS also decreased by 5% when compared to the past 15 YA. The CALF was at the average level, and VCIx was 0.88. Crop condition development based on NDVI for this region was at the 5-year average level during most monitoring period, but it was below average in March.

In the Mixed maize/barley and rapeseed zone from the Center to the Atlantic Ocean, slightly warmer (TEMP 0.5°C) and sunnier (RADPAR 3%) weather was observed, but precipitation was below average (RAIN -30%). Estimated BIOMSS was 11% lower than average, CALF was at the average level and VCIx was at 0.91. The regional NDVI profile presented a slightly lower but close-to-average trend.

In the Maize-barley and livestock zone along the English Channel, RADPAR and TEMP were above average by 3% and 0.8°C. RAIN was lower than the average (-26%). BIOMSS decreased by 7%. CALF was average and VCIx was relatively high at 0.94. The regional NDVI profile also presented an overall close-to-average trend, except for mid-January, when it exceeded the 5 years maximum.

In the Rapeseed zone of eastern France, the NDVI profile also indicated general below-average conditions, although it was slightly above the average in early and mid-January. Overall, RAIN in this period dropped by 22% from the average levels, while TEMP increased by 0.1°C. RADPAR increased by 9%. BIOMSS was about 1% lower than average while CALF was at the average level, and VCIx was 0.9.

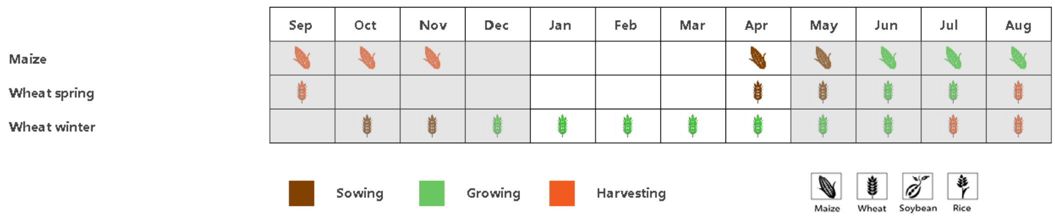
In the Massif Central dry zone, TEMP and RADPAR were 0.1°C and 7% higher than the average, respectively, while RAIN decreased by 31%. The VCIx was 0.9 and BIOMSS decreased by 3% which indicated a below-average cropping season in the region. Crop conditions based on the NDVI profile were also below the average levels.

The Southwestern maize zone is one of the major irrigated regions in France. The regional NDVI profile also presented a below-average trend. RAIN in the period was 29% lower than average, while TEMP was near average. RADPAR slightly increased by 3%. BIOMSS was also 5% lower than average, while CALF was 1% below average. The VCIx was recorded at 0.79, indicating below-average crop conditions.

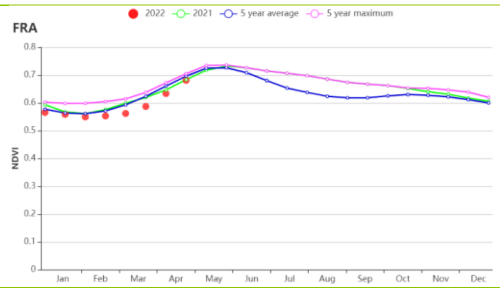
In the Eastern Alpes region, the NDVI profile also presented an overall below average trend, but it was close to average in late April. RAIN in the region was 36% lower than average, while TEMP was slightly higher than average level (+0.1 °C) and RADPAR was 10% higher than the 15YA. BIOMSS was 8% lower than the fifteen-year average. VCIx for the region was recorded at 0.8 and CALF was at the average level, indicating overall below-average crop conditions.

The Mediterranean zone also presented an overall lower NDVI profile. The region recorded a low VCIx (0.74). TEMP and RADPAR were above average by 1.1 °C and 6%, respectively, while RAIN was lower than average by 45%. BIOMSS and CALF decreased by 19% and 2%. This region is showing below-average crop conditions due to the low precipitation throughout the monitoring period.

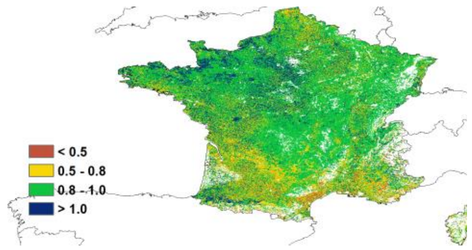
Figure 3.16 France's crop condition, January - April 2022



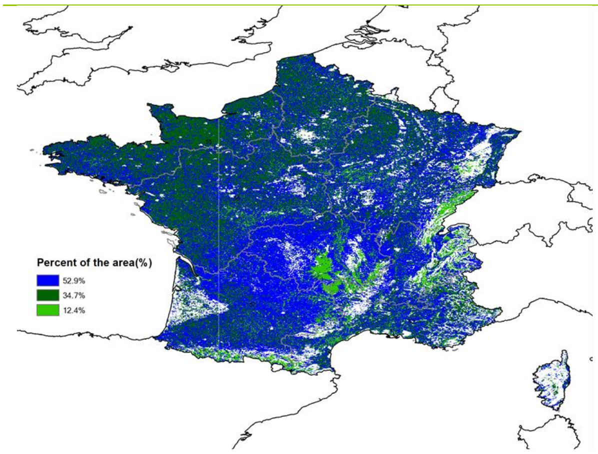
(a). Phenology of major crops



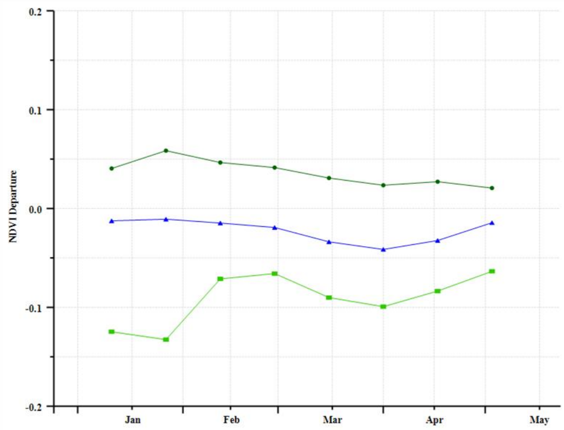
(b) Crop condition development graph based on NDVI



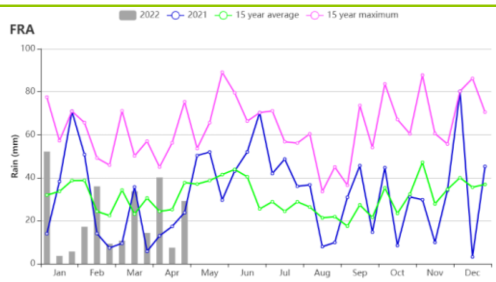
(c) Maximum VCI

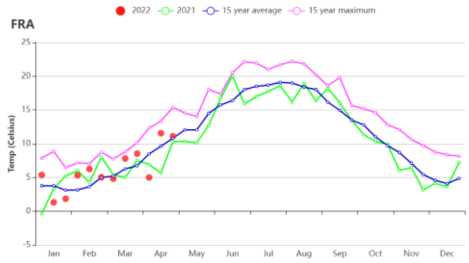


(d) Spatial NDVI patterns compared to 5YA

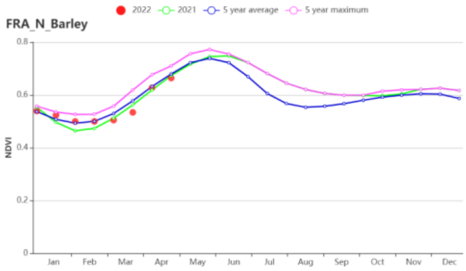


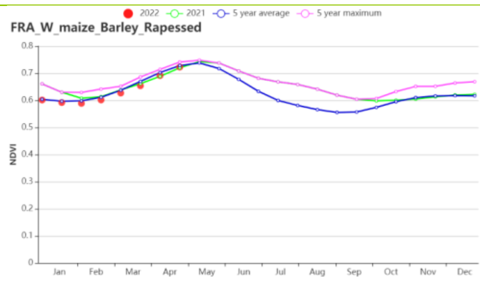
(e) NDVI profiles



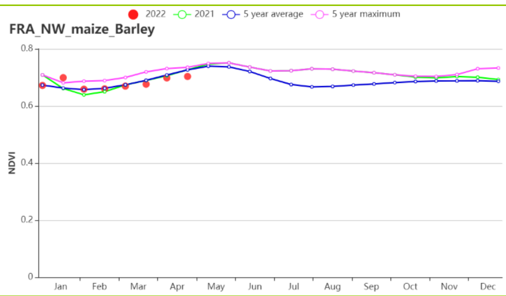


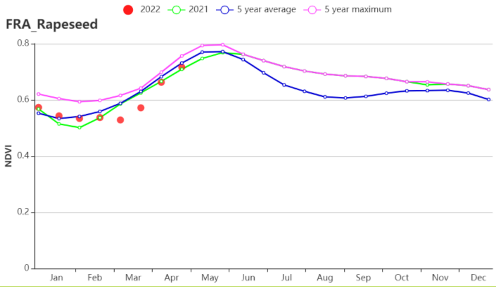
(f) Rainfall profiles (g) Temperature profiles



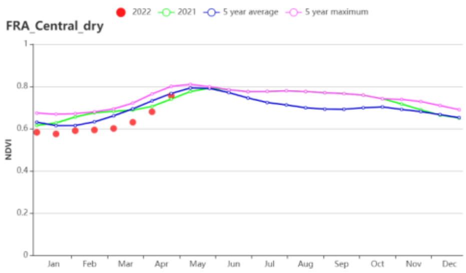


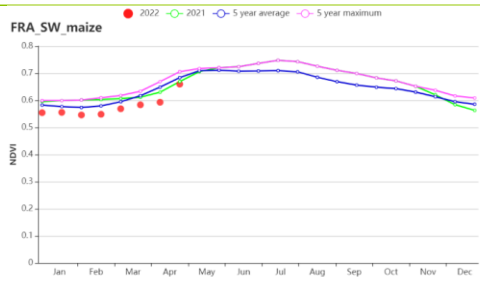
(h) Crop condition development graph based on NDVI (Northern barley region (left) and Mixed maize, Barley and Rapeseed zone (right))



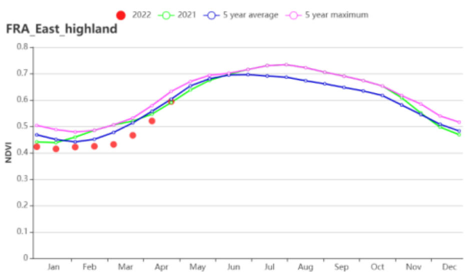


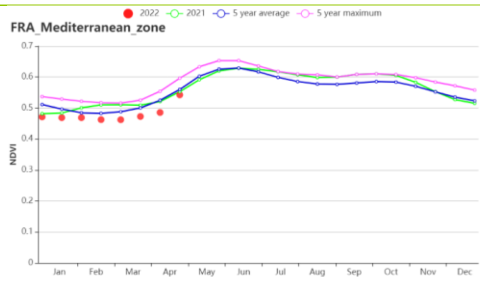
(i) Crop condition development graph based on NDVI (Maize, barley and livestock zone (left) and Rapeseed zone (right))





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





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

Table 3.25 France's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, January - April 2022

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Northern Barley zone	234	-19	6.5	0.6	568	6	545	-5
Mixed maize/barley and rapessed zone from the Centre to the Atlantic Ocean	223	-30	7.6	0.5	609	3	548	-11
Maize barley and livestock zone along the English Channel	242	-26	7.8	0.8	575	3	567	-7
Rapeseed zone of eastern France	282	-22	4.9	0.1	621	9	540	-1
Massif Central Dry zone	254	-31	4.9	0.1	659	7	535	-3
Southwest maize zone	318	-29	6.5	0.0	671	3	577	-5
Alpes region	282	-36	3.5	0.1	735	10	444	-8
Mediterranean zone	197	-45	6.5	1.1	770	6	423	-19

Table 3.26 France's agronomic indicators by sub-national regions, current season's values and departure from 5YA, January - April 2022

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Northern Barley zone	100	0	0.88
Mixed maize/barley and rapessed zone from the Centre to the Atlantic Ocean	100	0	0.91
Maize barley and livestock zone along the English Channel	100	0	0.94
Rapeseed zone of eastern France	99	0	0.90
Massif Central Dry zone	100	0	0.90
Southwest maize zone	97	-1	0.79
Alpes region	87	0	0.80
Mediterranean zone	87	-2	0.74

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[GBR] Kingdom

This report covers the vegetative growth period of winter wheat, winter barley and rapeseed. The proportion of irrigated cropland in Kingdom is only 2% and agro-meteorological conditions play a decisive role in the growth of most crops. According to the crop condition development graph, NDVI values were close to average from January to April. Rainfall (RAIN -21%) was significantly below average, temperatures and radiation were above average (TEMP +0.8°C; RADPAR +7%). The combined impact of these agroclimatic factors resulted in decreased biomass (BIOMSS -2%). The seasonal RAIN profile shows that rainfall was fluctuating in the monitoring period. The temperature was above or close to average for most parts of the period.

The national average VCIx was 0.94. CALF (99%) was unchanged compared to its five-year average. The NDVI departure cluster profiles indicate that: (1) most of arable land in the United Kingdom experienced average crop conditions. (2) 6.2% of arable land experienced a marked drop of crop conditions in early-February, mainly in Wales. Most likely, the large drop in NDVI can be attributed to cloud cover in the satellite images or snow. Altogether, the conditions for wheat in the UK are assessed to be slightly below average, mainly due to a rainfall deficit.

Regional analysis

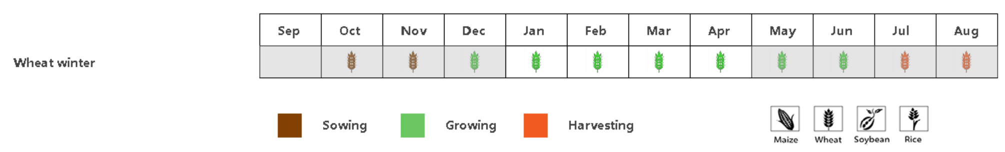
Based on cropping systems, climatic zones and topographic conditions, three sub-national regions can be distinguished: 1) **Central sparse crop region**, 2) **Northern barley region**, and 3) **Southern mixed wheat and barley region**. The fractions of cropped arable land (CALF) in all subregions are average compared to the 5-year average.

The **Northern barley region** experienced below-average rainfall (RAIN -15%), while temperature and radiation were significantly above average (TEMP +0.8°C; RADPAR +6%). Biomass was above average (BIOMSS +5%). NDVI was close to average according to the crop condition graph. The VCIx was 0.94. Altogether, the output of wheat is expected to be near average.

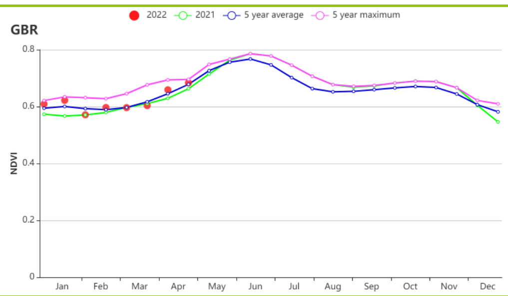
The **Central sparse crop region** is one of the major agricultural regions in terms of crop production. The rainfall was below average (RAIN -22%), while temperature and radiation were significantly above average (TEMP +0.8°C, RADPAR, +8%). This resulted in an average estimate for biomass (BIOMSS +1%). NDVI values were close to average, except for January. The VCIx was at 0.95. Altogether, the conditions for wheat are expected to be near average.

Southern mixed wheat and barley zone experienced a severe rainfall deficit (RAIN -27%). Temperature and radiation (TEMP +0.8°C; RADPAR +7%) were similar to the Central sparse crop region. The rainfall defict resulted in biomass estimates that were below average (BIOMSS -8%). NDVI was near average according to the crop condition graph in this reporting period. The VCIx was 0.94. Altogether, the output of wheat is expected to be near average.

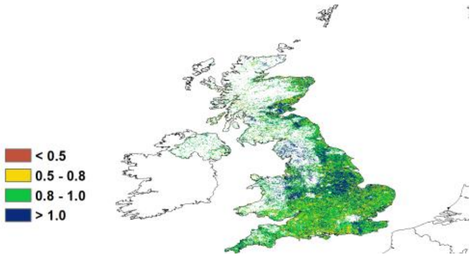
Figure 3.17 United Kingdom's crop condition, January - April 2022



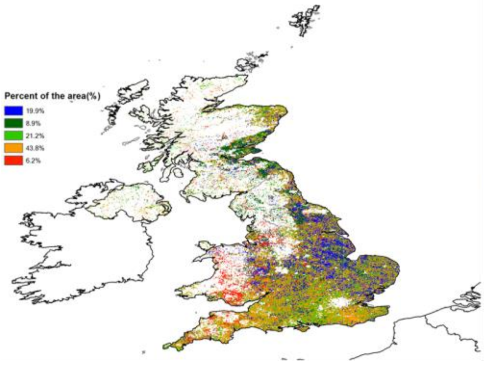
(a). Phenology of major crops

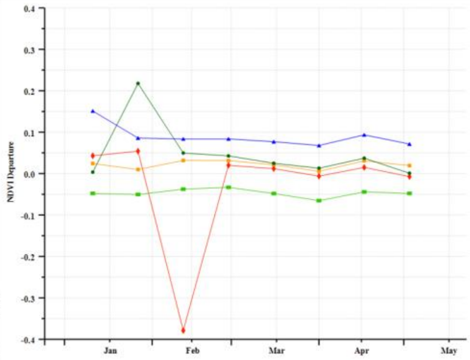


(b) Crop condition development graph based on NDVI



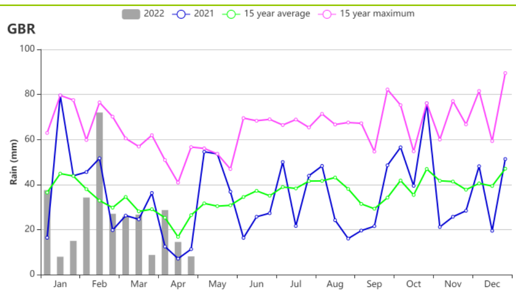
(c) Maximum VCI

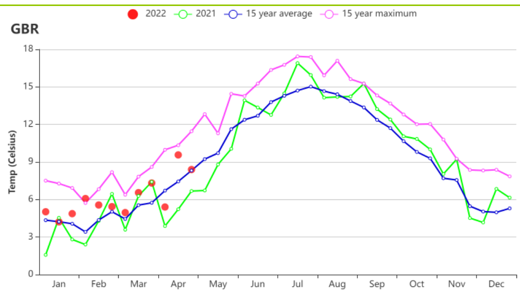




(d) Spatial NDVI patterns compared to 5YA

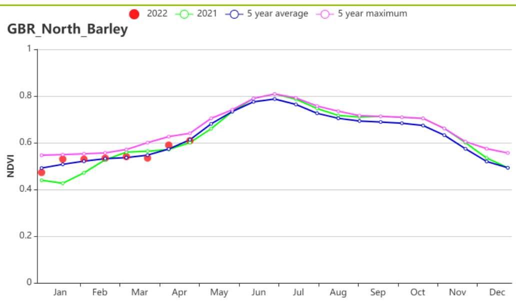
(e) NDVI profiles

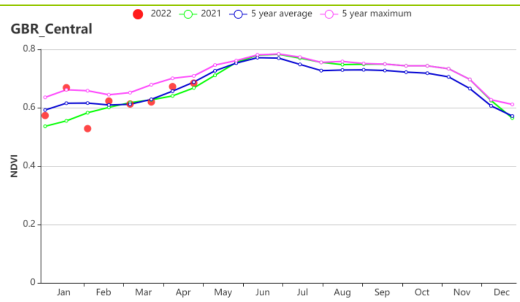




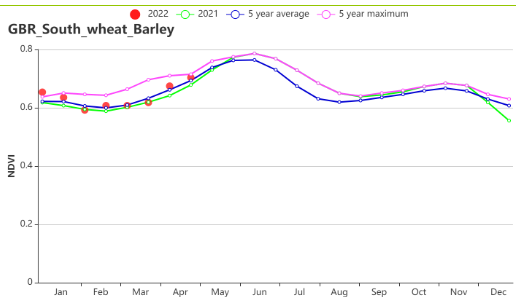
(f) Rainfall profiles

(g) Temperature profiles





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



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

Table 3.27 United Kingdom's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, January - April 2022

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m^2)	Departure (%)	Current (gDM/m^2)	Departure (%)
Northern Barley region(UK)	407	-15	5.2	0.8	404	6	536	5
Central sparse crop region (UK)	311	-22	6.0	0.8	458	8	554	1
Southern mixed wheat and Barley zone (UK)	222	-27	6.7	0.8	508	7	519	-8
Northern Barley region(UK)	407	-15	5.2	0.8	404	6	536	5

Table 3.28 United Kingdom's agronomic indicators by sub-national regions, current season's values and departure from 5YA, January - April 2022

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Northern Barley region(UK)	96	0	0.94
Central sparse crop region (UK)	99	0	0.95
Southern mixed wheat and Barley zone (UK)	100	0	0.94
Northern Barley region(UK)	96	0	0.94

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

[HUN] Hungary

This reporting period covers the main growing season of winter wheat, sown in September and October. According to the crop condition development graph, NDVI values were below average over the entire period. The proportion of irrigated cropland in Kingdom is only 4% and agro-meteorological conditions play a decisive role in the growth of most crops. The overall rainfall (RAIN -38%) and temperatures (TEMP -0.4°C) in this period were below average. The solar radiation (RADPAR +6%) was above average as compared to the 15YA. The low rainfall was mainly due to below-average rainfall in January, February, March and mid-April, which delayed the growth of winter wheat, resulting in a 21% decrease of estimated biomass. The national CALF was 90%, which was 6% below the 5YA. Rainfall had recovered to average levels in April. This helped the crops recover to average levels by the end of this monitoring period. Below-average to average winter wheat production can be expected, if rainfall remains sufficient in the coming monitoring period.

The national average VCIx was 0.83. The NDVI departure cluster profiles indicate that: 16.6% of arable land experienced above-average crop conditions from January to mid-March, below average in late-March, and above average in April, mainly distributed in west Hungary, middle Hungary and east Hungary. 20.8% of arable land experienced below-average crop conditions from January to mid-April, above average in late-April, mainly distributed in east Hungary. 62.5% of arable land experienced below-average crop conditions, scattered over the whole Hungary.

Regional analysis

Based on cropping systems, climatic zones, and topographic conditions, four sub-national regions are described below: **Central Hungary**, **the Great Plain (Puszta), Northern Hungary** and **Transdanubia**. During this reporting period, CALF was below average for all the four subregions (-3%, -7%, -5% and -5%, respectively).

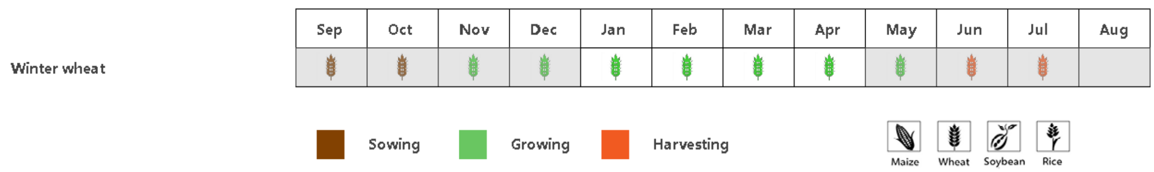
Central Hungary is one of the major agricultural regions in terms of crop production. A sizable share of winter wheat is planted in this region. According to the NDVI development graphs, the values were below average in the whole period. Agro-climatic conditions presented below-average rainfall (RAIN -49%) and temperature (TEMP -0.3°C), and above-average radiation (RADPAR +7%). Biomass (BIOMSS -30%) was below average mainly due to below-average rainfall in January, February, March and mid-April, which slowed the growth of winter wheat. The VCIx was 0.83. The crop conditions in this region are slightly below average.

The Puszta region mainly grows winter wheat, maize and sunflower, especially in the counties of Jaz-Nagykum-Szolnok and Bekes. According to the NDVI development graphs, the values were below average in the whole period. Agro-climatic conditions presented below-average rainfall (RAIN -35%) and temperature (TEMP -0.6°C), and above-average radiation (RADPAR +5%). Biomass (BIOMSS -21%) was below average mainly due to below-average rainfall in January, February, March and mid-April, which delayed the growth of winter wheat. The VCIx was 0.84. The crop conditions in this region are expected to be below average.

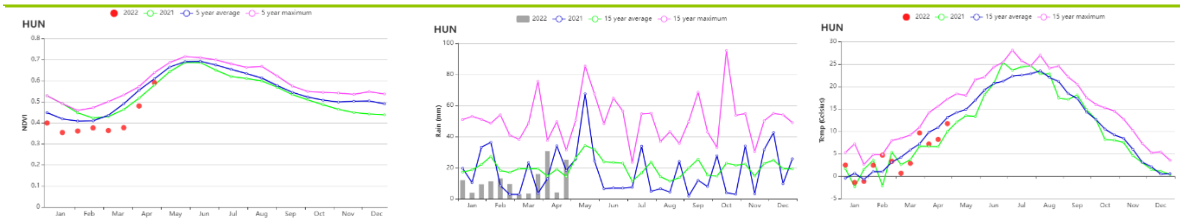
Northern Hungary is another important winter wheat region. According to the NDVI development graphs, the values were below average in the whole period. Agro-climatic conditions presented below-average rainfall (RAIN -44%) and temperature (TEMP -0.2°C), and above-average radiation (RADPAR +5%). Biomass (BIOMSS -24%) was below average mainly due to below-average rainfall in January, February, March and mid-April, which delayed the growth of winter wheat. The VCIx was 0.80. The crop conditions in this region are expected to be below average.

Southern Transdanubia cultivates winter wheat, maize, and sunflower, mostly in Somogy and Tolna counties. According to the NDVI development graphs, the values were below average in the whole period. Agro-climatic conditions presented below-average rainfall (RAIN -39%) and temperature (TEMP -0.3°C), which resulted in a below-average biomass (BIOMSS -20%). The maximum VCI was favorable at 0.82. The crop conditions in this region are expected to be below average.

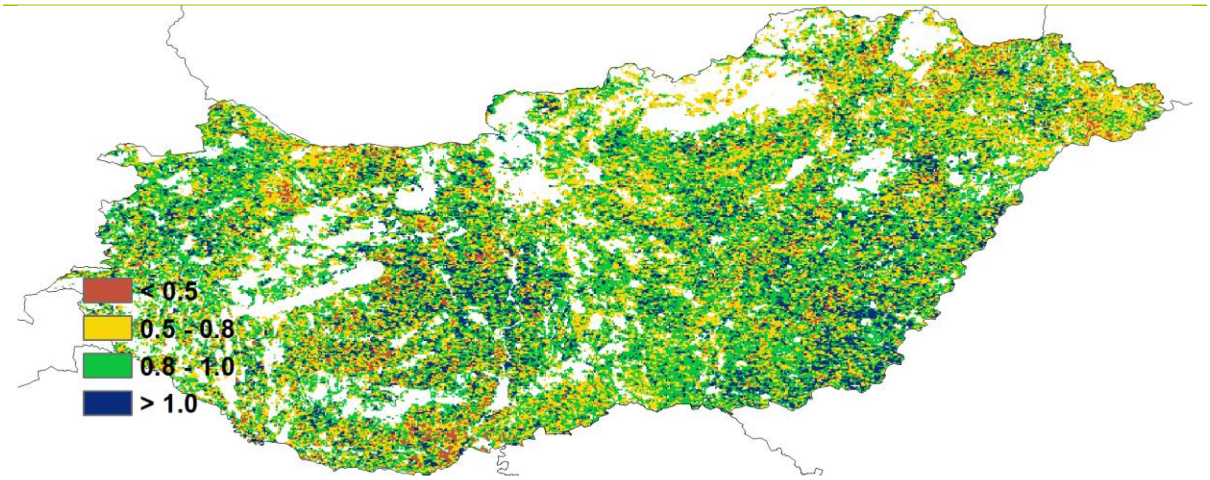
Figure 3.18 Hungary's crop condition, January-April 2022



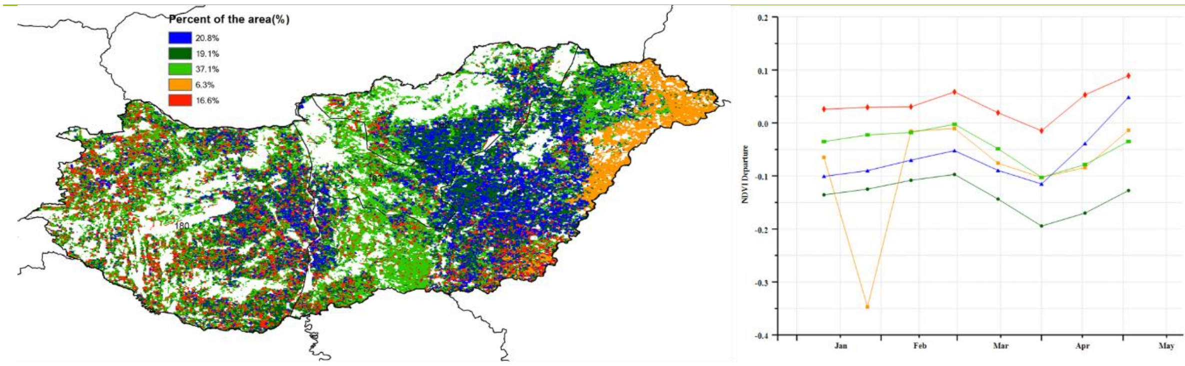
(a). Phenology of major crops



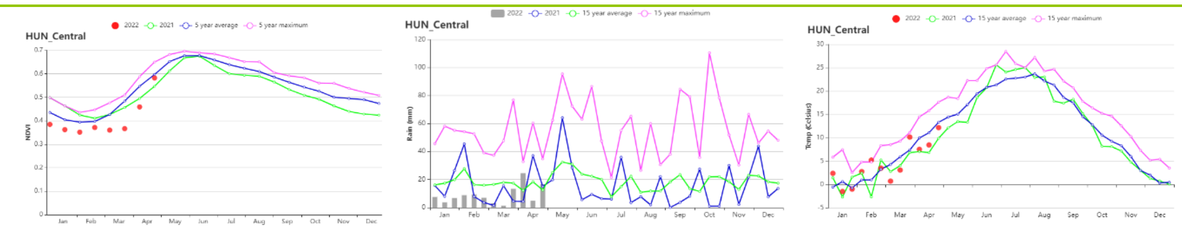
(b) Crop condition development graph based on NDVI, RAIN and TEMP



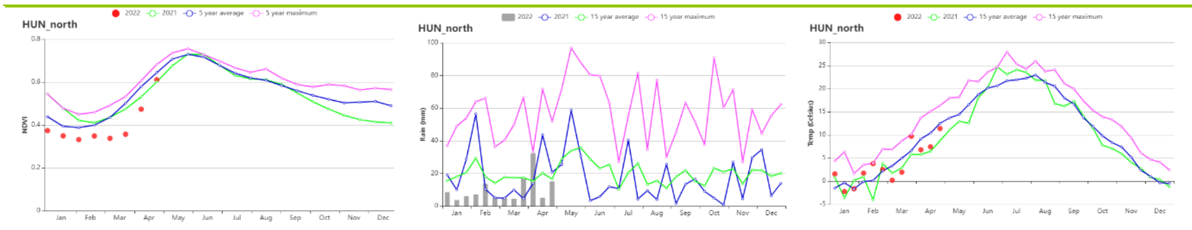
(c) Maximum VCI



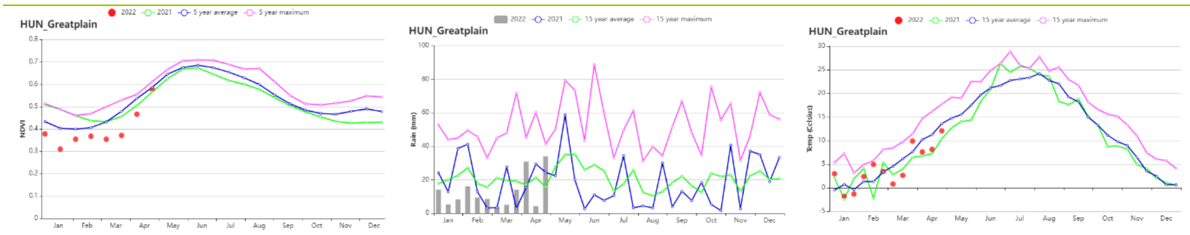
(d) Spatial distribution of NDVI profiles.



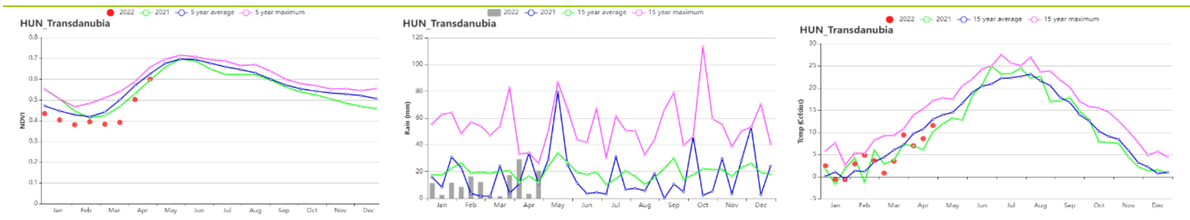
(e) Crop condition development graph based on NDVI, RAIN and TEMP



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



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



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

Table 3.29 Hungary's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, January-April 2022

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Central Hungary	107	-49	4.5	-0.3	675	7	340	-30
North Hungary	123	-44	3.6	-0.2	634	5	360	-24
The Puszta	152	-35	4.3	-0.6	658	5	401	-21
Transdanubia	136	-39	4.5	-0.3	701	8	397	-20

Table 3.30 Hungary's agronomic indicators by sub-national regions, current season's values and departure from 5YA, January-April 2022

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current (%)
Central Hungary	94	-3	0.83
North Hungary	94	-5	0.80
The Puszta	87	-7	0.84
Transdanubia	91	-5	0.82

[IDN] Indonesia

From January to April, the harvest of the main rice was completed, while the rainy season maize in Java and Sumatra was still growing between January and February, and the harvest started in March.

The proportion of irrigated cropland in Indonesia is only 14% and agro-meteorological conditions play a decisive role in the growth of most crops. CropWatch agroclimatic indicators show that precipitation (RAIN -6%) was below the 15YA, while radiation (RADPAR +5%) and temperature (TEMP +0.2°C) were slightly above average, which led to a slight increase of the potential biomass production (BIOMSS +1%).

NDVI clusters and profiles show that 56.7% of the cropland was significantly below the 5YA at the beginning of the monitoring period, but returned to normal in mid-February. The crop conditions on 43.4% of arable land were close to the 5YA, mainly in Medan, Bandung, Java, Kupang, Timor, and Ambon. Considering that the area of cropped arable land in Indonesia was close to the 5YA (CALF 100%) and the VCIx value reached 0.95, the crop conditions are anticipated to be average or slightly above.

Regional analysis

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

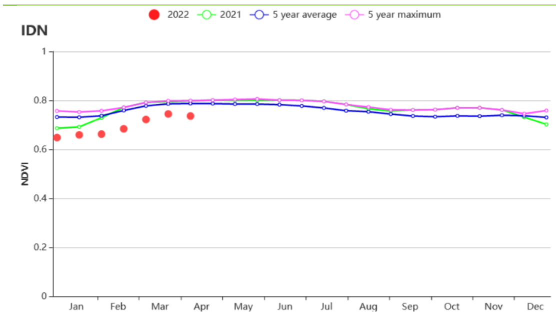
According to the agroclimatic conditions of Java, temperature (TEMP +0.1°C) and radiation (RADPAR +7%) were above average, whereas precipitation (RAIN -6%) was below the 15YA, which may have resulted in average potential biomass production (BIOMSS +0%). The NDVI development graphs indicate that crop conditions were close to average in January, mid-March and April, but below the 5YA at other times. Crop conditions on Java Island can be expected to be close to average.

In the Kalimantan and Sulawesi region, precipitation (RAIN -10%) was below average, but temperature (TEMP +0.2°C) and radiation (RADPAR +6%) were above the 15YA. They resulted in an increase in the potential biomass production (BIOMSS +1%). The NDVI development graphs show that crop conditions were below the 5YA. Overall, crop conditions in Kalimantan and Sulawesi are assessed as close to or slightly above average.

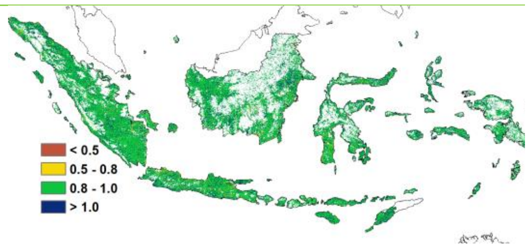
In Sumatra, precipitation (RAIN -3%) was below the 15YA, whereas temperature (TEMP +0.2°C) and radiation (RADPAR +5%) were above average, which led to an increase in the potential biomass production (BIOMSS +1%). According to the NDVI development graphs, crop conditions were close to average in mid-March, but below average at other times. Crop conditions in this region are anticipated to be above average.

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

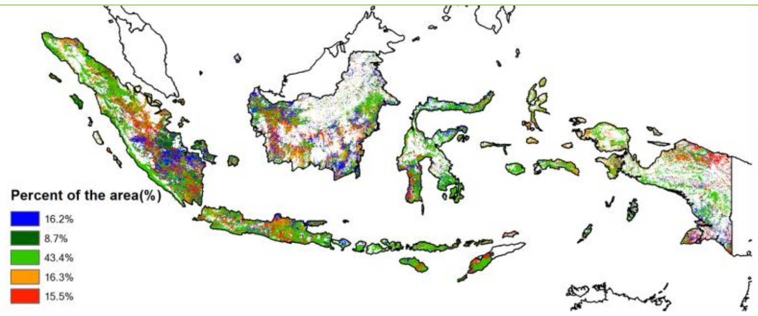
(a). Phenology of major crops



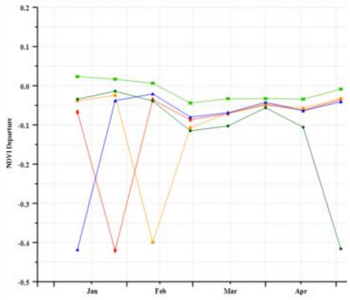
(b) Crop condition development graph based on NDVI



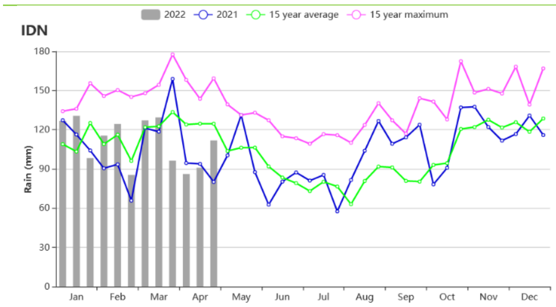
(c) Maximum VCI



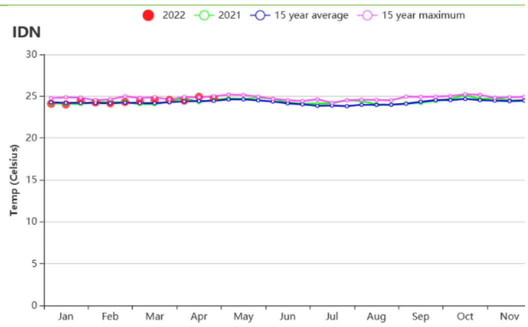
(d) Spatial NDVI patterns compared to 5YA



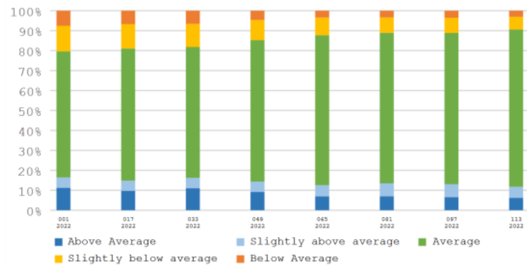
(e) NDVI profiles



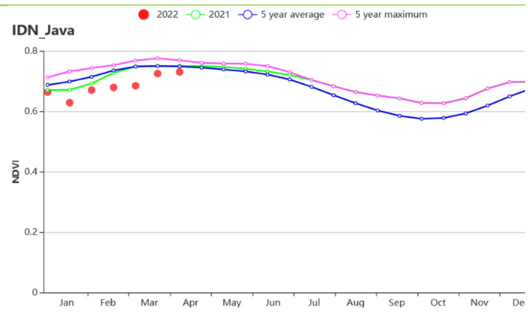
(f)Rainfall profiles



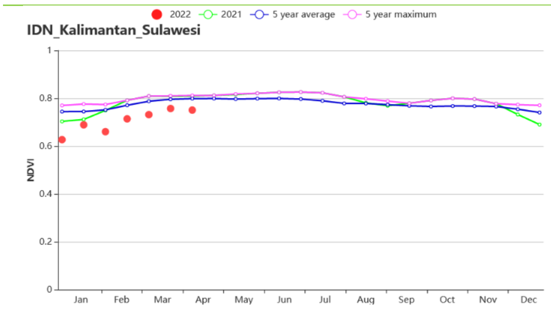
(g)Temperature profiles

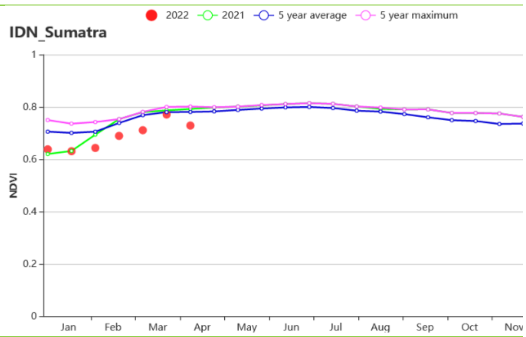


(h) Proportion of NDVI anomaly categories compared with 5YA



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





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

Table 3.31 Indonesia's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, January – April 2022

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Java	1249	-6	25.1	0.1	1281	7	1470	0
Kalimantan and Sulawesi	1196	-10	24.7	0.2	1197	6	1495	1
Sumatra	1285	-3	24.5	0.2	1181	5	1482	1
West Papua	1637	-4	23.6	0.1	1051	5	1443	2

Table 3.32 Indonesia's agronomic indicators by sub-national regions, current season's values and departure from 5YA, January – April 2022

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

[IND] India

The current monitoring period covers most of the wheat and winter (Rabi) rice growing periods. Harvest for both crops was mostly completed by the end of April, while maize and summer (Kharif) rice were harvested by January. The graph of NDVI development shows that the crop conditions were close to or above the 5-year average in general.

The proportion of irrigated cropland in India is 50% and agro-meteorological conditions play an important role in the growth of almost half of the crops. Rainfall is not the major influential factor. The CropWatch agroclimatic indicators show that nationwide, TEMP and RADPAR were close to average, whereas RAIN was below the 15YA (-26%). The BIOMSS decreased by 1% compared with the 15YA due to the lower rainfall. The overall VCIx was high, with a value of 0.93. As can be seen from the spatial distribution, only the northwestern region recorded values below 0.80. Most of India had high VCIx values. These spatial patterns of VCIx were thus generally consistent with those of NDVI. The southern and northeastern region showed above-average crop conditions while the conditions were slightly below average in the northwestern regions. The spatial distribution of NDVI profiles shows that before March, 81.7% of the areas showed above-average crop conditions in the central and southern regions. Punjab and Haryana, which are important wheat producing states, experienced daily maximum temperatures that were above 35ºC starting from mid-March, when wheat was still in the grainfilling period. This caused a high percentage of shrivelled grains and yield loss for these two states. Wheat had already been mostly harvested in the other wheat producing states by the time the heat wave started. CALF increased by 18% compared to the 5YA. At the country level, conditions for crop production were close to average.

Regional analysis

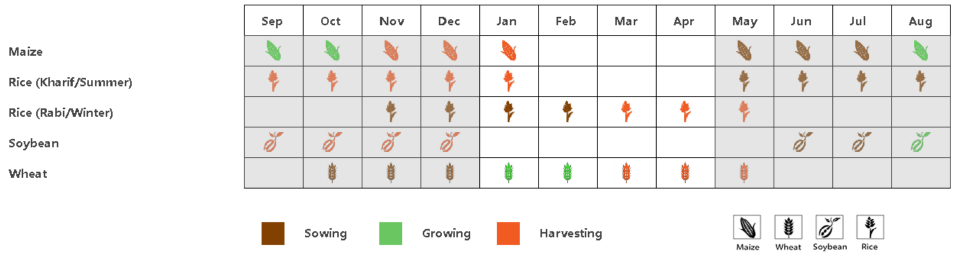
India is divided into eight agro-ecological zones: the Deccan Plateau (94), the Eastern coastal region (95), the Gangetic plain (96), the Assam and north-eastern regions (97), Agriculture areas in Rajasthan and Gujarat (98), the Western coastal region (99), the North-western dry region (100) and the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

The four agro-ecological zones of the Deccan Plateau, Eastern coastal region, Gangetic plain and Western Himalayan region showed similar trends in agricultural indices. Compared to the same period of previous years, RAIN had decreased significantly, especially in the Deccan Plateau (-69%). The TEMP and RADPAR were slightly above average, and BIOMSS was below the 15-year average. CALF showed the same trends for the four regions. They were all above average. The graph of NDVI development shows that the crop growth of the four states was close to or above the 5-year average until mid-March, when it started to decline sharply. Generally, the crop production is expected to be near average.

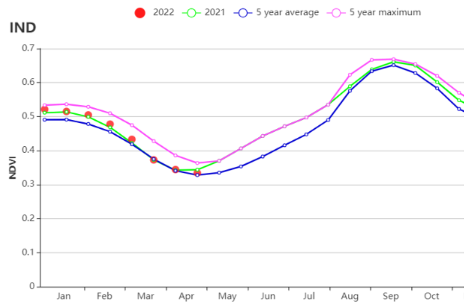
The agriculture areas in Rajastan and North-western dry region recorded similar trends of agricultural indices in this monitoring period. Compared to the same period of the previous years, RAIN increased significantly by 57% in the agriculture areas in Rajastan and Gujarat and by 88% for the North-western dry region. TEMP was slightly above average. The RADPAR was close to average for both regions. BIOMSS was increased significantly because it benefitted from sufficient rainfall. Both regions recorded increases of CALF. VCIx was above 0.85. The graph of NDVI development shows that the crop growth for both regions was generally close to and above the 5-year average. The crop production is expected to be average.

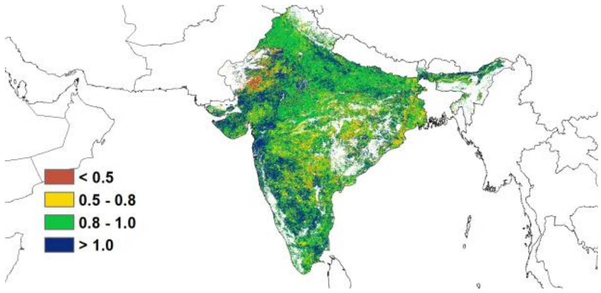
The Assam and north-eastern regions and Western coastal region recorded similar trends of agricultural indices in this monitoring period. Compared to the same period of the previous years, RAIN decreased by 21% in the Assam and north-eastern regions and by 42% for the Western coastal region. TEMP and RADPAR were both close to average. The BIOMSS had decreased due to the insufficient rainfall. Both regions recorded increases of CALF. VCIx was above 0.94. The graph of NDVI development shows that crop growth for both regions was generally close to and above the 5-year average. The crop production is expected to be close to average.

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

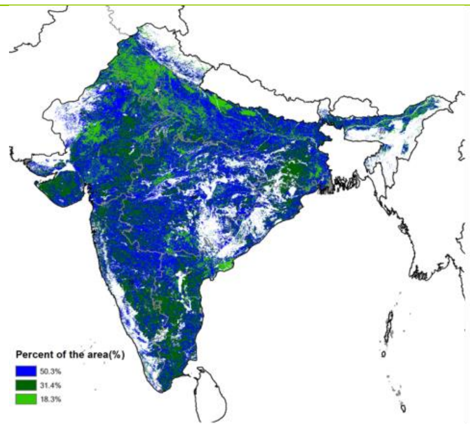


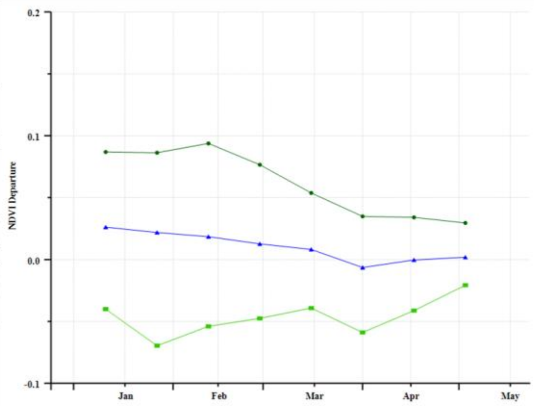
(a) Phenology of major crops



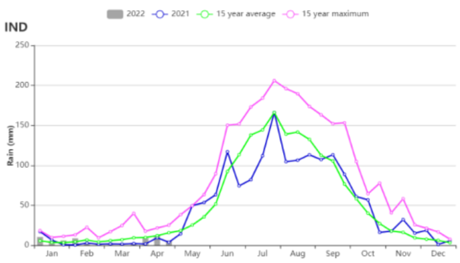


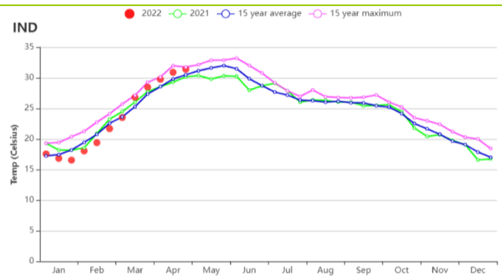
(b) Crop condition development graph based on NDVI (c) Maximum VCI



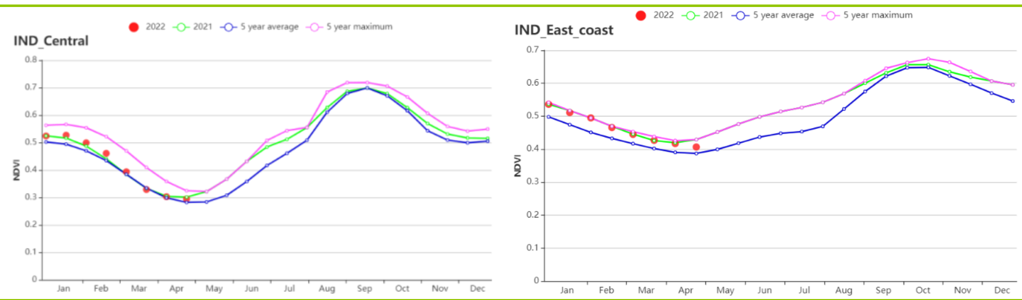


(d) Spatial NDVI patterns compared to 5YA (e) NDVI profiles

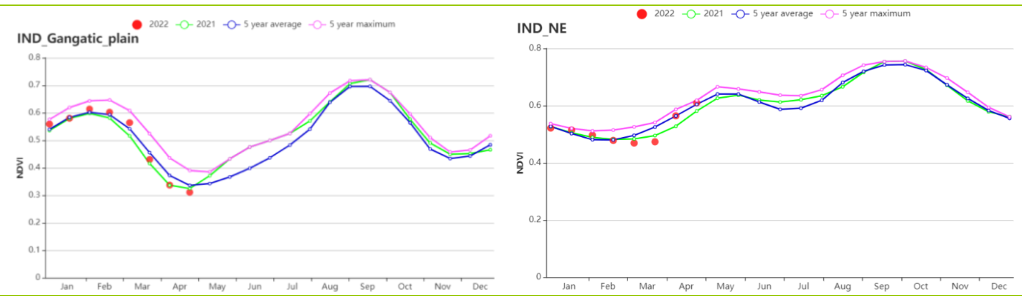




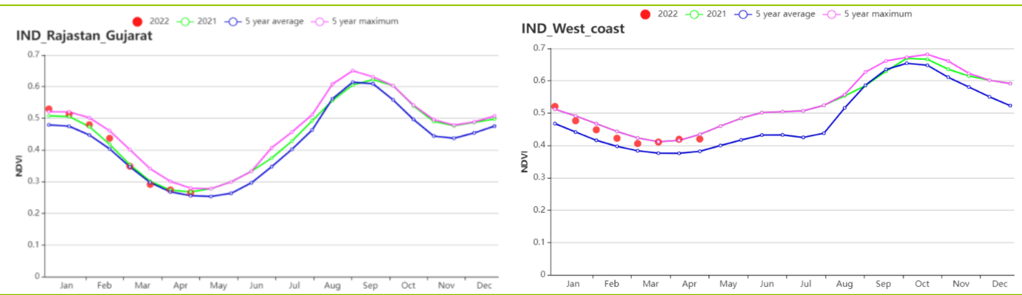
(f) Rainfall profiles (g) Temperature profiles



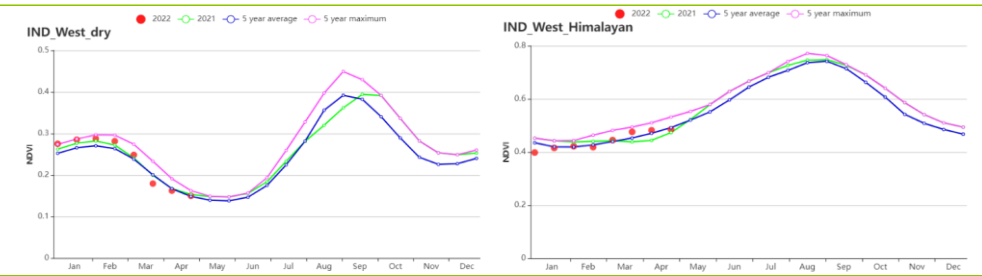
(h) Crop condition development graph based on NDVI (Deccan Plateau (left) and Eastern Coastal Region (right))



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



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



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

Table 3.33 India's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, January - April 2022

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Deccan Plateau	7	-69	25.0	0.0	1307	3	443	-4
Eastern coastal region	49	-40	25.6	-0.1	1321	2	539	-4
Gangatic plain	53	-11	22.1	0.0	1195	2	453	-3
Assam and north-	259	-21	17.7	-0.5	1090	-1	609	-6

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m^2)	Departure (%)	Current (gDM/m^2)	Departure (%)
eastern regions								
Agriculture areas in Rajastan and Gujarat	17	57	25.1	0.4	1271	0	459	11
Western coastal region	49	-42	26.1	0.0	1340	0	525	-5
North-western dry region	28	88	24.4	1.1	1223	0	457	14
Western Himalayan region	236	-33	10.8	1.3	1099	5	444	-1

Table 3.34 India's agronomic indicators by sub-national regions, current season's values and departure from 5YA, January - April 2022

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Deccan Plateau	82	19	0.88
Eastern coastal region	88	23	0.92
Gangatic plain	93	6	0.93
Assam and north-eastern regions	93	1	0.94
Agriculture areas in Rajastan and Gujarat	76	27	0.97
Western coastal region	80	44	0.99
North-western dry region	21	39	0.85
Western Himalayan region	89	3	0.92

[IRN] Iran

This monitoring period covers the vegetative and early reproductive phases of winter wheat. Rice planting started in April. The proportion of irrigated cropland in Iran is 70% and rainfall is not major influential factor. Nationwide, the accumulated rainfall was below average (RAIN -25%), while temperature and radiation were above average (TEMP +1.0°C, RADPAR +2%). The BIOMSS index was 13% below average. The national average of maximum VCI index was 0.60, and the Cropped Arable Land Fraction (CALF) decreased by 24% as compared to the recent five-year average.

According to the national NDVI development graphs, crop conditions were above average throughout the monitoring period on about 12.7% of the cropland (marked in dark green), mainly in the provinces of Khuzestan, Qazvin, Alborz, Golestan, Mazandaran and Hamadan in the western and northern regions, while crop conditions were below average throughout the monitoring period on about 12.6% of the cropland (marked in light green), mainly located in some parts of Aredbil, Ilam and Lorestan in the west and north-western regions. 38.0% of the cropland showed close-to-average crop conditions (marked in red). The remaining croplands experienced below-average crop conditions in late January and then recovered to average or above average levels (marked in blue and orange). The below-average NDVI values in late January are most likely due to the snow or cloud cover as indicated by the rainfall profile.

In general, the conditions for the winter crops were not favorable due to below-average rainfall.

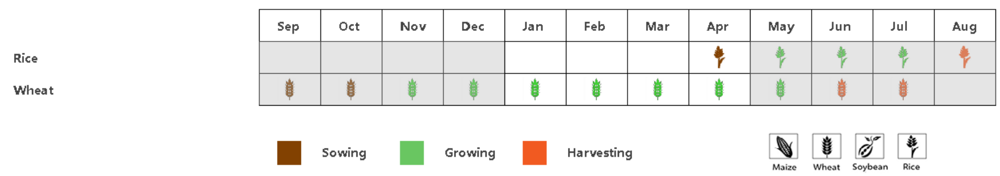
Regional analysis

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

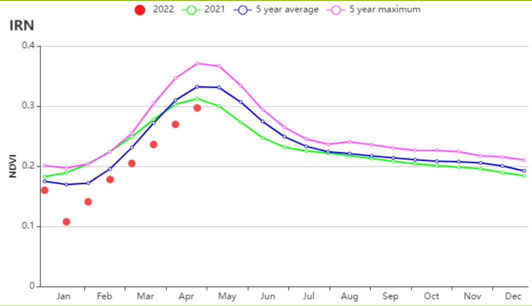
In the **Semi-arid to sub-tropical hills of the west and north** region, NDVI profiles show a similar change of patterns as for the whole country. The accumulated rainfall was 183 mm (24% below average), while temperature and radiation were above average (TEMP +0.9°C, RADPAR +2%). The influence of rainfall exceeded that of radiation and temperature, which resulted in a decrease of BIOMSS by 13%. CALF declined by 26%. The average VCIx (0.63) indicates unfavourable crop conditions for winter wheat.

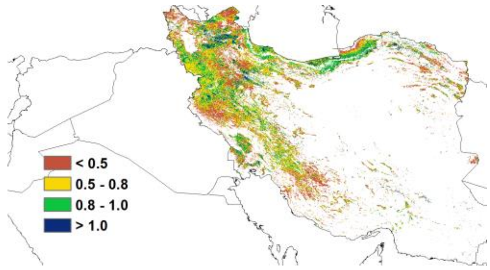
Crop conditions in the **Arid Red Sea coastal low hills and plains** region were also below the five-year average throughout the whole monitoring period. This region experienced a deficit of rainfall (RAIN -29%) but received more sunshine (RADPAR +2%). The temperature was above average (TEMP +1.2°C) . BIOMSS decreased by 11%. The CALF decreased by 11% compared to the five-year average, and the national VCIx (0.54) was also quite low, indicating the unfavorable outlook for winter crops in this region.

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



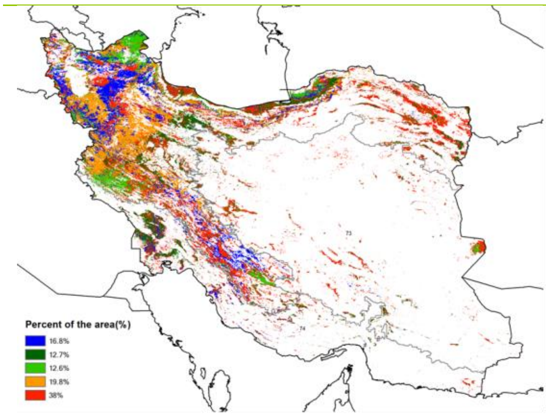
(a). Phenology of major crops

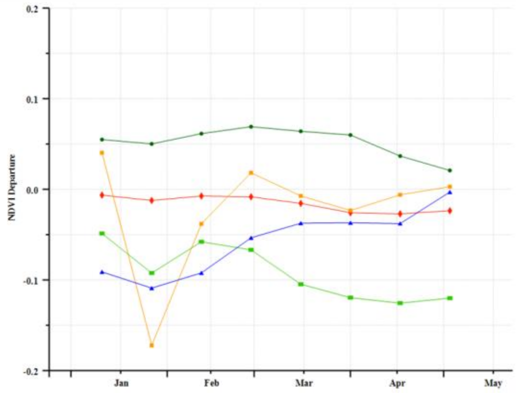




(b) Crop condition development graph based on NDVI

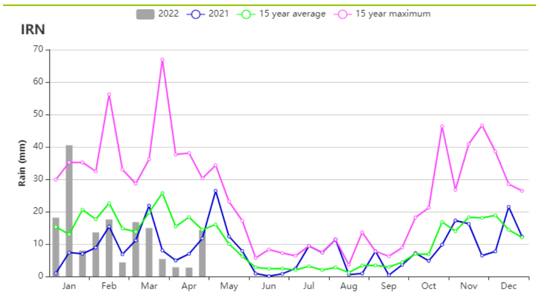
(c) Maximum VCI

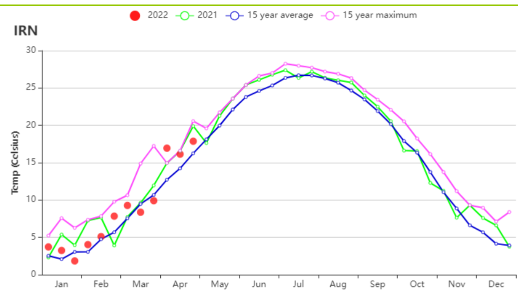




(d) Spatial NDVI patterns compared to 5YA

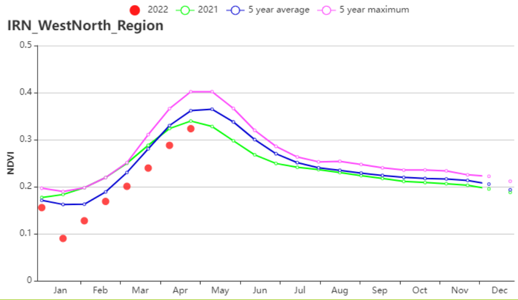
(e) NDVI profiles

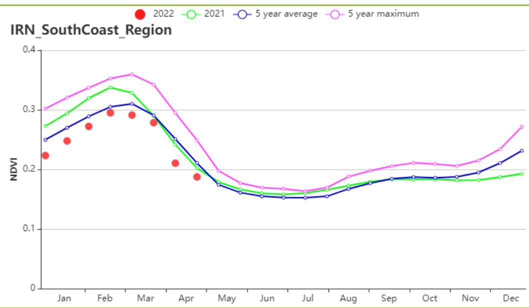




(f) Rainfall profiles

(g) Temperature profiles





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

Table 3.35 Iran's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, January - April 2022

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Semi-arid to sub-tropical hills of the west	183	-24	6.8	0.9	991	2	407	-13

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
and north								
Arid Red Sea coastal low hills and plains	106	-29	18.5	1.2	1084	2	458	-11

Table 3.36 Iran's agronomic indicators by sub-national regions, current season's values and departure from 5YA, January - April 2022

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Semi-arid to sub-tropical hills of the west and north	20	-26	0.63
Arid Red Sea coastal low hills and plains	26	-11	0.54

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

[ITA] Italy

This reporting period covers the main growing season of winter wheat, which was sown between October and December. Based on the agroclimatic and agronomic indicators, the crop conditions in Italy were below the 5-year average from March to April.

The proportion of irrigated cropland in Italy is 40% and agro-meteorological conditions play an important role in the growth of more than half of the crops and rainfall is not the major influential factor. The total rainfall in this period was significantly below the 15YA (RAIN −50%), the temperature was below the 15YA (TEMP -0.2°C) and RADPAR was 8% above the 15YA. The lower rainfall was mainly due to below − average rainfall from mid-January to late-April, which slowed the green-up of winter wheat. The significantly lower rainfall resulted in a 22% decrease of BIOMSS compared to the 15YA. But CALF at the national level was 95%, close to the average (-1%). And the VCIx was close to normal (0.81).

Except for a few areas in the north and south parts of the country (Piemonte, Lombardia, Trentino-Alto Adige, Veneto, and Basilicata), the VCIx was above 0.80 (green and blue) for most of the cultivated land.

The NDVI departure cluster profiles indicate that 42.9% (red and orange) of arable land experienced above-average crop conditions in January and February, mainly located in Abruzzo, Calabria, and Basilicata. 33.9% (Light green and dark green) of arable land experienced slightly below − average crop conditions, scattered in Piemonte, Sicily, Apulia, Campania and Lombardia. This area is the main distribution area of winter wheat in Italy (Po Valley and part of southeast area). The below-average NDVI indicates that conditions for winter wheat were unfavorable. For the remaining 12% (dark green) of arable land, NDVI remained below average throughout the reporting period. As shown in the NDVI cluster map, on about 26.2% (Light green) of arable land, NDVI was near average in January and February, and then below average in March and April. Overall, prospects for winter wheat are unfavorable.

Regional analysis

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

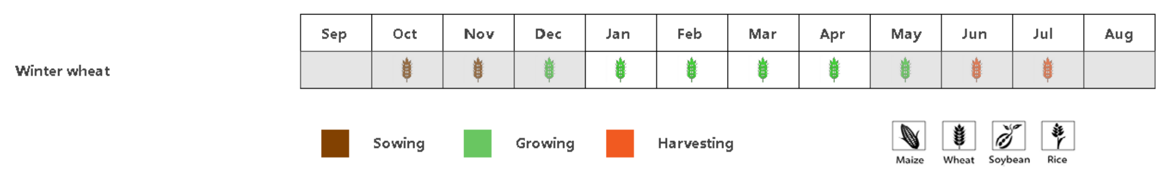
East coast (mainly in Puglia, Marche, and Abruzzi) experienced below-average rainfall (RAIN -46%), while temperature was slightly lower (-1%) and solar radiation was above 15YA (9%). The potential biomass production was below average (BIOMSS -22%). VCIx was 0.83. The crop condition development graph indicates that NDVI was slightly below average over the past five years.

Crop production in **Po Valley** (mainly in Piemonte, Lombardia and Veneto) was affected by low rainfall (RAIN −50%), above −average temperature (TEMP +0.3°C) and solar radiation (RADPAR+10%). BIOMSS was below the 15YA by 12%. VCIx reached 0.78, which was the lowest among the four AEZs in Italy. The crop condition development graph indicates that the crop conditions were below average. The Po Valley is the main wheat producing region in Italy, the significantly low BIOMSS as well as VCIx indicate poor conditions for wheat during this monitoring period.

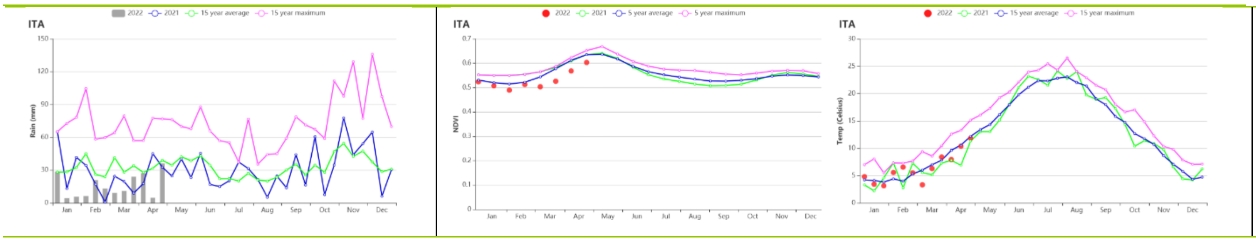
The Islands recorded a below-average precipitation (RAIN -54%) and temperature (TEMP -0.6°C). RADPAR was slightly above average (+2%). BIOMSS decreased by 35% compared with the 15YA. The maximum VCI was only 0.79. The Cropping Intensity was 100%, which is the highest in the four regions. NDVI was very close to average expect for March. The crop production in this region is expected to be close to average.

In **Western Italy**, RAIN (-52%) and TEMP (-0.3°C) were below, while RADPAR (+10%) was above average. The maximum VCI was 0.83. The severe rainfall deficit caused a decrease in the biomass production potential in this region by 21%. The NDVI was slightly below average. CropWatch expects a below −average production.

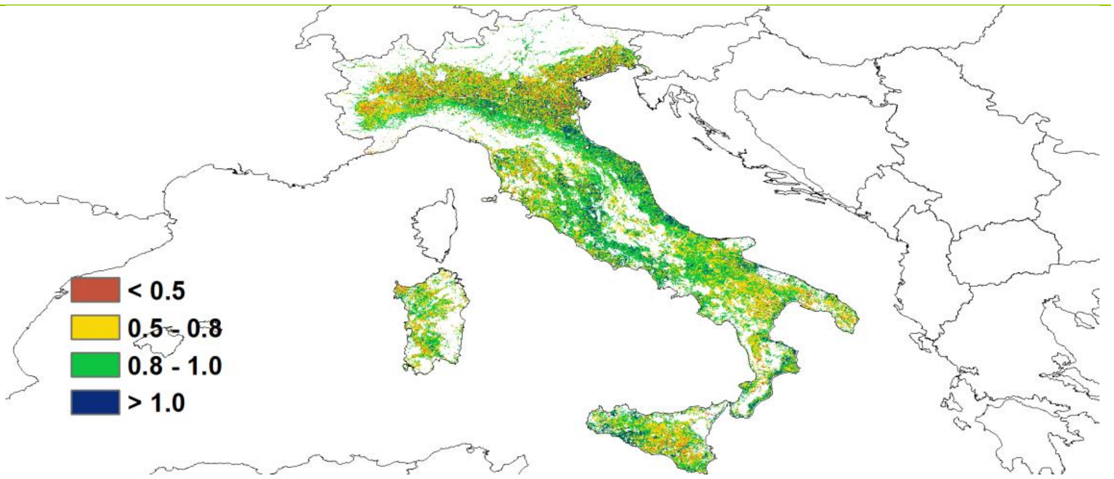
Figure 3.22 Italy's crop condition, January - April 2022



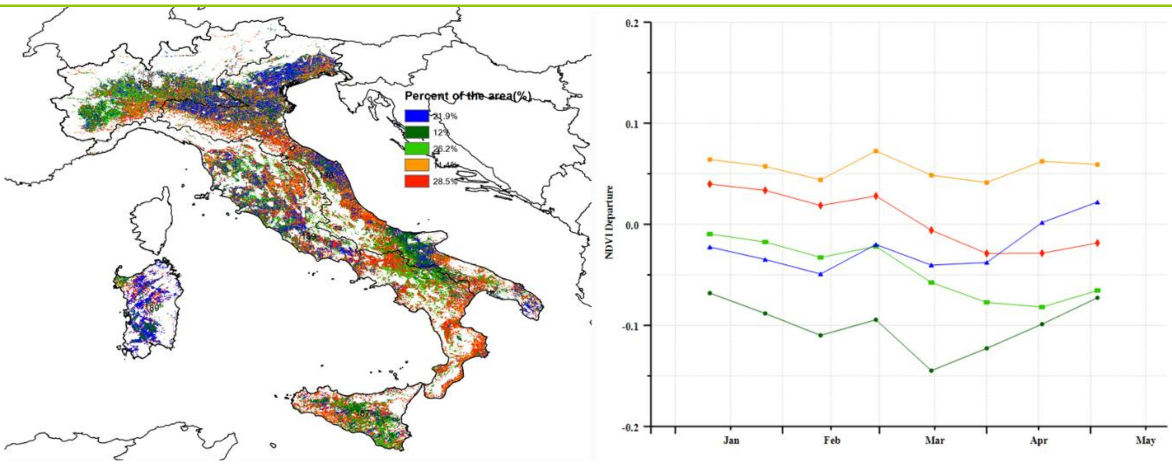
(a) Phenology of major crops



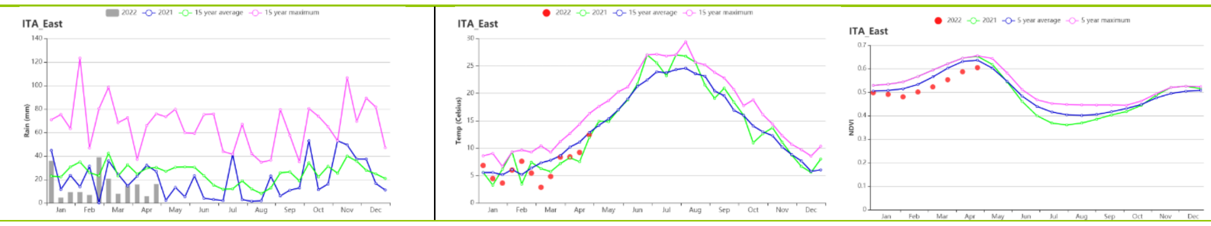
(b) Crop condition development graph based on NDVI, RAIN and TEMP (Italy).



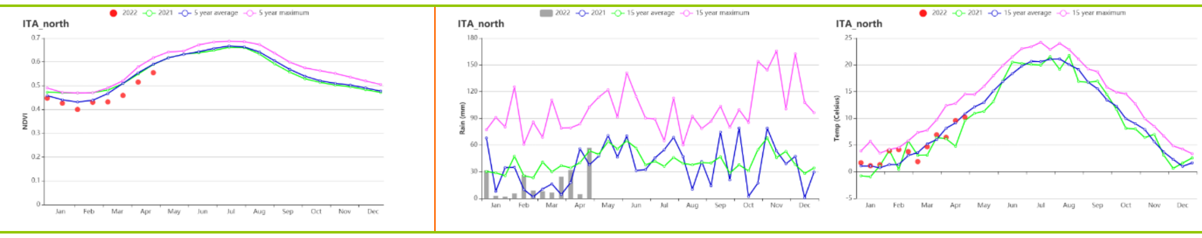
(c) Maximum VCI



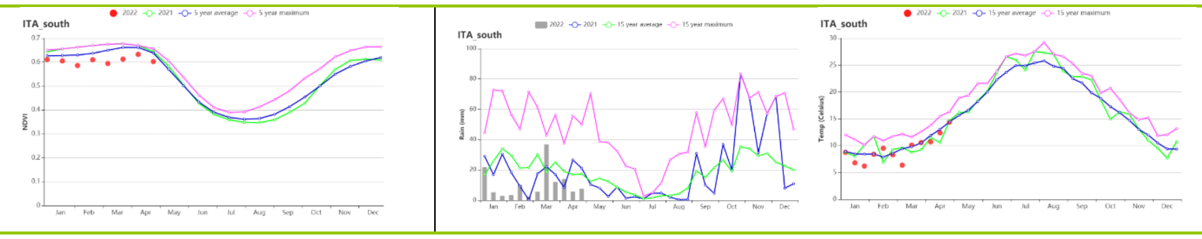
(d)Spatial distribution of NDVI profiles.



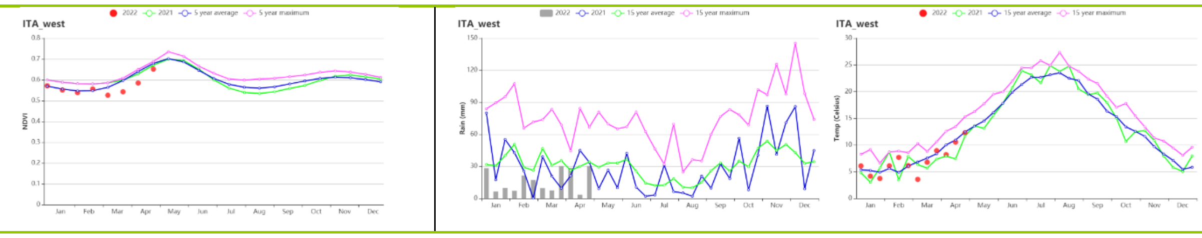
(e) Crop condition development graph based on NDVI, RAIN and TEMP (East Italy).



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



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



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

Table 3.37 Italy's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, January - April 2022

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
East Coast	185	-46	6.7	-1.0	817	9	471	-22

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m^2)	Departure (%)	Current (gDM/m^2)	Departure (%)
Po Valley	210	-50	4.6	0.3	741	10	424	-12
Islands	128	-54	9.4	-0.6	868	2	397	-35
Western Italy	200	-52	7	-0.3	801	10	497	-21

Table 3.38 Italy's agronomic indicators by sub-national regions, current season's values and departure from 5YA, January - April 2022

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
East Coast	99	0	0.83
Po Valley	87	-3	0.78
Islands	100	0	0.79
Western Italy	99	0	0.83

[KAZ] Kazakhstan

No crops were cultivated in most of the country during this monitoring period. Only some minor winter crops were grown in the southern regions. The proportion of irrigated cropland in Kazakhstan is only 3% and agro-meteorological conditions play a decisive role in the growth of crops. Compared to the 15-year average, accumulated rainfall was above average (RAIN +6%), while radiation was below average (RADPAR -6%). Although the temperature was above average (TEMP+2°C), the average temperature value for the reporting period was below 0°C. The dekadal precipitation was below average in late January, early and late February and all of April. The dekadal temperature was generally above average except in mid and late March. It is noticeable that the temperatures warmed up to above 0°C in early April and stayed above average in April. The favorable agro-climatic conditions resulted in an increase of BIOMSS by 14%. According to the NDVI profiles, the national average NDVI values were lower than 0.1 because of freezing conditions from January to March. The average NDVI increased to above 0.2 in April due to the warming temperatures.

Above-average precipitation, a trend which had lasted from November to March, will be favorable for the sowing of spring wheat in May.

Regional analysis

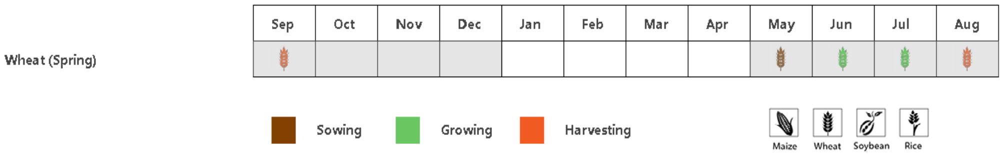
Based on cropping systems, climatic zones and topographic conditions, four sub-national agro-ecological regions can be distinguished for Kazakhstan, among which three are relevant for crop cultivation: the Northern region (112), the Eastern plateau and southeastern region (111) and the South region (110).

In the **Northern region**, the accumulated precipitation was close to average, and temperature was above average (TEMP +2.8°C), while RADPAR was below average (-8%). The warm and wet weather resulted in an increase of BIOMSS by 16%.

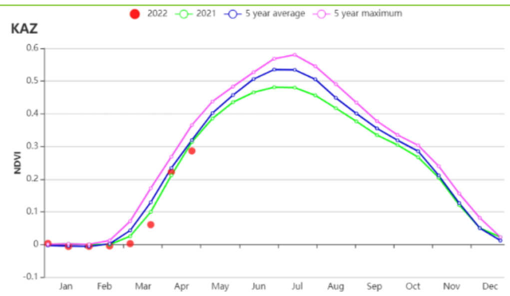
Agro-climatic conditions in the **Eastern plateau and southeastern region** were normal. The average rainfall and temperature were above average (RAIN +10%, TEMP +1.3°C). RADPAR was close to average. The favorable weather conditions led to an increase of potential biomass by 7%. Compared to the other regions, the higher CALF value (30%) indicated some agricultural activities in this region. The NDVI profiles showed that the NDVI was below average in April, but similar to last year.

The **South region** had the largest precipitation departure (RAIN +22%) among the three regions. The temperature was above average (TEMP +2.3°C), while the solar radiation was below average (RADPAR -9%). The combination of agro-climatic indicators resulted in an increase of the BIOMSS index by 17%.

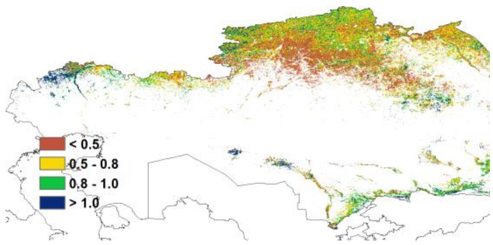
Figure 3.23 Kazakhstan's crop condition, January-April 2022



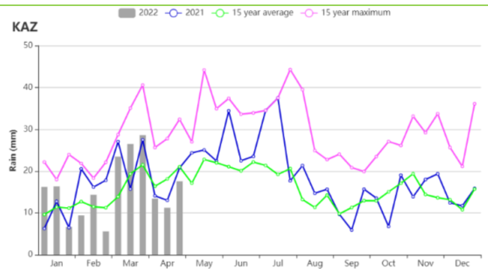
(a). Phenology of major crops



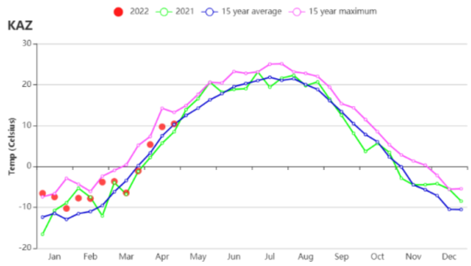
(b) Crop condition development graph based on NDVI



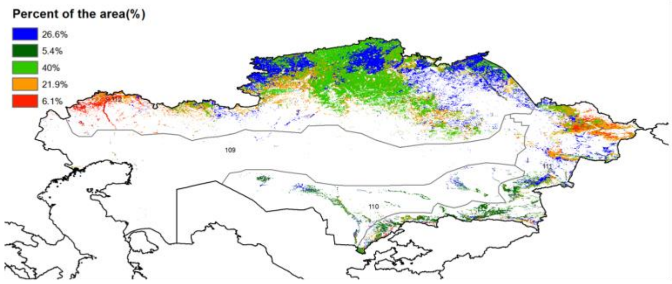
(c) Maximum VCI



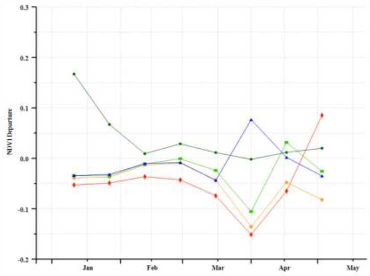
(d) Rainfall profiles



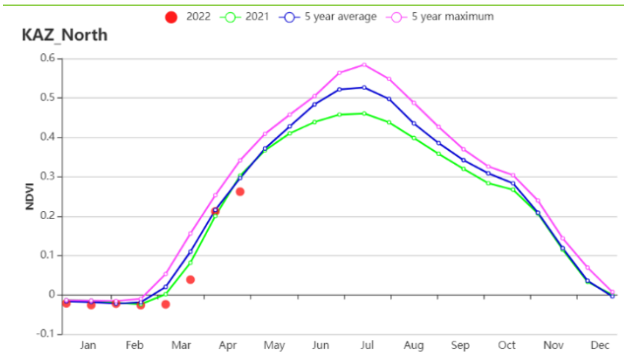
(e) Temperature profiles



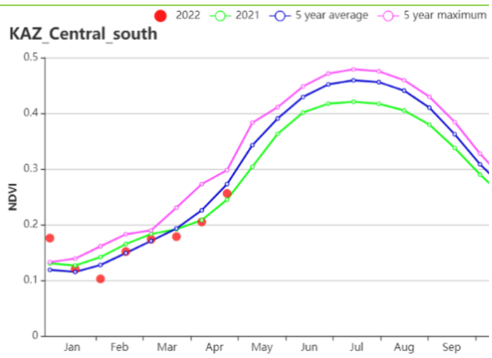
(f) Spatial NDVI patterns compared to 5YA



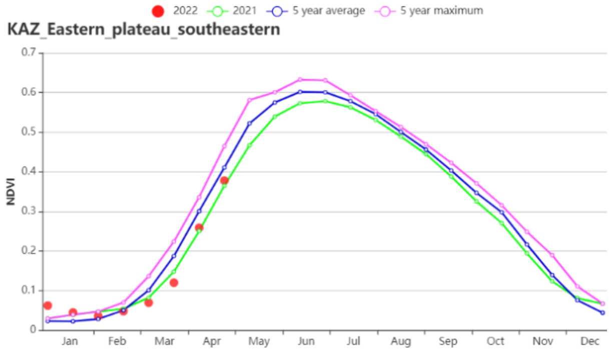
(g) NDVI profiles



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



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



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

Table 3.39 Kazakhstan agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, January - April 2022

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Northern region	158	1	-3.4	2.8	537	-8	310	16
Eastern plateau and southeastern region	262	10	-1.8	1.3	1453	-1	326	7
South region	205	22	5.0	2.3	694	-9	448	17

Table 3.40 Kazakhstan, agronomic indicators by sub-national regions, current season's values and departure from 5YA, January - April 2022

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Northern region	4	-42	0.64
Eastern plateau and southeastern region	30	-22	0.69
South region	8	3	0.93

[KEN] Kenya

Kenya experiences two rainy seasons: The long rains last from March to September and the short rains from October to December. Maize can be grown during the long and short rains, whereas wheat is grown during the long rains only. In the monitoring period from January to April 2022, the short rain maize had been harvested and the sowing of long rain maize began, while the planting of wheat will start in May only.

The proportion of irrigated cropland in Kazakhstan is 11% and agro-meteorological conditions play a important role in the growth of crops. At the national scale, precipitation was 204 mm, 55% below average. When looking into sub-national level, rainfall was lower in all areas. The weather was slightly warmer (TEMP +0.6°C) and RADPAR was slightly above the 15YA (+5%). BIOMSS was 21% lower than average due to insufficient rainfall. According to the national rainfall profiles, the 10 −day accumulations of rainfall presented conditions that were close to the 5YA in January to February and below the average in the following two months.

The NDVI development graph at the national level hovered along the 5YA trends in Jan uary to Mid-February but the NDVI values were below average in March and April. It can be noticed that the below −average rainfall in March and April resulted in this situation. At the same time, the lower precipitation in March and April may lead to a delay in long rain maize planting. Therefore, conditions for the short rains maize were more favorable than for the long rains maize (sowing in March and April). Based on the NDVI clusters and the corresponding NDVI departure profiles, the western and central part of Kenya (red area), which accounts for 35.6% of the country's cultivated land, has near-average NDVI values, while other areas show significant deviations in the January to May crop growth. This is consistent with the maximum VCI graph which shows that the green spots representing VCI between 0.8 and 1.0 were equally distributed in the central and western regions. The national average VCI value reached 0.80 and the cropped arable land fraction decreased by 2% as compared to the 5YA. In brief, the national crop condition is below average, due to the planting of long rains maize suffered from drier −than −normal conditions in March and April.

Regional analysis

In the Eastern coastal region, the rainfall was greatly below average (−50%), which resulted in a decreased estimate for biomass (−24%) while the temperatures (+0.8 ° C) and RADPAR (+3%) were moderately above average. The low rainfall delayed sowing and establishment of the long rainy season maize. The NDVI values stayed below the 5YA, and the CALF decreased by 10% to 83%. The maximum VCI was 0.64, which is the lowest among the four AEZs in Kenya. Overall, the crop conditions were below average for both livestock and crop production in the coastal areas.

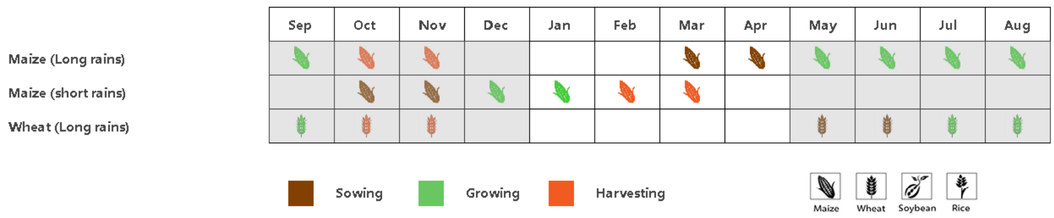
The **Highland agriculture zone** recorded 222 mm of rain, which was below the 15YA (-54%). Temperature was close to the 15YA (+0.7°C), whereas RADPAR was slightly above average (+6%). But BIOMSS was below average (-20%). The NDVI profile was near average between January to February but was below average in March to April. As with the eastern coastal region, the sowing of maize in the long rainy season was also affected by the lack of rainfall. At the same time, the increase in precipitation during April led to an increasing trend of NDVI values. The maximum VCIx value was recorded at 0.81. In this area, cropped arable land fraction almost stayed unchanged. Overall, crop growth has been severely affected by the drought conditions.

In the **Northern region**, precipitation was below average at 142 mm (-56%). The temperature was close to the 15YA (+0.9°C), while RADPAR was above average (+5%). BIOMSS was below average (-21%). The maximum VCIx was normal at 0.70. The below-average trend of its crop condition development graph indicates that the area was affected by drought between March and April. The sowing of long rain maize was delayed. In addition, CALF decreased (-7%) to 72%.

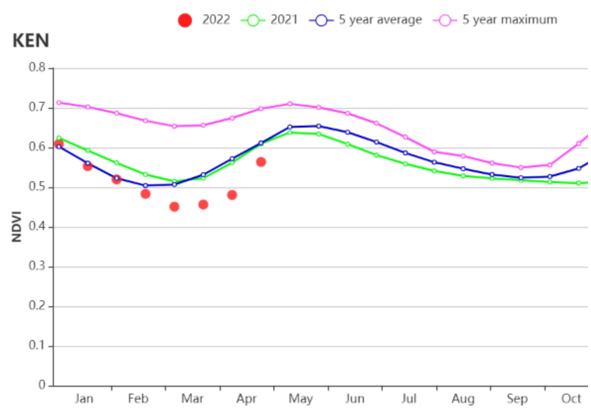
In general, the region has seen a decrease in rainfall, biomass, and CALF. This indicates that the region is severely affected by the drought.

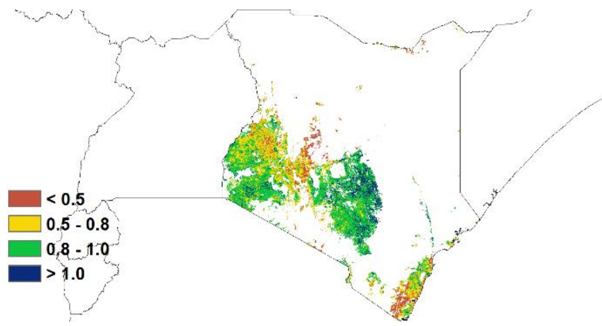
The **Southwest region** includes the areas of Narok, Kajiado, Kisumu, Nakuru and Embu. It had the largest negative deviation in rainfall (-68%). The following values of indicators were observed: TEMP 20.9°C (+0.3°C), RADPAR (+4%) and BIOMSS (-27%). The decrease in precipitation led to a large decrease in biomass. However, NDVI values were close to the 5YA except for mid-March. In addition, CALF was unchanged (100%). VCIx value remained at a high level (0.86). All in all, the parameters indicate close to average conditions for this area.

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

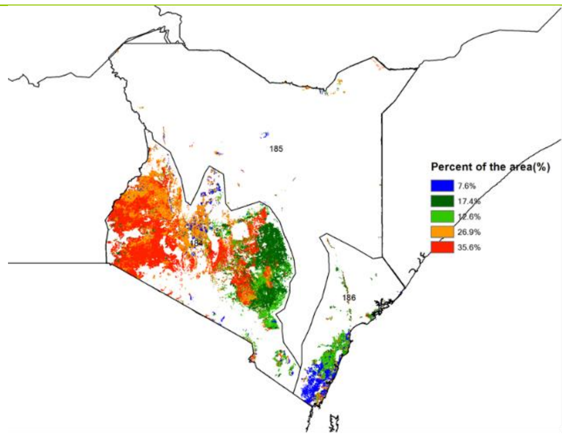


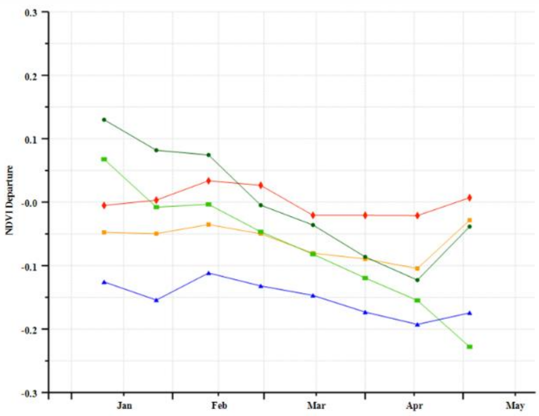
(a). Phenology of major crops



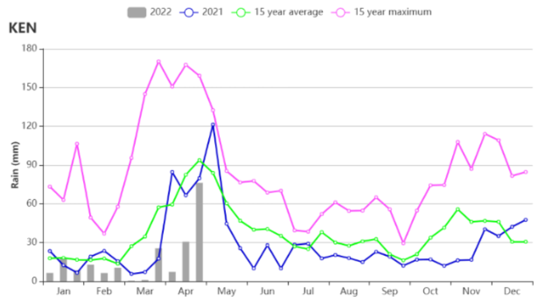


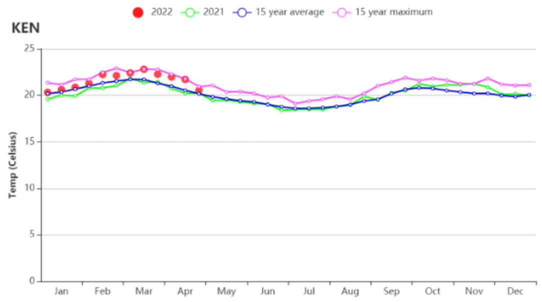
(b) Crop condition development graph based on NDVI (c) Maximum VCI



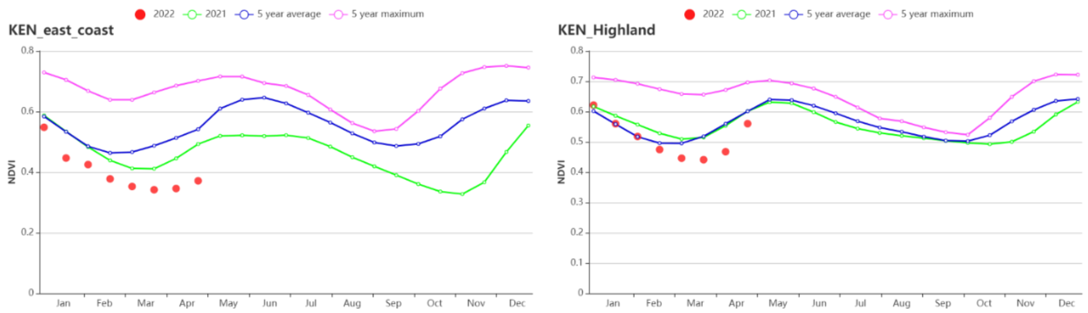


(d) Spatial NDVI patterns compared to 5YA (e) NDVI profiles

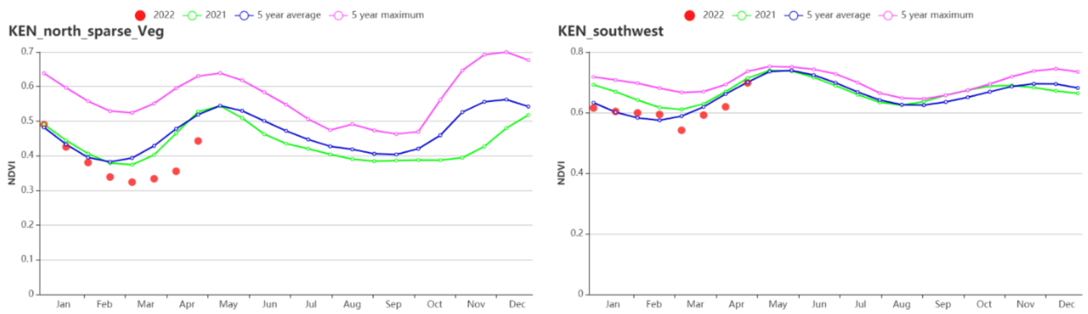




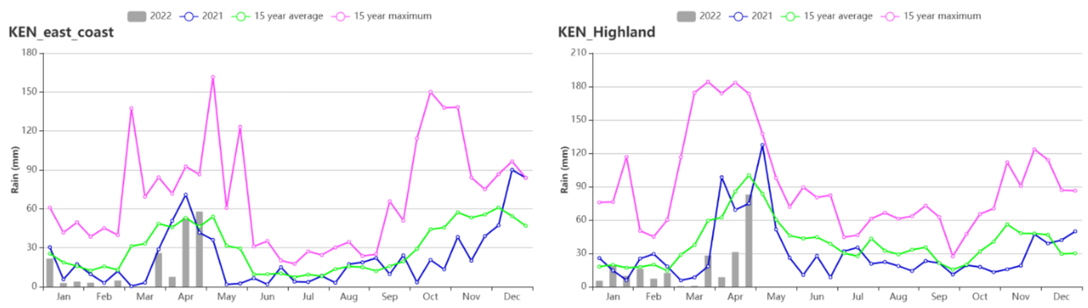
(f) Time series rainfall (g) Time series temperature



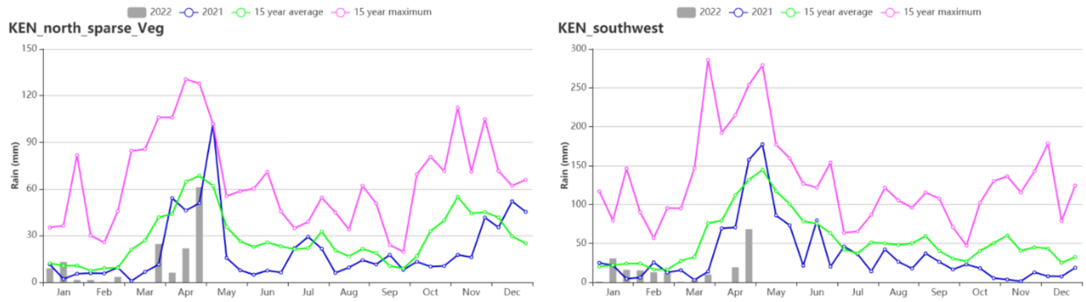
(h) Crop condition development graph based on NDVI, The eastern coastal region(left), The Highland agriculture zone(right)



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



(j) RAIN condition development graph based on NDVI, the eastern coastal region(left), The Highland agriculture zone(right)



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

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

January-April 2022

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m2)	Departure (%)	Current (gDM/m2)	Departure (%)
Coast	181	-50	27.6	0.8	1396	3	814	-24
Highland agriculture zone	222	-54	20.2	0.7	1396	6	683	-20
nothern rangelands	142	-56	24.9	0.9	1414	5	683	-21
South-west	189	-68	20.9	0.3	1372	4	695	-27

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

January-April 2022

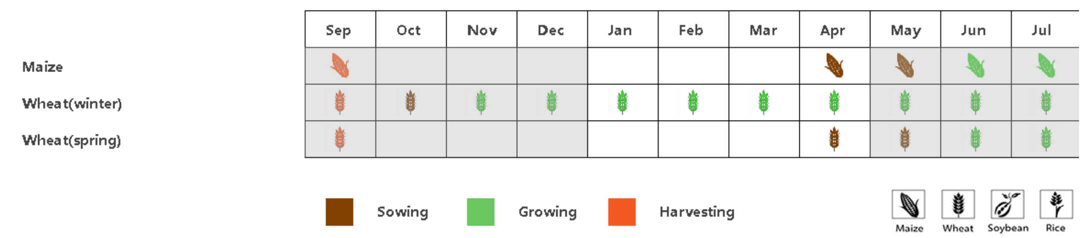
Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Coast	83	-10	0.64
Highland agriculture zone	94	-1	0.81
northern rangelands	72	-7	0.70
South-west	100	0	0.86

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

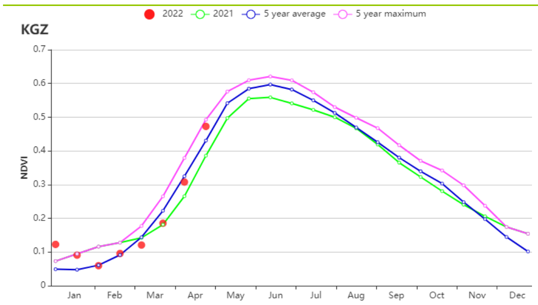
[KGZ] Kyrgyzstan

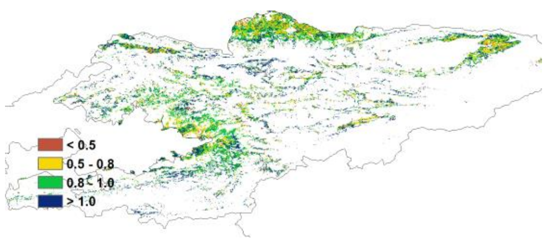
Only a small area of winter wheat is grown in Kyrgyzstan. Spring crops were planted in April in the southern part. Among the CropWatch agro-climatic indicators, RADPAR was slightly below average (-1%), while TEMP (+0.4℃) and RAIN (+12%) were above average. The combination of these factors resulted in an above-average BIOMSS (+5%) compared to the recent fifteen-year average. As shown by the NDVI development graph, the winter vegetation conditions were generally above average except for March and early April. The spatial NDVI clustering profile shows that most of the cultivated regions had average or above-average crop conditions. It's worth noting that 18.5% of the cultivated regions (marked in light green, mainly distributed in western Osh, central Naryn, and Southern Jalal-Abad) had close-to-average crop conditions before March. Then, the crop conditions dropped to below-average in middle March, most likely due to rainfall that exceeded the recent 15-year maximum, and gradually recovered to average at the end of the monitoring period. This situation is confirmed by the VCIx map which shows relative high values (>0.8) distributed across the whole country. The national average VCIx was 0.95, indicating favorable crop conditions. The cropped arable land fraction increased by 14%, indicating that more land was cultivated. Crop conditions are favorable due to above-average precipitation.

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

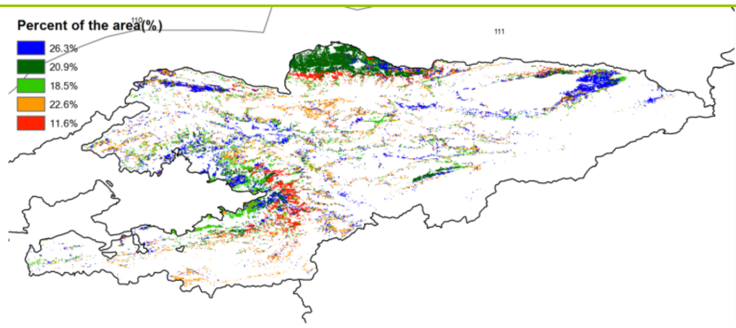


(a). Phenology of major crops

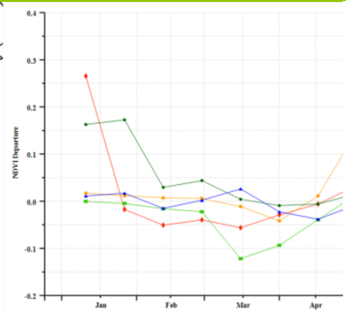




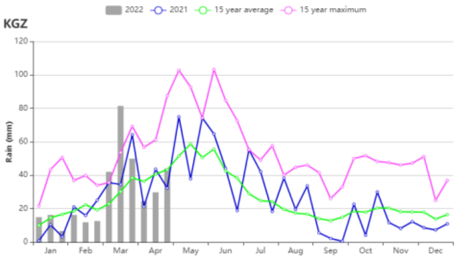
(b) Crop condition development graph based on NDVI (c) Maximum VCI



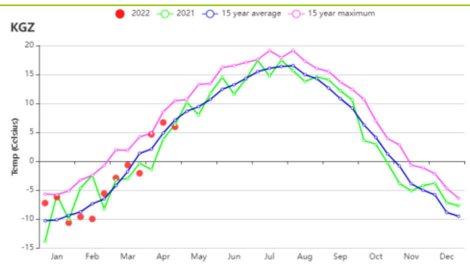
(d) Spatial NDVI patterns compared to 5YA



(e) NDVI profiles



(f) Rainfall profiles



(g) Temperature profiles

Table 3.43 Kyrgyzstan's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, January - April 2022

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Kyrgyzstan	351	12	-3.1	0.4	829	-1	301	5

Table 3.44 Kyrgyzstan's agronomic indicators by sub-national regions, current season's values and departure from 5YA, January - April 2022

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Kyrgyzstan	57	14	0.95

[KHM] Cambodia

This reporting period covers the main harvesting stage of medium rice, late rice, and floating rice, which had a slightly below average production estimate according to the previous monitoring period. The period also covers the main growth stage of dry season early rice, dry season maize, and soybean, which benefitted from favorable growth conditions as monitored by the Cropwatch system.

The proportion of irrigated cropland in Cambodia is 8% and agro-meteorological conditions play an important role in the growth of crops. During this monitoring period, Cambodia experienced wetter and relatively cooler weather conditions. Compared to the same period of the past 15 years, the precipitation in Cambodia was 27% higher (RAIN), while the average temperature was slightly cooler by 0.1°C (TEMP) and the radiation was slightly higher as well (RADPAR +1%). The abundant rainfall resulted in a 14% higher potential biomass (BIOMSS) than average, which shows a favorable climatic condition for crop growth, which is consistent with the NDVI profile. As is shown by the NDVI profile, the national-scale NDVI recovered to average in mid-January, then reached and exceeded the maximum value of the past 5 years in February and March. Since mid-January, NDVI has stayed above average. According to the spatial NDVI patterns, 4 patterns could be identified: 1) about 59.3% of the cropland (in red and light green) in the country experienced a positive NDVI deviation, and these croplands were mainly located in the lower Mekong River basin and around the Tonle Sap Lake. 2) about 21.7% of the cropland (in dark green) maintained a slightly below-average NDVI, and these croplands mainly appeared in the northwestern Banteay Meanchey and were scattered in the lower Mekong River basin. 3) around 12.8% of the croplands (in blue) experienced a steady decline from the peak starting in mid-February. These croplands were mainly located in southern Banteay Meanchey and western Prey Veng. 4) the remaining 6.2% of the croplands (in yellow) had a below-average NDVI throughout the entire period. These croplands were in southeastern Kandal and western Prey Veng. Considering that the VCIx value was as high as 0.93 and the CALF index significantly rose by 12%, both the growth of soybean and the estimated production of dry-season maize and dry-season early rice were favorable.

Regional analysis

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

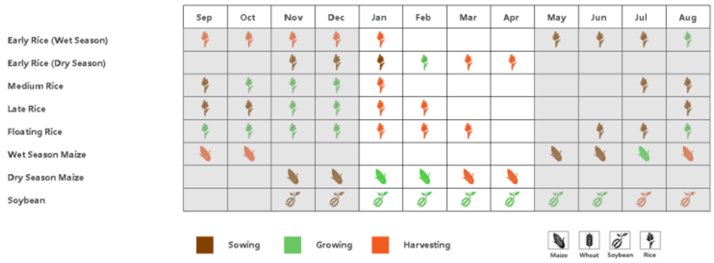
For **Tonle Sap Lake region**, it experienced a 34% higher precipitation (RAIN), 0.3°C lower temperature (TEMP), and about 1% higher radiation (RADPAR), resulting in a 15% higher potential biomass (BIOMSS). The regional NDVI was close to average in January and then remained above average. Noteworthily, the NDVI exceeded the maximum value of the past 5 years in March. In addition, the CALF index in this region increased by 18% and the VCIx value was as high as 0.92, indicating favorable crop conditions.

For the **Mekong Valley region**, the precipitation in this zone was significantly higher by 38% (RAIN), the temperature was near average (TEMP), and radiation was 1% higher (RADPAR). Abundant precipitation resulted in a higher potential biomass (BIOMSS +15%), indicating favorable climatic condition for crop growth. Like the Tonle Sap Lake zone, the NDVI in this zone was close to average in January and then gradually approached the maximum level of the past 5 year in March. Considering that the regional CALF index increased by 9% and the VCIx value reached 0.93, the crop condition in this zone is predicted to be favorable as well.

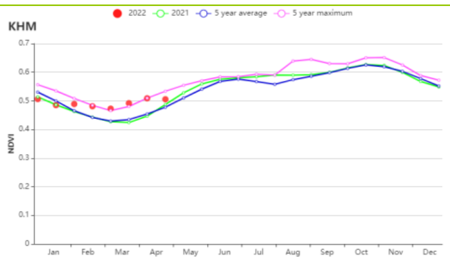
For the N**orthern plains and Northwest**, the zone had an 8% higher precipitation (RAIN), about 0.1°C higher temperature (TEMP), and average radiation (RADPAR), resulting in a potential biomass increase by about 8% (BIOMSS). Crop NDVI in the zone was close to average before early February, and then increased and was higher than average. The CALF index in the zone reached 98% and the VCIx value was at 0.93, so the crop production in the zone is estimated to be favorable as well.

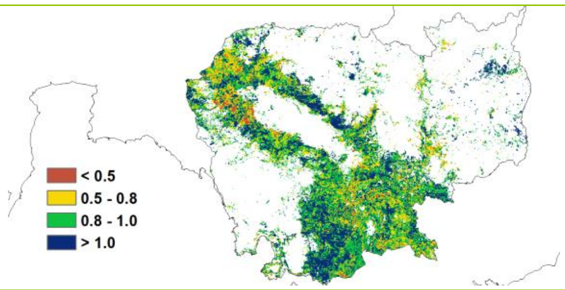
For the **Southwestern hilly region**, precipitation in this region was 43% above average (RAIN), temperature was about 0.6°C lower (TEMP), and radiation was about 3% higher (RADPAR), resulting in a higher potential biomass in this region (BIOMSS +21%). In terms of the NDVI profile, the NDVI was likewise close to average in January and then gradually rose and was close to the maximum level of past 5 years. Meanwhile, the CALF index was as high as 99% and the VCIx index was close to 0.93, so the crop condition in this region was favorable as well.

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

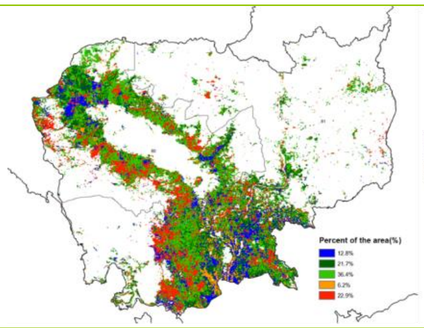


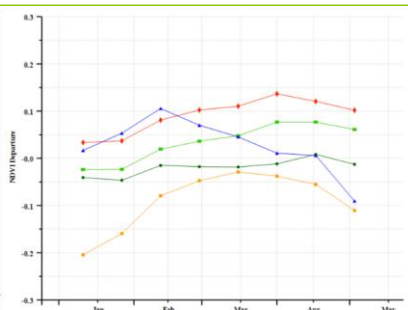
(a). Phenology of major crops



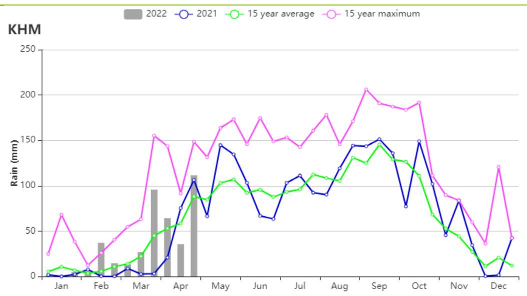


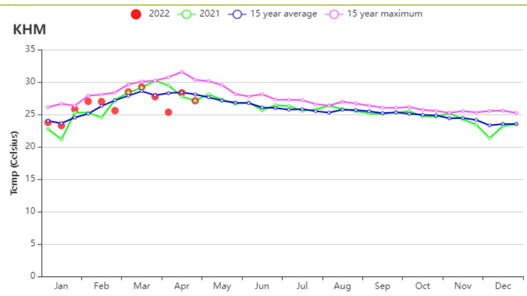
(b) Crop condition development graph based on NDVI (c) Maximum VCI



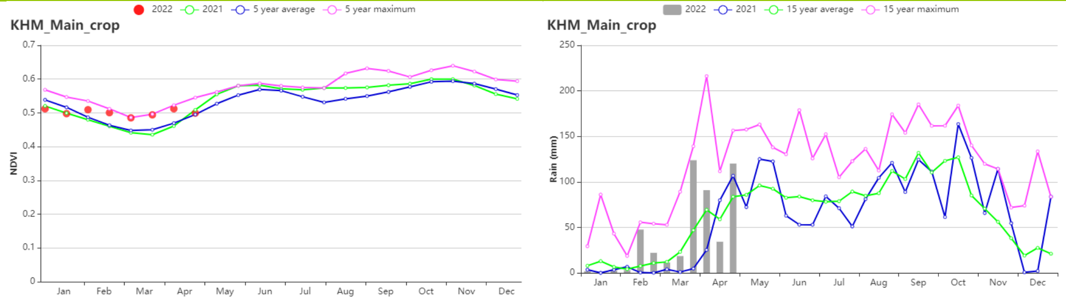


(d) Spatial NDVI patterns compared to 5YA (e) NDVI profiles

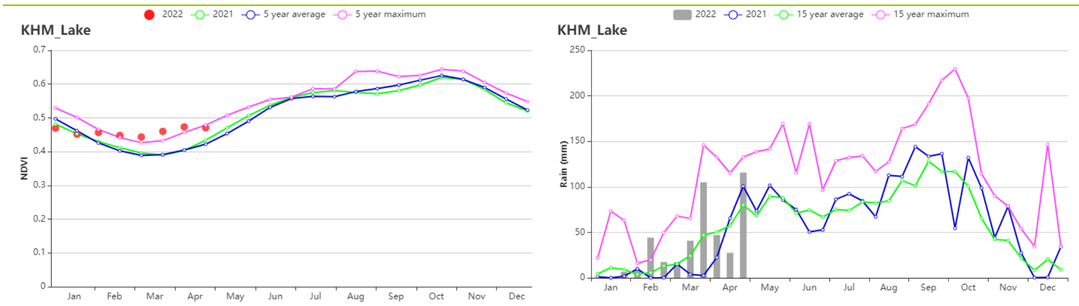




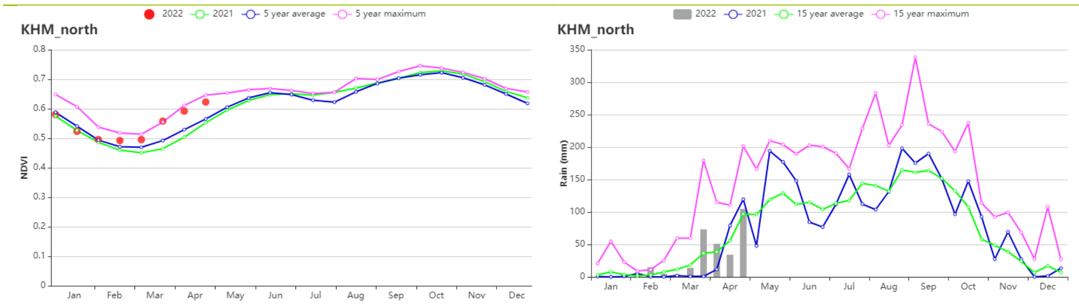
(f) Rainfall profiles (g) Temperature profiles



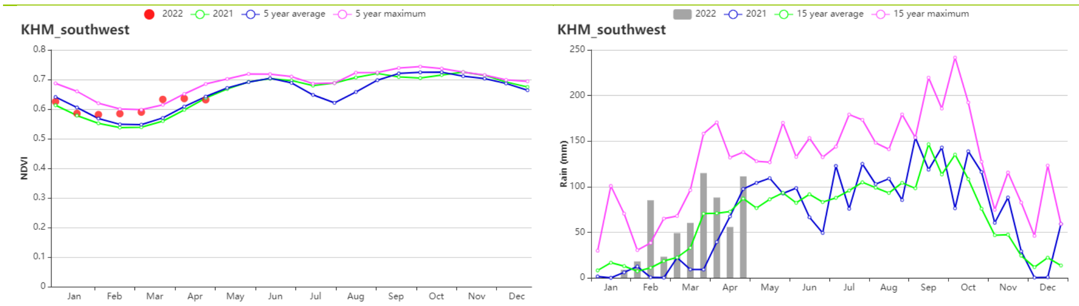
(h) Crop condition development graph based on NDVI (left) and time series rainfall profile (right) in Mekong valley region



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



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



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

Table 3.45 Cambodia's agroclimatic indicators by sub-national regions, current season's values, and departure from 15YA, January - April 2022

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Tonle-Sap	430	34	26.5	-0.3	1195	1	998	15
Mekong valley	306	8	26.6	0.1	1186	0	854	8
Northern plain and northeast	306	8	26.6	0.1	1186	0	854	8

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Southwest hilly region	615	43	24.3	-0.6	1222	3	1190	21

Table 3.46 Cambodia's agronomic indicators by sub-national regions, current season's values, and departure from 5YA, January - April 2022

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Tonle-Sap	82	18	0.92
Mekong valley	91	9	0.93
Northern plain and northeast	98	6	0.93
Southwest hilly region	99	2	0.93

[LKA] Sri Lanka

This report covers both the main (Maha) and second cropping season (Yala) of Sri Lanka. The harvest of main season crops (maize and wheat) took place between January to March. Sowing of the second season crops started in April. According to the CropWatch monitoring results, crop conditions were assessed as close to, but below average for the monitoring period.

The proportion of irrigated cropland in Sri Lanka is 41% and agro-meteorological conditions play an important role in the growth of more than half of the crops, rainfall is not the major influential factor. During this period, the country experienced the Northeast-Monsoon from January to February, followed by the First Inter-Monsoon, during which the island typically experiences cold and dry windy weather. At the national level, precipitation was markedly above the 15YA (RAIN +22%), while temperature and radiation were near the average level. The remarkable increase of rainfall in early April ensured sufficient water supply for the sowing of crops. The fraction of cropped arable land (CALF) was comparable to the 5YA. BIOMSS was up by 14% compared to the 15YA. As shown in the NDVI development graph, NDVI was generally close to average during the period. The maximum VCI for the whole country was 0.92.

As shown by the NDVI clusters map and profiles, more than half of country's cropland showed close to, but below average crop conditions. These croplands were distributed over the whole country. The decline in crop conditions was most likely due to the lack of fertilizer, resulting from a ban on the use of chemical fertilizer in Sri Lanka, which will likely lead to an annual drop of at least 30% in paddy yields nationwide. The abnormal NDVI departure values in January and April were mainly caused by cloud cover. The maximum VCI showed high values all over the country.

Regional analysis

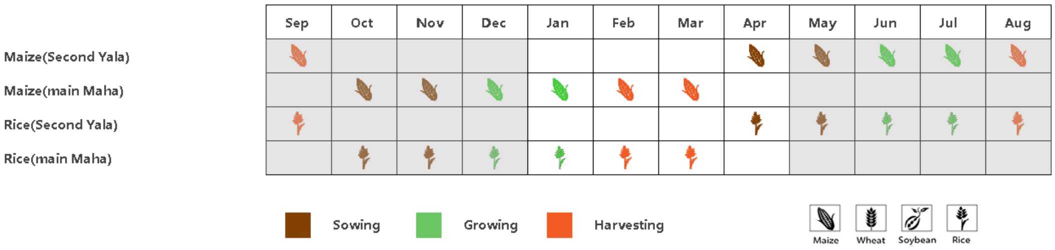
Based on the cropping system, climatic zones and topographic conditions, three sub-national agroecological regions can be distinguished for Sri Lanka. They are the Dry zone, the Wet zone, and the Intermediate zone.

In the Dry zone, the recorded RAIN (533 mm) was 19% above average. TEMP was 0.1°C above average and RADPAR was average. BIOMSS increased by 18% as compared to the 15YA. CALF was the same as the 5YA level with 99% of cropland utilized. NDVI was average in general, with below-average values in early January and above-average values in April. The VCIx for the zone was 0.91. Overall, crop conditions were near average for this zone.

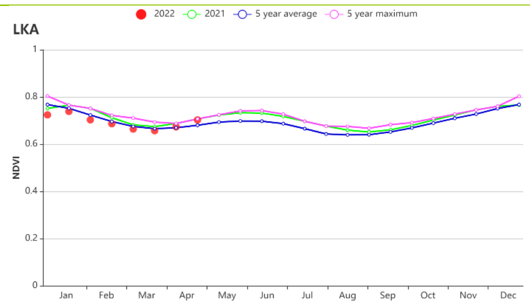
For the Wet zone, RAIN (1007 mm) was 28% above average as compared to the 15YA. TEMP and RADPAR decreased by 0.3°C and 1% respectively. BIOMSS was 7% above the 15YA and cropland was fully utilized. NDVI values showed slight deviation from average during the period. The VCIx value for the zone was 0.94. Crop conditions were near average for this zone.

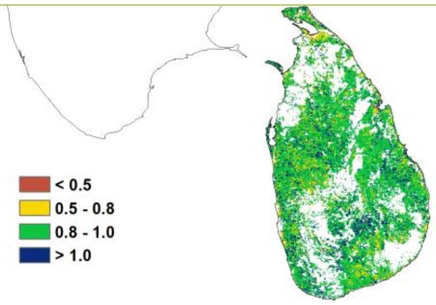
The Intermediate zone also experienced sufficient rain (729 mm) with a 9% increase from the 15YA. TEMP was 0.2°C above average and RADPAR was average compared to the 15YA. With full use of cropland, BIOMSS was 8% above the average. The NDVI values were similar to the Wet zone and the VCIx value for this zone was 0.93. Conditions of crops were close to average.

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



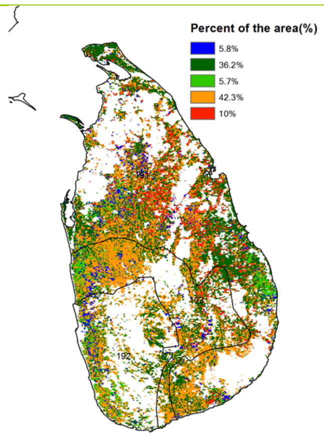
(a). Phenology of major crops

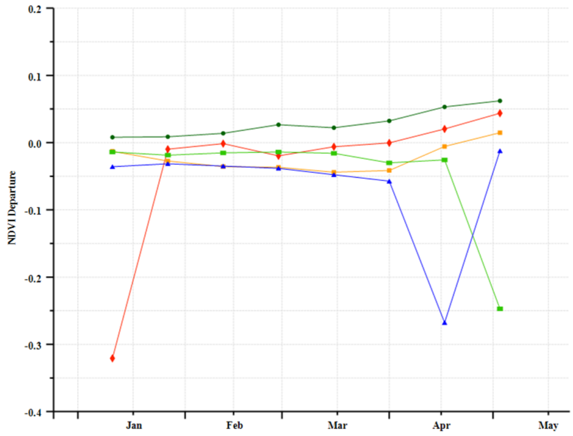




(b) Crop condition development graph based on NDVI

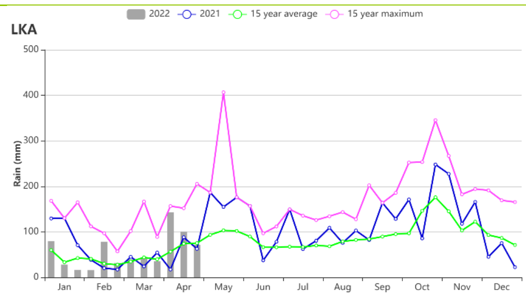
(c) Maximum VCI

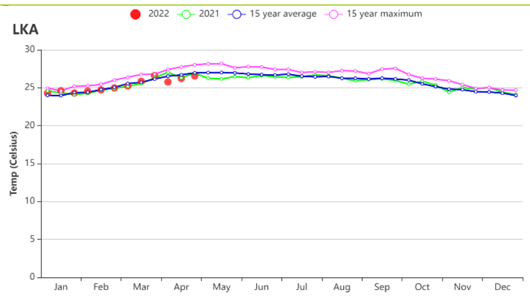




(d) Spatial NDVI patterns compared to 5YA

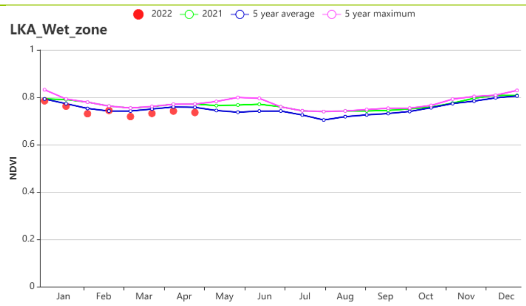
(e) NDVI profiles

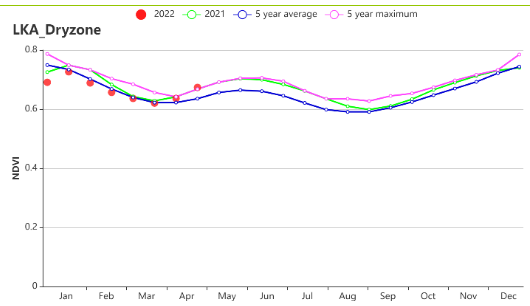




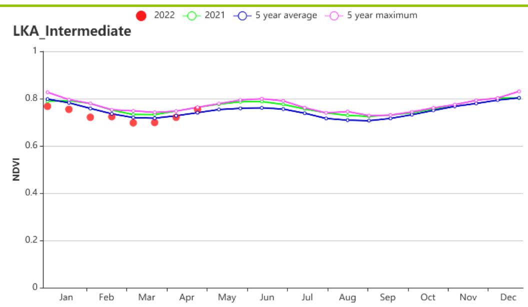
(f) Rainfall profiles

(g) Temperature profiles





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



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

Table 3.47 Sri Lanka's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, January - April 2022

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Dry zone	533	19	25.8	0.1	1286	0	1260	18
Wet zone	1007	28	24.3	-0.3	1178	-1	1330	7
Intermediate zone	729	9	24.2	0.2	1185	0	1239	8

Table 3.48 Sri Lanka's agronomic indicators by sub-national regions, current season's values and departure from 5YA, January - April 2022

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Dry zone	99	0	0.91
Wet zone	100	0	0.94
Intermediate zone	100	0	0.93

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

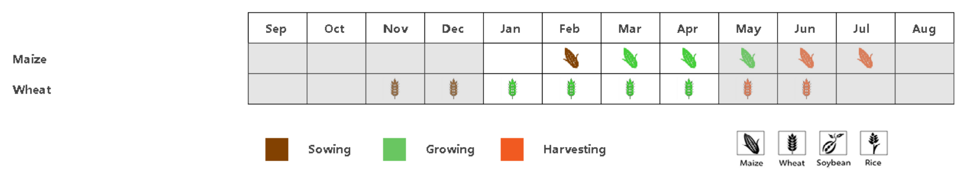
[MAR] Morocco

This reporting period covers the main growing stage of wheat, while maize planting started in February. The proportion of irrigated cropland in Morocco is 15% and agro-meteorological conditions play an important role in the growth of most crops. Precipitation had been 51% below the average during the previous monitoring period. The drought conditions continued during this monitoring period, as the CropWatch agro-climatic indicators show that the recorded rainfall was 184 mm, 15% below the 15-year average (15YA). The rainfall index graph shows that the rainfall was less than the 15YA during the January to mid-February period, with higher rainfall than the 15YA between late February and early April (>20 mm). The average temperature was only 0.2°C below the 15YA. The temperature index graph shows that the temperature fluctuated around the 15YA. RADPAR was slightly lower than the 15YA by 0.1% while BIOMSS was higher than the 15YA by 5%. The nationwide NDVI crop development graph shows that the crop conditions were far below the 5-year average (5YA) due to severe drought conditions, particularly during January and mid-February as confirmed by the rainfall index graph. The NDVI profile map indicates that about 21.1% of cultivated areas were slightly above the 5YA, and 78.9% were below the 5YA with some improvement in April. The VCIx was at 0.51, and the CALF was below the 5YA by 32%. Conditions for wheat production were highly unfavorable.

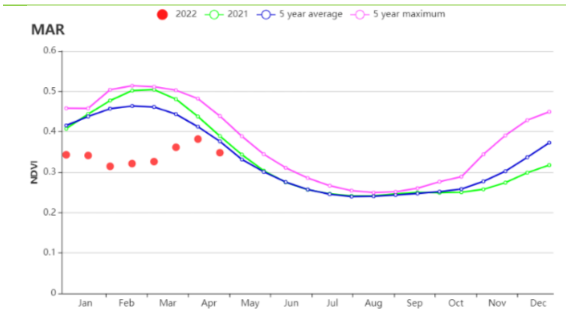
Regional analysis

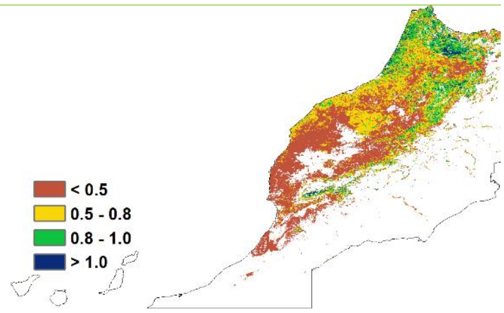
Based on the cropping system, climatic zones, and topographic conditions, Morocco is subdivided into four agro-ecological zones (AEZ). Only three are relevant for crop production: Sub-humid northern highlands including the central Centre-Nord Region and northern Centre-Sud, Warm semiarid zone covering the regions of North-Oriental and the broad Tensift Region, and Warm sub-humid zone of the Nord-Ouest Region. The agroclimatic indicators for the three AEZs show a decrease in rainfall (-17%, -17%, and -12%, respectively) and the temperature was also below 15YA by 0.2°C. RADPAR was higher than the 15YA by 2% in the first zone while it was at the 15YA in the second and third zones. BIOMSS was below the 15YA by 6%, 4%, and 4% in the three zones, respectively. The NDVI-based crop condition development graphs show similar conditions for the three zones following the national crop development NDVI graph. The VCIx was 0.67, 0.38, and 0.63, and the CALF was below the 5YA by 21%, 56%, and 15%, respectively in the three zones, implying poor prospects for cereal production.

Figure 3.28 Morocco's crop condition, January– April 2022

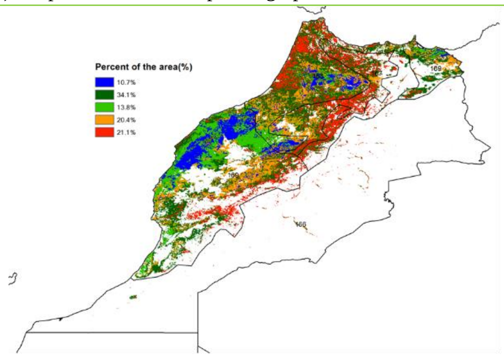


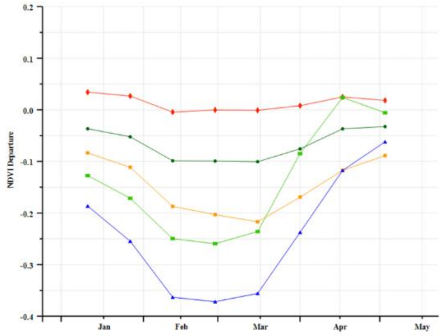
(a). Phenology of major crops



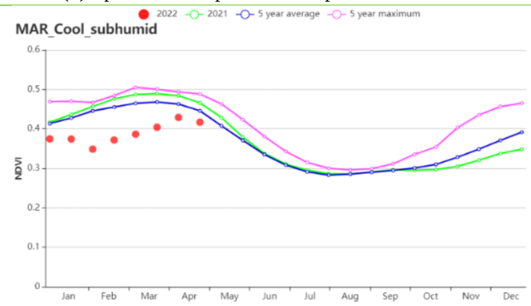


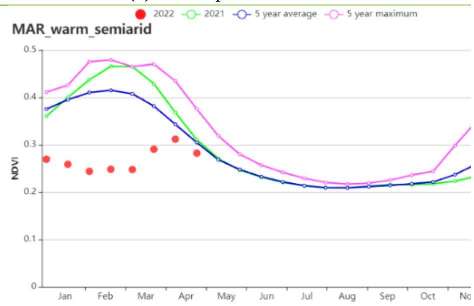
(b) Crop condition development graph based on NDVI (c) Maximum VCI



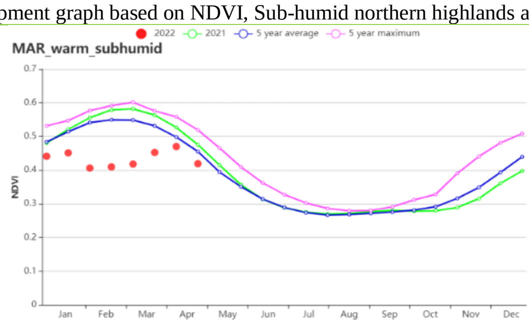


(d) Spatial NDVI patterns compared to 5YA (e) NDVI profiles

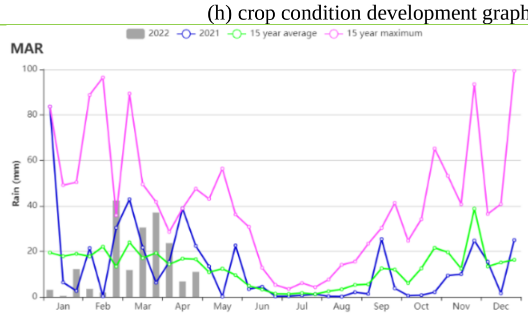


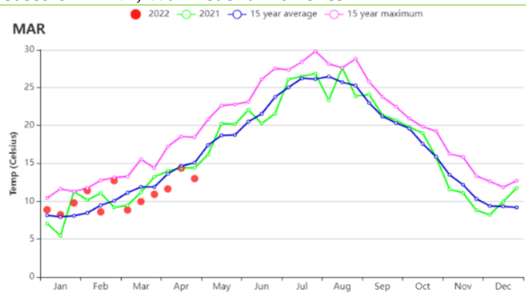


(f) crop condition development graph based on NDVI, Sub-humid northern highlands and (g) Warm semiarid zones



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





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

Table 3.49 Morocco's agroclimatic indicators by sub-national regions, current season's values, and departure from 15YA, January – April 2022

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m^2)	Departure (%)	Current (gDM/m^2)	Departure (%)
Sub-humid northern highlands	255	-17	9.0	-0.2	974	2	559	-6
Warm semi-arid zones	115	-17	12.0	-0.2	1062	0	421	-4
Warm sub-humid zones	248	-12	10.0	-0.2	966	0	564	-4

Table 3.50 Morocco's agronomic indicators by sub-national regions, current season's values, and departure from 5YA, January – April 2022

Region	CALF		Maximum VCI
	Current (%)	Departure (%)	Current
Sub-humid northern highlands	57	-1	0.67
Warm semi-arid zones	21	-56	0.38
Warm sub-humid zones	70	-15	0.63

[MEX] Mexico

This report covers the production of irrigated wheat, typically sown in November and December, as well as of irrigated winter maize, sown roughly one month earlier. Maize and wheat were at the harvesting stage in March and April, respectively. Rice and soybean sowing began in April.

The proportion of irrigated cropland in Morocco is 35% and agro-meteorological conditions play an important role in the growth of most crops, rainfall is not the major influential factor. The CropWatch agroclimatic indicators show that RAIN was near the 15YA, TEMP decreased by 0.1°C and RADPAR was above average (+2%). Accordingly, BIOMSS increased by 2% as compared to the 15YA. CALF was 57%. It had decreased by 5%. The VCIx was 0.73.

In terms of Agro-climatic conditions, precipitation and temperature were at the average level for the country. However, precipitation was not evenly distributed. The rainfall deficit was more pronounced in the north, where the drought conditions persisted. According to VCI spatial patterns, very high values (greater than 1.0) occurred mainly in northern Tamaulipas. Extremely low values (less than 0.5) occurred in the northern border area, mainly in Sonora, Coahuila de Zaragoza and Chihuahua.

As shown in the spatial NDVI profiles and distribution map, 9.1% of the total cropped areas were above average during the entire monitoring period, mainly distributed in Campeche, Yucatán and Tabasco. Half of the total cropped areas were below average. 12.6% of the areas were significantly below average, mainly in Coahuila de Zaragoza, and 36.9% were slightly below average, mainly in Veracruz and Jalisco.

Overall, the crop conditions were similar to last year, but lower than the 5YA average. The prolonged drought still persists, especially in the north. However, the production of irrigated maize and wheat, which predominantly takes place in Sinaloa and Sonora, is close to average.

Regional analysis

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

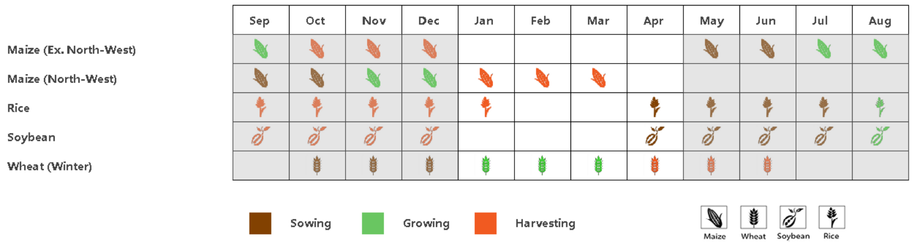
The Arid and semi-arid region, located in northern and central Mexico, accounts for about half of the planted area in the country. The agro-climatic condition showed that RAIN decreased by 40%, TEMP decreased by 0.3°C and RADPAR increased by 3%. According to the NDVI development graph, crop condition in this region was at the same level as last year. CALF decreased by 15% compared with the 5YA. This region was most affected by the below-average rainfall and VCIx was only 0.62.

The region of Humid tropics with summer rainfall is located in southeastern Mexico. RAIN was significantly above average (+59%), TEMP decreased by 0.1℃, RADPAR decreased by 1% and BIOMSS increased by 17%. As shown in the NDVI development graph, crop conditions were close to average from January to April. CALF was 99%. The increased precipitation brought some relief from the drought. The VCIx (0.89) confirms that crops grew better in this region than in other regions, which was due in large part to increased precipitation.

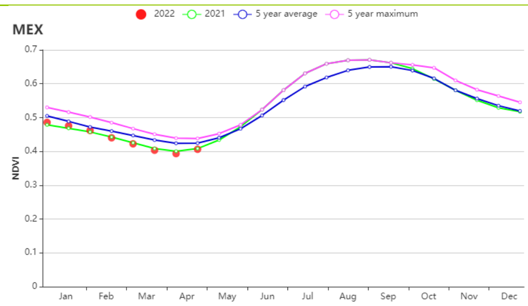
The Sub-humid temperate region with summer rains is situated in central Mexico. According to the NDVI development graph, crop conditions were below but close to average, and later recovered to average levels. The agro-climatic conditions were close to the average level. RAIN decreased by 61%, TEMP increased by 0.2°C, RADPAR increased by 3%, and BIOMSS decreased by 21% compared to the 15YA. CALF was 47%, and VCIx for this zone was 0.80.

The region called Sub-humid hot tropics with summer rains is located in southern Mexico. During the monitoring period, crop conditions were close to average as shown by the NDVI time profiles. Agro-climatic conditions were close to average levels, including RAIN (-21%), RADPAR (+2%) and BIOMSS (-10%). CALF was 79%. The VCIx for the region was 0.79.

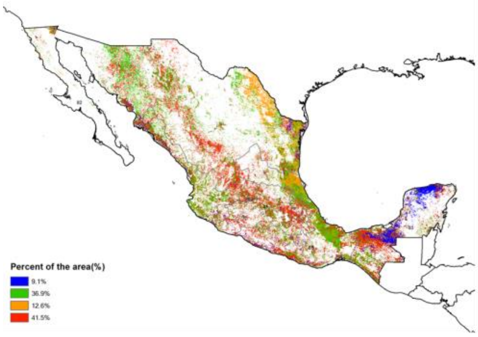
Figure 3.29 Mexico's crop condition, January - April 2022

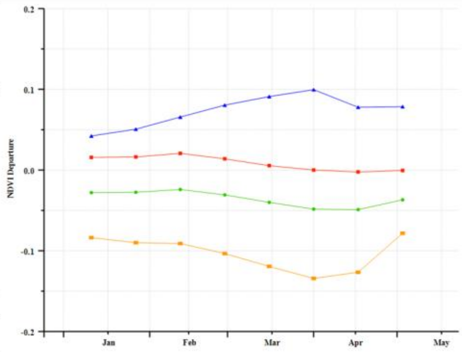


(a). Phenology of major crops

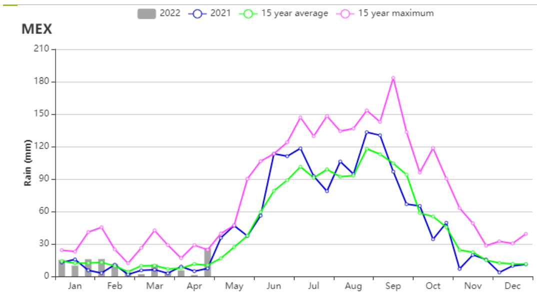


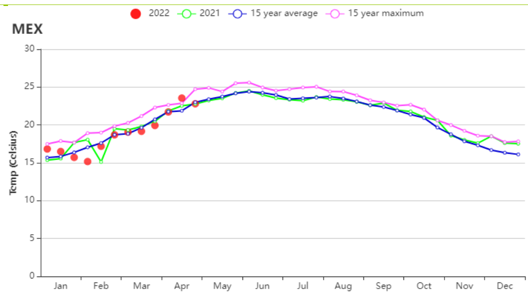
(b) Crop condition development graph based on NDVI (c) Maximum VCI



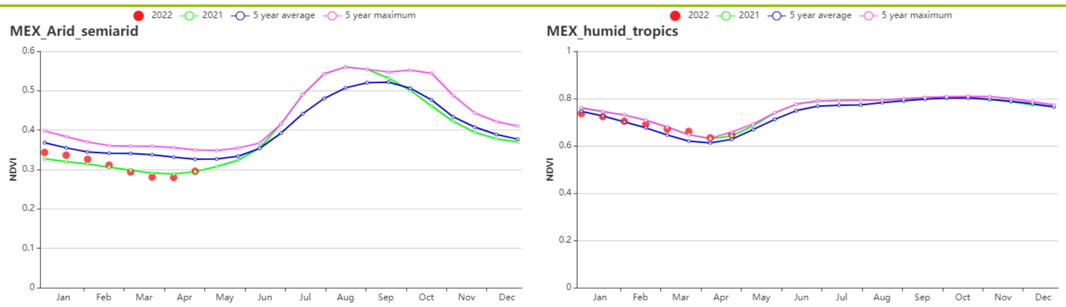


(d) Spatial NDVI patterns compared to 5YA (e) NDVI profiles

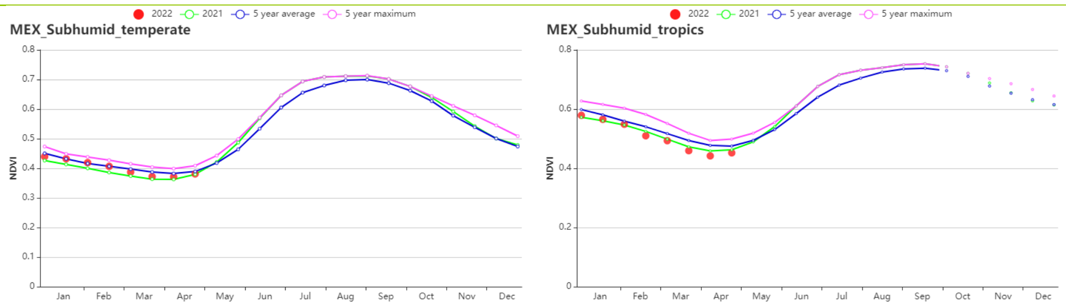




(f) Rainfall profiles (g) Temperature profiles



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



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

Table 3.51 Mexico's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, January - April 2022

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Arid and semi-arid regions	42	-40	15.6	-0.3	1265	3	333	-15
Humid tropics with summer rainfall	373	59	23.2	-0.1	1157	-1	895	17
Sub-humid temperate region with summer rains	42	-61	18.2	0.2	1347	3	384	-21
Sub-humid hot tropics with summer rains	96	-21	20.3	0.0	1274	2	473	-10

Table 3.52 Mexico's agronomic indicators by sub-national regions, current season's values and departure from 5YA, January - April 2022

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Arid and semi-arid regions	30	-17	0.62
Humid tropics with summer rainfall	99	0	0.89
Sub-humid temperate region with summer rains	47	1	0.8
Sub-humid hot tropics with summer rains	79	-1	0.79

[MMR] Myanmar

During this reporting period, the weather was warmer and drier than usual. The harvest of maize started in January, whereas that of the second rice crop started in March. Wheat reached maturity in February. The country is plagued by an internal conflict, which has caused displacement of people, restrictions of movement and trade, as well as a surge of input prices for crop production.

The proportion of irrigated cropland in Myanmar is 26% and agro-meteorological conditions play an important role in the growth of most crops. Compared to the 15YA, RAIN was lower (-5%) while TEMP was higher (+0.3ºC) and RADPAR was down by 3%. As a result, BIOMSS was slightly above the average (+1%). Compared to the 5YA, the utilization of cropland dropped by 1%. NDVI values were average during the entire period. The maximum VCI during this period was 0.85.

As shown by the NDVI clusters map and profiles, the crop conditions across the country were quite different. More than half (69.3%) of the country’s cropland showed average and above average crop conditions. It was mainly located in the Central Plain. The remaining 30.7% trended below average throughout this monitoring period. The lowest VCI values were observed for parts of the Central Plain. During this monitoring period, the crop conditions for most of the country were fair.

Regional analysis

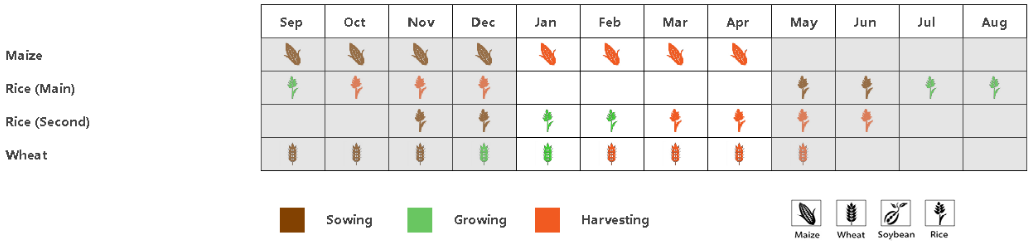
Three sub-national agro-ecological zones (AEZ) can be distinguished for Myanmar based on the cropping system, climatic zones and topographic conditions. They are the Central plain, the Hills and the Delta and Southern Coast regions.

The **Central Plain** had a marked rainfall deficit (RAIN -33%), RADPAR dropped by 3% and TEMP was up by 0.6ºC compared to the 15YA. BIOMSS was 4% lower than the 15YA. CALF (-3%) showed that only 69% of the cropland was fully utilized. NDVI was near the level of the 5YA for most of the period and was above-average in early April. The VCIx was 0.81. Crop conditions for this region were slightly below average.

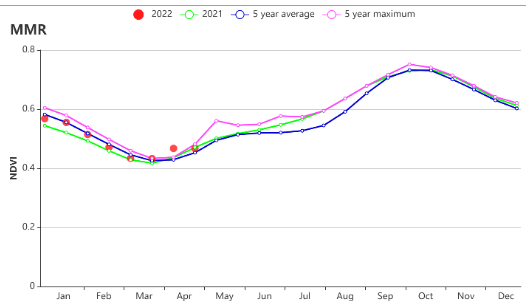
The **Hills region** also had below-average rainfall (RAIN -8%). RADPAR was 3% below average and TEMP increased by 0.1ºC. BIOMSS was the same as the 15YA. Most of the cropland was fully utilized (CALF 93%). The NDVI values were close to the 5YA during the whole period. The VCIx was 0.89. Crop conditions are assessed as close to the 5YA level.

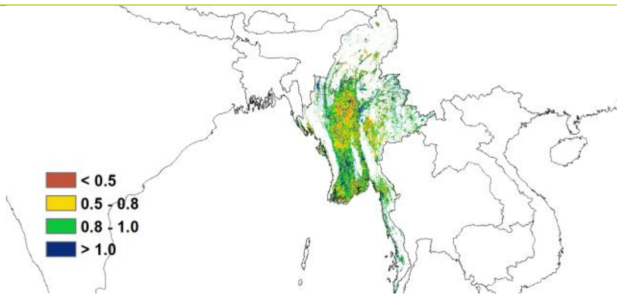
The **Delta and Southern Coast region** had the highest RAIN compared with the other two sub-national regions, and it was 18% above the 15YA. TEMP was 0.3ºC above average while RADPAR decreased by 4%. BIOMSS was 10% above the 15YA. The cropland was not fully utilized (CALF 88%). VCIx was 0.88. The NDVI values were near the 5YA. Crop conditions in this region were near average.

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



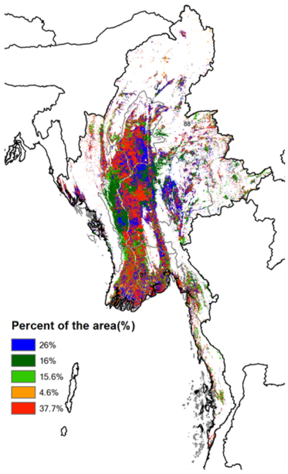
(a). Phenology of major crops

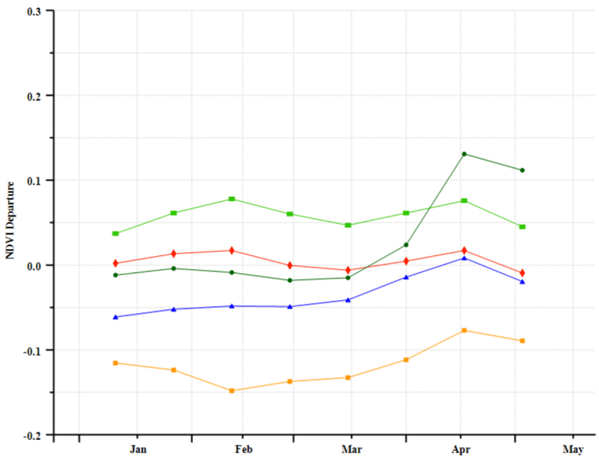




(b) Crop condition development graph based on NDVI

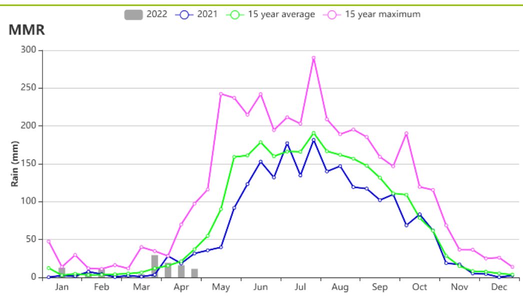
(c) Maximum VCI

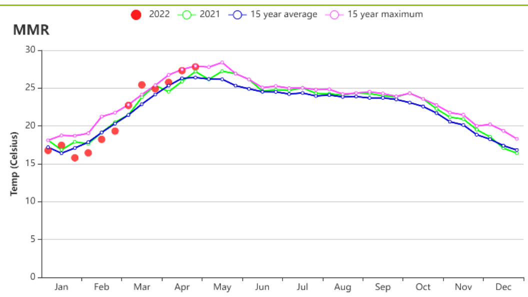




(d) Spatial NDVI patterns compared to 5YA

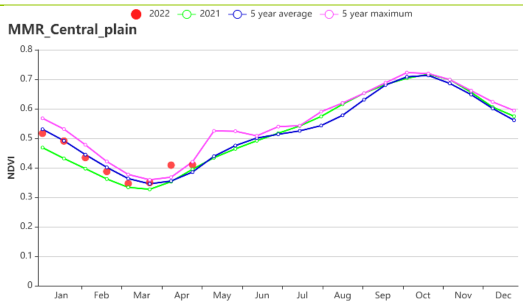
(e) NDVI profiles

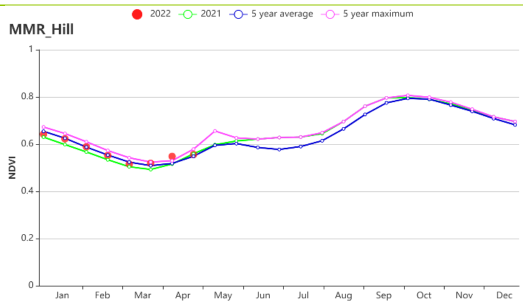




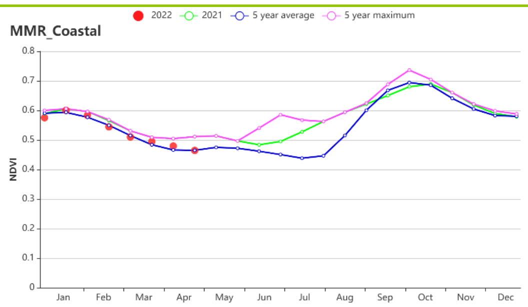
(f) Rainfall profiles

(g) Temperature profiles





(h) Crop condition development graph based on NDVI (central plain (left) and hills region (right))



(i) Crop condition development graph based on NDVI (delta and southern coast region)

Table 3.53 Myanmar's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, January - April 2022

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m^2)	Departure (%)	Current (gDM/m^2)	Departure (%)
Central plain	45	-33	22.7	0.6	1227	-3	471	-4
Hills region	139	-8	19.0	0.1	1192	-3	529	0
Delta and southern-coast	158	18	26.4	0.3	1234	-4	711	10

Table 3.54 Myanmar's agronomic indicators by sub-national regions, current season's values and departure from 5YA, January - April 2022

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Central plain	69	-3	0.81
Hills region	93	0	0.89
Delta and southern-coast	88	0	0.88

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

[MNG] Mongolia

During the monitoring period from January to April 2022, no crops were grown in Mongolia due to the cold winter weather. Summer crops (mainly spring wheat and potatoes) will be planted in May. The proportion of irrigated cropland in Mongolia is only 3% and agro-meteorological conditions play a decisive role in the growth of almost all crops. According to the CropWatch agroclimatic indicators, rainfall was significantly below the 15YA in the Altai region (-41%) and Gobi Desert region (-52%), while above average in the Central and Eastern Steppe region (+23%). Accordingly, the average rainfall in Mongolia was close to the 15YA (70mm). Similar to the trend reported in the last bulletin, Mongolia was warmer than usual (+0.5°C), while RADPAR was slightly below average (-2%). The potential biomass was slightly above average (BIOMSS +1%) and the maximum VCI was 0.95.

According to the development graph based on NDVI, the vegetation conditions in Mongolia were normal, and the spatial distribution of NDVI profiles also shows that NDVI of most regions was close to average. Overall, the climate and soil conditions at the start of the summer crop season were normal.

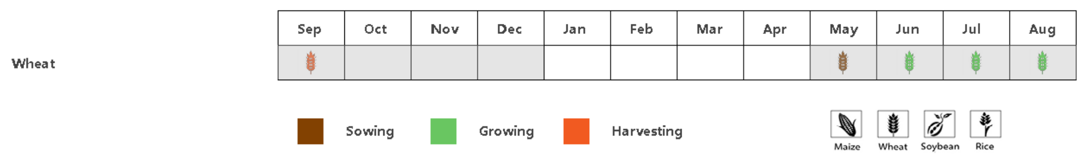
Regional analysis

Hangai Khuvsgul region: The average temperature was slightly above average (+0.2°C), while rainfall and solar radiation were below average (-5% and -2%). Thus, the potential biomass was decreased by 8%. The development graph based on NDVI shows that vegetation conditions were below average throughout this monitoring period.

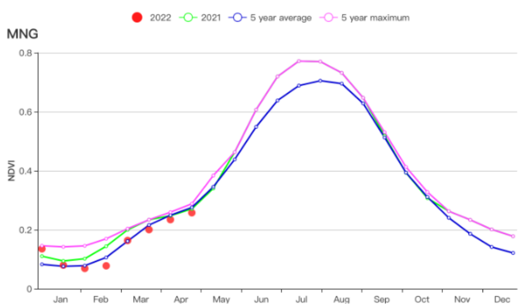
Selenge-Onon region: The agroclimatic conditions for this region were normal (RAIN +3%, TEMP +0.5°C, RADPAR -2%, BIOMSS +5%), the maximum VCI was 0.96, and the development graph based on NDVI also indicates normal vegetation conditions.

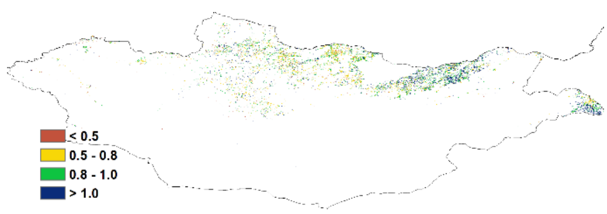
Central and Eastern Steppe Region: Rainfall was significantly above average (+23%), the average temperature increased by 0.5°C, and solar radiation decreased by 3%. The combination of the factors resulted in a higher BIOMSS (+14%) compared to the fifteen-year average, and the maximum VCI was 1.13. Overall crop prospects are average.

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

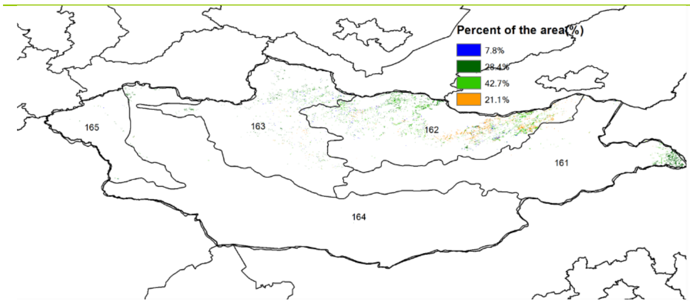


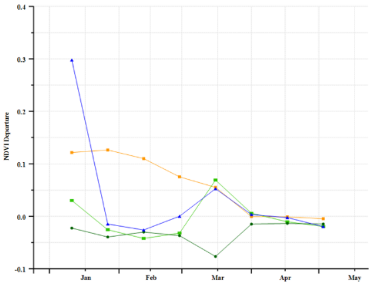
(a) Phenology of major crops



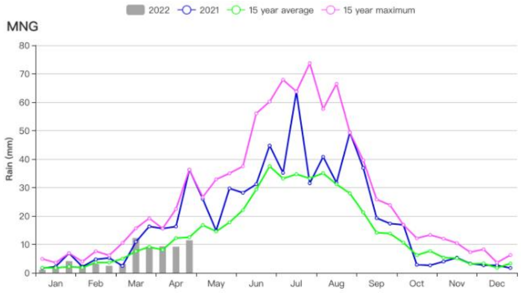


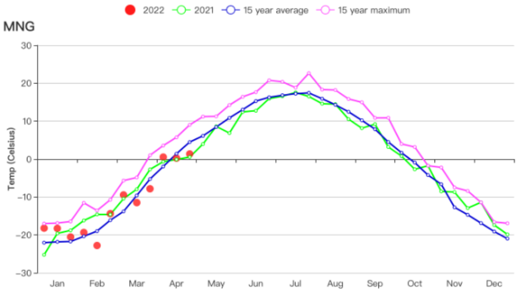
(b) Crop condition development graph based on NDVI (c) Maximum VCI



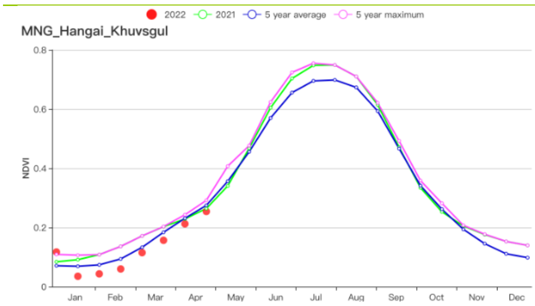


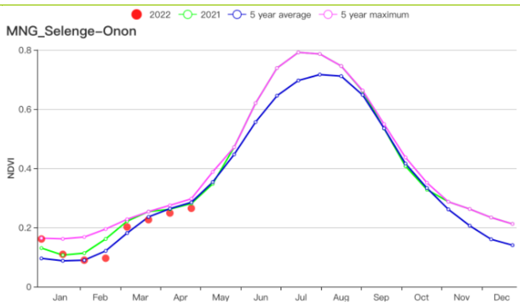
(d) Spatial NDVI patterns compared to 5YA (e) NDVI profiles



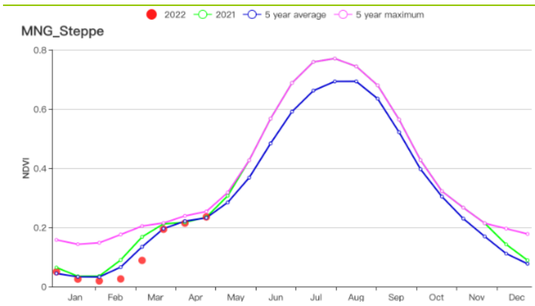


(f) Rainfall profiles (g) Temperature profiles





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



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

Table 3.55 Mongolia's agroclimatic indicators by sub-national regions, current season's values, and departure from 15YA, January - April 2022

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m2)	Departure (%)	Current (gDM/m2)	Departure (%)
Hangai Khuvsgul Region	64	-5	-13.3	0.2	787	-2	125	-8
Selenge-Onon Region	72	3	-10.9	0.5	773	-2	172	5
Central and Eastern Steppe Region	82	23	-11.2	0.5	789	-3	182	14
Altai Region	72	-41	-11.6	0.6	744	0	129	-9
Gobi Desert Region	30	-52	-10.9	0.8	767	3	89	-29

Table 3.56 Mongolia's agronomic indicators by sub-national regions, current season's values, and departure from 5YA, January - April 2022

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Hangai Khuvsgul Region	3	173	0.89
Selenge-Onon Region	7	312	0.96
Central and Eastern Steppe Region	0	669	1.13
Altai Region	2	1525	0.76
Gobi Desert Region	0	-21	0.74

[MOZ] Mozambique

In Mozambique, the agricultural season lasts from November to May of the following year. Coinciding with the rainy season, the current monitoring period (January- April 2022) covers the growing stages of rainfed maize and rice crops in the northern region of the country, while in the south, the harvesting of both maize and rice was completed in April. This period also covers the growing stages of wheat, which has its harvesting scheduled for May.

The proportion of irrigated cropland in Mozambique is only 4% and agro-meteorological conditions play a decisive role in the growth of almost all crops. Nationwide, climate adversities played a significant role in crop development. The monsoon season was off to a late start last year, as rain was 30% below the 15YA in the period from October to December. During this monitoring period, the country recorded three tropical storms and cyclones (including Ana, Batsirai and Gombe). These events brought together intensive rains that contributed to the increases recorded in rainfall (RAIN +9%). The temperature increased by 0.2ºC. Radiation dropped by 2% while the total biomass production was near average.

The effects of the climate adversities (tropical storms and cyclones) are shown by the national crop conditions development graph based on NDVI, in which the crop conditions were below the average of the past five years from early January to late April. This is also confirmed by the spatial NDVI patterns together with the NDVI profiles revealing that nationwide, crop conditions were unfavourable during a major part of the growing season, recovering in late April only. Provinces of Zambezia, Nampula, Tete and Sofala are the provinces that showed the worst crop conditions. The cropped arable land fractions were near average and the maximum VCI was 0.92. The crop condtions were unfavorable due to erratic rainfall.

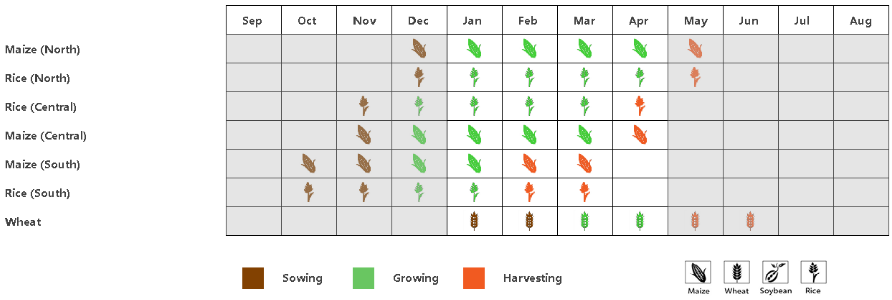
Regional analysis

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

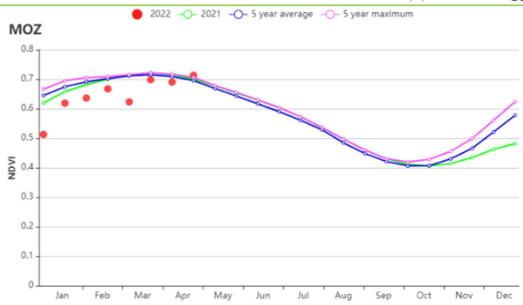
The regional crop development graphs based on NDVI indicate that the crop conditions were unfavourable in all regions from early January till late April when these conditions started to recover. During the monitoring period, the agroclimatic indicators show decreases in rainfall in the Buzi basin (-22%), Low Zambezi River basin (-1%) and the Southern region (-24%), while significant increases were observed in the Northern high-altitude areas (+11%) and the Northern Coast (+36%). The regions of the Buzi basin and Southern region were warmer, recording increases in temperature by 0.8ºC and 0.6ºC, respectively. Radiation decreased in the Northern high-altitude areas (-2%), Low Zambezi River basin (-3%), and Northern coast (-3%), while it increased in the Southern region by 1%. Influenced by the decreases recorded in rainfall, the total biomass production decreased by 2%, 5% and 7% in the Low Zambezi River basin, Buzi basin and Southern region, respectively. In the Northern high-altitude region and Northern coast, the biomass increased by 3% and 5% respectively.

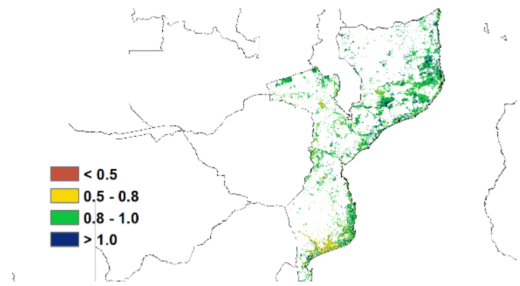
The agronomic indicators show about average CALF in all agro-ecological regions and the maximum VCI in these regions varies from 0.86 to 0.96.

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



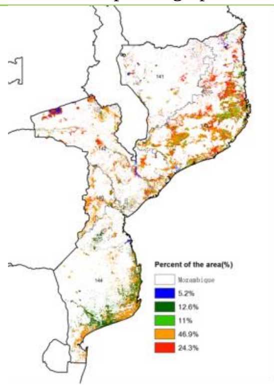
(a). Phenology of major crops

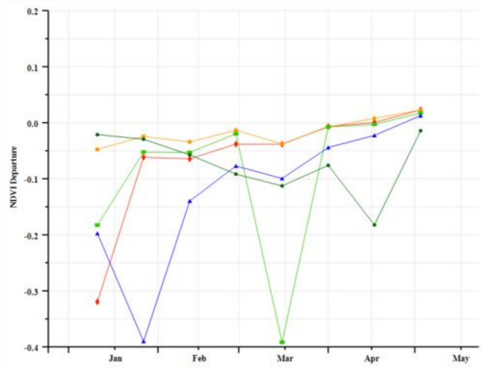




(b) Crop condition development graph based on NDVI

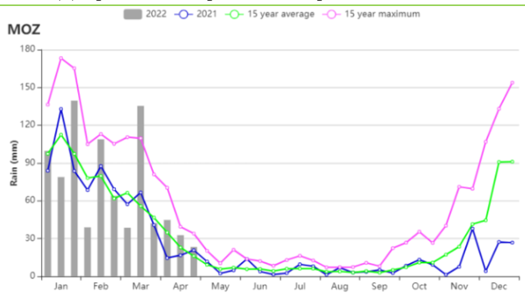
(c) Maximum VCI

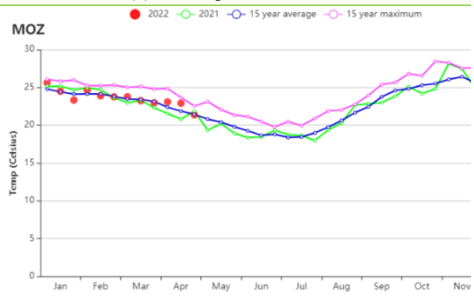




(d) Spatial NDVI patterns compared to 5YA

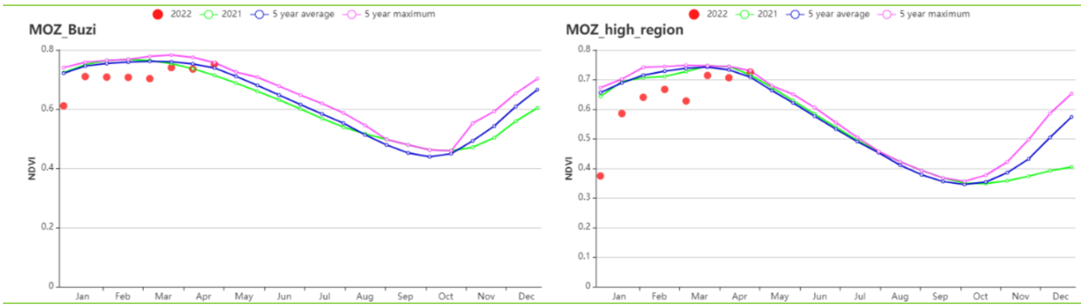
(e) NDVI profiles



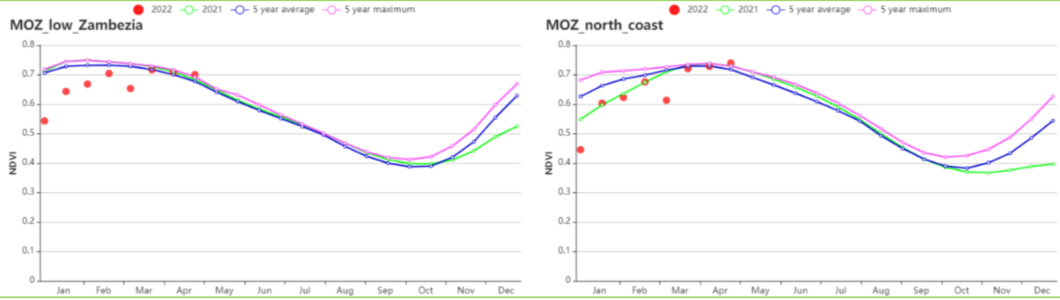


(f) Time series profile of rainfall

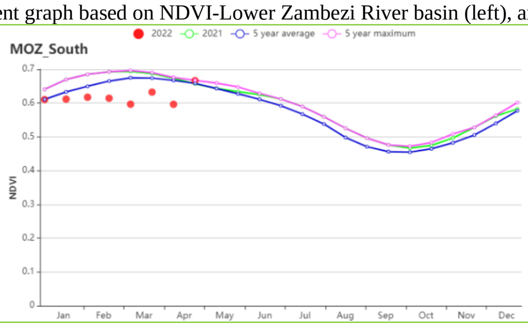
(g)Time series profile of temperature



(h) Crop condition development graph based on NDVI-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)



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

Table 3.57 Mozambique's agroclimatic indicators by sub-national regions, current season's values, and departure from 15YA, January - April 2022

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m^2)	Departure from 15YA (%)	Current (gDM/m^2)	Departure from 15YA (%)
Buzi basin	546	-22	22.3	0.8	1241	0	1090	-5
Northern high-altitude areas	1112	11	21.9	0.0	1124	-2	1392	3
Low Zambezia River basin	775	-1	23.5	0.1	1165	-3	1222	-2
Northern coast	1177	36	23.7	-0.1	1169	-3	1487	5
Southern region	364	-24	25.3	0.6	1224	1	995	-7

Table 3.58 Mozambique's agronomic indicators by sub-national regions, current season's values, and departure from 5YA, January - April 2022

Region	CALF		Maximum VCI
	Current (%)	Departure from 5YA (%)	Current
Buzi basin	100	0	0.91
Northern high-altitude areas	100	0	0.96
Low Zambezia River basin	99	0	0.92
Northern coast	100	0	0.95
Southern region	99	0	0.86

[NGA] Nigeria

This report covers the dry season of Nigeria. The harvesting of last year's second maize and irrigated rice crops ended in January. The sowing of maize started in March in the main and southern areas while the sowing of rainfed rice started in April.

The proportion of irrigated cropland in Nigeria is only 0.4% and agro-meteorological conditions play a decisive role in the growth of almost all crops. The CropWatch agroclimatic indicators showed that the rainfall was below the 15YA (-20%) and the average temperature was lower than the 15YA (-0.6°C). Significant rains started in mid-April only, causing a delay in the start of the growing season, as can be seen in the development of the NDVI curve. Solar radiation increased by 2%. Due to the decline of rainfall, the BIOMSS was below the 15YA (-2%).

According to the crop condition development graph based on NDVI, the NDVI of the country was near the 5YA at the start and the end of this period, and below the 5YA in the middle of this period. The maximum VCI graph showed that the lower values appeared mainly in the northern area and the higher value appeared mainly in the middle and southwestern area. As shown in the spatial NDVI profiles and distribution map, 56.6% of the total cropped areas were near the 5YA during the whole period mainly in the middle and northern area of the country. About 30.2% of the total cropped areas were slightly below the 5YA during the whole period, mainly in the middle area of the country. In the southern area of the country, the NDVI was below the 5YA in March and April. Overall, the crop conditions in most areas were near the average at the end of this monitoring period.

Regional Analysis

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

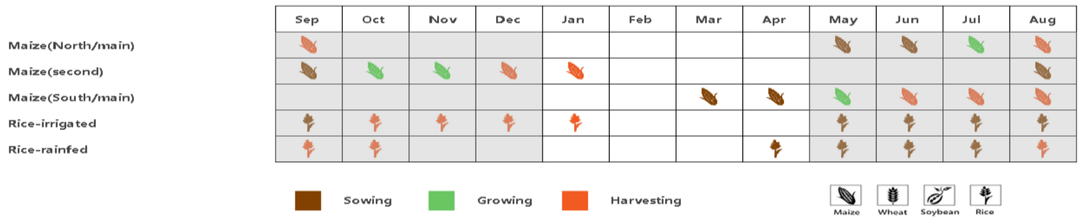
The **Sudan-Sahel savanna** zone is located in northern Nigeria. The agro-climatic condition showed that rainfall decreased by 63% and the overall temperature decreased by 0.9°C. The radiation increased by 0.4%. The BIOMSS was above the 15YA (+8%). The CALF was 2% and the maximum VCI was 0.72. According to the NDVI development graph, crop conditions in the zone were near average from January to April.

The **Guinea savanna** region is predominantly located in the central region of the country. Compared to the 15YA, TEMP decreased by 0.6°C, RAIN decreased by 17%, RADPAR was 1% above the 15YA, and BIOMSS was above the 15YA (+4%). The CALF was 9% and the maximum VCI was 0.80. According to the NDVI development graph, crop conditions in the region were near average from January to February and below average from March to April.

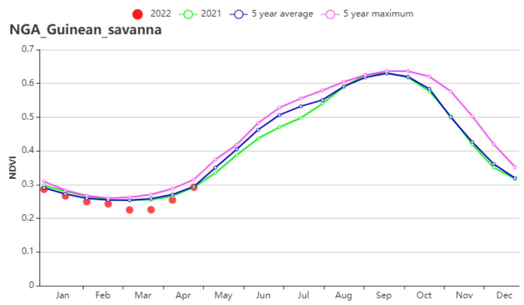
The **Derived savanna** region is a transition zone between the Guinea savanna and Humid forest zones. Rainfall increased by 2% and the temperature decreased by 0.7°C. The radiation increased by 3% compared to the 15YA and the BIOMSS decreased by 3% compared to the 15YA. The CALF was 71% and the maximum VCI was 0.88. According to the NDVI development graph, crop conditions in the region were near the average in January and below average from February to April.

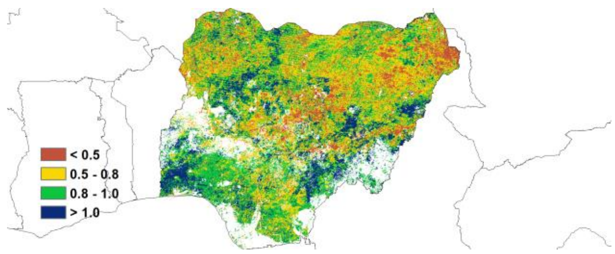
The **Humid forest** zone is in the southern area of the country. The rainfall decreased by 30% and the average temperature was near the 15YA (-0.1°C). The radiation increased by 2% and the BIOMSS decreased by 12%. The CALF was 96% and the maximum VCI was 0.87. According to the NDVI development graph, crop conditions in the zone were near the average in January and below average from February to April.

Figure 3.33 Nigeria's crop condition, January-April 2022

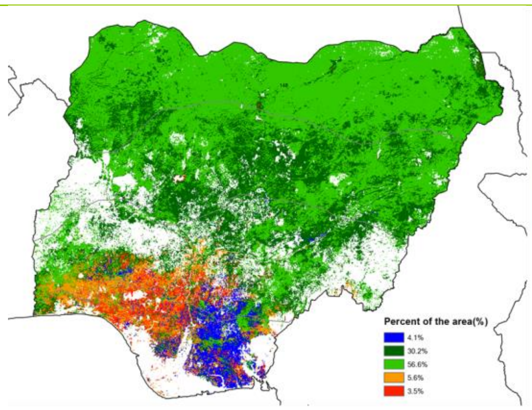


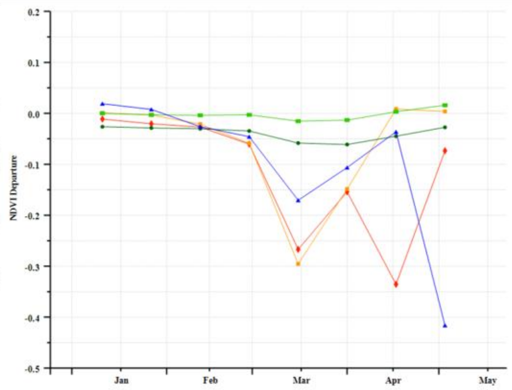
(a) Phenology of major crops



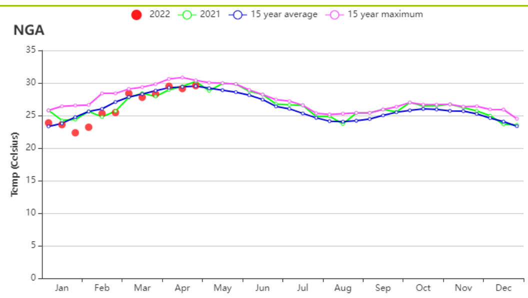


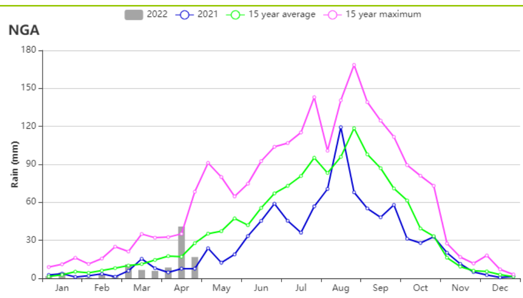
(b) Crop condition development graph based on NDVI (c)Maximum VCI



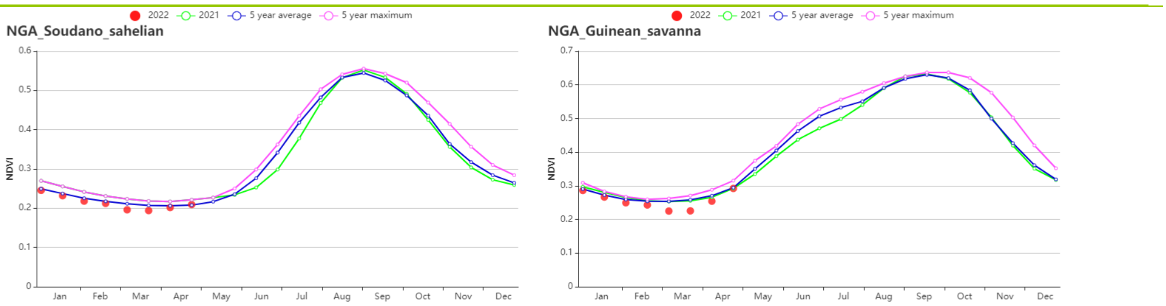


(d) Spatial NDVI pattern compared to 5YA (e)NDVI profiles

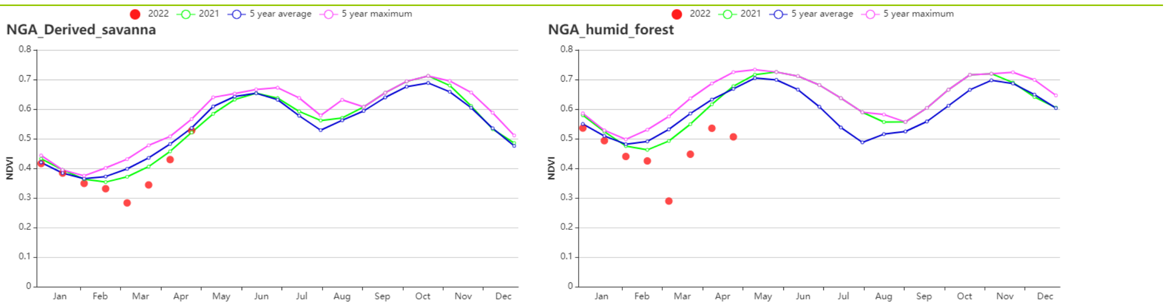




(f) Time series temperature profile (g) Time series rainfall profile



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



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

Table 3.59 Nigeria's agro-climatic indicators by sub-national regions, current season's values and departure from 15YA. January-April 2022

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m²))	Departure from 15YA (%)	Current (gDM/m²)	Departure from 15YA (%)
Sudan-Sahel savanna	1	-63	25.7	-0.9	1386	0	347	8
Guinea savanna	20	-17	25.8	-0.6	1390	1	501	4
Derived savanna	113	2	27.0	-0.7	1350	3	608	-3
Humid forest	307	-30	27.2	-0.1	1288	2	931	-12

Table 3.60 Nigeria's agro-climatic indicators by sub-national regions, current season's values and departure from 5YA. January-April 2022

Region	CALF		Maximum VCI
	Current (%)	Departure from 5YA (%)	Current
Sudan-Sahel savanna	2	-8	0.72
Guinea savanna	9	-1	0.80
Derived savanna	71	0	0.88
Humid forest	96	-2	0.87

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

[PAK] Pakistan

This monitoring period covers most of the winter wheat cycle from the vegetative stage to harvest. It also includes the field preparation and sowing of maize. Crop conditions were unfavorable from January to April based on the agroclimatic and agronomic indicators.

The proportion of irrigated cropland in Pakistan is 80% and rainfall is not the major impact factors in the growth of crops. Compared to the 15YA, RAIN was 40% below, while air temperature (TEMP +1.9℃) and photosynthetically active radiation (RADPAR +5%) were above average during this period. The combination of all the agro-climatic indicators resulted in a below-average BIOMSS (-5%). At the national level, the dekad RAIN was continuously below average from the middle of March to April, together with TEMP reaching or exceeding the 15YA maximum values in the same period. Drier and hot weather resulted in below-average estimates of BIOMSS. In the Northern highlands and Northern Punjab the decreases were 14% and 8% respectively.

The crop condition development graph based on NDVI for Pakistan presented close to average levels from January to early March. Subsequently, conditions were below average from middle March to April mainly due to the drier and warmer weather mentioned above. The spatial NDVI patterns and profiles showed that 39.1% of the cropped areas were below average, mainly distributed in North highlands, Punjab and Sindh after March. Especially Punjab, which is an important wheat producing state, experienced a heat wave starting from mid-March. This may have caused a yield loss for winter wheat, because of terminal heat stress during the grain-filling period. The fraction of cropped arable land (CALF) increased by 4%. Crop conditions were slightly below average for Pakistan.

Regional analysis

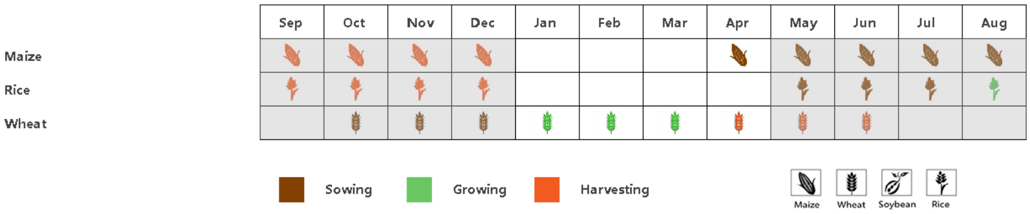
For a more detailed spatial analysis, CropWatch subdivides Pakistan into three agro-ecological regions based essentially on geography and agro-climatic conditions: the Northern highlands, Northern Punjab region and the Lower Indus river basin.

RAIN of **Northern highlands** was 44% below average. TEMP (+2.2℃) and RADPAR (+8%) were both above average. The region experienced warmer and drier weather, and the estimated BIOMSS departure was -14%. The NDVI development graph shows below-average crop conditions except for March during this period, especially in the north. The region had the lowest CALF of 49% among the three AEZs, but it was above the 5YA by 1%. Crop conditions were below average.

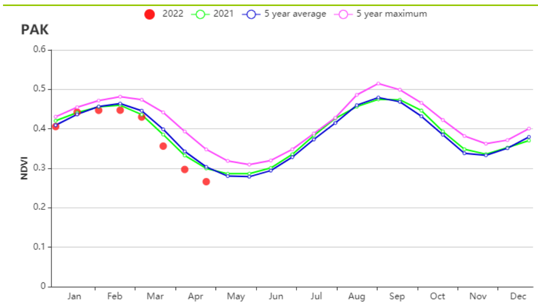
Northern Punjab is the main agricultural region in Pakistan. It recorded low RAIN, 11% below average. TEMP (+1.4℃) and RADPAR (+3%) were both above average. Drier and hot weather resulted in below-average estimates of BIOMSS by 8% compared to the recent fifteen-year average. The NDVI development graph shows above average crop conditions in the key growing period from January to early March. Later, crop conditions were below average due to hot and dry weather. The region had a CALF of 88%, which was above the 5YA by 1%. The combination of these factors is causing a reduction in crop production as compared to last year.

In the **Lower Indus river basin in south Punjab and Sindh**, RAIN was below average by 7%, while TEMP (+1.6℃) and RADPAR (+1%) were both above average. The estimated BIOMSS departure was +7%. Crop condition based on NDVI were close to or above average from January to early March, indicating favorable conditions. The CALF of 71% was above the average by 7%. Overall, prospects were satisfactory.

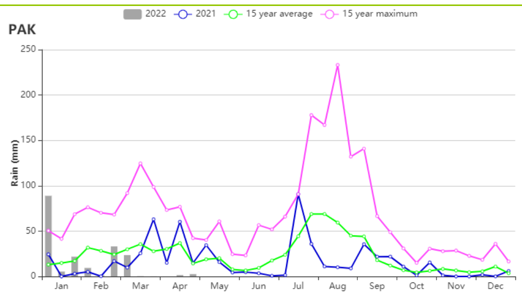
Figure 3.34 Pakistan crop condition, January-April 2022

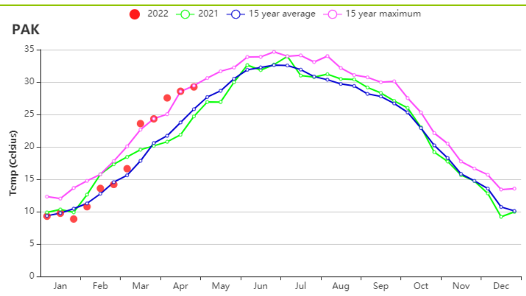


(a) Phenology of major crops

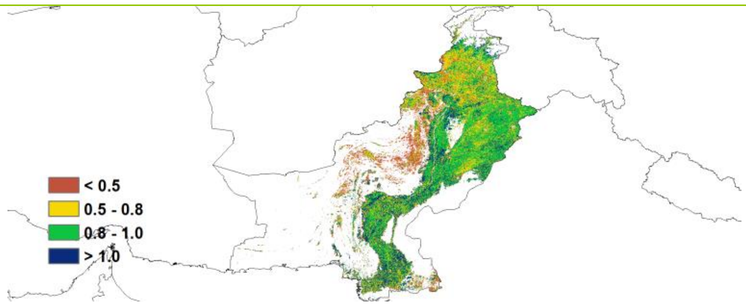


(b) Crop condition development graph based on NDVI

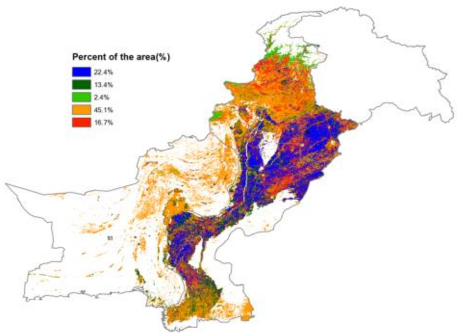


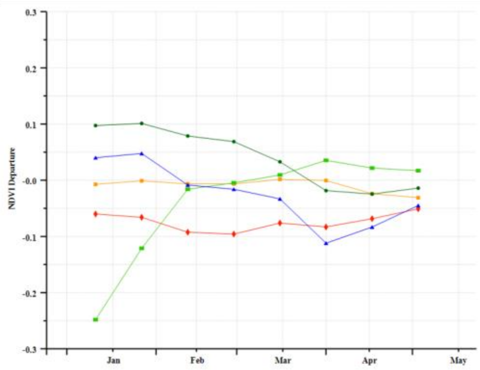


(c) Time series precipitation profile (d) Time series air temperature profile



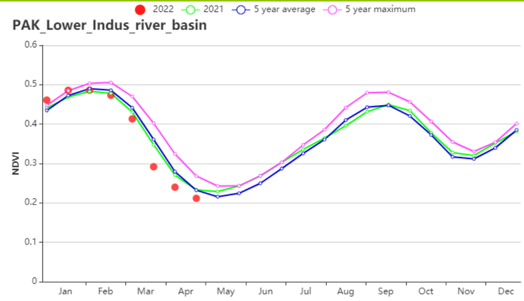
(e) Maximum VCI

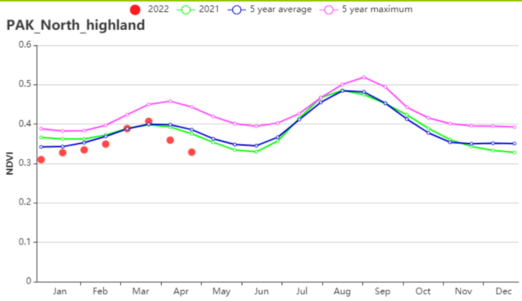




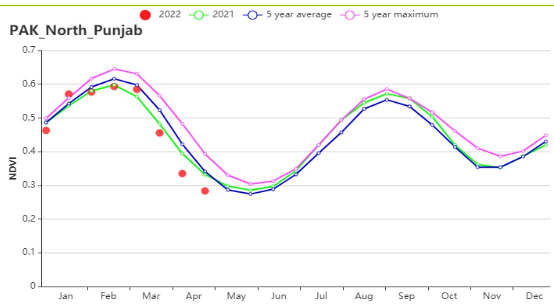
(f) Spatial NDVI patterns compared to 5YA

(g) NDVI profiles





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



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

Table 3.61 Pakistan's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, January-April 2022

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (℃)	Departure (℃)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Lower Indus river basin	47	-7	23.8	1.6	1176	1	478	7
Northern highlands	253	-44	10.1	2.2	1020	8	442	-14
Northern Punjab	183	-11	19.7	1.4	1043	3	542	-8

Table 3.62 Pakistan's agronomic indicators by sub-national regions, current season's values and departure from 5YA, January-April 2022

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Lower Indus river basin	71	7	0.86
Northern highlands	49	1	0.77
Northern Punjab	88	1	0.87

[PHL] Philippines

This reporting period covers the grain-filling and harvest periods of the second rice and maize crops. Sowing of main maize and rice started in April. The proportion of irrigated cropland in Philippines is 20% and agro-meteorological conditions play an important role in the growth of most crops. The Philippines experienced significantly wetter conditions. Compared to the 15YA, the precipitation during the reporting period in the Philippines was significantly higher (RAIN +47%), while the temperature (TEMP) was almost at average and radiation was slightly lower (RADPAR -1%). The abundant precipitation resulted in a higher potential biomass (BIOMSS +12%) compared to the average. However, more precipitation did not bring expected better crop conditions. As is shown by the NDVI profile, the national NDVI stayed below average before mid-March, and then kept close to average. Considering the increased precipitation, the below-average NDVI in February and March can be partly attributed to the cloud cover in the satellite images. According to the spatial NDVI patterns, there are generally three patterns, 1) about 66.5% cropland (in light green) maintained a close-to-average NDVI the whole period. These regions were mainly located on Luzon Island and middle to western Mindanao Island. 2) around 19.3% of croplands (in dark green and blue) underwent a slightly below-average NDVI with a sudden drop. The sudden drop was concentrated in March, which was the result of a low pressure, bringing high intensity rainfall and triggering flooding in Region XII and BARMM of the Philippines. 3) about 15.5% of the cropland experienced a decline in NDVI after early March, and these regions mainly appeared in the eastern Mindanao Island. Considering that the crop NDVI was mostly close to average, and the CALF almost reached 100%, and the VCIx index was at 0.95, the estimated production for the Philippines is normal.

Regional analysis

Based on the cropping systems, climatic zones, and topographic conditions, three main agro-ecological regions can be distinguished for the Philippines. They are **the Lowlands region** (northern islands), **the Hilly region** (Island of Bohol, Sebu, and Negros), and **the Forest region** (mostly southern and western islands). All the regions are characterized by a stable cropped arable land fraction (CALF almost 100%) and a high maximum VCI value (VCIx ⩾0.92).

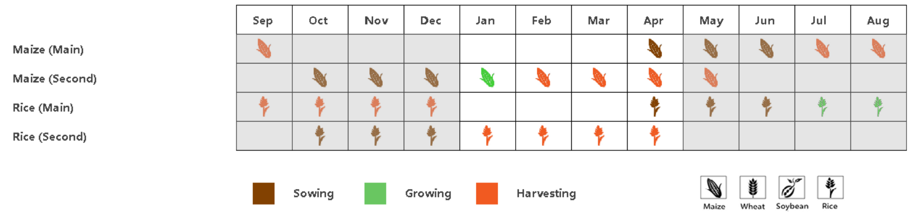
For the **Lowland region**, 32% higher precipitation (RAIN), average temperature (TEMP), and about 3% higher radiation (RADPAR) were observed. The higher precipitation brought a higher potential biomass (BIOMSS +12%). As is shown by regional rainfall series profile, the increased precipitation occurred mainly in March and April, resulting in an above-average NDVI at the end of this period. Moreover, the CALF was almost at 100% and the VCIx value was as high as 0.94, indicating normal crop conditions in this region.

In the **Hilly region**, precipitation was about 83% higher, temperature was 0.3°C lower, and radiation was 3% higher than average. Increased precipitation and radiation promoted the potential biomass as expected, resulting in an increase of 16% (BIOMSS). However, NDVI for crops in this zone fluctuated widely and remained below average before April and stayed near average in April. The big drop of NDVI in February and March was mainly due to the influence of moisture and clouds in the hilly region, thus it does not reflect the real dynamic of crop growth. The NDVI recovered to average at the end of monitoring period, indicating a normal crop growth.

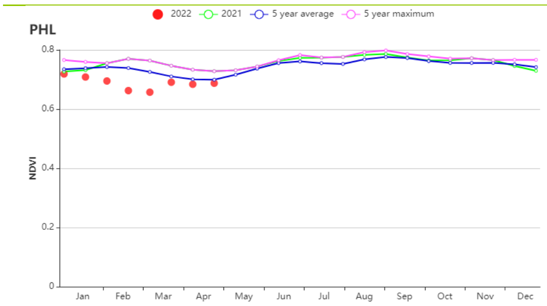
For the **Forest region**, the precipitation increased by about 53%, resulting in an increase of potential biomass as well (BIOMSS +12%). The temperature (TEMP) was near average, and the radiation (RADPAR) was lower by 4%. Although precipitation increased a lot, the NDVI in this region stayed below average during the whole monitoring period. The NDVI gradually declined starting in February, which corresponds to the harvest of second maize and second rice. The increase of NDVI starting in mid-March corresponds to the sowing of main rice and main maize.

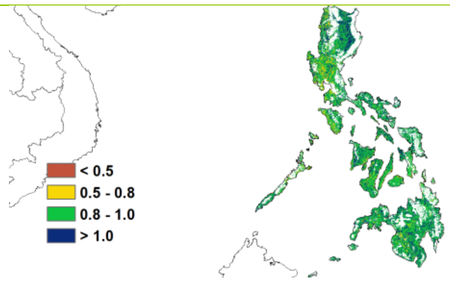
However, the NDVI was still below average. Although the CALF index in the area is close to 100% and the VCIx index is 0.96, it is presumed that the crop growth in the region was slightly below average considering the low NDVI.

Figure 3.35 Philippines' crop condition, January - April 2022

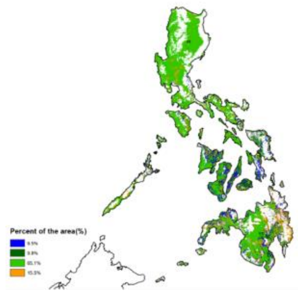


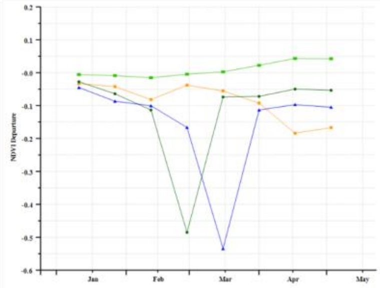
(a). Phenology of major crops



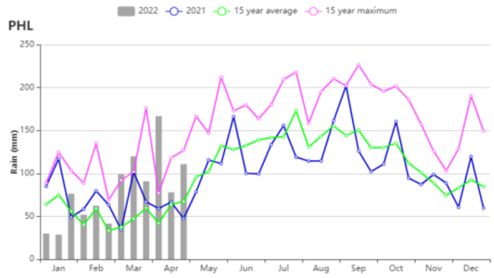


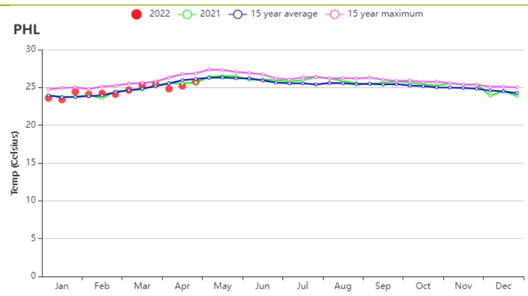
(b) Crop condition development graph based on NDVI (c) Maximum VCI



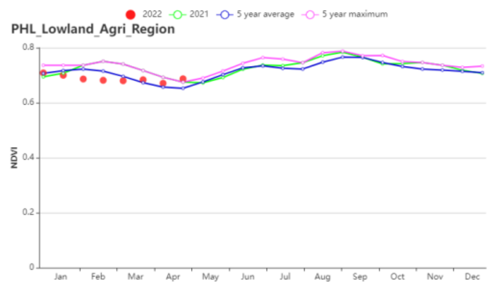


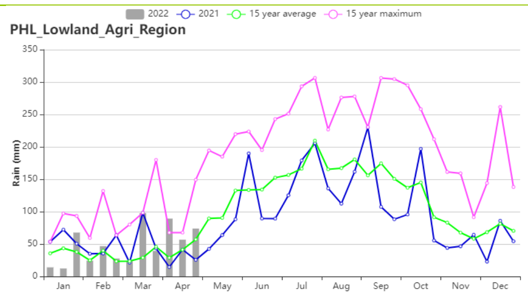
(d) Spatial NDVI patterns compared to 5YA (e) NDVI profiles



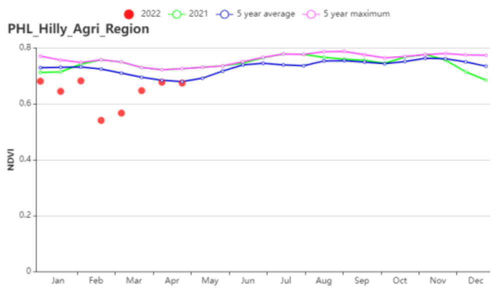


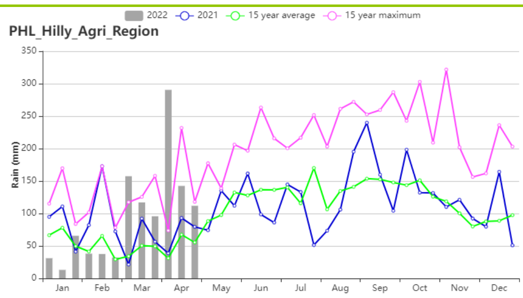
(f) Rainfall profiles (g) Temperature profiles



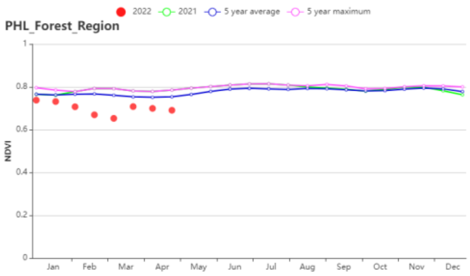


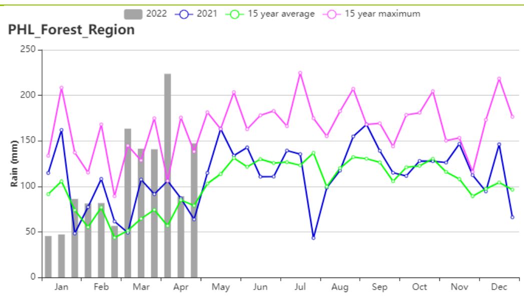
(h) Crop condition development graph based on NDVI (left) and time series rainfall profile (right) in Lowland region





(i) Crop condition development graph based on NDVI (left) and time series rainfall profile (right) in Hilly reigon





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

Table 3.63 Philippines' agroclimatic indicators by sub-national regions, current season's values, and departure from 15YA, January - April 2022

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Forest region	1303	52	24.6	0.0	1133	-4	1418	12
Hilly region	1133	83	26.1	-0.3	1217	-3	1388	16
Lowlands region	573	32	24.4	0.0	1145	3	1078	12

Table 3.64 Philippines' agronomic indicators by sub-national regions, current season's values, and departure from 5YA, January - April 2022

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Forest region	100	0	0.96
Hilly region	100	0	0.93
Lowlands region	100	0	0.94

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

[POL] Poland

During this monitoring period winter, wheat, triticale, barley and rye passed through winter dormancy and spring green-up. The proportion of irrigated cropland in Poland is only 1% and agro-meteorological conditions play a decisive role in the growth of crops. Agroclimatic conditions at the national scale were close to normal, with cumulative precipitation, average temperature and photosynthetically active radiation only slightly higher by 1%, 0.2°C and 1%, respectively, compared to the average for the same period in the last 15 years. However, the potential biomass level was slightly lower by 1% due to the dry and cold March. This can also be seen in the NDVI trend line, where NDVI in January and February was overall higher than the average level of the previous year and the same period of the last 5 years, but in March, NDVI suddenly dropped to the average level of the previous year and the same period of the last 5 years until mid-April. This drop was due to below-average precipitation in March. However, thanks to high rainfall in early April, the crops were able to recover and the overall crop growth was similar to the historical level by the end of the monitoring period. As can be seen from the spatial NDVI profiles, there were significant differences in growth in different regions in January and February. This was probably due to snow cover on the ground. The best vegetation condition index at the national scale was 0.89, whereas the areas below 0.8 were mainly located in the northern and eastern parts of the country. The proportion of cultivated land was 97%, a decrease of 2% compared with the average of the last 5 years.

Overall, although crop growth in March was lower than historical levels due to the dry and cold weather, abundant precipitation in January and February and timely precipitation in April allowed crop growth to recover quickly in April, and overall crop growth was close to average at the end of this monitoring period.

Regional analysis

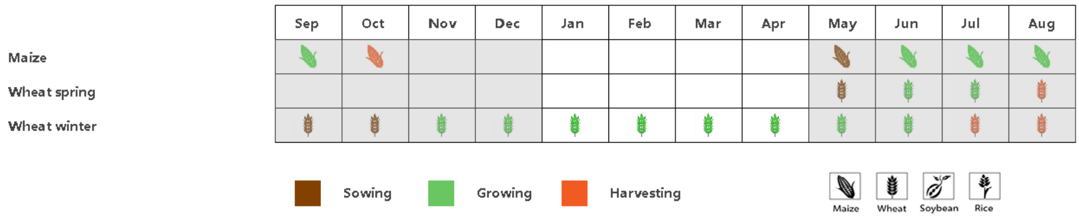
Poland is divided into four subregions based on agro-ecological characteristics, namely: (a) **Northern oats and potatoes area** (including the Western Pomeranian, Eastern Pomeranian and Wamenia-Masuria regions), (b) **Northern-central wheat and sugar-beet area** (including the Cuyavia-Pomeranian to Baltic Sea region), (c) **Central rye and potatoes area** (including the Lubus to South Podlaski and North Lublin regions) and (d) **Southern wheat and sugar-beet area** (including the southern Lower Silesia to South Lublin and the Carpathian along the Czech and Slovak border).

The agronomic indicators in the **Northern oats and potatoes area** and the **Northern-central wheat and sugar-beet area** were higher than the previous averages. Compared with the averages of the same period in the last 15 years, RAIN in the two subregions was 4% and 1% higher, TEMP was 0.6°C higher, the RADPAR was 2% and 3% higher, and BIOMSS was 2% higher. CALF in the two subregions was 93% and 96%, which was 4% and 1% lower, respectively, and VCIx were 0.83 and 0.89. Similar to the national NDVI trend, conditions in the two subregions also dropped to the average level of the same period in the last 5 years in March and remained below average until the end of April.

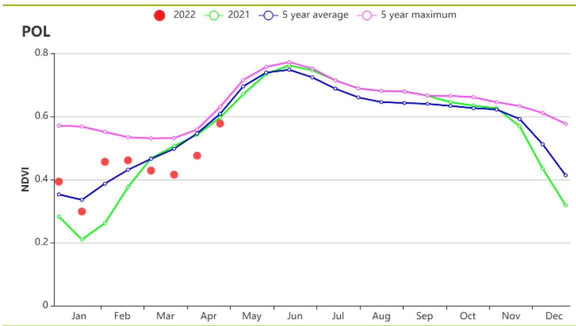
Compared to the average of the same period of the last 15 years, TEMP and RADPAR in the **Central rye and potatoes area** were slightly higher by 0.3°C and 1%, respectively, and RAIN and BIOMSS were both at the same level as before. CALF in this zone was 97%, which was 1% lower than the average level of the last 5 years, and VCIx was 0.91. The overall distribution of crop growth was the same as in the above-mentioned regions, but the crop growth in this zone had recovered to the average level of the same period of the last 5 years at the end of April.

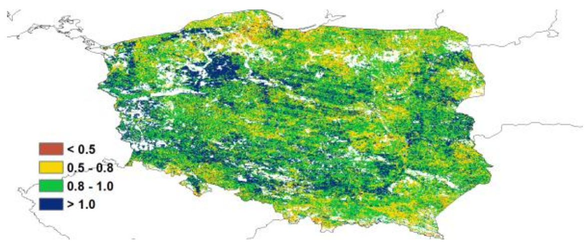
RAIN and RADPAR in Southern wheat and sugar-beet area were 2% and 1% higher, respectively, compared with the average of the last 15 years, but TEMP and BIOMSS were 0.3°C and 4% lower, respectively. CALF was 96%, which was 2% lower than the average of the last 5 years, and VCIx was 0.88. The crop growth process in this region was similar to the other 3 sub-regions, and by the end of April, the crop growth recovered to near the average of the last 5 years and was higher than last year in late April.

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

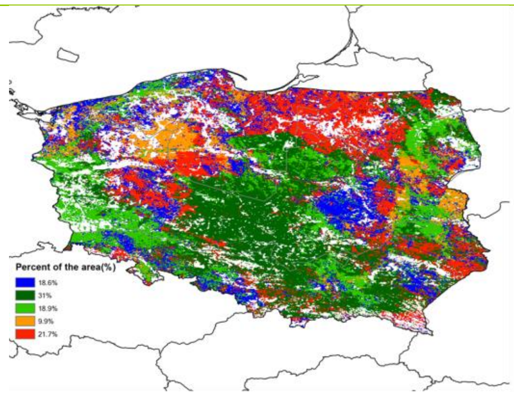


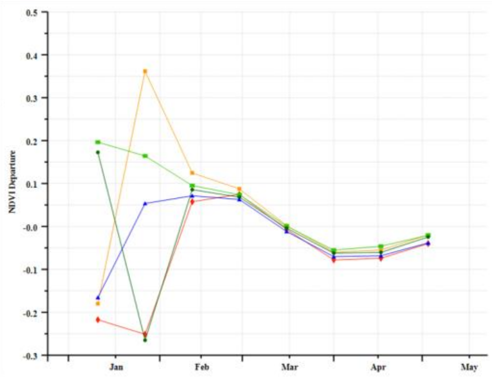
(a). Phenology of major crops



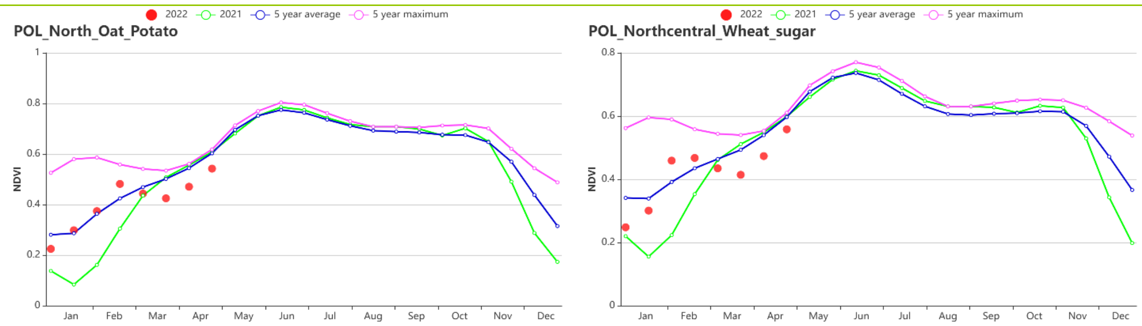


(b) Crop condition development graph based on NDVI (c) Maximum VCI

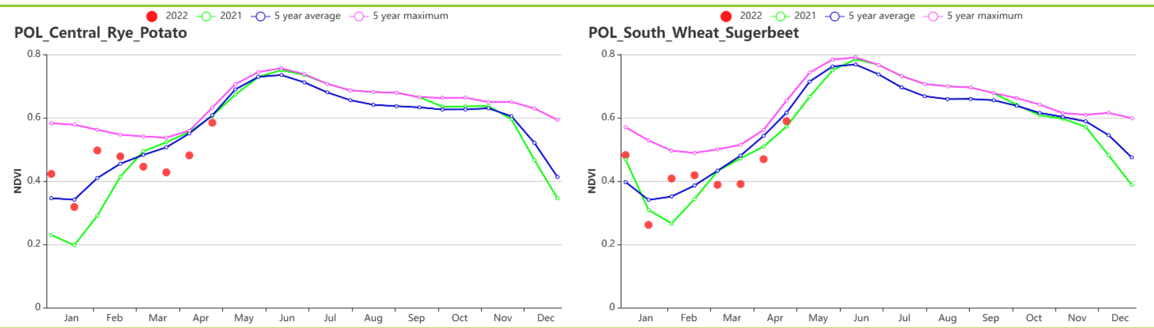




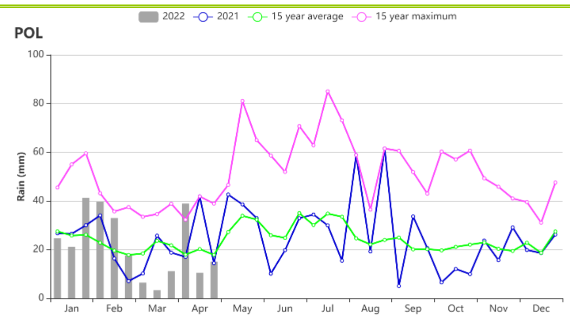
(d) Spatial NDVI patterns compared to 5YA (e) NDVI profiles



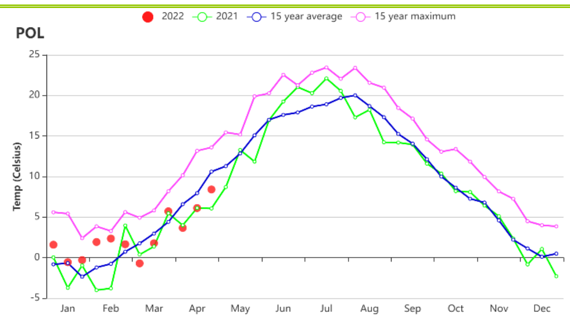
(f) Crop condition development graph based on NDVI, Northern oats and potatoes area (left) and Northern-central wheat and sugar beet area (right).



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



(h) Rainfall index



(i) Temperature Index

Table 3.65 Afghanistan's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, January - April 2022

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Central region	29	14	14.4	-0.6	1411	-4	221	12
Dry region	27	19	20.8	-0.7	1449	-3	171	13
Dry and irrigated cultivation region	91	41	16.4	-1.3	1369	-4	262	27
Dry and grazing region	1	-94	18.8	-1.6	1440	-3	77	0

Table 3.66 Afghanistan's agronomic indicators by sub-national regions, current season's values and departure from 5YA, January - April 2022

Region	Cropped arable land fraction		Cropping intensity		Maximum VCI
	Current (%)	Departure (%)	Current (%)	Departure (%)	Current
Central region	10	72	108	4	0.91
Dry region	6	122	110	-2	0.57
Dry and irrigated cultivation region	13	27	107	0	0.66
Dry and grazing region	1	159	101	-2	0.62

[ROU] Romania

Winter wheat is the main crop that is grown in Romania during this reporting period. It was sown last October. The proportion of irrigated cropland in Romania is only 4% and agro-meteorological conditions play a decisive role in the growth of most crops. At the national level, rainfall was 31% below average, down to 179 mm; average temperature was 0.3℃ lower and radiation 5% above average. The influence of low rainfall should be noted, as the water supply is vital for wheat growth. Due to the low rainfall, biomass decreased by 16%. The CALF of Romania decreased by 15% and the current maximum VCI is at 0.76, which is unfavorable for production. According to the NDVI at the country level, crop conditions were lower than average during the reporting period, which was consistent with the low rainfall.

Overall, crop conditions were not optimal in Romania during this reporting period. Winter wheat already suffered from drier-than-normal conditions between October and January. Rainfall in the coming months will be critical for sustained crop growth. Currently, the outlook for the 2022 wheat harvest in Romania is unfavorable.

Regional analysis

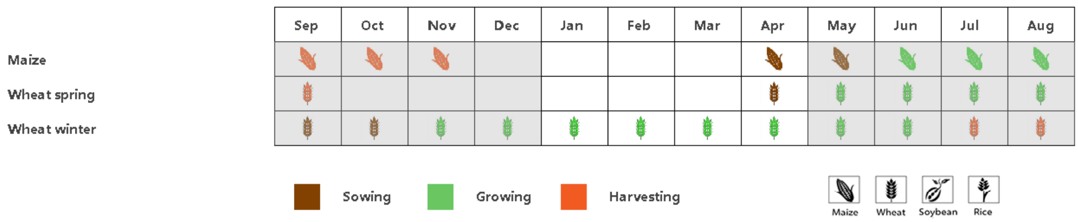
More spatial detail is provided below for three main agro −ecological zones: the **Central mixed farming and pasture Carpathian hills**, the **Eastern and southern maize, wheat and sugar beet plains** and the **Western and central maize, wheat and sugar beet plateau**.

For the **Central mixed farming and pasture Carpathian hills**, compared to the 15YA, rainfall decreased by as much as 25%, temperature was 0.4 ℃ lower and radiation was 4% up. The BIOMSS decreased by 11%. According to the NDVI development graph, crop conditions were below average almost throughout the entire reporting period. The regional average VCI maximum was 0.82. Since this agro −ecological zone occupies only a small fraction of cropland in Romania, its low NDVI is not significant for Romania's crop production.

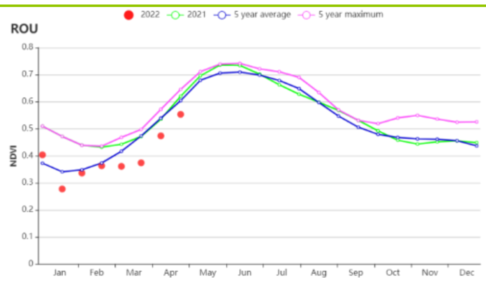
For the **Eastern and Southern maize, wheat and sugar beet plains**, as compared to the 15YA, rainfall decreased by 42%, temperature increased by 0.3 ℃, radiation increased by 6% and biomass decreased by 20%, which is the largest decrease among the three sub regions. The NDVI development graph shows that crop conditions dropped to below average after February. The VCI max value of this region was 0.73 and according to the distribution map, the blue and red line shows that VCI values were decreasing in March in most of the central and middle region, especially in the southeast area of this sub-region (counties of Tulcea and Constanta), representing about 14.3% of the national cropland. They indicate unfavorable crop conditions.

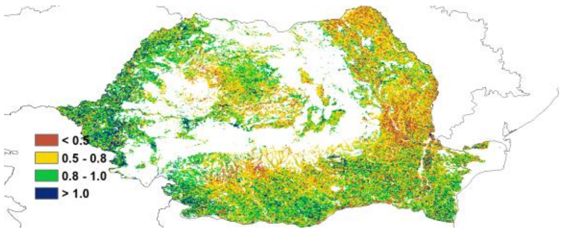
For the **Western and central maize, wheat and sugar beet plateau**, rainfall was lower than average by 21%, temperature was lower by 1.1 ℃, radiation was 3% higher and the biomass decreased by 11%. Maximum VCI of this region was 0.81. NDVI dropped below the 5YA starting in early March, but climbed to near average levels by the end of this monitoring period. Crop conditions were slightly unfavorable.

Figure 3.37 Romania's crop condition, January - April 2022



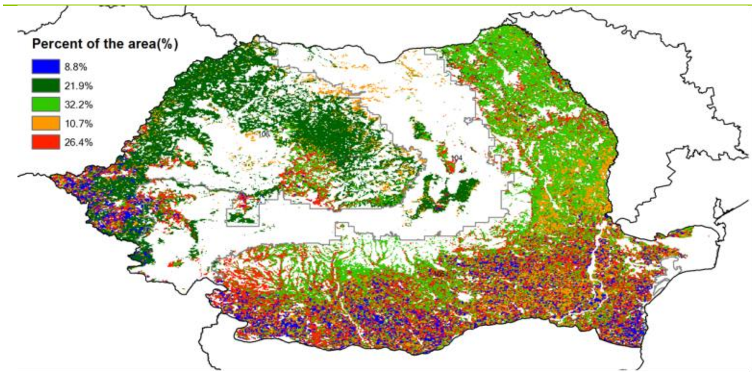
(a). Phenology of major crops

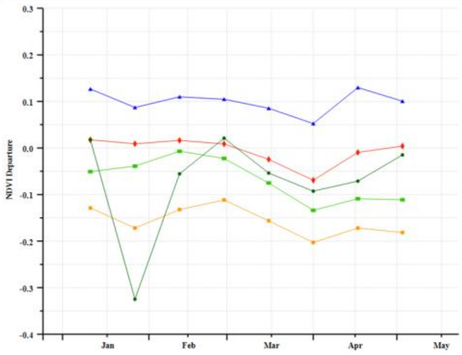




(b) Crop condition development graph based on NDVI

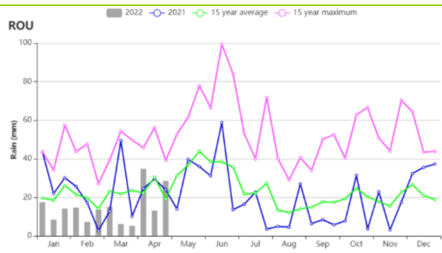
(c) Maximum VCI

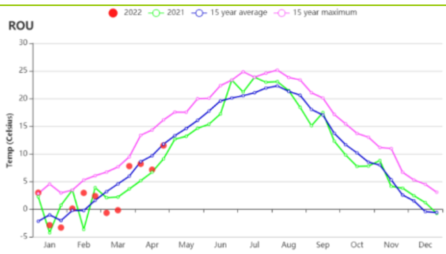




(d) Spatial NDVI patterns compared to 5YA

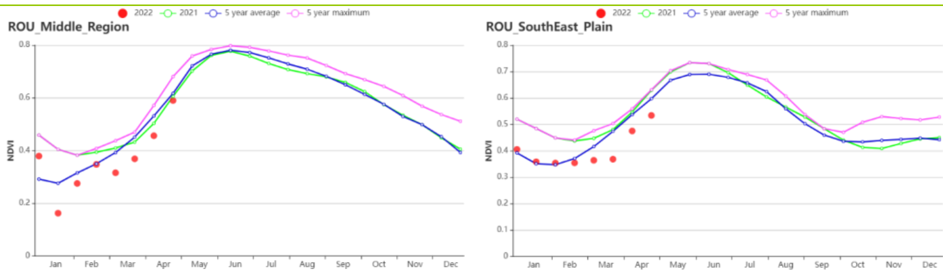
(e) NDVI profiles



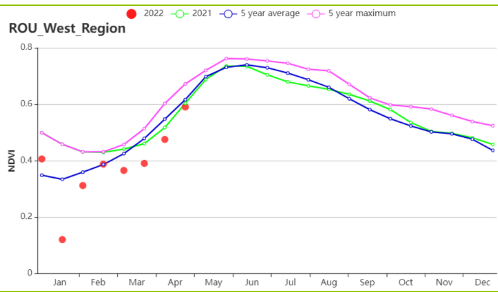


(f) Rainfall profiles

(g) Temperature profiles



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



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

Table 3.67 Romania's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, January - April 2022

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Central mixed farming and pasture Carpathian hills	218	-25	1.3	-0.4	664	4	381	-11
Eastern and southern maize, wheat and sugar beet plains	141	-42	4.1	0.3	694	6	391	-20
Western and central maize, wheat and sugar beet plateau	211	-21	2.2	-1.1	665	3	425	-11

Table 3.68 Romania's agronomic indicators by sub-national regions, current season's values and departure from 5YA, January - April 2022

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Central mixed farming and pasture Carpathian hills	90	-7	0.82
Eastern and southern maize, wheat and sugar beet plains	74	-19	0.73
Western and central maize, wheat and sugar beet plateau	90	-7	0.81

[RUS] Russia

From February to May in the Russian Federation, the snow melts and crops begin to grow. Different regions of Russia have different dates for the beginning of the growing season, depending on climatic conditions. Winter crops resume their growth after the winter dormancy and snow melt periods. The sowing of summer crops starts in April and lasts until late May.

The proportion of irrigated cropland in Russia is only 3% and agro-meteorological conditions play a decisive role in the growth of almost all crops. According to national data, NDVI development was slightly delayed until the end of March but reached the 5-year average by the end of April. Atmospheric precipitation generally remained above the 15-year average, except for late February, mid-March and late April. The air temperature mainly remained above the 15-year average values until March, and then it became equal to the 15-year average and the level of the previous year from March to April.

Most main regions of winter crop production showed a negative NDVI departure during the winter period. The only exception was the North Caucasus, which had mostly positive NDVI departure during almost the whole reporting period. Positive NDVI departures were observed in April in South Caucasus, Middle Volga and Central Chernozem regions. VCIx for these regions was 0.8-1 or even above 1. In most regions of winter crop production, winter crop yields are expected to be close to the level of the previous year or slightly above it. However, the agroclimatic conditions of the coming months are important and may still affect the yield of the winter crops.

Regional analysis

South Caucasus

Precipitation was below the 15-year average by 17%, which is the highest negative departure in Russia. Temperatures was equal to the 15-year average. RADPAR was 2% above the 15-year average. Biomass was below the 15-year average by 3%. The VCIx was 0.83. CALF was below the 5-year average by 2%. NDVI was mostly above the 5-year average from January to February, then slightly below average and returned to average levels in April. The decrease in precipitation during the analyzed period may indicate lower snow cover and lower soil moisture after winter dormancy period. But as the general situation was close to the average in April, we expect winter crop yields to be close to the level of the 5-year average.

North Caucasus

Atmospheric precipitation was 14% above the 15-year average. Temperatures was by 1.3°C above the 15-year average. RADPAR was 5% below the 15-year average. Biomass was 8% above the 15-year average. The VCIx was 0.90. CALF was 12% above the 5-year average. NDVI remained below the 5-year average and the previous year's level during winter possibly due to higher snow cover as indicated by the increase in precipitation. In April, NDVI increased significantly exceeding the 5-year maximum. As agroclimatic conditions for winter crops in the region were favorable, we can expect winter crop yields to be higher than the 5-year average and close to 5-year maximum.

Central Russia

Atmospheric precipitation was 18% above the 15-year average. Air temperatures were by 0.8°C above the 15-year average. RADPAR was 17% below the 15-year average. Biomass was 3% below the 15-year average. The VCIx was 0.80. CALF was 40% below the 5-year average. NDVI was mostly below the 5-year average and the previous year's level possibly due to decrease in CALF and higher snow cover in winter.

Generally, precipitation was favorable for winter crops, but the decrease in CALF can result in decrease in winter crop production. It might get compensated for by increased sowing of summer crops.

Central black soil area

The amount of precipitation was 30% above the 15-year average. Air temperatures were 1.3°C above the 15-year average. RADPAR was 19% below the 15-year average. Biomass was 4% above the 15-year average. The VCIx was 0.92. CALF was 6% below the 5-year average. NDVI was mostly below the 5-year average and the previous year's level during winter possibly due to higher snow cover. However, in April it increased reaching the level of the previous year and the 5-year average as agroclimatic conditions were generally favorable. As a result, we expect winter crop yields to be at the level of the 5-year average or above it.

Middle Volga

Atmospheric precipitation was 19% above the 15-year average. Air temperatures were 2.4°C above the 15-year average. RADPAR was 20% below the 15-year average. Biomass was 12% above the 15-year average. VCIx was 0.86. CALF was by 25% below 5-year average. Due to higher amount of snow indicated by increased atmospheric precipitation and lower CALF, registered NDVI was mostly below the 5-year average and the previous year's level until April, when it reached the previous year's level. As agroclimatic conditions were mainly favorable, and judging by NDVI pattern, we expect winter crop yields to be close to the level of the previous year.

Ural and western Volga

Atmospheric precipitation was 1% below the 15-year average. Temperatures were 2.3°C above the 15-year average. RADPAR was 8% below the 15-year average. Biomass was 12% above the 15-year average. VCIx was 0.83. CALF was 63% below the 5-year average. Possibly due to lower CALF, NDVI was mostly lower compared to the 5-year average and the previous year's level. Only in early April it became equal to the 5-year average. As agroclimatic conditions were close to average, we expect yields to be close to the 5-year average.

Eastern Siberia

Atmospheric precipitation was 17% above the 15-year average. Temperatures were 1.7°C above the 15-year average. RADPAR was 7% below the 15-year average. Biomass was 5% above the 15-year average. The VCIx was 0.55. CALF was 51% below 5-year average. Due to higher amount of snow, registered NDVI was significantly lower compared to the 5-year average and the previous year's level. The significant decrease in CALF can result in lower winter crop production. However, as the area of winter crops in this region is insignificant, it will not affect the production of winter crops in the Russian Federation.

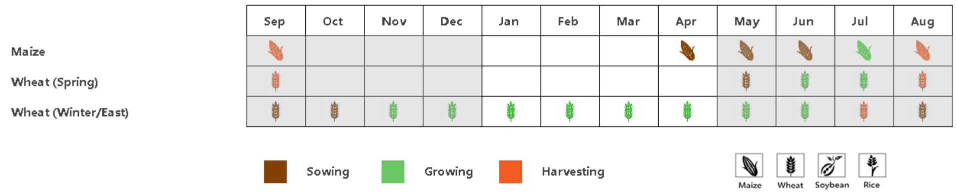
Middle Siberia

Precipitation was 9% below the 15-year average. Temperatures were by 0.8°C above the 15-year average. RADPAR was close to the 15-year average. Biomass was near the 15-year average. VCIx was 0.86. CALF was 20% above the 5-year average. NDVI was mostly below the 5-year average and the previous year's level possibly. As a result, winter crop production may decrease. But as the area of winter crops in this region is insignificant, the decrease in winter crop production will have little effect on the production of winter crops in the Russian Federation.

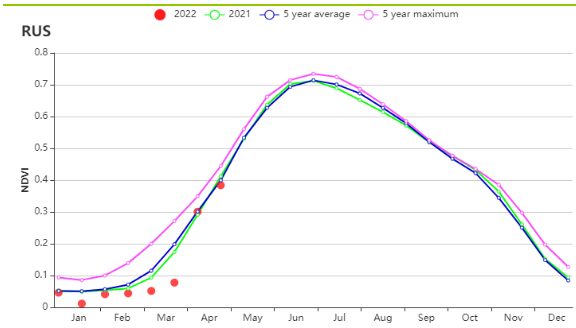
Western Siberia

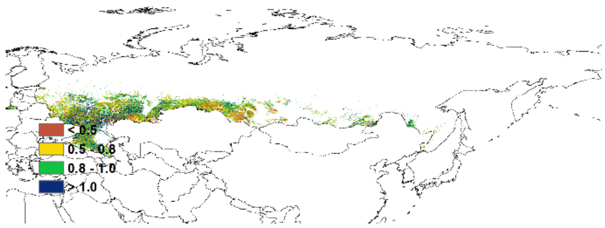
The amount of precipitation was 15% below the 15-year average. Air temperatures were 2.5°C above the 15-year average. RADPAR was near the 15-year average. Biomass was 10% higher than the 15-year average. VCIx was 0.71. CALF was 82% below the 5-year average. NDVI was mostly below the 5-year average and the previous year's level. As the area of winter crops in this region is insignificant, it will not affect the production of winter crops in the Russian Federation.

Figure 3.38 Russia's crop condition, January – April 2022

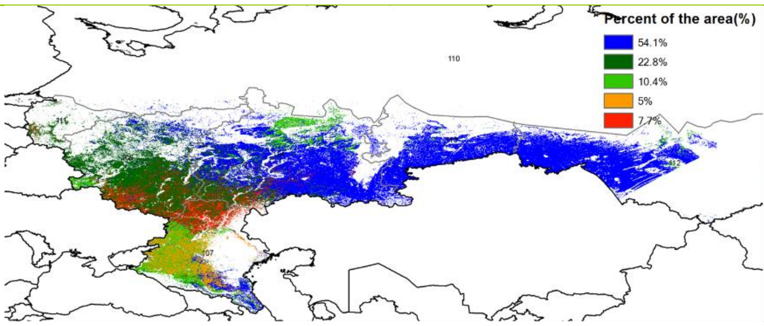


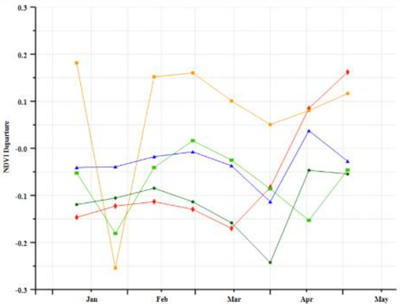
(a) Phenology of major crops



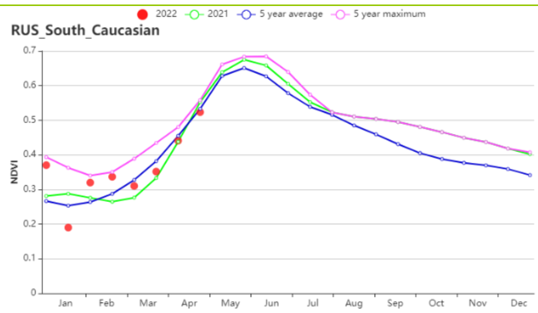


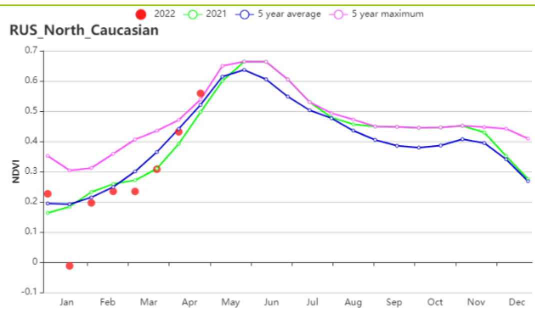
(b) Crop condition development graph based on NDVI (c) Maximum VCI



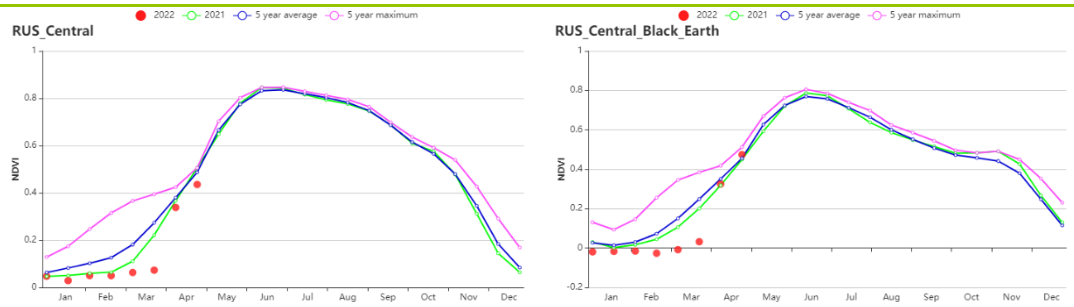


(d) Spatial NDVI patterns compared to 5YA (e) NDVI profiles

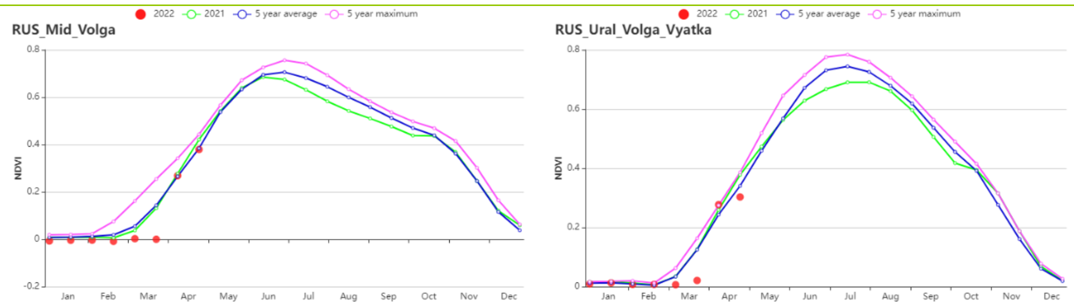




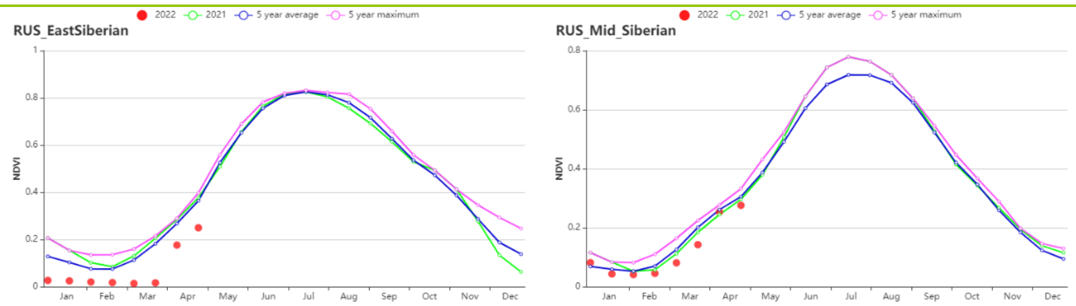
(f) Crop condition development graph based on NDVI, Southern Caucasus (left) and Northen Caucasus (right).



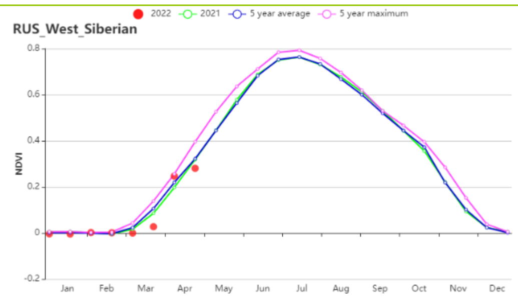
(g) Crop condition development graph based on NDVI, Central Russia (left) and Central black soils area (right).



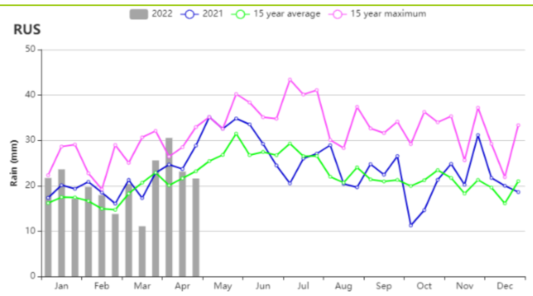
(h) Crop condition development graph based on NDVI, Middle Volga (left) and Ural and western Volga region (right).

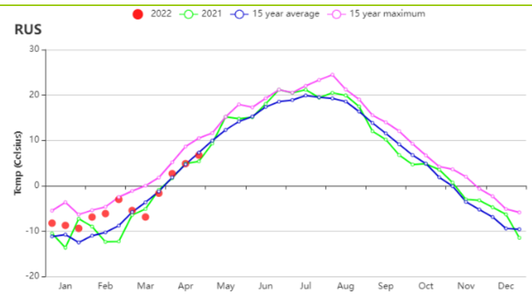


(i) Crop condition development graph based on NDVI, Eastern Siberia (left) and Middle Siberia (right).



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





(k) Rainfall index

(l) Temperature Index

Table 3.69 Russia's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, January – April 2022

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Central Russia	314	18	-2.1	0.8	315	-17	294	-3
Central black soils area	339	30	-0.5	1.3	365	-19	354	4
Eastern Siberia	226	17	-8.2	1.7	604	-7	205	5
Middle Siberia	113	-9	-10.7	0.8	635	0	160	0
Middle Volga	306	19	-2.7	2.4	343	-20	297	12
Northern Caucasus	288	14	2.8	1.3	558	-5	466	8
Southern Caucasus	232	-17	1.5	0.0	688	2	389	-3
Ural and western Volga region	185	-1	-4.9	2.3	388	-8	254	12
Western Siberia	163	-15	-5.4	2.5	478	0	247	10

Table 3.70 Russia's agronomic indicators by sub-national regions, current season's values and departure from 5YA, January – April 2022

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Central Russia	43	-40	0.80
Central black soils area	52	-6	0.92
Eastern Siberia	13	-51	0.55
Middle Siberia	8	20	0.86
Middle Volga	22	-25	0.86
Northern Caucasus	77	12	0.90
Southern Caucasus	71	-2	0.83
Ural and western Volga region	4	-63	0.83
Western Siberia	1	-82	0.71

[THA] Thailand

The period from January to April falls into the dry season in Thailand. It is the growing and harvest season for the second rice crop. Maize planting started in April. The proportion of irrigated cropland in Thailand is 23% and agro-meteorological conditions play an important role in the growth of most crops, rainfall is not the major influential factor. During this monitoring period, the rainfall was significantly above average (+34%), while the temperature was below the 15YA (TEMP -0.2°C) with below-average radiation (RADPAR -7%).

Sufficient rainfall led to above-average potential production (BIOMSS, +17%). According to the profile of the NDVI development graph, the crop conditions were favorable, even reaching the five-year maximum. The maximum vegetation condition index (VCIx) was relatively high at 0.94. The crop condition in 71.6% of cropped area was above average, while only 28.4% of the cropped area was below average, mainly in Chumphon, Prachuap Khilikhan, Surat Thani, Nakhon Si Thammarat, Kampaeng Phet and Udon Thani. Considering the cropped arable land fraction during the growing season was also above average (CALF, +12%), the CropWatch anticipated production for second rice is favorable.

Regional analysis

The regional analysis covers four main agro-ecological zones (AEZ) of Thailand: **Central double and triple-cropped rice lowlands, North-eastern single-cropped rice region, South-eastern horticulture area, and Western and southern hill areas**. The characteristics of rice planting are dependent on rice cultivation topology.

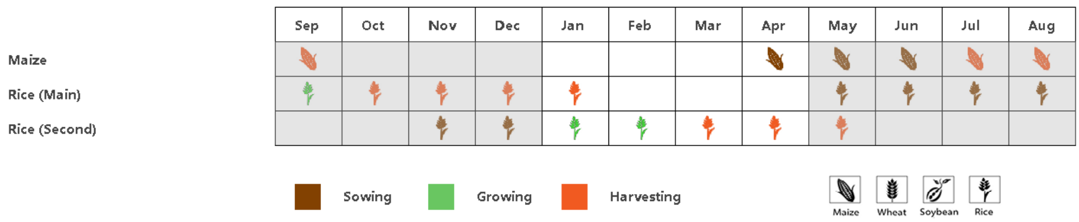
Central double and triple-cropped rice lowlands is the major region for the second rice**.** Indicators for this region show a similar pattern as for the whole country: Temperature and radiation were below average (TEMP -0.1°C; RADPAR -2%) whilst the rainfall was higher than the 15YA by 22%. These weather factors led to a biomass increase (+15%). The fraction of cropped arable land (CALF) increased by 8% and the maximum VCI was 0.88. According to the NDVI profile, the NDVI values exceeded the 5-year maximum from February to March 2022. In April, crop condition was close to the 5YA. The second rice production is forecasted to be favorable.

In the **North-eastern single-cropped rice region,** temperature was below average (-0.2ºC) and rainfall and radiation had increased by 31% and 2%, respectively. Estimated biomass was 14% above the 15YA. VCIx was 0.94 and CALF increased by 3% compared with the 5Y average.

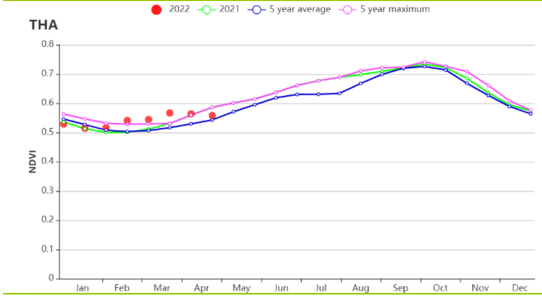
Crop conditions in the **Western and southern hill areas** experienced wetter than average conditions (RAIN +30%). Temperature and solar radiation were close to average (TEMP -0.2ºC; RADPAR -1%). Estimated biomass was higher by 16%. VCIx was 0.93.

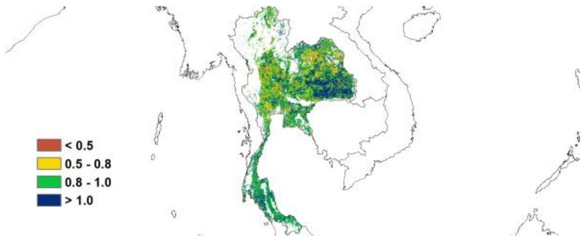
The **South-eastern horticulture area** experienced above-average rainfall (RAIN +48%) while the temperature was below average (TEMP -0.5℃) with averaged solar radiation (RADPAR 0%), leading to a biomass increase (BIOMSS 21%).

Figure 3.39 Thailand's crop condition, January - April 2022

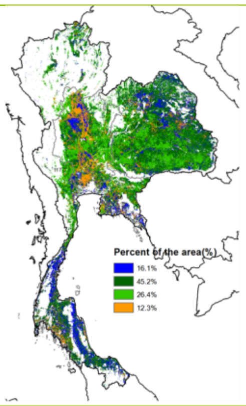


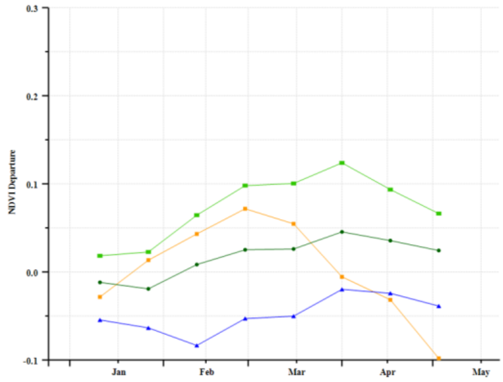
(a). Phenology of major crops



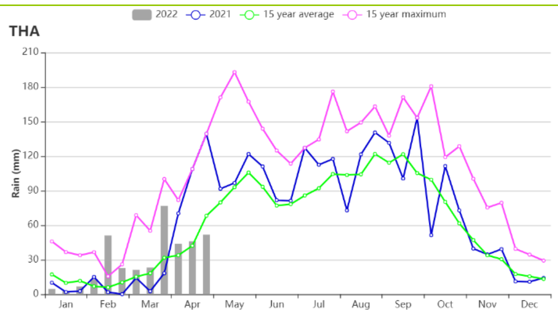


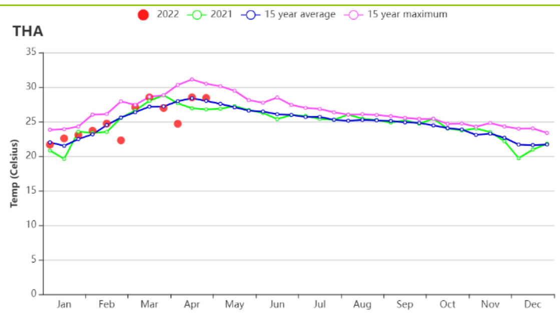
(b) Crop condition development graph based on NDVI (c) Maximum VCI



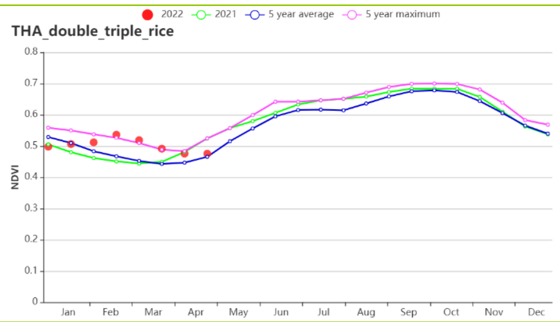


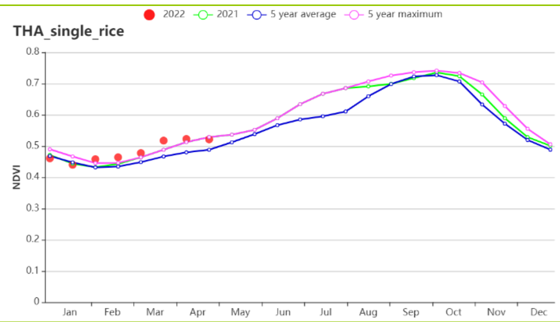
(d) Spatial NDVI patterns compared to 5YA (e) NDVI profiles



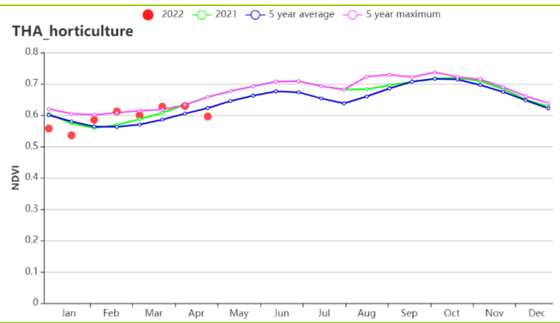


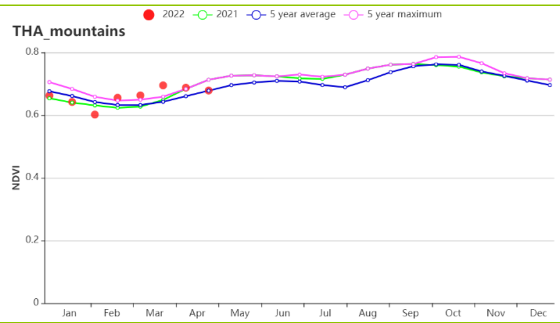
(f) Rainfall profiles (g) Temperature profiles





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





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

Table 3.71 Thailand's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, January - April 2022

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m^2)	Departure (%)	Current (gDM/m^2)	Departure (%)
Central double and triple-cropped rice lowlands	255	22	26.9	-0.1	1164	-2	819	15
South-eastern horticulture area	441	31	26.4	-0.2	1221	2	1060	14
Western and southern hill areas	395	30	24.3	0.0	1213	-1	936	16
Single-cropped rice north-eastern region	349	48	25.3	-0.5	1128	0	863	21

Table 3.72 Thailand's agronomic indicators by sub-national regions, current season's values and departure from 5YA, January - April 2022

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Central double and triple-cropped rice lowlands	93	8	0.88
South-eastern horticulture area	98	3	0.94
Western and southern hill areas	99	2	0.93
Single-cropped rice north-eastern region	88	24	0.96

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

[TUR] Turkey

Crop conditions in Turkey were generally below average throughout the monitoring period. The period from January to April is the growing season of winter crops. Winter wheat is the main crop. At the end of the monitoring period, maize and rice had been sown and winter wheat was in the late growth stages. The proportion of irrigated cropland in Turkey is 20% and agro-meteorological conditions play an important role in the growth of most crops, rainfall is not the major influential factor. Rainfall (RAIN -5%) was slightly below average, while sunshine (RADPAR +2%) and temperature (TEMP -0.1°C) were close to average, resulting in a potential biomass estimate that was below average (BIOMSS -5%). Cropped arable land fraction (CALF) was nearly 30% lower than the average level and the maximum VCI was 0.59.

From the crop condition development graph based on NDVI, NDVI nationwide was mostly lower than in the same period of last year. Especially in the eastern, central and western regions of Turkey, crop growth was below average during the monitoring period, mainly in the provinces of Bolu, Bilecik, Kutahya, Eskisehir, Afyonkarahisar, Sivas, Bingol, Mus, Erzurum and Bitlis, where CALF was also below average. The areas with better-than-average crop conditions were mainly located in and around the provinces of Edirne, Tekirdag, Kirklareli, Balikesir, Manisa, Izmir, and Aydin in western and northwestern Turkey. Overall, winter crop production in Turkey is likely to be lower than last year due to the largely inferior NDVI and lower CALF.

Regional analysis

The regional analysis covers four agro-ecological zones (AEZ): **the Black Sea region, the Central Anatolia region, the Eastern Anatolia region and the Marmara Aegean and Mediterranean lowland region.**

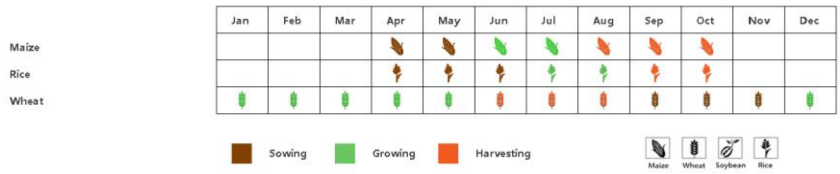
In **the Black Sea region**, crop conditions were below average throughout the monitoring period except for early January. Rainfall (RAIN +4.5%) was better than average, Temperature (TEMP -1.7°C) was slightly below average, and sunshine (RADPAR +1%) was slightly above average. Potential biomass (BIOMSS) was 9.6% lower than average. The maximum VCI was 0.7, and the cropped arable land fraction (CALF) had dropped by 7.5%. In summary, the crop yield is expected to be slightly lower than the average.

The Central Turkey's Anatolia region is the main grain producing area. Crop conditions were slightly below average throughout the monitoring period. Rainfall (RAIN -2.7%) was below average. Sunshine (RADPAR +2.7%) was slightly above average, temperature (TEMP -1.4°C) was slightly below average, and potential biomass (BIOMSS) decreased by 3.7%. Cropped arable land fraction (CALF) had dropped significantly. It was 51% lower than the average level. The time series rainfall profile for the area shows that rainfall in mid-February was significantly lower than the 15-year average, while it rose sharply in early March. Rainfall irregularities may have led to a significant reduction in the cropped arable land fraction (CALF). The maximum VCI average was 0.5 and crop yields in the region are expected to be below average.

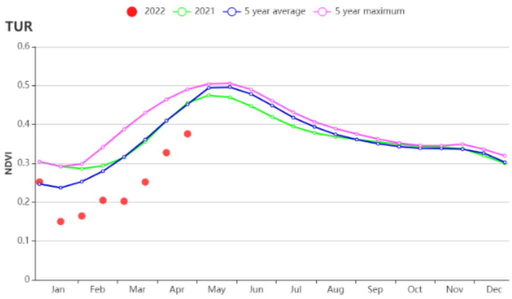
In **Eastern Anatolia**, crop conditions were above or near average in early and mid-January, but then below average. Rainfall (RAIN -13.3%) and temperature (TEMP -0.4°C) were below average. Sunshine was above average (RADPAR +1.4%). The combination of these factors led to a 6% reduction in potential biomass (BIOMSS). Cropped arable land fraction (CALF) decreased by 54%, the largest decrease among the four agro-ecological zones in Turkey, and the average value of the maximum VCI was 0.4. The significant CALF decrease for the region was due to the irregular rainfall during both the previous and current monitoring periods. Crop yields in the region are expected to be below average.

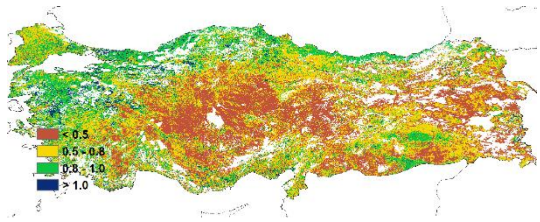
As shown by the crop condition development graph based on NDVI in **the Marmara Aegean and Mediterranean lowland region**, crop growth was near the average level or slightly better than the average level. Rainfall (RAIN -4.6%) and temperature (TEMP -0.7°C) were below average and Sunshine (RADPAR +2%) was slightly above average. Cropped arable land fraction (CALF) was lower than the 5YA (-11.7%). In addition, the maximum VCI for this area was 0.7. Crop yields and production in this region are expected to be slightly below average.

Figure 3.40 Turkey's crop condition, January-April 2022



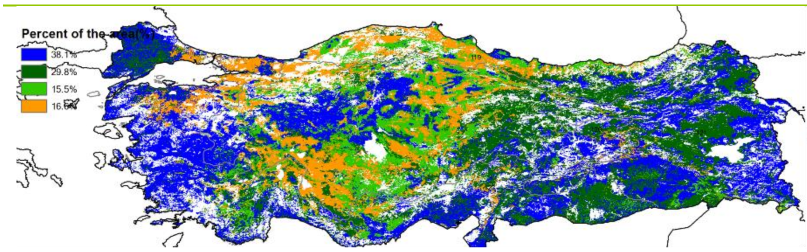
(a). Phenology of major crops

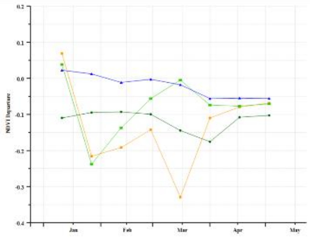




(b) Crop condition development graph based on NDVI

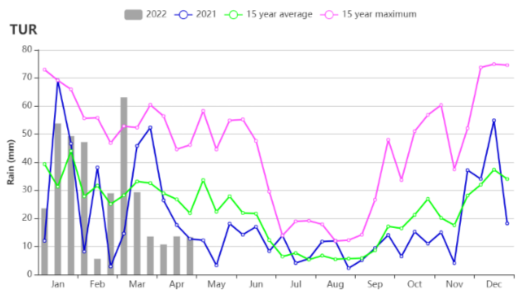
(c) Maximum VCI

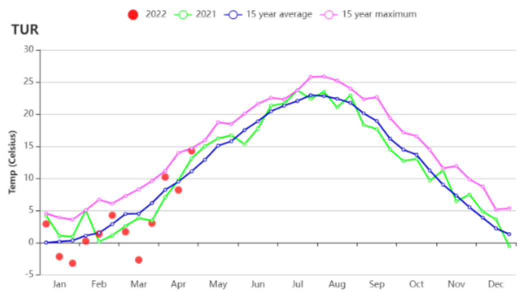




(d) Spatial NDVI patterns compared to 5YA

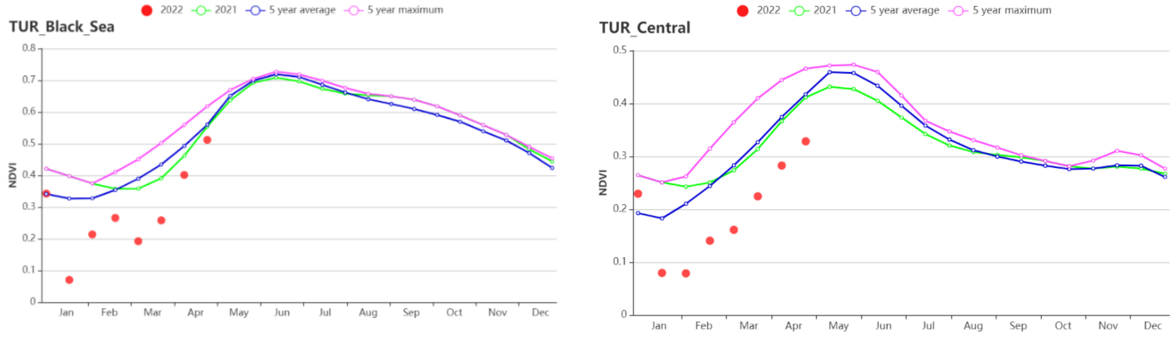
(e) NDVI profiles



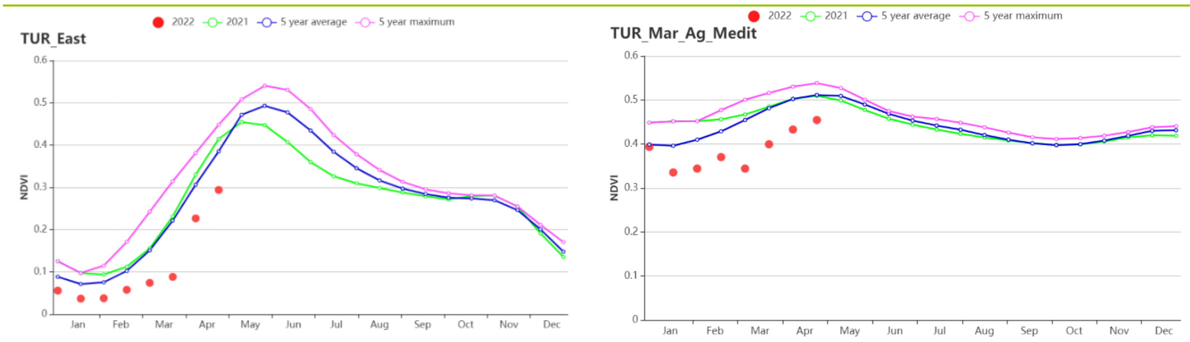


(f) Time series rainfall profile

(g) Time series temperature profile



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



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

Table 3. 73 Turkey's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, January-April 2022

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure from 15YA (%)	Current (° C)	Departure from 15YA (° C)	Current (MJ/m2)	Departure from 15YA (%)	Current (gDM/m2)	Departure from 15YA (%)
Black Sea region	451.6	4.5	0.6	-1.7	719.3	1.0	425.2	-9.6
Central Anatolia region	287.7	-2.7	1.8	-1.4	843.5	2.7	459.8	-3.7
Eastern Anatolia region	371.5	-13.3	-0.1	-0.4	837.2	1.4	383.9	-6.0
Marmara Agean Mediterranean lowland region	372.4	-4.6	6.6	-0.7	851.2	2.0	594.1	-4.1

Table 3. 74 Turkey's agronomic indicators by sub-national regions, current season's values and departure from 5YA, January-April 2022

Region	CALF		Maximum VCI
	Current(%)	Departure from 5YA (%)	Current

Black Sea region	69.7	-7.5	0.7
Central Anatolia region	20.9	-51.1	0.5
Eastern Anatolia region	17.5	-54.3	0.4
Marmara Agean Mediterranean lowland region	66.2	-11.7	0.7

[UKR] Ukraine

In the Ukraine, wheat, maize, canola and sunflower are the major crops. This monitoring period (January to April, 2022) leads to the flowering stage of wheat and canola, which will be reached in May. Main sowing period for maize will be in May as well.

The proportion of irrigated cropland in Ukraine is only 2% and agro-meteorological conditions play a decisive role in the growth of almost all crops. Russia's conflict against the Ukraine had started in February. It is disrupting crop production and export to the world market. Accordingly, the G7 Foreign and Development Ministers' meeting in May stated that "Considering Ukraine accounts for a considerable share of global food supply, the current conflict has caused one of the most serious foods and energy crises in modern history, which now threatens the most vulnerable people in the world." During this period, CropWatch observed that the overall agroclimatic situation was not favorable for crop growth. The rainfall (225 mm) and sunshine (502 MJ/m2) were 7% and 5% below the 15-year average, respectively, while temperature (1.8℃) was 0.2℃ above the average. Due to the drier and warmer climate, the potential biomass of crops was estimated to be 6% less than the 15-year average. In the agronomic aspect, the maximum VCI reached 0.73 only. Due to the conflict, only 61% of cropland was cropped in this season, which was significantly (-21%) lower than the 5-year average.

Remote sensing-based national crop condition development curve showed the NDVI was consistently lower than the 5-year average since March. In line with the national NDVI dynamics, NDVI in all crop areas was lower than average since March, especially in the fertile Donbas and other areas in eastern and northern Ukraine, accounting for 41.2% of the area. Crop productions prospects are highly unfavorable.

Since the winter crop area increased 3.8% in Ukraine, the production of winter crops increased 2.1% (520 thousand tonnes). The area increase of winter crops in the Donetsk and Luhansk regions of eastern Ukraine has led to a doubling of production in both regions.

Regional analysis

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

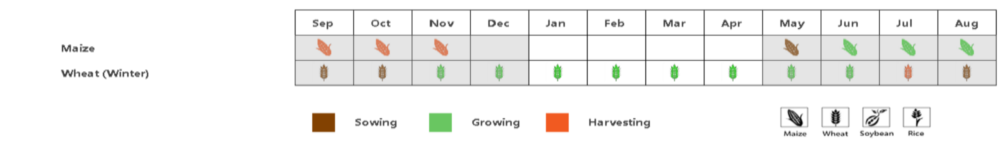
Central wheat area was a little deficient in rainfall (-6%) and had a lower radiation (-7%) in comparison to the 15-year average, while temperature was 0.4℃ higher. Weather-based projected biomass was close to the average (-1%). CALF (-22%) was greatly reduced to 0.53, indicating a large reduction in land being cropped. VCIx was 0.71. NDVI trended below average as well. Considering the lower CALF and below average development of NDVI, total winter wheat production will be far below average.

Eastern Carpathian hills received less rainfall (-6%) and had a lower temperature (-0.4℃). Radiation was near average. Lower rainfall and temperature negatively affected crops, and the potential biomass is estimated to be 6% lower than the 15-year average. Similar to the central wheat area, agronomic indicators showed low CALF (0.67, -28%) and VCIx (0.69). Combined with the low regional NDVI, the prospects for crop production are unfavorable.

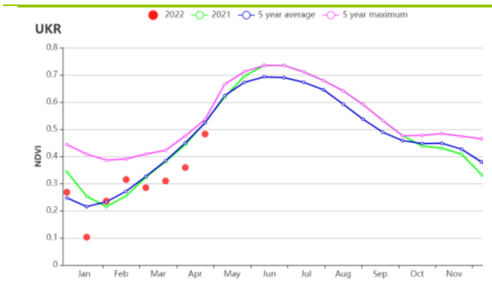
Northern wheat area experienced average rainfall (+0%) and higher temperature (+0.2℃) compared to the 15-year average. Sunshine decreased by 10% in this season. CropWatch estimated the potential biomass to be 3% below average. A 0.57 CALF indicates that only half of the arable land is cropped. This indicator was decreased by 26% compared to the 5-year average. The area also reached a moderate VCIx (0.72). In summary, the prospects for crop condition are unfavorable.

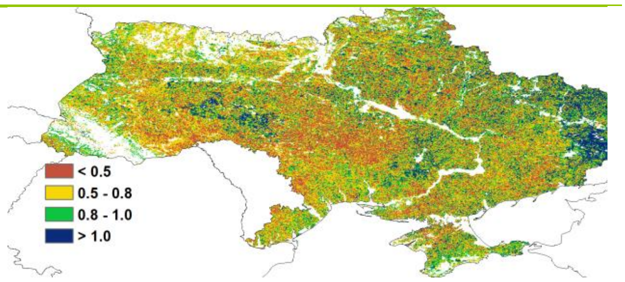
Southern wheat and maize area were highly deficient in rainfall (-19%) but experienced a higher temperature (+0.4℃) and a normal radiation (-1%). The shortage in rainfall led to an 11% decrease in potential biomass. Agronomic indicators were consistent with other AEZs, the region had a relatively low CALF (0.68, -16%) and VCIx (0.75). Regional NDVI was also marginally lower than the 5-year average indicating the crop condition was below average.

Figure 3.41 Ukraine's crop condition, January - April 2022

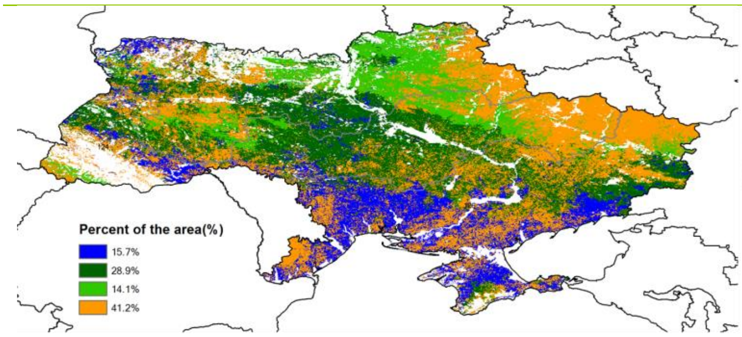


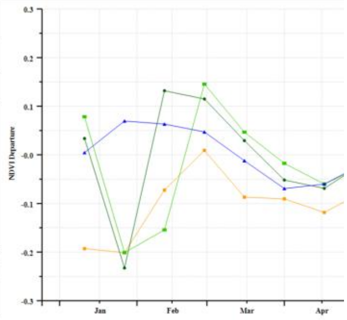
(a). Phenology of major crops



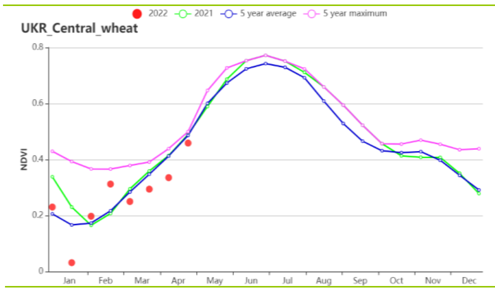


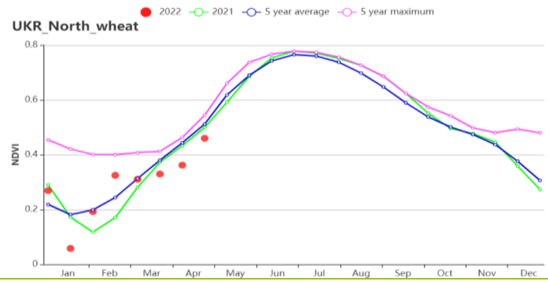
(b) Crop condition development graph based on NDVI (c) Maximum VCI



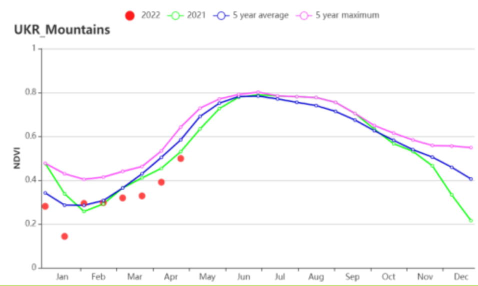


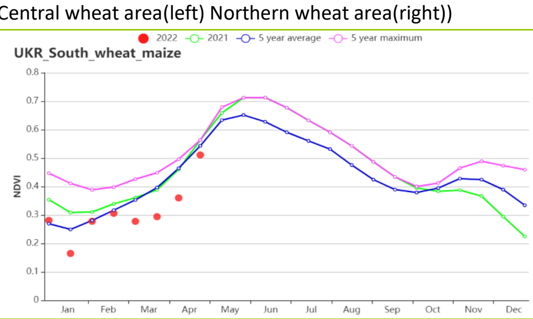
(d) Spatial NDVI patterns compared to 5YA (e) NDVI profiles



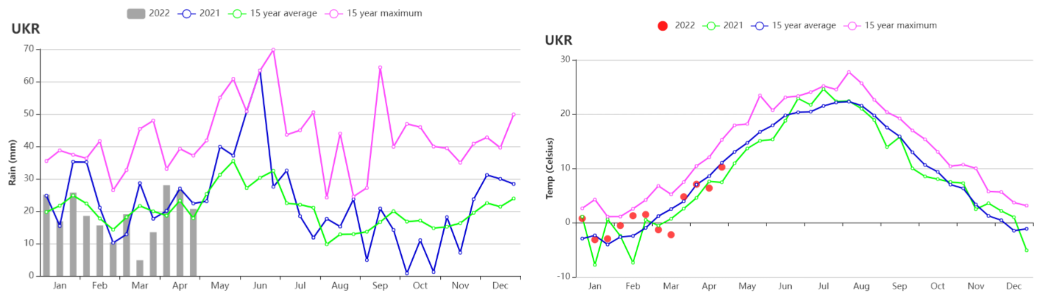


(e) Crop condition development graph based on NDVI (Central wheat area(left) Northern wheat area(right))





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



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

Table 3. 75 Ukraine's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, January - April 2022

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Central wheat area	217	-6	1.5	0.4	483	-7	415	-1
Eastern Carpathian hills	264	-6	1.1	-0.4	551	0	407	-6
Northern wheat area	251	0	1.2	0.2	432	-10	404	-3
Southern wheat and maize area	180	-19	2.7	0.4	567	-1	399	-11

Table 3. 76 Ukraine's agronomic indicators by sub-national regions, current season's values and departure from 5YA, January - April 2022

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Central wheat area	53	-22	0.71
Eastern Carpathian hills	67	-28	0.69
Northern wheat area	57	-26	0.72
Southern wheat and maize area	68	-16	0.75

Outlook for Ukraine winter crops production

Ukrainian winter crops were planted from September to November of the previous year. According to CropWatch, the total area of winter crops for the 2021/2022 season increased by 350 thousand ha from 2020/2021 season, or up by 3.8%. Among the winter crops, the wheat and barley area accounts for 7.595 million ha, while rapeseed accounts for 1.775 million ha.

About 3.076 million hectares of crops are distributed in the conflict zone, accounting for about 32.8% of the winter sown area in Ukraine, which is significantly lower than the current international mainstream report (50%). Of these, 2.376 million hectares are wheat crops, or about 31.3% of total wheat area. The area of oil seed rape is 700,000 hectares, or about 39.4% of the total oilseed rape area of the Ukraine.

The area under crops in the Lugansk and Donetsk regions increased by 364,000 hectares and 377,000 hectares, respectively, compared to last year, with a significant increase of 126.7% and 96.3%, respectively. Dnepropetrovsk and Odessa regions, which are more affected by the conflict, are the main winter crop producing regions in Ukraine, with 914,900 and 852,700 hectares of winter crop area, accounting for 9.8% and 9.1% of Ukraine's winter sown area, respectively. The conflict makes it dangerous for farmers to manage their fields due to land mines and shelling. They also lack access to inputs, such as fuel, seeds, fertilizer, chemicals for crop protection and last but not least, manpower. Farming operations also face economic uncertainty, as they do not know whether they can harvest and market their crops.

Table 3. 77 Monitoring and variation of winter crop area in Ukraine in 2022

State	Winter Crop area in 2021	Winter Crop area in 2022	Variation	Departure
	（Thousand ha）	(Thousand ha)	（Thousand ha）	(%)
Cherkasy	253.3	306.6	53.3	21
Chernihiv	209.8	170.2	-39.6	-18.9
Chernivtsi	37	29.7	-7.3	-19.9
Dnepropetrovsk	741.6	914.9	173.3	23.4
Donetsk	399.2	775.8	376.6	94.3
Ivano-Frankivsk	69.5	85.1	15.6	22.5
Kharkiv	594.8	627.1	32.3	5.4
Kherson	715.5	781.7	66.2	9.3
Khmelnytsky	304.2	209.3	-94.9	-31.2
Kirovograd	488	446.4	-41.6	-8.5
Kiev	232.6	172.5	-60.1	-25.8
Lugansk	287.1	650.7	363.6	126.7
Lviv	219.5	135.7	-83.8	-38.2
Nikolaev	765.7	911.8	146.1	19.1
Odessa	1107.5	852.7	-254.8	-23
Poltava	267.3	231.3	-36	-13.5
Rivne	141	152.9	11.9	8.5
Sumy	190.9	99.6	-91.3	-47.8
Ternopil	270	204.2	-65.8	-24.4
Vinnytsia	400.4	269.2	-131.2	-32.8
Volyn	206.4	197.6	-8.8	-4.2
Transcarpathian	24.4	18.3	-6.1	-25.1
Zaporozhye	862.6	973.4	110.8	12.8

Zhytomyr	195.4	153	-42.4	-21.7
Ukraine*	9020.9	9369.9	349	3.90%

* Crimea is not included

Most of the Ukraine is rain-fed arable land. Rainfall was 6-19% below the average of the past 15 years. This, in combination with cooler spring temperatures and lack of inputs led to an overall decline in crop growth across Ukraine in late April (Figure 1), with 51% of the country's winter crop growing areas having lower crop growth than the average level of the same period of the past five years. The situation improved in early May (Figure 1). Only 29% of winter crops were worse than average level, while 52% was close to average. The potential total national winter cereal production is estimated at 44.967 million tons, an increase of 520,000 tons or only 1.2% (Table 2).

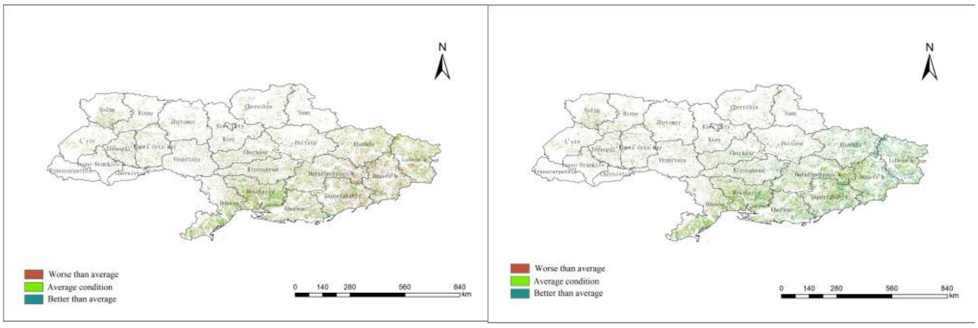


Figure 3.42 Winter crop condition in Ukraine in later April (left) and early May (right) 2022

The situation of winter crops varies significantly among the Ukrainian regions. Donetsk, Luhansk and Kharkiv in eastern Ukraine had 10% higher precipitation, which makes the winter grain yields in the three regions increase by 18%, 13.3% and 3.9% year-on-year, respectively. Coupled with the increase in winter crops planting area, the total winter crops production in Donetsk and Luhansk regions could potentially double, increasing by 2.468 million tons and 1.871 million tons, respectively. In Kharkiv, winter crop production is anticipated to increase by 319 thousand tons, or 9.6%. These numbers show the current potential for winter wheat production. They do not take into account the impact of the conflict on farming operations, logistics and trade.

In the south-central Ukraine, the Cherkasy, Dnepropetrovsk, Kherson, Nikolaev and Zaporozhye regions were affected by dry weather and the forecasted crop yields decreased to different degrees, but thanks to the significant increase in the area planted with winter cereals, most of the major producing regions in the south-central Ukraine achieved an increase in potential production. Most of the northern and western regions of Ukraine suffered from the double impact of shrinking acreage and drought-induced yield decline, and an overall decline in winter cereal production.

Table 3. 78 Crop production forecast for winter crops for 2022 in Ukraine

States	2021	2022				
	Production (Thousand tons)	Yield variation (%)	Area Variation (%)	Production (Thousand tons)	Variation of Production (%)	Variation of Production (Thousand tons)
Cherkasy	1509	-1.8	21	1793	18.9	285
Chernihiv	1120	-7	-18.9	844	-24.6	-275
Chernivtsi	241	-1.7	-19.7	190	-21.1	-51
Dnepropetrovsk	3466	-5.6	23.4	4038	16.5	572
Donetsk	1907	18	94.3	4375	129.4	2468
Ivano-Frankivsk	413	-2.8	22.4	492	19	79
Kharkiv	3333	3.9	5.4	3653	9.6	319
Kherson	3129	-6.8	9.3	3187	1.8	58
Khmelnytsky	1931	-3.7	-31.2	1279	-33.8	-652
Kirovograd	2470	-7.6	-8.5	2088	-15.5	-383
Kiev	1435	-2.6	-25.8	1037	-27.8	-398
Lugansk	1194	13.3	126.6	3065	156.8	1871
Lviv	1178	-0.7	-38.2	723	-38.6	-455
Nikolaev	3350	-2.4	19.1	3893	16.2	543
Odessa	4439	-3.5	-23	3299	-25.7	-1139
Poltava	1561	-4.7	-13.5	1287	-17.6	-274
Rivne	795	-1.3	8.4	851	7.1	56
Sumy	1056	-4.6	-47.8	526	-50.2	-530
Ternopil	1773	1.9	-24.4	1367	-22.9	-406
Vinnytsia	2396	-11.2	-32.8	1431	-40.3	-965
Volyn	979	-3.2	-4.3	907	-7.4	-72
Transcarpathian	87	-1.8	-25	64	-26.3	-23
Zaporozhye	3577	-8.4	12.8	3697	3.4	120
Zhytomyr	997	-1.3	-21.7	770	-22.7	-227
Ukraine*	44447	-2.6	3.9	44967	1.2	520

* Crimea is not included

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

[USA] United States

During this monitoring period from January to April 2022, winter wheat was the main crop being cultivated. It passed through tillering, green up, jointing and heading stages. Maize, rice and soybeans planting started in April. In general, the conditions for winter wheat were below average due to dry and cool weather.

The proportion of irrigated cropland in United States is 16% and agro-meteorological conditions play an important role in the growth of most crops. Rainfall is not the major influential factor on irrigated cropland. Rainfall and temperature were 5% and 0.3°C below the 15-year average, respectively. Rainfall deficits were prevalent in major wheat production areas such as Kansas (-27%), Texas (-30%), Nebraska (-34%) and California (-66%). Below average rainfall in those major winter crops producing states resulted in water stress as the water demands for winter wheat increased significantly from green-up. The serious shortage of water caused a significant decrease of potential biomass, such as in Kansas (-17%), Texas (-18%), Nebraska (-17%) and Carlifornia (-33%). Due to below average rainfall, poor crop conditions were observed by CropWatch agronomic indicators. The cropped arable land fraction (CALF) was 47%, which was 11% below the average of the past five years. Main regions with a drop in CALF were the Southern and Northern Plains, as well as the Corn belt. Crop conditions were poor across the highlands with maximum VCI values below 0.5. Normalized Difference Vegetation Index (NDVI) departure clustering showed that the area most affected by the drought conditions was the Southern Plains. In short, CropWatch assesses that crop conditions were poor for most of the winter wheat during this reporting period.

Regional Analysis

Winter crops are grown mainly in the Southern Plains (No. 196), Northwest (No. 195) and California (No. 190). Winter wheat growth conditions are highly spatially heterogeneous due to different agroclimatic, agronomic and irrigation infrastructure conditions.

1. Southern Plains

The Southern Plains is the most important winter wheat growing region and includes Kansas, Oklahoma and Texas. During this reporting period, winter wheat growth was poor due to severe water shortages caused by insufficient rainfall between March and April (Figure h). CropWatch agroclimatic indicators showed below-average rainfall (-14%) and temperature (-0.4°C), which were not conducive to winter wheat growth. The maximum vegetation condition index (VCIx) was 0.58 and potential biomass was 13% below average. In addition to the poor conditions, it is noteworthy that the percentage of the cropped arable land fraction was reduced by 24% compared to the 5-year average. The reduced CALF might be related to the delayed sowing of the summer crops. In short, CropWatch assesses crop growth in the southern plains as below average and crop production for this monitoring period is expected to be below average.

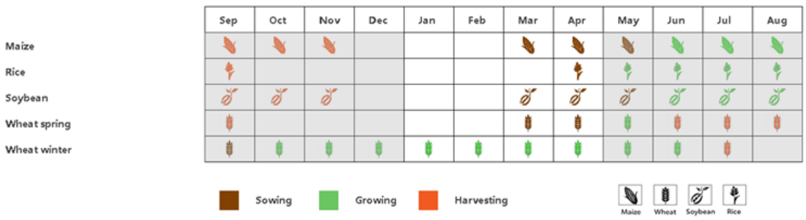
2. Northwest

The Northwest is another important winter wheat production area in the United States. Crop growth conditions in this region were slightly below average due to cold and dry weather, but still better than in 2021. Compared to the past 15-year average, rainfall and temperatures were 14% and 0.8°C below average, respectively. Potential biomass in the Northwest was 7% below average due to dry and cold weather. Other agronomic indicators show near-average crop conditions, with CALF 3% above average and a maximum vegetation condition index of 0.78.

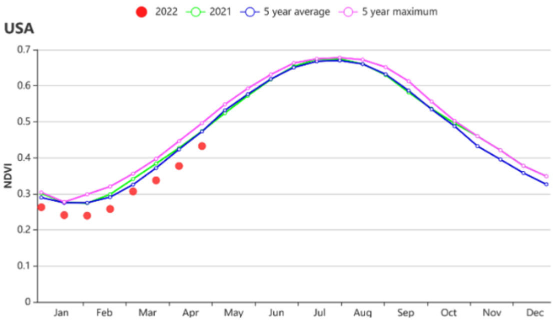
3. California

California is the most important producer of vegetables and fruits in the United States. It also is a major producer of winter wheat, which reached the maturity stage by late April. NDVI development profile indicates below-average crop conditions. California experienced severe rainfall deficits throughout the monitoring period. Rainfall was 65% lower than the 15YA and temperatures were 0.5°C warmer than the 15YA. The severe drought resulted in a 32% reduction in potential biomass. Most crops in California can be irrigated, although water levels in the reservoirs are relatively low due to the prolonged drought. As a result of the irrigation, CALF and the VCIx were near average during this reporting period. In short, CropWatch assesses California's crop conditions as below average.

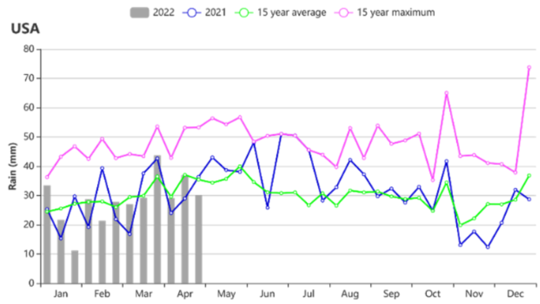
Figure 3. 43 United States crop condition, January-April 2022



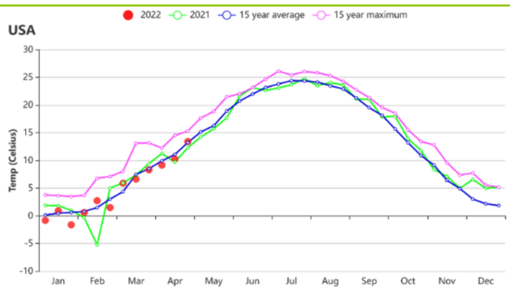
(a). Phenology of United States from January to April 2022



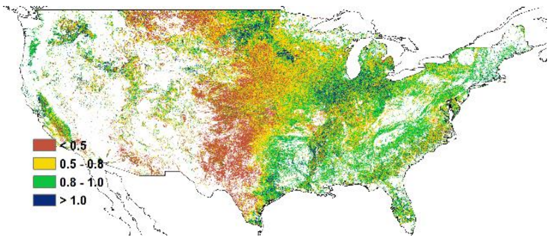
(b). Crop condition development graph based on NDVI



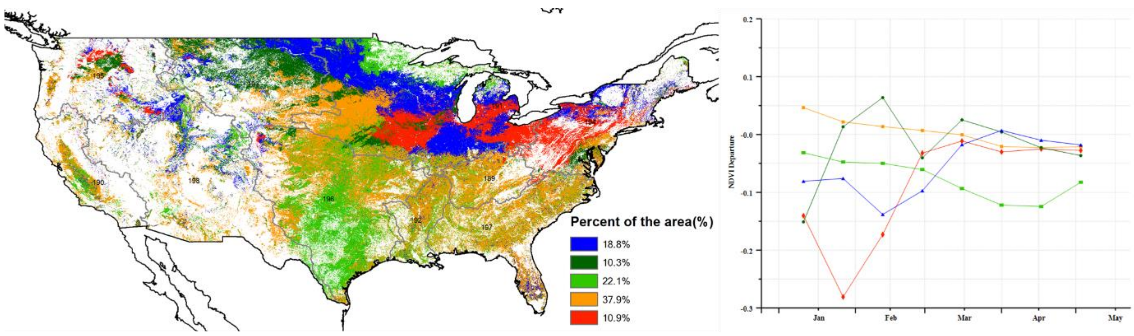
(c). Time series rainfall profile



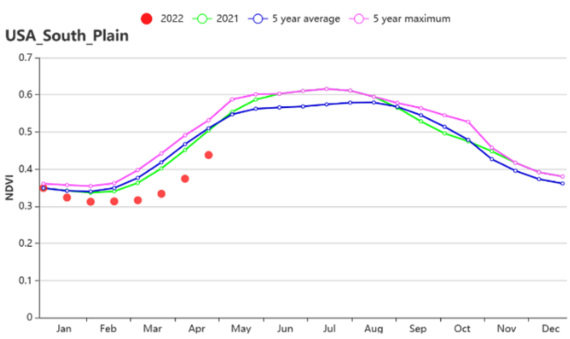
(d). Time series temperature profile

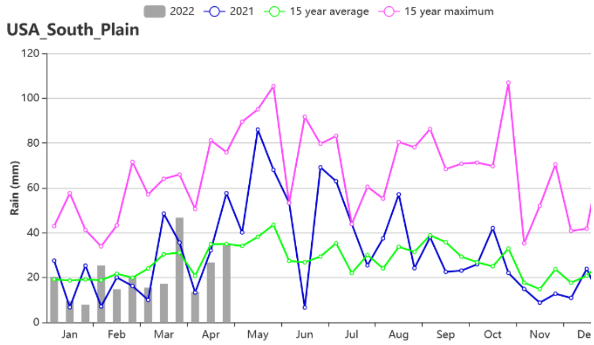


(e). Maximum VCI



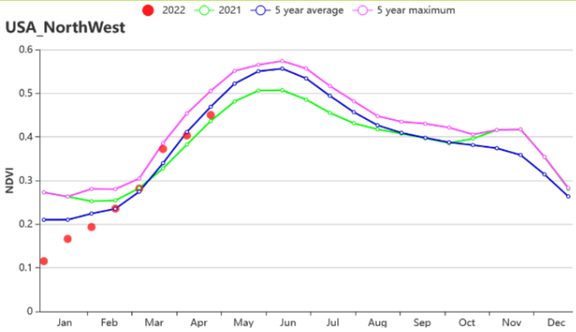
(f). Spatial distribution of NDVI profiles

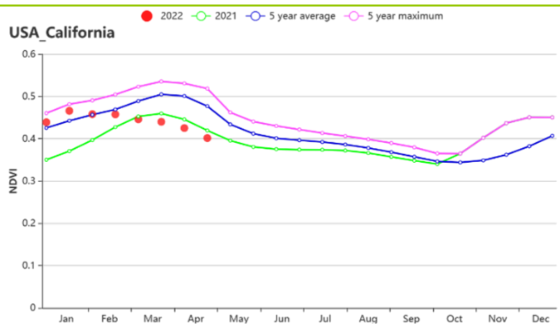




(g). Crop condition development graph in South Plain

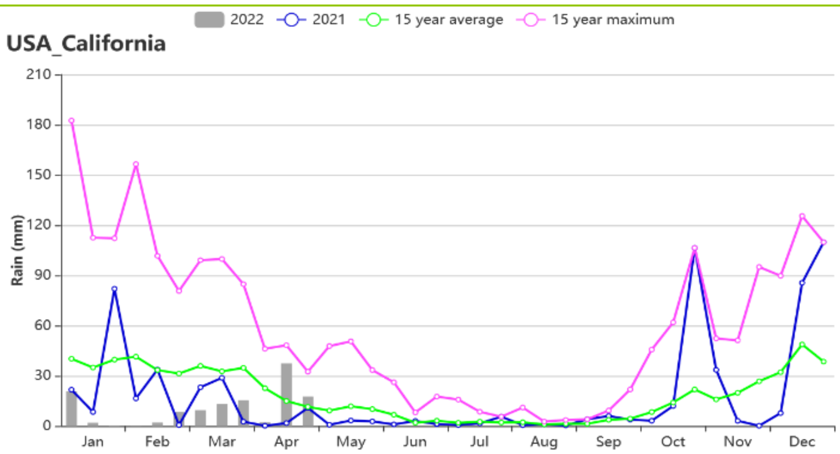
(h).X Time series rainfall pofile





(i). Crop condition development graph in Northwest

(j). Crop condition development graph in California



(k). Time series rainfall pofile of Carlifornia

Table 3.79 United States' agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, January - April 2022

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m2)	Departure from 15YA (%)	Current (gDM/m2)	Departure from 15YA (%)
Corn Belt	343	3	-0.9	-1.1	663	-2	358	-12
Northern Plains	217	1	-2.3	-0.9	746	0	319	-9
Lower Mississippi	526	-3	10.8	-0.4	859	7	813	-3
Southeast	435	-1	12.7	0.6	922	4	847	5
Southern Plains	435	-1	12.7	0.6	922	4	847	5
North-eastern areas	419	-1	1.5	0.1	703	3	444	1
Northwest	377	-14	0.4	-0.8	663	1	371	-7
Blue Grass region	559	7	6.3	-0.2	796	7	647	-1
California	129	-65	9.3	0.5	981	9	358	-32

Table 3.80 United States'agronomic indicators by sub-national regions, current season's values and departure, January - April 2022

Region	CALF		Maximum VCI
	Current(%)	Departure from 5YA (%)	Current
Corn Belt	30	-19	0.77
Northern Plains	4	-63	0.63
Lower Mississippi	78	4	0.85
Southeast	99	0	0.83
Southern Plains	48	-24	0.58
North-eastern areas	95	2	0.83
Northwest	56	3	0.78
Blue Grass region	97	0	0.78
California	74	-1	0.75

[UZB] Uzbekistan

The monitoring period from January to April covers the main growth period of winter wheat and the planting of maize in Uzbekistan. The proportion of irrigated cropland in Uzbekistan is 30% and agro-meteorological conditions play an important role in the growth of most crops. Rainfall is not the major influential factor on irrigated cropland. The national average VCIx was 0.86, and the cropped arable land fraction increased by 11%. Among the CropWatch agroclimatic indicators, the temperature had increased by 1.7°C compared to the 15YA, especially in January and April. Rainfall was significantly above average in January and March, while below average in February and April. The accumulated rainfall decreased by 9%. RADPAR was close to average. The combination of these factors resulted in a decreased BIOMSS (-4%) compared to the 15YA.

The monitoring results reported in the last bulletin showed that the agroclimatic conditions were not favorable for the sowing and early growth of winter wheat, and the results of this monitoring period also indicated that the overall crop conditions were unfavorable, especially for the western part of Kashkadarya in the Eastern hilly cereals zone. Both the NDVI cluster graph and maximum VCI map show poor crop condition in those regions. At the national level, the NDVI of Uzbekistan had returned to the average level in April. Prospects for production of winter cereals are slightly unfavorable.

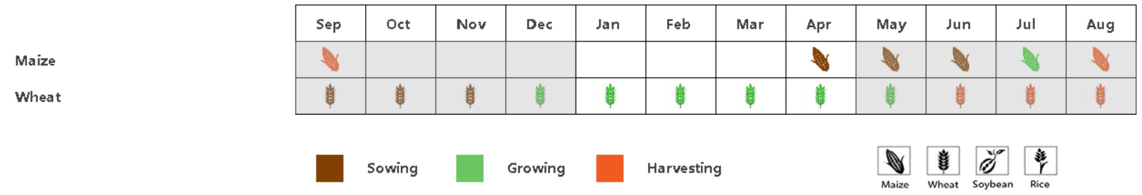
Regional analysis

In **the Central region with sparse crops**, crop conditions were roughly average. RAIN and RADPAR were below the fifteen-year average (-3% and -2%), whereas the temperature was significantly above average (TEMP +2.2°C). Therefore, BIOMSS had decreased by 6%. The cropped arable land fraction was only 2%, and the maximum VCI was 0.68.

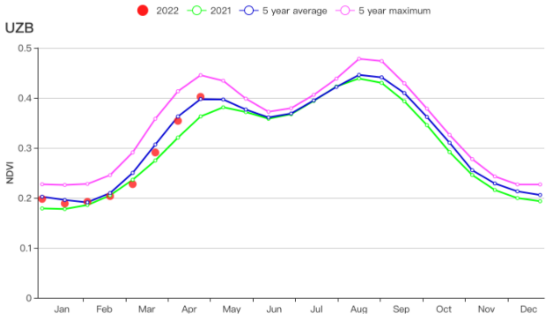
In **the Eastern hilly cereals zone**, NDVI was below the five-year average from late February to middle April and returned to the average level in late April. The RAIN was below 15YA (-9%), and TEMP was above the average (+1.7°C). The combination of these factors resulted in a decreased BIOMSS (-4%). The maximum VCI index was 0.84 and Cropped Arable Land Fraction increased by 11% compared to the five-year average. Overall crop prospects are expected to be close to normal.

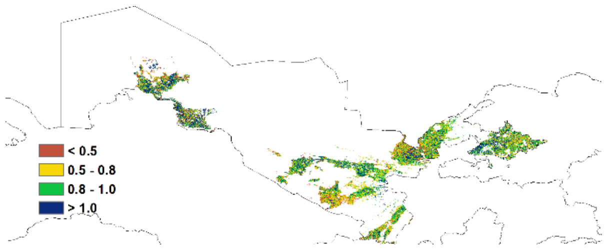
In **the Aral Sea cotton zone**, RAIN was 16% below the fifteen-year average and RADPAR was below average as well (-4%), while TEMP was above average (+1.6°C). These factors resulted in a slight decrease in BIOMSS (-6%). The maximum VCI graph shows that most of this region had high values of VCIx (>1.0), and the average VCIx of this region is 0.98. No croplands are cultivated during this monitoring period.

Figure 3.44 Uzbekistan crop condition, January - April 2022



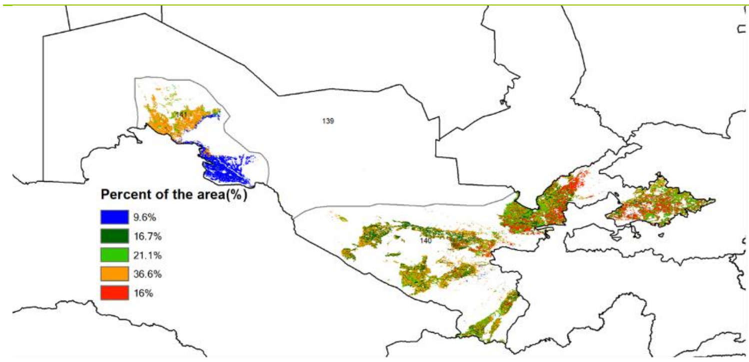
(a) Phenology of major crops

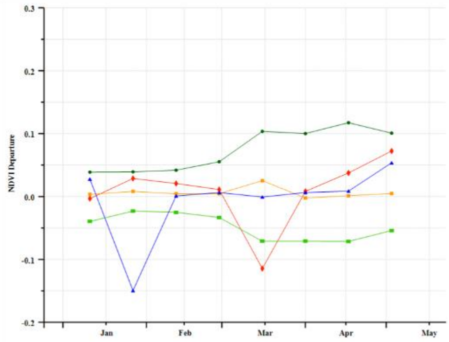




(b) Crop condition development graph based on NDVI

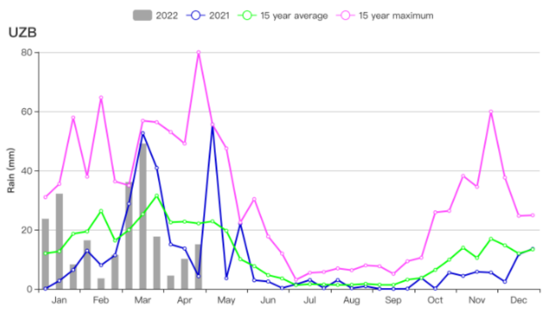
(c) Maximum VCI

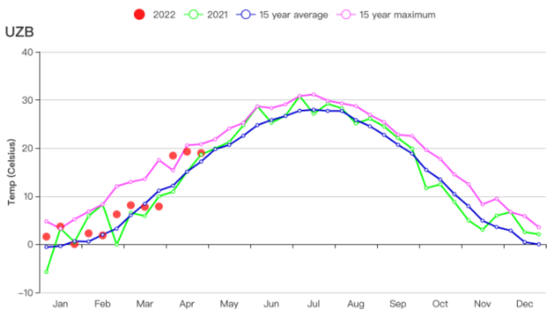




(d) Spatial NDVI patterns compared to 5YA

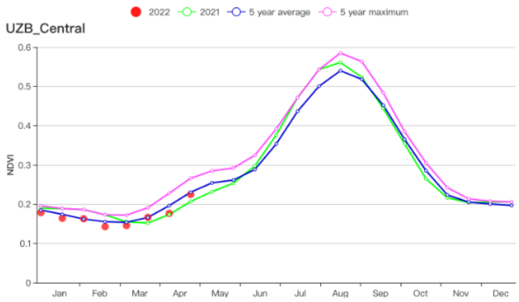
(e) NDVI profiles

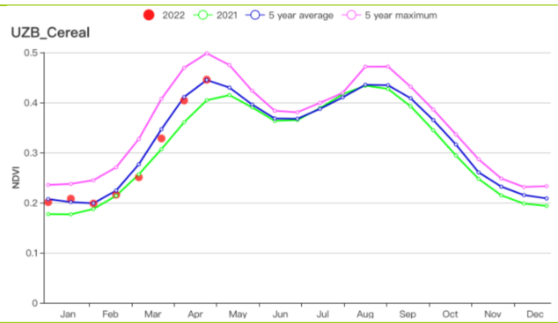




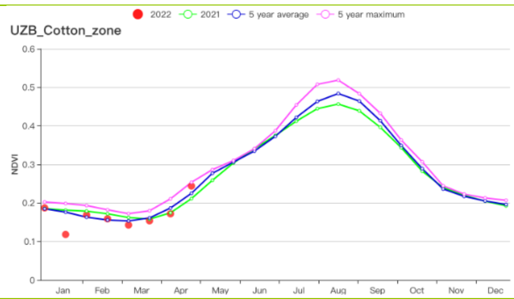
(f) Rainfall profiles

(g) Temperature profiles





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



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

Table 3.81 Uzbekistan's agroclimatic indicators by sub-national regions, current season's values, and departure from 15YA, January - April 2022

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m2)	Departure (%)	Current (gDM/m2)	Departure (%)
Central region with sparse crops	118	-3	9	2.2	810	-2	314	-6
Eastern hilly cereals zone	248	-9	8.1	1.7	842	0	463	-4
Aral Sea cotton zone	55	-16	7.3	1.6	773	-4	242	-6

Table 3.82 Uzbekistan's agronomic indicators by sub-national regions, current season's values, and departure from 5YA, January - April 2022

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Central region with sparse crops	2	25	0.68
Eastern hilly cereals zone	58	11	0.82
Aral Sea cotton zone	2	119	0.98

[VNM] Vietnam

This monitoring period covers the growing period and harvest of winter rice, followed by planting of summer rice in the central part. The winter-spring rice in the Mekong Delta and southeast of Vietnam was harvested in February. It was followed by summer-autumn rice in March. The planting of winter-spring rice in the north had started in January. It will be harvested in May.

The proportion of irrigated cropland in Vietnam is 32% and agro-meteorological conditions play an important role in the growth of most crops. Rainfall is not the major influential factor on irrigated cropland. CropWatch agro-climatic indicators showed average radiation (975 MJ/m2, +0%) and temperature (20.7°C, -0.1°C). Because of higher precipitation (381 mm, +24%), the BIOMSS (+11%) showed an increase compared to the 15YA. The VCIx (0.93) was high, and the CALF (96%, +0%) was close to the 5YA.

Based on the NDVI development graph, the crop conditions were below the 5YA in the first half of this monitoring period. The large negative departures in January and February were presumably caused by cloud cover in the satellite images. The crop conditions rose to near the 5YA in early March and exceeded the maximum in late March. From January to April the precipitation was generally near the 15YA and surpassed the fifteen-year-maximum in mid-February and late March. While the temperature was above the 15YA, except for late February and early April, when it was below the 15YA. As to the spatial distribution of NDVI profiles, crop conditions on 54.2% were near average, located in the northwest and the south of Vietnam. Overall, the crop conditions were favorable. The winter rice in the north, which will be harvested in May, experienced above-average conditions.

Regional analysis

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

In the **Central Highlands**, due to the significant increase of RAIN (309 mm, +20%), the BIOMSS increased by 12%. CALF was 99% and VCIx was 0.96. According to the NDVI development graph, crop conditions were higher than the 5YA since February and exceeded the five-year-maximum at the end of the monitoring period. Based on the agroclimatic indicators, the crop conditions were expected to be above average.

In the **Mekong River Delta region,** TEMP (27.5°C, +0.1°C) was close to the 15YA, and RADPAR (1235 MJ/m2, +3%) was above the 15YA. The RAIN (432 mm, +39%) and the BIOMSS (+20%) were significantly increased. CALF was same as the 5YA and VCIx was 0.89. According to the NDVI development graph, crop conditions were slightly below the 5YA. Overall, the winter crop production was slightly below average.

In the region of **North Central Coast,** the RADPAR was same as the 15YA, and the TEMP was 19.0°C with a decrease by 0.4°C. RAIN (471 mm, +34%) showed a significant increase, and BIOMSS increased (+12%). CALF was same as the 5YA, and VCIx was 0.96. The crop condition development graph shows that NDVI fluctuated greatly. Crop condition in this region were expected to be near average.

In the **North East region**, RAIN (393 mm, +18%) increased， while RADPAR (697 MJ/m2, -2%) decreased. The BIOMSS increased by 7%. CALF was 99% and VCIx was 0.94. According to the NDVI development graph, crop conditions fluctuated widely, and in March showed a high value exceeding the five-year-maximum. The crop conditions were expected to be above average.

In the **North West region**, RAIN (314 mm, +24%) showed a markable increase, and the TEMP (17.3°C) was same as the 15YA. RADPAR decreased by 2%. The BIOMSS significantly increased (+12%). CALF was 100% and VCIx was 0.97. According to the NDVI development graph, except in early January and

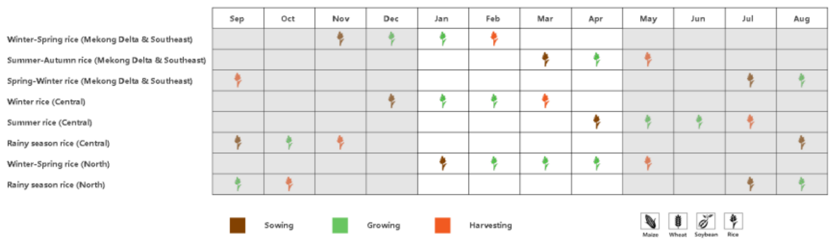
February, NDVI values were near the 5YA and peaked in late March. Crop conditions in this region were expected to be above average.

In the region of **Red River Delta**, RAIN (350 mm, +13%) and BIOMSS (803 gDM/m2, +4%) increased significantly. TEMP (18.7°C, -0.6°C) was below average. CALF was 95% and VCIx was 0.87. According to the crop condition development graph, the NDVI was below the 15YA, except at the end of March, NDVI exceeded the five-year-maximum. Based on the agroclimatic indicators, the crop conditions in this region were above the average.

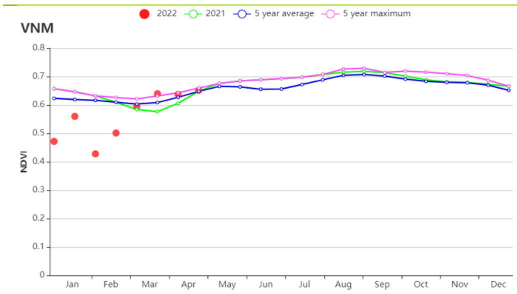
In the **South Central Coast,** with the increased of RAIN (486 mm, +16%), TEMP (20.7°C, +0.2°C) and RADPAR (1070 MJ/m2, +4%), BIOMSS (969 gDM/m2, 10%) significantly increased. CALF was 98% and VCIx was 0.95. According to the crop condition development graph, the NDVI fluctuated widely until in March. Thus, crop conditions in this region were close to the average.

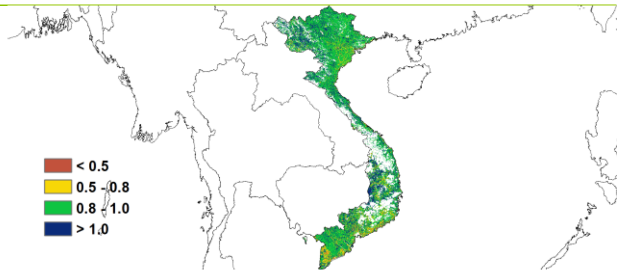
In the **South East region,** RADPAR (1189 MJ/m2) was same as the 15YA, TEMP (26.2°C, +0.2%) and RAIN (270 mm, +83%) were both above the 15YA, BIOMSS (828 gDM/m2, +8%) increased. CALF was 94% and VCIx was 0.88. According to the crop condition development graph, the NDVI values were near the 5YA According to the agroclimatic indicators, crop conditions in this region were about average.

Figure 3. 45 Vietnam's crop conditions, January – April 2022

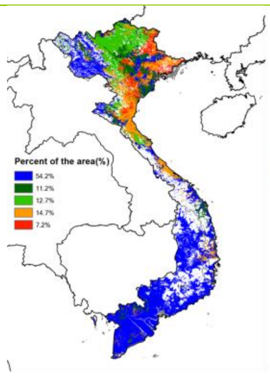


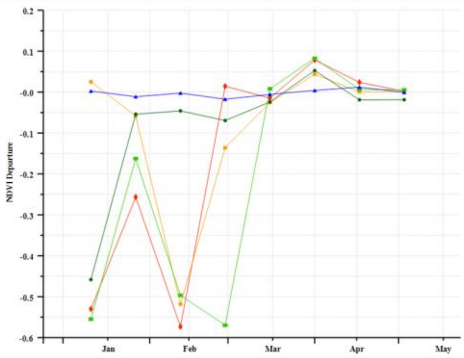
(a) Phenology of major crops



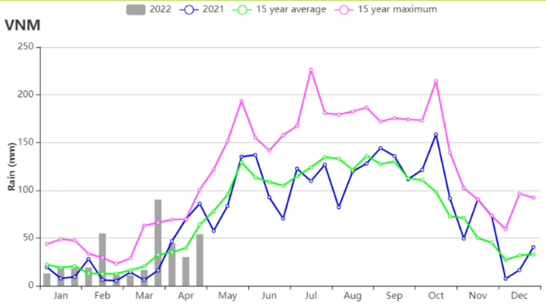


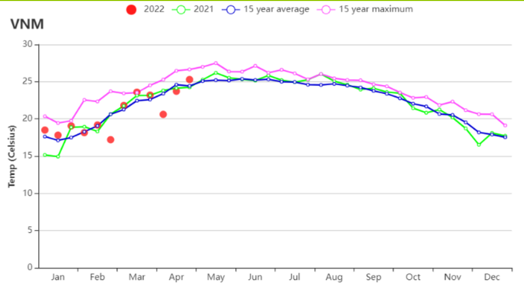
(b) Crop condition development graph based on NDVI (c) Maximum VCI





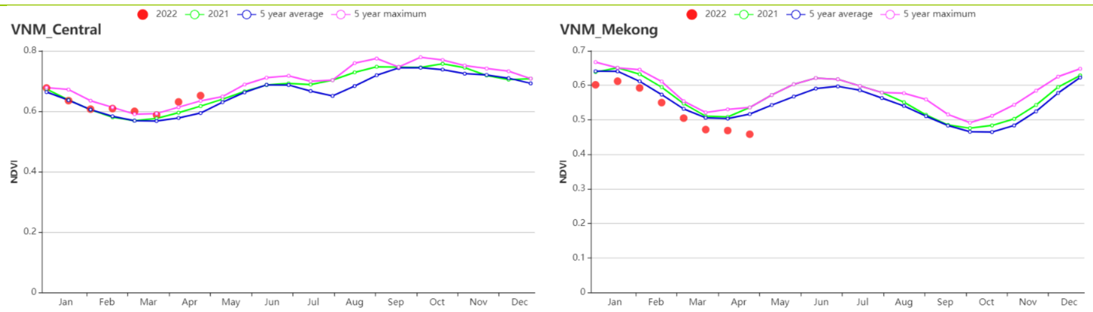
(d) Spatial NDVI patterns compared to 5YA (e) NDVI profiles



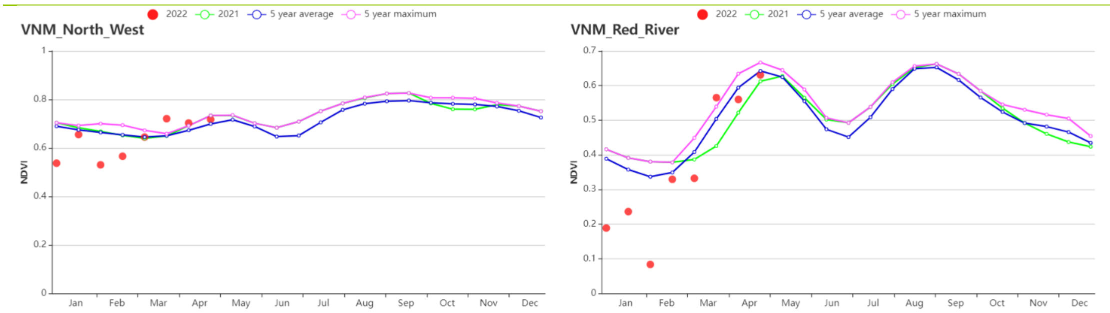


（f) Rainfall profiles

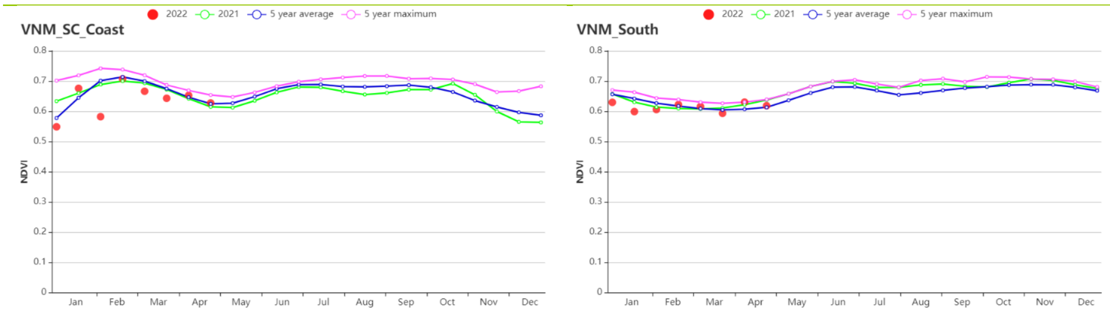
(g) Temperature profiles



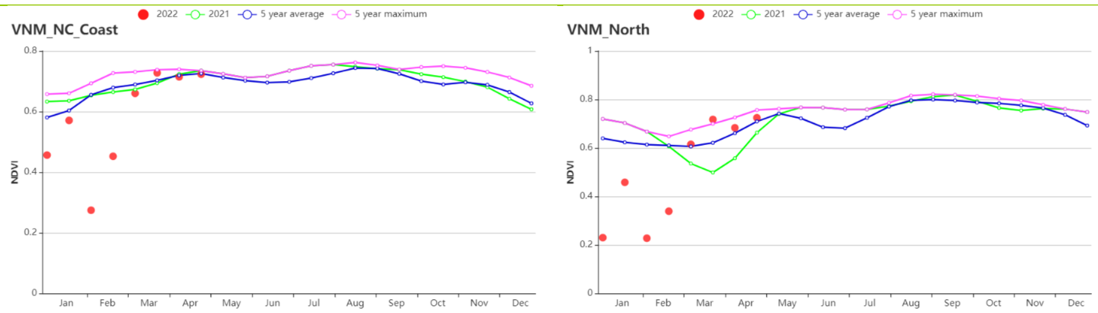
(h) Crop condition development graph based on NDVI Central Highlands Vietnam (left), and Mekong River Delta (right)



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



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



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

Table 3. 83 Vietnam's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, January – April 2022

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	当前值 (MJ/m²)	Current (mm)	Departure (%)	Current (°C)
Central Highlands	309	20	21.9	-0.2	1142	1	818	12
Mekong River Delta	432	39	27.5	0.1	1235	3	1065	20
North Central Coast	471	34	19.0	-0.4	888	-0	917	12
North East	393	18	16.7	-0.0	697	-2	806	7
North West	314	24	17.3	0.0	943	-2	763	12
Red River Delta	350	13	18.7	-0.6	656	2	803	4
South Central Coast	486	16	20.7	0.2	1070	4	969	10
South East	270	8	26.2	0.2	1189	-0	828	8

Table 3. 84 Vietnam's agronomic indicators by sub-national regions, current season's values and departure from 5YA, January – April 2022

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Central Highlands	99	1	0.96
Mekong River Delta	86	-0	0.89
North Central Coast	99	0	0.96
North East	99	0	0.94
North West	100	0	0.97
Red River Delta	95	2	0.87
South Central Coast	98	1	0.95
South East	94	1	0.88

[ZAF] South Africa

In South Africa, soybean and maize are the main crops being produced during this monitoring period. In the west, maize planting finished in January and harvest will start in June. In the east, maize harvest started in April. Soybean was grown from January to March and harvest began in April.

The proportion of irrigated cropland in South Africa is 9% and agro-meteorological conditions play an important role in the growth of most crops. Based on the NDVI development graph, the crop conditions were above the 5-year average during the entire monitoring period. At the national level, the CropWatch agroclimatic indicators show that radiation was above the 15-year average (RADPAR +2%). With a lower rainfall (RAIN -40%) and average temperature (TEMP +0.1℃), the potential biomass decreased by 16% compared to the 15-year average mainly due to the below average rainfall. The maximum vegetation condition index (VCIx) was 0.92, and the cropped arable land fraction (CALF) increased by 4% compared with the last 5 years. According to the VCIx, conditions in the Mediterranean zone, where wheat is an important crop, were better than in the western region (Gauteng, Mpumalanga). As to the spatial distribution of NDVI profiles, crop conditions on about 15.7% of the cropland were below average mainly in the central and southern parts, and on about 57.6% above average mainly in the northern regions during the whole monitoring period, respectively. Crop conditions on 19.2% were above average until March, then below average, and 7.4% was below average until February and then above average. The areas with negative departures were mainly in the center of the western region, most located in Gauteng, Mpumalanga, North West and Orange free state province. Overall, crop conditions were favorable.

Regional analysis

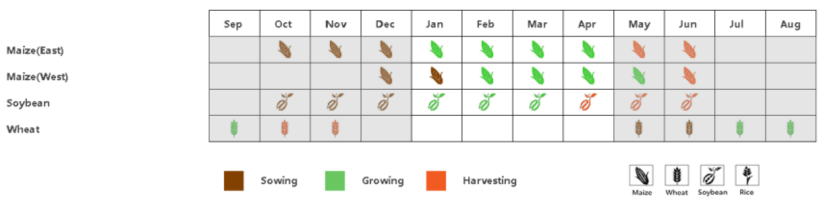
Rainfall in the Arid and desert zones was significantly below average (88mm, -22%) and the temperature was near average (20.6°C, -0.1°C), whereas radiation was slightly above average (+2%), and potential biomass decreased by 5% due to the insufficient rainfall. Cropped arable land fraction (CALF) increased significantly (+21%) and VCIx was 0.99. 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 after March. Crop production is expected to be favorable.

In the Humid Cape Fold mountains, the temperature was near average (+0.4 °C), and rainfall was below average (-25%). With lower rainfall, potential biomass was below the 15-year average (-8%). CALF was 97% and VCIx was 0.93. The crop condition development graph based on NDVI also indicates normal crop conditions.

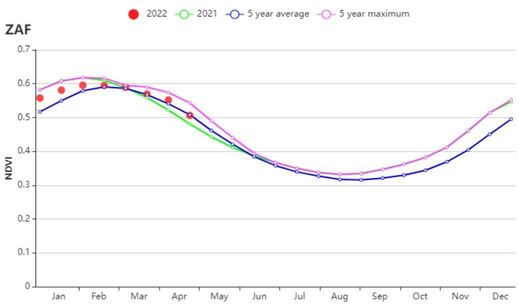
In the Mediterranean zone, the temperature was near average (19.5 °C, +0.2 °C), while rainfall witnessed a significant decrease (68 mm, -31%) and radiation was slightly above average (+1%). The estimated potential biomass decreased by 8% due to the insufficient rainfall. CALF increased substantially (29%, +44%) and VCIx was 0.94. According to the crop condition development graph, the NDVI was above the 5-year average for most of the period and even above 5-year maximum in January. Crop conditions were favorable.

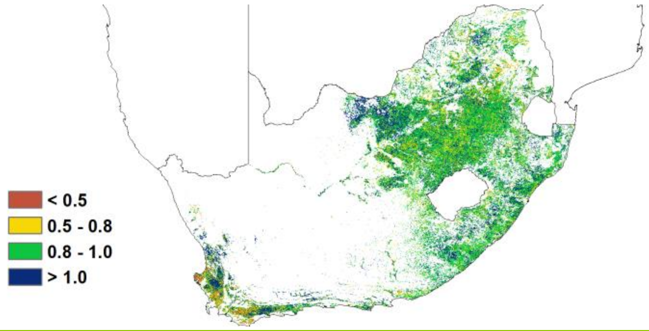
In the Dry Highveld and Bushveld maize areas, rainfall (RAIN -44%) was below the 15-year average and temperature was near average (+0.1°C). Radiation was near average (+2%). Potential biomass decreased by 20%. CALF was slightly above the 5YA (99%, +3%) and VCIx was 0.91. Notably, during this monitoring period, the area was in the rainy season. The rainfall was below average, but able to sustain the crop growth (RAIN 127mm). Therefore, maize was not under water stress and the crop condition development graph based on NDVI shows that the NDVI was above the 5-year average for most of the period. In all, the crop conditions were favorable.

Figure 3.46 South Africa's crop condition, January - April 2022



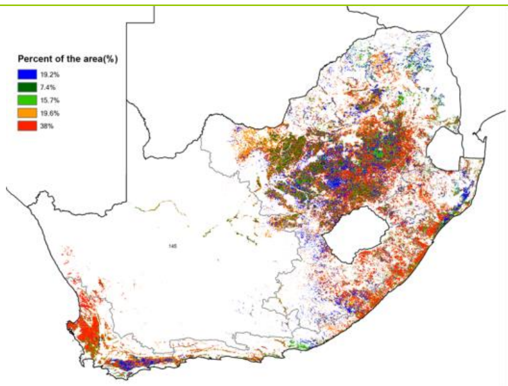
(a). Phenology of major crops

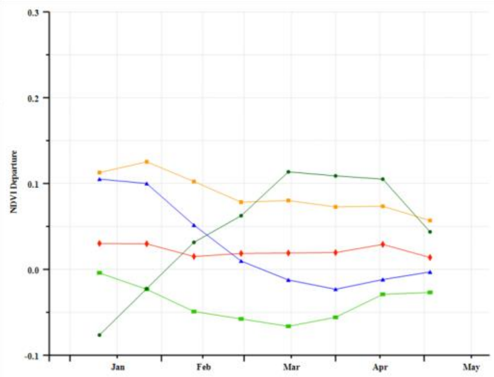




(b) Crop condition development graph based on NDVI

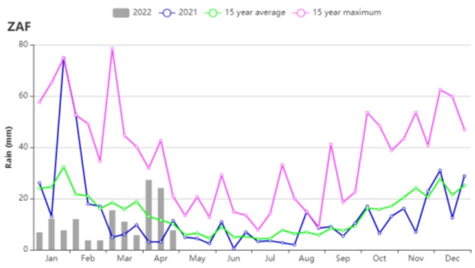
(c) Maximum VCI

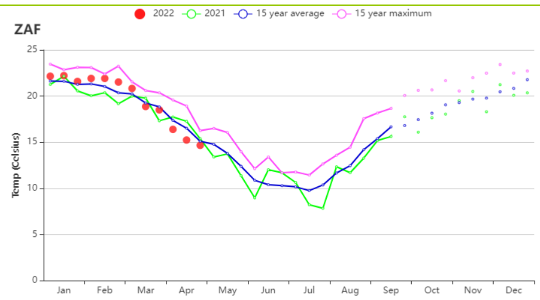




(d) Spatial NDVI patterns compared to 5YA

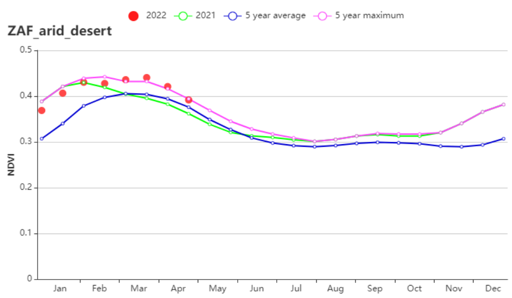
(e) NDVI profiles

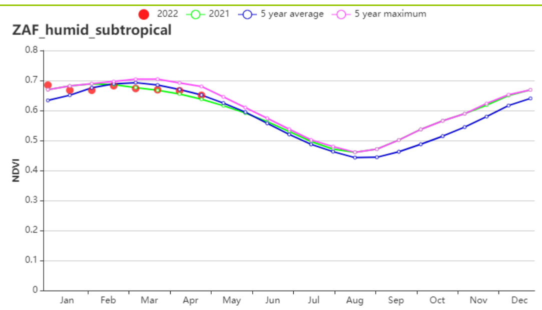




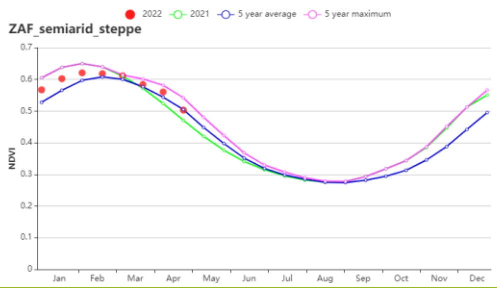
(f) Rainfall profiles

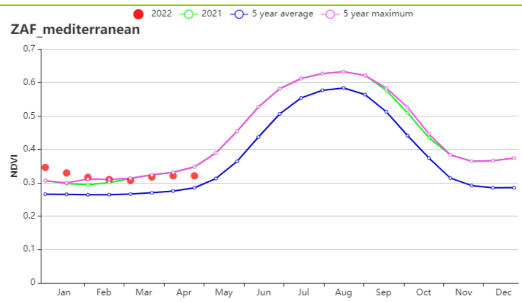
(g) Temperature profiles





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





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

Table 3.85 South Africa's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, January - April 2022

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Arid and desert zones	88	-22	20.6	-0.1	1350	2	564	-5
Humid Cape Fold mountains	252	-25	20.0	0.4	1168	3	797	-8
Mediterranean zone	68	-31	19.5	0.2	1323	1	512	-8
Dry Highveld and Bushveld maize areas	127	-44	19.6	0.1	1293	2	587	-20

Table 3.86 South Africa's agronomic indicators by sub-national regions, current season's values and departure from 5YA, January - April 2022

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Arid and desert zones	67	21	0.99
Humid Cape Fold mountains	97	1	0.93
Mediterranean zone	29	44	0.94
Dry Highveld and Bushveld maize areas	99	3	0.91

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

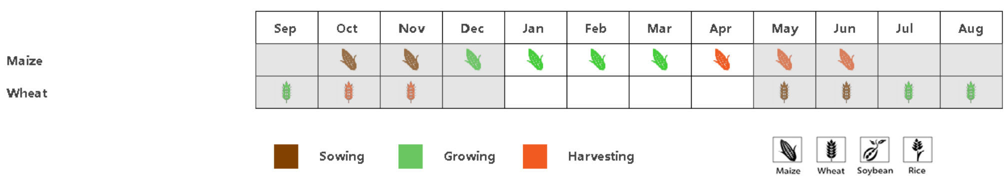
[ZMB] Zambia

This report covers the main growth period for rainfed crop production in Zambia. The major cereal crops in the field included maize, sorghum and millet. They were planted from mid-November to early January, depending on the agro-ecological region. The proportion of irrigated cropland in Zambia is only 4% and agro-meteorological conditions play a decisive role in the growth of almost all crops. In the eastern parts of the country, below-average monthly rainfall in November and December and above-average temperatures during the same period contributed to a lack of soil moisture and affected land preparation, planting and germination. The CropWatch agronomic indicators at the national scale showed a decrease in rainfall (919 mm, -6%) while the temperature was unchanged (20.9ºC, +0%). Similarly, there was no significant changes in radiation (1166 MJ/m2, 0%), biomass production (1242 gDM/m2, 0%) and CALF (100%). The NDVI profile indicated below 5-year average conditions from January to March, which could be attributed to the late planting of the crops. However, the crops had mostly recovered by the time of the peak of the growing season. Overall, the VCIx was 0.94 varying from 0.80 to 1.00, with some instances in the southern and eastern parts of the country, which experienced values below 0.8.

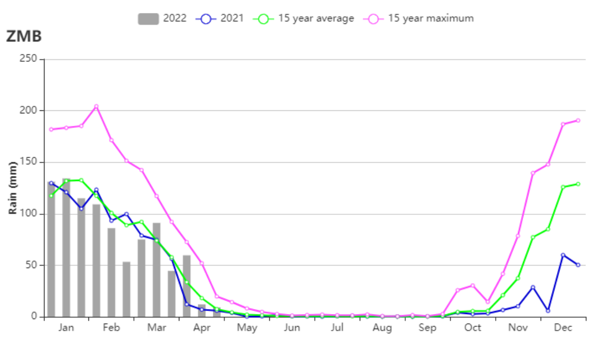
Regional Analysis

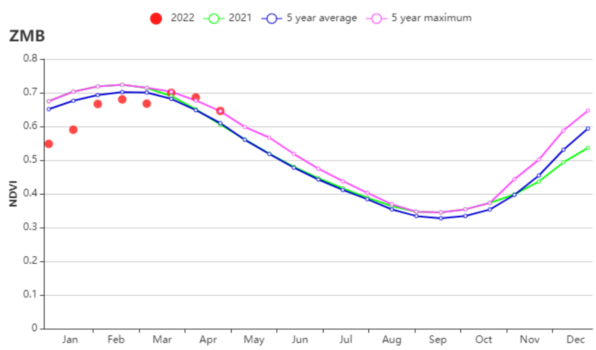
The regional analysis showed a reduction in rainfall in the Western Semi-arid plain (-25%), Luangwa-Zambezi valley (-16%), and Central Eastern and Southern plateau (-5%), while the Northern high rainfall region experienced an increase in rainfall (1152 mm, +2%). A reduction in solar radiation (-4%) was observed in Western semi-arid plain, and when combined with reduced rainfall, there was a decline in potential biomass production (-5%). The Luangwa-Zambezi rift valley also experienced a decrease in biomass production. Poor plant establishment early in the year due to lack of moisture heavily affected biomass production in most of the three critically affected regions. The VCIx varied from 0.92 to 0.94 across the regions, with the lowest recorded in the Western semi-arid plain (0.92) and Luangwa-Zambezi rift valley (0.93). However, the area under cultivation remained at 100% in all the regions. The reported period is critical for the development of cereal crops, and moisture stress can cause large crop yield reduction nationwide.

Figure 3. 47 Zambia's crop condition, January - April 2022



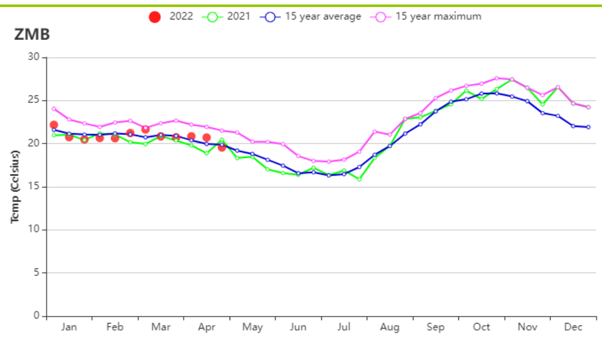
(a). Phenology of major crops



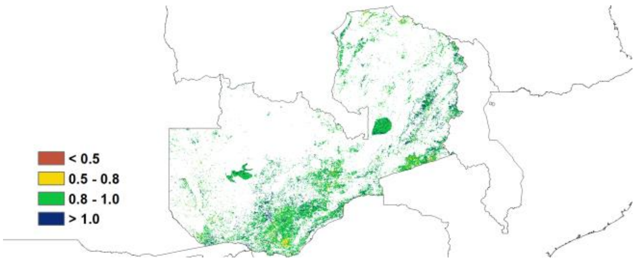


(b) Time series rainfall profile

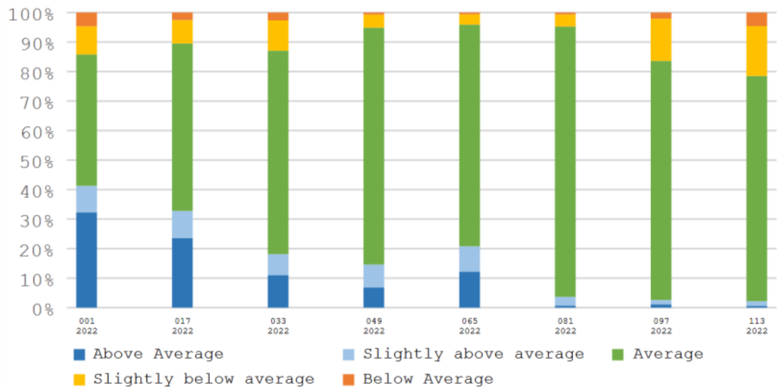
(c) Crop condition development graph based on NDVI



(d) Time series temperature profile



(e) Maximum VCI



(f) Agroclimatic Statistics

Table 3.87 Zambia's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, January - April 2022

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Luangwa-Zambezi rift valley	691	-16	22.0	+0.1	1248	+1	1136	-3
Western Semi-arid plain	569	-25	22.5	0.0	1175	-4	1142	-5
Central-Eastern, Southern Plateau	908	-5	20.9	0.0	1186	+2	1288	+3
Northern High rainfall	1152	+2	19.7	0.0	1102	0	1314	+1

Table 3.88 Zambia's agronomic indicators by sub-national regions, current season's values and departure from 5YA, January - April 2022

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Luangwa-Zambezi rift valley	100		0.93
Western Semi-arid plain	100		0.92
Central-Eastern, Southern Plateau	100		0.95

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Northern High rainfall	100		0.94

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). Section 4.2 provides detailed analysis of the winter wheat planted area, projected yield and production as well as the total winter crops production. The early rice planted area is also estimated by integration of optical and SAR data over the major producing provinces. 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 (4.3). Section 4.4 describes trade prospects (import/export) of major crops. Additional information on the agroclimatic indicators for agriculturally important Chinese provinces are listed in table A.11 in Annex A.

4.1 Overview

This report covers the main growing period of winter wheat and rapeseed. The sowing of the first summer crops, such as spring maize and early rice started in March. Half cropland in China is irrigated and agro-meteorological conditions play important role for the rest crops. Rainfall is not the major influential factor on irrigated cropland.

Generally speaking, agro-climatic conditions over the major winter crops producing regions were favorable. For China, RAIN and TEMP increased by 19% and 0.3℃, respectively, as compared to the 15-year average, whereas RADPAR decreased by 2%. Consequently, BIOMSS was 7% above average. During the reporting period, rainfall in China's main winter crop producing areas was 6% lower than average and temperature was 0.5℃ higher. Sowing of winter crops was delayed in the North China Plain due to excessive soil moisture. After mid April, thanks to above average solar radiation and optimal temperatures, as well as optimal crop management, crop growth in the North China Plain was significantly higher than in previous years. In early May, crop conditions were better than average in most of the main production provinces and regions.

National CALF increased 1% and VCIx was quite favorable, with a value of 0.92.

Spatially, 66.7% of the arable land (marked in light green) experienced close-to-average precipitation throughout the monitoring period. Arable land in the remaining regions all went through some rainfall fluctuations. The blue marked areas (21.2% of the cropland), mainly distributed in northern part of Southwest China and northern part of Lower Yangtze region, experienced negative rainfall anomalies (more than 30 mm/dekad below average) in early April, and positive rainfall anomalies (more than 60 mm/dekad above average) in late April. The dark green marked areas (12.1% of the cropland), mainly distributed in southern part of Southwest China, southern part of Lower Yangtze region, had the biggest positive rainfall departure (approximately +80 mm/dekad) in middle Feburary, and the biggest negative rainfall departure (approximately -45 mm/dekad) in early April. Temperature anomalies varied over time across the whole country. The light green marked areas, including some parts of Heilongjiang, Jilin, and Inner Mongolia, had the biggest positive temperature departure (more than 4.5℃ above average) in early March. The blue marked areas, including southern Inner Mongolia, western Loess region, southern Lower Yangtze region, most parts of Southwest China, and Southern China, had the biggest negative temperature departure (more than 3.0℃ below average) in early and late Feburary. Uncropped areas mainly occurred in the North-west and North-east regions and some parts in Inner Mongolia, Gansu, Ningxia, Shaanxi, Shanxi, and Hebei.

In April, the cropping season was well underway in southern and central China. According to the spatial VCIx patterns, favorable crop conditions (VCIx larger than 0.8) occurred widely across China; values between 0.5 and 0.8 were observed for some parts in Inner Mongolia, Gansu, Ningxia, Shaanxi, Shanxi, and

Hebei, where cropland was not fully cultivated during the monitoring period according to the CALF map. The potential biomass showed significant variability across regions. Positive anomalies (more than 20%, marked in blue) occurred in central Northeast China, southern Inner Mongolia, western Loess region, southern Huanghuaihai, and most parts of Southwest China, while negative anomalies (-20% or more) were mainly observed in some parts of Shanxi, Shaanxi, Hebei, Shandong, Henan, Ningxia, Jiangsu, and Anhui. When it comes to VHIn, high values (above 36%) are widespread in China, indicating limited water deficit effects on most of the winter crops.

As for the main producing regions at the sub-national level, rainfall was above average, ranging from +10% to +31%, except for Huanghuaihai (-6%). TEMP was all at or above average, and the range of temperature departures is from +0.0°C to +0.7°C, with the highest positive departure in Northeast China. RADPAR was below average, except for Southern China. Consequently, BIOMSS increased in almost all the regions compared to average with the anomalies ranging from 3% to 15%, except for Huanghuaihai. CALF in all regions was all slightly above average but still lower than same period in 2021 except for Loess Region where CALF was 3% below average. Almost no crops are in field in Northeast China and Inner Mongolia during this monitoring period, CALF values are not representative. As for VCIx, the values were quite high for all the regions, ranging between 0.85 and 0.99, with values less than 0.9 occurred in Loess region and Northeast China mainly related to the reduced cultivated areas.

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

Region	Agroclimatic indicators				Agronomic indicators		
	Departure from 15YA (2004-2018)				Departure from 5YA (2014-2018)		Current period
	RAIN (%)	TEMP (°C)	RADPAR (%)	BIOMSS (%)	CALF (%)	Cropping intensity (%)	Maximum VCI
Huanghuaihai	-6	0.5	-2	-11	8	0.94	-6
Inner Mongolia	10	0.0	-2	6	/	0.94	10
Loess region	10	0.5	-4	3	-3	0.85	10
Lower Yangtze	19	0.3	-2	6	1	0.93	19
Northeast China	16	0.7	-3	15	/	0.89	16
Southern China	13	0.0	4	7	1	0.94	13
Southwest China	31	0.1	-6	12	1	0.99	31

Figure 4.1 China crop calendar

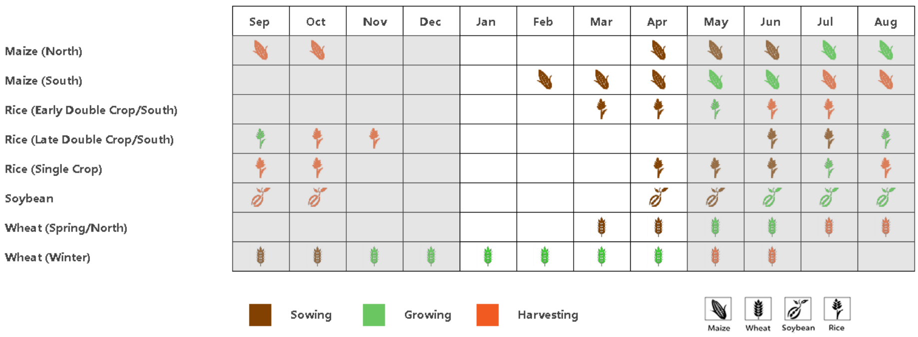
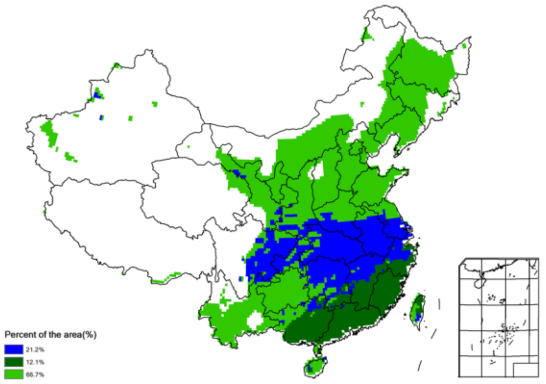


Figure 4.2 China spatial distribution of rainfall profiles, January - April 2022



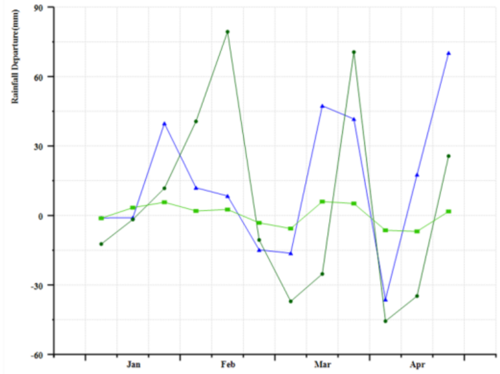
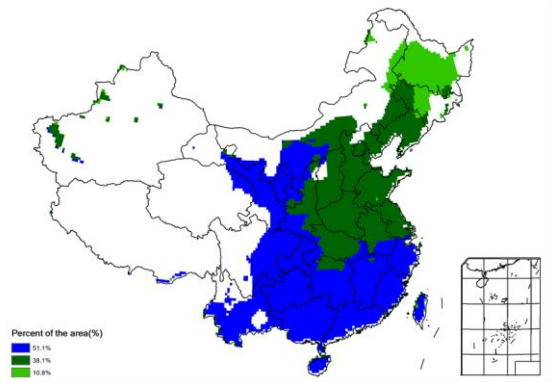


Figure 4.3 China spatial distribution of temperature profiles, January - April 2022



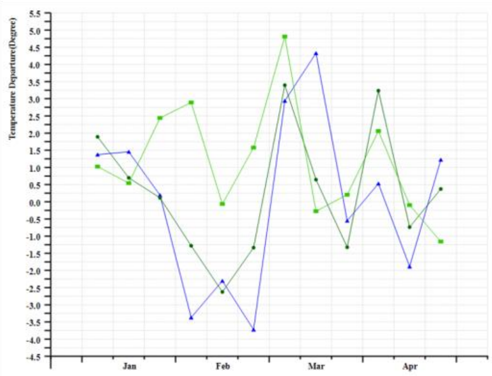
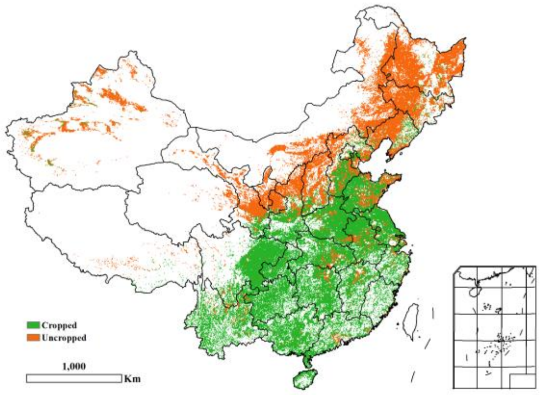


Figure 4.4 China cropped and uncropped arable land, by pixel, January - April 2022

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



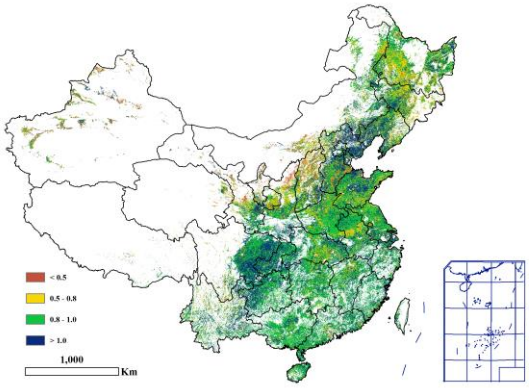
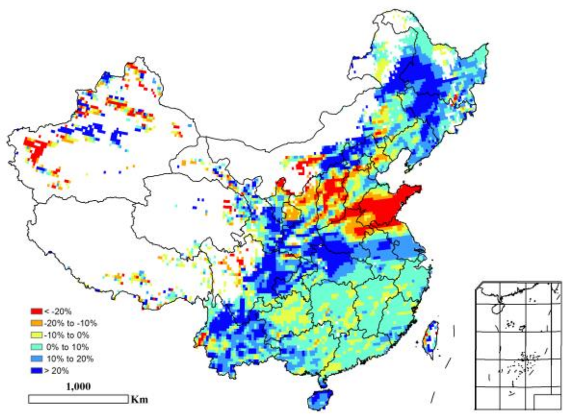
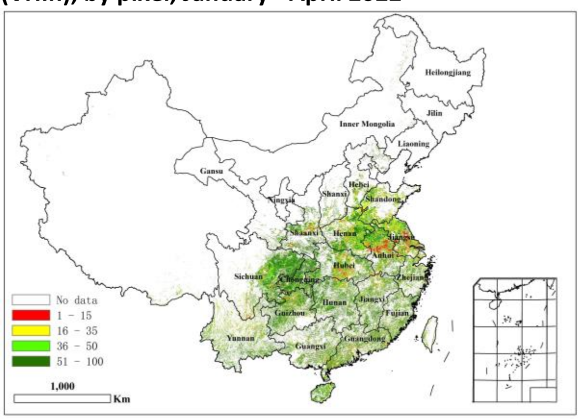


Figure 4.6 China biomass departure map from 15YA, by pixel, January - April 2022

Figure 4.7 China minimum Vegetation Health Index (VHIn), by pixel, January - April 2022





4.2 China's crop production

(1)Winter crop production

The total winter crop production of China is expected to be 141.57 million tonnes in 2022, with a decrease by 1.64 million tonnes (-1.1%). Winter wheat sown area was 1.9% lower than 2021. The increases in crop yield by 0.8%, failed to offset the impact of reduction in area planted.

Table 4.2 winter crop production (million tonnes) and annual variation (%) in China's major winter crop-producing provinces and cities in 2021

	Production in 2021	2022			
	(Thousand tonnes)	Area variation (%)	Yield variation (%)	production variation (%)	winter crop production (Thousand tonnes)
Hebei Province	12764	-3.5	1.6	-2.0	12508
Shanxi Province	2241	1.3	2.8	4.2	2334
Jiangsu Province	13964	-1.5	1.7	0.2	13988
Anhui Province	15096	-2.5	-1.4	-3.9	14509
Shandong Province	27249	-2.2	1.9	-0.4	27152
Henan Province	33188	-3.7	1.7	-2.1	32493
Hubei Province	6226	-2.1	1.2	-0.9	6168
Sichuan Province	5820	-0.6	2.8	2.2	5950
Shannxi Province	4135	-0.9	-0.8	-1.7	4065
Gansu Province	3517	0.9	0.4	1.3	3563
Xinjiang Province	5077	-1.3	2.1	0.8	5118
Subtotal	129278			-1.1	127849
Other Provinces*	13925			-1.5	13719
National*	143203	-1.9	0.8	-1.1	141567

*Note: winter crop from Taiwan Province are not included in the total production of other provinces and the country.

Due to the regional flooding that caused excessively wet soil conditions, the area sown of winter crops in North China Plain decreased in Henan (-3.7%), Hebei (-3.5%), Shandong (-2.2%) and Anhui (-2.5%). The area reduction led to a production decrease in Henan (-690 thousand tonnes), Hebei (-260 thousand tonnes), Shandong (-100 thousand tonnes) and Anhui (-590 thousand tonnes). Although the winter crop planting area in Sichuan Province also shrank by 0.6%, the weather conditions were generally favorable. Winter crop yield of Sichuan increased by 2.8% and the production increased by 130 thousand tonnes, which is the largest increase among major winter crop-producing provinces. Changes in production levels in other major provinces were within ± 100 thousand tonnes.

(2) Remote sensing-based winter wheat planted area estimation

For the 2021-22 season, China's winter wheat planted area was 23,292.5 thousand hectares, down 546.9 thousand hectares or 2.3% year-on-year (Table 4.2, Figure 4.8), mainly due to severe flooding in some areas of northern China during the winter wheat sowing period in the autumn of 2021. Continuous heavy rainfall led to excessively wet soil conditions and delayed wheat sowing. Some fields had remained very wet for a prolonged period and could not be planted anymore before the window for winter wheat sowing closed. Out of the 11 winter wheat producing provinces and regions, 8 provinces and regions had a decrease in wheat planted area. Winter wheat area increased slightly in Shaanxi, Gansu and Xinjiang

Table 4.3 Remote sensing monitoring of acreage of winter wheat planted in main producing provinces in 2022

Province	Planted area (thousand hectares)		Area changes (Thousands of hectares)	Variation(%)
	2021	2022		
Hebei	2165.9	2089.6	-76.3	-3.5
Shanxi	411.5	416.9	5.4	1.3
Jiangsu	2741.9	2678.4	-63.4	-2.3
Anhui	3027.3	2978.1	-49.2	-1.6
Shandong	4186.6	4093.7	-92.9	-2.2
Henan	5488.4	5287.0	-201.4	-3.7
Hubei	1113.3	1094.5	-18.8	-1.7
Sichuan	492.5	492.1	-0.4	-0.1
Shaanxi	805.6	797.0	-8.6	-1.1
Gansu	503.3	529.4	26.1	5.2
Xinjiang	582.9	588.2	5.3	0.9
Subtotal	21519.2	21044.9	-474.2	-2.2
Other*	2320.2	2247.6	-72.6	-3.1
China*	23839.4	23292.5	-546.9	-2.3

*Note: The estimated planted area does not include Taiwan Province.

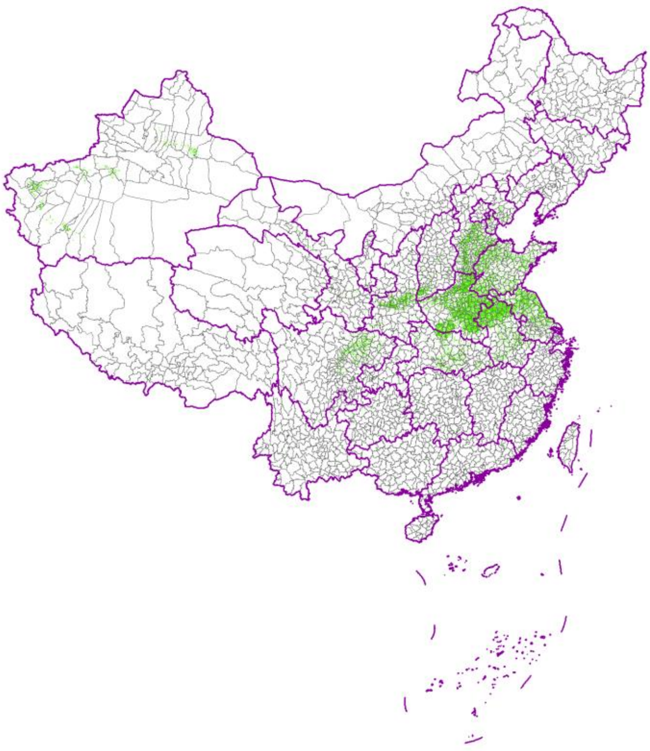


Figure 4.8 National winter wheat planting distribution in 2022

The five provinces with the largest reductions in wheat planted areas were: Henan (-201.4 thousand hectares), Shandong (-92.9 thousand hectares), Hebei (-76.3 thousand hectares), Jiangsu (-63.4 thousand hectares) and Anhui (-49.2 thousand hectares). The reduced winter wheat planted area in those five major producing provinces accounted for 88.4% of the reduction in winter wheat area of China.

Henan Province, as the largest winter wheat producer, planted a total of 5287.0 thousand hectares of wheat in 2022, 3.7% less than in 2021. During the weeks leading up to the sowing period in 2021, Henan Province suffered heavy rainfall and in some regions, the soil was too wet for tillage and planting. The regions with the largest decreases in winter wheat planted area were in Nanyang and Shangqiu.

The winter wheat planted area in Shandong Province is 4093.7 thousand hectares, down 2.2% compared to 2021. As in Henan, the decreased winter wheat planted area also resulted from the heavy rainfall and localized flooding along the Yellow River, mainly in Heze (-30.9 thousand hectares), Dezhou (32.0 thousand hectares) and Liaocheng (37.0 thousand hectares). Winter wheat planted area in Linyi, Binzhou, Qingdao, Weifang and other places increased from 2021, which to a certain extent offset the impact of reduced planting area in western Shandong.

In Hebei province, 2022 winter wheat planting area was 2089.6 thousand hectares, a decrease by 3.5%. The areas with a decline were concentrated near the three cities of Handan, Hengshui and Xingtai, out of which Handan had the largest decline. Reasons for the decline were the wet soil conditions, as well as the winter crop rotation fallow guide issued by the local water conservation agency. Conversion of cropland to built-up land was one of the reasons for the decline in Quzhou County, Qiu County, Feixiang and other places.

In the Anhui Province, the 2022 winter wheat planting area was 2978.1 thousand hectares, a year-on-year reduction of 1.6%. The reduction in wheat planting area mainly occurred in the region of northern Liu'an Huoqiu County and Shou County, Chuzhou County in the west of Dingyuan County and the eastern city of Tianchang. No significant change in wheat acreage in the main winter wheat producing areas north of the Huai River were observed.

(3) Winter wheat production forecast

Based on multi-source remote sensing data, including Sentinel 1/2, Landsat 8 as of mid-May 2022, in combination with the latest agro-meteorological information and ground truth samples, as well as 10m resolution cropland mask, a remote sensing-based crop yield model and big data method for crop planted area estimation method were used to monitor the winter wheat yield in China in 2022. We systematically assessed the impact of the delayed autumn sowing in 2021 and of the cold wave that hit the northern region in the spring of 2022 on the growth and yield of winter wheat.

Total national winter wheat production in 2022 is estimated at 127.64 million tonnes, a decrease of 1.53 million tonnes or 1.2% from 2021 (Table 4.3). Aided by warming temperatures and ideal soil moisture conditions, even late sown wheat caught up to average levels observed in previous years by the time it had reached the heading stage. Low rates of diseases incidence, as well as relatively sunny skies and average temperatures created favorable conditions for wheat growth and the grain filling period, which started in mid April. Out of the total wheat area, the crop status for 12% was below that of last year. These areas were scattered throughout the main production areas. On about 7% of the area, winter wheat growth was better than in the same period of last year, mainly in northwestern Shandong, central and northeastern Jiangsu, Shaanxi and south-central Shanxi. For the remaining 81%, the status was close to the average level of the past five years. Thus, most of the wheat fields were able to compensate for the late sowing.

The forecasted average winter wheat yield for 2022 is 5,480 kg/ha, 1.1% higher than in 2021, mainly due to favorable weather conditions starting in mid to late April. They were conducive for grainfilling, resulting in an increase in wheat yields year-on-year; however, due to a 2.3% year-on-year contraction in winter wheat planted area, the national winter wheat production was still lower than last year. The total winter wheat production increased in only four non-core wheat-producing provinces in Shaanxi, Sichuan, Gansu and Xinjiang out of the the 11 main provinces.

The wheat production situation varies significantly among the major winter wheat-producing provinces and regions. Anhui and Shaanxi had more precipitation in late April, which improved the growth. But the lack of rain in early and mid May was not conducive for grain growth. Peak vegetation cover was lower than last year, and the yield dropped by 1.5% in Anhui and 0.7% in Shaanxi. The provinces of Henan, Shandong and Hebei in the Yellow Huaihai Plain area had below average precipitation starting in early April. But the irrigation facilities in the main wheat producing areas of the three provinces are well developed. Thanks to timely irrigation and ideal temperature and solar radiation conditions, the crop growth rate was higher than in previous years starting in mid-April. Yield increases were 1.7% in Henan, 1.9% in Shandong and 1.6% in Hebei. Similarly, conditions were favorable in Sichuan as well, aided by ideal weather conditions, resulting on a yield increase by 2.7% year-on-year. In Shanxi, precipitation was near average. Wheat growth exceeded the rates of last year and the yield is expected to increase by 2.8%.

In general winter wheat was in above average conditions starting from the heading stage, resulting in higher yields. But the year-on-year reduction in planted area still led to a year-on-year reduction by more than 100,000 tonnes of production in the four provinces of Henan (-680,000 tonnes), Shandong (-450,000 tonnes), Hebei (-250,000 tonnes) and Anhui (-100,000 tonnes). These reductions accounted for 97% of the total reduction in production.

In general, the prospects for the upcoming wheat harvest period are favorable.

Table 4.4 Area (thousand ha), yield (kg/ha), production (million tonnes) and variation (%) of winter wheat by province in China in 2022

	Area		Yield		production		
	2022	Variation	2022	Variation	2022	Variation	Variation
	(Thousands hectares)	(%)	(kg/ha)	(%)	(Thousand tonnes)	(%)	(Thousand tonnes)
Hebei	2090	-3.5	5838	1.6	12200	-2	-250
Shanxi	417	1.3	5420	2.8	2260	4.2	90
Jiangsu	2678	-2.3	5068	1.7	13570	-0.6	-80
Anhui	2978	-1.6	4710	-1.5	14030	-3.1	-450
Shandong	4094	-2.2	6573	1.9	26910	-0.4	-100
Henan	5287	-3.7	6119	1.7	32350	-2.1	-680
Hubei	1095	-1.7	4072	1.3	4460	-0.4	-20
Sichuan	492	-0.1	4002	2.7	1970	2.6	50
Shaanxi	797	-1.1	3891	-0.7	3100	-1.8	-60
Gansu	529	5.2	4129	1.8	2190	7.1	140
Xinjiang	588	0.9	5608	0.4	3300	1.3	40
Subtotal	21045	-2.2	5528	1.1	116330	-1.1	-1310
Other*	2248	-3.1	5031	1.3	11310	-1.8	-210
National*	23293	-2.3	5480	1.1	127640	-1.2	-1530

*Note: Winter wheat in Taiwan Province is not included.

(4)Early rice planted area

The preparation and transplanting of early rice in China's major early rice producing provinces was completed in late April. The total area of early rice was 6404.7 thousand hectares with an increase of 22.4 thousand hectares from 2021 (6382.3 thousand hectares).

Early rice sown area in Anhui and Hubei provinces both decreased, while it increased in the other six major rice production provinces. Two reasons led to the increase of early rice area in the four top provinces Hunan(+1.0%), Jiangxi (+1.6%), Guangxi (+1.7%) and Guangdong (+0.8%): 1) the government raised the minimum price line of rice and issued a bonus on double-season rice pattern. 2) Covid-19 has prevented some farmers from holding a job in a town and therefore, they focus more on field work.

Table 4.5 Remote sensing monitoring results of early rice preparation and transplanting area in China's main winter crop-producing provinces and regions in 2022

	Area (thousand hectares)		variation (%)	Area variation (Thousands of hectares)
	2021	2022		
Fujian	155.8	159	2	3.2
Zhejiang	111.8	113.9	1.9	2.1
Jiangxi	1144.7	1163.1	1.6	18.4
Guangxi	931.2	947.1	1.7	15.9
Hunan	1522.3	1537.9	1	15.5
Anhui	185.2	179.3	-3.2	-5.9
Hubei	150.7	147.8	-1.9	-2.9
Guangdong	828.1	834.7	0.8	6.6
Subtotal	5029.9	5082.7	1.1	52.8
National	6382.3	6404.7	0.4	22.4

4.3 Regional analysis

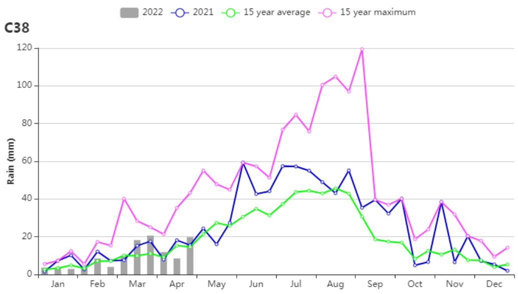
Figures 4.10 through 4.16 present crop condition information for each of China's seven agricultural regions. The provided information is as follows: (a) Phenology of major crops; (b) Crop condition development graph based on NDVI, comparing the current season up to January 2022 to the previous season, to the five-year average (5YA), and to the five-year maximum; (c) Spatial NDVI patterns for January to April 2022 (compared to the (5YA)); (d) NDVI profiles associated with the spatial patterns under (c); (e) maximum VCI (over arable land mask); and (f) biomass for January to April. Additional information about agro-climatic indicators and BIOMSS for China is provided in Annex A.

Northeast region

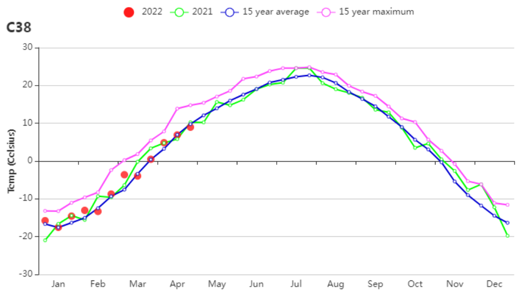
Due to the cold winter weather, this monitoring season (January to April 2022) was ahead of crop sown in the northeast region of China. CropWatch Agroclimatic Indicators (CWAIs) show that the precipitation greatly deviated from the average level. The total precipitation increased by 16%. It was above average level in mid-March and late-March. The photosynthetically active radiation was below average (RADPAR - 3%) and the temperatures were above average (TEMP +0.7°C). Altogether, the potential biomass was 15% above the fifteen-year average level.

Overall, higher precipitation and warmer temperatures are beneficial to the spring sowing in the northeast region of China. However, sowing dates in some low-lying areas in the region were delayed about a week due to waterlogging caused by above average rainfall. Warmer temperatures in May will facilitate the germination and good establishment of the summer crops.

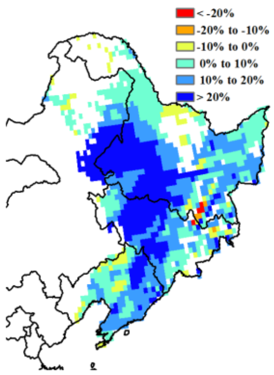
Figure 4.9 Crop condition China Northeast region, January - April 2022



(a) Time series rainfall profile



(b) Time series temperature profile



(c) Potential biomass departure from 15YA

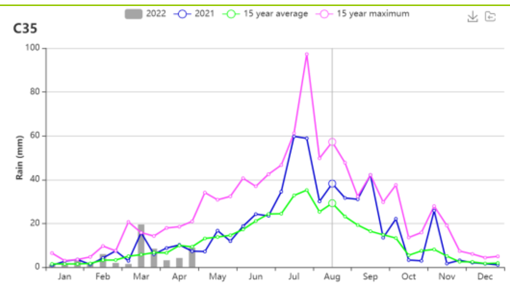
(d) Waterlogged fields of Zhaoguang farm in HeiLongjiang province （2022-5-14）

(e) Waterlogged fields of Wudalianchi City in HeiLongjiang province （2022-5-14）

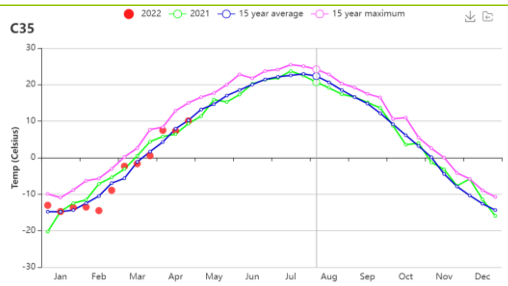
Inner Mongolia

During the first three months of this year, no crops were grown in Inner Mongolia due to the cold temperatures. Sowing activities gradually started in late April. Agro-climatic indicators of the reporting period show that rainfall was above average (RAIN +10%), TEMP was close to the 15YA, while RADPAR was slightly below average (-2%). The resulting BIOMSS was above average (+6%). Though the average of VCIx was 0.94 for the whole area, it is of limited agronomic significance at this time of the year. The rainfall, which was significantly higher than the historical average will be beneficial to the germination of crops and grazing lands. Current prospects for the region are favorable, but weather conditions in the following months are very critical.

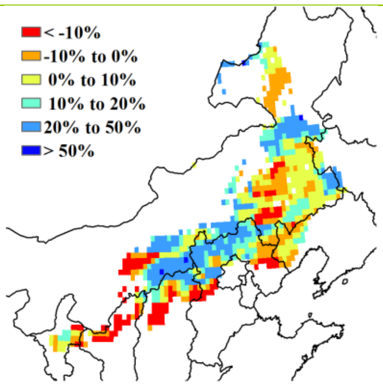
Figure 4.10 Crop condition China Inner Mongolia, January – April 2022



(a) Time series rainfall profile



(b) Time series temperature profile



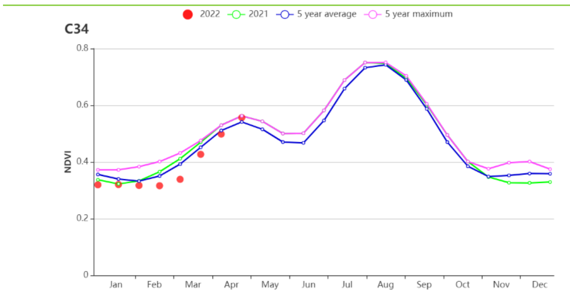
(c) Biomass departure

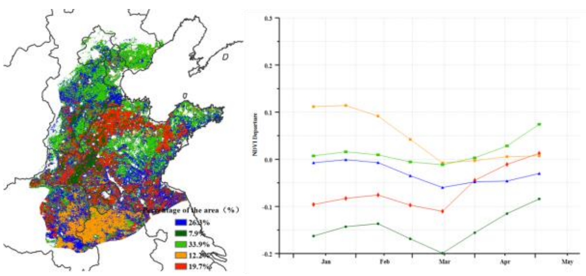
Huanghuaihai

The monitoring period (January to April) covers the spring green-up and jointing stages of winter wheat in Huanghuaihai. Due to the delayed sowing last year, the harvest time will be delayed by about 1 week. Agro-climate indicators showed that precipitation (-6%) and radiation (-2%) in this area were below the 15YA, but temperature (+0.5°C) was above. The combination of these weather parameters led to a decrease of potential biomass by 11%. The CALF exceeded the 5YA by 8% but still lower than 2021 JFMA, and the maximum VCI value was 0.94.

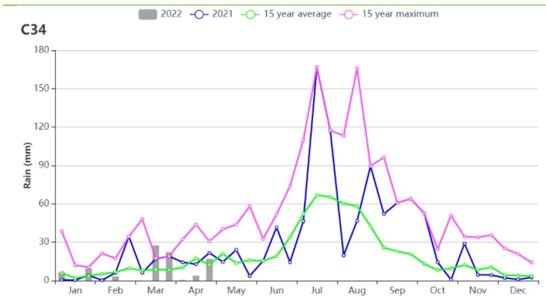
Based on the NDVI-based crop growth profile, the crops grew a bit more slowly in February and early March due to cooler than average temperatures, but reached the 5-year maximum level at the peak growing period by the end of April. As the NDVI clusters and profiles showed, only 12.2% of the cropland in Northeastern Anhui was higher than the 5YA before mid-March. Crops in the areas of Southern Hebei, Northeastern Shandong, Eastern Henan, and Northern Jiangsu (blue, red, and dark green colors in the NDVI departure clustering map) presented below-average conditions until mid-March, but recovered quickly thereafter. The map of maximum VCI presented a similar trend as the spatial NDVI pattern. Generally, the crop conditions in this important winter wheat production region are normal.

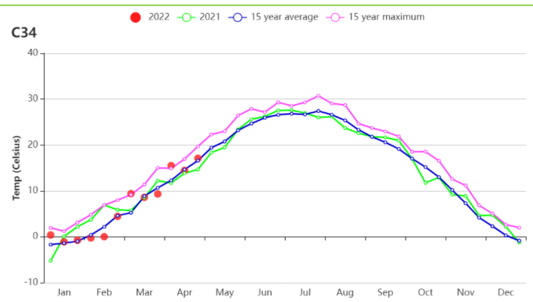
Figure 4.11 **Crop condition China Huanghuaihai, January - April 2022**



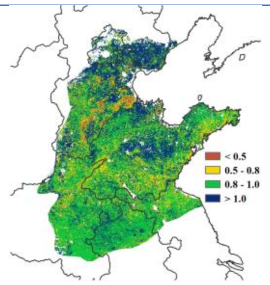


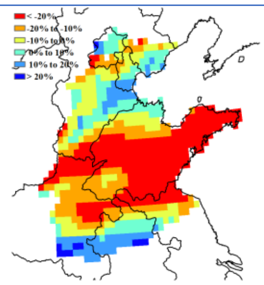
(a) Crop condition development graph based on NDVI (b) Spatial NDVI patterns compared to 5YA(c) NDVI profiles





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





(f) Maximum VCI (g) Biomass departure

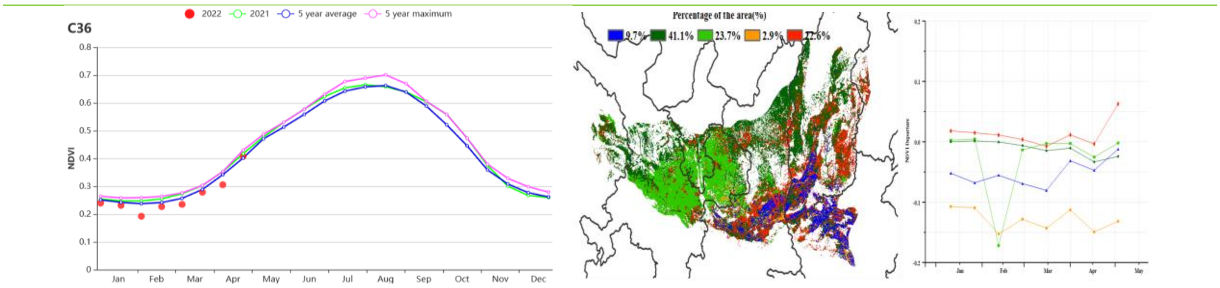
Loess region

During this reporting period, winter wheat, spring wheat and spring maize were the predominant crops grown in this region. Winter wheat sowing started from late September to mid-October and will be harvested in mid-June. Spring wheat and spring maize were sown from late March to April. During the monitoring period, the crop conditions in the Loess region were close to the 5YA.

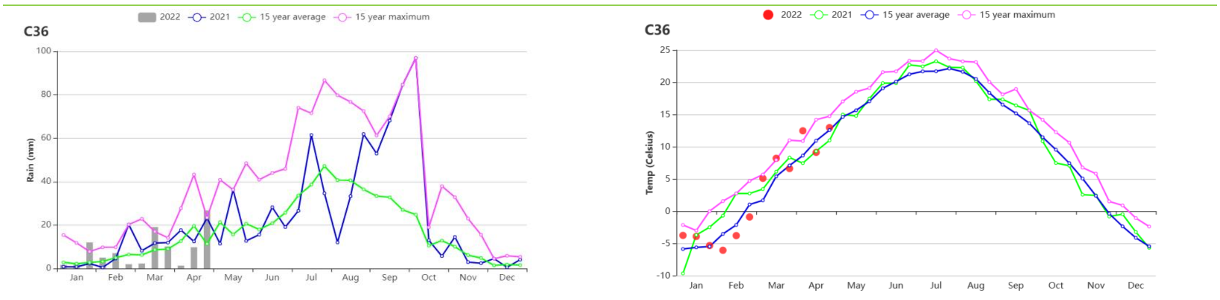
The CropWatch Agroclimatic Indicators (CWAIs) show that the precipitation was above average by 10%, the temperature increased by 0.5°C, and radiation was reduced by 4%. Due to the increase in precipitation and temperature, potential biomass increased by 3% compared to the 15YA. The precipitation exceeded the 15-year maximum in late January, mid-March and late April, but other time during the monitoring period also presented the periodic precipitation shortage. Temperatures were slightly above average in January, then dropped to below average in February, and fluctuated from March to April.

According to the regional NDVI development graph, the crop conditions were slightly below the 5YA until mid-April, but recovered to 5YA by late April and early May. NDVI clusters and profiles show that crop conditions in most regions were close to the average with minor negative departures. In western Henan, southern Gansu, Shaanxi and Shanxi (accounting for 12.6% of the total cropland area), the crop conditions were lower than the average level. The Maximum VCl map shows a low value of VClx (0.85). CALF was at 37%, lower than the average level but higher than the same period last year. All in all, the agricultural conditions in the Loess region were close to the average.

Figure 4.12 **Crop condition China Loess region, January - April 2022**

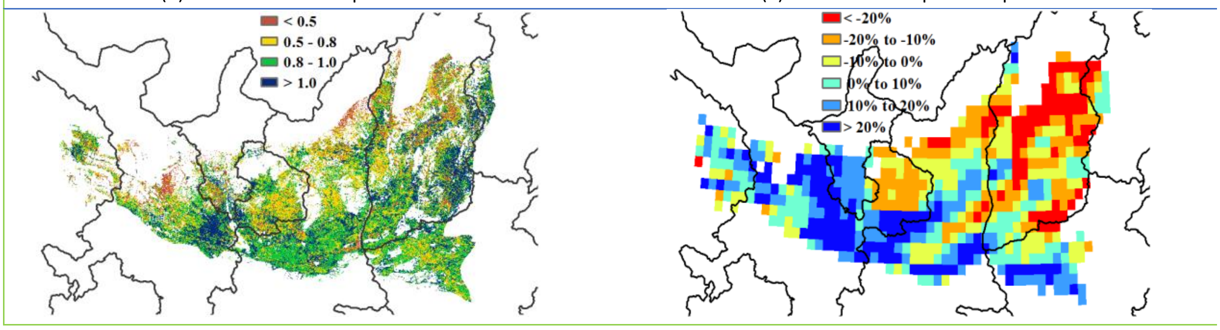


(a) Crop condition development graph based on NDVI (b) Spatial NDVI patterns compared to 5YA (c) NDVI profiles



(d)Time series rainfall profile

(e)Time series temperature profile



(f) Maximum VCI

(g) Biomass departure

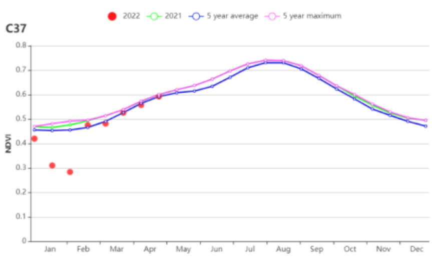
Lower Yangtze region

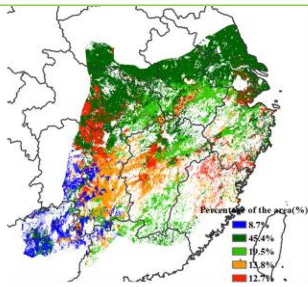
During this monitoring period, only winter crops like wheat and rapeseed were in the field, mostly in the north of the region, including parts in Hubei, Henan, Anhui and Jiangsu provinces. Limited winter crops were planted in Fujian, the southern Jiangxi and Hunan provinces.

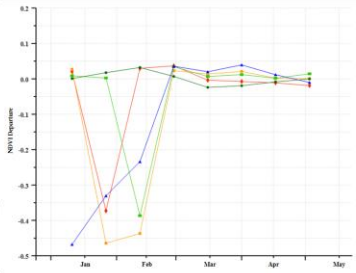
According to CropWatch agro-climatic indicators, the accumulated precipitation and temperature were 19% and 0.3℃ higher than the 15-year averages, respectively. The photosynthetically active radiation was slightly below average (RADPAR -2%) because of increased number of rainy days. The above-average precipitation resulted in an increase of biomass potential production by 6%, as compared to the 15YA. According to the NDVI-based crop development profiles, the crop growth was generally close to the average level during this period. The NDVI departure clustering analysis also reflected the overall normal crop growth conditions. 45.4% of the area, mostly distributed in the north of this region, including the central and southern Jiangsu, central Anhui, southern Henan and northern Hubei provinces, presented near-average crop conditions throughout this monitoring period. The crop condition in other parts had also been close to average since late February. The potential biomass departure map shows a similar pattern. The potential biomass levels in the northern part of the region were up to 20% higher than the average in previous years. The other parts generally had above-average potential biomass departures of up to 10%. The average VCIx of this region was 0.93, and most of the area had VCIx values ranging from 0.8 to 1. The proportion of NDVI anomaly categories showed most parts of the area had average or above-average crop conditions compared to previous years. The proportion of VHIm categories, as compared to the 5YA indicated that the crops in this area were minimally affected by drought.

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

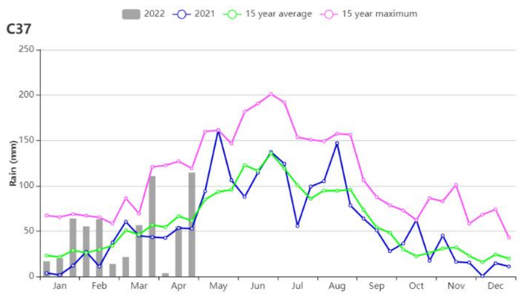
Figure 4.13 **Crop condition China Lower Yangtze region, January 2022 – April 2022**

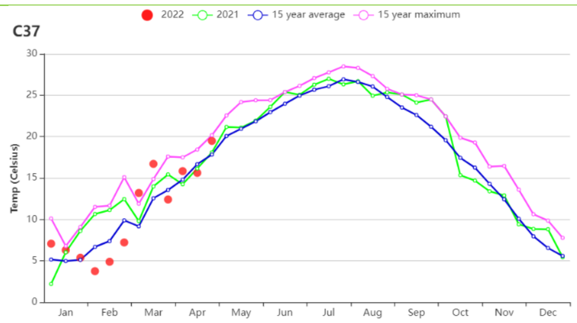




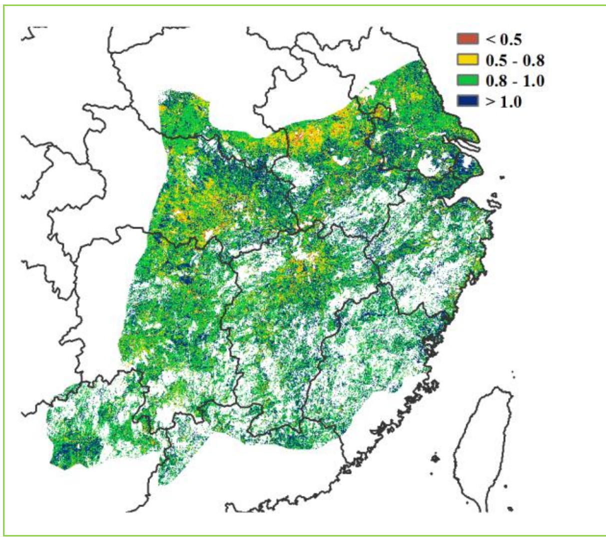


(a) Crop condition development graph based on NDVI (b) Spatial NDVI patterns compared to 5YA (c) NDVI profiles

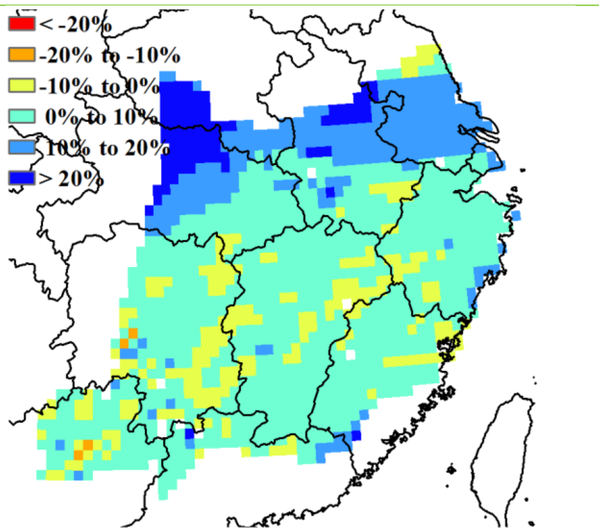




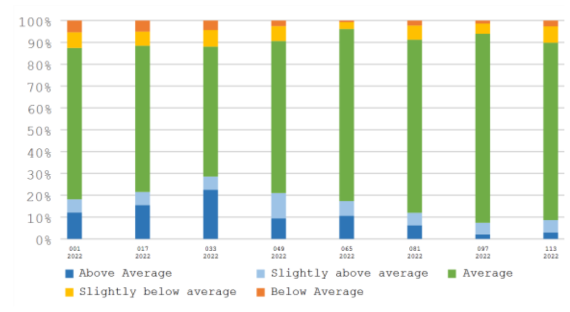
(d)Time series rainfall profile (e)Time series temperature profile



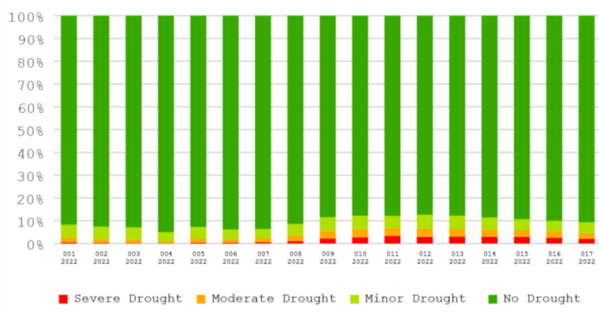
(f) Maximum VCI



(g) Biomass departure



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



(i) Proportion of VHIm categories compared with 5YA

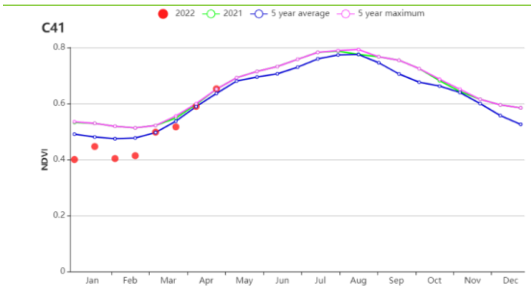
Southwest region

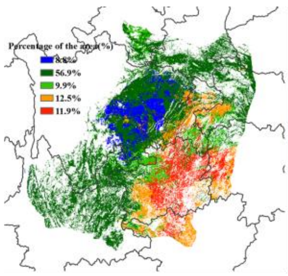
This report covers the overwintering periods upto to ripening stage of winter wheat in southwestern China. According to the regional NDVI profile, crop conditions were generally below the 5-year average before March and exceeded the average since April.

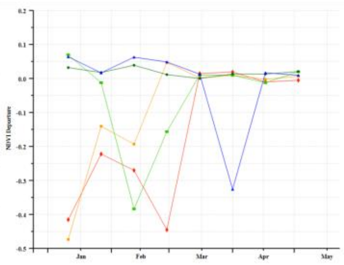
Rainfall was above the 15-year average (RAIN, +31%) but radiation was below average (RADPAR, -6%). Temperature was average (TEMP +0.1°C). The resulting BIOMSS was 12% above average mainly due to the above-average rainfall. The cropped arable land fraction remained at the same level as in the last five years.

According to the NDVI departure clustering map and the profiles, NDVI values were close to average in most areas after February. In Yunnan and Sichuan, the crop conditions were generally normal and above average during the monitoring period, mainly benefit from abundant precipitation (See Annex A.11), but crop growth was less favorable in Guizhou before March and below average in central-eastern Chongqing in February. The VCIx reached 0.99. All in all, crop conditions were generally average.

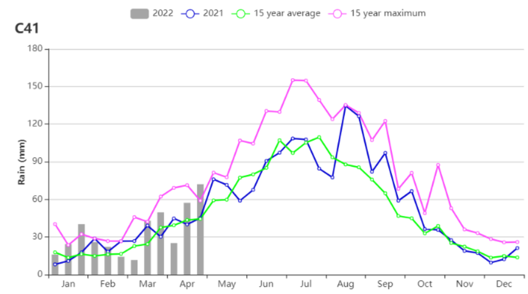
Figure 4.14 **Crop condition China Southwest region, January - April 2022**

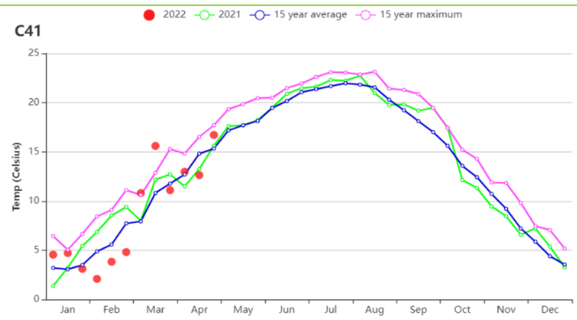




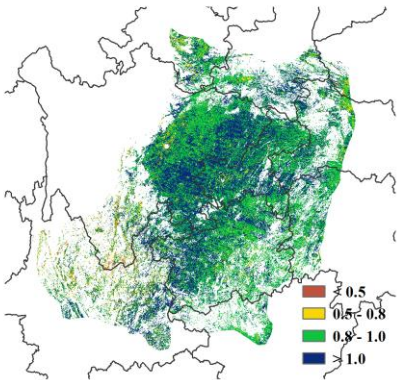


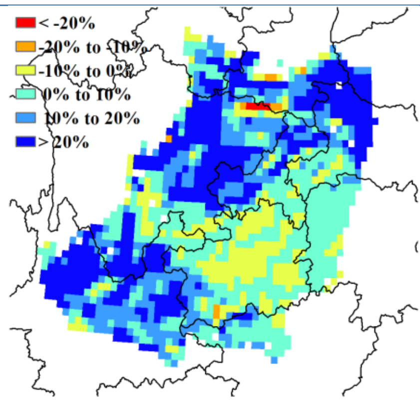
(a) Crop condition development graph based on NDVI (b) Spatial NDVI patterns compared to 5YA (c) NDVI profiles





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





(f) Maximum VCI (g) Biomass departure

Southern China

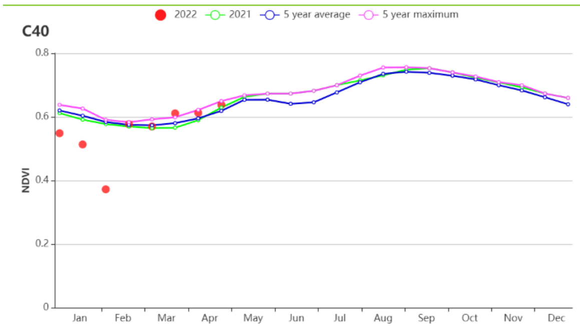
This reporting period covers the jointing, grain-filling up to maturity stages of winter wheat and seedling and transplanting of early rice in Southern China. According to the regional NDVI profile, crop conditions were in general slightly above average.

Rainfall (+13%) and radiation (+4%) were above the 15YA. Temperature was average. The BIOMSS was 7% above average mainly due to the above-average rainfall. The cropped arable land fraction remained at the same level as in the last five years.

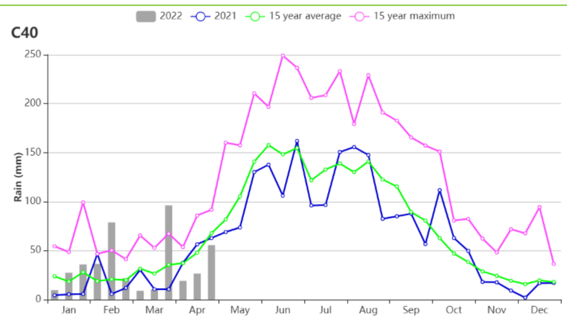
According to the NDVI departure clustering map and the profiles, values were close to average in most regions during this monitoring period in Southern China. In January and February, NDVI values in Guangxi and Guangdong were notably below average mainly due to excessive precipitation and lower temperature which slowed the growth of winter wheat and spring maize. The persistently above average rainfall from mid-January to mid-February has basically relieved the winter drought, prompting the crop conditions to above-average levels in the second half of the reporting period. In March, the temperature increased markedly, which was also good for the growth of rice seedlings. In April, weather conditions were favorable for the tillering of rice. The average VCIx of the Southern China region was 0.94, and most area had VCIx values ranging from 0.80 to 1.00. Low VCIx values were only scattered in Yunnan, Guangxi and Guangdong province which was consistent with the below-average BIOMSS map.

All in all, crop conditions were slightly above average.

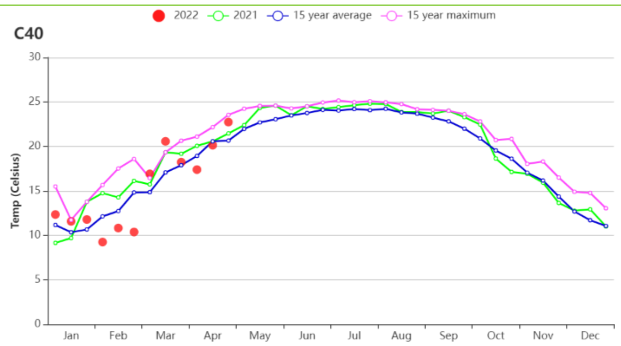
Figure 4.15 **Crop condition Southern China region, January - April 2022**



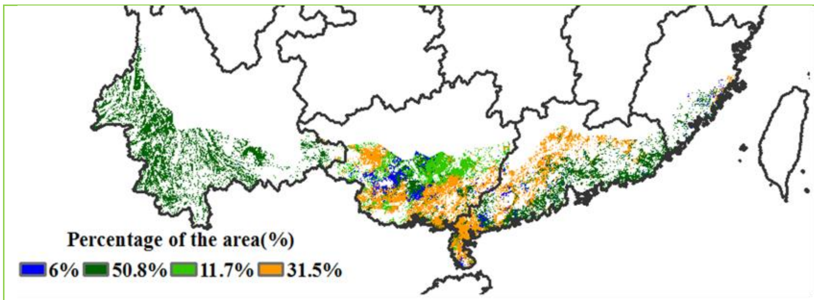
(a) Crop condition development graph based on NDVI

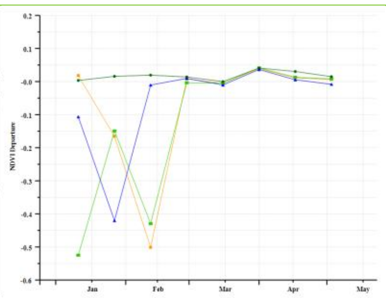


(b) Time series rainfall profile



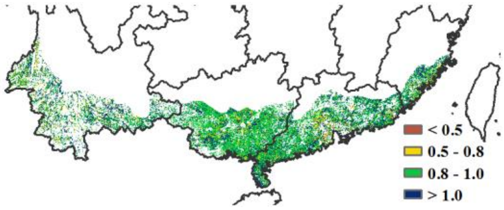
(c)Time series temperature profile

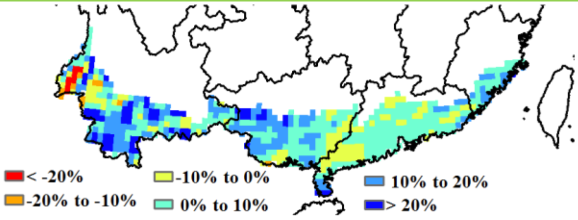




(d) Spatial NDVI patterns compared to 5YA

(e) NDVI profiles





(f) Maximum VCI

(g) Biomass departure

4.4 Major crops trade prospects

Trade prospects for major cereals and oil crop in China for 2022

Maize

In the first quarter, China imported 7.0983 million tonnes of maize, an increase of 5.5% over the same period of last year, with an import volume of US $2.289 billion. It was mainly imported from the Ukraine and United States, accounting for 56.4% and 41.7% of total imports, respectively. The export of maize was very limited, much less than 1000 tonnes.

Rice

In the first quarter, China imported 1.657 million tonnes of rice, an increase of 14.2% over the previous year, with an import volume of US $706 million. The main import sources were Pakistan, India, Thailand, Myanmar and Vietnam, accounting for 28.3%, 27.5%, 15.1%, 13.8% and 7.9% of the total imports, respectively. The export of rice was 428.8 thousand tonnes, a decrease of 34.7% over the same period last year, and the export volume was US $211 million. It is mainly exported to Egypt, Papua New Guinea, South Korea, Bulgaria and Côte d'Ivoire, accounting for 33.4%, 13.0%, 7.8%, 7.0% and 7.0% of the total exports, respectively.

Wheat

In the first quarter, China imported 3.051 million tonnes of wheat, an increase of 4.6% over the same period last year, with an import volume of US $1.123 billion. The main import sources were Australia, France and Canada, accounting for 52.5%, 37.5% and 9.8% of the total import, respectively. The export of wheat was 32.8 thousand tonnes, a decrease of 1.17 times over the same period last year, with an export volume was US $15.1323 million and the export price was US $462/ton. Wheat and mixed wheat was exported to Afghanistan.

Soybean

In the first quarter, China imported 20.295 million tonnes of soybeans, with a decrease of 4.1% over the same period last year, with an import volume was US $12.33 billion. The main import source countries were the United States and Brazil, accounting for 66.1% and 31.4% of the total import volume, respectively. The soybean export was 20.9 thousand tonnes, with an increase of 1.5% over the same period last year, and the export volume was US $27.1357 million. It was mainly exported to South Korea and Japan, accounting for 48.2% and 28.4% of the total export volume, respectively.

Trade prospects for major cereals and oil crop in China for 2022

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

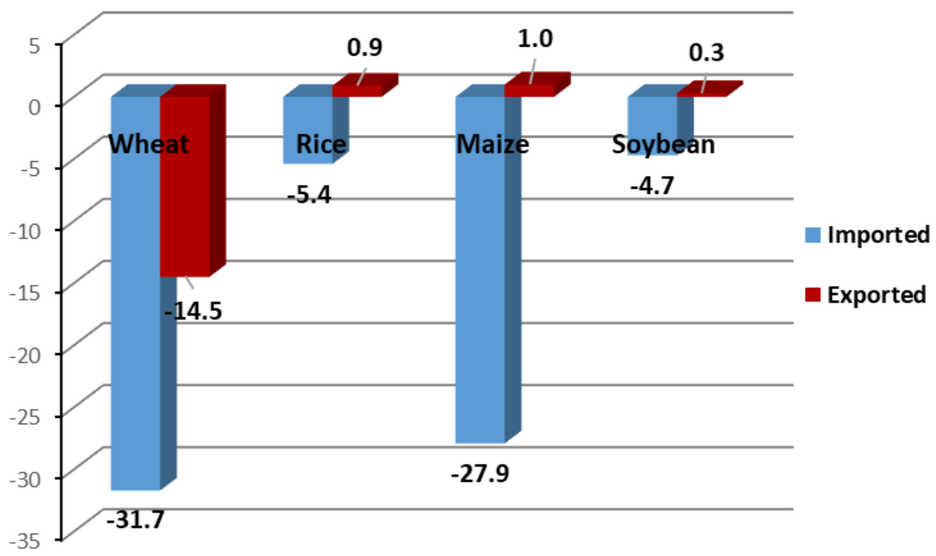
In 2022, China's maize import decreased by 27.9%, and its export was basically the same as last year. The COVID-19 superimposed the impact of the dispute between Russia and Ukraine, the international maize price rose sharply, the advantage of maize import price weakened, the maize import fell from last year's high, and the export remained at a low level. It is estimated that China's maize imports will decrease in 2022.

In 2022, rice imports decreased by 5.4% and exports increased by 0.9%. Affected by the conflict between Russia and Ukraine and other factors, global grain prices have risen sharply, China's rice import demand has weakened, and the export is basically the same as last year. It is estimated that China's rice import will decrease in 2022.

In 2022, China's wheat import decreased by 31.7% and export decreased by 14.5%. Due to the conflict between Russia and Ukraine, the COVID-19 and other factors, the international wheat prices rose sharply, resulting in a sharp decline in wheat imports. Wheat exports remained at a low level. Wheat imports are expected to decrease significantly in 2022.

In 2022, China's soybean import decreased by 4.7%, and the export was basically the same as last year. Due to the vigorous implementation of the soybean and oil production capacity improvement project in China, the soybean sowing area, yield and self-sufficiency rate will rise steadily from 2022. China's soybean imports are expected to decrease in 2022.

Figure 4.16 Rate of change of imports and exports for rice, wheat, maize, and soybean in China in 2022 (%)



Chapter 5. Focus and perspectives

Building on the CropWatch analyses presented in chapters 1 through 4, this chapter presents first early outlook of crop production for 2021 (section 5.1), as well as sections on recent disaster events (section 5.2), an update on El Niño (section 5.3) , and the impact of the Russia Ukraine conflict on global food security (section 5.4).

5.1 CropWatch food production estimates

Table 5.1 presents this year's second forecast by the CropWatch team of global maize, rice, wheat, and soybean production in 2022. Winter crops in the Northern Hemisphere are still growing and summer crops are in the early stages, or yet to be planted in May. The harvest of the 2021/22 summer or monsoon season in the Southern Hemisphere has been completed. CropWatch will further update and review the production in the August and November 2022 CropWatch bulletins.

This bulletin uses the global crop monitoring system (CropWatch) to quantitatively assess the crop growth of 35 major agricultural producing and exporting countries from January to mid-May 2022 and to conduct remote sensing monitoring and forecasting of bulk food and oil crops (maize, rice, wheat, and soybean). All the analyses are based on multi-source remote sensing data (e.g., Sentinel-1/2), and are combined with global agroclimatic and agronomic conditions. The percentage of modeled production in global production varies: 21.5% for maize, 58.8% for rice, 75.9 % for wheat (mostly northern hemisphere winter wheat), and 45.5 % for soybeans. CropWatch production estimates rely on crop-specific remote sensing indicators (major producing countries), combining ground observation, statistics (minor producing countries) and crop masks.

(1) Global production

For 2022, CropWatch forecasts the global production of the four main crops as follows: Maize production at 1.086 billion tonnes, an increase of 8.37 million tonnes (+0.8%); Rice production at 769 million tonnes, an increase by +5.47 million tonnes (+0.7%); Wheat production at 713 million tonnes, decreasing by 7.53 million tonnes (-1.0%); Soybean production at 310 million tonnes, decreasing by 3.3% (Table 5.1). During January to early May 2022, the global agricultural climate conditions were generally normal, though extreme heat and severe drought conditions in some regions affected the production of wheat and soybean. In addition, armed conflicts and the Covid-19 pandemic caused a tightening of food exports and exacerbated the shortage of wheat available for international trade.

(2) Wheat supply situation is threatened by shrinked sown area, decreased yield by drought, extreme heat and regional conflicts

During the autumn of 2021 in the northern hemisphere, conditions were generally on the dry side, causing winter wheat sown area to decline at varying degrees as compared to the year before. In the northern hemisphere, the period for sowing of rainfed winter wheat lasts from mid September to mid November. During late September to mid-October 2021, short-term rainfall deficits occurred in Europe, Middle East, Central Asia and the south of the USA. As a result, the wheat sown areas decreased in Hungary, Italy, Poland, Romania, Russia, Iran, the United States and Afghanistan. Iran and Romania had the largest reduction in winter wheat acreage, shrinking by 11.2% and 11.0% respectively. China's winter wheat sown area decreased by 2.3%, mainly due to severe flooding in some areas of northern China during the winter wheat sowing period. In addition, heavy rainfall and excessive soil wetness delayed wheat sowing in some areas. However, conditions during the winter and spring were quite favorable for wheat growth in most of China. Thanks to developed irrigation facilities, India's and Pakistan’s wheat sowing was stable. Wheat planting area increased by 2.7% and 1.5%, respectively. The eastern region of Ukraine had experienced a significant increase in wheat sown area and the national winter wheat sown area increased by 3.9%.

Some wheat-producing countries suffered from drought and extreme heat, causing shrivelled grains and a production decline in more than a dozen wheat-producing countries. In the Punjabs of India and Pakistan, as well as in Haryana, temperatures were 5ºC higher than usual starting from mid March. The ensuing terminal heat stress caused a fast brown-down of the crops and shortened the grainfilling period. At the national level, this resulted in wheat yields decreases by 4.9% with production of 25.57 million tonnes in Pakistan and by 2.8% with 93.24 million tonnes production in India. In addition to high-temperatures, continued drought has also led to a yield reduction in the United States, Iran, Italy, Romania and Afghanistan, and other countries. The most serious drought occurred in Morocco. It had started during the wheat sowing period and lasted until late winter. It caused a significant reduction by 40% in wheat production to 5.4 million tonnes. Wheat yields in the Ukraine and Turkey were also affected by drought conditions. However, the increase in wheat sown area mitigated the yield decrease and led to a slight increase in total wheat production. Global wheat production is expected to be 713 million tonnes, a further decline after 2021’s reduced production. The global wheat supply is expected to remain tight, considering Ukranian wheat cannot be exported via the Black Sea because of the war, economic sanctions against Russia and wheat export limitations imposed by several countries.

(3) Brazil drought leads to reduced soybean production in the southern hemisphere

The La Niña led to a severe drought in Brazil's main soybean-producing regions, causing soybean production to decline by 7.09 million tonnes. This is a continuation of the reduction observed for last year. The total 2022 soybean production of Argentina and Brazil, two major soybean-producing countries in the southern hemisphere, was 140.98 million tonnes, a 4.7% reduction in production. Drought conditions led to a 4.9% decline in Brazil's soybean yields. Total production is estimated at 89.21 million tonnes, which is 7.09 million tonnes or 7.4% lower than last year. Argentina’s soybean production is expected to be 51.77 million tonnes, an increase of about 0.3%. Thanks to the favorable weather conditions, the soybean yield increased by 2.1% and offseted the negative impact of a reduction in planted area.

(4) With expanded sown area, maize production is expected to increase

The sown area increases of southern hemisphere and equatorial countries contributed to an increased production. The drought at the Horn of Africa caused a significant reduction in maize production. Sowing of maize in the USA and Europe started in mid April only. Total maize production in the southern hemisphere and equatorial countries (Table 1, about 21.5% of total global maize production) is expected to be 233.16 million tonnes with an increase of 10.37 million tonnes (+4.7%), due to an increase in maize growing areas in countries such as Angola, Argentina, Mexico, Mozambique, South Africa and Thailand. Higher maize prices make it more lucrative for farmers to grow maize. Brazil's first season maize area was significantly reduced by the severe drought, but the second season maize area increased significantly by 9.2%, and the annual maize area still increased slightly. Thanks to the expansion of maize growing area, most of the southern hemisphere and equatorial region countries’ maize production increased slightly, and Brazil's second season maize production increased significantly, prompting the Brazil's annual maize production to increase by 9.0%. Among the world's major maize-producing countries, only Kenya's maize was affected by a severe drought. It caused a reduction in both yields and area, resulting in a 12.9% decrease of maize production. Based on remote sensing analyses, CropWatch found that maize sowing progress was delayed in Russia (-22.4%), Ukraine (-35.0%), Romania (-14.6%), Italy (-5.9%), the United States (-13.1%) and Canada (-27.8%) .

(5) Global rice production is well expected

The rice producìont in most rice-producing countries of South and Southeast Asia increased slightly, contributing to an increase of 5.47 million tonnes in global rice production, while rice production in the Philippines and Thailand decreased slightly. This monitoring period marks the dry season in most of South and Southeast Asia countries. The beginning of the rainy season varies between April and June. Most rice production during the winter months is irrigated. Bangladesh (4.2%), Cambodia (1.1%), India (1.5%), Indonesia (3.1%), Myanmar (4.8%), Sri Lanka (3.3%), and Vietnam (1.7%) experienced a increase in rice production. Thailand and the Philippines experienced a small decline in rice area, resulting in a 0.7% and 0.2% decrease in rice production, respectively. In the southern hemisphere countries such as Argentina, Brazil, and Mozambique, rice area also shrank, resulting in a reduction of 2.9%, 9.1%, and 5.3% in rice production, respectively.

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

	Maize		Rice		Wheat		Soybean	
	2022	**Δ %**	**2022**	**Δ %**	**2022**	**Δ %**	**2022**	**Δ %**
Afghanistan					3617	-7.4		
Angola	2737	4.3	49	9.8				
Argentina	54971	2.9	1846	-2.9			51774	0.3
Bangladesh	3933	0.1	50142	4.2				
Brazil	90887	9	10774	-9.1			89206	-7.4
Cambodia			10044	1.1				
China					127635	-1.2		
Egypt					11240	-2		
France					35907	0.7		
Germany					27680	5.6		
Hungary					5050	2.2		
India			184599	1.5	93244	-0.2		
Indonesia	16917	1.1	68422	3.1				
Iran					11094	-12.5		
Italy					7473	-3.6		
Kenya	1990	-12.9						
Mexico	25366	2.7			3917	14		
Morocco					5406	-40.1		
Mozambique	2148	2.2	378	-5.3				
Myanmar	1872	-1.3	26058	4.8				

Pakistan					25573	-3.5		
Philippines	7330	3.5	20498	-0.2				
Poland					10915	1.1		
Romania					6609	-17.4		
Russia					53883	-0.1		
South Africa	11446	-0.1						
Sri Lanka			2609	3.3				
Thailand	4374	3.1	40060	-0.7				
Turkey					16899	0.5		
Ukraine					24499	1.6		
United Kingdom					13075	1.6		
United States					49630	-4.4		
Uzbekistan					8052	7.2		
Vietnam	5637	4.8	47393	1.7				
Zambia	3554	-0.9						
Subtotal	233162	4.7	452828	1.6	541398	-1.6	140980	-4.7
Other	852390	-0.2	316661	-0.6	171450	0.7	168962	-2
Global	1085552	0.8	769490	0.7	712848	-1	309942	-3.3

Several natural and man-made disasters keep threatening global health, food, and the economy in 2022. The current report highlights the major disasters with the most significant impacts on human life in 2022.

5.2 Disaster events

Several natural and man-made disasters keep threatening global health, food, and the economy in 2022. The current report highlights the major disasters with the most significant impacts on human life in 2022.

Drought

Morocco is facing a record drought threatening the country's water resources and food security. With only 15% of agricultural land using irrigation systems, rising temperatures and irregular rainfall have affected agricultural production in the country, including the citrus and horticultural crops, particularly in the Souss-Massa region. Consequently, Morocco's cereal production in 2022 reached its lowest level since 2008, 69% down from last year. This year's drought mainly affected the winter cereals, while spring crops are expected to fare better. To mitigate the impact of the severe drought, Morocco has undertaken drought risk management initiatives and launched a nearly 10 billion dirhams ($1 billion) aid programme to help its agriculture industry, and spent 32 billion dirhams ($3.3 billion) on subsidies of soft wheat, cooking gas and sugar.

Figure 5.1 The effects of the drought on vegetation in Morocco In 2022 form satellite images
(source: https://www.copernicus.eu/en/media/image-day-gallery/effects-drought-vegetation-morocco).

The Horn of Africa is experiencing one of its most severe droughts in recent history, with more than 15 million people acutely food insecure in Ethiopia, Kenya, and Somalia. Drought is helpful to reduce the impact of desert locusts disaster since 2019. Latest forecasts indicate that the March to May 2022 rainy season is likely to be average to below average. If the current March-May rains fail, this would be the first time in the last 40 years that the region has endured four consecutive below-normal seasons. Due to the present severe drought, millions of livestock have died, including more than 1.5 million animals in Kenya, and over 1.5 million livestock in Somali and Ethiopia. Moreover, food prices are rising in many drought-affected areas, due to a combination of macro-economic challenges, below-average harvests, and rising prices on international markets. The cost of a food basket has already risen by 66% in Ethiopia and by 36% in Somalia, leaving families unable to afford even basic items and forcing them to sell their hard-earned properties. More funding is immediately required to help families in their fight against the drought impacts.

Another food crisis is ongoing in West Africa and the Sahel in 2022, where food insecurity has reached an unprecedented level. The estimated number of food-insecure people has been on an upward trend since 2014 and almost quadrupled between 2019 and 2022, driven by severe shocks: localized shortfalls in cereal production, worsening conflicts and insecurity, high food prices, and reduced cross-border trade due to the COVID-19 pandemic. Food insecurity conditions could worsen further if constrained access to fertilizers and unfavorable weather conditions resulted in lower cereal production in 2022.

Floods and Landslides

A Series of severe floods hit South Africa in 2022 but the extreme event was on 11-13 April when heavy rainfall caused flooding and landslides caused in southern and south-eastern parts of South Africa, particularly the Provinces of KwaZulu-Natal and Eastern Cape. The floods caused the death of 443 people in KwaZulu-Natal and over 40,000 were missing. More than 40,000 people have been displaced, while nearly 4,000 houses were destroyed and more than 8,000 others were damaged, mostly across Durban City and its surrounding areas. Hence, on the 18th of April, the President of South Africa declared a national state of disaster due to flood severity.

Figure 5.2 The devastating impacts of floods in KwaZulu-Natal Province (KZN), South Africa, in April 2022 (https://floodlist.com/africa/south-africa-kwazulu-natal-floods-april-2022).

In Brazil, three hours of extremely heavy rain on 15th February 2022 led to more than 250 landslides, including mudslides that caused mass destruction in Petrópolis, a city built on a hillside like many low-income neighborhoods located in the north of Rio de Janeiro. The mudslides took everything in their path: cars, homes, and people, causing the death of 231 people, with five people missing. The recorded rain in a few hours on the 15th of February was more than the rains that typically occur in the whole month of February, being the highest in more than 90 years. While experts attribute the increased rainfall to climate change and weather, the growth of the city is also to blame for the disaster. As Petrópolis has expanded, residents have moved onto the hills, clearing forests that once acted as a buffer against mudslides and building homes on terrain that is often too steep and unsuitable for development.

Figure 5.3 The mudslides caused by floods in Petrópolis, Rio de Janeiro, in February 2022 (https://floodlist.com/america/brazil-floods-landslides-petropolis-march-2022).

Landslides, floods, electrical storms, and strong winds caused by the 2022 rainy season have been affecting Colombia since the 15th of March, causing the death of 28 people, one person is missing and 45 individuals sustained injuries. Besides, more than 100 houses have been destroyed and 2,000 others were damaged in addition to the distraction of 335 road sections, 38 bridges, and 17 educational institutions.

In Australia, the east coast endured three intense weather systems that led to record rains and flooding from late February to early April. On the 30th of March, an intense low-pressure system brought heavy rains to Australia’s east coast, forcing thousands to flee their homes. The first three months of 2022 brought a year's worth of rain to Sydney. On the 7th of April, Sydney received nearly a month's rain overnight, leading to the evacuation of thousands of people.

Figure 5.4 Properties inundated by floods in Goodna, Australia on the 2nd of March, 2022 (https://www.npr.org/sections/pictureshow/2022/03/02/1083314101/photos-record-breaking-floods-devastate-eastern-australia).

Covid-19

The Covid-19 pandemic has remained a global threat to human lives and national economies. Besides its massive impacts on global health, food security and the economy of all countries were significantly affected since enough food is available globally, but COVID-19 is disrupting supply and demand in complex ways. In the poorest countries, the virus poses a serious threat to food security and livelihoods, where agricultural production systems are more labor-intensive and there is less capacity to withstand a severe macroeconomic shock. Besides, there has been a major shift in the structure of demand, with a collapse in demand from restaurants, hotels, and catering, the closure of open markets, and a surge in demand from supermarkets. Measures put in place to prevent or slow the spread of COVID-19 are also disrupting the functioning of food supply chains. The impacts on labour are of particular concern leading to a vulnerable food sector. Measures to contain the spread of the COVID-19 are causing delays and disruptions to transport and logistics services. Border closures and additional procedures and checks have led to congestion and delays, affecting the transit of perishable products. For example, social distancing requirements have reduced the number of import and export inspectors at borders, increasing the time needed for customs clearance.

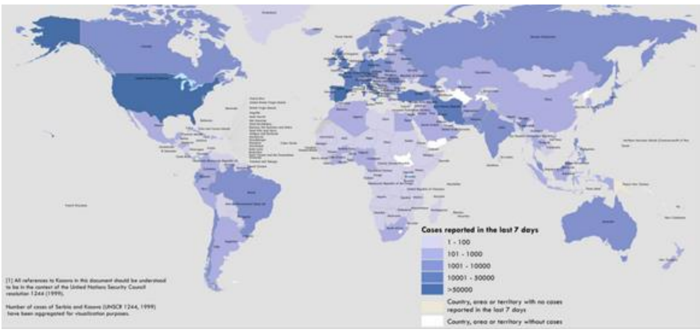


Figure 5.5 Countries, territories, or areas with reported confirmed cases of COVID-19, the 4th of April 2020 (Source: World Health Organization).

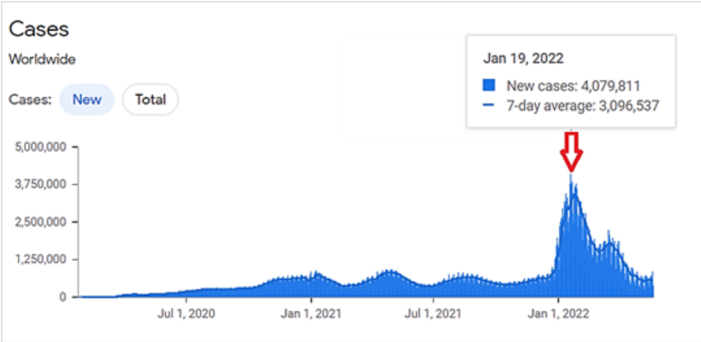


Figure 5.6 The number of cases increased significantly by the start of 2022 (source: JHU CSSE COVID-19 Data).

5.3 Update on El Niño

According to the Australian Government Bureau of Meteorology, the 2021–2022 La Niña continues in the tropical Pacific, with little change in strength in the past few weeks. Several indicators of La Niña, including tropical Pacific Sea surface temperatures, cloudiness near the Date Line, and the Southern Oscillation Index (SOI), have maintained or slightly increased their strength over the past fortnight.

Figure 5.10 illustrates the behavior of the standard Southern Oscillation Index (SOI) for the period from April 2021 to April 2022. The SOI increased from 4.1 in January until 22.6 in April, indicating a typical and increasing La Niña during the monitoring period.

Another commonly used measure of El Niño is known as the Oceanic Niño Index (ONI). Figure 5.11 shows several ONIs and their locations. Values of the three key ONIs for April 2022 were: NINO3 −0.5 °C, NINO3.4 −0.7 °C, and NINO4 −0.6 °C. It implies that the average sea surface temperature in all three regions is lower than the historical average. Moreover, the three key NINO indices decreased 0.1 °C compared to March. This is an indication that the La Niña slightly increased its strength over the past month.

Sea surface temperature (SSTs) for April 2022 (Figure 5.12) show cool SST anomalies across the central to eastern equatorial Pacific and along the coastline of South America, and mostly weak warm SST anomalies over parts of the Maritime Continent. Compared to March, cool anomalies in the central to eastern tropical Pacific have strengthened, while in the west SST anomalies are closer to average than they were during March.

In conclusion, from January to April, La Niña continued to be active in the tropical Pacific and its atmospheric indicators were stronger than the oceanic ones. This resulted in a continued impact of La Niña on global weather and climate during the monitoring period. For example, La Niña conditions increased the chances of above average rainfall for much of eastern Australia and caused relatively rare widespread cold and snowy weather in northeastern China. Autumn in the Southern Hemisphere is the usual time of the year in which ENSO events decay and return to neutral. However, no such empirical trend of decay has been observed so far.

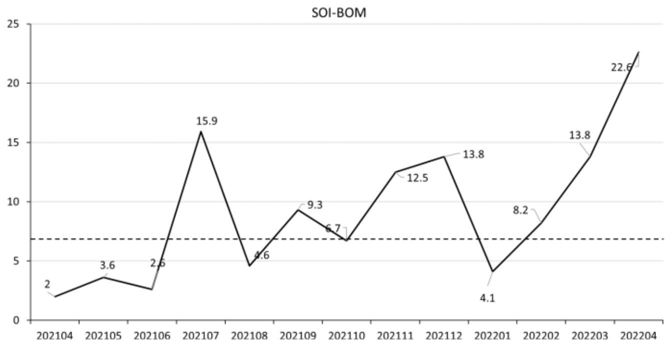


Figure 5.7 Monthly SOI-BOM time series from April 2021 to April 2022

(Source: http://www.bom.gov.au/climate/enso/soi/).

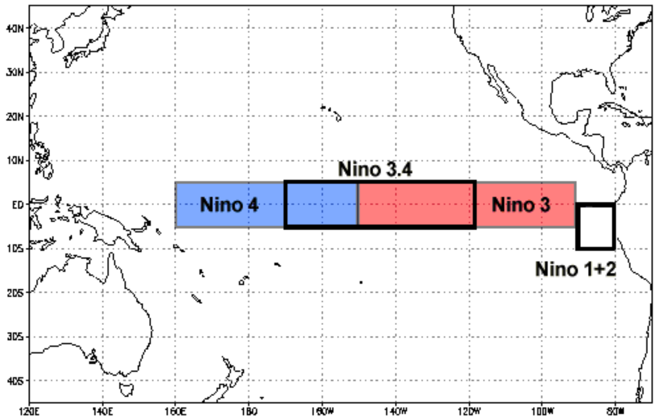


Figure 5.8 Map of NINO Region(Source: https://www.ncdc.noaa.gov/teleconnections/enso/sst).

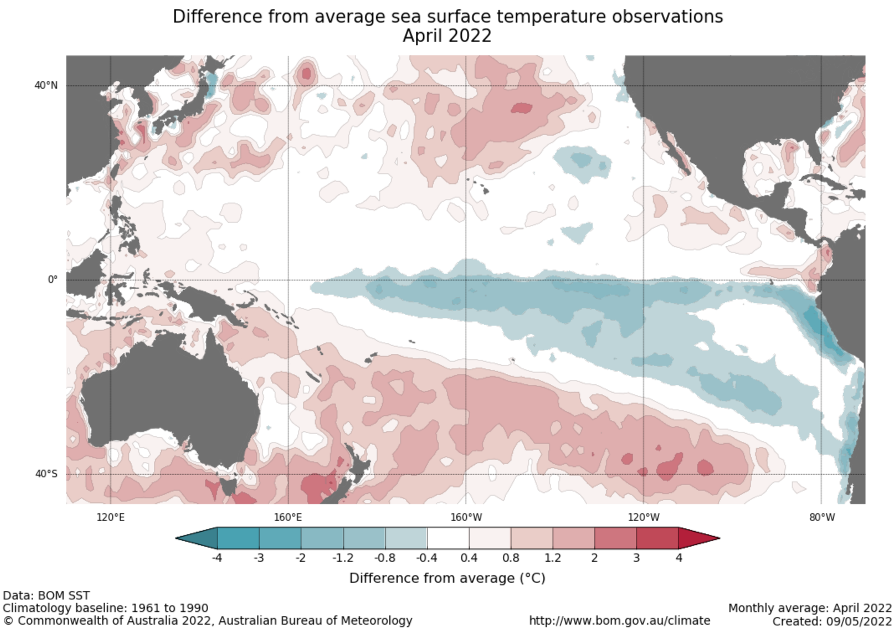


Figure 5.9 Monthly temperature anomalies in the tropical Pacific for April 2022

(Source: http://www.bom.gov.au/climate/enso/wrap-up/#tabs=Sea-surface).

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5.4 The impact of the Russia Ukraine conflict on global food security

Both Ukraine and Russia are important food exporters to the global markets. According to FAOSTAT, nearly 30 countries have relied on Ukraine and Russia for at least 50 percent of their wheat imports during the last five years. Russia is the largest wheat exporter in the world and Ukraine is the ‘breadbasket of Europe’ and a major exporter of wheat, maize and sunflower oil. Both countries accounted for about 30% of the global wheat market in 2021.The conflict between the two major crop exporters and economic sanctions imposed by the West against Russia and its oligarchs, in addition to the ongoing COVID-19 pandemic have created further downward pressure on the global economy (He, 2022).

The Russian-Ukrainian conflict that began on the 24th of February 2022 has caused loss of life, citizens’ displacement, and massive destruction of infrastructure in Ukraine. More than 6.4 million people had been forced to abandon their homes and flee across borders to safety, while millions more are internally displaced. The conflict has resulted in the suspension of commercial operations in Ukraine's ports, hampering the country's ability to export its products. Nearly 50 countries depend on the Russian Federation and Ukraine for at least 30 percent of their wheat import needs. Subsequently, the FAO Cereal Price Index achieved a record value in March 2020 (since 1990).

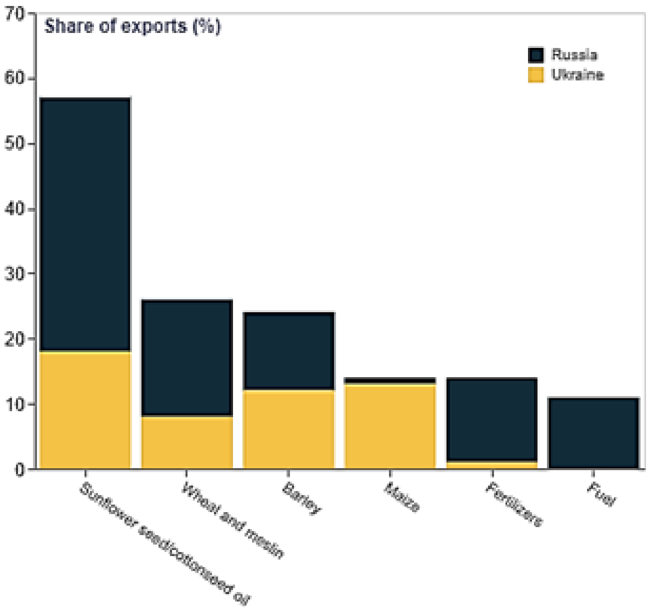

Figure 5.10 Share of total world exports for major food-related commodities (2020). Source: World Integrated Trade Solution, WITS (2022).

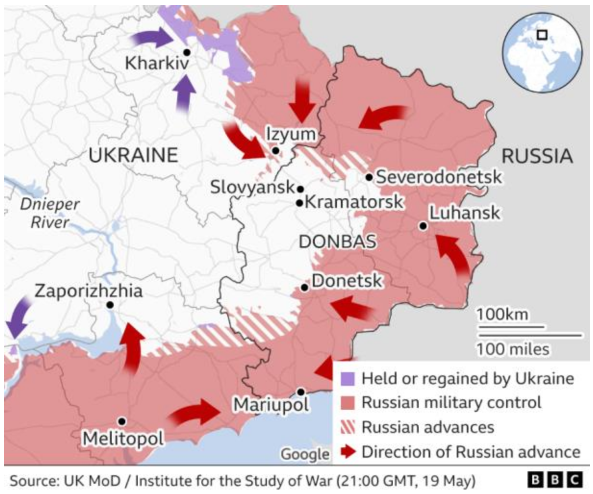

Figure 5.11 The situation of the conflict between Russia and Ukraine

The participation of the Ukraine in the world market is indispensable for the global food supply. The fertile black soils are key to the high productivity of Ukrainian agriculture. These soils have a high humis content and therefore can store large amounts of nutrients and moisture. The Ukranian black soils account for 40% of the total black soil area in the world. They are mainly concentrated in the central and eastern regions of the country.

Since 24 February 2022, the conflict between Russia and Ukraine has expanded significantly. As the winter crops were already planted in the previous year, the conflict had no impact on the planted area for winter crops. Since 19 April, the conflict reaches Ukraine's eastern Donbas region. It has put eastern Ukraine major winter crops producing regions in the front line of the conflict. It is likely to cause the proportion of harvest in the conflict zone to drop to about 60%, which means that about 1.2 million hectares of winter crops cannot be harvested, including about 900,000 hectares of wheat crops.

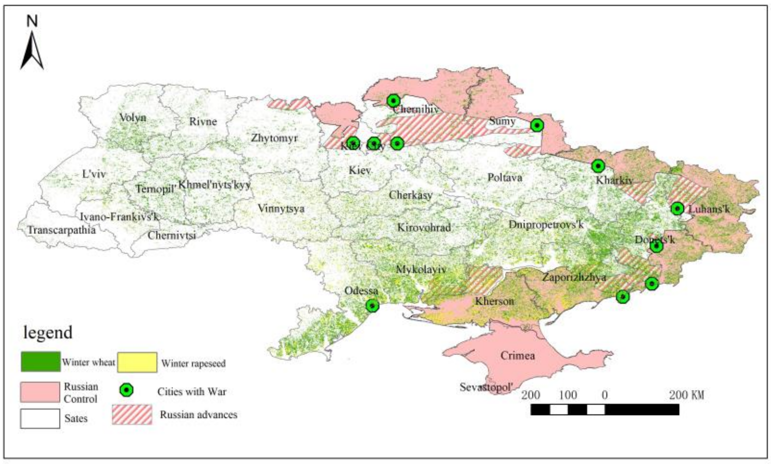

Figure 5.12 The distribution of winter crops in Ukraine

The situation for spring crops is more worrisome. The lack of labor, fuel and agricultural inputs in the southern regions due to the conflict has had a significant impact on the sowing of spring crops. The Ukrainian government estimates that 50-70% of agricultural land is usually grown with summer crops. According to a survey conducted by the Ukrainian government, four out of five of nearly 1,300 large agricultural enterprises do not have enough fuel to plant this summer.

Labor and the accessibility of the farms might be another issue. More than 6.4 million refugees have left Ukraine,[1]. Approximately one-quarter of the country's total population had left their homes in Ukraine by 20 March. This will have a dramatic effect on the management and harvest of winter crops. Safety is a problem for farmers when operating machinery in the field.

Ukraine is also the biggest exporter of sunflower oil and the second largest of barley. Global agricultural markets have endured supply-side shocks and price spikes before. Even before the conflict started in February 2022, many countries around the world were struggling to get access to adequate food supplies following the economic downturn triggered by Covid-19. According to the Global Report on Food Crises 2022, about 193 million people face acute food insecurity in 2021. This represents an increase of nearly 40 million people compared to the previous high reached in 2020.

With the closure of Black Sea ports, exports of cereals have been drastically reduced [FAO, AMIS]. Grains exports are currently limited to 500,000 tons a month, down from as much as 5 million tons before the conflict [Bloomberg]. Previously, 96% of Ukraine's grain, oilseeds and vegetable oils were exported by sea. The situation has now changed to 70% by rail and 30% through the only two ports currently in operation - Reni and Izmail on the Danube.. The Ukrainian government has asked the EU to plan for storage and logistic support for the next harvests [Ouest France].

Global wheat exports in 2021 were 206 million tons. The combined wheat exports of Russia and Ukraine accounted for nearly 28.5% of the global share. Ukraine exported 24 million tons of wheat, accounting for 11.6%. Russian wheat exports of amounted to 35 million tons, accounting for 16.9% of global wheat exports. It was the world's largest wheat exporter.

The current Russia-Ukraine conflict has had a major impact on the global food security situation, with wheat prices having risen by 44% so far this year. From March 2021 to March 2022, India's wheat exports totaled 7.85 million tons, a 275% increase from the previous year. An extreme and ongoing heatwave has cut into India's wheat harvest. The worst affected Indian states due to the heatwave were the two major wheat-growing regions – Punjab and Haryana. In order to stabilize domestic prices, India banned exports in May.

In 2020/21, Ukraine was the world's largest exporter of sunflower oil, accounting for 47% of exports, followed by Russia (29%), Argentina, the European Union (EU) and Turkey (6-7% each). Sunflower production is mainly located in the east, north and south of the country, i.e., the areas most affected by the conflict. It will dramatically affect the supply of sunflower oil.

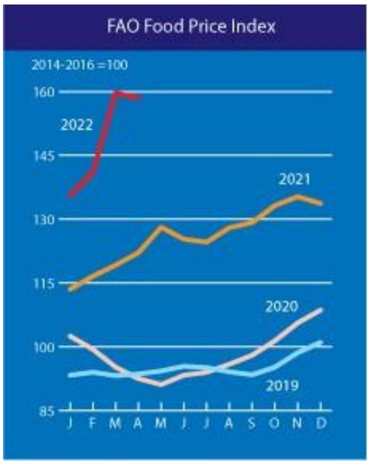

Figure 5.13 FAO Food Price Index

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Annex A. Agroclimatic indicators and BIOMSS

We also stress that the reference period, referred to as "average" in this bulletin covers the 15- year period from 2007 to 2021. Although departures from the 2007-2021 are not anomalies (which, strictly, refer to a "normal period" of 30 years), we nevertheless use that terminology. The specific reason why CropWatch refers to the most recent 15 years is our focus on agriculture, as already mentioned in the previous paragraph. 15 years is deemed an acceptable compromise between climatological significance and agricultural significance: agriculture responds much faster to persistent climate variability than 30 years, which is a full generation. For "biological" (agronomic) indicators used in subsequent chapters we adopt an even shorter reference period of 5 years (i.e. 2017-2021) but the BIOMSS indicator is nevertheless compared against the longer 15YA (fifteen- year average). This makes provision for the fast response of markets to changes in supply but also to the fact that in spite of the long warming trend, some recent years (e.g. 2008 or 2010-13) were below the trend.

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. The improved approach includes sunshine (RADPAR), TEMP and RAIN.

Table A.1 January 2022 – April 2022 agroclimatic indicators and biomass by global Monitoring and Reporting Unit (MRU)

65 Global MRUs		RAIN Current (mm)	RAIN 15YA dep. (%)	TEMP Current (°C)	TEMP 15YA dep. (°C)	RADPAR Current(MJ/m²)	RADPAR 15YA dep. (%)	BIOMSS Current (gDM/m²)	BIOMSS 15YA dep. (%)
C01	Equatorial central Africa	661	-14	23.3	-0.1	1225	2	1148	-4
C02	East African highlands	139	-49	20.2	0.4	1382	3	543	-18
C03	Gulf of Guinea	122	-13	27.1	-0.1	1326	1	617	-5
C04	Horn of Africa	315	-35	22.1	0.5	1340	5	799	-13
C05	Madagascar (main)	1317	11	22.4	0.1	1147	-2	1430	2
C06	Southwest Madagascar	384	-30	25.6	0.5	1256	1	1008	-7
C07	North Africa-Mediterranean	172	-19	10.3	-0.4	956	0	452	-7
C08	Sahel	29	30	27.1	-0.5	1369	0	360	-9
C09	Southern Africa	557	-7	22.1	0.2	1222	0	969	-6
C10	Western Cape (South Africa)	86	-29	19.3	0.2	1293	2	542	-8
C11	British Columbia to Colorado	324	-11	-2.8	-0.3	715	1	289	-6
C12	Northern Great Plains	231	0	-0.6	-0.9	729	0	331	-12
C13	Corn Belt	456	8	-0.3	-0.6	649	-1	373	-6

C14	**Cotton Belt to Mexican Nordeste**	372	-6	11.4	0.0	909	5	661	-4
C15	**Sub-boreal America**	271	26	-8.6	-0.7	489	-8	181	-12
C16	**West Coast (North America)**	326	-34	7.3	0.0	821	6	406	-24
C17	**Sierra Madre**	50	-41	16.6	0.0	1326	3	359	-15
C18	**SW U.S. and N. Mexican highlands**	75	-39	8.9	-0.3	1098	3	316	-17
C19	**Northern South and Central America**	435	3	23.2	-0.1	1176	1	816	3
C20	**Caribbean**	253	26	23.7	0.3	1189	3	835	12
C21	**Central-northern Andes**	871	-12	15.3	0.0	1063	2	822	-2
C22	**Nordeste (Brazil)**	202	-51	26.6	1.1	1309	4	791	-21
C23	**Central eastern Brazil**	467	-50	24.9	1.4	1234	4	1003	-26
C24	**Amazon**	1034	-19	24.5	0.3	1143	7	1404	-3
C25	**Central-north Argentina**	662	25	22.7	-0.6	1143	0	1067	3
C26	**Pampas**	513	5	22.4	0.1	1174	-1	1027	3
C27	**Western Patagonia**	367	44	12.9	-0.6	1200	0	604	4
C28	**Semi-arid Southern Cone**	271	42	17.6	-0.7	1283	-1	628	6
C29	**Caucasus**	303	-10	3.0	-0.1	810	1	437	-5
C30	**Pamir area**	289	-31	4.9	1.8	946	5	415	-5
C31	**Western Asia**	155	-20	8.6	1.6	899	0	399	-8
C32	**Gansu-Xinjiang (China)**	113	10	-2.1	0.2	870	-2	210	1
C33	**Hainan (China)**	396	42	21.0	-0.3	925	-3	912	19
C34	**Huanghuaihai (China)**	92	-6	6.4	0.5	895	-2	274	-11
C35	**Inner Mongolia (China)**	61	10	-4.7	0.0	883	-2	193	6
C36	**Loess region (China)**	99	10	2.5	0.5	940	-4	289	3
C37	**Lower Yangtze (China)**	594	19	10.7	0.3	700	-2	797	6
C38	**Northeast China**	115	16	-5.8	0.7	763	-3	244	15
C39	**Qinghai-Tibet (China)**	362	-3	0.4	0.0	1045	0	315	-1
C40	**Southern China**	426	13	15.2	0.0	865	4	789	7
C41	**Southwest China**	401	31	8.6	0.1	746	-6	645	12
C42	**Taiwan (China)**	362	25	19.3	0.0	960	-2	773	8
C43	**East Asia**	287	-1	-1.2	0.8	764	-2	331	4
C44	**Southern Himalayas**	149	-12	18.7	0.1	1132	1	502	-2
C45	**Southern Asia**	64	-25	25.6	-0.1	1306	2	537	-2
C46	**Southern Japan and the southern fringe**	467	-5	7.3	0.9	815	1	627	-1

	of the Korea peninsula								
C47	Southern Mongolia	59	-3	-11.8	0.5	802	-3	113	-8
C48	Punjab to Gujarat	56	-12	23.5	0.9	1208	1	473	6
C49	Maritime Southeast Asia	1292	-2	24.3	0.2	1158	5	1444	3
C50	Mainland Southeast Asia	302	27	24.7	0.0	1185	-1	824	12
C51	Eastern Siberia	206	-2	-8.4	1.5	558	-1	190	3
C52	Eastern Central Asia	94	7	-11.7	0.8	693	-2	156	2
C53	Northern Australia	954	-7	26.3	0.6	1302	5	1322	-3
C54	Queensland to Victoria	325	39	21.0	0.1	1143	-4	814	14
C55	Nullarbor to Darling	113	6	21.3	0.2	1261	2	616	6
C56	New Zealand	336	13	14.8	0.2	1025	1	720	-2
C57	Boreal Eurasia	322	5	-3.4	1.0	385	-1	258	2
C58	Ukraine to Ural mountains	293	13	-0.7	1.1	386	-12	345	2
C59	Mediterranean Europe and Turkey	270	-26	6.6	-0.5	820	5	517	-11
C60	W. Europe (non Mediterranean)	257	-22	4.5	0.2	600	5	481	-6
C61	Boreal America	388	25	-6.8	1.1	401	-9	200	7
C62	Ural to Altai mountains	181	-3	-4.3	2.3	529	-4	277	12
C63	Australian desert	146	32	22.4	0.0	1269	-1	624	4
C64	Sahara to Afghan deserts	55	-28	17.4	0.5	1162	1	358	-9
C65	Sub-arctic America	66	-17	-22.1	0.7	306	-4	37	4

Table A.2 January 2022 – April 2022 agroclimatic indicators and biomass by country

Country code	Country name	RAIN Current (mm)	RAIN 15YA Departure (%)	TEMP Current (°C)	TEMP 15YA Departure(°C)	RADPAR Current (MJ/m²)	RADPAR 15YA Departure (%)	BIOMSS Current (gDM/m²)	BIOMSS 15YA Departure (%)
ARG	Argentina	532	34	21.6	-0.5	1173	0	962	8
AUS	Australia	325	18	21.7	0.2	1173	-2	794	10
BGD	Bangladesh	83	-40	23.2	-0.1	1188	0	524	-10
BRA	Brazil	628	-38	24.7	1.1	1214	4	1097	-19
KHM	Cambodia	410	27	26.6	-0.1	1192	1	969	14
CAN	Canada	346	15	-6.3	-0.5	523	-7	211	-8
CHN	China	352	19	6.7	0.3	800	-2	460	7
EGY	Egypt	49	-3	14.6	-1.0	993	-2	271	-8
ETH	Ethiopia	94	-48	20.8	0.3	1389	2	494	-17
FRA	France	259	-29	6.2	0.4	647	6	528	-7
DEU	Germany	293	-2	3.8	0.2	528	1	499	1
IND	India	64	-26	23.4	0.0	1256	1	487	-1
IDN	Indonesia	1323	-6	24.4	0.2	1169	6	1479	1
IRN	Iran	159	-25	8.7	1.0	1019	2	396	-13
KAZ	Kazakhstan	189	6	-2.5	2.3	606	-6	323	14
MEX	Mexico	123	0	18.9	-0.1	1257	2	446	-8

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 (%)
MMR	Myanmar	122	-5	21.5	0.3	1210	-3	548	1
NGA	Nigeria	101	-20	26.4	-0.6	1358	2	534	-2
PAK	Pakistan	185	-40	14.8	1.9	1088	5	452	-5
PHL	Philippines	956	48	24.6	0.0	1144	-1	1264	12
POL	Poland	262	1	2.6	0.2	482	1	455	-1
ROU	Romania	179	-31	3.0	-0.3	677	5	401	-16
RUS	Russia	246	10	-3.5	1.6	443	-9	277	6
ZAF	South Africa	137	-40	19.6	0.1	1282	2	605	-16
THA	Thailand	364	34	25.2	-0.2	1180	0	904	17
TUR	Turkey	352	-5	3.2	-1.0	831	2	491	-5
GBR	United Kingdom	306	-21	6.1	0.8	463	7	535	-2
UKR	Ukraine	225	-7	1.8	0.2	502	-5	408	-6
USA	United States	341	-5	4.8	-0.3	803	3	436	-8
UZB	Uzbekistan	228	-9	8.0	1.7	836	0	418	-4
VNM	Vietnam	381	24	20.7	-0.1	975	0	871	11
AFG	Afghanistan	183	-41	7.5	2.2	1017	5	421	-11
AGO	Angola	698	-14	21.9	-0.1	1198	2	1213	-2
BLR	Belarus	300	15	0.4	0.4	368	-11	367	-4
HUN	Hungary	141	-38	4.2	-0.4	671	6	393	-21
ITA	Italy	191	-51	6.4	-0.2	790	8	448	-22
KEN	Kenya	204	-55	21.6	0.6	1398	5	700	-21
LKA	Sri_Lanka	683	22	25.3	0.0	1249	0	1277	14
MAR	Morocco	184	-15	10.7	-0.2	1013	0	466	-5
MNG	Mongolia	70	1	-11.7	0.5	777	-2	154	1
MOZ	Mozambique	847	9	23.6	0.2	1179	-2	1269	0
ZMB	Zambia	919	-6	20.9	0.0	1166	0	1242	0
KGZ	Kyrgyzstan	351	12	-3.1	0.4	829	-1	301	5

*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 Jan- April.*

Table A.3 Argentina, January 2022 – April 2022 agroclimatic indicators and biomass (by province)

	RAIN Current (mm)	RAIN 15YA Departure (%)	TEMP Current (°C)	TEMP 15YA Departure(°C)	RADPAR Current (MJ/m²)	RADPAR 15YA Departure (%)	BIOMSS Current (gDM/m²)	BIOMSS 15YA Departure (%)
Buenos Aires	377	55	19.8	-1.0	1205	-1	887	18
Chaco	473	-6	25.4	0.6	1115	-2	1018	-6
Cordoba	443	58	21.3	-0.9	1227	1	924	10
Corrientes	667	29	24.8	0.9	1167	0	1117	4
Entre Rios	744	94	22.2	-0.7	1165	-2	1090	17
La Pampa	211	19	20.9	-0.9	1278	2	784	12
Misiones	528	-18	23.6	0.7	1207	0	1168	-4

Santiago Del Estero	796	66	22.9	-1.1	1102	-1	1147	11
San Luis	181	-13	20.6	-0.8	1279	3	718	-5
Salta	1037	12	19.9	-0.3	1063	-1	1188	2
Santa Fe	593	58	23.1	-0.6	1151	-2	1058	14
Tucuman	975	57	18.9	-0.3	1101	-3	1079	6

Table A.4 Australia, January 2022 – April 2022 agroclimatic indicators and biomass (by state)

	RAIN Current (mm)	RAIN 15YA Departure (%)	TEMP Current (°C)	TEMP 15YA Departure(°C)	RADPAR Current (MJ/m²)	RADPAR 15YA Departure (%)	BIOMSS Current (gDM/m²)	BIOMSS 15YA Departure (%)
New South Wales	386	64	21.3	-0.3	1142	-7	909	24
South Australia	122	9	20.6	0.2	1174	-2	570	-1
Victoria	254	36	19.2	0.6	1113	-1	745	16
W. Australia	194	11	22.2	0.3	1267	2	652	4

Table A.5 Brazil, January 2022 – April 2022 agroclimatic indicators and biomass (by state)

	RAIN Current (mm)	RAIN 15YA Departure (%)	TEMP Current (°C)	TEMP 15YA Departure (°C)	RADPAR Current (MJ/m²)	RADPAR 15YA Departure (%)	BIOMSS Current (gDM/m²)	BIOMSS 15YA Departure (%)
Ceara	359	-42	26.9	0.9	1279	3	1033	-16
Goias	288	-72	25.6	2.6	1277	5	779	-46
Mato Grosso Do Sul	295	-66	26.2	1.7	1172	-3	895	-35
Mato Grosso	656	-49	25.2	1.1	1226	10	1183	-22
Minas Gerais	477	-48	23.3	1.6	1261	5	923	-28
Parana	551	-35	22.7	1.3	1160	-1	1136	-13
Rio Grande Do Sul	560	3	22.3	0.6	1158	-2	1117	2
Santa Catarina	659	-13	20.2	0.5	1132	1	1234	2
Sao Paulo	439	-59	24.2	1.9	1173	2	935	-32

Table A.6 Canada, January 2022 – April 2022 agroclimatic indicators and biomass (by province)

	RAIN Current (mm)	RAIN 15YA Departure (%)	TEMP Current (°C)	TEMP 15YA Departure (°C)	RADPAR Current (MJ/m²)	RADPAR 15YA Departure (%)	BIOMSS Current (gDM/m²)	BIOMSS 15YA Departure (%)
Alberta	217	20	-5.5	-0.1	529	-5	244	-3
Manitoba	298	56	-9.3	-2.1	519	-10	170	-26
Saskatchewan	212	23	-7.3	-1.0	533	-7	212	-15

Table A.7 India, January 2022 – April 2022 agroclimatic indicators and biomass (by state)

	RAIN Current (mm)	RAIN 15YA Departure (%)	TEMP Current (°C)	TEMP 15YA Departure (°C)	RADPAR Current (MJ/m²)	RADPAR 15YA Departure (%)	BIOMSS Current (gDM/m²)	BIOMSS 15YA Departure (%)
Andhra Pradesh	25	-39	26.6	-0.2	1337	2	506	-2
Assam	335	-17	17.8	-0.9	1034	-1	690	-4
Bihar	29	-34	22.5	-0.2	1219	2	433	-7
Chhattisgarh	5	-83	24.0	-0.3	1317	4	435	-7
Daman and Diu	2	39	26.5	0.1	1359	-1	470	44
Delhi	96	67	20.4	-0.2	1124	-1	483	10
Gujarat	7	125	26.3	0.1	1320	0	467	16
Goa	5	-61	26.7	0.0	1361	-2	478	-4
Himachal Pradesh	246	-24	11.5	1.2	1096	5	481	-4
Haryana	108	59	20.5	0.3	1115	0	495	12
Jharkhand	13	-65	22.9	0.0	1269	4	421	-8
Kerala	213	-29	25.9	-0.1	1303	-1	787	-7
Karnataka	27	-58	26.0	0.0	1343	1	500	-8
Meghalaya	257	-13	18.3	-0.8	1083	-1	682	3
Maharashtra	4	-65	26.7	0.0	1345	1	463	-1
Manipur	176	-33	15.2	-0.3	1165	1	508	-17
Madhya Pradesh	5	-70	24.1	0.2	1284	3	426	-3
Mizoram	136	-26	17.5	-0.8	1208	-1	496	-13
Nagaland	360	-20	13.2	-1.5	1063	-1	697	-5
Orissa	15	-60	24.1	-0.3	1300	5	454	-6
Puducherry	114	-5	27.2	0.1	1378	0	718	6
Punjab	174	22	19.9	0.8	1067	2	537	4
Rajasthan	29	63	23.9	0.9	1218	0	454	10
Sikkim	62	-18	12.4	2.5	1239	-1	319	4
Tamil Nadu	129	-40	26.2	0.4	1313	-1	683	-6
Tripura	165	-32	21.5	-0.5	1166	0	598	-9
Uttarakhand	129	1	14.2	0.9	1158	2	439	6
Uttar Pradesh	42	-9	21.8	-0.2	1189	1	434	-4
West Bengal	40	-42	23.8	0.0	1226	2	477	-7

Table A.8 Kazakhstan, January 2022 – April 2022 agroclimatic indicators and biomass (by oblast)

	RAIN Current (mm)	RAIN 15YA Departure (%)	TEMP Current (°C)	TEMP 15YA Departure (°C)	RADPAR Current (MJ/m²)	RADPAR 15YA Departure (%)	BIOMSS Current (gDM/m²)	BIOMSS 15YA Departure (%)
Akmolinskaya	136	-8	-3.9	2.8	567	-6	299	16
Karagandinskaya	115	-9	-4.1	2.5	668	-3	299	14
Kustanayskaya	178	8	-3.3	3.1	491	-12	310	19
Pavlodarskaya	101	-15	-4.5	2.3	597	1	280	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 (%)
Severo kazachstanskaya	124	-22	-4.3	2.7	507	-2	282	17
Vostochno kazachstanskaya	171	-6	-4.5	1.6	716	1	273	6
Zapadno kazachstanskaya	278	37	0.3	3.1	436	-24	397	18

Table A.9 Russia, January 2022 – April 2022 agroclimatic indicators and biomass (by oblast, kray and republic)

	RAIN Current (mm)	RAIN 15YA Departure (%)	TEMP Current (°C)	TEMP 15YA Departure (°C)	RADPAR Current (MJ/m²)	RADPAR 15YA Departure (%)	BIOMSS Current (gDM/m²)	BIOMSS 15YA Departure (%)
Bashkortostan Rep.	268	10	-4.0	2.4	392	-14	272	13
Chelyabinskaya Oblast	173	1	-4.7	2.2	439	-11	266	13
Gorodovikovsk	213	-9	3.7	0.9	594	0	515	8
Krasnodarskiy Kray	255	0	-1.5	0.7	565	0	340	2
Kurganskaya Oblast	167	-4	-4.7	2.4	411	-8	262	13
Kirovskaya Oblast	290	1	-4.2	1.8	284	-16	244	6
Kurskaya Oblast	333	27	-0.2	0.8	351	-21	359	0
Lipetskaya Oblast	329	29	-0.6	1.4	356	-20	349	5
Mordoviya Rep.	332	26	-1.7	2.0	318	-24	313	8
Novosibirskaya Oblast	154	-20	-5.5	2.7	447	0	243	11
Nizhegorodskaya O.	298	10	-2.6	1.7	293	-23	286	5
Orenburgskaya Oblast	254	10	-2.3	2.9	429	-19	322	17
Omskaya Oblast	165	-12	-4.9	3.0	428	0	257	16
Permskaya Oblast	296	7	-4.6	2.3	293	-16	240	11
Penzenskaya Oblast	354	33	-1.1	2.4	338	-23	336	13
Rostovskaya Oblast	258	4	2.7	1.4	552	-2	477	9
Ryazanskaya Oblast	339	26	-1.2	1.5	314	-24	323	3
Stavropolskiy Kray	206	-20	3.2	0.5	639	2	460	-2
Sverdlovskaya Oblast	217	3	-5.2	2.1	344	-11	235	8
Samarskaya Oblast	335	35	-1.6	2.9	348	-26	329	16
Saratovskaya Oblast	364	49	-0.1	2.8	385	-24	375	16
Tambovskaya Oblast	355	34	-0.5	1.9	364	-20	356	9
Tyumenskaya Oblast	190	-3	-5.0	2.6	386	-2	249	14

	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 (%)
Tatarstan Rep.	329	27	-2.9	2.3	305	-23	283	11
Ulyanovskaya Oblast	336	37	-1.7	2.5	327	-25	319	14
Udmurtiya Rep.	314	12	-4.0	2.2	283	-20	252	10
Volgogradskaya O.	305	35	1.2	2.2	479	-12	426	13
Voronezhskaya Oblast	310	22	0.3	1.6	434	-14	389	8

Table A.10 United States, January 2022 – April 2022 agroclimatic indicators and biomass (by state)

	RAIN Current (mm)	RAIN 15YA Departure (%)	TEMP Current (°C)	TEMP 15YA Departure (°C)	RADPAR Current (MJ/m²)	RADPAR 15YA Departure (%)	BIOMSS Current (gDM/m²)	BIOMSS 15YA Departure (%)
Arkansas	567	7	8.7	-0.4	814	5	756	-1
California	126	-66	9.6	0.5	989	9	354	-33
Idaho	283	-22	-1.8	-1.1	720	1	323	-11
Indiana	445	-5	2.7	-0.5	698	2	497	-5
Illinois	456	8	2.2	-1.0	699	0	483	-8
Iowa	284	-8	-1.2	-1.4	684	-1	373	-13
Kansas	158	-27	5.8	-0.1	907	5	404	-17
Michigan	369	4	-2.5	-1.0	561	-8	305	-11
Minnesota	329	28	-6.2	-2.3	558	-11	232	-24
Missouri	441	9	4.5	-0.7	777	4	572	-4
Montana	242	4	-2.7	-0.8	702	-1	314	-7
Nebraska	138	-34	2.2	-0.1	840	3	372	-17
North Dakota	282	52	-5.5	-1.9	627	-6	252	-20
Ohio	422	-5	2.4	-0.2	696	4	484	-2
Oklahoma	276	-8	8.8	-0.4	903	5	533	-10
Oregon	384	-21	2.7	-0.7	683	4	431	-7
South Dakota	199	-7	-1.7	-1.0	731	-1	348	-8
Texas	183	-30	12.9	-0.6	966	5	468	-18
Washington	502	1	2.1	-0.8	566	-3	429	-4
Wisconsin	365	18	-4.4	-1.6	574	-9	271	-16

Table A.11 China, January 2022 – April 2022 agroclimatic indicators and biomass (by province)

	RAIN Current (mm)	RAIN 15YA Departure (%)	TEMP Current (°C)	TEMP 15YA Departure (°C)	RADPAR Current (MJ/m²)	RADPAR 15YA Departure (%)	BIOMSS Current (gDM/m²)	BIOMSS 15YA Departure (%)
Anhui	481	45	9.1	0.7	769	-5	655	8
Chongqing	460	30	9.3	0.2	702	-2	718	13
Fujian	610	1	12.7	0.6	747	4	878	5
Gansu	179	36	0.6	0.2	916	-6	331	12
Guangdong	586	8	16.0	0.1	785	10	911	4
Guangxi	510	13	14.0	-0.2	646	4	847	6
Guizhou	421	4	9.0	-0.2	578	-7	721	3

	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 (%)
Hebei	52	-1	0.6	-0.3	904	-3	207	2
Heilongjiang	124	19	-7.1	1.2	709	-5	240	15
Henan	199	39	8.0	0.6	854	-5	411	5
Hubei	494	45	8.7	0.4	738	-6	710	13
Hunan	623	19	10.0	0.1	632	-2	790	3
Jiangsu	286	24	8.8	0.9	854	0	570	5
Jiangxi	713	17	11.0	0.2	648	-5	843	2
Jilin	111	6	-5.1	0.4	808	-2	260	16
Liaoning	87	8	-2.1	-0.3	866	-1	247	10
Inner Mongolia	72	22	-6.5	0.3	841	-2	189	10
Ningxia	77	13	0.4	-0.1	979	-2	243	4
Shaanxi	166	23	4.8	0.7	893	-4	366	11
Shandong	48	-45	6.3	0.6	918	-1	227	-24
Shanxi	54	-19	1.4	0.5	930	-3	217	-10
Sichuan	446	55	7.2	0.3	802	-7	590	14
Yunnan	270	22	11.1	-0.2	998	-4	605	13
Zhejiang	594	16	9.7	0.6	709	-4	795	5

Annex B. Quick reference to CropWatch indicators, spatial units and methodologies

The following sections give a brief overview of CropWatch indicators and spatial units, along with a description of the CropWatch production estimation methodology. For more information about CropWatch methodologies, visit CropWatch online at www.cropwatch.com.cn**.**

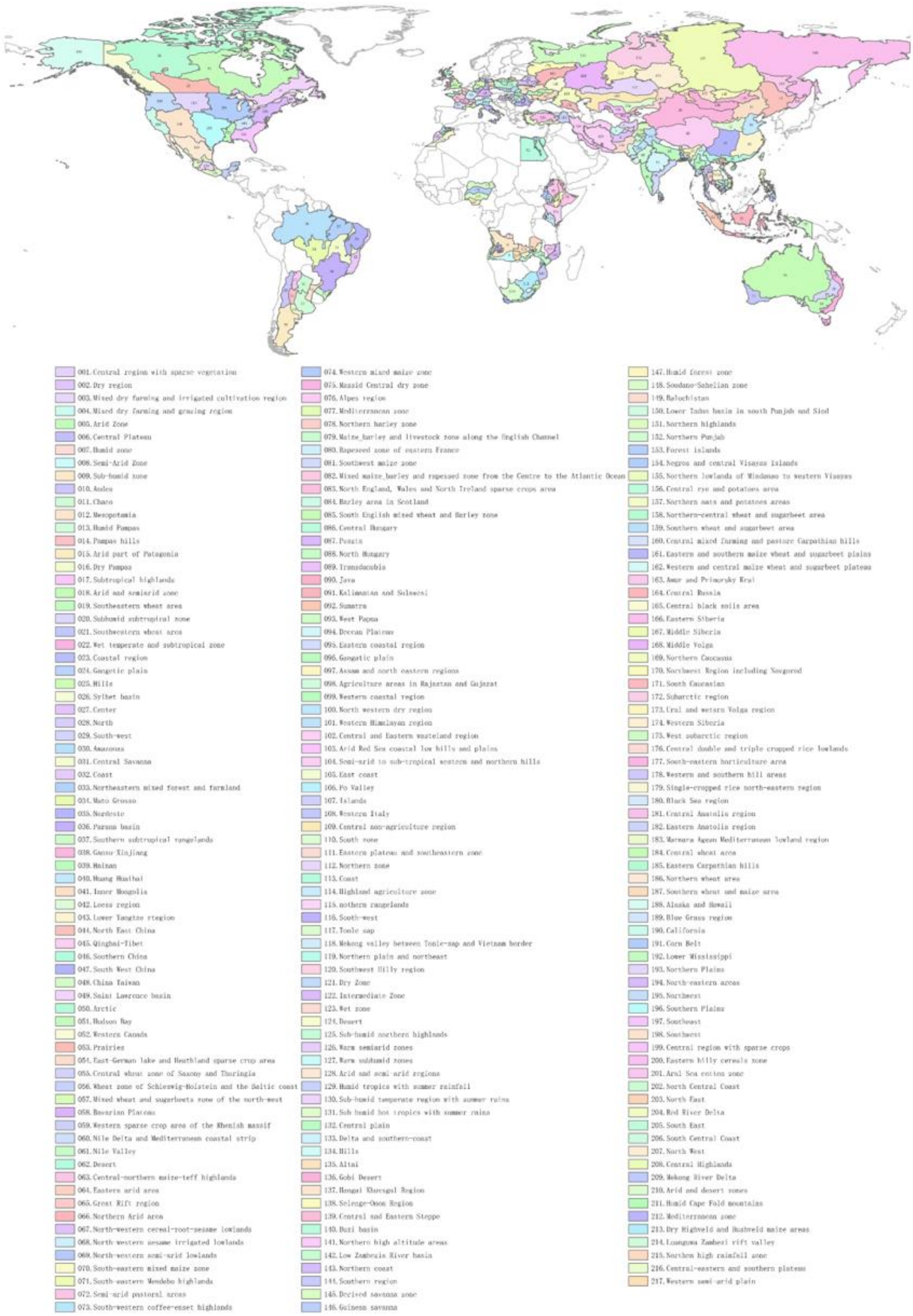
Agroecological zones for 44 key countries

Overview

217 agroecological zones for the 44 key countries across the globe

Description

44 key agricultural countries are divided into 217 agro-ecological zones based on cropping systems, climatic zones, and topographic conditions. Each country is considered separately. A limited number of regions (e.g., region 001, region 027, and region 127) are not relevant for the crops currently monitored by CropWatch but are included to allow for more complete coverage of the 44 key countries. Some regions are more relevant for rangeland and livestock monitoring, which is also essential for food security.



CropWatch indicators

The CropWatch indicators are designed to assess the condition of crops and the environment in which they grow and develop; the indicators—RAIN (for rainfall), TEMP (temperature), and RADPAR (photosynthetically active radiation, PAR)—are not identical to the weather variables, but instead are value-added indicators computed only over crop growing areas (thus for example excluding deserts and rangelands) and spatially weighted according to the agricultural production potential, with marginal areas receiving less weight than productive ones. The indicators are expressed using the usual physical units (e.g., mm for rainfall) and were thoroughly tested for their coherence over space and time. CWSU are the CropWatch Spatial Units, including MRUs, MPZ, and countries (including first-level administrative districts in select large countries). For all indicators, high values indicate "good" or "positive." The Agro-meteorological indicators use 2014-2021 average as reference, which enhances quick marketing reaction.

INDICATOR			
BIOMSS			
Biomass accumulation potential			
Crop/ satellite	Grams dry matter/m², pixel or CWSU	An estimate of biomass that could potentially be accumulated over the reference period given the prevailing rainfall and temperature conditions.	Biomass is presented as maps by pixels, maps showing average pixels values over CropWatch spatial units (CWSU), or tables giving average values for the CWSU. Values are compared to the average value for the recent fifteen years (2007-2021), with departures expressed in percentage.
CALF			
Cropped arable land and cropped arable land fraction			
Crop/ Satellite	[0,1] number, pixel or CWSU average	The area of cropped arable land as fraction of total (cropped and uncropped) arable land. Whether a pixel is cropped or not is decided based on NDVI twice a month. (For each four-month reporting period, each pixel thus has 8 cropped/ uncropped values).	The value shown in tables is the maximum value of the 8 values available for each pixel; maps show an area as cropped if at least one of the 8 observations is categorized as "cropped." Uncropped means that no crops were detected over the whole reporting period. Values are compared to the average value for the last five years (2017-2021), with departures expressed in percentage.
CROPPING INTENSITY			
Cropping intensity Index			
Crop/ Satellite	0, 1, 2, or 3; Number of crops growing over a year for each pixel	Cropping intensity index describes the extent to which arable land is used over a year. It is the ratio of the total crop area of all planting seasons in a year to the total area of arable land.	Cropping intensity is presented as maps by pixels or spatial average pixels values for MPZs, 43 countries, and 7 regions for China. Values are compared to the average of the previous five years, with departures expressed in percentage.
NDVI			
Normalized Difference Vegetation Index			
Crop/ Satellite	[0.12-0.90] number, pixel or CWSU average	An estimate of the density of living green biomass.	NDVI is shown as average profiles over time at the national level (cropland only) in crop condition development graphs, compared with previous year and recent five-year average (2017-2021), and as spatial patterns compared to the average showing the time profiles, where they occur, and the percentage of pixels concerned by each profile.
RADPAR			
CropWatch indicator for Photosynthetically Active Radiation (PAR), based on pixel based PAR			
Weather /Satellite	W/m², CWSU	The spatial average (for a CWSU) of PAR accumulation over agricultural pixels, weighted by the production potential.	RADPAR is shown as the percent departure of the RADPAR value for the reporting period compared to the recent fifteen-year average (2007-2021), per CWSU. For the MPZs, regular PAR is shown as typical time profiles over the spatial unit, with a map showing where the profiles occur and the percentage of pixels concerned by each profile.
RAIN			
CropWatch indicator for rainfall, based on pixel-based rainfall			

INDICATOR			
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			
Crop/ Satellite	Number, pixel to CWSU	The average of VCI and the temperature condition index (TCI), with TCI defined like VCI but for temperature. VHI is based on the assumption that "high temperature is bad" (due to moisture stress), but ignores the fact that low temperature may be equally "bad" (crops develop and grow slowly, or even suffer from frost).	Low VHI values indicate unusually poor crop condition, but high values, when due to low temperature, may be difficult to interpret. VHI is shown as typical time profiles over Major Production Zones (MPZ), where they occur, and the percentage of pixels concerned by each profile.
VHIn			
Minimum Vegetation health index			
Crop/ Satellite	Number, pixel to CWSU	VHIn is the lowest VHI value for every pixel over the reporting period. Values usually are [0, 100]. Normally, values lower than 35 indicate poor crop condition.	Low VHIn values indicate the occurrence of water stress in the monitoring period, often combined with lower than average rainfall. The spatial/time resolution of CropWatch VHIn is 16km/week for MPZs and 1km/dekad for China.

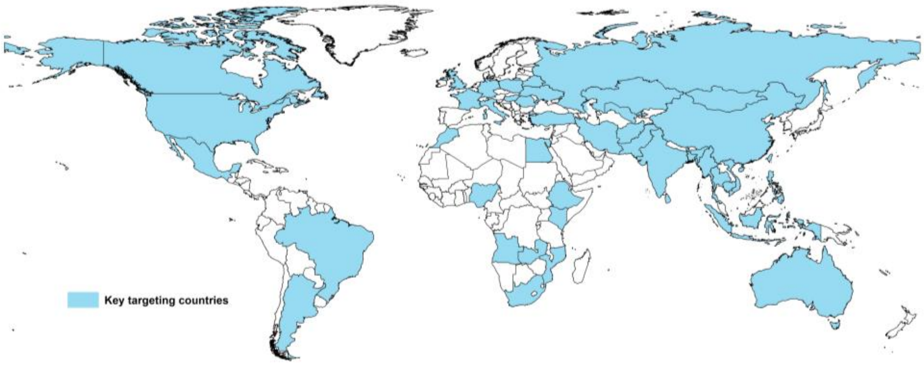
Note: Type is either "Weather" or "Crop"; source specifies if the indicator is obtained from ground data, satellite readings, or a combination; units: in the case of ratios, no unit is used; scale is either pixels or large scale CropWatch spatial units (CWSU). Many indicators are computed for pixels but represented in the CropWatch bulletin at the CWSU scale.

CropWatch spatial units (CWSU)

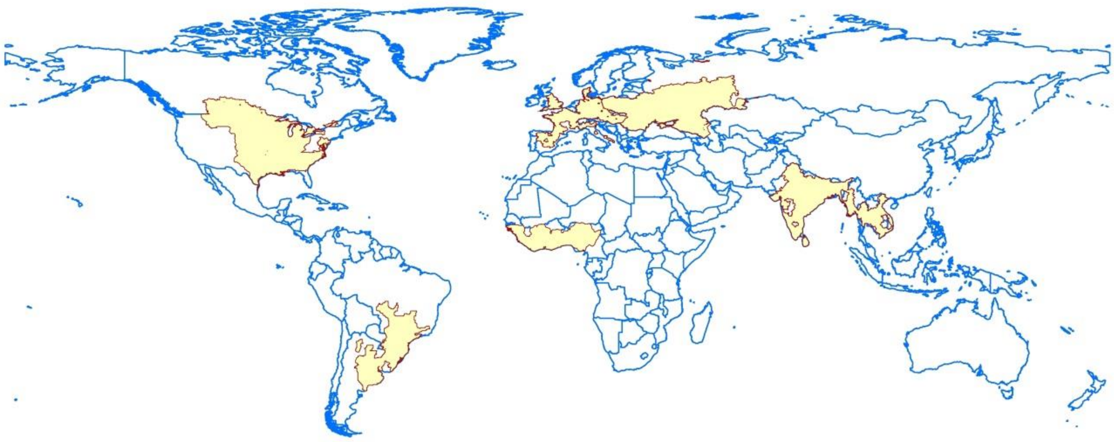
CropWatch analyses are applied to four kinds of CropWatch spatial units (CWSU): Countries, China, Major Production Zones (MPZ), and global crop Monitoring and Reporting Units (MRU). The tables below summarize the key aspects of each spatial unit and show their relation to each other. For more details about these spatial units and their boundaries, see the CropWatch bulletin online resources.

SPATIAL LUNITS	
CHINA	
Overview	*Description*
Seven monitoring regions	The seven regions in China are agro-economic/agro-ecological regions that together cover the bulk of national maize, rice, wheat, and soybean production. Provinces that are entirely or partially included in one of the monitoring regions are indicated in color on the map below.

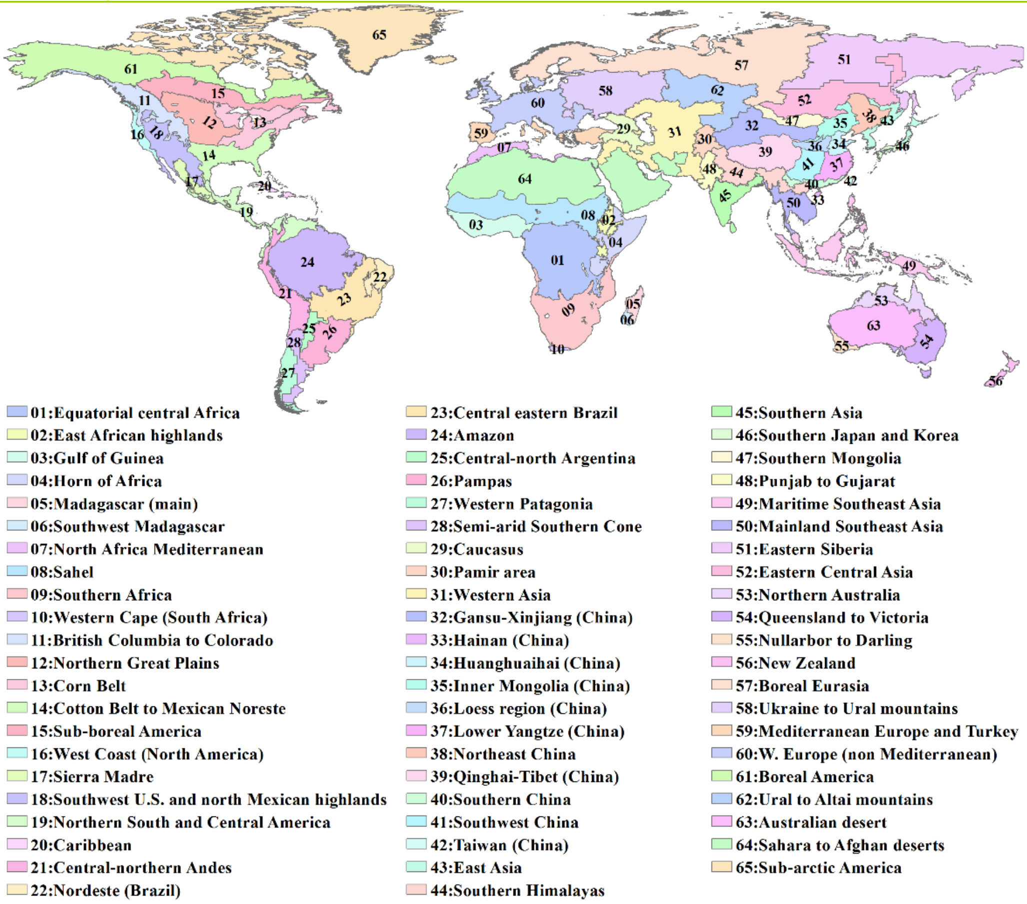
Countries (and first-level administrative districts, e.g., states and provinces)	
Overview	*Description*
"Forty two plus one" countries to represent main producers/exporters and other key countries.	CropWatch monitored countries together represent more than 80% of the production of maize, rice, wheat and soybean, as well as 80% of exports. Some countries were included in the list based on criteria of proximity to China (Uzbekistan, Cambodia), regional importance, or global geopolitical relevance (e.g., four of five most populous countries in Africa). The total number of countries monitored is "42 + 1," referring to 42 and China itself. For the nine largest countries—, United States, Brazil, Argentina, Russia, Kazakhstan, India, China, and Australia, maps and analyses may also present results for the first-level administrative subdivision. The CropWatch agroclimatic indicators are computed for all countries and included in the analyses when abnormal conditions occur. Background information about the countries' agriculture and trade is available on the CropWatch Website, **www.cropwatch.com.cn**.



Major Production Zones (MPZ)	
Overview	*Description*
Six globally important areas of agricultural production	The six MPZs include West Africa, South America, North America, South and Southeast Asia, Western Europe and Central Europe to Western Russia. The MPZs are not necessarily the main production zones for the four crops (maize, rice, soybean, wheat) currently monitored by CropWatch, but they are globally or regionally important areas of agricultural production. The seven zones were identified based mainly on production statistics and distribution of the combined cultivation area of maize, rice, wheat and soybean.



Global Monitoring and Reporting Unit (MRU)	
Overview	*Description*
65 agro-ecological/agro-economic units across the world	MRUs are reasonably homogeneous agro-ecological/agro-economic units spanning the globe, selected to capture major variations in worldwide farming and crops patterns while at the same time providing a manageable (limited) number of spatial units to be used as the basis for the analysis of environmental factors affecting crops. Unit numbers and names are shown in the figure below. A limited number of units (e.g., MRU-63 to 65) are not relevant for the crops currently monitored by CropWatch but are included to allow for more complete coverage of global production. Additional information about the MRUs is provided online under **www.cropwatch.com.cn** .



Production estimation methodology

The main concept of the CropWatch methodology for estimating production is the calculation of current year production based on information about last year's production and the variations in crop yield and cultivated area compared with the previous year. The equation for production estimation is as follows:

$$Production_i = Production_{i-1} * (1 + \Delta Yield_i) * (1 + \Delta Area_i)$$

Where i is the current year, $\Delta Yield_i$ and $\Delta Area_i$ are the variations in crop yield and cultivated area compared with the previous year; the values of $\Delta Yield_i$ and $\Delta Area_i$ can be above or below zero.

For the 43 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):

$$Area_i = a + b * CALF_i$$

Data notes and bibliography

Notes

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Online resources

Online Resources posted on **www.cropwatch.cn** , **http://cloud.cropwatch.cn/**

This bulletin is only part of the CropWatch resources available. Visit **www.cropwatch.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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