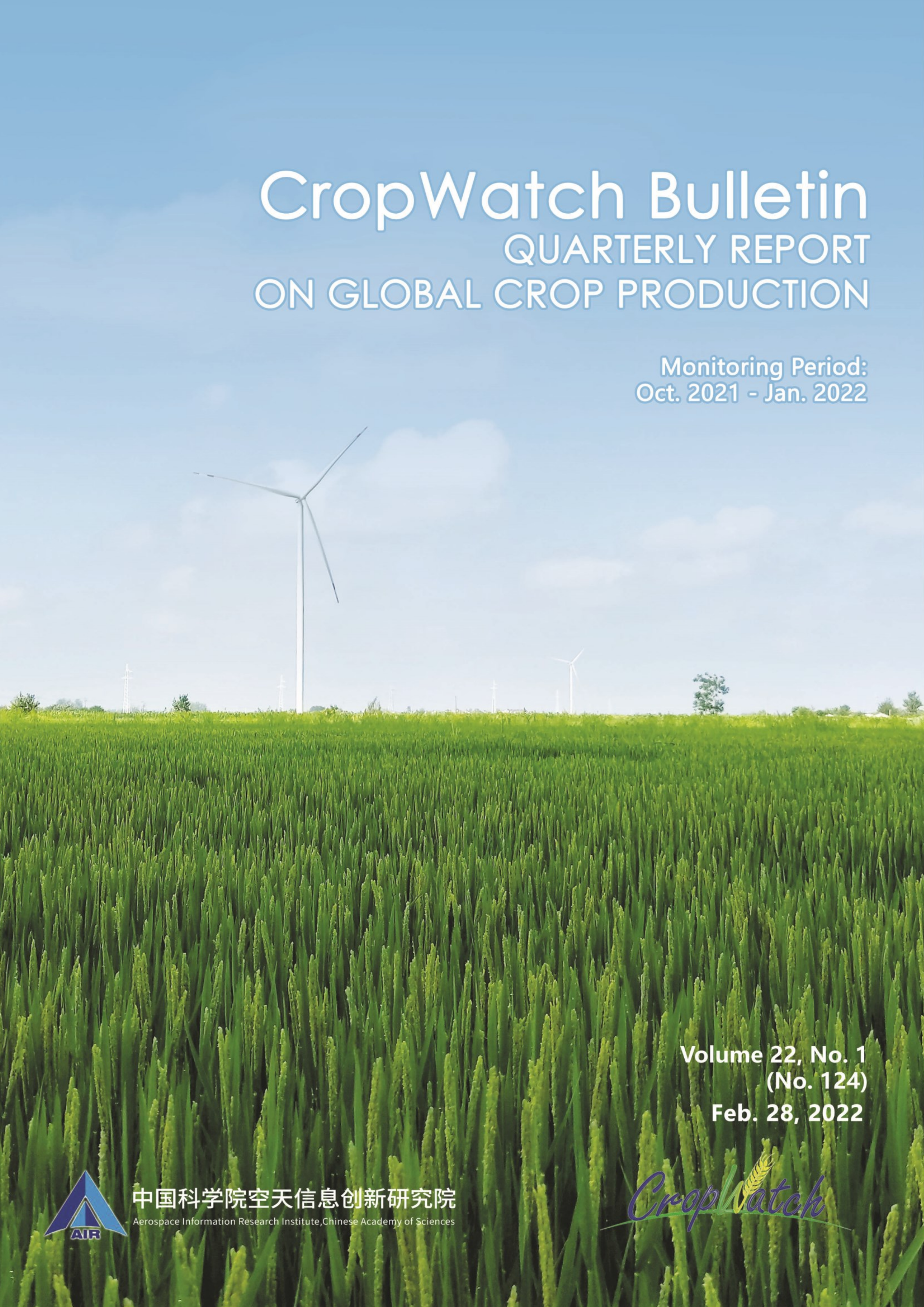

CropWatch Bulletin

QUARTERLY REPORT ON GLOBAL CROP PRODUCTION

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CropWatch

February 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/.

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

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Abbreviations

5YA	Five-year average, the average for the four-month period from October of the previous year to January of the current year for 2017-2021; one of the standard reference periods.
15YA	Fifteen-year average, the average for the four-month period from October of the previous year to January of the current year for 2007-2021; one of the standard reference periods and typically referred to as “average”.
AEZ	Agro-Ecological Zone
BIOMSS	CropWatch agroclimatic indicator for biomass production potential
BOM	Australian Bureau of Meteorology
CALF	Cropped Arable Land Fraction
CAS	Chinese Academy of Sciences
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 October 2021 and January 2022, a period referred to in this bulletin as the ONDJ (October, November, December and January) period or just the "reporting period." The bulletin is the 124th 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 January 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 agro-climatic 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 major cereal and oil crops (maize, rice, wheat and soybean) countries in the Southern Hemisphere and some tropical and sub-tropical countries. Subsequent sections of Chapter 5 describe the global disasters that occurred from October 2021 to January 2022.

This bulletin covers the beginning of the rainy season in the Southern Hemisphere, as well as the sowing period and early vegetative growth of (winter) wheat in the Northern Hemisphere.

Agro-climatic conditions

Global temperatures continued their upward trend in 2021. It was slightly slowed by La Niña, which is expected to last until April 2022. Nevertheless, 2021 was the sixth warmest year on record. Temperatures were 0.84ºC above the average of the 20th century. In Brazil, deforestation, fueled by high prices for soybean, maize and beef intensified even more in 2021. It had hit the highest point in the last 15 years. A new study found that a warmer, dryer environment already has pushed 28% of Amazonian agricultural space out of its optimum climate conditions. The research predicted that 51% of the region's agricultural land would move out of its ideal climate by 2030.

As expected, La Niña had a negative effect on precipitation in the south of Brazil and Paraguay and eastern Africa. However, other regions were also plagued by drought as well, such as the Maghreb and Morocco in particular. That country is experiencing the most severe drought conditions of the last 30 years. Heavy rainfall in January brought some relief to Central Asia and especially Afghanistan, which had suffered from a prolonged drought. Most of Africa south of the Sahara received below average rainfall. The monsoon rains north of the equator stopped earlier than normal and in the south, they started with a delay. This has caused drought conditions in northern Zimbabwe, Mozambique, Zambia, Malawi, Tanzania and Madagascar. The southern Plains, an important winter wheat production region of the USA encompassing Texas, Oklahoma and Kansas has experienced moderate to extreme drought conditions starting last fall. Rainfall was below average for most of Europe in October and early November, when precipitation returned to average levels for Central and Eastern Europe. Rainfall was near average for the important rice production countries in Southeast Asia. It was more abundant than usual in regions along the Yellow River in China. It caused localized flooding, which in turn delayed sowing of winter wheat. Above average rainfall, which is attributed to La Niña, provided favorable conditions for wheat production in Australia.

Key findings of this report

Maize: Favorable weather conditions helped ensure good harvest conditions in the USA and Europe. The drought in the south of Brazil is impacting its maize production, causing a drop by 5%. Conditions have been favorable in Argentina, CropWatch estimates an increase in production by 9% in Argentina. Africa south of the equator: Sowing was impacted by a delay in the onset of the monsoon season. Below average rainfall is causing drought conditions and yield losses. Conditions are favorable for winter maize production in south and south-east Asia.

Rice: Conditions during the monsoon season were favorable in South and Southeast Asia, thus harvest conditions were favorable. The combined output from the 12 countries monitored by CropWatch, accounting for 36% global rice production, is expected to increase by 1.5%.

Wheat: Conditions for wheat production in the Southern Hemisphere were generally favorable, apart from Brazil, which suffered from drought conditions. Argentina, South Africa and Australia benefitted from above average rainfall which resulted in record yield levels. Winter wheat was off to a slow start in Europe and Turkey, but conditions returned to average starting in mid-November. Winter wheat in the southern Plains of the USA is impacted by drought conditions. Sowing was delayed in regions along the Yellow River in China due to abnormally high rainfall in the autumn. Overall, global wheat production is projected to drop by 2% from 2021.

Soybean: Conditions are mixed in Brazil: Favorable in Mato Grosso, while the south of Brazil and Paraguay are impacted by drought conditions. Conditions in Argentina are favorable. CropWatch estimates an increase in production by 1% in Brazil and 4% in Argentina over the last year.

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 October 2021 to January 2022, ONDJ, 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 2021 ONDJ numeric values of CWAIs by MRU. Although they are expressed in the same units as the corresponding climatological variables, CWAIs are spatial averages limited to agricultural land and weighted by the agricultural production potential inside each area.

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

1.2 Global overview

2021 was the sixth warmest year on record. Temperatures were 0.84ºC above the average of the 20thcentury. A La Niña episode, which tends to cool global temperatures, helped slow the increase in temperature.

In October, much warmer than usual temperatures were recorded for the Eastern USA and northeastern Siberia. Eastern Europe and Central Asia recorded close to normal or even below average temperatures. Precipitation was above average in the north-west of the USA, East Asia and Scandinavia. The rest of Europe, from the west to the Ural, however experienced below average rainfall. A rainfall deficit was recorded for Central Asia and the Pampas in Argentina as well.

In November, temperatures were above average for most of north America, apart from the southeast of the USA. In Africa, above average temperatures were observed for the countries bordering the southern Sahara. Siberia also experienced above average temperatures. Most of the USA, as well as the near East and Central Asia experienced drier than usual conditions. Wetter conditions were observed for Eastern Asia, mainly the North China plain as well as for Eastern Australia.

In December, the South-East of the USA experienced strong positive temperature departures, whereas in the North-West of Canada, temperatures were below average. They were warmer than usual as well in Central and Eastern Asia. The strongest precipitation deficits were recorded for Southern Brazil, Paraguay and the south-east of the USA. The Maghreb also experienced far drier than normal conditions, together with Central and Eastern Asia.

In January 2022, temperatures were cooler than average for the eastern half of North America and the Indian sub-continent. North Africa also experienced below average temperatures. Precipitation was above average in the Horn of Africa, South Africa, South Asia and Southeast Asia, as well as Southern Australia. Drier than usual conditions were observed for the southern USA and Mexico, as well as Western Europe and the Maghreb.

Figure 1.1 shows unweighted averages of the CropWatch Agroclimatic Indicators (CWAIs), i.e. the arithmetic means of all 65 MRUs, which are relatively close to average. CWAIs are computed only over agricultural areas, and they display a relatively average situation, globally. During the monitoring period, temperatures were 0.4ºC above the 15YA, rainfall was below average, whereas solar radiation was near average.

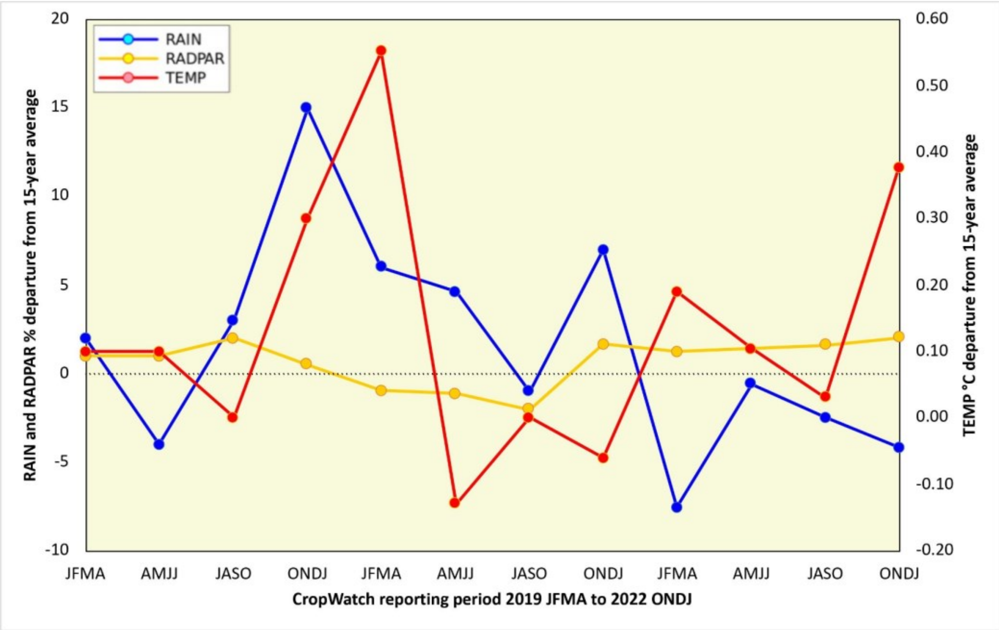


Figure 1.1 global departure from recent 15-year average of the RAIN, TEMP and RADPAR indicators. The last period covers October 2021 to January (ONDJ) 2022 (average of 65 MRUs, unweighted).

1.3 Rainfall

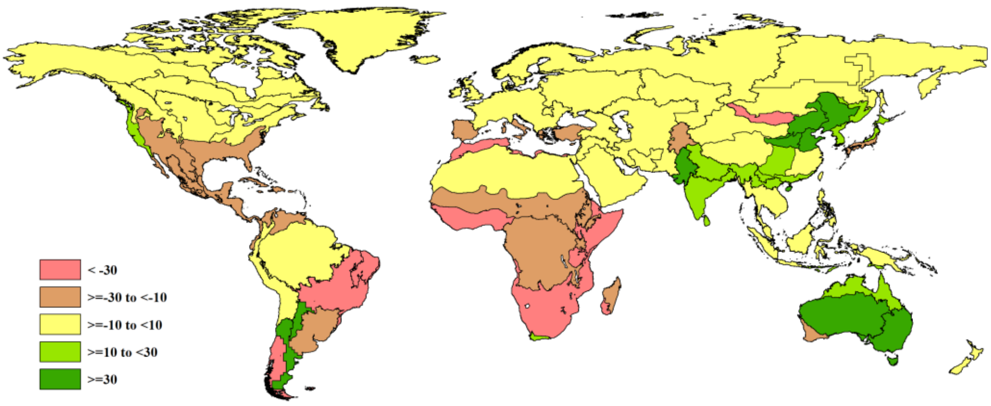


Figure 1.2 Global map of rainfall anomaly (as indicated by the RAIN indicator) by CropWatch Mapping and Reporting Unit: departure of October 2021 to January 2022 total from 2007-2021 average (15YA), in percent.

The rainfall departure map shows dryer conditions (< -30%) for most of the important crop production regions in Brazil, West Africa, Southern and Eastern Africa, as well as for the Maghreb. California, the Andes region in Argentina, Central Chile, South and Eastern Asia, together with most of Australia, were the only zones that received above average rainfall. In the remaining zones, conditions were drier than usual, mainly in the southern half of North America, southern Brazil and most of sub-Saharan Africa and Central Asia.

1.4 Temperatures

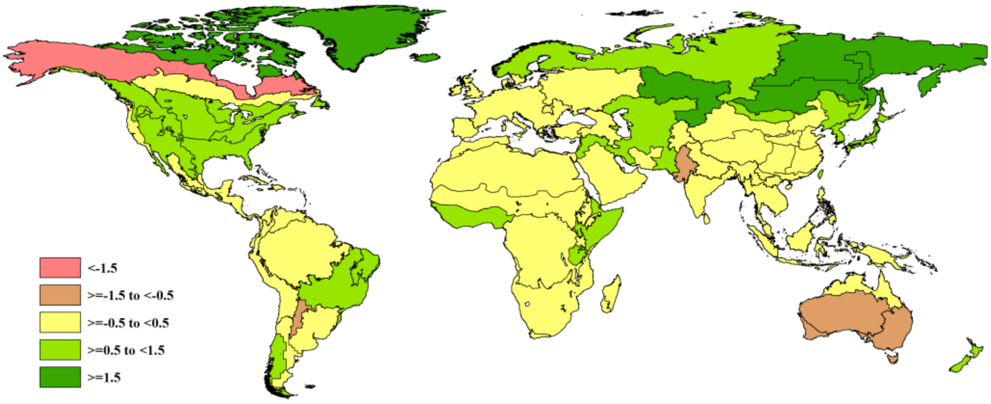


Figure 1.3 Global map of temperature anomaly (as indicated by the TEMP indicator) by CropWatch Mapping and Reporting Unit: departure of October 2021 to January 2022 average from 2007-2021 average (15YA), in °C.

Much cooler than average (<-1.5ºC) departures were observed for northern Canada and Alaska. Below average temperatures in the range of -1.5 to -0.5ºC were recorded for most of Pakistan and Australia. Most of South America, apart from Brazil, most of Africa, Europe and South and Southeast Asia experienced average temperatures. Warmer than usual temperatures were recorded for the USA, Siberia, Korea and Japan.

1.5 RADPAR

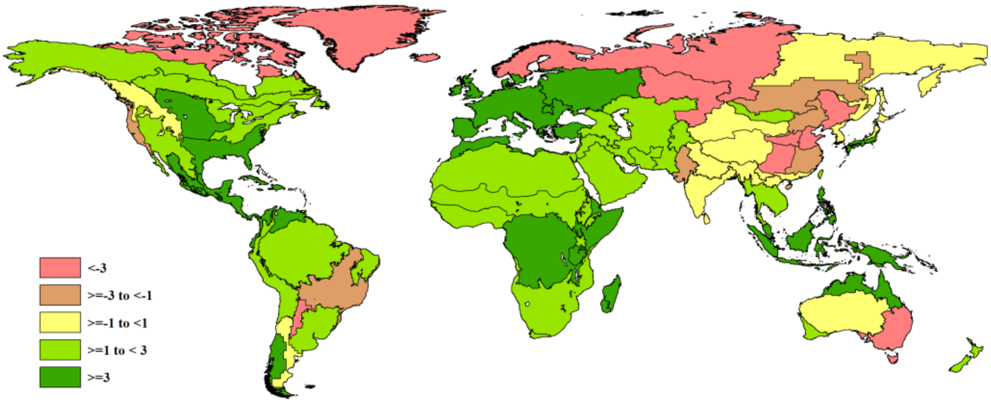


Figure 1.4 Global map of photosynthetically active radiation anomaly (as indicated by the RADPAR indicator) by CropWatch Mapping and Reporting Unit: departure of October 2021 to January 2022 total from 2007-2021 average (15YA), in percent.

Solar radiation was above average for most of the Americas, except for the crop production region in Brazil. It was also above average for all of Africa, Europe, apart of the Scandinavian countries and the middle of Russia. Below average radiation was observed for Eastern China and the southeast of Australia.

1.6 BIOMSS

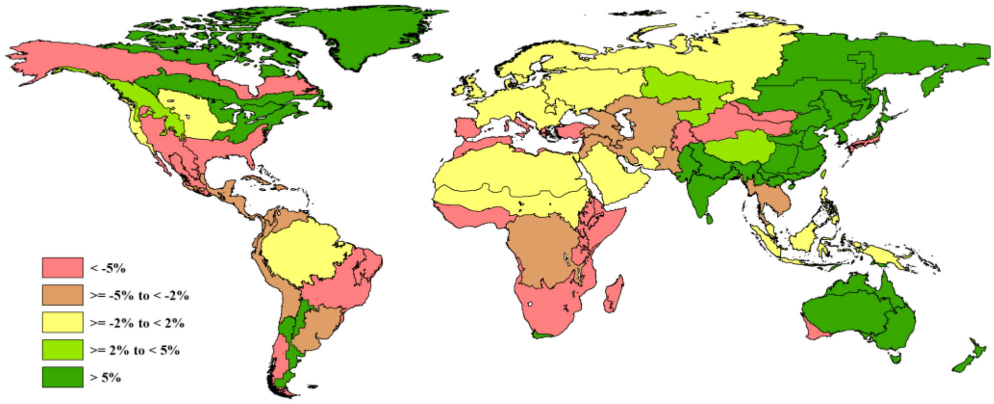


Figure 1.5 Global map of biomass accumulation (as indicated by the BIOMSS indicator) by CropWatch Mapping and Reporting Unit: departure of October 2021 to January 2022 total from 2007-2021 average (15YA), in percent.

Potential biomass production, which is calculated by taking rainfall, temperature and solar radiation into account, was more than 5% below the 15YA for the southern USA, the crop production region in Brazil, western, southern and eastern Africa, as well as Central Asia. It was also below average for the drought-stricken Maghreb and Mediterranean coast. Above average production was estimated for the Northeastern of USA, South and East Asia, Australia ,and the main production zones of Canada.

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 (October 2021-January 2022)

	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
West Africa	145	-31	25.6	0.6	1256	2	615	-9
North America	264	-15	6.3	1.1	555	4	453	-1
South America	529	-41	23.7	0.5	1348	3	1108	-12
S. and SE Asia	325	13	20.3	-0.3	1017	0	664	10
Western Europe	316	-13	5.6	-0.1	333	9	505	-7
Central Europe and W. Russia	259	0	0.7	0.6	243	7	371	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 (October of the previous year to January) for 2007-2021.*

Table 2.2 Agronomic indicators by Major Production Zone, current season values and departure from 5YA (October 2021-January 2022)

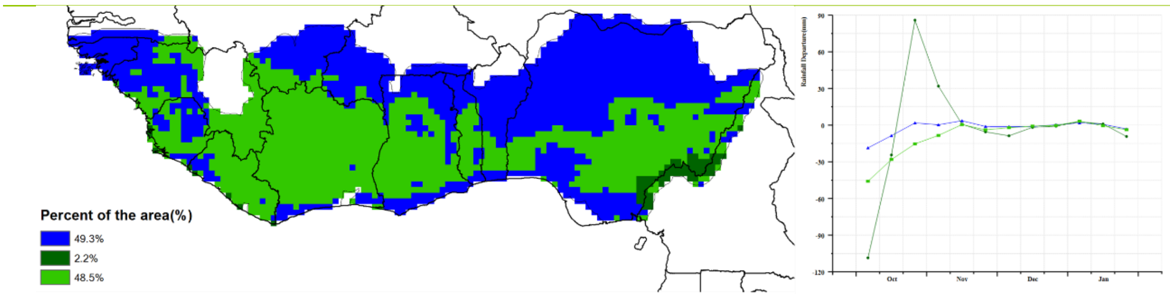
	CALF (Cropped arable land fraction)		Maximum VCI
	Current	5A Departure (%)	Current
West Africa	94	0	0.92
North America	66	-2	0.78
South America	98	0	0.85
S. and SE Asia	98	2	0.93
Western Europe	91	1	0.93
Central Europe and W Russia	78	4	0.83

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

2.2 West Africa

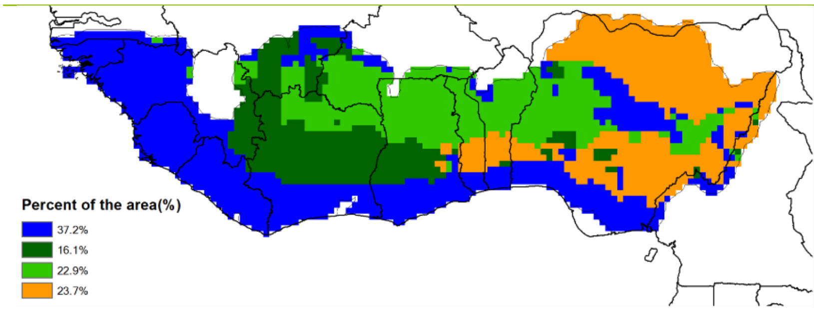
This reporting period covers the harvesting period of the major food crops. For Nigeria and the other countries in this region, these are millet, sorghum, rainfed rice and the main season maize. For the coastal regions, harvest of second season cassava crops started in January while the one-year-old cassava crop was still growing. According to the climatic indicators for the region, the average rainfall was 145 mm (-31%). A rainfall deficit was observed for all countries: Liberia (416 mm -21%), Sierra Leone (347 mm -15%), Equatorial Guinea (1,235 mm -5%), Togo (37 mm -64%), Burkina Faso (2 mm -91%), Nigeria (140 mm -25%), Ghana (110 mm -41%), Côte d'Ivoire (144 mm -45%) and Guinea (124 mm -37%). Due to the low rainfall, localized severe to moderate drought incidences were observed. The average temperature of the MPZ varied from 23.4°C (Equitoria Guinea) to 28.1°C (Gambia) with a regional average of 25.6°C (+0.6°C) and potential solar radiation was 1,256 MJ/m^2 (-2%). The accumulated biomass production potential of the region decreased by 9%. The cultivated arable cropped area (CALF) for the region was above 90% (+2%) except for Nigeria, where it was at 87% (+1%). The regional vegetative health index (VCIx) was at 0.92, indicating good crop conditions in most parts of the region except for Nigeria (0.89) and Burkina Faso (0.83). These CropWatch indicators showed stable, yet drier-than-usual climatic conditions for crop production. The early start of the lean (dry) season will make it more challenging for livestock production, as less biomass will be available for grazing. This MPZ continues to face challenges in production, distribution and widespread use of certified seeds, fertilizers and pesticides for optimal production systems, exacerbated by the devastating effects Covid-19 had on the economies.

Figure 2.1 West Africa MPZ: Agroclimatic and agronomic indicators, October 2021 - January 2022.

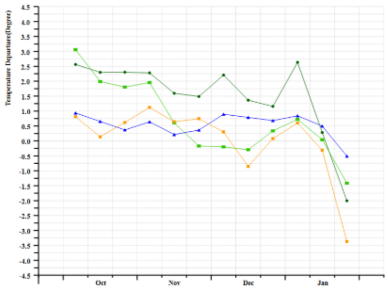


a. Spatial distribution of rainfall profiles

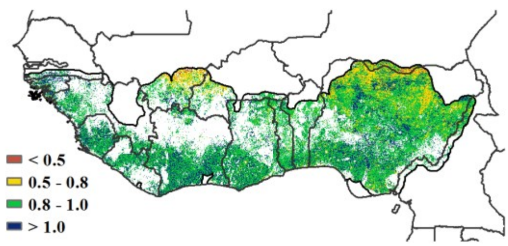
b. Profiles of rainfall departure from average (mm)



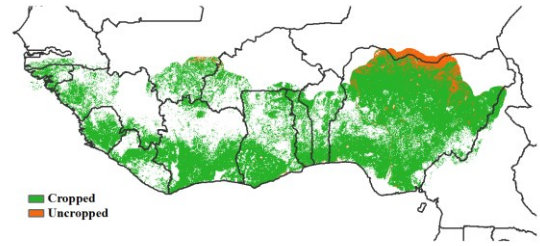
c. Spatial distribution of temperature profiles



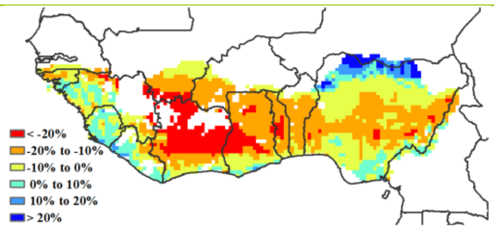
d. Profiles of temperature departure from average (mm)



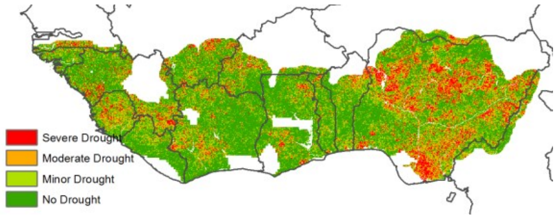
e. Maximum VCI



f. Cropped arable land



g. Biomass accumulation potential departure



h. VHI minimum

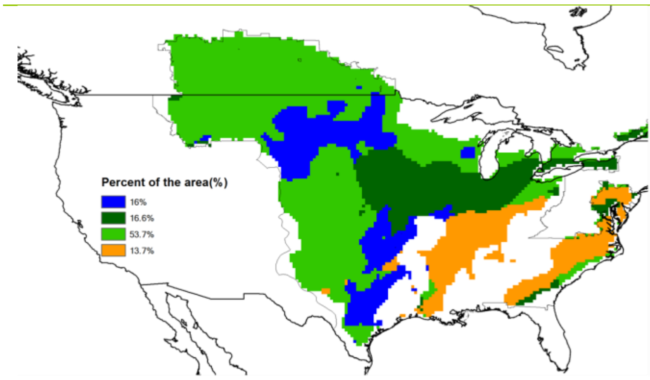
Note: For more information about the indicators, see Annex B.

2.3 North America

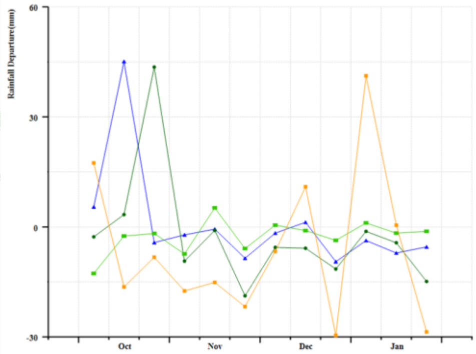
This reporting period begins in October 2021 and ends in January 2022. The winter wheat is the dominant crop, and this reporting period covers the sowing, tillering, and overwintering periods of winter wheat. Overall, crop conditions for the winter wheat were below average due to a lack of precipitation, especially in the Southern Plains.

Precipitation was below average (RAIN: 264 mm; -15%), whereas temperatures (TEMP: 6.3℃; +1.1ºC) and radiation (555 MJ/㎡; +4%) were above the 15YA. The Southern Plains, the main winter crop growing area, received below-average rainfall. At the same time, the region also experienced significantly warmer temperatures. The rainfall deficit was most severe in December, leading to the onset and development of drought, as indicated by the minimum vegetation health index (VHIn). Dry and warming weather has little influence on winter wheat sowing but harmed winter wheat tillering. The negative deviation in potential biomass (<-20%) also confirms the unfavorable conditions in this region. For the other regions, conditions were close to normal.

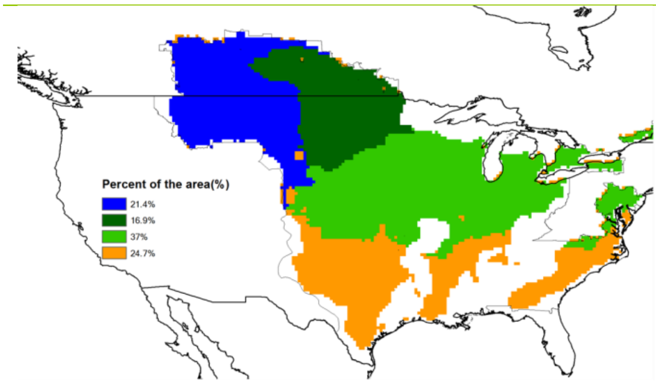
Figure 2.2 West Africa MPZ: Agroclimatic and agronomic indicators, October 2021-January 2022.



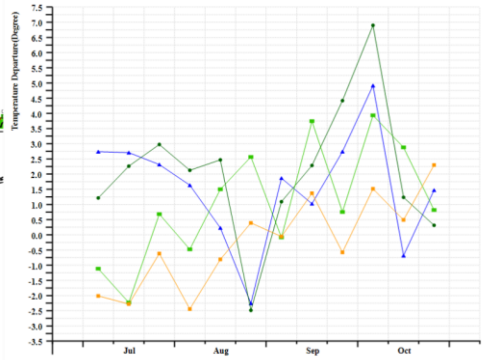
a. Spatial distribution of rainfall profiles



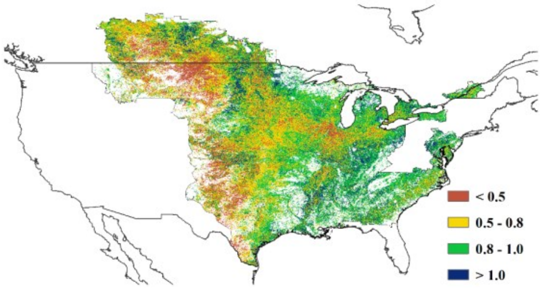
b. Profiles of rainfall departure from average (mm)



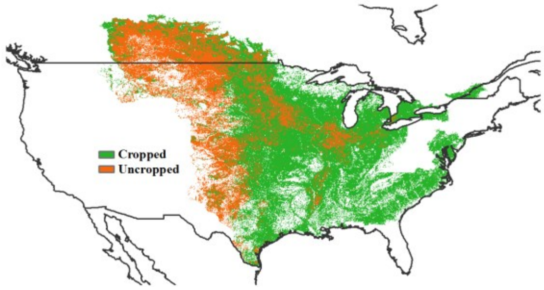
c. Spatial distribution of temperature profiles



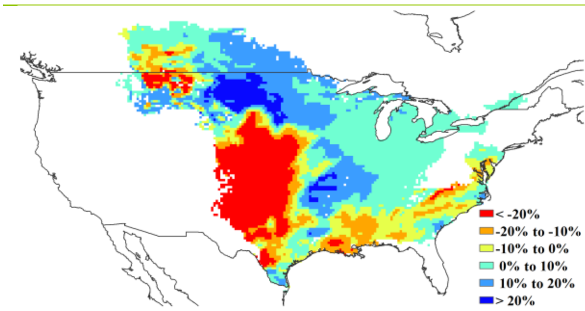
d. Profiles of temperature departure from average (mm)



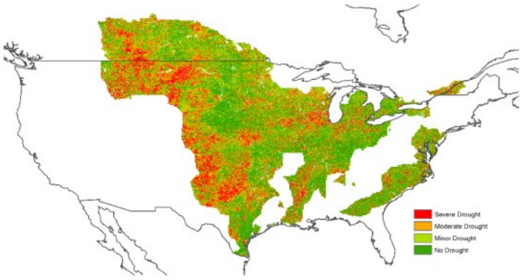
e. Maximum VCI



f. Cropped arable land



g. Biomass accumulation potential departure



h. VHI minimum

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

2.4 South America

This reporting period covers the main growing stages for early maize and early soybean and rice, the planting of late maize and late soybean and the harvesting of wheat.

Spatial distribution of rainfall profiles showed five clustering profiles. The north east of the zone (light green areas) showed strong negative anomalies during November and beginning of

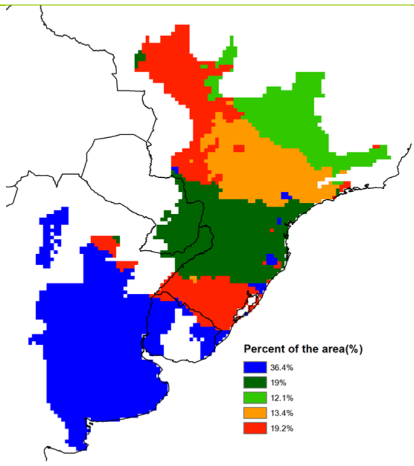
December, and a high positive anomaly at the beginning of January. The red areas in the north west of the zone, southern Brazil, and North Chaco in Argentina showed moderate negative anomalies during almost the entire study period, except for a slight positive anomaly in mid-December. The orange region in the center north showed quite strong negative anomalies during the entire period. The negative departures increased over time. The dark green areas in the center south of Brazil, Paraguay and North Mesopotamia in Argentina showed high variability, moving from positive to negative anomalies all along the study period. The highest positive anomalies were observed at the beginning and at the end. The blue areas, covering the Pampas and Subtropical Highlands in Argentina and most of Uruguay showed reduced anomalies during most of the study period, except for high positive anomalies during January.

Temperature showed five clustering profiles following a North East - South West pattern. North of the zone (light green areas) showed high temperature anomalies with a tendency to reduce in time. More to the South (dark green areas) lower positive anomalies were observed than for the light green profile. It showed a tendency to reduce in time too. The red areas located in Brazil, Paraguay and North Mesopotamia in Argentina started with negative anomalies and finished the period with positive anomalies. Orange areas (South of Brazil, Uruguay and North East Argentina) showed a similar tendency as the red profile, except for a stronger positive anomaly during January. The rest of Argentina (blue areas) showed a highly variable profile, with positive anomalies at the end of October, November, and December and beginning of January, and negative anomalies at the beginning of October, November and December, and end of January.

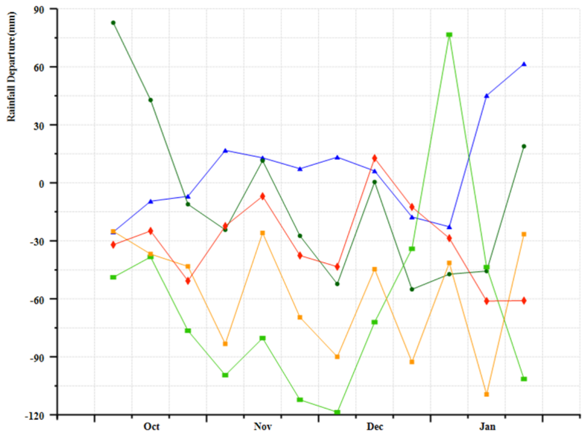
BIOMSS showed almost a North East-South West pattern. Poorest conditions (more than 20 % negative departure) were found in the North of Brazilian agricultural area, as well as in the south of Brazil. Less negative values were observed in the rest of Brazil, Paraguay, Uruguay and North East Argentina. Positive anomalies were observed in the rest of Argentina, indicating overall favorable weather conditions in the country. CALF was almost complete, with the exception of sites in South Buenos Aires and North Subtropical Highlands in Argentina that remained uncropped. High VCIx values (higher than 0.8) were observed in the north of the zone, and South Argentina (with the exception of areas located in the southern extreme of Buenos Aires province with values lower than 0.5). The center of the MPZ was dominated by intermediate values (between 0.5 and 0.8).

The region showed variable conditions during the reporting period. The north of the zone in Brazil showed poor conditions, with quite high temperature anomalies and strong negative anomalies in BIOMSS. Other regions like most of Argentina showed good conditions with positive BIOMSS departure values and less precipitation and temperature anomalies. In addition, the center of the MPZ and part of Argentina showed low VCIx, with below-average crop conditions.

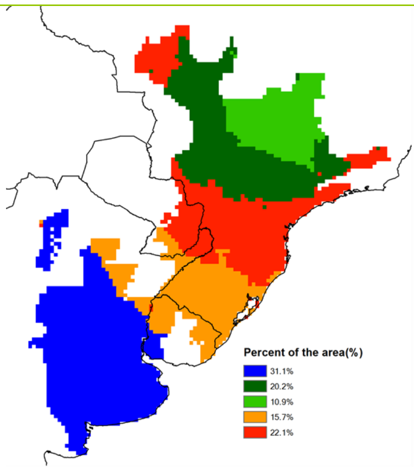
Figure 2.3 South America MPZ: Agroclimatic and agronomic indicators, October 2021 to January 2022.



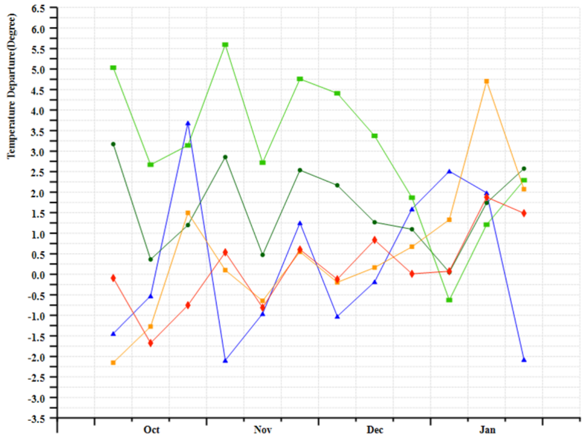
a. Spatial distribution of rainfall profiles



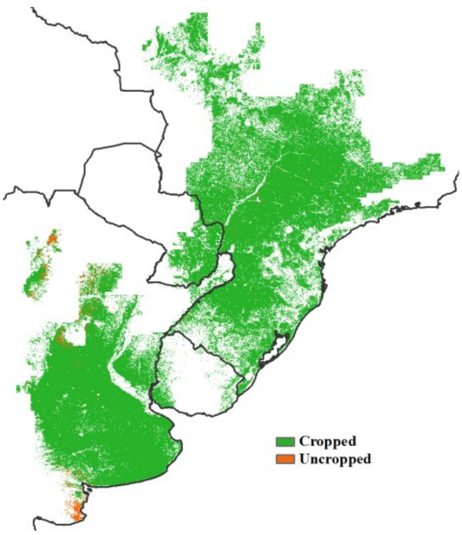
b. Profiles of rainfall departure from average (mm)



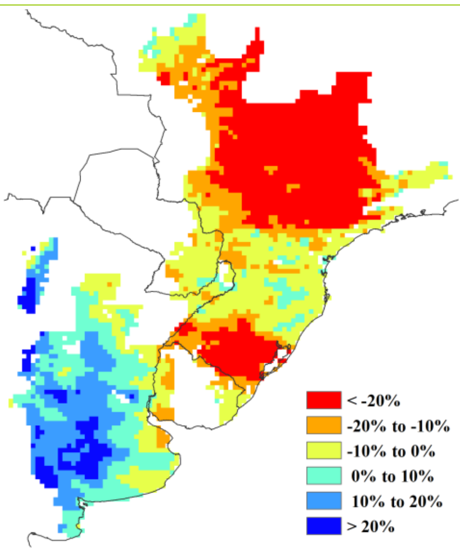
c. Spatial distribution of temperature profiles



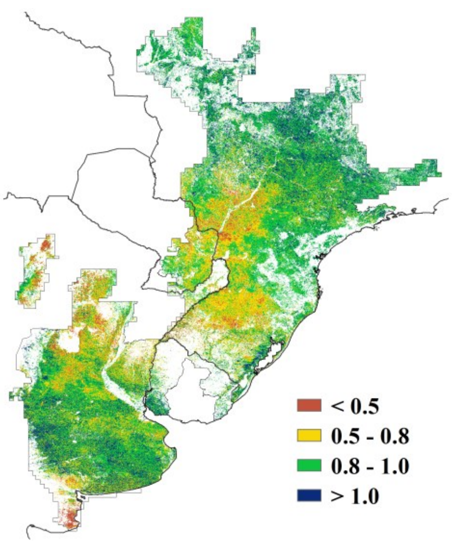
d. Profiles of temperature departure from average (mm)



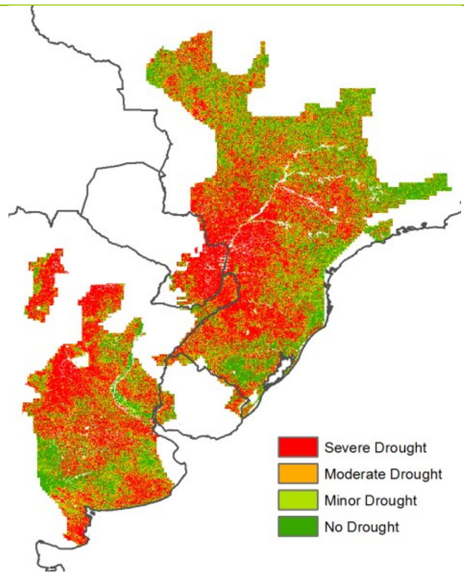
e. Cropped arable land



f. Biomass accumulation potential departure



g. Maximum VCI



h. VHI minimum

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

2.5 South and Southeast Asia

The South and Southeast Asia MPZ includes India, Bangladesh, Cambodia, Myanmar, Nepal, Thailand, Laos and Vietnam. In this period, the monsoon rice was harvested and some winter crops, such as wheat and maize were sown in India and Bangladesh. In the other countries, mainly rice and maize were sown as well.

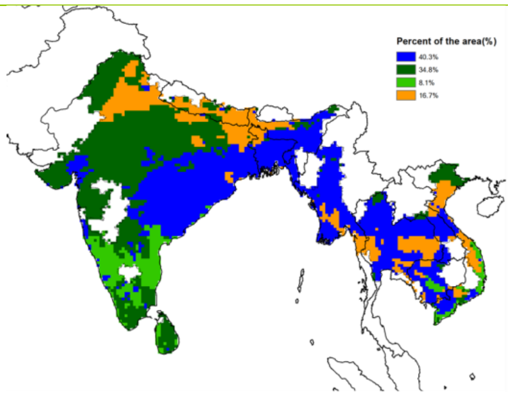
According to the CropWatch agroclimatic indicators, the RADPAR was unchanged compared with the 15YA, the temperature was slightly below the 15YA (TEMP -0.3℃). However, the accumulated precipitation was significantly above average (RAIN +13%), which led to an increase in the potential biomass production (BIOMSS +10%). CALF increased by 2% compared with the 5YA, reaching 98% and the VCIx of the MPZ was 0.93. In general, higher rainfall helped with the establishment of winter crops.

According to the spatial distribution of rainfall profiles, the precipitation for 16.7% of the MPZ (northern India, northern Vietnam, Nepal, southern Myanmar and eastern Thailand) peaked in October and that for 8.1% of the MPZ (southern India and eastern Vietnam) in November. The precipitation in other regions was close to the average after late October. The spatial distribution temperature profiles show that temperature fluctuated greatly in the entire MPZ. The temperature departures in 6.2% of the MPZ fluctuated slightly above and below the average until early December, then gradually increased and reached a small peak in late January, mainly in northeast Thailand, central Laos and northern Vietnam. In other areas, the temperature slowly dropped after mid-January.

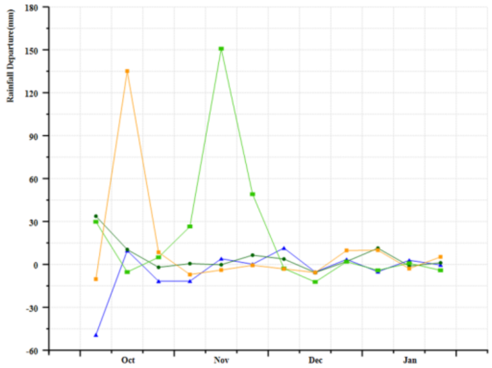
The BIOMASS departure map reveals that the potential biomass in northern and southern India was 20% higher than the average level while the potential biomass in central and eastern India, Myanmar and Thailand is estimated to be below average. The Maximum VCI shows that the index in northern, western and southern India and other scattered areas was higher than 1.0. CALF indicates that a high portion of the region was planted, with the exception of areas in northern India.

In summary, crops conditions are near the average level in India and Bangladesh, whereas for South East Asia, conditions were slightly below average.

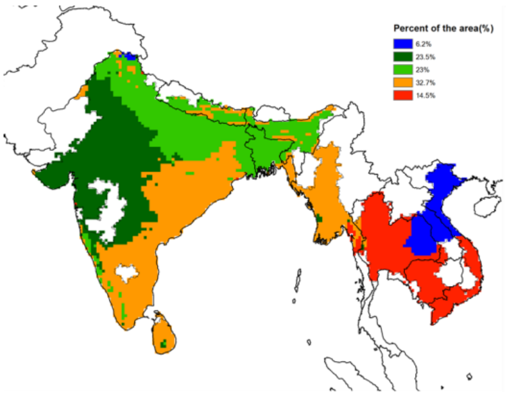
Figure 2.4 South And Southeast MPZ: Agroclimatic and agronomic indicators, October 2021-January 2022.



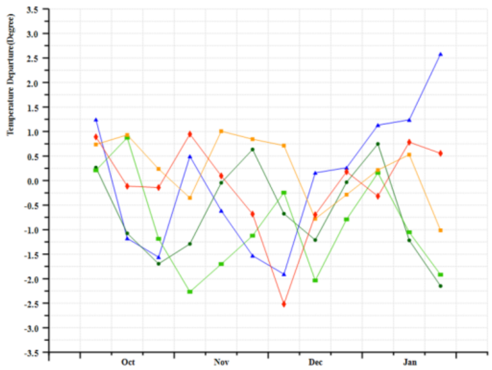
a.Spatial distribution of rainfall profiles



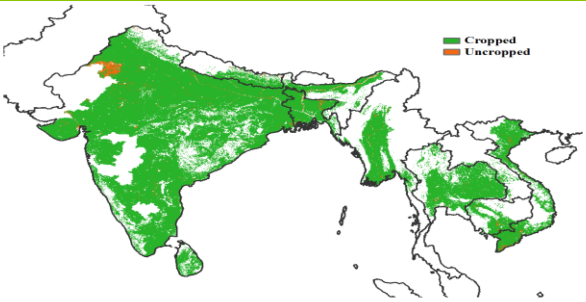
b.Profiles of rainfall departure from average (mm)



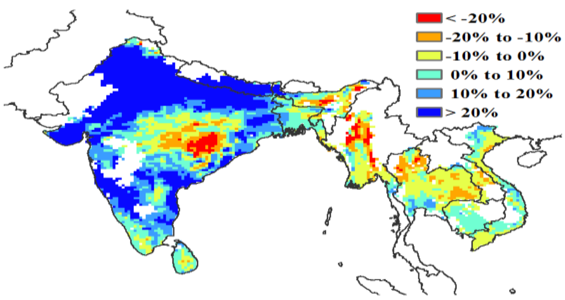
c.Spatial distribution of tempreature profiles



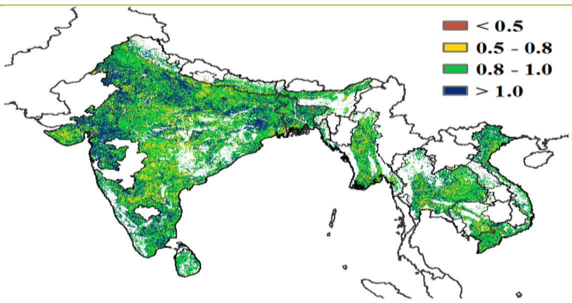
d.Profiles of temperature departure from average (℃)



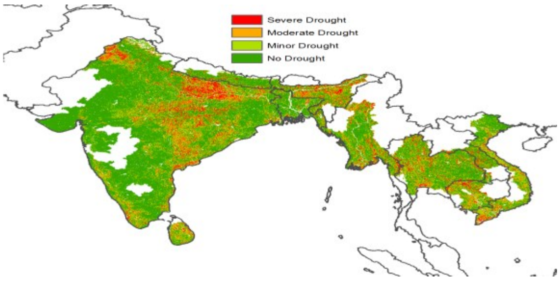
e.Cropped and uncropped arable land



f.Potential biomass departure from 5YA



g.Maximum VCI



h.VHI Minimum

N

2.6 Western Europe

The harvesting period of summer crops and the sowing as well as the growing period of winter crops were included in this monitoring period in the major production zone (MPZ) of Western Europe. Generally, crop conditions were close to average or above average in most parts of this MPZ based on the integration of agroclimatic and agronomic indicators (Figure 2.6)

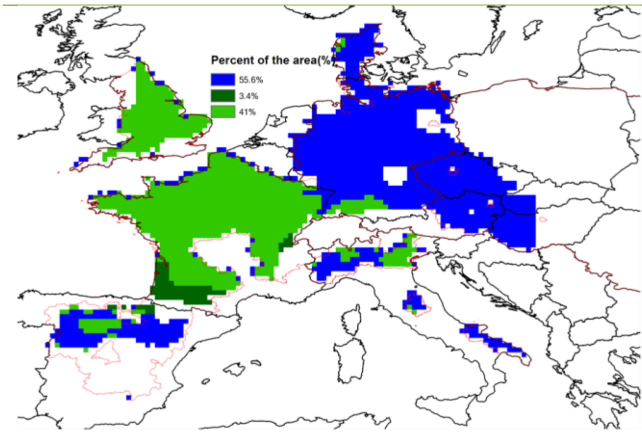
Precipitation was significantly below average over the whole MPZ (-13%) and significant spatio-temporal differences in precipitation were observed between different countries: (1) Precipitation was below average throughout the almost whole MPZ until late November; (2) From late-November to the end of the monitoring period, precipitation hovered around or slightly below average in 55.6 percent of the MPZ areas (most parts of Spain, North-west and south-east and central Italy, Denmark, most parts of Germany, the Czech Republic, south-western Slovakia, eastern Austria and western Hungary); (3) Precipitation was significant below average from late-November to late January, with the exception of early and later December and early January, 44.4% of the MPZ areas (UK, North-east Italy, most part of France and South-east Baden-Wurttemberg in Germany); (4) Precipitation in North central Spain, northeastern Rhône-Alpes, southern Nouvelle-Aquitaine and Midi-Pyrénées in France was significantly above average during the monitoring period, except between mid-December and mid to late January. Countries with the most severe precipitation departures included Spain (RAIN -29%), Slovakia (RAIN -25%), Czech Republic (RAIN -18%), Austria (RAIN -16%), France (RAIN -16%), Germany (RAIN -15%), UK (RAIN -15%) and Hungary (RAIN -11%). Persistent precipitation deficit in most areas in the early part of the monitoring period provided favorable conditions for the harvest of the summer crops and the sowing of winter crops. However, their germination and early development may have been delayed.

Temperature for the MPZ as a whole was slightly below average (TEMP, -0.1%), but radiation was significantly above average with RADPAR at +9%. As shown in the spatial distribution of Temperature profiles, 41.9 percent of the MPZ areas (Spain, most parts of France and South-west Germany) experienced colder-than-usual conditions throughout the monitoring period, except for late-December and early-January; 42.8 percent of the MPZ areas (UK, most parts of Italy, North-west France, Central Germany, the Czech Republic, south-western Slovakia, eastern Austria and western Hungary) experienced temperatures hovering around the average throughout the monitoring period; 15.3 percent of the MPZ areas (Denmark and North central Germany) experienced significant warmer-than-usual conditions during the monitoring period, except for the period in early-mid October, early November, late November-early December and late December.

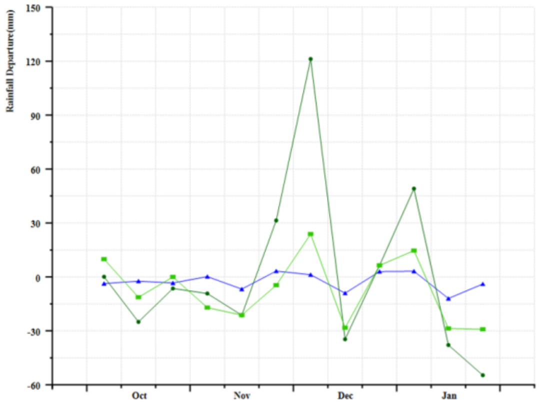
Due to precipitation deficit and overall colder-than-usual conditions, the biomass accumulation potential was 7% below average. Significant BIOMSS departures (-20% and less) was estimated for most parts of Spain and west-central France. In contrast, BIOMSS was above average (sometimes exceeding a 10% departure) for south-western France, southern UK and northern and south-eastern Italy. The average maximum VCI for the MPZ reached 0.93.

More than 91% of arable land was cropped, which is 1% above the recent five-year average. Most uncropped arable land was concentrated in Spain, northern and southeastern Italy, with patchy distribution in central, southeastern and southwestern France, central Germany, central UK and western Austria. The VHI minimum map shows that most parts of the Western European MPZ were mostly under normal (no drought) conditions. Only small areas, mainly in southern Spain and the Po Valley, had large pockets with severe drought. Overall, crop conditions were close to average or above average in most parts of this MPZ.

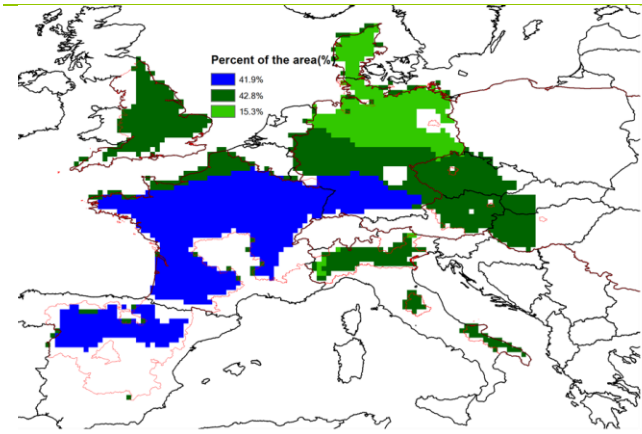
Figure 2.5 Western Europe MPZ: Agroclimatic and agronomic indicators, October 2021-January 2022.



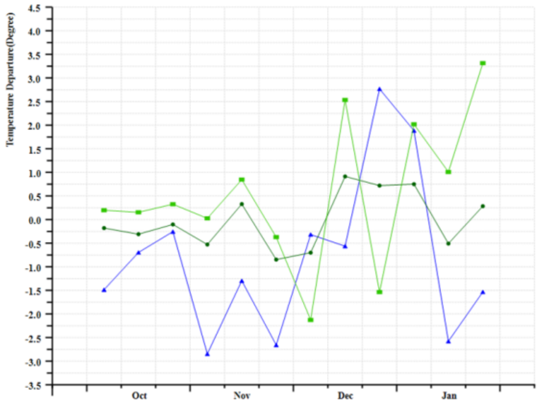
a. Spatial distribution of rainfall profiles



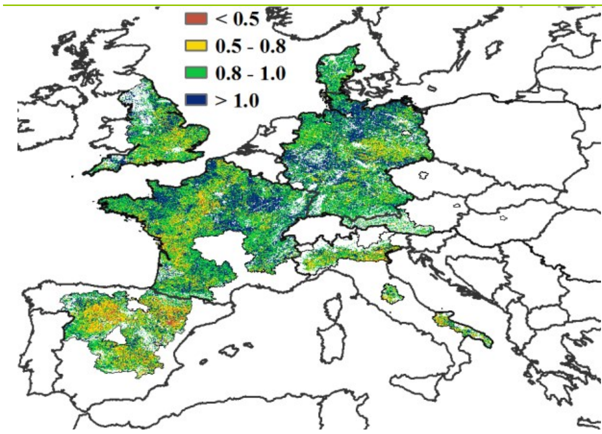
b. Profiles of rainfall departure from average (mm)



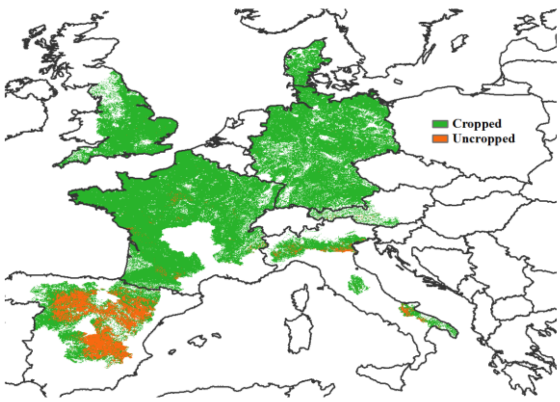
c. Spatial distribution of temperature profiles



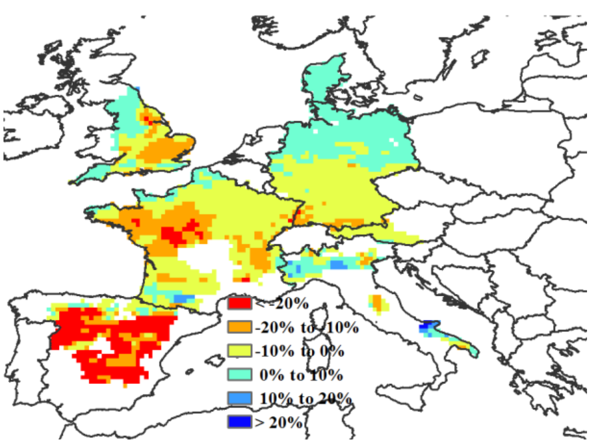
d. Profiles of temperature departure from average (mm)



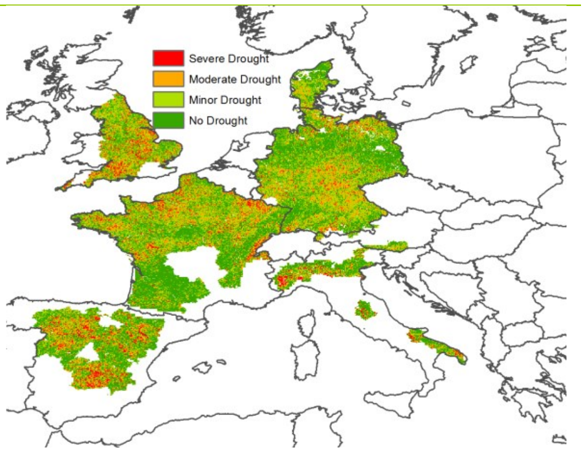
e. Maximum VCI



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 harvesting period of summer crops and the sowing as well as the growing period of winter crops. In general, the agroclimatic indicators in this MPZ were close to average, including near-average precipitation, 0.6 ℃ higher temperature, and 3% higher photosynthetic active radiation.

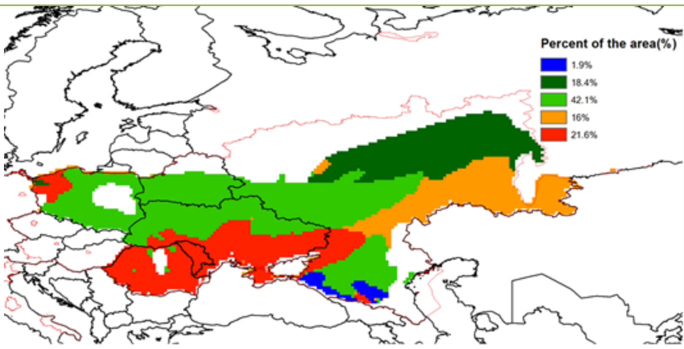
According to the spatial distribution map of rainfall departure, the rainfall in most areas was above the average from October 2021 to January 2022. The specific spatial and temporal distribution characteristics were as follows: (1) In October, 79.7% of the regions received below-average precipitation, which may have delayed germination of winter wheat in those regions. However, in early October the precipitation in the regions accounting for 1.9% of the MPZ was above average and reached the highest positive departure level. That region was mainly located in southern Russia. (2) From late November to mid-December, 98.1% of the regions received above-average precipitation, which was distributed in other regions except for parts of southern Russia. High precipitation during this period helped mitigate the negative impact due to the reduced precipitation in October. (3) In January 2022, 21.6% of the region received below-average precipitation, mainly in southern Ukraine, Moldova, Romania, and northwestern Poland.

The temperature departure distribution map shows that the temperature change trend was the same for the entire MPZ. The specific spatial and temporal distribution characteristics were as follows: (1) In October, temperatures were below average in 30.8% of the MPZ. (2) In mid-November, temperatures were below average for 17.6% of the MPZ, mainly in southwestern Belarus and Poland. (3) From late November to mid-December, the temperature in the whole MPZ was above average, and in late December, the temperature in the whole MPZ was below average.

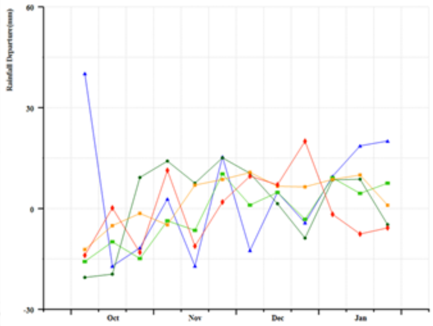
The biomass accumulation potential (BIOMASS) was 10% below average in south-eastern Russia, southwestern Poland, parts of Slovakia and Hungary, and a small part of Romania, whereas the potential cumulative biomass in the remaining regions was essentially on par with the average.

During this monitoring period, most of the arable land in MPZ was cultivated, with a CALF value of 77% (+4%), and the uncultivated arable land was mainly distributed in the southwest of the Ural and eastern regions of Ukraine. The VCIx showed a significant spatial variation, with an average value of 0.83. The regions below 0.8 were mainly in southeastern Russia, eastern Ukraine, Moldova, and eastern Hungary. The minimum health vegetation index is similar to the distribution of the best vegetation condition, with severe drought areas mainly in the southeast of Ukraine and southwest of the Ural. Overall, CropWatch agroclimatic and agronomic indicators show that crop growth was expected to be above average during this monitoring period.

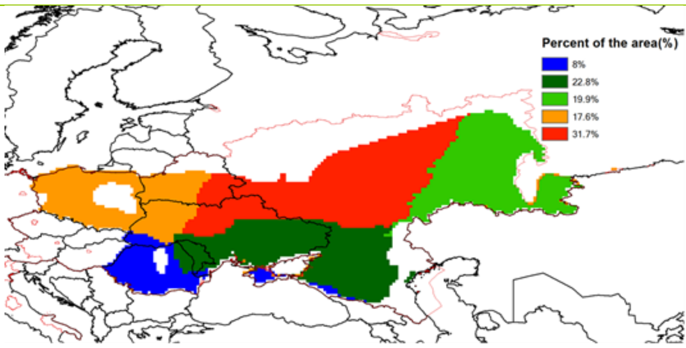
Figure 2.6 Central Europe-Western Russia MPZ: Agroclimatic and agronomic indicators, October 2021-January 2022.



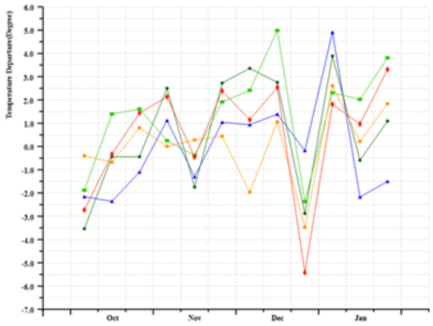
a. Spatial distribution of rainfall profiles



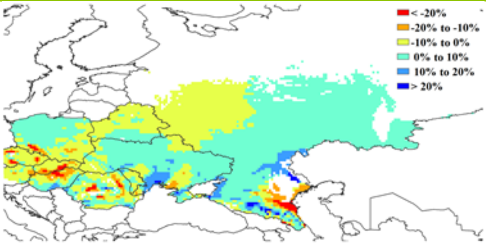
b. Profiles of rainfall departure from average (mm)



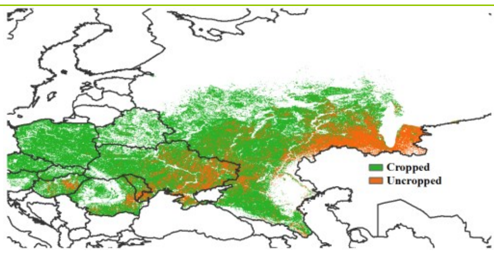
c. Spatial distribution of temperature profiles



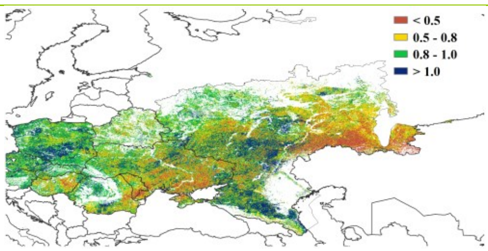
d. Profiles of temperature departure from average (mm)



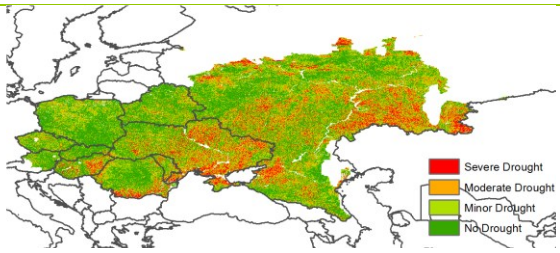
e. Biomass accumulation potential departure



f. Cropped arable land



g. Maximum VCI



h. VHI minimum

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

Chapter 3. Corn 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: Harvest in the Northern Hemisphere was completed by last November. Production conditions were generally favorable, especially in the USA and Ukraine, as described in the November 2021 CropWatch bulletin. In the Southern Hemisphere, maize planting started at the beginning of the rainy season in November and December. In Brazil, most maize is sown as a second crop towards the end of the rainy season, after soybean harvest in February. Full season maize was sown in October in Brazil. The south of Brazil was affected by a precipitation deficit. In Argentina, the second largest maize exporter, closely followed by Brazil in 3rd position, growth conditions for maize have been favorable so far. Mexico's irrigated maize production is impacted by a reduction in area, since water levels in the reservoirs are still below average. In South Africa and the north of Angola, conditions for maize production have been quite favorable, However, the other African countries south of the equator are being impacted by drought conditions. Especially

Madagascar, Malawi, Mozambique, Tanzania, Zambia and Zimbabwe, are hit hard. Winter maize production was off to a good start in Bangladesh, India and southeast Asia.

Rice: Harvest of rainfed rice in China, Pakistan, India, Bangladesh and South-East Asia was completed by December. The conditions during the monsoon season had been quite favorable for high production levels. Rainfall in South-East Asia was close to normal levels during this monitoring period. However, the drought conditions of the Mekong River Basin, which started in 2019, are taking a toll on rice production. It impacts not only the Tonle Sap basin in Cambodia, but the delta in Vietnam as well, where increased salinization of the rice fields is hurting production. Production in the other parts of the world is minor in relation to Asia. It is expected to remain stable in Nigeria and West Africa as a whole, although rainfall had stayed below average. Conditions for rice in Argentina, predominantly sown in Mesopotamia, are average. The season was off to a good start, but rainfall deficits in December and January may jeopardize production. The situation is similar in adjacent regions in Brazil.

Wheat: Conditions for wheat production in the Southern Hemisphere were generally favorable, apart from Brazil, which suffered from drought conditions. Argentina, South Africa and Australia benefitted from above average rainfall which result in record yield levels. The winter wheat production regions in the southern plains of the USA are impacted by below average rainfall. The rainfall deficit is even larger in the Maghreb, especially in Morocco. Prospects are highly unfavorable for that country. Planting of winter wheat in Europe benefitted from relatively dry conditions, which lasted into November. This however slowed the germination and establishment of the plants. Winter conditions have been relatively mild and wet, helping the plants catch up. Conditions were similar in Turkey and the Middle East. Abundant precipitation in January helped restore soil moisture levels in that region. In China, the winter wheat sowing period was marked by abundant rainfall which caused flooding along the Yellow River. Most fields could still get sown in time and above average rainfall helped with the establishment of the crops. In South Asia, most wheat is irrigated, and the rainfall has little impact on its wheat production. Overall, conditions are favorable.

Soybean: Soybean planting for the 2021/22 season started in October in Brazil. Conditions were favorable in the center and north of the country. In Mato Grosso, harvest started in January. In the south (Parana and Rio Grande do Sul) production has been negatively impacted by drought conditions. The drought, related to La Niña, has hampered soybean production in neighboring Paraguay and Argentina as well. Hence, prospects for soybean production in the Southern Hemisphere are mixed.

Weather anomalies and biomass production potential changes

(1) Rainfall

The west and north-west of the USA benefitted from above average rainfall in October and November, which provided some relief for the drought-stricken region. Precipitation was near average in the Canadian Prairies as well, which helps restore moisture levels for the summer crops. The South and East of the USA, as well as Mexico and Central America had a rainfall deficit in the range of -10 to -30%. In South America, rainfall was above average in Bolivia, and the Pampas in Argentina. In Brazil, conditions were mixed: severe drought conditions in the south and coastal regions, and more favorable conditions in Mato Grosso. In Africa, most countries experienced a severe shortfall in rain. The largest deficits were recorded for Morocco, West Africa and all of Africa south of the equator. Conditions were drier than usual in Western Europe as well, but average to above average rainfall in December and January improved the situation. High rainfall also brought some relief to Afghanistan in January, which had suffered from a prolonged drought. Conditions are dryer than normal in Syria and Jordan as well. Apart from Myanmar, all regions in South and East Asia received average to above average precipitation. Most of India, Nepal and the North China Plain experienced rainfall anomalies that were higher than +30%. The south and east of Australia also received above average rainfall.

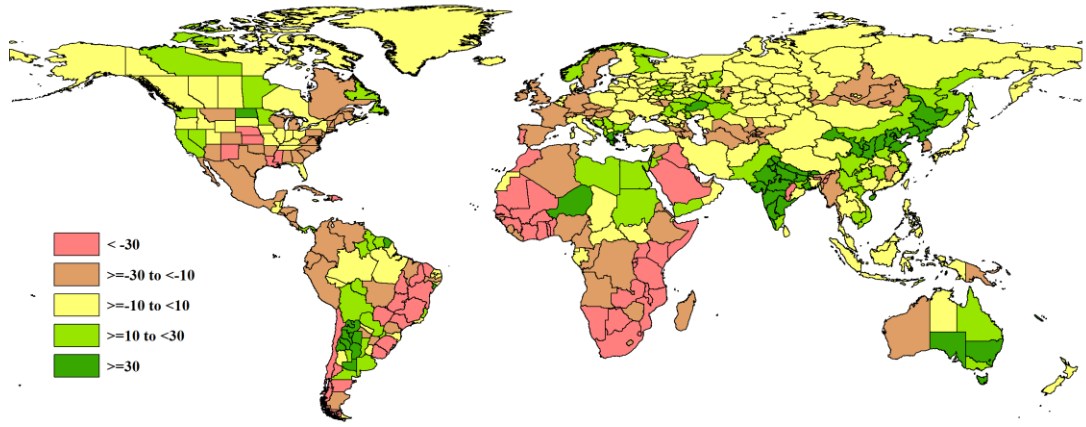


Figure 3.1 National and subnational rainfall anomaly (as indicated by the RAIN indicator) of October 2021-January 2022 total relative to the 2007-2021 average (15YA), in percent

(2) Temperatures

Temperatures were warmer than the 15YA for most of the USA, Mexico and eastern Canada. Cooler than normal temperatures were observed for western Canada and Alaska. In South America, most of Brazil, as well as Paraguay, Uruguay and the main crop production regions in Argentina experienced warmer than usual conditions. Below average temperatures were observed for the Andes region in Argentina and Bolivia. Temperatures were near average for most of Europe, with the exception of France and some countries in the Balkans. Cooler than usual temperatures were recorded for Pakistan and northern India and Nepal. Most of Siberia experienced temperatures that were more than 1.5ºC warmer than average. Temperatures were cooler than the average in the wheat producing regions of Australia.

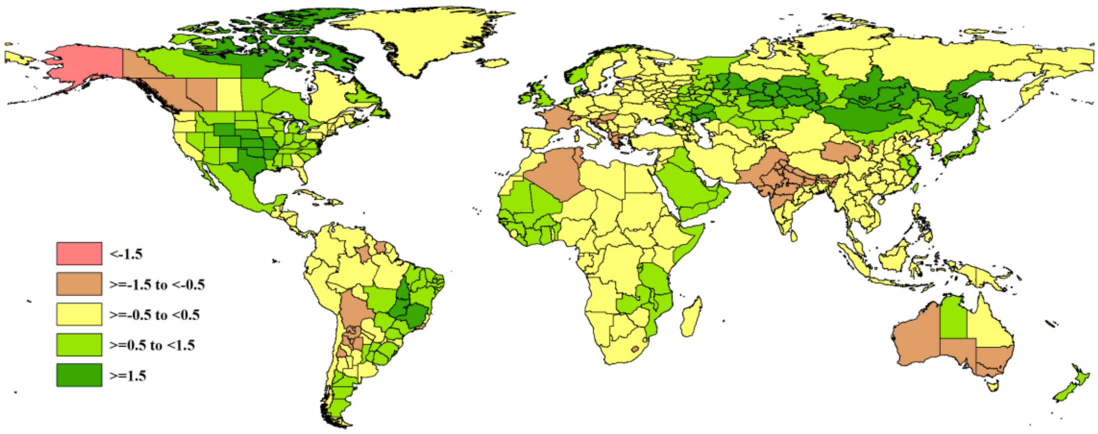


Figure 3.2 National and subnational temperature anomaly (as indicated by the TEMP indicator) of October 2021-January 2022 average relative to the 2007-2021 average (15YA), in °C

(3) RADPAR

Higher solar radiation increases photosynthesis and thus crop production potential and yields. Solar radiation was above average for most of Canada and the USA, except for the regions bordering the Pacific Ocean. Mexico, Central America and the northern regions of South America also experienced above average rainfall. Mato Grosso, as well as Bolivia and the Andean regions in Argentina experienced a sunshine deficit by more than 3%. Most of Africa received average to above average solar radiation, except for Zimbabwe, Botswana, Senegal and Libya. In Europe, conditions were generally sunnier as well, especially in the West and East. In the north of India, Nepal and most of the crop production regions in China, solar radiation was below average. Conditions were sunnier than usual for most of Australia, apart from the Southeast.

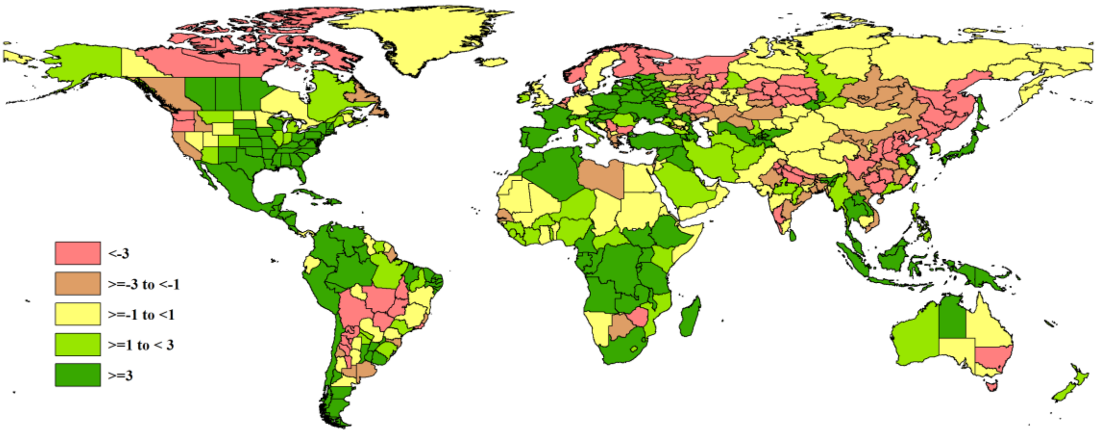


Figure 3.3 National and subnational sunshine anomaly (as indicated by the RADPAR indicator) of October 2021-January 2022 total relative to the 2007-2021 average (15YA), in percent

(4) Biomass accumulation potential

The BIOMSS indicator is controlled by temperature, rainfall and solar radiation. In some regions, rainfall is more limiting, whereas in other ones, mainly the tropical ones, solar radiation tends to be the limiting factor. Biomass estimates were lower by more than 10% as compared to the 15YA for the drought affected winter wheat production of the southern High Plains of the USA. For Mexico, Colombia and Venezuela lower biomass production was estimated as well. For almost all of Argentina a positive departure from the 15YA was calculated. In Brazil, conditions for biomass production were less favorable and deficits larger than -10% were estimated for most crop production regions. Similarly, the conditions for biomass production in the south-west of Europe, the Maghreb, most of West Africa, southern and Eastern Africa were not conducive for biomass production and estimates were 5 to 10% and even more below average. Conditions for biomass production were favorable or Pakistan, India and most of the crop production regions in Eastern China. Conditions were mixed in Australia: below average in the West and more than 10% above average in the East.

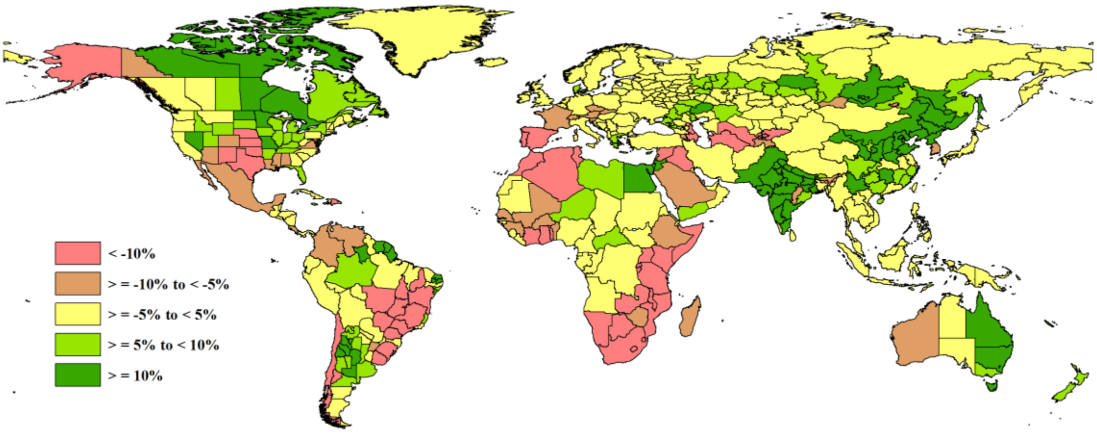


Figure 3.4 National and subnational biomass production potential anomaly (as indicated by the BIOMSS indicator) of October 2021-January 2022 total relative to the 2007-2021 average (15YA), in percent

Table 3.1 October 2021 – January 2022 agro-climatic and Agronomic indicators by country, current value and departure from average.

Code	Country	Agro-climatic indicators				Agronomic indicators	
		Departure from 15YA (2007-2021)				Departure from 5YA (2017-2021)	Current
		RAIN (%)	TEMP(°C)	PAR(%)	BIOMSS (%)	CALF (%)	VCIx
AFG	Afghanistan	-2	-0.3	2	1	46	0.49
AGO	Angola	-19	0.4	4	-3	16	0.84
ARG	Argentina	18	0.2	0	5	-12	0.83
AUS	Australia	30	-0.7	-2	8	4	0.84
BGD	Bangladesh	-6	-0.4	-2	4	-1	0.95
BLR	Belarus	-4	0.2	12	0	0	0.83
BRA	Brazil	-28	0.9	0	-13	2	0.92
KHM	Cambodia	12	-0.2	0	3	1	0.88
CAN	Canada	-1	0.2	2	6	1	0.80
CHN	China	18	0.3	-3	11	1	0.90
EGY	Egypt	28	-0.1	1	12	7	0.78
ETH	Ethiopia	-24	0.1	3	-8	1	0.93
FRA	France	-16	-0.8	13	-8	0	0.93
DEU	Germany	-15	0.0	0	-1	0	0.96
HUN	Hungary	-11	-0.6	9	-3	0	0.76
IND	India	26	-0.4	-1	18	3	0.94
IDN	Indonesia	2	0.2	5	3	0	0.96
IRN	Iran	-4	0.4	2	-4	26	0.48
ITA	Italy	-2	-0.3	2	3	0	0.86
KAZ	Kazakhstan	2	1.4	-2	2	-7	0.57
KEN	Kenya	-34	0.4	2	-14	11	0.85
KGZ	Kyrgyzstan	-25	0.1	3	-14	0	0.73
MEX	Mexico	-14	0.6	6	-6	-6	0.84
MNG	Mongolia	-4	1.7	0	5	2	0.93
MAR	Morocco	-51	0.1	6	-29	6	0.50
MOZ	Mozambique	-30	0.5	2	-14	-3	0.80
MMR	Myanmar	-16	0.3	3	-4	-1	0.91
NGA	Nigeria	-25	0.2	3	-4	1	0.89
PAK	Pakistan	23	-0.5	0	13	12	0.79
PHL	Philippines	-6	0.1	2	-3	0	0.96
POL	Poland	-10	0.0	6	-1	0	0.95
ROU	Romania	-5	0.0	2	-1	-2	0.84
RUS	Russia	5	1.1	-1	4	-1	0.82
ZAF	South Africa	-34	-0.3	4	-11	2	0.94
LKA	Sri_Lanka	9	0.2	7	4	0	0.94
THA	Thailand	-8	0.0	4	-4	0	0.93
TUR	Turkey	-8	-0.2	3	-3	3	0.77
UKR	Ukraine	-5	0.2	8	3	-1	0.77
GBR	United Kingdom	-15	0.5	1	-1	0	0.95
USA	United States	-12	1.0	4	-2	-1	0.80
UZB	Uzbekistan	-21	0.3	3	-12	19	0.72
VNM	Vietnam	21	0.0	-2	2	0	0.95
ZMB	Zambia	-37	1.1	4	-15	-2	0.84

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 October 2021 - January 2022 period to the previous season and the five-year average (5YA) and maximum; (c) Maximum Vegetation Condition Index over arable land (VCIx) for October 2021 - January 2022 by pixel; (d) Spatial NDVI patterns up to October 2021 - January 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 October 2021 - January 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 October 2021 - January 2022.

[AFG] Afghanistan

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

The agro-climatic conditions showed that RAIN decreased by 2%, TEMP decreased by 0.3°C and RADPAR increased by 2%. However, rain was far below average until late December. The estimated biomass was near the average. The cropped arable land fraction (CALF) increased by 22%. According to the spatial distribution of NDVI profiles, the overall crop growth in Afghanistan was below the average level.

From October to December, the drought in Afghanistan had a great impact, as it prevented the planting of wheat in most areas. As shown in the spatial NDVI profiles and distribution map, the growth of crops on 18.7% of the crop land area was lower than the average level and mainly distributed in eastern Afghanistan. Although eastern Afghanistan is an irrigated agricultural area, the irrigation facilities have been damaged or were not well maintained due to the war. Therefore, the growth of crops was lower than the average level. Additionally, about 49.2% of total cropped areas were slightly below average, mainly distributed in southern Afghanistan. Only 16.6% of the total cropped areas were positive during the entire monitoring period. The strong negative departures in January can be attributed either to snow or cloud cover in the satellite images. The heavy precipitation in January changed the situation from drought to flood in some parts of the country. The prolonged drought, which is the most severe in decades, together with the armed conflict, has caused very poor crop conditions.

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.

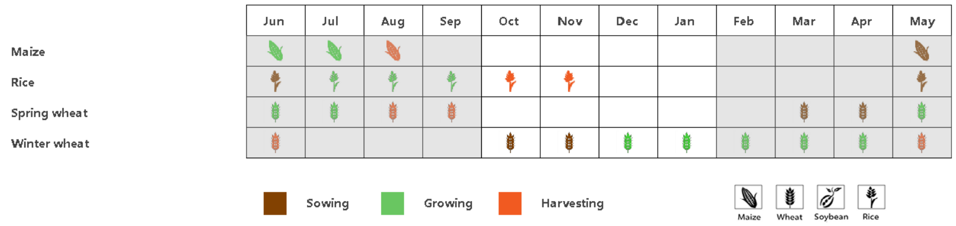
The RAIN in the Central region with sparse vegetation was 92 mm (-21%). The TEMP was 0.1°C, and the RADPAR was 825 MJ/m^2, at an average level. According to the NDVI-based crop condition development graph, the NDVI was slightly lower than the average level between October and January. BIOMSS decreased by 12%, CALF had decreased by 4% and VCIx was 0.34.

The Dry region recorded 100 mm of rainfall (RAIN +8%), TEMP was lower than average at 6.7°C, and RADPAR was 868 MJ/m^2. According to the NDVI-based development graph, crop conditions were lower than the five-year average in the monitoring period. CALF in this region was only 1% and VCIx was 0.18.

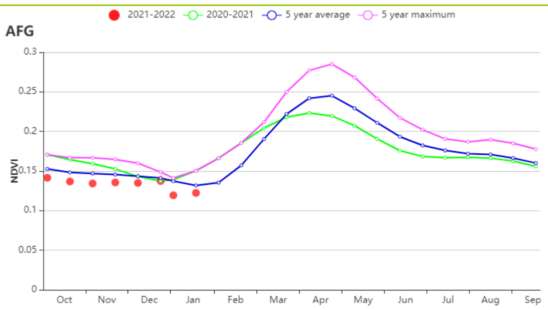
In the Mixed dry farming and irrigated cultivation region, the following indicator values were observed: RAIN 170 mm (-10%); TEMP 2.8°C (-0.2°C); RADPAR 734 MJ/m^2 (+3%). BIOMSS decreased by 3% and CALF was 30% above average. According to the NDVI-based crop condition development graph, NDVI was close to the average level and VCIx was 0.83.

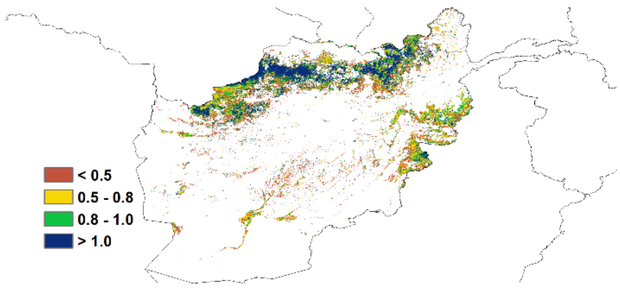
The Mixed dry farming and grazing region recorded 128 mm of rainfall (RAIN +26%). TEMP was 5.6°C (-0.1°C) and RADPAR was 789 MJ/m^2, near average levels. CALF was 0%. VCIx was 0.34 and BIOMSS increased by 8%. According to the crop condition development graph, the NDVI was much lower than the 5YA throughout the monitoring period.

Figure 3.5 Afghanistan's crop condition, October 2021 – January 2022

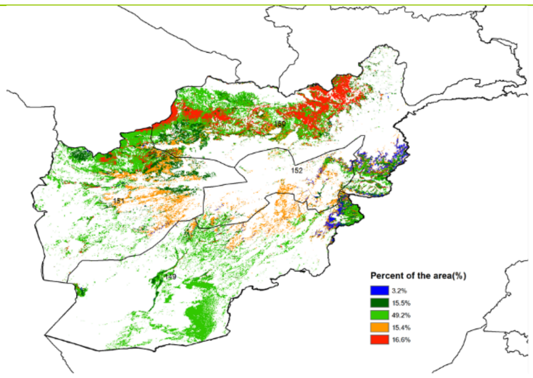


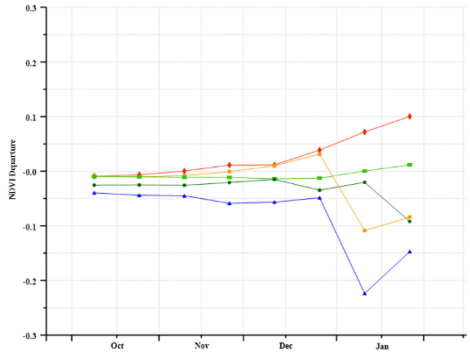
(a). Phenology of major crops



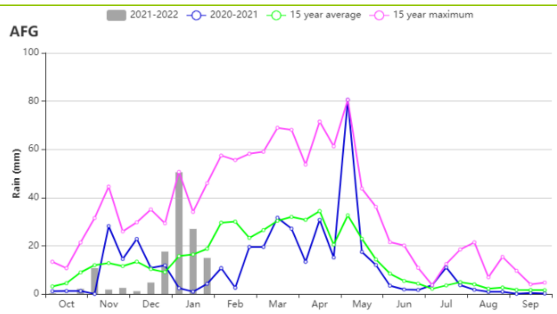


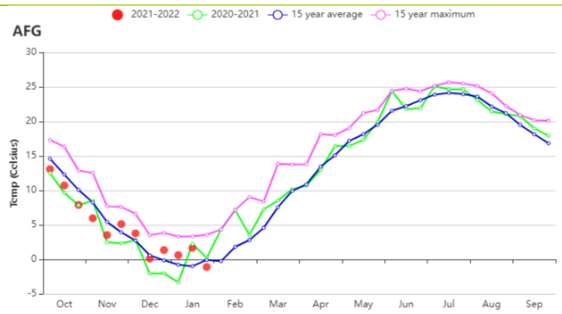
(b) Crop condition development graph based on NDVI (c) Maximum VCI



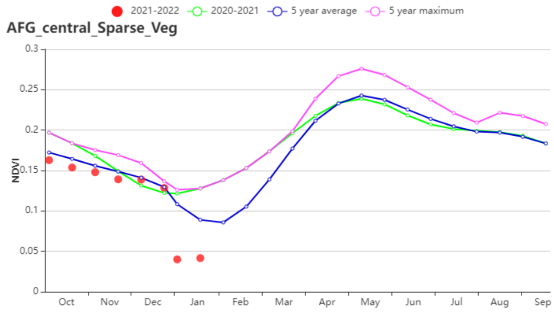


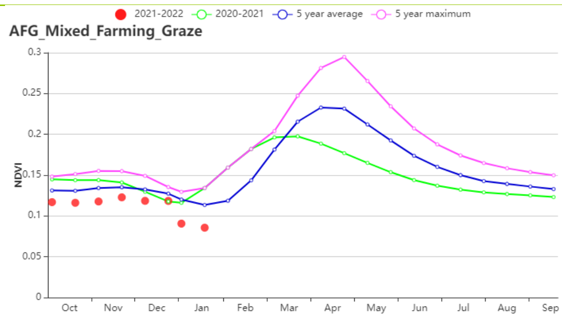
(d) Spatial NDVI patterns compared to 5YA (e) NDVI profiles



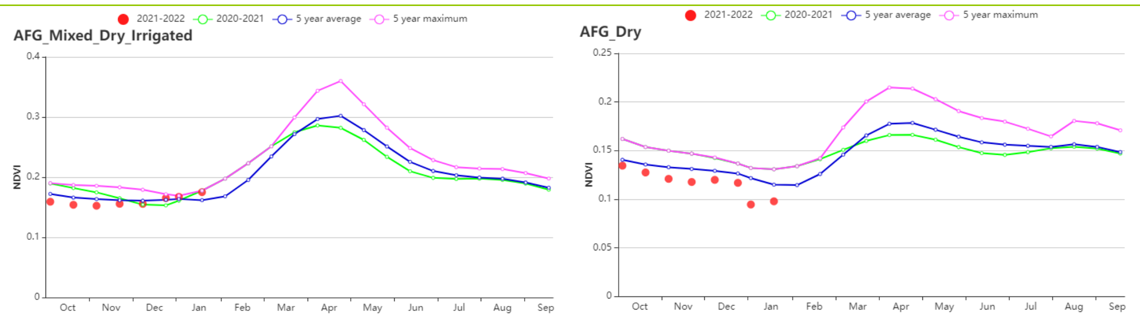


(f) Rainfall profiles (g) Temperature profiles





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



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

Table 3.2 Afghanistan's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, October 2021 – January 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	92	-21	0.1	0.0	825	3	239	-12
Dry region	100	8	6.7	-0.5	868	1	289	3
Mixed dry farming and irrigated cultivation region	170	-10	2.8	-0.2	734	3	339	-3
Mixed dry farming and grazing region	128	26	5.6	-0.1	789	1	332	8

Table 3.3 Afghanistan's agronomic indicators by sub-national regions, current season's values and departure from 5YA, October 2021 – January 2022

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Central region	2	-4	0.34
Dry region	1	-16	0.18
Dry and irrigated cultivation region	6	30	0.83
Dry and grazing region	0	39	0.34

[AGO] Angola

The monitoring period October 2021-January 2022 covers the late sowing and main growth stages of the country's major crops, which are maize and rice. The CropWatch agroclimatic indicators show that nationwide, rainfall was below the average of the past fifteen years (RAIN -19%). The temperature was close to the average (TEMP +0.4°C) while the radiation increased by 4%. The below-average recorded rainfall, in combination with increases in both temperature and radiation contributed to the slight decrease in the total potential biomass production (BIOMSS -3%).

The crop condition development graph, based on the NDVI profile, indicates below-average conditions, when compared to the 5YA. Unfavourable crop conditions were observed in 51.4% of the country's arable land area during the entire reporting period, mostly influenced by the rainfall deficit in the southern region. Most of these areas are located in the province of Cunene, Huila Huambo and Benguela. With CALF decreasing by 3%, the maximum VCIx for this period was 0.88. The spatial VCIx map shows that the worst crop conditions are located in the provinces of Namibe, Cunene and Huila, regions that recorded significant rainfall deficits. The crop prospects for the country are unfavorable.

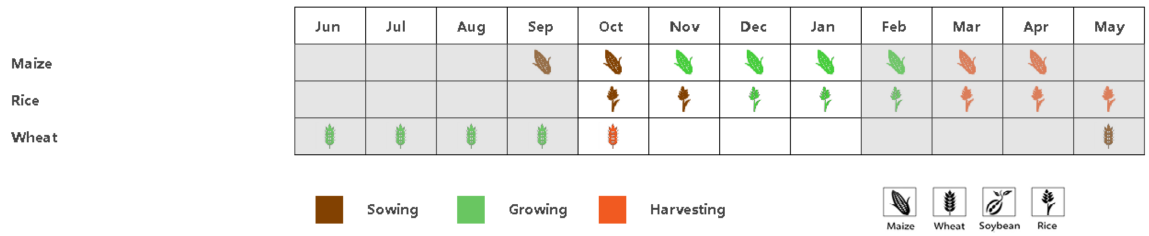
Regional Analysis

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

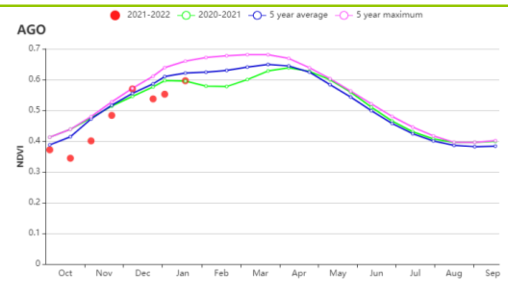
Except for the arid zone that showed above-average rainfall (+2%), below-average rainfall was observed in the Central Plateau (-10%), Humid zone (-16%), Semi-arid zone (-26%) and the Sub-humid zone (-15%). Temperature showed positive anomalies in all the agroecological zones. Regarding the radiation, apart from the Semi-arid zone which recorded below-average radiation (-2%), the remaining regions registered increases, with the highest increases being observed in the Humid zone (+11%), Central Plateau (+8%) and Sub-humid zone (+7%). Except for the semi-arid region which recorded a decrease in the total biomass production by 8%, in all the remaining zones, the biomass was close to the average of the past fifteen years.

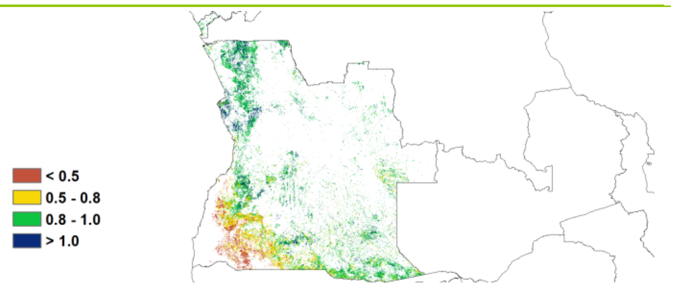
The regional crop development graphs based on NDVI indicate unfavourable crop conditions through the entire monitoring period in the Arid, Central Plateau and Sub-humid zones. In these regions, the CALF decreased by 1% in the Arid zone, 2% in the Central Plateu and 3% in the Sub-humid zone. Crop conditions were reported to be below the average of the past five years in the Humid and Semi-arid zones. In these regions, CALF was near the average of the past five years in the Humid zone while it decreased by 4% in the Semi-arid zone. In all the agro-ecological regions, VCIx values varying from 0.67 (in the Arid zone) to 0.96 (in the Humid zone) were observed.

Figure 3.6 Angola's crop condition, October 2021 – January 2022



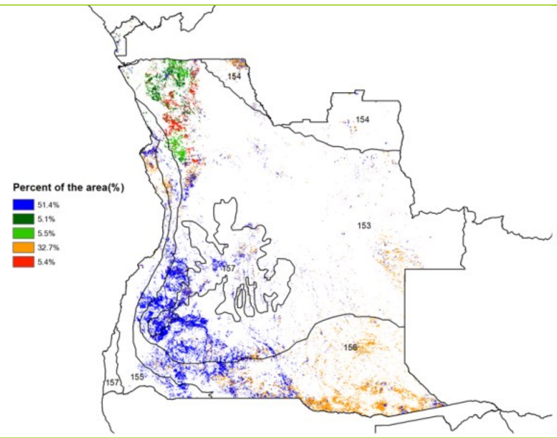
(a). Phenology of major crops

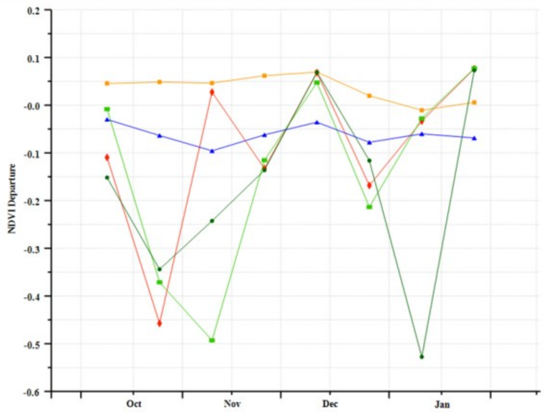




(b) Crop condition development graph based on NDVI

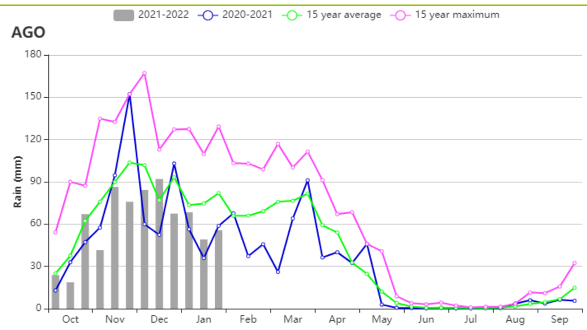
(c) Maximum VCI

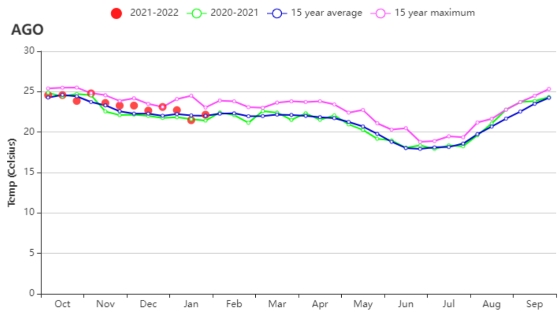




(d) Spatial NDVI patterns compared to 5YA

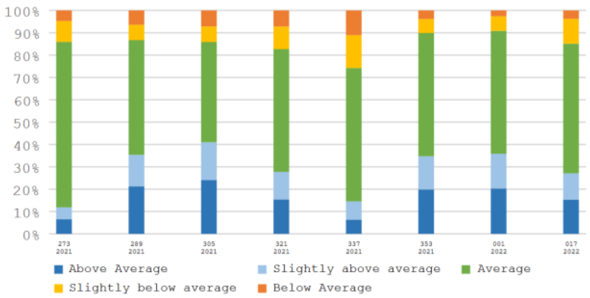
(e) NDVI profiles



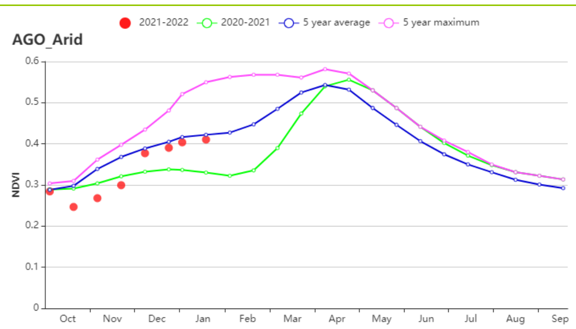


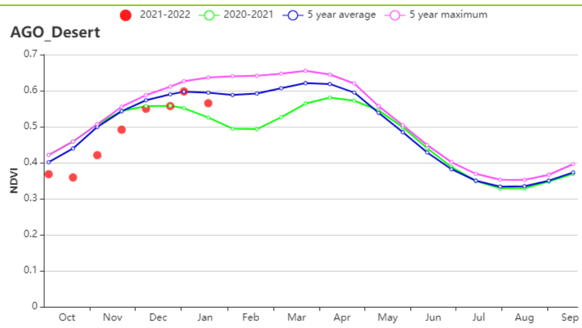
(f) National time-series rainfall profiles

(g) National time-series temperature profiles

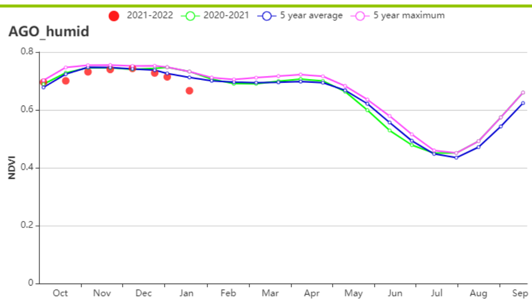


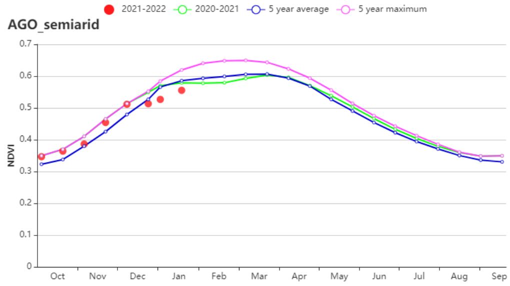
(h) Proportion of NDVI anomaly categories compared with 5YA



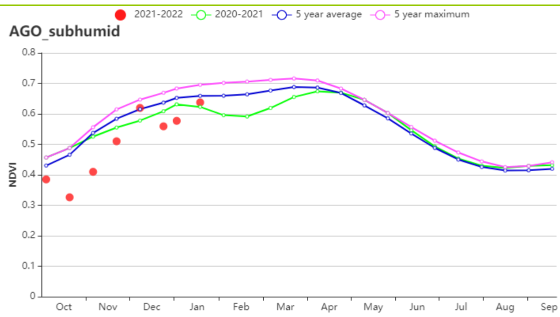


(i) Crop condition development graph based on NDVI - Arid zone (left) and Central Plateau (right)





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



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

Table 3.4 Angolas's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, October 2021 – January 2022

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m^2)	Departure (%)	Current (gDM/m^2)	Departure (%)
Arid region	416	2	25.0	0.1	1393	3	1032	-1
Central Plateau	979	-10	19.6	0.3	1255	8	1281	1
Humid zone	1116	-16	22.4	0.3	1285	11	1532	1
Semi-Arid Zone	472	-26	24.7	0.5	1291	-2	1081	-8
Sub-humid zone	874	-15	22.5	0.3	1268	7	1326	0

Table 3.5 Angolas's agronomic indicators by sub-national regions, current season's values and departure from 5YA, October 2021 – January 2022

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Arid region	46	-1	0.67
Central Plateau	89	-2	0.87
Humid zone	100	0	0.96
Semi-Arid Zone	84	-4	0.81
Sub-humid zone	93	-3	0.87

[ARG] Argentina

The reporting period covers the main growing stages for early maize, early soybean, and rice, and the planting of late maize and late soybean as well as the harvesting of wheat.

For the whole country, rainfall showed a positive anomaly of +18%, TEMP showed a slight positive anomaly (+0.2℃), RADPAR was at average and BIOMSS showed a 5% positive anomaly.

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

RAIN showed a negative anomaly in Mesopotamia (-11%), a slight positive anomaly in Chaco (+4%) and strong positive anomalies in Humid Pampas (+32%) and Subtropical Highlands (+68%). TEMP showed negative anomalies in Chaco (-0.1℃) and Subtropical Highlands (-0.9℃). Positive TEMP anomalies were observed in Humid Pampas (+0.3℃) and Mesopotamia (+0.7℃). Related to the strong positive anomaly in RAIN, Subtropical Highlands showed a strong negative anomaly in RADPAR (-9%). Positive anomalies were observed in Chaco (+2%) and Mesopotamia (+5%), while Pampas showed no anomaly in RADPAR. BIOMSS showed negative anomalies in Chaco (-1%) and Mesopotamia (-4%), and positive anomalies in Humid Pampas (+10%) and Subtropical Highlands (+12%).

CALF showed no anomaly in Mesopotamia and a positive anomaly (+2%) in Humid Pampas, being almost complete in both regions. Chaco and Subtropical highlands showed negative anomalies of -3% and -9%, respectively. VCIx showed regular values for Chaco (0.72), Subtropical Highlands (0.72) and Mesopotamia (0.78) and good conditions in Humid Pampas (0.87).

For the whole country, crop condition development graph based on NDVI showed during most of the period values below average. Observed values were very similar to those observed during the last growing season. Humid Pampas showed above average values during October and beginning November, near average values since end November up to December and below average values during January. Chaco showed for all the reporting period, below average conditions. Values up to beginning December were higher than the last growing season, while values since end of December were below those observed in the last growing season mainly due to the shortage of rainfall in December and early January. Moisture tended to be normal thanks to favorable rainfall in mid and late-January which might accelerate crop development in Chaco region. Mesopotamia, which is major rice producing region, showed no anomalies during October and beginning November, but negative anomalies since then. Since end December, values were also lower than the last growing season. Subtropical Highlands showed below average values during all the reporting period, presenting values also lower than the last growing season since end December.

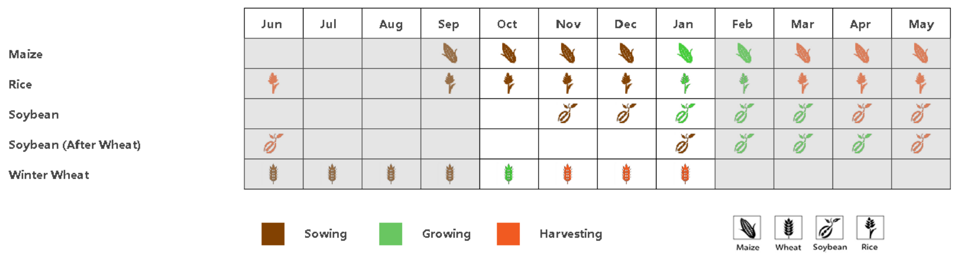
Rainfall profiles showed near average conditions during most of the period in Argentina, except for end of December and beginning of January, when higher negative anomalies were observed. Chaco and Mesopotamia showed strong negative anomalies in precipitation at the beginning of December and January. Pampas showed also negative anomalies at end December and beginning January, and Subtropical highlands at beginning January only. TEMP profile changed between positive and negative anomalies along the reporting period with higher frequency of negative anomalies.

Spatial distribution of NDVI profiles showed several homogeneous patterns. North of the country was dominated by the red profile, which showed below average conditions along all the reporting period, presenting its lowest values during end December and January. This profile was also observed in Center East of Pampas. Blue profile was observed in South East and North West Pampas and West Subtropical Highlands and showed below average values except for the beginning and the end of the reporting period where no anomalies were observed. Most of the Pampas was dominated by a mixture of dark green and light green profiles. The first profile showed average values in general and above average values in November and December. Light green profile showed negative anomalies during October and November and recovered to above average values since December.

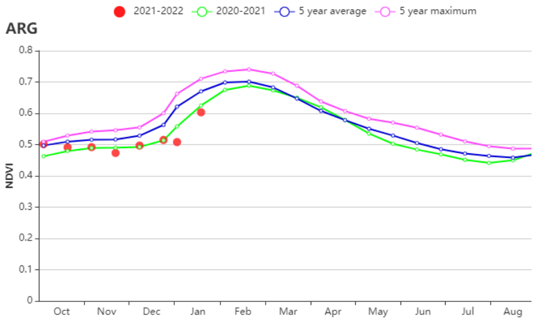
Maximum VCI showed quite good conditions (values higher than 0.8) in Humid Pampas, excepting an area in South West of Buenos Aires province which showed poor conditions (values below 0.5). Good conditions were also observed in West Subtropical Highlands, North East Chaco and South Mesopotamia.

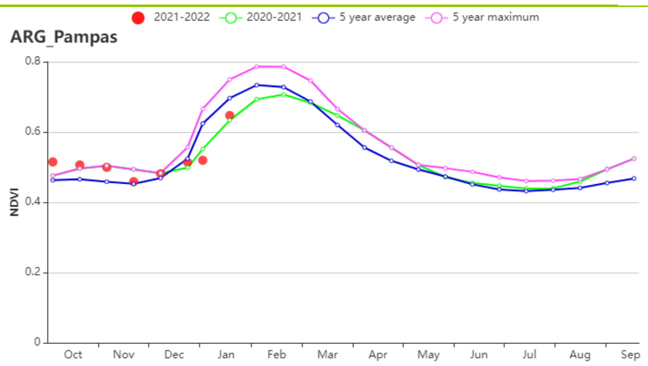
Argentina showed variable conditions among zones. Pampas, the main agricultural region, showed in general good conditions for crop growing with NDVI profiles above or near average and high VCIx values. Mesopotamia and Chaco showed negative anomalies in NDVI, precipitation and intermediate VCIx values. Subtropical Highlands showed also negative anomalies and variable VCIx values.

Figure 3.7 Argentina's crop condition, October 2021 – January 2022

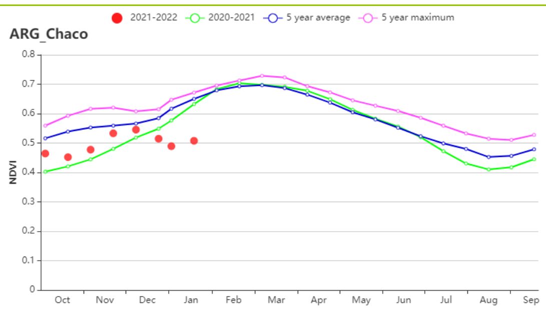


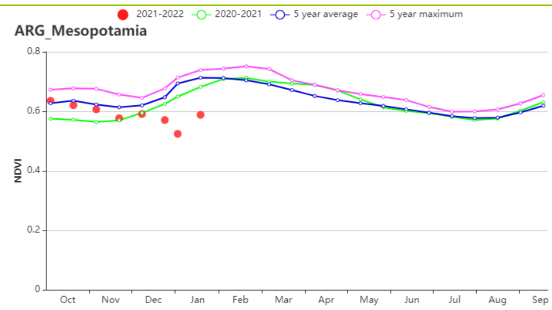
(a). Phenology of major crops



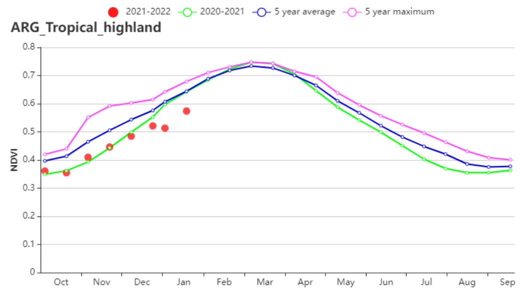


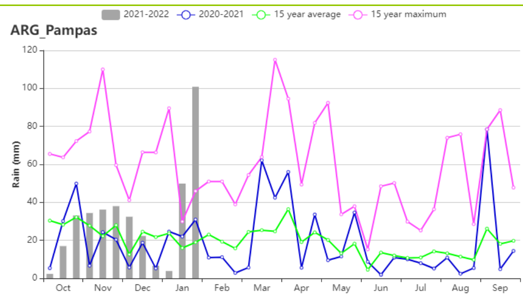
(b) Crop condition development graph based on NDVI (c) Crop condition development graph based on NDVI (Pampas)



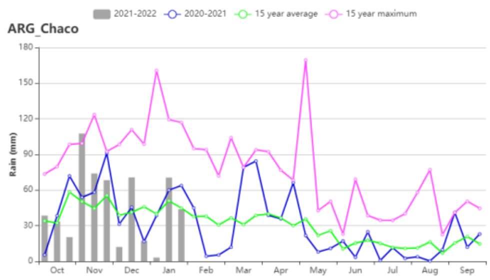


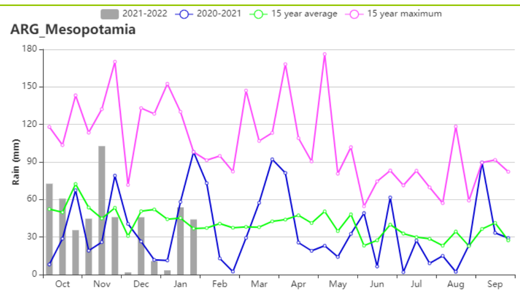
(d) Crop condition development graph based on NDVI (Chaco) (e) Crop condition development graph based on NDVI (Mesopotamia)



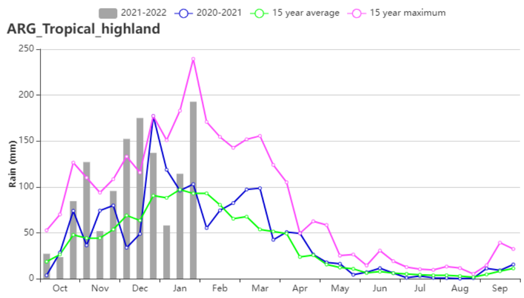


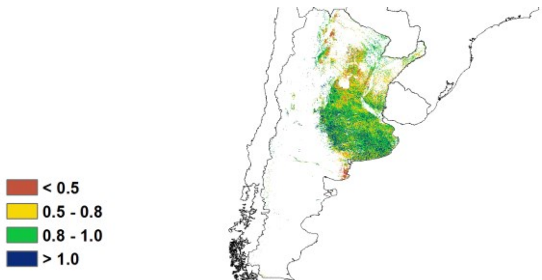
(f) Crop condition development graph based on NDVI (Subtropical Highlands) (g) Time series rainfall pofile (Pampas)



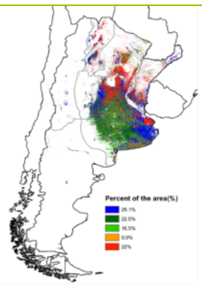


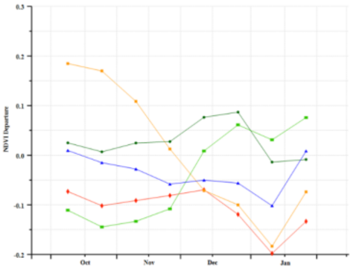
(h) Time series rainfall pofile (Chaco) (i) Time series rainfall pofile (Mesopotamia)





(j) Time series rainfall pofile (Subtropical Highlands) (k) Maximum VCI





(l) Spatial distribution of NDVI profiles

Table 3.6 Argentina's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, October 2021 – January 2022

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Chaco	559	4	25.0	-0.1	1397	2	1175	-1
Mesopotamia	522	-11	23.8	0.7	1487	5	1139	-4
Humid Pampas	377	32	21.6	0.3	1508	0	1013	10
Subtropical highlands	1239	68	20.9	-0.9	1235	-9	1311	12

Table 3.7 Argentina's agronomic indicators by sub-national regions, current season's values and departure from 5YA, October 2021 – January 2022

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Chaco	93	-3	0.72
Mesopotamia	100	0	0.78
Humid Pampas	99	2	0.87
Subtropical highlands	83	-9	0.72

[AUS] Australia

Based on the phenology calendar, the current period covers the harvest of wheat and barley in Australia. The remote sensing based NDVI profiles showed favorable conditions, as the crop conditions were better than the maximum of the last 5 years, especially in November and December. Based on the spatial NDVI patterns, 32.6% of the cropland had generally favorable NDVI departures over the whole period, while the remaining area was close to the average of the last 5 years.

Compared to the 15YA, the largest agroclimatic variation was rainfall, which increased by 30%, to 341 mm. Combined with slightly below average temperature (-1°C) and radiation (-2%), the potential accumulated biomass was 8% above the average. The CALF increased by 22% compared to the 5YA, and VCI was 0.84. VCIx in the southeast Australia was generally better than in the southwest.

In general, the crop conditions in the current period were favorable. According to the rainfall profile, the above average rainfall was mostly concentrated in November. Drier weather in December improved conditions for wheat harvest. All in all, above average production can be expected for Australia.

Regional analysis

This analysis adopts five agro-ecological regions for Australia, namely the Arid and Semi-arid Zone, Southeastern Wheat Zone, Sub-humid Subtropical Zone, Southwestern Wheat Zone, Wet Temperate and Subtropical Zone. The Arid and Semi-arid Zone, in which hardly any crop production takes place, was not analyzed.

Three of the four AEZs analyzed, i.e., Southeastern wheat zone, Sub-humid subtropical zone, and Wet temperate and subtropical zone, presented a similar pattern for the agroclimatic indicators, with largely above average rainfall (+46%, +37%, +36%), slightly below average temperature (-1.1°C, -0.8°C, -0.4 °C) and radiation (-3% for all). As a result, the climatic indicators-based biomass estimates were above average (+9%, +9%, +16%). The CALF and VCIx in these 3 zones were good, especially the CALF in the Subhumid subtropical zone increased by 94%. This means that more arable land in this zone was cultivated. The NDVI profiles of the zones further confirms the good conditions, in which the NDVI departures were all better than 5YA and better than the 5-year maximum starting from November. The crop conditions in the EAST group were favorable.

The remaining one, Southwestern Wheat Zone, showed the opposite conditions, with below-average rainfall (-15%) and temperature (-0.7°C), slightly above average radiation (+1%). The biomass was consequently below average (-5%). The CALF increased slightly (+12%), and VCIx was 0.84. Combined with the NDVI profile, which were close to the 5-year maximum, the crop conditions in this group were also favorable.

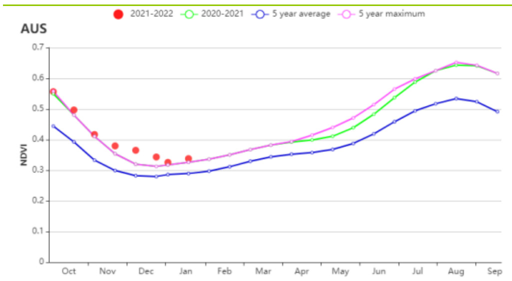
Figure 3.8 Australia's crop condition, October 2021 – January 2022

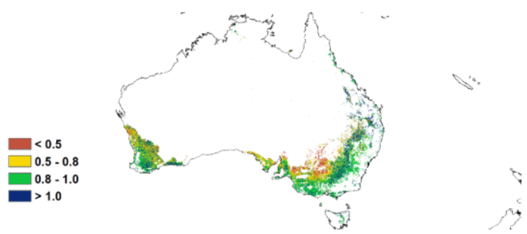
	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr
Wheat											

Sowing Growing Harvesting

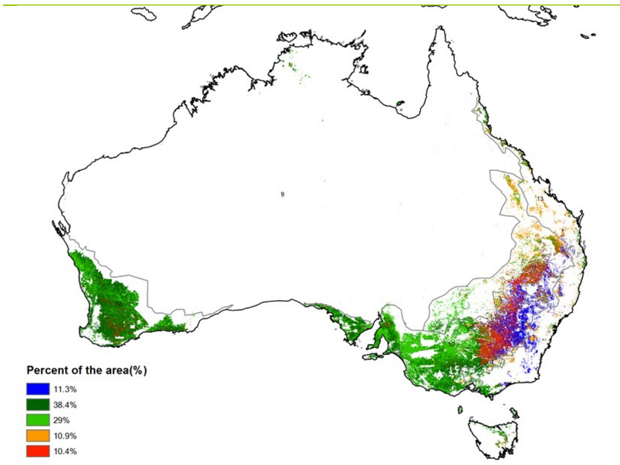
Maize Wheat Soybean Rice

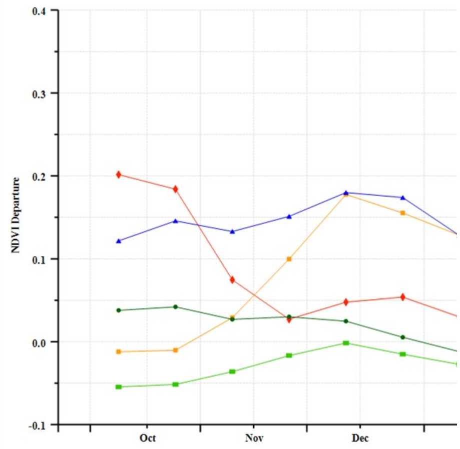
(a). Phenology of major crops



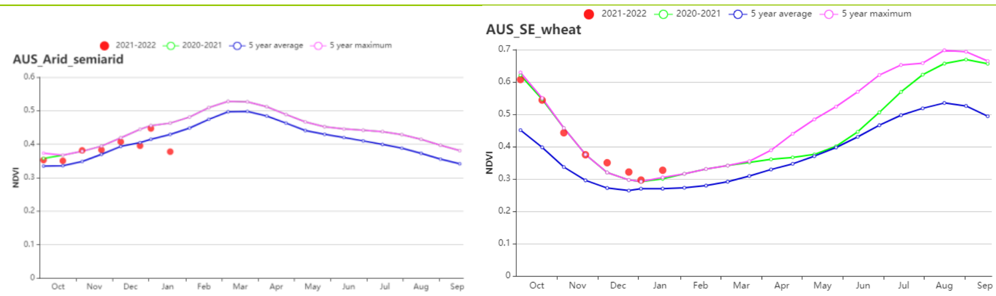


(b) Crop condition development graph based on NDVI (c) Maximum VCI

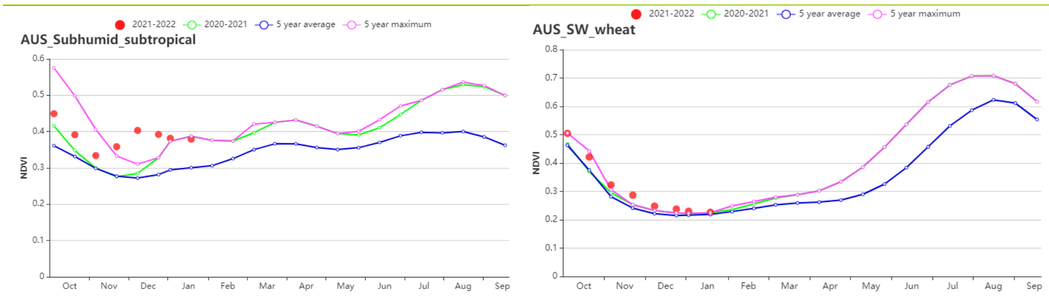




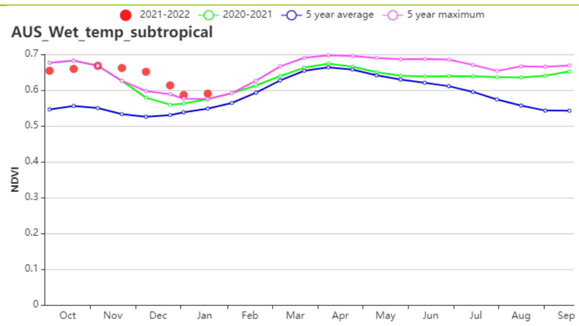
(d) Spatial NDVI patterns compared to 5YA (e) NDVI profiles



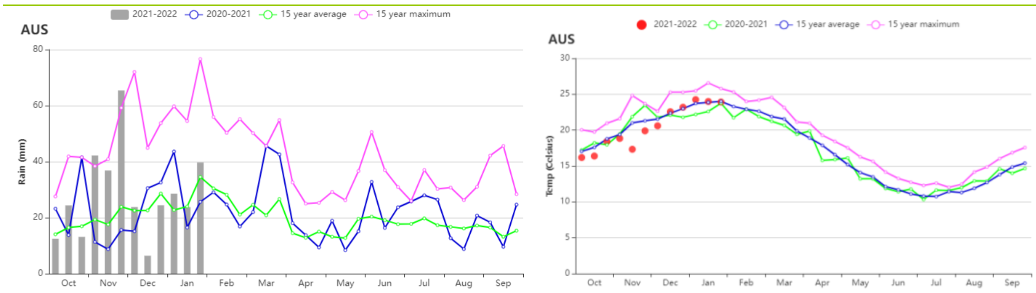
(f) Crop condition development graph based on NDVI (Arid and semiarid zone (left) and Southeastern wheat area (right))



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



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



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

Table 3.8 Australia's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, October 2021 – January 2022

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Arid and semiarid zone	561	-1	27.5	0.4	1447	3	950	1
Southeastern wheat area	277	46	19.0	-1.1	1432	-3	834	9
Subhumid subtropical zone	350	37	23.3	-0.8	1460	-3	976	9
Southwestern wheat area	91	-15	19.0	-0.7	1540	1	605	-5
Wet temperate and subtropical zone	487	36	18.9	-0.4	1362	-3	1048	16

Table 3.9 Australia's agronomic indicators by sub-national regions, current season's values and departure from 5YA, October 2021 – January 2022

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Arid and semiarid zone	61	8	0.84
Southeastern wheat area	80	18	0.80
Subhumid subtropical zone	74	94	0.88
Southwestern wheat area	68	12	0.84
Wet temperate and subtropical zone	99	6	0.97

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

[BGD] Bangladesh

During the reporting period, the growing and harvesting of Aman rice and the sowing of Boro rice, maize and wheat were the main farming activities. For the whole nation, both rainfall and TEMP were below average (-6% and -0.4°C, respectively). RADPAR was below average (-2%). However, sufficient rainfall in October provided abundant soil moisture, which was conducive to the growth of Aman rice, and BIOMSS was above average (+4%). After October, the dry weather facilitated the completion of rice harvest and sowing. The national NDVI development graph shows that overall crop conditions were above the 5-year average in early October due to the abundant rainfall and then returned to the 5-year average from November to January. The maximum Vegetation Condition Index (VCIx) was 0.95, with most areas showing values higher than 0.8 and CALF had increased by 2%. Overall, the CropWatch indicators as well as the VCIx map indicate average crop conditions in Bangladesh.

Regional analysis

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

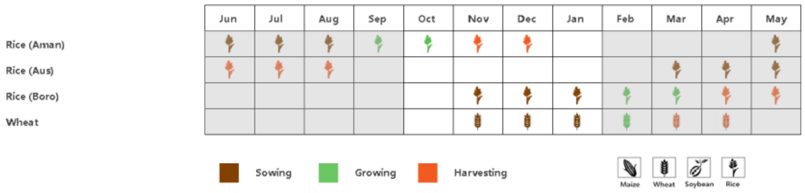
In the Coastal region, both RAIN and TEMP were below average (-8% and -0.1°C, respectively). RADPAR was also below average (-3%). But abundant rainfall in the middle of October was beneficial to the growth of rice. BIOMSS was above average (+5%). The crop condition development graph based on NDVI shows that crop conditions were above the 5-year average in the middle of October and then returned to average. CALF was 91% and VCIx was 0.89. Overall, crop conditions were close to the average for this zone.

In the Gangetic Plain, RAIN was above average (+25%). Both TEMP and RADPAR were below the average (-0.7°C and -2%, respectively). BIOMSS were above average (+7%). The crop condition development graph based on NDVI shows that crop conditions were close to the 5-year average except November. During the monitoring period, CALF (97%) was above average (+1%) and VCIx was 0.94. Crop conditions of this region were close to the average.

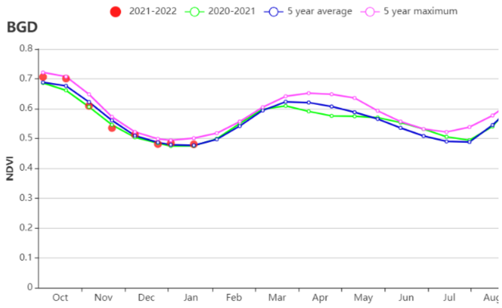
The Hills experienced the largest drop in rainfall (-32%). RADPAR was also below average (-2%), but TEMP was above average (+0.4°C). BIOMASS was close to average. During the monitoring period, the crop condition development graph based on NDVI shows that crop conditions were close to average and even reached the 5-year maximum in January. CALF was 98% and VCIx was 0.96, indicating average crop conditions.

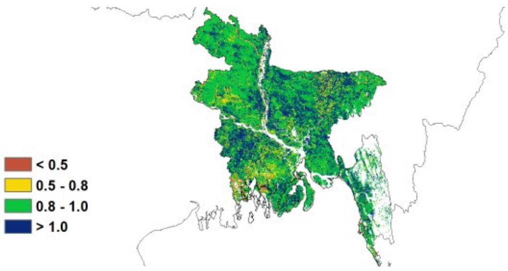
In the Sylhet basin, below-average rainfall (-16%) and cooler temperatures (-0.6°C) were recorded. RADPAR was close to average. BIOMSS was estimated 2% higher than the 15YA. The crop condition development graph based on NDVI shows that crop conditions were above the 5-year maximum in October and then decreased to average from November to January. For the Sylhet basin, CALF was 95% (+5%) with a favorable VCIx (0.97). Based on the above information, crop conditions were close to the average for this zone.

Figure 3.9 Bangladesh's crop condition, October 2021- January 2022



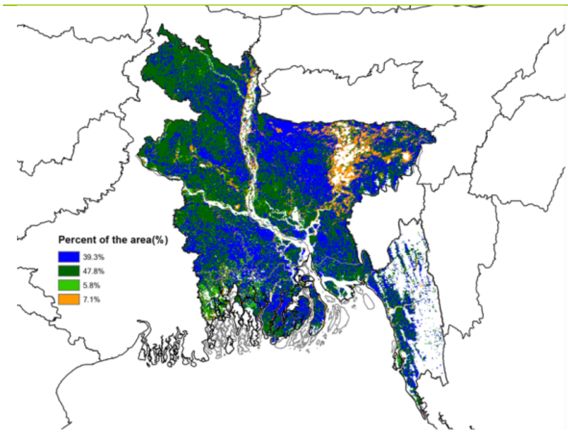
(a). Phenology of major crops

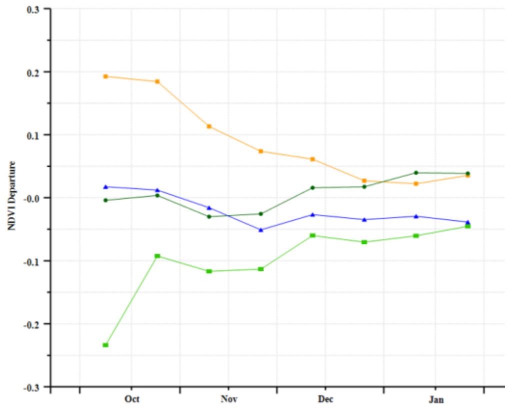




(b) Crop condition development graph based on NDVI

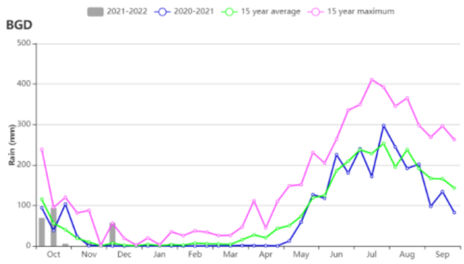
(c) Maximum VCI

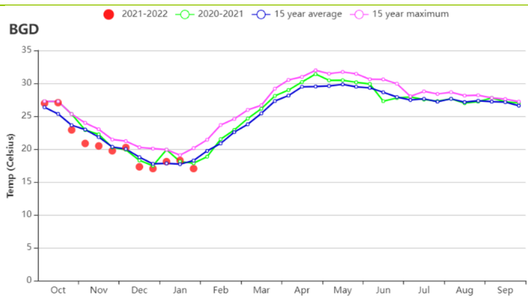




(d) Spatial NDVI patterns compared to 5YA

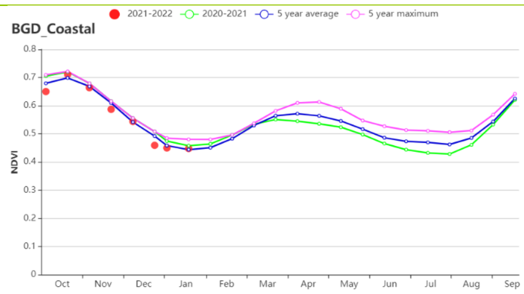
(e) NDVI profiles

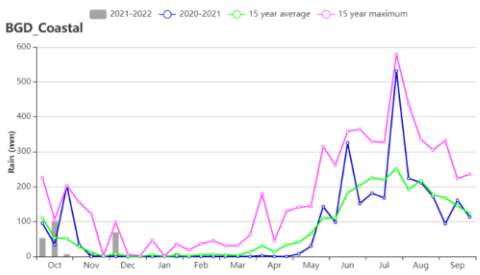




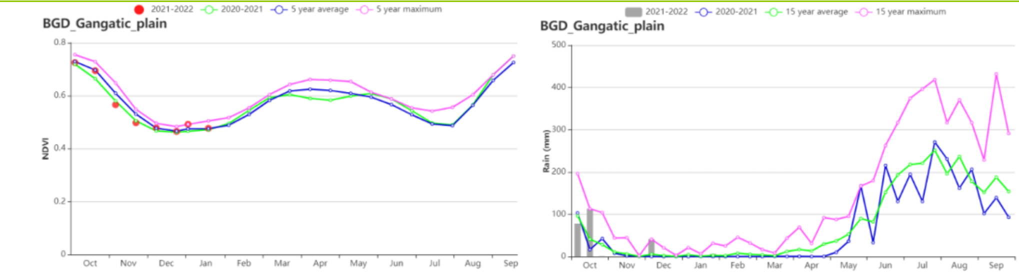
(f) Rainfall profiles

(g) Temperature profiles

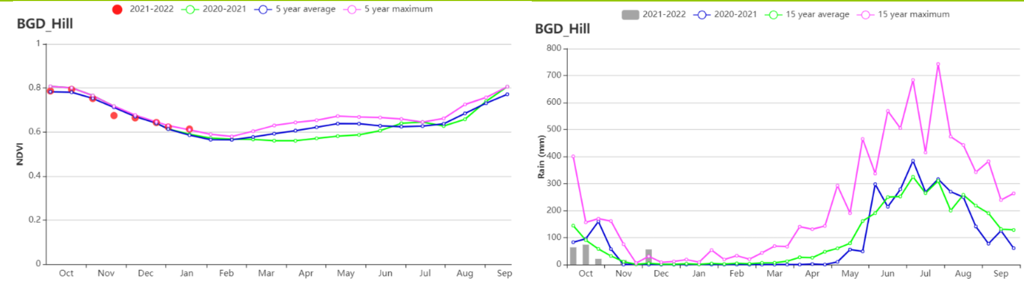




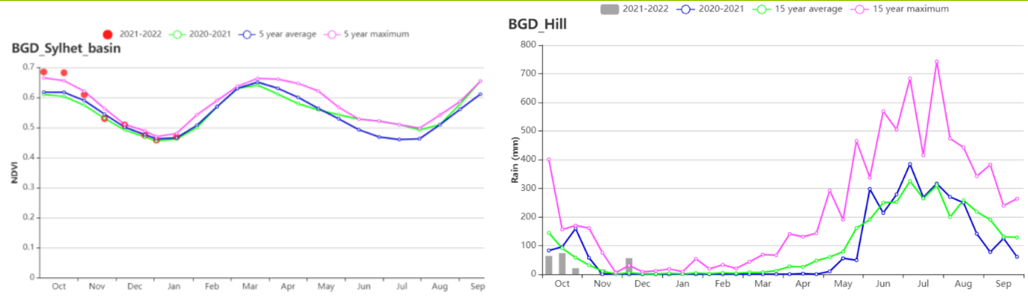
(h) Crop condition development graph based on NDVI (left) and rainfall profile (right) of Coastal region



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



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



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

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

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Coastal region	249	-8	21.8	-0.1	997	-3	658	5
Gangetic plain	248	25	20.1	-0.7	951	-2	570	7
Hills	238	-32	21.0	0.4	1002	-2	657	0
Sylhet basin	222	-16	20.1	-0.6	962	0	571	2

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

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Coastal region	91	0	0.89
Gangetic plain	97	1	0.94
Hills	98	1	0.96
Sylhet basin	95	5	0.97

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, which was sown in October, is the major crop in the field during this monitoring period. Agro-climatic conditions had decreased rainfall compared to 15YA average (RAIN 270 mm or -4%), especially in central and southern region. Both temperature (TEMP 1.1°C or 0.2°C above average) and radiation (RADPAR 179 MJ/m^2 or 12%) increased. Nearly all the arable land was cropped (CALF at about 99%) and the maximum vegetation condition index (VCIx) was high (0.83). Weather based projected potential biomass remain the same level as before.

At the national level, NDVI was below average in October, and then close to the 5YA in November but declined in December. Crop condition in about 77.5% cropped area was below but close to the 5-year average, in agreement with the national VCIx map. According to the spatial distribution maps, although VCIx was satisfactory in most areas of the country (>0.8), there was an apparent drop of NDVI profiles in many areas from December to January, the reason for this might be ice and snow cover.

Regional analysis

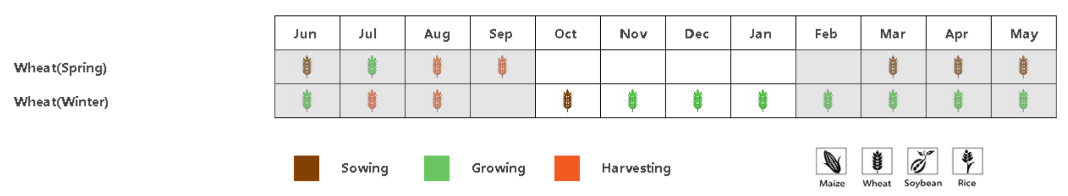
Based on cropping system, climatic zones and topographic conditions, regional analyses for three agro-ecological zones (AEZ) are provided, including Northern Belarus (028, Vitebsk, the northern area of Grodno, Minsk and Mogilev), Central Belarus (027, Grodno, Minsk and Mogilev and Southern Belarus (029)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

Northern Belarus (Vitebsk, northern area of Grodno, Minsk and Mogilev) had more rainfall (2%) and slightly increased temperature (+0.1°C) than average, radiation also increased (12%). Agronomic indicators showed satisfactory values: 99% for CALF and 0.82 for VCIx. Crop condition is good.

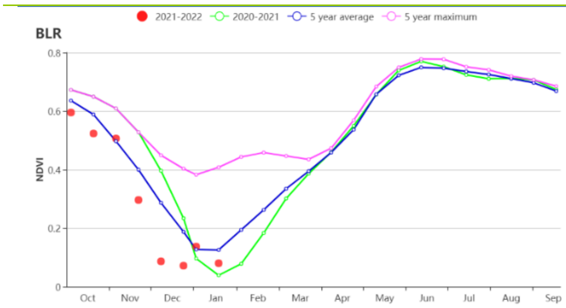
In **Central Belarus**, the regions of Grodno, Minsk and Mogilev recorded lower rainfall (-9%), slightly higher temperature (+0.2°C) and above average radiation (12%). The BIOMSS is projected to remain the same level as before. Nearly full cropped arable land (CALF at 98%) and a VCIx value of 0.83 were observed. The overall situation was favorable for winter crops.

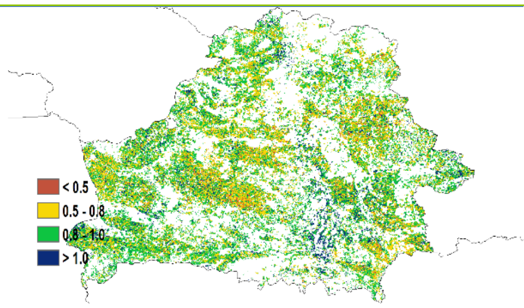
The **Southern Belarus** (southern halves of Brest and Gomel regions) experienced the same agro-climatic condition as Central area. Lower rainfall (-12%), higher temperature (+0.2°C) and radiation (12%) were recorded. The BIOMSS is projected to increase by 1%. Favorable agronomic indicators (CALF 99%, VCIx 0.84) were observed, the growth status of winter wheat in the following season needs close attention.

Figure 3.10 Belarus's crop condition, October 2021- January 2022.



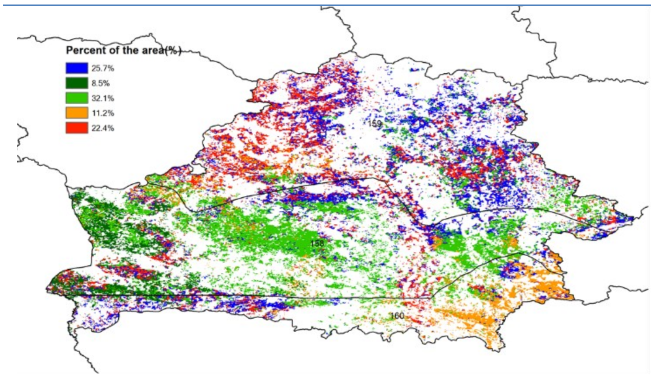
(a). Phenology of major crops

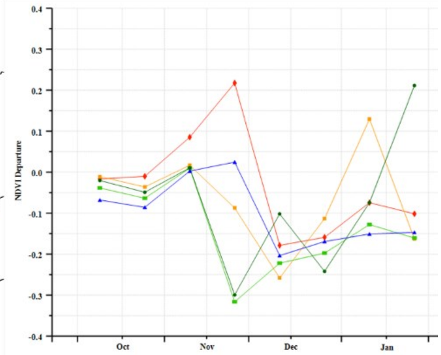




(b) Crop condition development graph based on NDVI

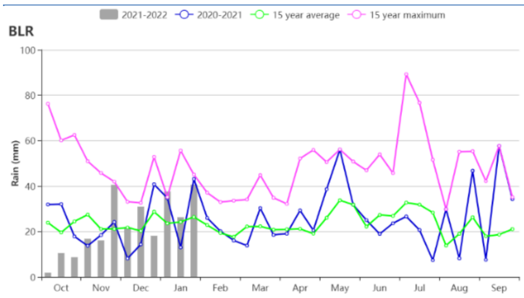
(c) Maximum VCI

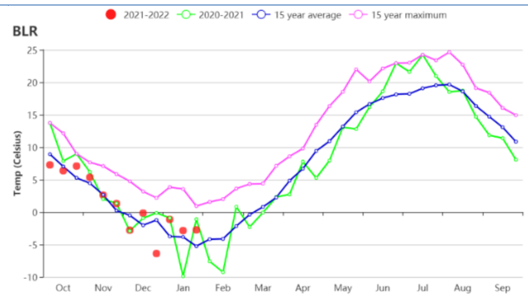




(d) Spatial NDVI patterns compared to 5YA

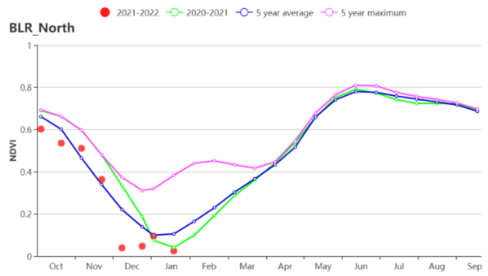
(e) NDVI profiles

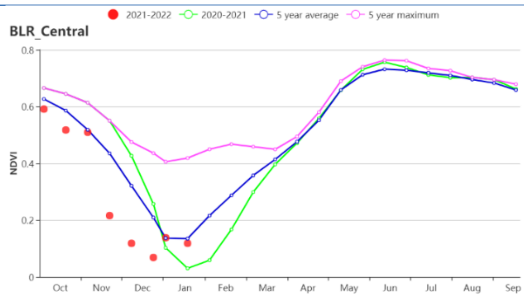




(f)Rainfall time series

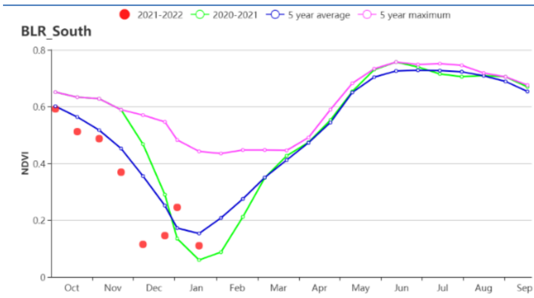
(g) Temperature time series





(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, October 2021- January 2022.

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Center	255	-9	2	0.2	185	12	399	0
North	298	2	0	0.1	161	12	365	-1
South-west	232	-12	2	0.2	208	12	414	1

Table 3.13 Belarus's agronomic indicators by sub-national regions, current season's values and departure from 5YA, October 2021- January 2022.

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Center	98	-1	0.83
North	99	-1	0.82
South-west	99	1	0.84

[BRA] Brazil

During the period from October 2021 to January 2022, the harvest of wheat had concluded. Soybean, first season maize and rice in Central-South Brazil reached the peak vegetation cover by the end of monitoring period. The sowing of rice in Northern Brazil started in late January, while the planting of maize in the north will start at the end February.

The 2021-2022 summer crops were adversely affected by the prolonged dry and warmer-than-usual weather, with overall crop conditions slightly below average level. At the national level, Brazil received 659 mm rainfall on average, 28% below the 15YA. CropWatch Agro-Climatic Indicators (CWAIs) present 0.9°C higher temperature and average radiation compared with the 15YA. The below-average rainfall and above average temperature resulted in unfavorable soil moisture for crop growth and caused a 13% reduction of potential biomass. Most central and southern Brazil suffered from severe water shortage while few states received well above average rainfall along the East coast and in the Northwest. Extreme dry weather was observed in the top nine major agricultural producing states except for Santa Catarina where rainfall was just 5% below the 15YA. Negative rainfall departures by more than 40% were observed for all other major agricultural producing states such as Goias, Sao Paulo, Minas Gerais, Mato Grosso Do Sul and Ceara. Temperatures in those five major states were all well above average, more than 0.9ºC higher than the 15YA. The largest negative departure of rainfall and positive temperature anomaly were both found in Goias, resulting in a 40% drop in potential biomass. Radiation was in general close to average ranging from -5% in Goias to +4% in Ceara compared with the average. Low rainfall, high temperature and radiation resulted in below average BIOMSS in all major agricultural producing states. According to the BIOMSS departure map and the meteorological drought conditions illustrated by the standard precipitation index map, the water stress affected area further expanded and worsened for most of southern Brazil as compared to the November 2021 Bulletin.

National rainfall profiles also confirmed the continuously dry weather. Each ten-days rainfall average was below average, except for early January when rainfall was slightly above average but did not effectively alleviate the persistent drought conditions. The lack of rainfall reduced crop growth as shown in the crop condition development graph based on NDVI. Vegetation greenness presents below-average values throughout the monitoring period. Spatial distribution of NDVI departure from 5YA and the corresponding profiles presented significantly below-average NDVI in southern Mato Grosso Do Sul, Parana, and Rio Grande Do Sul. The output of soybean and first season maize might further drop from last year's low production. Accordingly, the VCIx map also presents low values (< 0.8) in Southern Brazil (figure b). Below-average rainfall was also observed in Central Brazil including Mato Grosso, Sao Paulo, Goias, and Minus Gerias. Crop conditions were improving to average due to the average to above-average rainfall in January. Meanwhile, VCIx values in most other regions of Brazil show average to above average conditions. At the national level, VCIx was 0.92. CALF was at 99%, 2% above the 5YA, indicating overall limited effects from the dry weather on the sowing of the crops.

In general, crop conditions in Brazil were slightly below average by the end of monitoring period. Production of first season maize, second season maize and soybean are all forecasted to be below average, but close to those of last year (2020-2021).

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 Central Savanna, the East coast, Parana River, Amazon zone, Mato Grosso zone, Southern subtropical rangelands, mixed forest, and farmland, and the

Nordeste. During this monitoring period, Central Savanna, Mato Grosso, Nordeste and Parana basin have suffered from significantly below-average rainfall, ranging from -48% to -62%. Together with above average temperature, the dry and hot weather resulted in below-average BIOMSS in those four zones ranging from 15% below the 15YA in Nordeste to 35% below average in Central Savanna. Weather conditions were slightly below average in Mato Grosso and Northeastern mixed forest and farmland while they were near average at the East coast and above average in Amazonas.

According to the NDVI profiles, crop growth conditions in Central Savanna, Coast and Northeastern mixed forest and farmland zones were below average at the end of 2021, but improved to the average level in January. This can be attributed to the above average rainfall in late December 2021 to early January 2022, which mitigated the water stress. CALF in those three AEZs were slightly above average with high VCIx values (all higher than 0.95).

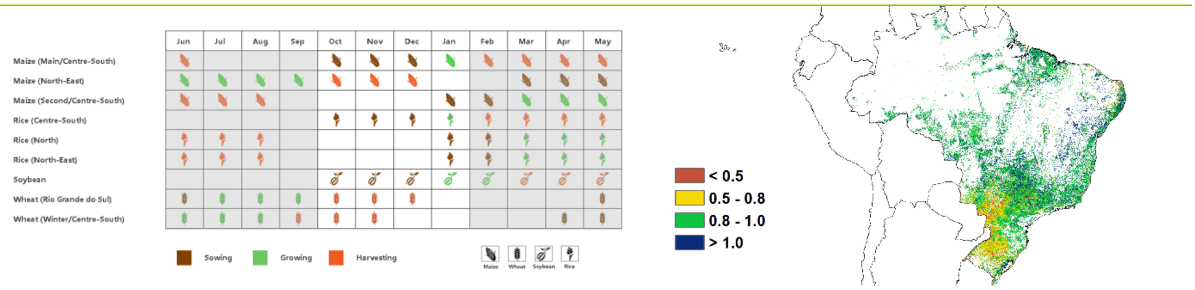
Mato Grosso, as the top maize producing zone, also experienced moderate negative departures in rainfall. The total precipitation was more than 1000 mm during the monitoring period which in theory provides sufficient water to meet the crop demand. However, the rainfall profiles presented an uneven distribution of rainfall during the four months, with well below average rainfall except for mid-November, and mid to late-December. The miss-match between rainfall and water demand resulted in unfavorable crop growth condition. According to the VCIx map, the poorest crop conditions were mostly located at the center to the north of the zone, while other regions in the AEZ present average to above conditions.

Southern subtropical rangelands and the Parana basin are the major producing zones for the soybean and first season maize. The below average rainfall in the two AEZs resulted in severe drought which was clearly indicated by the VCIx map. Accordingly, the average VCIx for the two zones also ranks at the bottom of the eight AEZs. As shown in the rainfall profiles, the rainfall was continuously below average throughout the monitoring period. The above average temperature further accelerated the loss of soil moisture. The comparison between the Standard Precipitation Index (SPI) map in this bulletin and the November 2021 bulletin indicates that the severity of drought intensified. The negative departures of NDVI from the 5YA further increased, showing poor growth conditions and decreasing yield perspectives for summer crops.

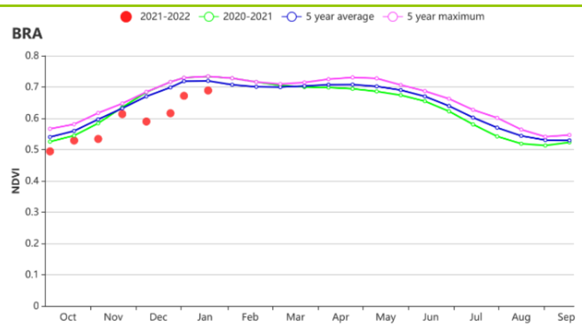
Nordeste is dominated by dry and hot weather. It received the least rainfall of just 133 mm in the eight zones. Nevertheless, the NDVI-based crop development profiles present above-average growth conditions. Considering the semi-arid climate in the region, most crops are irrigated which contributes to the above average condition. Irrigation resulted in the highest VCIx values for this zone, as compared with others. CALF reached 96%, which is 33% above the 5YA.

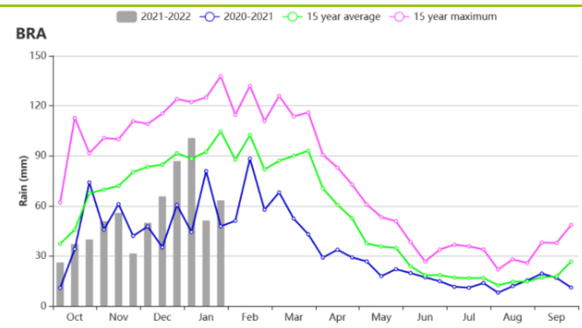
For more indicators and detailed information, it is recommended to visit CropWatch Explore (http://cropwatch.com.cn/newcropwatch/main.htm).

Figure 3.11 Brazil's crop condition, October 2021 – January 2022

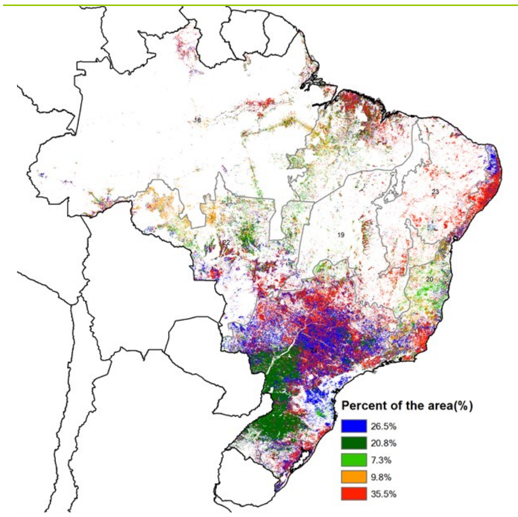


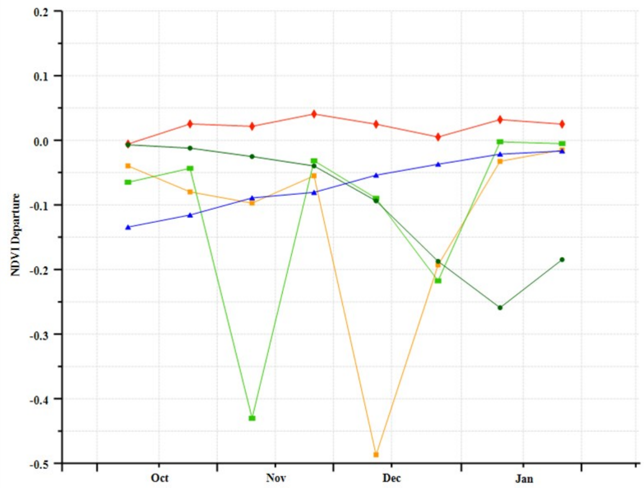
(a) Phenology of major crops (b) Maximum VCI



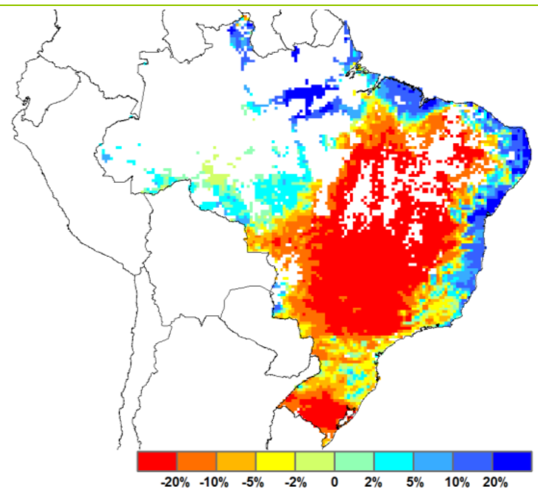


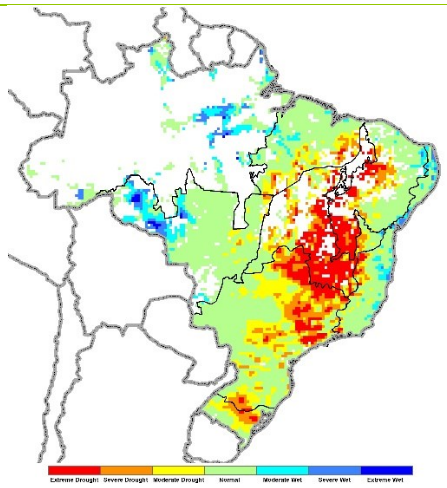
(c) Crop condition development graph based on NDVI of Brazil (d) Time series rainfall profile of Brazil



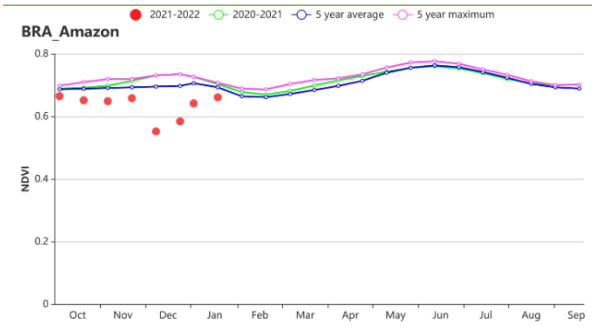


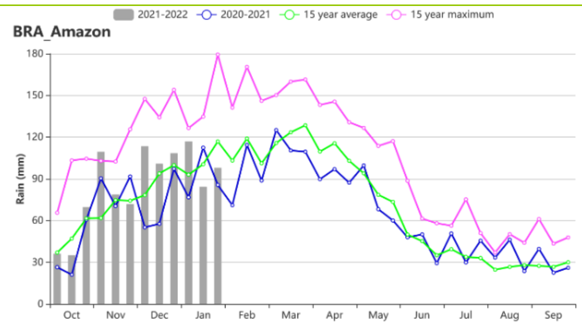
(e) Spatial distribution of NDVI departure from 5YA and NDVI departure profiles corresponding to the clusters



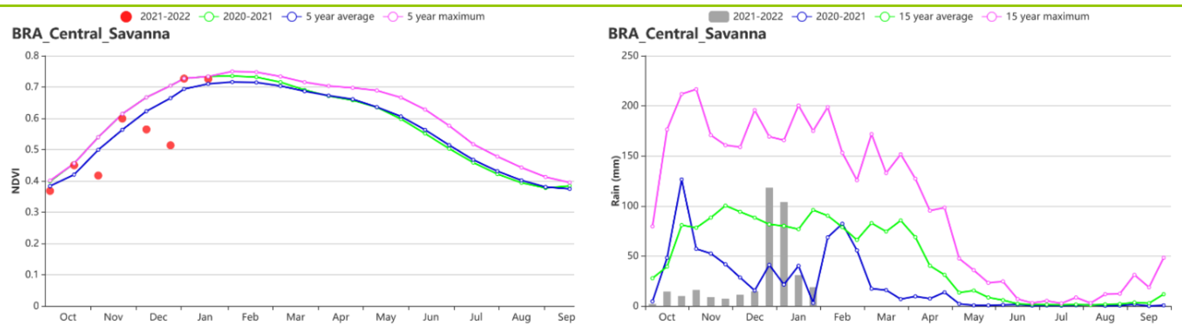


(f) Potential biomass departure from 15YA (g) Meteorological drought measured by standard precipitation index

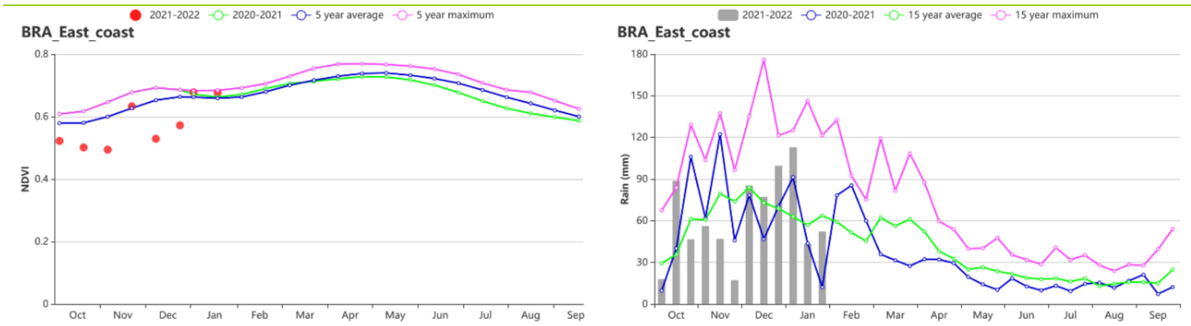




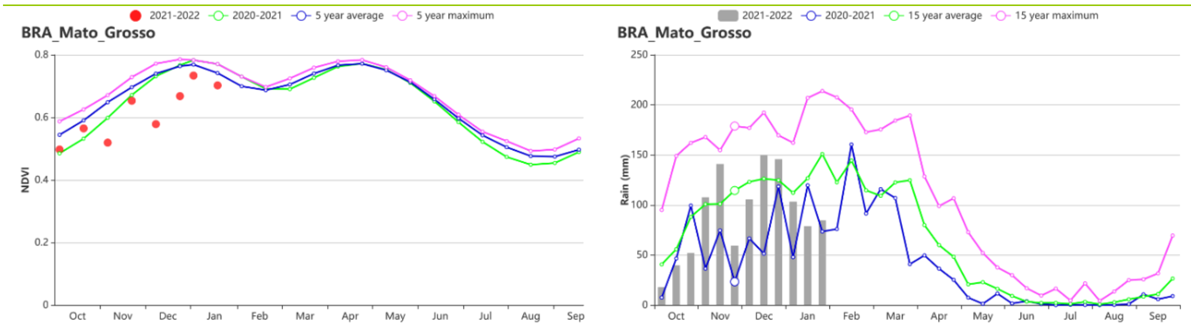
(h) Crop condition development graph based on NDVI (left) and rainfall profile (right) of Amazon



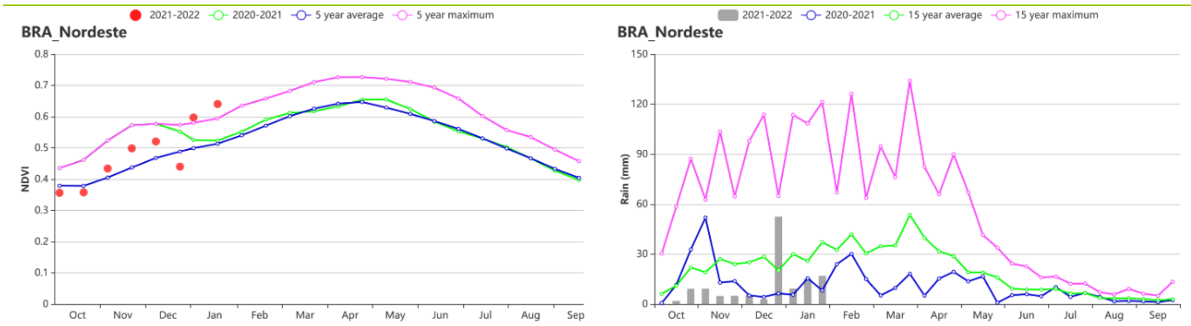
(i) Crop condition development graph based on NDVI (left) and rainfall profile (right) of Central Savanna



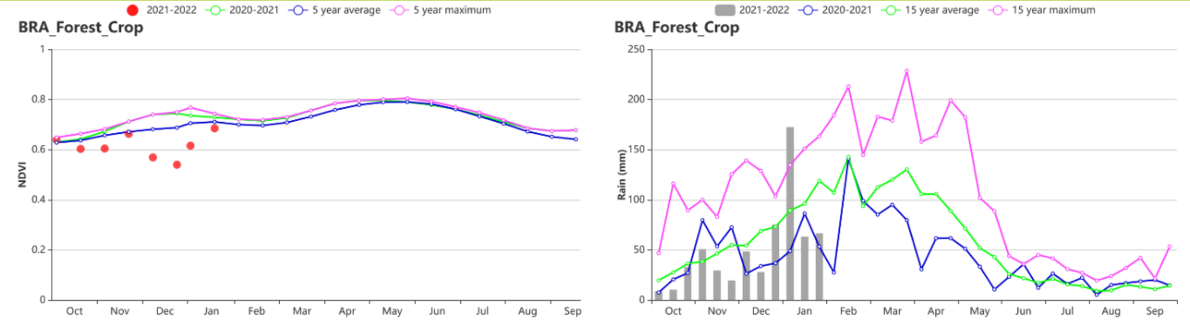
(j) Crop condition development graph based on NDVI (left) and rainfall profile (right) of Coast zone



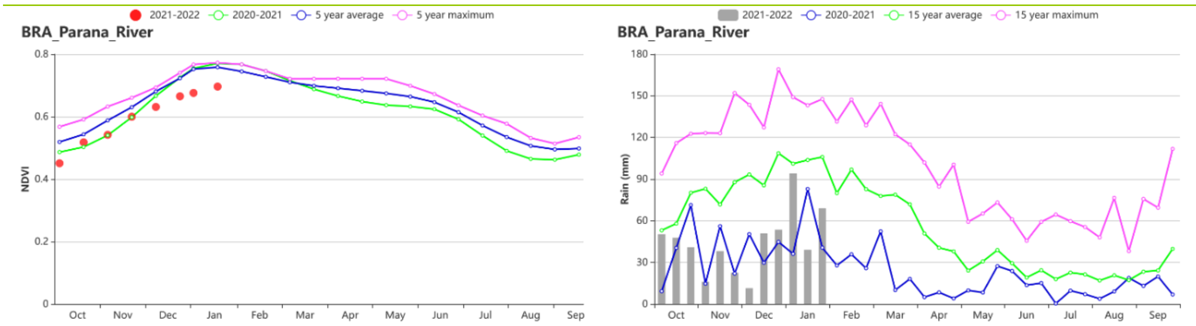
(k) Crop condition development graph based on NDVI (left) and rainfall profile (right) of Mato Grosso



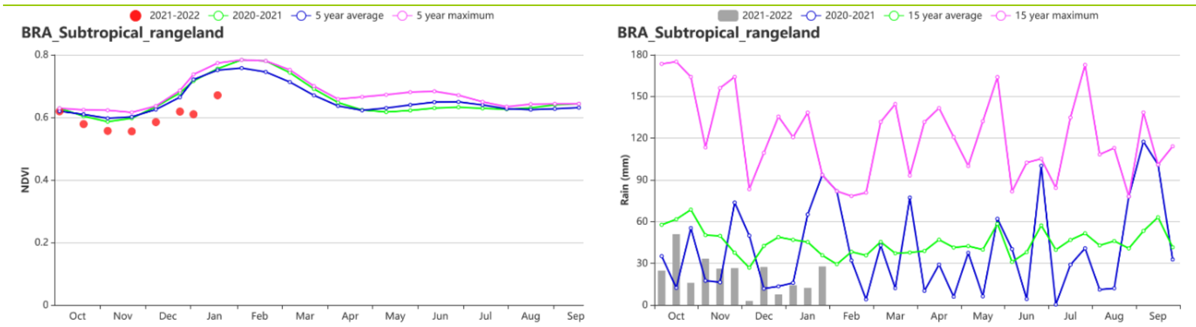
(l) Crop condition development graph based on NDVI (left) and rainfall profile (right) of Nordeste



(m) Crop condition development graph based on NDVI (left) and rainfall profile (right) of Northeastern mixed forest and farmland



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



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

Table 3.14 Brazil's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, October 2021 – January 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	1024	9	26.0	-0.3	1203	3	1487	8
Central Savanna	357	-62	27.0	2.4	1234	-3	861	-35
Coast	745	-1	23.4	0.4	1297	3	1209	5
Northeastern mixed forest and farmland	605	-16	27.2	0.5	1245	3	1220	-7
Mato Grosso	1085	-14	25.9	0.6	1122	-3	1394	-8
Nordeste	133	-52	27.6	1.4	1366	2	695	-15
Parana basin	534	-48	24.3	1.4	1296	-1	1128	-21

Southern subtropical rangelands	271	-53	22.4	0.6	1430	3	934	-19

Table 3.15 Brazil's agronomic indicators by sub-national regions, current season's values and departure from 5YA, October 2021 October 2021 – January 2022

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure from 5YA (%)	Current
Amazonas	100	0	0.95
Central Savanna	99	1	0.98
Coast	98	3	0.96
Northeastern mixed forest and farmland	100	1	0.96
Mato Grosso	100	0	0.95
Nordeste	96	33	1.05
Parana basin	100	0	0.87
Southern subtropical rangelands	100	0	0.79

[CAN] Canada

This monitoring period covers the harvest of summer crops in Canada, including corn and soybeans, as well as the seeding and early growth of winter wheat.

With the exception of winter wheat, there were few crops in the field. The situation of summer crops was reported in the last bulletin. For winter crops, agro-climatic conditions were near average. Compared to the 15-year average, rainfall was 1% lower, while radiation was slightly higher (RADPAR +2%). The average temperature for this period was -3.7°C. It was slightly above the 15YA (TEMP +0.2°C). All agroclimatic conditions resulted in a slight increase in potential biomass (BIOMSS +6%). Most winter wheat is grown in southeastern Ontario, near Toronto and Ottawa. According to the temperature profile, starting in November, temperatures dropped below 0°C and winter wheat went dormant. In December and January, the temperature dropped sharply to about -15°C. Precipitation during winter wheat planting was near average, which allowed the crop to germinate and grow well before dormancy. Conditions for winter wheat have been near average so far, but winter crop yields will depend largely on agroclimatic conditions in the next monitoring period.

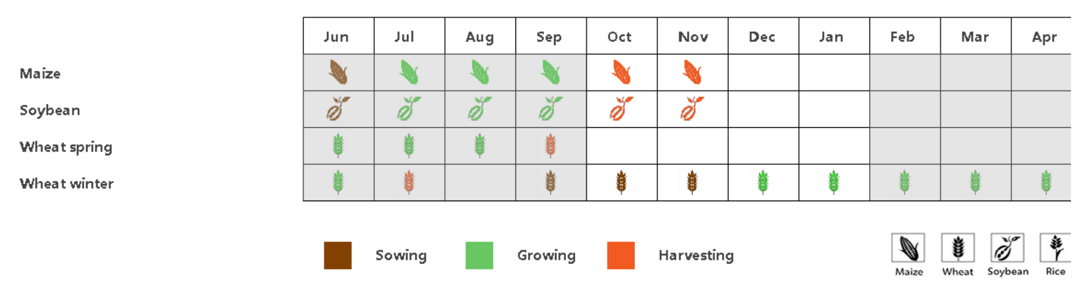
Regional analysis

The Prairies (the area identified as 30 in the NDVI clustering map) and the St. Lawrence Basin (26, covering Ontario and Quebec) are the main agricultural areas.

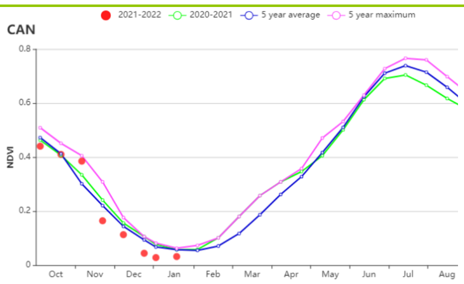
The Prairies is the main crop production area in Canada. It grows mainly summer crops, due to the rather dry and extreme cold conditions during winter. In this reporting period, the rainfall (RAIN +8%), radiation (RADPAR +5%) and temperature (TEMP +0.1°C) were above average, leading to a slightly increased potential production (BIOMSS +4%).

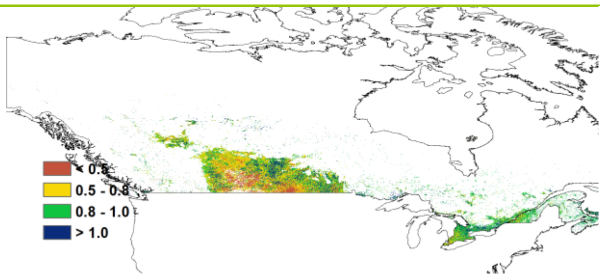
The Saint Lawrence basin is the main winter wheat production region. Most winter wheat is usually grown in Ontario. The temperature (TEMP +0.4°C) and radiation (RADPAR +2%) were above average, while rainfall (RAIN -9%) was below average, leading to a slightly increased potential production (BIOMSS +7%). According to the NDVI development graph,the crop conditions were slightly below average. Considering that cropped arable land fraction was also slightly below average (CLAF -1%), the situation of crops is assessed as slightly below average.

Figure 3.12 Canada's crop condition, October 2021 – January 2022

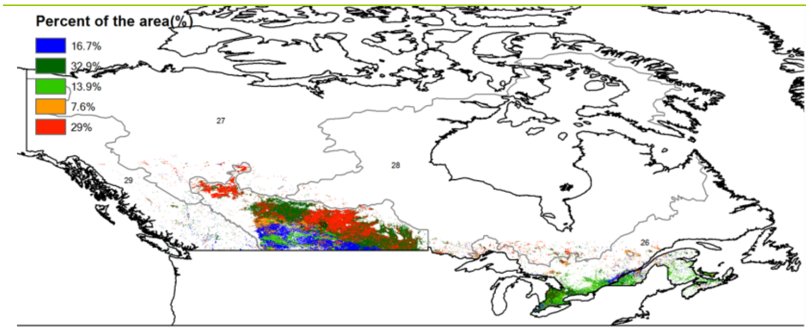


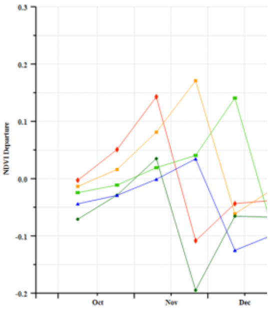
(a). Phenology of major crops



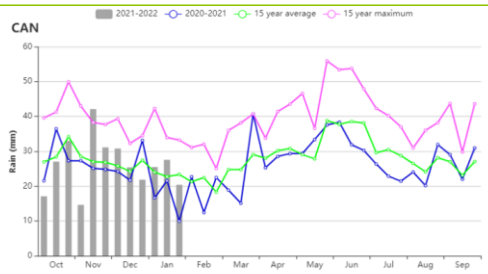


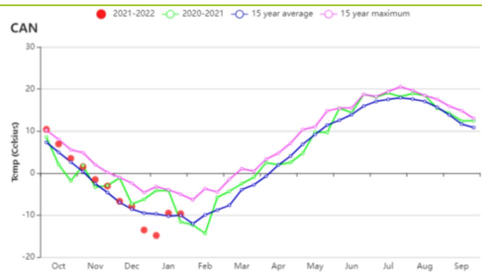
(b) Crop condition development graph based on NDVI (c) Maximum VCI



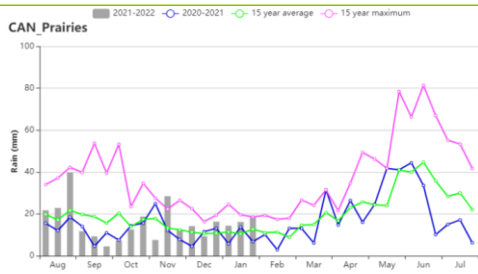


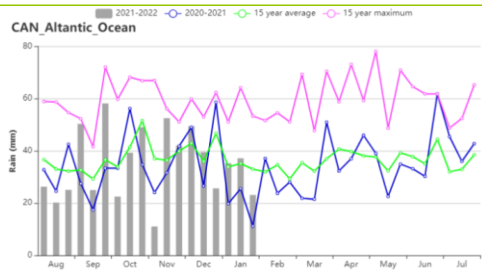
(d) Spatial NDVI patterns compared to 5YA (e) NDVI profiles



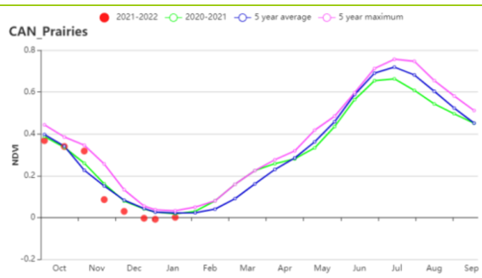


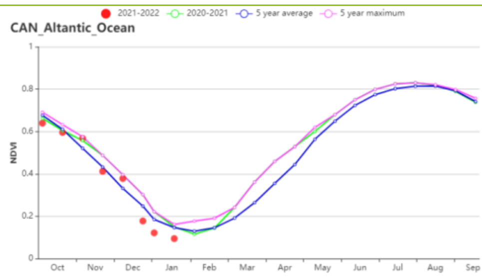
(f) Rainfall profiles (g) Temperature profiles





(h) Rainfall time series (Canadian Prairies region (left) and Saint Lawrence basin region (right))





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

Table 3.16 Canada's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, October 2021 – January 2022

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Saint Lawrence basin	426	-9	-0.6	0.4	322	2	375	7
Prairies	176	8	-4.8	0.1	302	5	269	4

Table 3.17 Canada's agronomic indicators by sub-national regions, current season's values and departure from 5YA, October 2021 – January 2022

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Saint Lawrence basin	98	-1	0.91
Prairies	40	11	0.76

[DEU] Germany

The monitoring period covers the late stages of sugar beets, which got harvested in October and November, and the sowing period of winter cereals which started in September. Adequate soil moisture, neither too wet nor too dry, is crucial for the germination and early establishment of the winter cereals, mostly wheat, barley and triticale. Based on the agroclimatic and agronomic indicators, the crop conditions in Germany were generally below or close to the 5-year average in most regions.

CropWatch agroclimatic indicators show that total precipitation was below average (RAIN -15%), both temperature and radiation were close to the average of the past 15 years. As can be seen from the time series of the rainfall profile, Germany experienced below-average precipitation until late October; then above-average precipitation from November to early-December except for mid-November and mid-December; and then below-average again in mid to late January. Most of the country experienced average temperature conditions during the monitoring period, except for early and late November and early December, which were significantly below average, mid-December, and early and late January, which were significantly above average. Due to a combination of precipitation deficit and average temperature and sunshine conditions, the biomass accumulation potential (BIOMSS) decreased by 1% at the nationwide level as compared to the 15YA. Persistent precipitation deficit in most areas in the early part of the monitoring period was good for summer crop harvesting in Germany, while the germination of the winter cereals was delayed in some parts of the country.

CropWatch agronomic indicators based on NDVI development graph at the national scale show that NDVI values were above average, even close to the 5-year maximum level in early October, and then below average from mid-October to mid-November due to a precipitation deficit in that period. Subsequent drops in NDVI can be attributed to either fog, cloud cover or snow on the ground. These factors also caused large negative departures in the spatial NDVI profiles. The above average temperatures in January caused the increase to average or even above average NDVI levels in that month. These observations were also confirmed by VCI values in the spatial distribution of maximum VCI map. It reached 0.96 at the national scale.

Overall, crop conditions were close to the 5-year average in most parts of Germany by the end of this monitoring period.

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.

The large negative NDVI departures that were observed for all regions in November and December are artifacts, due to cloud cover, fog or snow.

Schleswig-Holstein and the Baltic coast is the major winter wheat zone of Germany. Compared to the past 15 years' average, the CropWatch agroclimatic indicators RAIN (+2%) and temperature (TEMP, +0.7°C) were above average, while radiation (RADPAR, -2%) was below average. Due to favorable precipitation and temperature, biomass (BIOMSS) was increased by 4%. As shown in the crop condition development graph based on NDVI, the values were above average or even close to the 5-year maximum in early-October, and below average from mid-October to December. The area had a high CALF (100%) as well as a favorable VCIx (1.01) indicating favorable crop prospects.

Wheat and sugar-beets are major crops in the Mixed wheat and sugar-beets zone of the north-west. RAIN (-14%) was significantly below average and radiation (RADPAR, -4%) was also below average, while temperature (TEMP, +0.4°C) was above average. Due to suitable temperatures and adequate precipitation conditions during late October, late November to early December and late December to late January, biomass (BIOMSS) was 2% above average. As shown in the crop condition development graph based on NDVI, the values were above the 5-year maximum in early-October, and then average between mid-late October and November. They recovered to average levels in January. The area had a high CALF (100%) as well as a favorable VCIx (0.98).

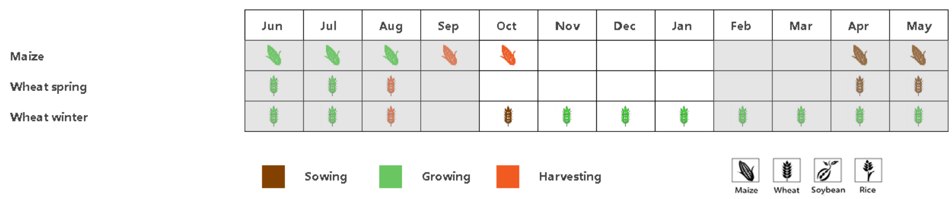
The Central wheat zone of Saxony and Thuringia is another major winter wheat zone; The CropWatch agroclimatic indicator show that this region experienced a precipitation deficit (-13%) with slightly warmer weather (TEMP, +0.1°C) and radiation below average (RADPAR, -1%) which led to average biomass (BIOMSS). As shown in the crop condition development graph based on NDVI, the values were above average only in early-October. The area has a high CALF (100%) as well as a favorable VCIx (0.91).

The East-German Lake and Heathland sparse crop area experienced a rainfall deficit (RAIN, -7%) but with above average temperature (TEMP, +0.1°C) and radiation (RADPAR, +1%). Suitable temperature and sunshine conditions contributed to a 1% increase in biomass (BIOMSS). NDVI values were above the 5-year maximum in early-October. The area had a high CALF (100%) and a high VCIx (0.93).

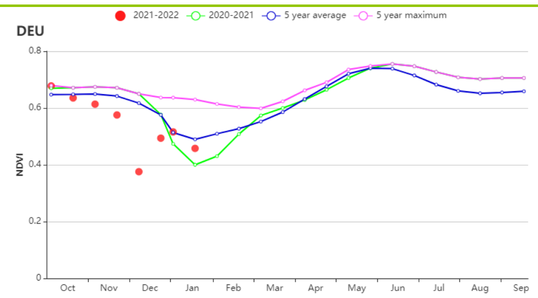
The cropland in the Western sparse crop area of the Rhenish massif experienced below average rainfall (RAIN -13%) and temperature (TEMP -0.2°C), while radiation (RADPAR, 0%) was average, which led to a biomass (BIOMSS) decrease by 3%. As shown in the crop condition development graph based on NDVI, the NDVI values and crop condition was close to the 5-year maximum from October to mid-November. The area had high CALF (100%) and a high VCIx (1.01).

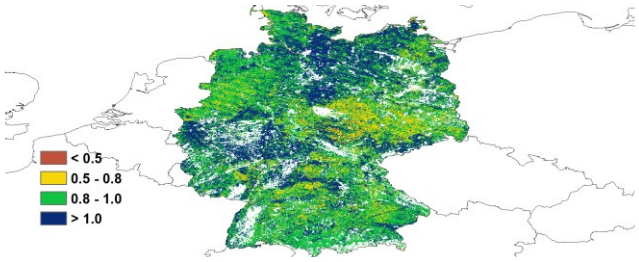
Dry weather was recorded in the Bavarian Plateau (RAIN, -23%), with below average temperatures (-0.6°C). The persistent precipitation deficit in the early part of the monitoring period led to a BIOMSS decrease by 7% compared to the average of the past 15 years. The area had a high CALF (100%) as well as a favorable VCIx (0.95). As shown in the crop condition development graph based on NDVI, the values were only close to the 5-year average before mid-October, late December and early January

Figure 3.13 Germany's crop condition, October 2021-January 2022

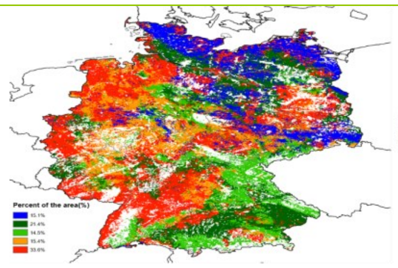


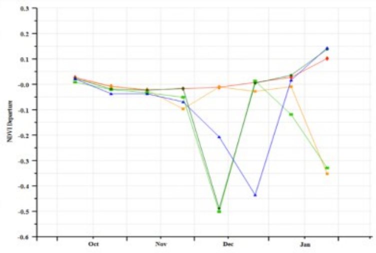
(a). Phenology of major crops



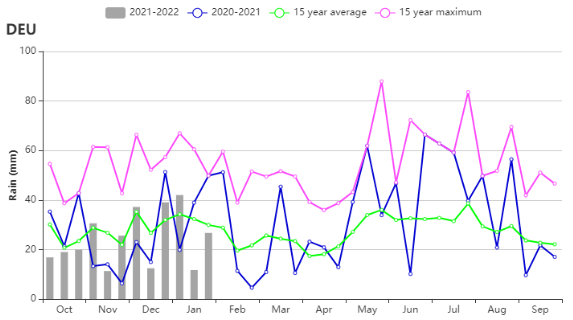


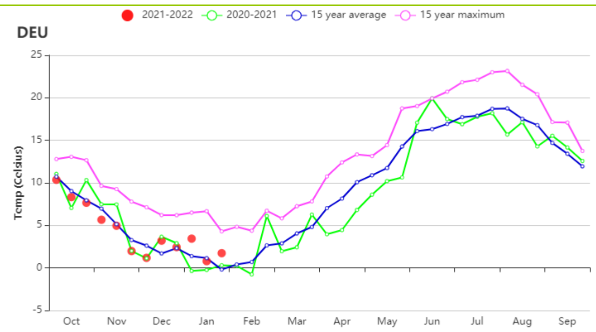
(b) Crop condition development graph based on NDVI (c) Maximum VCI



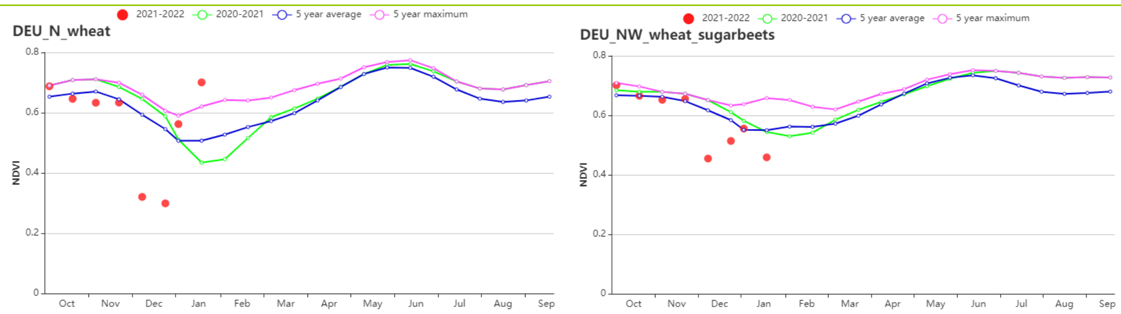


(d) Spatial NDVI patterns compared to 5YA (e) NDVI profiles

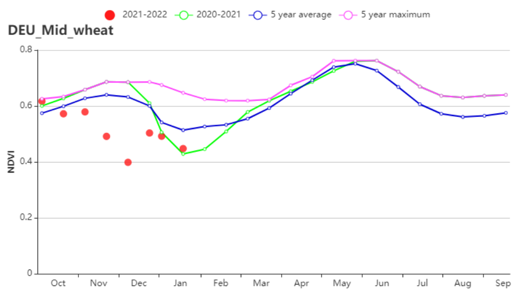


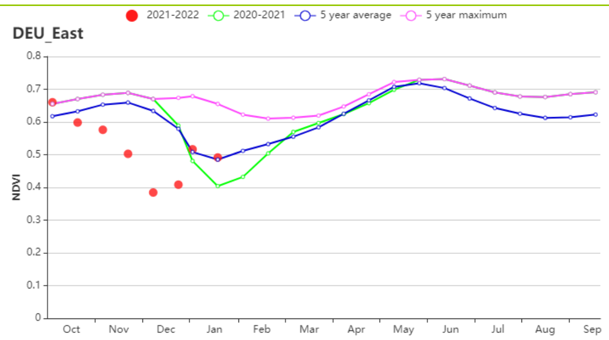


(f) Rainfall profiles (g) Temperature profiles

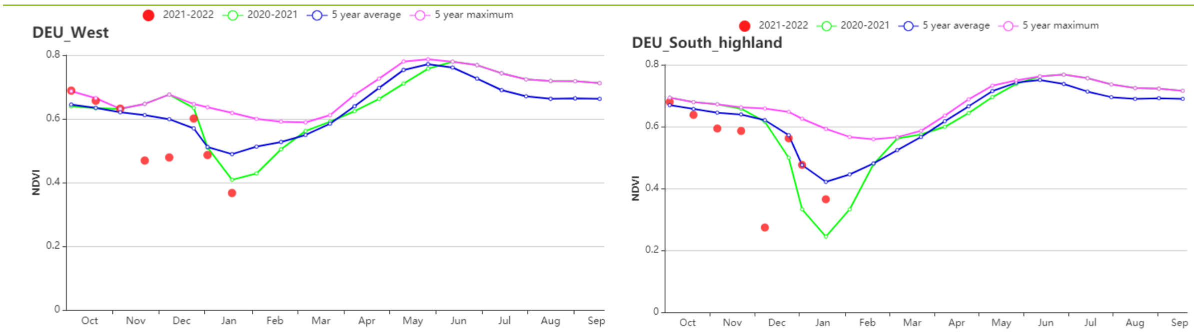


(h) Crop condition development graph based on NDVI (Wheat zone of Schleswig-Holstein and the Baltic coast (left) and Mixed wheat and sugar beets zone of the north-west(right))





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



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

Table 3.18 Germany's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, October 2021-January 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	355	2	6.1	0.7	167	-2	562	4
Mixed wheat and sugarbeets zone of the north-west	295	-14	5.8	0.4	188	-4	547	2
Central wheat zone of Saxony and Thuringia	249	-13	4.2	0.1	211	-1	483	0
East-German lake and Heathland sparse crop area	265	-7	4.3	0.1	212	1	498	1
Western sparse crop area of the Rhenish massif	282	-13	4.0	-0.2	222	0	481	-3

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m^2)	Departure (%)	Current (gDM/m^2)	Departure (%)
Bavarian Plateau	293	-23	2.6	-0.6	291	3	433	-7

Table 3.19 Germany's agronomic indicators by sub-national regions, current season's values and departure from 5YA, October 2021-January 2022

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

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

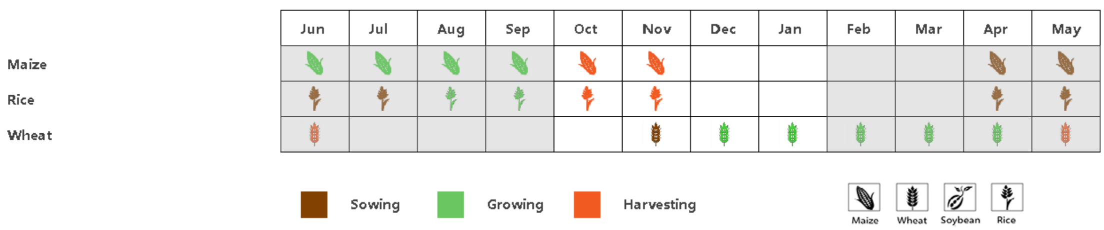
[EGY] Egypt

During this reporting period, the summer crops such as maize and rice were harvested, followed by the sowing of winter wheat in November. The CropWatch agro-climatic indicators showed that rain and temperature were 28% above and 0.1°C below the 15-year (15YA) average, respectively. According to the rainfall profile, high rainfall >10 mm, fell in mid-November, late-December, and mid to late-January. The temperature profile fluctuated around 15YA, above the 15YA during November. Both RADPAR (0.6%) and BIOMSS (12%) were above the 15YA. In general, the nationwide NDVI profile was below the 5YA crop conditions. The NDVI spatial pattern shows that only 7.1% of the cultivated area was above the 5YA across the study period, 22.4% was above the 5YA starting from November, 36.7% fluctuated around 5YA, and 33.9 was below the 5YA. For the whole country, the VCIx value was 0.78, and the CALF exceeded the 5YA by 3%, indicating reasonable crop conditions.

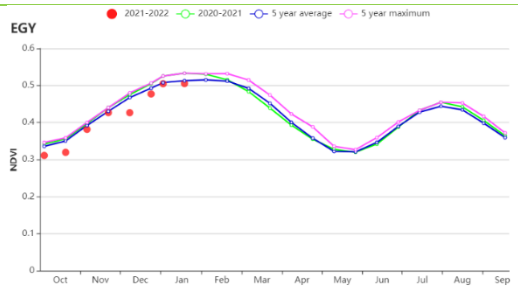
Regional Analysis

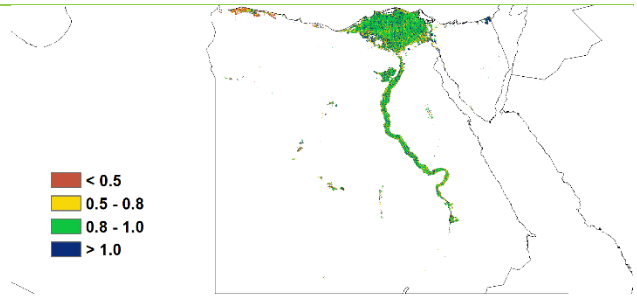
Egypt can be subdivided into three agro-ecological zones (AEZs) based on cropping systems, climatic zones, and topographic conditions. Only two are relevant for crops: 1) the Nile Delta and the Mediterranean coastal strip and 2) the Nile Valley. All agro-climatic indicators for these two AEZs are consistent with the national trend. Rainfall was 23%, 5% above the 15YA, where temperatures were 0.2°C below the 15YA in both zones. Solar radiation (RADPAR) was 0.9% above and 0.5% below 15YA in the first and second zones. Biomass was above the 15YA by 15% and 10% in both zones. CALF was up by 3% and 2%, while the VCIx was 0.80 and 0.82 in both zones. The NDVI-based crop condition development graphs in both zones were similar to the nationwide NDVI profile. Since most of the agricultural land in Egypt is irrigated, the rainfall had little impact on the production levels of maize and rice. However, additional water usually has a beneficial effect. The unusually high rainfall that occurred during November (around 15 mm) may have slightly delayed the sowing of winter wheat; therefore, the conditions for winter wheat have been favorable so far.

Figure 3.14 Egypt's crop condition, October 2021 - January 2022



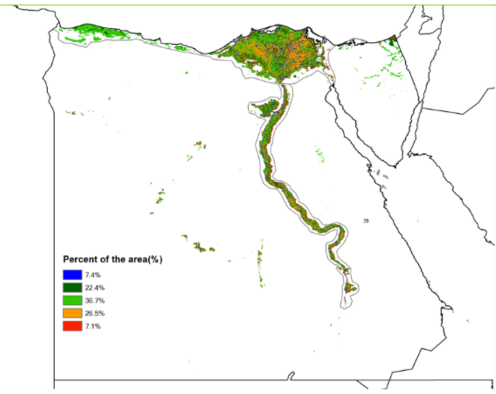
(a). Phenology of major crops

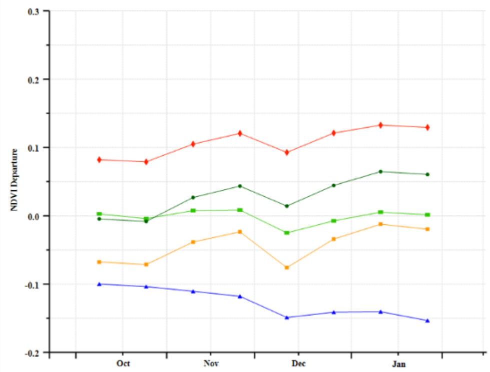




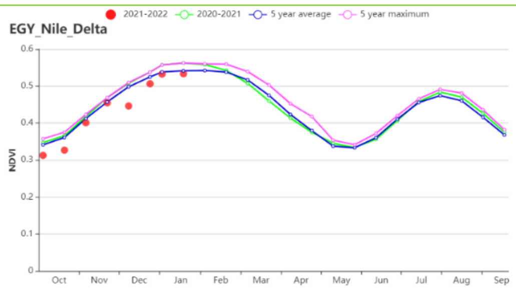
(b) Crop condition development graph based on NDVI

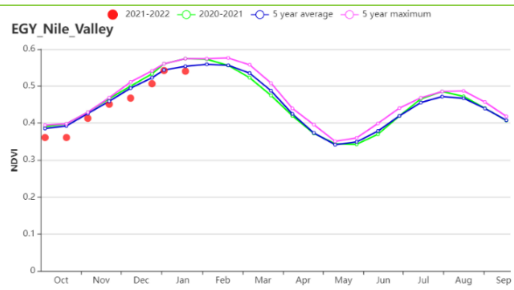
(c) Maximum VCI



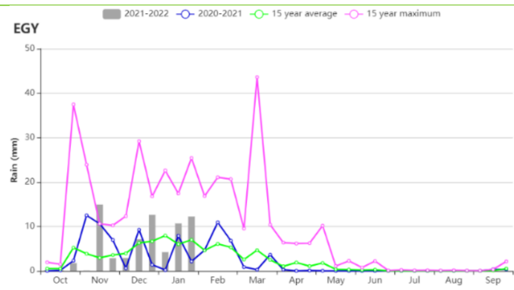


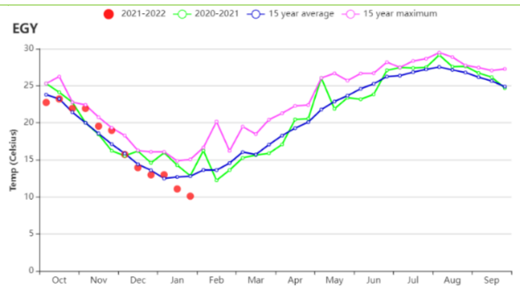
(d). Spatial NDVI patterns compared to 5YA (e). NDVI profiles





(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 3.20 Egypt's agroclimatic indicators by sub-national regions, current season's values, and departure from 15YA, October 2021 - January 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	78	32	17.1	-0.2	764	0.9	344	15
Nile Valley	13	5	16.7	-0.2	863	-0.5	211	10

Table 3.21 Egypt's agronomic indicators by sub-national regions, current season's values, and departure from 5YA, October 2021 - January 2022

Region	CALF		Maximum VCI
	Current (%)	Departure from 5YA (%)	Current
Nile Delta and Mediterranean coastal strip	71	3	0.80
Nile Valley	80	2	0.82

[ETH] Ethiopia

The main food crops in Ethiopia are teff, wheat, barley and maize. Good crop condition was mentioned during the last monitoring period, except for the Tigray region. This monitoring period covers October 2021 to January 2022, which is the harvest period for grains.

At the national level, the agroclimatic indicators cumulative precipitation (RAIN -24%), average temperature (TEMP +0.1°C) and photosynthetically active radiation (RADPAR +3%) point to dry, temperate and sunny crop ripening and harvesting conditions. The estimated cumulative potential biomass (BIOMSS) decreased by 7% due to the reduced precipitation. However, this is somewhat misleading. Since cereal crops required less water during harvest, relatively low precipitation would not reduce production but is beneficial for harvest. As shown by the crop condition development graph based on NDVI, crop conditions were close to the 5-year average. The maximum VCI graph also confirmed this fact, as almost the whole country had a maximum VCI greater than 0.8. The spatial distribution of NDVI profiles revealed that most areas had good crop conditions.

In general, crops were growing well in most regions of Ethiopia and were harvested under favorable conditions. CropWatch estimates favorable outputs for the summer crops, except for Tigray, where farmland was left fallow due to the armed conflict.

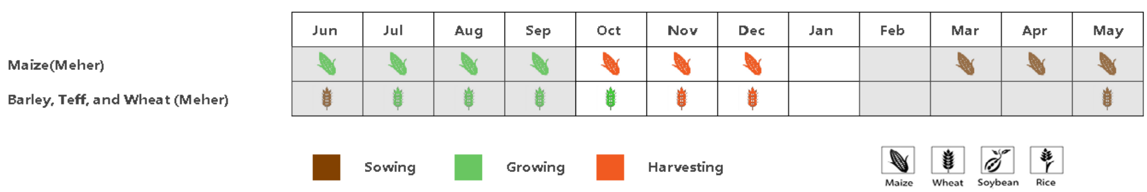
Regional analysis

In **the Semi-arid pastoral areas**, a typical livestock production zone, mean temperature and photosynthetically active radiation were close to the 15-year average (TEMP +1.0° C, RADPAR +2%) while cumulative precipitation was decreased by 36%. Cumulative potential biomass decreased by 2%. At the same time, the NDVI values in the region were around the 5-year average for the reporting period. The maximum VCI was 0.78. Compared to the 5-year average, CALF decreased by 18%, which means cropland was left fallow. Overall, the outlook for livestock production is normal in the region.

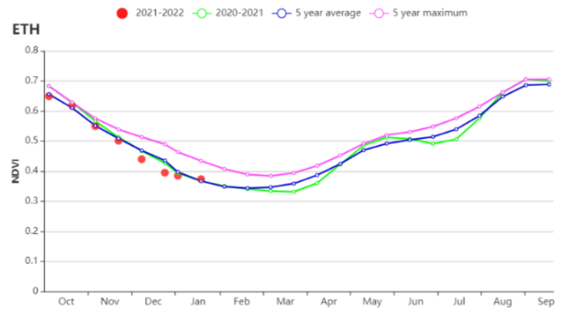
The agroclimatic conditions in the **Southeastern Mendebo highlands zone, South-eastern mixed maize zone** and **the Western mixed maize zone** were very similar to the Semi −arid pastoral areas, with low precipitation but average temperature and photosynthetically active radiation close to the15-year average. The NDVI was also near the average level, which means that the harvest was progressing normally. However, the difference was that CALF in all three regions was around the average level and the maximum VCI was above 0.9. This indicates that the crop production in these regions, especially for maize, was favorable.

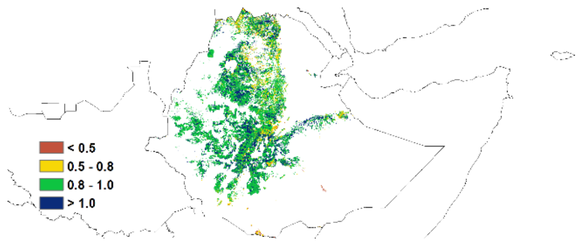
The northern arid area is an agricultural area in northern Ethiopia. Due to the war, the cropped arable land fraction was almost zero and a severe food shortage is developing.

Figure 3.15 Ethiopia's crop condition, October 2021-January 2022



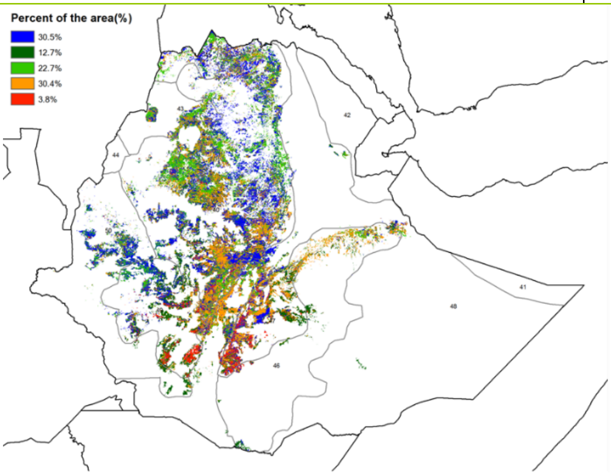
(a) Phenology of major crops

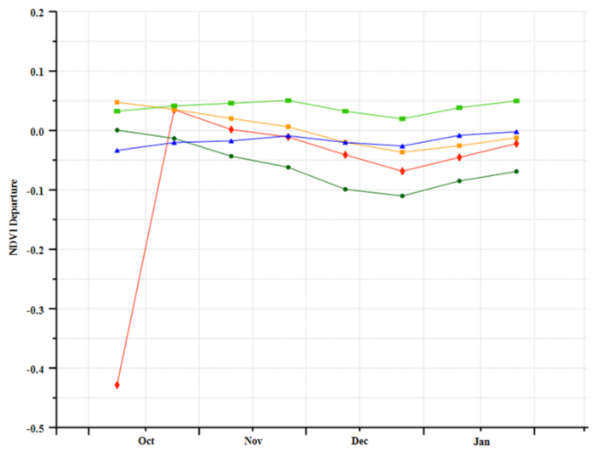




(b) Crop condition development graph based on NDVI

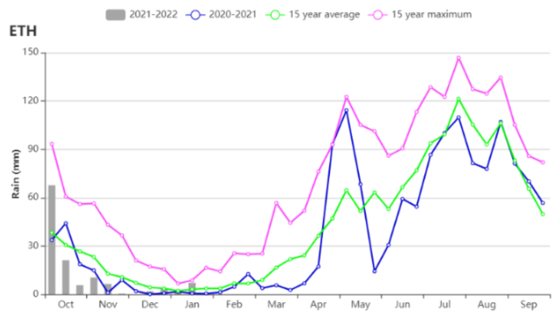
(c) Maximum VCI

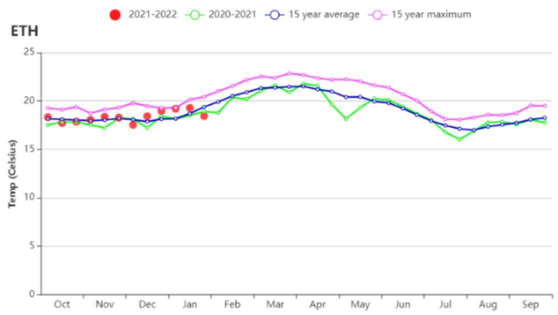




(d) Spatial NDVI patterns compared to 5YA

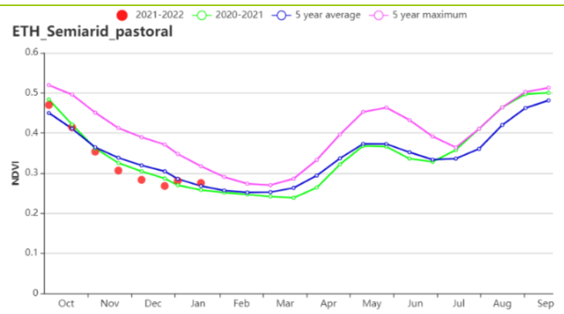
(e) NDVI profiles

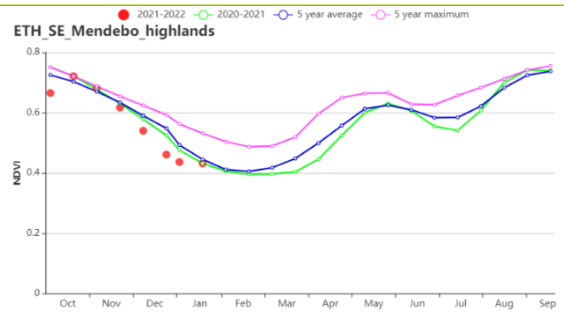




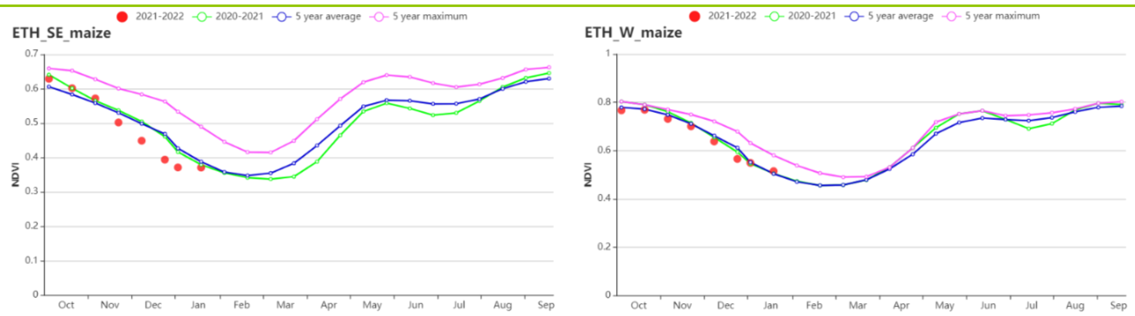
(f) Rainfall profiles

(g) Temperature profiles

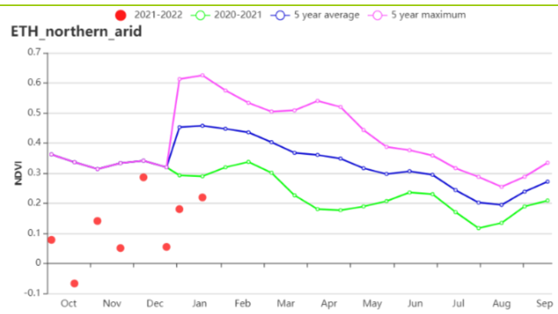




(h) Crop condition development graph based on NDVI (Semi-arid pastoral (left) South-eastern Mendebo highlands (right))



(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 3.22 Ethiopia's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, October 2021-January 2022

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m^2)	Departure (%)	Current (gDM/m^2)	Departure (%)
Semi-arid pastoral areas	47	-36	21.0	1.0	1361	2	482	-2
South-eastern Mendebo highlands	96	-22	15.0	0.2	1375	7	411	-12
South-eastern mixed maize zone	117	-7	18.4	0.4	1351	7	469	-7
Western mixed maize zone	275	-20	21.7	0.0	1288	3	710	-9
Northern arid area	31	112	25.7	1.2	1325	2	502	14

Table 3.23 Ethiopia's agronomic indicators by sub-national regions, current season's values and departure from 5YA, October 2021-January 2022

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Semi-arid pastoral areas	72	18	0.78
South-eastern Mendebo highlands	100	0	0.96
South-eastern mixed maize zone	96	2	0.93
Western mixed maize zone	100	0	0.93
Northern arid area	0	-100	0.39

[FRA] France

This monitoring period covers the harvest of maize as well as the sowing and early growth period of winter wheat. CropWatch agro-climatic indicators show that the temperature was slightly below average over the monitoring period (TEMP -0.8°C). It was above average only in late December and early January. RAIN was 16% below average, while sunshine (RADPAR) was 12% above. Due to unfavorable precipitation and temperature 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 above the 5YA in October and dropped below starting in November. Cropped arable land fraction (CALF) departure value was above average by 1%. The spatial distribution of maximum VCI (VCIx) across the country also reached a range of 0.85 to 1.00. Overall, crop conditions were close to average.

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, slightly cooler weather was observed (TEMP -0.3°C) while RADPAR was above average (7%) and RAIN was below average (-7%). The BIOMSS decreased by 3% when compared to the 15-year average. The CALF was higher than the average (+2%), and VCIx was 0.94. Crop condition development based on NDVI for this region was close to the 5-year average, but lower than average on November.

In the Mixed maize/barley and rapeseed zone from the Center to the Atlantic Ocean, slightly cooler (TEMP -0.9°C) and drier (RAIN -29%) conditions were observed and RADPAR was above average by 18%. BIOMSS was below average by 14% while the NDVI profile showed the regional crop conditions were slightly lower than average levels especially in November. The CALF was increased by 2%, and VCIx was 0.88.

In the Maize-barley and livestock zone along the English Channel, RAIN and TEMP were below average by 22% and 0.3°C. RADPAR was higher than the average (+17%). BIOMSS decreased by 7%. CALF was average and a relatively high VCIx was recorded at 0.96, all indicating normal crop conditions, except for late December, when precipitation was below average.

Overall, in the Rapeseed zone of eastern France, RAIN in this period was 18% lower than the 15-year average, while TEMP decreased by 1°C and RADPAR was increased by 12%. BIOMSS was about 8% lower than average with a high VCIx level (1.0). CALF was above average by 1%. The NDVI profile indicated that the crop conditions were close but slightly below the 5-year average especially in November and December.

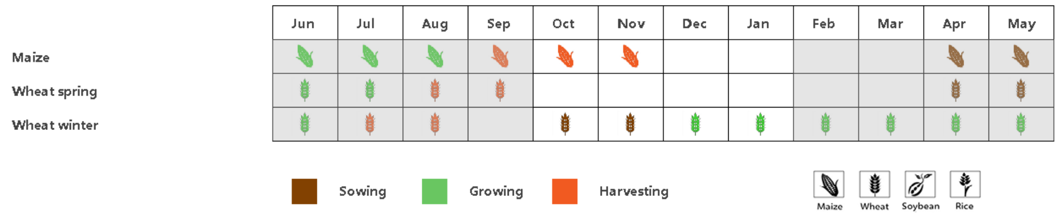
In the Massif Central dry zone, TEMP and RAIN were 1.1°C and 18% lower than the average, respectively, while RADPAR increased by 15%. The VCIx was 0.97 and BIOMSS decreased by 8% which indicates below-average conditions in this region. CALF was average. Crop conditions based on the NDVI profile indicated that growth conditions were above average before November and below average after November.

The Southwestern maize zone is one of the major irrigated regions in France. The regional NDVI profile presented an average trend except for December and January, when the VCIx recorded moderate levels (0.93) and BIOMSS was 4% lower than average. RAIN in the period was 5% lower than average, while TEMP was 0.9°C lower. RADPAR increased by 11%. CALF was above average by 1%.

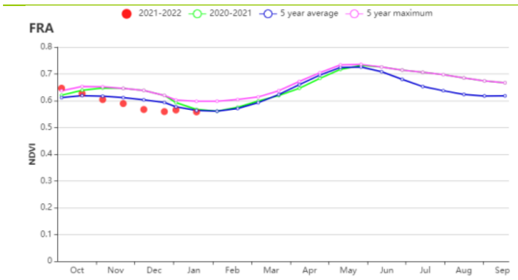
In the Eastern Alpes region, crop conditions presented a below-average trend. RAIN and TEMP in the region were 11% and 1.1°C lower than average, while RADPAR was 11% higher than the average. BIOMSS was also lower than the 15-year average (-9%). VCIx for the region was recorded at 0.95. CALF increased by 3%.

In the Mediterranean zone, NDVI also recorded a below-average trend. The region recorded a relatively low VCIx level (0.85). RAIN and TEMP were lower than the average (-22% and -0.6°C, respectively), while RADPAR was higher than average 9%. CALF also increased by 2%. BIOMSS was below average by 6%.

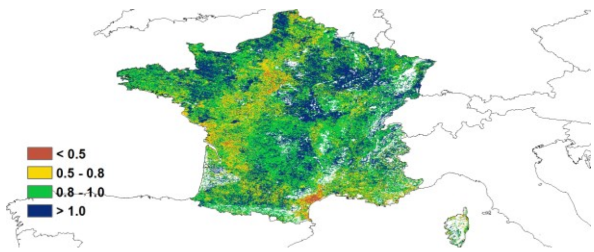
Figure 3.16 France's crop condition, October 2021 – January 2022



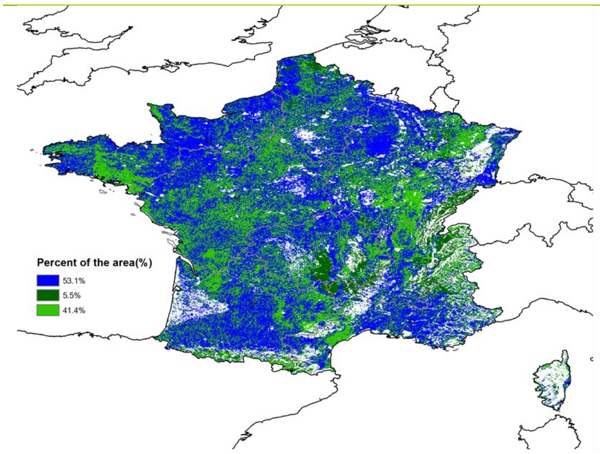
(a). Phenology of major crops



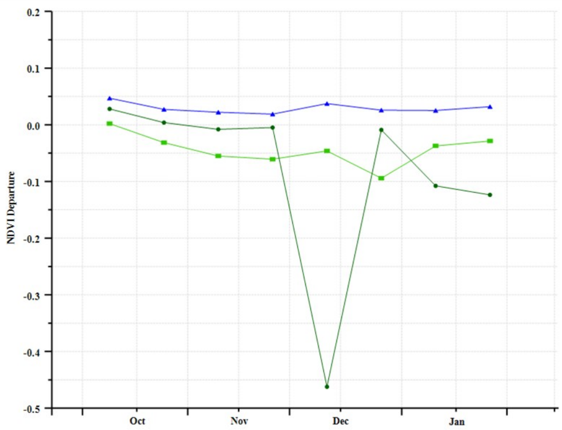
(b) Crop condition development graph based on NDVI



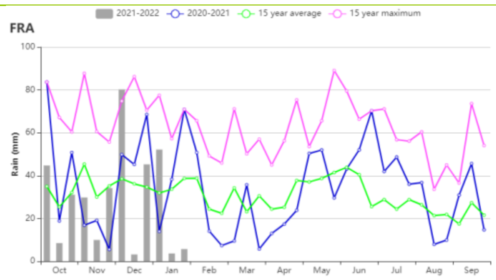
(c) Maximum VCI



(d) Spatial NDVI patterns compared to 5YA

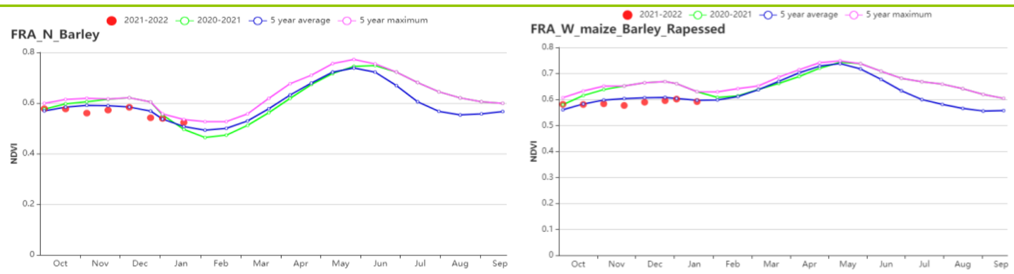


(e) NDVI profiles

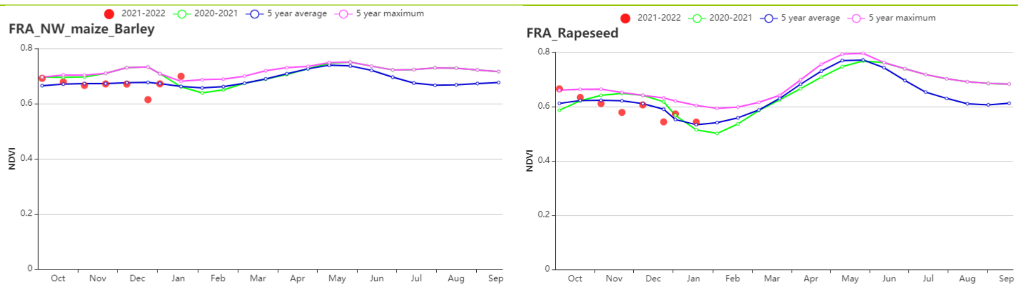


(f) Rainfall profiles

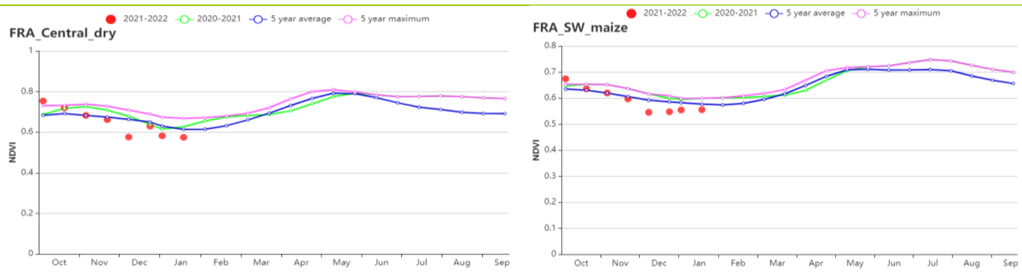
(g) Temperature profiles



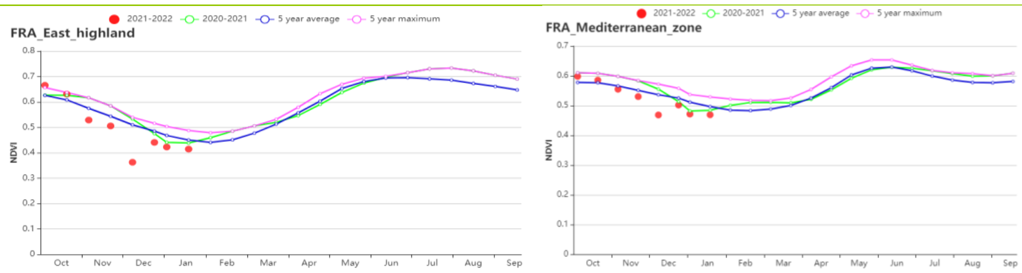
(h) Crop condition development graph based on NDVI (Northern barley region (left) and Mixed maize, Barley and Rapeseed zone (right))



(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 3.24 France's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, October 2021 – January 2022

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Northern Barley zone	333	-7	6.5	-0.3	257	7	580	-3
Mixed maize/barley and rapessed zone from the Centre to the Atlantic Ocean	266	-29	7.2	-0.9	362	18	554	-14
Maize barley and livestock zone along	321	-22	8.1	-0.3	307	17	615	-7

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
the English Channel								
Rapeseed zone of eastern France	345	-18	4.3	-1.0	315	12	504	-8
Massif Central Dry zone	327	-18	4.5	-1.1	397	15	514	-8
Southwest maize zone	432	-5	6.6	-0.9	440	11	585	-4
Alpes region	455	-11	2.9	-1.1	422	11	446	-9
Mediterranean zone	326	-22	5.9	-0.6	492	9	507	-6

Table 3.25 France's agronomic indicators by sub-national regions, current season's values and departure from 5YA, October 2021 – January 2022

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Northern Barley zone	100	2	0.94
Mixed maize/barley and rapessed zone from the Centre to the Atlantic Ocean	98	2	0.88
Maize barley and livestock zone along the English Channel	100	0	0.96
Rapeseed zone of eastern France	100	1	1.00
Massif Central Dry zone	100	0	0.97
Southwest maize zone	98	1	0.93
Alpes region	97	3	0.95
Mediterranean zone	94	2	0.85

[GBR] United Kingdom

The planting of winter wheat, winter barley and rapeseed took place between September and November. The NDVI development curves were close to the 5-year average in the monitoring period except for late December, which may be caused by cloud or snow. Rainfall for the country was below average (RAIN -15%), while temperature (TEMP +0.5°C) and (RADPAR +1%) were above average. The below-average rainfall resulted in a slightly below-average biomass (BIOMSS -1%). The seasonal RAIN profile shows that the rainfall was fluctuating in the monitoring period. The TEMP profile shows that temperature was overall above or close to average except late November and early December.

The national average VCIx was 0.95. CALF (100%) was unchanged compared to its five-year average. The NDVI departure cluster profiles indicate that: (1) 51.7% of arable land experienced average crop conditions, mainly in East of England and North East England. (2) 5% of arable land, mainly in East Midlands had average crop conditions during most of the monitoring period, except for early January when they were above average. (3) 43.4% of arable land experienced average crop conditions from October to early December before a marked drop in mid-December, and subsequently recovered to average in January, mainly in Southeast England and Southwest England. Most likely, the large drops of NDVI can be attributed to cloud cover in the satellite images and snow. Altogether, the conditions for winter wheat in the UK are assessed as normal.

Regional analysis

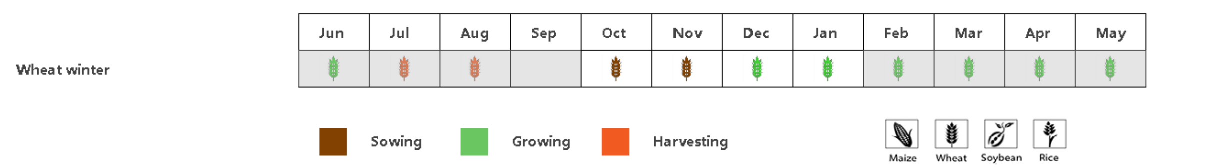
Based on cropping systems, climatic zones, and topographic conditions, three sub-national regions are described below: **Northern barley region**, **Central sparse crop region** and **Southern mixed wheat and barley region**. All three sub-regions are characterized by an unchanged fraction of cropped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

In the **Northern barley region**, NDVI was close to average or below average. Rainfall (RAIN -9%) and radiation (RADPAR -12%) were below average , and temperature (TEMP +0.7°C) was above average. Biomass was above average (BIOMSS +5%). The VCIx was 1.

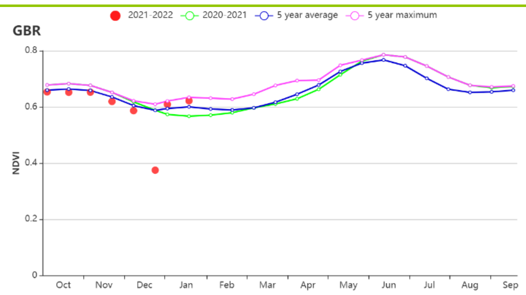
The **Central sparse crop region** is one of the country's major regions for crop production. NDVI was close to average or below average except for late January. Rainfall (RAIN -12%) and radiation (RADPAR -3%) were below average , and temperatures (TEMP +0.6 ° C) were above average. Biomass （BIOMSS +4%） was above average. The VCIx was 0.98.

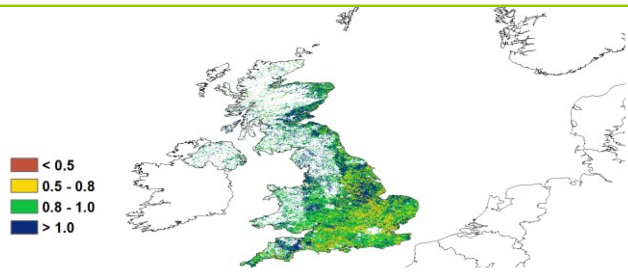
In the **Southern mixed wheat and barley zone**, NDVI was close to average except for early January. This region experienced the largest rainfall deficit (RAIN -24%), while radiation (RADPAR +9%) and temperature (TEMP +0.3°C) were below average. The below-average rainfall resulted in the below-average biomass (BIOMSS -6%). The VCIx was 0.92.

Figure 3.17 United Kingdom's crop condition, October 2021 – January 2022



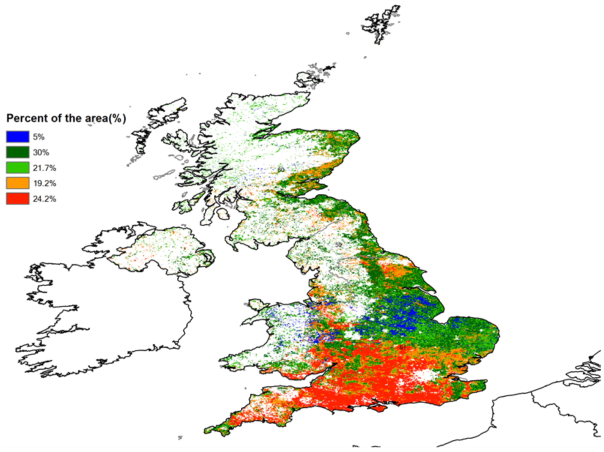
(a). Phenology of major crops

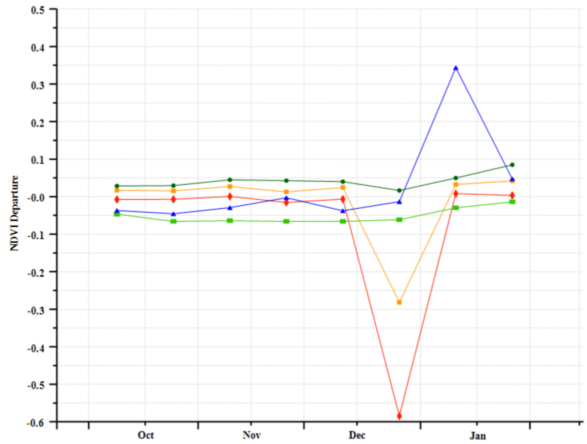




(b) Crop condition development graph based on NDVI

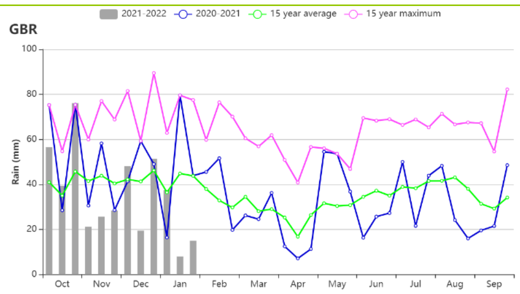
(c) Maximum VCI

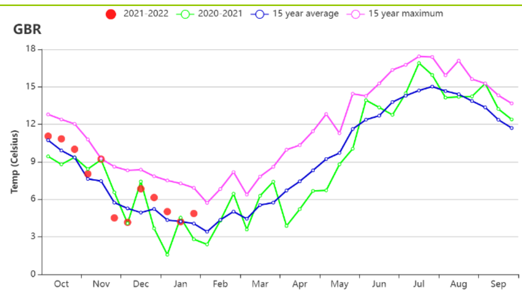




(d) Spatial NDVI patterns compared to 5YA

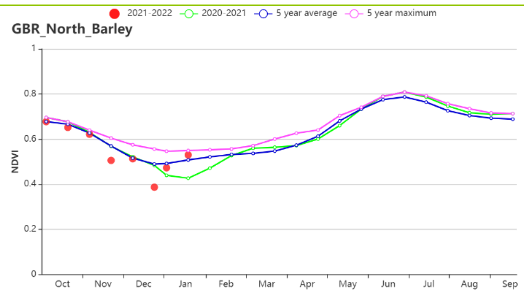
(e) NDVI profiles

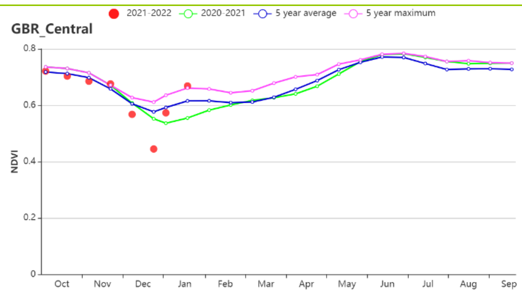




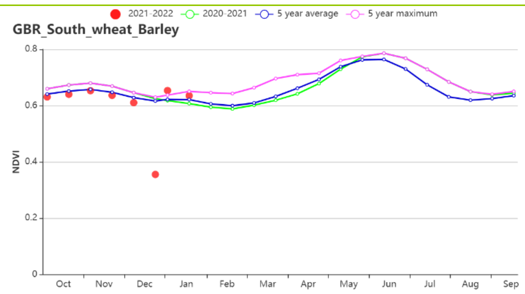
(f) Rainfall profiles

(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 3.26 United Kingdom's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, October 2021 – January 2022

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Northern Barley region(UK)	561	-9	6.2	0.7	117	-12	560	5
Central sparse crop region (UK)	464	-12	7.1	0.6	160	-3	599	4
Southern mixed wheat and Barley zone (UK)	297	-24	7.6	0.3	212	9	575	-6

Table 3.27 United Kingdom's agronomic indicators by sub-national regions, current season's values and departure from 5YA, October 2021 – January 2022

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Northern Barley region(UK)	100	0	1.00
Central sparse crop region (UK)	100	0	0.98
Southern mixed wheat and Barley zone (UK)	100	0	0.92

[HUN] Hungary

In Hungary, winter wheat sowing ended in October. NDVI values were below average throughout this monitoring period. Agro-climatic indicators show that rainfall and temperature were below average (RAIN -11%, TEMP -0.6°C), radiation was above average (RADPAR +9%) and BIOMSS had a 3% decrease due to the lower rainfall. The seasonal RAIN profile shows that the rainfall in late November and December was above average which helped alleviate the moderate drought conditions.

The national average VCIx was 0.76. CALF (80%) was lower by 13% as compared to its 5YA. The NDVI departure cluster profiles indicate that: (1) 16.7% of arable land experienced above-average crop conditions, scattered around Western Hungary, middle Hungary and Eastern Hungary. (2) 50.1% of arable land experienced below-average crop conditions, scattered around Eastern Hungary and Western Hungary. (3) 27.1% of arable land, mainly in middle Hungary and Eastern Hungary, had slightly above-average crop conditions in October and below average from November to January. (4) 6.1% of arable land experienced above-average crop conditions in early October, below average from middle November to late December, and followed by a marked drop in January, mainly in Eastern Hungary. Altogether, the conditions for winter wheat in this period are assessed as slightly below average.

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.

Central Hungary is one of the major agricultural regions in terms of crop production. A sizable share of winter wheat, maize and sunflower is planted in this region. According to the NDVI development graphs, NDVI values were below average throughout the monitoring period. Agro-climatic indicators show that rainfall and temperature were below average (RAIN -23%, TEMP -0.6°C), radiation was above average (RADPAR +11%), and BIOMSS had a 11% decrease due to the lower rainfall. The VCIx was 0.76. Cropped arable land fraction (CALF) experienced a 16% decrease compared to the 5YA. The crop conditions in this region are slightly below average.

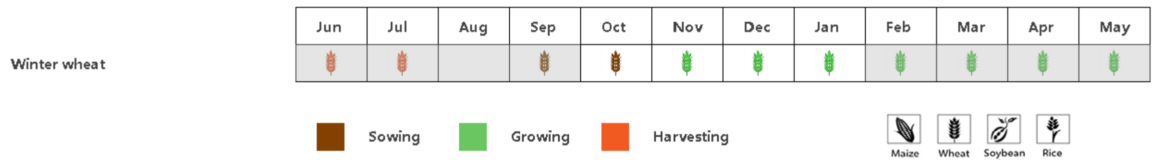
The Puszta (The Great Plain) region mainly grows winter wheat, maize and sunflower, especially in the counties of Jaz-Nagykum-Szolnok and Bekes. According to the NDVI development graph, crop conditions were below average throughout the monitoring period. The rainfall was below average (-6%). Temperature was also below average (TEMP -0.6°C), whereas radiation was above (RADPAR +7%), which resulted in above-average biomass (BIOMSS +1%). The maximum VCI was 0.75. Cropped arable land fraction (CALF) experienced a 14% decrease compared to the 5YA. The crop production in this region is expected to be close to average.

Northern Hungary is another important winter wheat region. During this reporting period, according to the NDVI development curve, crop conditions were below average throughout the monitoring period. Agro-climatic indicators show that rainfall and temperature were below average (RAIN -34%, TEMP -0.5°C), radiation was above average (RADPAR +14%), and BIOMSS had a 15% decrease due to below average rainfall. The maximum VCI was 0.70. Cropped arable land fraction (CALF) experienced a 23% decrease compared to 5YA. The crop production in this region is expected to be below average.

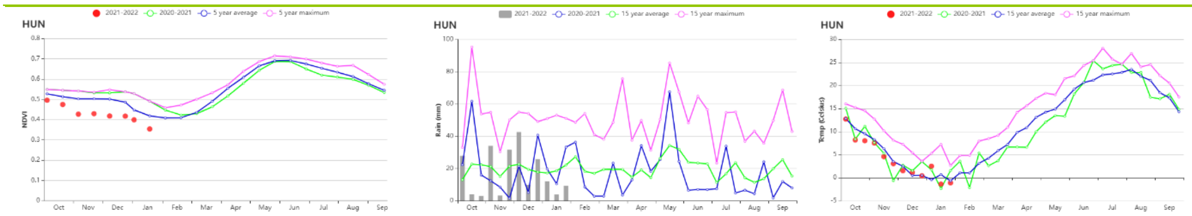
Southern Transdanubia cultivates winter wheat, maize, and sunflower, mostly in Somogy and Tolna counties. Crop conditions were below average throughout the monitoring period. Rainfall and temperature were below average (RAIN -7%, TEMP -0.7°C), whereas solar radiation was above average (RADPAR +9%) and biomass was below average (BIOMSS -3%). The maximum VCI was favorable at

0.77. Cropped arable land fraction (CALF) experienced an 8% decrease compared to the 5YA. The crop conditions in this region are slightly below average.

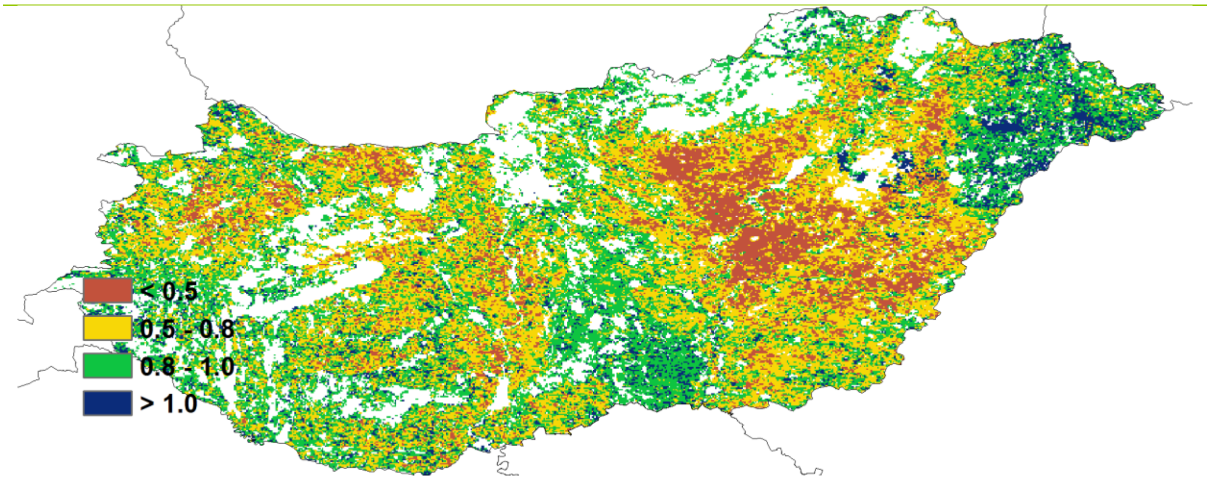
Figure 3.18 Hungary's crop condition, October 2021-January 2022



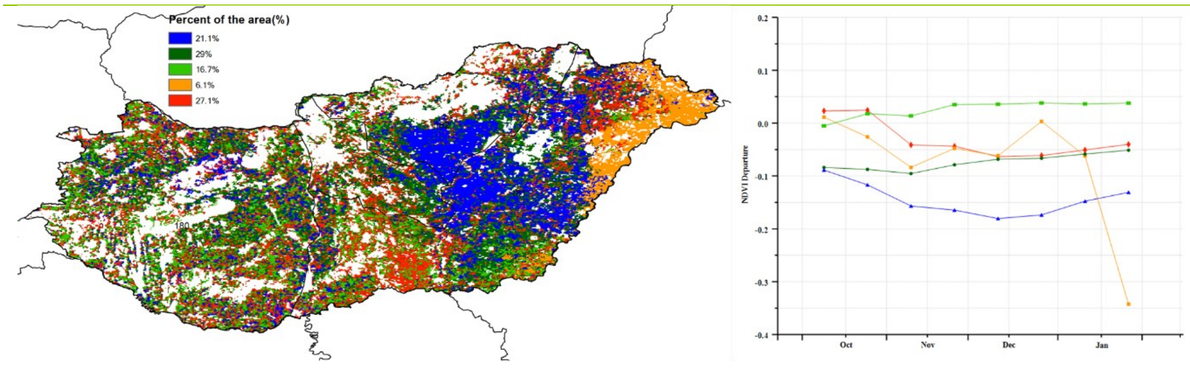
(a). Phenology of major crops



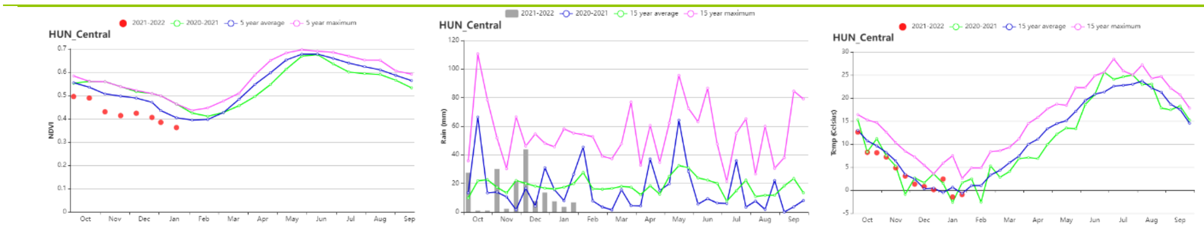
(b) Crop condition development graph based on NDVI, RAIN and TEMP



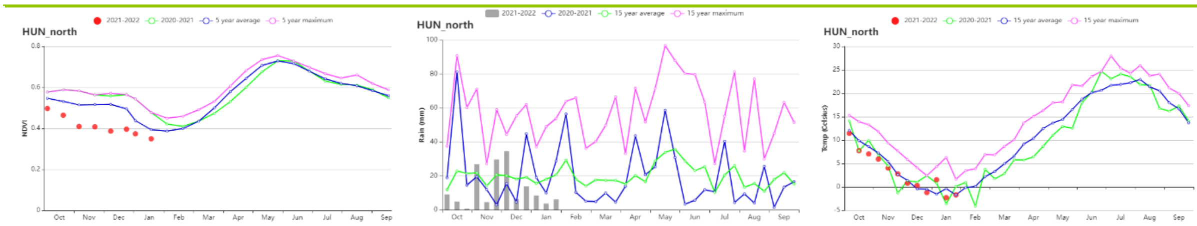
(c) Maximum VCI



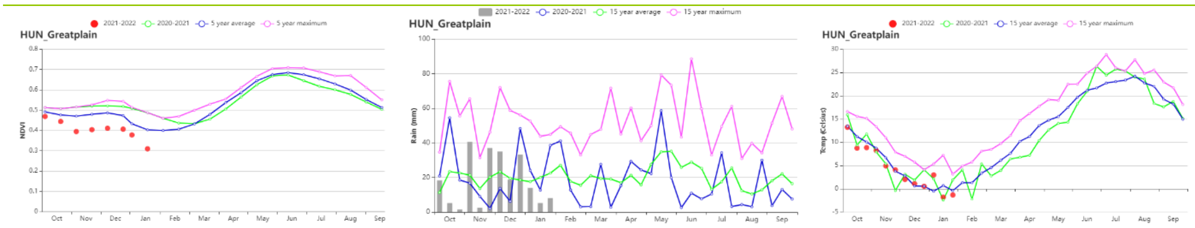
(d) Spatial distribution of NDVI profiles.



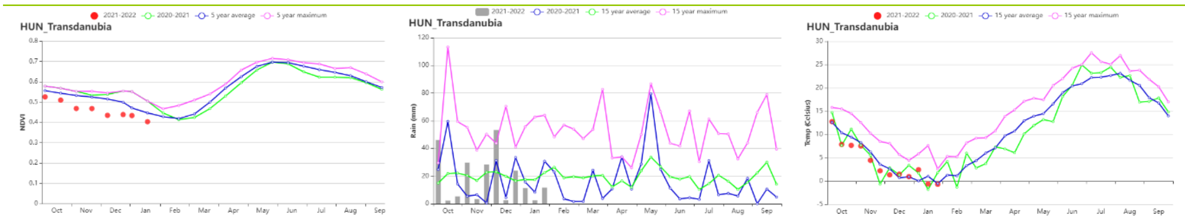
(e) Crop condition development graph based on NDVI, RAIN and TEMP



(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 3.28 Hungary's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, October 2021-January 2022

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Central Hungary	167	-23	3.9	-0.6	369	11	405	-11
North Hungary	149	-34	3.1	-0.5	354	14	375	-15
The Puszta	219	-6	4.3	-0.5	363	7	474	1
Transdanubia	220	-7	4.0	-0.7	380	9	464	-3

Table 3.29 Hungary's agronomic indicators by sub-national regions, current season's values and departure from 5YA, October 2021-January 2022

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current (%)
Central Hungary	81	-16	0.76

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current (%)
North Hungary	73	-23	0.70
The Puszta	74	-14	0.75
Transdanubia	88	-8	0.77

[IDN] Indonesia

The monitoring period covers the harvest of the dry season maize and the second rice in Java, and the planting of main season rice and the main season maize in Java and Sumatra.

CropWatch agroclimatic indicators show that temperature (TEMP +0.2°C), precipitation (RAIN +2%), and radiation (RADPAR +5%) were all slightly above average, which led to an increase of the potential biomass production (BIOMSS +3%).

According to the regional NDVI development graph, crop conditions were slightly below average. The NDVI departure cluster profiles indicate that: crop conditions in 40% of the cropped area were close to the 5YA, which were located in Sumatra, Java, Kupang, Timor, Kalimantan. In 51.5% of cultivated area, crop conditions were significantly below average in the beginning but recovered to slightly below average after January. This region was mostly located in Sumatra, Kalimantan, Semarang, Sulawesi, Ambon. The area of cropped arable land (CALF 99%) in the country was close to the 5YA and the VCIx value was 0.96. The crop conditions can be anticipated to be close to or slightly above average.

Regional analysis

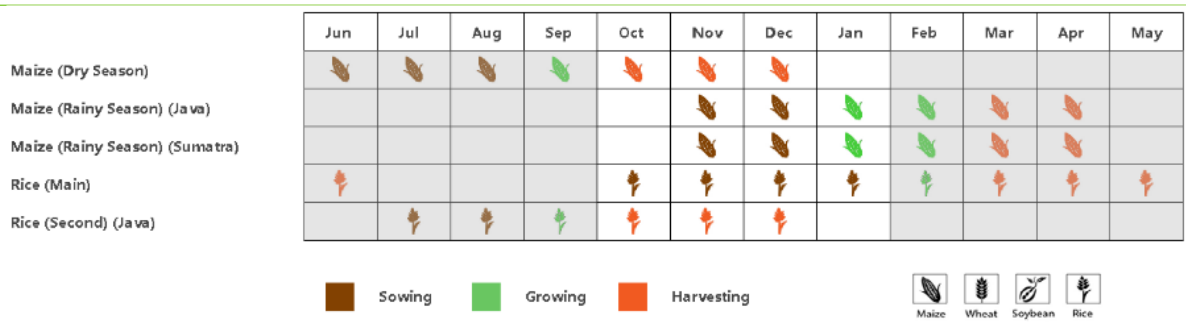
Indonesia has been divided into four agro-ecological zones, namely **Sumatra** (92), **Java** (90, the main agricultural region in the country), **Kalimantan and Sulawesi** (91) and **West Papua** (93), among which the first three are relevant for crops cultivation. The numbers correspond to the labels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

Java experienced rainy conditions. Precipitation (RAIN +7%) and radiation (RADPAR +5%) were above the 15YA, whereas temperature (TEMP +0°C) was close to average, resulting in an above-average potential biomass production (BIOMSS +8%). As shown in the NDVI development graphs, crop conditions were below the 5YA in mid-November and mid-January, but close to average at other times. Overall, crop conditions in **Java** are anticipated to be above average.

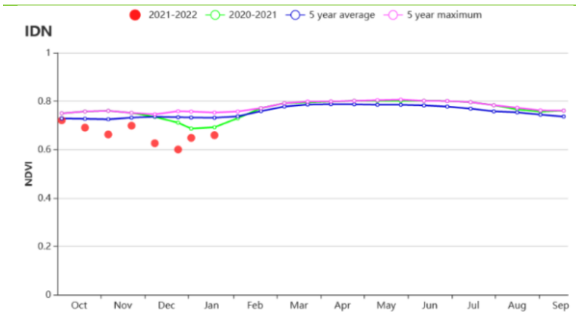
In the **Kalimantan and Sulawesi** region, precipitation (RAIN +4%), temperature (TEMP +0.1°C) and radiation (RADPAR +5%) were above the 15YA, which led to an increase of the potential biomass production (BIOMSS +4%). According to the NDVI development graph, crop conditions were below the 5YA. Crop conditions in this region are expected to be above average.

In **Sumatra**, precipitation (RAIN -1%) was below the 15YA. However, temperature (TEMP +0.2°C) and radiation (RADPAR +7%) were above the 15YA. They resulted in an increase in the potential biomass production (BIOMSS +1%). As shown in NDVI development graphs, crop conditions were below average. Crop conditions in this region are assessed as close to or lightly above average.

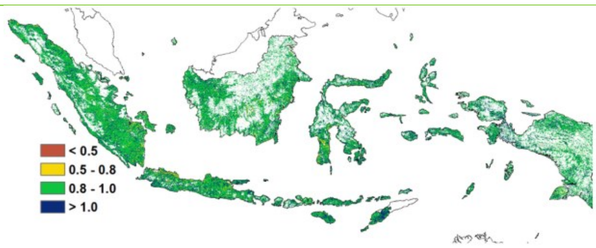
Figure 3.19 Indonesia's crop condition, October 2021 – January 2022



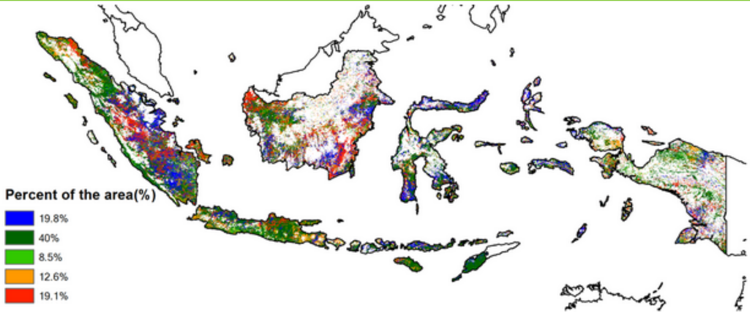
(a). Phenology of major crops



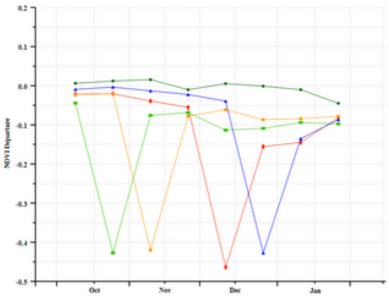
(b) Crop condition development graph based on NDVI



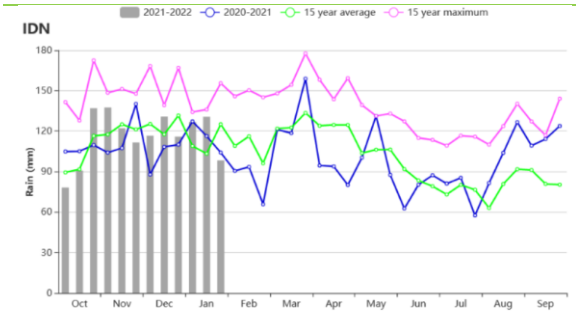
(c) Maximum VCI



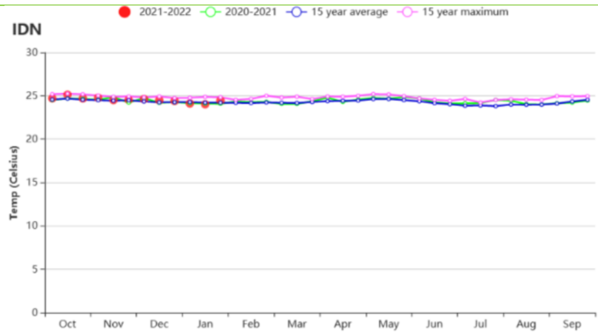
(d) Spatial NDVI patterns compared to 5YA



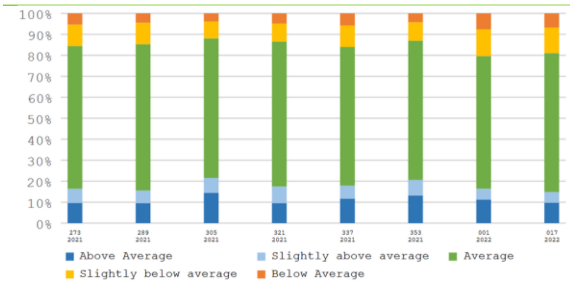
(e) NDVI profiles



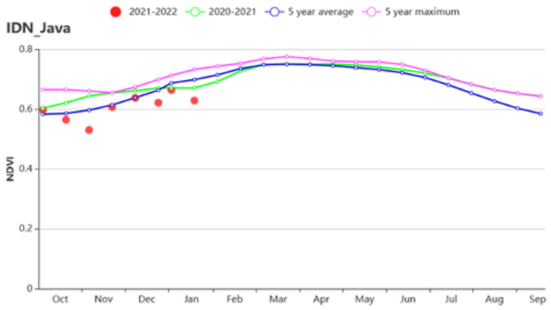
(f) Rainfall profiles



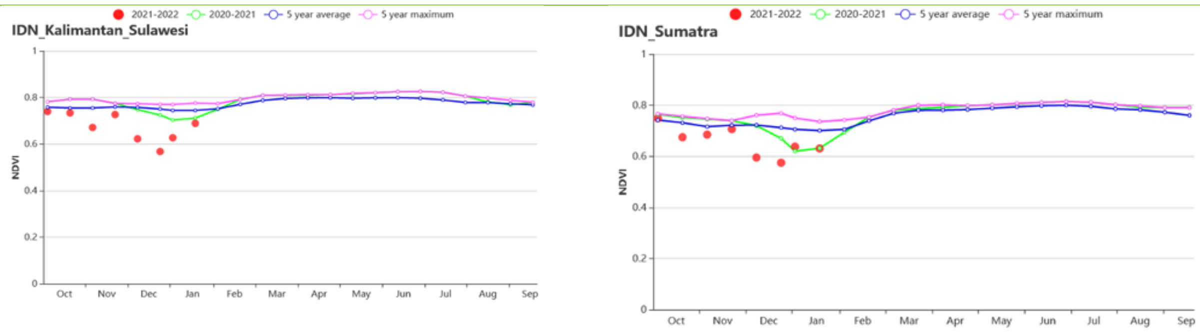
(g) Temperature profiles



(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 3.30 Indonesia's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, October 2021 – January 2022

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Java	1206	7	25.6	0.0	1319	5	1473	8
Kalimantan and Sulawesi	1306	4	24.7	0.1	1208	5	1521	4
Sumatra	1428	-1	24.5	0.2	1146	7	1493	1
West Papua	1612	0	23.9	0.3	1091	4	1446	3

Table 3.31 Indonesia's agronomic indicators by sub-national regions, current season's values and departure from 5YA, October 2021 – January 2022

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Java	99	1	0.96
Kalimantan and Sulawesi	100	0	0.96
Sumatra	100	0	0.96
West Papua	100	0	0.97

[IND] India

The current monitoring period covers the late growth and harvest of Kharif (summer) maize, rice and soybean, and the planting and early growth of Rabi (winter) rice and wheat. The graph of NDVI development shows that the crop conditions were above average in general, except for November.

The CropWatch agroclimatic indicators show that nationwide, TEMP (-0.4°C) and RADPAR were close to average, whereas RAIN was above the 15YA (+26%). The sufficient rainfall compensated for the low TEMP and RADPAR, resulting in a BIOMSS increase by 18% compared with the 15YA. The overall VCIx was high, with a value of 0.94. 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 western and northeastern regions showed above-average crop conditions while the conditions were slightly below average in the southern regions. The spatial distribution of NDVI profiles shows that after November, 55% of the areas showed above-average crop conditions in the western and southern regions. CALF increased by 4% compared to the 5YA. The agroclimatic indicators were generally favorable.

Regional analysis

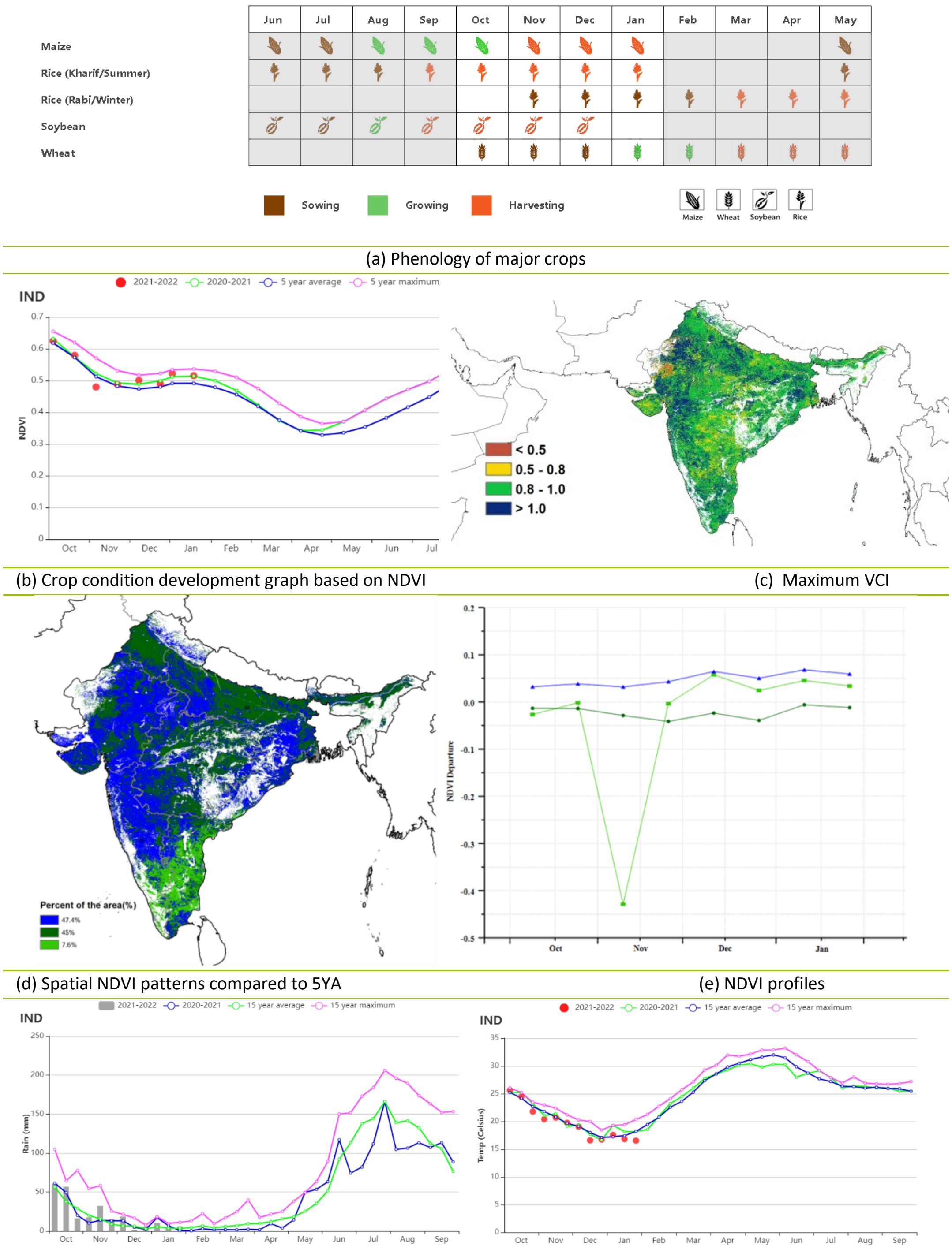
India is divided into eight agro-ecological zones: the Deccan Plateau (94), the Eastern coastal region (95), the Gangetic plain (96), the Assam and north-eastern regions (97), Agriculture areas in Rajasthan and Gujarat (98), the Western coastal region (99), the North-western dry region (100) and the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

The five agro-ecological zones of the Gangatic plain, the Agriculture areas in Rajastan and Gujarat, the Western coastal region, the North-western dry region and the Western Himalayan region showed similar trends in agricultural indices. Compared to the same period of previous years, RAIN had increased significantly, especially in the North-western dry region (+335%). The TEMP and RADPAR were slightly below average, the BIOMSS was significantly above the 15-year average. It benefitted from the sufficient rainfall. CALF showed the same trends. They all were above average. The graph of NDVI development shows that the crop growth of these five agro-ecological regions during this monitoring period were closed or above the 5-year average in most months. Generally, the crop production is expected to be above average.

The Deccan Plateau and Gujarat and the Assam and north-eastern regions recorded similar trends of agricultural indices in this monitoring period. Compared to the same period of the previous years, RAIN decreased significantly by 13% in the Deccan Plateau and by 16% for the Assam and north-eastern regions. TEMP was slightly below average. The RADPAR was slightly above average for both regions and compensated for the rainfall effect and caused an increase in BIOMSS. Both regions recorded increases of CALF. VCIx was above 0.89. The graph of NDVI development shows that the crop growth for both regions was generally below the 5-year average. The crop production is expected to be below average.

The Eastern coastal region recorded 411 mm of RAIN, which was above average (+14%). TEMP was at 22.4°C (+0.1°C) and RADPAR was at 1075 MJ/m² (-1%). BIOMSS was above the 15YA (+13%). CALF reached 99% which was slightly above average, and VCIx was 0.92. The graph of NDVI development shows that the crop growth of the region during the monitoring period exceeded the 5-year average in most months. The outlook of crop production in this region is favorable.

Figure 3.20 India's crop condition, October 2021 – January 2022



(a) Phenology of major crops

(b) Crop condition development graph based on NDVI

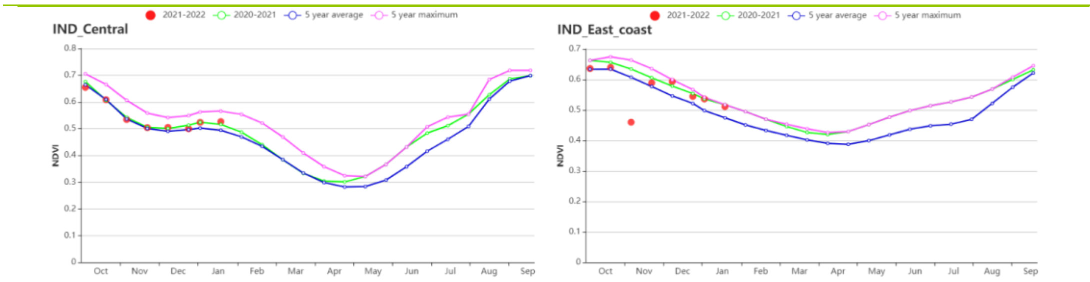
(c) Maximum VCI

(d) Spatial NDVI patterns compared to 5YA

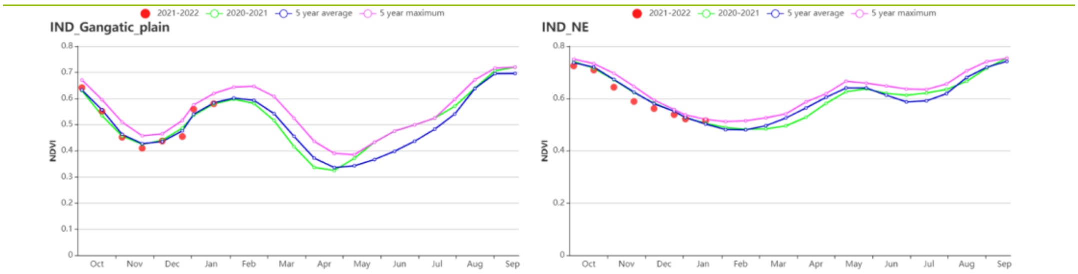
(e) NDVI profiles

(f) Rainfall profiles

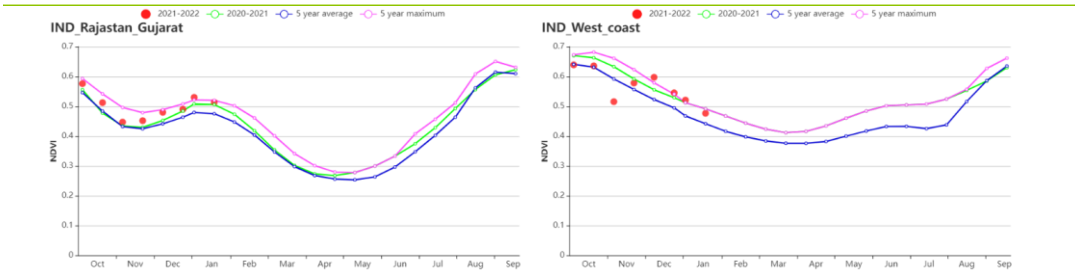
(g) Temperature profiles



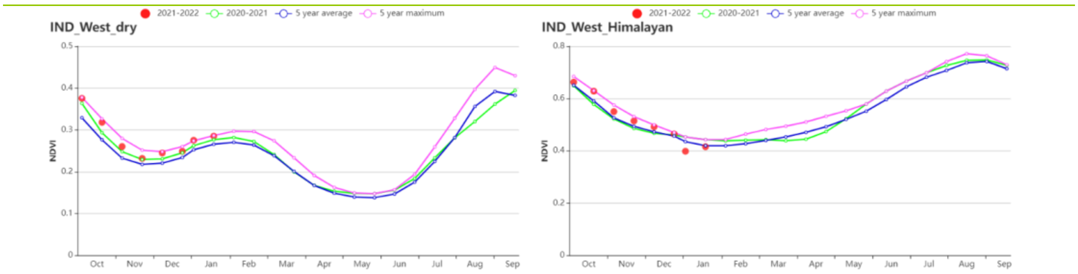
(h) Crop condition development graph based on NDVI (Deccan Plateau (left) and Eastern Coastal Region (right))



(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 3.32 India's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, October 2021 – January 2022

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Deccan Plateau	88	-13	19.9	-0.3	1078	1	472	5
Eastern coastal region	411	14	22.4	0.1	1075	-1	859	13
Gangatic plain	202	115	17.8	-0.7	932	-3	505	36

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Assam and north-eastern regions	270	-16	16.1	-0.7	926	3	538	-3
Agriculture areas in Rajastan and Gujarat	114	192	20.9	-0.8	1033	-1	503	41
Western coastal region	475	35	23.0	-0.4	1115	-2	849	16
North-western dry region	66	335	21.0	-0.2	985	-2	404	35
Western Himalayan region	222	48	7.2	-1.0	872	-2	360	17

Table 3.33 India's agronomic indicators by sub-national regions, current season's values and departure from 5YA, October 2021 – January 2022

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Deccan Plateau	99	1	0.90
Eastern coastal region	99	4	0.92
Gangatic plain	99	1	0.95
Assam and north-eastern regions	96	1	0.90
Agriculture areas in Rajastan and Gujarat	95	10	0.97
Western coastal region	100	5	0.96
North-western dry region	43	95	1.02
Western Himalayan region	95	2	0.95

[IRN] IRAN

Crop conditions were below average throughout the whole monitoring period according to the crop condition development graph based on NDVI. The sowing of winter wheat was completed in October. Temperature and radiation were both above average (TEMP +0.4℃, RADPAR +2%), while rainfall was below average (RAIN -4%) as compared to the 15YA. The lack of rainfall resulted in a slight decrease in the BIOMSS index by 4% as compared to the 15YA. The Cropped Arable Land Fraction (CALF) decreased by 2% compared to the recent five-year average and the national average of maximum VCI index was 0.48.

According to the spatial distribution of NDVI profiles, approximately 11.5% of the cropland (marked in dark green) had above-average crop conditions during the whole monitoring period. The crop conditions of roughly 43% of the croplands, marked in light green, were near average during the whole monitoring period. 17.5% of the cropland (marked in orange) in the provinces of West Azerbaijan, Kordestan and Zanjan had near or above-average crop conditions before mid-January, and the crop conditions dropped to below average in late January. Crop conditions in the rest of the cultivated areas (marked in blue and red) were all near average at first and then dropped to below average, mainly including the provinces of West Azerbaijan, East Azerbaijan, Ardebil, Zanjan, Kordestan, Kermanshah, Hamadan, Lorestan, Ilam, and Fars. The drop in NDVI in January can be attributed to cloud or snow cover. Overall, the crop condition for winter crops was slightly below average.

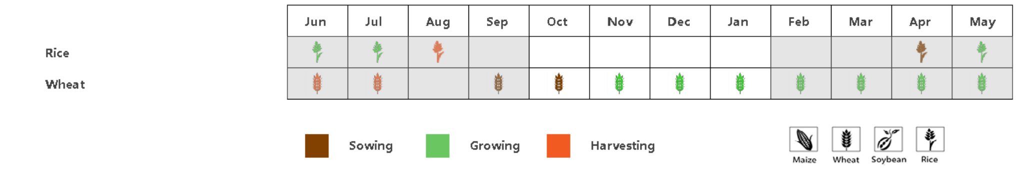
Regional analysis

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

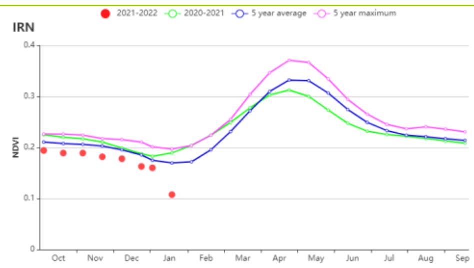
In the **Semi-arid to sub-tropical hills of the west and north region**, crop conditions were slightly below average during the whole monitoring period. This AEZ is a mountainous, relatively high-altitude region. Snow cover is common, and thus the low NDVI values observed for January are not representative. Temperature was 0.4°C above average, the accumulated rainfall was 191 mm (5% below average), and radiation was slightly above average (RADPAR +3%). The unfavorable weather conditions resulted in a decrease of BIOMSS by 7% compared to the recent 15-year average. The CALF decreased by 1%, and the average VCIx (0.50) was rather low. Crop conditions were slightly unfavorable.

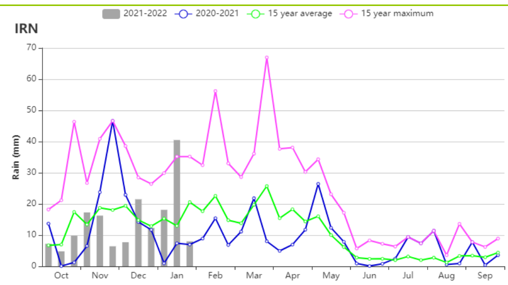
The **Arid Red Sea coastal low hills and plains region** also had below average crop conditions during the whole monitoring period. This AEZ received 150 mm rainfall during the reporting period, 1% below the 15YA average (RAIN -1%). Temperature was 0.9°C above average (TEMP +0.9℃), and radiation was 2% above average (RADPAR +2%). BIOMSS was near average (+2%). The CALF decreased by 5% compared to the 5YA, reflecting that less land was cultivated. The average VCIx of this region was 0.45. Crop conditions were slightly unfavorable.

Figure 3.21 Iran's crop condition, October 2021 - January 2022



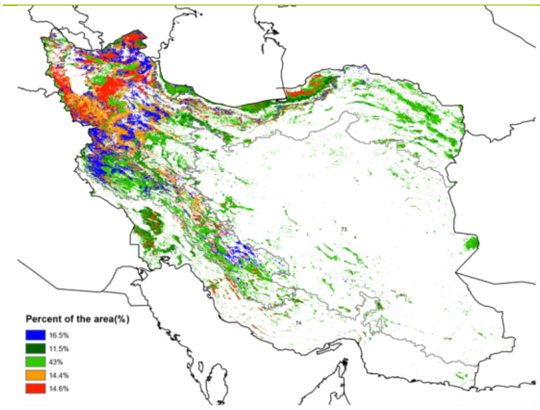
(a). Phenology of major crops

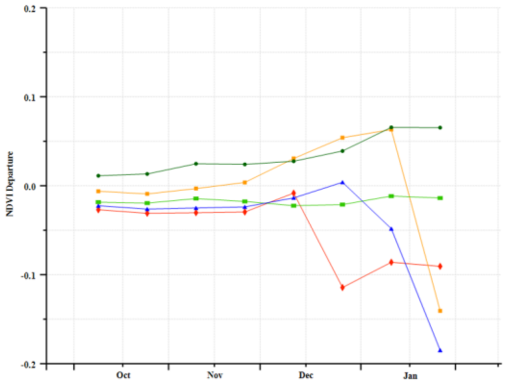




(b) Crop condition development graph based on NDVI

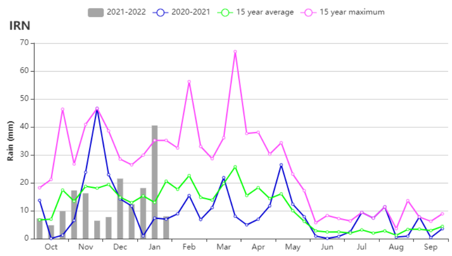
(c) Maximum VCI

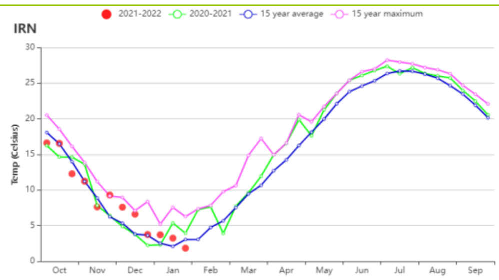




(d) Spatial NDVI patterns compared to 5YA

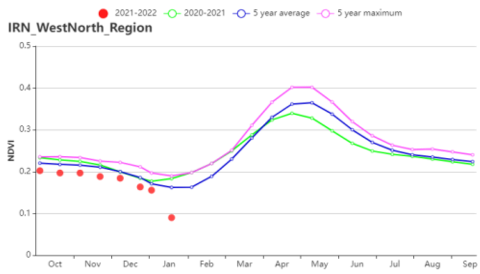
(e) NDVI profiles

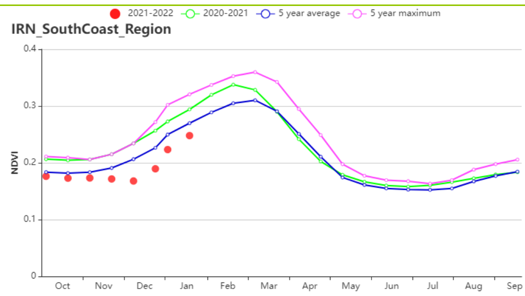




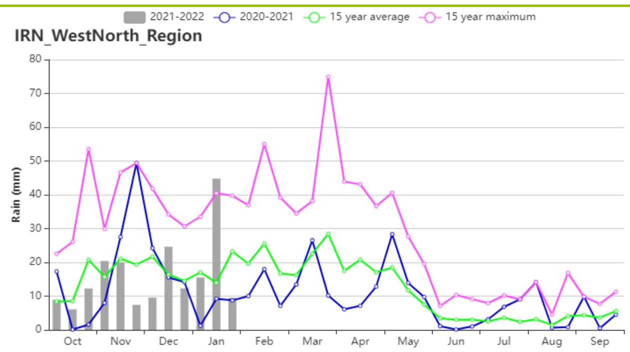
(f) Rainfall profiles

(g) Temperature profiles





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



(i) Time series rainfall profile (Semi-arid to sub-tropical hills of the west and north region)

Table 3.34 Iran's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, October 2021-January 2022

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m^2)	Departure (%)	Current (gDM/m^2)	Departure (%)
Semi-arid to sub-tropical hills of the west and north	191	-5	6.8	0.4	754	3	361	-7
Arid Red Sea coastal low hills and plains	150	-1	18.7	0.9	865	2	467	2

Table 3.35 Iran's agronomic indicators by sub-national regions, current season's values and departure from 5YA, October 2021-January 2022

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Semi-arid to sub-tropical hills of the west and north	9	-1	0.50
Arid Red Sea coastal low hills and plains	17	-5	0.45

[ITA] Italy

This report covers the sowing of winter wheat in October and November. According to the crop condition development graph, NDVI values were slightly below average. In this period, the overall rainfall (RAIN -2%) and temperatures (TEMP, -0.3°C) were slightly below the 15YA. PADPAR was above average (+2%). The combined effect of three factors led to a 3% increase in estimated BIOMSS.

The national average VCIx was 0.86. CALF (92%) was equal to its five-year average. The NDVI departure cluster profiles indicate that: (1) 19.9% of arable land experienced above-average crop conditions, mainly in Palermo, Agrigento, Gela, Calabria and the east coast. (2) 25.1% of arable land experienced slightly below-average crop conditions, mainly in Verona, Venezia and Grosseto. (3) 22% of arable land, mainly in Ancona, Pesaro, Arezzo and Parma, was slightly below average from October to middle November and above average from late November to January. (4) 33% of arable land was slightly below average in October, above average in November, and below average in December and January, mainly in northern Italy. CropWatch estimates that crop conditions were slightly below but close to average for this monitoring period.

Regional analysis

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

On the **East coast**, rainfall was higher by 2%, while temperature and RADPAR were lower by 0.2°C and 2% respectively and potential biomass was 4% higher than the average of the last 15 years. Higher rainfall mainly occurred in November and early January, while the NDVI was below average from October to middle November, above average late November and early December, below average from middle November to January. VCIx in the subregion reached 0.84, CALF was 82%. It was 2% lower than the average of the last 5 years. In general, crop growth was fair.

In **Po Valley**, RADPAR was above average by 7%, while rainfall and temperature were lower by 17% and 0.4°C respectively and potential biomass was 1% higher than the average of the last 15 years. Lower rainfall mainly occurred in mid-December, mid and late January. Whereas the NDVI was below average from October to mid-December, and close to average from late December to January. VCIx in the subregion reached 0.87. CALF experienced a 1% increase compared to the 5YA. Overall, agronomic conditions were near average.

Compared to the average of the last 15 years, rainfall on the **Islands** was significantly higher by 33%, temperature and RADPAR were lower by 0.7°C and 1%, respectively. Abundant precipitation during the growing season was positive for the crops, which resulted in an 8% increase in BIOMSS. The rainfall in early December exceeded the maximum level of the past 15 years. VCIx in the subregion reached 0.86. CALF experienced a 1% decrease compared to the 5YA. During this monitoring period, agronomic conditions were close to average for the islands.

In **Western Italy**, rainfall was higher by 7%, while temperature and RADPAR were lower by 0.2°C and 1% respectively and potential biomass was 1% higher than the average of the last 15 years. Higher rainfall mainly occurred in early December and late December of growing season, while the NDVI was below average in October and November, and close to average in December and January. VCIx in the subregion reached 0.85. CALF was average compared to 5YA. Overall, agronomic conditions were close to average for crop growth in this area.

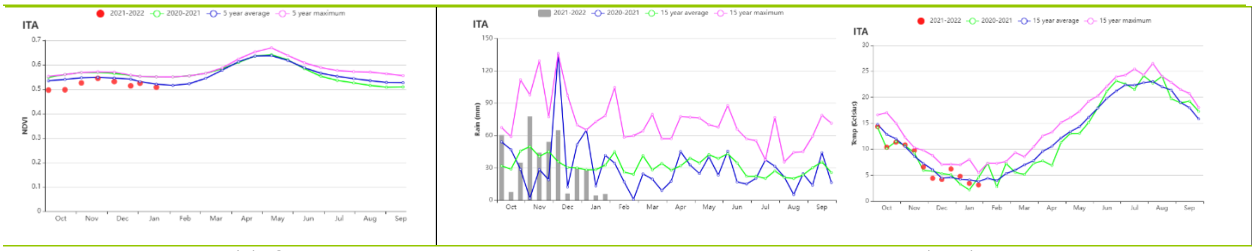
Figure 3.22 Italy's crop condition, October 2021-January 2022

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

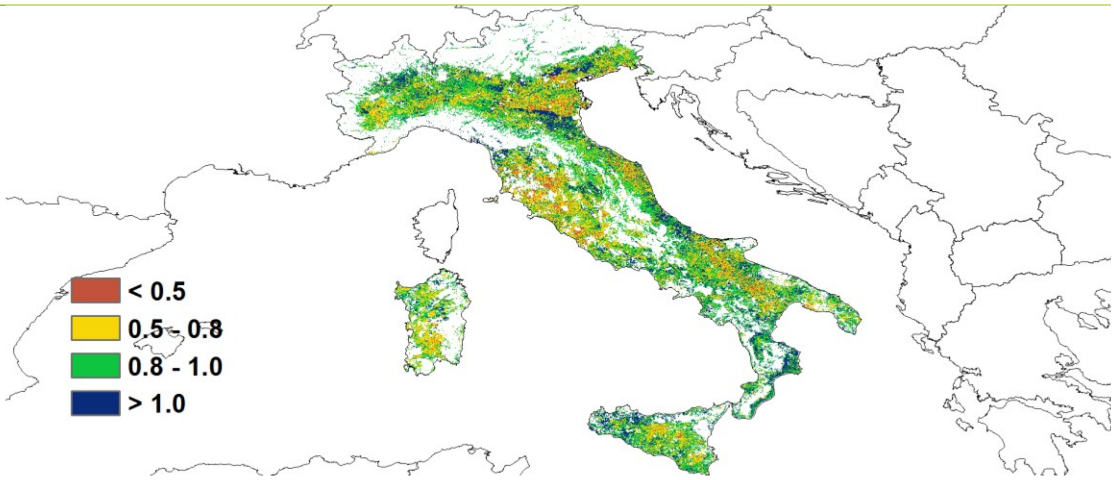
Sowing Growing Harvesting

Maize Wheat Soybean Rice

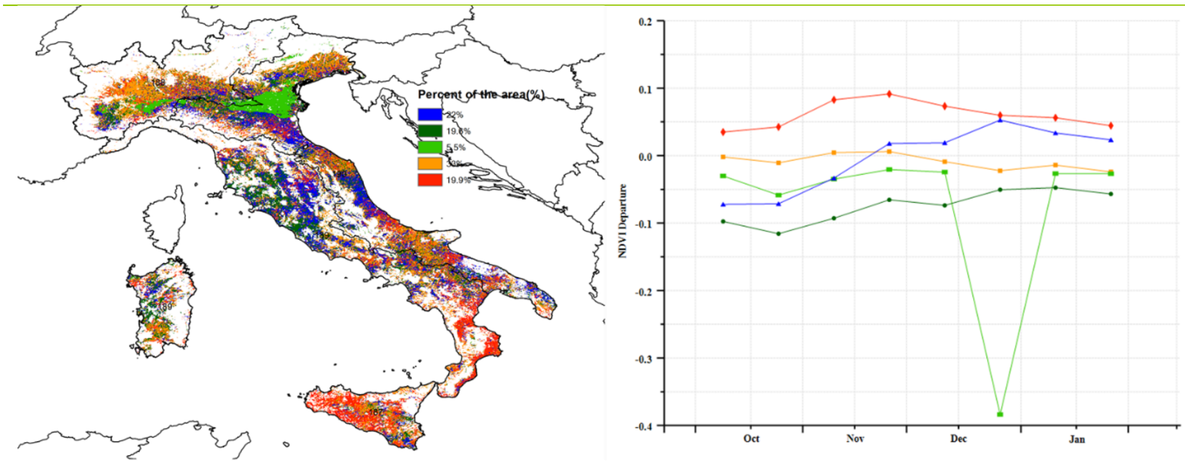
(a). Phenology of major crops



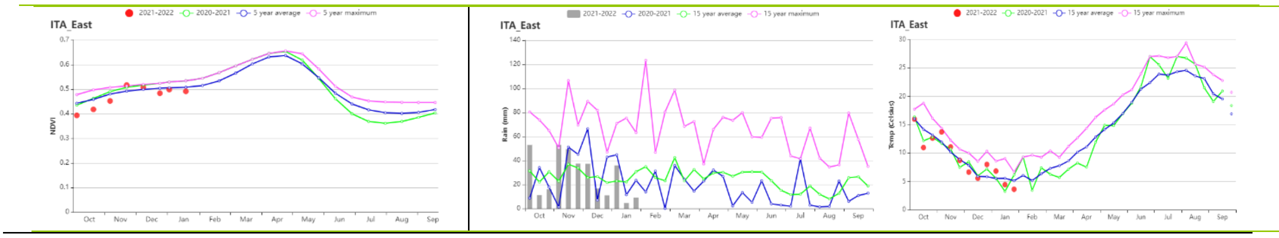
(b) Crop condition development graph based on NDVI, RAIN and TEMP (Italy).



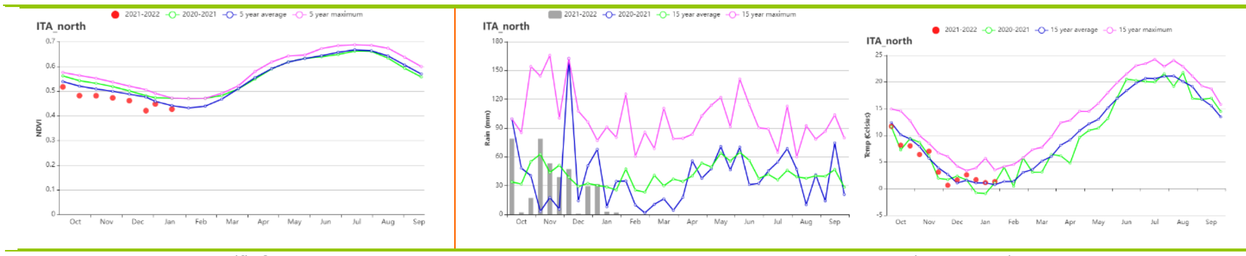
(c) Maximum VCI



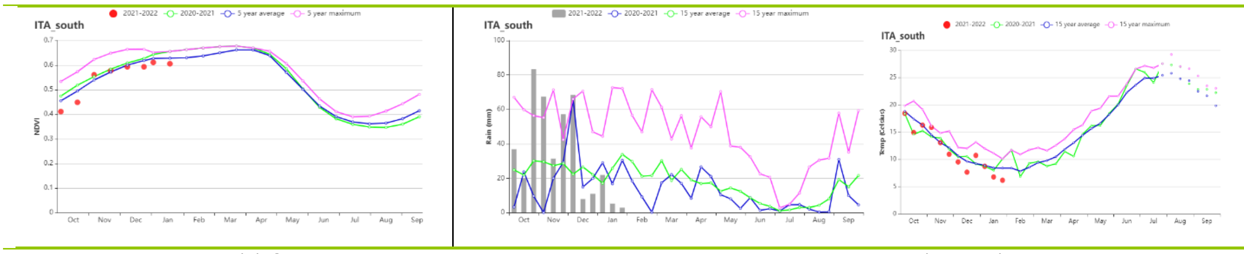
(d)Spatial distribution of NDVI profiles.



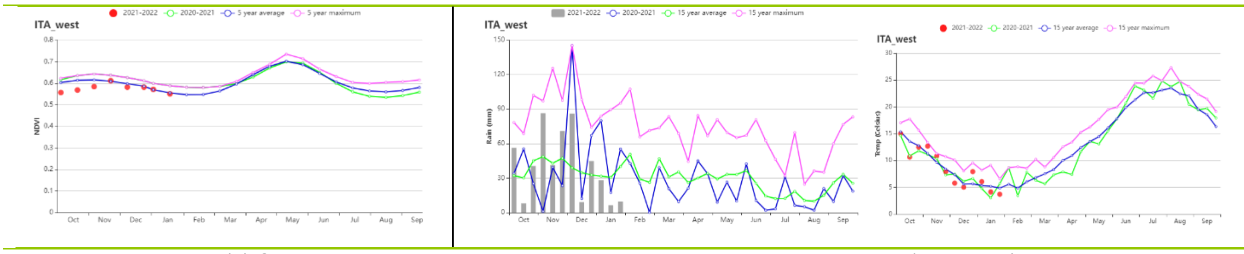
(e) Crop condition development graph based on NDVI, RAIN and TEMP (East Italy).



(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 3.36 Italy's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, October 2021-January 2022

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
East coast	334	2	9.0	-0.2	474	-2	608	4
Po Valley	383	-17	4.4	-0.4	421	7	481	1
Islands	413	33	11.6	-0.7	576	-1	694	8
Western Italy	488	7	8.5	-0.2	463	-1	660	1

Table 3.37 Italy's agronomic indicators by sub-national regions, current season's values and departure from 5YA, October 2021-January 2022

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current (%)
East coast	82	-2	0.84
Po Valley	88	1	0.87
Islands	95	-1	0.86
Western Italy	97	0	0.85

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

[KAZ] Kazakhstan

No crops were cultivated in most of the country during this monitoring period, except for some minor winter crops planted in the southern regions. Compared to the 15-year average, accumulated rainfall and temperature were above average (RAIN +2%, TEMP +1.4 ° C), while radiation was below average (RADPAR -2%). The dekadal precipitation was above the 15-year average from the mid-November to mid-January. The dekadal temperature was above average from mid-November to January. The agro-climatic conditions resulted in a minor increase in estimated BIOMSS by 2%. According to the NDVI profiles, the national average NDVI values were lower than 0.2 starting from November because of freezing conditions.

Overall, the agro-climate conditions were normal in the monitoring period.

Regional analysis

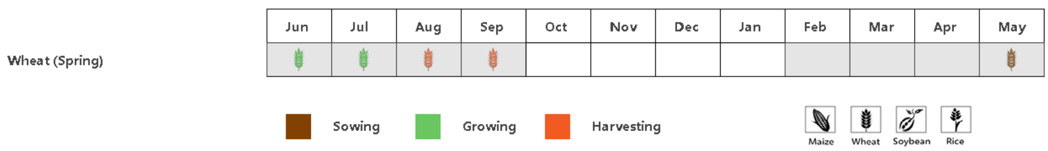
Based on cropping systems, climatic zones and topographic conditions, four sub-national agro-ecological regions can be distinguished for Kazakhstan, among which three are relevant for crop cultivation: the Northern region (112), the Eastern plateau and southeastern region (111) and the South region (110).

In the **Northern region**, the accumulated precipitation (RAIN +6%) and temperature (TEMP +1.6°C) were above average, while RADPAR was below average by 3%.

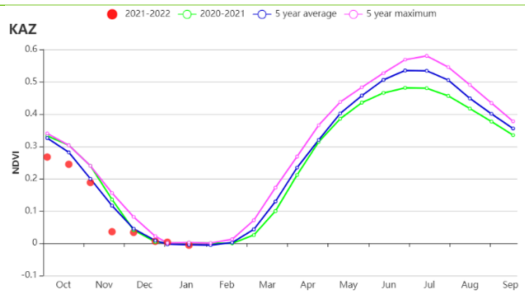
In the **Eastern plateau and southeastern region**, the accumulated precipitation (RAIN -3%) was below average, while the temperature (TEMP +0.9°C) was above average. The rain deficit resulted in a minor decrease of BIOMSS by 1%.

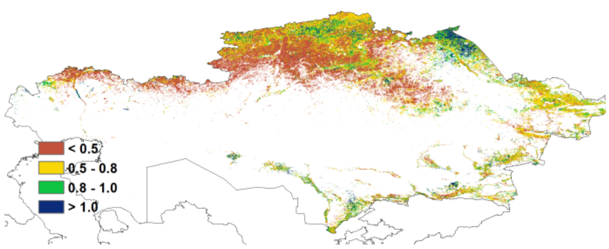
The **South region** received 125 mm of rainfall, which was the lowest amount and the biggest departure among the three regions. Due to the deficit of rainfall (RAIN -10%), the potential biomass decreased by 2%. The average VCIx for this region was 0.75 and CALF was below average by 41%.

Figure 3.23 Kazakhstan's crop condition, October 2021 – January 2022



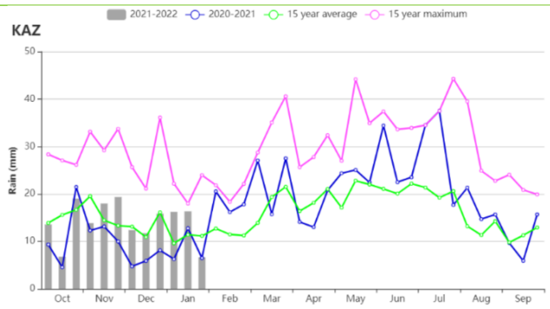
(a). Phenology of major crops



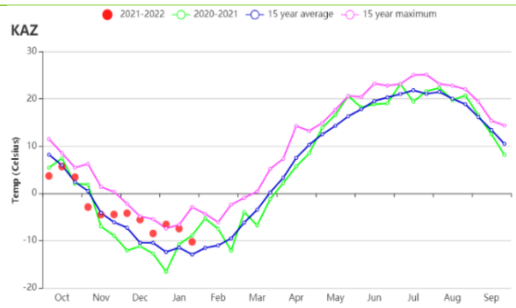


(b) Crop condition development graph based on NDVI

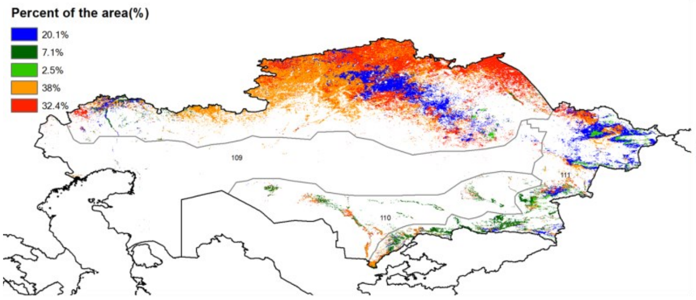
(c) Maximum VCI



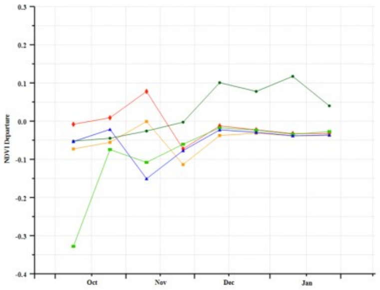
(d) Rainfall Index



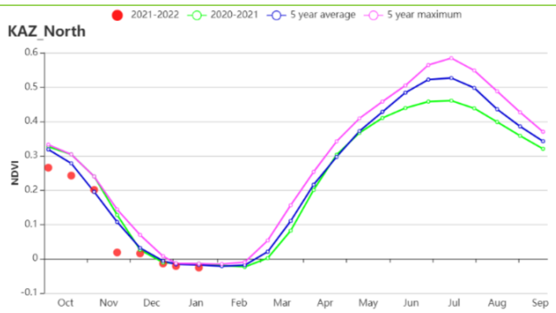
(e) Temperature Index



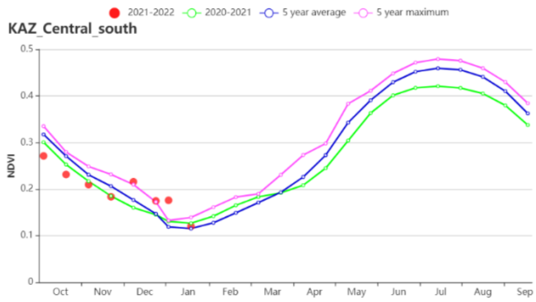
(f) Spatial NDVI patterns compared to 5YA



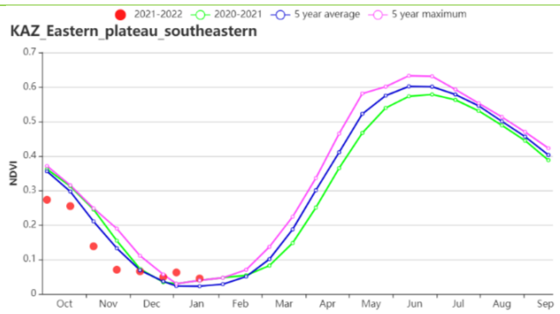
(g) NDVI profiles



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



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



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

Table 3.38 Kazakhstan agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, October 2021 – January 2022

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Northern region	157	6	-4.4	1.6	277	-3	252	3
Eastern plateau and	208	-3	-2.6	0.9	467	0	255	-1

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
southeastern region								
South region	125	-10	2.6	1.0	487	-1	308	-2

Table 3.39 Kazakhstan, agronomic indicators by sub-national regions, current season's values and departure from 5YA, October 2021 – January 2022

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Northern region	8	-27	0.54
Eastern plateau and southeastern region	18	-14	0.66
South region	5	-41	0.75

[KEN] Kenya

Kenya experiences two rainy seasons: The long rains last from March to May 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. This report for the monitoring period from October 2021 to January 2022 covers the short rain season and the harvest of wheat and long rain maize. Short rain maize was sown in October and November.

At the national scale, precipitation was 277 mm, 34% below average. When looking into sub-national level, rainfall was lower in all areas. The weather was slightly warmer and RADPAR was close to the 15YA (TEMP +0.4°C, RADPAR +2%). BIOMSS was 14% 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 15YA in the December and January but significant below average in the October and November.

The NDVI development graph at the national level shows that the NDVI values from October to December were below average. It can be noticed that the sowing of maize in the short rainy season was delayed and in some areas there may be no harvest. This is mainly due to the significant decrease in rainfall. Based on the NDVI clusters and the corresponding NDVI departure profiles, the western part of Kenya (blue area), which accounts for 43.6% of the country's cultivated land, has near-average NDVI values, while other areas show significant deviations in the October to December crop growth. This is consistent with the maximum VCI map, which shows a relatively low VCI of between 0.5 and 0.8 in the central and southeastern regions.

Regional analysis

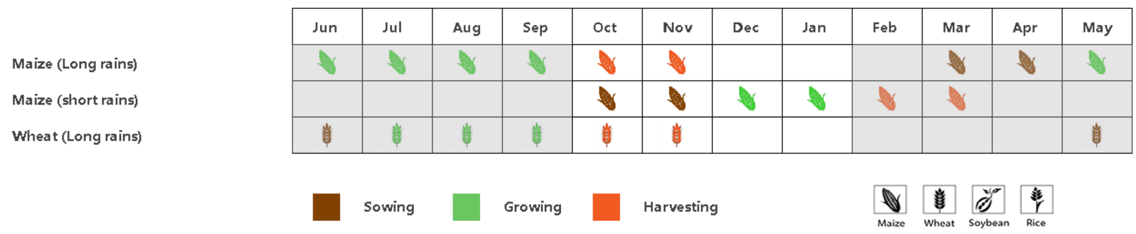
The **Eastern coastal region** had the largest negative deviation in rainfall (-27%), 0.5°C above average temperature and 4% above average RADPAR. Lack of rainfall resulted in a 12% decrease in BIOMSS and a significant decrease in NDVI from October to December compared to the 5YA. This indicates that the conditions for sowing of short rainy season maize was impacted. Drought conditions also led to a decrease in crops planted area. CALF decreased by 11% as compared to the 5YA. The maximum VCIx was only 0.67, the lowest among the four AEZs in Kenya. Overall, the situation in the coastal areas is very unfavorable with poor prospects for livestock and crop production.

The **Highland agriculture zone** recorded 297 mm of rain, which was below the 15YA (-29%). Temperature was close to the 15YA (+0.4°C), whereas RADPAR was slightly above average (+2%). BIOMSS was below average (-12%). The NDVI was slightly below the 5YA from October to December. As with the eastern coastal region, the sowing of maize in the short rainy season was also affected by the lack of rainfall. The maximum VCIx value (0.89) is the highest in four AEZs in Kenya. The CALF was unchanged compared with the 5YA. Overall, crop growth has been severely affected by drought conditions from October to January.

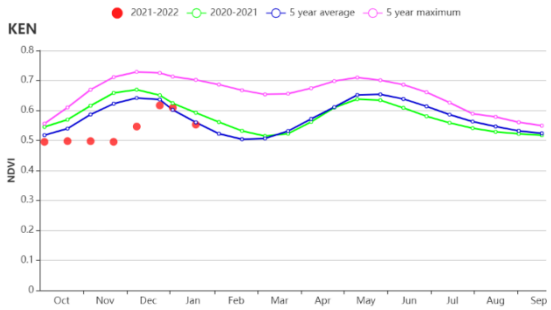
In the **Northern region**, precipitation was below average at 265 mm (-30%). The temperature was close to the 15YA (+0.5°C), while RADPAR was above average (+3%). BIOMSS was below average (-11%). The maximum VCIx was normal at 0.72. The below-average trend of its crop condition development graph indicates that the area was affected by drought between October and December. The sowing of maize in the short rainy season was delayed. In addition, CALF decreased (-8%) to 75%. In general, the region has seen a decrease in rainfall, biomass, and CALF. This indicates that the region is severely affected by drought from October to January.

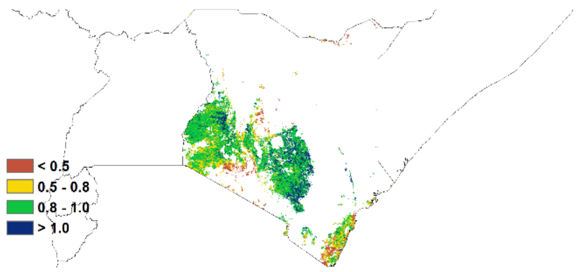
The **Southwest region** includes the areas of Narok, Kajiado, Kisumu, Nakuru and Embu. Precipitation was 145 mm, which is 68% below the average. The following values of indicators were observed: TEMP 20.6°C (+0.4°C), RADPAR (-4%) and BIOMSS (-34%). The significant decrease in precipitation led to a significant decrease in biomass. However, NDVI values were close to the 5YA. Despite the large variation in precipitation, its CALF and RADPAR were close to average and the VCIx value remained at 0.85. All in all, the parameters indicate slightly below average conditions for this area.

Figure 3.24 Kenya's crop condition, October 2021-January 2022

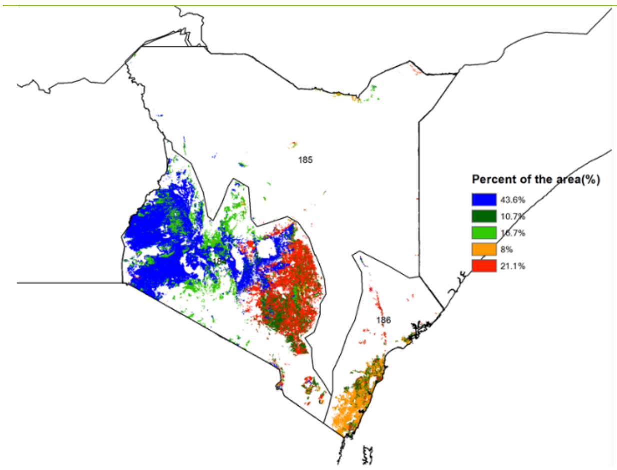


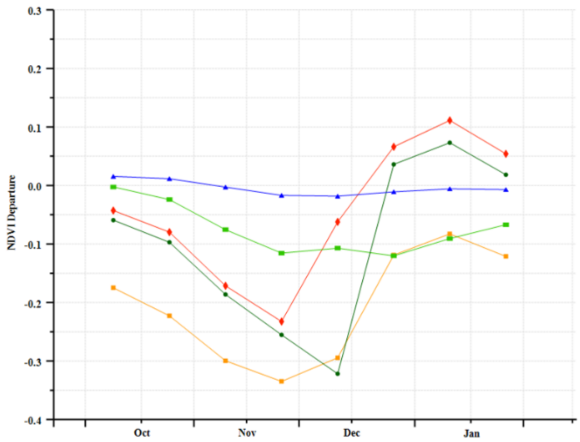
(a). Phenology of major crops



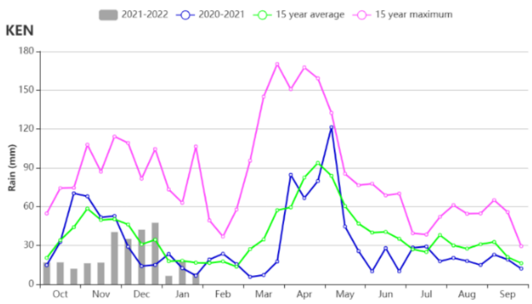


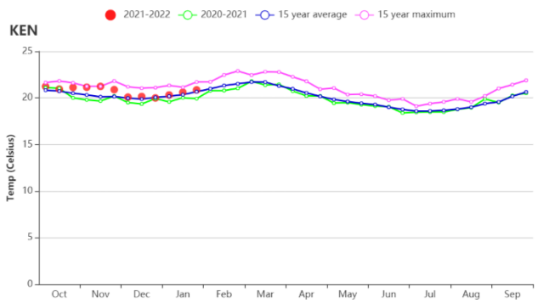
(b) Crop condition development graph based on NDVI (c) Maximum VCI



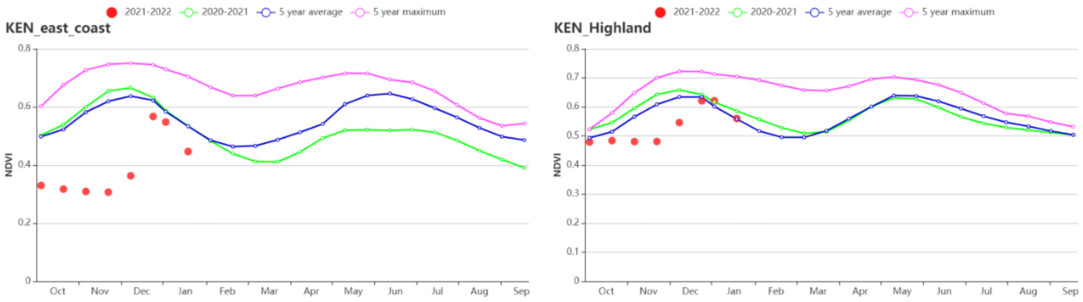


(d) Spatial NDVI patterns compared to 5YA (e) NDVI profiles

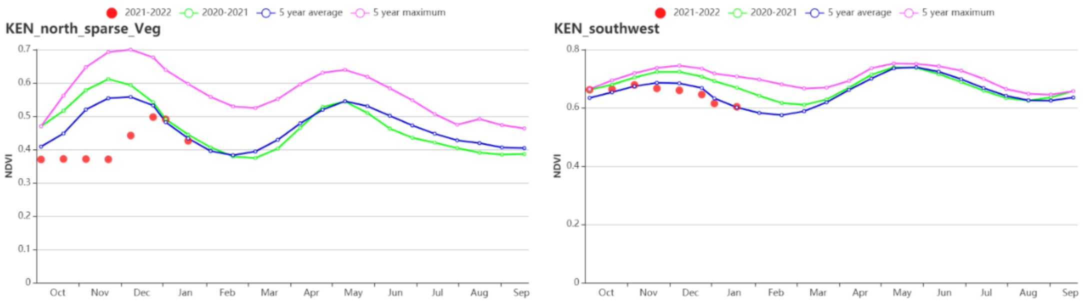




(f) Time series rainfall (g) Time series temperature



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



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

Table 3.40 Kenya's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA,October 2021-January 2022

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Coast	384	-27	26.3	0.5	1465	4	1121	-12
Highland agriculture zone	297	-29	19.3	0.4	1282	2	730	-12
nothern rangelands	265	-30	23.6	0.5	1378	3	825	-11
South-west	145	-68	20.6	0.4	1226	-4	621	-34

Table 3.41 Kenya's agronomic indicators by sub-national regions, current season's values and departure, October 2021-January 2022

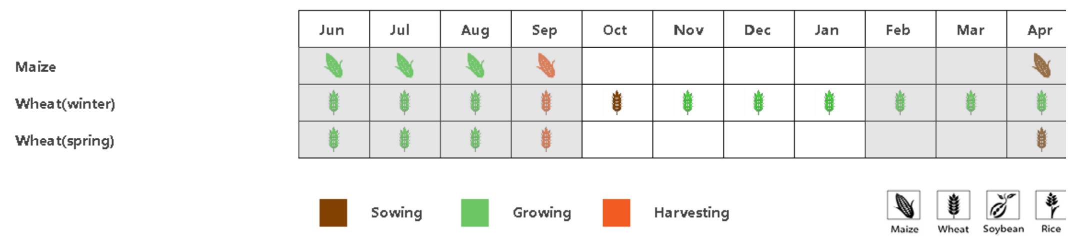
Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Coast	83	-11	0.67
Highland agriculture zone	96	0	0.89
northern rangelands	75	-8	0.72
South-west	100	1	0.85

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

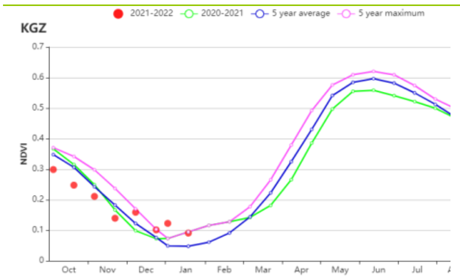
[KGZ] Kyrgyzstan

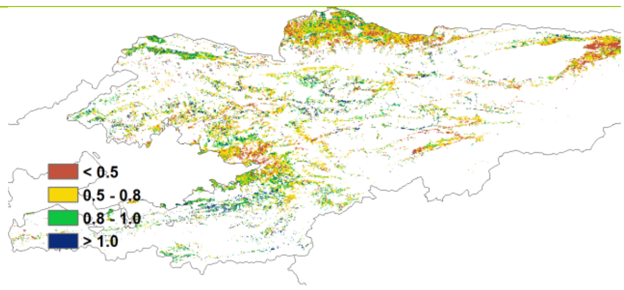
The sowing of winter wheat in Kyrgyzstan was completed in October. During the months of October to January, the CropWatch agro-climatic indicators RADPAR (+3%) and TEMP (+0.1°C) were slightly above average, while RAIN was below average (-25%). The combination of these factors resulted in a decreased estimate for BIOMSS (-14%) compared to the fifteen-year average. As shown by the NDVI development graph, the vegetation conditions were below average during October and November and improved to above average for the rest of the monitoring period. This might be due to the above-average temperatures observed between November and January. In terms of the spatial NDVI clustering profile, 15.5% of the cultivated area (marked in light green) showed below-average crop conditions until mid December and gradually recovered to close-to-average conditions. 39.6% of the cultivated area (marked in orange) had close-to-average crop conditions throughout the whole monitoring period, mainly located in northern Issyk-Kul, northern Osh, southern Jalal-Abad, and central Talas. The remaining areas improved to above-average conditions starting in December. The spatial pattern of maximum Vegetation Condition Index (VCIx) was in accord with the spatial distribution of the NDVI profiles. The national average VCIx was 0.73. Agro-climatic and agronomic conditions were mixed with CALF at 12%, 30% below average. Overall, the lack of rainfall during the early growing stage of crops from November to December and the substantial decrease in CALF indicate unfavorable crop conditions in Kyrgyzstan.

Figure 3.25 Kyrgyzstan's crop condition, October 2021 to January 2022



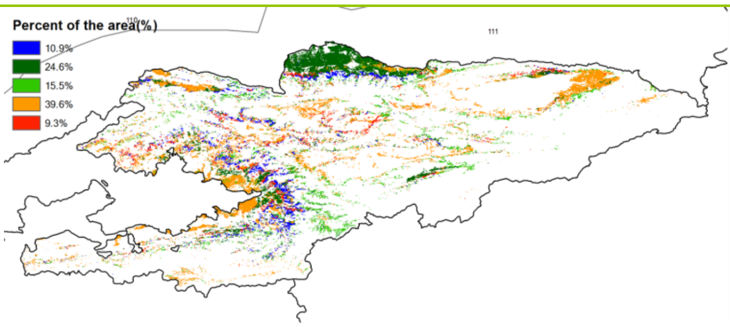
(a). Phenology of major crops



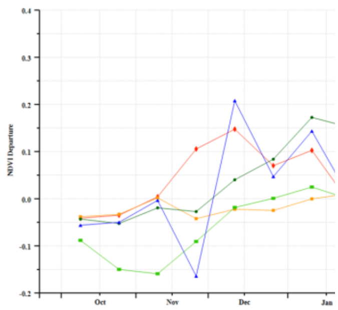


(b) Crop condition development graph based on NDVI

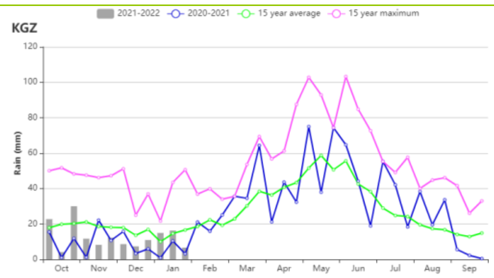
(c) Maximum VCI



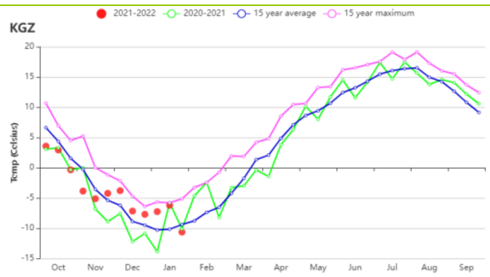
(d) Spatial NDVI patterns compared to 5YA



(e) NDVI profiles



(f) Rainfall profiles



(g) Temperature profiles

Table 3.42 Kyrgyzstan agro-climatic indicators, current season's values and departure from 15YA, October 2021 to January 2022

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Kyrgyzstan	154	-25	-4.2	0.1	614	3	202	-14

Table 3.43. Kyrgyzstan agronomic indicators, current season's values and departure from 5YA, October 2021 to January 2022

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Kyrgyzstan	12	-30	0.73

[KHM] Cambodia

Cambodia has gradually entered the dry season starting in November, when the harvest of wet-season early rice was ended and the sowing of dry-season early rice began subsequently. Moreover, the sowing of dry season maize and soybean was over in December, after that started the harvest of medium rice, late rice and floating rice in January.

During this monitoring period, Cambodia experienced wetter and relatively cooler weather conditions. Compared to the same period in the past, the precipitation in Cambodia was 12% higher (RAIN), while the average temperature was slightly cooler by 0.2°C (TEMP) and the radiation was basically close to average (RADPAR). The relatively abundant rainfall resulted in a 3% higher potential biomass than average (BIOMSS), however, NDVI profile for the country shows that crop growth condition was consistently below average during the monitoring period. The time series graph of precipitation shows that the excess precipitation was mainly due to above-average precipitation in mid-late October, mid-November and late December. The above-average precipitation in mid-late October mainly coming from the impact of the 18th Typhoon KOMPASU, while the accumulated precipitation in mid-November and late December both reached their respective highest levels in the past 15 years. Considering that the gap between actual crop growth condition and average level did not start to decrease until late December, this indicates that the increased precipitation in October and November did not contribute significantly to the growth of crops in the rainy season, and may even have caused damage to crops in the form of short duration heavy precipitation, while the increased precipitation in late December effectively alleviated the insufficiency of rainfall in the dry season and improved the crop growth condition, narrowing the gap between the actual crop growth condition and the average level. The spatial NDVI patterns show that the low NDVI in October was mainly caused by the negative NDVI deviation appearing in the light green area (about 24.2%) in early October and in the red area (about 9.2%) in late October, and these two negative deviations are most likely caused by the cloud cover on the satellite images. In addition, the below-average NDVI appearing in orange area (about 6%) and red area (except for late October) may be caused by moisture deficit due to uneven precipitation distribution. In addition, the record low flow levels of the Mekong River, which have persisted over the last 3 years, are negatively impacting the production potential, mainly in the important Tonle Sap Lake region. Considering that the VCIx value at the national scale was as high as 0.88 and the CALF index fell slightly by about 1%, the estimated production in the country is below average.

Regional analysis

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

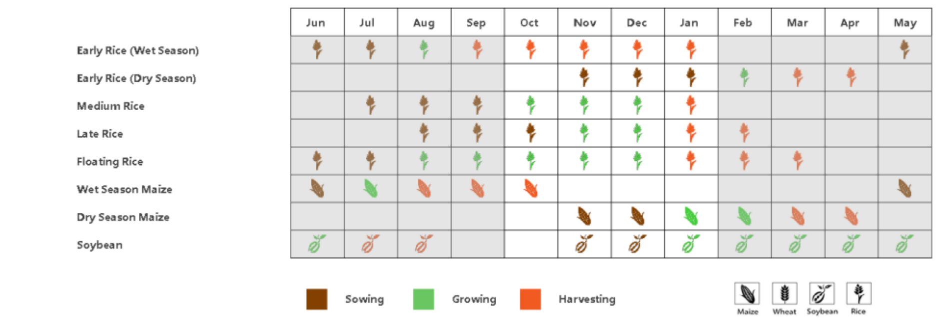
For **Tonle Sap Lake area**, the region experienced an 8% higher cumulative precipitation (RAIN), 0.2°C lower average temperature (TEMP), and about 1% lower radiation (RADPAR), resulting in about 2% higher potential biomass (BIOMSS). However, the NDVI of crops in this region was below average until late December, and the low NDVI was mainly caused by the negative NDVI deviation that occurred in southeastern Banteay Meanchey (orange area), eastern Pursat and western Kampong Thom (red area). In addition, the CALF index in this region was as high as 98% and the VCIx value was 0.89. However, the below average NDVI trajectory indicates slightly below average production levels.

For **Mekong Valley zone**, the precipitation in this zone was significantly higher by 18% (RAIN), the average temperature was about 0.2°C lower (TEMP), radiation was near average (RADPAR), and abundant precipitation resulted in a higher potential biomass (BIOMSS, +2%). Similar to the Tonle Sap Lake zone, NDVI in this zone was likewise below average until late December and then gradually approached average levels. Although the Mekong Valley zone has a high CALF index of 95% and an VCIx index of 0.87， the crop production in this zone is predicted to be sightly below average as .

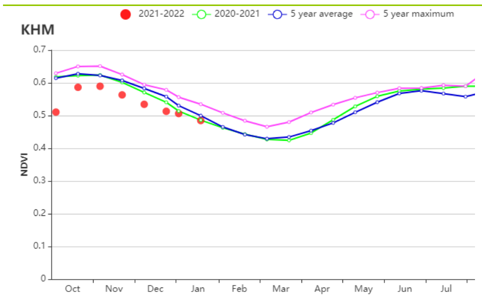
For **northern plains and northwest**, the zone had an 8% higher cumulative precipitation (RAIN), about 0.2°C lower average temperature (TEMP), and about 1% higher radiation (RADPAR), resulting in a potential biomass bias of about 3% (BIOMSS). Crop NDVI in the zone was below the average by about 0.1 in early October, and then was close to the average. The CALF index in the zone reached at 99% and the VCIx value was at 0.92, so the crop production in the zone is estimated to be fair.

For **southwestern hilly region**, the precipitation in this region was 12% above average (RAIN), the average temperature was about 0.2°C lower (TEMP), and the radiation was about 3% lower (RADPAR), resulting in a potential biomass in this region that was also about 2% higher (BIOMSS). In terms of the NDVI profile in this zone, the NDVI was significantly lower than average in the early October and then quickly rose close to average. Therefore, the decrease in NDVI was presumeably due to cloud cover on the satellite images. Thereafter, the NDVI decreased slightly, but quickly recovered to the average level. Meanwhile, the CALF index in this area is as high as 99% and the VCIx index is close to 0.91, so the crop production in this area is predicted to be close to the average.

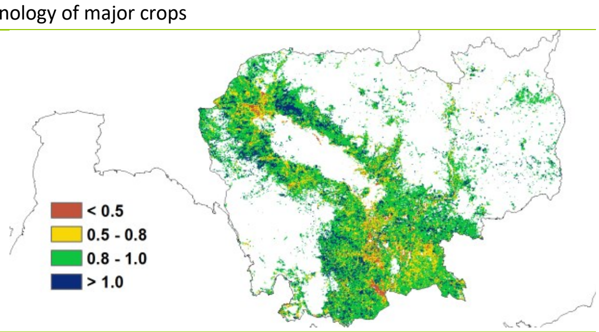
Figure 3.26 Cambodia's crop condition, October 2021 – January 2022



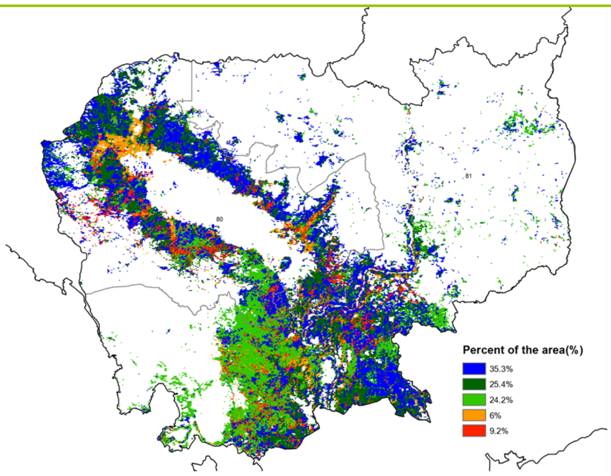
(a). Phenology of major crops

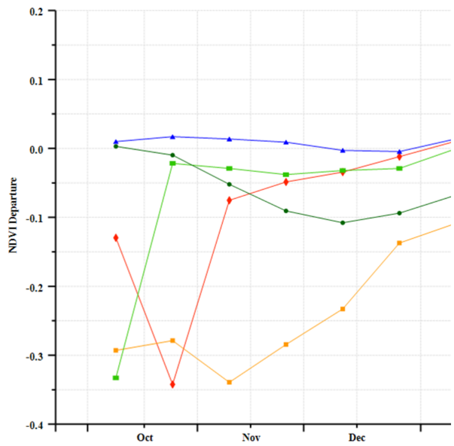


(b) Crop condition development graph based on NDVI

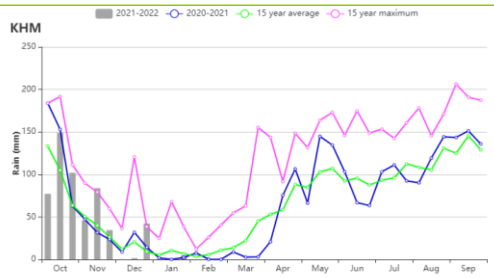


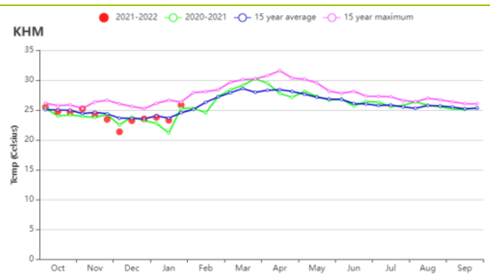
(c) Maximum VCI



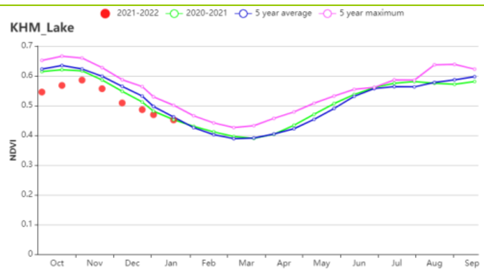


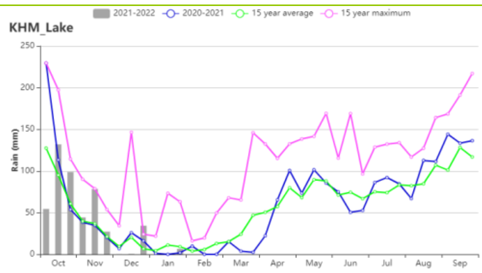
(d) Spatial NDVI patterns compared to 5YA (e) NDVI profiles



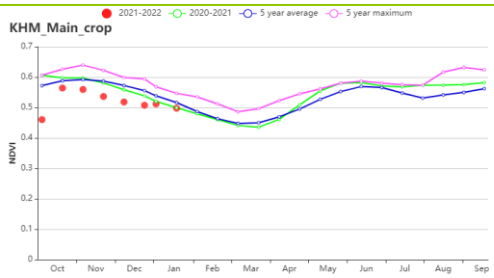


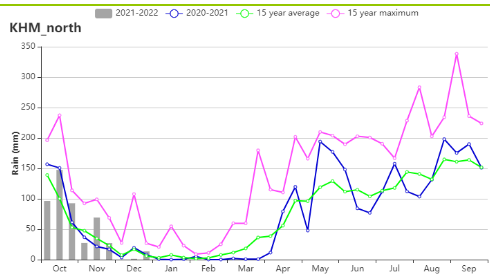
(f) Rainfall profiles (g) Temperature profiles



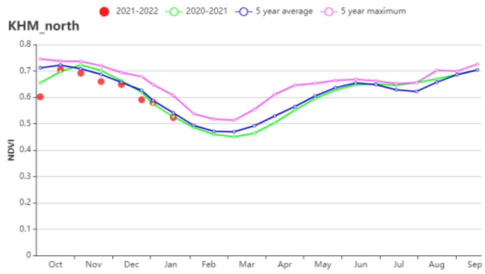


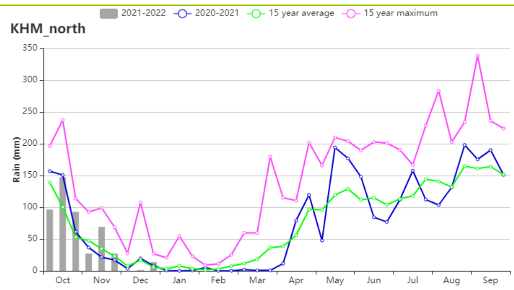
(h) Crop condition development graph based on NDVI (left) and rainfall profiles (right)) in Tonle Sap Lake region



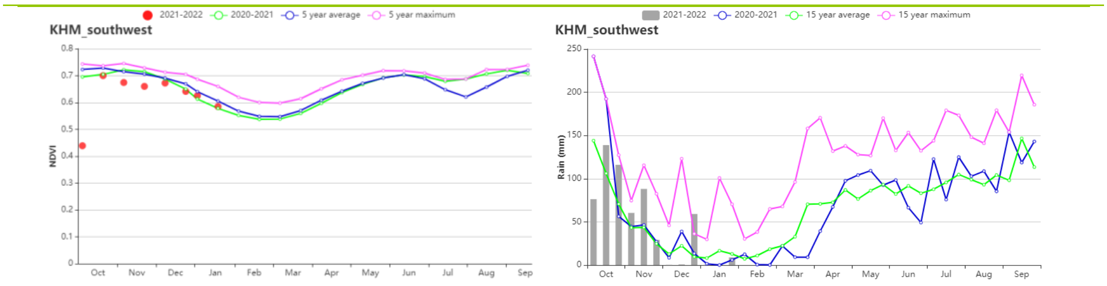


(i) Crop condition development graph based on NDVI (left) and rainfall profiles (right)) in Mekong Valley region





(j) Crop condition development graph based on NDVI (left) and rainfall profiles (right)) in northern plain and northwest



(k) Crop condition development graph based on NDVI (left) and rainfall profiles (right)) in southwest hilly region

Table 3.44 Cambodia's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, October 2021 – January 2022

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Tonle Sap Lake region	478	8	23.9	-0.2	1060	-1	936	2
Mekong valley region	677	18	24.8	-0.2	1092	0	1106	2
Northern plain and northeast region	479	8	23.9	-0.2	1066	1	905	3
Southwest Hilly region	579	12	22.9	-0.2	1055	-3	1036	2

Table 3.45 Cambodia's agronomic indicators by sub-national regions, current season's values and departure from 5YA, October 2021 – January 2022

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Tonle Sap Lake region	98	-1	0.89
Mekong valley region	95	-1	0.87
Northern plain and northeast region	99	0	0.92
Southwest Hilly region	99	0	0.91

[LKA] Sri Lanka

This report mainly covers the main season (Maha) of Sri Lanka, including the sowing and growing of rice and maize from October to January. According to the CropWatch monitoring results, crop conditions were assessed as close to, but slightly below average for the monitoring period.

During this period, the country experienced the Second Inter-monsoon from October to November and the Northeast-Monsoon after that, during which the whole island experienced wide-spread rain with strong winds in the first two months and followed by cold and dry windy weather. At the national level, precipitation was above the 15YA (RAIN +9%), and temperature (TEMP +0.2°C) and radiation (RADPAR +7%) were also above average. The remarkable increase of rainfall in October and November ensured sufficient water supply for the crops and further contributed to the good crop condition. The fraction of cropped arable land (CALF) was comparable to the 5YA. BIOMSS was up by 4% compared to the 15YA. As shown in NDVI development graph, NDVI was generally close to, yet below average during the period. The maximum VCI for the whole country was 0.94.

As shown by the NDVI clusters map and profiles, more than half of country's cropland showed below-average crop condition. These croplands were mainly distributed along the coast of the country, including Provinces of North Western, Western, Eastern and Sabaragamuwa, as well as scattered areas over Provinces of Northern Central. The maximum VCI showed high values all over the country except for some areas along the east and south coast.

Regional analysis

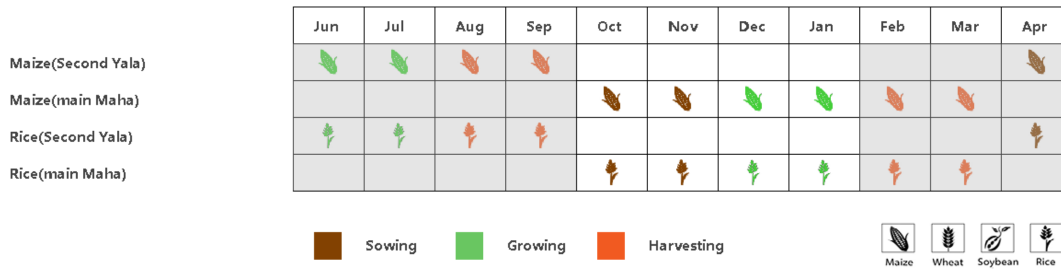
Based on the cropping system, climatic zones and topographic conditions, three sub-national agroecological regions can be distinguished for Sri Lanka. They are the Dry zone, the Wet zone, and the Intermediate zone.

In the **Dry zone**, the recorded RAIN (1030 mm) was 5% above average. TEMP and RADPAR were 0.2°C and 8% above average respectively, and BIOMSS increased by 4% as compared to the 15YA. CALF was near the 5YA level with 99% of cropland utilized. NDVI slightly fluctuated around the average. The VCIx for the zone was 0.93. Overall, crop conditions were near average for this zone.

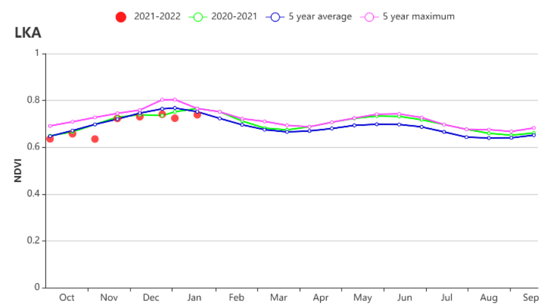
For the **Wet zone**, RAIN (1819 mm) was 14% above average as compared to the 15YA. TEMP was near average and RADPAR increased by 7%. BIOMSS was 2% above the 15YA and cropland was fully utilized. NDVI values showed significant deviation from average in early November and was close to average during other periods. The VCIx value for the zone was 0.97. Crop conditions were below average for this zone.

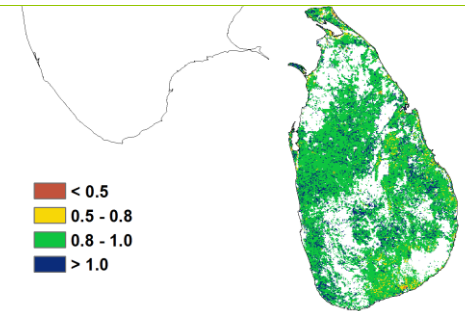
The **Intermediate zone** also experienced sufficient rain (1435 mm) with a 9% increase from the 15YA. TEMP was on average and RADPAR was 7% above average compared to the 15YA. With full use of cropland, BIOMSS was compared to average. The NDVI values were similar to the whole country and the VCIx value for this zone was 0.96. Conditions of crops were close to average.

Figure 3.27 Sri Lanka's crop condition, October 2021 – January 2022



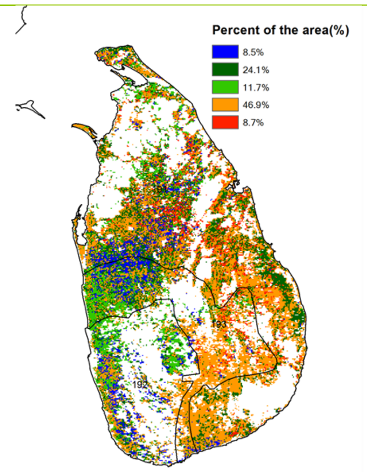
(a). Phenology of major crops

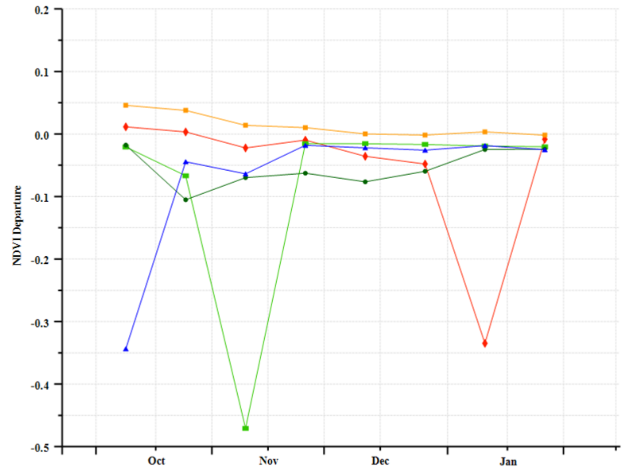




(b) Crop condition development graph based on NDVI

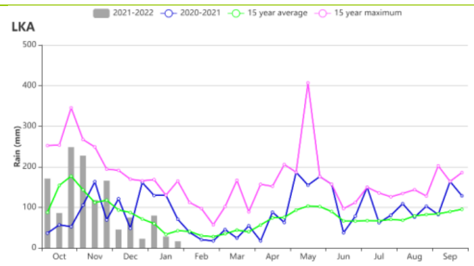
(c) Maximum VCI

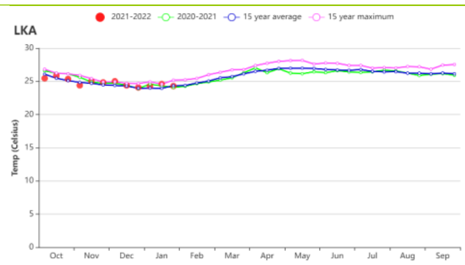




(d) Spatial NDVI patterns compared to 5YA

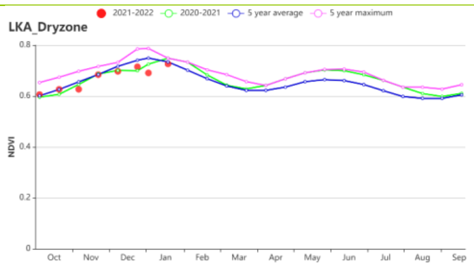
(e) NDVI profiles

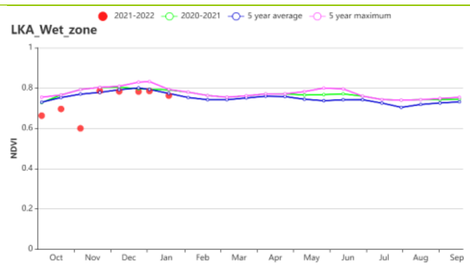




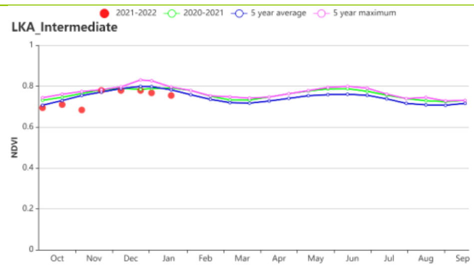
(f) Rainfall profiles

(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 3.46 Sri Lanka's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, October 2021 – January 2022

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Dry zone	1030	5	25.2	0.2	1195	8	1421	4
Wet zone	1819	14	24.1	0.1	1123	7	1438	2
Intermediate zone	1435	7	23.4	0.0	1099	7	1335	0

Table 3.47 Sri Lanka's agronomic indicators by sub-national regions, current season's values and departure from 5YA, October 2021 – January 2022

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Dry zone	99	0	0.93
Wet zone	100	0	0.97
Intermediate zone	99	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

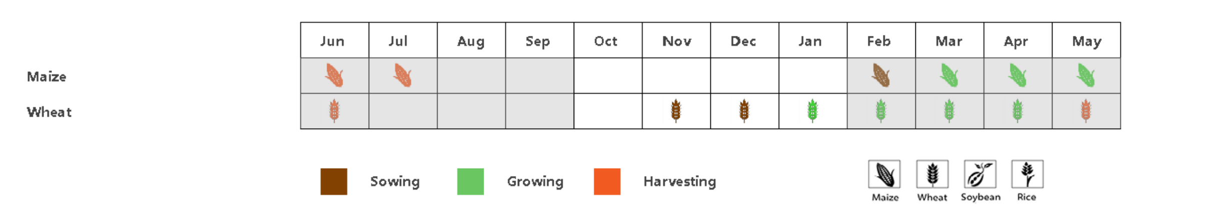
[MAR] Morocco

During this monitoring period, winter wheat, barley, and legumes are Morocco's main crops. Winter wheat sowing started in November and was completed in December. The CropWatch agro-climatic indicators show that rain and temperature were 51% below and 0.1°C above the 15-year average (15YA), respectively. According to the rainfall profile, high rainfall (>20 mm) fell in late-November and late-December. The temperature profile fluctuated near the 15YA but was below the 15YA during November. The RADPAR was 6.2% above the 15YA, while the BIOMSS was 29% below the 15YA. The nationwide NDVI graph indicates that crops conditions were below the 5YA across the study period. The NDVI spatial clustering map shows that conditions of only 10.3% were above the 5YA. The cereal production in Morocco is heavily dependent on rainfall since only 15% of the country's cropland is irrigated. This explains the below-average crop conditions. The country's VCIx value was 0.50, and the CALF was below the 5YA by 28%. Generally, crop conditions were below normal.

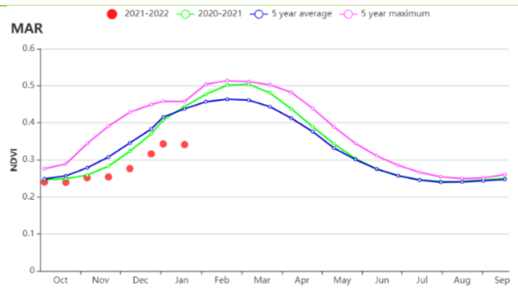
Regional analysis

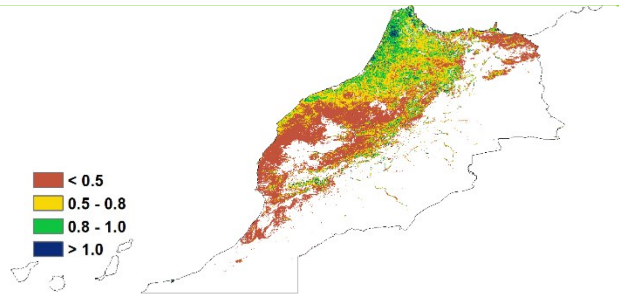
CropWatch adopts three agro-ecological zones (AEZs) relevant for crop production in Morocco: The Sub-humid northern highlands, the Warm semiarid zone, and the Warm sub-humid zone. All agro-climatic indicators measured for these three AEZs show nearly the same patterns. The rainfall for the three zones were 46%, 67%, 45% below the 15YA, respectively. The temperature was 0.2°C above the 15YA in the first and third zones and the same as the 15YA in the second zone. The RADPAR was above the 15YA by 7%, 6%, and 7%, while the BIOMSS was below the 15YA by 25%, 35%, and 25% for the three zones. In the three zones, the crop conditions based on the NDVI graph are indicated below the 5YA. Compared to the 5YA, CALF decreased by 21%, 58%, 10%, and the maximum VCI was lowest at 0.60, 0.35, 0.67 in the three zones.

Figure 3.28 Morocco's crop condition, October 2021 - January 2022



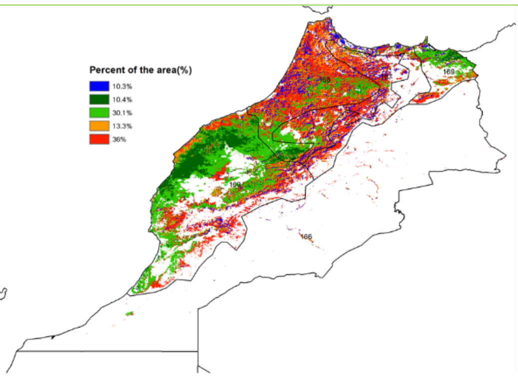
(a). Phenology of major crops

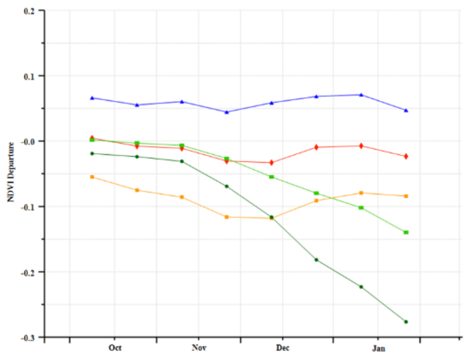




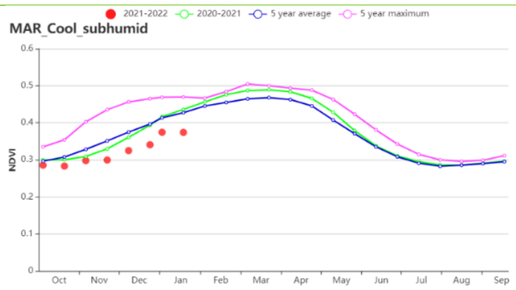
(b) Crop condition development graph based on NDVI

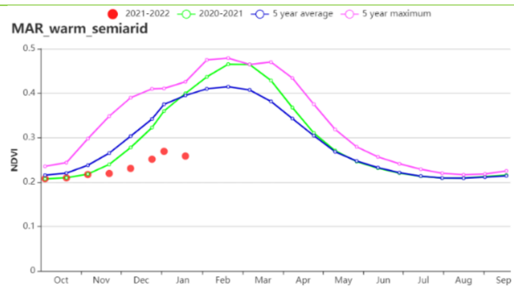
(c) Maximum VCI



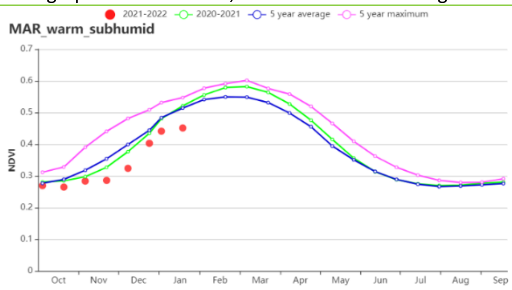


(d) Spatial NDVI patterns compared to 5YA (e) NDVI profiles

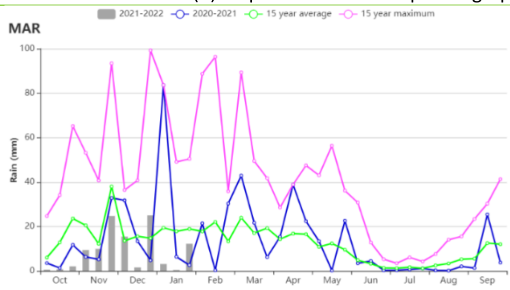


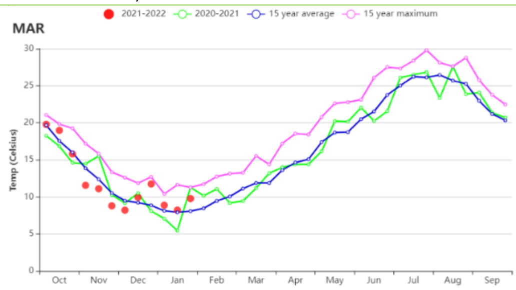


(f) crop condition development graph based on NDVI, Sub-humid northern highlands and (g) Warm semiarid zones



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





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

Table 3.48 Morocco's agroclimatic indicators by sub-national regions, current season's values, and departure from 15YA, October 2021 - January 2022

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m²)	Departure from 15YA (%)	Current (gDM/m²)	Departure from 15YA (%)
Sub-humid northern highlands	150	-46	10	0.2	781	7	400	-25
Warm semi-arid zones	47	-67	13	0.0	857	6	262	-35
Warm sub-humid zones	148	-45	12	0.2	777	7	409	-25

Table 3.49 Morocco's agronomic indicators by sub-national regions, current season's values, and departure from 5YA, October 2021 - January 2022

Region	CALF		Maximum VCI
	Current (%)	Departure from 5YA (%)	Current
Sub-humid northern highlands	34	-21	0.60
Warm semi-arid zones	13	-58	0.35
Warm sub-humid zones	59	-10	0.67

[MEX] Mexico

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

The CropWatch agroclimatic indicators show that RAIN decreased by 14% and TEMP increased by 0.6°C and RADPAR was above average (+6%). Accordingly, BIOMSS decreased by 6% as compared to the 15YA due to decreased RAIN. CALF was close to average and reached 85%. The VCI was 0.84.

In terms of Agro-climatic conditions, the national precipitation and temperature was at the average level during the monitoring period of this bulletin. According to figure b, crop growth was also at an average level. According to VCI spatial patterns, very high values (greater than 1.0) occurred mainly in eastern coastal areas, including Tamaulipas. Extremely low values (less than 0.5) occurred in the northeast border area, mainly in the Nuevo León, Coahuila de Zaragoza and western coastal areas.

As shown in the spatial NDVI profiles and distribution map, 55.4% of the total cropped areas were above average during the entire monitoring period, mainly distributed in the northeast and south coastal areas. 44.7% of the total cropped areas were below average, mainly in Sinaloa.

Overall, the crop conditions were slightly below the average level. Mexico still has not fully recovered from the prolonged drought conditions. Low water levels in the reservoirs explain the below-average conditions in irrigated regions, especially in Sinaloa.

Regional analysis

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

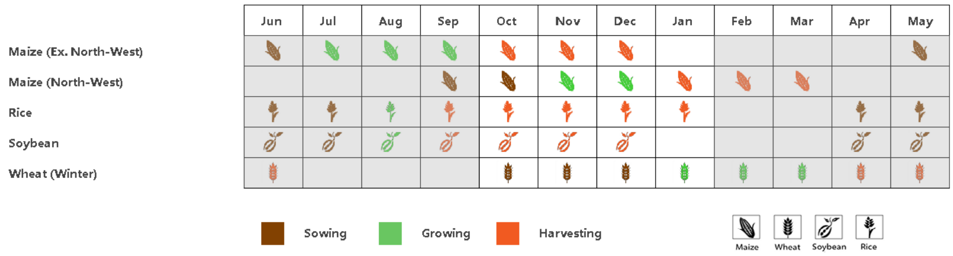
The Arid and semi-arid region, located in northern and central Mexico, accounts for about half of planted areas in the country. The agro-climatic condition showed that RAIN decreased by 22%, TEMP increased by 1°C and RADPAR increased by 3%. According to the NDVI development graph, crop condition in this region was below the average. CALF increased by 3% compared with the 5YA. The Arid and semi-arid region was one of the most drought affected region and the VCIx was 0.74.

The region of Humid tropics with summer rainfall is located in southeastern Mexico. RAIN was slightly below average (-4%), TEMP was 0.5℃ warmer, RADPAR increased by 9% and BIOMSS increased by 6%. As shown in the NDVI development graph, crop conditions were close to average from October to January. CALF was 100%. The VCIx (0.91) confirmed favorable crop conditions in this region.

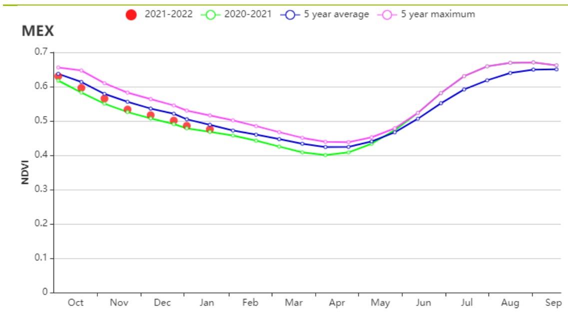
The Sub-humid temperate region with summer rains is situated in central Mexico. According to the NDVI development graph, crop conditions were below but close to average, and later recovered to average levels. The agro-climatic conditions were close to the average level. RAIN decreased by 27%, TEMP increased by 0.3°C, and RADPAR increased by 7% compared to the 15YA. BIOMSS decreased by 14% and CALF was 97%. High CALF made VCIx reach 0.92.

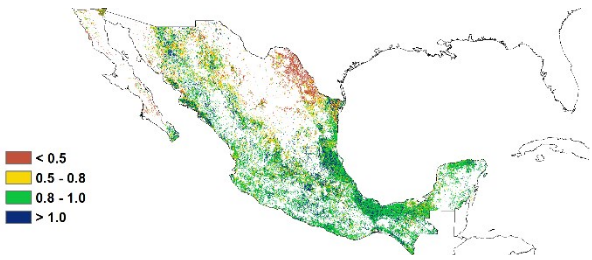
The region called Sub-humid hot tropics with summer rains is located in southern Mexico. During the monitoring period, crop conditions were close to average in four months as shown by the NDVI time profiles. Agro-climatic conditions were close to average levels, including RAIN (-17%), TEMP (+0.5℃) and RADPAR (+6%). CALF was 98% The VCIx for the region was 0.92 and BIOMSS was near average.

Figure 3.29 Mexico's crop condition, October 2021 - January 2022

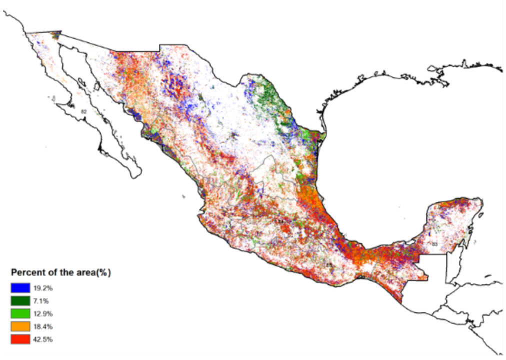


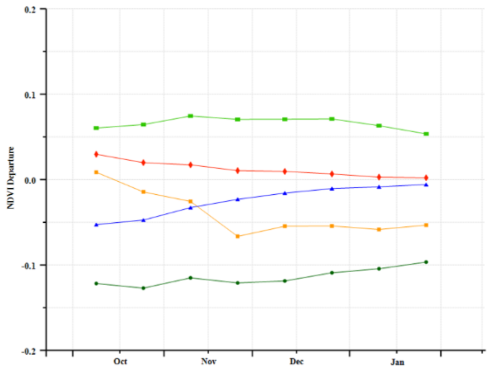
(a) Phenology of major crops



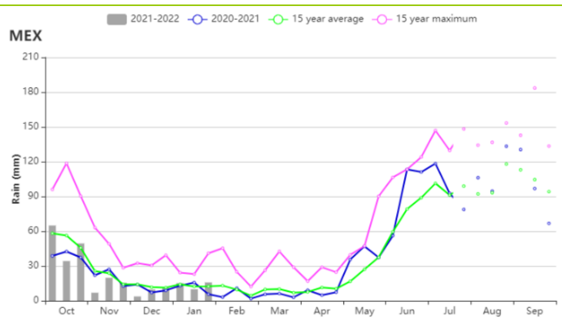


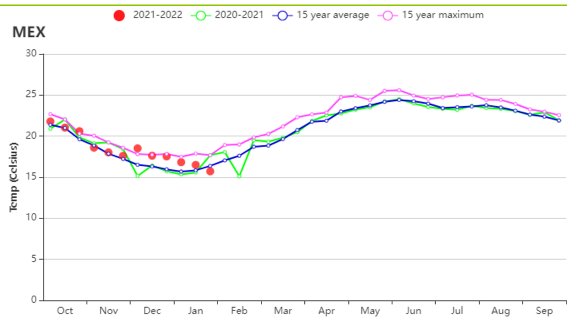
(b) Crop condition development graph based on NDVI (c) Maximum VCI



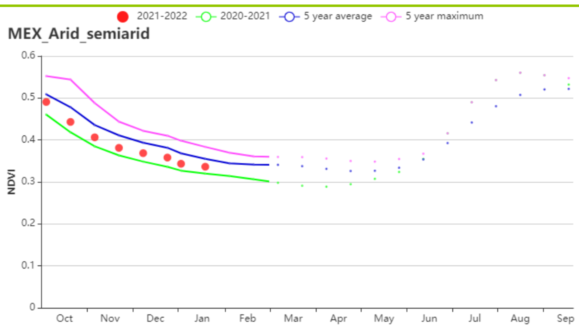


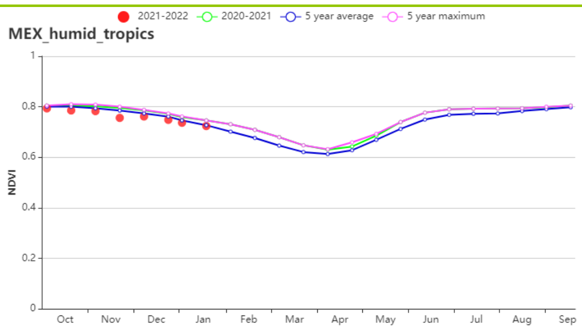
(d) Spatial NDVI patterns compared to 5YA (e) NDVI profiles



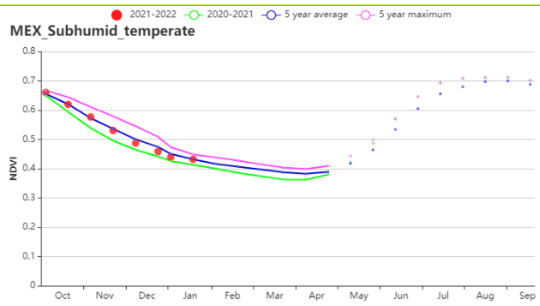


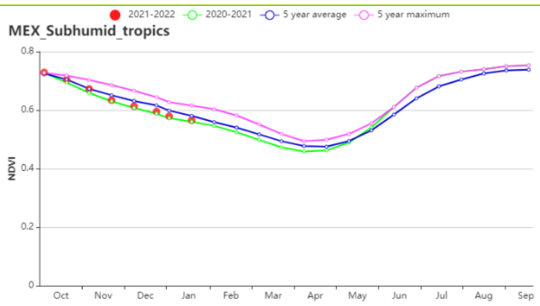
(f) Rainfall profiles (g) Temperature profiles





(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 3.50 Mexico's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, October 2021 - January 2022

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Central region	105	-22	15.8	1.0	997	3	384	-9
Dry region	548	-4	22.4	0.5	1043	9	1006	6
Dry and irrigated cultivation region	208	-27	16.4	0.3	1149	7	509	-14
Dry and grazing region	271	-17	19.7	0.5	1077	6	605	-8

Table 3.51 Mexico's agronomic indicators by sub-national regions, current season's values and departure from 5YA, October 2021 – January 2022

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Central region	67	-4	0.74
Dry region	100	0	0.91
Dry and irrigated cultivation region	97	3	0.92

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Dry and grazing region	98	1	0.92

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[MMR] Myanmar

During this reporting period, the rainy season came to an end. The planting of maize started in October. Its harvest will begin about 4 months later. The main rice was harvested as well in October and November, while the second rice was planted in November and December. During this monitoring period, the crop conditions for most of the country were fair.

Compared to the 15YA, RAIN was lower (-16%) while TEMP was higher (+0.3ºC), and RADPAR was up by 3%. As a result, BIOMSS was 4% below the average. The utilization of cropland was the same as the 5YA. NDVI values were close to average during the entire period. The maximum VCI during this period was 0.91.

A majority of the country's croplands suffered from slightly below-average crop conditions during the period. The above-average crop condition with positive NDVI departures accounted for 29.4% of the cropland that were mainly located in Central Plain and the Hills in the east. The remaining 70.6% trended below average throughout this monitoring period. The military takeover and its armed conflict against the civil population seems to be taking a toll on crop production. The abnormally low NDVI departure values in October were most likely caused by cloudy weather. The maximum VCI showed high values over most regions of the country.

Regional analysis

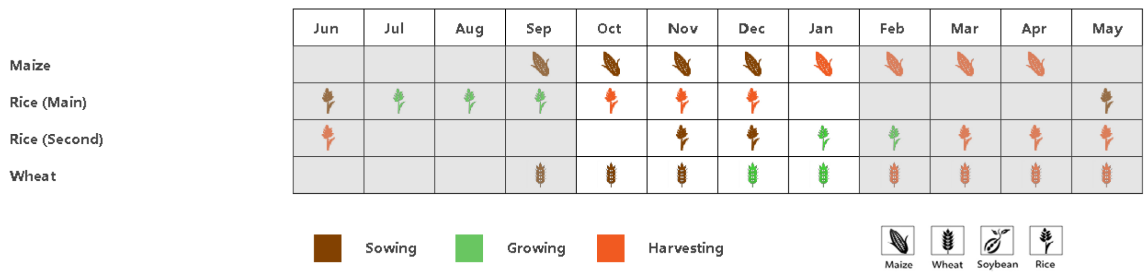
Three sub-national agro-ecological zones (AEZ) can be distinguished for Myanmar based on the cropping system, climatic zones and topographic conditions. They are the Central plain, the Hills and the Delta and Southern Coast regions.

The **Central Plain** had a marked rainfall deficit (RAIN -34%), with RADPAR up by 3% and TEMP up by 0.7ºC compared to the 15YA. BIOMSS was 9% lower than the 15YA. CALF showed that 99% of the cropland was fully utilized, the same as the 5YA. NDVI was slightly below the 5YA level during the whole period. The VCIx was 0.91. Crop conditions for this region were slightly below average.

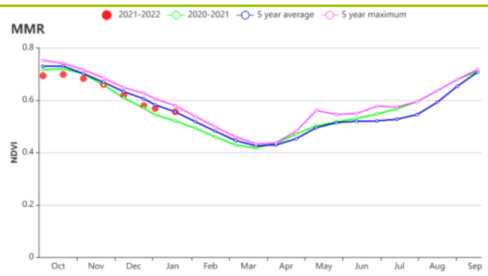
The **Hills** region also had below-average rainfall, at 278mm, with RAIN below the 15YA (-18%). RADPAR was 3% above average and TEMP increased by 0.2ºC. BIOMSS was 3% below the 15YA. The cropland was almost fully used (CALF +99%). The NDVI values were close to the 5YA during the whole period. The VCIx was 0.93. Crop conditions are assessed as close to the 5YA level.

The **Delta and Southern Coast** region had the highest RAIN (401 mm) compared with the other two sub-national regions, and it was 9% above the 15YA. TEMP and RADPAR increased by 0.1ºC and 1% respectively. BIOMSS was close to the 15YA. CALF was comparable to the 5YA and VCIx was 0.92. The NDVI values were below the 5YA especially in October. Crop conditions in this region were below average.

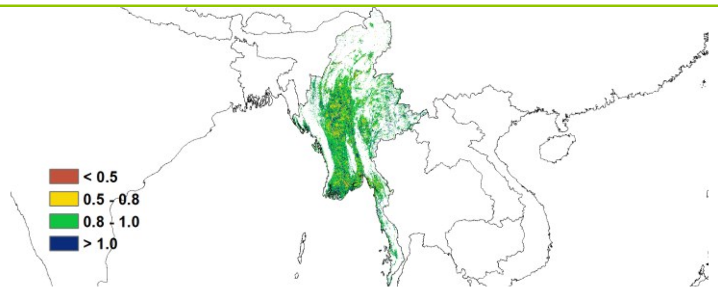
Figure 3.30 Myanmar's crop condition, October 2021 – January 2022



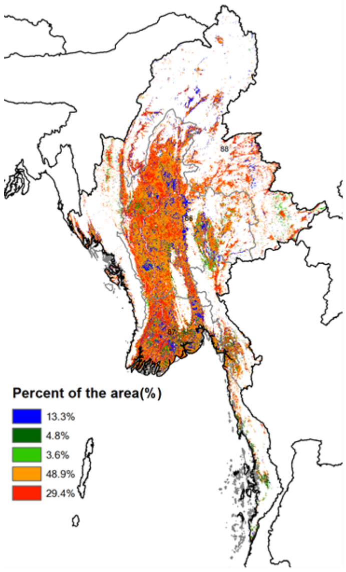
(a). Phenology of major crops

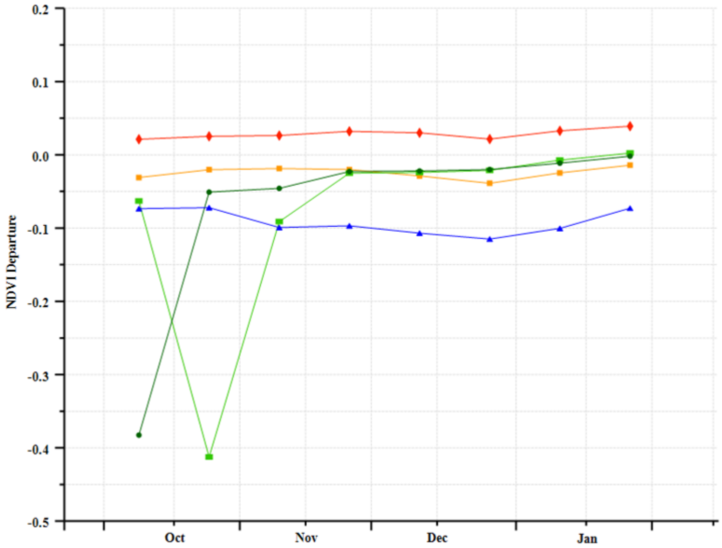


(b) Crop condition development graph based on NDVI



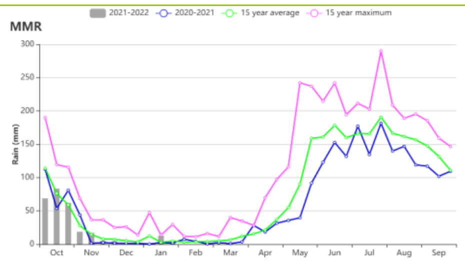
(c) Maximum VCI

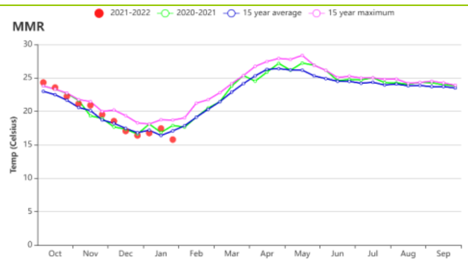




(d) Spatial NDVI patterns compared to 5YA

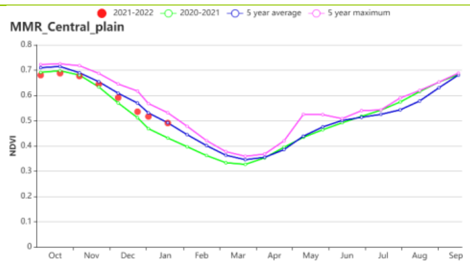
(e) NDVI profiles

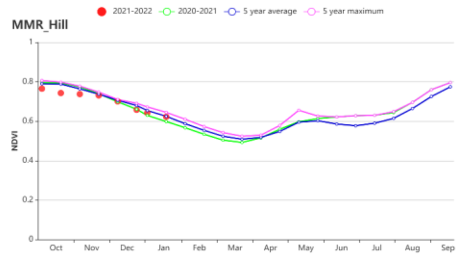




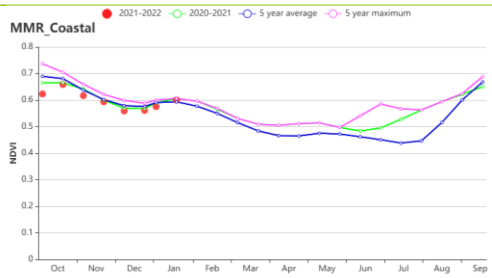
(f) Rainfall profiles

(g) Temperature profiles





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



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

Table 3.52 Myanmar's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, October 2021 – January 2022

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Central plain	202	-34	19.8	0.7	1051	3	587	-9
Hills region	278	-18	17.3	0.2	1014	3	615	-3
Delta and southern-coast	401	9	24.7	0.2	1129	1	817	-1

Table 3.53 Myanmar's agronomic indicators by sub-national regions, current season's values and departure from 5YA, October 2021 – January 2022

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Central plain	99	0	0.91
Hills region	99	0	0.93
Delta and southern-coast	98	0	0.92

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[MNG] Mongolia

No crops were cultivated in Mongolia during the monitoring period from October 2021 to January 2022. This country only grows summer crops from May to September. Among the CropWatch agroclimatic indicators, RAIN was slightly below average, RADPAR was equal to the 15YA, and temperatures were above average (TEMP +1.7°C). The temperature profile shows that Mongolia was warmer than usual starting from mid-November. Simulated BIOMSS increased by 5%, and the national average VCIx was 0.93.

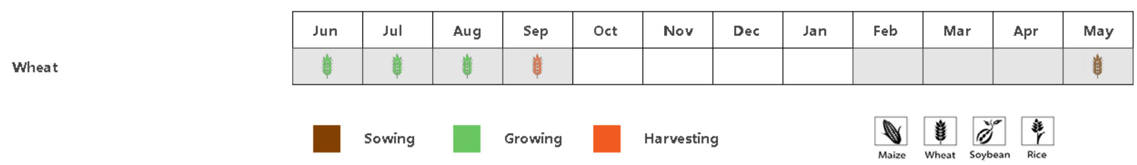
Regional analysis

In the **Hangai Khuvsgul Region**, accumulated rainfall was slightly below average (RAIN -7%), while the temperature was above average (TEMP +1.6°C). RADPAR was equal to average, and BIOMSS was slightly above average (4%).

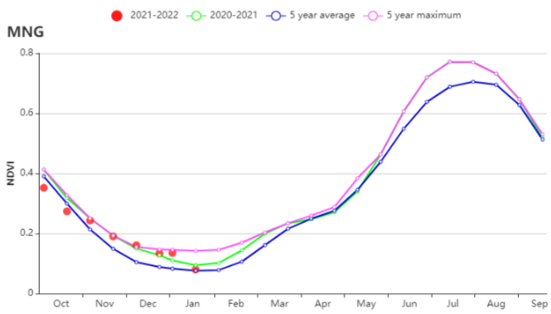
The **Selenge-Onon Region** is the main production area of spring wheat. RAIN decreased by 3%, TEMP increased by 1.8°C, RADPAR was equal to the average, and BIOMSS increase by 6%. Overall, the agroclimatic conditions in this region were normal.

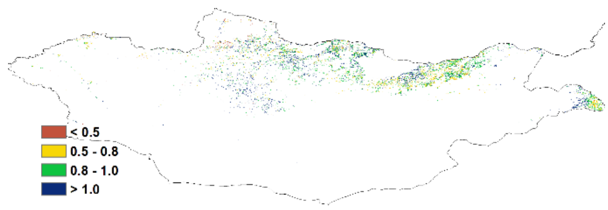
The **Central and Eastern Steppe Region** was the only one with increased precipitation (RAIN +5%) among the three regions. TEMP was above average (1.6°C), while RADPAR decreased by 2%. Consequently, BIOMSS increased by 13%, which was the highest among these regions.

Figure 3.31 Mongolia's crop condition, October 2021 - January 2022



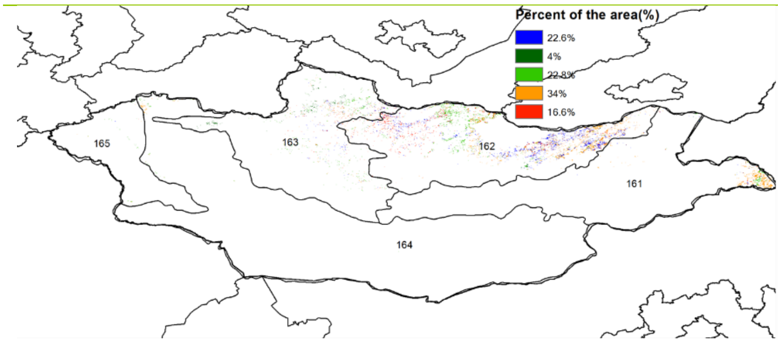
(a) Phenology of major crops

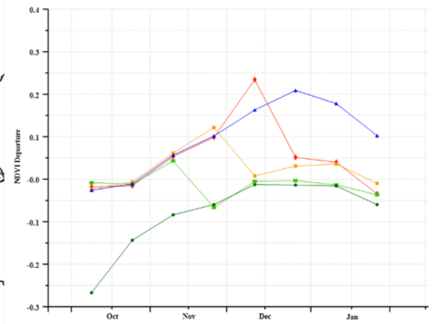




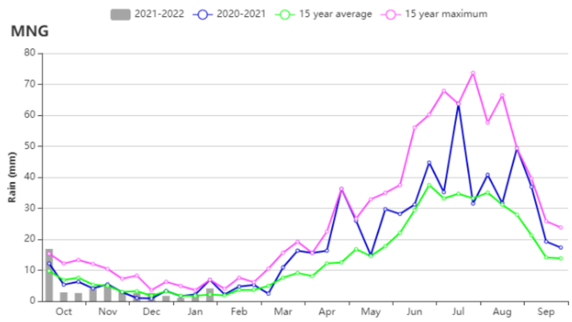
(b) Crop condition development graph based on NDVI

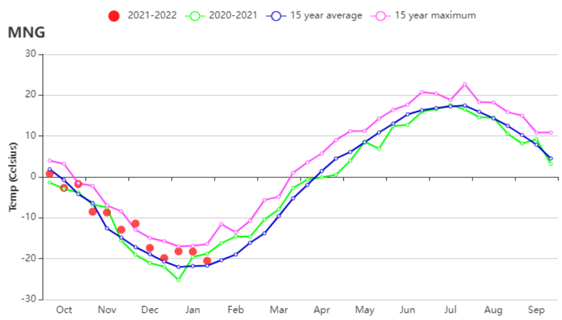
(c) Maximum VCI



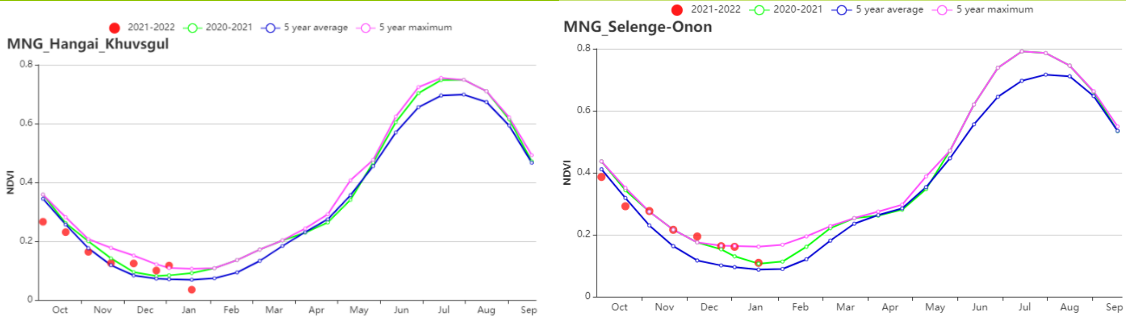


(d) Spatial NDVI patterns compared to 5YA (e) NDVI profiles

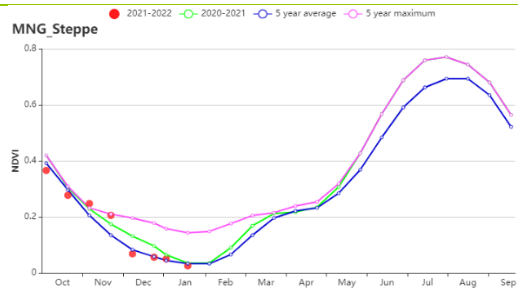




(f) Rainfall profiles (g) Temperature profiles



(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 3.54 Mongolia's agroclimatic indicators by sub-national regions, current season's values, and departure from 15YA, October 2021 - January 2022

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Hangai Khuvsgul Region	42	-7	-13.0	1.6	455	0	103	4
Selenge-Onon Region	49	-3	-10.9	1.8	446	0	130	6
Central and Eastern Steppe Region	65	5	-11.0	1.6	450	-2	157	13
Altai Region	72	-9	-12.4	0.6	418	1	102	-10
Gobi Desert Region	36	-28	-11.5	0.6	410	1	81	-17

Table 3.55 Mongolia's agronomic indicators by sub-national regions, current season's values, and departure from 5YA, October 2021 - January 2022

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Hangai Khuvsgul Region	10	36	0.91
Selenge-Onon Region	34	19	0.94
Central and Eastern Steppe Region	38	196	0.92
Altai Region	5	400	0.74
Gobi Desert Region	9	-4	0.82

[MOZ] Mozambique

Nationwide, the reporting period (October 2021 – January 2022) covers the land preparing, planting and early growth stages of the major crops, i.e., maize, rice and wheat, corresponding to the agricultural season 2021/22. The above-mentioned period was characterized by below-average rains in the northern coast region that contributed to the delay in sowing in the Provinces of Nampula, Cabo Delgado and Niassa. Compared to the previous fifteen years' nationwide average, the rainfall (RAIN) registered a decrease by 30% while both temperature (TEMP) and radiation (RADPAR) increased by 0.5ºC and 1%, respectively. The combination of these factors resulted in a decrease of the total biomass production (BIOMSS) by about 14%.

During this period, the climate adversities had played a negative role in the early growing period of major crops in the north and central region of the country. In late January, these regions were overwhelmed with the tropical cyclone Ana which brought intensive storms and rains. This event left thousands of hectares of cultivated land devastated. This fact is confirmed by the crop condition development graph based on NDVI, which indicates below-average crop conditions during the entire monitoring period compared to the past five years average. The same is also shown by the Spatial NDVI patterns, with only 28.5% (mostly in the southern region, covering the provinces of Maputo, Gaza and Inhambane) of the arable land presenting about average crop conditions. With the CALF recording an increase of just 1% compared to the past 5YA, the country's maximum VCIx was 0.88. Despite the favourable crop conditions recorded in the southern region, generally, crop conditions in Mozambique were unfavourable and below average production is forecasted for the agricultural year 2021/22 if the conditions remain the same throughout the agricultural season..

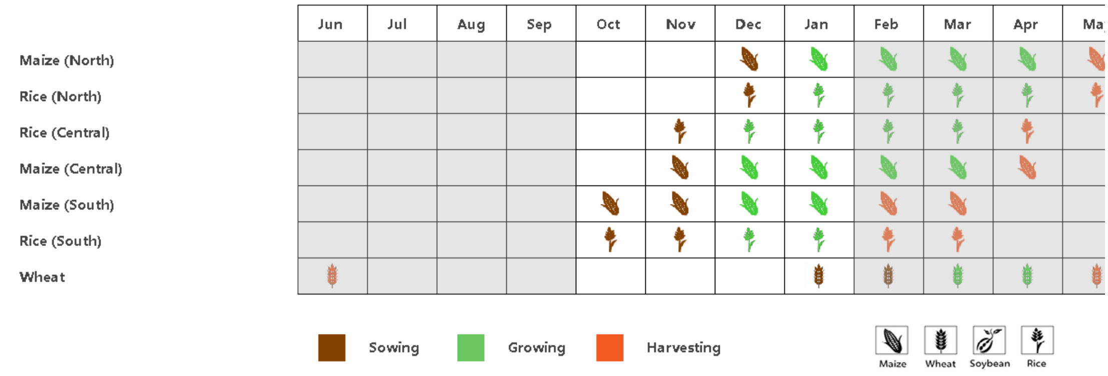
Regional analysis

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

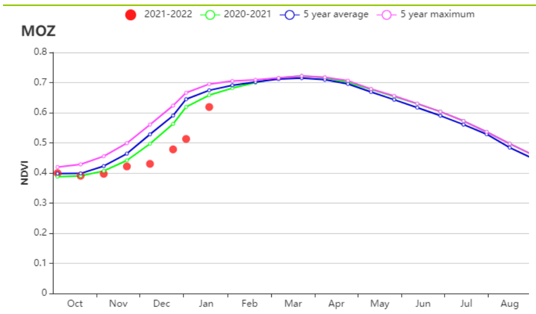
As mentioned in the above national analysis, the climate adversities had a negative impact on crop conditions nationwide. The regional crop conditions based on NDVI indicate that apart from the southern region, crop conditions were unfavourable. In all the agroecological regions, the rainfall significantly decreased. Regions such as the Low Zambezi River basin, Northern high-altitude areas and Buzi basin have recorded the most significant decreases (-43%, -41% and -33%, respectively). Contrary to rainfall, increases in temperature varying from 01ºC to 0.9ºC were verified in all the agroecological zones. Increases were also verified for the radiation, where the Northern high-altitude areas and Low Zambezia River basin presented big increases of 6% and 3%, respectively. Total biomass production decreased in all agroecological zones and significant decreases of 24%, 17% and 16% were observed in the Northern high-altitude areas, Low Zambezia River basin and Northern coast, respectively.

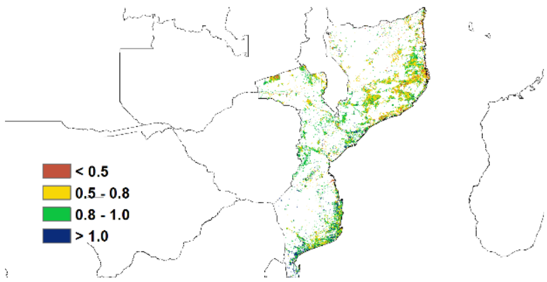
The agronomic indicators for this period relevel that the cropped arable land fraction was near the 5YA in the Buzi basin while decreases of 7% and 3% were observed in the Northern high-altitude areas and the Low Zambezia River basin, respectively. At the same time, increases by 2% in CALF were verified in both the Northern coast and the Southern region. The current maximum VCIx varied from 0.74 to 0.88.

Figure 3.32. Mozambique's crop condition, October 2021–January 2022



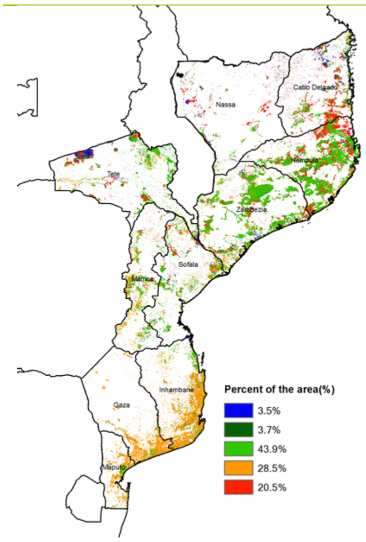
(a) Phenology of major crops

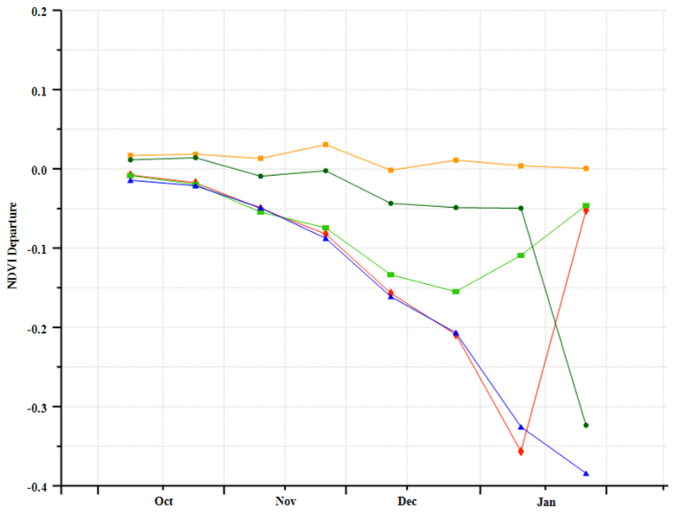




(b) Crop condition development graph based on NDVI

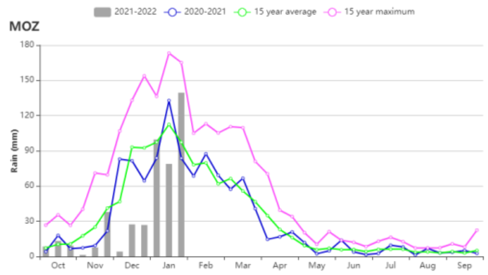
(c) Maximum VCI

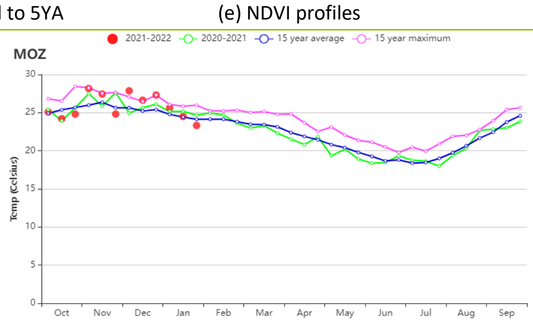




(d) Spatial NDVI patterns compared to 5YA

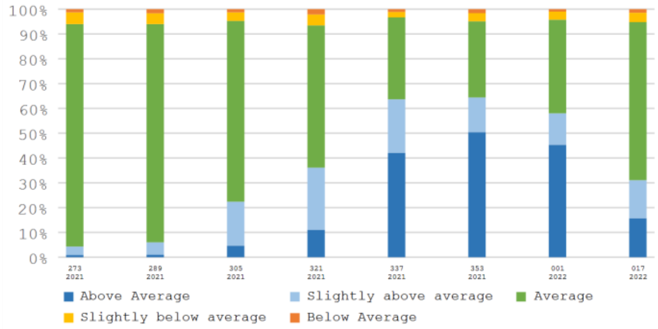
(e) NDVI profiles



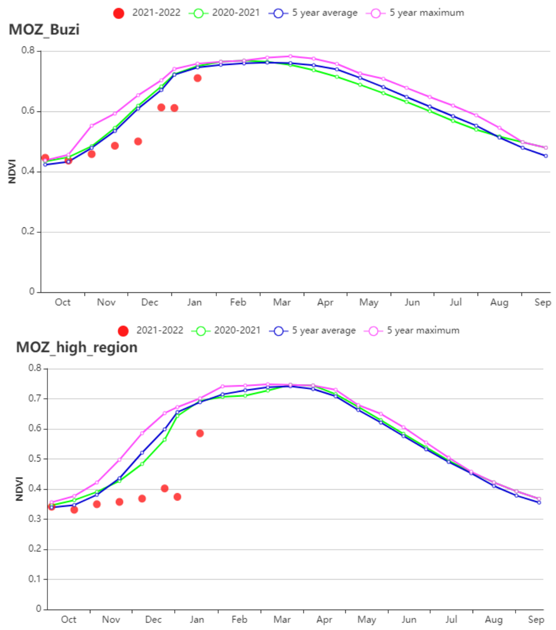


(f) National rainfall profiles

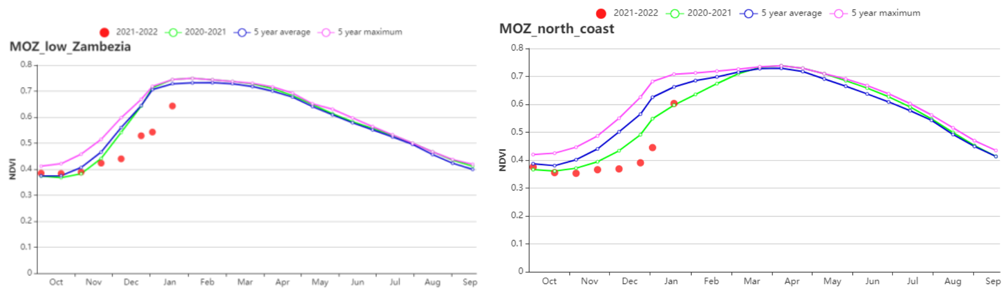
(g) National temperature profiles



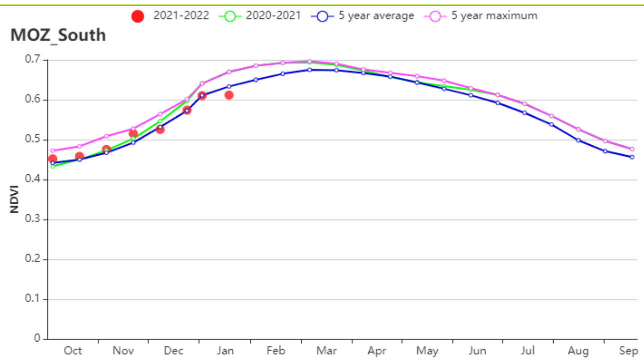
(h) Proportion of NDVI anomaly categories compared with 5YA



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



(j) 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 3.56. Mozambique's agroclimatic indicators by sub national regions, current season's values and departure from 15YA, October 2021 – January 2022

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Buzi basin	499	-33	23.8	0.4	1373	0	1090	-8
Northern high-altitude areas	469	-41	25.1	0.9	1362	6	924	-24
Low Zambezia River basin	409	-43	26.5	0.8	1391	3	976	-17
Northern coast	540	-15	26.4	0.5	1319	1	990	-16
Southern region	369	-24	25.6	0.1	1319	0	1045	-4

Table 3.57. Mozambique's agronomic indicators by sub national regions, current season's values and departure from 5YA, October 2021 – January 2022

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure from 5YA (%)	Current
Buzi basin	100	0	0.87
Northern high-altitude areas	90	-7	0.74
Low Zambezia River basin	96	-2	0.82
Northern coast	94	2	0.74
Southern region	97	2	0.88

[NGA] Nigeria

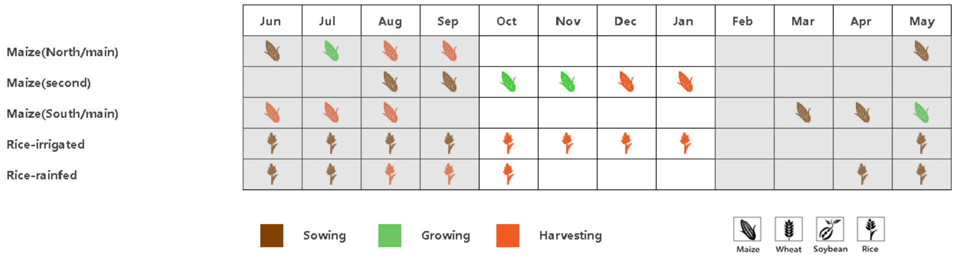
This report covers the beginning of the main dry season in Nigeria, during which, the second season maize, rice and other crops such as sorghum are grown. In the northern region, the harvest of the main maize started in August. It was followed by the sowing of the second season maize, which reached maturity in December or January. In the south, maize was harvested in July and August. The harvesting of rainfed rice started in August, followed by that of irrigated rice two months later.

The Copwatch agroclimatic indicators show that the rainfall was below the 15YA (-25%) and the average temperature was slightly higher than the 15YA (+0.2°C). Rainfall had stayed below the 15YA starting in late August. Solar radiation increased by 5%. Due to low rainfall, the estimated BIOMSS was below the 15YA (-4%). The observed maximum vegetation condition index (VCI) was 0.89 and the CALF was higher than the 5YA (+1%).

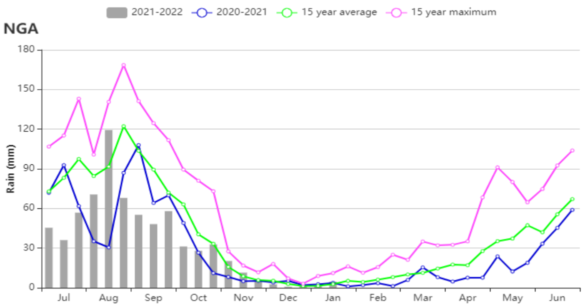
According to the crop condition development graph based on NDVI, the NDVI of the country trended below the 5YA during the reporting period. The maximum VCI graph shows that the lowest value was found in the Sahel savanna region, while the highest values were scattered across the country. As shown in the spatial NDVI profiles and distribution map, about 40.9% of the total cropped areas, mainly distributed in the Guinea and Sudan-Sahel regions, maintained almost a constant value and were near the 5YA during the entire monitoring period. Even though 3% of the country experienced the maximum dip, it can be seen that most parts of the cropped areas are around average. The strong negative departures can be attributed to cloud cover in the satellite images.

All in all, the crop conditions were below average in the Sudano-Sahelien zone and NGA Guinean savanna due to a rainfall deficit. Slightly better conditions, though still below average, were observed for the remaining regions.

Figure 3.33 Nigeria's crop condition, October 2021 - January 2022

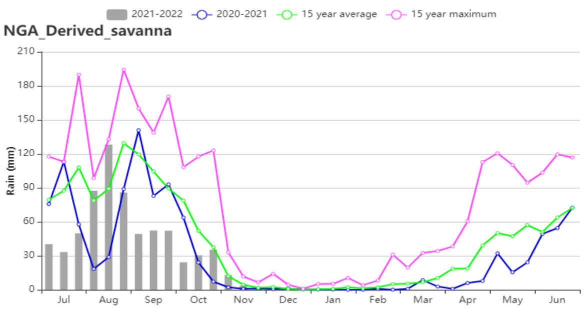


(a) Phenology of major crops



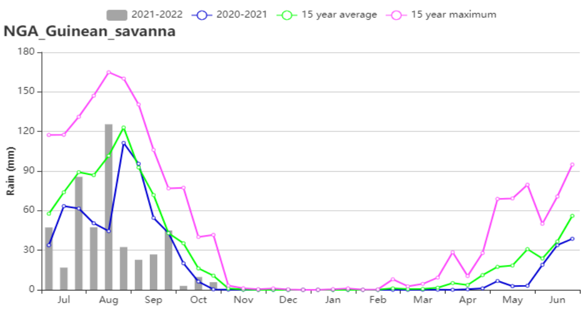
(b) Time series rainfall profile of Nigeria

The highest rainfall is around 120 mm, which is slightly below the 15YA maximum of 170 mm, and the 15YA average reaches 110 mm. And rainfall was relatively low at less than 30 mm within the period of reporting (October-January) which is the dry period.



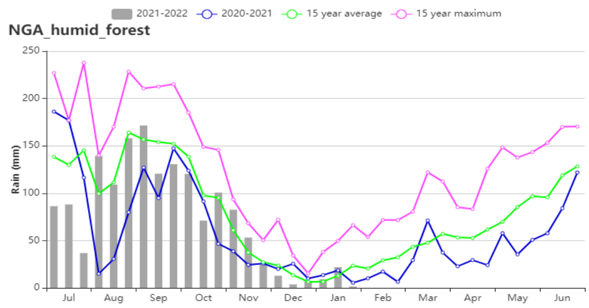
(c) Time series rainfall profile of Derived savanna

The Derived savanna also recorded a maximum raifall of 130 mm. Even though the rainfall stretched over a long period of time, it still did not reach the 15YA in the region. There was fluctuation between October and November, with 0 mm rainfall for the rest of the period.



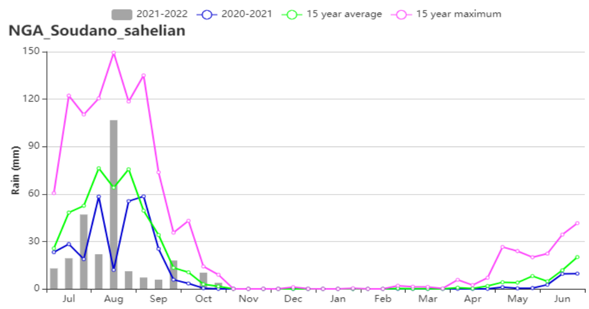
(d) Time series rainfall profile of Guinea savanna

Rainfall in the Guinea savanna region was not stable as it fluctuated between months but the highest rainfall was recorded at 130 mm in August 2021. The month of October up to January recorded the least or no rainfall.



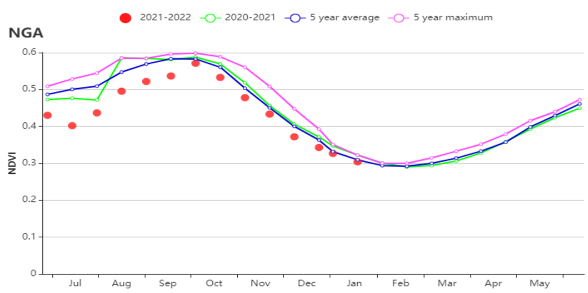
(e) Time series rainfall profile of Humid forest

In the Humid forest,there had been more rainfall. The maximum raifall was about 170 mm and the region had experienced a steady increase in rainfall from July to September and it started to decrease towards November. Even though December and January recoreded the lowest raifall within the period the region still received significant amount of rainfall in the month of October 2021.



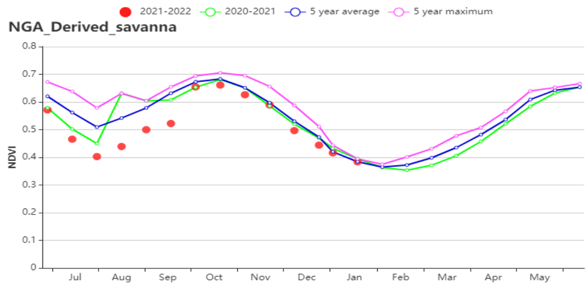
(f) Time series rainfall profile of Sudan Sahel region

In Sudan Sahel region, the maximum rainfall of 115 mm was recorded in August while the lowest was around October. No rainfall was recorded from November 2021 to January 2022. This region had experienced the least rainfall. This is the period when farmers have to rely on irrigation farming.



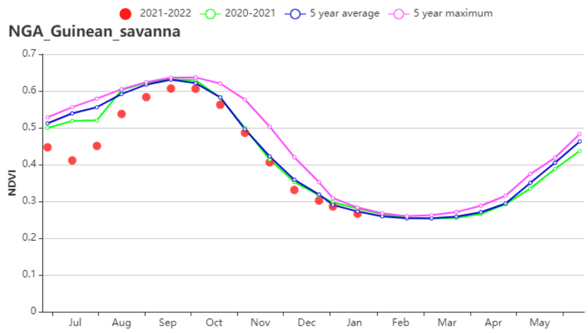
(g) Crop condition development graph based on NDVI

Generally, the NDVI for the country gained a steady increase from the month of July 2021 to January 2022 compared to values recorded between January and May 2021, with the maximum value recorded for the period being 0.58 between September to October 2021 and it is relatively close to the 5YA.



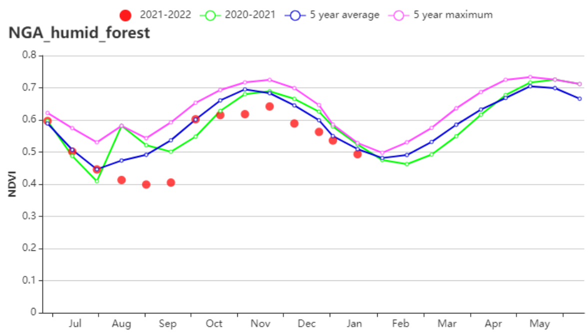
(h) Crop condition development graph based on NDVI

The Derived savanna also recorded a decline in the NDVI value in the month of July-August which increased to 0.66 in october 2021, but started to decline towards December 2021. The NDVI value for this region is also close to the 5YA.



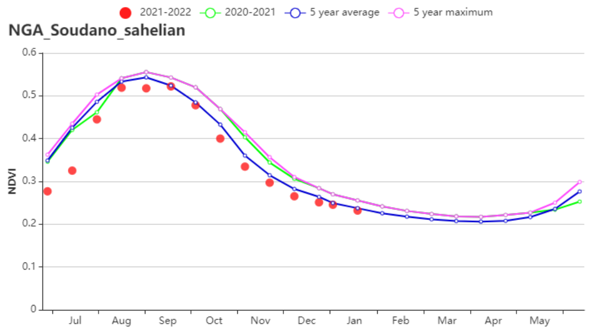
(i) Crop condition development graph based on NDVI

The NDVI in the Guinea savanna recorded its highest value in September-October 2021 reaching 0.61 while the lowest value is 0.28 for the region. The maximum NDVI value for the region within the period is 0.49 and it is near the 5YA.



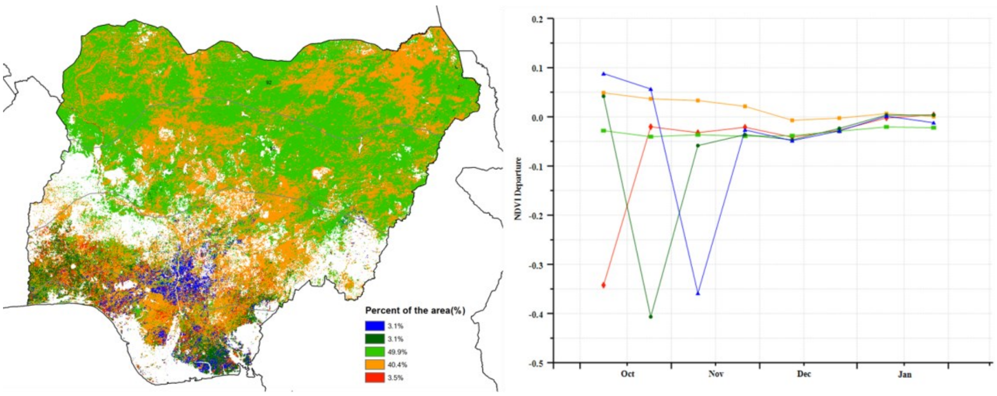
(j) Crop condition development graph based on NDVI

In the Humid forest, the NDVI recorded a high value of 0.6 in June, which dropped quickly to 0.4 between August and September 2021. It gained a significant increase from 0.59 between April-May 2021 to 0.65 in November 2021. Then it started to decline again in December. The graph above shows that the maximum NDVI value within the period falls below the 5YA while the values for December and January are in line with the 5YA.



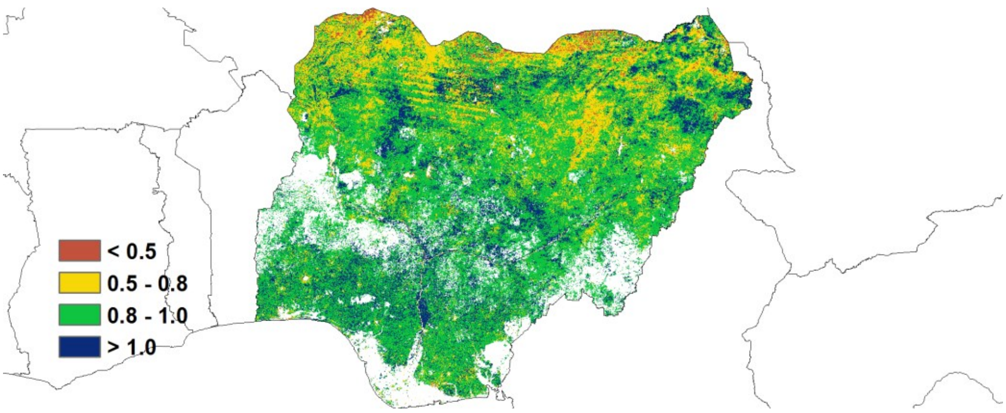
(k) Crop condition development graph based on NDVI

In the Sudan Sahel, the NDVI value increased to 0.28 in the month of June 2021 compared to the value of 0.26 in January 2021. It further increased to about 0.51 in September 2021 being the maximum value recorded. But by January it had dropped to 0.23, while on average, the NDVI values for the period are in line with the 5YA.



(l) Spatial distribution of NDVI profiles

As shown in the figure (l) above (spatial NDVI profiles and distribution map) about 40.9% of the total cropped areas maintained almost a constant value and were near the 5YA during the entire monitoring period and they were mainly distributed in the Guinea and Sudan Sahel regions. Even though 3% of the country experienced the maximum decrease, it can be seen that most parts of the cropped areas are around average.



(m) Maximum VCI

The figure above shows the VCI values. The minimum VCI is less than 0.5, observed in the northernmost fringes of the Sudan Sahel region. while the most observed in the central shows the VCI range from 0.8-1.0 (green colour). The maximum VCI is greater than 1.0 and is sparingly distributed across the country.

Table 3.58 Nigeria's agro-climatic indicators by sub-national regions, current season's values and departure from 15YA, October 2021 - January 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	14	-6	24.3	-0.1	1275	2	448	10
Guinea savanna	19	-70	24.4	0.3	1316	2	465	-10
Derived savanna	109	-44	25.6	0.4	1297	4	606	-10
Humid forest	508	-7	26.1	0.2	1219	3	1012	-2

Table 3.59 Nigeria's agronomic indicators by sub-regions, current season's values and departure from 5YA, October 2021 -January 2022

region	CALF		VCI
	Current(%)	Departure from 5YA(%)	Current
Sudan-Sahel savanna	66	4	0.83
Guinea savanna	98	0	0.89
Derived savanna	99	0	0.96
Humid forest	98	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

[PAK] Pakistan

This reporting period covers the planting and vegetative growth of winter wheat, as well as the harvest of maize and rice in October. Crop conditions were favorable from October 2021 to January 2022.

Nationwide, RAIN (+23%) was above average, TEMP (-0.5 ° C) was below and RADPAR (0%) was close to the 15YA. The three main agro-ecological regions had above average rainfall during this reporting period: The Lower Indus river basin in south Punjab and Sind (+167%), Northern highland (+2%) and Northern Punjab (+183%). Temperatures were below average in the three regions. The combination of all the agro-climatic indicators resulted in a BIOMSS increase by 13% compared to the fifteen-year average.

October and November covered the senescence and drying down of rice, maize and cotton. Hence, the NDVI values provide little insights into the crop conditions. At the national level, they were above the average of the last five years in October, as shown by the NDVI development graph. Later in November the conditions decreased to below average, 32.3% of the cropped areas were slightly below average, mainly in the north of Sind, along the lower Indus river, some areas of Northern highland and Northern Punjab. Winter wheat was sown in November. Most of the Punjab and the lower Indus river basin, the two major wheat producing areas, had above-average condition according to the spatial NDVI patterns and profiles. The national average of VCIx was 0.79 and CALF increased by 11%. Winter wheat prospects are favorable.

Regional analysis

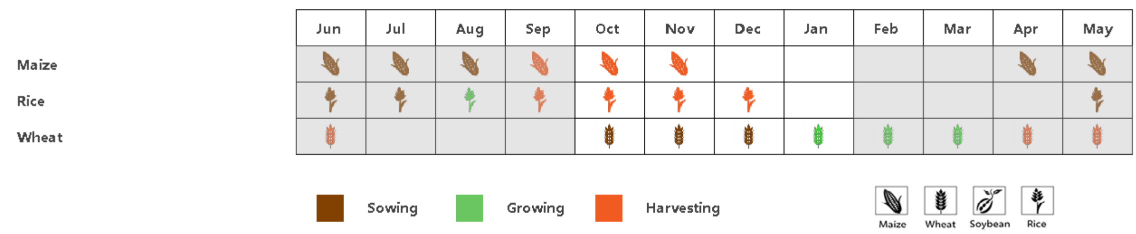
For a more detailed spatial analysis, CropWatch subdivides Pakistan into three agro-ecological regions based essentially on geography and agro-climatic conditions: the Northern highlands, Northern Punjab region and the Lower Indus river basin.

In the **Lower Indus river basin in south Punjab and Sind**, RAIN was sharply above average by 167%, while TEMP was on average and RADPAR was below average by 1%. BIOMSS was up by 26% as compared to the fifteen-year average. During early stages of winter wheat growth, from December to January, crop conditions based on NDVI development profiles were above average and exceeded the maximum value in January. More arable land was planted confirmed by the CALF at 76%. It was higher than the previous five years average by 14%. VCIx at 0.92 indicated favorable crop condition. Generally, crops have good prospects.

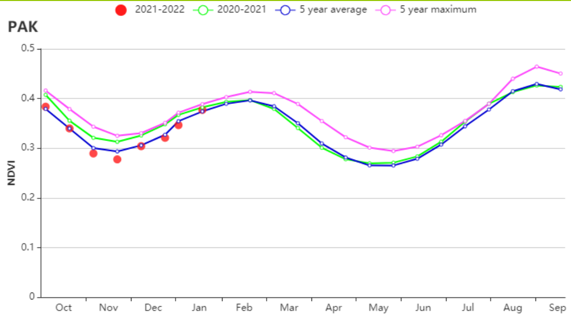
RAIN (+2%) was slightly above average in the **Northern highland** region, together with higher RADPAR (+1%) and lower TEMP (-0.7 ° C). As a result, estimated BIOMSS decreased by 3%. The NDVI development graph showed below-average crop conditions starting in November, evidenced by lower VCIx for most of this region. CALF was at 48%, an increase over the five-year average by 7%. Crop prospects are normal.

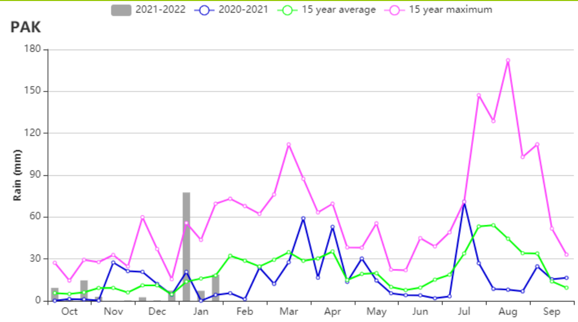
Northern Punjab is the main agricultural region in Pakistan. It recorded a far above-average RAIN (+183%). TEMP departure was -0.7 ° C, and RADPAR was below average by 2%. The resulting BIOMSS increased by 37%. Crop condition assessed through NDVI based crop development profiles showed close to average values in October and November. It subsequently increased to above average in December, and above the maximum value in late January. The CALF reached 86%, which was 8% above the five-year average. VCIx was high at 0.93. Overall, the winter wheat production potential for the region is high.

Figure 3.34 Pakistan crop condition, October 2021 - January 2022



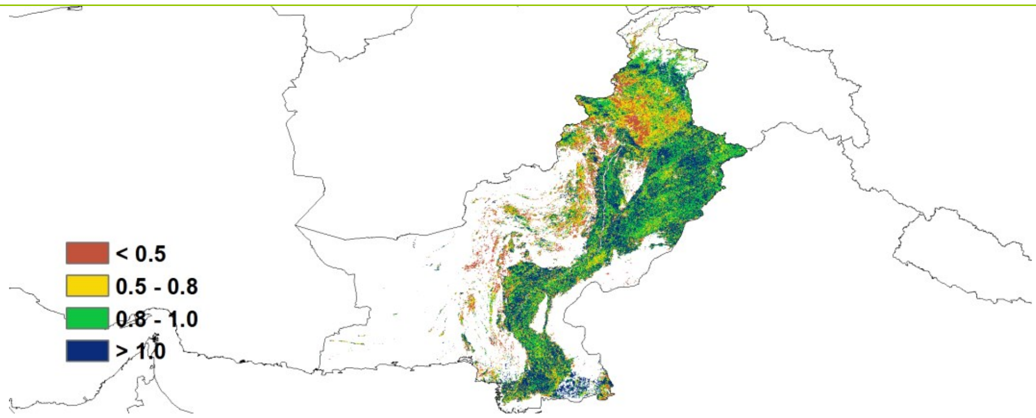
(a). Phenology of major crops



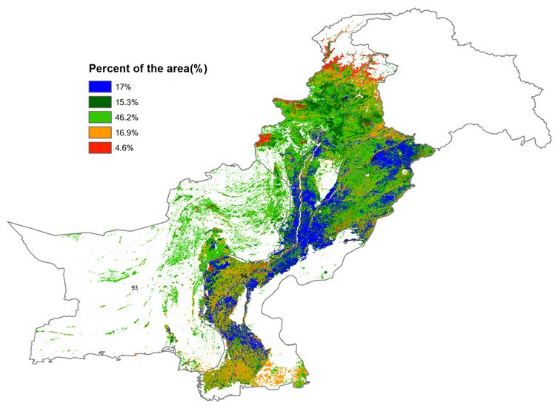


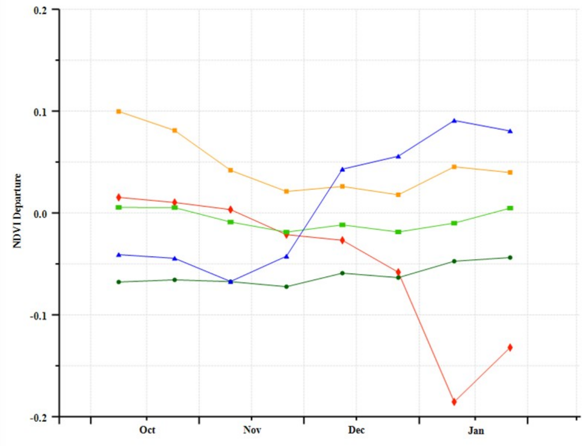
(b) Crop condition development graph based on NDVI

(c) Time series precipitation profile



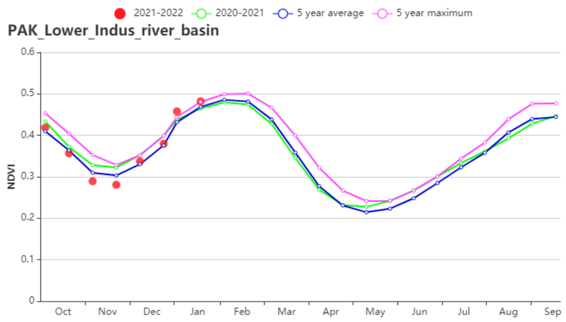
(d) Maximum VCI

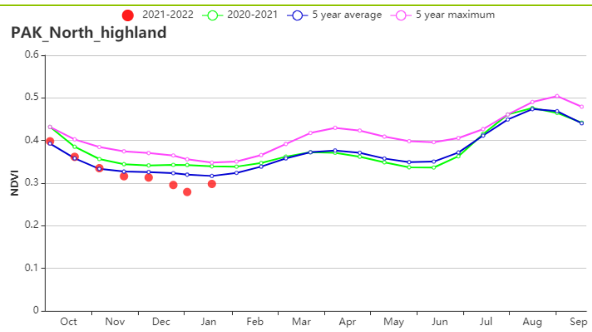




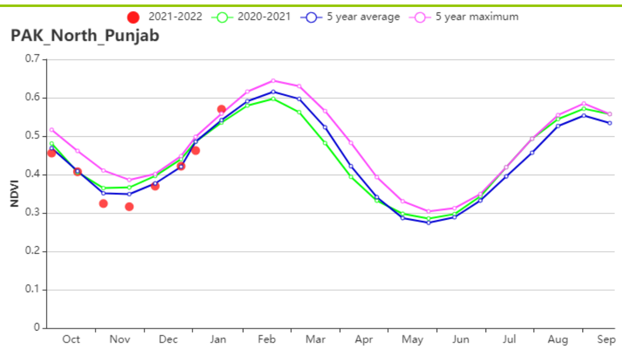
(e) Spatial NDVI patterns compared to 5YA

(f) NDVI profiles





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



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

Table 3.60 Pakistan's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, October 2021- January 2022

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (℃)	Departure (℃)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Lower Indus river basin	49	167	20.3	-0.0	945	-1	369	26
Northern highlands	170	2	7.0	-0.7	809	1	303	-3
Northern Punjab	179	183	16.3	-0.7	808	-2	422	37

Table 3.61 Pakistan's agronomic indicators by sub-national regions, current season's values and departure from 5YA, October 2021- January 2022

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Lower Indus river basin	76	14	0.92
Northern highlands	47	7	0.75
Northern Punjab	86	8	0.93

[PHL] Philippines

During this monitoring period, the sowing period for both second maize and second rice in Philippines ended in December. Harvest of main season rice was completed by the end of December as well. The Philippines experienced drier and relatively warmer weather conditions. Compared to the 15YA, the precipitation in the Philippines was lower (RAIN - 6%), while the average temperature (TEMP + 0.1ºC) and radiation were higher (RADPAR +2%). The lack of precipitation resulted in a lower potential biomass (BIOMSS -3%) compared to the average. The NDVI profile for the country also shows that crop growth was consistently below average during the monitoring period. The NDVI profile shows two NDVI troughs, which occurred in early October and mid-December. They coincided with the timing of the two typhoons that passed over the Philippines: Typhoon Kompasu in early-mid October and Typhoon Rai in mid-late December, with Typhoon Rai causing greater damage to the crops. Cloud cover in the satellite images and flooding may have caused the sharp drops in NDVI. The typhoons also brought necessary rains for crop growth. For example, after the passing of the Typhoon Rai, NDVI recovered to average levels by the end of December. However, as shown by the time series of rainfall profile, the precipitation had dropped below average again starting in late December. Therefore, the precipitation deficit in January is likely to be the main reason for another decrease in NDVI. Overall, the estimated production in the Philippines is presumed to be slightly below average considering that the NDVI for the country was consistently below average, and the CALF index in the country decreased slightly by about 1%.

Regional analysis

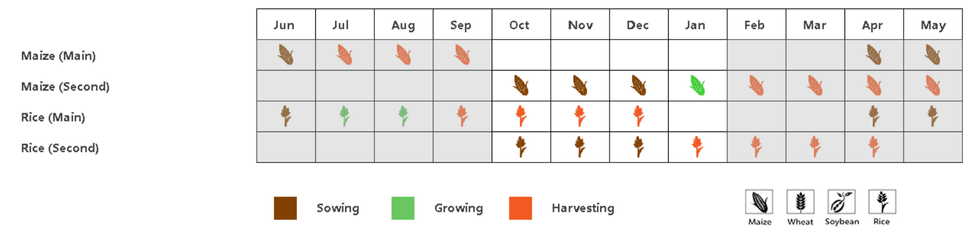
Based on the cropping systems, climatic zones and topographic conditions, three main agro-ecological regions can be distinguished for the Philippines. They are **the Lowlands region** (northern islands), **the Hilly region** (Island of Bohol, Sebu and Negros), and **the Forest region** (mostly southern and western islands). All the regions are characterised by a stable cropped arable land fraction (CALF almost 100%) and a high maximum VCI value (VCIx ⩾0.95).

For the **Lowland zone**, lower cumulative precipitation by 17% (RAIN), higher temperature by 0.1°C (TEMP), and higher radiation by about 6% (RADPAR) were observed. The sunny weather created favorable conditions for the harvest of the main season rice. However, lack of precipitation resulted in a negative potential biomass bias of about 6% (BIOMSS) in this zone. Although precipitation was significantly lower, it still met the soil moisture requirements for crop planting, which is consistent with the crop growth conditions reflected by the NDVI profile for this zone. The NDVI profile shows that the NDVI was close to the average for most of the time. Although the below-average NDVI emerged in early October and mid-December, the results of spatial NDVI pattern shows that the two low NDVIs were caused by the negative NDVI departures appearing in dark green (mainly in Mindoro, Lucena and Naga) and blue area (mainly in eastern Mindoro and eastern Luzon), respectively. Considering that both NDVI departures were large and that NDVI returned to normal levels within a short period of time, it is highly likely that they were caused by cloud cover in the satellite images. Therefore, it is presumed that the crop growth in this area is normal.

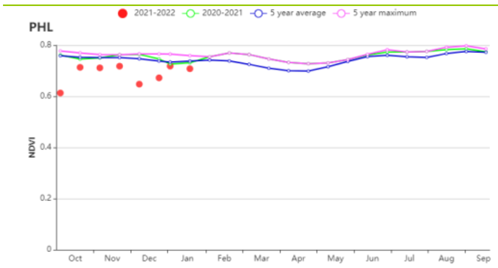
In the **Hilly region**, cumulative precipitation was about 2% higher, temperature was 0.2°C higher, and radiation was 1% higher than average. Despite the slight increase in both precipitation and temperature, the potential biomass in this zone was about 2% lower than average. NDVI for crops in this zone fluctuated widely and remained below average during the monitoring period. Similar to the Lowland Zone, the troughs in NDVI occurred in early October and mid to late December, presumably also due to cloud cover in the satellite images. Nevertheless, the NDVI in this region was also below average at other times, mainly because the NDVI of crops in the yellow area (mainly located in Pannay, Bohol and Leyte island) was consistently lower than average by about 0.1. Therefore, it is assumed that the crop growth in this area was slightly below average.

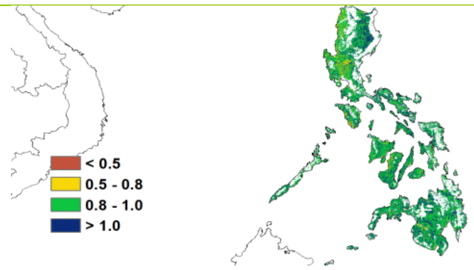
For the **Forest zone**, the potential biomass was lower by about 1% (BIOMSS), although the precipitation remained near average. The average temperature was about 0.1°C higher (TEMP), and the radiation was near average (RADPAR). Similarly, NDVI in this zone was always below average during the monitoring period, and although there were also NDVI troughs, they were not significant, suggesting that cloud cover had less influence on the satellite images of this region. The spatial NDVI pattern shows that the sudden drop in NDVI appearing in dark green (scattered in Mindanao Island) and yellow areas (mainly in northwestern and middle Mindanao Island) is the main cause of the NDVI trough in this region. Although the CALF index in the area is close to 100% and the VCIx index is 0.97, it is presumed that the crop growth in the area is slightly below average considering the low NDVI.

Figure 3.35 Philippines' crop condition, October 2021 – January 2022



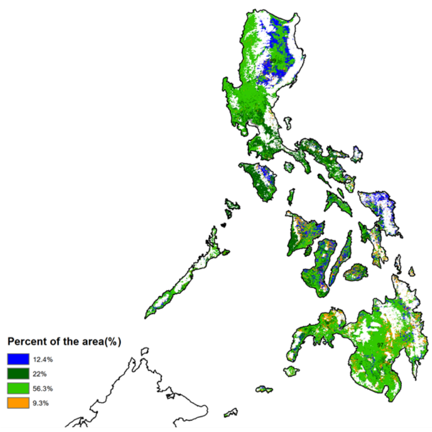
(a). Phenology of major crops

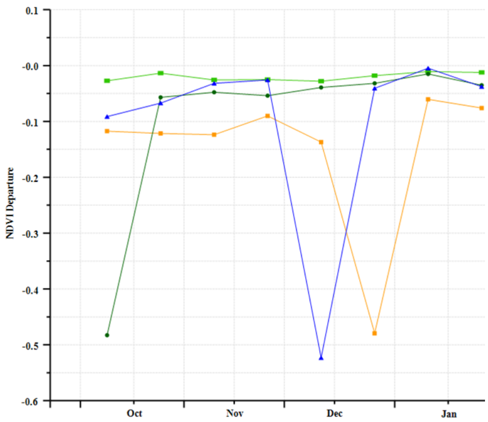




(b) Crop condition development graph based on NDVI

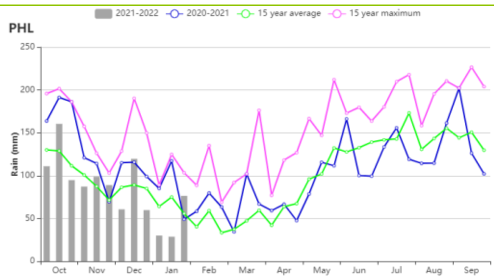
(c) Maximum VCI





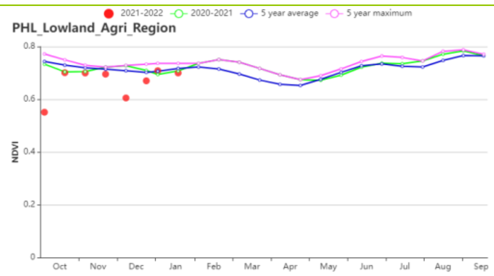
(d) Spatial NDVI patterns compared to 5YA

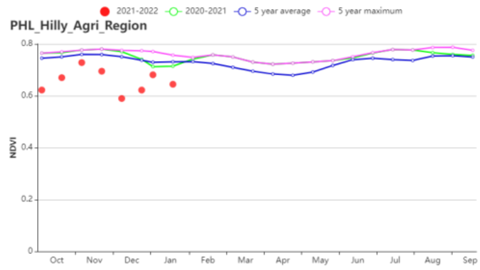
(e) NDVI profiles



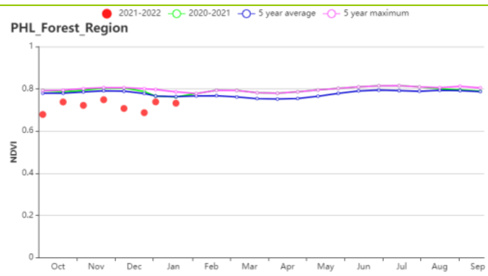
(f) Rainfall profiles

(g) Temperature profiles





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



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

Table 3.62 Philippines ‘ agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, October 2021 – January 2022

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Forest region	1237	0	24.8	0.1	1083	0	1412	-1
Hillyregion	1190	2	26.5	0.2	1138	1	1434	-2
Lowlands region	760	-17	24.3	0.1	1008	6	1125	-6

Table 3.63 Philippines ‘ agronomic indicators by sub-national regions, current season’s values and departure from 5YA, October 2021 – January 2022

Region	Cropped arable land fraction		Maximum VCI	
	Current (%)	Departure (%)	Current (%)	Current
Forest region	100	0	0.97	100
Hilly region	100	0	0.95	100
Lowlands region	100	0	0.95	100

[POL] Poland

This monitoring period covers the maize harvest in October and the sowing as well as the growing period of winter wheat. Compared to the average of last 15 years, RAIN was lower by 10%, RADPAR was higher by 6% and TEMP was close to average, with a slightly lower BIOMSS (-1%). Cropwatch's last monitoring results indicated that winter crop planting may be slightly delayed, resulting in a lower NDVI than that of the corresponding period. However, the subsequent above-average precipitation combined with the near-average temperatures in October and November, favored the initial growth of winter crops.

The proportion of arable land planted was close to 100% and VCIx reached 0.95. Only a few regions had VCIx values below 0.5. They were sporadically distributed in eastern Poland. In general, the agrometeorological and agronomic parameters indicate favorable conditions for the growth of winter crops in Poland during this monitoring period.

Regional analysis

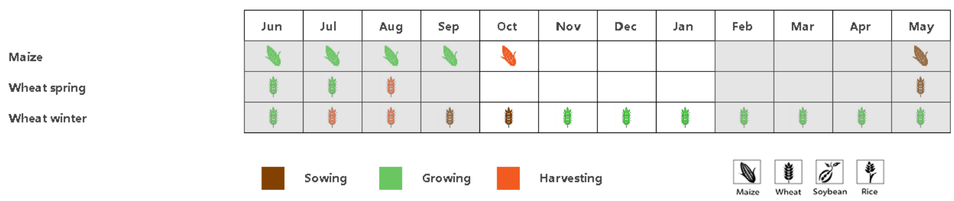
Four agro-ecological zones (AEZ) are examined more closely below. They include the **Northern oats and potatoes areas** (the northern half of west Pomerania, eastern Pomerania and Warmia-Masuria), the **Northern-central wheat and sugar-beet area** (Kuyavia-Pomerania to the Baltic Sea), the **Central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

Compared to the average of the same period of the last 15 years, TEMP and RADPAR were both higher in **Northern oats and potatoes areas** (TEMP +0.3°C; RADPAR +3%) and **Northern-central wheat and sugar-beet area** (TEMP +0.2°C; RADPAR +1%), although with the lower RAIN (-3% and -7%), resulting in the higher BIOMSS (+1% and +2%). CALF in the two zones were both close to 100% and VCIx reached 0.92 and 0.89, respectively. Overall, crop conditions were favorable.

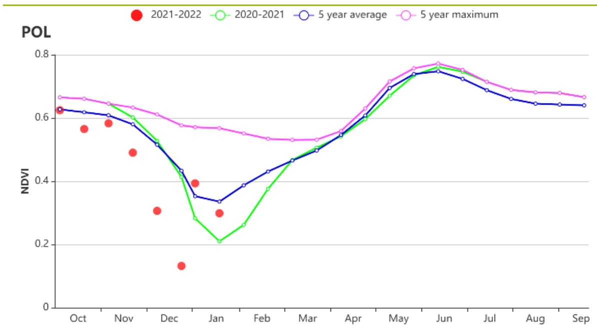
In **Central rye and potatoes area**, RAIN was below average by 9%, RADPAR was 4% higher, and TEMP was close to the 15-year average, which resulted in average estimates for BIOMSS. In addition, CALF was up to 100%, and VCIx reached 0.96. In general, crop growth conditions were favorable.

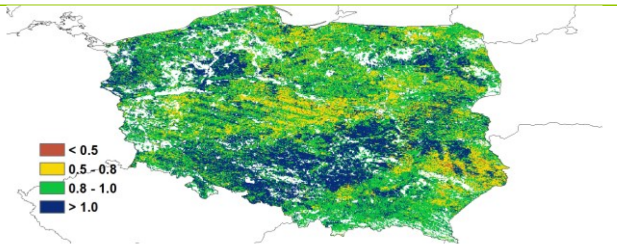
Compared with the average of last 15 years, RAIN and TEMP were both lower by 15% and 0.2°C, respectively, in **Southern wheat and sugar-beet area**, combined with higher RADPAR (+9%). The resulting BIOMSS was below average by 4%. In this zone, CALF was 99% and VCIx was 0.96. Crop growth conditions were normal.

Figure 3.36 Poland's crop condition, October 2021 – January 2022



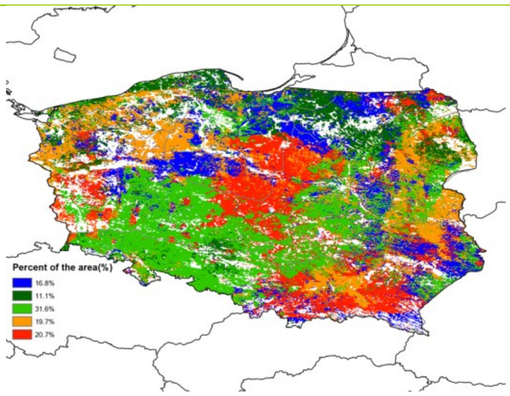
(a). Phenology of major crops

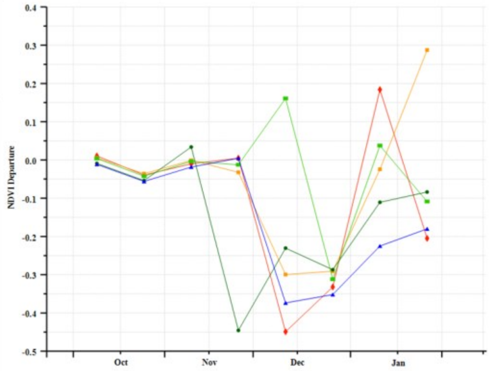




(b) Crop condition development graph based on NDVI

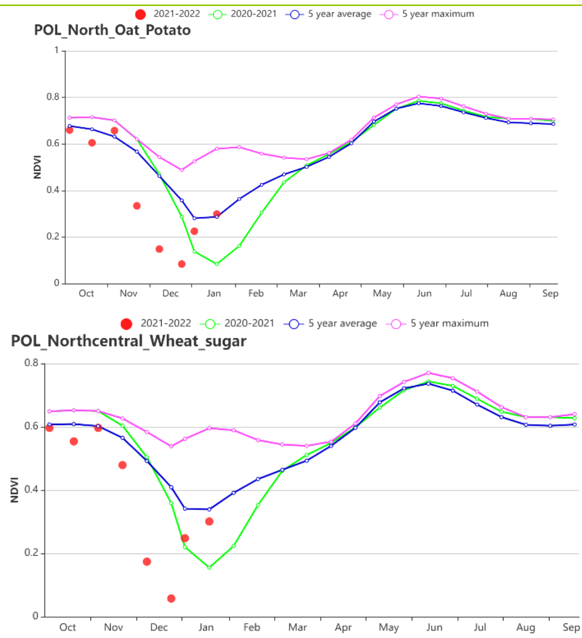
(c) Maximum VCI



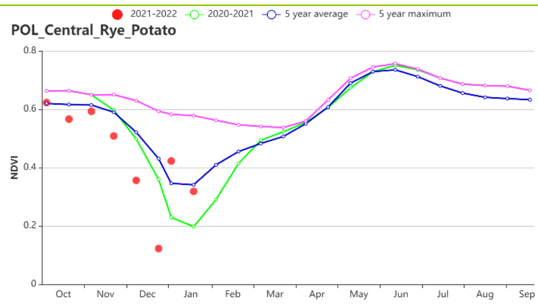


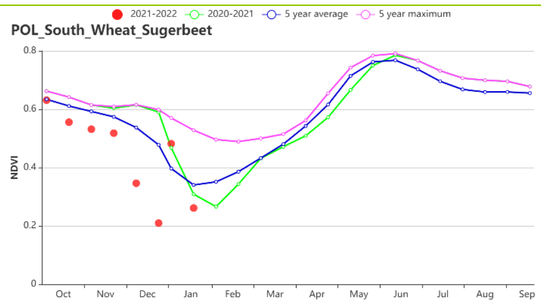
(d) Spatial NDVI patterns compared to 5YA

(e) NDVI profiles

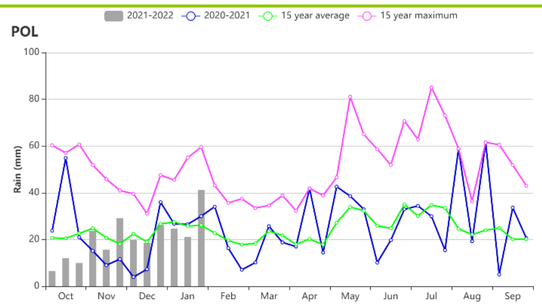


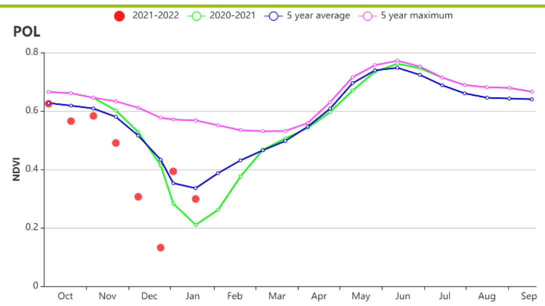
(f) Crop condition development graph based on NDVI, Northern oats and potatoes area (left) and Northern-central wheat and sugar beet area (right).





(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 3.64 Poland's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, October 2021 - January 2022

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Northern oats and potatoes areas	303	-3	3.5	0.3	168	3	464	1
Northern-central wheat and sugarbeet area	261	-7	3.8	0.2	179	1	478	2
Central rye and potatoes area	247	-9	3.6	0.0	203	4	471	0
Southern wheat and sugarbeet area	221	-15	2.5	-0.2	270	9	422	-4

Table 3.65 Poland's agronomic indicators by sub-national regions, current season's values and departure from 5YA, October 2021 - January 2022

Region	Cropped arable land fraction		Maximum VCI
	Current	Departure (%)	Current
Northern oats and potatoes areas	100	0	0.92
Northern-central wheat and sugarbeet area	100	0	0.89
Central rye and potatoes area	100	0	0.96
Southern wheat and sugarbeet area	99	0	0.96

[ROU] Romania

The reporting period includes the harvest of the 2021 maize crop and the planting of the 2021-2022 winter wheat, which started in September. Overall, crop conditions were favorable. The agroclimatic indicators show that rainfall was 5% lower than average; TEMP was near average. RADPAR was 2% higher than average and biomass was 1% lower than average. The nationwide NDVI profile shows that crop conditions were below average during most of the reporting period. Romania had suffered from a rainfall deficit during the previous monitoring period. The rainfall deficit continued well into November. The moisture conditions improved in December only, when rainfall reached above-average conditions. All in all, conditions in Romania are below average.

Regional analysis

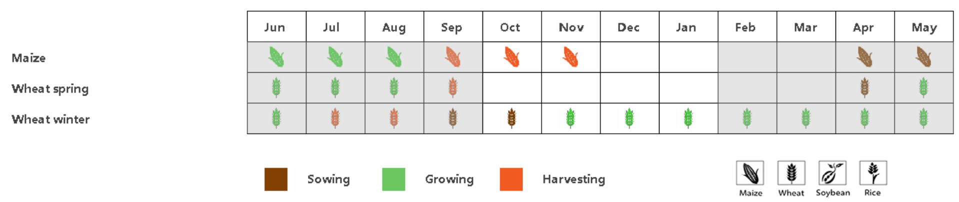
More spatial detail is provided below for the three main agro-ecological zones: the Central mixed farming and pasture Carpathian hills, the Eastern and southern maize, wheat and sugar beet plains and the Western and central maize, wheat and sugar beet plateau.

For the Central mixed farming and pasture Carpathian hills, compared to the 15YA, radiation increased by 2%, rainfall increased by 2% while temperature decreased 0.2℃ and BIOMSS decreased by 2%. According to the NDVI development graph, crop conditions were below average during the reporting period except for early January. The regional average maximum VCI was at 0.91. Regional CALF was 99% and 3% higher than average. The NDVI spatial distribution shows that NDVI was fair throughout the reporting period. However, this zone occupies only a small fraction of cropland in Romania.

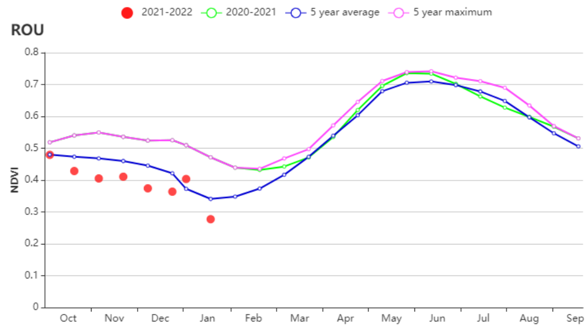
For the Eastern and Southern maize, wheat and sugar beet plains, rainfall largely decreased by 13%, temperature increased by 0.2℃, radiation increased 1% and biomass decreased 1% as compared to the 15YA. The NDVI development graph shows that crop conditions were below average before late December and above average in January. Regional CALF was only 78% and 2% lower than average. Maximum VCI value of this region was 0.79 and according to the distribution map, VCI values were below 0.80 in the southeast area of this sub-region (counties of Tulcea and Constanta), representing about 14.3% of the national cropland.

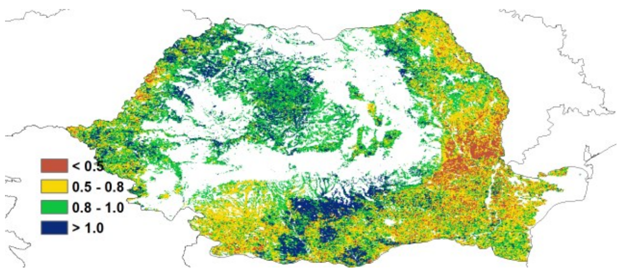
For the Western and central maize, wheat and sugar beet plateau, radiation was higher than average by 4%, temperature was 0.3℃ lower and rainfall was 1% higher and biomass increased by 1%. Spatial NDVI profiles show that crop conditions were around average in October and December but far below average in late January. Those negative departures were probably due to cloud cover, fog or snow. Regional CALF was 97%, 6% higher than average. Maximum VCI of this region was 0.93, and the spatial distribution was between 0.8 and 1.0 in most of the subregion areas. The spatial NDVI distribution shows that NDVI in most of this sub-region followed the long-term trend from October to December.

Figure 3.37 Romania's crop condition, October 2021 – January 2022



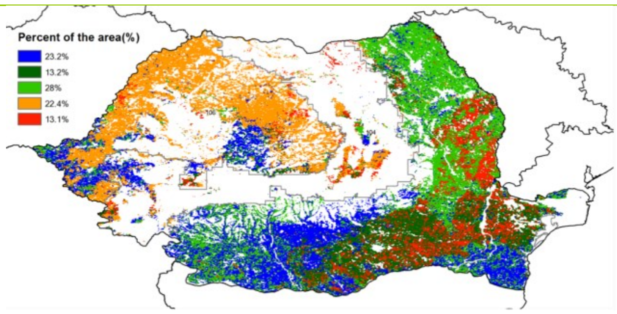
(a). Phenology of major crops

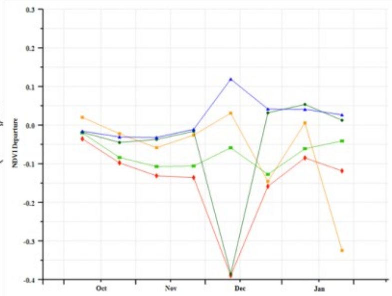




(b) Crop condition development graph based on NDVI

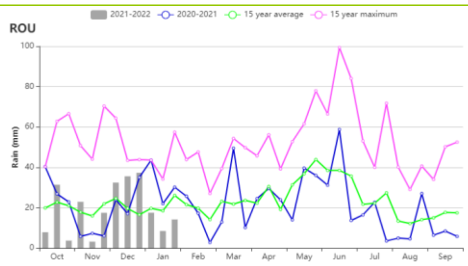
(c) Maximum VCI

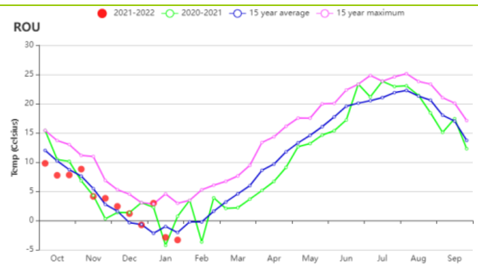




(d) Spatial NDVI patterns compared to 5YA

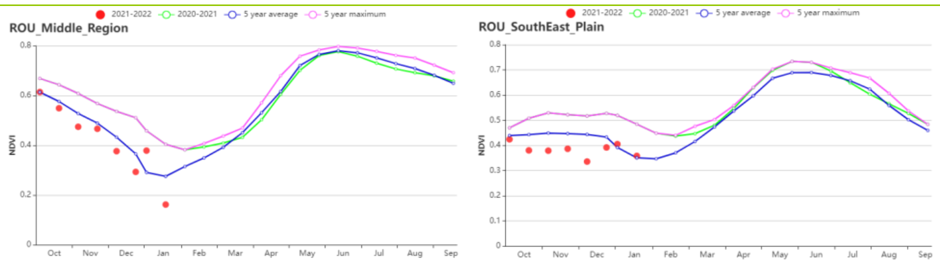
(e) NDVI profiles



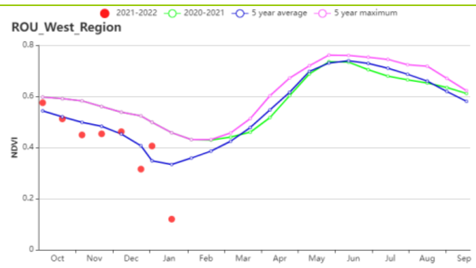


(f) Rainfall profiles

(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 sugarbeet plains (right))



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

Table 3.66 Romania's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, October 2021 – January 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	263	2	1.9	-0.2	384	2	401	-2
Eastern and southern maize, wheat and sugar beet plains	205	-13	4.3	0.2	390	1	449	-1
Western and central maize, wheat and sugar beet plateau	251	1	3.1	-0.3	381	4	444	1

Table 3.67 Romania's agronomic indicators by sub-national regions, current season's values and departure from 5YA, October 2021 – January 2022

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Central mixed farming and pasture Carpathian hills	99	3	0.91
Eastern and southern maize, wheat and sugar beet plains	78	2	0.79
Western and central maize, wheat and sugar beet plateau	97	6	0.93

[RUS] Russia

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

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

Precipitation in October was below the level of the previous year. In November and December, it was mainly close to the 15-year average. In the beginning of November and in the first half of January, the amount of precipitation exceeded the 15-year average. This helped build up snow cover and thus protect the plants against frost.

Temperature from October till November was at the level of the last year and the 15-year average. From December, temperature was above the 15-year average and last year's value.

Major winter crop production regions mostly experienced positive NDVI departure with VCIx above 0.8.

Only Middle Volga region and Ural and Western Volga region showed negative NDVI departure with VCIx below 0.8. Due to the lack of rainfall in the autumn, there was a delay in sowing, which resulted in later germination and emergence of winter wheat seedlings, which is reflected in lower NDVI values in these two winter crop production regions.

Regional analysis

South Caucasus

Rainfall in the South Caucasus was 7% below the 15-year average. Temperature was 0.4°C higher than the 15-year average. RADPAR increased slightly (+1%) compared to the 15-year average. Biomass was down by 2% from the 15-year average. Cropped area increased significantly and was 71% above the 5-year average. VCIx was 1.04.

NDVI was slightly higher than normal from the beginning of October till the end of December. Only in early January it was below the 5-year average due to snow cover establishment.

Generally, conditions for winter crops were favorable in this region, and its status was better than normal.

North Caucasus

In the North Caucasus, precipitation increased by 16% compared to the 15-year average. Temperatures increased by 0.8°C compared to the 15-year average. The RADPAR value was 2% higher than the 15-year average. The biomass value increased by 6%. Cropped area increased by 50% compared to the 5-year average. The VCIx value was 0.94.

The NDVI value at the beginning of the monitoring period and at the beginning of January was higher than the 5-year average. In early December, it dropped below the 5-year average and the level of the previous year, which indicates the establishment of snow cover.

These parameters indicate favorable conditions for winter crops in this region. Their status is likely to be better than normal.

Central Russia

In Central Russia, temperatures stayed at the level of 15-year average, and rainfall increased by 8% compared to the 15-year average. RADPAR increased by 6%. Biomass decreased by 2% relative to the 15-year average. Cropped area stayed at the level of the 5-year average. VCIx was 0.89.

NDVI was below the average during the report period except for early November.

Overall, winter crops status was below average for this region.

Central black soil area

In Central Black Earth Region, temperature increased by 0.4°C compared to the 15-year average. The amount of precipitation was equal to the 15-year average, and RADPAR was higher by 3%. The amount of biomass stayed at the 15-year average. Cropped area increased by 9% relative to the 5-year average. VCIx was 0.86.

During the period from October to the end of November, NDVI was above last year's value and equal to the 5-year average.

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

Middle Volga

In the Middle Volga region, the amount of precipitation increased by 8% compared to the 15-year average. Temperature increased by 1.1°C compared to the 15-year average. RADPAR decreased by 3% compared to the 15-year average. Biomass increased by 5% compared to the 15-year average. Cropped area was by 11% lower than the 5-year average. VCIx was 0.71, the lowest in the Russian Federation.

During the period from October to the end of November, NDVI was below the 5-year average and the value of the previous year.

Conditions for winter crops were below average for this region.

Ural and western Volga

In the Ural and the Western Volga region, the amount of precipitation decreased by 3% and temperature increased by 1.8°C compared to the 15-year average. RADPAR was below the 15-year average by 2%. Biomass was higher than the 15-year average by 6%. Cropped area was by 19% lower than the 5-year average. VCIx was 0.71.

NDVI was below the 5-year average in October and November. At the beginning of November, it reached the 5-year maximum.

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

Eastern Siberia

In Eastern Siberia, the precipitation and temperature were higher than the 15-year average by 22% and 1.6°C respectively. RADPAR was lower by 4% compared to the 15-year average. Biomass was higher by 10% compared to the 15-year average. Cropped area was 2% lower than the 5-year average. VCIx was 0.80.

During October, NDVI was below the 5-year average, but in November, it was equal to the 5-year maximum and to the previous year's value.

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

Middle Siberia

In Middle Siberia, rainfall decreased by 3%, and temperature increased by 1.9°C compared to the 15-year average. RADPAR was at the level of the 15-year average. Biomass was 7% higher than the 15-year average. Cropped area was 13% higher than the 5-year average. VCIx was 0.85.

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

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

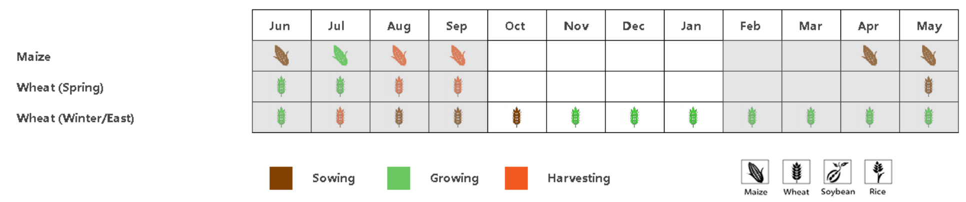
Western Siberia

In Western Siberia, rainfall decreased by 1%, and air temperature increased by 2.5°C relative to the 15-year average. The RADPAR was 9% lower than the 15-year average. Biomass increased by 7% compared to 15-year average. Cropped area increased by 12% compared to 5-year average. VCIx was 0.82.

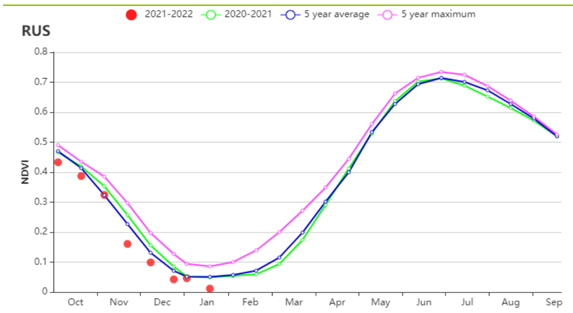
NDVI was mainly close to the level of the previous year and below the 5-year average.

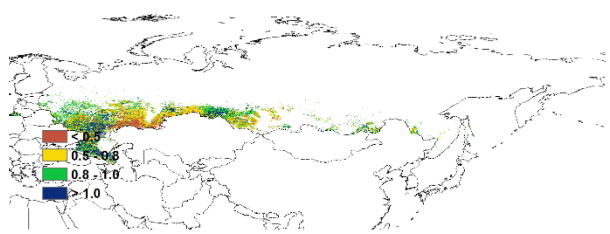
The area of winter crops is insignificant in this region, therefore its agroclimatic conditions will not affect winter crop production in the Russia Federation.

Figure 3.38 Russia's crop condition, October 2021 – January 2022

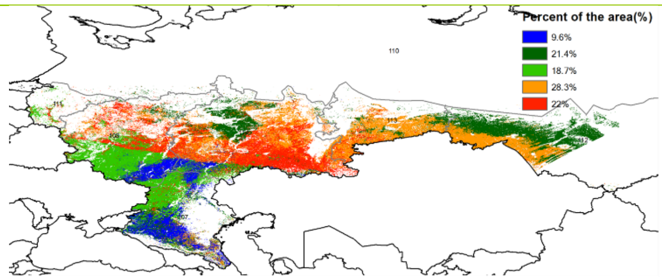


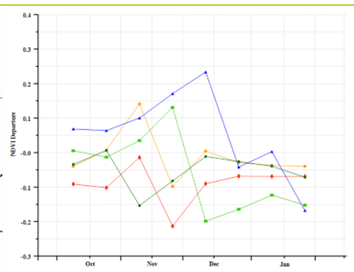
(a) Phenology of major crops



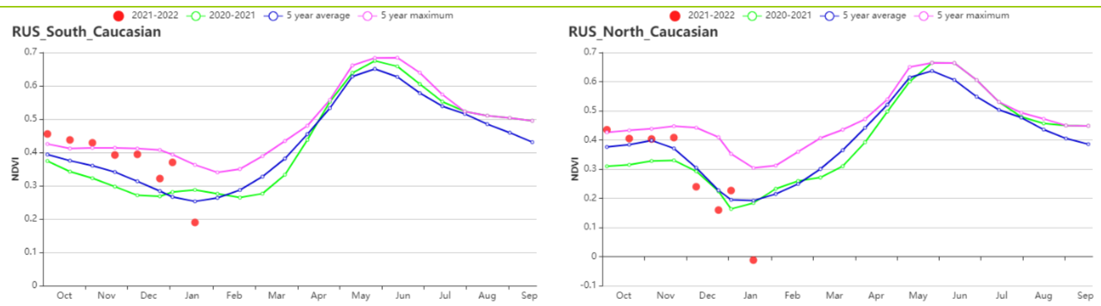


(b) Crop condition development graph based on NDVI (c) Maximum VCI

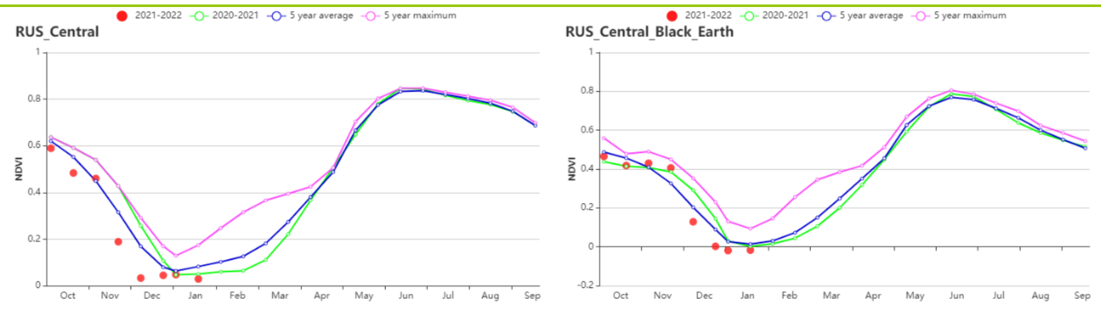




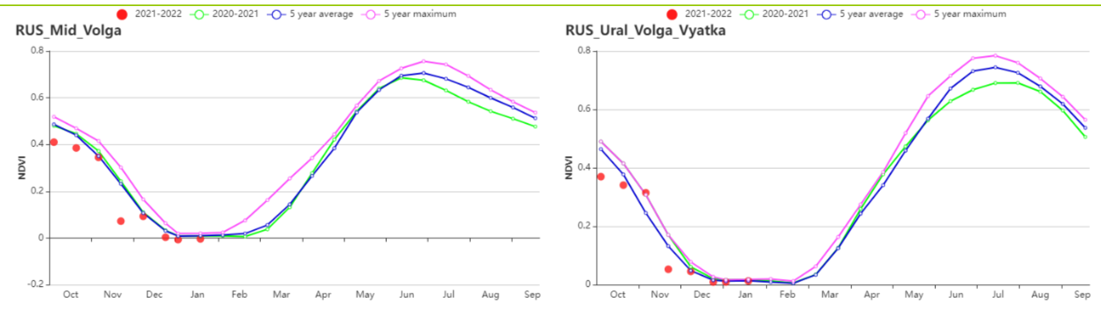
(d) Spatial NDVI patterns compared to 5YA (e) NDVI profiles



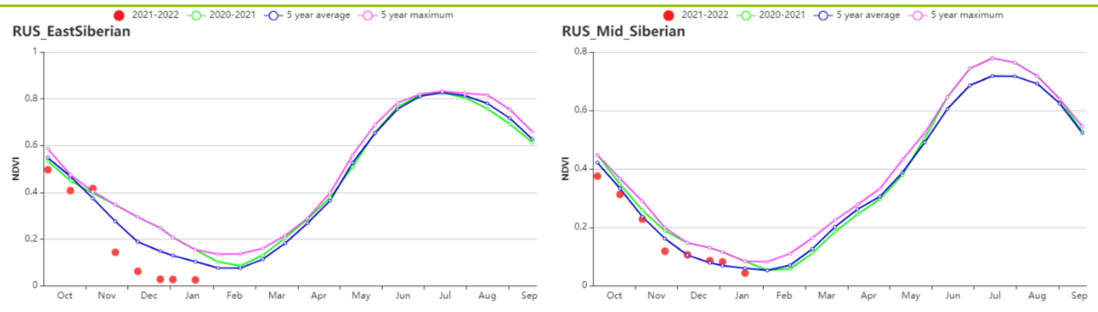
(f) Crop condition development graph based on NDVI, Southern Caucasus (left) and Northen Caucasus (right).



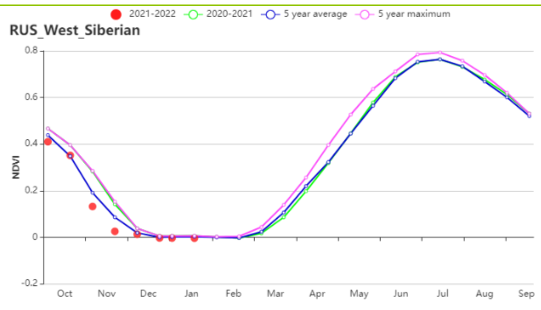
(g) Crop condition development graph based on NDVI, Central Russia (left) and Central black soils area (right).



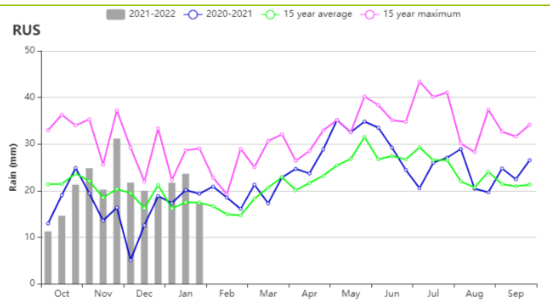
(h) Crop condition development graph based on NDVI, Middle Volga (left) and Ural and western Volga region (right).



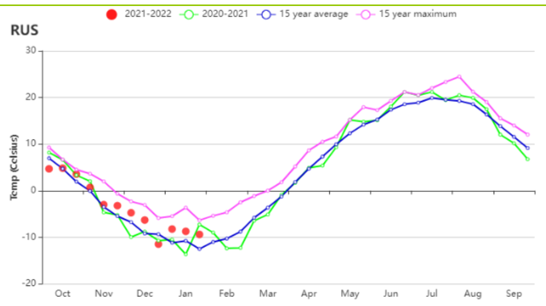
(i) Crop condition development graph based on NDVI, Eastern Siberia (left) and Middle Siberia (right).



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



(k) Rainfall index



(l) Temperature Index

Table 3.68 Russia's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, October 2021 – January 2022

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Central Russia	321	8	-1.6	0.0	138	6	308	-2
Central black soils area	262	0	-0.4	0.4	199	3	346	0
Eastern Siberia	262	22	-8.2	1.6	340	-4	219	10
Middle Siberia	109	-13	-10.5	1.9	315	0	141	7
Middle Volga	282	8	-3.0	1.1	171	-3	279	5
Northern Caucasus	282	16	3.3	0.8	333	2	453	6
Southern Caucasus	222	-7	2.9	0.4	431	1	390	-2
Ural and western Volga region	179	-3	-5.3	1.8	173	-2	228	6
Western Siberia	223	-1	-5.6	2.5	189	-9	216	7

Table 3.69 Russia's agronomic indicators by sub-national regions, current season's values and departure from 5YA, October 2021 – January 2022

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Central Russia	99	0	0.89
Central black soils area	82	9	0.86
Eastern Siberia	87	-2	0.80
Middle Siberia	46	13	0.85
Middle Volga	60	-11	0.71
Northern Caucasus	75	50	0.94
Southern Caucasus	87	71	1.04
Ural and western Volga region	52	-19	0.71
Western Siberia	61	12	0.82

[THA] Thailand

From October to January, the reporting period covers the harvest of the main rice crop and the start of the second rice season. According to CropWatch agroclimatic indicators, Thailand experienced average weather conditions compared to the last 15 years. The radiation (RADPAR +4%) was slightly above average, while rainfall (RAIN -8%) was below average. Temperature was unchanged (TEMP +0.0°C). The combination of these agroclimatic parameters resulted in a below average estimate for biomass accumulation (BIOMSS -4%). According to the NDVI development graph, the crop conditions were slightly below average. The NDVI departure clustering and the corresponding profiles show that for 77.4% of the cropland the crop conditions were close to average. For the remaining cropland, crop conditions were below average before November. However, the strong negative departures in NDVI can be attributed to cloud cover in the satellite images. Areas which trended below average were located in the southern hills (including Surat Thani, Chumphon, Ranong and Prachuap Khilikhan). National VCIx value was at 0.93 and CALF remained near average. Considering the unfavorable conditions described in the November 2021 bulletin and the conditions of this monitoring period, the crop outputs are assessed as slightly below average. For second rice, average weather indicators lead to fair crop condition.

Regional analysis

The regional analysis below focuses on some of the already mentioned agro-ecological zones of Thailand, which are mostly defined by the rice cultivation typology. Agro-ecological zones include **Central double and triple-cropped rice lowlands** (115), **South-eastern horticulture area (116), Western and southern hill areas (117)** and **the Single-cropped rice north-eastern region (118)**.

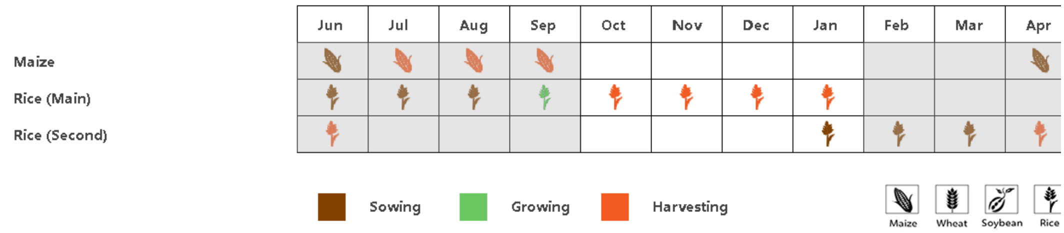
Compared to the 15YA, **Central double and triple-cropped rice lowlands** experienced cooler and drier conditions. Radiation (RADPAR +5%) was above average accompanied by lower temperatures (TEMP -0.1°C) and lower rainfall (RAIN -10%). This condition led to an unchanged estimate for BIOMSS (BIOMSS +0%). The NDVI development graph shows that crop conditions were below the five-year average for most of the monitoring period, although the high VCIx value at 0.92 indicates that crops were favourable during the main growing season and the peak growth period. All in all, conditions were slightly below average.

Indicators for the **South-eastern horticulture area** shows that temperature (TEMP -0.2°C) was below average accompanied by higher radiation (RADPAR +3%) and rainfall (RAIN +18%). They led to a slightly above-average estimate for BIOMSS (BIOMSS +4%). According to the NDVI development graph, however, the crop conditions were slightly below average during this monitoring period. VCIx was at of 0.92. All in all, conditions were slightly below average.

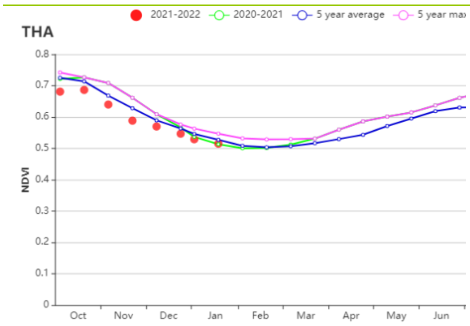
Agroclimatic indicators show that the conditions in the **Western and southern hills** were slightly below average: rainfall (RAIN, -7%) was below average, while and radiation (RADPAR +3%) was above average. Accompanied with average temperature (TEMP -0.0°C), the weather conditions led to a 4% decrease in BIOMSS. According to the favorable VCIx value of 0.95, crop conditions were assessed as close to average.

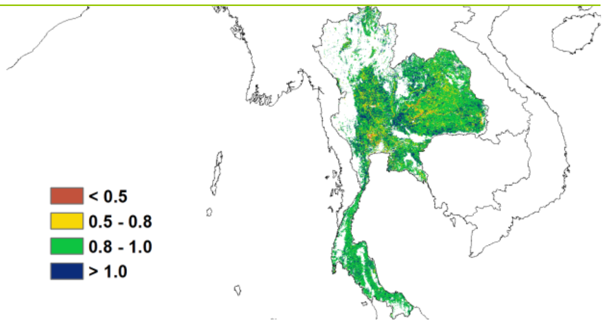
In the **Single-cropped rice north-eastern region** precipitation was below average by 16%, while radiation was above average by 5%. The temperature was close to average. All these agroclimatic indicators led to a decreased potential biomass (BIOMSS -6%). According to the NDVI development graph, the crop conditions were close to average. Considering the favorable VCIx value of 0.91, the crop conditions are assessed as normal.

Figure 3.39 Thailand's crop condition, October 2021 – January 2022



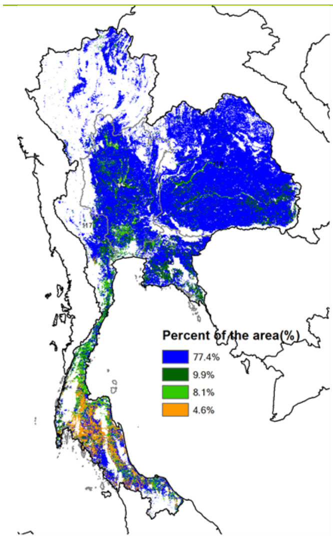
(a). Phenology of major crops

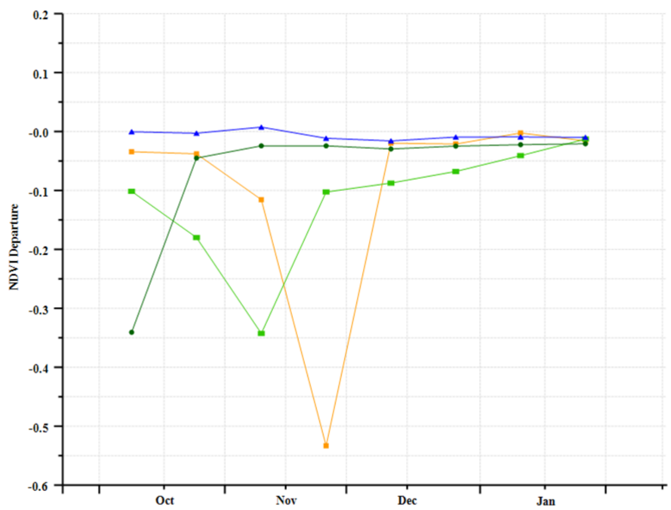




(b) Crop condition development graph based on NDVI

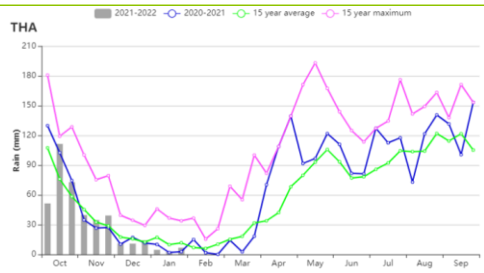
(c) Maximum VCI

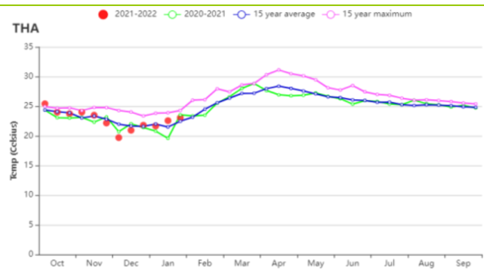




(d) Spatial NDVI patterns compared to 5YA

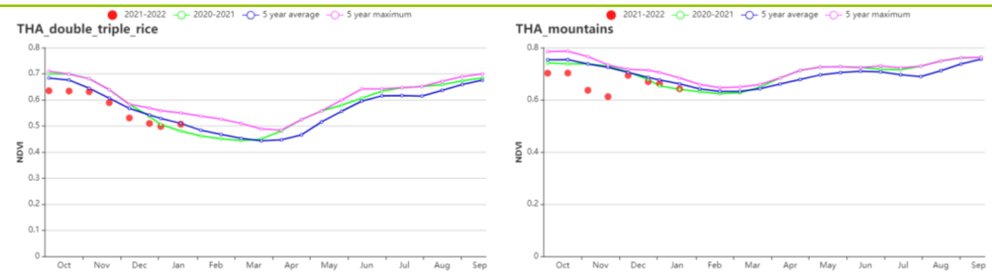
(e) NDVI profiles



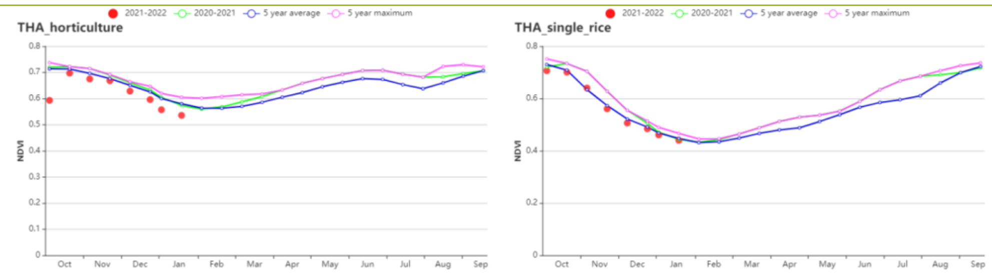


(f) Rainfall profiles

(g) Temperature profiles



(h) Crop condition development graph based on NDVI (Central double and triple-cropped rice lowlands (left) and Western and southern hill areas (right))



(i) Crop condition development graph based on NDVI (South-eastern horticulture area (left) and Single-cropped rice north-eastern region (right))

Table 3.70 Thailand's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, October 2021 – January 2022

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Central double and triple-cropped rice lowlands	340	-10	23.2	-0.1	1113	5	804	0
South-eastern horticulture area	472	18	24.5	-0.2	1109	3	927	4
Western and southern hill areas	517	-7	22.3	0.0	1102	3	912	-4
Single-cropped rice north-eastern region	243	-16	22.5	0.0	1090	5	656	-6

Table 3.71 Thailand's agronomic indicators by sub-national regions, current season's values and departure from 5YA, October 2021 – January 2022

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Central double and triple-cropped rice lowlands	99	0	0.92
South-eastern horticulture area	99	0	0.92
Western and southern hill areas	100	0	0.95
Single-cropped rice north-eastern region	100	0	0.91

[TUR] Turkey

In October, at the beginning of this reporting period, maize and rice harvests were reaching the completion, while winter wheat planting was in progress. NDVI was slightly lower than the five-year average during the monitoring period. The sharp decrease in late January was due to snow. Both temperature and rainfall were below average (TEMP -0.2°C, RAIN -8%), but radiation was above average (+3%). The combined agroclimatic conditions resulted in a slightly below average potential biomass (-3%). The cropped arable land fraction (CALF) increased by 6% and the maximum VCI (VCIx) was 0.77.

The spatial NDVI patterns almost exactly correspond to the spatial distribution of VCIx. NDVI was close to or slightly above average on 39.5% of the croplands (marked in blue), mostly in western and southern parts, including the provinces of Edirne, Tekirdag, Bursa, Balisesir, Eskisehir, Afyon, Manisa, Urfa, and Malatya. NDVI was below average during the whole monitoring period on 29.6% of the croplands marked in yellow. These areas are mainly located in the middle and southeastern parts including the provinces of Konya, Ankara, Kirsehir, Nevsehir, Mardin, Diyarbakir, and Siir, indicating below-average crop conditions. It is worth noting that the maps indicated a sharp decline for 30.9% of the cropland in middle to late January, which was due to snow cover. Precipitation was above the 15YA maximum in December. This ample precipitation will be beneficial for winter wheat.

Regional analysis

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

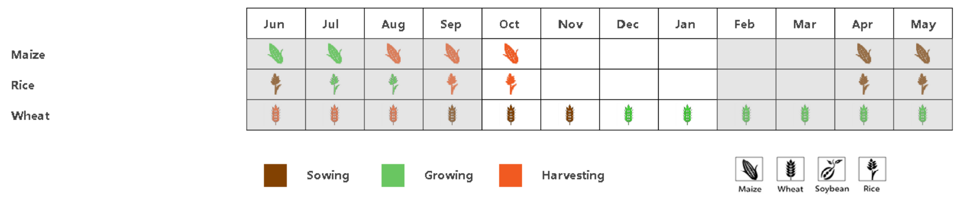
In the Black Sea region, the NDVI was slightly above average only during mid-December, while below average during the rest of the monitoring period. Radiation was well above average (RADPAR +3%), while temperature and rainfall were below average (TEMP -0.3° C, RAIN -3%), resulting in a slight increase of biomass (-1%). VCIx reached 0.96 and CALF was up by 6%, indicating around average crop conditions.

The Central Anatolian region had below average NDVI during the monitoring period except for late December and late January. Radiation was above average (RADPAR +4%), while rainfall and temperature were below average (RAIN -11%, TEMP -0.3°C). The potential biomass production was below average (BIOMSS -4%). The cropped arable land fraction (CALF) was largely above average by 22% and VCIx was 0.75.

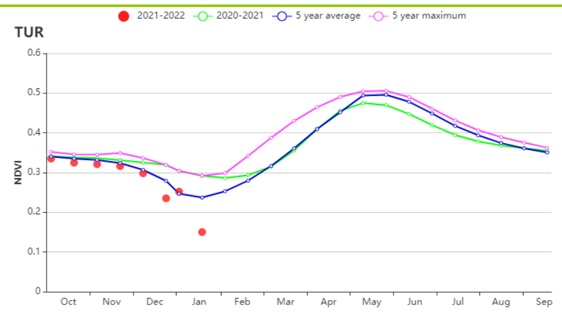
In the Eastern Anatolian region, the NDVI was below average from December to January, presumably due to snow cover. This zone also experienced a precipitation shortage (RAIN -27%) and lower temperature (TEMP -0.1℃). Sunshine was good (RADPAR +5%). Biomass was down with the largest departure in subregions (BIOMSS -6%).

As shown by the NDVI profile in the Marmara Aegean Mediterranean lowland region, NDVI was slightly below average during the whole monitoring period. The rainfall was around average, which was the smallest departure from the average among of the four AEZs. Radiation was 1% above and temperature was 0.2°C below the average. BIOMSS decreased by 1% and CALF increased by 2% compared to their respective average. The VCIx was 0.76. Crop production prospects are estimated to be fair to normal.

Figure 3.40 Turkey's crop condition, October 2021 – January 2022

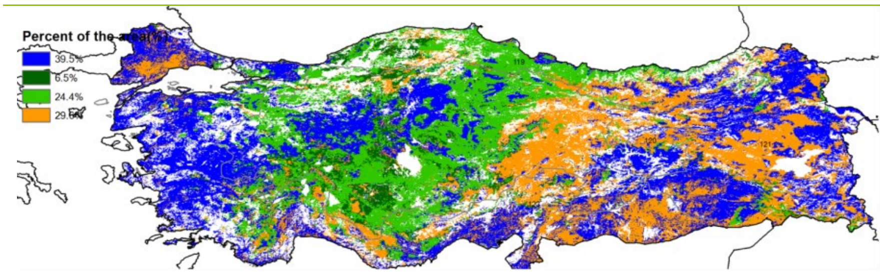


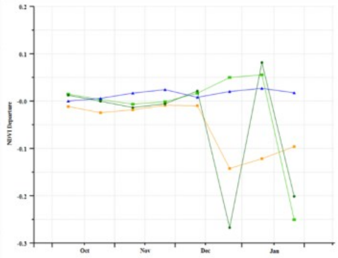
(a). Phenology of major crops



(b) Crop condition development graph based on NDVI

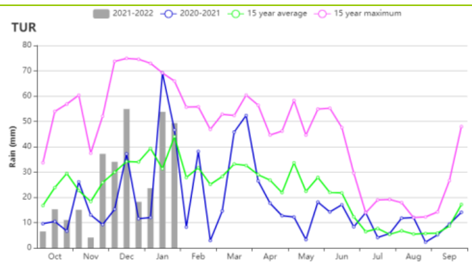
(c) Maximum VCI

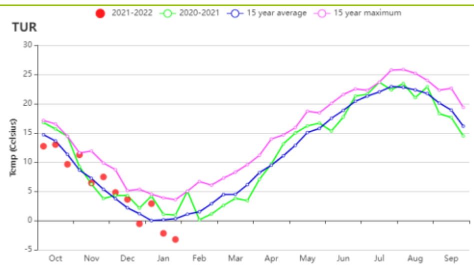




(d) Spatial NDVI patterns compared to 5YA

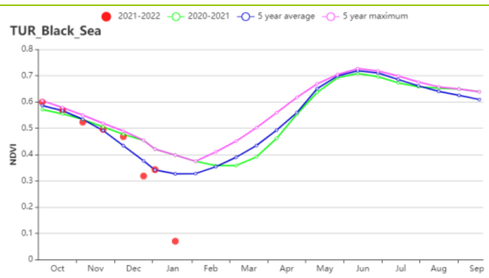
(e) NDVI profiles

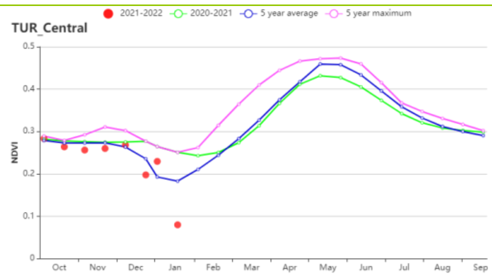




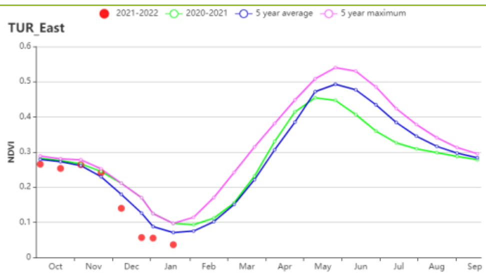
(f) Rainfall profiles

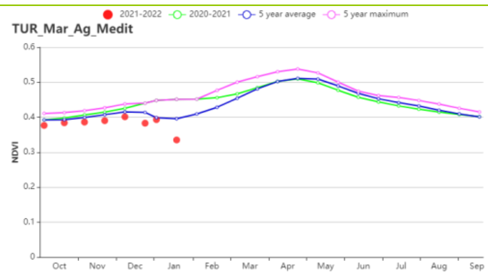
(g) Temperature profiles





(h) Crop condition development graph based on NDVI (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 3.72 Turkey's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, October 2021 – January 2022

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m^2)	Departure (%)	Current (gDM/m^2)	Departure (%)
Black Sea region	409	-3	3.7	-0.3	494	3	500	-1
Central Anatolia region	242	-11	4.1	-0.3	604	4	454	-4
Eastern Anatolia region	248	-27	2.0	-0.1	634	5	402	-6
Marmara Agean Mediterranean lowland region	406	0	8.8	-0.2	595	1	621	-1

Table 3.73 Turkey's agronomic indicators by sub-national regions, current season's values and departure from 5YA, October 2021 – January 2022

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Black Sea region	81	6	0.96
Central Anatolia region	20	22	0.75
Eastern Anatolia region	13	-3	0.74
Marmara Agean Mediterranean lowland region	61	2	0.76

[UKR] Ukraine

The whole country generally experienced warmer conditions. The start of the winter wheat growing season was hampered by below-average rainfall in September and October. Agroclimatic indicators showed that rainfall was 5% lower while temperature rose by 0.2 °C and sunshine increased by 8% as compared to 15YA. These climatic conditions were favorable for maize harvest. CropWatch estimated the potential biomass was 3% above 15YA. The agronomic indicators presented that the cropped arable land fraction (CALF) was closed to the 15YA (-1%) and the maximum vegetation condition index (VCIx) reached a moderate value of 0.77. The satellite-based NDVI graph shows that the crop conditions were lower than the 5YA throughout most of the period. The below-average development of NDVI in October was due to the continuous deficiency of rainfall from September to October and had a negative effect on the establishment of winter wheat. The drop in NDVI in December might have been caused by snow or cloud cover in the satellite images. High precipitation in December and January helped restore soil moisture and the crops may recover from the below-average conditions during spring green up. The spatial distribution of NDVI shows that NDVI in nearly all cropped areas substantially dropped in December and were 0.1 to 0.2 units lower than the average in mid-January. As shown by VCIx map, crop conditions were lower in southern Ukraine, VCIx was even below 0.5 in Kherson, Zaporizhia oblasts. All in all, the situation was fair at the national level.

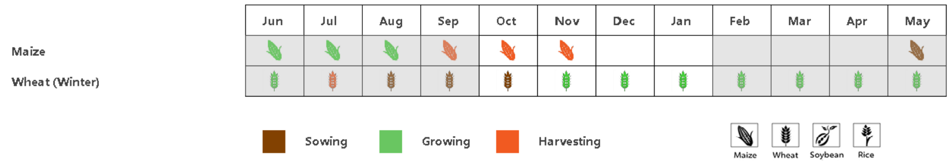
Regional analysis

Based on cropping system, climatic zones and topographic conditions, regional analyses are provided below for four agro-ecological zones (AEZ), including the **Central wheat area** (including Poltava, Cherkasy, Dnipropetrovsk and Kirovohrad Oblasts), **Northern wheat area** (including Rivne, Zhytomyr and Kiev oblasts), **Eastern** Carpathian **hills** (Lviv, Zakarpattia and Ivano-Frankivsk oblasts) and S**outhern wheat and maize area** (Mykolaiv, Kherson and Zaporizhia oblasts).

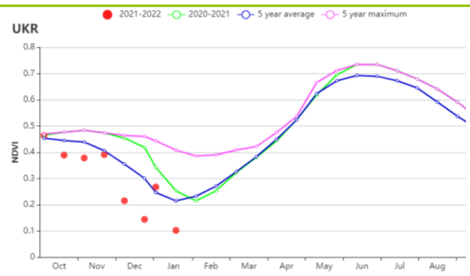
In this period, **Central wheat area, Northern wheat area and Southern wheat and maize area** shared similar agroclimatic conditions. All these AEZs received less rainfall (from -3% to -9%) but had higher temperatures (from +0.2°C to +0.5°C) and above average sunshine (from +6% to 11%). CropWatch estimated the potential biomass was slightly higher (from +2% to +4%) in comparison to 15YA. Agronomic indicators show moderate CALF (0.68 and 0.52) and VCIx (0.78 and 0.69) in **Central wheat area** and **Southern wheat and maize area**. This indicates overall moderate condition in these two AEZs. In the **Northern wheat area**, a 0.88 CALF indicates that most of the arable land is cropped. It also attained good VCIx of 0.84 showing good prospects for winter crops.

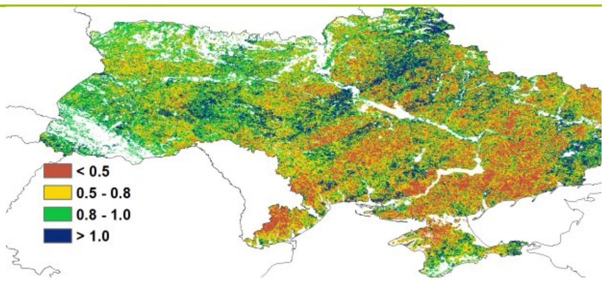
Compared to the other three AEZs, **Eastern Carpathian hills** received normal rainfall (+0%) but experienced lower temperature (-0.3°C) and higher radiation (+9%). Biomass was estimated to be around the 15YA (-1%). Agronomic indicators show very good CALF (0.98) and VCIx (0.88). Despite the NDVI of this area being lower since December, all other conditions indicate good crop prospects.

Figure 3.41 Ukraine's crop condition, October 2021 - January 2022

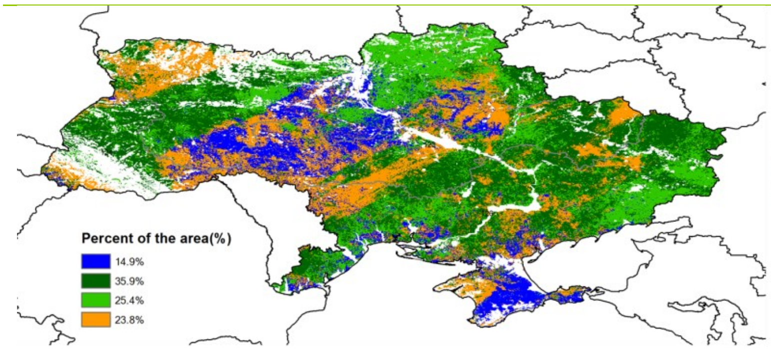


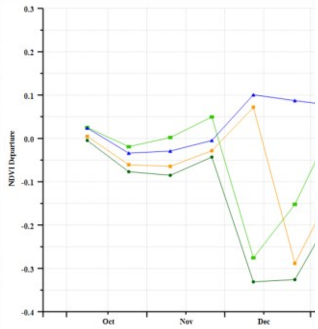
(a). Phenology of major crops



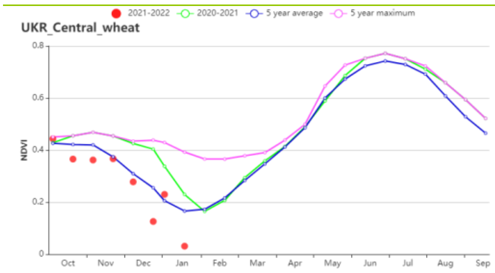


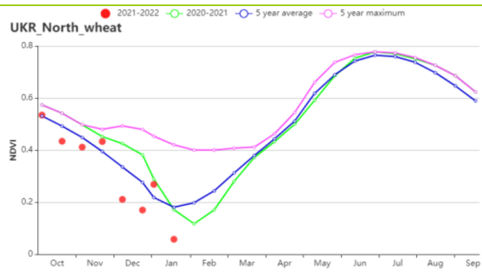
(b) Crop condition development graph based on NDVI (c) Maximum VCI



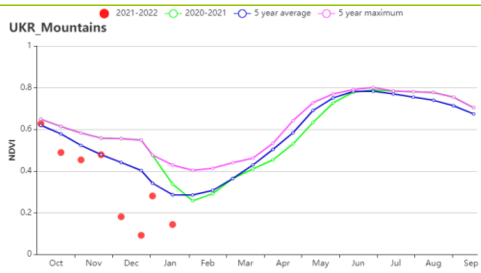


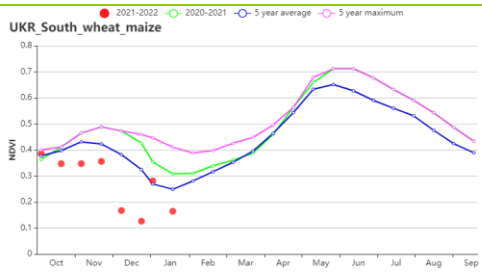
(d) Spatial NDVI patterns compared to 5YA (e) NDVI profiles



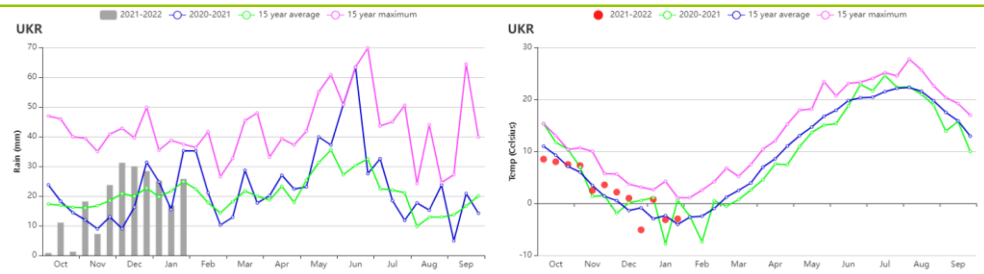


(e) Crop condition development graph based on NDVI (Central wheat area(left) Northern wheat area(right))





(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 3.74 Ukraine's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, October 2021 - January 2022

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Central wheat area	205	-9	2.1	0.4	287	9	421	4
Eastern Carpathian hills	254	0	1.7	-0.3	315	9	408	-1
Northern wheat area	226	-7	1.8	0.2	249	11	414	2
Southern wheat and maize area	205	-3	3.4	0.5	326	6	444	3

Table 3.75 Ukraine's agronomic indicators by sub-national regions, current season's values and departure from 5YA, October 2021 - January 2022

Region	Cropped arable land fraction		Crop Intensity		Maximum VCI
	Current (%)	Departure (%)	Current	Departure (%)	Current
Central wheat area	68	5	0.78	68	5
Eastern Carpathian hills	98	1	0.88	98	1
Northern wheat area	88	3	0.84	88	3
Southern wheat and maize area	52	-13	0.69	52	-13

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

This reporting period begins in October 2021 and ends in January 2022. Winter crops were the dominant crop during this period, covering the sowing, tillering and overwintering stages of winter cereals. Overall, crop conditions for the winter crop were below average due to drought conditions that occurred in the Southern Plains and some states of the Midwest.

As a whole, the United States experienced a relatively warm and dry winter. Compared with the 15-year average (15YA), precipitation was 12% below average, the temperature was above average by 1.0℃, and radiation was 4% above average. The agro-climatic conditions vary in the three winter crops producing areas: the Southern Plains, Northwest, and California. As the most important winter crop production area, the Southern Plains experienced extremely dry and warm winter weather with severe drought prevailing in the major states of the region. On the contrary, wet agro-climatic conditions were observed in Northwest and California.

The marked heterogeneity of agro-climatic conditions leads to significant differences in crop development across regions. Crop conditions were generally below average in the Southern Plains due to a rainfall deficit. The map of NDVI departure clustering indicated that crop conditions in the Southern Plains deteriorated starting in mid-November 2021. Unfavorable crop conditions are also captured by a VCIx below 0.5. On the contrary, favorable crop conditions were observed in California with almost all of the areas showing VCIx above 1. Above average crop conditions in California were also supported by NDVI departure above 0. Crop conditions in the northwestern U.S. were mixed, with good crop conditions occurring until late November and then returning to below-average conditions when winter crops entered the dormant period.

In conclusion, the crop condition of the winter crops was assessed as below average. In the next reporting period, winter crops will be at jointing to flowering stage with high water demand, and CropWatch will closely watch the agro-climatic and agronomic dynamics, especially in the Southern Plains.

Regional analysis

This reporting period covers the sowing and establishment of the winter cereals and focuses on three AEZs, the Southern Plains, Northwest, and California.

Southern Plains

Southern Plains, the top producer of winter crops, experienced an extremely dry and warm fall and winter with rainfall 23% below average and temperature 1.9℃ above average. Conditions in each state were as follows: Kansas (RAIN: -37%, TEMP: +2. 2°C), Oklahoma (RAIN: -28%, TEMP: +2.1°C) and Texas (RAIN: -27%, TEMP: +1.9°C). Although this period is in the early stage of winter crops and water demand is low, the serve drought hampered the growth of winter crops before overwintering. Poor crop conditions prevailed in this area. Potential biomass was 24%, 17%, 14% lower than the 15YA in Kansas, Oklahoma, and Texas respectively. Departures in potential biomass (-12%), and CALF (-6%), as well as low value of VCIx (0.73) all indicated the unfavorable crop conditions in the Southern Plains.

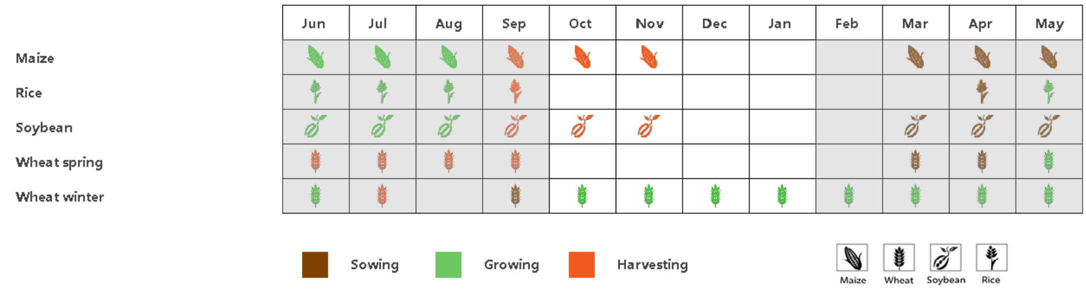
Northwest

Wet agroclimatic conditions occurred in the Northwest, such as Washington (rainfall: +20%, temperature: +0.1°C), and Idaho (rainfall: +6%, temperature: +0.8°C). Compared to the 15YA, precipitation and temperature are 10% and 0.5°C above average, respectively. NDVI curves indicate good crop conditions until mid-December. The good crop condition is also reflected in the VCIx value of 0.90. Wet and warm agro-climatic conditions had facilitated crop planting, with CALF 17% higher than average compared to the last 5-year average. If the good agro-climatic conditions continue, above-average production can be expected in the region.

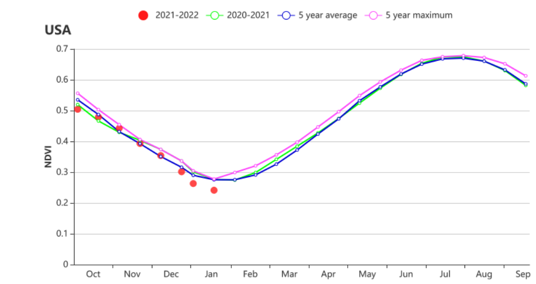
California

California is the most important vegetable and fruit producing region in the United States, and an important winter wheat producing region. The weather in the region is dominated by a Mediterranean climate with wet and warm winters. The region experienced a favorable agroclimate that created a conducive environment for the sowing and tillering of winter wheat, as well as the growth of vegetable and fruits. Compared to the 15YA, rainfall was 19% above the 15YA and temperatures were 0.3℃ below. The development of the NDVI curve indicates good crop conditions, which are close to optimal compared to the 5-year average. The VCIx value for California was 0.88, reflecting good crop conditions. Warm and wet weather promoted crop planting, and CALF in California was 13% higher than average compared to the past 5 years. In summary, crop conditions in California were assessed as favorable.

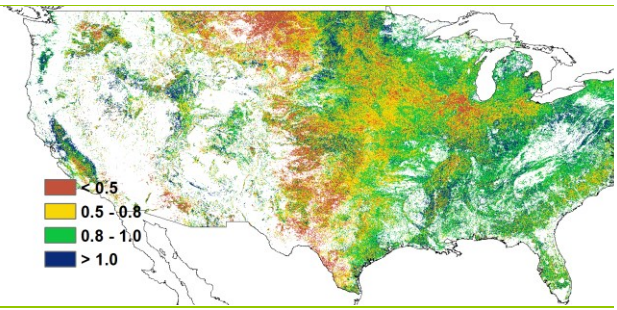
Figure 3.42 United States crop condition, October 2021 – January 2022



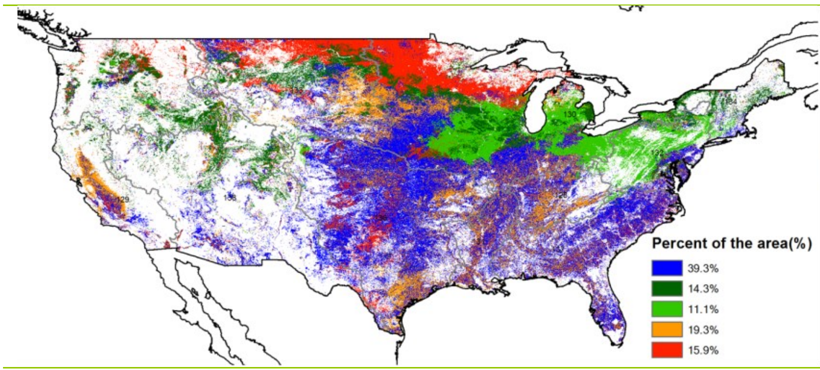
(a). Phenology of major crops



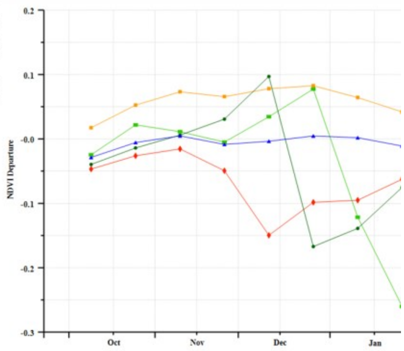
(b) Crop condition development graph based on NDVI



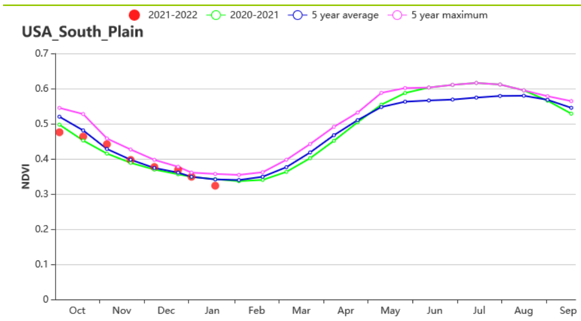
(c) Maximum VCI



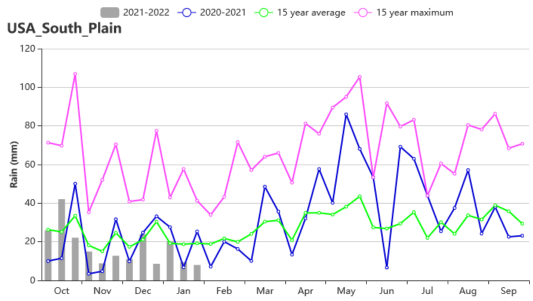
(d) Spatial NDVI patterns compared to 5YA



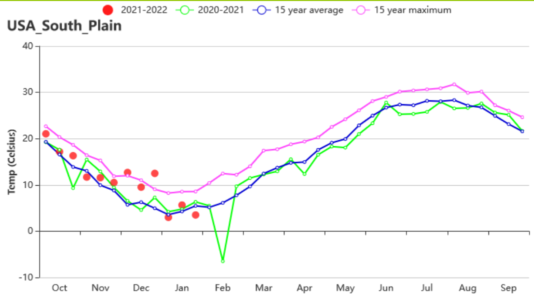
(e) NDVI profiles



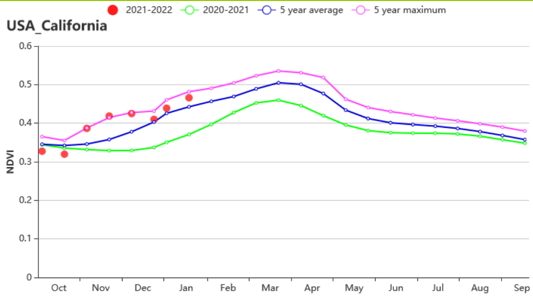
(f) Crop condition development graph based on NDVI (South Plains



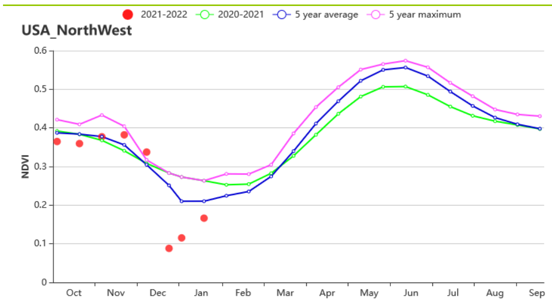
(g) Rainfall profiles(South Plains)



(h) Temperature profiles (South Plains)



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



(j) Crop condition development graph based on NDVI(NorthWest)

Table 3.76 United States agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, October 2021 – January 2022

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
California	384	16	9.4	-0.3	639	-1	476	0
Corn Belt	272	-6	2.5	0.9	457	3	443	6
Lower Mississippi	348	-30	12.6	1.5	657	5	762	-3
North-eastern areas	353	-15	3.8	0.5	468	5	498	2
Northwest	498	10	1.8	0.5	394	-3	410	4
Northern Plains	154	-2	0.6	1.5	485	2	330	5
Southeast	325	-19	13	0.7	700	5	714	-3
Southwest	140	-11	6	1.1	762	3	326	-5
Southern Plains	208	-23	11.3	1.9	707	6	435	-12

Table 3.77 Afghanistan's agronomic indicators by sub-national regions, current season's values and departure from 5YA, October 2021 – January 2022

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
California	70	13	0.88
Corn Belt	79	-3	0.80
Lower Mississippi	90	2	0.91
North-eastern areas	100	0	0.94
Northwest	49	17	0.90
Northern Plains	26	-5	0.66
Southeast	100	0	0.90
Southwest	26	14	0.82
Southern Plains	64	-6	0.73

[UZB] Uzbekistan

The monitoring period from October 2021 to January 2022 covers the sowing and early growth stages of winter wheat in Uzbekistan. Among the CropWatch agroclimatic indicators, TEMP and RADPAR were above average (+0.3°C and +3%), while RAIN was below average (-21%), especially in October and November. The Insufficient rainfall from October to mid-December and cooler temperature in October and November may have had a negative impact on the emergence and tillering of winter wheat. The BIOMSS decreased by 12%, and the NDVI development graph shows that the crop conditions were below the five-year average until January. This phenomenon is also visible in the NDVI cluster graph. More than 61.9% of the agriculture areas had below-average conditions in October and November. The national average VCIx was 0.72, and the cropped arable land fraction decreased by 26%. Close to average rainfall starting in mid-December and above average rainfall in January may help improve the situation during the green-up phase in the spring. For this period, conditions for winter wheat were unfavorable.

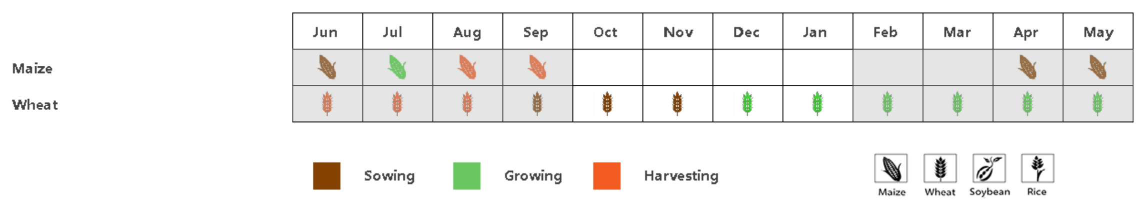
Regional analysis

In the **Central region with sparse crops**, the NDVI development graph shows that the crop conditions were below average from October to November, and close to the average in December and January. Rain was below average (-18%), while TEMP and RADPAR were slightly above average (+0.4°C and +3%). Consequently, BIOMSS decreased by 13% compared to the 15YA. The agro-climatic conditions of this region were unfavorable.

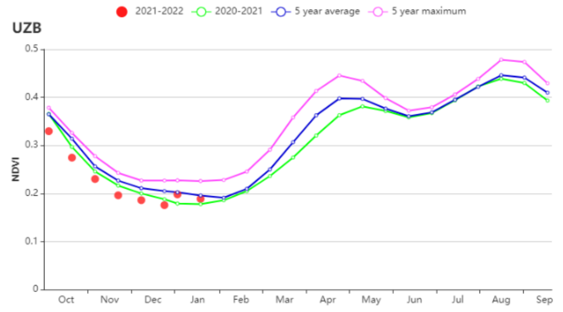
In the **Eastern hilly cereals zone**, RAIN was below average (-21%), while TEMP and RADPAR were slightly above average (+0.4°C and+3%). The cropped arable land fraction (17%) was the highest among the three main crop regions, but it decreased by 27% compared to the 5YA. And the BIOMSS decreased by 13%, the maximum VCI index was 0.69. The crop condition development graph also shows unfavorable conditions for this region from October to January.

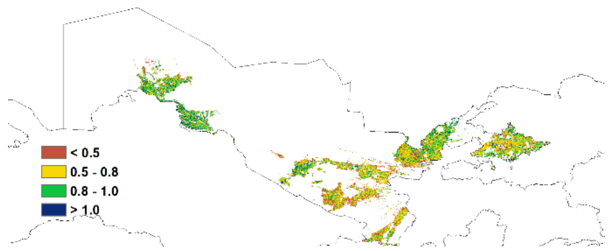
In the **Aral Sea cotton zone**, precipitation was 15% below the fifteen-year average and the average temperature was below average as well (TEMP -0.3°C), while RADPAR was slightly above average (+2%). These factors resulted in a slight decrease in BIOMSS (-9%). The agro-climatic conditions of this region were unfavorable.

Figure 3.43 Uzbekistan crop condition, October 2021 - January 2022

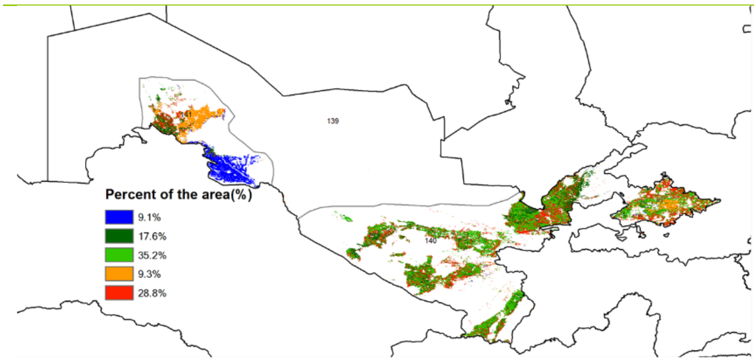


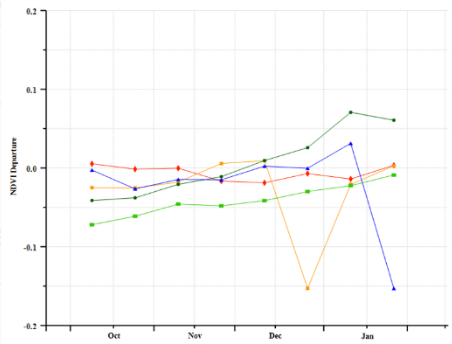
(a) Phenology of major crops



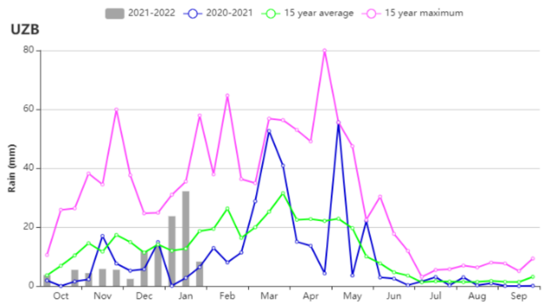


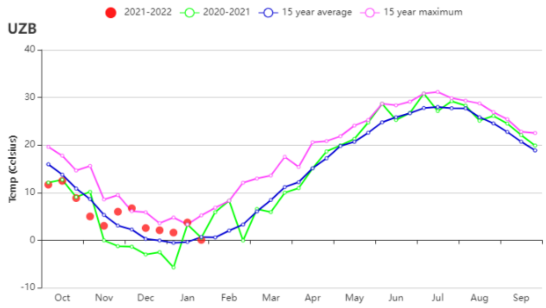
(b) Crop condition development graph based on NDVI (c) Maximum VCI



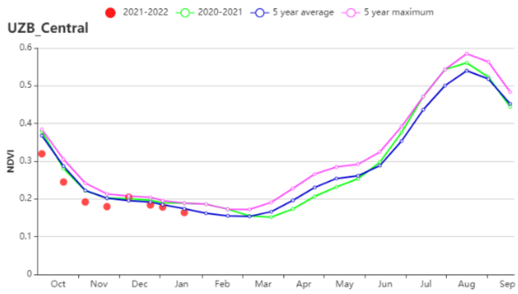


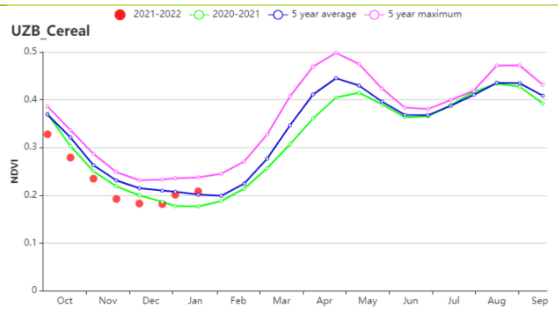
(d) Spatial NDVI patterns compared to 5YA (e) NDVI profiles



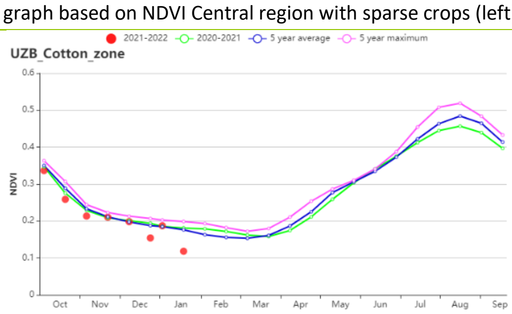


(f) Rainfall profiles (g) Temperature profiles





(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 3.78 Uzbekistan's agroclimatic indicators by sub-national regions, current season's values, and departure from 15YA, October 2021 - January 2022

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m^2)	Departure (%)	Current (gDM/m^2)	Departure (%)
Central region with sparse crops	58	-18	5.3	0.4	596	3	186	-13
Eastern hilly cereals zone	125	-21	5.5	0.4	634	3	286	-13
Aral Sea cotton zone	44	-15	3.4	-0.3	557	2	170	-9

Table 3.79 Uzbekistan's agronomic indicators by sub-national regions, current season's values, and departure from 5YA, October 2021 - January 2022

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Central region with sparse crops	7	-67	0.66
Eastern hilly cereals zone	17	-27	0.69
Aral Sea cotton zone	4	-5	0.83

[VNM] Vietnam

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

The agro-climatic condition showed that TEMP (19.5°C) was close to the 15YA and the RADPAR was below average (-2%), but rainfall was above average RAIN (+21%). The resulting estimate for BIOMSS showed an increase by 2% compared to the 15YA. The VCIx (0.95) was high, and the CALF (97%, +1%) was above the 5YA.

Based on the NDVI development graph, the crop conditions were below the 5YA during the whole monitoring period, especially in October, November and January. According to the spatial distribution of NDVI profiles, crop conditions on about 58.7% of the country were slightly below the average, mainly distributed over South Vietnam, Nghe An Province, Thai Binh Province and Thanh Hoa Province. Crop conditions on another 6.8% of the area were significantly below average in early October and early January, mainly distributed over Ha Giang Province and Lao Cai Province. However, these strong negative departures are most likely due to cloud cover in the satellite images. Overall, the crop conditions are expected to be below average.

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**, TEMP (20.8°C, -0.1°C) was slightly below the average, and RAIN (786 mm, +34%) was significantly above the average. Although the RADPAR (912 MJ/m^2, -1%) decreased, the BIOMSS increased by 6%. CALF was 99% and VCIx was 0.96. The crop condition development graph showed that NDVI was near the 5YA, except in early October, late November and early December. The crop conditions are expected to be near average.

In the **Mekong River Delta region**, TEMP (25.8°C, -0.1°C) and RADPAR (1109 MJ/m^2, +1%) were close to the 15YA, while RAIN (812 mm, +11%) was significantly above. CALF was 93% and VCIx was 0.92. According to the NDVI development graph, crop conditions were slightly below the 5YA except in December. Overall, the crop conditions were slightly below average.

In the **North Central Coast**, RAIN was higher than the 15YA (711 mm, +6%), and TEMP (18.0°C, +0.1°C) was near average. RADPAR was 675 MJ/m^2 with a slight decrease by 1% and BIOMSS decreased slightly (-1%). CALF was above the 5YA and VCIx was 0.94. According to the NDVI development graph, crop conditions were below the 5YA. They are estimated to be below average.

In the **North East region**, RAIN (483 mm, +27%) increased significantly. TEMP was the same as the 15YA (15.9°C, +0°C) and RADPAR (630 MJ/m^2, -6%) was lower. The BIOMSS increased by 4%. CALF was 100% and VCIx was 0.98. According to the NDVI development graph, crop conditions fluctuated greatly. The crop conditions were mixed, but close to average.

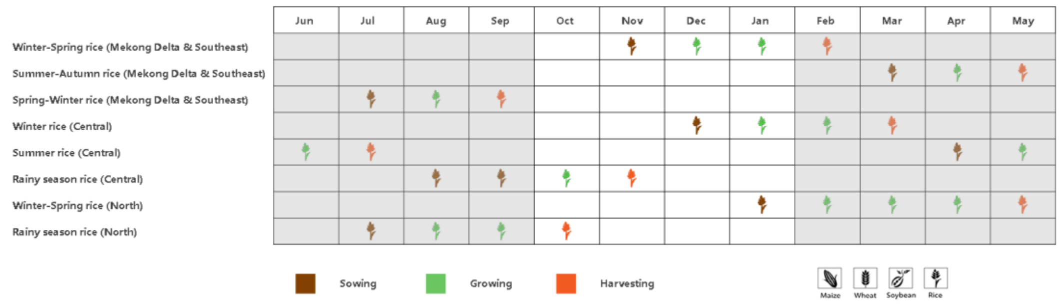
In the **North West region**, TEMP (15.5°C, +0°C) was the same as the 15YA, while RAIN (377 mm, +29%) had increased significantly. RADPAR (765 MJ/m^2, -1%) was close to the average, and the BIOMSS increased 7% compared to the 15YA. CALF was 100% and VCIx was 0.97. According to the NDVI development graph, crop conditions fluctuated greatly. In late November and early December, the NDVI approached the 5-year-maximum. Overall, the crop conditions are expected to be favorable.

In the region of the **Red River Delta**, RAIN (558 mm, +23%) increased significantly and TEMP (18.8°C, -0.2°C) was below the 15YA. Due to the decreased RADPAR (612 MJ/m^2, -7%), the BIOMSS (-4%) was below the average. CALF was 92% and VCIx was 0.89. According to the crop condition development graph, NDVI was below the 5YA especially in January. Overall, the crop conditions in this region were below average.

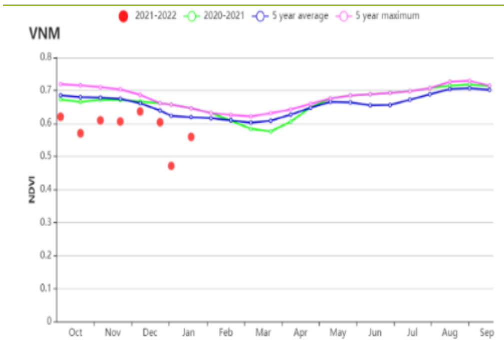
In the **South Central Coast**, RADPAR (696 MJ/m^2, -2%) was below the 15YA, TEMP (20.0° C, +0.1%) and RAIN (1454 mm, +34%) were both above the 15YA. The BIOMSS increased by 4%. CALF was 96% and VCIx was 0.92. According to the crop condition development graph, the NDVI was below the 5YA except in late January showing a high value exceeding the 5YA. Thus, crop conditions in this region were about average.

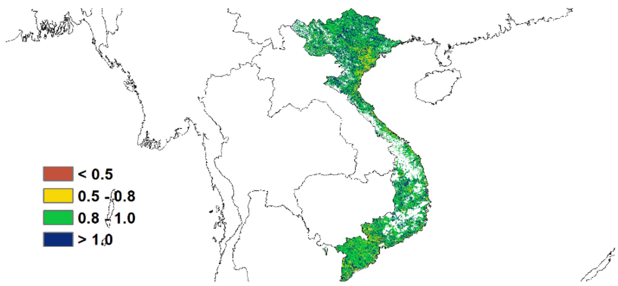
In the **South East region**, TEMP (24.3° C, -0.1° C) was slightly below the average, and RAIN (792 mm, +18%) was above the 15YA. BIOMSS (+1%) was above the 15YA. CALF was 96% and VCIx was 0.93. As shown by the crop condition development graph, except at the beginning of this monitoring period, the NDVI was close to the 5YA. According to the agroclimatic indicators, crop conditions in this region are expected to be near average.

Figure 3.44 Vietnam's crop condition, October 2021 – January 2022



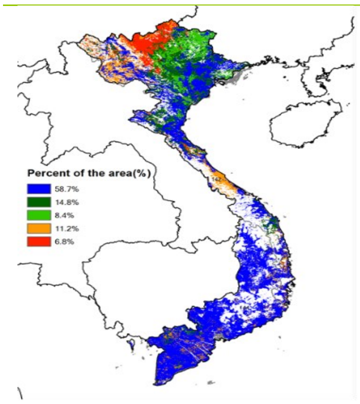
(a). Phenology of major crops

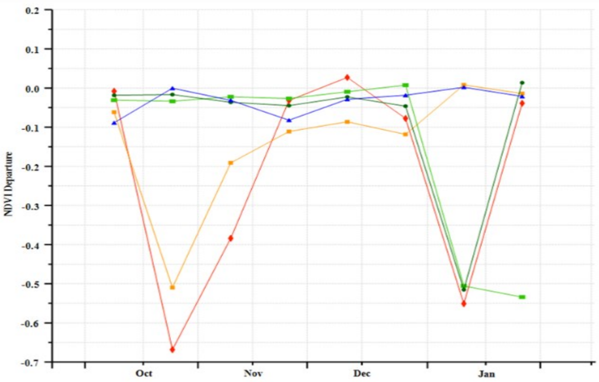




(b) Crop condition development graph based on NDVI

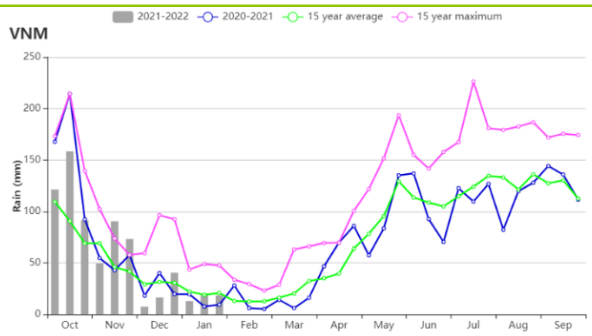
(c) Maximum VCI

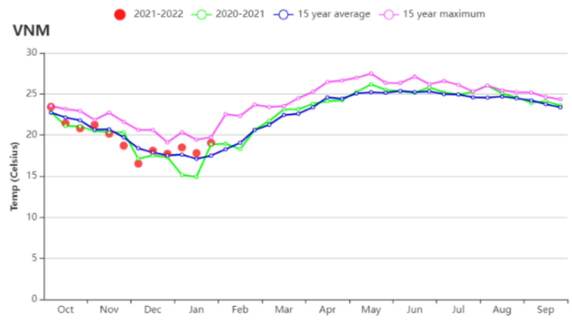




(d) Spatial NDVI patterns compared to 5YA

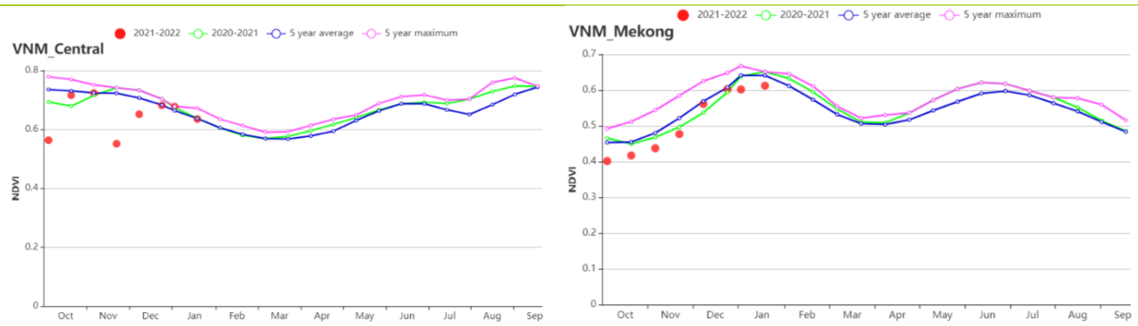
(e) NDVI profiles



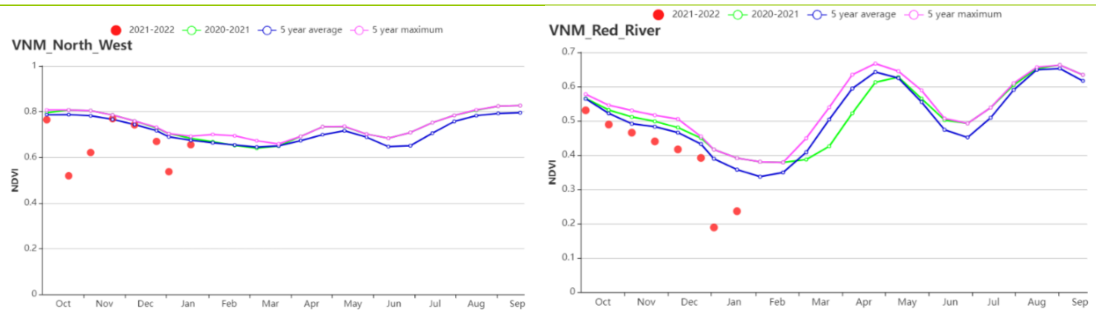


(f) Rainfall profiles

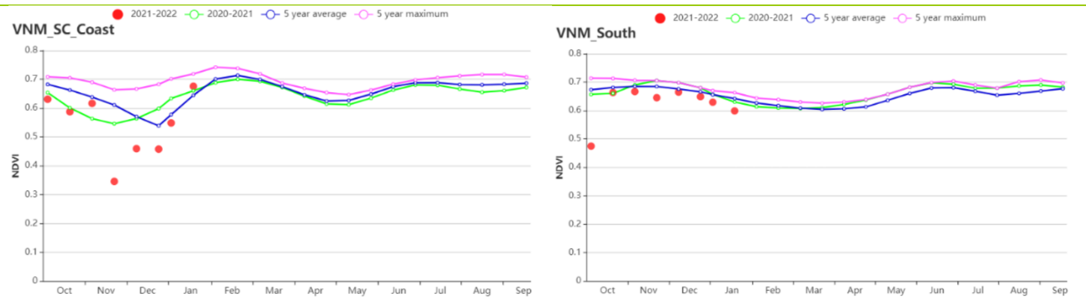
(g) Temperature profiles



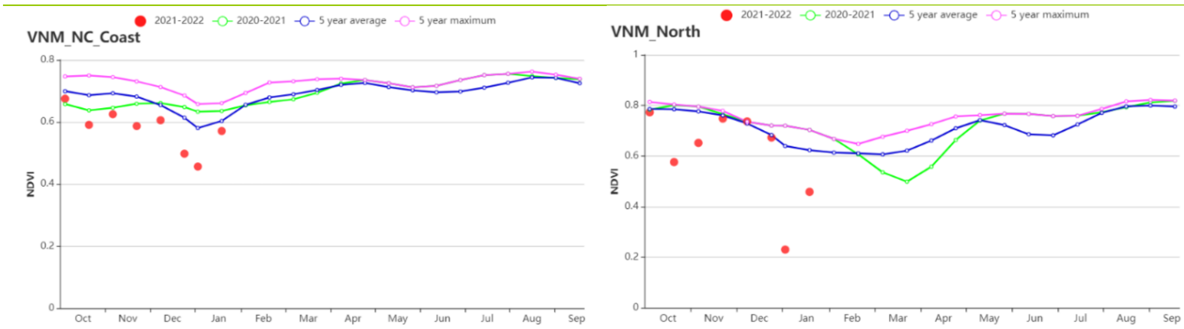
(h) Crop condition development graph based on NDVI Central Highlands Vietnam (left), and Mekong River Delta (right).



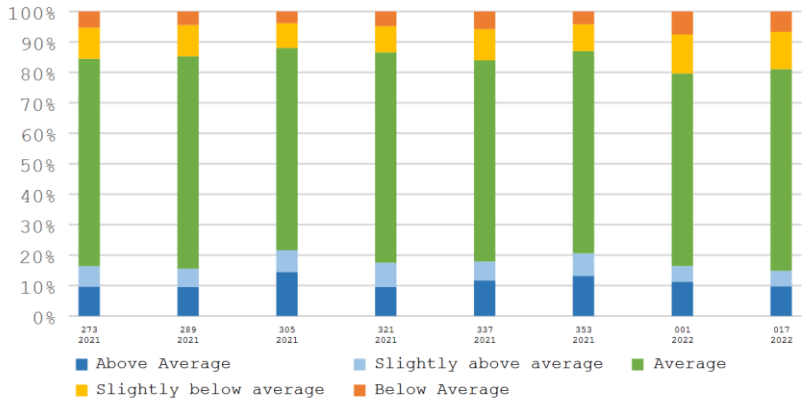
(i) Crop condition development graph based on NDVI North West Vietnam (left), and Red River Delta (right).



(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).



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

Table 3.80 Vietnam's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, October 2021 – January 2022

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m^2)	Departure (%)	Current (gDM/m^2)	Departure (%)
Central Highlands	786	34	20.8	-0.1	912	-1	978	6
Mekong River Delta	812	11	25.8	-0.1	1109	1	1222	-2
North Central Coast	711	6	18.0	0.1	675	-1	892	-1
North East	483	27	15.9	0.0	630	-6	772	4
North West	377	29	15.5	0.0	765	-1	682	7
Red River Delta	558	23	18.8	-0.2	612	-7	791	-4
South Central Coast	1454	34	20.0	0.1	696	-2	1183	4
South East	792	18	24.3	-0.1	1078	0	1103	1

Table 3.81 Vietnam's agronomic indicators by sub-national regions, current season's values and departure from 5YA, October 2021 – January 2022

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Central Highlands	99	0	0.96
Mekong River Delta	93	2	0.92
North Central Coast	95	1	0.94
North East	100	0	0.98
North West	100	0	0.97
Red River Delta	92	2	0.89
South Central Coast	96	1	0.92
South East	96	0	0.93

[ZAF] South Africa

In South Africa, wheat is the main crop harvested during this monitoring period. Maize sowing started in October for the east and in December for the west. Soybean planting also started in October.

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 +4%). With a lower rainfall (RAIN -34%) and a slightly lower temperature (TEMP -0.3℃), the potential biomass decreased by 11% compared to the 15-year average. The maximum vegetation condition index (VCIx) was 0.94, and the cropped arable land fraction (CALF) increased significantly by 25% 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 eastern region (like Gauteng, Mpumalanga). As to the spatial distribution of NDVI profiles, crop conditions on about 12.5% and 33.4% of the cropland were below or above average during the whole monitoring period, respectively. Crop conditions on 23.5% were average until November, then above average, and 30.7% was below average until December and then above average. The areas with negative departures were mainly in the center of the eastern region, most located in Gauteng, Mpumalanga, North West and Orange free state province. Overall, crop conditions were favorable.

Regional analysis

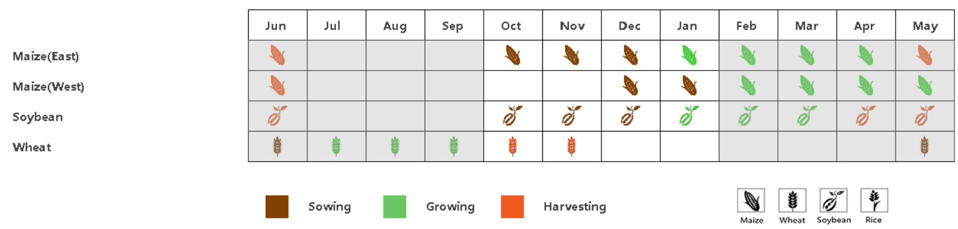
Rainfall in the Arid and desert zones was significantly above average (189 mm, +58%) and the temperature was near average (19.9°C, -0.6°C), whereas radiation was slightly above average (+2%), and potential biomass increased by 12%. Cropped arable land fraction (CALF) increased significantly (+115%) and VCIx was 1.03. The crop condition development graph based on NDVI indicates that the crop conditions were generally above the 5-year average and even above the 5-year maximum in December. Crop production is expected to be favorable.

In the Humid Cape Fold mountains, the temperature was near average (19.4 °C, +0.1 °C), and rainfall was below average (268 mm, -33%). With lower rainfall, potential biomass was below the 15-year average (-10%). CALF was 97% and VCIx was 0.98. The crop condition development graph based on NDVI also indicates favorable conditions.

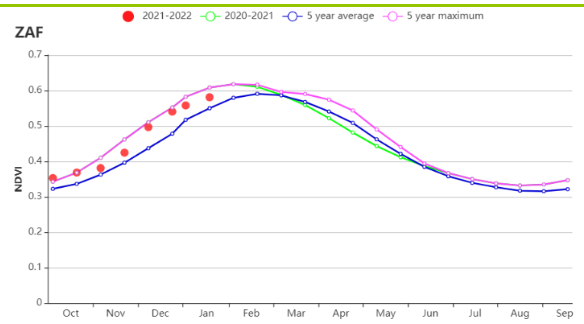
In the Mediterranean zone, the temperature was near average (18.2 °C, -0.1 °C), while rainfall witnessed a significant increase (147mm, +24%) and radiation was slightly above average (+1%). The estimated potential biomass increased significantly by 11% due to the sufficient rainfall. CALF increased substantially (73%, +28%) and VCIx was 0.93. According to the crop condition development graph, the NDVI was above the 5-year maximum for most of the period. Crop conditions were favorable.

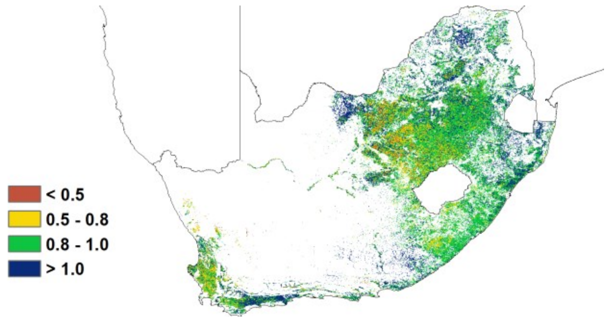
In the Dry Highveld and Bushveld maize areas, rainfall (168 mm, -39%) and temperature (20.0 °C, -0.4°C) were below the 15-year average. Radiation was near average (1529 MJ/m^2, +4%). Potential biomass decreased by 15%. CALF was significantly above the 5YA (94%, +28%) and VCIx was 0.92. The crop condition development graph based on NDVI shows the NDVI was above the 5-year average for most of the period. Crop conditions were favorable.

Figure 3.45 South Africa's crop condition, October 2021 – January 2022



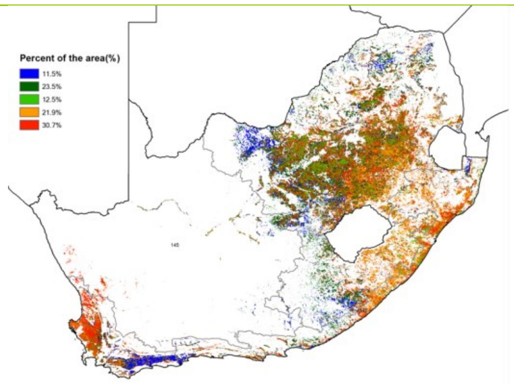
(a) Phenology of major crops

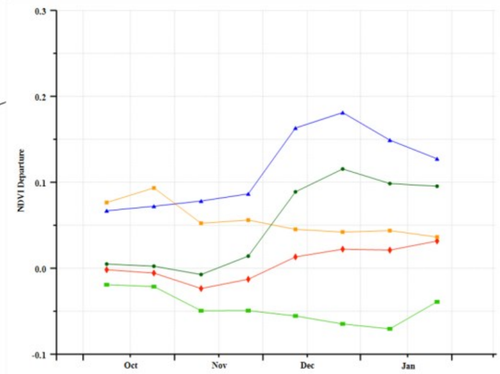




(b) Crop condition development graph based on NDVI

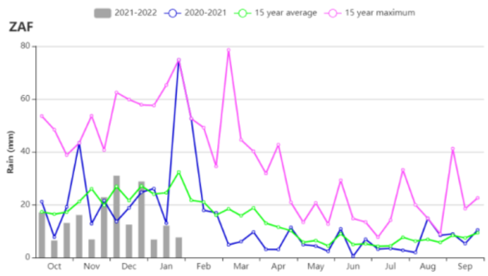
(c) Maximum VCI

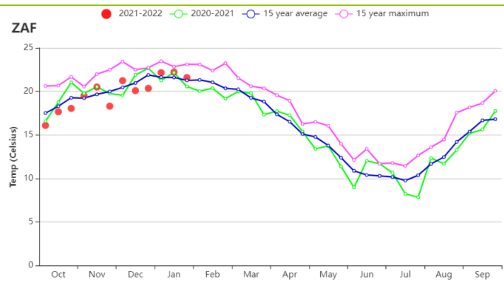




(d) Spatial NDVI patterns compared to 5YA

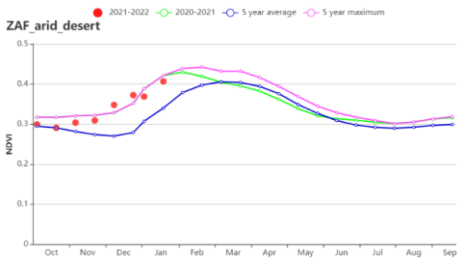
(e) NDVI profiles

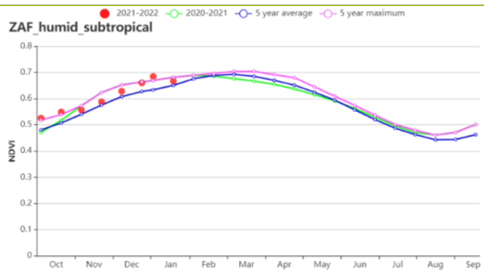




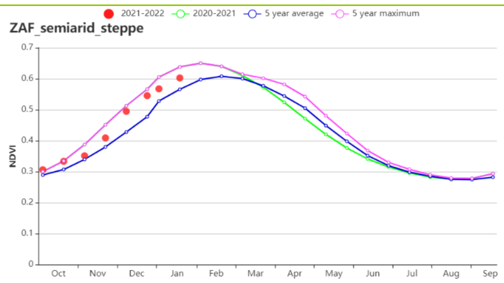
(f) Rainfall profiles

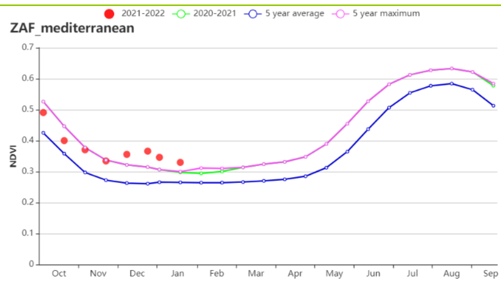
(g) Temperature profiles





(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 3.82 South Africa's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, October 2021 – January 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	189	58	19.9	-0.6	1646	2	760	12
Humid Cape Fold mountains	268	-33	19.4	0.1	1351	7	887	-10
Mediterranean zone	147	24	18.2	-0.1	1594	1	703	11
Dry Highveld and Bushveld maize areas	168	-39	20.0	-0.4	1529	4	752	-15

Table 3.83 South Africa's agronomic indicators by sub-national regions, current season's values and departure from 5YA, October 2021 – January 2022

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Arid and desert zones	51	115	1.03
Humid Cape Fold mountains	97	4	0.98
Mediterranean zone	73	28	0.93
Dry Highveld and Bushveld maize areas	94	28	0.92

[ZMB] Zambia

The reporting period covers the onset and establishment of the rainy season. It is characterized by the land preparation for and planting of rainfed cereal crops and legumes/pulses and the harvesting of irrigated crops. Late onset (November and December rainfall being below the 15YA) and reduced seasonal rainfall particularly in eastern parts dampened the agricultural production prospects for the 2021/2022 cereal production. Some heavy rains, recorded in early January, caused localized flooding and damage in most parts of southern Zambia.

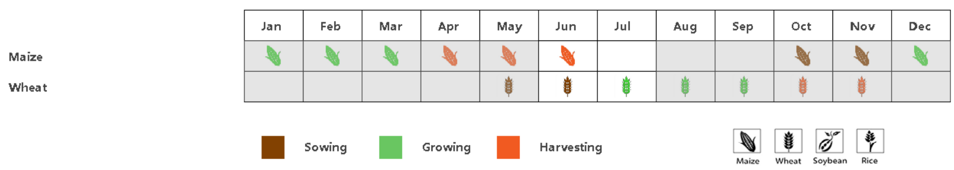
This monitoring period recorded a below normal rainfall of 551 mm (RAIN -37%), an average temperature of 24.6°C (+1.1%) and an average radiation of 1366 MJ/m^2 (+4%), resulting in potential biomass production reduction (BIOMSS -15%). The cropped arable land fraction (CALF) was 96% (-2%) and the VCIx was 0.84. Countrywide, climatic indicators generally showed unfavorable condition for early crop establishment for the main cereals (maize, sorghum and millet) and pulses/legume (soybean, groundnuts, cowpeas, sunflower, beans, pumpkins etc).

Regional analysis

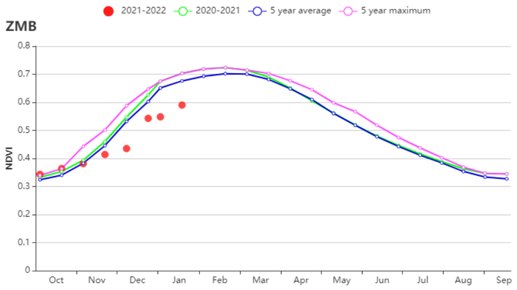
The analyses of the agro-ecological regions show that the rainfall was below normal in all regions. The reduction ranged from -43% (**Western Semi-arid Plateau**) to -31% (**Luangwa-Zambezi Rift Valley**) resulting in reduction in potential biomass production by (-17% to - 11%) in all three regions. The average temperature in the regions varied from 23.3°C to 25.5°C with positive departure (+0.7°C to 1.3°C) from the 15YA. The radiation in all agro-ecological zones was more than 1247 MJ/m$^{2.}$ A negative departure (-6%) was observed for the Western **Semi-Arid** region.

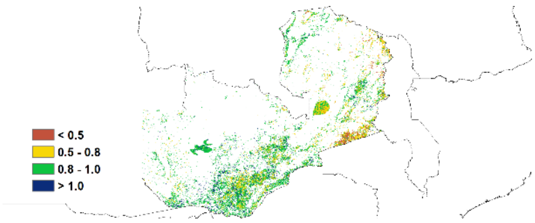
The observed Cropped Arable Land Fraction (CALF) was above 91% in all the regions however the crop condition based on NDVI showed low coverage in later parts of the reporting period. The maximum vegetation health index (VCIx) was the lowest in **Central -Eastern Plateau** region (0.80) and **Northern High Rainfall** (0.82) while **Western semi-arid** and **Luangwa-Zambezi valleys** (0.89). In general, the traditionally low rainfall regions experienced increased rainfall, hence favorable conditions for crop productions. The weather outlook indicates a higher-than-normal probability of above-average cumulative rainfall, which portrays favourable yield prospects for the 2021/22 cereal crops. The potential risk is the infestation of fall army worms and outbreaks of African migratory locusts in southern and western provinces. The impact of the COVID-19 pandemic, primarily due to constraints on incomes and economic access to food has been a key factor contributing to food insecurity at national level. Despite a slow start of the season CropWatch expects a below-average to average production for 2021/2022 season.

Figure 3.46 Zambia crop condition, October 2021 - January 2022

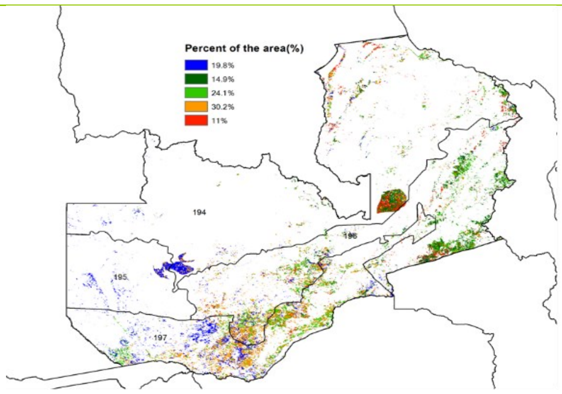


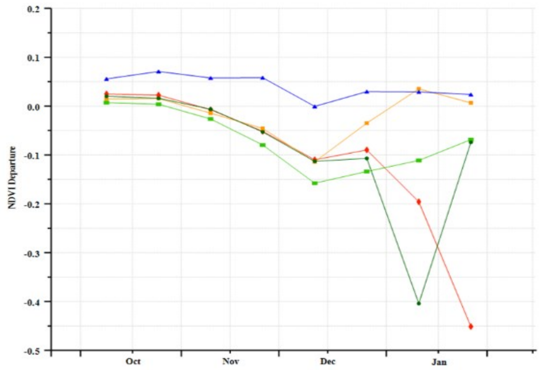
(a) Phenology of major crops



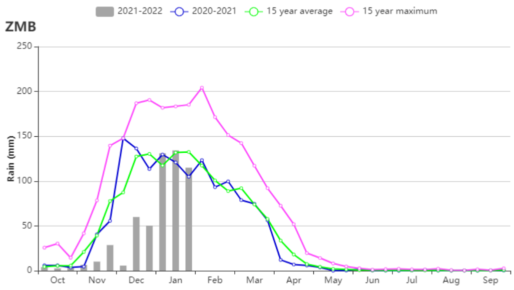


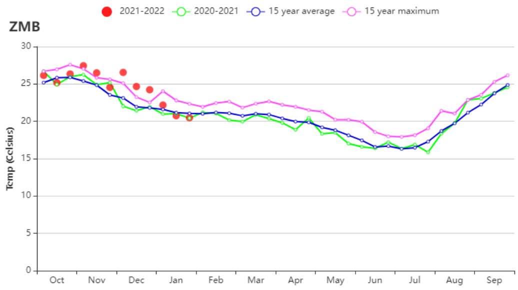
(b) Crop condition development graph based on NDVI (c) Maximum VCI



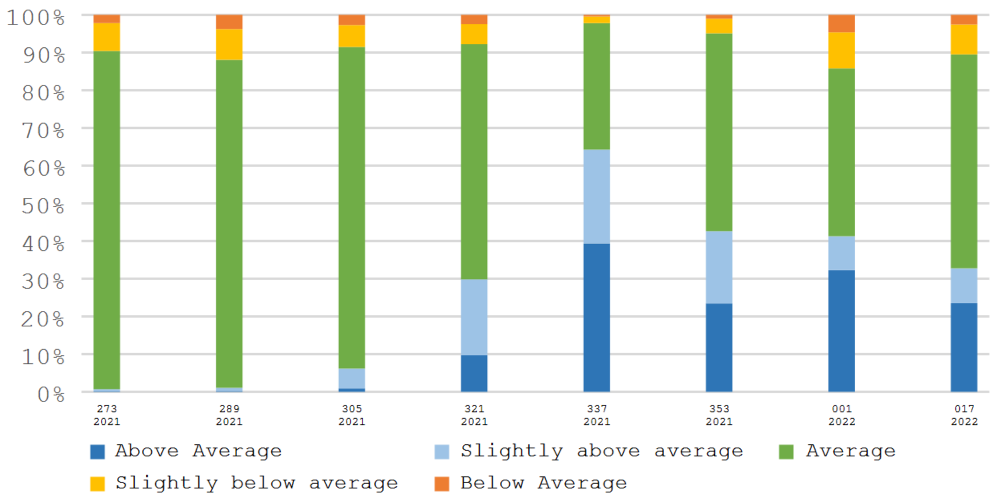


(d) Spatial NDVI patterns compared to 5YA (e) NDVI profiles





(f) Rainfall profiles (g) Temperature profiles



(i) Propotion of NDVI anormaly categories compared with 5YA

Table 3.84 Country's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, October 2021 – January 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	551	-31	25.5	+0.7	1390	0	1055	-11
Northern high rainfall zone	633	-36	23.3	+1.3	1350	+8	1082	-15
Central Eastern and southern plateau	513	-38	25.0	+1.2	1400	+6	998	-17
Western semi-arid plain	474	-43	25.5	+0.8	1247	-6	1069	-17

Table 3.85 Country's agronomic indicators by sub −national regions, current season's values and departure from 5YA, October 2021– January 2022

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
Luangwa-Zambezi rift valley	99	+2	0.89
Northern high rainfall zone	98	-1	0.82
Central, eastern and southern plateau	91	-5	0.80
Western semi-arid plain	99	+1	0.89

Chapter 4. China

This chapter starts with a brief overview of the agro-climatic and agronomic conditions in China over the reporting period (section 4.1). Next it describes the situation by region, focusing on the seven most productive agro-ecological regions of the east and south: Northeast China, Inner Mongolia, Huanghuaihai, Loess region, Lower Yangtze, Southwest China, and Southern China (4.2). Section 4.3 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

Agro-climatic conditions were quite favorable in China from October 2021 to January 2022. Rainfall and temperature had increased by 18% and 0.3°C over the 15YA, respectively. Radiation was 3% below the 15YA. The abundant rainfall resulted in the above-average potential biomass (+11%). Due to the complexity and variability of climatic conditions in China, weather conditions vary over different agroecological zones. Temperatures in six of the agroecological zones (AEZs) of China were at or above average, ranging from 0.0°C to +1.0°C. Only Loess region had slightly below-average temperature (-0.1℃). All AEZs received above-average rainfall, and the departure of rainfall from the 15YA ranged from +9% to +113%. The potential biomass is a synthetic indicator taking rainfall, radiation, and temperature into consideration. Potential biomass in all seven AEZs was above average, with the smallest positive departure of +6% in Southern China and the biggest positive departure of +31% in Huanghuaihai and Loess region, indicating rather favorable agroclimatic conditions.

Rainfall departure clustering and temperature departure clustering reveal detailed spatiotemporal patterns. 65.9% of the agricultural area (marked in blue) had near-average rainfall, mainly covering Northeast, southern part of Northern China, Southwest, and northern part of Southern China, etc. Other regions in China went through some small fluctuation in rainfall. Excessive rainfall (more than +110 mm/dekad) occurred mainly in early October in the provinces of eastern Sichuan, southern Ningxia, central Shaanxi, Shanxi, southern Hebei, northern Guangxi, Guangdong and some parts in adjacent provinces. Cultivated area marked in dark green, mainly in Lower Yangtze region, also received largely above-average rainfall (almost +60 mm/dekad) in middle October, mainly in some parts of Anhui, Jiangsu, Hubei, Henan, Hunan, Jiangxi and Fujian. As for the temperature departure clustering, dark green marked region, mainly in Northeast, had the biggest fluctuation with the biggest positive departure (more than +6.5℃) in early December and biggest negative departure (almost -4℃) in late December. However, there was no crop in this area during the monitoring period, so the highly fluctuated temperatures had no impact on the crops.

Higher-than-usual rainfall, which caused localized flooding conditions and excessively wet soil in the field, delayed the sowing of winter wheat, especially in Loess region and Huanghuaihai. A record-breaking rainfall caused devastating floods and landslides, mainly located in the provinces of Shanxi and Shaanxi in October. The planted area of winter crops decreased by 2 percent in Shanxi and 1 percent in Shaanxi. On the other hand, the adequate soil moisture is beneficial for the growth of winter crops, so the crop conditions in these areas were quite favorable. Moreover, the areas along the Yellow River, especially near the cities of Zhengzhou and Kaifeng in Henan province, and Liaocheng and Dezhou in Shandong provinces, were flooded for a long period and the planting of winter wheat was also delayed. The crop condition was below average in these areas, reflected by the maximum vegetation condition index (VCIx).

At the provincial level, only 4 provinces (Jiangxi -12%, Fujian -6%, Guangdong -4%, and Anhui -1%) had negative rainfall anomalies. The negative temperature anomalies were only recorded in 5 provinces, ranging from -0.5°C (Ningxia) to -0.1°C (Guangxi). Winter wheat cultivated across northern China is going through the overwintering period, while there were hardly any crops grown in Northeast China and Inner Mongolia during this period. Although the wet conditions in October caused a delay in winter wheat planting especially in the Loess and Huanghuaihai regions, good soil moisture condition is beneficial to the growth of winter crops after the wintering period. If the agroclimatic conditions during the greenup stage are favorable, it may be helpful to compensate for the impact of late sowing of winter wheat. In general, prospects for winter wheat production are still close to normal.

Table 4.1 CropWatch agroclimatic and agronomic indicators for China, October 2021 – January 2022, departure from 5YA and 15YA

Region	Agroclimatic indicators			Agronomic indicators		
	Departure from 15YA			Departure from 5YA		Current period
	RAIN (%)	TEMP (°C)	RADPAR (%)	BIOMSS (%)	CALF (%)	Maximum VCI
Huanghuaihai	56	0.3	-4	31	6	0.80
Inner Mongolia	39	0.3	-2	16	60	0.96
Loess region	113	-0.1	-4	31	13	0.97
Lower Yangtze	9	0.3	-2	8	4	0.92
Northeast China	54	1.0	-5	21	18	0.85
Southern China	11	0.2	1	6	0	0.94
Southwest China	20	0.0	-7	9	0	0.97

Figure 4.1 China crop calendar

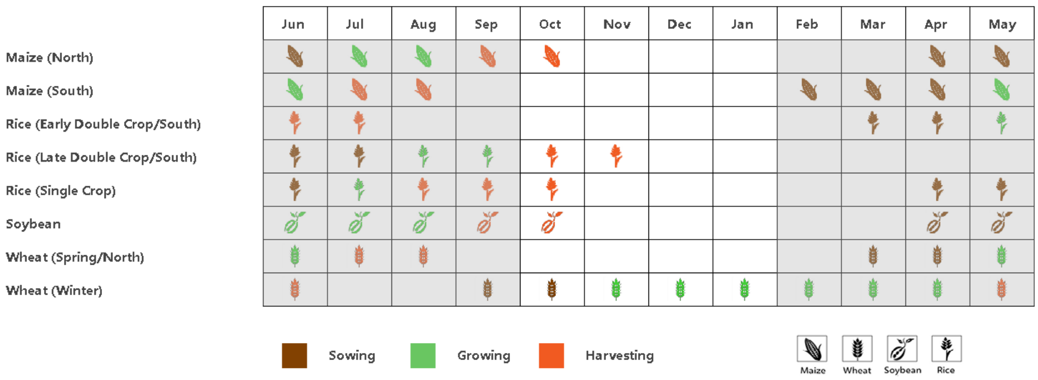


Figure 4.2 China spatial distribution of rainfall profiles, Oct 2021 to Jan 2022

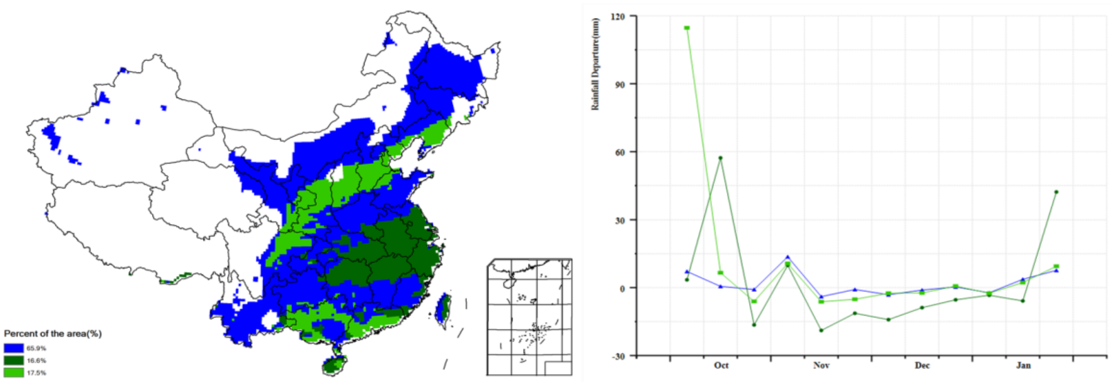


Figure 4.3 China spatial distribution of temperature profiles, Oct 2021 to Jan 2022

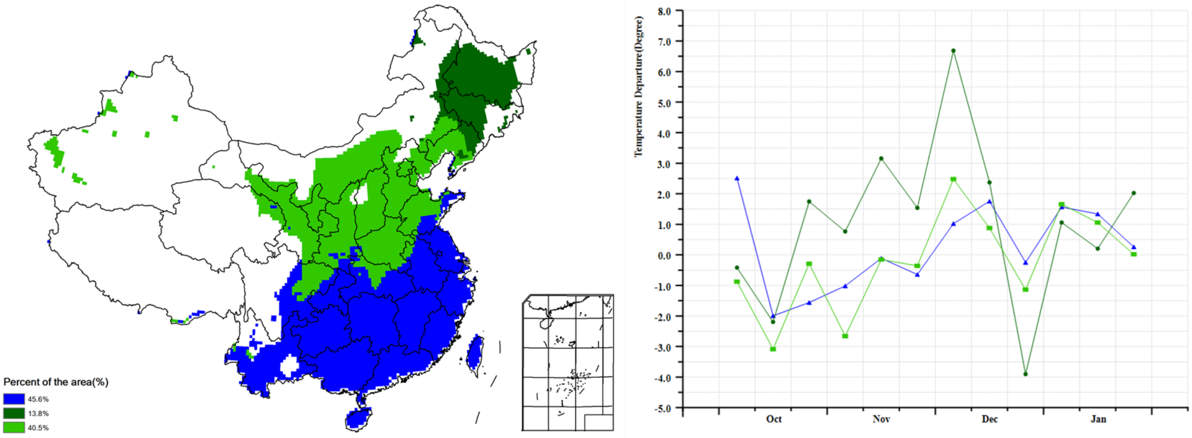


Figure 4.4 China maximum Vegetation Condition Index (VCIx), by pixel, Oct 2021 to Jan 2022

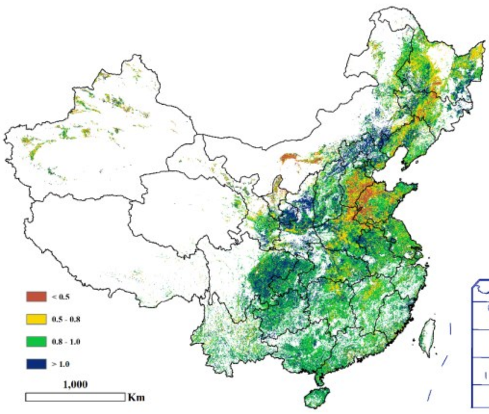
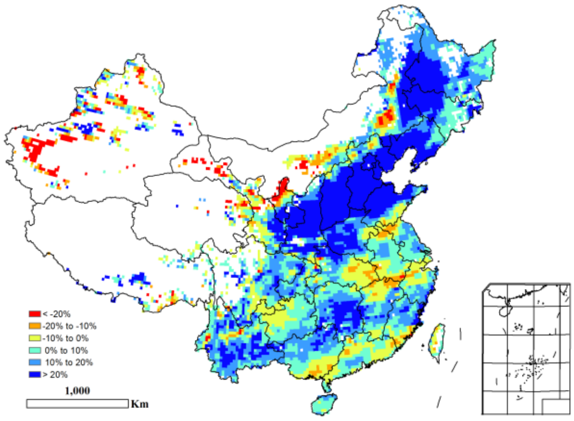


Figure 4.5 China biomass departure map from 15YA, by pixel, Oct 2021 to Jan 2022



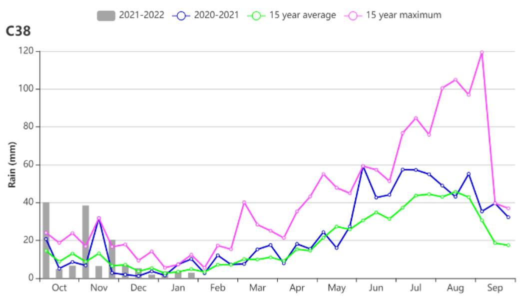
4.2 Regional analysis

Figures 4.6 through 4.12 present crop condition information for each of China's seven agricultural regions. The provided information is as follows: (a) Crop condition development graph based on NDVI (b) Spatial NDVI patterns for October 2021 to January 2022 (compared to the (5YA)); (c) NDVI profiles associated with the spatial patterns under (b); (d) maximum VCI (over arable land mask); and (e) biomass for October 2021 to January 2022. Additional information about agro-climatic indicators and BIOMSS for China is provided in Annex A.

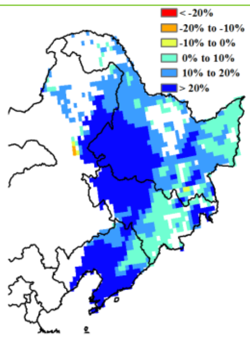
Northeast region

Due to the cold weather, no crops were growing in the northeast of China during this monitoring season (October 2021 to January 2022). CropWatch Agroclimatic Indicators (CWAIs) showed that the overall precipitation increased by 54%. It was significantly above average in early October, and early November. The favorable weather conditions was also reflected by the estimate of potential biomass, which was 21% above average. Almost all cropland in the area presented above-average BIOMSS.

Figure 4.6 Crop condition China Northeast region, October 2021 – January 2022



(a)Time series rainfall profile

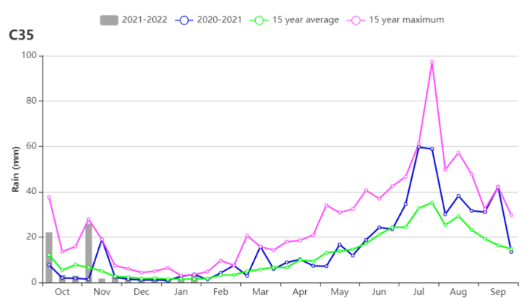


(b) Biomass departure

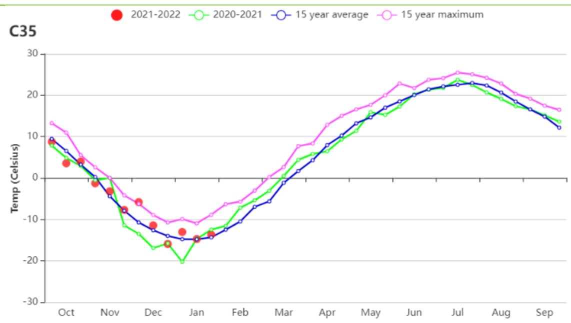
Inner Mongolia

During this monitoring period, no winter crops were grown in Inner Mongolia due to seasonal low temperatures. The weather conditions in this period were favorable, rainfall (+39%) was significantly above average, above-average snow and rainfall will help provide adequate soil moisture for the land preparation and establishment of the spring crops. CropWatch Agroclimatic Indicators showed TEMP (0.3°C) was slightly above average, while RADPAR (-2%) was below average. Biomass accumulation potential (BIOMSS) was simulated at 16% above the average level. Conditions in the next reporting period will be more critical for the 2022 production.

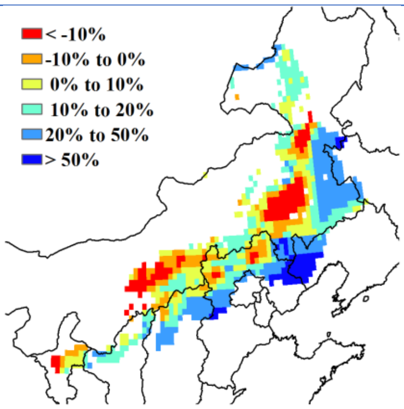
Figure 4.7 **Crop condition Inner Mongolia, October 2021 – January 2022**



(a)Time series rainfall profile



(b)Time series temperature profile



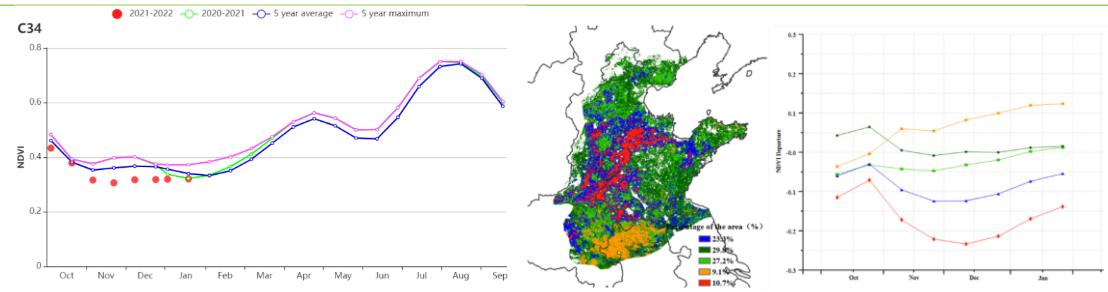
(c) Biomass departure

Huanghuaihai

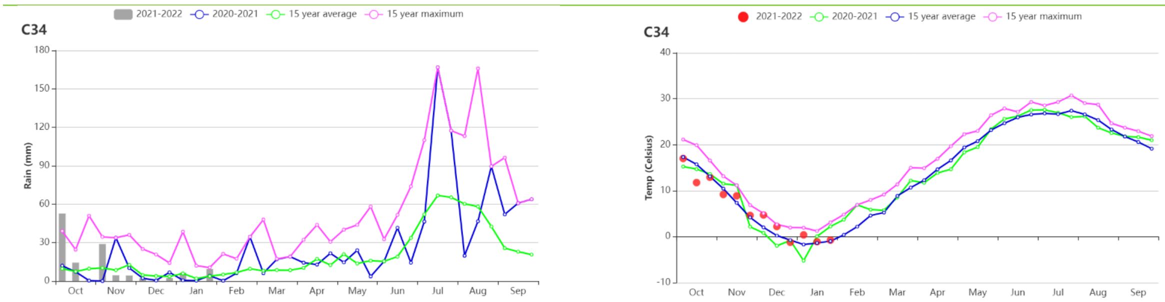
Winter wheat is the main crop that is being grown in this monitoring period (October 2021 to January 2022). Sowing took place mostly in October. Precipitation (+56%) and temperature (+0.3℃) in this area were above the 15 years average, but radiation (-7%) was below. The combination of these weather parameters led to an estimated increase of the potential biomass by 31%. The CALF exceeded the 5YA by 6%.

Based on the NDVI-based crop growth profile, the crop growth conditions were lower than the 5YA during the whole monitoring period. The main reason is the flooding along the Yellow River during the summer crops sowing in 2021 autumn resulted in the delay of winter wheat sowing. The crop condition was below average before the wintering period. As shown by NDVI clusters and profiles, only 9.1% of cropland over Northeastern Anhui were higher than the 5YA after mid-October, whereas crops in the areas of Northern Henan, Northwestern Shandong and Southern Hebei (blue and red color in NDVI departure clustering map) were at below average condition during the whole monitoring period due to the delayed sowing. The map of maximum VCI presented a similar trend as the spatial NDVI pattern. Overall, crop conditions in this important region were below average.

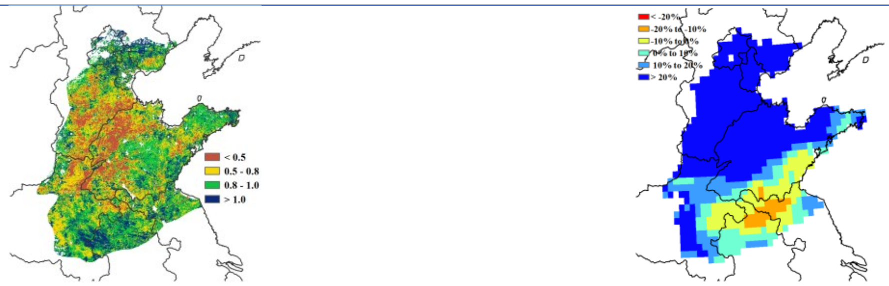
Figure 4.8 **Crop condition China Huanghuaihai, October 2021 – January 2022**



(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

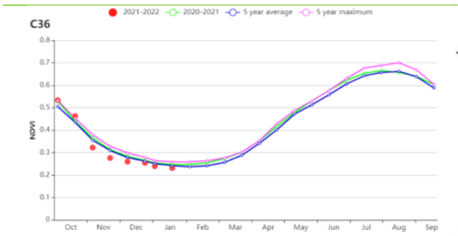
Loess region

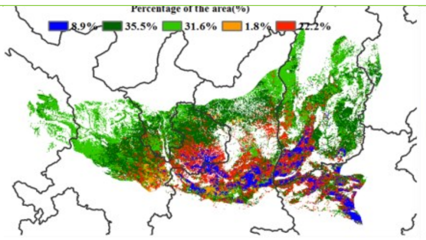
Winter wheat is the predominant crop during this monitoring period in this region. Winter wheat sowing was started in September and completed in October. During the monitoring period, the crop conditions were close to the 5YA.

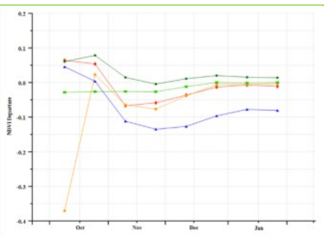
The CropWatch Agroclimatic Indicators (CWAIs) show that rainfall (RAIN) was above average by 113%, temperature (TEMP) decreased by 0.1°C, and radiation (RADPAR) was reduced by 4% compared to the 15YA. Benefited from significantly higher precipitation, the potential biomass (BIOMSS) was above average by 31%.According to the regional NDVI development graph, crop conditions in the Loess Region has been slightly below the 5YA since November 2021 after emergence. The region experienced record-breaking rainfall in early October, which triggered devastating floods and landslides in the Shaanxi and Shanxi provinces. Heavy rainfall in some areas continued for about 15 days, causing significant delay in winter wheat sowing, but the total planted area of summer crops were less affected, with the area decreasing by 1 percent in Shaanxi and 2 percent in Shanxi. NDVI clusters and profiles show that crop conditions in most part of the region were close to average. In eastern Gansu, southern Shaanxi, southern Shanxi and northwestern Henan (accounting for 8.9% of the total cropland area), the crop conditions were always lower than the average level. The average VCIx was 0.97 in the whole region; CALF was at 84%, higher than the average level but lower than the same period last year.

All in all, the Loess Region's overwintering crop conditions were close to average, despite the winter wheat sowing date being postponed in some areas of Shanxi and Shaanxi provinces.

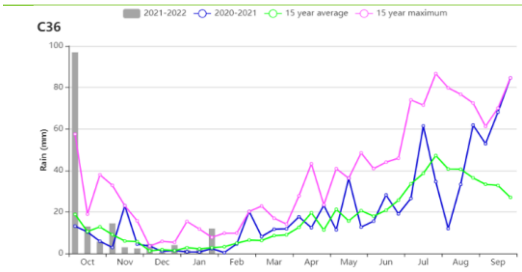
Figure 4.9 **Crop condition China Loess region, October 2021 – January 2022**

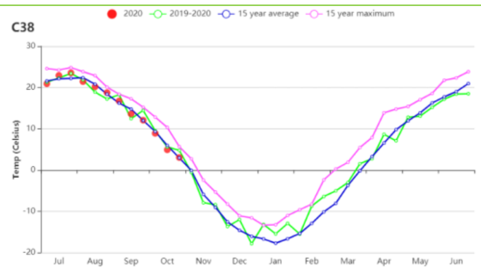




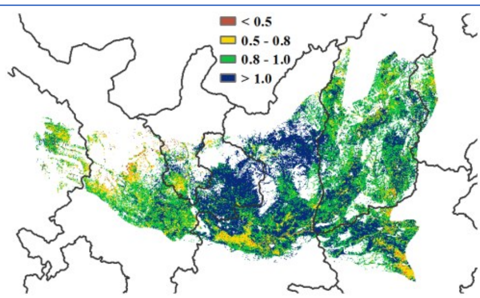


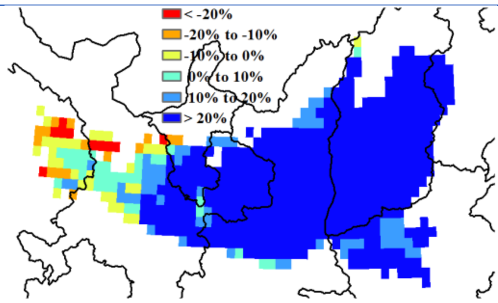
(a) Crop condition development graph based on NDVI (b) Spatial NDVI patterns compared to 5YA (c) NDVI profiles





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





(f) Maximum VCI (g) Biomass departure

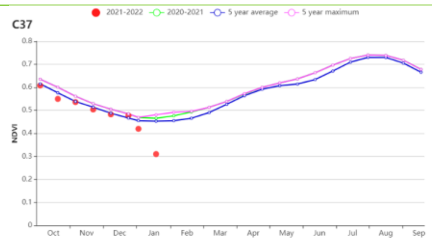
Lower Yangtze region

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.

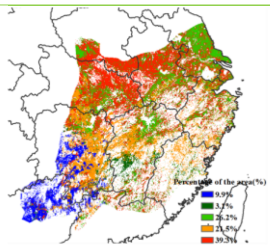
According to CropWatch agro-climatic indicators, the accumulated precipitation and temperature were 9% and 0.3℃ higher than the 15-year averages, respectively. The photosynthetically active radiation was slightly below average (RADPAR -2%) because of increased rainy days. The above average precipitation resulted in an 8% increase of biomass potential production 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 condition, while 39.3% of the area, mostly distributed in the north of this region, including the southern Jiangsu, central Anhui, southern Henan and northern Hubei provinces, presented better crop conditions compared to the 5-year average. The crop condition in other areas was slightly below the average, including the central east of Jiangsu, the southern Anhui and the area around Poyang Lake in Jiangxi (light green area). However, the potential biomass departure map shews a different spatial pattern. Hubei presented lower than the average biomass, but the NDVI was higher than previous years, indicating the limited impact of unfavorable climatic conditions on crops. The average VCIx of this region was 0.92, and most area had VCIx values ranging from 0.8 to 1.

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

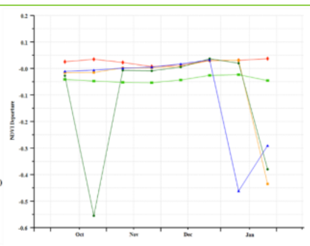
Figure 4.10 **Crop condition China Lower Yangtze region, October 2021 – January 2022**



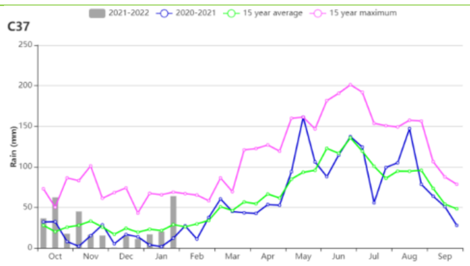
(a) Crop condition development graph based on NDVI



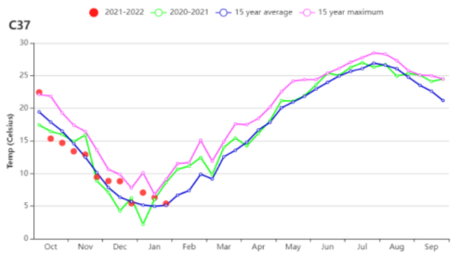
(b) Spatial NDVI patterns compared to 5YA



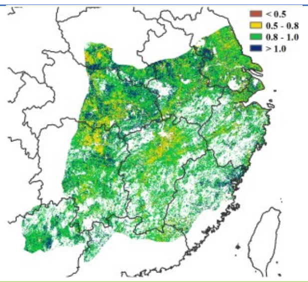
(c) NDVI profiles



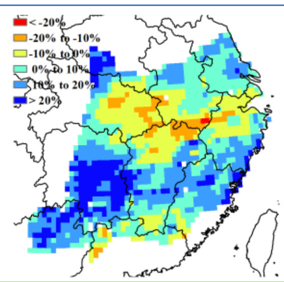
(d)Time series rainfall profile



(e)Time series temperature profile



(f) Maximum VCI



(g) Biomass departure

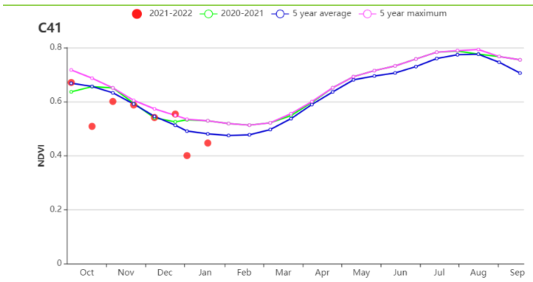
Southwest region

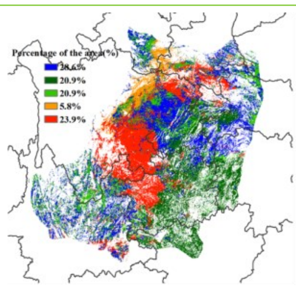
The reporting period covers the wintering period of winter crops (mainly winter wheat) in southwestern China. According to the regional NDVI profile, crop conditions were generally normal, but slightly below average in January.

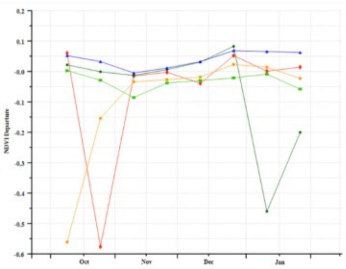
Rainfall was above the 15-year average (RAIN +20%) but solar radiation was below average (RADPAR -7%). Temperature was average (TEMP +0.0°C). The resulting BIOMSS was 9% above average mainly due to the above-average rainfall. The cropped arable land fraction remained at the same level as in the last five years.

According to the NDVI departure clustering map and the profiles, NDVI values were close to average in most regions. In Chongqing and northern Yunnan, the crop conditions were generally normal during the monitoring period. Crop condition in Guizhou was in general above average, mainly due to abundant precipitation (See Annex A.11), but crop growth was unfavorable in northwestern Guizhou in October and below average in central-eastern Guizhou in January. Abundant precipitation in Sichuan is generally favorable for crop growth, crop condition remained at or slightly above average. The VCIx reached 0.97. All in all, crop conditions were generally average.

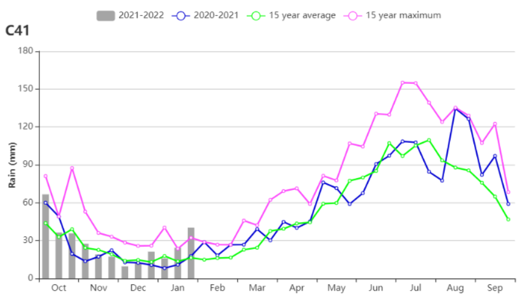
Figure 4.11 Crop condition China Southwest region, October 2021 – January 2022

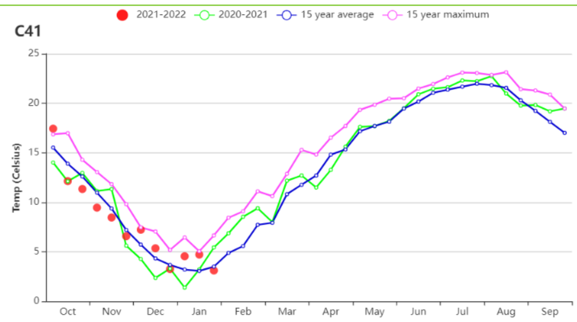






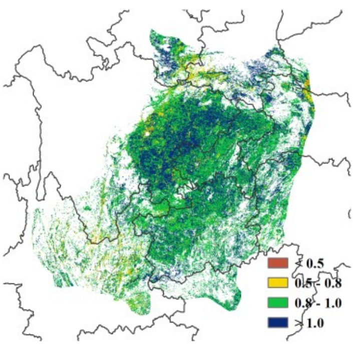
(a) Crop condition development graph based on NDVI (b) Spatial NDVI patterns compared to 5YA(c) NDVI profiles

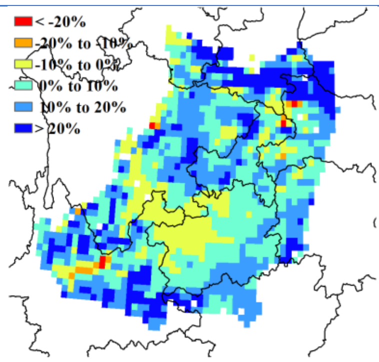




(d)Time series rainfall profile

(e)Time series temperature profile





(f) Maximum VCI

(g) Biomass departure

Southern China

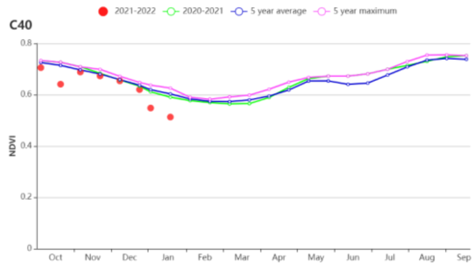
During this monitoring period in Southern China, rice was harvested in November. Only a few crops are grown over the winter period.

On average, rainfall was above the 15-year average (RAIN +11%). Temperature and radiation were near average (TEMP +0.2°C, RADPAR +1%). Lacking of rain in November favored the harvest of rice. BIOMSS was 6% above average mainly due to abundant rainfall. Affected by partial rainfall shortage, BIOMSS in eastern Guangdong, Gongxi and Fujian was below the 15YA. According to the NDVI profile, crop condition was slightly below the 5YA. The cropped arable land fraction remained close to the 5YA.

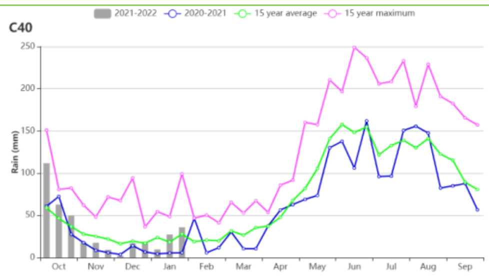
According to the NDVI departure clustering map and the profiles, values were slightly below average, which indicates that crops were in normal condition. 22.3% of cropland scattered in eastern Guangxi and southern Guangdong fell to below average levels. The average VCIx of the Southern China was 0.94, and almost all regions presented a VCIx above 0.80.

All in all, crop conditions were close to normal.

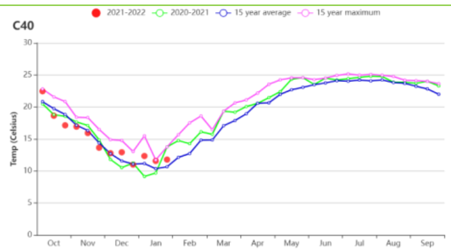
Figure 4.12 Crop condition Southern China region, October 2021 – January 2022



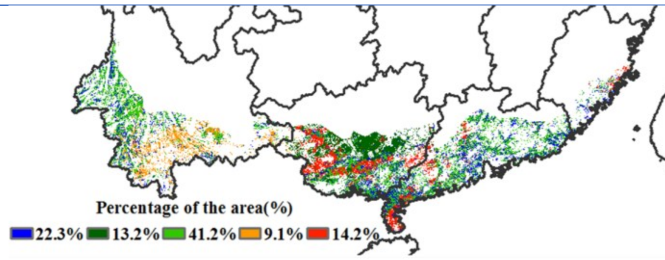
(a) Crop condition development graph based on NDVI



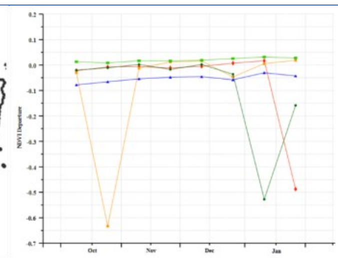
(b) Time series rainfall profile



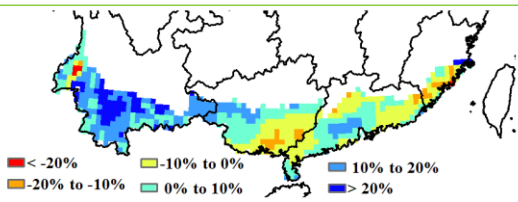
(c) Time series temperature profile



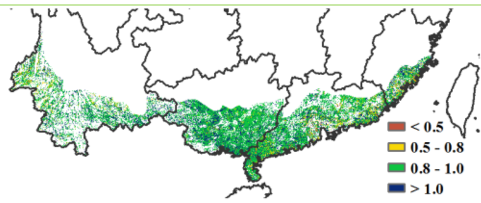
(d) Crop condition development graph based on NDVI



(e) NDVI profiles



(f) Biomass departure



(g) Maximum VCI

4.3 Major crops trade prospects

Trade prospects for major cereals and oil crop in China for 2021

Maize

In 2021, China imported 28.35 million tonnes of corn, 1.5 times the same period last year, the main source countries of imports were United States and Ukraine, accounting for 69.9% and 29% of the total import respectively.

Rice

In 2021, China imported 4.96 million tonnes of rice, an increase of 68.7% over the same period last year, with the main import sources being India, Vietnam, Pakistan, Myanmar and Thailand, accounting for 22.0%, 21.7%, 19.4%, 16.0% and 12.9% of the total import respectively. The domestic and international price difference and feed demand gap are the main factors for the increase of imports.

Wheat

In 2021, China imported 9.77 million tonnes of wheat, an increase of 16.6% over the same period last year. The main source countries of imports were Australia, the United States, Canada and France, accounting for 28.1%, 27.9%, 26% and 14.6% of the total import respectively.

Soybean

In 2021, China imported 96.518 million tonnes of soybeans, a decrease of 3.8% over the same period last year, and the main source countries of imports were Brazil, the United States and Argentina, accounting for 60.2%, 33.5% and 3.9% of the total import 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 2021 and the Major Agricultural Shocks and Policy Simulation Model, it is predicted that the import of major grain crops will decreased year-on-year and the export will increase slightly in 2022.

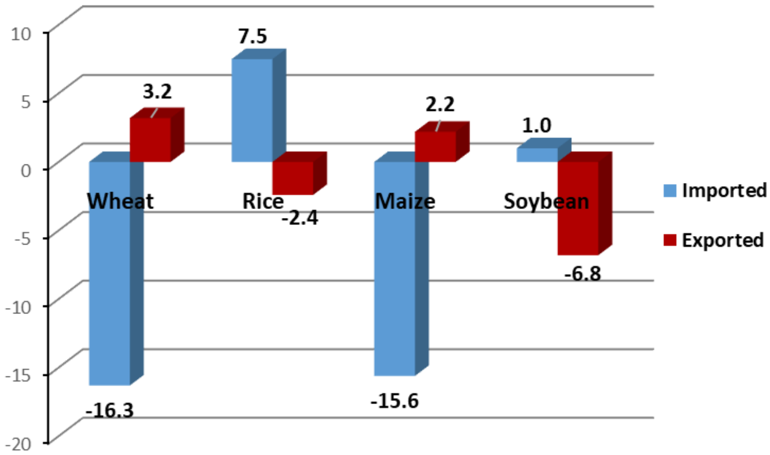
The global maize market maintains a relatively loose supply and demand pattern, but affected by climate, the dispute between Russia and Ukraine and other uncertain factors, the market price fluctuation intensifies. It is expected that China's maize import will fall in 2022 from this year's high, but it will remain at a relatively high level, with a year-on-year decrease of 15.6% and export will increase by 2.2%.

The global rice market has maintained a loose supply and demand pattern, and the relationship between domestic feed grain supply and demand has improved. It is expected that the growth rate of China's rice import will decline in 2022, with a year-on-year increase of 7.5% and export will decrease by 2.4%.

The supply-demand relationship in the global wheat market is tightening, and the price is bullish. However, the structure of China's wheat import is relatively stable, and the feed demand has a downward trend. It is expected that China's wheat import will decrease by 16.3% and export will increase by 3.2% in 2022.

Affected by La Nina, the global soybean supply and demand is tightening, and the domestic soybean consumption demand is relatively stable. It is expected that China's soybean import will be basically the same as last year, and the import will slightly increase by 1% and export will decrease by 6.8% in 2022.

Figure 4.13 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), and an update on El Niño (section 5.3).

5.1 CropWatch food production estimates

Methodological introduction

CropWatch production estimates are based on a combination of remote-sensing models combined with CropWatch global agro-climatic and agronomic indicators as well as meteorological data from over 20,000 meteorological weather stations around the world. The major grain crops (maize, rice, wheat) and soybean production of 43 major producers and exporters are estimated and predicted for 2022. The results are as follows.

Production estimates

This bulletin includes only the major producers in the Equatorial region, and the Southern Hemisphere where crop development is sufficiently advanced to ensure that estimates are reliable. Some isolated Northern Hemisphere countries are also included such as Pakistan, and India.

CropWatch production estimates rely on crop-specific remote sensing indicators, i.e. based on different crop masks for each crop. For each crop listed in Table 5.1, both yield variation and cultivated area variation are taken into account when deriving the production estimates. Depending on the agricultural practices, crop growing stages, and environmental conditions, different indicators are used to as predictor variables and to calibrate the yield model for each country.

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%
				Africa				
Angola	2940	12	48	6				
Egypt					11254	-2		
Kenya	1990	-13						
Morocco						-27		
Mozambique	2163	3	380	-5				
Nigeria	10710	3						
South Africa	11203	-2						
Zambia	3284	-8						
Asia								

	Maize		Rice		Wheat		Soybean	
	2022	Δ%	2022	Δ%	2022	Δ%	2022	Δ%
Bangladesh	4026	2	51491	7				
Cambodia			9695	-2				
India					95942	3		
Indonesia	17315	3	67290	1				
Myanmar			24838	0				
Pakistan					27564	4		
Philippines			20469	0				
Sri Lanka			2485	-2				
Thailand			40421	0				
Vietnam			46942	1				
America								
Argentina	58142	9	1812	-5			53556	4
Brazil	79262	-5	11667	-2			97374	1
Mexico	25366	3			4187	22		

Maize

Table 5.1 lists the results of the maize production prediction for eleven countries, including the 2nd and 3rd largest exporters: Brazil and Argentina. The total maize production of the 11 countries roughly accounts for 20% of global production. Suffering from prolonged drought in Central Brazil, maize production dropped by 5% from 2021. The first season maize in Central and Southern Brazil was severely affected by the drought, resulting in a 7% production drop. Although the rainfall in January 2022 is beneficial for second maize, water deficits in the major maize producing states still exist, and a 4% decrease of second maize production is projected by CropWatch. Dry weather further expanded to Paraguay, while Argentina received sufficient rainfall for the summer crops. Favorable soil moisture benefited maize development, contributing to a 9% increase in production. Drought conditions also occurred in several major maize producing countries in Africa. Kenya and Zambia experienced continuous drought since or even before the sowing of maize, resulting in a drop of maize production by 13% and 8%, respectively. Shortage of rainfall delayed the sowing of maize which caused the decrease of planted area as compared to 2021. Meanwhile, insufficient soil moisture also hampered the development of maize and reduced the average maize yield. Adverse weather conditions in major maize producing regions in South Africa damaged maize yield and the maize production dropped by 2% from 2021. Favorable conditions benefited all crops in Angola with a 12% production increase for maize as compared to the 2021 drought year. Maize production in Mozambique, Nigeria, Bangladesh, and Indonesia are all projected to be slightly above 2021. Although maize in North-West Mexico sown in September 2021 was affected by drought, the total maize production for 2021-2022 is still 3% above 2020-2021.

Rice

This current production prediction mainly focuses on the key producing countries in South and Southeast Asia. The combined output from the 12 countries monitored, accounting for 36% global rice production, is expected to increase by 1.5%. Rice production of most countries remains close to that of 2021 except for Bangladesh, where weather conditions mostly benefited Aman rice development, with rice production up by 7% from 2021. In Cambodia, low water levels in the Mekong River and drought at the early growing stage of dry season rice and the key growing period of rainy season rice affected rice output. Total rice production is estimated to drop by 2% from the previous year. Rice production of Mozambique, Brazil and Argentina decreased by 5%, 2% and 5% mainly due to the reduced yield.

Wheat

The harvest of wheat in Southern Hemisphere including Argentina, Australia, Brazil, Ethiopia, South Africa and Zambia concluded by the end of 2021. This bulletin focuses on the wheat producers in tropical and sub-tropical regions including Egypt, Morocco, India, Pakistan, and Mexico. Among these countries, wheat production in Morocco is forecast to drop by 27% from 2021 bumper production as affected by the lack of water. Significant negative departures of rainfall result in reduced yield and planted area. In contrast, Mexico outputs 22% more wheat compared with the previous drought year, which might result in decreased wheat imports. As wheat are mostly irrigated in Egypt, India and Pakistan, the wheat production is mostly affected by the wheat planted area. It is observed by satellite images that wheat area expanded from the previous year in the two Asia countries while it decreased in Egypt. A slight increase in Pakistan and India, by 4% and 3% respectively, is forecasted. Wheat production is projected to drop by 2% from 2021.

Soybean

Brazil and Argentina are among the top 3 exporters of the commodity. CropWatch projects increased soybean production for both countries. In Argentina, favorable meteorological conditions benefited the soybean in major producing states including Cordoba, Santa Fe and Buenos Aires, resulting in a 3% increase of soybean yield and a 4% increase of soybean production. In Brazil, drought in central and southern Brazil resulted in lower soybean yields in Parana and Rio Grande Do Sul. The largest soybean producing state, Mato Grosso, is less affected and an increased production is estimated. The national soybean production is forecast at 97,374 thousand tons, up by 1% from 2021.

5.2 Disaster events

Several natural or man-made disasters threatened human lives, food production, and the global economy. The current report discusses the main disasters and their global impacts during the period between October 2021 and January 2022. Extreme conditions by type are present as bellows:

Flood&Strom

In Indonesia, heavy rains, which were 70% to 100% higher than normal levels, hit the country between late November and January. They affected thousands of people and caused flooding conditions in urban and rural regions.

In Madagascar, which had been hit hard by a prolonged drought, a series of floods caused by heavy rainfall (226 mm falling during the night of 17-18 January 2022) hit the country's capital Antananarivo and other areas of the Analamanga Region in the center of the country. The floods caused the death of 11 people, landslides, and destruction of infrastructure. In Mozambique, tropical storm Ana made landfall in Angoche District, Nampula province, on January 24th. The storm significantly affected Zambezia and Tete provinces, causing the displacements of citizens, widespread floods, damages to public infrastructures and private homes, and interruption of basic services. As reported by the national government, the storm affected 180,869 people, injured 207 people, and killed at least 38 people, mostly in Zambezia, Nampula, and Tete provinces, flooding a total of 70,982 hectares of land.

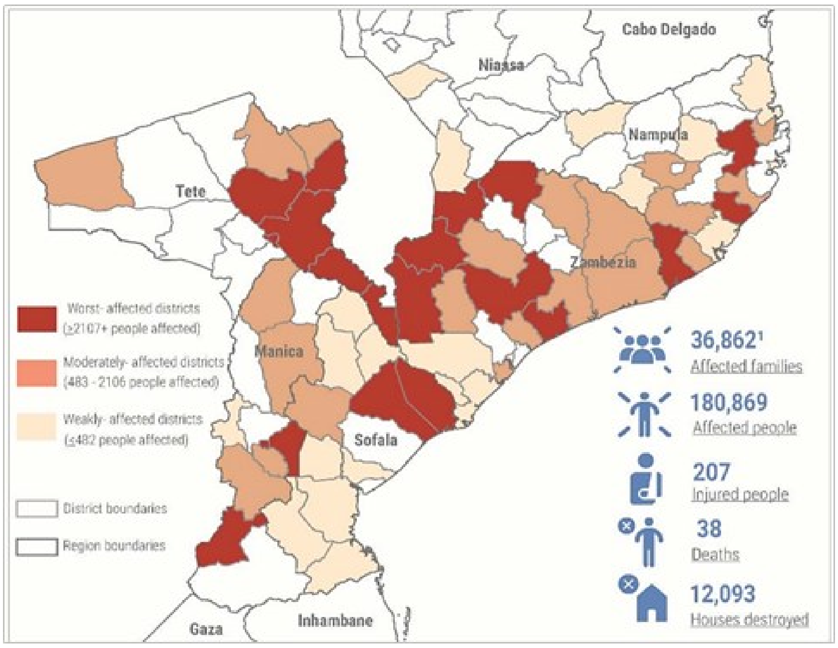


Figure 5.1 Impact of tropical storm Ana on six Mozambican provinces includes Nampula, Zambezi, Tete, Niassa, Sofala, and Manica. Data as of February 8th, 2022.

Drought

The end of 2021 witnessed an extreme drought in the state of California (USA), while the first two months of 2022 are shaping up to be the driest January and February in California's history. On October 5th, 2021, the drought map showed that around 50% of the state was under exceptional drought, while most of the remaining area was under extreme drought conditions. A heavy storm in the last week of October brought some relief to the area. As of January 4th, the situation had improved to severe drought for most of the state.

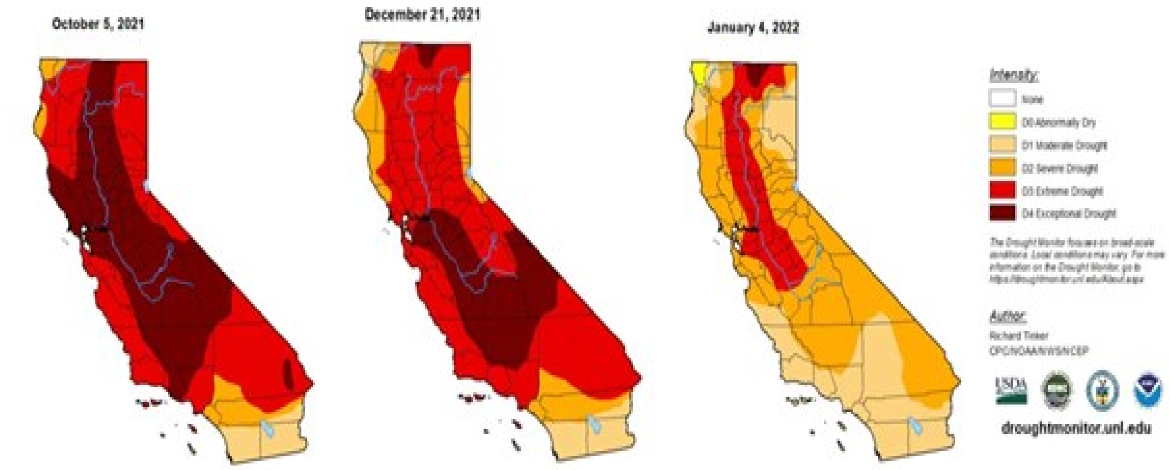


Figure 5.2 Maps show what California's drought situation looked like on October 5th, 2021 (left), December 21st, 2021 (middle), and January 4th, 2022 (right). (Source: U.S. Drought Monitor)

In Southern Africa, rainfall was significantly below average across Madagascar, Malawi, central and northern Mozambique, and northwestern Zimbabwe starting in October. Although rainfall improved in these areas in early January, significant delays in the rains were expected to impact crop production by reducing or delaying the planted area directly. The pastures' quality and livestock health will be highly dependent on the amount and distribution of rains. Besides the impact on agriculture, around 336,000 people (29% of the total population) are predicted to be facing high acute food insecurity and require urgent humanitarian assistance between December 2021 and March 2022 due to severe drought conditions. In Tanzania, several media outlets have reported that more than 62,000 animals have died as a result of the drought.

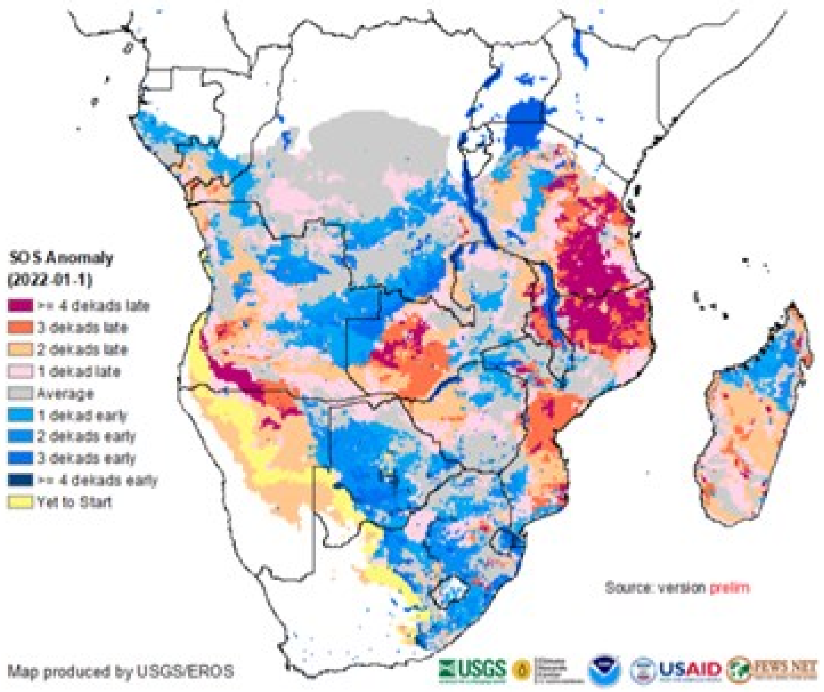


Figure 5.3 The Onset of 2021/2022 season rainfall compared to average timing, as of 10 January 2022. Source: USGS/FEWS NET.

In Morocco, the Moulouya River, a 500-kilometer waterway that is one of the longest rivers in the North African kingdom and a vital lifeline for farmers in areas near the Algerian border, was cutoff for the first time in November 2021 due to years of drought and over-pumping. Due to the lack of rainfall and the drop in reservoir levels to unprecedented levels, Moroccan experts warn that the country is experiencing one of the worst droughts in the last three decades, which will lead to huge losses in cereal and legume crops. In addition to cereal production, high feed prices under the impact of the drought are also having an impact on the local livestock industry, and many farmers are selling their herds.

Figure 5.4 A farmer walks down his dried-out melon field in Morocco.

In Afghanistan, a prolonged, multi-year drought, in addition to the war, has caused a severe food shortage. The humanitarian situation in Afghanistan in 2021 was one of the worst globally, with nearly half of the population – some 18.4 million people – already in need of humanitarian and protection assistance in 2021. The UN World Food Program (WFP) reached approximately 9.4 million people with food assistance across 34 provinces between September 1st and December 30th, 2021. With the current drought conditions in 2022, an estimated 22.8 million people, or 55 percent of the population, are expected to be in crisis or at the emergency levels of food insecurity (IPC 3+) between November 2021 and March 2022.

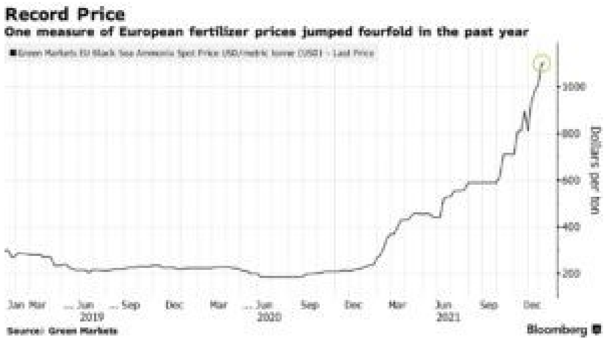
In Syria, more than a decade of war has caused tremendous suffering for the civilian population. Northeastern Syria is experiencing its worst drought in nearly 70 years. It is exacerbated by Turkey's decision to withhold water from the Euphrates River. Historically low water levels in the Euphrates River have not just reduced access to water for drinking and domestic use for over five million people, but also triggered substantial harvest and income losses, decreased hydroelectricity generation, and an increase in water-borne diseases. In the mid to long-term, these developments are expected to have serious and cumulative impact on health, food insecurity, malnutrition rates, as well as the environment, with potentially irreversible consequences.

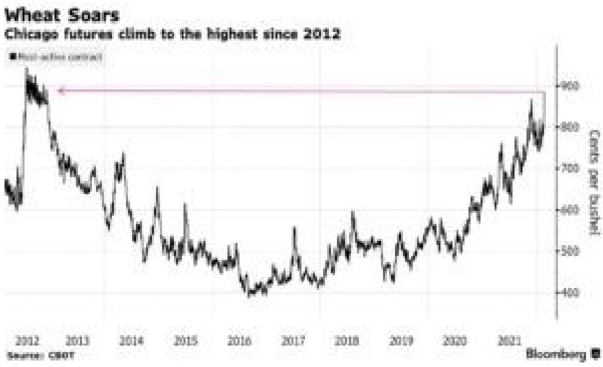
Jordan also faced an unprecedented drought crisis in recent months. The King Talal Dam, the Kingdom's largest dam, was at dangerously low levels, and six water dams out of 14 had dried up due to rainfall shortages. The dam covers 80% of the water needs of farmers in the Jordan Valley, which amount to 400,000 to 550,000 cubic meters per day, and the drying up will directly affect the irrigation of local crops.

In the Mekong River, the mainstream flows have dropped to their lowest levels in more than 60 years during the last three years due to reduced rainfall, construction of dams and diversion of water into other basins. This impacts not only the Tonle Sap basin in Cambodia, but the delta in Vietnam as well, where increased salinization of the rice fields is hurting production.

High fertilzier prices

In addition to the impact of trade restrictions and social distance restrictions in the context of COVID-19, higher fertilizer prices under the influence of the energy crunch, export restrictions, and trade sanctions are expected to have a large impact on agricultural production. The average retail price of most fertilizers reportedly continued to climb in the second week of February 2022. Russia is a low-cost, high-volume global producer of all major fertilizers and the world's second largest producer of potash after Canada. The war of Russia against the Ukraine and ensuing sanctions against Russia are expected to hurt trade flows and may lead to further increases in fertilizer prices. In Belarus, potash supplies account for one-fifth of the global supply. Sanctions have already led to turmoil in the potash market, leaving global potash contracts settled at the highest prices since 2008. The rise in fertilizer prices is expected to have a negative impact on food production in developing countries. From avocado, corn and coffee farms in South America to coconut and oil palm plantations in Southeast Asia, high fertilizer prices are putting pressure on farmers in developing countries, making cultivation expensive and forcing many to cut back on production. According to the International Fertilizer Development Center, a global nonprofit organization, demand for fertilizer in sub-Saharan Africa could fall by 30 percent in 2022. That would mean 30 million tons less food produced, which is equivalent to the food needs of 100 million people. Concerns about food production will in turn further boost rising food prices. In the U.S., wheat prices hit its highest level in nine years amid supply concerns. In addition, soybean prices climbed to a nine-year high.





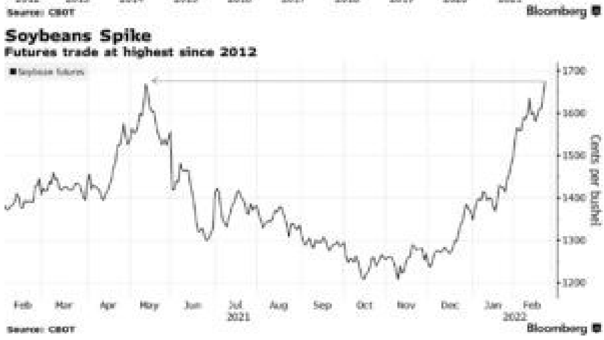


Figure 5.5 The Fertilizer Crisis Is Getting Real for Europe Food Prices, by Yuliya Fedorinova, Megan Durisin, and Veronika Gulyas, January 21, 2022 (left), Wheat Hits Nine-Year High on Supply Fears, by Megan Durisin and Allison Nicole Smith, February 23, 2022 (middle), Soybeans Soar to 9-Year High with South America Supply in Doubt, by Kim Chipman and Megan Durisin, February 23, 2022 (right).

Desert locust

After more than two years of threatening the agricultural and pastoral livelihoods and the food security of millions of people, mainly in the Horn of Africa and Yemen, the desert locust upsurge has finally declined. On January 4th, 2022, the last control operations took place against the remaining immature swarms in northeast Somalia. No more locusts were seen in Ethiopia and Kenya, where the dry conditions reduce the likelihood of any future development of new swarms. Limited breeding regions were still observed along the Egypt/Sudan border on the Red Sea coast, as well as in northern Eritrea, Saudi Arabia, and Yemen.

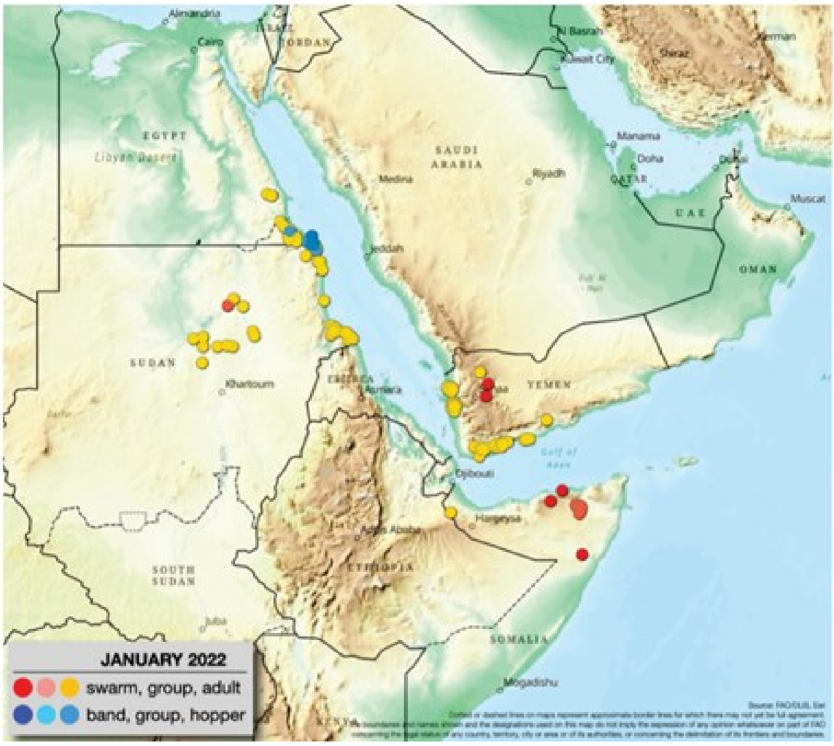


Figure 5.6 The distribution and movement of desert locusts in January 2022, as observed by FAO (https://www.fao.org/ag/locusts/common/ecg/1914/en/DL517e.pdf).

External links

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Corrientes, Argentine Wildfires - Center for Disaster Philanthropy

Water crisis and drought threaten more than 12 million in Syria and Iraq - Syrian Arab Republic | ReliefWeb

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5.3 Update on El Niño

According to the Australian Government Bureau of Meteorology, the ENSO Outlook remains that La Niña has peaked, but its influence will persist until April. Climate models and observations suggest the 2021-22 La Niña has peaked, and will most likely return to neutral El Niño-Southern Oscillation (ENSO) (neither La Niña nor El Niño) during March to May. La Niña increases the chance of tropical cyclones and above average rainfall across northern and eastern Australia from December 2021 to February 2022 and, to a lesser degree, from March to April. As La Niña weakens it can continue to influence global weather and climate. Atmospheric and oceanic indicators remain at La Niña levels, but have likely peaked in strength. While eastern tropical Pacific sea surface temperatures remain cooler than average, beneath the surface, waters in the central and eastern Pacific are now warming. These changes in the sub-surface typically foreshadow a breakdown in a La Niña event, which normally occurs from March to May. In the atmosphere, decreased cloudiness along the Date Line, strengthened trade winds in the western Pacific and a positive Southern Oscillation Index (SOI) reflect a mature La Niña.

Figure 5.7 illustrates the behavior of the standard Southern Oscillation Index (SOI) published by the Australian Bureau of Meteorology (BOM) for the period from January 2021 to January 2022. Sustained positive values of the SOI above +7 typically indicate La Niña while sustained negative values below -7 typically indicate El Niño. Values between about +7 and -7 generally indicate neutral conditions. During this monitoring period, SOI increased from 6.7 in October to 12.5 in November, and peaked at 13.8 in December before falling back to 4.1 in January.

Another commonly used measure of El Niño is known as the Oceanic Niño Index (ONI). Figure 5.8 shows several ONIs and their locations. Historically, scientists have classified the intensity of El Niño based on Sea surface temperature (SST) anomalies exceeding a pre-selected threshold in a certain region of the equatorial Pacific. The most commonly used region is the Niño 3.4 region, and the most commonly used threshold is a positive SST departure from normal greater than or equal to +0.5°C. Since this region encompasses the western half of the equatorial cold tongue region, it provides a good measure of important changes in SST and SST gradients that result in changes in the pattern of deep tropical convection and atmospheric circulation. The criteria, that is often used to classify El Niño episodes, is that five consecutive 3-month running mean SST anomalies exceed the threshold. SST values in the Niño 3.4 region may not be the best choice for determining La Niña episodes but, for consistency, the index has been defined by negative anomalies in this area. A better choice might be the Niño 4 region, since that region normally has SSTs at or above the threshold for deep convection throughout the year. Values of the three key NINO indices for January 2022 were: NINO3 -1.0°C, NINO3.4 -0.7°C, and NINO4 -0.2°C. It will most likely return to neutral El Niño-Southern Oscillation.

Sea surface temperature (SSTs) for January 2022 (Figure 5.9) indicate weak cool SST anomalies across most of the eastern half of the equatorial Pacific. Weak warm SST anomalies were observed over parts of the Maritime Continent and the Coral Sea and parts of Queensland's east coast.

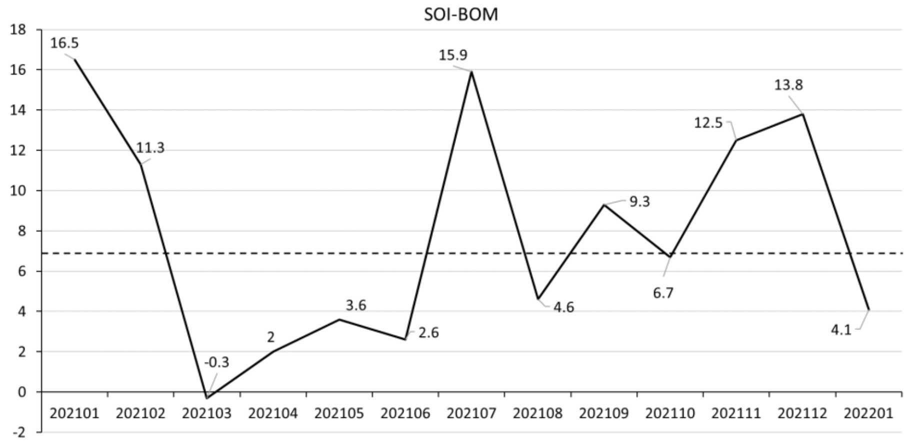


Figure 5.7 Monthly SOI-BOM time series from January 2021 to January 2022 (Source: http://www.bom.gov.au/climate/enso/soi/)

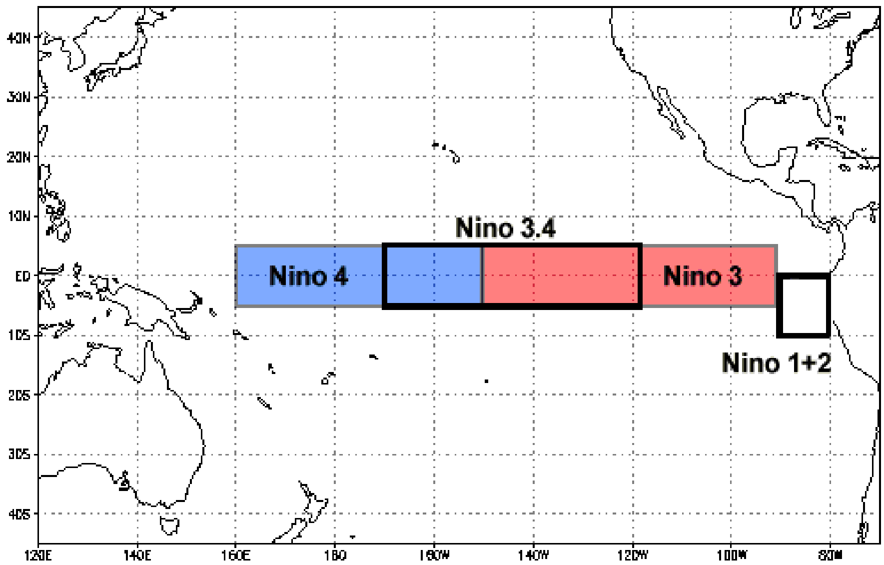


Figure 5.8 Map of NINO Region

(Source: https://www.ncdc.noaa.gov/teleconnections/enso/sst)

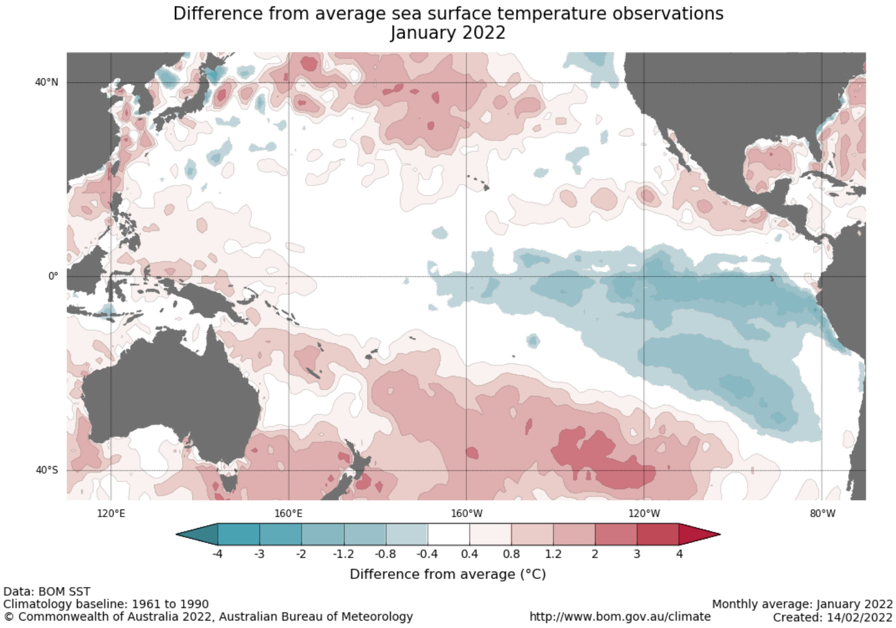


Figure 5.9 Monthly temperature anomalies in the tropical Pacific for January 2022

(Source: http://www.bom.gov.au/climate/enso/wrap-up/#tabs=Sea-surface)

Annex A. Agroclimatic indicators and BIOMSS

Table A.1 October 2021 – January 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	715	-20	23.4	0.4	1276	7	1193	-3
C02	East African highlands	164	-30	18.4	0.2	1341	3	527	-10
C03	Gulf of Guinea	156	-31	25.8	0.6	1251	2	642	-9
C04	Horn of Africa	222	-43	22.1	0.6	1354	6	707	-18
C05	Madagascar (main)	760	-13	23.2	0.2	1407	5	1183	-7
C06	Southwest Madagascar	145	-62	26.3	0.3	1518	7	762	-20
C07	North Africa-Mediterranean	132	-34	11.6	-0.4	753	6	355	-21
C08	Sahel	54	-13	25.5	0.2	1259	1	481	2
C09	Southern Africa	380	-30	23.8	0.3	1396	2	932	-12
C10	Western Cape (South Africa)	178	24	18.0	-0.1	1557	2	746	11
C11	British Columbia to Colorado	374	4	-1.6	0.7	441	0	307	3
C12	Northern Great Plains	175	-7	2.2	1.2	497	4	341	-2
C13	Corn Belt	369	-8	2.9	0.7	434	3	475	8
C14	Cotton Belt to Mexican Nordeste	285	-23	12.6	1.2	697	5	600	-6
C15	Sub-boreal America	227	3	-6.2	0.1	248	3	248	8
C16	West Coast (North America)	593	18	7.8	-0.2	513	-3	500	0
C17	Sierra Madre	205	-18	15.8	0.4	1091	5	469	-10
C18	SW U.S. and N. Mexican highlands	118	-15	9.4	0.9	803	3	346	-6
C19	Northern South and Central America	627	-11	22.4	0.1	1100	6	955	-4
C20	Caribbean	301	-21	24.0	0.2	1081	6	865	-3
C21	Central-northern Andes	861	-7	15.5	-0.1	1170	2	814	-4
C22	Nordeste (Brazil)	155	-43	27.3	1.3	1379	3	724	-12
C23	Central eastern Brazil	575	-39	25.8	1.2	1242	-2	1129	-17
C24	Amazon	1026	-1	25.4	0.1	1185	3	1397	1
C25	Central-north Argentina	816	54	23.5	-0.7	1331	-4	1251	10
C26	Pampas	477	-13	22.5	0.4	1436	2	1083	-3

C27	**Western Patagonia**	207	-31	12.9	0.5	1573	7	603	-7
C28	**Semi-arid Southern Cone**	277	61	18.5	0.0	1620	-1	701	6
C29	**Caucasus**	268	-10	4.5	0.1	579	3	430	-4
C30	**Pamir area**	159	-18	2.5	-0.3	738	3	285	-9
C31	**Western Asia**	136	-7	7.4	0.5	673	2	326	-4
C32	**Gansu-Xinjiang (China)**	73	-3	-4.0	-0.4	596	1	138	-6
C33	**Hainan (China)**	756	36	21.1	0.4	751	-1	903	7
C34	**Huanghuaihai (China)**	128	56	5.7	0.3	625	-4	314	31
C35	**Inner Mongolia (China)**	70	39	-5.9	0.3	574	-2	168	16
C36	**Loess region (China)**	160	113	0.6	-0.1	675	-4	290	31
C37	**Lower Yangtze (China)**	319	9	10.8	0.3	626	-2	630	8
C38	**Northeast China**	142	54	-6.6	1.0	460	-5	227	21
C39	**Qinghai-Tibet (China)**	213	4	0.0	-0.5	873	-1	279	2
C40	**Southern China**	378	11	14.8	0.2	744	1	710	6
C41	**Southwest China**	326	20	7.8	0.0	557	-7	578	9
C42	**Taiwan (China)**	312	-4	21.3	1.0	831	2	669	2
C43	**East Asia**	369	17	0.0	0.9	494	-1	357	8
C44	**Southern Himalayas**	239	15	15.7	-0.4	924	0	512	13
C45	**Southern Asia**	346	16	21.9	-0.2	1083	0	740	11
C46	**Southern Japan and the southern fringe of the Korea peninsula**	380	-20	9.4	0.6	637	10	612	-7
C47	**Southern Mongolia**	36	-30	-12.7	0.6	477	2	94	-6
C48	**Punjab to Gujarat**	115	177	19.7	-0.6	971	-2	443	36
C49	**Maritime Southeast Asia**	1367	-1	24.4	0.2	1146	6	1456	2
C50	**Mainland Southeast Asia**	461	1	22.6	0.1	1052	2	833	-2
C51	**Eastern Siberia**	247	3	-7.6	2.0	275	1	207	11
C52	**Eastern Central Asia**	72	-4	-11.9	1.8	368	-1	131	8
C53	**Northern Australia**	924	17	26.8	0.4	1439	3	1342	8
C54	**Queensland to Victoria**	360	44	19.8	-0.9	1410	-4	919	11
C55	**Nullarbor to Darling**	91	-15	19.0	-0.7	1540	1	605	-5
C56	**New Zealand**	357	10	14.4	1.1	1298	1	870	8
C57	**Boreal Eurasia**	409	7	-2.5	0.5	116	-6	274	1
C58	**Ukraine to Ural mountains**	285	4	-0.3	0.4	193	4	348	1
C59	**Mediterranean Europe and Turkey**	341	-10	8.2	-0.3	563	5	542	-7

C60	**W. Europe (non Mediterranean)**	341	-9	4.9	-0.2	307	5	507	-2
C61	**Boreal America**	370	-8	-8.3	-2.0	140	2	174	-16
C62	**Ural to Altai mountains**	191	-1	-4.9	1.8	262	-3	230	3
C63	**Australian desert**	162	52	20.4	-1.2	1556	-1	709	6
C64	**Sahara to Afghan deserts**	61	0	16.8	0.2	951	2	320	1
C65	**Sub-arctic America**	106	-7	-17.2	2.1	39	-5	66	33

Table A.2 October 2021 – January 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**	516	18	22.2	0.2	1455	0	1060	5
AUS	**Australia**	341	30	20.5	-0.7	1434	-2	870	8
BGD	**Bangladesh**	241	-6	20.5	-0.4	970	-2	598	4
BRA	**Brazil**	659	-28	25.5	0.9	1253	0	1144	-13
KHM	**Cambodia**	541	12	24.1	-0.2	1069	0	979	3
CAN	**Canada**	316	-1	-3.7	0.2	289	2	275	6
CHN	**China**	264	18	6.2	0.3	618	-3	404	11
EGY	**Egypt**	70	28	17.1	-0.1	775	1	281	12
ETH	**Ethiopia**	127	-24	18.4	0.1	1361	3	481	-8
FRA	**France**	348	-16	5.9	-0.8	373	13	542	-8
DEU	**Germany**	292	-15	4.3	0.0	228	0	496	-1
IND	**India**	245	26	19.7	-0.4	1024	-1	592	18
IDN	**Indonesia**	1396	2	24.5	0.2	1176	5	1494	3
IRN	**Iran**	170	-4	8.4	0.4	782	2	353	-4
KAZ	**Kazakhstan**	170	2	-3.5	1.4	343	-2	257	2
MEX	**Mexico**	257	-14	18.4	0.6	1050	6	536	-6
MMR	**Myanmar**	281	-16	19.5	0.3	1048	3	644	-4
NGA	**Nigeria**	140	-25	25.1	0.2	1283	3	568	-4
PAK	**Pakistan**	143	23	11.4	-0.5	869	0	340	13
PHL	**Philippines**	1016	-6	24.7	0.1	1052	2	1287	-3
POL	**Poland**	248	-10	3.3	0.0	217	6	457	-1
ROU	**Romania**	232	-5	3.5	0.0	384	2	440	-1
RUS	**Russia**	246	5	-3.5	1.1	219	-1	263	4
ZAF	**South Africa**	181	-34	19.8	-0.3	1516	4	766	-11
THA	**Thailand**	400	-8	22.7	0.0	1100	4	811	-4
TUR	**Turkey**	323	-8	5.5	-0.2	593	3	510	-3
GBR	**United Kingdom**	426	-15	7.1	0.5	169	1	578	-1
UKR	**Ukraine**	219	-5	2.5	0.2	291	8	428	3
USA	**United States**	291	-12	6.6	1.0	571	4	447	-2
UZB	**Uzbekistan**	117	-21	5.3	0.3	627	3	262	-12
VNM	**Vietnam**	698	21	19.5	0.0	809	-2	939	2
AFG	**Afghanistan**	133	-2	4.4	-0.3	791	2	312	1
AGO	**Angola**	730	-19	23.3	0.4	1277	4	1226	-3
BLR	**Belarus**	270	-4	1.1	0.2	179	12	388	0
HUN	**Hungary**	207	-11	3.9	-0.6	369	9	452	-3

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 (%)
ITA	Italy	419	-2	7.5	-0.3	465	2	600	3
KEN	Kenya	277	-34	20.7	0.4	1310	2	768	-14
LKA	Sri_Lanka	1283	9	24.8	0.2	1171	7	1424	4
MAR	Morocco	105	-51	11.9	0.1	815	6	322	-29
MNG	Mongolia	49	-4	-11.6	1.7	446	0	121	5
MOZ	Mozambique	454	-30	25.8	0.5	1346	2	995	-14
ZMB	Zambia	551	-37	24.6	1.1	1366	4	1039	-15
KGZ	Kyrgyzstan	154	-25	-4.2	0.1	614	3	202	-14

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

Table A.3 Argentina, October 2021 – January 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	316	20	20.5	0.2	1506	-1	940	9
Chaco	511	-12	25.0	-0.1	1367	2	1165	-5
Cordoba	423	53	23.0	0.3	1500	-1	1059	12
Corrientes	482	-23	24.5	0.8	1464	5	1128	-9
Entre Rios	414	-1	23.4	0.9	1541	5	1086	2
La Pampa	338	49	21.5	-0.3	1545	-1	1031	19
Misiones	829	12	23.2	0.2	1437	3	1296	-4
Santiago Del Estero	728	42	24.2	-0.6	1363	-1	1248	7
San Luis	272	20	21.6	-0.2	1495	-3	933	6
Salta	1411	61	20.3	-1.1	1171	-10	1338	8
Santa Fe	505	17	24.4	0.6	1501	4	1161	6
Tucuman	1090	100	19.7	-0.5	1288	-9	1252	17

Table A.4 Australia, October 2021 – January 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	396	47	20.2	-1.5	1402	-7	970	13
South Australia	178	33	18.5	-1.0	1463	0	707	5
Victoria	298	25	17.1	-0.5	1396	0	831	8
W. Australia	138	-11	20.1	-0.6	1541	2	621	-6

Table A.5 Brazil, October 2021 – January 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	124	-40	28.4	0.8	1421	4	726	-2
Goias	416	-64	27.2	2.9	1224	-5	904	-40
Mato Grosso Do Sul	525	-42	27.1	1.3	1285	-3	1208	-17
Mato Grosso	966	-23	26.0	0.7	1126	-3	1351	-11
Minas Gerais	565	-50	24.2	1.8	1267	0	1073	-23
Parana	638	-29	22.4	0.6	1329	1	1247	-11
Rio Grande Do Sul	391	-36	21.8	0.5	1419	2	1030	-14
Santa Catarina	755	-5	19.3	-0.1	1244	-2	1255	-3
Sao Paulo	482	-57	24.4	1.5	1302	2	1091	-26

Table A.6 Canada, October 2021 – January 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	156	1	-5.5	-0.5	281	4	242	-2
Manitoba	233	23	-4.8	0.8	293	3	287	14
Saskatchewan	164	4	-4.9	0.3	307	6	271	6

Table A.7 India, October 2021 – January 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	325	38	22.6	-0.1	1096	-1	811	17
Assam	278	-15	16.6	-0.9	905	4	541	-5
Bihar	263	148	18.6	-0.5	943	-3	515	30
Chhattisgarh	71	-42	19.7	0.0	1096	2	444	-8
Daman and Diu	93	152	25.7	-0.5	1147	0	588	26
Delhi	301	727	16.5	-1.5	865	-6	609	113
Gujarat	90	184	23.5	-0.8	1097	0	506	25
Goa	436	82	25.3	-0.7	1154	-2	937	29
Himachal Pradesh	221	49	8.0	-0.9	870	-2	385	19
Haryana	226	484	16.7	-1.0	860	-5	540	92
Jharkhand	150	19	18.2	-0.2	1019	0	492	10
Kerala	980	31	24.4	0.0	1076	-4	1123	3
Karnataka	476	63	22.4	-0.3	1097	-3	881	20
Meghalaya	249	-30	17.2	-0.5	940	5	532	-10
Maharashtra	178	50	22.1	-0.5	1131	1	603	12

	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 (%)
Manipur	251	-32	13.5	-0.7	950	5	562	-5
Madhya Pradesh	74	35	19.0	-0.5	1050	1	422	12
Mizoram	267	-27	16.4	-0.5	975	0	601	-2
Nagaland	282	-35	12.8	-1.1	912	9	570	-9
Orissa	188	-2	20.5	0.2	1058	-1	591	6
Puducherry	741	32	25.8	0.1	1141	0	1213	14
Punjab	202	182	16.1	-0.9	820	-4	483	55
Rajasthan	112	405	19.4	-0.5	970	-3	448	51
Sikkim	227	306	9.0	-0.5	1016	-3	343	41
Tamil Nadu	858	24	23.8	0.1	1065	-1	1185	11
Tripura	249	-30	19.0	-0.3	965	1	599	-1
Uttarakhand	174	144	9.8	-1.2	909	-4	374	43
Uttar Pradesh	176	209	17.3	-1.1	917	-4	480	46
West Bengal	260	55	19.9	-0.5	976	-2	591	15

Table A.8 Kazakhstan, October 2021 – January 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	148	0	-5.0	1.6	292	-2	233	0
Karagandinskaya	124	-2	-5.5	1.2	360	-1	221	-4
Kustanayskaya	149	-2	-4.6	1.5	268	0	252	3
Pavlodarskaya	132	2	-5.0	1.9	261	-6	234	2
Severo kazachstanskaya	147	-10	-5.2	1.8	221	-4	230	3
Vostochno kazachstanskaya	208	0	-5.1	1.2	389	-1	228	-1
Zapadno kazachstanskaya	252	40	-0.5	1.7	270	-6	355	11

Table A.9 Russia, October 2021 – January 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.	262	3	-4.5	1.3	189	0	245	5
Chelyabinskaya Oblast	144	-12	-5.3	1.3	217	1	233	4
Gorodovikovsk	224	-1	4.3	0.7	349	2	509	7
Krasnodarskiy Kray	280	2	-0.4	1.4	307	2	346	8
Kurganskaya Oblast	162	-9	-5.3	1.6	180	-2	229	4
Kirovskaya Oblast	333	6	-3.9	0.9	108	-2	254	5
Kurskaya Oblast	258	-6	0.1	0.3	207	5	359	-1

	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 (%)
Lipetskaya Oblast	245	-7	-0.6	0.5	193	2	340	0
Mordoviya Rep.	254	-8	-1.9	0.7	160	-3	303	2
Novosibirskaya Oblast	234	4	-5.7	2.7	162	-13	213	7
Nizhegorodskaya O.	310	6	-2.4	0.6	128	-4	290	2
Orenburgskaya Oblast	238	12	-3.2	1.4	249	-1	280	5
Omskaya Oblast	200	0	-5.4	2.6	151	-14	220	8
Permskaya Oblast	331	11	-4.7	1.6	117	-4	233	8
Penzenskaya Oblast	252	-8	-1.7	0.8	178	-3	307	2
Rostovskaya Oblast	264	12	3.0	0.8	320	3	461	6
Ryazanskaya Oblast	303	10	-1.2	0.4	161	2	319	-1
Stavropolskiy Kray	216	-9	4.0	0.3	373	0	460	-1
Sverdlovskaya Oblast	210	-1	-5.2	2.0	145	2	225	9
Samarskaya Oblast	279	13	-2.3	1.2	191	-6	299	4
Saratovskaya Oblast	277	18	-0.8	1.2	228	-4	339	6
Tambovskaya Oblast	251	-7	-0.8	0.7	190	-2	336	1
Tyumenskaya Oblast	211	2	-5.3	2.4	138	-10	223	9
Tatarstan Rep.	281	3	-3.1	1.2	144	-6	275	5
Ulyanovskaya Oblast	243	-2	-2.3	0.9	173	-4	296	4
Udmurtiya Rep.	327	10	-4.0	1.3	116	-8	251	6
Volgogradskaya O.	268	27	1.0	1.2	277	-1	398	8
Voronezhskaya Oblast	225	-10	0.2	0.6	234	1	370	2

Table A.10 United States, October 2021 – January 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	395	-16	10.8	1.7	623	5	780	9
California	386	19	9.7	-0.3	646	-1	472	0
Idaho	347	6	0.0	0.8	453	-1	377	7
Indiana	389	-4	5.3	0.9	479	2	582	7
Illinois	352	-3	5.1	0.9	490	1	579	9
Iowa	232	-9	2.4	0.9	495	4	459	6
Kansas	118	-37	8.0	2.2	671	8	306	-24
Michigan	301	-15	1.7	0.5	353	1	447	7
Minnesota	266	17	-1.8	0.6	376	0	361	11

	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 (%)
Missouri	318	-5	7.1	1.5	575	5	626	12
Montana	164	-12	-0.3	1.3	437	1	326	3
Nebraska	99	-37	5.0	2.3	593	5	278	-24
North Dakota	231	53	-1.7	0.7	398	1	363	21
Ohio	360	-8	4.9	0.8	466	4	566	7
Oklahoma	189	-28	11.0	2.1	702	7	423	-17
Oregon	543	5	4.1	0.2	398	-4	468	2
South Dakota	163	3	1.7	1.5	499	3	359	7
Texas	196	-27	14.7	1.9	767	6	456	-14
Washington	677	20	3.0	0.1	314	-4	442	1
Wisconsin	223	-21	-0.4	0.5	399	3	397	8

Table A.11 China, October 2021 – January 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	213	-1	9.2	0.6	652	1	464	0
Chongqing	294	7	8.7	0.0	543	-2	600	9
Fujian	365	-6	12.8	0.3	616	-3	729	9
Gansu	175	62	-0.9	-0.2	691	-3	269	11
Guangdong	373	-4	16.2	0.3	747	2	700	1
Guangxi	391	6	13.8	-0.1	626	-5	746	8
Guizhou	396	12	8.7	0.0	459	-7	689	5
Hebei	128	171	-0.6	-0.1	600	-4	254	59
Heilongjiang	131	37	-8.3	1.3	411	-6	215	20
Henan	126	14	6.9	0.0	629	-6	345	17
Hubei	223	1	8.3	0.3	627	-3	483	3
Hunan	358	12	10.0	0.1	580	-6	697	15
Jiangsu	214	13	9.5	0.7	672	4	464	5
Jiangxi	306	-12	11.3	0.4	620	-3	652	5
Jilin	147	46	-5.8	0.7	499	-5	241	20
Liaoning	167	103	-2.2	0.2	552	-4	274	31
Inner Mongolia	60	16	-7.6	0.7	529	-2	150	11
Ningxia	86	53	-1.6	-0.5	716	-1	194	7
Shaanxi	198	82	2.8	0.0	644	-5	334	25
Shandong	116	57	5.8	0.4	636	-3	303	28
Shanxi	148	162	-0.8	0.0	642	-4	259	42
Sichuan	327	27	6.2	-0.1	561	-9	504	8
Yunnan	361	21	10.1	0.2	719	-3	651	11
Zhejiang	405	10	10.4	0.5	616	1	693	6

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**.**

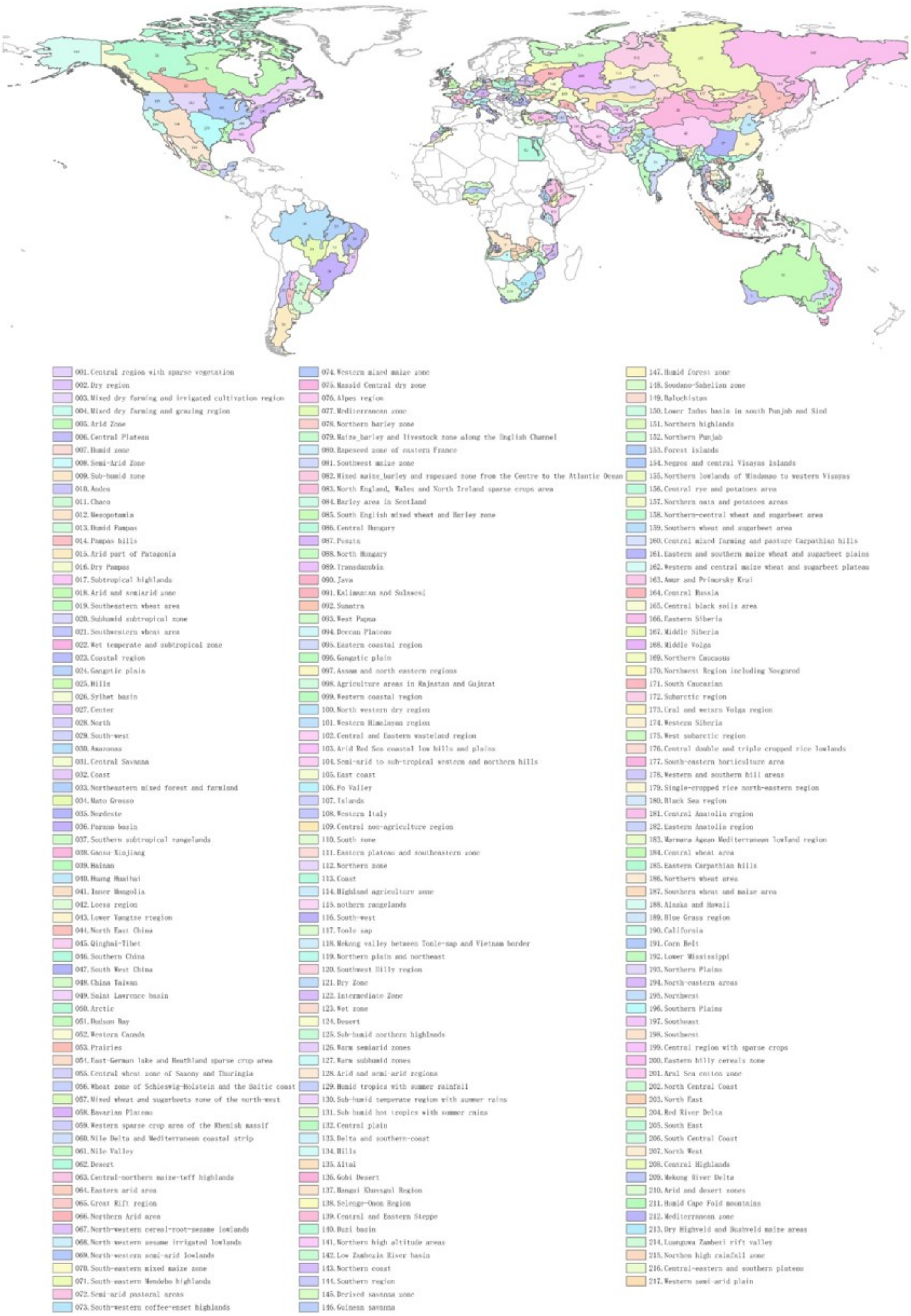
Agroecological zones for 43 key countries

Overview

217 agroecological zones for the 43 key countries across the globe

Description

43 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 43 key countries. Some regions are more relevant for rangeland and livestock monitoring, which is also essential for food security.



CropWatch indicators

The CropWatch indicators are designed to assess the condition of crops and the environment in which they grow and develop; the indicators—RAIN (for rainfall), TEMP (temperature), and RADPAR (photosynthetically active radiation, PAR)—are not identical to the weather variables, but instead are value-added indicators computed only over crop growing areas (thus for example excluding deserts and rangelands) and spatially weighted according to the agricultural production potential, with marginal areas receiving less weight than productive ones. The indicators are expressed using the usual physical units (e.g., mm for rainfall) and were thoroughly tested for their coherence over space and time. CWSU are the CropWatch Spatial Units, including MRUs, MPZ, and countries (including first-level administrative districts in select large countries). For all indicators, high values indicate "good" or "positive."

INDICATOR			
BIOMSS			
Biomass accumulation potential			
Crop/ satellite	Grams dry matter/m^2, pixel or CWSU	An estimate of biomass that could potentially be accumulated over the reference period given the prevailing rainfall, temperature and RADPAR 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

INDICATOR			
			only) in crop condition development graphs, compared with previous year and recent five-year average (2017-2021), and as spatial patterns compared to the average showing the time profiles, where they occur, and the percentage of pixels concerned by each profile.
RADPAR			
CropWatch indicator for Photosynthetically Active Radiation (PAR), based on pixel based PAR			
Weather/Satellite	W/m^2, CWSU	The spatial average (for a CWSU) of PAR accumulation over agricultural pixels, weighted by the production potential.	RADPAR is shown as the percent departure of the RADPAR value for the reporting period compared to the recent fifteen-year average (2007-2021), per CWSU. For the MPZs, regular PAR is shown as typical time profiles over the spatial unit, with a map showing where the profiles occur and the percentage of pixels concerned by each profile.
RAIN			
CropWatch indicator for rainfall, based on pixel-based rainfall			
Weather/ satellite	Liters/m^2, CWSU	The spatial average (for a CWSU) of rainfall accumulation over agricultural pixels, weighted by the production potential.	RAIN is shown as the percent departure of the RAIN value for the reporting period, compared to the recent fifteen-year average (2007-2021), per CWSU. For the MPZs, regular rainfall is shown as typical time profiles over the spatial unit, with a map showing where the profiles occur and the percentage of pixels concerned by each profile.
TEMP			
CropWatch indicator for air temperature, based on pixel-based temperature			
Weather/ satellite	°C, CWSU	The spatial average (for a CWSU) of the temperature time average over agricultural pixels, weighted by the production potential.	TEMP is shown as the departure of the average TEMP value (in degrees Centigrade) over the reporting period compared with the average of the recent fifteen years (2007-2021), per CWSU. For the MPZs, regular temperature is illustrated as typical time

INDICATOR			
			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.

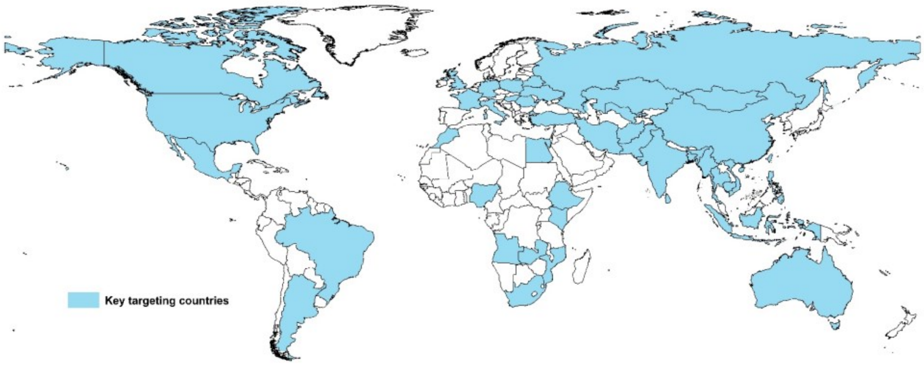
Note: Type is either "Weather" or "Crop"; source specifies if the indicator is obtained from ground data, satellite readings, or a combination; units: in the case of ratios, no unit is used; scale is either pixels or large scale CropWatch spatial units (CWSU). Many indicators are computed for pixels but represented in the CropWatch bulletin at the CWSU scale.

CropWatch spatial units (CWSU)

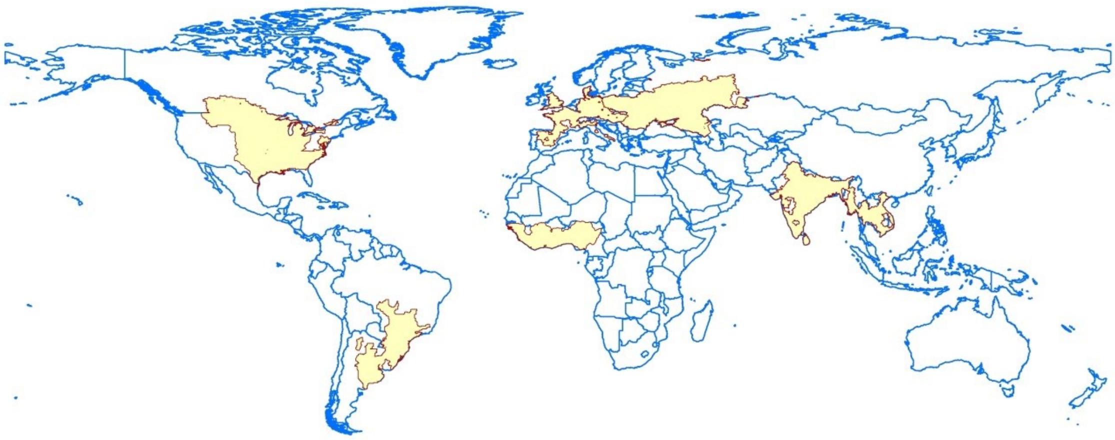
CropWatch analyses are applied to four kinds of CropWatch spatial units (CWSU): Countries, China, Major Production Zones (MPZ), and global crop Monitoring and Reporting Units (MRU). The tables below summarize the key aspects of each spatial unit and show their relation to each other. For more details 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.

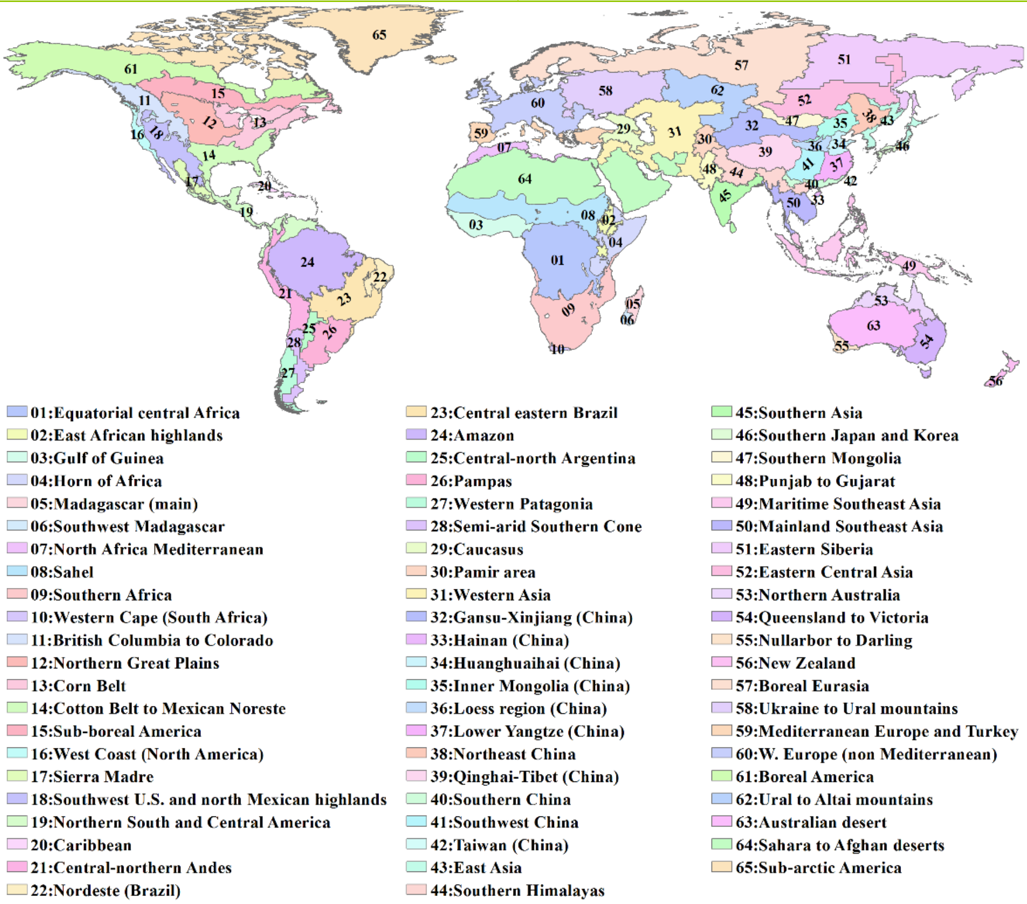
Countries (and first-level administrative districts, e.g., states and provinces)	
Overview	*Description*
“Forty two plus one” countries to represent main producers/exporters and other key countries.	CropWatch monitored countries together represent more than 80% of the production of maize, rice, wheat 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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