Chapter 3. Core countries

3.1 Overview

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

Introduction

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

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

Overview of weather conditions in major agricultural exporting countries

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

Maize: Maize exports are dominated by just 4 countries: USA, Brazil, Argentina and the Ukraine. Together, they supply almost 90% of the maize being traded internationally. During this monitoring period, maize planting had started in late September in southern Brazil. Conditions were generally on the dry side, due to the continuing La Niña conditions, which may further constrain production in southern Brazil and Argentina. In the USA, the largest exporter, conditions were generally favorable. During the previous monitoring period, conditions were reported to be on the dry side for the northern parts of Iowa. However, they returned to normal in August. Combined with the favorable conditions in the key maize producing states, high production levels can be expected for the USA. Weather conditions for maize production were also favorable in the Ukraine, where record yields have been forecasted as well. Conditions in West Africa were less favorable, as rain was about 30% below average. Rain was normal in Ethiopia. In China, moisture was abundant and parts of the North China Plain experienced flooding conditions. Harvest was also hampered in parts of area by rains that lasted well into October.

Rice: Four out of the 5 top rice exporting countries are located in South and Southeast Asia: India supplies about 1/3 of the rice that is internationally traded, followed by Thailand with 1/5. The USA, number 3, supplies less than 10%. Vietnam contributes about 7% and Pakistan close to 6%. The southern rice

producing regions of the USA had received plenty of rainfall, whereas California, the second most important production region, was affected by an extreme drought. Weather conditions in Southeast Asia, with a combined market share of slightly more than 25%, were close to normal. In China, rice benefitted from normal to above normal rainfall. In South Asia, conditions were also favorable for rice production and Indian farmers harvested a record setting rice crop.

Wheat: Conditions for wheat production in Argentina and Brazil were generally favorable, although some regions within those two countries had been affected by drought conditions. Especially in Parana (Brazil) conditions were not so favorable due to drier than normal weather and frosts in July and August. Wheat production in the northern and western states of the USA and in the Canadian Prairies was negatively affected by extreme heat and drought conditions. Conditions for wheat were generally favorable for most of Europe and the Ukraine. They were less favorable in the Urals and Volga region of Russia and neighboring Kazakhstan, causing a drop in production as compared to last year. Conditions for spring wheat in China were generally favorable. Similarly, wheat in Australia also benefitted from good rainfall.

Soybean: Similar to maize, the soybean market is dominated by few countries: Brazil, the USA and Argentina account for more than 80% of total production. Brazil's share is more than half of the soybean traded on the international market, followed by the USA (30%), Argentina (5%), Paraguay (4%) and Canada (3%). Soybean planting for the 2021/22 season started in October in Brazil. Dry weather in the first half of October provided good conditions for sowing. Subsequent heavy rains in late October helped with germination and crop establishment. Weather conditions in most of the soybean producing region of the USA were favorable and high yields can be expected.

Weather anomalies and biomass production potential changes

(1) Rainfall

Rainfall anomalies depict the average departure of rainfall from the 15YA. The map shows average rainfall departures for the 4-month period. They do not show short term water deficits. Nevertheless, they indicate where rainfall was generally favorable or not for crop production.

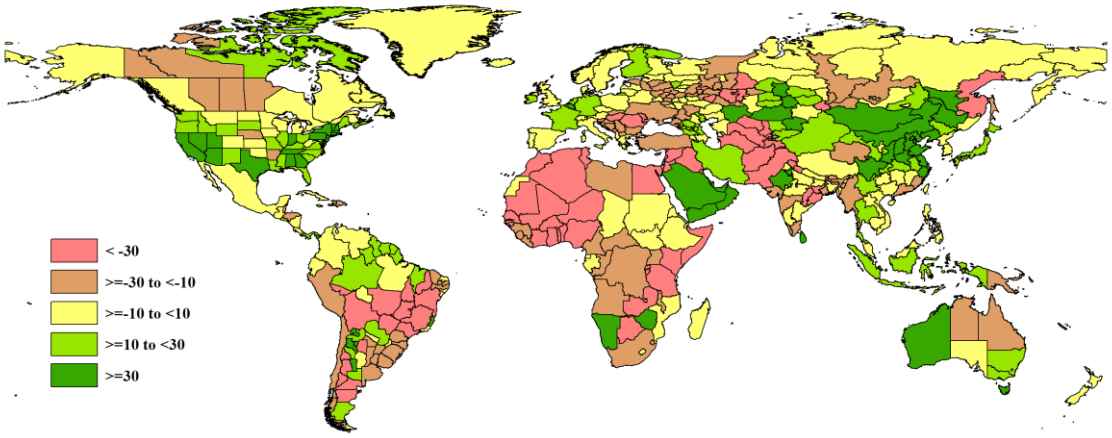


Figure 3. 1 National and subnational rainfall anomaly (as indicated by the RAIN indicator) of July to October 2021 total relative to the 2006-2020 average (15YA), in percentage.

Heavy rains in late October brought a welcome relief for the West Coast of the USA. On average, rainfall was above average for most of the USA, although crop production in the West, Northwest and Northern Plains, as well as in the Canadian Prairies had been severely impacted by the drought conditions in July and August. In South America, wheat was the main crop that was grown in the Pampas of Argentina and southern Brazil. In parts of Argentina, conditions were favorable, whereas most of Brazil had been impacted by drought conditions. In South Africa, the Cape Province received normal to above normal

rainfall, whereas most of the other regions of the continent received below average rainfall. In West- and East Africa, rainfall was more than 30% below average. Western and northern Europe received above average rainfall, whereas it was below average in Hungary and parts of Romania. Summer is generally a dry period for the countries bordering the eastern Mediterranean basin. Nevertheless, rainfall was below average in that region. Dry conditions were also recorded for Irak, Iran, Afghanistan, Central Asia, the Volga and southern Ural region of Russia. In neighboring Kazakhstan, rainfall was near average. But it could not compensate for the rainfall deficit that had been recorded during the previous monitoring period. Rainfall in India was mixed, but conditions were generally favorable for rice production. In Southeast Asia, as well as China, rice also benefitted from an ample supply of moisture. Rainfall in the North China Plain was above average. Rains lasted until October, negatively impacting the harvest season of the maize crop and subsequent sowing of the winter wheat crop. Conditions were favorable for wheat production in Australia due to average to above average rainfall.

(2) Temperature anomalies

Average and warmer than average temperatures were recorded for all regions south of the equator, except for the southern tip of Africa. In the USA and Canada, temperatures were above average average, except for Arizona, and the Southeast. The Midwest and the Canadian Prairies experienced above average temperatures. Westafrica also experienced warmer than usual temperatures. Cooler temperatures occurred in regions with above average rainfall, such as Western Europe, Mongolia and the north of China. A severe cold spell in late September caused below average temperatures in Kazakhstan and the southern Ural. Apart from the aforementioned regions, temperatures where mostly near average in most of Asia. In the import winter crop production regions of Australia, temperatures were near average.

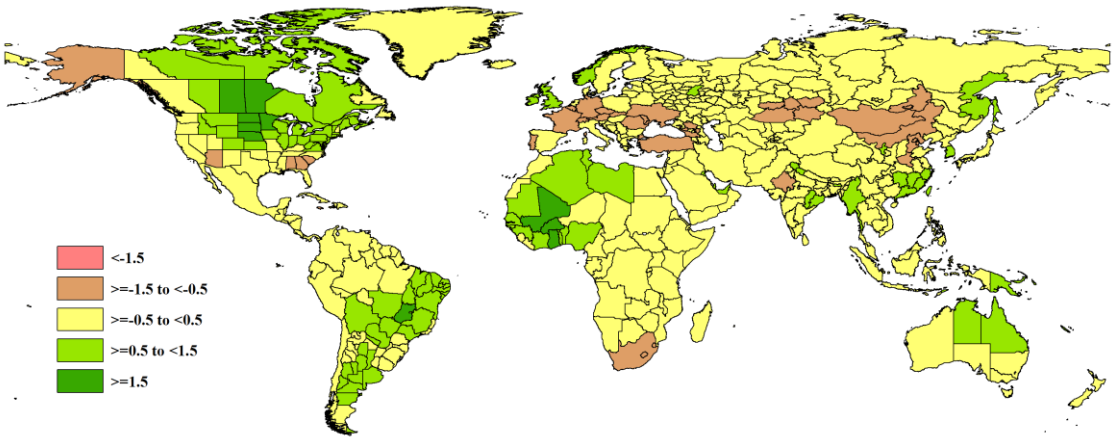


Figure 3. 2 National and subnational temperature anomaly (as indicated by the TEMP indicator) of July to October 2021 average relative to the 2006-2020 average (15YA), in °C

(3) RADPAR anomalies

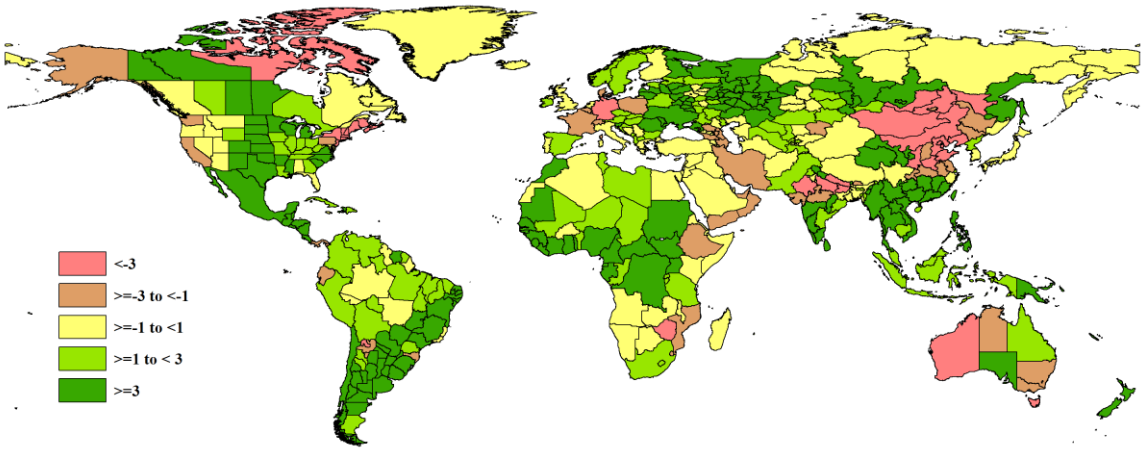


Figure 3. 3 National and subnational sunshine anomaly (as indicated by the RADPAR indicator) of July to October 2021 total relative to the 2006-2020 average (15YA), in percentage

Similar to the temperatures, solar radiation was predominantly above average in most regions south of the equator. Zimbabwe, Mozambique, as well as Western and Southeastern Australia are the notable exceptions. In California and Washington State in the USA, which were plagued by wild fires and smog, radiation levels were more than 1% below average. The Northeast of the USA experienced solar radiation levels that were more than 3% below average. For the other regions in Central and North America, solar radiation was around or above average. Solar radiation was below average in France, Germany and Poland. For the other European countries, it was around or above average. Most of Eastern Europe and Russia experienced above average solar radiation. Ethiopia, Oman, Iran, Georgia, the Indo-Gangetic Plain, Mongolia and most of China, except the south, experienced below average solar radiation. Solar radiation was in general more than 3% above the 15YA in southern India and the rice producing countries in Southeast Asia.

(4) Biomass accumulation potential

The map depicting potential biomass production shows more variability than the other three maps. It shows mostly negative departures for most of South America, except some provinces in Argentina at the foothill of the Andes and for the heart of the Amazon basin. A positive departure is also shown for the USA. Below average production is estimated for the Canadian Prairies, mostly due to the drought conditions. A strong negative departure is also shown for most of West, North and East Africa. Estimates for Central Africa and Ethiopia hovered around the average. Average to above average production was estimated for western Europe. In Russia, the conditions were highly variable. For Turkey, Irak, Central Asia and Afghanistan a strong negative departure was estimated. In India, conditions were mixed, although generally positive. Average conditions to a strong positive departure was estimated for all of China and Australia. In Southeast Asia, conditions were generally on average.

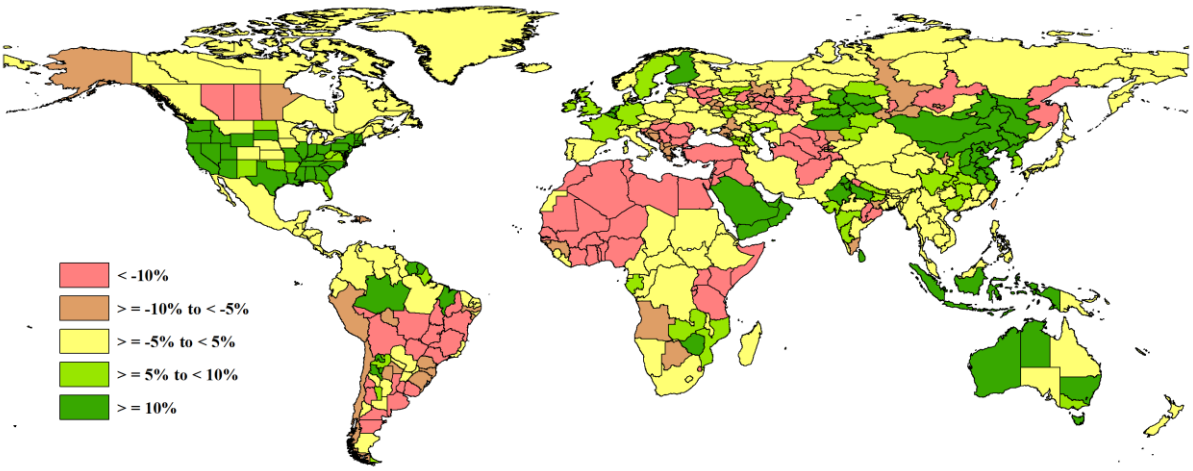


Figure 3. 4 National and subnational biomass production potential anomaly (as indicated by the BIOMSS indicator) of July to October 2021 total relative to the 2006-2020 average (15YA), in percentage

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

Code	Country	Agro-climatic indicators				Agronomic indicators		
		Departure from 15YA (2006-2020)				Departure from 5YA (2016-2020)		Current
		RAIN (%)	TEMP(°C)	PAR(%)	BIOMSS (%)	CALF (%)	CI (%)	VCIx
AFG	Afghanistan	-38	-0.1	1	-17	3	9	0.23
AGO	Angola	-15	0.2	0	-6	11	11	0.84
ARG	Argentina	-11	0.5	5	-6	-5	3	0.74
AUS	Australia	16	-0.1	-1	9	5	3	0.85
BGD	Bangladesh	-8	0.2	0	0	2	1	0.94
BLR	Belarus	-8	-0.1	3	-5	0	-1	0.89
BRA	Brazil	-27	0.8	3	-16	-2	7	0.81
KHM	Cambodia	-8	1.2	1	-5	-3	3	0.84
CAN	Canada	21	-0.7	-4	8	0	13	0.99
CHN	China	-60	0.5	0	-25	3	17	0.71
EGY	Egypt	-5	-0.2	-2	-3	1	1	0.95
ETH	Ethiopia	15	-0.6	-1	6	1	11	1.00
FRA	France	2	0.6	1	7	0	2	0.95
DEU	Germany	-35	-0.2	3	-17	0	20	0.73
HUN	Hungary	20	0.2	2	12	0	-1	0.95
IND	India	-11	0.1	1	5	1	10	0.91
IDN	Indonesia	21	0.1	-1	2	-6	3	0.45
IRN	Iran	-6	0.0	-1	-5	-5	4	0.71
ITA	Italy	21	-0.3	1	8	-26	-1	0.64
KAZ	Kazakhstan	-34	0.1	0	-13	-11	1	0.72
KEN	Kenya	24	-0.2	1	-1	-11	-1	0.73
MEX	Mexico	6	0.1	1	2	1	-7	0.90
MNG	Mongolia	33	-0.1	4	12	1	0	0.93
MAR	Morocco	-56	0.2	3	-27	-9	1	0.58
MOZ	Mozambique	1	0.1	3	1	2	-3	0.92
MMR	Myanmar	-13	0.6	7	-2	1	-6	0.94
NGA	Nigeria	36	-0.6	-4	12	2	2	1.02
PAK	Pakistan	7	-0.3	-2	6	3	0	0.87
PHL	Philippines	-32	0.7	5	-15	0	-6	0.91
POL	Poland	-35	0.3	2	4	1	13	0.70
ROU	Romania	-5	0.4	7	1	0	1	0.96
RUS	Russia	4	-0.2	-3	0	0	4	0.94
ZAF	South Africa	-38	-0.5	3	-18	1	15	0.84
LKA	Sri_Lanka	-6	0.0	3	-1	0	-1	0.87
THA	Thailand	11	0.2	5	4	0	-8	0.95

TUR	Turkey	-20	-0.6	0	-14	-16	3	0.63
UKR	Ukraine	-15	-0.6	4	-4	4	19	0.95
GBR	United Kingdom	22	0.4	2	11	-2	1	0.87
USA	United States	-48	0.2	1	-27	-11	2	0.73
UZB	Uzbekistan	3	0.2	5	2	1	2	0.95
VNM	Vietnam	-15	-0.7	2	-3	22	0	0.91
ZMB	Zambia	-35	0.2	-1	9	11	0	0.81

3.2 Country analysis

This section presents CropWatch analyses for each of 42 key countries (China is addressed in Chapter 4). The maps refer to crop growing areas only and include several graphs: (a) Phenology of major crops; (b) Crop condition development based on NDVI over crop areas at national scale, comparing the July - October 2020 period to the previous season and the five-year average (5YA) and maximum; (c) Maximum VCI (over arable land) for July - October 2020 by pixel; (d) Spatial NDVI patterns up to July - October 2020 according to local cropping patterns and compared to the 5YA; and (e) NDVI profiles associated with the spatial pattern under (d). Next, separate graphs (labeled as figures (f), (g), and subsequent letters) are included to illustrate crop condition development graphs based on NDVI average over crop areas for different regions within the country, again comparing the July - October 2020 period to the previous season and the five-year average (5YA) and maximum.

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

Figures 3.5 - 3.45 are Crop condition for individual countries ([AFG] Afghanistan - [ZMB] Zambia) including sub-national regions during July – October 2021.

[AFG] Afghanistan

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

The agro-climatic condition showed that RAIN decreased by 38%, and TEMP and RADPAR were close to the average level. The decrease in rainfall resulted in significantly lower biomass (-17%). The cropped arable land fraction (CALF) increased by 3%. VCIx was low, it reached only 0.23. It is worth noting that the rainfall was very low in northern Afghanistan. The hardest hit provinces were Badghis Province and Faryab Province. But drought conditions were observed for the other regions as well.

According to the spatial distribution of NDVI profiles, the overall crop growth in Afghanistan was below the average level. The growth of crops in 58.4% of the crop land area was lower than the average level and mainly distributed in northern Afghanistan, which may be related to the decrease of rainfall. Additionally, about 37.4% of total cropped areas were near average, mainly distributed in southern Afghanistan, and only 4.3% of the total cropped areas were positive during the entire monitoring period. The VCIx diagram represents the same conditions.

During the monitoring period, Afghanistan has suffered a severe drought, and the prospect for crop production is far below normal. Its effects were exacerbated by the war and the change in the Government, resulting in a shortage of food supply. According to relevant reports, more than half of Afghans are experiencing a food crisis.

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.

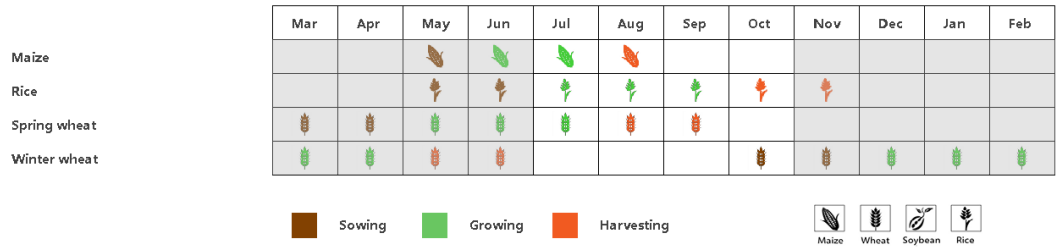
The RAIN in the Central region with sparse vegetation was 17 mm (-38%). The TEMP was 15°C, and the RADPAR was 1469 MJ/m2, at an average level. According to the NDVI-based crop condition development graph, the NDVI was slightly lower than the average level between July and October. BIOMSS decreased by 15%, CALF had increased by 7% and VCIx was 0.38.

The Dry region recorded 22 mm of rainfall (RAIN -10%), TEMP was higher than average at 21.5°C, and RADPAR was 1484 MJ/m2. 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 4% and VCIx was 0.2.

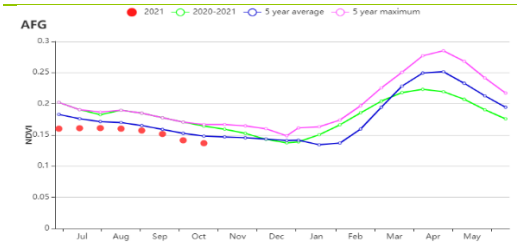
In the Mixed dry farming and irrigated cultivation region, the following indicator values were observed: RAIN 41 mm (-41%); TEMP 17.5°C (-0.1°C); RADPAR 1446 MJ/m2 (+2%). BIOMSS was 153 g DM/m2 (-26%) and CALF was 2% above average. According to the NDVI-based crop condition development graph, NDVI was lower than the average level and VCIx was 0.32.

The Mixed dry farming and grazing region recorded 1 mm of rainfall (RAIN -92%). TEMP was 20.1°C (-0.2°C) and RADPAR was 1478 MJ/m2, at an average level. CALF was 13% above the 5YA. VCIx was 0.09 and BIOMSS decreased by 23%. According to the crop condition development graph, the NDVI was much lower than the 5YA throughout the monitoring period.

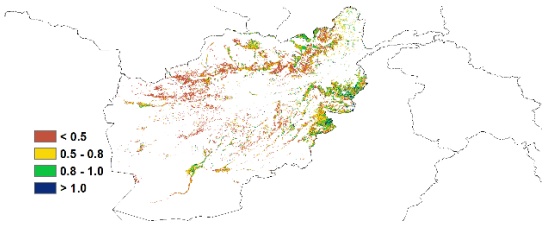
Figure 3. 5 Afghanistan's crop condition, July- October 2021



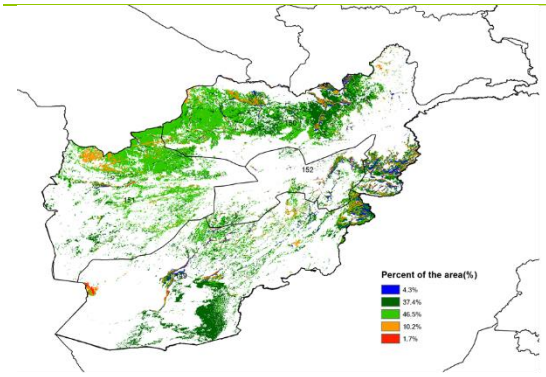
(a). Phenology of major crops



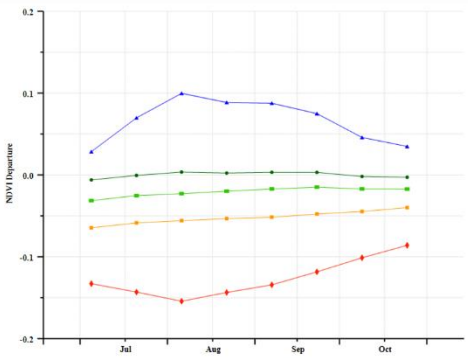
(b) Crop condition development graph based on NDVI



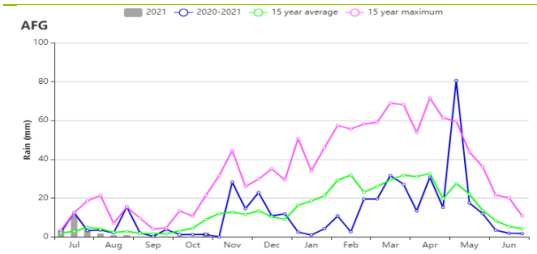
(c) Maximum VCI



(d) Spatial NDVI patterns compared to 5YA

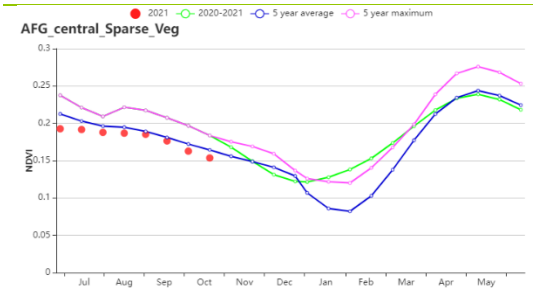


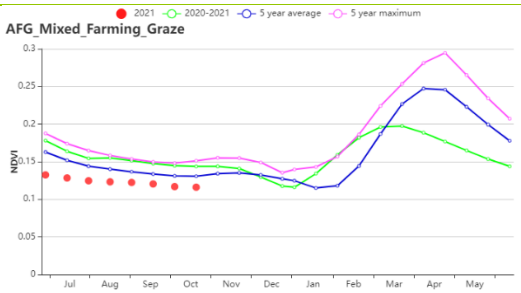
(e) NDVI profiles



(f) Rainfall profiles

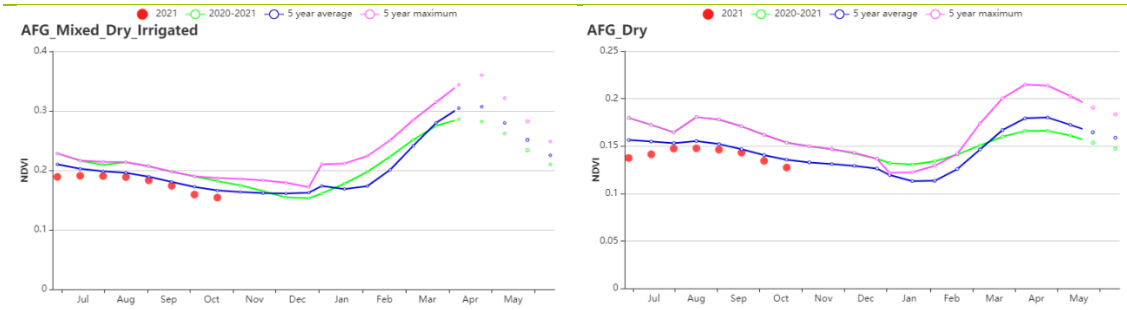
(g) Temperature profiles





(h) Crop condition development graph based on NDVI

(central_Sparse_Veg Region (left) and Mixed_Farming_Graze Region (right))



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

Table 3.2 Afghanistan's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, July – October 2021

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Central region with sparse vegetation	17	-38	15	0	1469	1	133	-15
Dry region	22	-10	21.5	0	1484	0	113	1
Mixed dry farming and irrigated cultivation region	41	-41	17.5	-0.1	1446	2	153	-26
Mixed dry farming and grazing region	1	-92	20.1	-0.2	1478	0	47	-23

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

Region	Cropped arable land fraction		Cropping intensity		Maximum VCI
	Current (%)	Departure (%)	Current (%)	Departure (%)	Current
Central region with sparse vegetation	7	7	106	1	0.38
Dry region	4	0	—	—	0.2
Mixed dry farming and irrigated cultivation region	11	2	115	8	0.32
Mixed dry farming and grazing region	0	13	113	10	0.09

[AGO] Angola

The current monitoring period covers the growing and harvesting stages of rainfed wheat in the provinces of Bengela, Kuanza Sul, Luanda, Bengo and Kuanza Norte. The planting of maize and rice began in late September and it is expected to last until late November. Estimated biomass dropped by 6%, due to below-average rainfall by (RAIN -15%). The temperature increased by 0.2ºC, while the radiation was near the average of the past fifteen years. The NDVI development graph indicates that nationwide, crop conditions were near the average of the past five years from July to September, deteriorating in early October till the end of the monitoring period, when the harvesting period of wheat was completed.

At the country level, the overall VCIx was acceptable, with a value of 0.84. According to its spatial distribution, the best VCIx values were recorded in the province of Cuando Cubango, Benguela, Cuanza Sul and Bengo. The VCIx spatial distribution was generally consistent with those of NDVI, according to the NDVI departures, in almost 46.9% of the arable land in these regions. The crop conditions were favourable from mid-July (when wheat started to develop) till late September.

Regional Analysis

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

In the Arid Zone, the agroclimatic indicators reveal that rainfall decreased significantly (RAIN -29%). Meanwhile, temperature and radiation increased by 0.5ºC and 1% respectively. The potential biomass for this region decreased by 15% compared to the 15-year average. In the region, crop conditions were favourable during almost the entire monitoring period, except for late October. Both the cropping intensity and CALF are higher than 5YA (111% and 34%, respectively), the maximum VCI in the arid zone was 0.76. Crop conditions were close to the average.

With crop conditions below the average of the past five years, the rainfall in the Central Plateau region decreased by 20%. The temperature recorded an increase of 0.1ºC while radiation decreased by about 1%. Following these conditions, the potential biomass production decreased by 6%. The significant drop in the total rainfall may have led to a decrease in CALF (-15%). But the cropping intensity increased by 22%, indicating that the annual crop area was above average. The maximum VCI for this region was 0.70. Crop conditions in this region were negative.

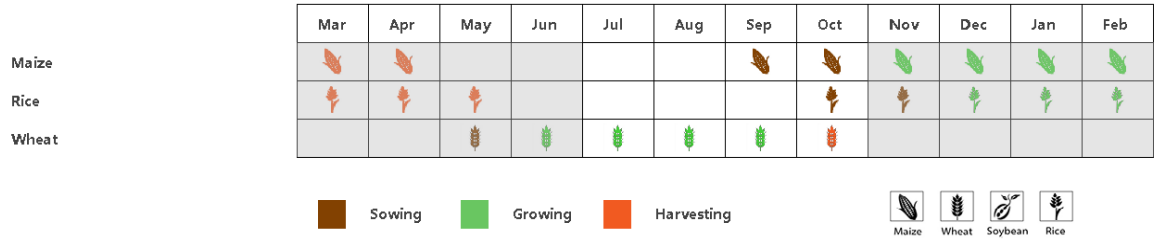
With both rainfall and temperature decreasing (RAIN -11% and TEMP -0.3ºC), and radiation increasing (RADPAR +3%), the Humid zone registered a drop in the potential biomass (BIOMSS -5%). However, the agroclimatic indicators had less impact on crop conditions, as the NDVI development graph revealed mixed crop conditions during the entire monitoring period. In this region, CALF was about the average of the past five years and he recorded VCIx was 0.92, indicating positive crop conditions during the growing period. The cropping intensity increased by 24%, indicating that the annual crop area was above average

Although the Semi-arid zone recorded an increase in rainfall (RAIN +1%) and radiation (RADPAR +3%), the potential biomass production in this region had decreased by 8%. The crop conditions development graph based on NDVI reveals generally above-average crop conditions during the entire monitoring period. The cropping intensity in this region increased in 4% while CALF increased by 39%. The VCIx observed in this region was of 0.89.

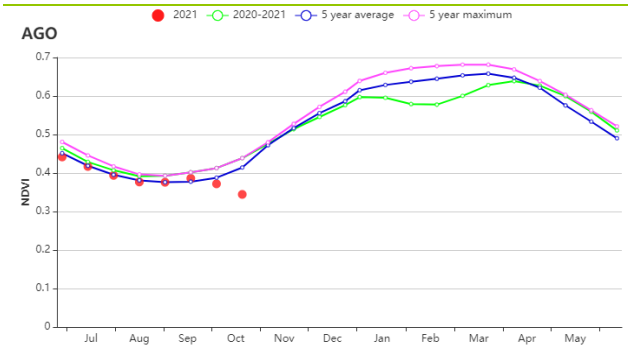
In the Sub-humid zone, rainfall decreased by 17%. Both temperature and radiation increased by 0.2ºC and 1%, respectively. The potential biomass production decreased by 5%. The NDVI development graph shows that crop conditions were generally below the average of the past five years during almost the entire monitoring period. With an increase of 1% in CALF, the Cropping Intensity had increased by 15%. The maximum VCI observed in this region was 0.81.

In general, based on the agroclimatic and agronomic indicator herein reported, the crop condition in the Central Plateau, Arid and Subhumid zones were less favorable， while crop conditions of Semi-arid zone and Sub-humid zone were favourable for the growing of wheat.

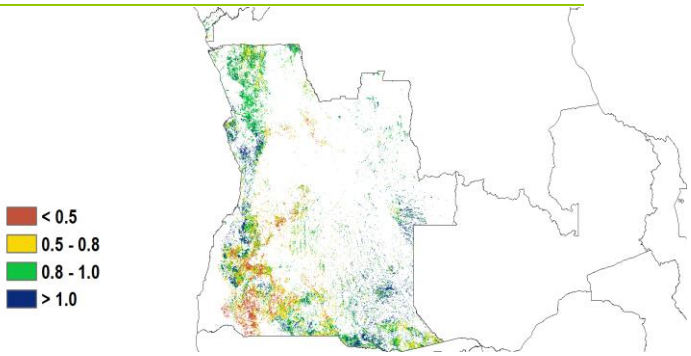
Figure 3. 6 Angola's crop condition, July – October 2021



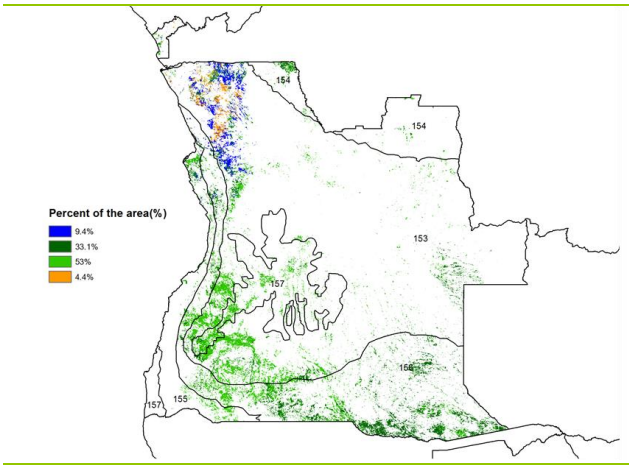
(a). Phenology of major crops



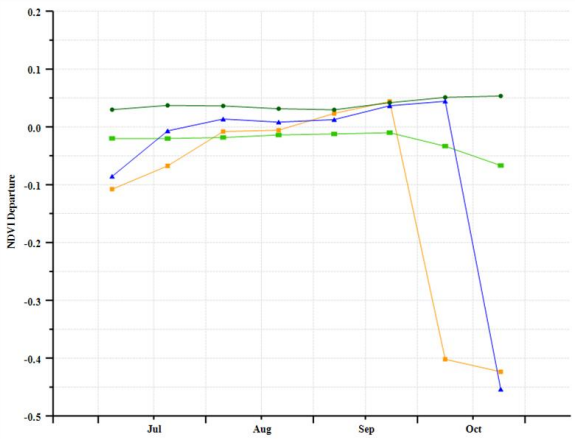
(b) Crop condition development graph based on NDVI



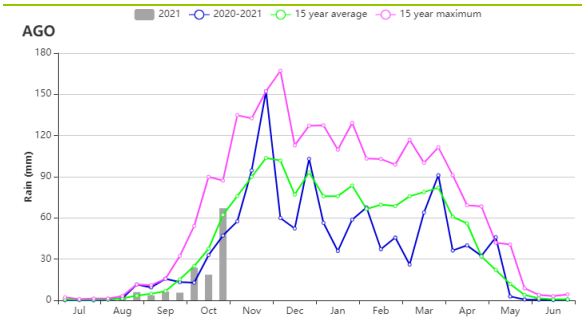
(c) Maximum VCI



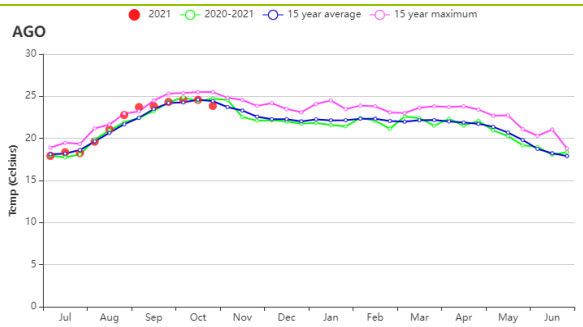
(d) Spatial NDVI patterns compared to 5YA



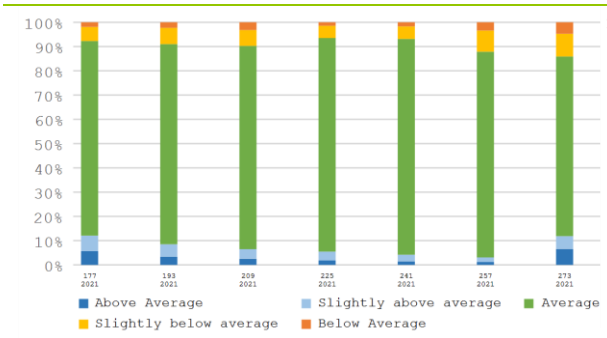
(e) NDVI profiles



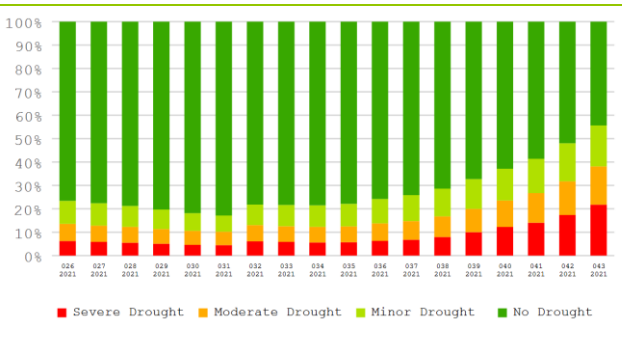
(f) National time-series rainfall profiles



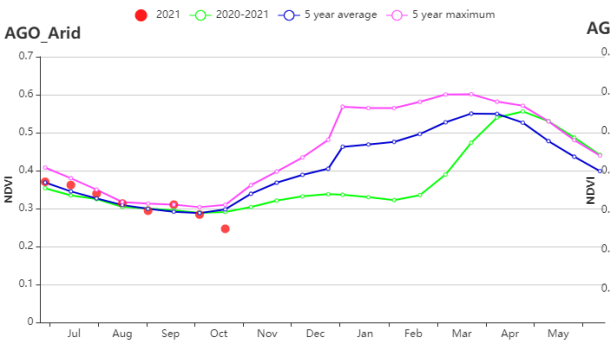
(g) National time-series temperature profiles



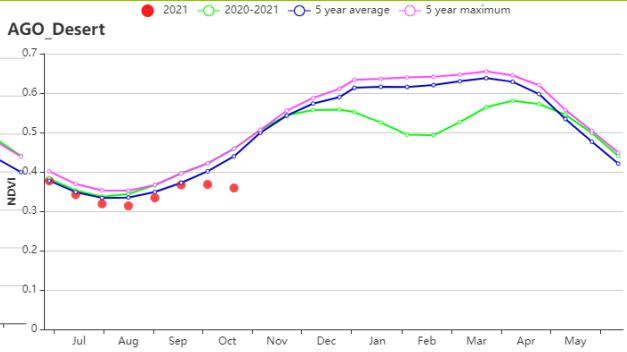
(h) Proportion of NDVI anomaly categories compared with 5YA



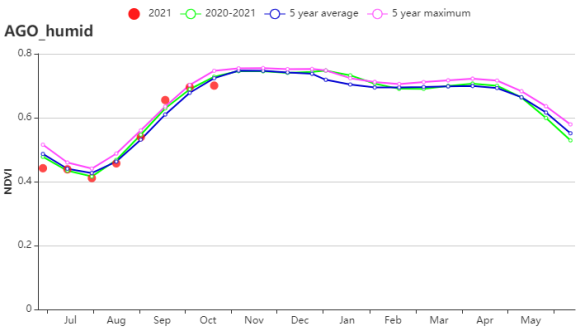
(i) Proportion of VHIm categories compared with 5YA



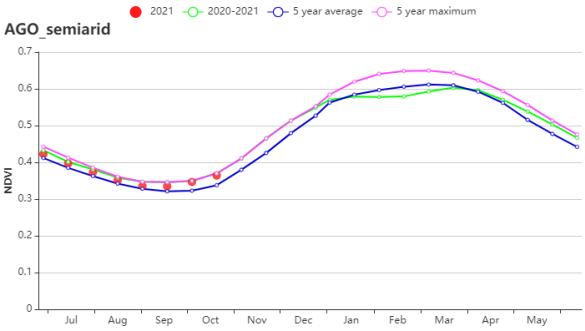
(j) Crop condition development graph based on NDVI- Arid zone



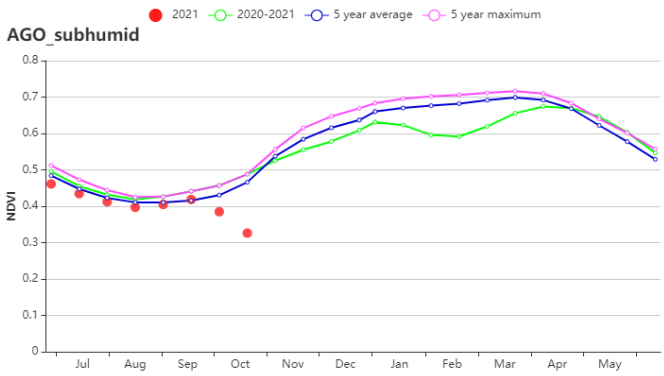
(k) Crop condition development graph based on NDVI - Central Plateau



(l) Crop condition development graph based on NDVI- Humid zone



(m) Crop condition development graph based on NDVI - Semi-arid zone



(n) Crop condition development graph based on NDVI- Sub-humid zone

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

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m^2)	Departure from 15YA (%)	Current (gDM/m2)	Departure from 15YA (%)
Arid Zone	64	-29	22.3	0.5	1355	1	395	-15
Central Plateau	120	-20	19.2	0.1	1352	-1	352	-6
Humid zone	476	-11	23.7	-0.3	1299	3	906	-5
Semi-Arid Zone	41	1	21.5	0.3	1377	-1	228	-8
Sub-humid zone	164	-17	22.0	0.2	1315	1	457	-5

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

Region	Cropped arable land fraction		Cropping Intensity		Maximum VCI
	Current (%)	Departure from 5YA (%)	Current (%)	Departure from 5YA (%)	Current
Arid Zone	34	56	111	5	0.76
Central Plateau	37	-15	122	22	0.70
Humid zone	100	0	157	24	0.92
Semi-Arid Zone	44	39	105	4	0.89
Sub-humid zone	62	1	119	15	0.81

[ARG] Argentina

The reporting period covers the main growing period of winter crops and the sowing of early maize and rice. Part of the period is a fallow period for the summer crops. The overall crop conditions in Argentina varied between regular and poor.

For the whole country, rainfall showed a 11% negative anomaly, TEMP showed a positive anomaly (+0.5°), RADPAR showed positive anomalies by +5%. Due to the shortage of rainfall, BIOMSS was negatively affected at 6% below 15YA. Rainfall profiles showed slightly negative anomalies during most of the period, except for a strong rain event at the beginning of September. Overall, weather conditions were variable.

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 are less relevant for this period.

Except for the Subtropical Highlands that showed positive anomalies in RAIN (+31 %), negative anomalies were observed in Chaco (-20 %), Humid Pampas (-13 %) and Mesopotamia (-11 %). TEMP showed positive anomalies for the four AEZs: Humid Pampas (+0.6°), Chaco (+0.4°), Subtropical Highlands (+0.4°) and Mesopotamia (+0.3°). RADPAR showed positive anomalies in Humid Pampas (+6 %), Mesopotamia (+6 %) and Chaco (+5 %), while Subtropical Highlands showed negative anomaly (-1 %). Thanks to the sufficient rainfall in Subtropical Highlands, BIOMSS showed positive anomalies by +9%. In contrast, it was below 15YA for the other three AEZs: Humid Pampas (-7%), Mesopotamia (-9%), and Chaco (-8%) mainly due to the shortage of rainfall.

CALF was almost complete in Mesopotamia (98%). The other AEZs showed low CALF values: Subtropical Highlands (53 %), Humid Pampas (77%), the major winter crops growing region, and Chaco (80 %). Cropping Intensity index showed positive anomaly in Humid Pampas (+5 %) and in Subtropical Highlands (+1 %). No anomalies were observed for Chaco and a slightly negative one for Mesopotamia (-2 %). Maximum VCI showed average conditions for Mesopotamia (0.81), and lower values for Humid Pampas (0.76), Chaco (0.67) and Subtropical Highlands (0.58).

For the whole country, crop condition development graph based on NDVI showed negative anomalies during July and August. Starting in September, NDVI values were near the 5 year average and above the 2020 values for the same period. Several differences were observed among regions. Humid Pampas showed almost no anomalies during July and August, and positive anomalies starting in September. The peak NDVI in Humid Pampas was well above those of the 5YA and the 2020 winter crops growing season, reflecting an increase signal of winter crops. Chaco and Subtropical Highlands showed negative anomalies during almost the entire reporting period. NDVI in Mesopotamia remained at average levels during the whole period although sufficient rainfall provided favorable soil moisture conditions.

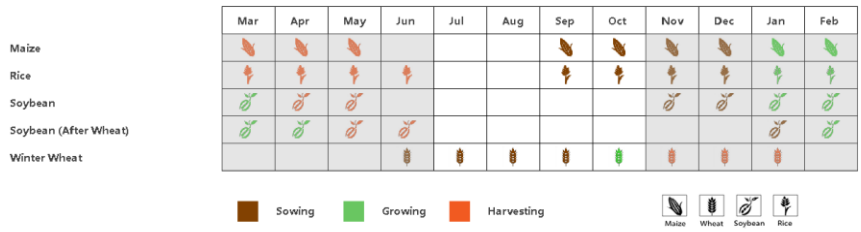
Spatial distribution of NDVI profiles showed some homogeneous patterns. Two profiles showed negative anomalies during the entire reporting period: the green profile showed stronger negative anomalies than the red profile. These profiles were located in North West Pampas, Subtropical Highlands and Chaco, as well as in a small region in Center East Pampas. Another homogeneous pattern showed slight negative anomalies during July and August and positive anomalies since September (blue profile) and was observed in Center and West Pampas. A pattern with high positive anomalies since August was observed in East Chaco (orange pattern). The dark green pattern, with slight positive anomalies, was sparsely scattered over the country.

Maximum VCI showed similar spatial patterns as the crop condition presented by the NDVI departure clusters. Below-average conditions (lower than 0.8) were mainly located in northern, northwest, and

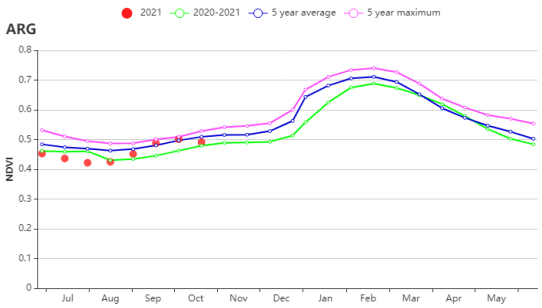
central Argentina. Poor conditions (lower than 0.5) were observed in North West Pampas and Subtropical Highlands, where crops might have suffered from drought. On the contrary, quite good conditions were observed in parts of the South East Pampas.

In general, Argentina showed regular and poor conditions. Below-average crop conditions were found all along the reporting period in Chaco and Subtropical Highlands as well as in North West and West Pampas with low VCIx values.

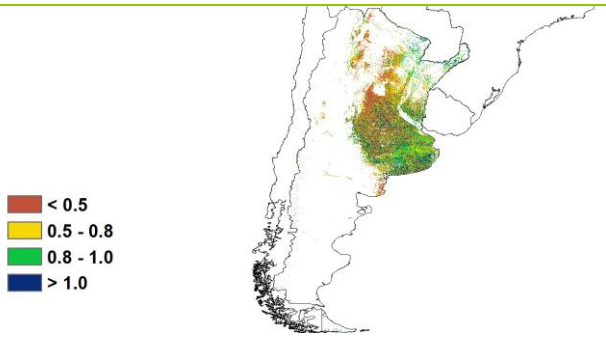
Figure 3.7 Argentina 's crop condition, July -October 2021



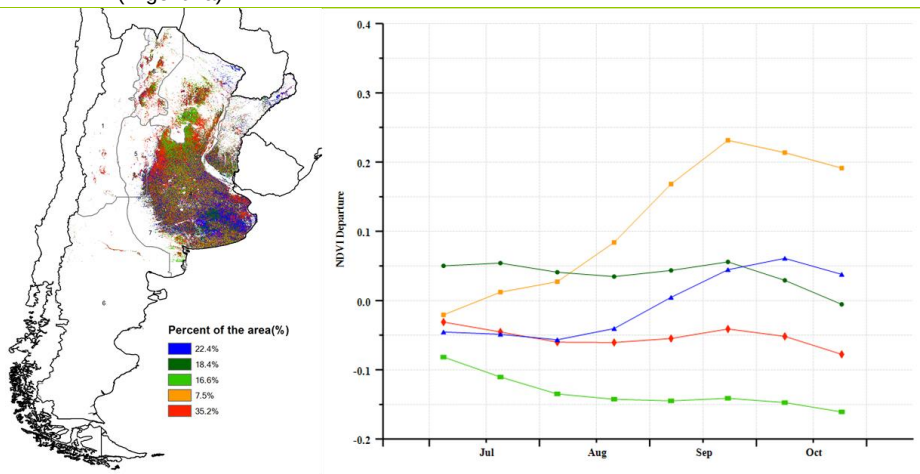
(a). Phenology of major crops



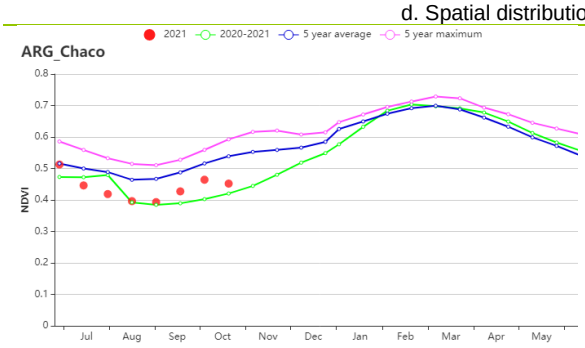
b. Crop condition development graph based on NDVI (Argentina).



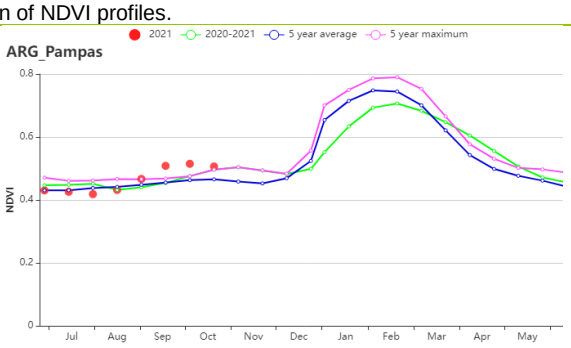
c. Maximum VCI.



d. Spatial distribution of NDVI profiles.

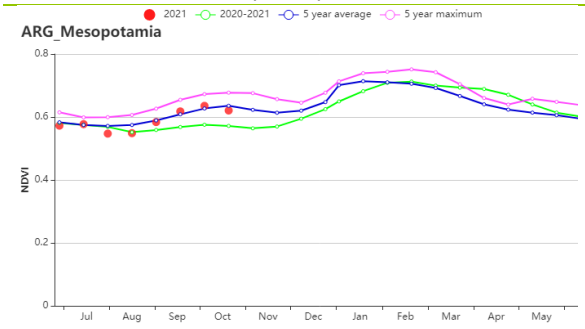


e. Crop condition development graph based on NDVI



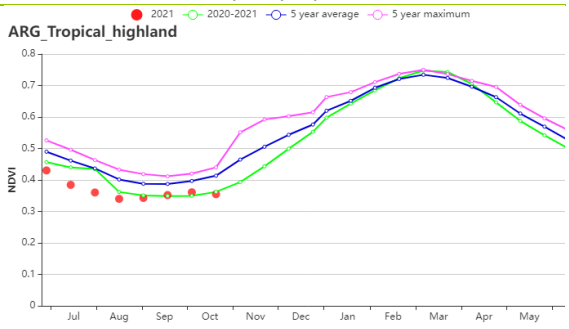
f. Crop condition development graph based on NDVI

(Chaco).

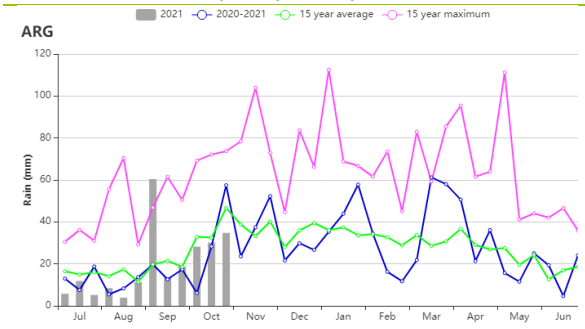


g. Crop condition development graph based on NDVI (Mesopotamia).

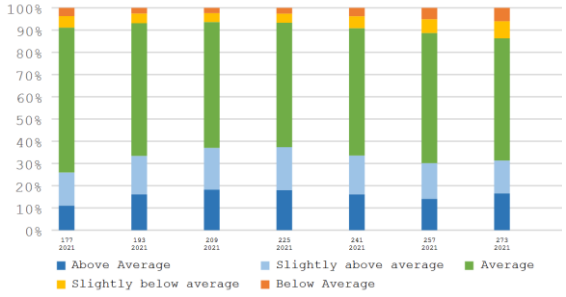
(Pampas).



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



i. Time series rainfall profile (Argentina).



j. Proportion of NDVI anomaly categories compared with 5YA.

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

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 (%)
Chaco	197	-20	18.3	0.4	982	5	577	-8
Mesopotamia	400	-11	16.2	0.3	918	6	763	-9
Humid Pampas	192	-13	13.3	0.6	945	6	513	-7
Subtropical highlands	177	31	16.2	0.4	1118	-1	482	9

Table 3.7 Argentina 's agronomic indicators by sub-national regions, current season's value and departure from 5YA, July -October 2021

Region	Cropped arable land fraction		Cropping Intensity		Maximum VCI
	Current (%)	Departure from 5YA (%)	Current (%)	Departure from 5YA (%)	Current
Chaco	80	-9	109	0	0.67
Mesopotamia	98	-1	114	-2	0.81
Humid Pampas	77	-4	116	5	0.76
Subtropical highlands	53	-26	105	1	0.58

[AUS] Australia

The current monitoring period covers the end of the sowing, main growth and early harvest periods of wheat and barley, which are the main cereal crops of Australia. The national NDVI profile was much better than the average of the last 5 years, nearly reaching the maximum levels.

In the current period, rainfall was higher than the 15-year average (RAIN +16%). The average temperature was normal while the sunshine was slightly below average (-1%). Abundant rainfall led to an increasing biomass (BIOMSS, +9%). The agronomic indicators were also positive, with a VCIx of 0.85 and an increased CALF (+5%).

The conditions in the four main wheat production states (New South Wales, South Australia, Victoria, and Western Australia) were similar, with above-average rainfall (ranging from +8% to +34%), slightly cooler temperature (ranging from -0.2°C to -0.5°C), average sunshine (ranging from -3% to +4%). Like the national indicators, the sufficient rainfall brought above average biomass (ranging from +2% to +15%). Spatially, the VCI map shows that the overall conditions in Australia were favorable, and the low values only appeared in New South Wales and north Victoria. The spatial NDVI profiles show the same pattern. The NDVI values for 16.1% of the crop areas were below average during this period and 39.4% were near average. The other areas were above average. Overall, the crop conditions for Australia were very favorable.

Regional analysis

This analysis adopts five agro-ecological regions for Australia, namely the Arid and Semi-arid Zone, Southeastern Wheat Zone, Subhumid 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.

During the current period, the four main AEZs had similar indicator departures: above-average rainfall and biomass. The conditions in these regions were all favorable.

The rainfall in the Southeastern wheat area was 17% above average, while the temperature (-0.4°C) and RADPAR (-1%) were slightly below average. Due to the sufficient rainfall, the biomass was also above average (BIOMSS, +8%). The CALF was average, CI was 108%, and the VCIx was 0.81.

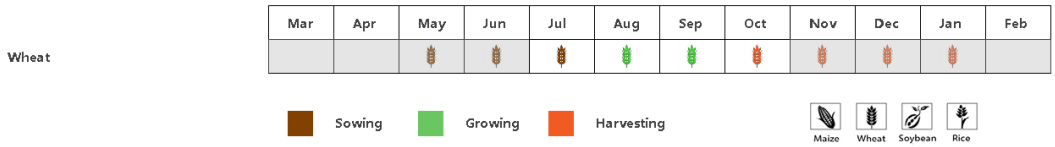
The agroclimatic indicators in the Subhumid subtropical zone were stable, with a slightly increased rainfall (RAIN, +4%), average temperature and sunshine. The biomass (+8%), CALF (+29%), and CI (113%, +8%) were above average. VCIx was also favorable (0.78).

The largest rainfall departure appeared in Southwestern wheat area (+36%), which resulted in a decreased temperature (-0.6°C) and sunshine (-5%). However, the sufficient rain caused an above average estimate of the biomass (+17%). The agronomic indicators were favorable (CALF +8%, CI 0%, VCIx 0.99).

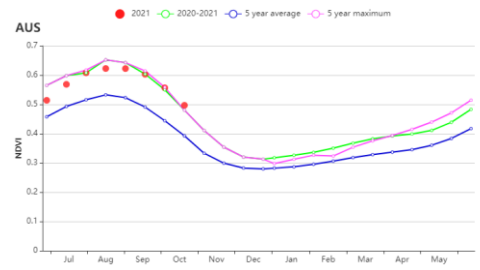
The rainfall in Wet temperate and subtropical zone was also above average (+16%), which led to an increased biomass (+7%). Unlike the other 3 regions, the temperature was slightly above average (+0.2 °C), while the sunshine was still below average (-1%). The CALF was 0.95, which was average, CI was 102% (decreased by 4%), and VCIx was 0.84.

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

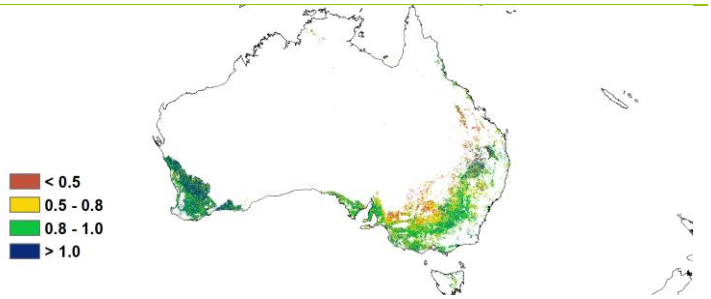
Figure 3.8 Australia's crop condition, July - October 2021



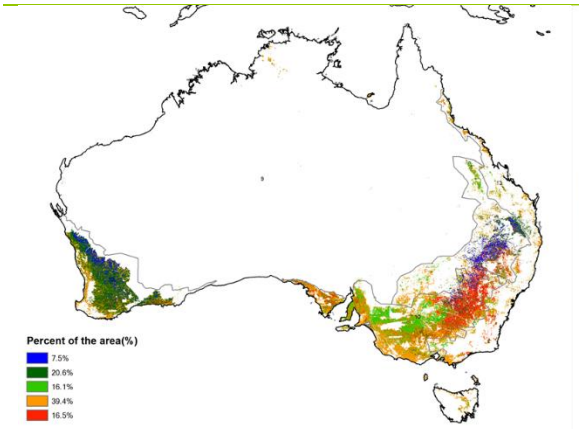
(a). Phenology of major crops



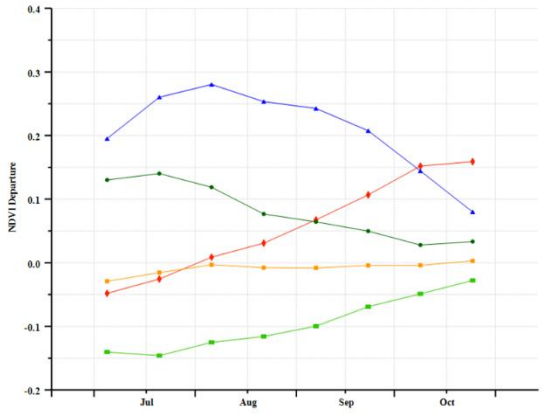
(b) Crop condition development graph based on NDVI



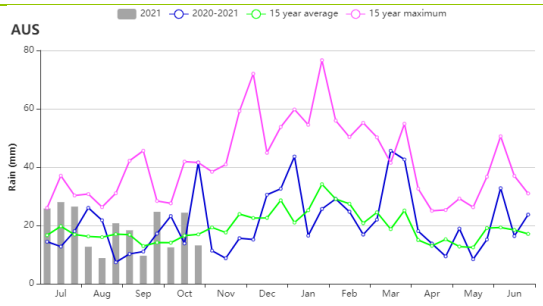
(c) Maximum VCI



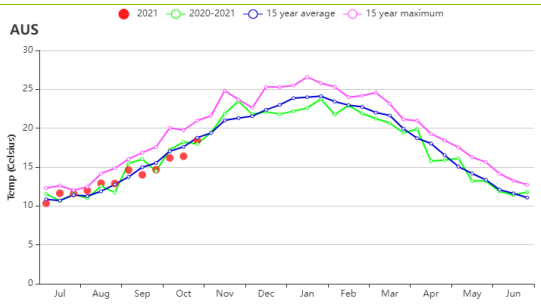
(d) Spatial NDVI patterns compared to 5YA



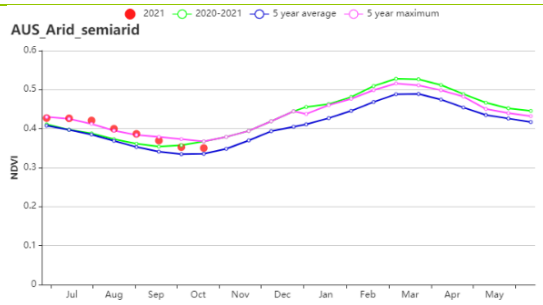
(e) NDVI profiles

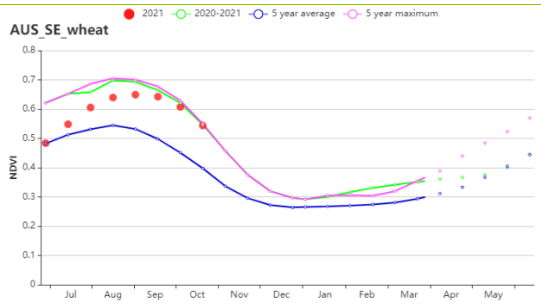


(f) Rainfall profiles

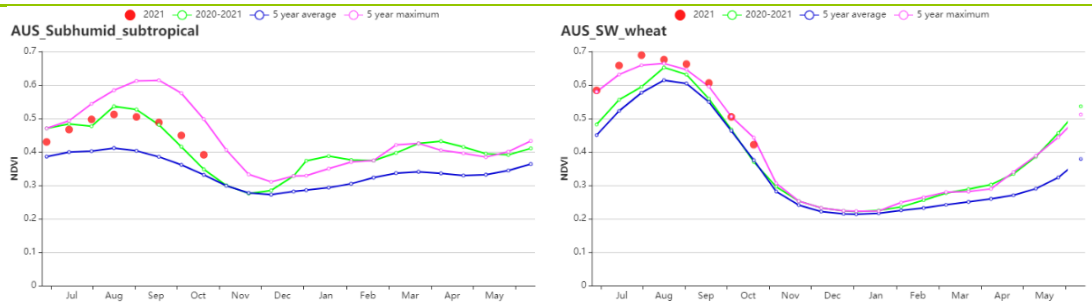


(g) Temperature profiles

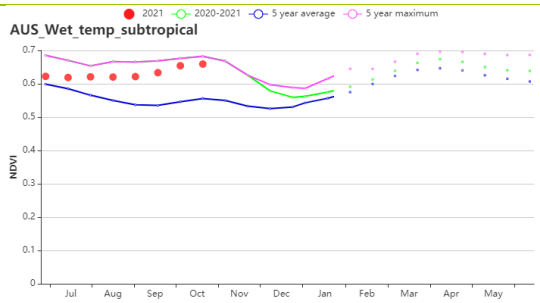




(h) Crop condition development graph based on NDVI (Arid and semiarid zone (left) and Southeastern wheat area (right))



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



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

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

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Arid and semiarid zone	57	-14	23.4	0.9	1248	1	326	-4
Southeastern wheat area	241	17	11.7	-0.4	833	-1	591	8
Subhumid subtropical zone	153	4	15.3	0.0	1065	0	525	8
Southwestern wheat area	316	36	12.5	-0.6	817	-5	700	17
Wet temperate and subtropical zone	259	16	13.2	0.2	931	-1	626	7

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

Region	Cropped arable land fraction		Cropping intensity		Maximum VCI
	Current (%)	Departure (%)	Current (%)	Departure (%)	Current
Arid and semiarid zone	60	16	102	1	0.83
Southeastern wheat area	93	0	108	7	0.81
Subhumid subtropical zone	71	29	113	8	0.78
Southwestern wheat area	97	8	100	0	0.99
Wet temperate and subtropical zone	95	0	102	-4	0.84

[BGD] Bangladesh

During the reporting period, near 15YA rainfall and TEMP in July and August allowed the sowing of the main rice crop (Aman) and the harvesting of Aus rice to be completed in August. September and October covered the main growth period of Aman rice, the rainfall was near average and TEMP was slightly above average. For the whole reporting period, rainfall was below average (-8%) and TEMP was above average (+0.2℃). Both RADPAR and BIOMSS were close to the 15-year average. The national NDVI development graph showed that overall crop conditions were below the 5-year average in July and August and returned to the 5-year average in September and October. These drops in August might have been due to cloud cover in the satellite images. The spatial NDVI pattern showed that 26.2% of the cultivated area were close to average and 24.6% were below average during the whole period. 49.3% had a big drop in August and recovered to average in September, mainly distributed in Gangetic Plain and the Sylhet basin. The maximum Vegetation Condition Index (VCIx) was 0.94, with most areas showing values higher than 0.8 and CALF had increased by 2%. Overall, the conditions were favorable for the Aman rice production in Bangladesh.

Regional analysis

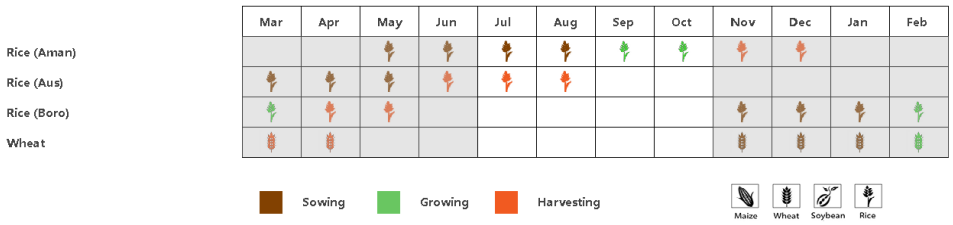
Bangladesh can be divided into four agro-ecological zones (AEZ): Coastal region, the Gangetic Plain, the Hills, and the Sylhet basin.

In the Coastal region, both RAIN and TEMP were above average (+6% and +0.2°C, respectively) while RADPAR was below average (-1%). The potential biomass was average. The crop condition development graph based on NDVI showed that crop conditions were below the 5-year average and returned to average in the end of October. The excessive rainfall in July might have delayed the sowing of Aman rice. Cropping intensity (CI 145%) was lower than the 5YA by 8%. CALF was 91% and VCIx was 0.90. Overall, crop conditions were close to the average for this zone.

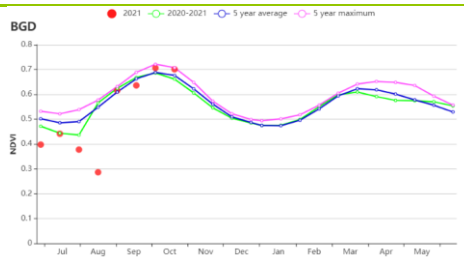
Both RAIN and RADPAR were below average (-11% and -1%, respectively) in the Gangetic Plain. TEMP and BIOMSS were above average (+0.1°C and 2%, respectively). The crop condition development graph based on NDVI showed that crop conditions were close to the 5-year average in September and October. During the monitoring period, CALF (96%) and CI (188%) were above average (+1% and +2%, respectively) and VCIx was 0.95. Crop conditions of this region were close to the average.

The Hills and the Sylhet basin experienced similar conditions in this period. They recorded less rainfall (-10% and -9%, respectively). Both had warmer temperature (+0.3℃) and more sunshine (+1%) as compared to the 15YA, which were beneficial for the growth of rice in September and October. Potential biomass for the Hills was estimated 2% lower than the 15YA average and and the Sylhet basin was close to average. For the hills, CALF and CI were 98% (+1%) and 135% (+6%) with a favorable VCIx (0.98). CALF and CI were higher than the 5YA by 4% and 2% (91% and 171%, respectively) and VCIx was 0.95 for the Sylhet basin. Crop development based on NDVI also showed near or above average levels in September and Octorber in the Hills and the Sylhet basin. Based on the above information, favorable prospects for rice in these two zones can be expected.

Figure 3.9 Bangladesh's crop condition, July - October 2021

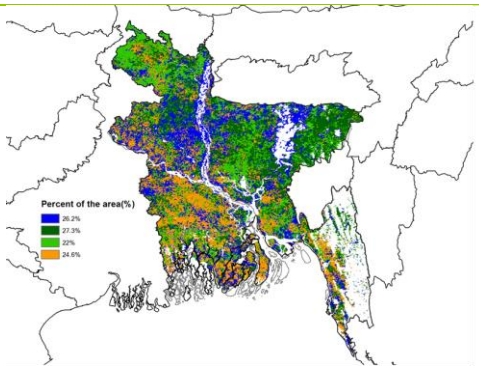


(a). Phenology of major crops

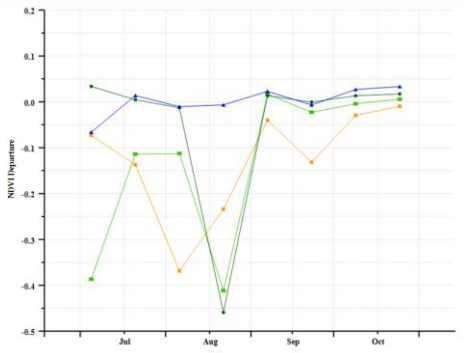


(b) Crop condition development graph based on NDVI

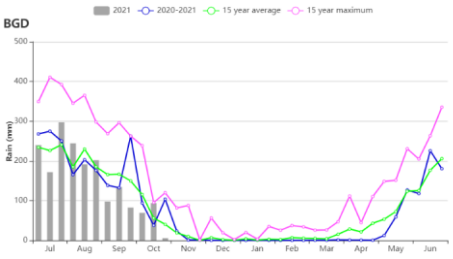
(c) Maximum VCI



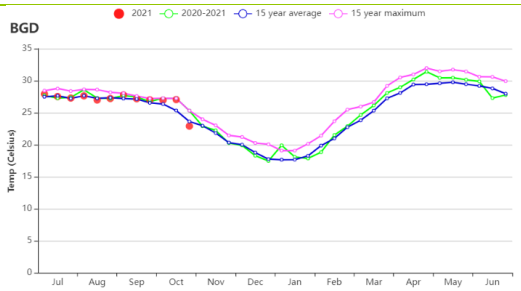
(d) Spatial NDVI patterns compared to 5YA



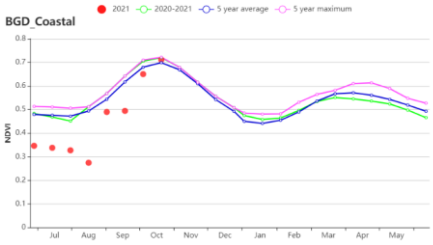
(e) NDVI profiles

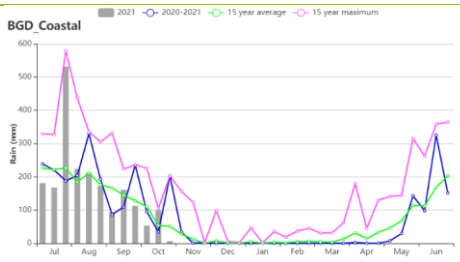


(f) Rainfall profiles

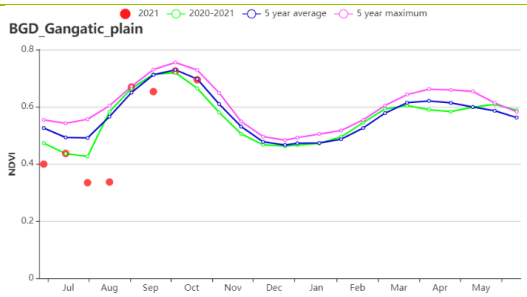


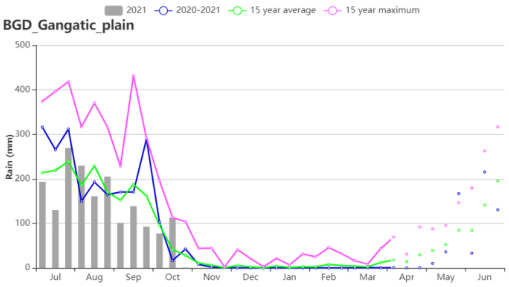
(g) Temperature profiles



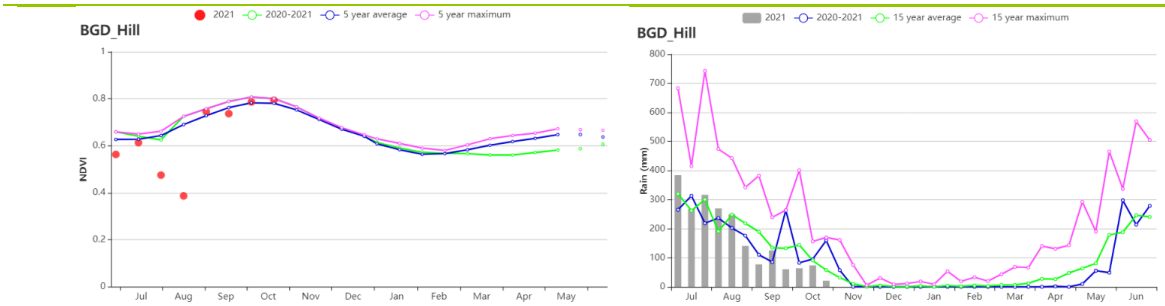


(h) Crop condition development graph based on NDVI (left) and rainfall profile (right) of Coastal region

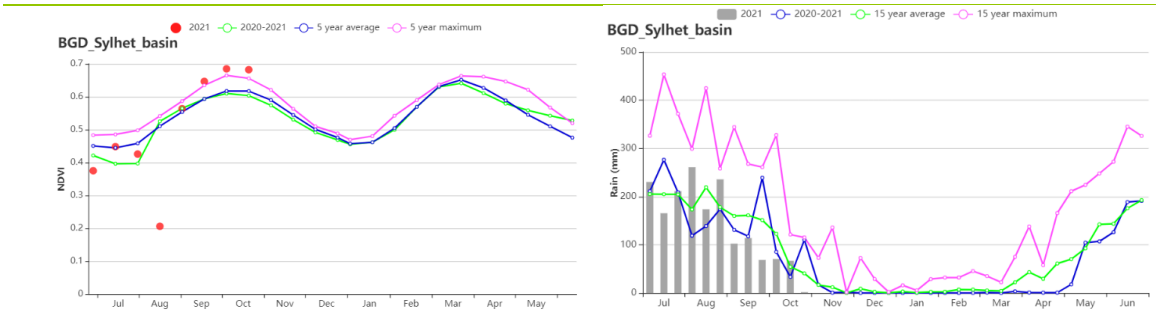




(i) Crop condition development graph based on NDVI (left) and rainfall profile (right) of Gangetic plain



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



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

Table 3.10 Bangladesh's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, July - October 2021

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Coastal region	2014	6	27.5	0.2	1164	-1	794	0
Gangetic plain	1720	-11	27.1	0.1	1080	-1	723	2
Hills	2052	-10	26.3	0.3	1089	1	749	-2
Sylhet basin	1700	-9	26.9	0.3	1063	1	714	0

Table 3.11 Bangladesh's agronomic indicators by sub-national regions, current season's values and departure from 5YA, July - October 2021

Region	Cropped arable land fraction		Cropping intensity		Maximum VCI
	Current (%)	Departure (%)	Current (%)	Departure (%)	Current
Coastal region	91	0	145	-8	0.90
Gangetic plain	96	1	188	2	0.95
Hills	98	1	135	6	0.98
Sylhet basin	91	4	171	2	0.95

[BLR] Belarus

The reporting period includes the harvesting of spring wheat from August to September and the planting of winter wheat in October. The nationwide rainfall amount was 260 mm, 8% below the 15YA average. Temperature decreased slightly (14°C, -0.1°C) while radiation was somewhat above average (RADPAR, 812MJ/m², 3%). The potential biomass was below average (-5%). Agronomic conditions were generally favorable: good values of VCIx (0.89) and cropped arable land fraction (CALF, 100%) were observed. However, due to the decrease of rainfall in north and south Belarus during the period of winter wheat sowing, crop prospects for the next season in these areas might be affected.

The NDVI development graph indicates that crop condition had gradually recovered to the level of the 5-year average starting in August. Crop condition in about 90.2% cropped area was close to or above the 5-year average, in agreement with the national VCIx map. There was an apparent drop in NDVI profiles in some of the areas from August to September, the reason for this might be the shortage of rainfall during this period. According to the VCIx distribution map, VCIx was satisfactory in most cropped areas of the country (above 0.8), indicating fair crop prospects, while low values were scattered in the southern area.

Although agronomic indicators were generally favorable starting in August, below average rainfall in the northern and southern area caused low soil moisture conditions and may have negatively impact on germination of winter wheat. Crop conditions in most areas of the country during the past months were generally close to the 5-year average, indicating favorable crop prospects.

Regional analysis

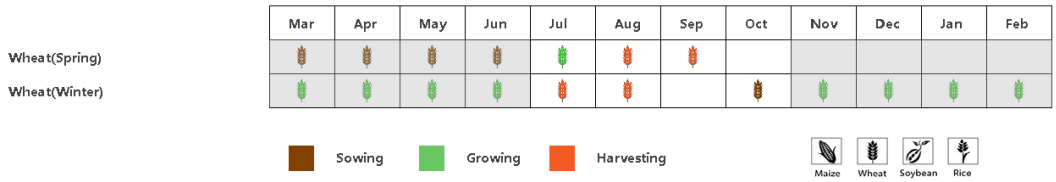
Regional analyses are provided for three agro-ecological zones (AEZ) defined by their cropping systems, climatic zones, and topographic conditions, including Northern Belarus (028, Vitebsk, the northern area of Grodno, Minsk and Mogilev), Central Belarus (027, Grodno, Minsk and Mogilev and Southern Belarus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

North Belarus recorded a radiation increase (+5%) combined with slightly higher temperatures (+0.1°C) and lower rainfall (-12%). And potential biomass decreased by 7% below average. The VCIx had reached 0.91, and CALF had reached 100%. The NDVI development curve was generally near average level. Winter wheat may grow normally based on agro-climatic indicators in this area but the impact of lower soil moisture in this period on winter wheat germination and early establishment requires close attention.

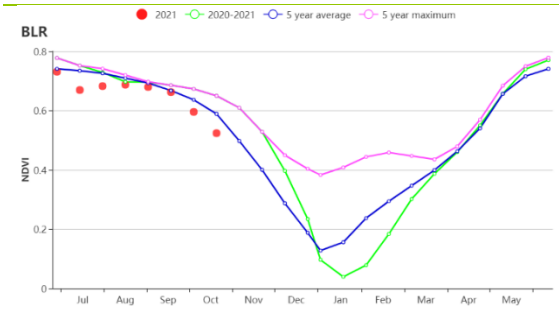
Central Belarus also experienced more sunshine (+1%) and slightly lower temperature (-0.2°C) and increased rainfall (+1%). Similar to northern Belarus, high CALF (100%) and VCIx (0.88) were also recorded. The NDVI growth curve was generally near the average trend from July to October. The potential biomass decreased by about 3%, and cropping intensity was also 4% below average, therefore winter wheat conditions in this area might also need close monitoring.

Precipitation in **Southern Belarus** was below the 15YA average level (-10%), and the temperature was slightly lower by -0.2°C and radiation was increased by 3%. Potential biomass was expected to decrease by 6%. The CALF and the VCIx were 100% and 0.89 respectively. The water shortage in the previous period might have caused a negative impact on the production of spring wheat and the impact of lower soil moisture in this period on winter wheat also requires close attention.

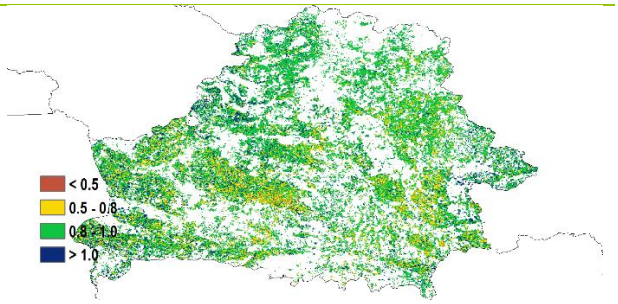
Figure 3.10 Belarus's crop condition, July - October 2021.



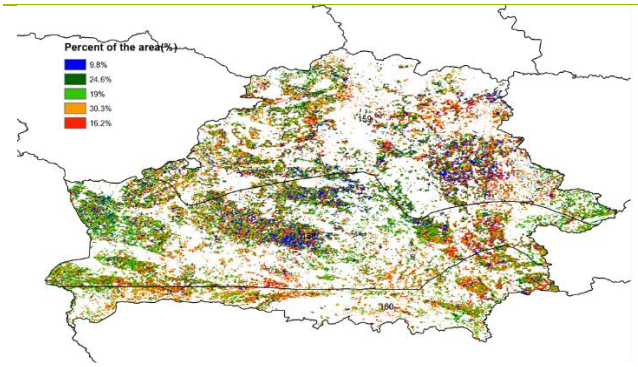
(a). Phenology of major crops



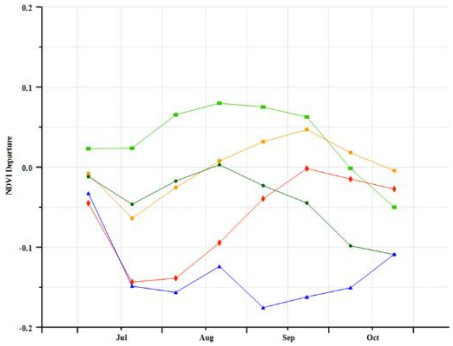
(b) Crop condition development graph based on NDVI



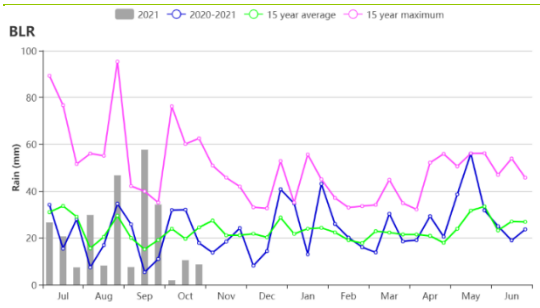
(c) Maximum VCI



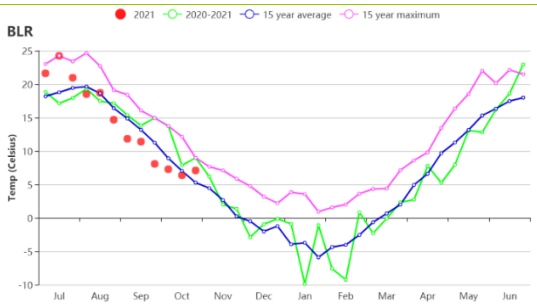
(d) Spatial NDVI patterns compared to 5YA



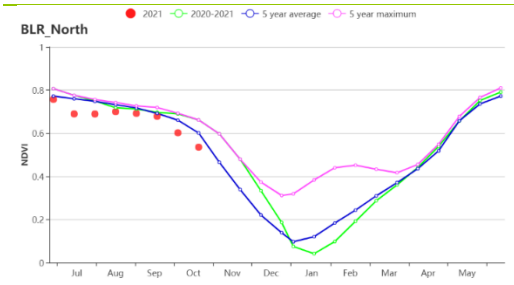
(e) NDVI profiles



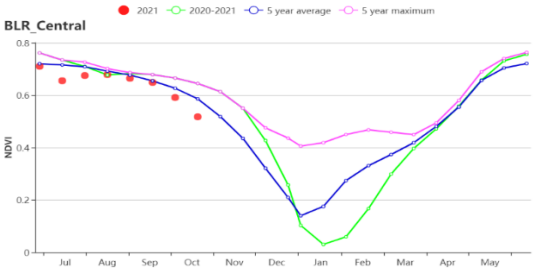
(f)Rainfall time series



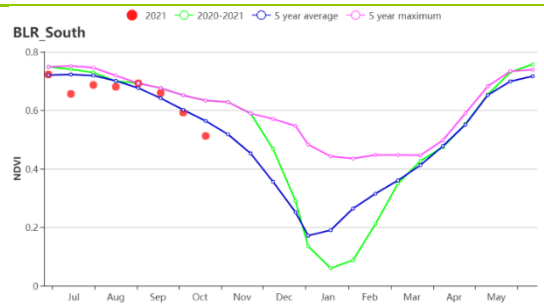
(g) Temperature time series



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



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



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

Table 3.12 Belarus's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, July - October 2021.

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Center	273	1	14	-0.2	810	1	700	-3
North	266	-12	14	0.1	794	5	707	-7
South-west	223	-10	15	-0.2	862	3	645	-6

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

Region	Cropped arable land fraction		Cropping Intensity		Maximum VCI
	Current (%)	Departure (%)	Current (%)	Departure (%)	Current
Center	100	0	97	-4	0.88
North	100	0	102	2	0.91
South-west	100	0	101	1	0.89

[BRA] Brazil

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

The 2020-2021 summer crops growing season was dominated by overall dry and warmer-than-usual weather in Brazil. The prolonged dry weather continued during the recent four months from July to October. CropWatch Agro-climatic Indicators (CWAIs) present below-average conditions with 27% lower rainfall, 0.8°C higher temperature and 3% above average radiation compared with the 15YA. Although the temperature and radiation were in general favorable for crops, the significantly below-average rainfall resulted in a 16% reduction of potential biomass. Dry weather conditions were widespread across central and southern Brazil. In contrast, most states in north and northwest Brazil received close-to-average rainfall. The extreme dry weather was observed in some major agricultural producing states such as Goias, Sao Paulo, Mato Grosso, Mato Grosso Do Sul and Minas Gerais with over 50% negative rainfall anomalies. Accordingly, temperatures in those five major states were all well above average with more than 1.0ºC higher than the 15YA. Positive anomalies of radiation were observed in most states except for the Acre, Santa Catarina, and Rio de Janeiro where RADPAR was slightly below average. The largest positive departure of RADPAR occurred in Pernambuco and Sergipe at 8% above average. Low rainfall, high temperature and radiation resulted in severe water stress in central Brazil which is clearly indicated by the significant below average BIOMSS on the BIOMSS departure map. The meteorological drought conditions illustrated by the standard precipitation index map also confirmed the severe to extreme drought in most of central Brazil.

As reflected by the national rainfall profiles, the current monitoring period covers the end of the dry season and the start of the rainy season. During the dry season period from June to mid-September, the rainfall was close to average while it was below average in late-September and October. This indicates a late start of the wet season which might delay the sowing, emergence and early development of summer crops.

The crop condition development graph based on NDVI for Brazil presents below average values throughout the monitoring period due to water stress. The chart showing proportions of different crop condition categories from July to October 2021 presented increasing proportions of below-average crop condition from 9% in early September to 16% in late October which indicated the adverse effect of dry weather in Brazil. Spatially, crops in the north and northwest presented above-average NDVI as they benefited from the normal or above-average rainfall while NDVI in most other regions stayed at or below average according to the NDVI departure clustering maps and profiles. This pattern coincided with the abnormal weather pattern with wet condition in the north and northwest and extreme dry and hot weather in the center. Mato Grosso, Parana, Sao Paulo and Mato Grosso Do Sul suffered from prolonged dry weather conditions resulting in significant negative NDVI departures (light green color in figure f). Accordingly, the VCIx map also presents low values (< 0.8) in central Brazil covering vast areas in Mato Grosso, Mato Grosso Do Sul, Goias, Minus Gerias to Sao Paulo (figure b). It is noteworthy that the top wheat producing state Rio Grande do Sul presented above-average crop conditions, an indication of favorable wheat outputs in the state. At the national level, VCIx was 0.81 and CALF was 2% below the 5YA. At the annual base, cropping intensity increased by 7% indicating that the total cultivated crop area was at an above-average level.

All in all, crop conditions in Brazil were below average and the establishment of the summer crops was delayed due to the late start of the wet season. Wheat production in Parana was affected by drought, while Rio Grande do Sul benefitted from normal conditions and an above-average wheat production is estimated for the latter. Currently, the early summer crops suffered from a considerable soil moisture deficit. As it is still at early stage of the summer crops, their establishment will mainly depend on the weather conditions in the coming months.

Regional analysis

Considering the differences of 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. Four AEZs including Central Savanna, Mato Grosso, Nordeste and Parana basin received significantly below-average rainfall (-43% to -81%) which was similar to the dry weather pattern at the national scale. Central Savanna and Nordeste received less than 50 mm rainfall during the last four months. Both temperature and radiation in each zone was higher than average with the largest temperature departure in Central Savanna by +1.5ºC and the largest radiation anomaly at +5% in Coast Zone. The overall dry and hot weather resulted in below-average BIOMSS in most zones except for Amazonas (5% above average) and Northeastern mixed forest and farmland (7% above average) where rainfall was slightly above average.

Maize in Northeastern mixed forest and farmland was at harvesting stage which almost concluded by the end October. Overall average weather conditions with 3% above average rainfall, 0.4 degree higher temperature and 1% above average RADPAR were observed in the zone, resulting in a 7% positive departure in BIOMSS. Thanks to the normal weather conditions, the highest VCIx value was observed in Northeastern mixed forest and farmland at 0.95. NDVI profile also presented overall average crop condition during the monitoring period. CALF in the region was 99%, close to the 5YA. Maize production in the region is estimated at average level.

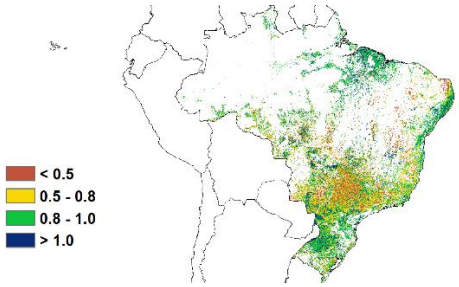
Wheat is mostly cultivated in southern subtropical rangelands and the Parana basin. Located in the south of Brazil, the southern subtropical rangelands zone received the highest rainfall among the eight AEZs at 515 mm, but still at 15% below average level. Significantly above-average rainfall in August to September benefited wheat development and grain-filling, indicating a promising wheat yield in the region. The average VCIx in the region was 0.84 which was above average. Although the CALF in the regions was 1% below the 5YA, wheat production was still at above average levels estimated by CropWatch. Overall unfavorable conditions in the Parana basin hampered the wheat development although most wheat in the region was irrigated. Less farmland was used for wheat cultivation as reflected by the 5% below average CALF during the wheat growing period. Average VCIx value in the region was 0.77. CropWatch puts the wheat production in the region at below-average level.

Central savanna also produces some wheat, mostly distributed in eastern Goias and southerwestern Minas Gerais. As the region received only 33 mm precipitation during the four months, all wheat in the region is definitely irrigated. It was shown by the CALF indicator that wheat area in the region was 9% above average. High resolution satellite image also confirmed the expansion of wheat sown area in 2021 compared with 2020 (figure q). CropWatch estimates a favorable wheat production in the region.

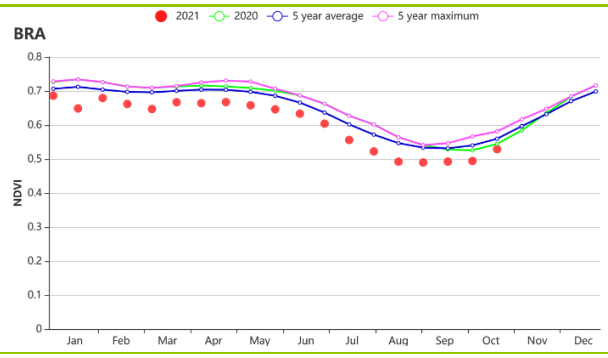
For more indicators and detailed information, it is recommended to visit CropWatch Explore (http://cropwatch.cn/newcropwatch/main.htm).

Figure 3. 11 Brazil's crop condition, July - October 2021

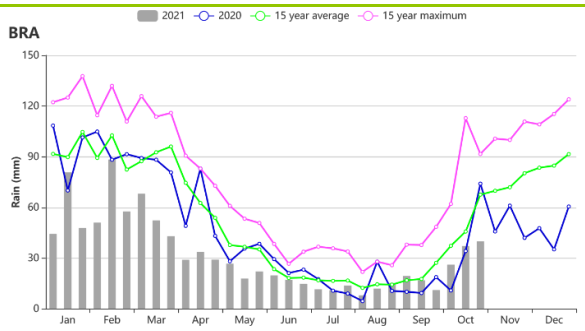
(a) Phenology of major crops



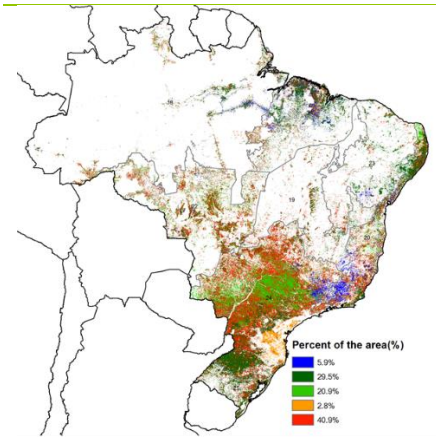
(b) Maximum VCI

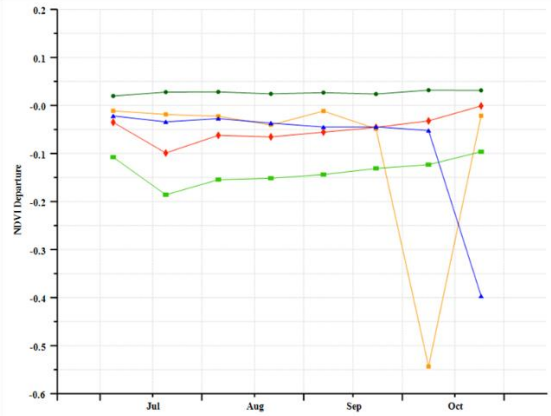


(c) Crop condition development graph based on NDVI of Brazil

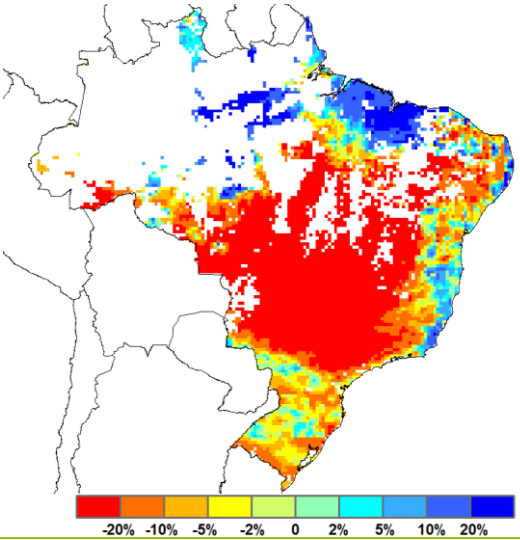


(d) Time series rainfall profile of Brazil

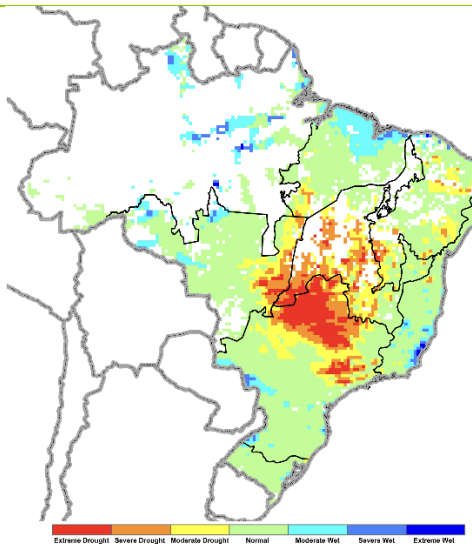




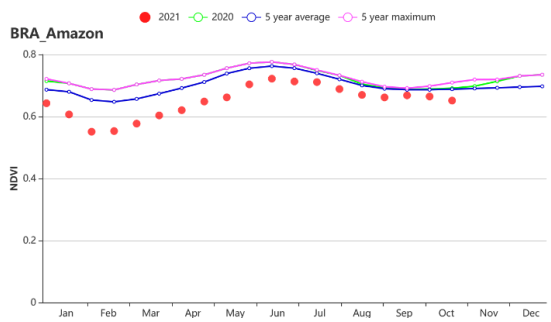
(e) Spatial distribution of NDVI departure from 5YA and NDVI departure profiles corresponding to the clusters

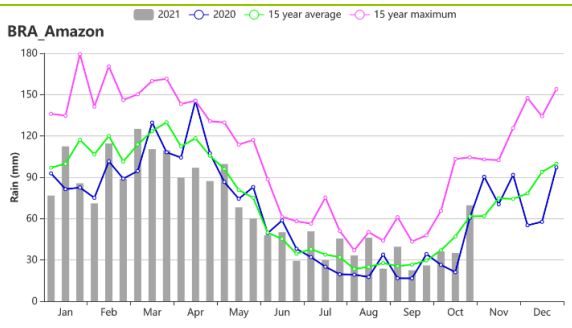


(f) Potential biomass departure from 15YA

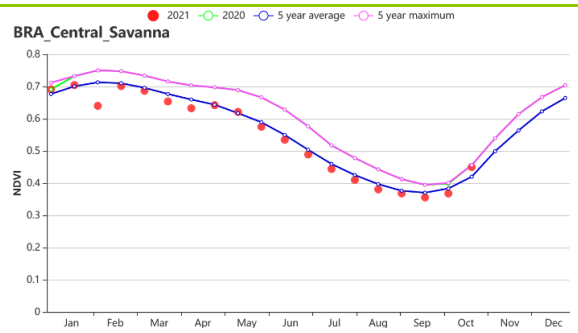


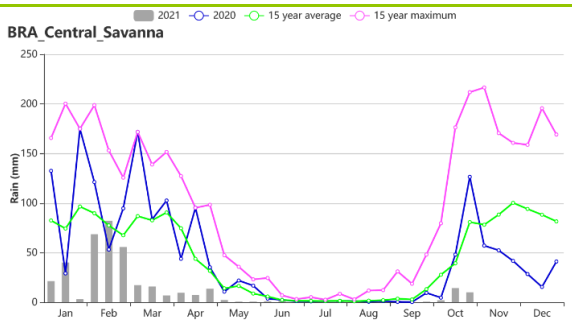
(g) Meteorological drought measured by standard precipitation index



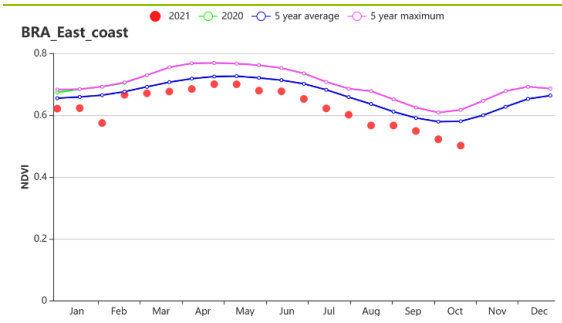


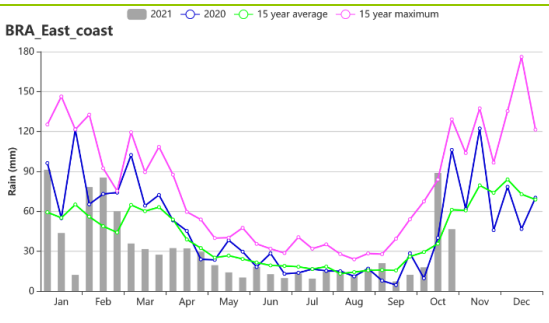
(h) Crop condition development graph based on NDVI (left) and rainfall profile (right) of Amazon



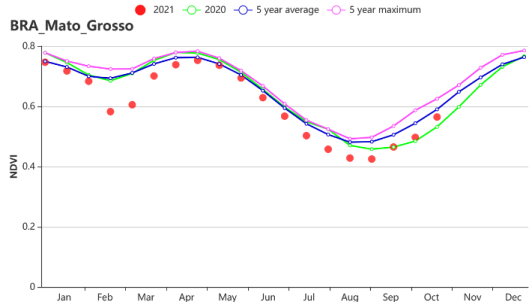


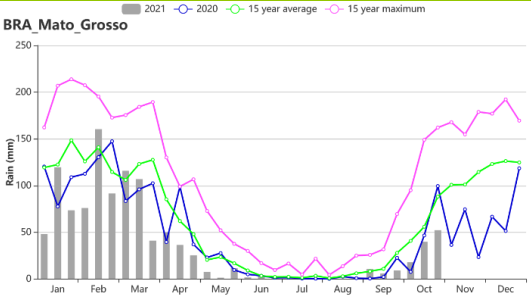
(i) Crop condition development graph based on NDVI (left) and rainfall profile (right) of Central Savanna



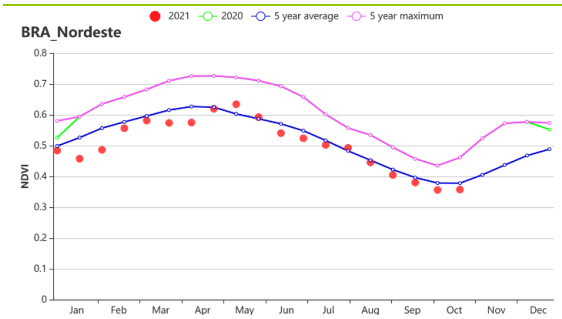


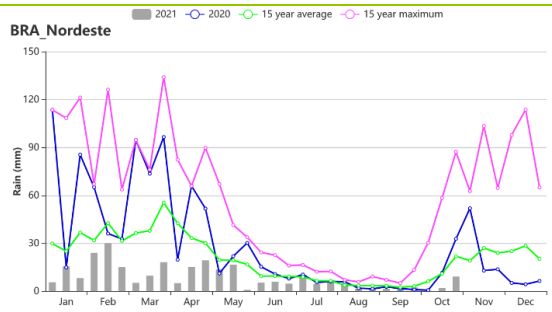
(j) Crop condition development graph based on NDVI (left) and rainfall profile (right) of Coast zone



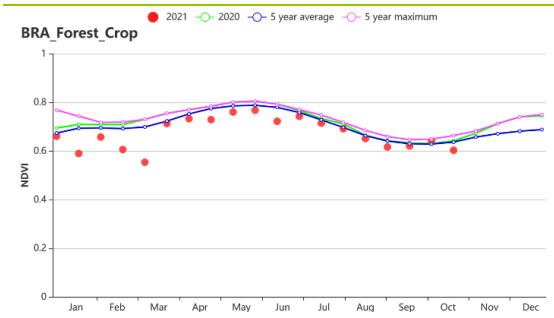


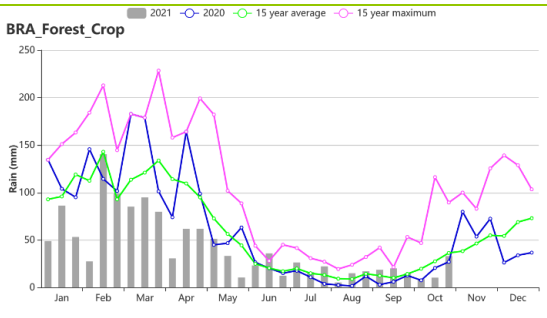
(k) Crop condition development graph based on NDVI (left) and rainfall profile (right) of Mato Grosso



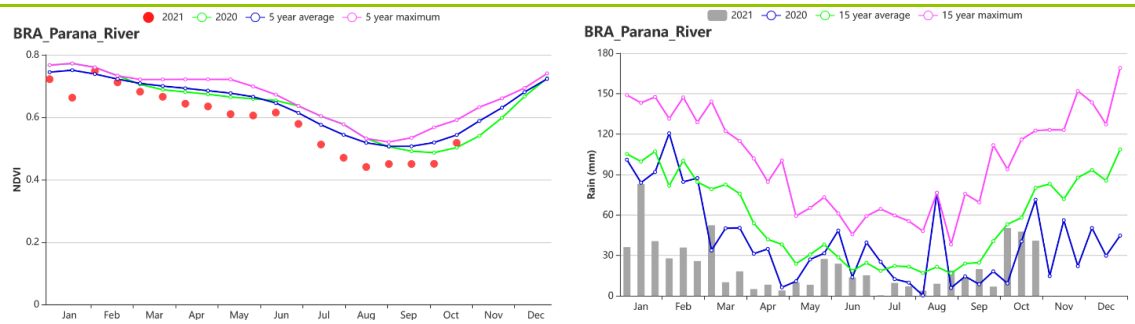


(L) Crop condition development graph based on NDVI (left) and rainfall profile (right) of Nordeste

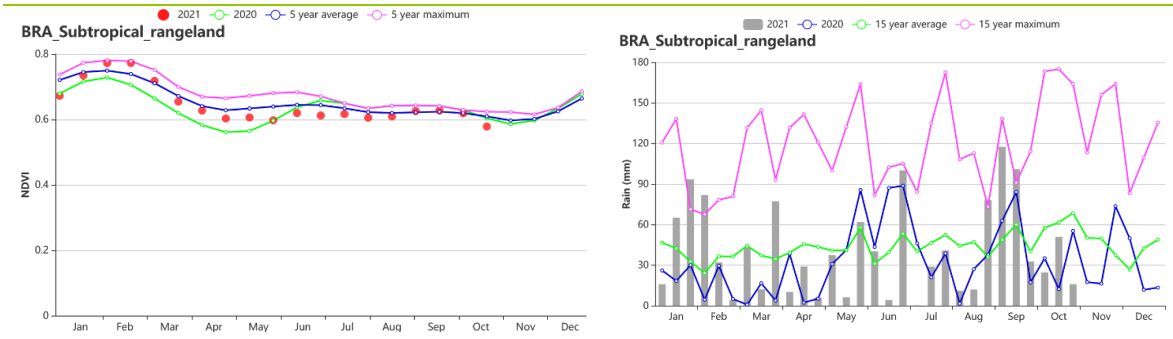




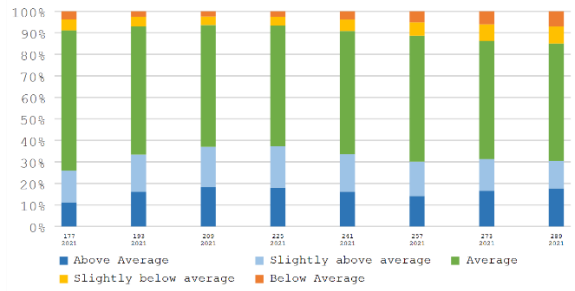
(m) Crop condition development graph based on NDVI (left) and rainfall profile (right) of Northeastern mixed forest and farmland



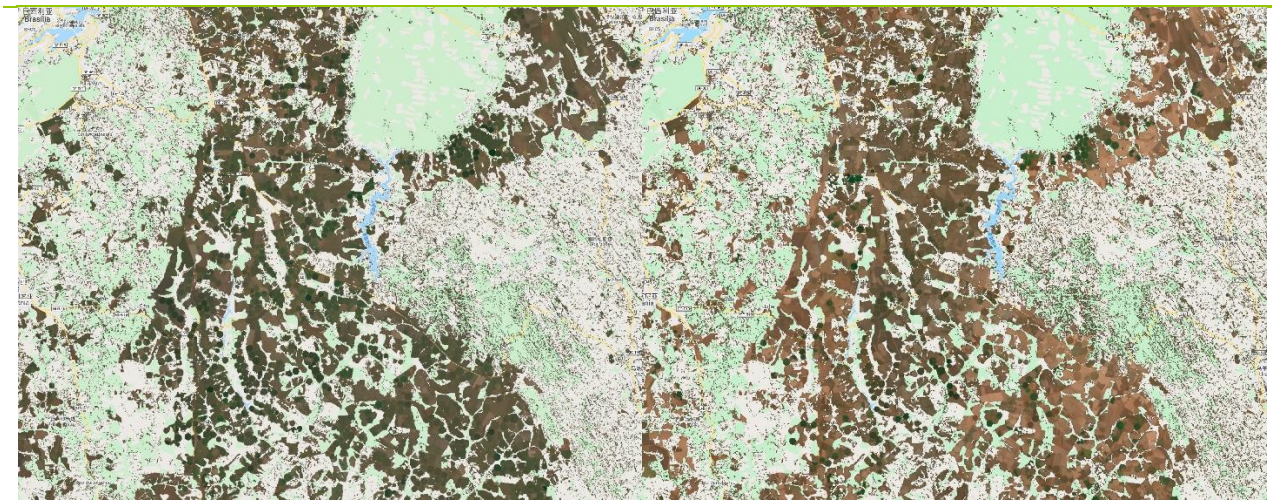
(n) Crop condition development graph based on NDVI (left) and rainfall profile (right) of Parana basin



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



(p) Proportion of different crop condition categories, July - October 2021



(q) More central pivot fields were cultivated with wheat in 2021 (left) compared with 2020 (right)

(Satellite data: Planet imageries in June to August during the two years)

Table 3.14 Brazil's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, July - October 2021

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure from 15YA	Current (°C)	Departure from 15YA	Current (MJ/m²)	Departure from 15YA	Current (gDM/m²)	Departure from 15YA

		(%)		(°C)		(%)		(%)
Amazonas	459	13	26.7	0.1	1244	1	1025	4
Central Savanna	33	-81	25.9	1.5	1284	4	272	-42
Coast	275	-2	21.2	0.4	1055	5	735	-2
Northeastern mixed forest and farmland	207	3	27.5	0.4	1289	1	775	7
Mato Grosso	137	-45	27	0.9	1169	1	427	-30
Nordeste	46	-44	25.5	0.9	1293	4	399	-16
Parana basin	228	-43	21.3	1	1095	4	558	-28
Southern subtropical rangelands	515	-15	15.4	0.2	856	3	899	-8

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

Region	Cropped arable land fraction		Maximum VCI	Cropping intensity	
	Current (%)	Departure from 5YA (%)	Current	Current (%)	Departure from 5YA (%)
Amazonas	100	0	0.91	124	5
Central Savanna	73	9	0.81	119	5
Coast	98	-1	0.80	120	7
Northeastern mixed forest and farmland	99	0	0.95	112	-5
Mato Grosso	91	0	0.80	163	9
Nordeste	69	1	0.75	112	6
Parana basin	91	-5	0.77	141	10
Southern subtropical rangelands	96	-1	0.84	136	11

[CAN] Canada

During this monitoring period, the harvest of spring wheat was complete while the harvests of maize and soybean were underway. The sowing of winter wheat takes place in September and October. According to agroclimatic indicators, Canada experienced warmer weather in this period. The overall conditions in this region were below average until September. In the Prairies, conditions were unfavorable whereas in the Saint Lawrence basin, they were close to the five-year average. Overall, crop conditions were unfavorable.

Compared with the 15-year average, the temperature and radiation were above average by 1.2°C and 1%, respectively. Nevertheless, the significant drop of rainfall (RAIN -8%) led to a decrease of potential biomass (BIOMSS -5%). The rainfall profile indicates that the deficit of precipitation mainly occured in July and early August, which is the major growing season of summer crops. Accordingly, the crop conditions were below average in that period as shown in the NDVI development graph, after which precipitation gradually recovered to above-average levels, but yield reductions in wheat-producing areas were unavoidable. Spatially, the crop condition was always below average in middle and north of Saskatchewan and Alberta, which accounted for 39.0% of cropped land, as shown in the NDVI cluster map. For 35.6% of total cropped land (marked as yellow and deep green), the crop was below average before September and improved to be close to average at the end of the monitoring period. In other regions, accounting for 25.4% of total cropped area, the crop condition was above but close to average, mainly in Quebec and Ontario (Saint Lawrence basin). For the whole year, the crop intensity is 103%, an increase by 3% when compared with the 5YA. The national maximum VCI value was 0.84, while CALF was slightly below average (CALF -3%). The overall conditions of the summer crops in Canada are assessed as below average.

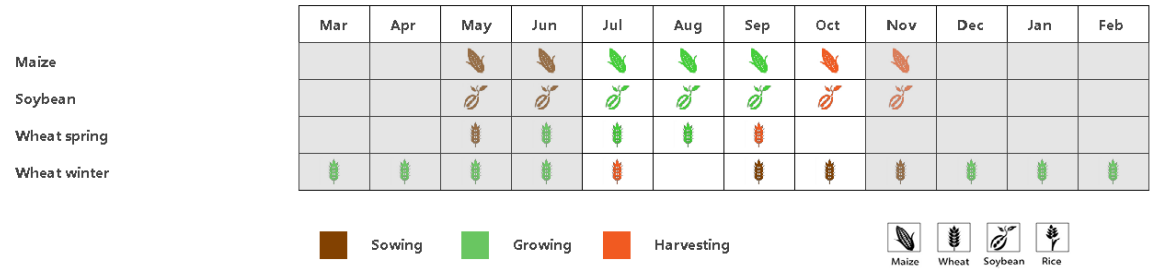
Regional analysis

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

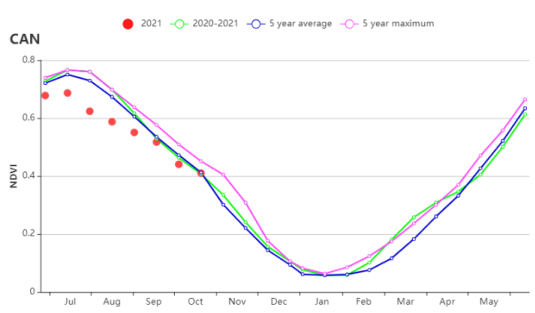
The **Prairies** is the main food production area in Canada. However, it suffered from dry weather conditions in this reporting period. The rainfall was significantly below average (RAIN 187, -24%) , while the temperature and radiation were slightly above average (TEMP +1.6℃; RADPAR +3%). According to the rainfall profile in the Prairies, rainfall was significantly below average in July and September. The deficit of rainfall led to a below-average potential production (BIOMSS -11%). The major crops in this region are winter wheat and spring wheat. According to the NDVI development graph and NDVI profile, crop conditions were below average before September and improved to be close to average by the end of the monitoring period. The negative departures during the growing season may have been caused by a rainfall deficit and they may also affect wheat yields. So, the crop condition in this region is unfavorable.

The conditions in the **Saint Lawrence basin** were slightly warmer (TEMP +0.9°C) and more humid (RAIN +2%) than the 15YA, while radiation was slightly below average (RADPAR -1%). This led to a close-to-average estimate for potential biomass (BIOMSS +2%). According to the NDVI development graph, crop conditions were close to average during the whole monitoring season. All in all, crop conditions were close to the five-year average.

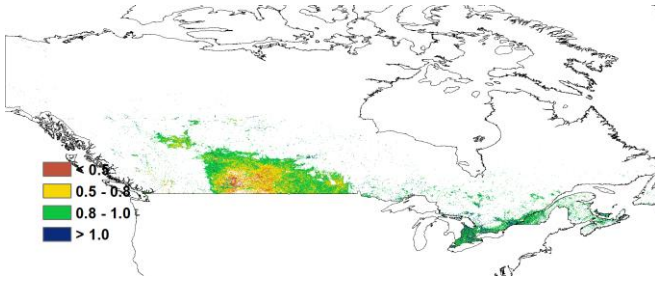
Figure 3.12 Canada's crop condition, July - October 2021



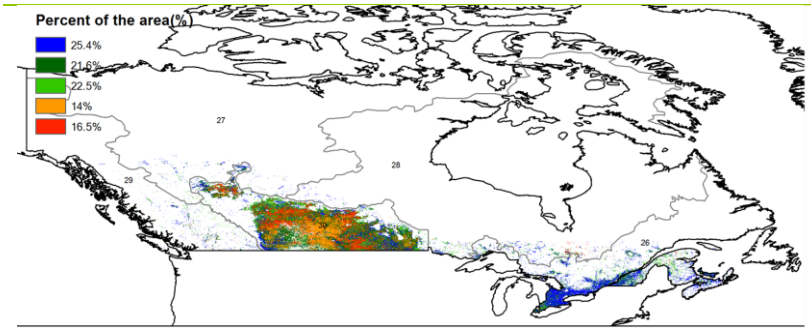
(a). Phenology of major crops



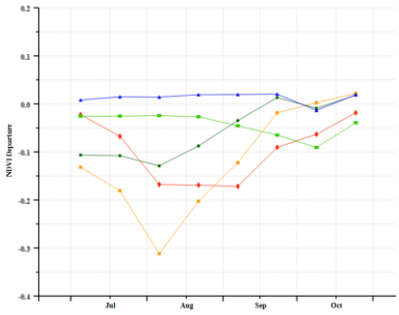
(b) Crop condition development graph based on NDVI



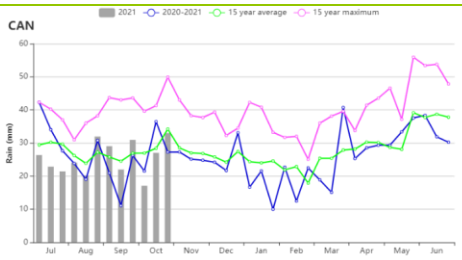
(c) Maximum VCI



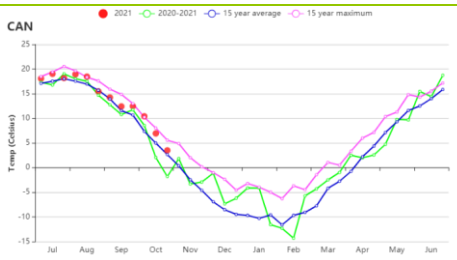
(d) Spatial NDVI patterns compared to 5YA



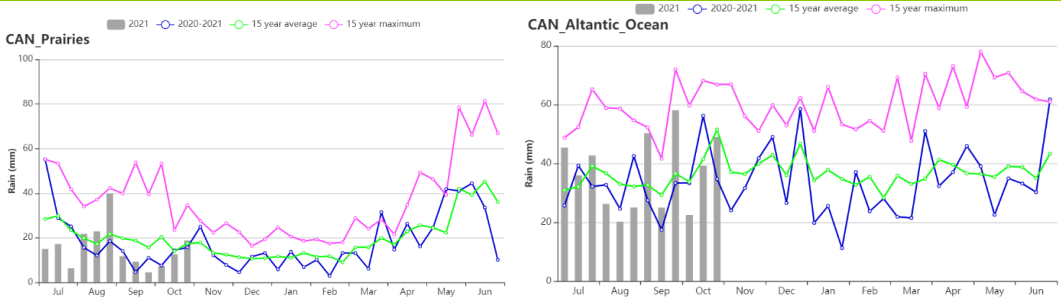
(e) NDVI profiles



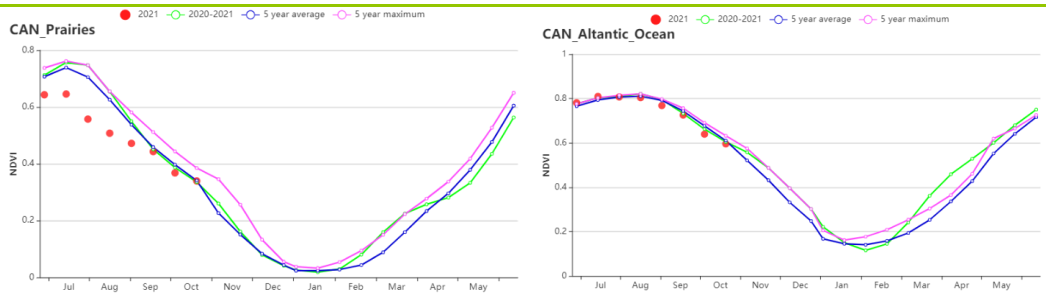
(f) Rainfall profiles



(g) Temperature profiles



(h) Rainfall profiles (Prairies region (left) and Saint Lawrence basin region (right))



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

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

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Saint Lawrence basin	440	2	15.2	0.9	892	-1	948	2
Prairies	187	-24	14.7	1.6	996	3	611	-11

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

Region	Cropped arable land fraction		Cropping intensity		Maximum VCI
	Current (%)	Departure (%)	Current (%)	Departure (%)	Current
Saint Lawrence basin	100	0	105	5	0.96
Prairies	95	-4	102	2	0.79

[DEU] Germany

During this monitoring period, the harvest of summer crops was mostly completed by the end of October, whereas the sowing of canola and winter wheat had started in September. Based on the agroclimatic and agronomic indicators, the crop conditions in Germany were generally above the 5-year average between July and early October in most regions, and then below average in mid-October.

At the national level, total precipitation was significantly above average (RAIN +21%), temperature was below average (TEMP -0.7°C) and radiation was also below average (RADPAR -4%). As can be seen from the time series of the rainfall profile, Germany experienced above-average precipitation from July to August, and then significantly below-average precipitation from September to October. Most of the country experienced cooler-than-usual conditions during this reporting period, except for September. Benefitting from adequate moisture conditions early in the summer growing season, the biomass accumulation potential (BIOMSS) was increased by 8% at the nationwide level as compared to the 15YA. Due to persistent and significantly precipitation deficits from September to October in some regions, grain filling for the summer crops may have been negatively impacted. On the other hand, this provided good conditions for harvest of the summer crops. This persistent precipitation deficit may also result in the delayed emergence of winter crops.

As shown by the NDVI development graph at the national scale, NDVI values were above average, even close to the 5-year maximum level from early July to early October, and then below average in mid-October. These observations are confirmed by the spatial NDVI profiles. Before mid-August, crop conditions were above average on 81.9% of the cropland. The proportion of cropland with above-average conditions was up to 87.2% from mid-August to mid-September. Due to persistent precipitation deficits starting in September, only 56.4% of the cropland from mid-September to mid-October and 39.2% of the cropland after mid-October were above average. These observations were also confirmed by higher VCI values in the spatial distribution of maximum VCI map. It reached 0.99 at the national scale. CALF during the reporting period was the same as for the recent five-year average.

Generally, the agronomic indicators show favorable conditions for most summer crops in Germany. Persistently and significantly below-average precipitation in October may have delayed the germination of winter wheat in the north and east of the country.

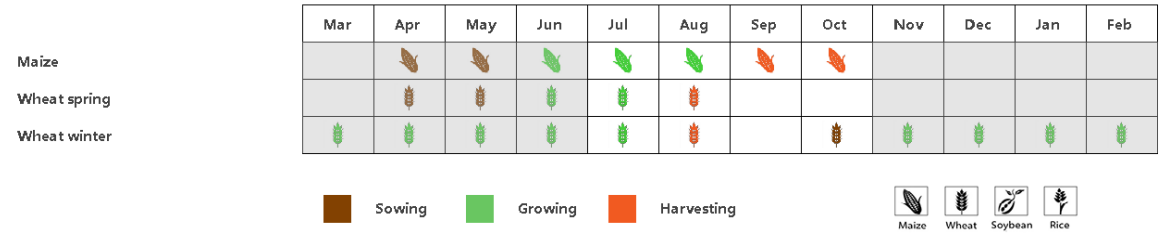
Regional analysis

According to the CropWatch agroclimatic and agronomic indicators, three sub-national agro-ecological regions, i.e., Wheat Zone of Schleswig-Holstein and the Baltic coast, Mixed Wheat and Sugar beet Zone of the North-west and western sparse crop area of the Rhenish massif experienced the same trend of precipitation, temperature and RADPAR, where precipitation was all significantly above average between +21% and +32%, temperature was all below average between -0.2°C and -0.8°C, PAR was all below average between -3% and -6% as compared to the average of the past 15 years. Since precipitation was above average during the entire monitoring period, the biomass accumulation potential (BIOMSS) in these three sub-national agro-ecological regions was above average between +8% and +19%. As shown by the time series rainfall profile of each agro-ecological region, precipitation in these three regions was also significantly above average from July to August, and close to average after mid-October. This provided favorable conditions for the growth of summer crops and establishment of the winter crops. As shown in the crop condition development graph based on NDVI, NDVI values were all above average, even close to the 5-year maximum level throughout the monitoring period. CALF of these three regions all reached 100%, with a zero departure from their 5YA. The cropping intensity (CI) of these three regions was all above the 5YA between +9% and +27%, and these three regions also recorded favorable VCIx value from 0.96 to 1.02, which indicates a high cropping intensity and favorable conditions for most summer crops.

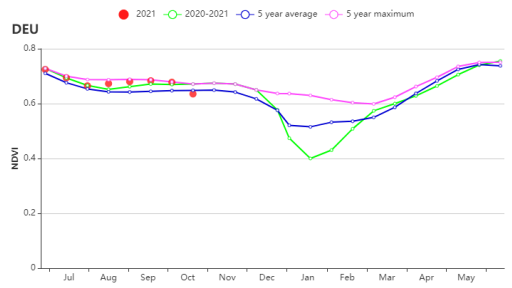
The other three sub-national agro-ecological regions of Central Wheat Zone of Saxony and Thuringia, Sparse Crop Area of the East-German Lake and Heathland area and Bavarian Plateau also experienced above-average precipitation, ranging from +15% and +19%. Temperature was below average between -0.7°C and -0.9°C and PAR was also below average between -2% and -5% compared to the 15YA. As shown by the time

series rainfall profile of each agro-ecological regions, precipitation in these three regions and the biomass accumulation potential (BIOMSS) were also above average between +1 % and +5% during entire monitoring period. But the magnitude of increased BIOMSS was significantly lower than in the other three sub-regions. Due to persistent and significant precipitation deficits from September to October, grain filling for the summer crops in these three regions was negatively impacted. The persistent precipitation deficit may have affected the establishment of the winter crops. As shown in the crop condition development graph based on NDVI, NDVI values were all above average, even close to or exceeding the 5-year maximum level from early July to early October, and then below average in mid-October, presumably due to persistent precipitation deficits. CALF of these three regions all reached 100%, with a zero departure from their 5YA. The cropping intensity (CI) of these three regions was above the 5YA between +9% and +14%, and these three regions also recorded favorable VCIx value from 0.97 to 0.99.

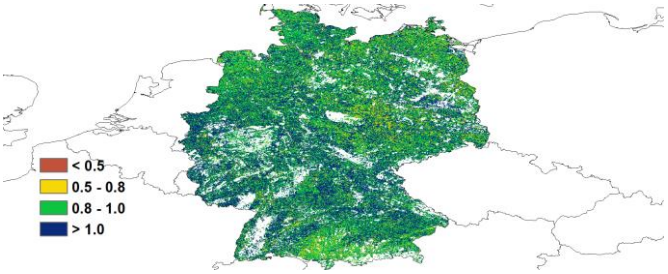
Figure 3.13 Germany's crop condition, July - October 2021



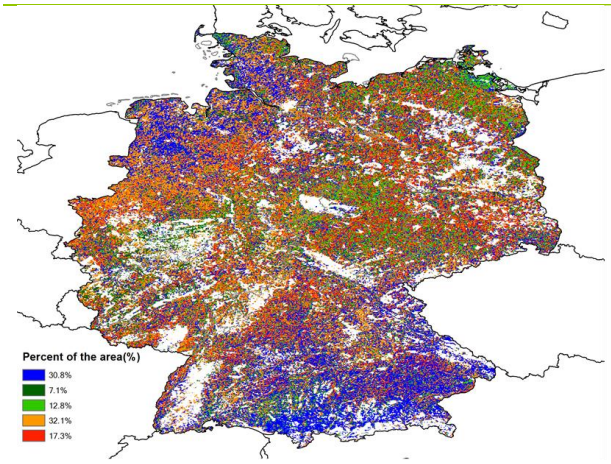
(a). Phenology of major crops



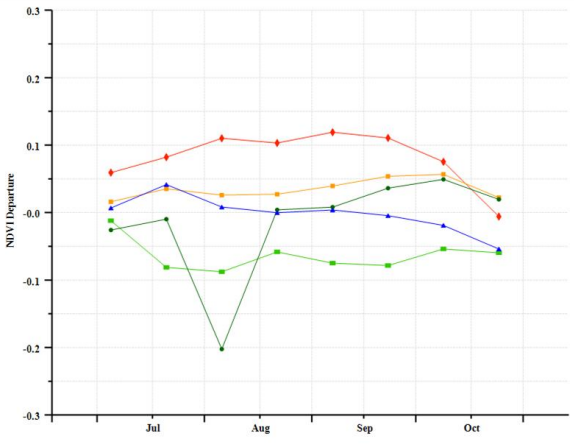
(b) Crop condition development graph based on NDVI



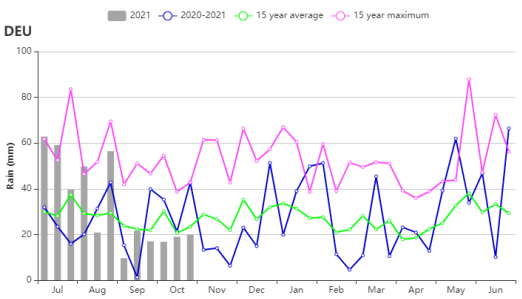
(c) Maximum VCI



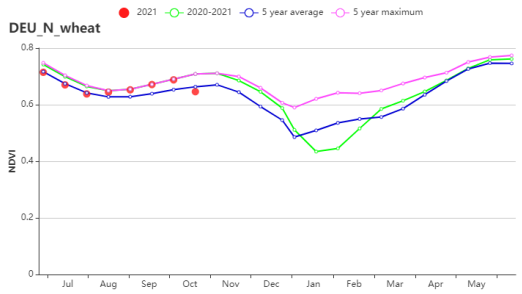
(d) Spatial NDVI patterns compared to 5YA

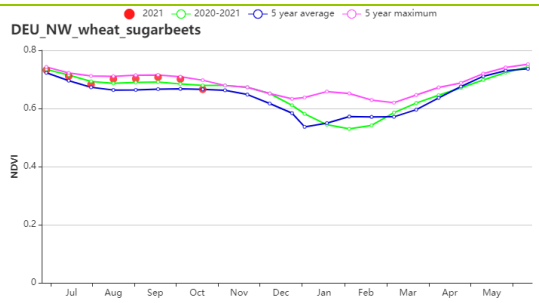


(e) NDVI profiles

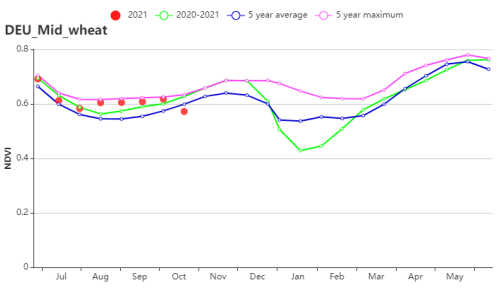


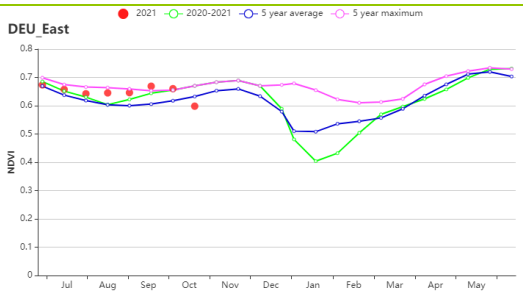
(f) Rainfall profiles (g) Temperature profiles



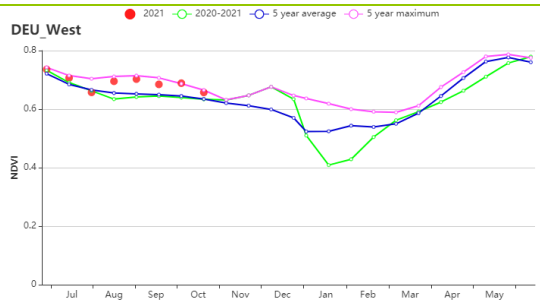


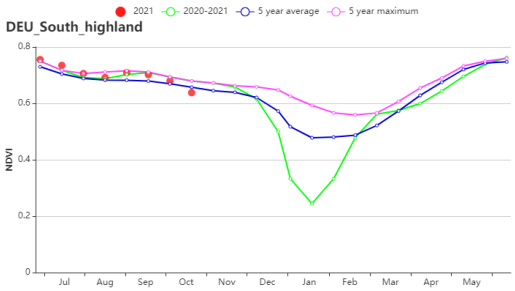
(h) Crop condition development graph based on NDVI (Wheat zone of Schleswig-Holstein and the Baltic coast (left) and Mixed wheat and sugar beets zone of the north-west(right))





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





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

Table 3.18 Germany's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, July - October 2021

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	**433**	**32**	**15.2**	**-0.2**	**747**	**-6**	**951**	**19**
Mixed wheat and sugarbeets zone of the north-west	**385**	**29**	**14.5**	**-0.4**	**778**	**-5**	**881**	**14**
Central wheat zone of Saxony and Thuringia	**312**	**15**	**14.1**	**-0.7**	**823**	**-5**	**751**	**2**
East-German lake and Heathland sparse crop area	**345**	**19**	**14.6**	**-0.7**	**813**	**-5**	**799**	**5**
Western sparse crop area of the Rhenish massif	**323**	**21**	**13.6**	**-0.8**	**852**	**-3**	**790**	**8**
Bavarian Plateau	**446**	**15**	**13.1**	**-0.9**	**918**	**-2**	**856**	**1**

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

Region	Cropped arable land fraction		Cropping intensity		Maximum VCI
	Current (%)	Departure (%)	Current (%)	Departure (%)	Current
Wheat zone of Schleswig-Holstein and the Baltic coast	**100**	**0**	**117**	**9**	**0.96**
Mixed wheat and sugarbeets zone of the north-west	**100**	**0**	**122**	**10**	**0.99**
Central wheat zone of Saxony and Thuringia	**100**	**0**	**127**	**14**	**0.97**
East-German lake and Heathland sparse crop area	**100**	**0**	**127**	**13**	**0.98**
Western sparse crop area of the Rhenish massif	**100**	**0**	**132**	**27**	**1.02**
Bavarian Plateau	**100**	**0**	**116**	**9**	**0.99**

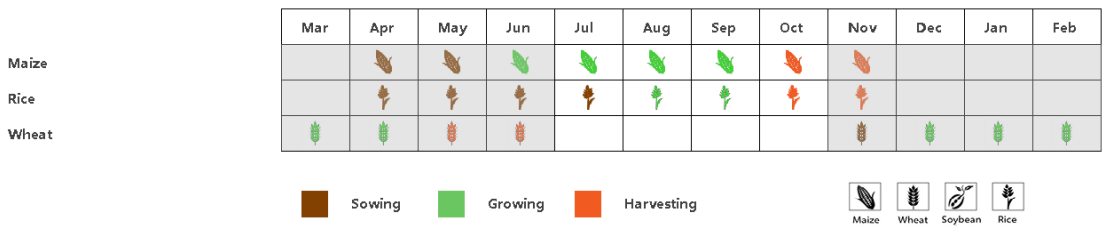
[EGY] Egypt

The reporting period (July - October) covers the growth and harvest of the main summer crops: maize and rice. Winter wheat sowing is about to start in early November. The current monitoring period is the dry season in Egypt, and the average rainfall was just 3 mm, 60% lower than the 15-year average (15YA). The average temperature was higher than the 15YA by 0.5°C; generally, the temperature profile shows slightly warmer conditions than the 15YA. The RADPAR was slightly higher than 15YA by only 0.4%, while the BIOMSS was below the 15YA by 25%. The nationwide NDVI profile was below the 5-year average (5YA) except for the end of July and the beginning of August. The NDVI spatial pattern shows that 11% of the cultivated area was above the 5YA, 59.9% fluctuated around the 5YA, and 29.1% was below. The Maximum Vegetation Condition Index (VCIx) map shows that the condition of the current crops was near average. The dominant VCIx values ranged between 0.50 and 1. This finding agrees with the whole country's VCIx value at 0.71. CALF exceeded the 5YA by only 3%. General, the crop conditions were favorable.

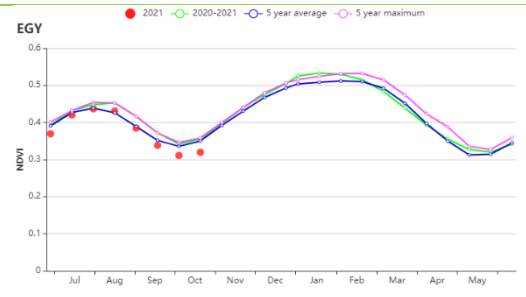
Regional Analysis

Based on crop planting systems, climate zones, and topographical conditions, Egypt can be divided into three agro-ecological zones (AEZs), two of which are suitable for crop cultivation. These are the Nile Delta and the southern coast of the Mediterranean and the Nile Valley. The average rainfall was 3 mm (-60%) in the Nile Delta and Mediterranean coast, while the Nile Valley recorded only 1 mm (-17%). Since virtually all crops in Egypt are irrigated, the impact of precipitation on crop yield is limited, but additional precipitation is nevertheless always beneficial. In both regions, the temperature was higher than the 15YA by 0.5 °C. The RADPAR was higher than the 15YA by 0.4% in the first zone and lower by 0.1% in the second zone. BIOMSS fell by 23% and 34% in the Nile Delta and Nile Valley, respectively. The NDVI development graph shows that crop conditions fluctuated around the average in both zones, with below-average values close to the harvesting stage in October. In both zones, CALF exceeded the 5YA by 3%. They also registered good VCIx values at 0.72 and 0.79 for the Nile Dela and Nile Valley, respectively, confirming proper crop conditions. Cropping Intensity estimates were at 182% and 158% for the Nile Delta and Nile Valley, respectively, indicating both regions had a mixture of single and double-cropping during the reporting period.

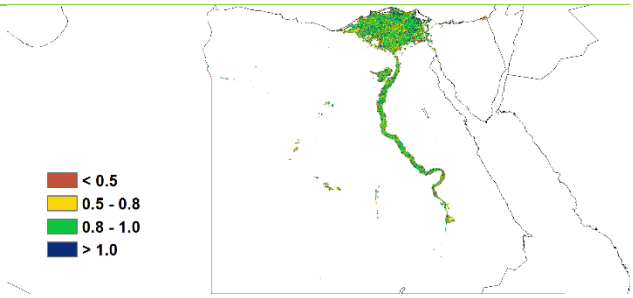
Figure 3.14 Egypt's crop condition, July - October 2021



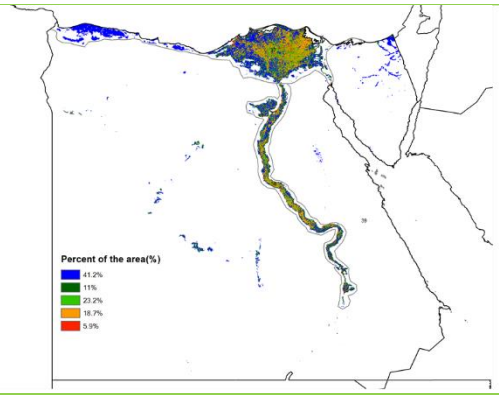
(a) Phenology of major crops



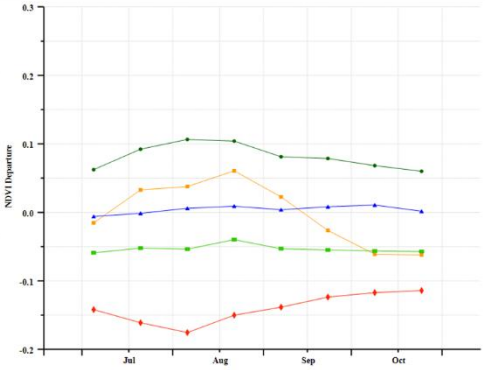
(b) Crop condition development graph based on NDVI



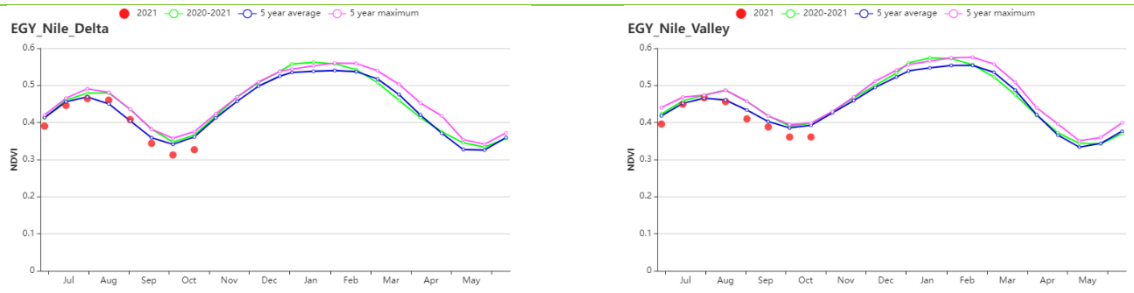
(c) Maximum VCI



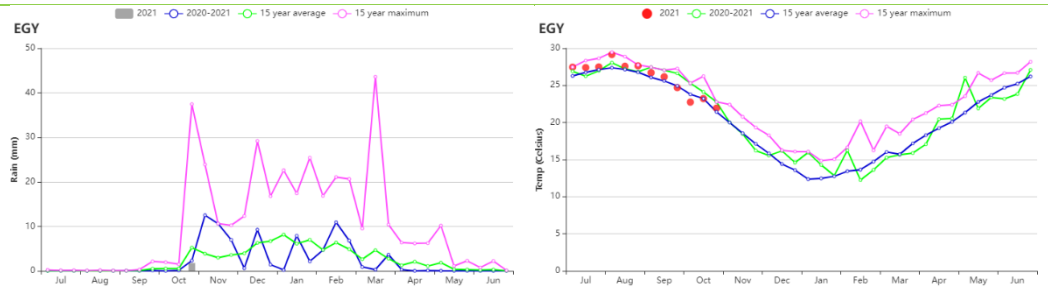
(d) Spatial NDVI patterns compared to 5YA



(e) NDVI profiles



(f) 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, July - October 2021

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	3	-60	26.0	0.5	1389	0.4	108	-23
Nile Valley	1	-17	28.2	0.5	1436	-0.1	20	-34

Table 3.21 Egypt's agronomic indicators by sub-national regions, current season's values and departure from 15YA/5YA, July - October 2021

Region	CALF		Cropping Intensity		Maximum VCI
	Current (%)	Departure from 5YA (%)	Current (%)	Departure from 5YA (%)	Current
Nile Delta and Mediterranean coastal strip	64	3	182	19	0.72
Nile Valley	70	3	158	13	0.79

[ETH] Ethiopia

The main food crops in Ethiopia are teff, wheat, barley and maize. The monitoring period is from July to October and encompasses the main growing and developmental seasons of all Meher crops. It was pointed out in the last report that delayed planting and armed conflict negatively affected crop production in Ethiopia. The situation is slightly different in this report. On the one hand, the idling of cropland due to armed conflict continued in Tigray, but on the other hand, the delayed sowing elsewhere did not have a significant impact on crop growth and development, and crops grew well, aided by generally favorable rainfall conditions.

At the national level, cumulative precipitation (RAIN -5%), average temperature (TEMP -0.2°C) and photosynthetically active radiation (RADPAR -2%) decreased slightly, as compared to the average of the last 15 years. The cumulative potential biomass (BIOMSS) decreased by 3%. As we can see from crop condition development graph based on NDVI, the effects of delayed crop sowing were still present in July, with NDVI values below the 5-year average. But thanks to abundant precipitation and suitable temperatures during the subsequent months, the NDVI values returned to the average levels. The maximum VCI graph also confirms this fact, as almost the whole country has a maximum VCI greater than 0.8. The spatial distribution of NDVI profiles reveals that the areas affected by the delayed sowing in July and early August are mainly located in the Oromiya and Southern Nations region. However, the NDVI values subsequently recovered to close to average levels. In general, crops are growing well in most regions of Ethiopia and CropWatch estimates favorable outputs for the summer crops, except for Tigray, where farmland was left idle due to the armed conflict.

Regional analysis

In **the Semi-arid pastoral areas**, a typical livestock production zone, cumulative precipitation, mean temperature and photosynthetically active radiation were close to the 15-year average (RAIN +4%, TEMP +0.2°C, RADPAR -3%) and cumulative potential biomass increased by 11%. At the same time, the NDVI values in the region were around the 5-year average for the reporting period. The maximum VCI was 0.86. Compared to the 5-year average, CALF increased by 16%. Cropping index was 100%, which means single-cropping in the region. Overall, the outlook for livestock production is favorable in the region.

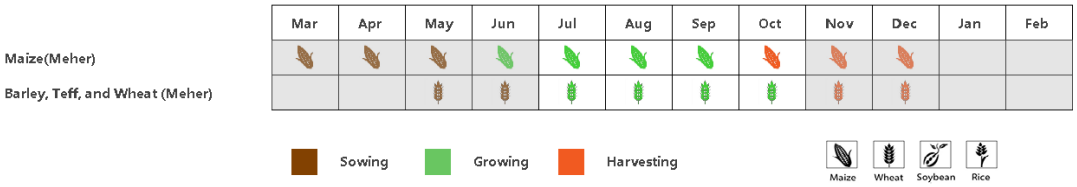
In **the Southeastern Mendebo highlands zone**, the CropWatch indicators are similar to the overall national situation. Cumulative precipitation (RAIN -4%), mean temperature (TEMP -0.3ºC) and photosynthetically active radiation (RADPAR -2%) were slightly lower than the 15YA. This resulted in a slight 7% decrease in cumulative potential biomass. The NDVI values were slightly below the 5-year average. Cropping index was 123%. In general, crop conditions in the region were average.

In **South-eastern mixed maize zone**, precipitation (RAIN +22%) and sunshine (RADPAR +0%) were adequate, temperature (TEMP -0.3°C) was suitable and cumulative potential biomass was higher than the average (+6%). The crop condition development graph based on NDVI shows that NDVI values fluctuated above or below the 5-year average after mid-August. The maximum VCI was 0.91 and CALF was 97%, equal to the 5-year average. Cropping index was 119%. CorpWatch estimates a favorable condition for autumn grain production in the region.

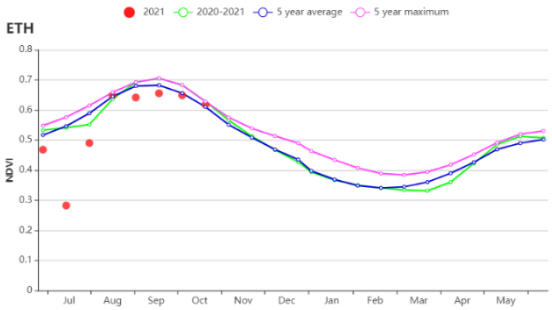
In **the Western mixed maize zone**, maize is the most important crop planted in the Meher season. The cumulative precipitation (RAIN -2%), average temperature (TEMP -0.4°C) and photosynthetically active radiation (RADPAR +1%) in the area were close to the 5-year average and estimated cumulative biomass was close to the 15-year average (-4%). The maximum VCI is 0.96 and CALF remains unchanged. Cropping index was 129%. The crops were in favorable conditions according to the CropWatch indicators.

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.

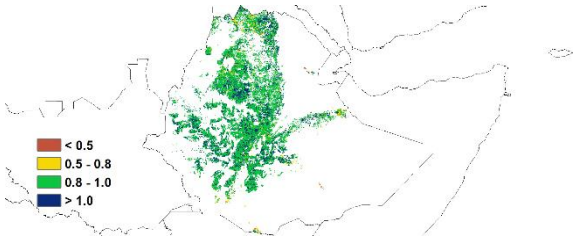
Figure 3.15 **Ethiopia's crop condition, July-October 2021**



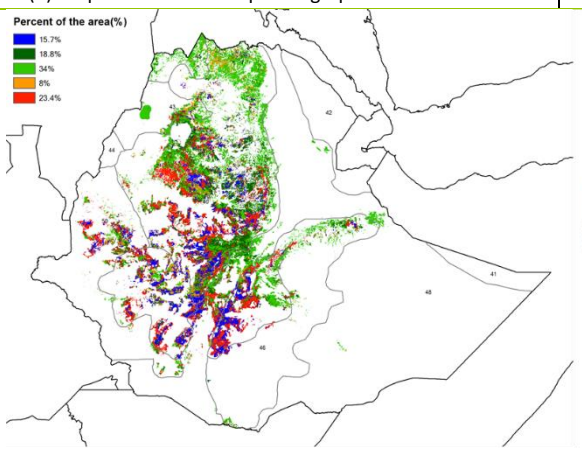
(a) Phenology of major crops



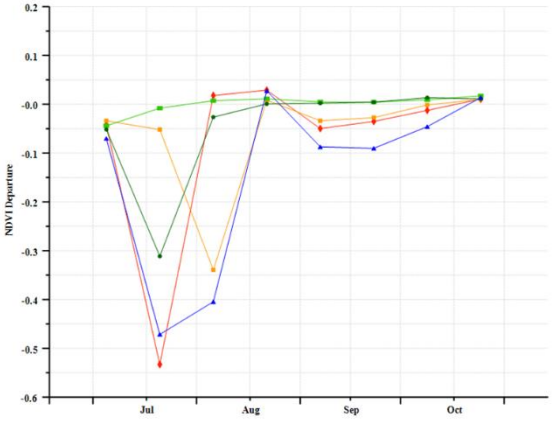
(b) Crop condition development graph based on NDVI



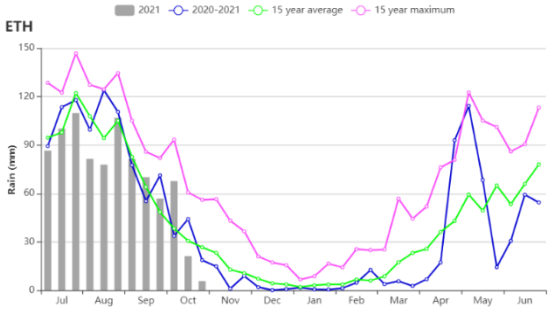
(c) Maximum VCI



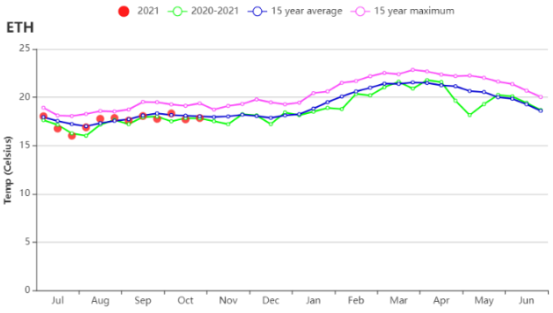
(d) Spatial NDVI patterns compared to 5YA



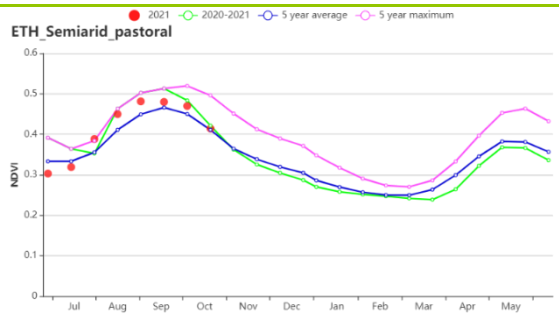
(e) NDVI profiles

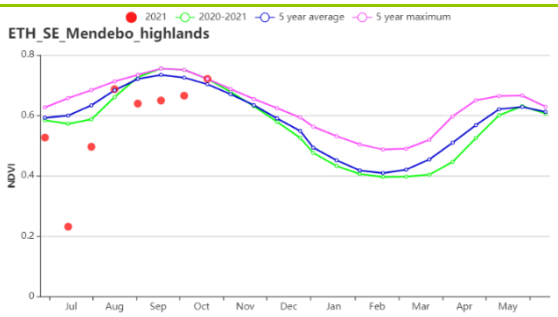


(f) Rainfall profiles

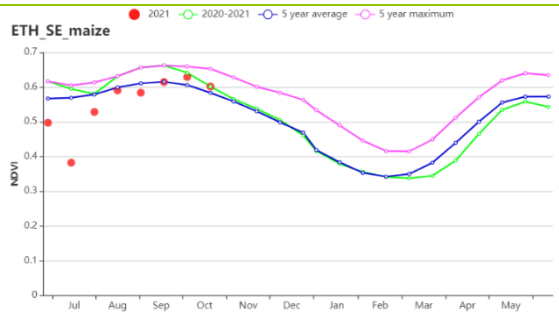


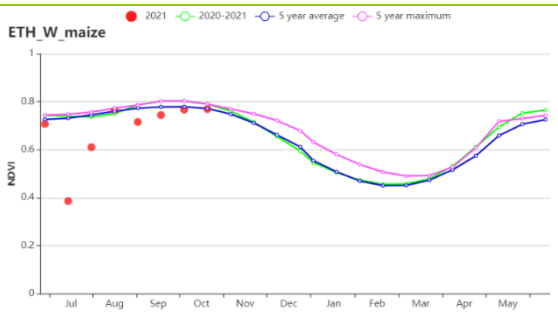
(g) Temperature profiles



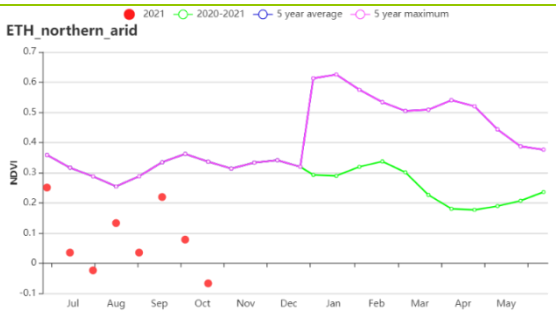


(h) Crop condition development graph based on NDVI (Semi-arid pastoral (left) South-eastern Mendebo highlands (right))





(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, July-October 2021

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m2)	Departure (%)	Current (gDM/m2)	Departure (%)
Semi-arid pastoral areas	177	4	23.1	0.2	1325	-3	634	11
South-eastern Mendebo highlands	467	-4	14.6	-0.3	1107	-2	729	-7
South-eastern mixed maize zone	447	22	18.1	-0.3	1188	0	830	6
Western mixed maize zone	1286	-2	19.4	-0.4	1080	-1	1168	-4
Northern arid area	180	70	29.2	-0.4	1279	-7	719	25

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

Region	Cropped arable land fraction	Cropping intensity	Maximum VCI

	Current (%)	Departure (%)	Current (%)	Departure (%)	Current
Semi-arid pastoral areas	78	16	100	-11	0.86
South-eastern Mendebo highlands	100	0	123	-3	0.97
South-eastern mixed maize zone	97	0	119	-1	0.91
Western mixed maize zone	100	0	129	10	0.96
Northern arid area	0	-100	100	0	0.34

[FRA] France

This monitoring period covers the final stages of spring wheat and winter wheat cultivation and harvest of maize, which started in September. The sowing of winter wheat started in October and will be completed in November. CropWatch agro-climatic indicators showed slightly below-average temperatures over the period (TEMP, -0.6°C). RAIN was significantly higher than the average (RAIN, +17%), especially in July and early September, which continued the trend of above-average precipitation observed during of the previous monitoring period. Sunshine was slightly lower than the average (RADPAR, -1%). Due to the generally favorable rainfall, temperature and sunshine conditions, the biomass accumulation was significantly above the national 15-year average (BIOMSS, +8%). Cropping intensity was above average level by 9%.

The national-scale NDVI development graph shows that the NDVI values were also significantly above the 5-year average. The crop conditions were even better than the 5-year maximum during the summer season. The spatial distribution of maximum VCI (VCIx) across the country also reached a high range of 0.89-1.03. CALF departure increased by 1%. Overall, high precipitation and proper sunshine and temperature during the summer season caused favorable growth conditions for all of France's agricultural regions. However, the high rainfall negatively impacted the harvest of barley and wheat crops, resulting in poor grain quality in some regions.

Regional analysis

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

In the Northern barley region, slightly cooler weather was observed (TEMP, -0.6°C) while RAIN and RADPAR were above average (RAIN +33% and RADPAR +1%) over the monitoring period. The BIOMSS significantly increased by 17% when compared to the past 15-year average. The CALF was near average, and VCIx was relatively high at 1.03. Cropping intensity increased by 18%. Crop condition development based on NDVI for this region was above the past 5-year average, and even above the 5-year maximum in July and August.

In the Mixed maize/barley and rapeseed zone from the Center to the Atlantic Ocean, slightly cooler (TEMP -0.5°C) and drier (RAIN -1%) conditions were observed and RADPAR was at the average. BIOMSS was above average by 1% while the NDVI profile showed the regional crop conditions were higher than average levels especially in summer season. Cropping intensity was higher than the average level by 15%. The CALF was increased by 1%, and VCIx was 0.99.

In the Maize-barley and livestock zone along the English Channel, RAIN and RADPAR were above average by 16% and 4%. TEMP was lower than the average (-0.1°C). BIOMSS increased by 12%. Cropping intensity increased by 18%. CALF was average and VCIx was 1.01. The regional NDVI profile also presented an overall higher than average trend, and was also higher than the 5-year maximum in July and August.

In the Rapeseed zone of eastern France, the NDVI profile also indicated above-average and maximum conditions. Overall, RAIN in this period was 23% higher than the 15-year average, while TEMP decreased by 1.0°C and RADPAR dropped by 2%. BIOMSS was about 9% higher than average while CALF was at the average level, and VCIx was 1.02. Cropping intensity was higher than average level 15%.

In the Massif Central dry zone, TEMP and RADPAR were 0.9°C and 5% lower than the average, respectively, while RAIN increased by 24%. CALF was at the average level. Cropping intensity decreased by 6%.The VCIx was high at 1.03 and BIOMSS increased by 9% which indicated a favorable cropping season in the region. Crop conditions based on the NDVI profile were also showing above-average levels during the

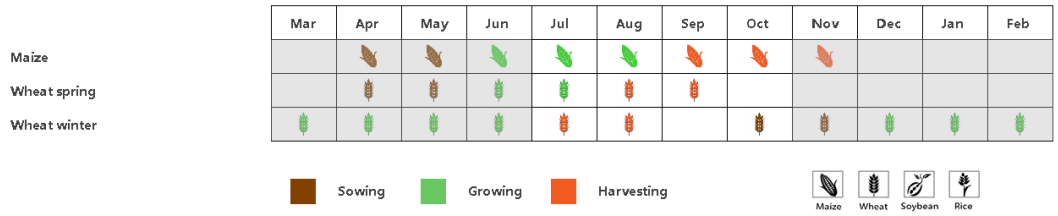
whole monitoring period.

The Southwestern maize zone is one of the major irrigated regions in France. The regional NDVI profile presented an above-average trend. The VCIx was recorded at a high level (1.02). BIOMSS was 1% lower than average. CALF was average. Cropping intensity was above the average 5%. RAIN in the period was at the average level, while TEMP was 0.6°C lower than average, and RADPAR dropped by 2%.

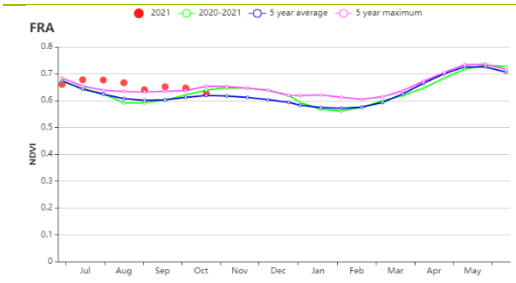
In the Eastern Alpes region, the NDVI profile also presented an above-average and close-to-maximum trend. RAIN in the region was 32% higher than average, while TEMP was lower than average (-0.9°C) and RADPAR was 6% lower than the 15YA. BIOMSS was 7% higher than the 15-year average. Cropping intensity was higher than average 3%. VCIx for the region was recorded at 1.02 and CALF was 1% higher than average level, indicating overall above-average crop conditions.

The Mediterranean zone also indicated an overall above-average NDVI profile, but was close to average in early July and late August. The region recorded a relatively low VCIx (0.89). RADPAR and TEMP were 2% and 0.4°C lower than average, while RAIN was higher than average (+11%) . Cropping intensity increased by 7%. BIOMSS and CALF increased by 6% and 2%. This region was also showing above-average crop conditions.

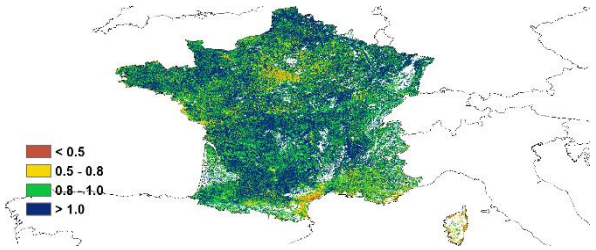
Figure 3.16 France's crop condition, July - October 2021



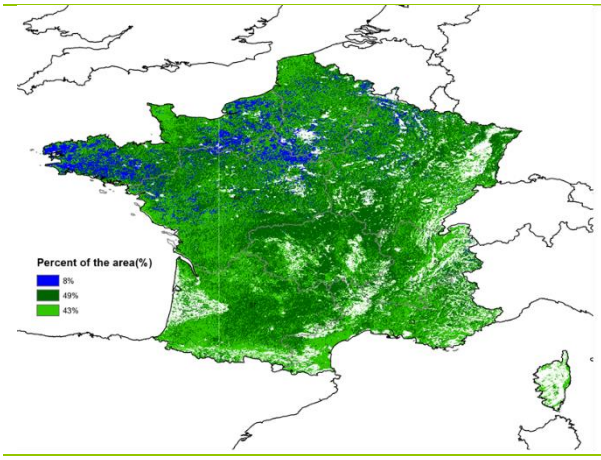
(a). Phenology of major crops



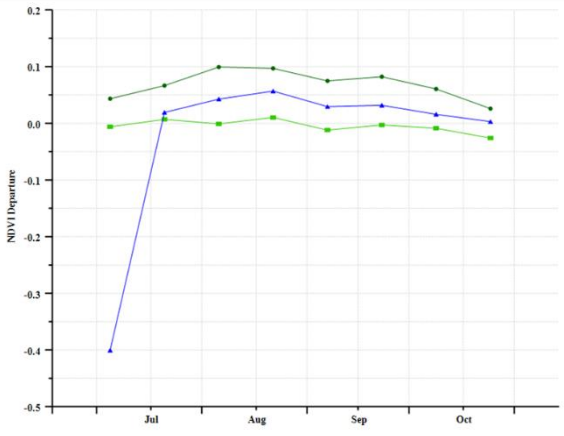
(b) Crop condition development graph based on NDVI



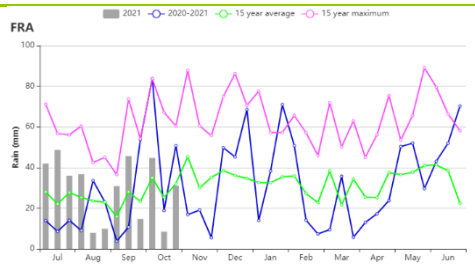
(c) Maximum VCI



(d) Spatial NDVI patterns compared to 5YA

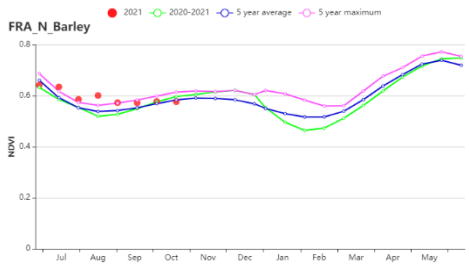


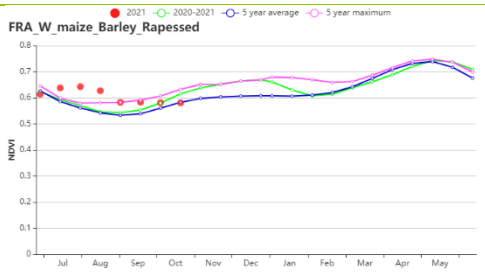
(e) NDVI profiles



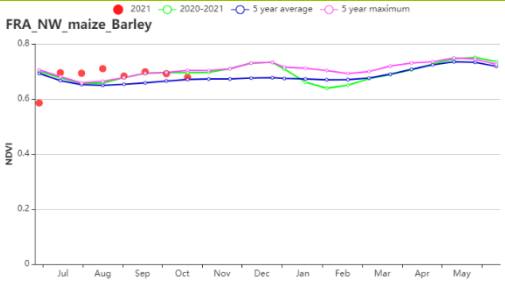
(f) Rainfall profiles

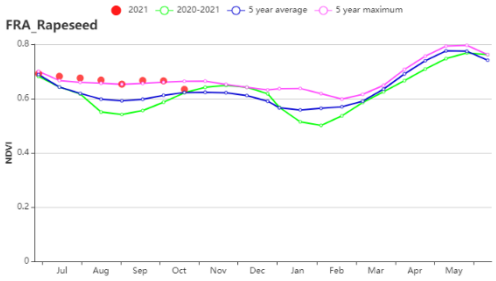
(g) Temperature profiles



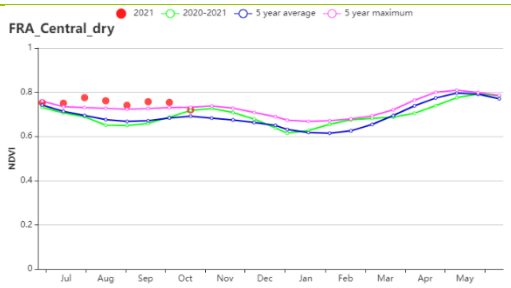


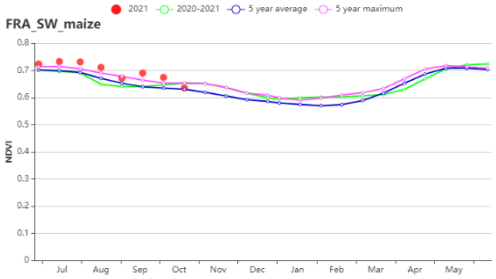
(h) Crop condition development graph based on NDVI (Northern barley region (left) and Mixed maize, Barley and Rapeseed zone (right))



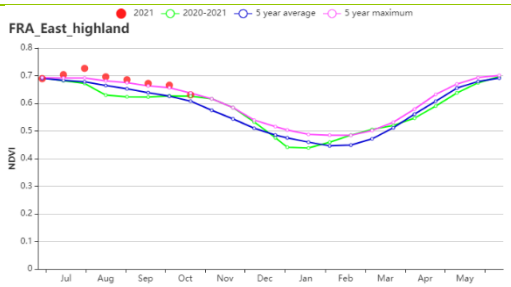


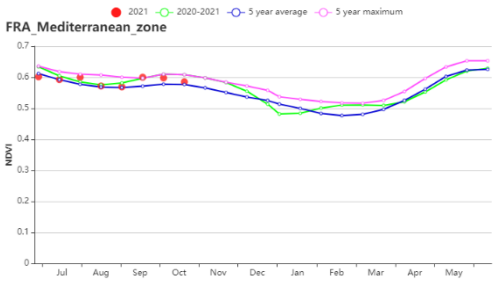
(i) Crop condition development graph based on NDVI (Maize, barley and livestock zone (left) and Rapeseed zone (right))





(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, July - October 2021

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Northern Barley zone	379	33	15.1	-0.6	855	1	885	17

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Mixed maize/barley and rapessed zone from the Centre to the Atlantic Ocean	256	-1	16.2	-0.5	946	0	738	1
Maize barley and livestock zone along the English Channel	311	16	15.4	-0.1	894	4	813	12
Rapeseed zone of eastern France	440	23	14.3	-1.0	918	-2	895	9
Massif Central Dry zone	391	24	14.3	-0.9	982	-5	883	9
Southwest maize zone	301	0	16.3	-0.6	1052	-2	797	-1
Alpes region	560	32	13.6	-0.9	1018	-6	925	7
Mediterranean zone	325	11	16.3	-0.4	1135	-2	772	6

Table 3. 25 France's agronomic indicators by sub-national regions, current season's values and departure from 5YA, July - October 2021

Region	Cropped arable land fraction		Cropping intensity		Maximum VCI
	Current (%)	Departure (%)	Current (%)	Departure (%)	Current
Northern Barley zone	100	0	130	18	1.03
Mixed maize/barley and rapessed zone from the Centre to the Atlantic Ocean	100	1	118	15	0.99
Maize barley and livestock zone along the English Channel	100	0	132	18	1.01
Rapeseed zone of eastern France	100	0	122	15	1.02
Massif Central Dry zone	100	0	102	-6	1.03
Southwest maize zone	100	0	111	5	1.02
Alpes region	98	1	107	3	1.02
Mediterranean zone	95	2	119	7	0.89

[GBR] Kingdom

By the end of this monitoring period, summer crops had been harvested and winter wheat was being sown. According to the crop condition development graph, crops experienced average conditions except July, when they were below or above the 5YA. NDVI values were close to average from August to October. Agro-climatic indicators show that rainfall, temperature and radiation were above average (RAIN, +2%, TEMP +0.6℃, RADPAR +1%), and favorable agro-climatic conditions resulted in an above-average BIOMSS (+7%). The seasonal RAIN profile shows that the rainfall was fluctuating in the monitoring period as compared to the 15 year average. The second half of August and September were below average, but October was close to the 15 year maximum. The temperature was close to the 15YA in most of the time and above average in mid-July, late July and early September.

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) 73.6% of arable land experienced average crop conditions, mainly in the south and east of UK. (2) 26.4% of arable land experienced a marked drop in July and August, then recovered to average conditions, mainly in the southeast and northeast of the UK. Most likely, the large drops can be attributed to cloud cover in the satellite images. Altogether, the conditions in the UK are assessed as average.

Regional analysis

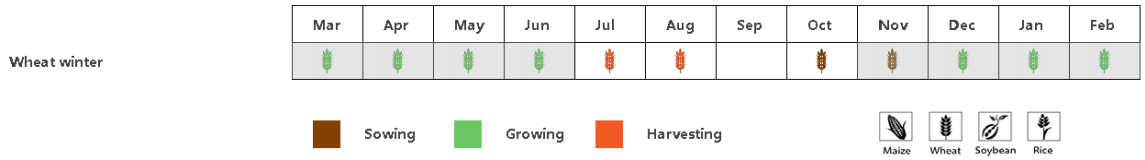
Based on cropping systems, climatic zones, and topographic conditions, three sub-national regions are described below: **Northern barley region**, **Central sparse crop region** and **Southern mixed wheat and barley region**. All three sub-regions are characterized by an unchanged fraction of arable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

In the **northern barley region**, NDVI was close to average except late July. Rainfall was below average (RAIN -7%), temperature (TEMP +0.9℃) and radiation (RADPAR +2%) were above average. Above-average temperature and radiation resulted in above-average biomass (+5%). This region is cultivated with a mixture of single and double cropping systems, and the CI (-1%) was slightly below average, while the VCIx was at 0.96.

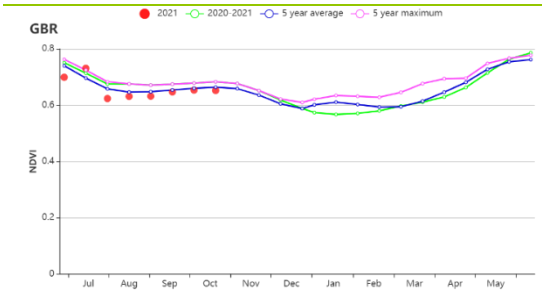
The **Central sparse crop region** is one of the country's major agricultural regions in terms of crop production. Crop condition development graph based on NDVI is similar to the northern barley region. Rainfall was close to average, temperature (TEMP +0.8℃) and radiation (RADPAR +0.5%) were above average. Above-average temperature and radiation resulted in above-average biomass (BIOMSS +4%). This region is cultivated with a mixture of single and double cropping systems, and the CI (+1%) was slightly above average, while the VCIx was at 0.95.

In the **Southern mixed wheat and barley zone**, NDVI was overall close to average. This region experienced the largest rainfall excess (RAIN +13%), temperature (TEMP +0.3°C) and radiation (RADPAR +0.7%) were above average. The favourable agro-climatic conditions resulted in the remarked above-average biomass (BIOMSS +12%). This region is cultivated with a mixture of single and double cropping systems, and the CI (+3%) was above average. The region had an above-average VCIx (0.95).

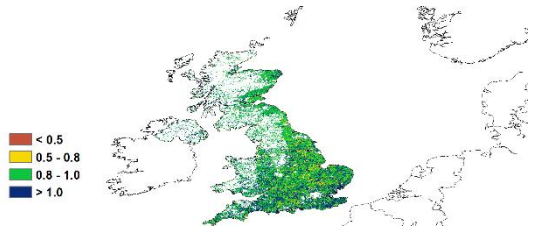
Figure 3.17 United Kingdom's crop condition, July - October 2021



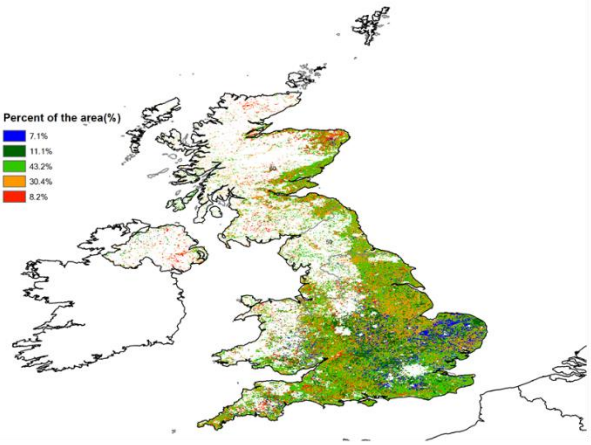
(a). Phenology of major crops



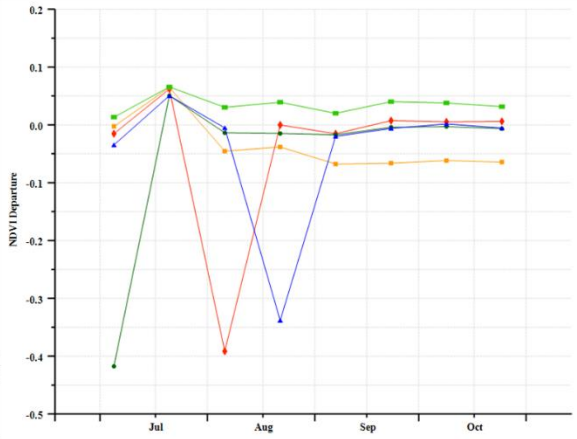
(b) Crop condition development graph based on NDVI



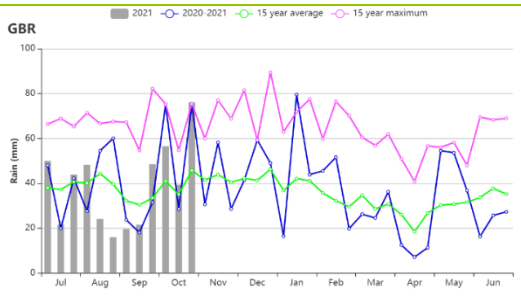
(c) Maximum VCI



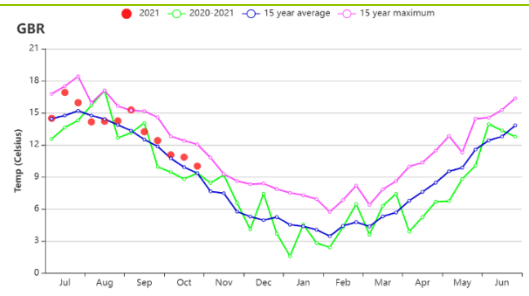
(d) Spatial NDVI patterns compared to 5YA



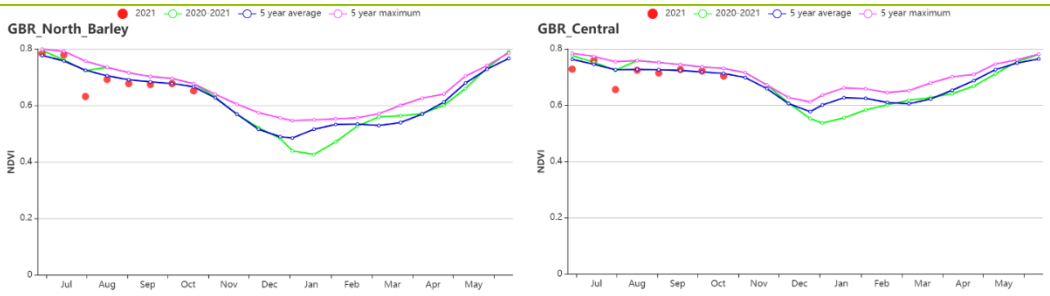
(e) NDVI profiles



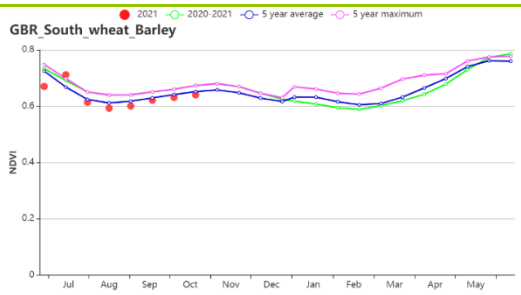
(f) Rainfall profiles



(g) Temperature profiles



(h) Crop condition development graph based on NDVI (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, July - October 2021

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Northern Barley region(UK)	536	-7	12	0.9	594	2	870	5
Central sparse crop region (UK)	486	0	13	0.8	633	0.5	901	4
Southern mixed wheat and Barley zone (UK)	392	13	14	0.3	725	0.7	882	12

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

Region	Cropped arable land fraction		Cropping intensity		Maximum VCI
	Current (%)	Departure (%)	Current (%)	Departure (%)	Current
Northern Barley region(UK)	100	0	105	-1	0.96
Central sparse crop region (UK)	100	0	119	1	0.95
Southern mixed wheat and Barley zone (UK)	100	0	123	3	0.95

[HUN] Hungary

In Hungary, summer crops were harvested in September and October. Winter wheat was sown in September and October.

At the national level, accumulated rainfall was below average (RAIN -35%), temperature decreased by 0.2°C, and radiation increased by 3%, which resulted in a below-average BIOMSS (BIOMSS -17%), as compared to the 15YA. According to the national NDVI development graphs, crop conditions were below average throughout the monitoring period. With the maximum VCI value reaching 0.73 at the national level and the cropped arable land fraction (CALF) at 100%, crop conditions are estimated as unfavorable because of lower rainfall. Crop production in Hungary is expected to be below average.

Some spatial and temporal detail is provided by the NDVI clusters: There were two main remarkable areas where the NDVI departure across the period was significant: Excellent crop conditions were observed for 19.5% of the area. It is mainly located in far western Transdanubia and eastern Great Plain, where the NDVI departure was below average in July and above average from August to October. About 35.4% of the area, mainly located in the Great Plain and near the Transdanubia, represents poor crop conditions, which was below average throughout the monitoring period. About 25.9% of the area extending from west to east of Hungry, NDVI was below average from July to early October, and above average in mid-to-late October. For the rest 19.2% of the area, located in the mid-east region of Hungary, NDVI was hovering around average from July to August, and was below average from September to October.

Regional analysis

Based on cropping systems, climatic zones and topographic conditions, Hungary is divided into four sub-regions: Northern Hungary, Central Hungary, the Great Plain (Puszta) and Transdanubia. Specific observations for the reporting period are included for each region. All sub-regions are characterized by unchanged fractions of cropped arable land (CALF) compared to the average, i.e. 100%, indicating full cropping.

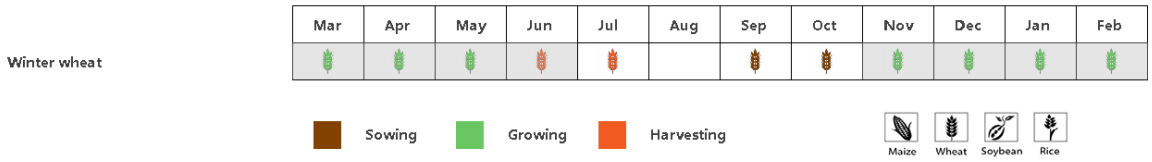
Central Hungary is one of the major agricultural regions in terms of crop production. A sizable share of winter wheat, maize and sunflower is planted in this region. According to NDVI development graphs, crop conditions were below average throughout the monitoring period. Agro-climatic conditions include below-average rainfall (RAIN, -38%) and temperature (TEMP -0.2°C), and above-average radiation (RADPAR +3%), which resulted in a below-average biomass (BIOMSS -16%). The VCIx was 0.68. Meanwhile Cropping intensity was 110% (+9%). So crop production in this region is expected to be below average.

The Puszta region mainly grows winter wheat, maize and sunflower especially in the counties of Jaz-Nagykum-Szolnok and Bekes. According to NDVI development graphs, crop conditions were below average throughout the monitoring period. The rainfall was below average (-35%). Temperature was also below average (TEMP -0.1°C), whereas radiation was above (RADPAR +2%), which resulted in a below-average biomass (BIOMSS -17%). The maximum VCI was 0.72. Cropping intensity was 117% (+14%). The crop production in this region is expected to be close to, but below average.

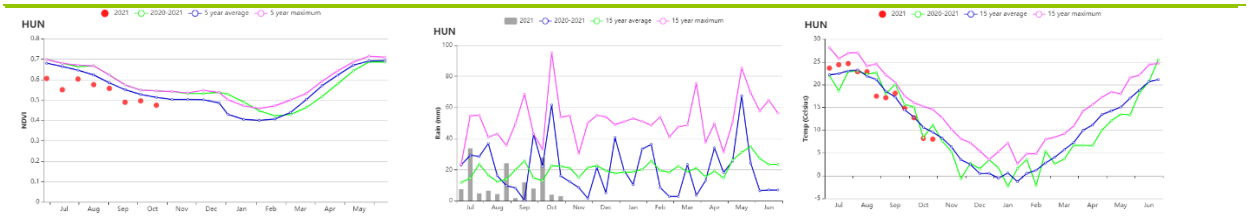
Northern Hungary is another important winter wheat region. During this reporting period crops showed unfavorable conditions according to the NDVI development curve. They were below average throughout this monitoring period, except for late August, when NDVI was near average. The rainfall was below average (RAIN -32%). Temperature was slightly below average (TEMP -0.4°C), and radiation was above average (RADPAR +2%). Estimated biomass decreased (BIOMSS -13%) due to the lower rainfall. The maximum VCI was 0.77. Cropping intensity was 125% (+21%). So the crop production in this region is expected to be close to, but below average.

Southern Transdanubia cultivates winter wheat, mostly in Somogy and Tolna counties. Crop condition was below average from July to October. Rainfall and temperature were below average (RAIN -35%; TEMP -0.2°C) , whereas solar radiation was above average (RADPAR +2%) and estimated biomass decreased (BIOMSS -18%) due to the lower rainfall in September and mid-to-late October. The maximum VCI was 0.74. Cropping intensity was 132% (+29%). The crop production in this region is expected to be close to, but below average.

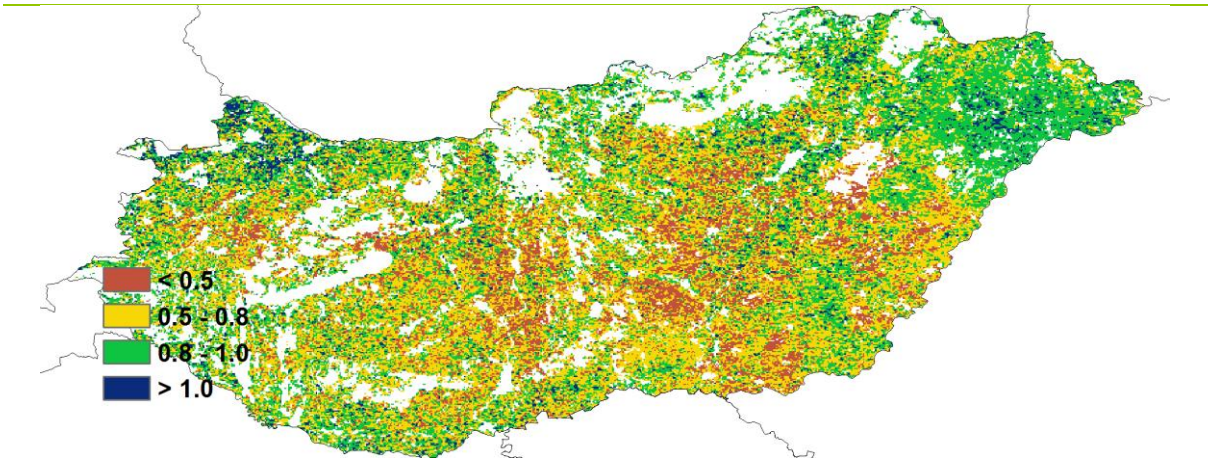
Figure 3.18 Hungary's crop condition, July -October 2021



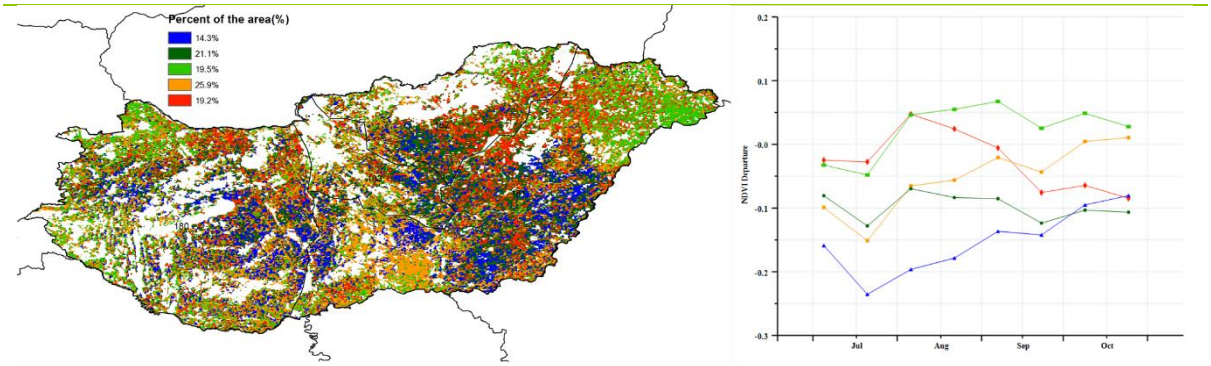
(a). Phenology of major crops



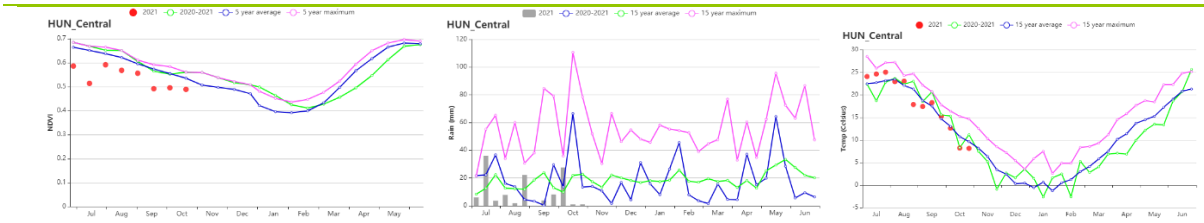
(b) Crop condition development graph based on NDVI, RAIN and TEMP



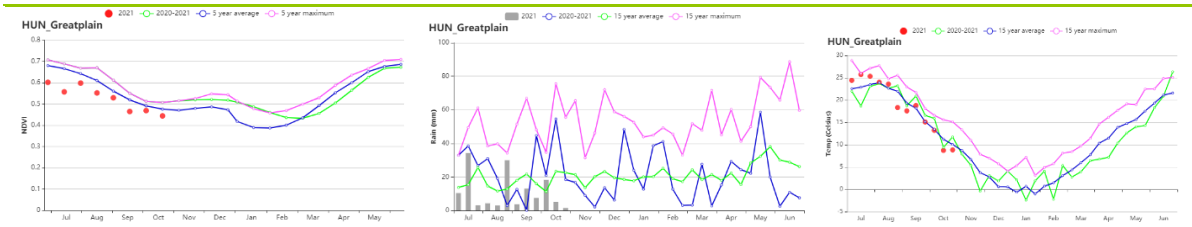
(c) Maximum VCI



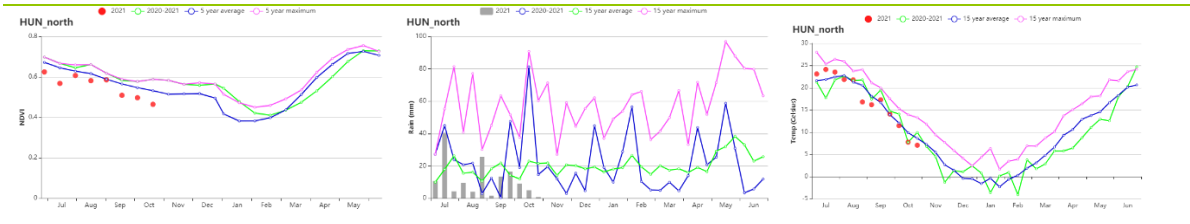
(d) Spatial distribution of NDVI profiles.



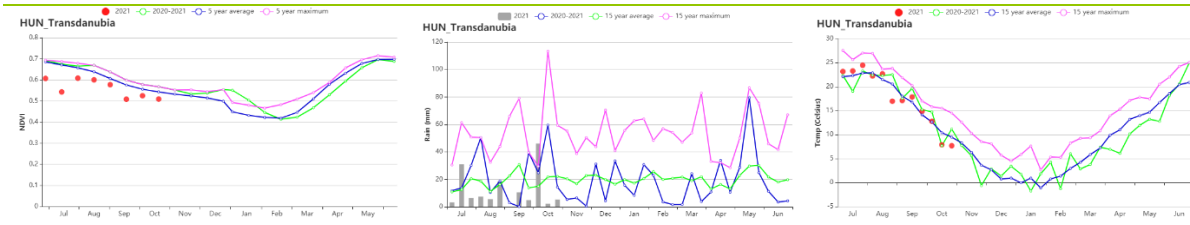
(e) Crop condition development graph based on NDVI, RAIN and TEMP



(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, July -October 2021

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Central Hungary	119	-38	18	-0.2	1059	3	546	-16
The Puszta	134	-35	19	-0.1	1045	2	574	-17
North Hungary	140	-32	17	-0.4	1018	2	578	-13
Transdanubia	141	-35	18	-0.2	1071	4	568	-18

Table 3. 29 Hungary's agronomic indicators by sub-national regions, current season's values and departure from 5YA, July -October 2021

Region	Cropped arable land fraction		Cropping Intensity		Maximum VCI
	Current (%)	Departure (%)	Current (%)	Departure (%)	Current (%)
Central Hungary	100	0	110	9	0.68
The Puszta	100	0	117	14	0.72
North Hungary	100	0	125	21	0.77

Region	Cropped arable land fraction		Cropping Intensity		Maximum VCI
	Current (%)	Departure (%)	Current (%)	Departure (%)	Current (%)
Transdanubia	100	0	132	29	0.74

[IDN] Indonesia

The dry season maize and the second rice were the main cereals being produced during this monitoring period. Their harvest began in October. The planting of the main rice crop also started in October. CropWatch agroclimatic indicators showed that temperature (TEMP +0.2°C), precipitation (RAIN +20%) and radiation (RADPAR +2%) were above the 15YA. The potential biomass production was above average (BIOMASS +12%).

According to the national NDVI development graph, crop conditions were slightly below the 5YA during this monitoring period. NDVI clusters and profiles showed that crop conditions in 61.9% of arable land were close to average or above average, mostly located in Java, Sumatra and West Papua. About 32.7% of arable land, located in Kalimantan, Sumatra, Molucca, Bandung, West Papua, were at first significantly below average but improved after October. The large negative departures can be attributed to cloud cover in the satellite images. The area of cropped arable land (CALF 99%) in the country was comparable to the 5YA and the VCIx value was 0.95. Cropping intensity (CI -1%) was near the 5YA. The national production is anticipated to be above average during the whole monitoring period.

Regional analysis

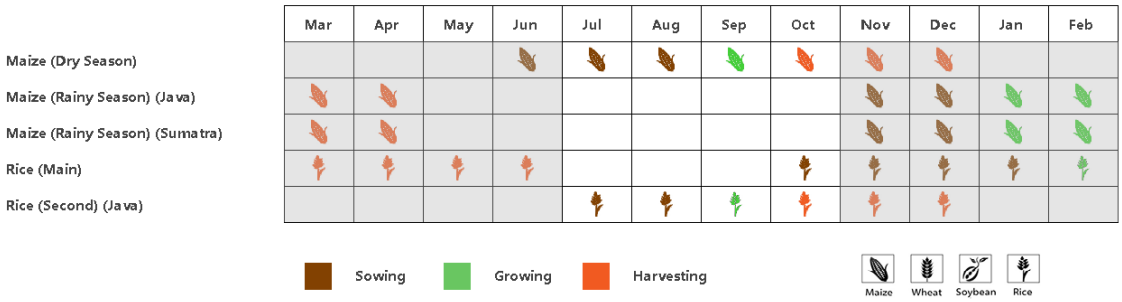
CropWatch focuses on four agro-ecological zones, namely **Sumatra** (92), **Java** (90), **Kalimantan and Sulawesi** (91) and **West Papua** (93), among which the former three are relevant for crops cultivation. The numbers of the zones correspond to the labels on the VCIx and NDVI profile maps. **Java**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

In the Java region, precipitation (RAIN +32%), temperature (TEMP +0.5°C) and radiation (RADPAR +3%) were above the 15YA, which may have resulted in the potential biomass production increase of 27%. According to the NDVI development graph, crop conditions were close to the 5YA. And cropping intensity (CI +6%) was above the 5YA. Overall, crop conditions in this region are expected to be above average.

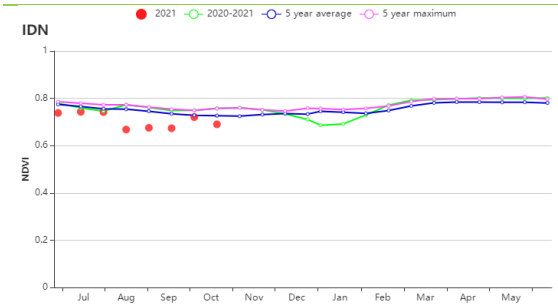
Kalimantan and Sulawesi experienced rainy conditions. Precipitation (RAIN +32%) was above average, whereas temperature (TEMP 0°C) was close to average and radiation (RADPAR -1%) was below the 15YA, which brought an increase in the potential biomass production (BIOMSS +14%). As shown in NDVI development graphs, crop conditions were below average in mid-August and mid-September, but close to average at other times. Cropping intensity (CI -2%) was below the 5YA. Crop conditions in this region are assessed as above average.

In **Sumatra**, the agroclimatic indices, precipitation (RAIN +7%), temperature (TEMP +0.2°C) and radiation (RADPAR +2%),were near average during the reporting period.They resulted in an increase in the potential biomass production (BIOMSS +5%). According to NDVI development graphs, crop conditions were slightly below the 5YA. In addition, cropping intensity (CI -1%)was below the 5YA. Crop conditions in **Sumatra** are expected to be above average.

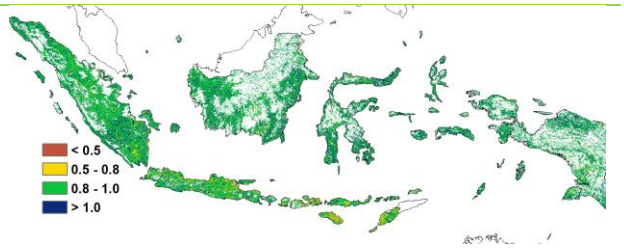
Figure 3.19 Indonesia's crop condition, July – October 2021



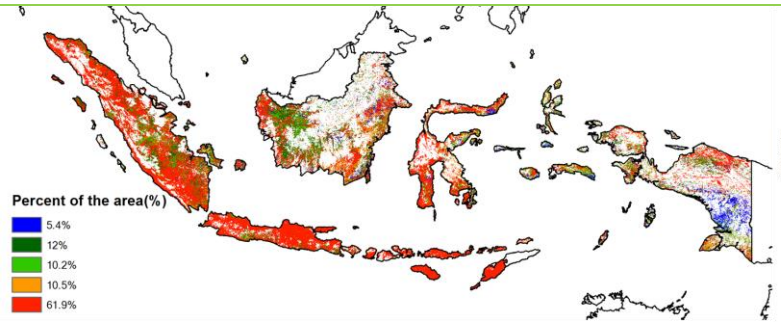
(a). Phenology of major crops



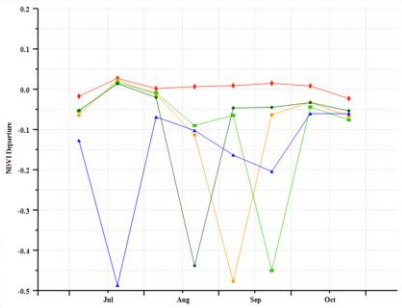
(b) Crop condition development graph based on NDVI



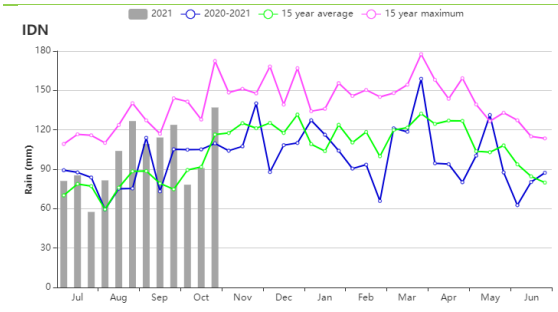
(c) Maximum VCI



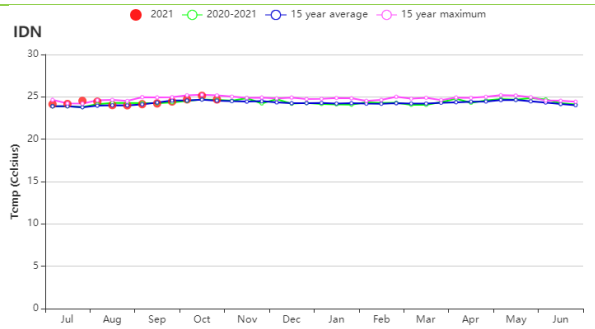
(d) Spatial NDVI patterns compared to 5YA



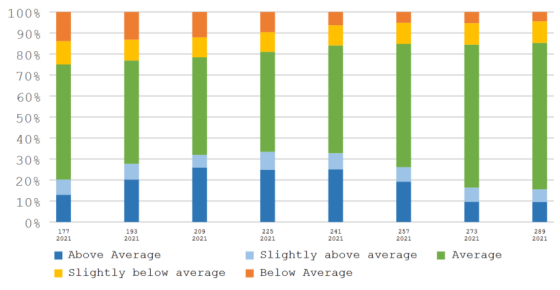
(e) NDVI profiles



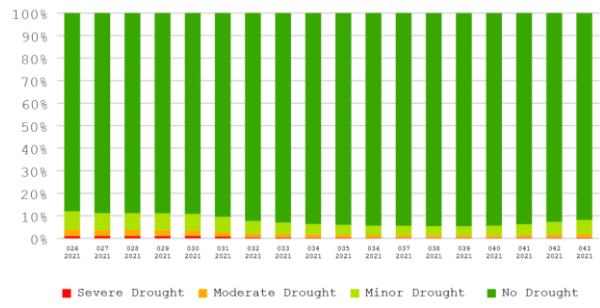
(f)Rainfall profiles



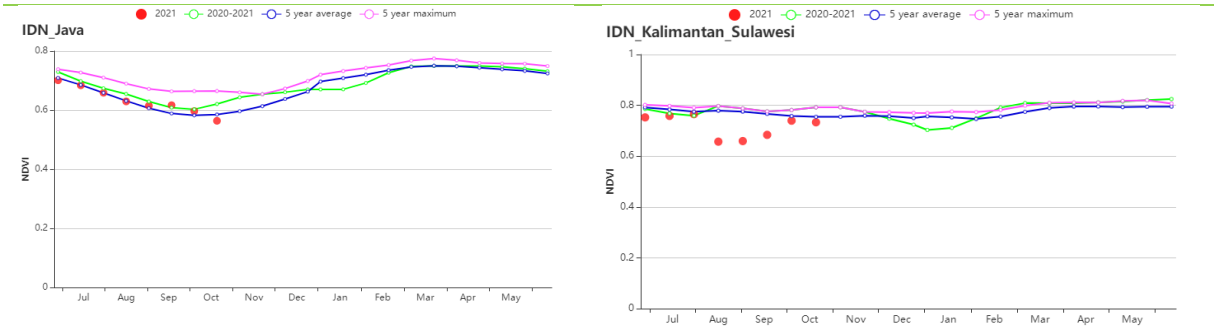
(g)Temperature profiles



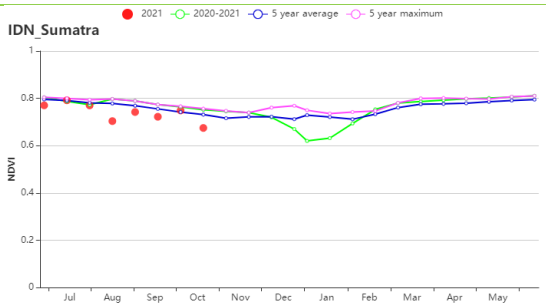
(h) Proportion of NDVI anomaly categories compared with 5YA



(i) Proportion of VHIn categories compared with 5YA



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



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

Table 3. 30 Indonesia's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, July – October 2021

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure from 15YA(%)	Current (°C)	Departure from 15YA(°C)	Current (MJ/m²)	Departure from 15YA(%)	Current (gDM/m²)	Departure from 15YA(%)
Java	404	32	25.3	0.5	1318	3	909	27
Kalimantan and Sulawesi	1228	32	24.5	0.0	1191	-1	1490	14
Sumatra	987	7	24.7	0.2	1216	2	1401	5
West Papua	1713	14	23.4	0.6	1044	8	1391	9

Table 3. 31 Indonesia's agronomic indicators by sub-national regions, current season's values and departure from 5YA, July – October 2021

Region	Cropped arable land fraction		Cropping Intensity		Maximum VCI
	Current (%)	Departure from 5YA(%)	Current(%)	Departure from 5YA(%)	Current
Java	98	1	131	6	0.89
Kalimantan and Sulawesi	100	0	131	-2	0.97
Sumatra	100	0	130	-1	0.95
West Papua	100	0	130	-3	0.97

[IND] India

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

The CropWatch agroclimatic indicators show that nationwide, TEMP (+0.1°C) and RADPAR were close to average, whereas RAIN was slightly below the 15YA (-11%). The average TEMP and RADPAR compensated for the low rainfall, resulting in a BIOMSS increase by 5% compared with the 15YA. The overall VCIx was high, with a value of 0.91. 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 southwestern and northeastern regions showed above-average crop conditions while the conditions were slightly below average in the northwestern regions. The spatial distribution of NDVI profiles shows that after October, 81.8% of the areas showed above-average crop conditions in the western and southern regions. CALF increased by 1% 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 three agro-ecological zones of the Deccan Plateau, the Assam and north-eastern regions, and the Western Himalayan region showed similar trends in agricultural indices. Compared to the same period of previous years, RAIN had decreased significantly, especially in the Western Himalayan region (-49%). The TEMP was slightly above average and RADPAR was above average, but the lower rainfall caused BIOMSS to be slightly lower than the 15-year average. CALF showed the same trends. They all were slightly above average (near+1%). The graph of NDVI development shows that the crop growth of these three agro-ecological regions during this monitoring period was below the 5-year average in most months. Generally, the crop production is expected to be below average.

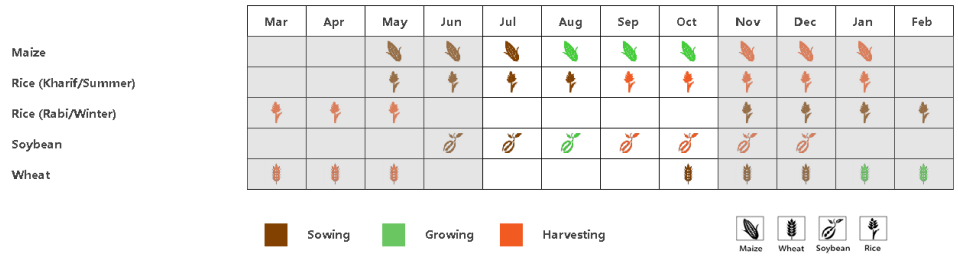
The Agriculture areas in Rajasthan and Gujarat and the North-western dry region recorded similar trends of agricultural indices in this monitoring period. Compared to the same period of the previous years, RAIN had increased significantly by 27% in the Agriculture areas in Rajasthan and Gujarat and by 68% for the North-western dry region. TEMP was slightly above average. The RADPAR was below 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 0.90. 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 and the Western coastal region recorded similar trends of agricultural indices in this monitoring period. Compared to the same period of the previous years, RAIN had decreased by 20% in the Eastern coastal region and by 7% for the Western coastal region. TEMP was near average. The RADPAR was above average for both regions. BIOMSS was below the average due to insufficient rainfall. Both regions recorded increases of CALF. VCIx was above 0.70. The graph of NDVI development shows that the crop growth for both regions was generally above the 5-year average. The crop production is expected to be above average.

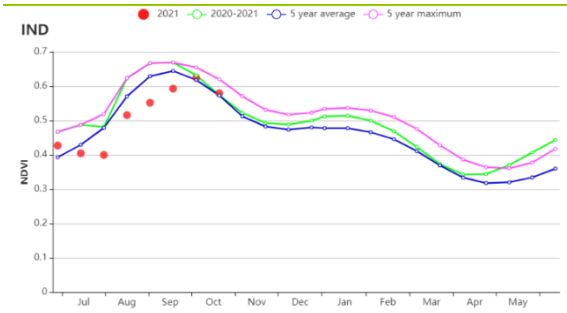
The Gangetic plain recorded 1084 mm of RAIN, which was slightly below average (-5%). TEMP was at 27.4°C (+0.1°C) and RADPAR was at 1103 MJ/m² (-2%). BIOMSS was above the 15YA (+8%). CALF reached 98% which was slightly above average, and VCIx was 0.93. The graph of NDVI development shows that the crop

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.

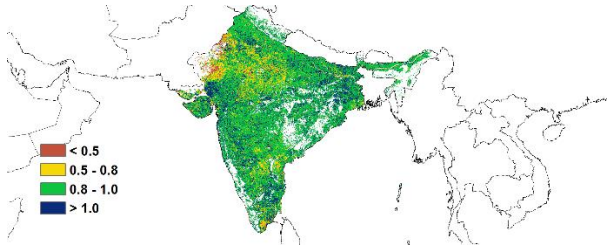
Figure 3.20 India's crop condition, July - October 2021



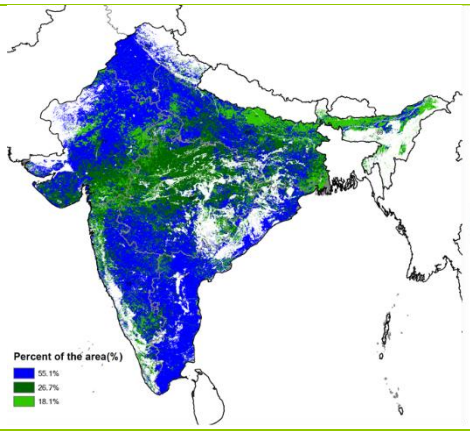
(a). Phenology of major crops



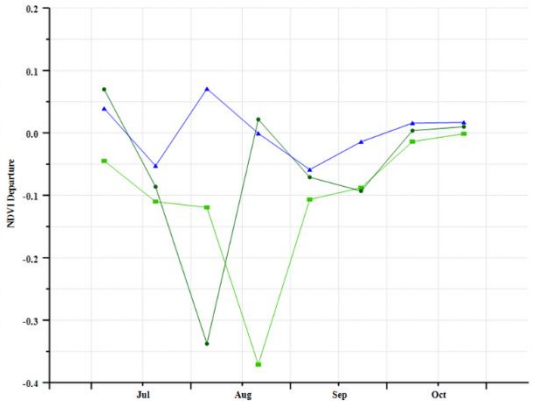
(b) Crop condition development graph based on NDVI



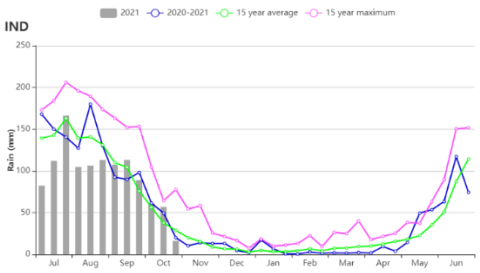
(c) Maximum VCI



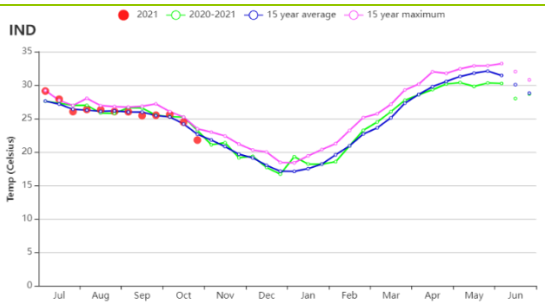
(d) Spatial NDVI patterns compared to 5YA



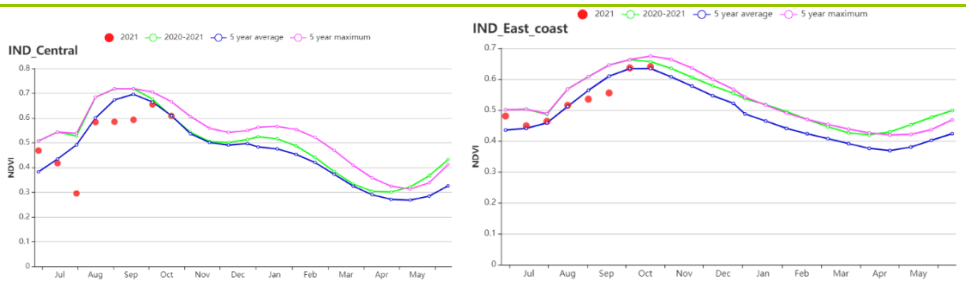
(e) NDVI profiles



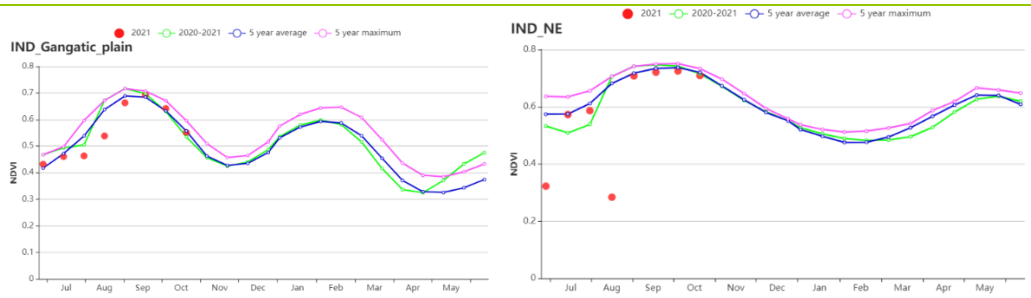
(f) Rainfall profiles



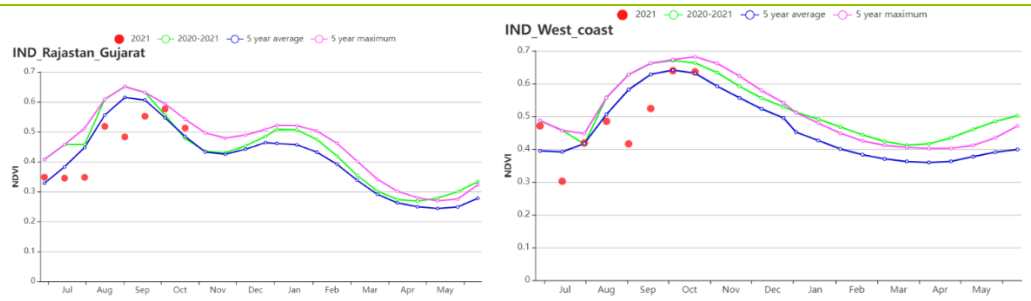
(g) Temperature profiles



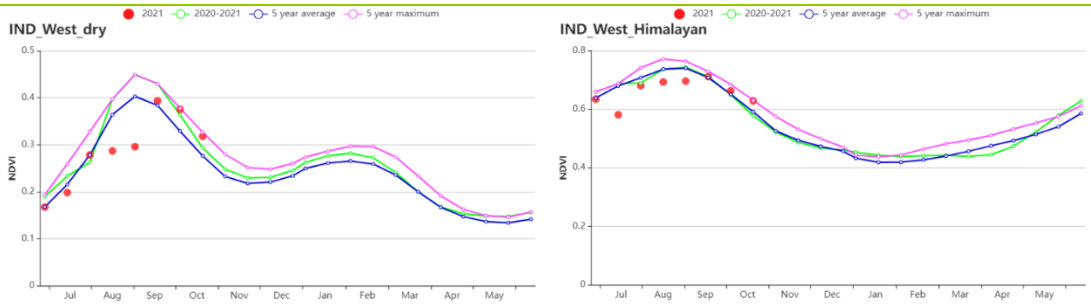
(h) Crop condition development graph based on NDVI (Deccan Plateau (left) and Eastern Coastal Region (right))



(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, July - October 2021

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Deccan Plateau	866	-21	25.8	0.4	1075	2	1247	-2
Eastern coastal region	854	-20	26.7	0.2	1130	2	1292	-3
Gangatic plain	1084	-5	27.4	0.1	1103	-2	1362	8
Assam and north-eastern regions	2078	-14	24.1	0.2	951	2	1440	2
Agriculture areas in	1208	27	27.0	-0.4	1026	-4	1284	22

Rajastan and Gujarat								
Western coastal region	1336	-7	23.9	-0.1	1021	6	1327	6
North-western dry region	601	68	30.2	-0.6	1194	-1	936	44
Western Himalayan region	472	-49	19.2	0.5	1250	4	754	-12

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

Region	Cropped arable land fraction		Cropping intensity		Maximum VCI
	Current (%)	Departure (%)	Current (%)	Departure (%)	Current
Deccan Plateau	99	0	135	13	0.92
Eastern coastal region	95	4	110	-1	0.92
Gangatic plain	98	0	195	17	0.93
Assam and north-eastern regions	96	1	0	0	0.93
Agriculture areas in Rajastan and Gujarat	94	0	146	15	0.89
Western coastal region	99	4	107	1	0.95
North-western dry region	44	3	132	5	0.72
Western Himalayan region	99	0	122	9	0.94

[IRN] Iran

The harvest of summer crops (irrigated potatoes and rice) was almost over by the end of August, while winter crops (wheat and barley) started to be sown in September. According to the NDVI-based crop condition development graph, the crop conditions in Iran during this whole monitoring period were worse than the 5-year average. The photosynthetically active radiation was 1% below average. The average temperature was 0.1℃ above average, whereas the accumulative rainfall was up by 21%. The potential biomass was 2% higher than the 15-year average. The national maximum vegetation condition index (VCIx) was 0.45, while the cropped arable land fraction (CALF) was 6% smaller than the average of the past 5-years.

The NDVI spatial patterns show that from July to October, 3.7% (marked in blue) and 19.5% (marked in red) of the cropped area had above or slightly above the 5-year average crop conditions throughout the whole monitoring period. The remaining cropped area experienced below-average crop conditions during the whole monitoring period. Four percent of the croped area (marked in orange) had the worst below-average crop conditions, mainly located in some parts of Mazadaran, Golestan, and Khuzestan. The spatial pattern of maximum Vegetation Condition Index (VCIx) was in accord with the spatial distribution of the NDVI profiles. Although crop production during this period relies on irrigation, the generally drier-than-usual conditions had a negative impact on production. The prolonged drought will also have a negative impact on the sowing and establishment of rainfed winter wheat, which is mainly grown in the north-west of the country and Fars province.

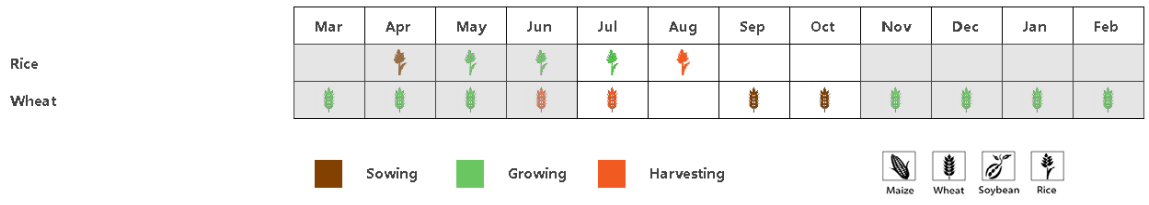
Regional analysis

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

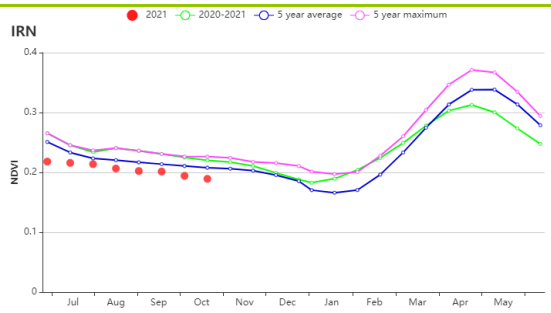
In the **semi-arid to the subtropical hilly region in the west and the north**, the cumulative precipitation during the monitoring period was 77 mm, 16% higher than average. Temperature was near average and photosynthetically active radiation was slightly below the 15YA (-1%). The potential biomass was 2% lower than average. Crop conditions were below the 5-year average. The proportion of cultivated land was 11%, which was 6% higher than the 5YA. Cropping intensity (CI) was slightly above the 5YA (+3%). The average VCIx for this region was 0.47, indicating an unfavorable crop prospect.

In the **coastal lowland in the arid red sea plain area**, the temperature was 0.4℃ above average. Although the accumulated precipitation was 219% above average, the total was only 35 mm. The photosynthetically active radiation was average. The potential biomass was 50% higher than the 15-year average. Crop conditions were generally around the 5-year average. During the monitoring period, CALF was 2% below the 5YA, while CI was 103% (2% below the 5YA). The value of VCIx was 0.37, also indicating unfavorable crop prospects.

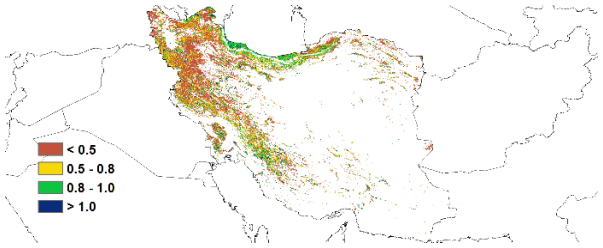
Figure 3.21 Iran's crop condition, July - October 2021



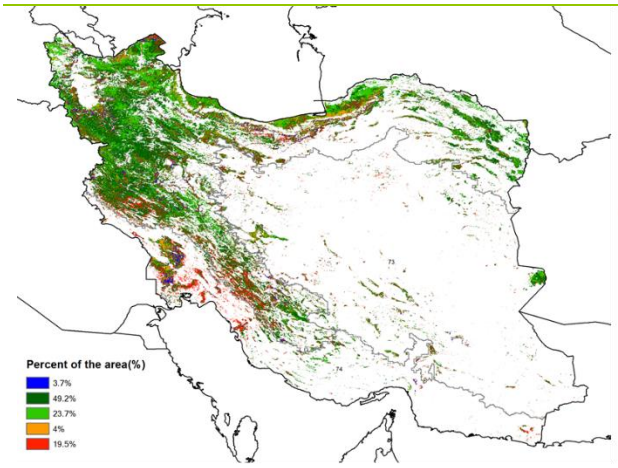
(a). Phenology of major crops



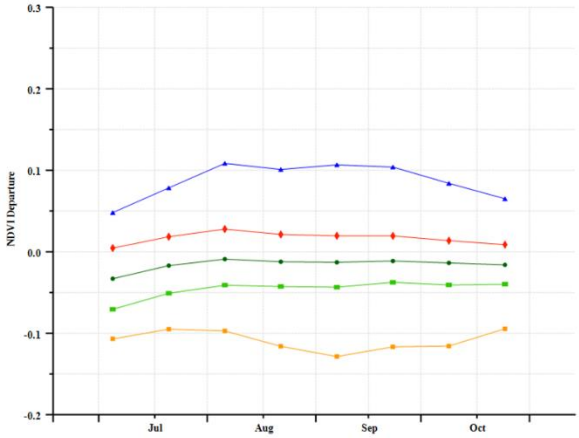
(b) Crop condition development graph based on NDVI



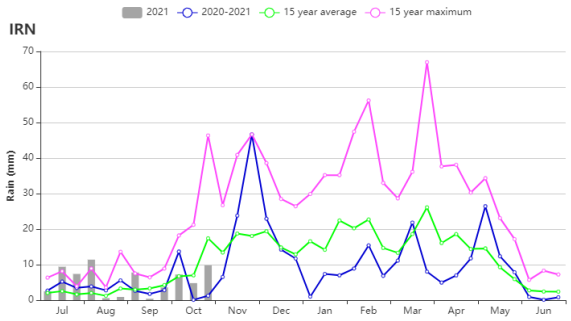
(c) Maximum VCI



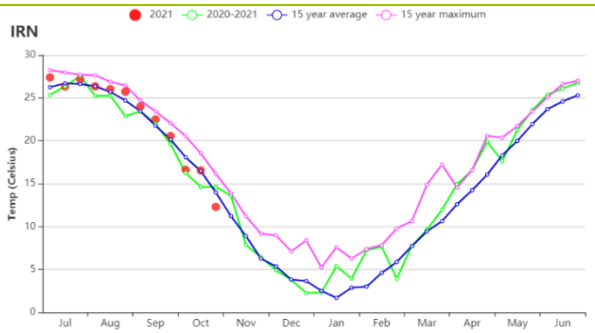
(d) Spatial NDVI patterns compared to 5YA



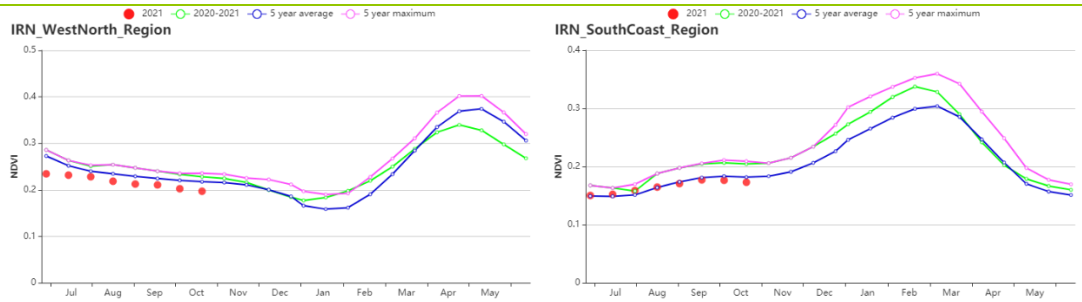
(e) NDVI profiles



(f) Rainfall profiles



(g) Temperature profiles



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

Table 3. 34 Iran's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, July - October 2021

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Semi-arid to sub-tropical hills of	77	16	21.0	0.0	1386	-1	224	-2

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
the west and north								
Arid Red Sea coastal low hills and plains	35	219	33.3	0.4	1463	0	136	50

Table 3. 35 Iran's agronomic indicators by sub-national regions, current season's values and departure from 5YA, July - October 2021

Region	Cropped arable land fraction		Cropping intensity		Maximum VCI
	Current (%)	Departure (%)	Current (%)	Departure (%)	Current
Semi-arid to sub-tropical hills of the west and north	11	-6	106	3	0.47
Arid Red Sea coastal low hills and plains	7	-2	103	-2	0.37

[ITA] Italy

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

At the national level, rainfall (-6%) and solar radiation (RADPAR -1%) were below the 15YA. The temperature was unchanged. Precipitation in July and September was near average, which was favorable for wheat growth. Potential biomass production was 5% below average. CALF was 82%, and VCIx was 0.71. Except for a few areas in the south and central part of the country, the VCIx was above 0.80 for most of the cultivated land. The crop condition development graph indicates that NDVI was below average in this reporting period. In summary, the overall crop conditions during this period were near average.

About 15.7% of the crops (areas in blue color), mainly located in the north Italy (Piemonte and Lombardia), showed a positive departure from the 5YA from July to October. 12.8% of arable land experienced below-average crop conditions (areas in red color), scattered in Umbria, Molise and Marche. About 22.8% of arable land (mainly in Lombardia, Lazio and Sardegna) experienced above-average crop conditions between July and August, below-average conditions between August and October. On about 22.4% of arable land, NDVI was near average in September, and then below average in October. For the remaining 26.2% of arable land, NDVI remained below average in July and August, and above average in September and October.

Regional analysis

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

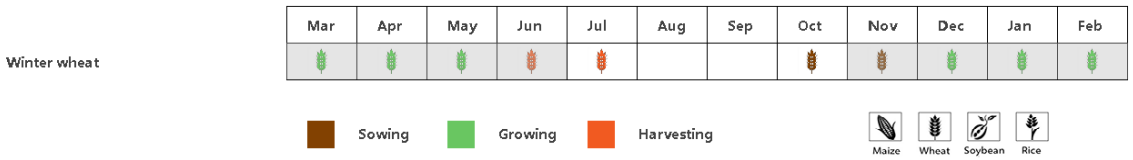
East coast (mainly in Puglia, Marche and Abruzzi) experienced below-average rainfall (RAIN -23%), unchanged temperature and unchanged solar radiation. The precipitation was below average in early August and September. The potential biomass production showed a decrease (BIOMSS -9%). VCIx was 0.59. The crop condition development graph indicates that NDVI was below the average of the past five years. The Cropping Intensity was 111%.

Crop production in the **Po Valley** (mainly in Piemonte, Lombardia and Veneto) was affected by slightly lower rainfall (RAIN -2%) and uchanged temperature and solar radiation. BIOMSS was below the 15YA by 5% and VCIx reached 0.83. The Cropping Intensity was 110%. The crop condition development graph indicates that the crop condition was near average during the entire reporting period. According to the agro-climatic indicators, a near-average output can be expected.

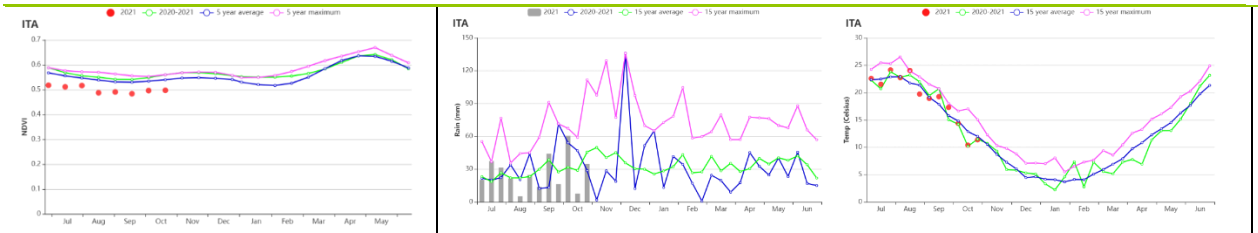
The Islands recorded a above-average precipitation (RAIN +26%) and temperature (TEMP +1°C). RADPAR was slightly below average (-1%). BIOMSS increased by 6% compared with the 15YA. The maximum VCI was only 0.59, the lowest among the four AEZs in Italy. The Cropping Intensity was 104%, which is the lowest in the four regions. NDVI was very close to average throughout the monitoring period. The crop production in this region is expected to be close to average.

In **Western Italy**, RAIN (-16%) and RADPAR (-1%) were all below average. The TEMP was unchanged. Although the precipitation was below average, it was sufficient for the growth of winter wheat in April and May, and the biomass production potential decreased in this region by 1%. The Cropping Intensity was 123%, which is the highest in the four regions. The NDVI was slightly below average. VCIx reached 0.69. CropWatch expects an average production.

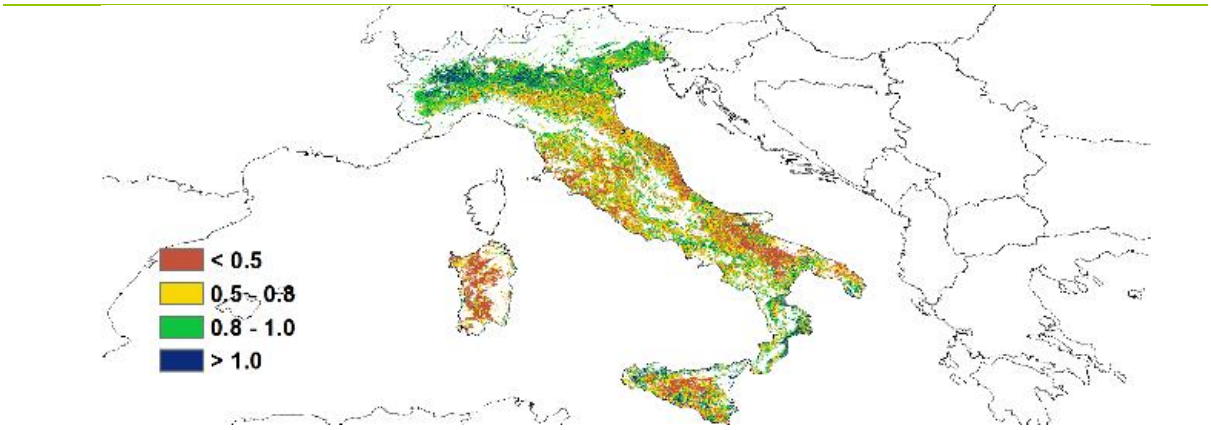
Figure 3.22 Italy's crop condition, July 2021- October 2021



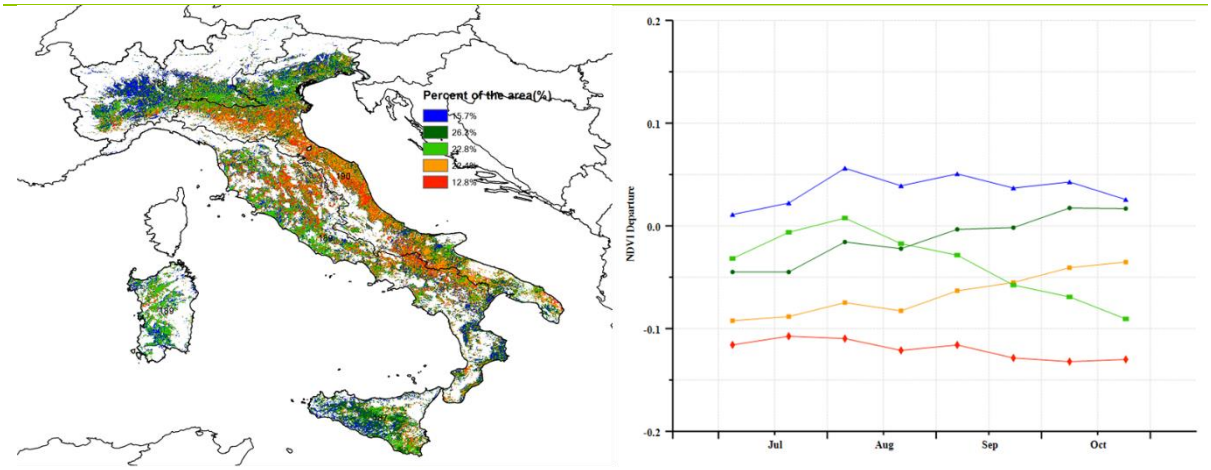
(a) Phenology of major crops



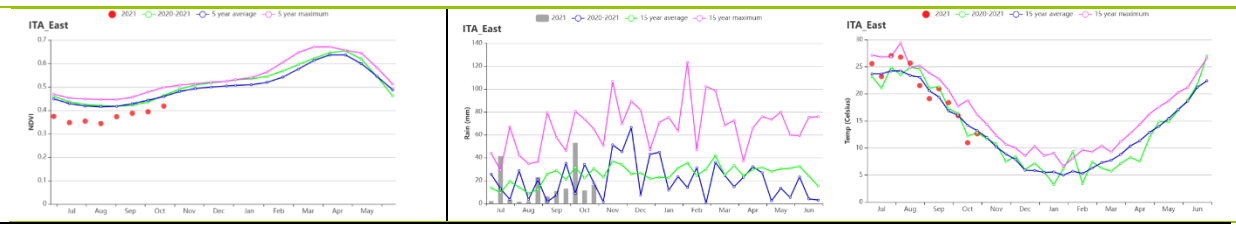
(b) Crop condition development graph based on NDVI, RAIN and TEMP (Italy).



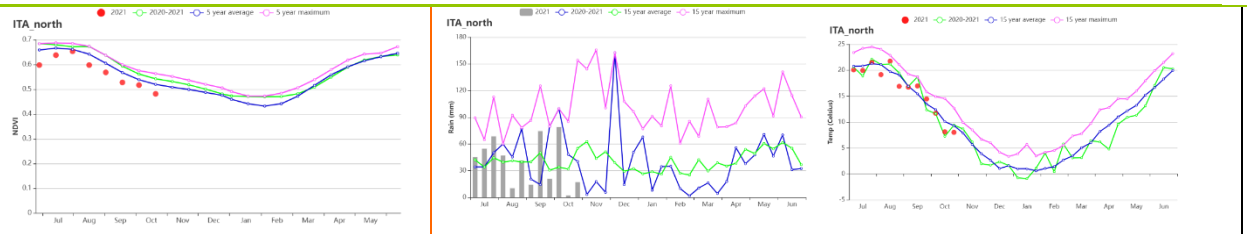
(c) Maximum VCI



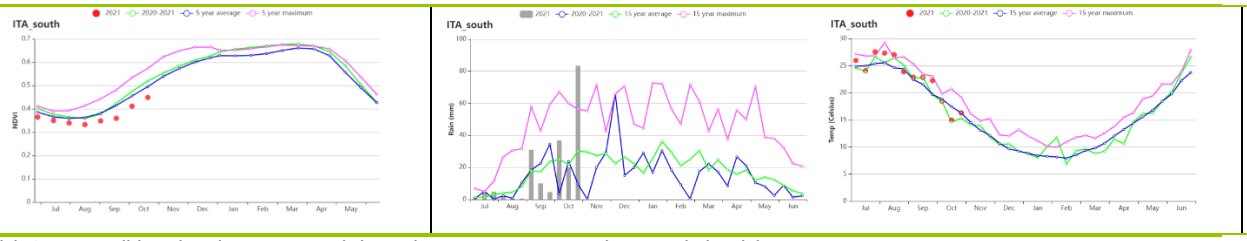
(d)Spatial distribution of NDVI profiles.



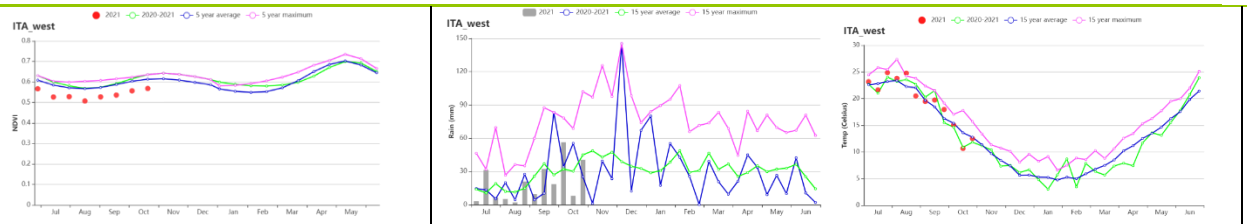
(e) Crop condition development graph based on NDVI, RAIN and TEMP (East Italy).



(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, April 2021-July 2021

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
East Coast	182	-23	21	0	1166	0	659	-9
Po Valley	475	-2	16	0	1075	0	836	-5
Islands	199	26	23	1	1268	-1	604	6
Western Italy	234	-16	20	0	1162	-1	697	-7

Table 3. 37 Italy's agronomic indicators by sub-national regions, current season's values and departure from 5YA, April 2021-July 2021

Region	Cropped arable land fraction		Maximum VCI
	Current (%)	Departure (%)	Current
East Coast	53	-20	0.59
Po Valley	99	0	0.83
Islands	53	-15	0.59
Western Italy	91	-4	0.69

[KAZ] Kazakhstan

This report covers the growth and harvest of spring wheat In Kazakhstan. The crop conditions were generally below average from July to October. Compared to the 15-year average, accumulated rainfall and radiation were above average (RAIN +23%, RADPAR +1%), while temperature was below average (TEMP -0.3°C). The dekadal precipitation was above the 15-year maximum in early and mid-July. The dekadal temperature reached the 15-year maximum in early July, while in October, it dropped by 4.5°C below average.

The national average maximum VCI index was 0.64 and the Cropped Arable Land Fraction (CALF) was below the 5YA by 26%. The cropping intensity (CI) was slightly below average by 1%. The spatial VCIx map matched well with the national crop condition development graphs. About 79.5% of croplands in most of the northern and central regions experienced unfavorable crop conditions from July to August. About 21.5% of croplands, which were mainly distributed in the north of Pavlodar and Shyghys Kazakhstan states, experienced favorable crop conditions from July to September. Although there was above-average railfall in July, the drier-than-usual conditions from April to June had a negative impact on the growth of spring wheat. Therefore, the spring wheat production was below average, as indicated by the NDVI curves which trended below the 5YA and last year's data.

Regional analysis

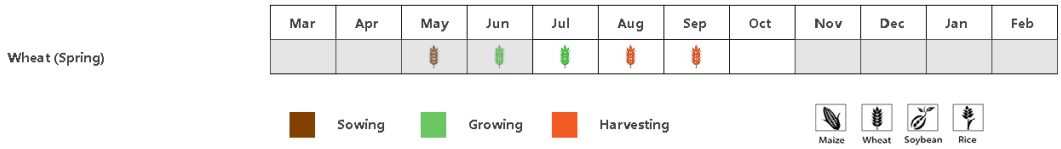
Based on cropping systems, climatic zones and topographic conditions, four sub-national agro-ecological regions can be distinguished for Kazakhstan, among which three are relevant for crop cultivation: the Northern region (112), the Eastern plateau and southeastern region (111) and the South region (110).

The Northern region is the main spring wheat production area. Although the accumulated rainfall was above average by 20%, the rainfall deficit in the last monitoring season had a significant negative impact on wheat growth. According to NDVI profiles, crop conditions were below average during the monitoring period. The average VCIx for this region was 0.60, and the proportion of cultivated land was 31% lower than the average. The cropping intensity (CI) was slightly below average by 1%. The spring wheat production is estimated to be below average.

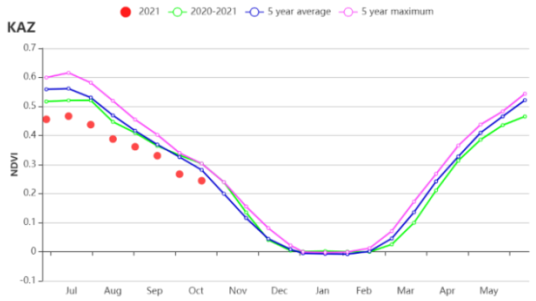
The Eastern plateau and Southeastern region had the largest positive precipitation departure (RAIN +24%) among the three regions, while temperature was below average (TEMP -0.3°C). Crop conditions in this region were below average during this reporting period. The average VCIx for this region was 0.76, and CALF was below average by 9%. The cropping intensity (CI) was close to the five-year average. Outputs for spring wheat are unfavorable.

The South region received 42 mm of rainfall, which was the lowest among the three regions. Due to the deficit of rainfall (RAIN -24%), the potential biomass decreased by 13%. The average VCIx for this region was 0.64 and CALF was below average by 22%. The cropping intensity (CI) was near average. The NDVI profiles show poor crop condition in this season. The lower soil moisture due to the rainfall deficit indicate unfavorable conditions for the sowing of winter crops in this region.

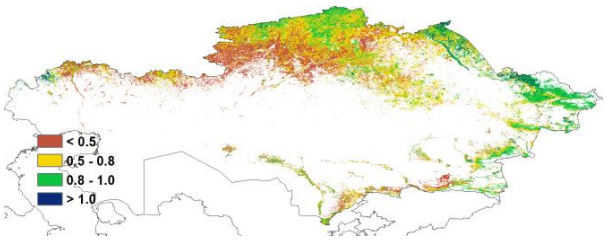
Figure 3.23 Kazakhstan’s crop condition, July – October 2021



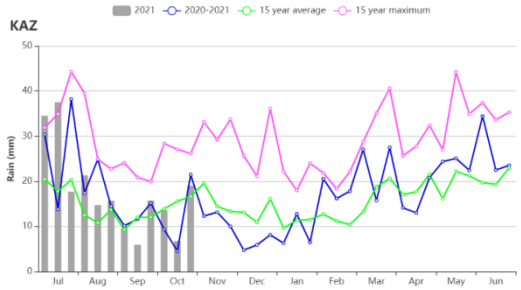
(a). Phenology of major crops



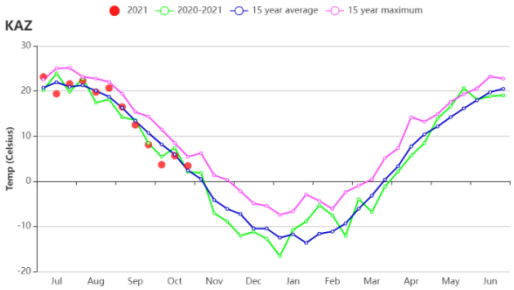
(b) Crop condition development graph based on NDVI



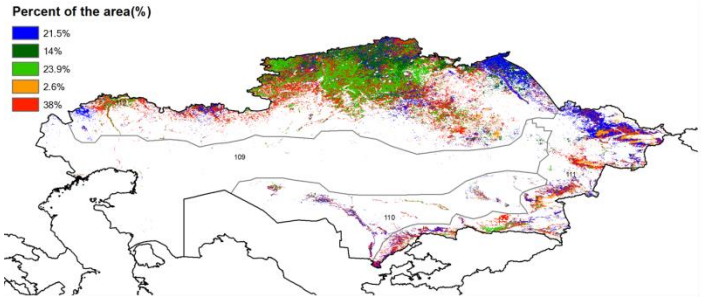
(c) Maximum VCI



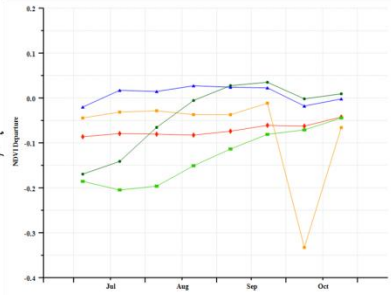
(d) Rainfall Index



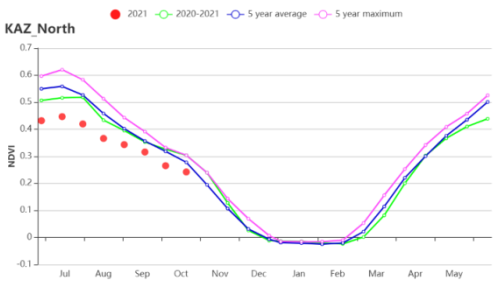
(e) Temperature Index



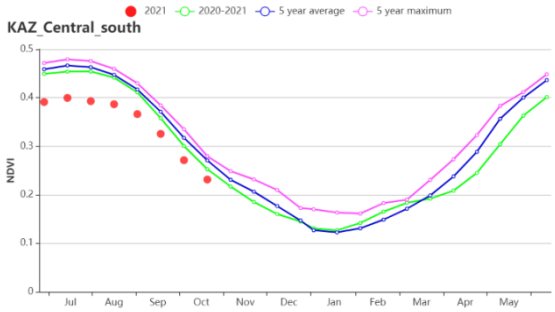
(f) Spatial NDVI patterns compared to 5YA



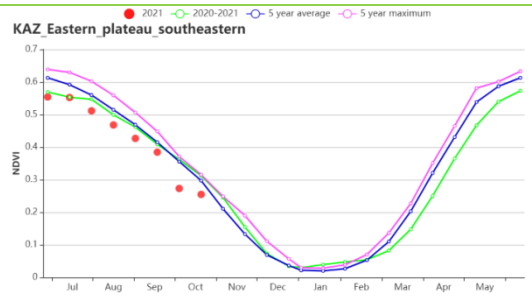
(g) NDVI profiles



(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 3.1 Kazakhstan agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, July – October 2021

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Northern region	198	20	14.2	-0.4	944	2	616	9
Eastern plateau and southeastern region	281	24	14.5	-0.3	1155	0	611	8
South region	42	-24	21.7	0.2	1273	2	298	-13

Table 3.2 Kazakhstan, agronomic indicators by sub-national regions, current season's values and departure from 5YA, July - October 2021

Region	Cropped arable land fraction		Cropping intensity		Maximum VCI
	Current (%)	Departure (%)	Current (%)	Departure (%)	Current
Northern region	57	-31	99	-1	0.60
Eastern plateau and southeastern region	75	-9	100	0	0.76
South region	46	-22	100	0	0.64

[KEN] Kenya

Kenya has two rainy seasons. The long rainy season lasts from March to May and the short rainy season lasts from October to December. Maize can be grown during the long and short rains, whereas wheat is grown during the long rains only. During this reporting period, the long rain maize and wheat were harvested, and the short rain maize was at the sowing stage.

At the national scale, precipitation was 228 mm, 34% below average. Temperature and radiation was close to average. Due to the shortage of rainfall, the BIOMSS was 13% lower than average. At the sub-national level, almost all regions received less rainfall. The NDVI development graph at the national level shows lower-than-average NDVI values from July to October, it indicates crop growth conditions were significantly below average. This was mainly due to a significant decrease in rainfall. According to the NDVI clusters and the corresponding NDVI departure profiles, western Kenya accounting for 45.6% of national cropland (areas in green color) had near-average NDVI values, while other areas showed significant deviations in crop growth. This was in agreement with the maximum VCI graph which shows relatively low VCI between 0.5 and 0.8 in the central and southeastern regions. In general, crops in Kenya were affected by the drought, with the exception of the north-western region.

Regional analysis

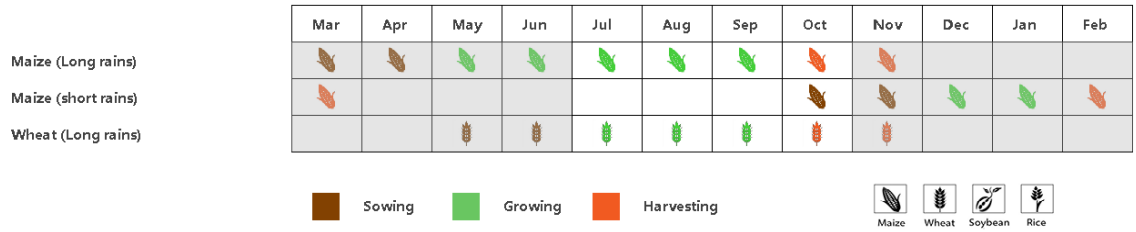
The largest negative departure in RAIN were observed in the **Eastern coastal region**, with 0.3°C above average TEMP and 5% above average RADPAR. The shortage of rainfall resulted in a 9% drop of BIOMSS and significant drop of NDVI compared with the 5YA throughout the monitoring period. The drought conditions also resulted in a reduction of crops planted area as indicated by a 24% drop in CALF compared to the 5YA. The maximum VCI was only 0.61. The Cropping Intensity was 143%, which was the highest in the four regions. In general, the crop condition were unfavorable in the coastal area with poor prospect for livestock and crop production.

The **Highland agriculture zone** recorded 248 mm of rain, which was below the 15YA (-31%). Although temperatures and RADPAR were close to average, significantly lower precipitation resulted in significant reductions in biomass (-13%). The NDVI was slightly below the 5YA from July to October. The maximum VCI value recorded was 0.71. The CALF was reduced (-13%) to 71%. The Cropping Intensity was 142%. Overall, crop growth has been severely affected by drought conditions in the upland agricultural areas where rainfall was below average.

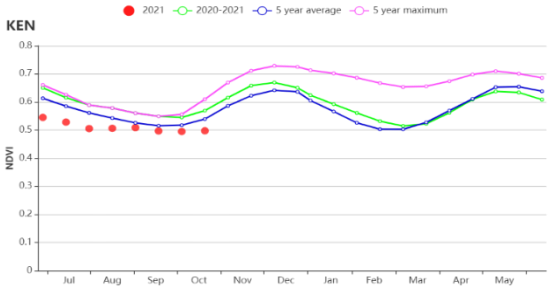
In **Northern rangelands region**, the precipitation was below average at 173 mm (-34%). Temperature was close to the 15YA, whereas RADPAR was above average (+2%). BIOMSS was below average (-12%). The below-average trend of its crop condition development graph indicates that the region was affected by drought. The maximum VCI was only 0.58, the lowest among the four AEZs in Kenya. Furthermore, the CALF was reduced (-25%) to 48%. The Cropping Intensity was 139%. All in all, the situation of crop growth in this area was very unfavorable.

The **Southwest region** includes the districts Narok, Kajiado, Kisumu, Nakuru, and Embu. Precipitation was at 309 mm，41% below average. The following indicator values were observed: TEMP 19.1°C (-0.1°C); RADPAR (-3%) and BIOMSS (-17%) both decreased. NDVI values generally closely followed the five-year average. Despite the large variation in precipitation, its CALF and RADPAR were stable and the VCIx value remained at a level of 0.85. The Cropping Intensity was 138%, which is the lowest in the four regions. This indicates normal crop growth in this region.

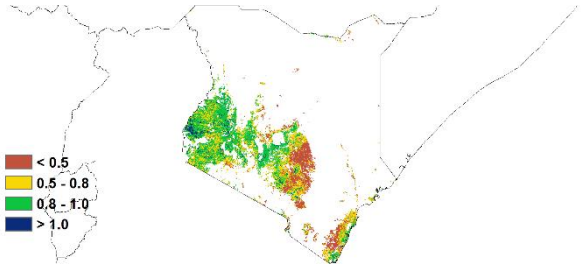
Figure 3.24 Kenya's crop condition, July-October 2021



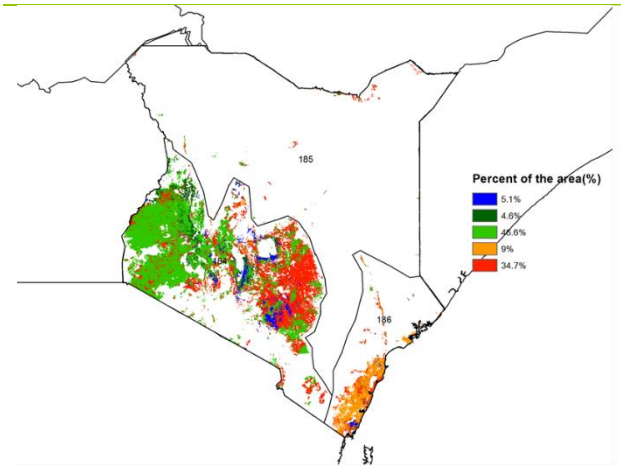
(a) Phenology of major crops



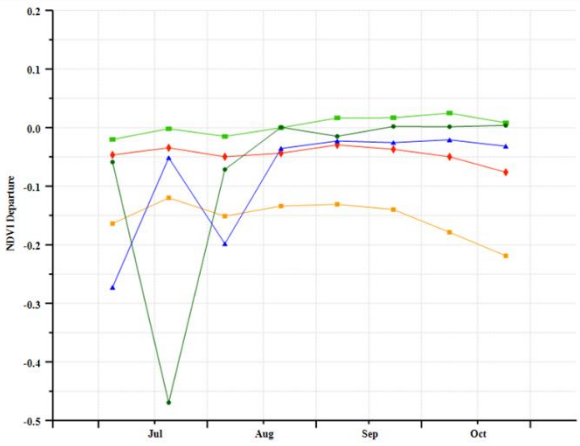
(b) Crop condition development graph based on NDVI



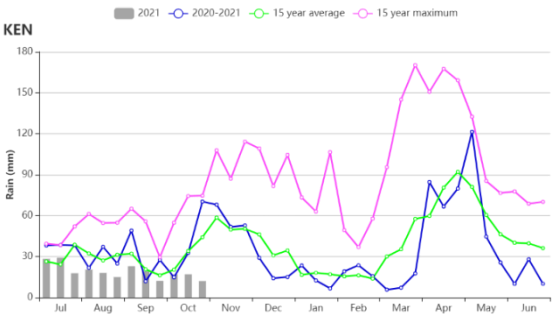
(c) Maximum VCI



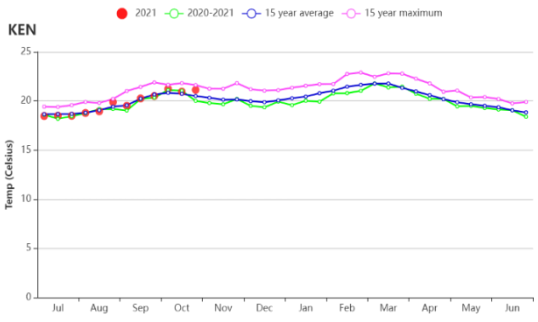
(d) Spatial NDVI patterns compared to 5YA



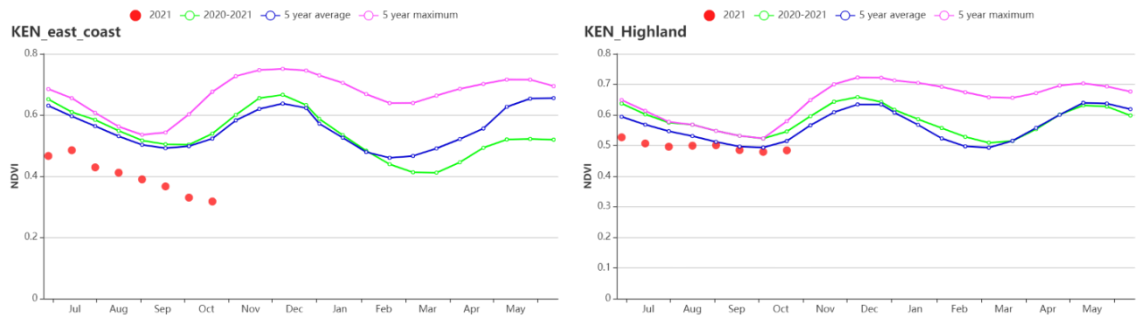
(e) NDVI profiles



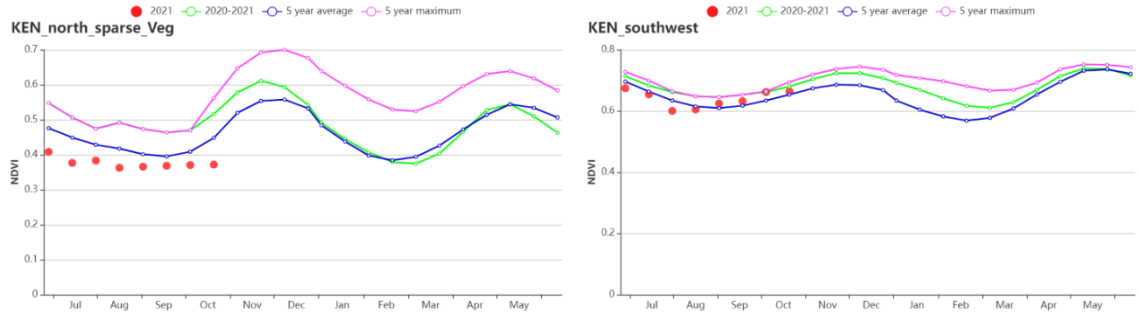
(f) Time series rainfall



(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, July -October 2021

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m2)	Departure (%)	Current (gDM/m2)	Departure (%)
Coast	148	-41	24.6	0.3	1288	7	773	-9
Highland agriculture zone	248	-31	18.4	0.1	1120	-1	598	-13
nothern rangelands	173	-34	22.9	0.2	1259	2	630	-12
South-west	309	-41	19.1	-0.1	1177	-3	813	-17

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

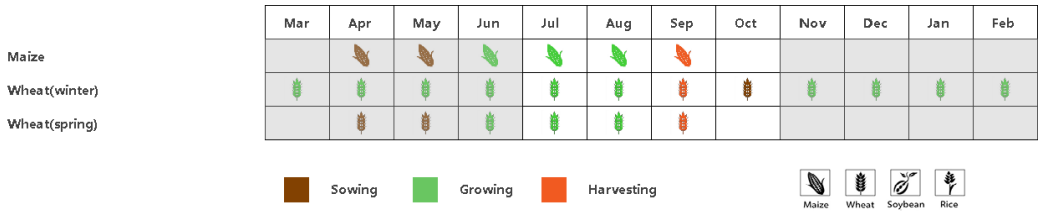
Region	Cropped arable land fraction		Maximum VCI	Cropping Intensity CI	
	Current (%)	Departure (%)	Current	Current (%)	Departure (%)
Coast	71	-24	0.61	143	2
Highland agriculture zone	71	-13	0.71	142	4
northern	48	-25	0.58	139	-3

rangelands					
South-west	100	1	0.85	138	-10

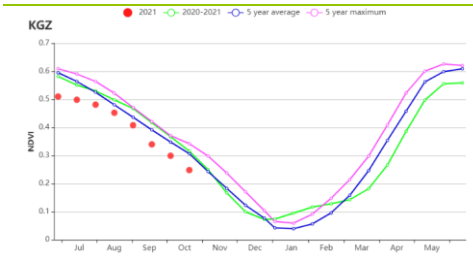
[KGZ] Kyrgyzstan

The reporting period covers the growth and harvest of wheat and maize. On the whole, crop conditions were below the 5-year average throughout the whole monitoring period. Among the CropWatch agro-climatic indicators, RAIN (+24%) increased largely, RADPAR (+1%) was slightly above average, while TEMP (-0.2 ℃) was below average. The combination of these factors resulted in a slightly below-average BIOMSS (-1%). as compared to the 15YA. The time series precipitation profile shows that precipitation was higher than average and even exceeded the 15-year maximum in early July. The temperature profile indicates that temperatures were a bit lower than the 15-year average in middle July, early to middle August and October. The spatial NDVI clustering profile shows that only 15.5% of the cultivated area (marked in blue) had average or above-average crop conditions, the remaining cultivated area all had below-average crop conditions. 42% of the cultivated area (marked in orange and dark green) had below-average crop conditions at the beginning of the monitoring period and then had the tendency to recover to near-average crop conditions. 10.4% of the cultivated area had close-to-average crop conditions, and then the crop conditions dropped to an even lower level at the end of the monitoring period, mainly located in northeastern Osh, eastern Talas, southeastern Jalal-Abad and central Naryn. The spatial pattern of maximum Vegetation Condition Index (VCIx) was in accord with the spatial distribution of the NDVI profiles. CALF decreased by 11% and the nationwide VCIx average was 0.73, which is in line with the unfavorable NDVI trend. Cropping intensity is 99%, slightly down 1%. Crop conditions in Kyrgyzstan can be assessed as unfavorable, and the crop prospect is not promising.

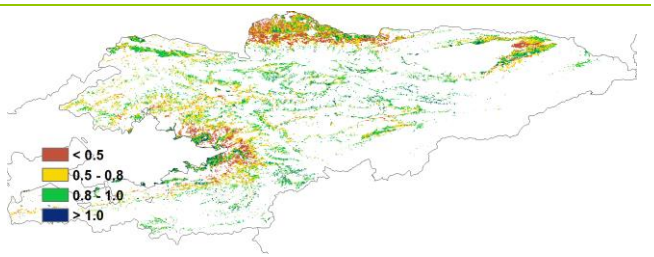
Figure 3.25 Kyrgyzstan's crop condition, July - October 2021



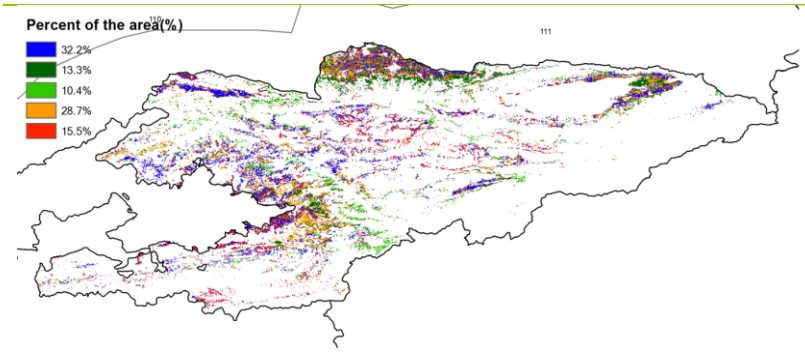
(a). Phenology of major crops



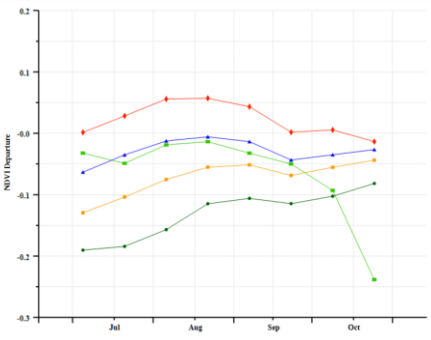
(b) Crop condition development graph based on NDVI



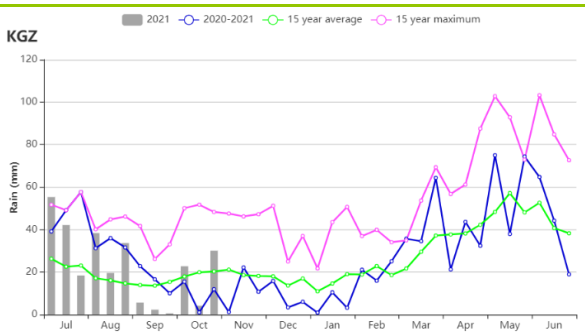
(c) Maximum VCI



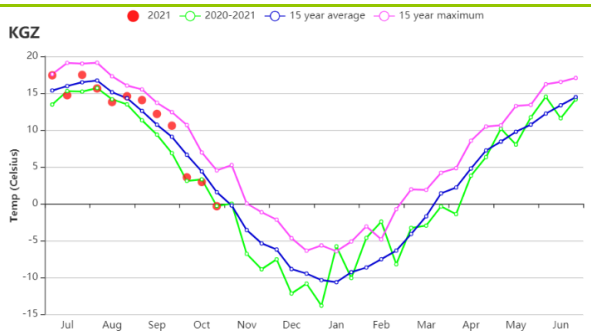
(d) Spatial NDVI patterns compared to 5YA



(e) NDVI profiles



(f) Rainfall profiles



(g) Temperature profiles

Table 3.38 Kyrgyzstan's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, July - October 2021

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Kyrgyzstan	273	24	11.4	-0.2	1304	1	474	-1

Table 3.39 Kyrgyzstan's agronomic indicators by sub-national regions, current season's values and departure from 5YA, July - October 2021

Region	Cropped arable land fraction		Cropping intensity		Maximum VCI
	Current (%)	Departure (%)	Current (%)	Departure (%)	Current
Kyrgyzstan	80	-11	99	-1	0.73

[KHM] Cambodia

This monitoring period covers the wet season in Cambodia, which lasts from May to October. The planting period of wet-season early rice and floating rice ended in July. It was followed by medium rice and late rice, which was completed in September and October, respectively. Harvest of the soybean and wet season maize ended in August and October, respectively.

Cambodia experienced wetter weather than usual during this monitoring period. As shown by the agro-climatic indicators, the precipitation (RAIN +5%) was above the 15YA, which can mainly be attributed to several tropical storms. Both the typhoon Cempakm in July and the tropical storms in September brought strong wind and rain, damaged the crops and decreased the NDVI. This is reflected in the NDVI profiles, although cloud cover in the satellite images can also cause large negative departures in NDVI. Temperatures were near average, and the radiation slightly increased (RADPAR +1%). The estimated potential biomass increased (BIOMSS +2%). The CALF was higher than average by 1% and the VCIx value was at 0.9. Moreover, the NDVI for the country was slightly lower than the average at the end of the monitoring period. All in all, the crop conditions were close to normal in Cambodia. The NDVI of 10.7% (orange color) of the arable land is mainly located in the southeast of Banteay Meanchey and the middle of Kampong Thom. It remained near or slightly below average until mid-August. For about 25.8% of the cropland, stable and slightly higher-than-average NDVI was observed. These croplands (blue color) were mainly located in Kandal, southern Preyveng, southern Svay Rieng and other areas scattered around the Tonle-Sap. The rest of the croplands (light green, dark green and red color) remained slightly below average for most of the monitoring period. All in all, the crop conditions were below average in the important Tonle Sap Lake area and near average for the rest of the country.

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.

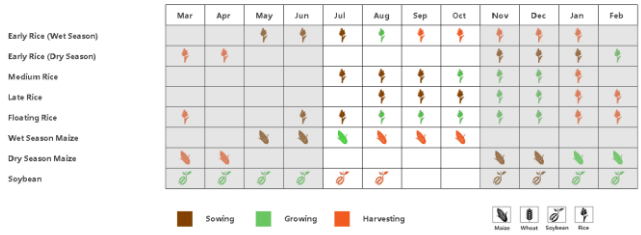
For the **Tonle Sap Lake** area, the rainfall (RAIN) increased by 12% while the temperature (TEMP) and radiation (RADPAR) were near average. In addition, the estimated biomass (BIOMSS) grew by 3%. Inflow from the Mekong River remained far below the long-term average, resulting in negative NDVI departures. As a result, the crop condition in this region was estimated below average.

The **Mekong valley** region experienced relatively dryer weather. The rainfall dropped by 2% (RAIN) and temperature increased by 0.2℃. The radiation was higher than average (RADPAR +1%). This resulted in a biomass estimate that was almost near average. According to the NDVI profile, although the NDVI fluctuated all the time, it recovered to average levels at the end, indicating the crop condition in this region was close to normal.

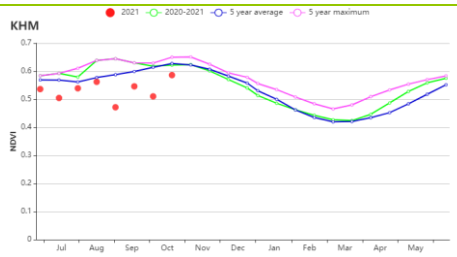
In the **Northern plain and northeast** region, the precipitation (RAIN) was 5% higher than average, accompanied by average temperature (TEMP) and above-average radiation (RADPAR, +3%). The resulted biomass (BIOMSS) increased by 2% and the VCIx value reached 0.93, which was the largest for all four regions. Moreover, the CALF stayed at 99%. All the indicators show that the crop growth for this region was good.

The **Southwest Hilly** region went through a wetter (RAIN, +9%) and slightly warmer period (TEMP, +0.2℃) compared to the 15YA. Although the radiation decreased (RADPAR -3%), the estimated biomass was near average (BIOMSS, no change). According to the NDVI profile, although the NDVI fluctuated, it recovered to average levels at the end of monitoring period, which indicates normal crop conditions.

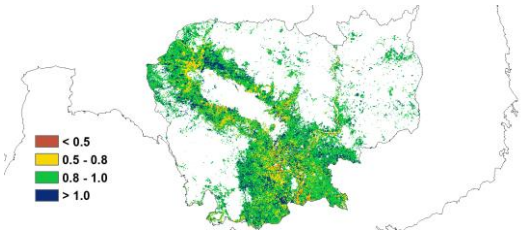
Figure 3.26 Cambodia's crop condition, July - October 2021



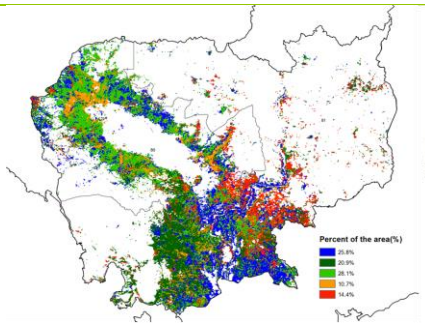
(a). Phenology of major crops



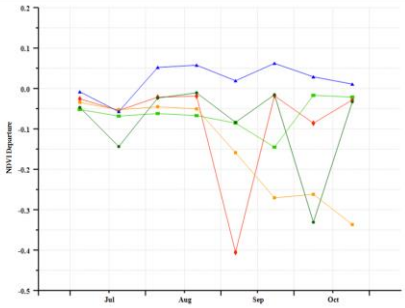
(b) Crop condition development graph based on NDVI



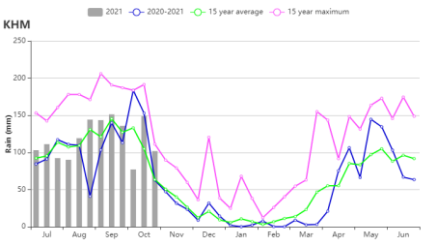
(c) Maximum VCI



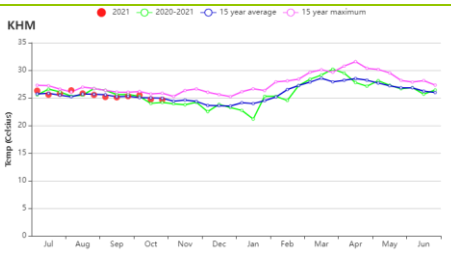
(d) Spatial NDVI patterns compared to 5YA



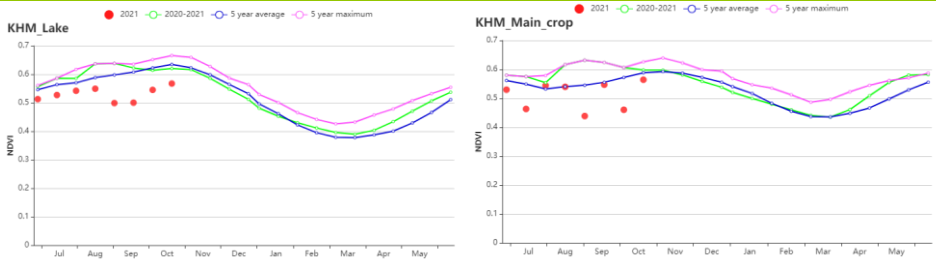
(e) NDVI profiles



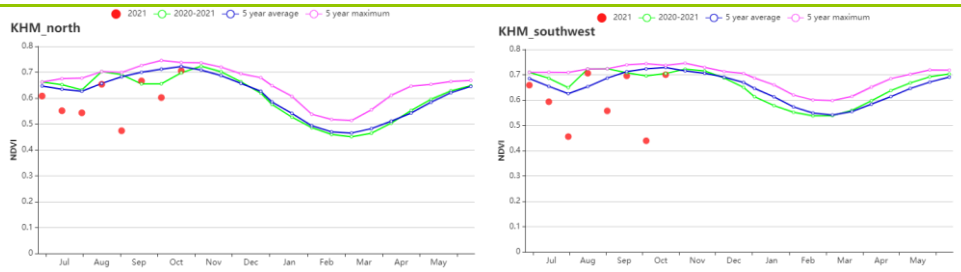
(f) Rainfall profiles



(g) Temperature profiles



(h) Crop condition development graph based on NDVI_Tonle-sap (left) and NDVI_Mekong valley (right)



(i) Crop condition development graph based on NDVI (Northern plain and northeast (left), Southwest Hilly region (right))

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

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Tonle-sap	1253	12	25.7	0.1	1102	0	1593	3
Mekong valley	1188	-2	26.0	0.2	1123	1	1604	0
Northern plain and northeast	1668	5	25.2	0.0	1089	3	1624	2
Southwest Hilly region	1367	9	24.6	0.2	1058	-3	1540	0

Table 3.41 Cambodia's agronomic indicators by sub-national regions, current season's values and departure from 5YA, July - October 2021

Region	Cropped arable land fraction		Cropping intensity		Maximum VCI
	Current (%)	Departure (%)	Current (%)	Departure (%)	Current
Tonle-sap	99	1	106	-8	0.90
Mekong valley	96	1	117	-6	0.90
Northern plain and northeast	99	0	102	-13	0.93
Southwest Hilly region	99	0	106	-17	0.93

[LKA] Sri Lanka

This report mainly covers the second season (Yala) of Sri Lanka, including the growing and harvesting of rice and maize from July to September, as well as the main season (Maha) early sowing of the crops in October. According to the CropWatch monitoring results, crop conditions were assessed as slightly below average for the monitoring period.

During this period, the country experienced the Southwest-Monsoon from July to September and the Second Inter-monsoon in October, during which the whole island experienced wide spread rain with strong winds. At the national level, precipitation was significantly above the 15YA (RAIN +33%), temperature was near average (TEMP -0.1°C) while radiation experienced a minor increase (RADPAR +4%). The remarkable increase of rainfall in early July 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 12% 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 0.93.

As shown by the NDVI clusters map and profiles, nearly half of country's cropland showed above-average crop condition while the rest showed unfavorable situation with negative NDVI departures. These croplands were mainly distributed along the west coast of the country, including Provinces of North Western, Western, Southern and Sabaragamuwa, as well as scattered areas over Provinces of Northern Central and Eastern. The maximum VCI showed high values around the country excepted for some areas along the east coast.

Regional analysis

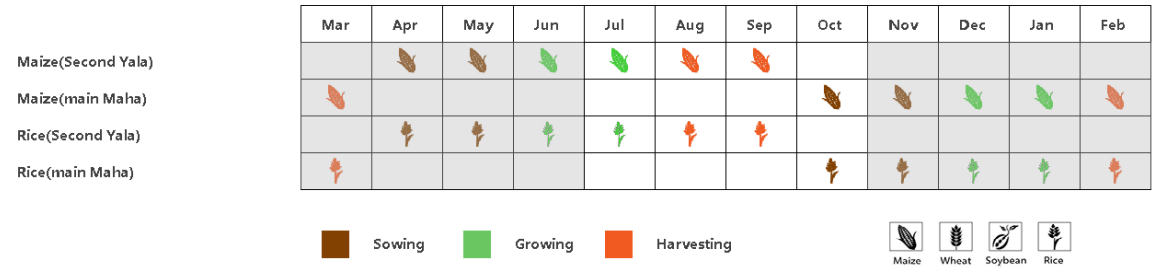
Based on the cropping system, climatic zones and topographic conditions, three sub-national agroecological regions can be distinguished for Sri Lanka. They are the Dry zone, the Wet zone, and the Intermediate zone.

In the **Dry zone**, the recorded RAIN (735 mm) was 23% above average. TEMP was 0.1°C below average and RADPAR was up by 4%, while BIOMSS increased by 16% as compared to the 15YA. CALF was near the 5YA level with 98% of cropland utilized. NDVI slightly fluctuated around the average. The VCIx for the zone was 0.91. Overall, crop conditions were near average for this zone.

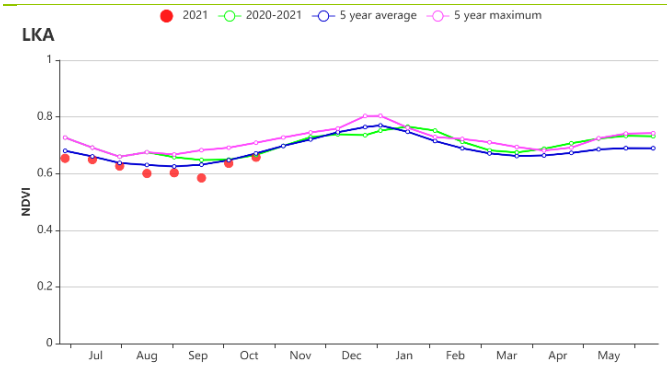
For the **Wet zone**, RAIN (2958 mm) was 39% above average as compared to the 15YA. TEMP was average and RADPAR increased by 3%. BIOMSS was 3% above the 15YA and cropland was fully utilized. NDVI values showed significant deviation from average for the whole period. The VCIx value for the zone was 0.98. Crop conditions were below average for this zone.

The **Intermediate zone** also experienced sufficient rain (1563 mm) with a 39% increase from the 15YA. TEMP dropped by 0.2°C and RADPAR was 11% above average compared to the 15YA. With full use of cropland, BIOMSS was 2% above 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.

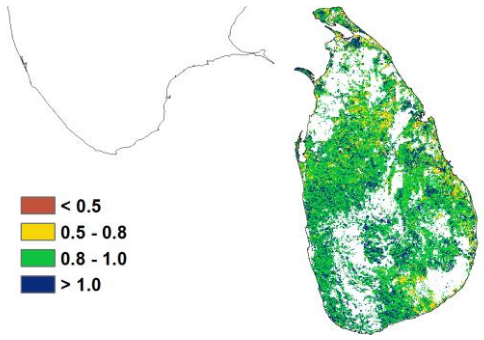
Figure 3.27 Sri Lanka's crop condition, July - October 2021



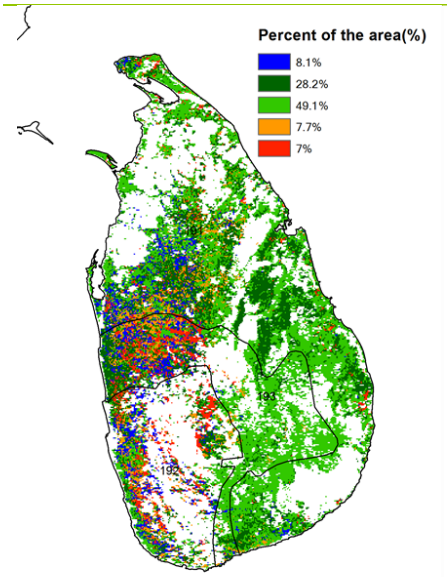
(a). Phenology of major crops



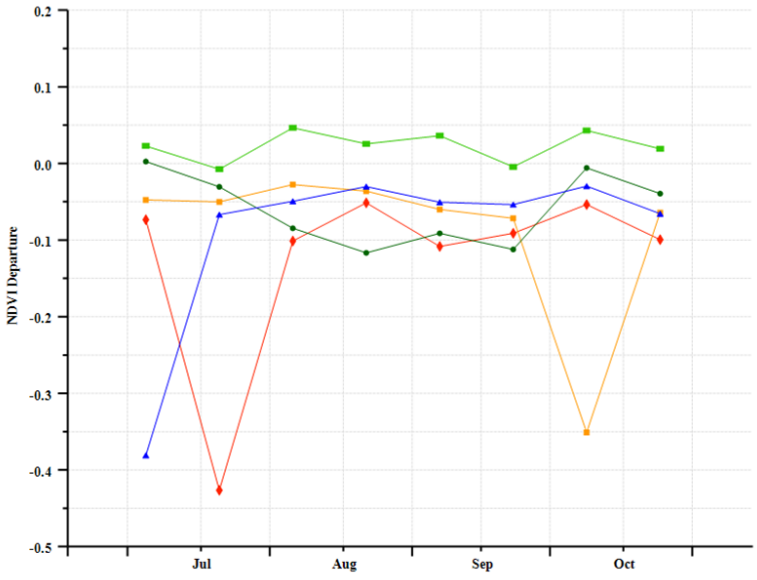
(b) Crop condition development graph based on NDVI



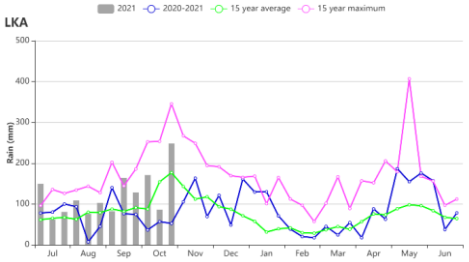
(c) Maximum VCI



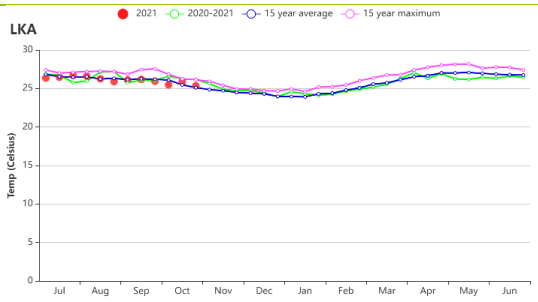
(d) Spatial NDVI patterns compared to 5YA



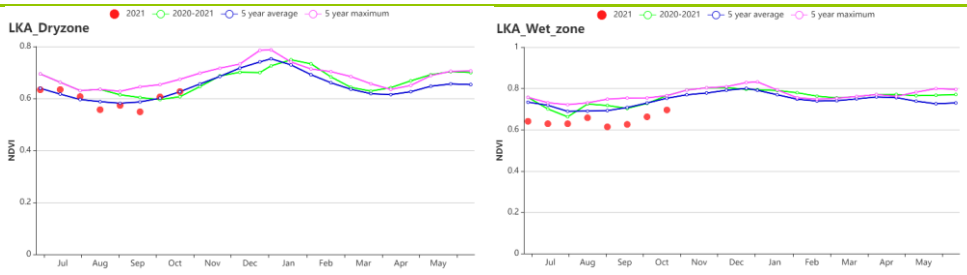
(e) NDVI profiles



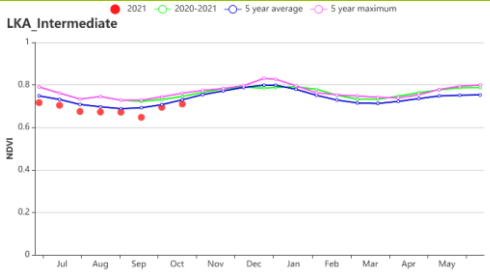
(f) Rainfall profiles



(g) Temperature profiles



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



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

Table 3.42 Sri Lanka's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, July - October 2021

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Dry zone	735	23	27.1	-0.1	1303	4	868	6
Wet zone	2958	39	24.1	0.0	1195	3	801	3
Intermediate zone	1563	39	24.5	-0.2	1177	2	769	2

Table 3.43 Sri Lanka's agronomic indicators by sub-national regions, current season's values and departure from 5YA, July - October 2021

Region	Cropped arable land fraction		Cropping intensity		Maximum VCI
	Current (%)	Departure (%)	Current (%)	Departure (%)	Current
Dry zone	98	1	147	3	0.91
Wet zone	100	0	106	-8	0.98
Intermediate zone	98	1	147	3	0.91

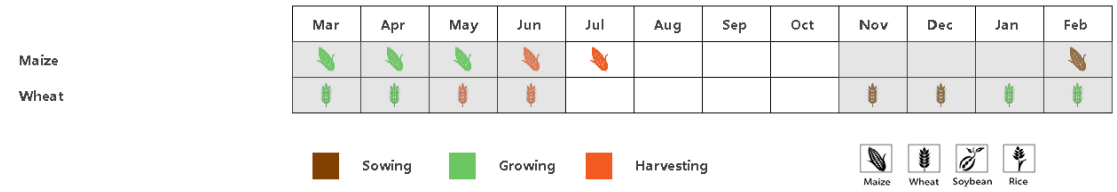
[MAR] Morocco

The reporting interval (July - October) covers only a part of irrigated maize harvested in July; no cereal crops are grown during this monitoring period (a slack season). The sowing of winter wheat starts in November. The cumulative rainfall was 38 mm, which is lower than the 15-year average (15YA) by 56%. The rainfall profile shows that the rainfall fell mainly during mid-September (> 20 mm). The average temperature was 22.9°C, which was higher than the 15YA by only 0.2°C. The temperature profile fluctuated around the average.

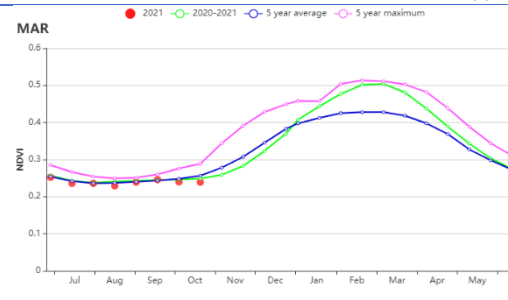
Regional analysis

CropWatch adopts three agro-ecological zones (AEZs) relevant to crop production in Morocco: the Sub-humid northern highlands, the Warm semiarid zone, and the Warm sub-humid zone. For the three zones in their listed order, respectively, rainfall was below the 15YA by 52%, 66%, and 49%; the temperature was higher than the 15YA by 0.3°C, 0.1°C, 0.2°C; RADPAR was higher than the 15YA by 3%, 4%, 3%; and BIOMSS were below the 15YA by 26%, 30%, 19%. Generally, the NDVI development graph shows that crop conditions were around the average in the three zones. The cropped arable land fraction (CALF) was below the 5YA by 3% and 25%, 10%, accordingly, the Maximum VCI value was 0.58, 0.59, 0.58 for the three zones in their listed order, implying the near-average conditions. Cropping Intensity estimates were at 104%, 101%, and 105% for the three zones in their listed order, respectively, indicating all regions dominated by single cropping during the investigation period.

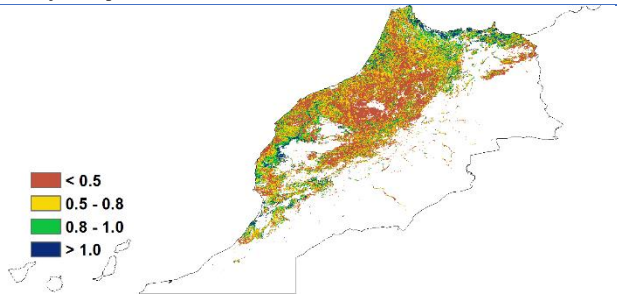
Figure 3.28 Morocco's crop condition, July - October 2021



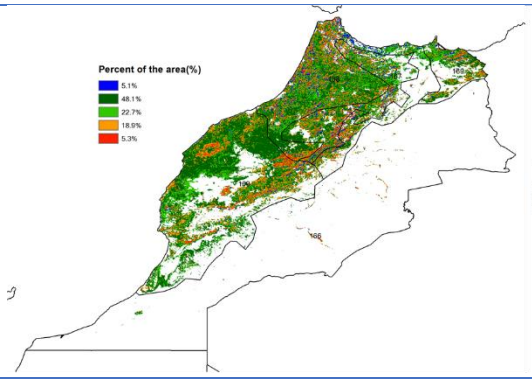
(a) Phenology of major crops



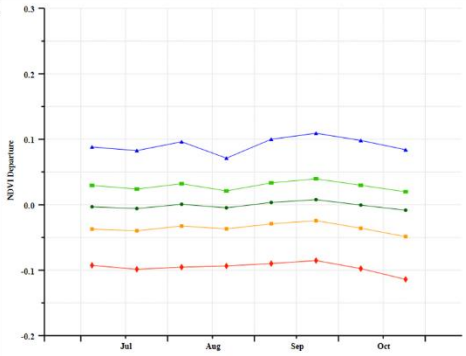
(b) Crop condition development graph based on NDVI



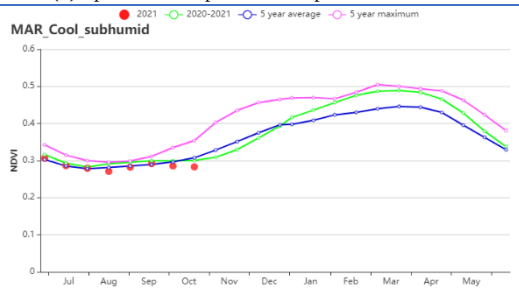
(c) Maximum VCI

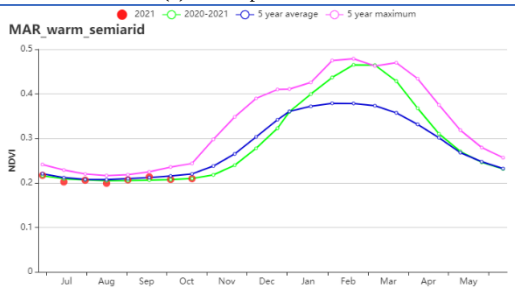


(d) Spatial NDVI patterns compared to 5YA

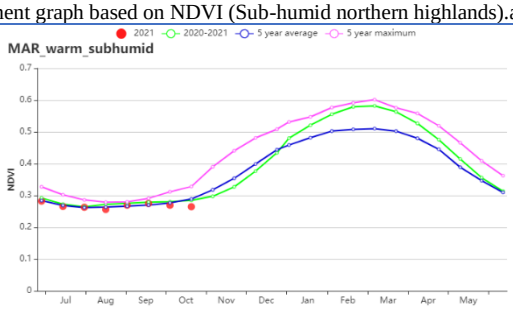


(e) NDVI profiles

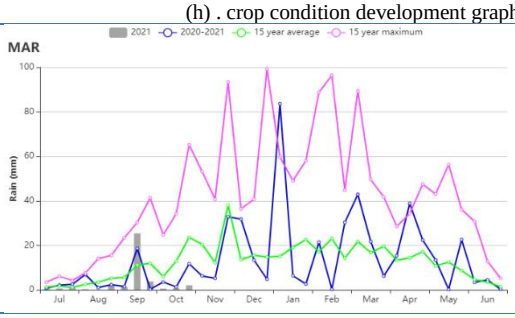




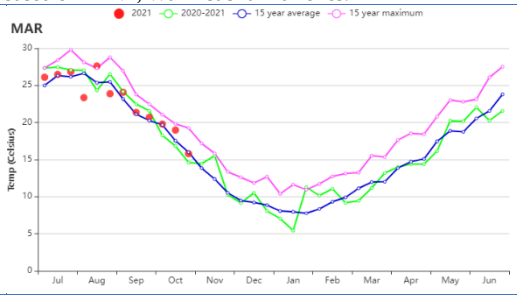
(f). Crop condition development graph based on NDVI (Sub-humid northern highlands).and (g). Warm semiarid zones)



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



(i) Time series profile of rainfall



(j)Time series profile of temperature

Table 3.44 Morocco's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, July - October 2021

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	50	-52	23	0.31	1396	3	365	-26
Warm semiarid zones	24	-66	23	0.10	1429	4	309	-30
Warm sub-humid zones	51	-49	23	0.18	1389	3	400	-19

Table 3.45 Morocco's agronomic indicators by sub-national regions, current season's values and departure from 15YA/5YA, July - October 2021

Region	CALF		Cropping Intensity		Maximum VCI
	Current (%)	Departure from 5YA (%)	Current (%)	Departure from 5YA (%)	Current
Sub-humid northern highlands	17	-3	104	0	0.58
Warm semiarid zones	2	-25	101	-1	0.59
Warm sub-humid zones	12	-10	105	2	0.58

[MEX] Mexico

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

The CropWatch agroclimatic indicators show that TEMP and RAIN were close to average and RADPAR was above average (+3%). Accordingly, BIOMSS increased by 1% as compared to the 15YA. CALF was close to average and reached 91% and cropping intensity decreased by 3%. Favorable weather conditions and relatively high CALF made the VCI reach 0.92.

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, 20.8% of the total cropped areas were above average during the entire monitoring period, mainly distributed in the northeast coastal and border areas. 50.7% of the total cropped areas were at an average level. Only 7.8% of the total cropped areas were below average, mainly in Sinaloa. In addition, 14.1% of the total cropped areas were at an average level in July and August and below average in September and October. This phenomenon may be caused by the harvest stage of maize and rice and other summer crops.

Overall, the crop conditions were at an average level. Although the crop land was affected by severe drought in winter, the agro-climatic conditions gradually returned to the normal level by April, so the impact of drought on crop growth was limited and a favorable production of the summer crops is estimated.

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. According to the NDVI development graph, crop condition in this region was close to average before September. CALF increased by 3% compared with the 5YA. The agro-climatic condition showed that RAIN increased by 3% and TEMP decreased by 0.1°C and RADPAR increased by 4%. The Arid and semi-arid region was the most drought affected region and the VCIx was 0.88.

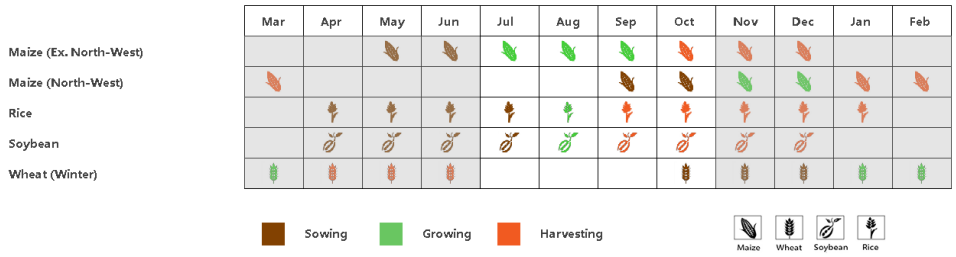
The region of Humid tropics with summer rainfall is located in southeastern Mexico. Conditions were favorable. RAIN was slightly below average (-2%), TEMP was 0.2℃ warmer and RADPAR increased by 5% and BIOMSS increased by 3%. As shown in the NDVI development graph, crop conditions were close to average from July to October. The VCIx (0.93) confirmed favorable crop conditions in this region.

The Sub-humid temperate region with summer rains is situated in central Mexico. According to the

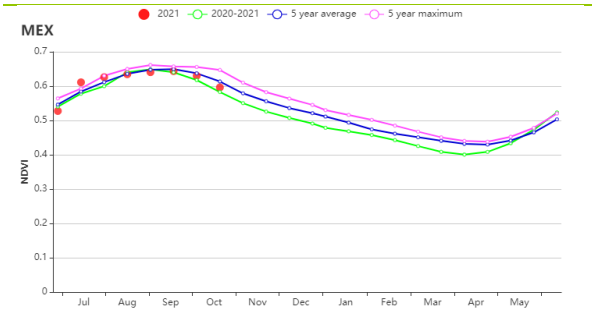
NDVI development graph, crop conditions were close to average in July and below average in August, but then recovered to average levels. The agro-climatic conditions were close to the average level. RAIN increased by 4%, TEMP increased by 0.1°C , and RADPAR increased by 1% compared to the 15YA. BIOMSS was also near average and CALF was 99%. Favorable meteorological conditions and high CALF made VCIx reach 0.96.

The region called Sub-humid hot tropics with summer rains is located in southern Mexico. During the monitoring period, crop conditions were below average in August and closed to average in other months as shown by the NDVI time profiles. Agro-climatic conditions were closed to average levels, including RAIN (+1%), TEMP (+0.2℃) and RADPAR (+3%). The VCIx for the region was 0.95 and BIOMSS was near average.

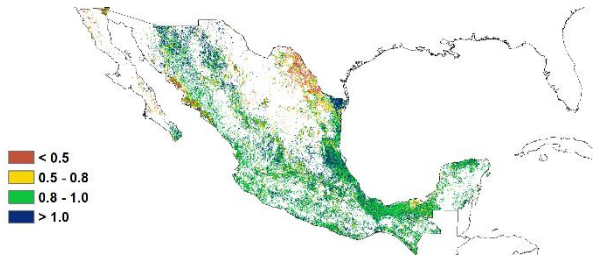
Figure 3.29 Mexico's crop condition, July-October 2021



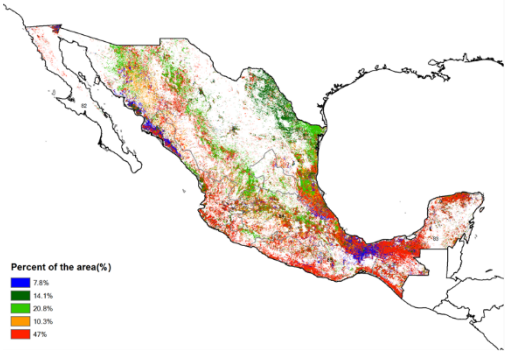
(a) Phenology of major crops



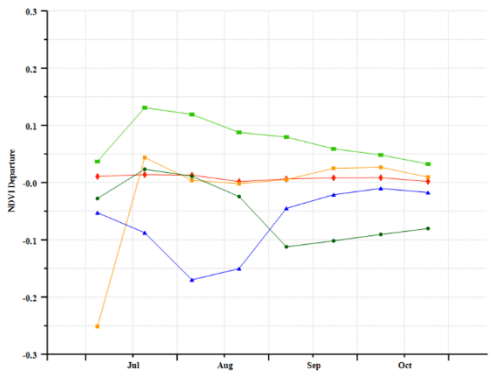
(b) Crop condition development graph based on NDVI



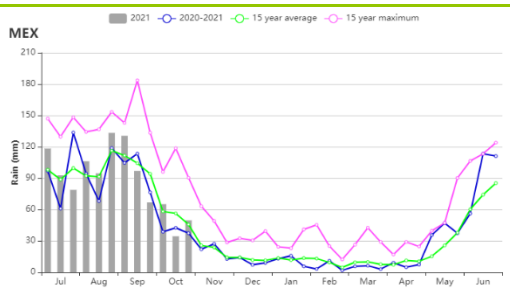
(c) Maximum VCI



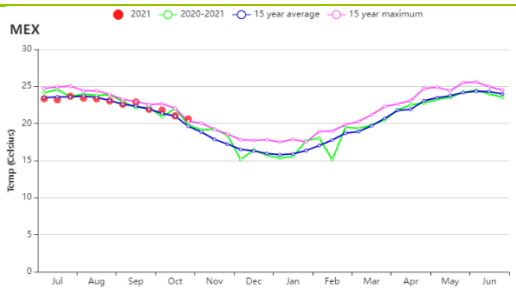
(d) Spatial NDVI patterns compared to 5YA



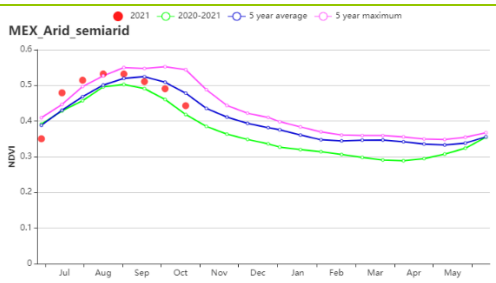
(e) NDVI profiles

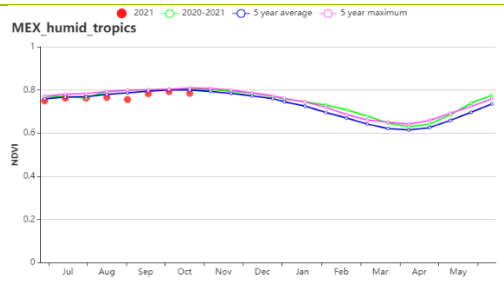


(f) Rainfall profiles

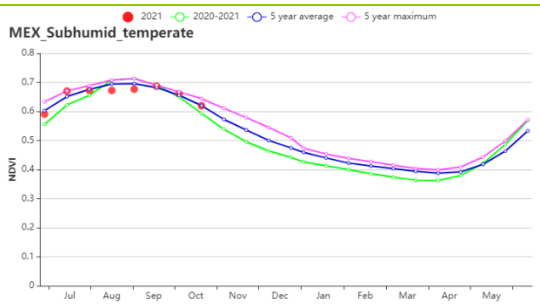


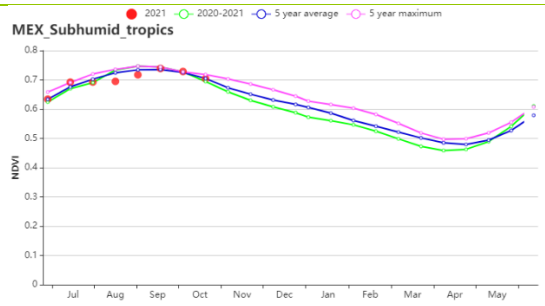
(g) Temperature profiles





(h) Crop condition development graph based on NDVI (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 3.46 Mexico's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, July – October 2021

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Arid and semi-arid regions	747	3	22.6	-0.1	1339	4	1056	2
Humid tropics with summer rainfall	1252	-2	25.1	0.2	1324	5	1495	3
Sub-humid temperate region with summer rains	1258	4	18.8	0.1	1230	1	1165	0
Sub-humid hot tropics with summer rains	1241	1	22.5	0.2	1265	3	1293	0

Table 3.47 Mexico's agronomic indicators by sub-national regions, current season's values and departure from 5YA, July – October 2021

Region	Cropped arable land fraction		Cropping intensity		Maximum VCI
	Current (%)	Departure (%)	Current (%)	Departure (%)	Current
Central region	82	3	98	-7	0.88
Dry region	100	0	112	1	0.93
Dry and irrigated cultivation region	99	1	104	-3	0.95
Dry and grazing region	96	1	110	-1	0.95

[MMR] Myanmar

This reporting period was dominated by the monsoon season. It will be followed by the drier and cooler winter months. The main rice growing season started in June and ended in October. The planting of maize and wheat started in September. According to the CropWatch monitoring results, crop conditions in Myanmar were below average during this monitoring period.

Compared to the 15YA, RAIN was lower (-13%) while TEMP was higher (+0.6ºC), and RADPAR was up by 7%. As a result, BIOMSS was 2% below the average. The utilization of cropland was close to the 5YA. NDVI values were below average during the entire period, especially in early August and late September. The maximum VCI during this period was 0.94.

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 only occurred in August. These areas accounted for 66.8% of the cropland and were mainly located in Mandalay Regions, as well as scattered areas over Regions of Bago, Ayeyarwady, Yangon, Tanintharyi and States of Shan, Kayin and Mon. The abnormally low NDVI departure values could be caused by cloudy weather. The maximum VCI showed high values over most regions of the country.

Regional analysis

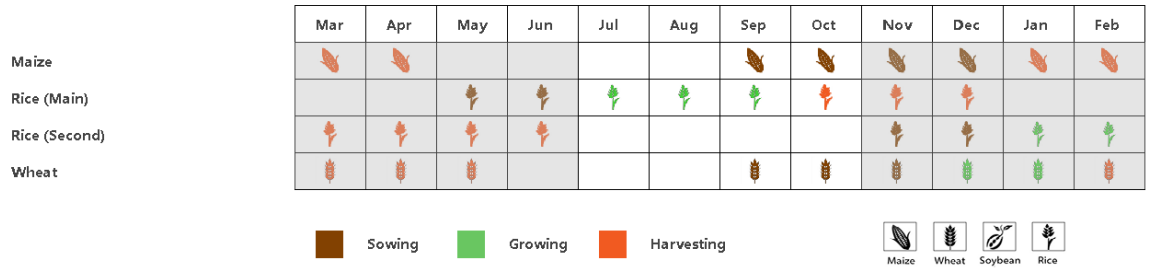
Three sub-national agro-ecological zones (AEZ) can be distinguished for Myanmar based on the cropping system, climatic zones and topographic conditions. They are the Central plain, the Hills and the Delta and Southern Coast regions.

The **Central Plain** had a marked rainfall deficit (RAIN -26%), with RADPAR up by 8% and TEMP up by 0.9ºC compared to the 15YA. BIOMSS was 5% lower than the 15YA. CALF showed that 98% of the cropland was fully utilized, and it was 1% above the 5YA. NDVI was consistently below the 5YA level during the whole period. The VCIx was 0.94. Crop conditions for this region were slightly below average.

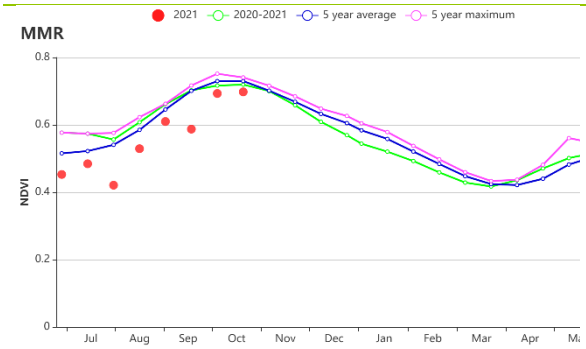
The **Hills** region also had a lack of rainfall, at 1593mm, with RAIN 12% below the 15YA. RADPAR was 9% above average and TEMP increased by 0.5 ºC. BIOMSS was close to the 15YA. The cropland was almost fully used (CALF 99%). The NDVI values were below the 5YA during the whole period. The VCIx was 0.96. Crop conditions are assessed as below the 5YA level.

The **Delta and Southern Coast** region had the highest RAIN (1849 mm) compared with the other two sub-national regions, but it was still 8% below the 15YA. TEMP and RADPAR increased by 0.3ºC and 5% 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 except for July and late August, when they were near average. Crop conditions in this region were below average.

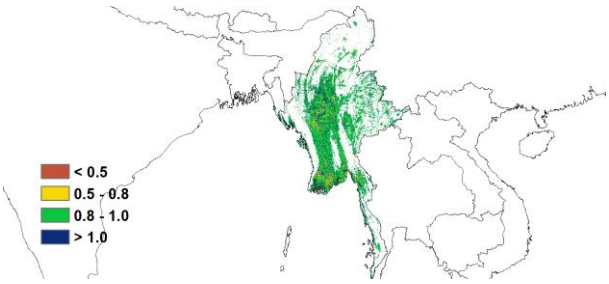
Figure 3.30 Myanmar's crop condition, July - October 2021



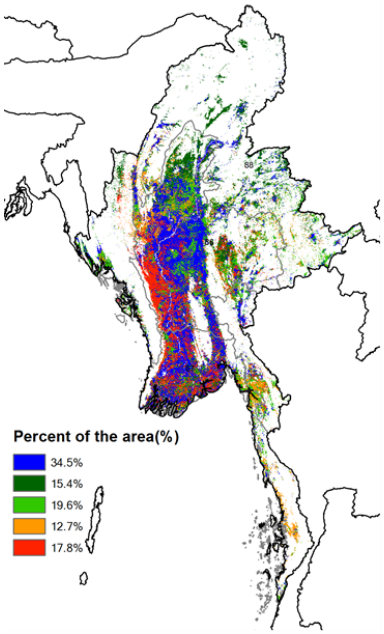
(a). Phenology of major crops



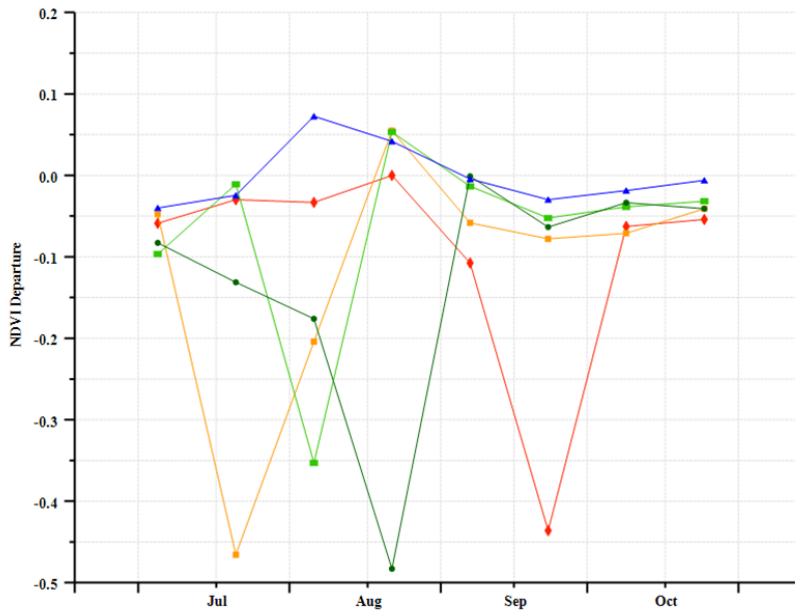
(b) Crop condition development graph based on NDVI



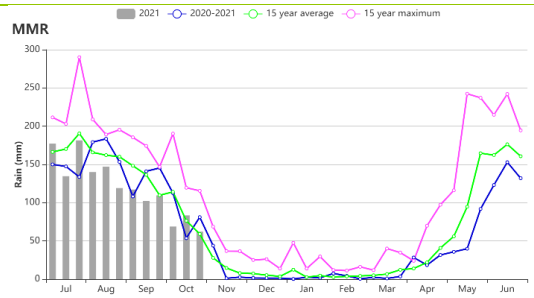
(c) Maximum VCI



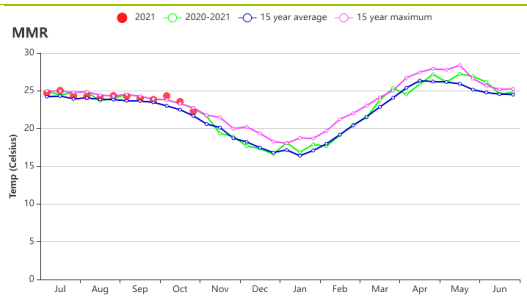
(d) Spatial NDVI patterns compared to 5YA



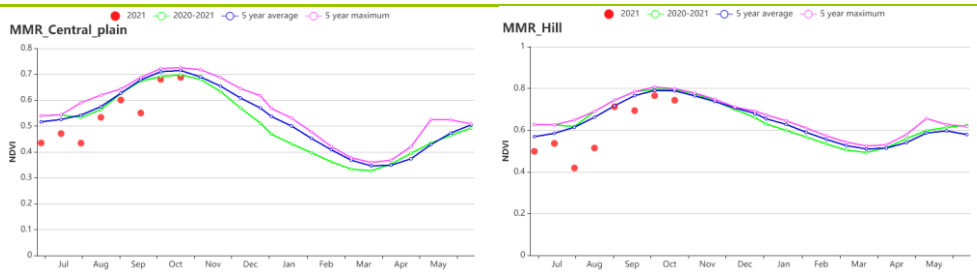
(e) NDVI profiles



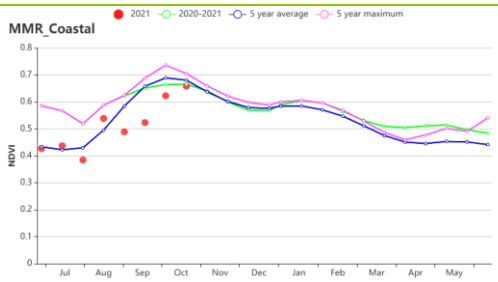
(f) Rainfall profiles



(g) Temperature profiles



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



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

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

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Central plain	864	-26	24.9	0.9	1133	8	733	5
Hills region	1593	-12	22.9	0.5	1041	9	635	4
Delta and southern-coast	1849	-8	26.0	0.3	1137	5	773	5

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

Region	Cropped arable land fraction		Cropping intensity		Maximum VCI
	Current (%)	Departure (%)	Current (%)	Departure (%)	Current
Central plain	98	1	95	-10	0.94
Hills region	99	0	104	-4	0.96
Delta and southern-coast	95	1	118	-5	0.92

[MNG] Mongolia

This reporting period from July to October covers the humid summer and autumn season in Mongolia, which corresponds to the main growing stage and harvesting stage of wheat in September, the main cereal crop in Mongolia. Among the CropWatch agroclimatic indicators, RAIN was above the 15YA (+36%), while TEMP and RADPAR were slightly below average (-0.6°C and -4%). The sufficient rainfall helped increase the estimated biomass by 12% as compared to the 15YA. The national VCIx was 1.02, the cropped arable land fraction increased by 1.5%, and the cropping intensity was 102, which had increased by 2% compared to the 5YA.

The spatial NDVI patterns map shows that the NDVI indices of 79.1% of areas in Mongolia were above average compared with the 5YA, and the maximum VCI map also demonstrates favorable crop conditions in the major crop production region.

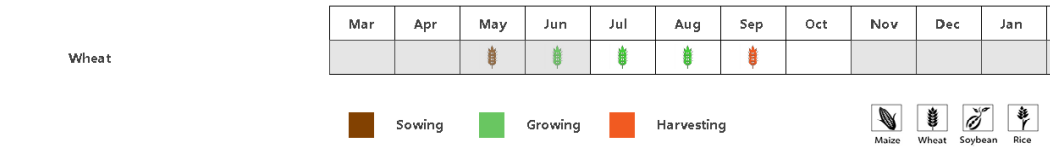
Regional analysis

Hangai Khuvsgul Region: TEMP and RADPAR decreased by 0.5°C and 5%, while RAIN was 49% above average. Accordingly, BIOMSS increased by 7% from the 15YA. The maximum VCI index was 0.97 and the cropped arable land fraction was 100%, up by 1%. The NDVI profile was above average and near the five-year maximum from July to early September. In conclusion, the crop conditions in Hangai Khuvsgul Region were favorable.

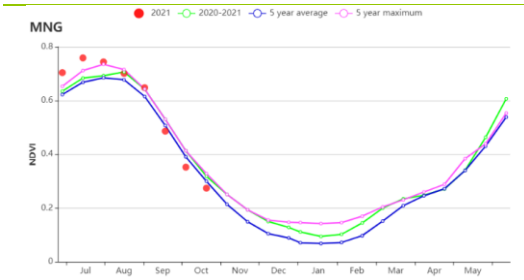
Selenge-Onon Region: TEMP and RADPAR were slightly below average (-0.8°C and -4%), while RAIN was above average (+28%). The BIOMSS increased by 11% compared to the 15YA. The maximum VCI index was 1.04, and the cropped arable land fraction increased by 1%. Crop conditions were significantly above the five-year maximum from July to August, and the maximum VCI indices of most areas were greater than 0.8. Overall, for this important agricultural production region of Mongolia, the crop production prospects were positive.

Central and Eastern Steppe Region: According to the NDVI development graph, crop conditions were above the five-year maximum from July to September. Rain was above average (+59%), while TEMP and RADPAR were below average (-0.6°C and -6%). Benefitting from the increased rainfall, BIOMSS increased by 32% compared to 15YA. The maximum VCI index was 1.04, and the cropped arable fraction increased by 2%. Overall crop prospects were favorable.

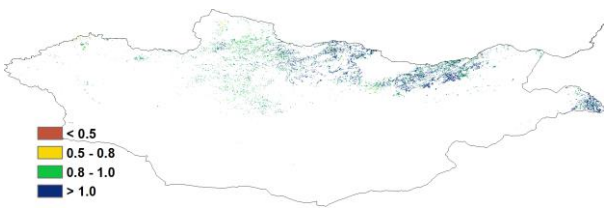
Figure 3.31 Mongolia's crop condition, July - October 2021



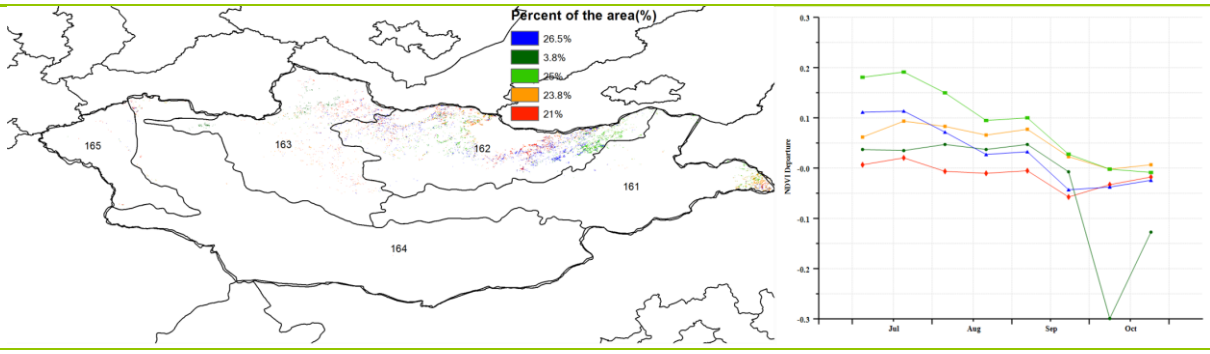
(a) Phenology of major crops



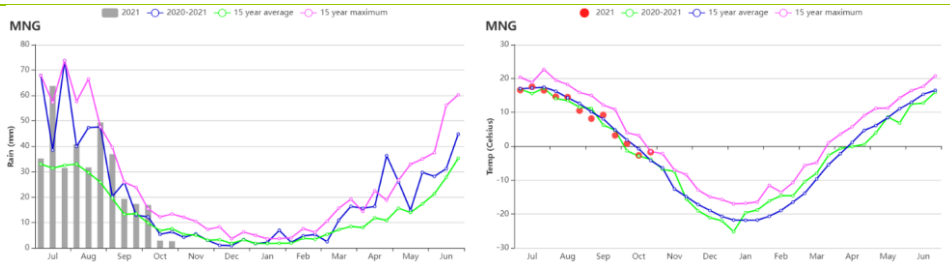
(b) Crop condition development graph based on NDVI



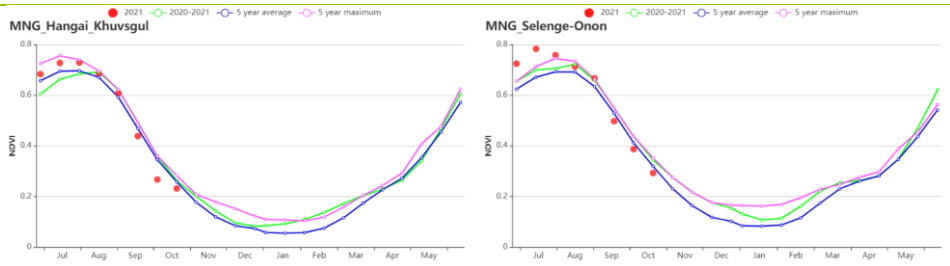
(c) Maximum VCI



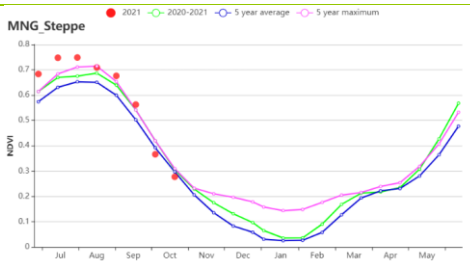
(d) Spatial NDVI patterns compared to 5YA (e) NDVI profiles



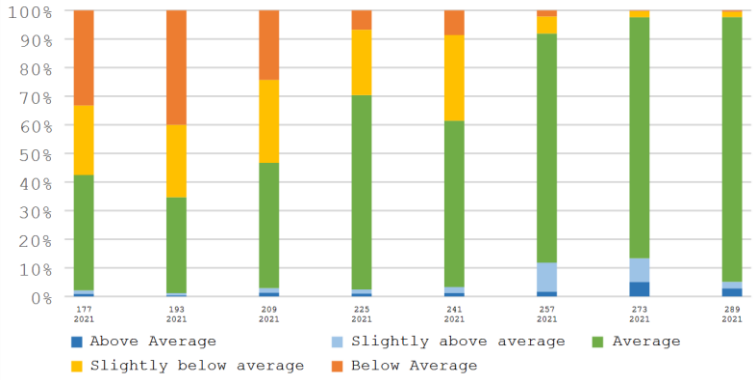
(f) Rainfall profiles (g) Temperature profiles



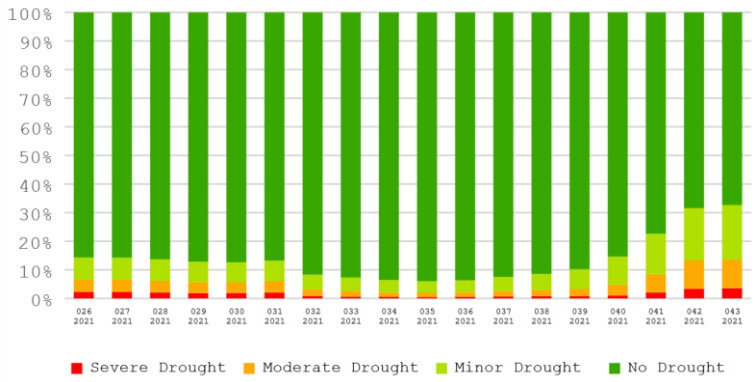
(h) Crop condition development graph based on NDVI (Hangai Khuvsgul Region (left) and Selenge-Onon Region (right))



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



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



(k) Proportion of VHIm categories compared with 5YA in Mongolia

Table 3.50 Mongolia's agroclimatic indicators by sub-national regions, current season's values, and departure from 15YA, July - October 2021

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Hangai Khuvsgul Region	420	49	6.4	-0.5	1006	-5	658	7
Selenge-Onon Region	329	28	9.4	-0.8	998	-4	733	11
Central and Eastern Steppe Region	333	59	12.8	-0.6	978	-6	855	32
Altai Region	360	-5	6.5	-0.4	1052	2	583	4
Gobi Desert Region	195	0	9.8	-0.1	1096	1	509	-1

Table 3.51 Mongolia's agronomic indicators by sub-national regions, current season's values, and departure from 5YA, July - October 2021

Region	Cropped arable land fraction		Cropping intensity		Maximum VCI
	Current (%)	Departure (%)	Current (%)	Departure (%)	Current
Hangai Khuvsgul Region	100	1	100	0	0.97
Selenge-Onon Region	100	1	102	2	1.04
Central and Eastern Steppe Region	100	2	100	0	1.04
Altai Region	83	4	100	0	0.87
Gobi Desert Region	81	9	101	1	0.91

[MOZ] Mozambique

The monitoring period in the analysis coincides with the dry period in Mozambique. This period covers mostly the land preparation for the 2021/2022 agricultural season. During the same period, the sowing of maize has started in southern Mozambique, followed by rice in late October. The agroclimatic indicators for this period reveal that except for the rainfall and potential biomass (RAIN +17% and BIOMSS +6%), the remaining indicators recorded a drop in about 0.3ºC and 2%, for temperature and radiation, respectively.

Nationwide, the NDVI development graph indicates average crop conditions during the entire monitoring period when compared to the average of the past five years. The maximum VCI recorded for this period was 0.87. The spatial distribution of VCIx across the country shows that better crop conditions were observed along the Limpopo and Zambezi River valleys, the Gùrué district (Zamgbézia province) and Nampula province where irrigation activities and annual crops can be found. Altogether, these regions account for 65.2% of the arable land. With the cropped arable land fraction increasing by 3% and Cropping Intensity about the average, overall, the crop conditions were favourable across the country.

Regional analysis

CropWatch 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.

A significant increase in rainfall (RAIN +34%) was recorded in the Buzi basin, while the temperature and radiation decreased by 0.5ºC and 4%. Combined, these conditions led to an increase in the potential biomass production in the region by 14%. The NDVI development graph indicates above-average crop conditions from early August until the end of the monitoring period. With CALF being situated near the average and Cropping Intensity increasing in 8%, the maximum VCI recorded for this region was 0.80.

Contrary to the Buzi basin, the rainfall in the Northern High-altitude areas recorded a significant drop by about 30% compared to the average of past fifteen years, followed by decreases in temperature (TEMP -0.1ºC), radiation (RADPAR -1%) and potential biomass (BIOMSS -6%). Even with these conditions, the NDVI development graph indicates close-to-average crop conditions during almost the entire monitoring period. Both the CALF and Cropping Intensity in this region increased by 5% and 1%, respectively, while the maximum VCI recorded was 0.84.

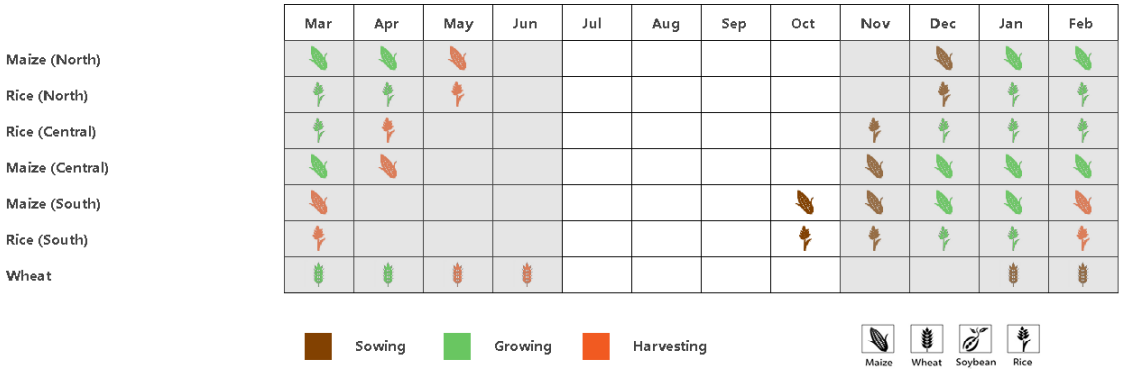
Increases in rainfall (RAIN +16%) were also observed in the Lower Zambezi River basin. Temperature and radiation recorded decreases of about 0.4ºC and 2%, respectively. The potential biomass production increased by 13%. According to the NDVI development graph, crop conditions were favourable compared to the average of the past five years. The region recorded an increase in CALF by 5% and the maximum VCI observed was 0.82.

Except for the potential biomass production (BIOMSS +4%), in the Northern coast, all the remaining agroclimatic indicators registered decreased (RAIN -1%, TEMP -0.1ºC, and RADPAR -1%). Crop conditions in this region were near the average of the past five years from July till late August, when the conditions dropped, remaining below the average till the end of the monitoring period. With CALF increasing by 1%, the maximum VCI was 0.89.

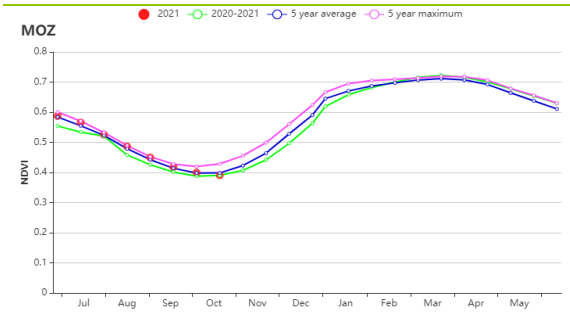
In the Southern region, rainfall increased by 19% while both temperature and radiation decreased by 0.5ºC and 4%. The potential biomass production in this region increased by 7% compared to the past fifteen years. These agroclimatic conditions led to above-average crop conditions during the entire monitoring period as indicated by the NDVI development graph. This region recorded the highest increase in CALF (CALF +7%).

The maximum VCI in this region was 0.90. The region can expect good production prospects of the current maize and rice, which were planted in October.

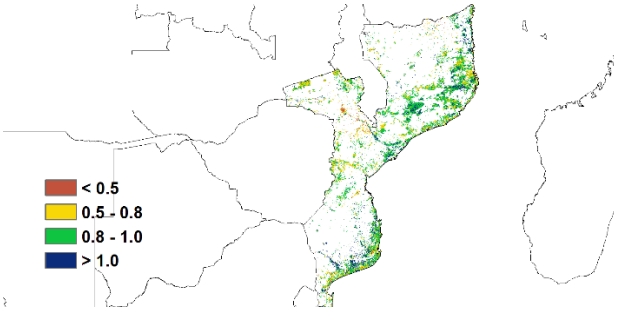
Figure 3.32 Mozambique's crop conditions, July-October 2021



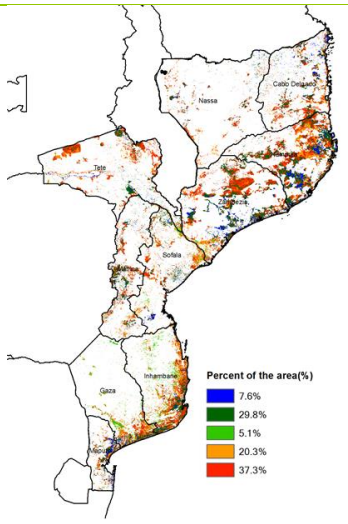
(a) Phenology of major crops



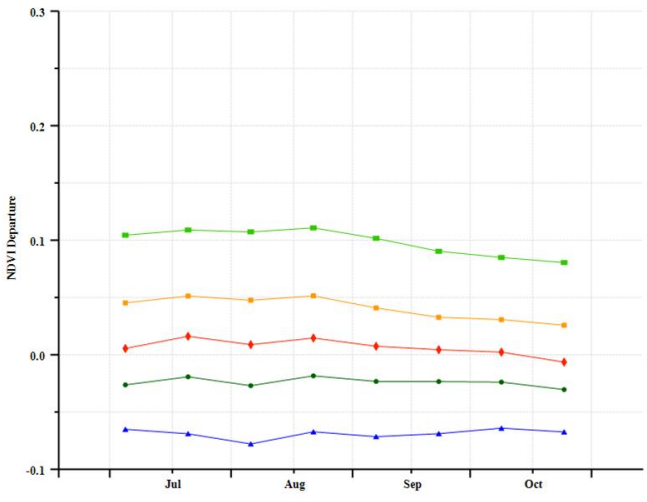
(b) Crop condition development graph based on NDVI



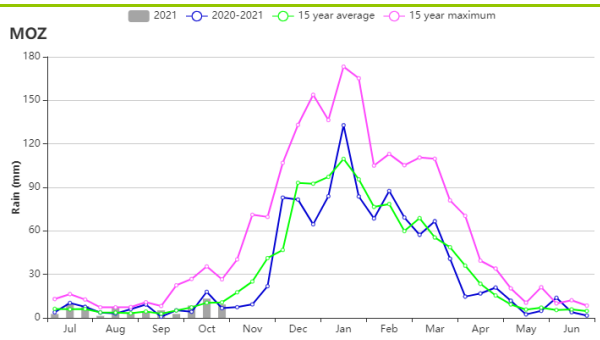
(c) Maximum VCI



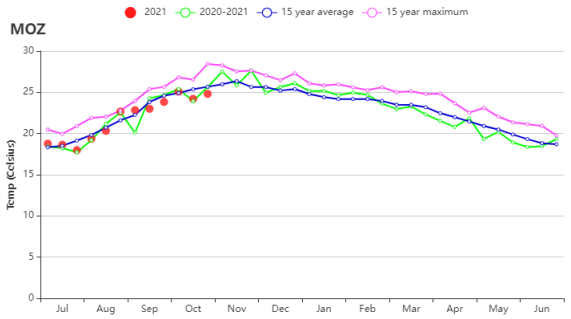
(d) Spatial NDVI patterns compared to 5YA



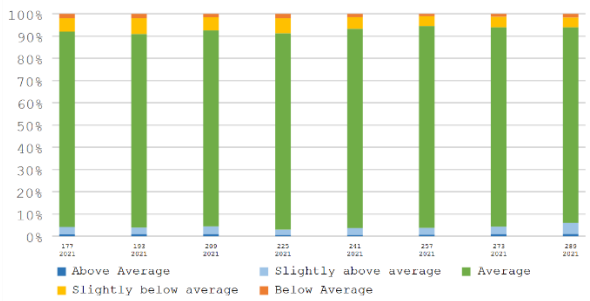
(e) NDVI profiles

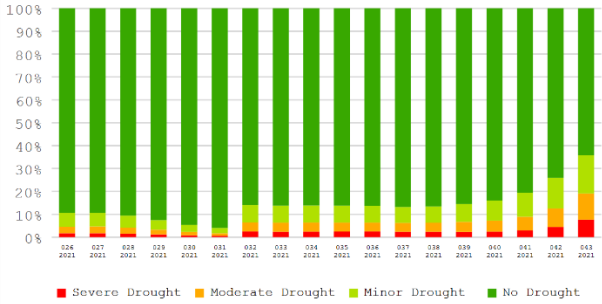


(f) National rainfall profiles

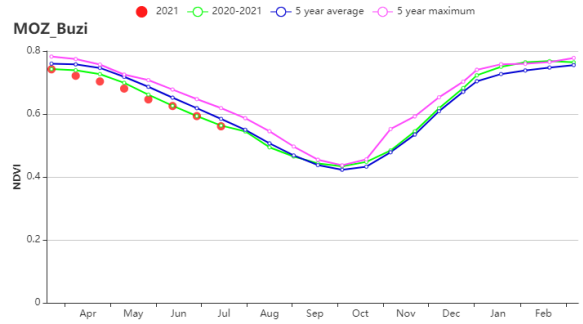


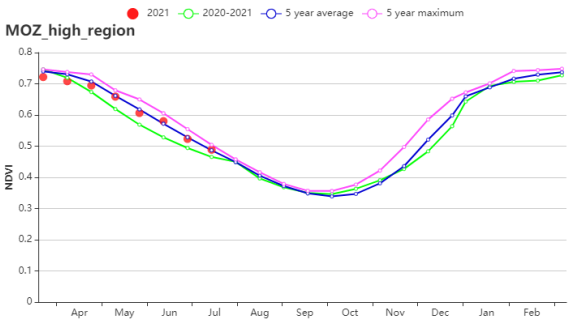
(g) National temperature profiles



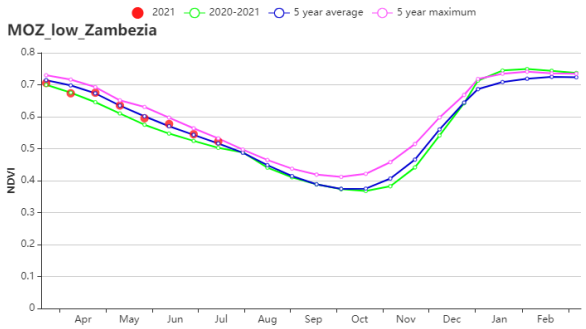


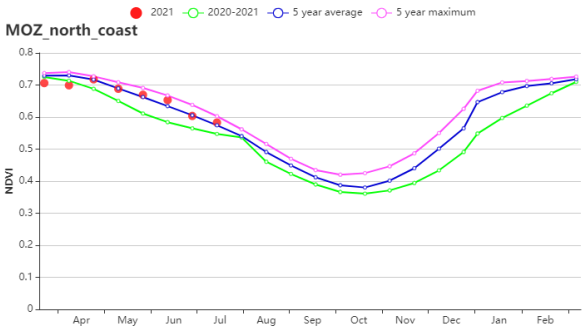
(h) Proportion of NDVI anomaly categories compared with 5YA (i) Proportion of VHIm categories compared with 5YA



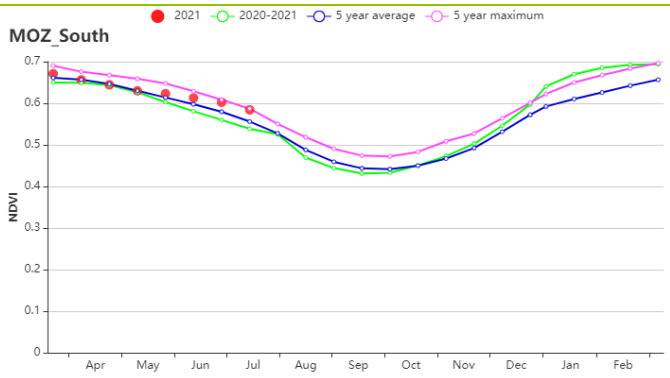


(i) Crop condition development graph based on NDVI-Buzi basin (left), and Northern high-altitude areas (right)





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



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

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

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Buzi basin	90	34	19.1	-0.5	1174	-4	595	14
Northern high-altitude areas	33	-30	21.7	-0.1	1181	-1	604	-6
Low Zambezia River basin	74	16	21.9	-0.4	1179	-2	646	13
Northern coast	75	-1	22.8	-0.1	1151	-1	667	4
Southern region	106	19	21.2	-0.5	1023	-4	576	7

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

Region	Cropped arable land fraction		Cropping intensity		Maximum VCI
	Current (%)	Departure from 5YA (%)	Current (%)	Departure from 5YA (%)	Current
Buzi basin	96	0	108	8	0.80
Northern high-altitude areas	85	5	101	1	0.84
Low Zambezia River basin	75	5	101	0	0.82
Northern coast	98	1	100	0	0.89
Southern region	95	7	100	0	0.90

[NGA] Nigeria

This report covers the main rainy season in Nigeria, during which, 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 will reach maturity in December or January. In the south, maize was harvested in July and August. The harvesting of rainfed rice was started in August, followed by that of irrigated rice two months later.

The CropWatch agroclimatic indicators show that the rainfall was below the 15YA (-32%) and the average temperature was higher than the 15YA (+0.7°C). Rainfall had stayed below the 15YA starting in late August. Solar radiation increased by 5%. Due to the decline of rainfall, the BIOMSS was below the 15YA (-15%). The observed maximum vegetation condition index (VCIx) was 0.91 and the CALF was lower than the 5YA (-3%).

According to the crop condition development graph based on NDVI, the NDVI of the country was below the 5YA during the reporting period. The maximum VCI graph shows that both higher and lower values appeared mainly in the northern area. As shown in the spatial NDVI profiles and distribution map, 24.5% of the total cropped areas were above the 5YA from the middle July to the end of October. About 42.1% of the total cropped areas were below the 5YA from July to early August and near the 5YA from August to October in the northern area of the country. Overall, the crop conditions in most of the cropped areas were below average.

Regional Analysis

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

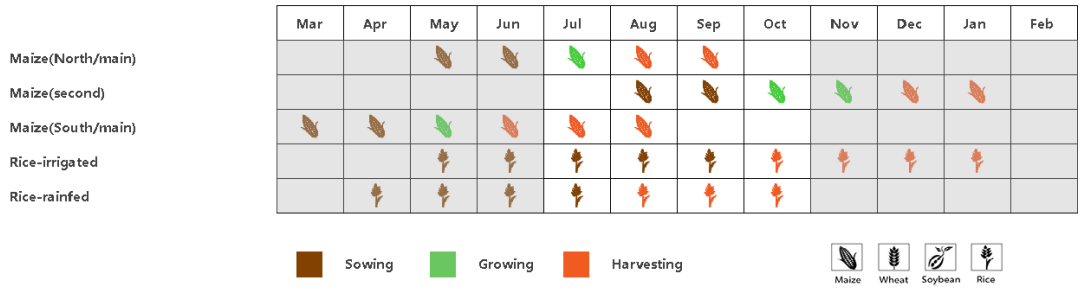
The **Sudan-Sahel savanna** zone is located in northern Nigeria. The agro-climatic condition showed that rainfall decreased by 42% and the overall temperature had increased by 0.6°C. The radiation increased by 2%. The BIOMSS was below the 15YA (-18%). The CALF was 84% and the maximum VCI was 0.89. According to the NDVI development graph, crop conditions in the zone were below average from July to August and near average from September to October.

The **Guinea savanna** region is predominantly located in the central region of the country. Compared to the 15YA, TEMP increased by 0.8°C, RAIN decreased by 42%, RADPAR was 4% above the 15YA, and BIOMSS was below the 15YA (-21%). The CALF was 99% and the maximum VCI was 0.91. According to the NDVI development graph, crop conditions in the region were below average from July to August and near average from September to October.

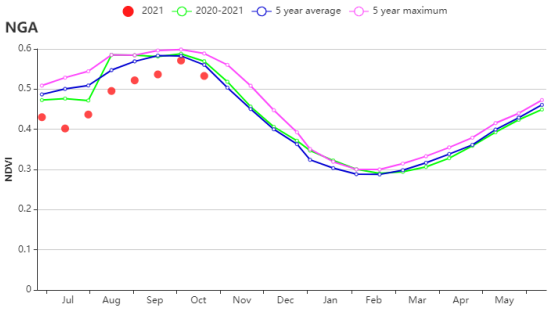
The **Derived savanna** region is a transition zone between the Guinea savanna and Humid forest zones. Rainfall decreased by 37% and the temperature increased by 0.7°C. The radiation increased by 7% compared to the 15YA and the BIOMSS decreased by 15% compared to the 15YA. The CALF was 99% and the maximum VCI was 0.95. According to the NDVI development graph, crop conditions in the region were below average from July to September and near average in October.

In the **Humid forest** zone the precipitation is quite high as compared to other regions. The rainfall decreased by 16% and the average temperature increased about 0.3°C. The radiation increased by 8% and the BIOMSS was near the 15YA (-1%). The CALF was 99% and the maximum VCI was 0.94. According to the NDVI development graph, crop conditions in the zone were below average throughout the monitoring period.

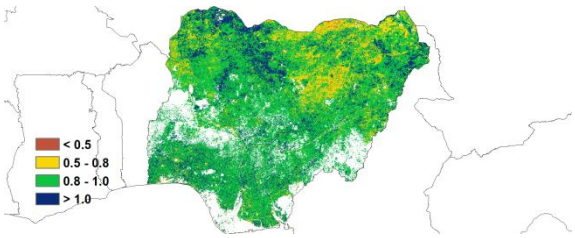
Figure 3.33 Nigeria's crop condition, July-October 2021



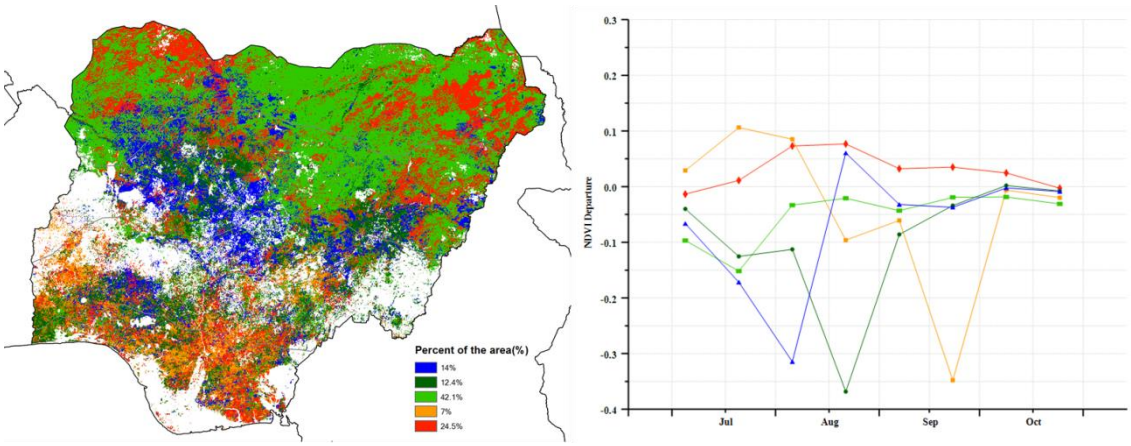
(a) Phenology of major crops



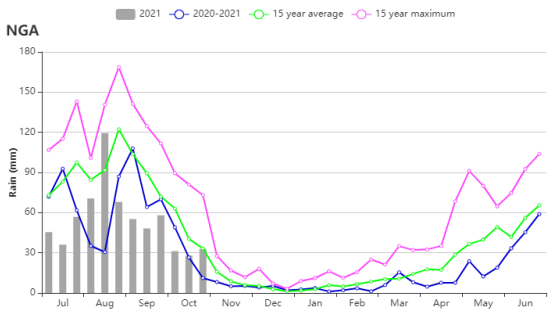
(b) Crop condition development graph based on NDVI



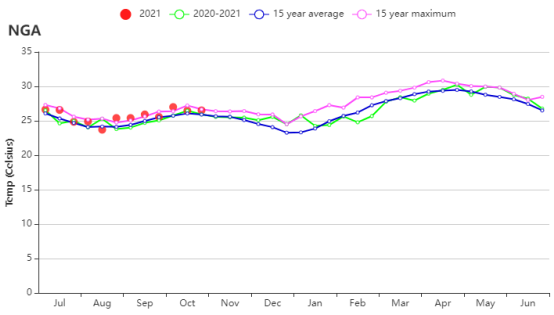
(c)Maximum VCI



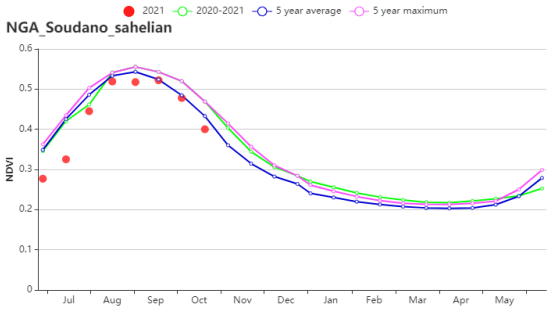
(d) Spatial NDVI pattern compared to 5YA and NDVI profiles

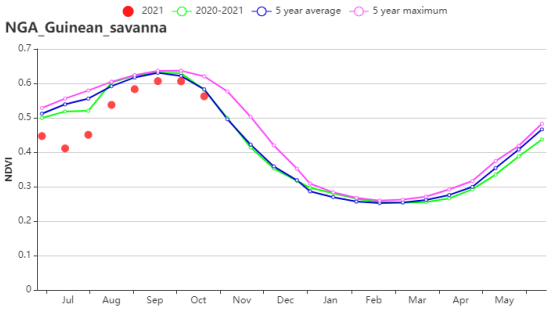


(e) Time series temperature profile

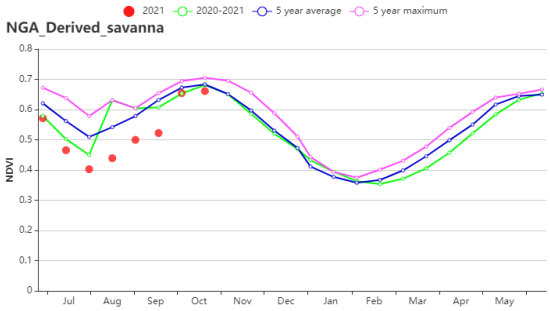


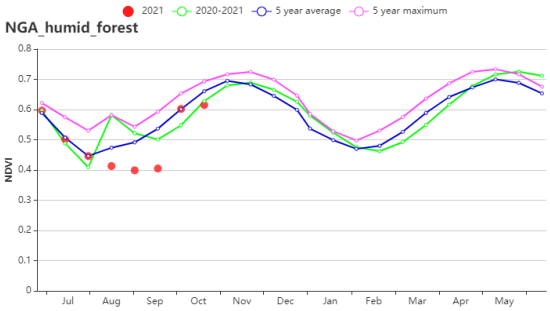
(f) Time series rainfall profile





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





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

Table 3.54 Nigeria's agro-climatic indicators by sub-national regions, current season's values and departure from 15YA. July-October 2021

region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure from 15YA(%)	Current (°C)	Departure from 15YA(°C)	Current (MJ/m^2)	Departure from 15YA (%)	Current (gDM/m^2)	Departure from 15YA(%)
Sudan-Sahel savanna	264	-42	28	0.6	1222	2	768	-18
Guinea savanna	468	-42	26	-0.8	1191	4	1003	-21
Derived savanna	668	-37	25	0.7	1127	7	1197	-15
Humid forest	1332	-16	24	0.3	1025	8	1503	-1

Table 3.55 Nigeria's agro-climatic indicators by sub-national regions, current season's values and departure from 5YA. July-October 2021

region	CALF		VCI
	Current (%)	Departure from 5YA(%)	Current
Sudan-Sahel savanna	84	-0.6	0.89
Guinea savanna	99	-0.4	0.91
Derived savanna	99	0.02	0.95
Humid forest	99	0.7	0.94

[PAK] Pakistan

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

RAIN was sharply below average (-35%), together with higher TEMP and RADPAR (0.3℃and 2% respectively), which resulted in a slight increase of estimated BIOMSS (+4%). CropWatch agro-climatic indicators were below average over the 15YA. The dekad rainfall was continuously below average for most dekads, except for second dekad in July, when it reached maximum levels. Especially the significantly drier-than-usual conditions in August caused unfavorable conditions for the production of summer crops, although most of them are irrigated. About 30% of the crop areas experienced drought in August, as shown in the VHIn graph. The fraction of cropped arable land was slightly above average (+1%).

As shown by the nationwide NDVI development graph, crop conditions were gradually getting better and reached average levels in early August, but stayed below average until middle of September due to low precipitation. According to the spatial NDVI patterns and profiles, 31.8% of the cropped areas presented continuously below-average conditions during the reporting period, which were mostly distributed in the North highland and Lower Indus basin. About 9.7% of cropland, concentrated in Timur Dan, north and west of Sukkur and southern Sindh, presented below-average conditions before early August but later recovered to average levels. At the annual scale, cropping intensity increased by 13% indicating that the total cultivated crop area was at an above-average level. All in all, crop production estimates for the summer crops are slightly below average.

Regional analysis

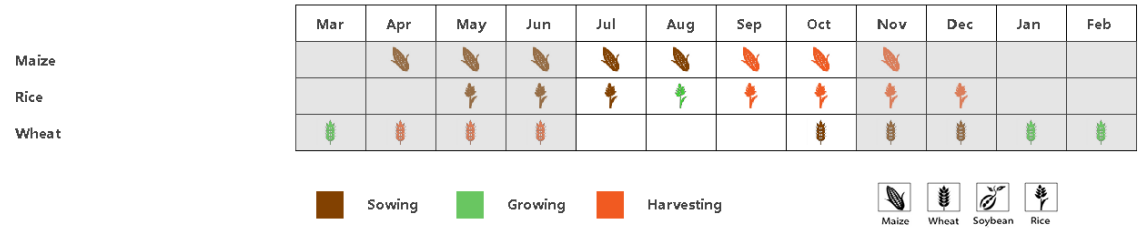
For a more detailed spatial analysis, CropWatch subdivides Pakistan into three agro-ecological regions based essentially on geography and agro-climatic conditions: the Northern highlands, Northern Punjab region and the Lower Indus river basin.

RAIN was slightly below average (-3%) and TEMP was above average by 0.2℃ in the **Lower Indus basin**. The estimated BIOMSS was 18% above average. NDVI was below average in late July and August, and later recovered to above average levels. The CALF value of 61% exceeds the average by 3% and the VCIx was 0.73. Overall, the situation for the region is below average.

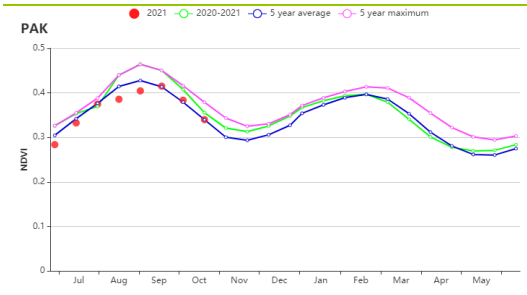
Compared to average, in the **Northern highland** region, RAIN sharply decreased by 49%, RADPAR and TEMP were above average (+3% and +0.2℃respectively). BIOMSS decreased by 17%. The region also showed a low CALF of 56%, which was lower than the 5YA by 4%. The NDVI profile stayed below average during July and late August, and subsequently recovered and exceeded the maximum in early August. In short, the situation for the region is assessed as below average.

In **Northern Punjab** region, which is the main agricultural region of Pakistan, recorded an above-average RAIN (+4%). TEMP and RADPAR were above average (+0.3℃ and +1% respectively). The resulting BIOMSS was above average by 15%. The NDVI profile presented below-average conditions in early July and late August, mainly due to a slow start of the monsoon rains. Heavy rainfall in middle July and early September promoted crop growth and NDVI exceeded the maximum of the 5YA in late September. In addition, CALF in this area reached 84%, which was up by 5% compared to the 5YA, and VCIx was at 0.90. Overall, the crop production potential for the region is assessed as favorable.

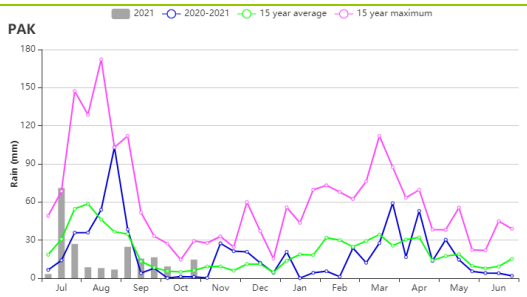
Figure 3.34 Pakistan crop condition, July-October, 2021



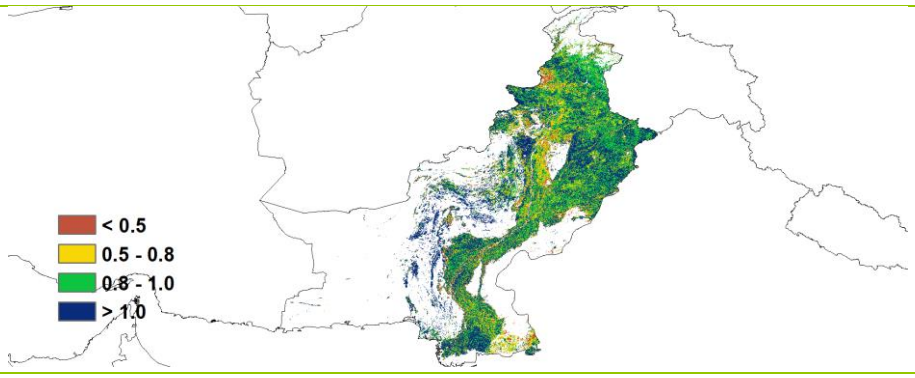
(a). Phenology of major crops



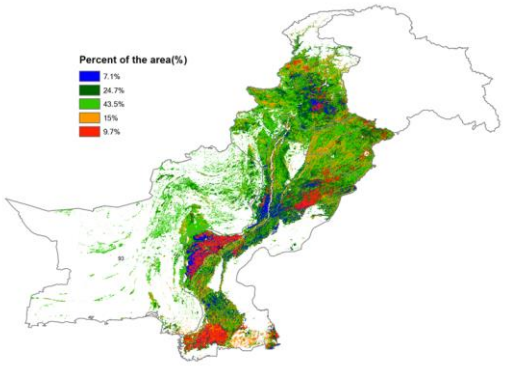
(b) Crop condition development graph based on NDVI



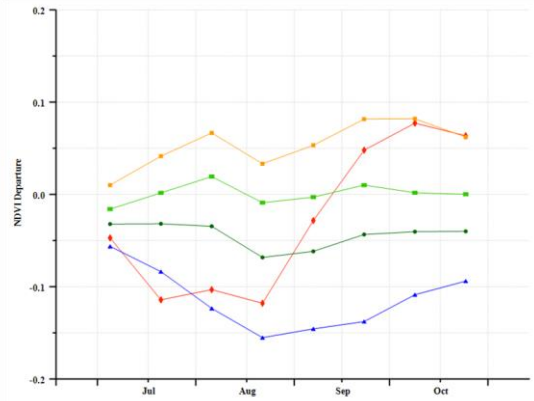
(c) Time series precipitation profile



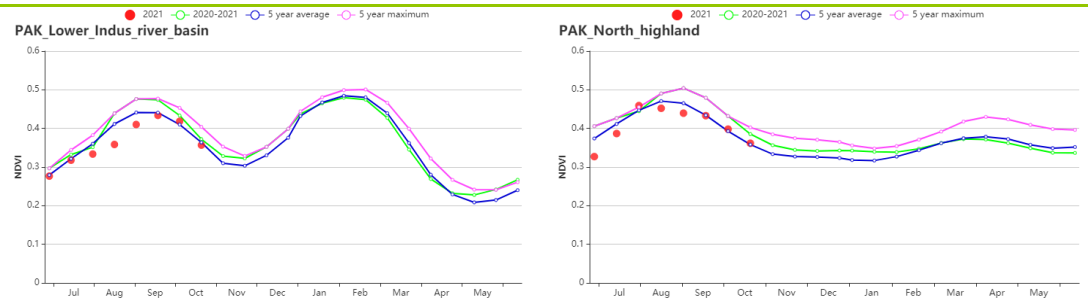
(d) Maximum VCI



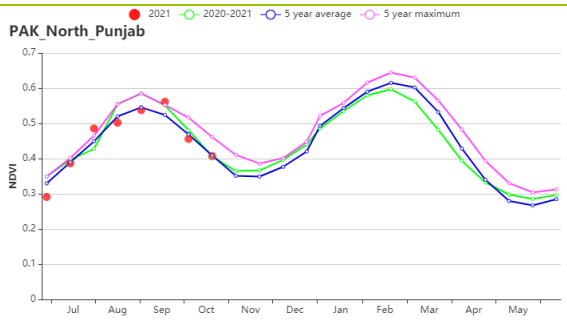
(e) Spatial NDVI patterns compared to 5YA



(f) NDVI profiles



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



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

Table 3.56 Pakistan's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, July-October 2021

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Lower Indus river basin	156	-3	33.0	0.2	1306	0	578	18
Northern highlands	191	-49	21.7	0.2	1407	3	578	-17
Northern Punjab	378	4	30.1	0.3	1275	1	884	15

Table 3.57 Pakistan's agronomic indicators by sub-national regions, current season's values and departure from 5YA, July-October 2021

Region	Cropped arable land fraction		Cropping Intensity		Maximum VCI
	Current (%)	Departure (%)	Current (%)	Departure (%)	Current
Lower Indus river basin	61	3	175	13	0.74
Northern highlands	56	-4	139	9	0.76
Northern Punjab	84	5	206	20	0.90

[PHL] Philippines

This monitoring period covers the rainy season in the Philippines, which usually lasts from May to early October. Within this monitoring period, the harvest of main maize ended in September, followed by the harvest of main rice in October. The sowing of second maize and second rice began in October.

The country experienced slightly dryer and warmer weather during this monitoring period. As shown by the agro-climatic indicators, average precipitation dropped by 5% as compared to the 5YA, despite of several typhoons that made landfall over the Philippines. One of them, named Chanthu, brought record precipitation and decreased the NDVI for the country to some extent. The temperature increased by 0.4℃ (TEMP) and the radiation by 7% (RADPAR). The estimated biomass remained near average (BIOMSS +1%). The CALF did not change and the VCIx value was as high as 0.96. All of these indicate that the crop conditions were close to normal in the Philippines.

With respect to the crops at the local scales, the NDVI for 12.9% (orange color) of the arable cropland decreased by about 0.2 units in August and by about 0.1 in October. Furthermore, about 54.8% of the cropland shared stable and close-to-average NDVI. These croplands (light green color) were mainly located in northern Luzon Island and Mindanao Island. The rest of the croplands (dark green and blue color) remained slightly below average for most of the monitoring time, and these areas were mainly clustered in southern Luzon Island and northern Visayas Island.

Regional analysis

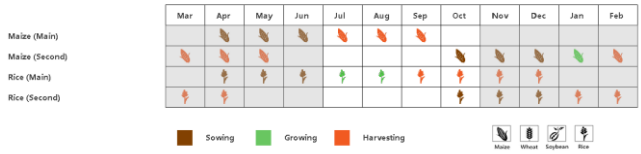
Based on the cropping systems, climatic zones and topographic conditions, three main agro-ecological regions can be distinguished for the Philippines. They are **the Lowlands region** (northern islands), **the Hilly region** (Island of Bohol, Sebu and Negros), and **the Forest region** (mostly southern 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 ⩾0.96).

For the L**owland region**, the rainfall decreased by 11% (RAIN), while the temperature increased by 0.4℃ (TEMP) and radiation increased by 7% (RADPAR). The estimated biomass dropped by 1% (BIOMSS). As shown by the NDVI profile, the negative NDVI departure increased throughout July and reached a maximum at the end of September, while the average precipitation and temperature in the region were at normal levels during the same period. Thus, the large negative departures in NDVI can be mainly attributed to cloud cover in the satellite images. In addition, warmer weather and more sunshine had a positive impact on the crops, bringing the NDVI values back to average levels by the end of October. As a result, the crop condition in this region is estimated to be generally normal.

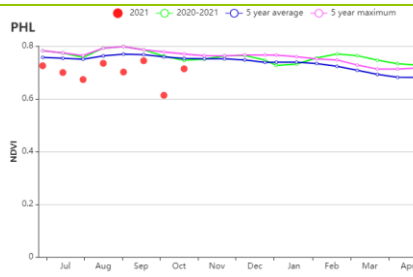
The **Hilly region** experienced a slightly wetter and warmer period. The rainfall was slightly higher than average by 1% (RAIN) and temperature increased by 0.5℃ (TEMP). The radiation was higher than average by 6% (RADPAR) and resulting biomass was higher than average by 2% (BIOMSS) as well. However, the NDVI was fluctuating below average since the end of July, which indicates that the crop conditions in this region are unfavorable.

In the **Forest region**, the precipitation was higher than average (RAIN +2%), accompanied by above-average temperature (TEMP, +0.4℃) and above-average radiation (RADPAR, +6%). The resulted biomass increased by 2% (BIOMSS). The VCIx value reached 0.96 and the CALF stayed at 100%. As shown by the NDVI profile, the NDVI for the region remained stable, slightly below average. All the indicators suggest that the crop growth for this region is normal.

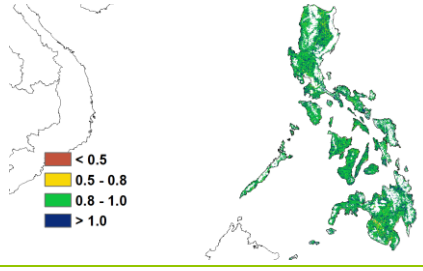
Figure 3.35 Philippines' crop condition, July - October 2021



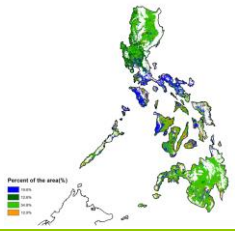
(a). Phenology of major crops



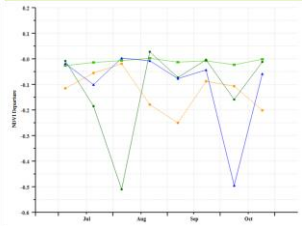
(b) Crop condition development graph based on NDVI



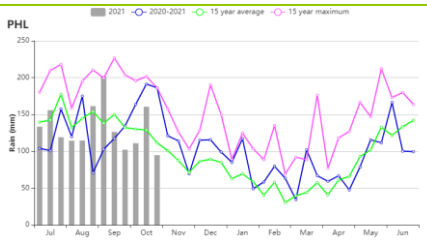
(c) Maximum VCI



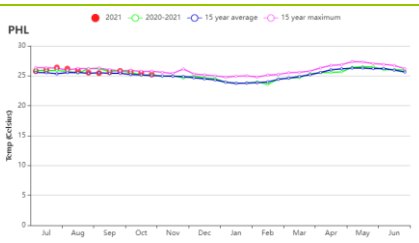
(d) Spatial NDVI patterns compared to 5YA



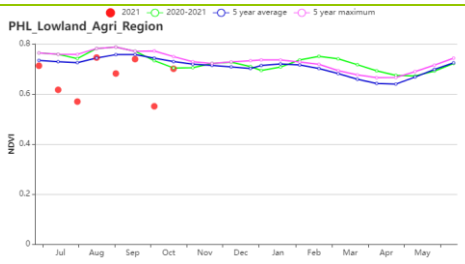
(e) NDVI profiles

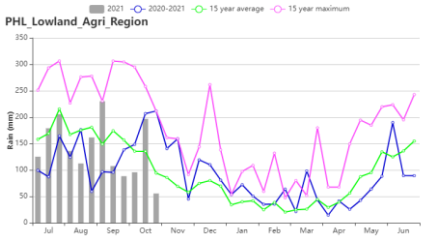


(f) Rainfall profiles

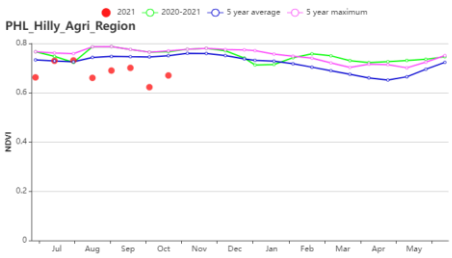


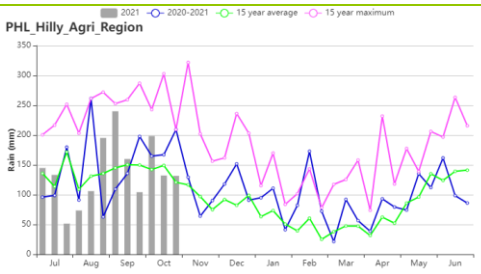
(g) Temperature profiles



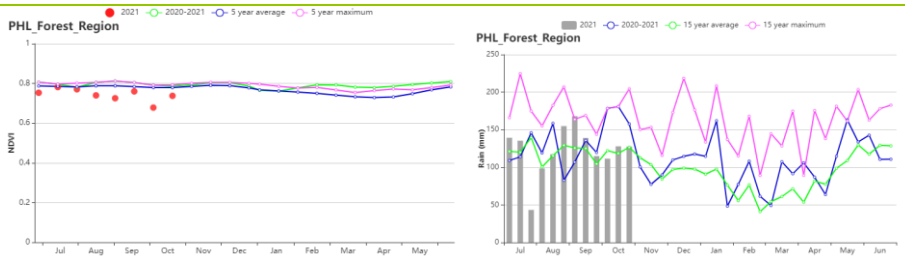


(h) Crop condition development graph based on NDVI (left) and time series rainfall profile (right) in Lowlands region





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



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

Table 3.58 Philippines' agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, July - October 2021

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Forest region	1478	2	25.6	0.4	1291	6	1552	2
Hilly region	1670	1	27.2	0.5	1314	6	1653	2
Lowlands region	1693	-11	25.7	0.4	1245	7	1565	-1

Table 3.59 Philippines' agronomic indicators by sub-national regions, current season's values and departure from 5YA, July - October 2021

Region	Cropped arable land fraction		Cropping intensity		Maximum VCI
	Current (%)	Departure (%)	Current (%)	Departure (%)	Current
Forest region	100	0	137	-3	0.96
Hilly region	100	0	121	-3	0.96
Lowlands region	100	0	154	5	0.96

[POL] Poland

The monitoring period covers the harvest of spring and winter wheat in July and August, as well as the main growth period of maize and its harvest in September and October. The planting of the new winter crops started in September. During this monitoring period, the agroclimatic conditions were close to the average and the crop growth was normal, but the yield of winter wheat, a summer crop, may be slightly below average due to the high temperatures and drought that affected the crops during the grain filling period, while the yield of maize can be expected to reach normal levels. Compared with the average of last 15 years, the national scale precipitation was 4% higher, temperature and photosynthetic effective radiation were slightly lower by 0.2°C and 3%, respectively, and the potential biomass was close to the average. Furthermore, CALF was up to 100% and VCIx was 0.94.

As shown by the graph, crop growth was close to average in July-August, reached the highest level in the past 5 years in early September, dropped back to the average level thereafter, and went below average in late October, which may be related to some delay in crop harvesting and sowing for the next season. This is also reflected in the temporal distribution of rainfall, which was above the highest level of last 15 years in early and late August. Overall, crop growth appears to be near average levels. The distribution map of VCIx shows that the vast majority of cultivated areas were above 0.8, and areas between 0.5 and 0.8 are only sporadically distributed in the eastern and central-western parts of the country. The crop clustering map shows that in all regions, NDVI was below average in October, which might have been due to delayed harvest of the summer crops because of wet conditions in September. They were followed by drier-than-normal conditions in October, which might have delayed germination of the winter crops. The maps show that 27% of the crops were above average during the monitoring period, mainly in the central and southern regions, 14.9% of the crops were consistently below the average for the same period, mainly in the northern regions, and 2.2% of the areas were significantly below average in late September and then recovered to the average. This may have been influenced by short term rainfall and flooding, mainly in the northwest.

Overall, crop growth in Poland seems to be normal, with harvested crop yields only slightly below average and average conditions for growing winter wheat.

Regional analysis

The country is divided into four zones according to agro-ecological characteristics, including: (a) the **Northern oats and potatoes areas** covering the northern half of West Pomerania, eastern Pomerania and Warmia-Masuria, (b) the **Northern-central wheat and sugar-beet area** (Kuyavia-Pomerania to the Baltic sea), (c) the **Central rye and potatoes area** (Lubusz to South Podlaskie and northern Lublin), and (d) the **Southern wheat and sugar-beet area** (Southern Lower Silesia to southern Lublin and Sub-Carpathian along the Czech and Slovak borders).

Compared to the average of the last 15 years, precipitation in the **Northern oats and potatoes area** was 3% higher, temperature was close to average, RADPAR was 5% lower, and BIOMSS was 3% higher benefiting from abundant precipitation. CALF was 100% and VCIx was 0.92. The crop growth curve shows that the crop growth was below average from July to early August due to the early drought and recovered to the average level from late August to September as the precipitation increased in August. But the precipitation in August-September also delayed the crop harvest and the sowing of the next season. The NDVI in October was significantly lower than the average level in the same period. Overall, crop growth appears normal and yields may be slightly below average. In addition, the CI for the year was only 90%,

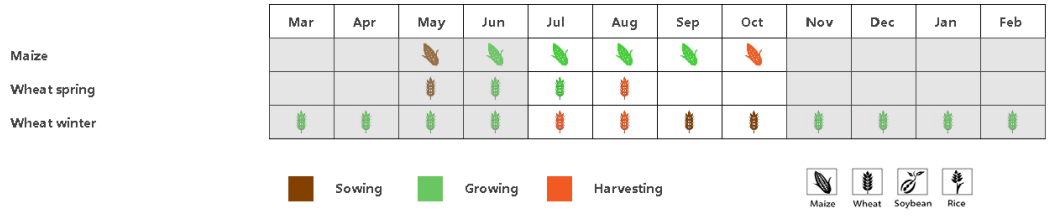
which is 12% lower than average.

In the **Northern-central wheat and sugar-beet area**, precipitation was 2% above average, temperature was on par with previous years, RADPAR was 4% below average, and BIOMSS was near the average of the last 15 years. The percentage of cultivated land was 100% and VCIx was 0.89. The crop was affected by high temperature and low precipitation in July, from near average in July to below average in early August, and recovered with the recharge of sufficient precipitation in August, even above average in early September, and declined to average thereafter and a low NDVI in October. Overall, crop growth was normal, but crop yield was below average due to the impact of the early drought and high temperature. CI of this sub-district was 97%, 8% lower than the average, and the annual crop planting was lower than in previous years.

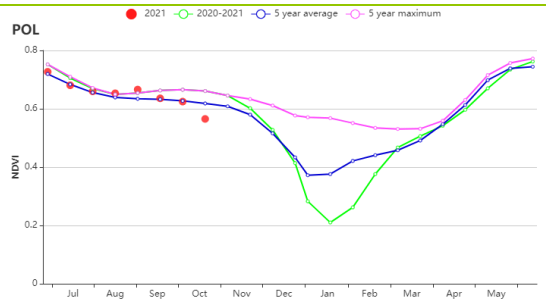
Compared with the average of the last 15 years, in the **Central rye and potatoes area**, precipitation was 6% higher, temperature was 0.2°C lower, RADPAR was 3% lower, and BIOMSS was flat. CALF was 100% and VCIx was 0.94. The crop growth in the zone was consistently above average, especially from late August to early September, and the NDVI was higher than the highest level of the last 5 years. NDVI was significantly lower in October. Overall, the crop growth was normal and the crop yield was close to the average. CI of this sub-district was 106%, which was slightly lower by 2% compared to the average.

In the **Southern wheat and sugar-beet area**, precipitation was 4% higher, temperature was 0.4°C lower, RADPAR was 1% lower, and BIOMSS was 1% lower. CALF was 100% and VCIx was 0.97. The crop growth in this sub-region was consistently above average, especially from August to early September, when the NDVI was higher than the highest level of the last 5 years, and similarly, the NDVI in October was significantly lower than the average level due to the delay in phenology. Overall, the crop growth was normal and the yield was stable. CI of this sub-district was 133%, which was 26% higher than the average.

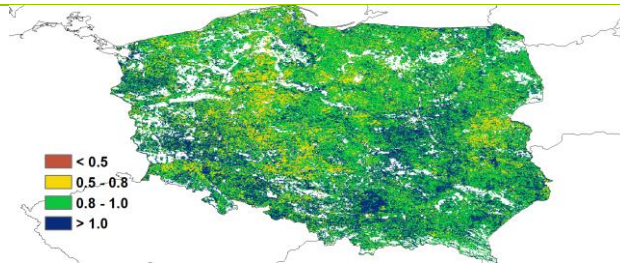
Figure 3.36 Poland's crop condition, July-October 2021



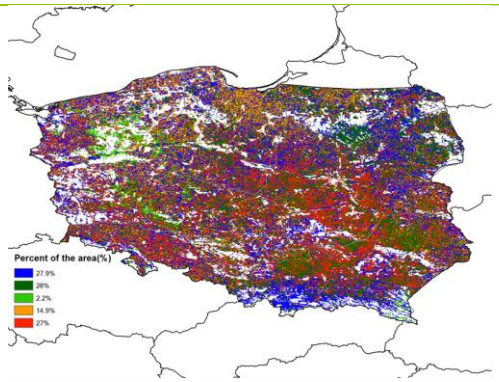
(a). Phenology of major crops



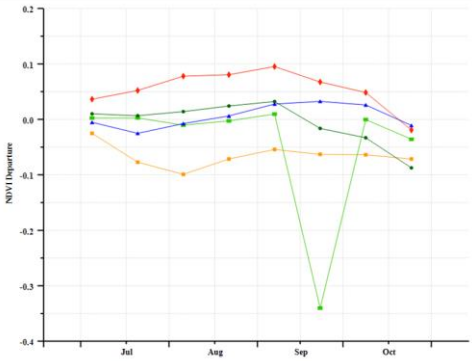
(b) Crop condition development graph based on NDVI



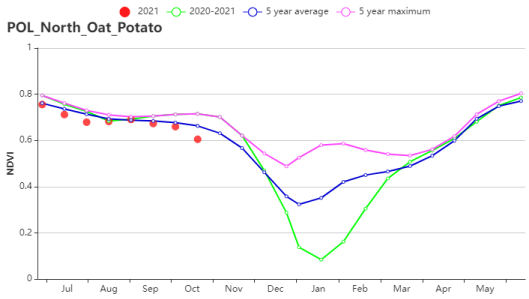
(c) Maximum VCI

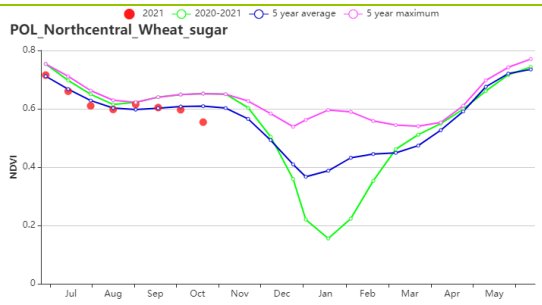


(d) Spatial NDVI patterns compared to 5YA

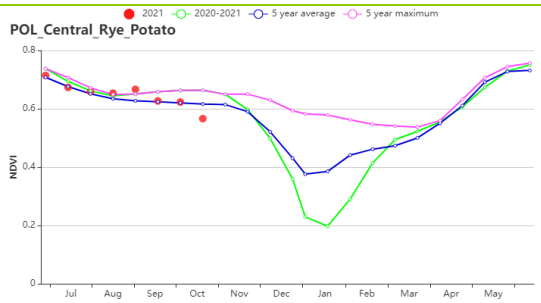


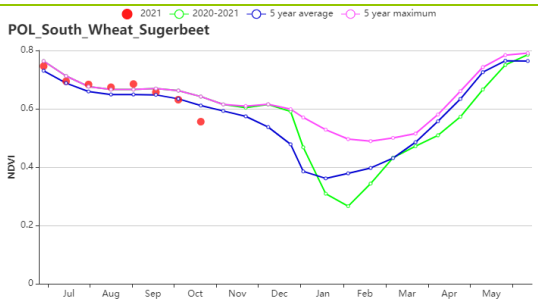
(e) NDVI profiles



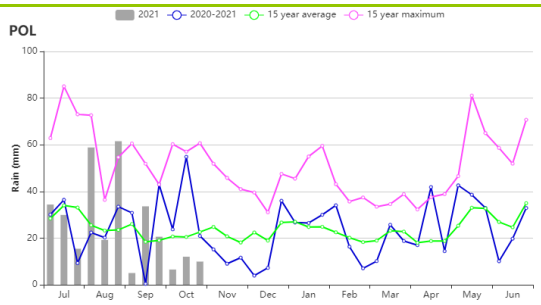


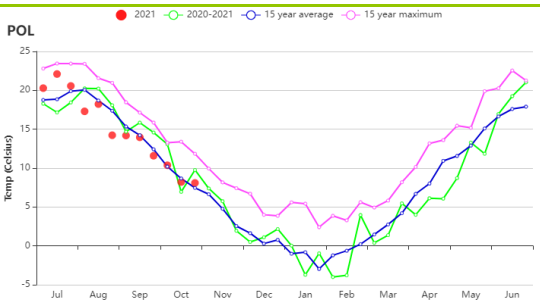
(f) Crop condition development graph based on NDVI, Northern oats and potatoes area (left) and Northern-central wheat and sugar beet area (right).





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

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	335	3	14.7	0.0	761	-5	819	3
Northern-central wheat and sugarbeet area	291	2	15.1	0.0	783	-4	751	0
Central rye and potatoes area	298	6	15.3	-0.2	812	-3	748	0
Southern wheat and sugarbeet area	315	4	14.5	-0.4	889	-1	759	-1

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

Region	Cropped arable land fraction		Cropping Intensity		Maximum VCI
	Current	Departure (%)	Current	Departure (%)	Current
Northern oats and potatoes areas	100	0	90	-12	0.92
Northern-central wheat and sugarbeet area	100	0	97	-8	0.89
Central rye and potatoes area	100	0	106	-2	0.94
Southern wheat and sugarbeet area	100	0	133	26	0.97

[ROU] Romania

The reporting period includes the harvest of wheat (which started in July), the sowing of the 2020-21 winter wheat (which started in September) and also the harvest of maize and other summer crops in September. Overall, crop conditions were fair. Rainfall was 38% lower than average; TEMP (-0.5°C) was below the 15YA, whereas RADPAR (+3%) was a bit higher than average and BIOMSS (-18%) was below average. The nationwide NDVI profile shows that crop conditions were a bit lower than average from July to early October and above average in late October. The temperature fluctuated around above-average levels and rainfall was below average in August. The southeast suffered from drought conditions, which had started already in the previous reporting period. The CALF of Romania during the reporting period was 99%, 1% lower than average and the maximum VCI was 0.84, which was fair. According to the spatial distribution of VCIx, the eastern subregion has higher values (0.8-1.0) than the western and central subregion (0.5-0.8). The NDVI pattern profile shows that regions marked with blue color located in the western and central maize, wheat and sugar beet plateau experienced a sharp decrease during July-October. NDVI was also far below average in the eastern and southern maize, wheat and sugar beet plain, shown in light green and red. Conditions improved in October, but all major summer crops grown in that region had reached maturity by then. These crops suffered from drought conditions, which had been observed already in the previous report. Hence, production prospects for this important region of Romania are unfavorable, while they are closer to normal for the other regions.

Regional analysis

More details are provided below for three main agro −ecological zones: the Central mixed farming and pasture Carpathian hills (160), the Eastern and southern maize, wheat and sugar beet plains (161) and the Western and central maize, wheat and sugar beet plateau (162).

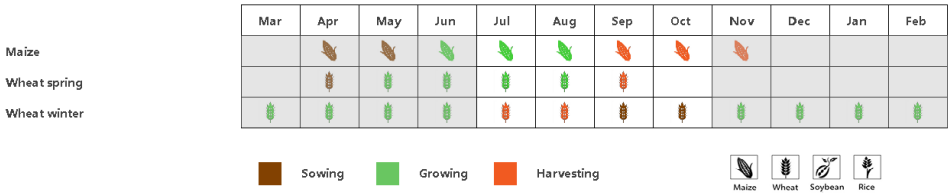
For the Western and central maize, wheat and sugar beet plateau, rainfall was lower than average by 39%, temperature was average (-0.4℃) and radiation was a bit higher (RADPAR +2%), and biomass decreased 17%, due to a decrease in rainfall. Spatial NDVI profiles show that crop condition was worse than average during July to early September, covering the growing periods of maize and spring wheat. Maximum VCI of this region was 0.80, a bit low and the spatial distribution was between 0.5 and 1.0. Also, the NDVI development decreased from July to October, consistent with the VCI values. The cropping intensity is 110, 9% higher than last year.

For the Central mixed farming and pasture Carpathian hills, rainfall decreased by as much as 41% below average while temperature decreased 0.6℃ and radiation increased 3%, and BIOMSS decreased 21%. The maximum VCI map shows values above 0.8, with the regional average at 0.84. The NDVI spatial distribution shows that NDVI was below average from July to August. As this AEZ occupies only a small fraction of cropland in Romania, a small patch of irrigated land in Transylvania, its fair NDVI cannot represent much of Romania's crop production. The cropping intensity is 108, 8% higher than last year.

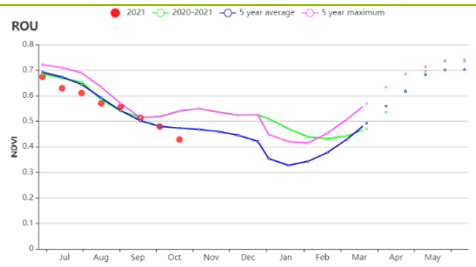
For the Eastern and Southern maize, wheat and sugar beet plains, rainfall decreased 38%, temperature decreased 0.5℃, radiation increased by 4% and biomass decreased 18%. The NDVI development graph shows that crop conditions were close to, yet a bit lower than average. The decrease of precipitation in this period caused drought conditions. VCIx value of this region was 0.86 and according to the distribution map, VCIx values were between 0.8-1.0 in most of the central and middle region (counties of Tulcea and Constanta), representing about 14.3% of national cropland. The cropping intensity was 129, 19% higher than last year.

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

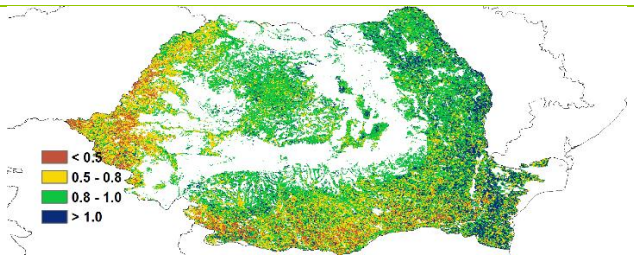
Figure 3.37 Romania's crop condition, July-October 2021



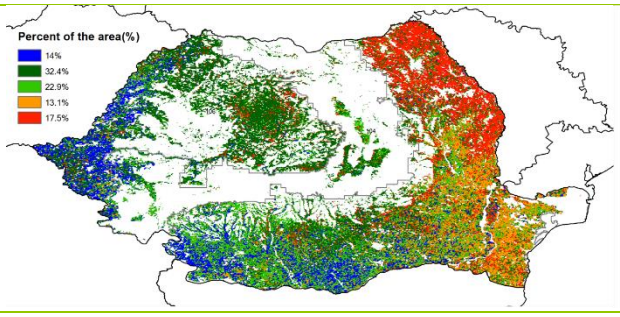
(a). Phenology of major crops



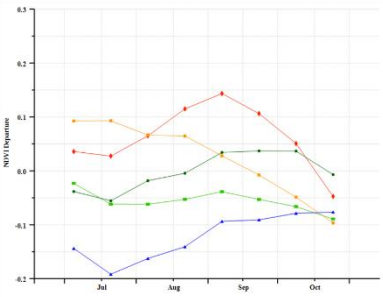
(b) Crop condition development graph based on NDVI



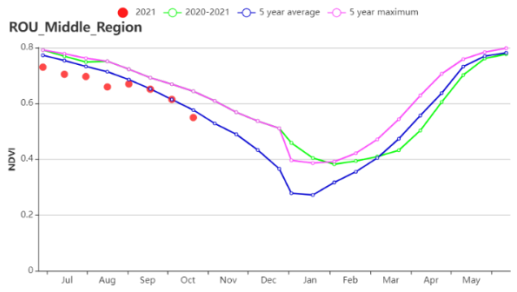
(c) Maximum VCI

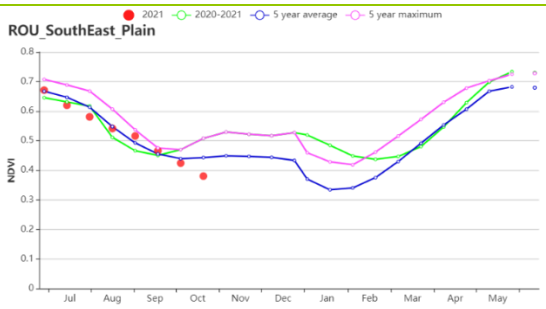


(d) Spatial NDVI patterns compared to 5YA

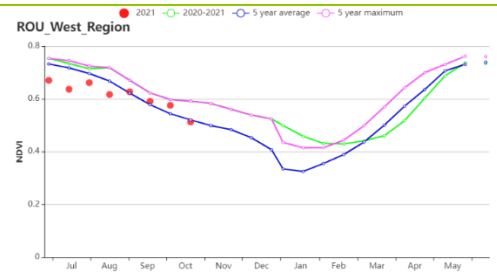


(e) NDVI profiles

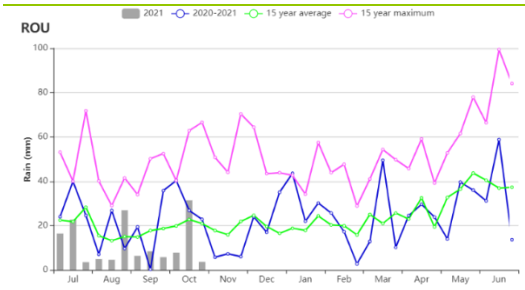




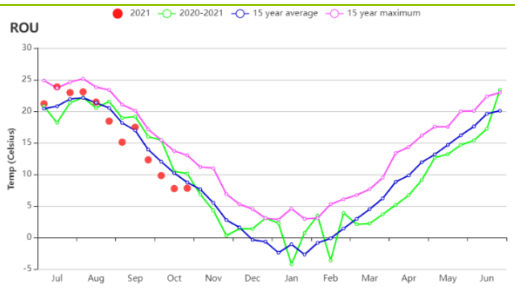
(f) Crop condition development graph based on NDVI (Central mixed farming and pasture Carpathian hills (left) and Eastern and southern maize, wheat and sugar beet plains (right))



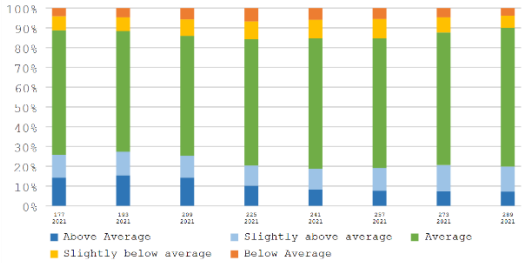
(g) Crop condition development graph based on NDVI (Western and central maize, wheat and sugar beet plateau)

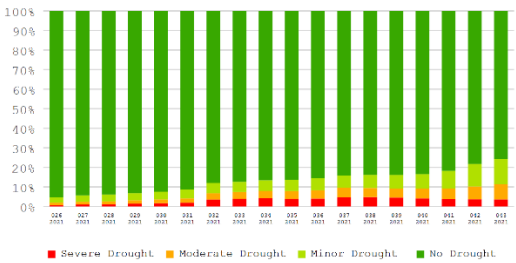


(h) Time series rainfall profile



(i) Time series temperature profile





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

Table 3.62 Romania's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, July-October 2021

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 mixed farming and pasture Carpathian hills	159	-41	14.4	-0.6	1080	3	569	-21
Eastern and southern maize wheat and sugar beet plains	132	-38	17.8	-0.5	1107	4	553	-18
Western and central maize wheat and sugar beet plateau	144	-39	16.3	-0.4	1073	2	571	-17

Table 3.63 Romania's agronomic indicators by sub-national regions, current season's values and departure from 5YA, July - October 2021

Region	Cropped arable land fraction		Maximum VCI	Cropping intensity	
	Current (%)	Departure from 5YA (%)	Current	Current (%)	Departure from 5YA (%)
Central mixed farming and pasture Carpathian hills	100	0	0.84	108	8
Eastern and southern maize wheat and sugar	100	2	0.86	129	19

Region	Cropped arable land fraction		Maximum VCI	Cropping intensity	
	Current (%)	Departure from 5YA (%)	Current	Current (%)	Departure from 5YA (%)
beet plains					
Western and central maize wheat and sugar beet plateau	100	0	0.8	110	9

[RUS] Russia

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

At the beginning of the period, rainfall was below average. By the end of August, precipitation decreased sharply. In early August and late September, there was a sharp increase in precipitation, which exceeded last year and the 15-year average.

Temperatures in Russia during the monitoring period from July to August exceeded last year and the 15-year average. At the end of August and until the end of the monitoring period the temperature was below the 15-year average and last year.

According to the national CropWatch data, NDVI during the monitoring period was below both the 5-year average and previous year. However, there were significant differences between regions: Above average crop conditions with VCIx above 0.8 are observed in Central and Black soil region with positive NDVI departure; South and North Caucasus regions also show positive NDVI departure with VCIx ranging from 0.5 to 1; Spring crop producing regions (Volga, Urals, Siberia) showed negative NDVI departure with VCIx ranging from <0.5 to 0.8 due to unfavourable weather conditions.

In regions with positive NDVI departure the crop yield is expected to be above or at the level of the previous year. In Volga and Ural regions the yield of spring crops is likely to be lower than in the previous year.

Regional analysis

South Caucasus

Rainfall was 15% above the 15-year average. Temperature and RADPAR were less than average by 0.6°C and 1%, respectively. BIOMSS showed a negative deviation of 9%. CALF was higher by 14% relative to the 5-year average. In the South Caucasus, CI increased by 4%. VCIx was 0.90.

In July, the NDVI was equal to last year's value, but it gradually increased in early August and exceeded the 5-year highest in September and October. This is an indicator of good situation with winter crop sowing, and good crop status before the snow cover establishment.

Judging by the Cropwatch indicators, the wheat harvest of 2020-2021 would be bigger than last year's and the average of last 5 years. It is expected that the harvest of summer crops will be equal to or slightly bigger than last year.

North Caucasus

Rainfall was down by 2% and temperature was down by 0.6°C. RADPAR increased slightly by 1%, and BIOMSS increased by 4% relative to the 15-year average. CALF increased by 14%. In the North Caucasus, CI increased by 4%. VCIx was 0.91.

At the beginning of the monitoring period, the NDVI was equal to last year and the 5-year average. But in September the NDVI reached a 5-year highest and was equal to average until the end of October. It is quite likely that summer crop yield would be slightly higher than last year.

Central Russia

Rainfall was down by 12%. Temperature and RADPAR increased by 0.1°C and by 3% respectively. BIOMSS increased by 9%. In Central Russia, CI decreased by 3% and CALF was equal to the 5-year average. VCIx was 0.94.

From July to October, the NDVI was below last year and the 5-year average, only reaching the 5-year average in early September.

The yield of 2020-2021 winter crop should be below last year and 5-year average. The yields of spring and summer crops should show a similar trend.

Central black soil area

Rainfall was 9% less than the 15-year average. Temperature was close to average. RADPAR and BIOMSS increased by 3% and 9% respectively. In the Central black soils area, CI decreased by 3% and CALF was equal to the 5-year average. VCIx was 0.88.

From July through mid-August, NDVI was below 5-year average, but in September and October it reached the last year's value.

Summer crop yield should be slightly below the average.

Middle Volga

Rainfall decreased by 21% relative to the 15-year average, which is the maximum deviation in Russia. Temperature decreased by 0.1°C. RADPAR and BIOMSS increased by 7% and 9% respectively. CALF decreased by 5% relative to the 5-year average. In the Middle Volga, CI decreased by 5%. VCIx at 0.76 showed the lowest value for Russia over the period.

NDVI was well below the 5-year average and last year, which was due to a decrease in rainfall in the Middle Volga.

The yields of winter, spring, and summer crop are all expected to be below the average of last year and the 5-year average. The 2021-2022 winter crop sowing campaign is likely to be delayed due to low soil moisture content.

Ural and western Volga

In the Ural and western Volga, rainfall was down by 16% relative to the 15-year average, while temperature increased by 0.2°C. RADPAR and BIOMSS increased by 8% and 6% respectively. CALF and CI decreased by 3% and 1% relative to the 5-year average. VCIx was 0.81.

Throughout the monitoring period, NDVI was below the 5-year average and the last year. At the end of October, NDVI was equal to average. The decrease in NDVI was due to a decrease in rainfall and an increase in temperature.

The yields of winter, spring, and summer crops are all expected to be below last year and the 5-year average. The 2021-2022 sowing campaign is likely to be close to normal.

Western Siberia

In Western Siberia, rainfall increased by 17% over the 15-year average. Temperature was down 0.2°C. Both of RADPAR and BIOMSS increased by 2%. CALF and CI decreased by 1% relative to the 5-year average. VCIx was 0.92.

The NDVI in Western Siberia was equal to last year and the 5-year average.

There are very few winter crops in this region. The yield of spring and summer crops is expected to be slightly below the 5-year average and previous year.

Middle Siberia

In Middle Siberia, rainfall and temperatures decreased by 19% and 0.1° C relative to the 15-year average, respectively. RADPAR and BIOMSS increased by 1% and 4% respectively. CALF decreased by 1% and CI increased by 4%. VCIx was 0.95.

In Middle Siberia, NDVI was higher than the 5-year maximum from July to August, andwas equal to the 5-year average from September to October.

The yields of spring, and summer crops are all expected to be above the 5-year average and previous year.

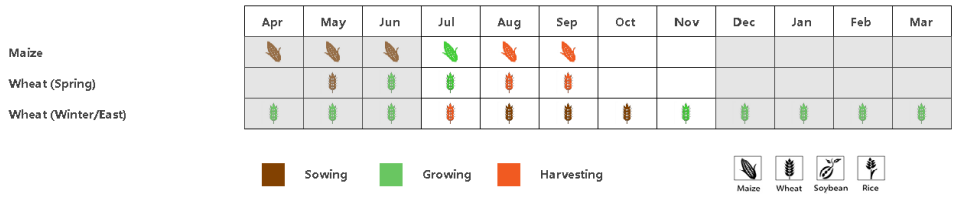
Eastern Siberia

In Eastern Siberia, compared to the 15-year average, rainfall decreased by 31%, while temperature increased by 0.1°C. RADPAR and BIOMSS increased by 10% and 4% respectively. CALF decreased by 1% and CI increased by 13%. The VCIx was 0.95.

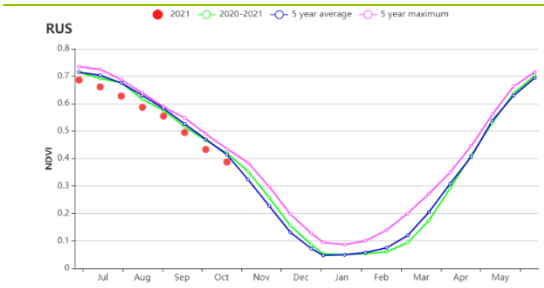
NDVI was close to the 5-year average from July to October.

According to the graphs, the yields of spring and summer crops are all expected to be below the 5-year average.

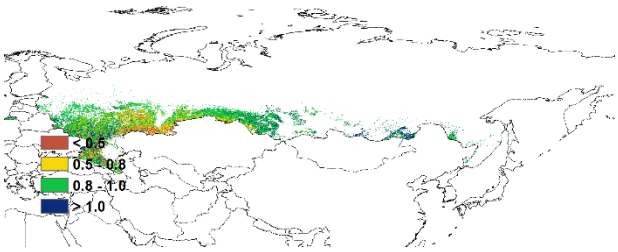
Figure 3.38 Russia's crop condition, July - October 2021



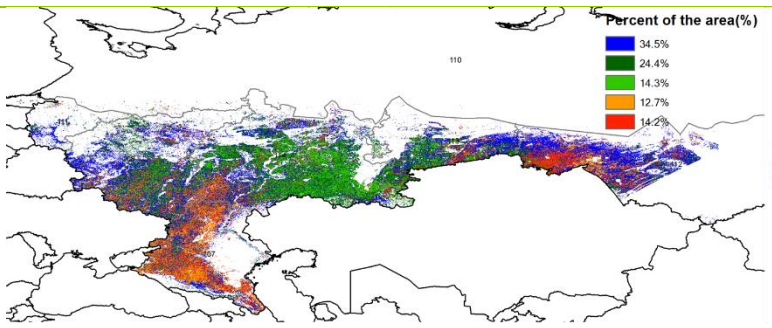
(a) Phenology of major crops



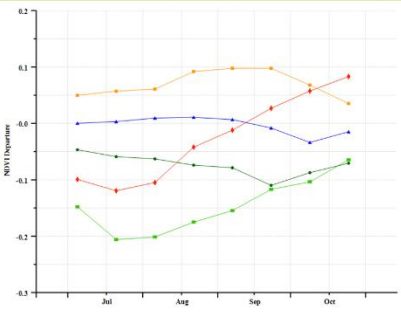
(b) Crop condition development graph based on NDVI



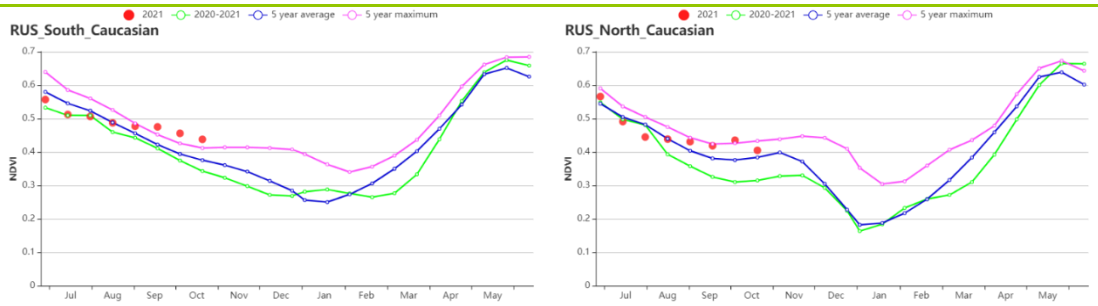
(c) Maximum VCI



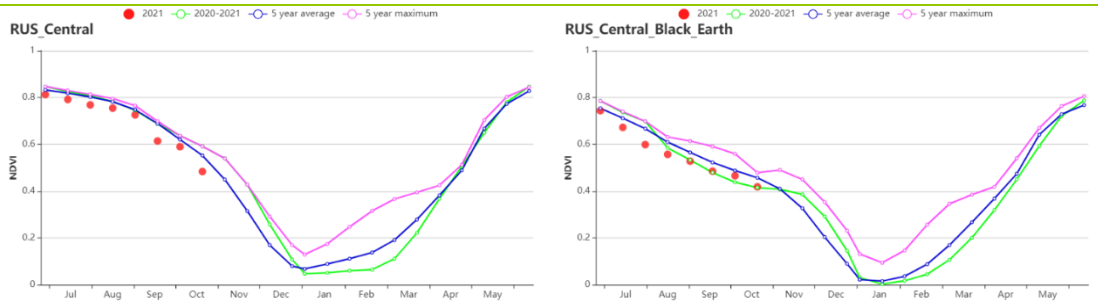
(d) Spatial NDVI patterns compared to 5YA



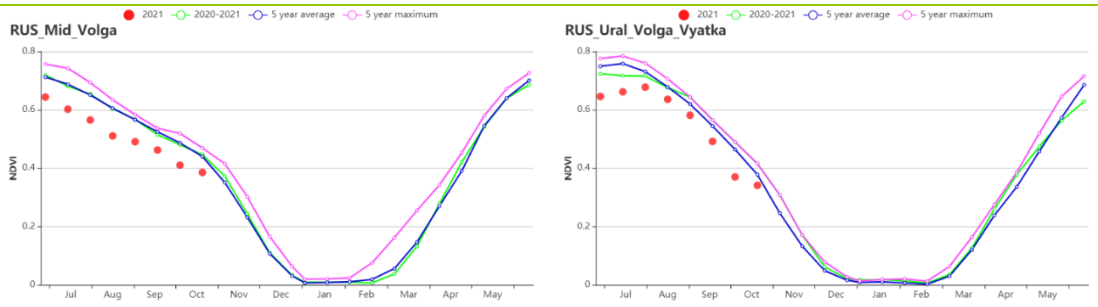
(e) NDVI profiles



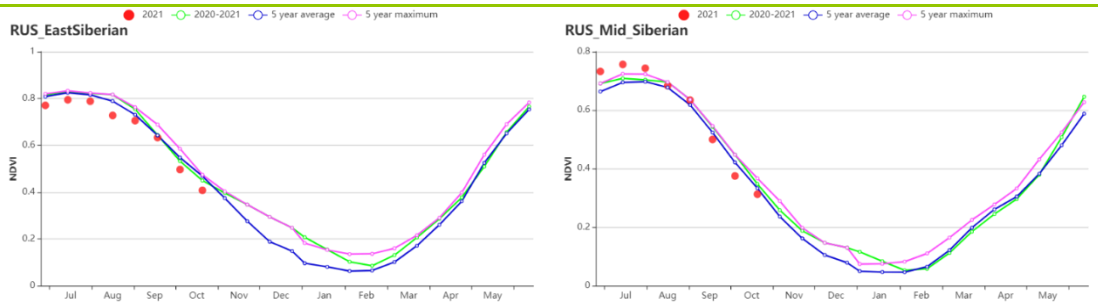
(f) Crop condition development graph based on NDVI, Southern Caucasus (left) and Northen Caucasus (right).



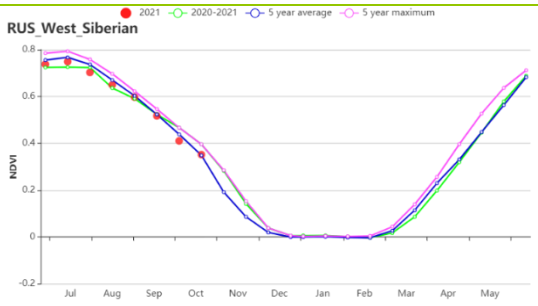
(g) Crop condition development graph based on NDVI, Central Russia (left) and Central black soils area (right).



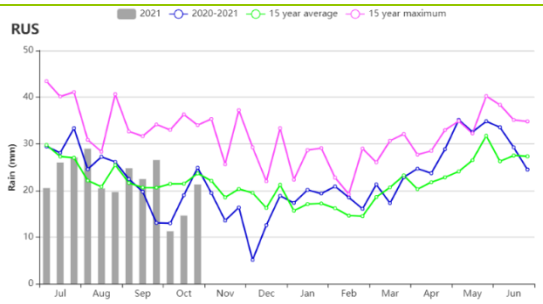
(h) Crop condition development graph based on NDVI, Middle Volga (left) and Ural and western Volga region (right).



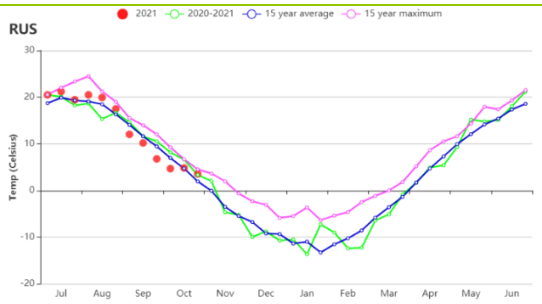
(i) Crop condition development graph based on NDVI, Eastern Siberia (left) and Middle Siberia (right).



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



(k) Rainfall index



(l) Temperature Index

Table 3.64 Russia's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, July - October 2021

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m^2)	Departure (%)	Current (gDM/m^2)	Departure (%)
Central Russia	276	-12	13.2	0.1	750	3	342	9
Central black soils area	213	-9	14.9	0.0	867	3	430	9
Eastern Siberia	346	-31	14.1	1.0	943	10	391	4
Middle Siberia	263	-19	9.4	-0.1	929	1	316	-4
Middle Volga	213	-21	13.9	0.3	852	7	396	9
Northern Caucasus	192	-2	18.7	-0.3	1054	1	563	4
Southern Caucasus	386	116	16.5	-0.6	1062	-1	465	-9
Ural and western Volga region	221	-16	12.3	0.2	803	8	341	6
Western Siberia	317	17	11.7	-0.2	822	2	340	2

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

Region	Cropped arable land fraction		Cropping Intensity		Maximum VCI
	Current (%)	Departure (%)	Current (%)	Departure (%)	Current
Central Russia	100	0	97	-3	0.94
Central black soils area	100	0	97	-3	0.88
Eastern Siberia	99	-1	113	13	0.95
Middle Siberia	99	1	104	4	1.00
Middle Volga	91	-5	95	-5	0.76
Northern Caucasus	95	14	107	4	0.91
Southern Caucasus	87	14	106	4	0.90
Ural and western Volga region	96	-3	99	-1	0.81
Western Siberia	99	-1	99	-1	0.92

[THA] Thailand

This monitoring period covers most of the growth cycle of main rice and the harvest of maize. According to CropWatch agroclimatic indicators, Thailand experienced wetter and warmer weather as compared to the 15YA. The rainfall (RAIN, +11%), temperature (TEM, +0.2°C), and radiation (RADPAR, +5%) from July to October were above average resulting in an above-average biomass production potential (BIOMSS, +4%). According to its profile, the temperature was around average but reached a 15-year maximum at the end of July and September. According to the NDVI development graph, crop conditions were close to average before September but were below average after that. The decrease of NDVI at the end of August may have been mainly due to cloud cover in the satellite images.

According to the NDVI departure clusters and the corresponding profiles, crop conditions were close to average on 73.5% of total arable land, located in all regions of Thailand. In an area accounting for 11.5% of total cropped area, crop conditions were close to average but deteriorated to below average after August. Crop conditions on 15.1% of total cropland were below average throughout this monitoring period, mostly located in Prachuap Khilikhan, Chumphon, and Krabi. In general, favorable conditions for crops were observed during the July to October period as indicated by high VCIx values at 0.95. Considering the average CALF and below-average crop intensity (Cropping Intensity, -8%), the crop conditions during this season are assessed as close to the average level.

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), the Single-cropped rice north-eastern region (118), and Western and southern hill areas (117). Among these regions, the first three of them are major agricultural production regions of Thailand.

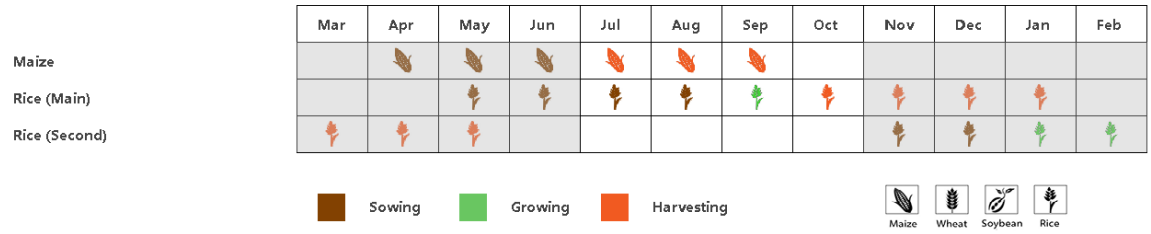
The **Central double and triple-cropped rice lowlands** is the major rice production zone of Thailand. It had received plenty of rainfall during this period. Rainfall was above average (RAIN, +34%), accompanied by average temperature (TEMP, 0.0°C) and slightly above-average radiation (RADPAR, +5%). As a result, above-average weather conditions resulted in an increase of potential production (BIOMSS, +9%). The NDVI development graph shows that crop conditions started to drop below average in September when the crops were approaching maturity.

The agro-climatic conditions in the **South-eastern horticulture area** were the same as in the Central region**:** Rainfall was above average (RAIN, +34%), accompanied with close-to-average radiation (RADPAR, +1%). The temperature was close to average (TEMP, +0.0℃). This agro-climatic condition led to a slight increase of potential production (BIOMSS, +5%). According to the NDVI development graph, the crop condition is close to the average of the recent 5 years after removing the effect of cloud contamination in the satellite images.

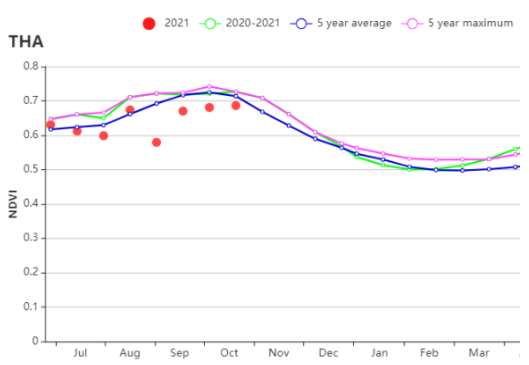
In the **Single-cropped rice north-eastern region,** precipitation was above average by 14%, while temperature and radiation were above average by 0.1℃ and 7%, respectively. These agro-climatic conditions led to an increase of BIOMSS by 7%. As a result, crop conditions were above average before September but dropped to slightly below average thereafter, according to the NDVI development graph.

For each region, the VCIx ranging from 0.95 to 0.96 indicates that the peak season was comparable to the 5YA. Almost all cropland was cultivated during the monitoring period.

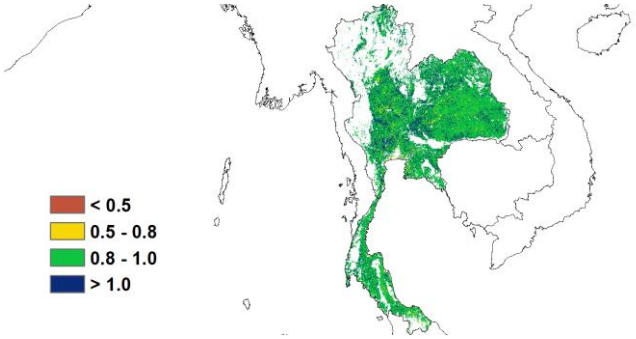
Figure 3.39 Thailand's crop condition, July - October 2021



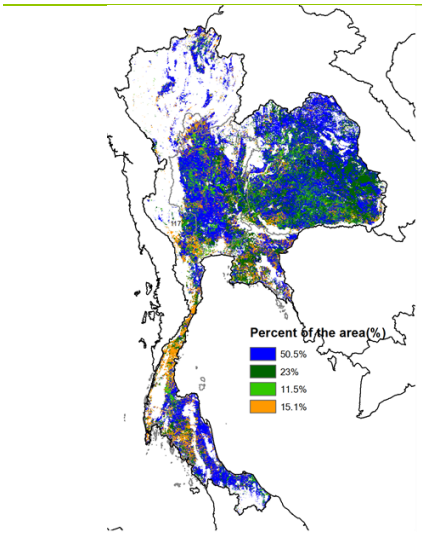
(a). Phenology of major crops



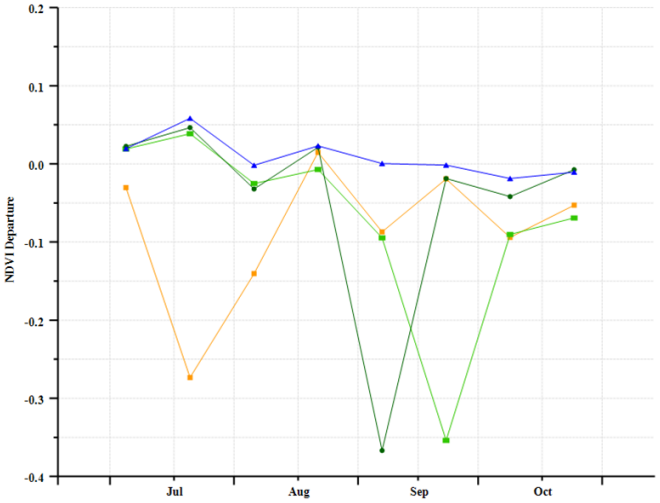
(b) Crop condition development graph based on NDVI



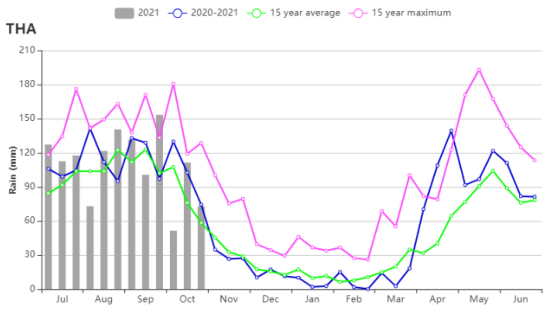
(c) Maximum VCI



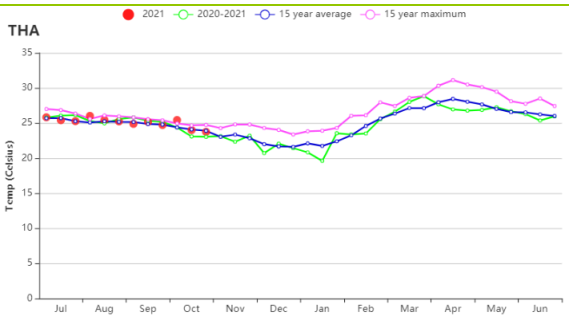
(d) Spatial NDVI patterns compared to 5YA



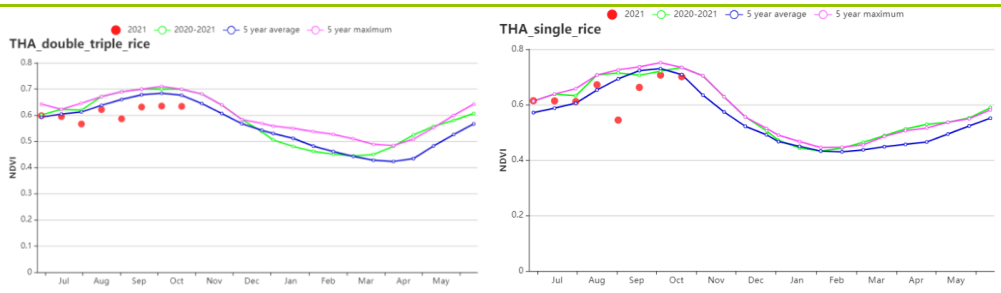
(e) NDVI profiles



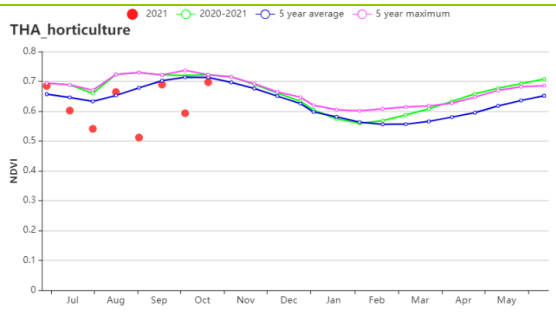
(f) Rainfall profiles



(g) Temperature profiles



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



(i) Crop condition development graph based on NDVI (South-eastern horticulture area)

Table 3.66 Thailand's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, July - October 2021

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	1545	40	25.4	0	1121	5	1616	9
South-eastern horticulture area	1759	34	25.8	0	1126	1	1651	5
Single-cropped rice north-eastern region	1477	14	25.4	0.1	1162	7	1625	7

Table 3.67 Thailand's agronomic indicators by sub-national regions, current season's values and departure from 5YA, July - October 2021

Region	Cropped arable land fraction		Cropping intensity		Maximum VCI
	Current (%)	Departure (%)	Current (%)	Departure (%)	Current
Central double and triple-cropped rice lowlands	100	0	121	-3	0.96
South-eastern horticulture area	100	0	113	-12	0.95
Single-cropped rice north-eastern region	100	0	100	-10	0.95

[TUR] Turkey

This monitoring period covers the end of the harvest period of winter wheat in July, as well as the growing seasons for rice and maize. Winter wheat sowing started in October. Nationwide, RAIN (-20%) and temperature (-0.6℃) were below average, whereas RADPAR (+0.1%) was slightly above the 15YA. BIOMSS was 14% below average. During this monitoring period, especially in mid-August and October, lack of rainfall has caused a negative impact on the growth of crops and caused a biomass decrease.

The NDVI-based crop condition development graph indicates below-average crop conditions during the whole monitoring period. The national average VCIx was 0.76. The southeastern, southern, and western provinces, such as Sanliurfa, Mardin, and Adana, experienced low VCIx values ranging from 0.5 to 0.8, indicating that crops in those regions were not satisfactory. Low VCIx (< 0.5), which indicates below-average crop conditions, was mainly observed for the central provinces such as Ankara, Yozgat and Kayseri.

In terms of the NDVI spatial departure clustering map, the results confirmed the spatial pattern described above. Due to the impact of low rainfall in April and May, strong negative departures of NDVI were observed. As shown by the VHIn graph, some areas went through dry conditions in the reporting period. Germination and establishment of winter wheat is also negatively impacted. All in all, due to the drought impact, crop conditions were below average for Turkey.

Regional analysis

The regional analysis includes four agro −ecological zones (AEZ): the Black Sea area, Central Anatolia, Eastern Anatolia and Marmara Aegean Mediterranean lowland zone.

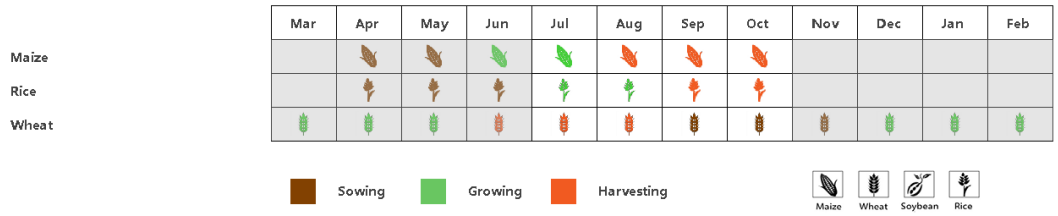
In the Black Sea zone, crop conditions were close to average. The rainfall was above average (RAIN +22%), while the temperature (TEMP) decreased by 1℃ and radiation decreased from the average (-6%). The cropped arable land fraction was 89%, 7% below average. The average value of VCIx was high at 0.81, the highest among all four AEZs of Turkey. Cropping intensity was at 111, 8.47% higher than average. The crop conditions are assessed to be close to normal.

In the Central Anatolian plateau, rainfall was far below average (RAIN -32%) during this monitoring period. TEMP (-0.8℃) and RADPAR (+0%) were close to the 15YA average, resulting in a decrease of the BIOMSS index (-17%). The average VCIx for this region was 0.62. The cropped arable land fraction was only 31%, a decrease by 10%. Cropping intensity was at 103, 1.12% higher than average. Crop conditions are assessed as below average.

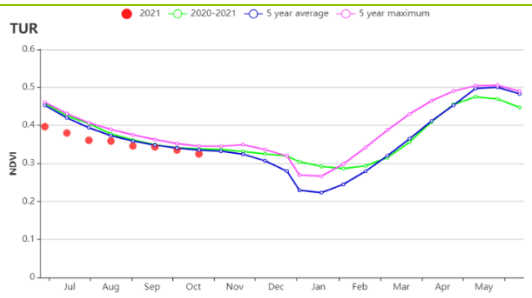
In Eastern Anatolia, rainfall was 5% below average, TEMP was 0.5℃ below average and RADPAR remained average. The lack of rainfall led to a decrease of biomass by 4%. The CALF was greatly lower at 24%, a 52% decrease compared to the average. With VCIx only at 0.46, cropping intensity 0.59% higher at 105, crop output is assessed to be below average.

As indicated by the NDVI profile, in the Marmara Aegean Mediterranean lowland zone, the crop conditions were below average during the reporting period (BIOMSS -25%). RAIN was 48% below average, which is the largest decrease among the four AEZs. The temperature was slightly below average (TEMP -0.2℃) and radiation increased slightly (RADPAR +2%) but not enough to offset the impact of lower rainfall. VCIx was 0.71, and CALF was down 1% at 56%. Cropping intensity was 2% higher at 109. Production in this region is expected to be below average.

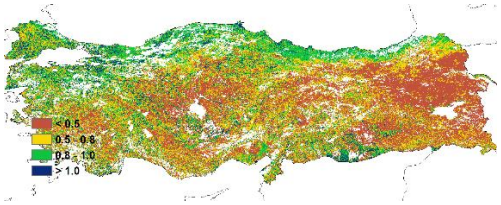
Figure 3.40 Turkey's crop condition, July-October 2021



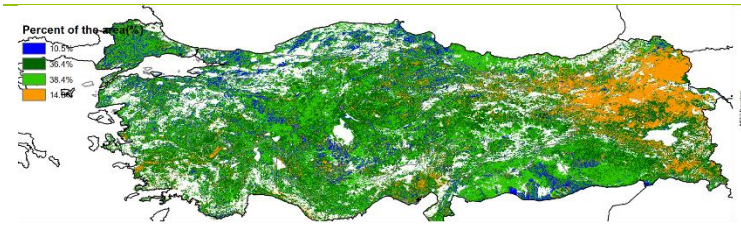
(a). Phenology of major crops



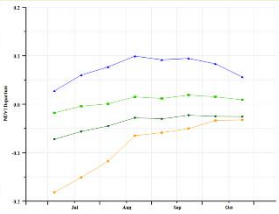
(b) Crop condition development graph based on NDVI



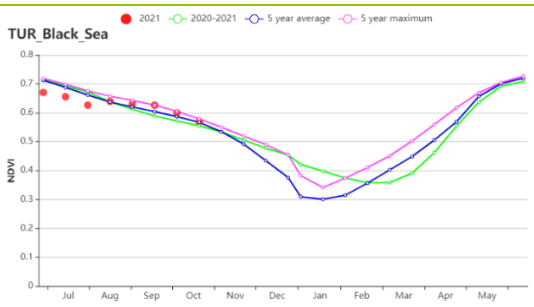
(c) Maximum VCI



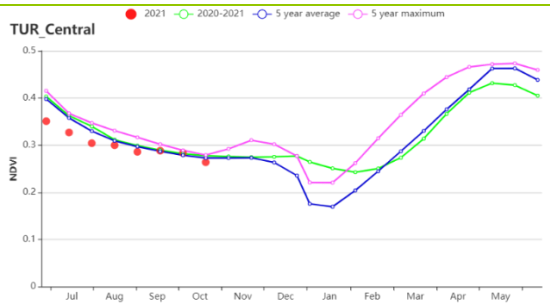
(d) Spatial NDVI patterns compared to 5YA



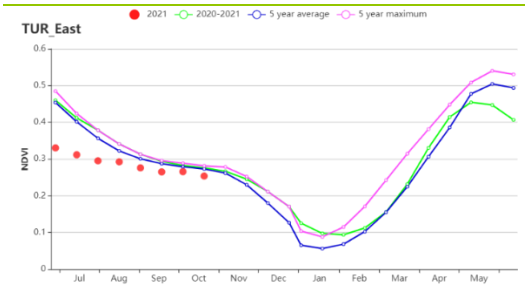
(e) NDVI profiles



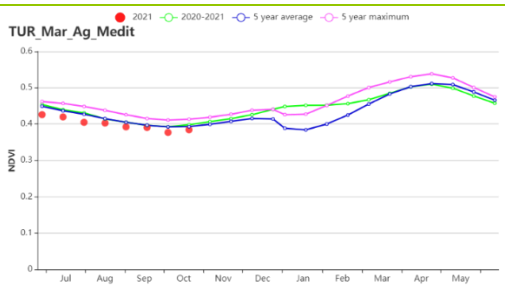
(f) Crop condition development graph based on NDVI (Black Sea region)



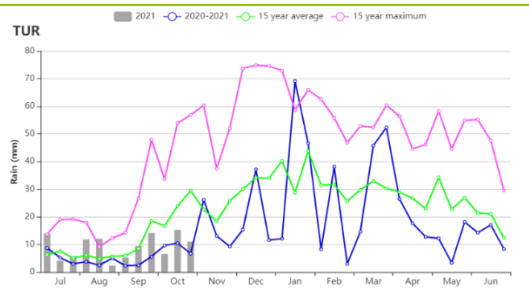
(g) Crop condition development graph based on NDVI (Central Anatolia region)



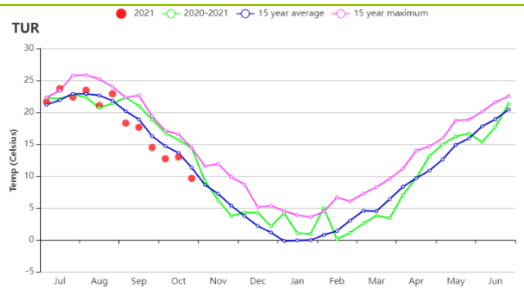
(h) Crop condition development graph based on NDVI (Eastern Anatolia region)



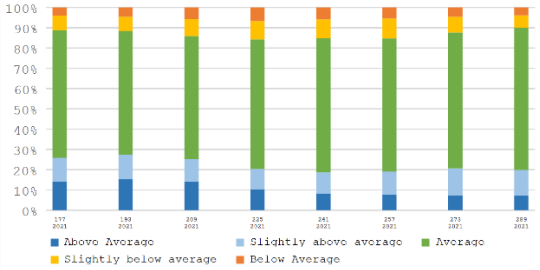
(i) Crop condition development graph based on NDVI (Marmara_Agean_Mediterranean lowland region)



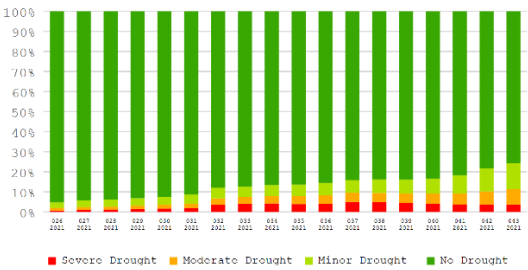
(h) Time series rainfall profile



(i) Time series temperature profile



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



(k) Proportion of VHIn categories compared with 5YA

Table 3.68 Turkey's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, July - October 2021

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m²)	Departure from 15YA (%)	Current (gDM/m²)	Departure from 15YA (%)
Black Sea region	335	22	14.3	-1	1050	-6	739	7
Central Anatolia region	73	-32	17.1	-0.8	1286	0	378	-17
Eastern Anatolia region	138	-5	17	-0.5	1310	0	419	-4
Marmara Agean Mediterranean lowland region	63	-48	21.3	-0.4	1339	2	332	-25

Table 3.69 Turkey's agronomic indicators by sub-national regions, current season's values and departure from 5YA, July - October 2021

Region	Cropped arable land fraction		Maximum VCI	Cropping intensity	
	Current (%)	Departure from 5YA (%)	Current	Current	Departure from 5YA (%)
Black Sea region	89	-7	0.81	111	8.47
Central Anatolia region	31	-10	0.62	103	1.12
Eastern Anatolia region	24	-52	0.46	105	0.59
Marmara Agean Mediterranean lowland region	56	-1	0.71	109	2.13

[UKR] Ukraine

This monitoring period covers the harvests of wheat in July and August, followed by maize in September and October. Winter wheat sowing started in September.

According to the agroclimatic and agronomic indicators of CropWatch, this season in Ukraine was drier than usual, rainfall was 15% less, temperature was 0.6℃ lower than the 15YA, and sunshine reached 998 MJ/m² (+4%). Nearly all cropland was cultivated (CALF reached 99%, +4%), cropping intensity was at 123% (+19%) and maximum vegetation condition index (VCIx) was 0.95, which indicated the conditions for the crops were favorable. Estimated biomass (BIOMSS, 610 g DM/m², -4%) at the national level was slightly below the 15YA.

During this period, NDVI at the national level was generally above the 5YA, even exceeding the 5-year maximum before October. As shown in the spatial NDVI patterns, NDVI in about 85.8% area of cropland was above or close to the 5YA until September. However, an obvious depression of NDVI was observed in middle October, which could be attributed to the rainfall deficiency in October. Time series of rainfall profile suggested the amount of precipitation was less than one-third of the 15YA in this month and the proportion of drought area had risen to 40% accordingly. Spatial VCIx pattern showed crop conditions in most croplands of Ukraine were good (VCIx was between 0.8 and 1), especially favorable in Donetsk, Crimea and Odessa region.

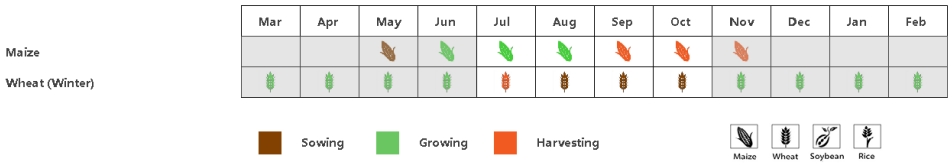
In summary, crop conditions in Ukraine were close to average and CropWatch estimates favorable production for wheat and maize. It is also noteworthy that the low rainfall at the end of the monitoring period is favorable for the drying and harvest of maize but has a negative impact on the germination and establishment of winter wheat.

Regional analysis

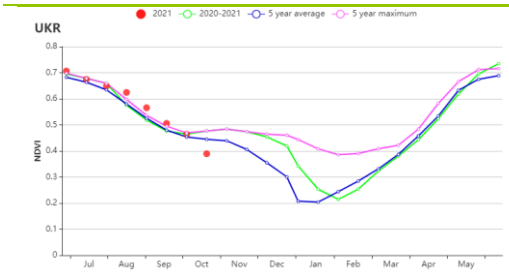
Regional analyses are provided for four agro-ecological zones (AEZ) defined by their cropping systems, climatic zones and topographic conditions. They are referred to as **Central wheat area** with the Poltava, Cherkasy, Dnipropetrovsk and Kirovohrad Oblasts; **Northern wheat area** with Rivne; **Eastern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

All four AEZs shared a similar pattern of agroclimatic conditions. Compared to the 15YA, the four zones received less rainfall from -3% in **Southern wheat and maize area** to -33% in **Eastern Carpathian hills**. Cooler temperature was also detected, from 0.4°C lower in Northern wheat area to 0.7°C lower in Southern wheat and maize area. Radiation was close to average with the largest positive departures for **Central wheat area** and **Northern wheat area** at 5% above average. The below-average rainfall in October had no impact on maize yields. It may have helped its harvest, but may have had a negative impact on the early development of winter wheat. Potential biomass showed a below-average level in most AEZs except for Southern wheat and maize area (0%), which had the smallest rainfall deficit (-4%). Agronomic indicators suggest the crop conditions were favorable for all AEZs. Cropping intensity was higher (+16-21%). CALF (0.99 to 1) and VCIx (0.92 to 0.98) indicate good crop prospects.

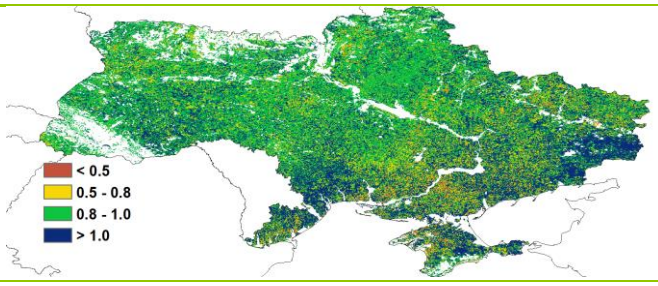
Figure 3.41 Ukraine's crop condition, July- October 2021



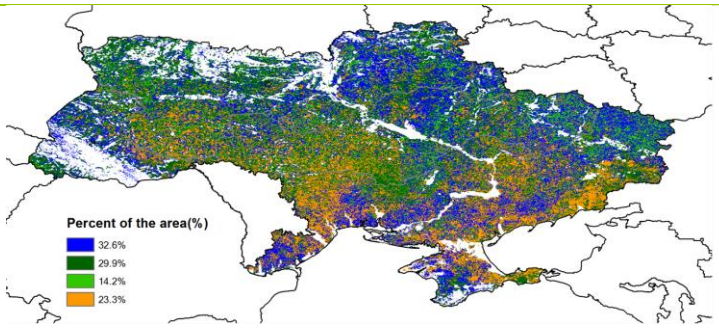
(a). Phenology of major crops



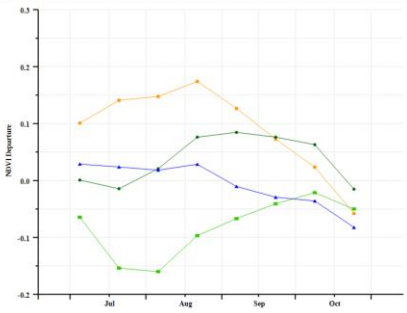
(b) Crop condition development graph based on NDVI



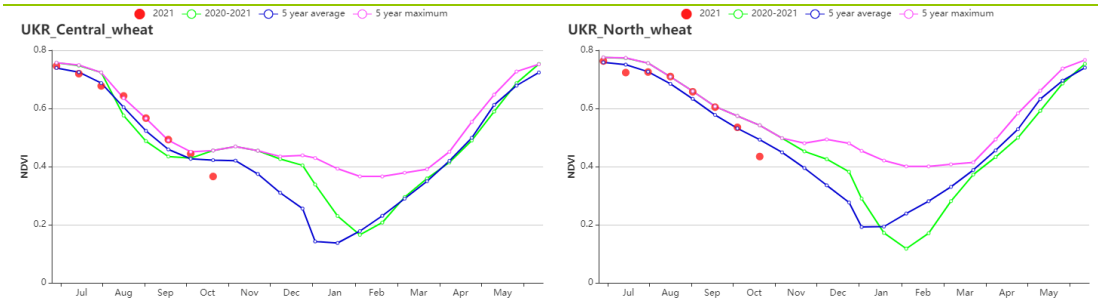
(c) Maximum VCI



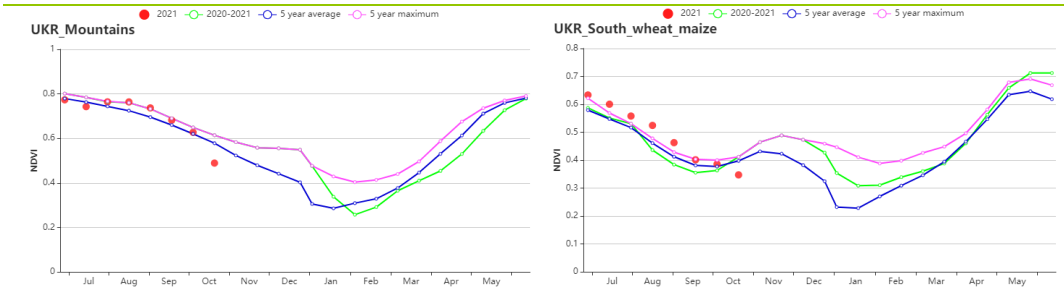
(d) Spatial NDVI patterns compared to 5YA



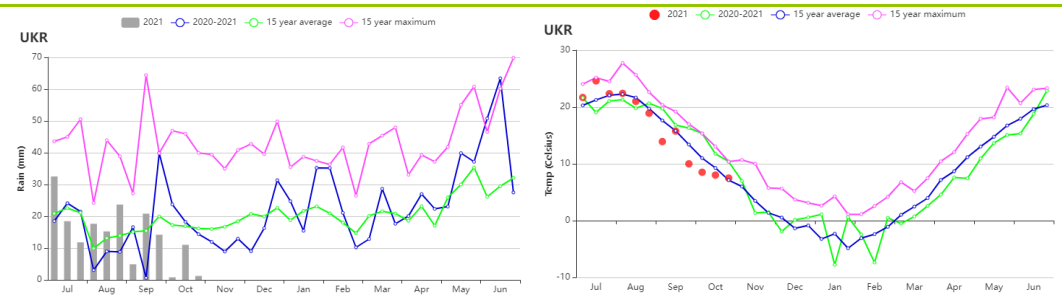
(e) NDVI profiles



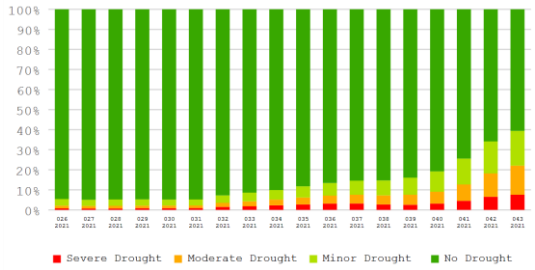
(e) Crop condition development graph based on NDVI (Central wheat area(left) Northern wheat area(right))



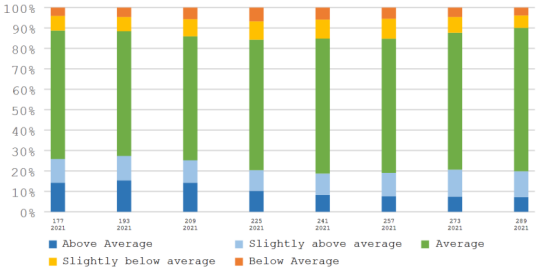
(f) Crop condition development graph based on NDVI (Eastern Carpathian hills(left) Southern wheat and maize area(right))



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



(h) Proportion of drought categories from January-July 2021



(i) Proportion of VHIm categories compared with 5YA

Table 3.70 Ukraine's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, July - October 2021

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Central wheat area	153	-17	16.1	-0.6	995	5	601	-3
Eastern Carpathian hills	189	-33	14.5	-0.5	968	1	599	-19
Northern wheat area	185	-19	15.2	-0.4	936	5	619	-7
Southern wheat and maize area	152	-4	17.8	-0.7	1045	3	598	0

Table 3.71 Ukraine's agronomic indicators by sub-national regions, current season's values and departure from 5YA, July - October 2021

Region	Cropped arable land fraction		Crop Intensity		Maximum VCI
	Current (%)	Departure (%)	Current	Departure (%)	Current
Central wheat area	100	0	121	21	0.92
Eastern Carpathian hills	100	0	122	21	0.95
Northern wheat area	100	0	117	16	0.93
Southern wheat and maize area	99	9	129	21	0.98

[USA] United States

The current reporting period (July to October) covers the mid- to late-growth stages of maize, rice, soybeans and the harvest period of spring wheat in the United States. The harvest of summer crops was almost completed by the end October. Overall, crop conditions were near the 5-year average.

Warm and wet weather prevailed in the United States, with higher rainfall (+22%), temperature (+0.4℃) and RADPAR (+2%) than the 15YA. Adequate precipitation effectively replenished soil moisture for crops at the late-growth stages, and warm weather created favorable conditions for photosynthetic processes, resulting in potential biomass being 11% higher than average at the national level. However, there were large differences among the regions, as discussed in the subsequent paragraphs. Significant increases in precipitation in the Northeast, Southeast, and Southwest resulted in local severe flooding events in some states, such as Tennessee (RAIN: +33%), Arizona (RAIN: +86%), and other states. Although some fields in these states were damaged by flooding, the increased precipitation effectively replenished soil moisture and was in general beneficial for summer crop growth.

As a whole, the national average cultivated arable land fraction (CALF) reached 86%, which was 2% below the 5YA, and the VCIx was 0.87, while the crop condition showed strong spatial heterogeneity. Thanks to the improved weather compared with the previous bulletins, crops had recovered from the stressed conditions during the previous months in parts of the Corn Belt, Northeast, Southeast, and Southwest. The VCIx was high in Alabama (0.97), Arizona (1.12), Georgia (0.98), Illinois (0.98), Indiana (0.97), Iowa (0.97), Mississippi (0.96), Ohio (0.98), and Tennessee (0.96). It's noteworthy that precipitation remained high during maturity and harvest stage. Excessively wet soil conditions may have impacted harvest progress in some regions. Poor crop conditions were observed in some states on the North Plain and northwest region, including Washington, Idaho, Montana, North Dakota, and South Dakota. Although increased precipitation was also observed in these areas during the monitoring period, the CALF still decreased by 9% to 18% and the maximum vegetation index (VCIx) ranged between 0.57 and 0.73. This region had experienced drought conditions already during the previous monitoring period.

In short, the favorable weather conditions in the Midwest and South helped boost production of maize, rice and soybean, whereas wheat, grown in the Western and northern states, suffered from the severe drought conditions.

Regional analysis

Corn Belt

This region is the most important maize and soybean producing area in the United States. During this monitoring period, crop growth conditions were above average due to favorable agro-climatic conditions. Rainfall (+10%), temperature (+1.2℃) and RADPAR (+4%) were higher than the 15YA, which favored the photosynthetic process of crops, resulting in 8% higher potential biomass than average. VCIx reached to 0.95, indicating the good crop growth condition. The CALF reached 100%, 2% above the 5YA and cropping intensity was also 2% above the average. All in all, production for this region recovered to the above-5YA level.

Northern Plains

This area is an important spring wheat and maize producing area. In general, the poor crop condition was indicated by the NDVI development profile. Rainfall in the current reporting period returned to normal and was 7% above the 15YA, and temperature (+1.6℃) and RADPAR (+2%) were higher than 15YA. The increased precipitation mitigated the effects of drought to some extent. However, the crop condition improved little due to strong negative impact of severe droughts that occurred in the northern plains in the previous reporting period. Agronomic indicators also showed unfavorable conditions, with a VCIx of only 0.59, the lowest among the AEZs, indicating poor crop growth in the region. Compared to the 5-year average, the CALF had significantly dropped by 24%. In short, CropWatch assessed below-average crop

conditions in the region, and crop production is expected to be far below average.

Lower Mississippi

The region is an important production area for rice, soybeans and maize. During this monitoring period, good crop growing conditions continued from the previous reporting period to the current reporting period. Overall, weather conditions were favorable for crop growth, with rainfall 15% above 15YA and RADPAR 4% below 15YA. The average temperature was 24.1°C, 0.1°C below the 15YA, but still the highest among the AEZs. The potential biomass was 15% above 15YA. The favorable crop condition was also confirmed by average VCIx of 0.95. The intensity of arable land use also increased during the monitoring period, with cropping intensity 2% higher than average. In short, the CropWatch assessed that above crop production can be expected in this region.

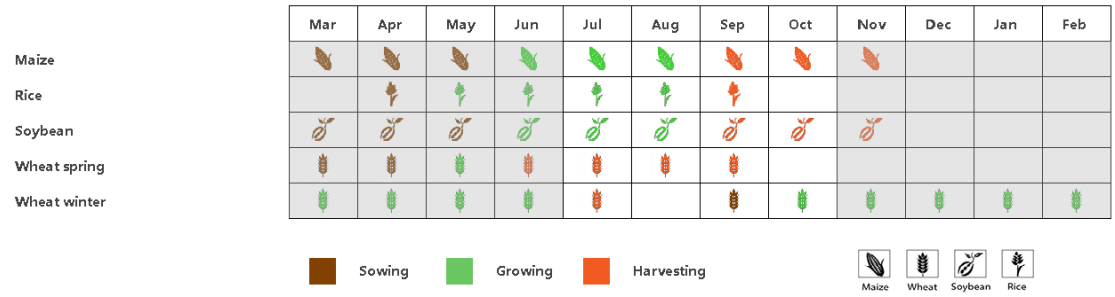
Southern Plains

The region is an important cotton, rice, and sorghum producing area in the United States. The crop conditions, as indicated by NDVI, were favorable. Compared to the 15 years average, rainfall (+18%), temperature (+0.1℃), and RADPAR (+5%) were above the 15YA, respectively, which provided generally favorable conditions for crop growth. The potential biomass was 11% above the 15-year average. The average value of VCIx reached 0.90, which indicates good crop conditions. The CALF was 4% above the 5YA. In short, good crop conditions were assessed by CropWatch for the South Plain.

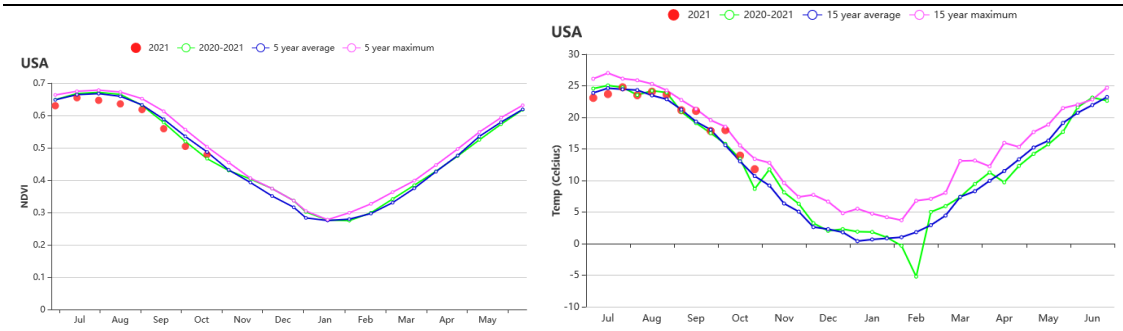
Northwest

The Northwest region is an important spring wheat producing region. During the reporting period, the climate was wet and warm with rainfall (+17%) and temperature (+0.5℃) above the 15YA, and RADPAR (+0%) close to average. During the last reporting period, the region had suffered from a severe drought that caused significant damage to crops in the area. Even when precipitation returned to above-average levels, the poor condition of the crops did not change. The VCIx was only 0.63 compared to the last five-year average, indicating poor crop conditions. The proportion of arable land under cultivation and the intensity of arable land use in the area decreased significantly during this monitoring period, with CALF at only 61% (12% below 5YA), and cropping intensity 4% below 5YA. In short, poor crop production in this area was assessed by CropWatch.

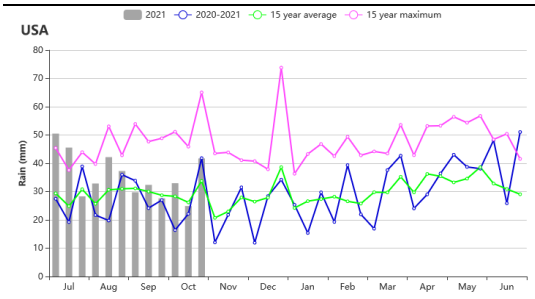
Figure 3.42 United States crop condition, July 2021 to October 2021

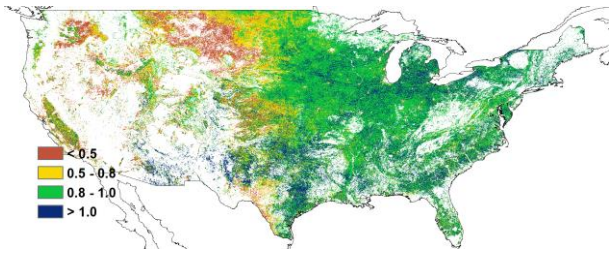


(a). Phenology of United States from July to October 2021

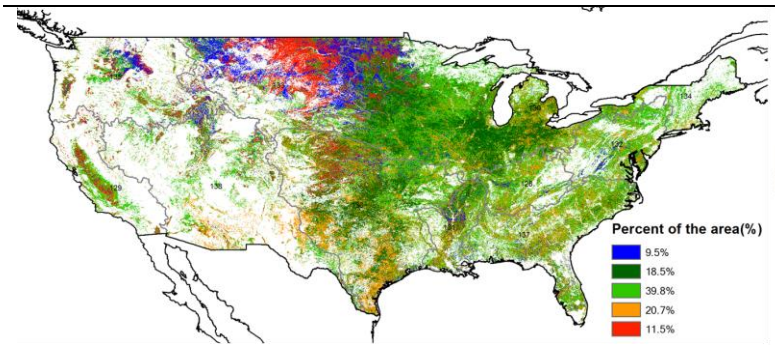


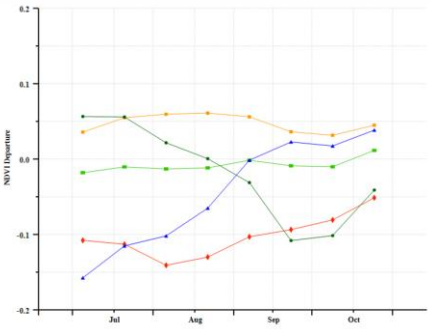
(b). Crop condition development graph based on NDVI (c) Time series temperature profile



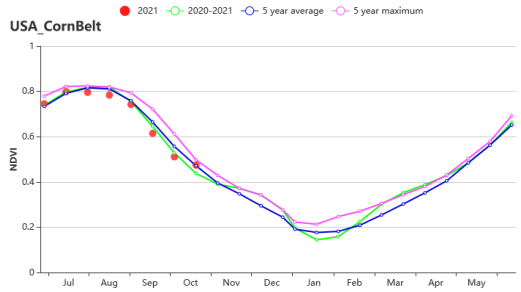


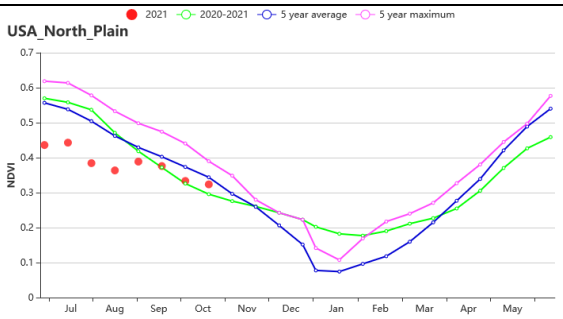
(d). Time series rainfall profile (e). Maximum VCI



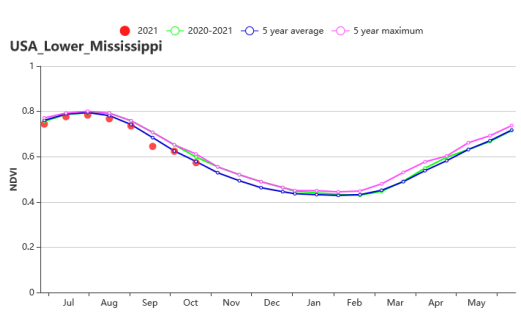


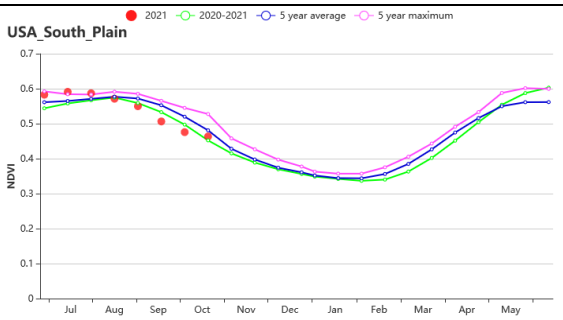
(f). Spatial distribution of NDVI profiles



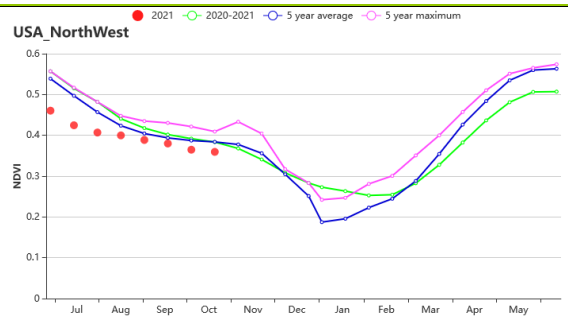


(g) Crop condition development graph in Corn Belt (h) Crop condition development graph in North Plain





(i) Crop condition development graph in Lower Mississippi (j) Crop condition development graph in South Plain



(i) Crop condition development graph in Northwest

Table 3.72 United States' agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, July 2021 - October 2021

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current(°C)	Departure(°C)	Current(MJ/㎡)	Departure (%)	Current (gDM/m2)	Departure (%)
Corn Belt	339	10	19.7	1.2	1126	4	909	8
Northern Plains	224	7	18.3	1.6	1185	2	746	7
Lower Mississippi	572	15	24.1	-0.1	1233	4	1225	15
Southeast	676	31	23.5	-0.4	1218	2	1291	16
Southern Plains	425	18	23.9	0.1	1274	5	995	11
North-eastern areas	514	36	18.6	0.8	1025	-2	1068	13
Northwest	193	17	15.5	0.5	1183	0	581	13
Blue Grass region	436	26	20.7	0	1168	1	1066	16
California	145	156	20.1	0.1	1388	-1	406	31

Table 3.73 United States' agronomic indicators by sub-national regions, current season's values and departure, July 2021 - October 2021

Region	Cropped arable land fraction		Maximum VCI	Cropping Intensity	
	Current (%)	Departure from 5YA (%)	Current	Current	Departure from 5YA (%)
Corn Belt	100	0	0.95	102	2

Northern Plains	62	-24	0.59	104	2
Lower Mississippi	100	0	0.95	102	2
Southeast	100	0	0.95	102	1
Southern Plains	89	4	0.9	102	-3
North-eastern areas	100	0	0.96	107	6
Northwest	61	-12	0.63	101	-4
Blue Grass region	100	0	0.95	103	3
California	100	0	0.95	103	0

[UZB] Uzbekistan

This monitoring period from July to October covers the growing and harvesting stage of maize. Wheat was harvested in July and August. Winter wheat sowing started in September and October. Summer precipitation is minimal, as rain falls mostly during winter. Most of the summer crops are irrigated. Among the CropWatch agroclimatic indicators, RAIN was below average (-48%), while TEMP and RADPAR were above average (+0.2°C and +1%). The combination of these factors resulted in a decrease of estimated BIOMSS (-27%) compared to the fifteen-year average. The NDVI development graph shows that crop conditions were below the five-year average during the monitoring period. As shown in the NDVI cluster graph and profiles, only about 14.7% of the agricultural areas had above-average conditions during the whole monitoring period, these areas are located mainly in the northern part of Namangan Province, the southern part of Ferghana Province, and along the Amu Darya River. The agricultural areas with maximum VCI indices above 0.8 were in Andijon Province, Namangan Province, Ferghana Province, Khorezm Province, and the eastern part of Bukhoro Province. The national average VCIx was 0.73, the cropped arable land fraction decreased by 11%, and the cropping intensity was 118. It had increased by 2%.

Overall, the prospects for crop production in Uzbekistan are unfavorable.

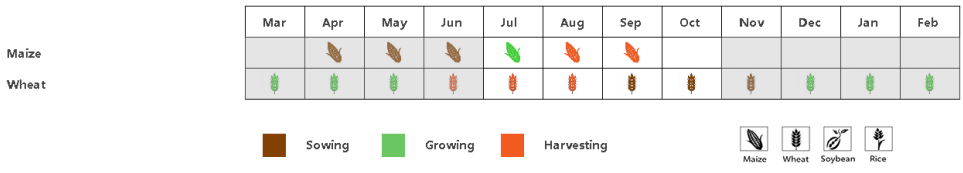
Regional analysis

In the **Aral Sea cotton zone**, crop condition was below the five-year average according to the NDVI development graph. TEMP and RADPAR were above 15YA (+0.3°C and +2%), while RAIN was below average (-61%). BIOMSS decreased by 45% compared to the 15YA. The maximum VCI index was 0.69 and the cropped arable land fraction decreased by 25%. The cropping intensity was close to the average. Affected by these factors, the crop prospects for this zone are unfavorable.

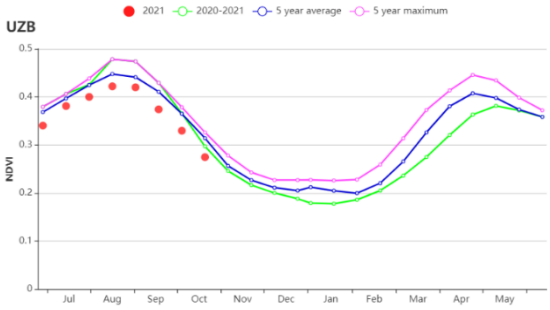
In the **Eastern hilly cereals zone**, NDVI was below the five-year average from July to October. The RAIN was below average (-48%), while TEMP and RADPAR were slightly above the fifteen-year average (+0.2°C and +1%). The combination of these factors resulted in a decreased BIOMSS (-23%). The maximum VCI index was 0.73 and the cropped arable land fraction decreased by 6%. The cropping intensity was above average by 2%. Overall, crop productions in this zone are expected to be negative.

The **Central region with sparse crops** also suffered from severe rainfall shortage (decreased by 71%), whereas temperature was slightly warmer (+0.3°C) and RADPAR was close to average (+1%). Consequently, BIOMSS decreased by 48% as compared to the 15YA. The maximum VCI was 0.81, cropping intensity was equal to the 5YA and the cropped arable land fraction increased by 3%. However, it is noteworthy that the unfavorable crop condition of this region had little impact on the crop productions of Uzbekistan since the crop fields are sparse in the region.

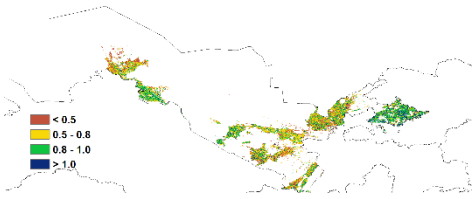
Figure 3.43 Uzbekistan crop condition, July - October 2021



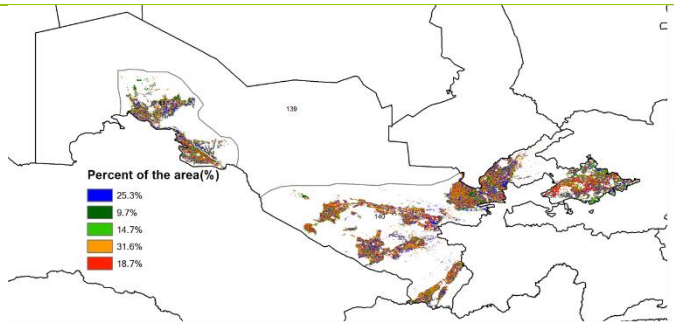
(a) Phenology of major crops



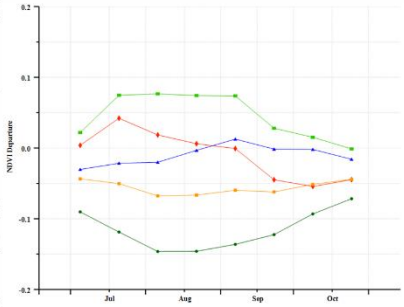
(b) Crop condition development graph based on NDVI



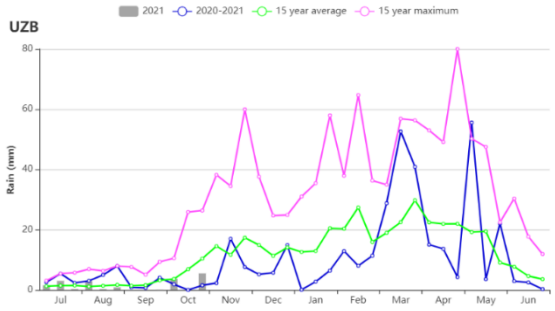
(c) Maximum VCI



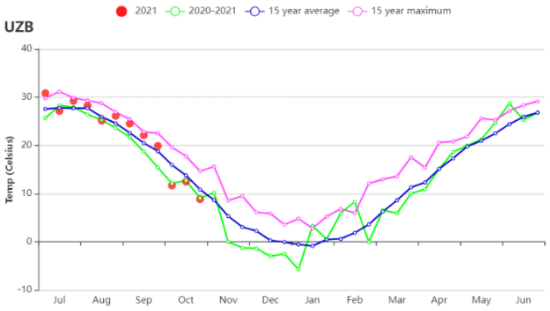
(d) Spatial NDVI patterns compared to 5YA



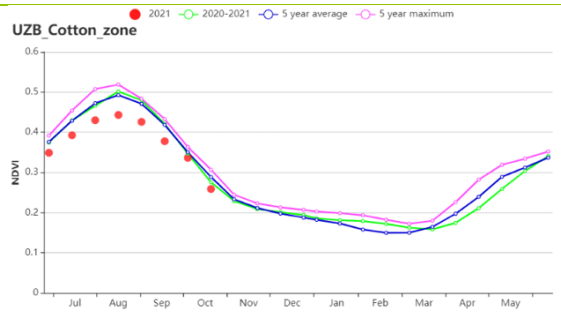
(e) NDVI profiles

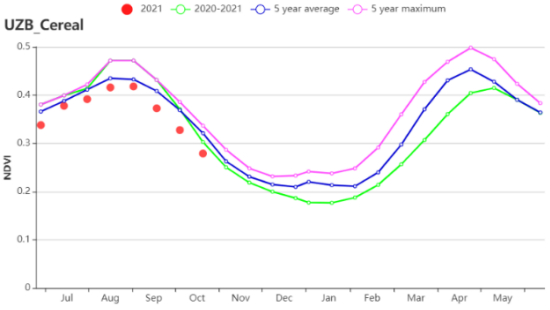


(f) Rainfall profiles

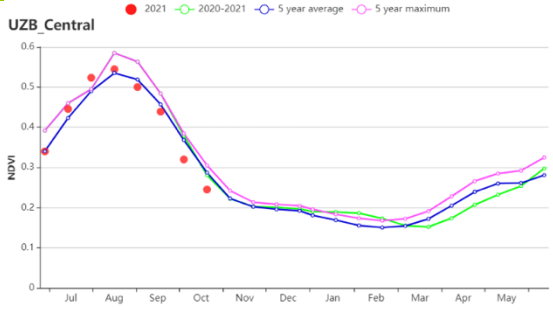


(g) Temperature profiles

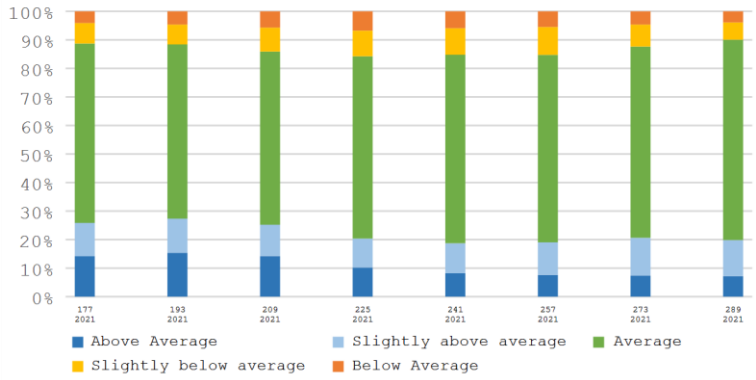




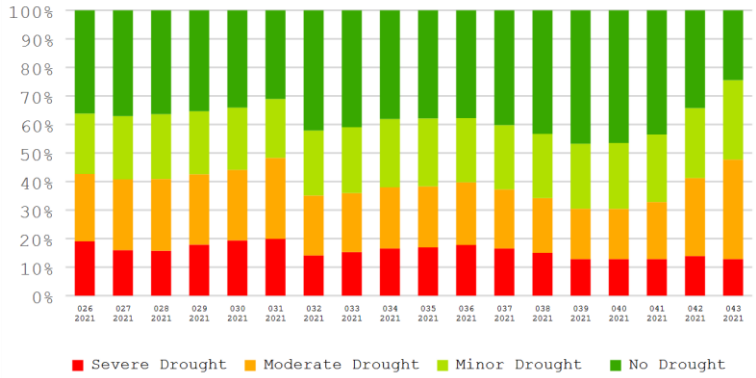
(h) Crop condition development graph based on NDVI Aral Sea cotton region (left) Eastern hilly cereals region (right)



(i) Crop condition development graph based on NDVI Central region with sparse crops



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



(k) Proportion of VHIn categories compared with 5YA in Uzbekistan

Table 3.74 Uzbekistan's agroclimatic indicators by sub-national regions, current season's values, and departure from 15YA, July - October 2021

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Aral Sea cotton zone	5	-61	23.5	0.3	1320	2	104	-45
Eastern hilly cereals zone	20	-48	22.0	0.2	1389	1	168	-23
Central region with sparse crops	4	-71	24.0	0.3	1356	1	88	-48

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

Region	Cropped arable land fraction		Cropping intensity		Maximum VCI
	Current (%)	Departure (%)	Current (%)	Departure (%)	Current
Aral Sea cotton zone	54	-25	101	1	0.69
Eastern hilly cereals zone	54	-6	124	3	0.73
Central region with sparse crops	79	3	100	0	0.81

[VNM] Vietnam

This monitoring period covers the entire period from the planting to harvesting of spring-winter rice in the Mekong river delta and rainy season rice in the north. In July, summer rice in Central Vietnam was harvested, followed by the planting of rainy season rice in August and September. It will be harvested in November.

CropWatch agro-climatic indicators showed higher precipitation (1451 mm, +3%), and TEMP (24.0°C, +0.2°C) as compared to the 15YA. Combined with above average radiation (1152, +5%), the BIOMSS (+2%) showed an increase compared to the 15YA. The VCIx (0.95) was high, and the CALF (97%, +1%) was above the 5YA. The cropping intensity was also above the five-year average (139%, +2%).

Based on the NDVI development graph, the crop conditions were below the 5YA during the whole monitoring period, especially from September to the end of this monitoring period. From July to August the precipitation was below the 15YA, but surpassed it after September, while the temperature was near the 15YA, except for a spike in early August. As to the spatial distribution of NDVI profiles, crop conditions on about 48% of the country were above the average, mainly distributed over Tuyen Quang Province, Cao Bang Province, Thai Binh Province, Thanh Hoa Province and Nam Dinh Province. Overall, the crop conditions are assessed as normal, except for the South Central Coast, where they were 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**, RAIN was significantly higher than the 15YA (1658 mm, +9%) and TEMP was near the 15YA (22.7°C). The RADPAR (1058 MJ/m2, +3%) and the BIOMSS (1473 gDM/m2, +2%) were both above the 15YA. Cropping intensity (115%, -9%) significantly decreased. CALF was 100% and VCIx was 0.96. The crop condition development graph shows that NDVI fluctuated greatly. Based on the agroclimatic indicators, the crop conditions were mixed.

In the **Mekong River Delta region**, TEMP (26.9°C, +0.2°C) was close to the 15YA, and RADPAR (1240 MJ/m2, +4%) was above the 15YA. The RAIN (1259 mm, -7%) was below average. The cropping intensity (184%, +7%) was significantly higher than the 5YA. CALF was higher (91%, +4%) and VCIx was 0.91. According to the NDVI development graph, crop conditions were above the 5YA in early July and August. Overall, the crop conditions were near average.

In the region of **North Central Coast**, RAIN increased 3% compared to the 15YA, and TEMP was 23.8°C with an increase by 0.2°C. RADPAR (1133 MJ/m2, +7%) showed a significantly increase, and BIOMSS increased slightly (+3%). Cropping intensity (119%, -7%) was significantly below the 5YA. CALF was the same as the 5YA, and VCIx was 0.96. According to the NDVI development graph, crop conditions were slightly below the 5YA, expect in the July showing a high value exceeding the 5-year-maximum. Crop condition in this region are expected to be near average.

In the **North East region**, TEMP (23.5°C, +0.1°C) was about the 15YA. Although RAIN (1565 mm, +4%) and RADPAR (1165 MJ/m2, +6%) both increased and were above the 15YA, the BIOMSS (1534 gDM/m2, +5%) was above average. Cropping intensity (146%, +13%) was significantly higher than the 5YA. CALF was 100% and VCIx was 0.98. According to the NDVI development graph, crop conditions were below the 5YA, especially in the early September and October. Overall, the crop conditions were expected to be favorable at most.

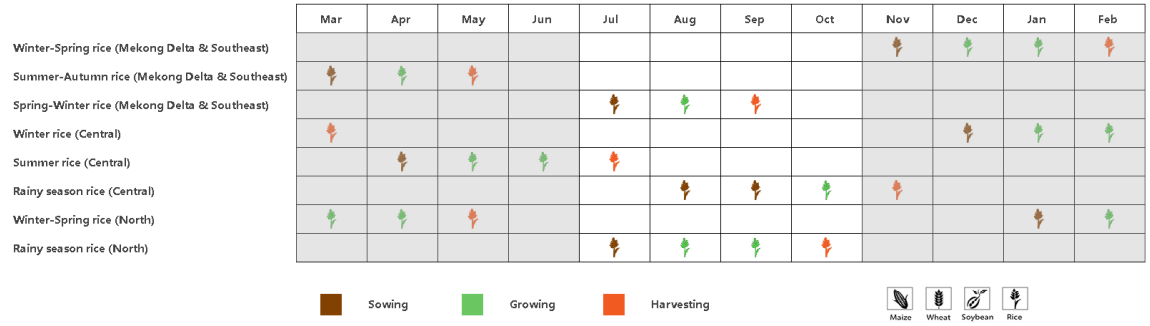
In the **North West region**, RAIN (1143 mm, +8%) showed a remarkable increase, and the TEMP (22.0°C, +0.2°C) was about the 15YA. RADPAR increased by 6%, which resulted in an increase of the BIOMSS (1399 gDM/m2, +2%). Cropping intensity (127%, +5%) was higher than the 5YA. CALF was 100% and VCIx was 0.98. According to the NDVI development graph, except in early September and October, NDVI values were below the 5YA. Crop conditions in this region were expected to be average at most.

In the region of **Red River Delta**, RAIN (1572 mm, +7%) and RADPAR (1185 MJ/m2, +3%) increased significantly. TEMP (26.4°C, +0.1°C) was near the 15YA and the BIOMSS (1662 gDM/m2, +4%) was higher. Cropping intensity (151%, +1%) was slightly above the 5YA. CALF was 97% and VCIx was 0.93. According to the crop condition development graph, the NDVI was generally below the 15YA. Regarding the agroclimatic indicators, the crop conditions in this region were near average.

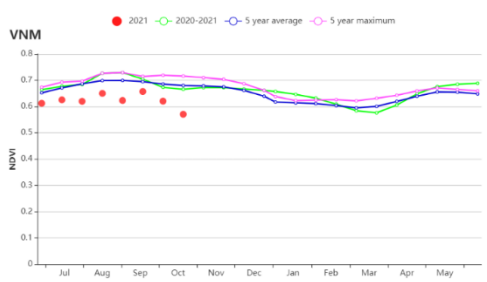
In the **South Central** Coast, with the increases of RAIN (1464 mm, +14%), TEMP (23.8°C, +0.4°C) and RADPAR (1109 MJ/m2, +4%), BIOMSS (1379 gDM/m2, 0%) was still the same as the 15YA. Cropping intensity (135%, -3%) was reduced. CALF was 96% and VCIx was 0.89. According to the crop condition development graph, the NDVI was both below the 5YA and the value of last year. Thus, crop conditions in this region were below average.

In the **South East region**, RAIN (1553 mm, -3%) was below the 15YA, TEMP (25.4°C, +0.2%) and RADPAR (1191 MJ/m2, +4%) were both above the 15YA, while BIOMSS (1542 gDM/m2, 0%) was the same as the 15YA. Cropping intensity (124%, -3%) was below the 5YA. CALF was 96% and VCIx was 0.97. As shown by the crop condition development graph, the NDVI fluctuated greatly. According to the agroclimatic indicators, crop conditions in this region were mixed.

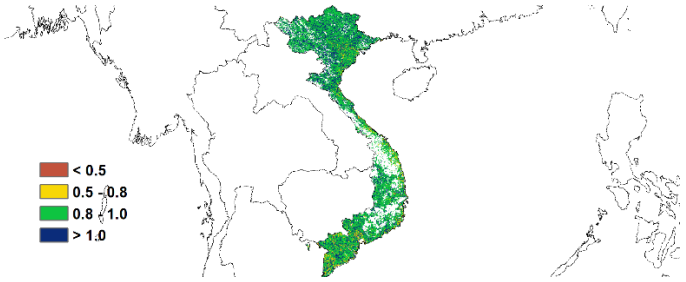
Figure 3.44 Vietnam's crop condition, July - October 2021



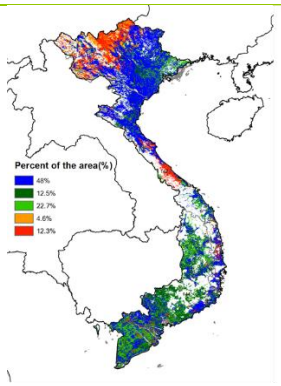
(a). Phenology of major crops



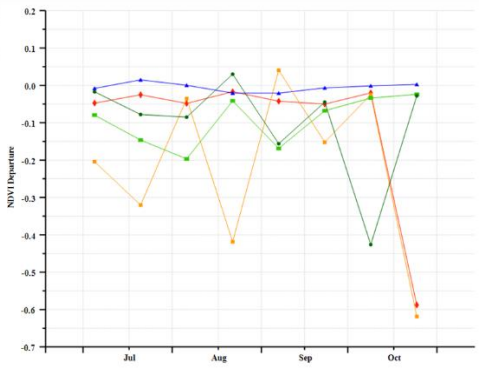
(b) Crop condition development graph based on NDVI



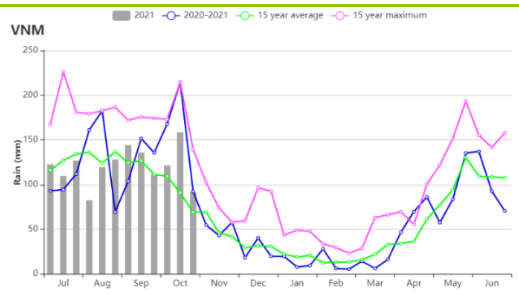
(c) Maximum VCI



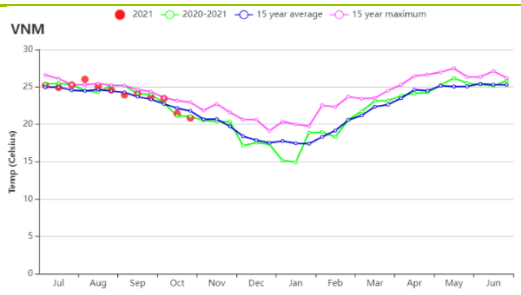
(d) Spatial NDVI patterns compared to 5YA



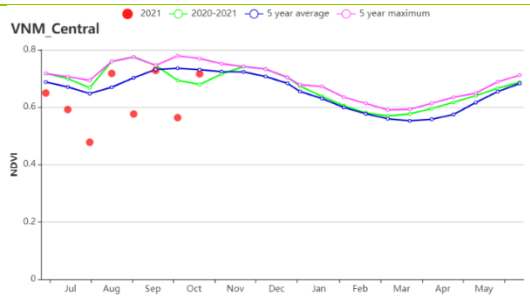
(e) NDVI profiles

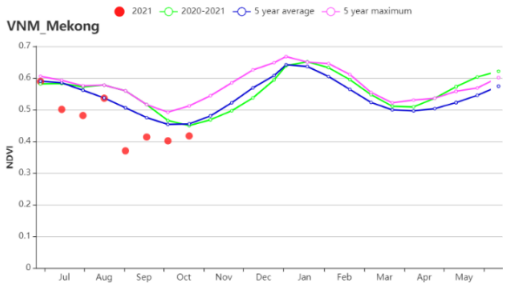


(f) Rainfall profiles

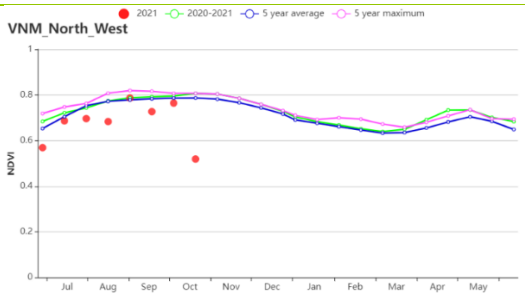


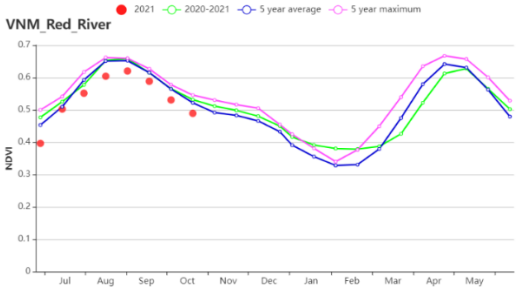
(g) Temperature profiles



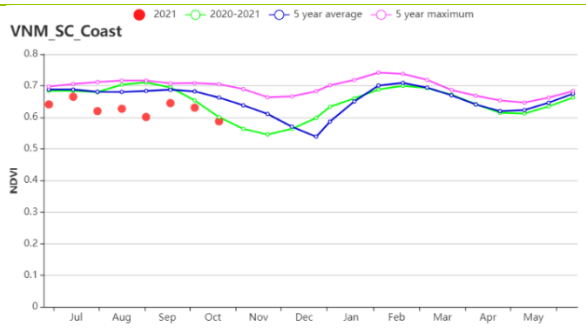


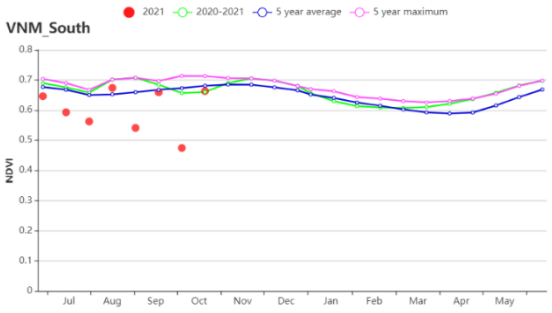
(h) Crop condition development graph based on NDVI Central Highlands Vietnam (left), and Mekong River Delta (right).



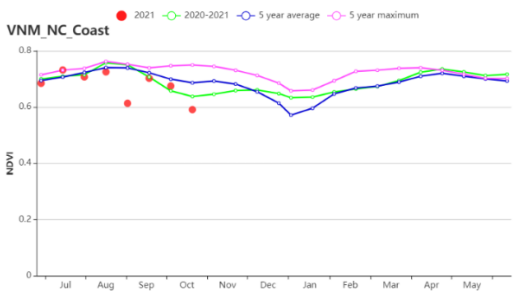


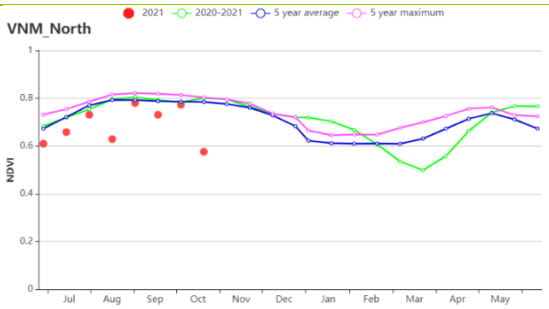
(i) Crop condition development graph based on NDVI North West Vietnam (left), and Red River Delta (right).



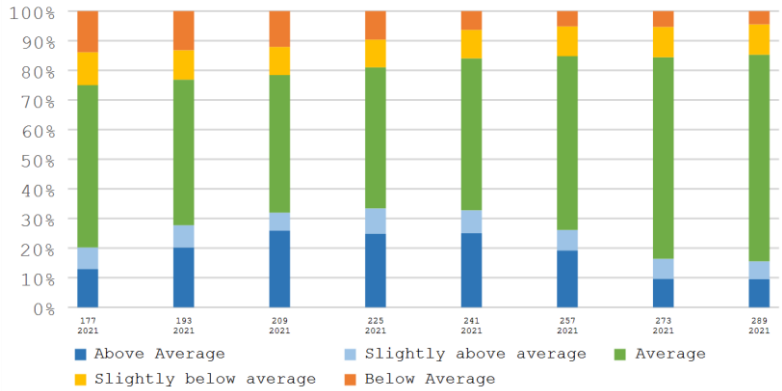


(j) Crop condition development graph based on NDVI South Central Coast Vietnam (left), and South East Vietnam (right).

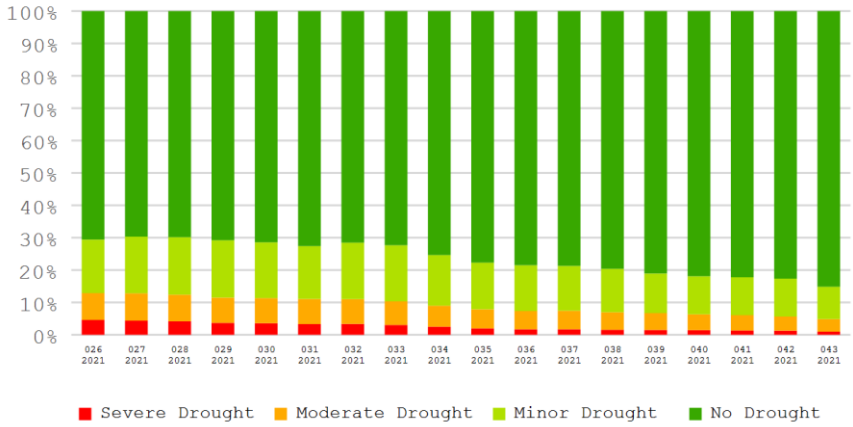




(k) Crop condition development graph based on NDVI North Central Coast Vietnam (left), and North East Vietnam (right).



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



(m) Proportion of VHIm categories compared with 5YA

Table 3.76 Vietnam's agronomic indicators by sub-national regions, current season's values and departure from 15YA, July - October 2021

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Central Highlands	1658	9	22.7	0.1	1058	3	1473	2
Mekong River Delta	1259	-7	26.9	0.2	1240	4	1706	1
North Central Coast	1441	3	23.8	0.2	1133	7	1484	3
North East	1565	4	23.5	0.1	1165	6	1534	5
North West	1244	0	22.0	0.2	1143	8	1399	2
Red River Delta	1572	7	26.4	0.1	1185	3	1662	4
South Central Coast	1464	14	23.8	0.4	1109	4	1379	0
South East	1553	-3	25.4	0.2	1191	4	1542	0

Table 3.77 Vietnam's agronomic indicators by sub-national regions, current season's values and departure from 5YA, July - October 2021

Region	Cropped arable land fraction		Cropping intensity		Maximum VCI
	Current (%)	Departure (%)	Current (%)	Departure (%)	Current
Central Highlands	100	0	115	-9	0.96
Mekong River Delta	91	4	184	7	0.91

Region	Cropped arable land fraction		Cropping intensity		Maximum VCI
	Current (%)	Departure (%)	Current (%)	Departure (%)	Current
North Central Coast	98	0	119	-7	0.96
North East	100	0	146	13	0.98
North West	100	0	127	5	0.98
Red River Delta	97	1	151	1	0.93
South Central Coast	96	0	135	-3	0.89
South East	96	1	124	-3	0.94

[ZAF] South Africa

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

Based on the NDVI development graph, the crop conditions were slightly above the 5-year average during this monitoring period and even exceeded the 5-year maximum in August and October. At the national level, the CropWatch agroclimatic indicators show that radiation was slightly above the 15-year average (RADPAR +2%). With a lower rainfall (RAIN -15%) and a slightly lower temperature (TEMP -0.7℃), the potential biomass decreased by 3% compared to the 15-year average. The maximum vegetation condition index (VCIx) was 0.91, and the cropped arable land fraction (CALF) increased significantly by 22% 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 58.2% of the cropland were below average during the whole monitoring period, 21.8% was on average during July to August and about 41.8% of the area was above average starting in September. The areas with negative departures were mainly in the center of the eastern region (like Gauteng, Mpumalanga province). Overall, crop conditions were slightly above average.

Regional analysis

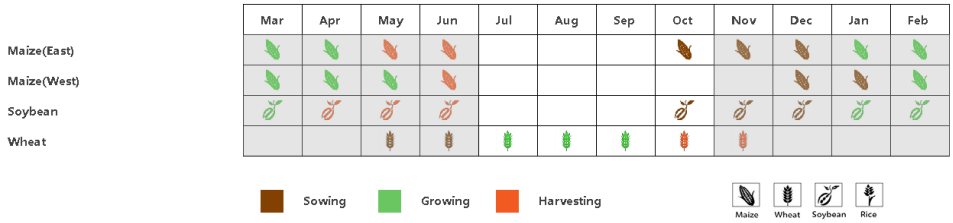
Rainfall in the Arid and desert zones was slightly below average (77mm, -9%) and the temperature was near average (12.7°C, -0.7°C), whereas radiation was slightly above average (+3%), and potential biomass decreased by -3% due to the insufficient rainfall. Cropped arable land fraction (CALF) increased significantly (+36%) and VCIx was 0.78. The cropping intensity was average (108%, +1%), indicating cropland utilization rate was normal. The crop condition development graph based on NDVI indicates that the crop conditions were generally above the 5-year average and only in late-July was slightly below average. Crop production is expected to be favorable.

In the Humid Cape Fold mountains, the temperature was near average (14.7 °C, -0.6 °C), and rainfall was below average (175mm, -15%). With lower rainfall (-15%), potential biomass was below the 15-year average (-5%). CALF was 83% and VCIx was 0.94. The cropping intensity was average (105%, +2%), indicating cropland utilization rate was normal. The crop condition development graph based on NDVI also indicates favorable conditions.

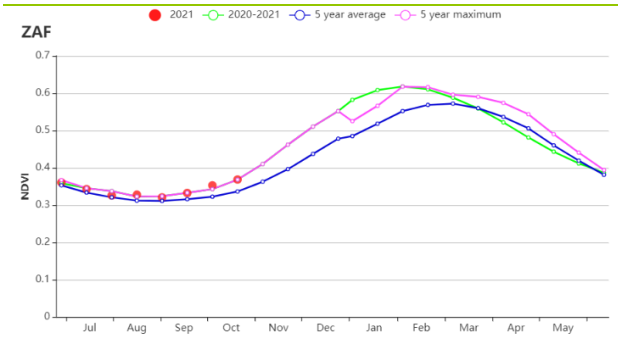
In the Mediterranean zone, the temperature was near average (11.8 °C, -0.8 °C), while rainfall witnessed a significant increase (316mm, +13%) and radiation was slightly above average (990 MJ/m2, +4%). The estimated potential biomass was increased significantly by 10% due to the sufficient rainfall. CALF increased substantially (89%, +6%) and VCIx was 0.93. The cropping intensity was average (101%, +1%), indicating cropland utilization rate was normal. 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 (69 mm, -23%) and temperature (13.7 °C, -0.7°C) were were below the 15-year average. Radiation was near average (1182 MJ/m2, +1%). Potential biomass decreased by 6%. CALF was significantly above the 5YA (17%, +47%) and VCIx was 0.90. The cropping intensity was near average (101%, 0%) indicating cropland utilization rate was normal. The crop condition development graph based on NDVI shows the NDVI was below the 5-year average for most of the period. However, most of land was fallow during the winter months and the planting of summer crops started in October only.

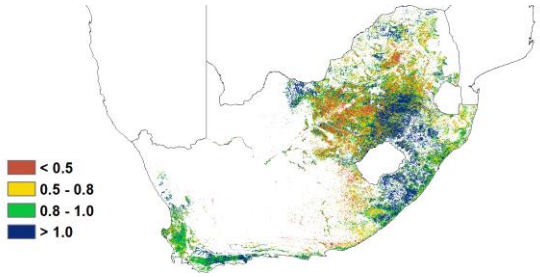
Figure 3.45 South Africa's crop condition, July - October 2021



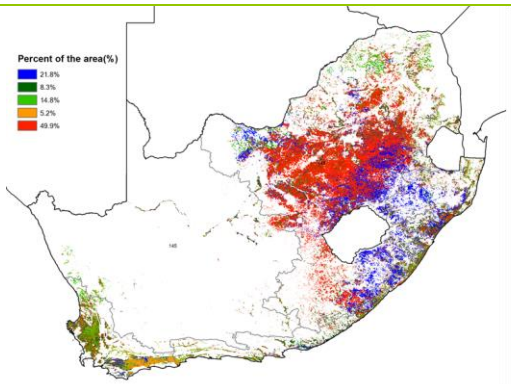
(a). Phenology of major crops



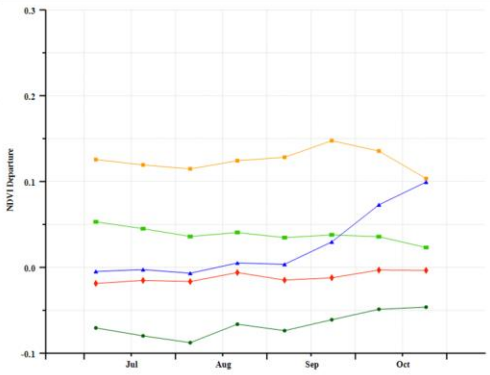
(b) Crop condition development graph based on NDVI



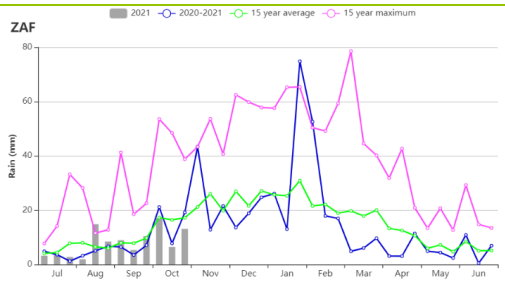
(c) Maximum VCI



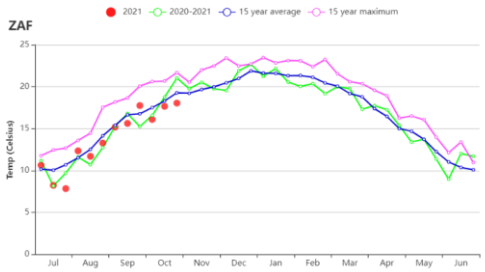
(d) Spatial NDVI patterns compared to 5YA



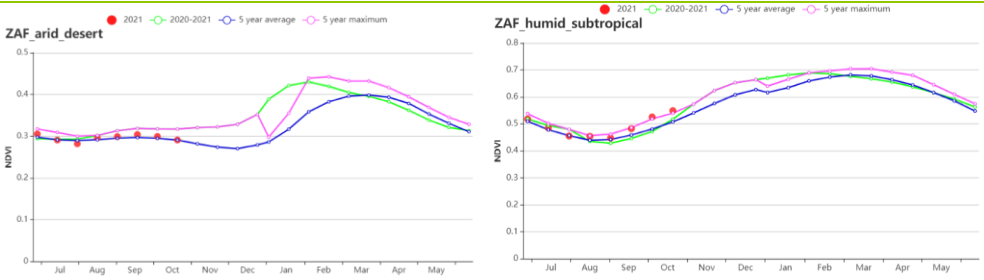
(e) NDVI profiles



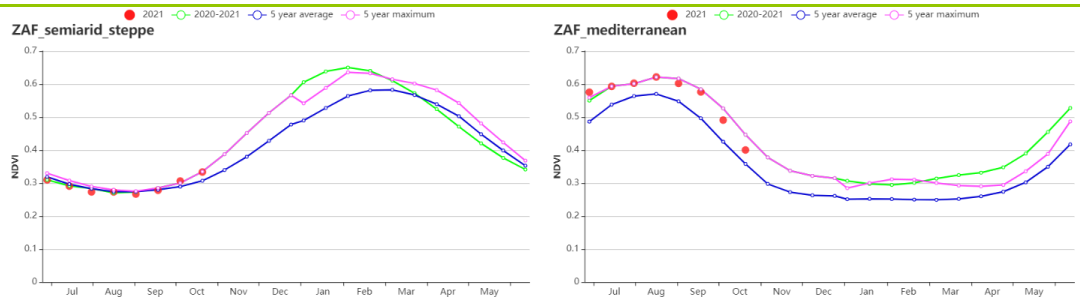
(f) Rainfall profiles



(g) Temperature profiles



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



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

Table 3.78 South Africa's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, July - October 2021

Region	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m²)	Departure (%)	Current (gDM/m²)	Departure (%)
Arid and desert zones	77	-9	12.7	-0.7	1142	3	340	-3
Humid Cape Fold mountains	175	-15	14.7	-0.6	989	3	568	-5
Mediterranean zone	249	13	11.8	-0.8	990	4	644	10
Dry Highveld and Bushveld maize areas	69	-23	13.7	-0.7	1182	1	345	-6

Table 3.79 South Africa's agronomic indicators by sub-national regions, current season's values and departure from 5YA, July - October 2021

Region	Cropped arable land fraction		Cropping intensity		Maximum VCI
	Current (%)	Departure (%)	Current (%)	Departure (%)	Current
Arid and desert zones	24	36	108	1	0.78
Humid Cape Fold mountains	83	13	105	2	0.94
Mediterranean zone	89	6	101	1	0.93
Dry Highveld and Bushveld maize areas	17	47	101	0	0.90

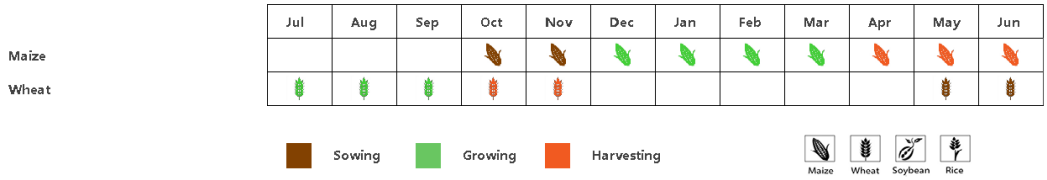
[ZMB] Zambia

This period covers the maturity and harvesting of the irrigated dry-season crops and the onset of the rainfed season. The key irrigated crops are wheat, green maize, horticultural crops and vegetables. Irrigated wheat was harvested from late September into October. At the national level, rainfall (-35%) and solar radiation (RADPAR -1%) were below the 15YA. The average temperature was 21.6℃ (+0.2%) and potential biomass production was 231 gDM/m2 (+9%). The cropped arable land fraction (CALF) was 46% and maximum VCI was 0.81. The overall conditions for the irrigated crops during this period were favorable. The total cereal production, the bulk being maize, was forecasted at about 4 million. Wheat production also benefitted from the generally favorable conditions.

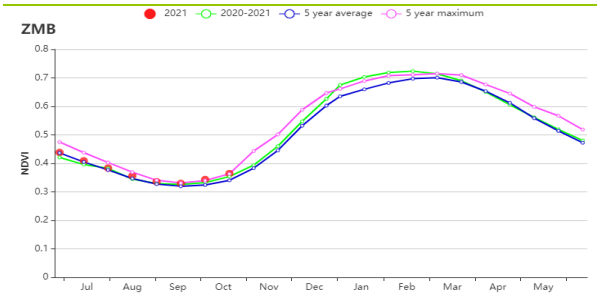
Regional Analysis

Based on regional analyses of the agro-ecological region, rainfall in all the agro-ecological zones was below the 15 years average with the **Northern High Rainfall Zoneand Central-Eastern and Southern Plateau** recording highest negative departure (-38% and -36% respectively). The temperature varied from **Northern High Rainfall Zone** (21.3℃, +0.1%) to **Western Semi-arid Plain** (22.3℃, +0.4%). The radiation in all agro-ecological zones was above 1350 MJ/m2 (+4%) except for the **Luangwa-Zambezi Rift Valley** with a slight decrease (-2%). Negative BIOMSS departures were observed in the **Luangwa-Zambezi Rift Valley** (-2%). A similar pattern was observed for the cropped arable land fraction (CALF), with the highest CALF in **Northern High Rainfall Zone** (81%, +3%), and with lower values but hihger positive departures in **Luangwa-Zambezi Rift Valley** (32%, +15%), **Central-Eastern and Southern Plateau** (36%, +22%) and the **Western Semi-Arid Plateau** (54%, +6%). The vegetation health index (VCIx) was above 80% in all the agro-ecological region except for **Luangwa-Zambezi Valley** (VCIx 75%). CropWatch expects an above-average production for 2021/2022 season which is estimated to be sufficient to meet the national consumption requirements.

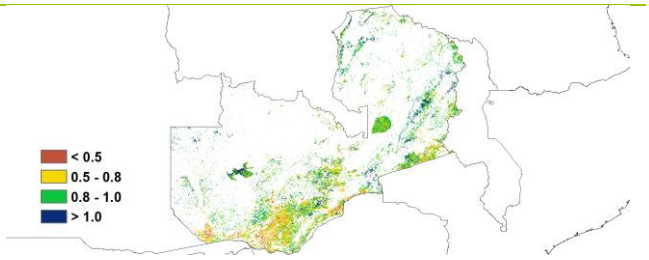
Figure 3.46 Zambia 's crop condition, July -October 2021



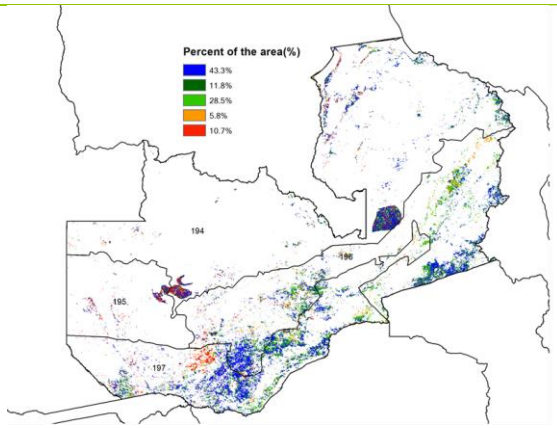
(a). Phenology of major crops

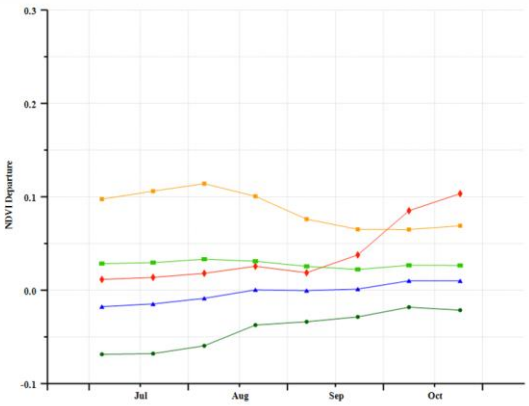


(b) Crop condition development graph based on NDVI



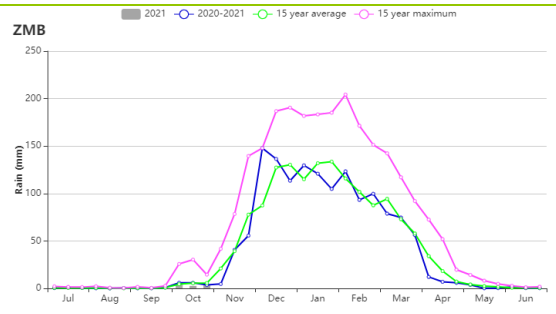
(c) Maximum VCI

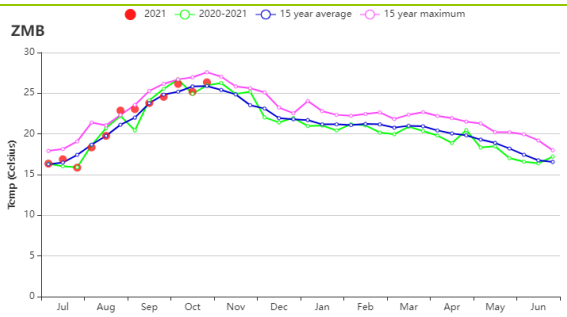




(d) Spatial NDVI patterns compared to 5YA

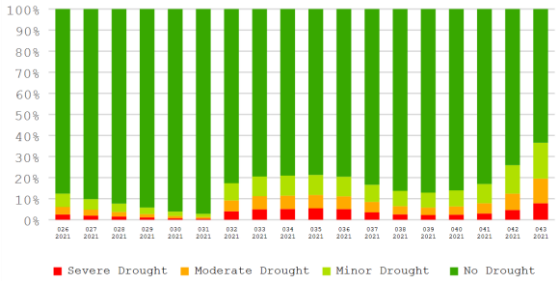
(e) NDVI profiles





(f) Rainfall time series profile

(g) Temperature time series profile



(h) Proportion of VHIm categories compared with 5YA

Table 3.80 Zambia 's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, July -October 2021

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 (%)
Northen high rainfall zone	20	-38	21.3	0.1	1408	0	20	-38
Central-eastern and southern plateau	7	-36	21.6	0.1	1359	-1	7	-36
Western semi-arid plain	12	-3	22.3	0.4	1374	-1	12	-3
Luangwa Zambezi rift valley	7	-12	21.6	0.1	1366	-2	7	-12

Table 3.81 Zambia 's agronomic indicators by sub-national regions, current season's value and departure from 5YA, July - October 2021

Region	Cropped arable land fraction		Cropping Intensity		Maximum VCI
	Current (%)	Departure from 5YA (%)	Current (%)	Departure from 5YA (%)	Current
Northen high rainfall zone	263	1	81	3	0.88
Central-eastern and southern plateau	244	15	36	22	0.83
Western semi-arid plain	161	-2	54	6	0.81
Luangwa Zambezi rift valley	212	24	32	15	0.75