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 41 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.

1. Introduction

The global agro-climatic patterns that emerge at the MRU level (chapter 1) are reflected with greater spatial detail at the national and subnational administrative levels described in this chapter. The “core countrie”, 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 5.1) although they 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 165 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.

2. Overview of weather conditions in major agricultural exporting countries

The current section provides a short overview of prevailing conditions among the major exporters of maize, rice, wheat and soybeans, conventionally taken as the countries that export at least one million tonnes of the covered commodities. Just 20 countries include the top 10 exporters with the United States and Argentina exporting all four crops and Brazil, Ukraine and Russia exporting three of them each!

Maize: Three out of four maize exporters where the crop was in the field during the reporting period had moderate to large excess precipitation, including Argentina (+14%), South Africa (+14%) and Paraguay (+21%). Both Argentina and Paraguay also had below average temperature (-1.2°C and -0.8°C) and sunshine (-4% and -1%), respectively. The Cropped Arable Land Fraction (CALF) was very close to average and Maximum VCI (VICx) was moderate, indicating some negative impact of excess precipitation. Although South Africa had an overall positive water balance, the value of +14% situation results from very dry conditions followed by a late season spell of abundant rainfall associated with the Mozambican cyclones (refer to section on disasters in chapter 5).

In India the period covered includes the harvest of Rabi crops, including Rabi maize and wheat. Agroclimatic and agronomic indicators describe a globally average situation which should also result in fair crops.

In the northern hemisphere where maize is still to be planted, significant precipitation excesses in the USA (+19%) and Serbia (+30%) have provided good soil moisture but may have negatively impacted winter wheat. Below average rainfall affected mostly France (-18%) and Hungary (-12%).

Rice: India, the main exporter of rice, cultivates the crop during both the Rabi season (where it has reached maturity) and the Kharif season, where the crop is in early stages. As mentioned above for maize, indicators give no reason for concern. In south-east Asia, the reporting period covers the late harvest of one crop and

the early stages of spring rice. Both Thailand and Vietnam recorded a moderate precipitation deficit (-12% and -6%) with above-average temperature and 6% excess sunshine compared with average. When taking into consideration CALF and VCIx, crop condition is assessed as average in Thailand but favourable in Vietnam where VCIx reaches 0.98. In Pakistan and the USA, the rice crop is yet to be planted and there is no reason for concern.

Wheat: Twenty countries in both hemispheres export more than 1 million tonnes of wheat. The top five exporters market more than 10 million tonnes internationally, including the USA, Canada, Russia, France and Australia. In Australia, the JFMA period covers the end of the 2018-19 harvest (up to January) and the early stages of the 2019-20 crop (from April). Very dry conditions have affected the period (RAIN down 17% below average) with a marked drop in CALF (-38%) and unfavourable VCIx (0.42), the lowest value by far among the 20 top exporters. The 2018-19 crop is unlikely to have been satisfactory, but the impact on the ongoing wheat season is still open.

Although the USA experienced very wet and cool conditions, the agronomic indicators reach values which indicate globally average conditions for winter wheat. Both Canada and Russia had about average precipitation and sunshine, but temperatures departed markedly from average with a drop in Canada (-1.4°C) and a rise in Russia (1.7°C). Both countries, however, recorded a drop in CALF (-28% and -35%) and just moderate VCIx (0.80 and 0.72), respectively. Crops are best assessed as just fair. Weather conditions relatively similar to those of Canada and Russia affected Ukraine but agronomic indicators are somewhat more favourable (-11% for CALF and VCIx at 0.81). Although France had a marked drop in RAIN (-18%), agronomic indicators are very favourable (normal CALF and rather large VCIx at 0.95) most probably resulting from favourable sunshine (+6%), a variable which is usually the dominant limiting factor in northern hemisphere winter wheat production.

Among the countries ranking 7 to 12 for wheat exports, which cover the range from nine to three million tons (Germany, Argentina, Kazakhstan, Romania, Bulgaria, India) all had close to or above average rainfall, with the largest positive departures in Bulgaria (+8%), Romania (+12%) and Argentina (+14%). All had VCIx values above 0.75 (up to 0.93 in Germany) but CALF was down 11% in Romania and and 13% in Kazakhstan, where warm weather (1.4°C above average) may have led to snow-melt and cold damage. For Argentinian wheat, the conditions are largely irrelevant as the harvest ended in early January.

All the remaining wheat exporters (ranks 13 to 20) had mostly slight to moderate precipitation deficits from -1% (Brazil) and -3% (Czechia) to -15% (United Kingdom), the only exception being Mexico with a very significant 49% drop. The only other "abnormal" weather was recorded in Lithuania (RADPAR +10%). In Mexico, where winter wheat is currently at mid-season, the States with the largest wheat production potential all suffered large rainfall deficits (Guanajuato -67%; Hidalgo -74%; Queretaro -82%). In spite of irrigation, the magnitude of the deficit is such that an impact on crops is very likely. In Brazil wheat is just being planted and mostly average JFMA weather is not expected to significantly affect the future output (to be harvested at the end of 2019).

Soybean: Among the eight countries that export more than 1 million tonnes of soybeans, all except Argentina, Brazil, Uruguay and Paraguay are located in the northern hemisphere and, as such, are planting or are still to plant soybeans that will develop from late spring and summer. In south America, however, the reporting period covers mid-season stages to early harvest and, as such, the current indicators are very relevant for soybean. Brazil experienced average conditions and indicators (VCIx at 0.78) point at average crop condition. Argentina, Uruguay and Paraguay experienced similar conditions characterised by above average precipitation (between +12% and +21%), below average temperature (0.8°C to 1.2°C below average) lower than normal sunshine (-1% to -5%). In Argentina, the only country for which CropWatch agronomic indicators are available, values are average. Altogether, the soybean output is therefore assessed as average as well at this stage of the season.

3. Weather anomalies and biomass production potential changes

A Caveat

All variables are compared against the recent 15-year average (2004-2018). This constitutes a change compared to the previous bulletins where BIOMSS was compared against the recent 5-year average (5YA). Agronomic indicators, however, are compared against the 5YA as before. Figure 3.1 shows "very dry" and "very wet" conditions in several areas that are currently in their dry season, for instance in the west African Sahel. In Niger, for instance, the rainfall deficit reaches 65%: 2 mm were estimated for a country where the 15YA reaches 6 mm over the reporting period. In other words, the country is in its dry season and no rain is actually expected: there is no drought. The text below refers only to areas where significant amounts of rainfall are actually expected. It is also stressed that in many equatorial areas where large amounts of rainfall are actually expected, below average rainfall not necessarily constitutes drought. An example in Malaysia during the current reporting period: average rainfall reaches 1042 mm, so that the amount recorded (712 mm) is 32% below average. 712 mm, however, corresponds to about 6 mm per day, which is sufficient to cover the requirements even of water demanding crops. In fact, the deficit in Malaysia probably corresponds to a slightly longer than average "dry season" in February and, as such, does not rise concerns.

Rainfall and biomass

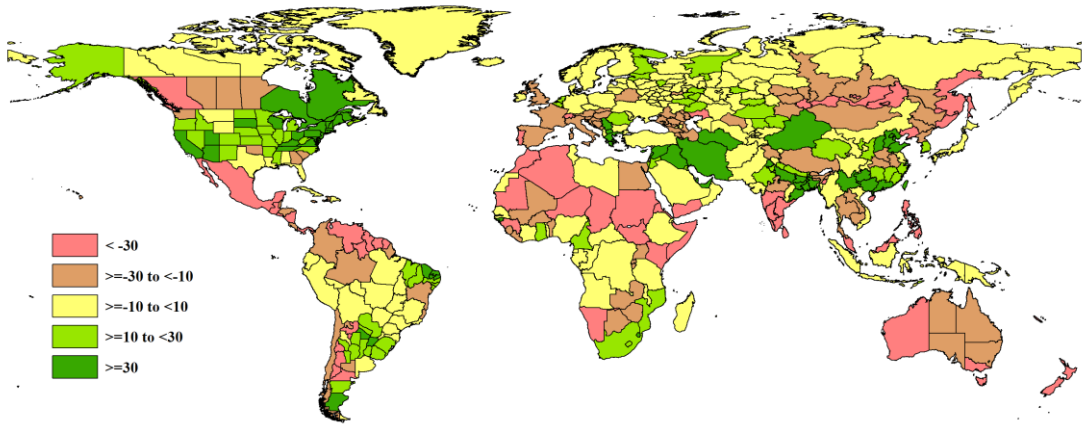


Figure 3.1 Global map of rainfall anomaly (as indicated by the RAIN indicator) by country and sub-national areas, departure from 15YA between January and April 2019

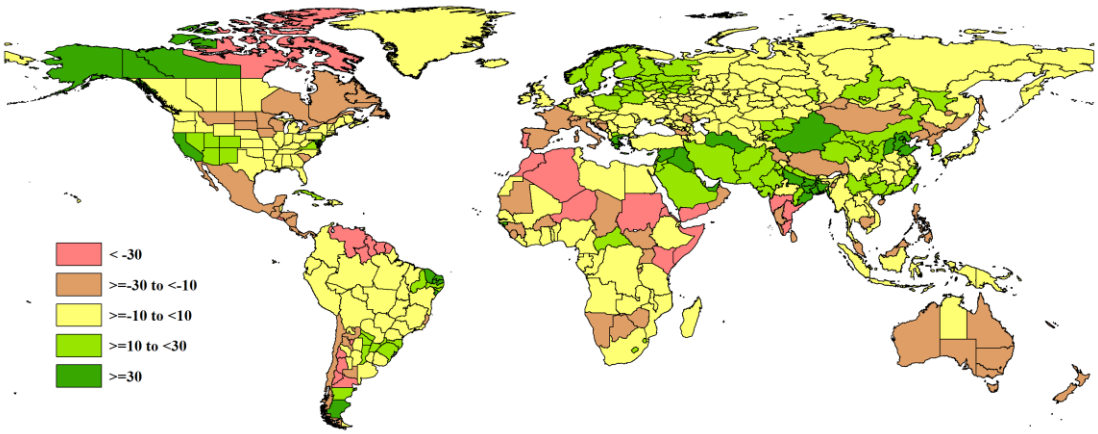


Figure 3.2 Global map of biomass production potential anomaly (as indicated by the BIOMSS indicator) by country and sub-national areas, departure from 15YA between January and April 2019

(1) Dry conditions

Rather dry conditions are observed in several tropical and equatorial countries, especially around the Caribbean basin, including Guyana and French Guyana (both at -80%), Suriname (-72%), Venezuela (-54%), Mexico (-49%), Panama (-46%) as well as Guatemala (-43%) and Nicaragua (-32%).

In the western Mediterranean area, several countries are likely to have suffered a shortage of precipitation for they main agricultural season, especially Portugal (-45%), Morocco (-39%) and Algeria (-34%).

In south-eastern Asia and Oceania, the largest deficits occurred in New Caledonia (-58%), THE Philippines (-49%), New Zealand (-32%).

In Africa, we need to report the precipitation shortfalls that occurred in the Horn of Africa in Somalia (-53%), Kenya (-40%) and Uganda (-25%) and in parts of Southern Africa that were not affected by the two cyclones that crossed to Mozambique Channel, namely Namibia (-42%).

(2) Wet conditions

The largest precipitation excesses at the national level include some countries bordering the Mozambique Channel (Mozambique +27%, Eswatini +35%), the eastern Mediterranean and the Middle-East (Kuwait +29%, Qatar +30%, Iran +39%, Lebanon +42%, Iraq +64%, UAE +71%, Syria +74%, Greece +76% and Cyprus +90%).

Some of those countries (e.g. Iran) are covered in chapter 5 (section on disasters) because of serious floods that also affected some neighbouring countries belonging to semi-arid central and western Asia such as Turkmenistan (+64%) central Asian countries Pakistan (+6%). Much of the destruction was due to heavy precipitation following a prolonged drought.

(3) Biomass

Biomass very closely follows precipitation as 84% of biomass variability is accounted for by rainfall variability, with very few exceptions usually brought about by low temperature, as in North Macedonia (RAIN +66%, BIOMSS +15%).

3.3 Temperature anomalies

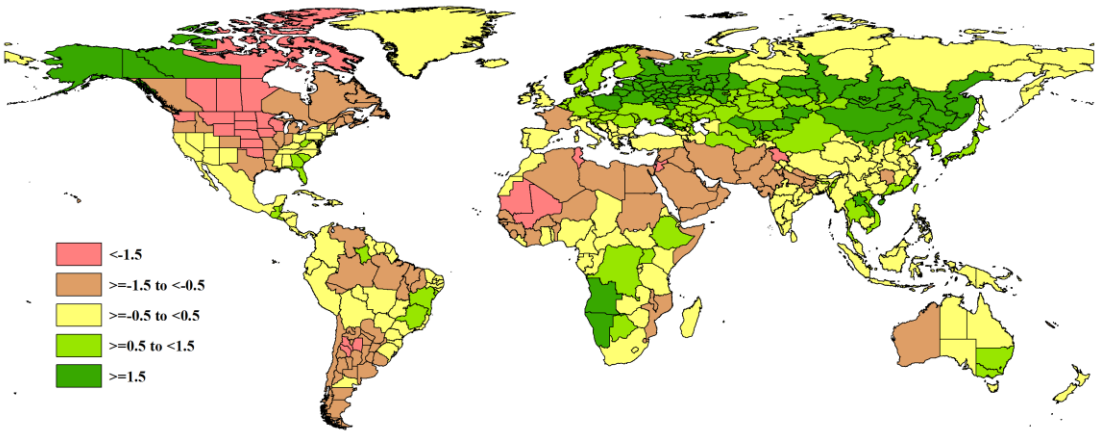


Figure 3.3 Global map of temperature anomaly (as indicated by the TEMP indicator) by country and sub-national areas, departure from 15YA between January and April 2019

(1) Low temperature

With the exception of Morocco, most of the area from west Africa to southern Himalayas areas experienced below average temperature, which includes a number of countries with departures in excess of 1.5°C; they occurred in Mauritania (-2.2°C), Jordan, Mali and Tunisia (all three at -1.6°C) and Israel (-1.5°C). Eleven more countries had cool weather (between 1.0°C and 1.4°C below average), mostly over winter crop areas

including Iraq (-1.4°C), Egypt (-1.3°C) and Pakistan (-1.3°C) and with the two Indian States of Bihar (-1.4°C) and Jharkhand (-1.0°C) as the easternmost areas.

On the American continent, the countries to mention include winter in Canada (-1.4°C) and summer in Argentina (-1.2°C), Chile (-1.1°C) and Uruguay (-1.0°C). In the US, the average departure was moderate (-0.7°C) but individual States recorded larger values which include South Dakota and Montana (-3.5), North Dakota (-3.0). Slightly less severe conditions prevailed in the major maize and soybean producing areas of Minnesota (-2.6), Nebraska (-2.4) and Iowa (-2.0). Some impact on winter wheat is likely in Nebraska.

(2) High temperature

Most high temperatures occurred in a huge area from Belgium to Japan across central Asia. In western Eurasia the largest departures occurred around and east of the Baltic, including Poland (+1.6°C), Russia (+1.7°C), Belarus (+1.9°C), Lithuania (+2.0), Estonia (+2.1) and Latvia (+2.2) with departures between +1.0°C and +1.4°C in Czechia, Denmark, Germany, Hungary, Slovakia and Ukraine. In Russia, some western Oblasts and Republics departures exceeded the listed ones, reaching +2.4°C in the Buryatia Republic and Vologda Oblast, +2.3°C in the Oblasts of Tver and Novgorod and between +2.2 and +2.0 in the Republic of Karelia and the Oblasts of Moscow, Arkhangelsk, Kostroma, Pskovs, Leningrad, Nizhny Novgorod, Vladimir and the Russian enclave in the EU, Kaliningrad. Several of the listed areas, especially in Russia, experienced snow-melt because of the warm wave with a potential negative impact on winter crops.

In central Eurasia, it is in order to list Mongolia (+2.2°C) as well as Kyrgyzstan, Uzbekistan and Kazakhstan which all averaged +1.4°C above the average. At the subregional level it is in order to mention some Regions in in Kazakhstan (Almaty +2.3°C, Kyzylorda +2.1 and Jambyl +1.9°C) and Russian Oblasts (including Yaroslav +2.5°C, Tomsk +2.0°C and Kemerovo +2.0°C). On the eastern margin of the continent, some Russian oblasts of limited agricultural importance and some Chinese provinces recorded high values, for instance the Jewish Autonomous (+3.4) and the Chita (+2.8) Oblasts, the Kray of Promorsky (+3.1°C), the Agin-Buryat Okrug (+2.9°C) as well the neighbouring Chinese provinces of Jilin (+2.8°C) and Heilongjiang (+3.6°C). Heilongjiang recorded one of the largest temperature anomalies among the more than 3100 countries, sub-national administrative units and agro-ecological zones monitored by CropWatch. Among agriculturally relevant areas it is exceeded only by some south-west African areas in Angola (Huila, Cunene) and Namibia (Ohangwena) with +3.7°C and +3.8°C anomalies. The largest departures occur north-western America, especially in the Yukon Territory in Canada, a subarctic region in Boreal America (MRU 61 which also includes Alaska), where temperature was 6.2°C above average, making it the most anomalous region in terms of temperature.

Three additional groups of countries are to be listed: (1) south-east Asian with Viet Nam (+1.2°C), Korea DPR (+1.3°C) and Laos (+1.5°C), (2) southern Africa with Botswana (+1.1°C), Angola (+1.7°C) and Namibia (+2.2°C) and (3) Guatemala (+1.4°C) and Belize (+1.5°C) in central America.

3.4 RADPAR anomalies

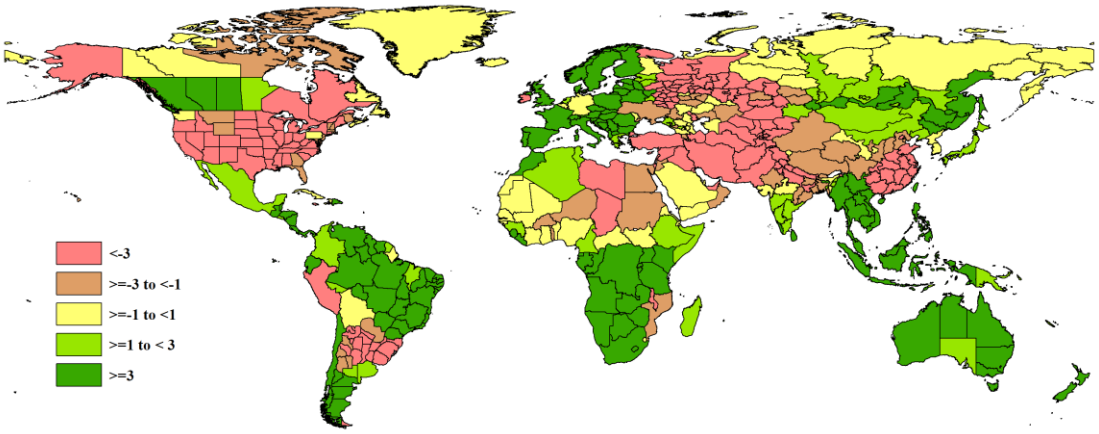


Figure 3.4 Global map of photosynthetically active radiation anomaly (as indicated by the RADPAR indicator) by country and sub-national areas, departure from 15YA between January and April 2019

(1) Below average sunshine

Compared with above-average sunshine, relatively few countries experienced below average sunshine (35%). Most of them have already been listed above among regions with wet and those with cool conditions. In central-western Asia. They include Uzbekistan and Tajikistan (-10%), Turkmenistan (-8%), Afghanistan (-6%) and Pakistan (-6%) leading to the western Mediterranean and Middle Eastern countries of Lebanon and Iraq (-8%), Syria (-7%) and Cyprus (-6%). The area is connected in the east with Nepal (-6%) through several northern Indian States including Haryana (-5%) and Himachal Pradesh (-7%)

In other continents, countries that deserve mention are Ireland (-7%) and the United States (-6%, with lowest values in Louisiana (-11%), -9% in California, Mississippi and Illinois, -8% in Arkansas, Indiana, South Dakota and Missouri and -7% in Iowa, Utah, Nevada, Texas, Oklahoma, Arizona and Nebraska.

(2) Above average sunshine

Above average sunshine was recorded in central and northern south America (+6% to +10% in Honduras, Guatemala, Costa Rica, Belize and Guyana), central and eastern Africa (+6% to 11% in the two Congos, Tanzania, Uganda, Rwanda and Burundi), and southern Africa (+6% to +9% in Mauritius, Angola, Namibia, Botswana and Lesotho) as well as in New Zealand (+9%).

Also to be mentioned: south-east Asia and seventeen European countries from France, Denmark and the United Kingdom (+6%) to Portugal and Montenegro (+10%) to the Baltic countries (+10% in Lithuania, +12% in Estonia). In south-east Asia, countries with departures larger than 6% include Thailand, Viet Nam, Philippines, Laos (+9%) and Malaysia (+10%). In several of them sunshine is the main limiting factor for the rice crop planted from January and the abundant sunshine will positively affect crop development and growth.

3.5 Combinations of anomalies

Globally, the most anomalous conditions are those that prevailed in the eastern Mediterranean and the Middle East, especially Lebanon and Iraq, with precipitation excess larger than 40%, low temperature (departure larger than 1.2°C and low sunshine below 8%). A group of neighbouring countries (Jordan, Israel, Syria and Cyprus) and Kuwait had high rainfall combined with low sunshine or cool weather, or both, but weaker departures than in Lebanon and Iraq.

Similar conditions with excess rain, cool weather and low sunshine also affected Nepal (RAIN +24%, TEMP -0.8°C, RADPAR -6%) and the United States (RAIN up 19%, temperature down 0.7°C and sunshine down 6%) during winter. As shown above, conditions can be more extreme when zooming into individual States. In

Latin America conditions were unusual in a similar fashion but in a different season (summer) in Uruguay and Argentina with a moderate increase in precipitation (+12% and +14%, respectively), cool weather (drops of 1.0°C and 1.2°C) and sunshine down (-5% and -4%).

In southern Africa, Namibia recorded a sharp drop in rainfall (-42%) associated with heatwave conditions (+2.2°C) and sunshine up 8%. Rangeland and cattle are bound to have suffered.

Table 3.0. January – April 2019 agro-climatic and Agronomic indicators by country, current value and departure from average.

Code	Country	Agro-climatic indicators				Agronomic indicators	
		Departure from 15YA (2004-2018)				Departure from 5YA (2014-2018)	Current
		RAIN (%)	TEMP(°C)	PAR(%)	BIOMSS (%)	CALF (%)	VCIx
AFG	Afghanistan	-2	-1.1	-6	4	-	0.78
AGO	Angola	-6	1.7	6	-2	-4	0.80
ARG	Argentina	14	-1.2	-4	1	-1	0.81
AUS	Australia	-17	0.5	4	-21	-	0.42
BGD	Bangladesh	32	0.3	-1	35	1	1.03
BLR	Belarus	-14	1.9	9	13	-15	0.81
BRA	Brazil	-1	-0.1	5	3	1	0.78
KHM	Cambodia	-26	0.0	4	-17	1	0.83
CAN	Canada	0	-1.4	2	-7	-	0.80
CHN	China	20	0.6	-4	10	-5	0.90
EGY	Egypt	-20	-1.3	-1	-19	4	0.97
ETH	Ethiopia	5	0.8	2	3	7	0.85
FRA	France	-18	-0.5	6	-15	0	0.95
DEU	Germany	5	1.2	1	9	0	0.93
HUN	Hungary	-12	1.0	4	-9	-5	0.83
IND	India	-3	-0.3	0	8	-3	0.83
IDN	Indonesia	-2	-0.4	4	-2	0	0.00
IRN	Iran	39	-0.7	-5	19	47	1.00
ITA	Italy	-24	0.1	9	-19	1	0.94
KAZ	Kazakhstan	4	1.4	-4	6	-	0.76
KEN	Kenya	-40	0.1	5	-39	-3	0.76
MEX	Mexico	-49	0.1	1	-29	1	0.82
MNG	Mongolia	-27	2.2	2	-18	-	0.91
MAR	Morocco	-39	0.0	3	-36	0	0.80
MOZ	Mozambique	27	-0.6	-1	4	0	0.94
MMR	Myanmar	1	0.3	4	1	2	0.94
NGA	Nigeria	9	-0.3	-1	8	-3	0.89
PAK	Pakistan	6	-1.3	-6	10	7	0.90
PHL	Philippines	-49	-0.5	7	-28	0	0.94
POL	Poland	-4	1.6	4	12	-2	0.85
ROU	Romania	12	0.8	3	5	-11	0.76
RUS	Russia	-3	1.7	-1	4	-35	0.72
ZAF	South Africa	14	0.3	5	8	0	0.83
LKA	Sri_Lanka	-31	-0.1	4	-23	0	0.96
THA	Thailand	-12	0.6	6	-10	-3	0.83
TUR	Turkey	-1	-0.1	-3	1	-7	0.75
UKR	Ukraine	-4	1.2	-1	2	-11	0.81
GBR	United Kingdom	-15	0.2	6	-3	0	0.99
USA	United States	19	-0.7	-6	3	-1	0.86
UZB	Uzbekistan	5	1.4	-10	9	-	1.00
VNM	Vietnam	-6	1.2	6	3	1	0.98
ZMB	Zambia	-12	0.0	4	-9	0	0.91

3.2 Country analysis

This section presents CropWatch analyses for each of 41 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 January - April 2019 period to the previous season and the five-year average (5YA) and maximum; (c) Maximum VCI (over arable land) for January - April 2019 by pixel; (d) Spatial NDVI patterns up to January - April 2019 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 January - April 2019 period to the previous season and the five-year average (5YA) and maximum.

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

Figures 3.5 - 3.45 are Crop condition for individual countries ([AFG] Afghanistan - [ZMB] Zambia) including sub-national regions during January - April 2019.

[AFG] Afghanistan

The current reporting period covers the early stages of spring wheat (which was planted in March) as well as the late dormancy and re-growth of winter wheat.

Precipitation reached 173mm, 1.9% lower than the average. Both temperature and sunshine were below average (TEMP 5.0°C, down 1.1°C; RADPAR: 919MJ/m², down 6%). The cropped arable land fraction (CALF) was only 19%, which nevertheless represents a significant rise (90%) above the 5YA. According to the NDVI development graph crops were poor between January and February, but their condition increased rapidly after February. The distribution map of the best vegetation condition index (VCIx) shows that the VCIx was highest in most areas of the north and the value reached 0.8. The national NDVI development profile for Afghanistan presents below average values before march but later improved. The spatial NDVI patterns compared to the five-year average indicate that NDVI was above average in 11.4% of arable land mainly in the north and west of Badghis and below average values in the other regions. NDVI was near average in 36.4% of the cultivated land areas, especially in Kandahar. Thirty-eight percent of the areas (including Daikondi, Oruzgan and neigboring areas) were below average.

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.

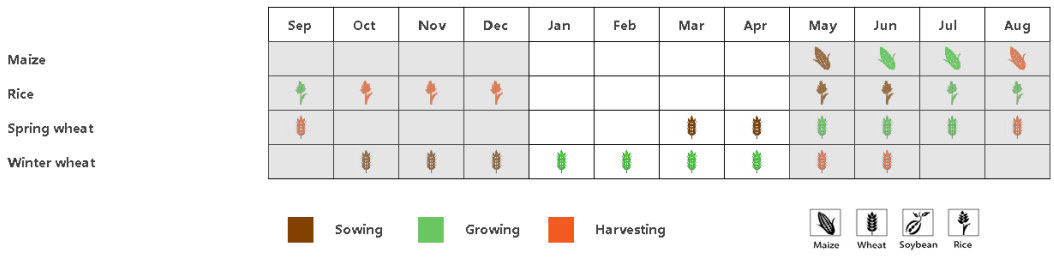
In the Central region with sparse vegetation, the following indicator values were observed: Rain 102mm, 28% down below average; TEMP 1.2°C, -1.2°C; RADPAR 960MJ/m^2, -5%; CALF 6%, +21% and VCIx: 0.75.

Precipitation of the Dry region was close to average at 139 mm. Temperature was the highest among the four AEZs. The CALF was seasonably low and VCIx was just 0.44.

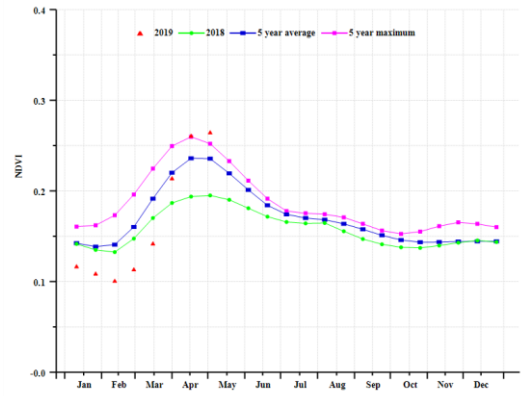
The Mixed dry farming and irrigated cultivation region consists mainly of farmland and irrigated areas and the effects of the drought mentioned in previous reports have been mitigated by normal rainfall amounts of 214mm. CALF reached 30%, which is the highest in the four regions and a significant increase over previous seasons (+79%). Overall, the VCIx in this area was very high, reaching 0.99.

Mixed dry farming and grazing region recorded 178 mm of RAIN, 7% above average. The temperature was 5.2°C, 1.8°C below average. The RADPAR was 949MJ/m^2, closed to the average. The CALF (21%) was 159% higher than the average and VCIx at 0.83 indicates good production prospects.

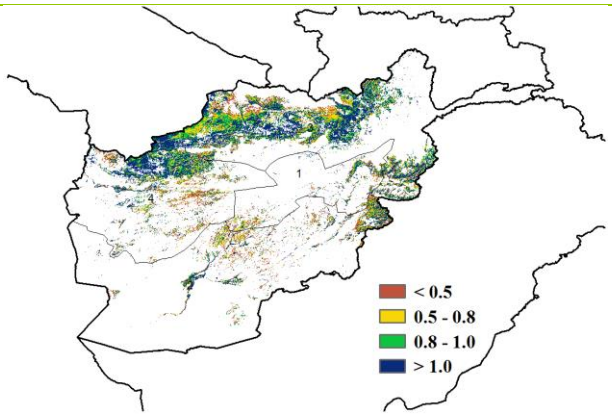
Figure 3.5 Afghanistan's crop condition, January - April 2019



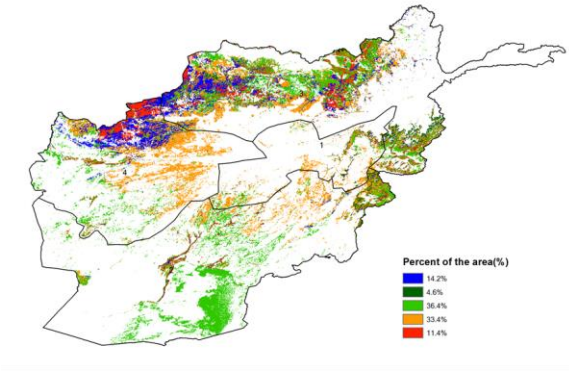
(a). Phenology of major crops



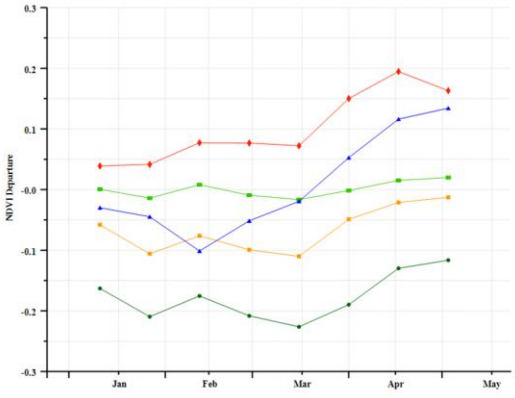
(b) Crop condition development graph based on NDVI



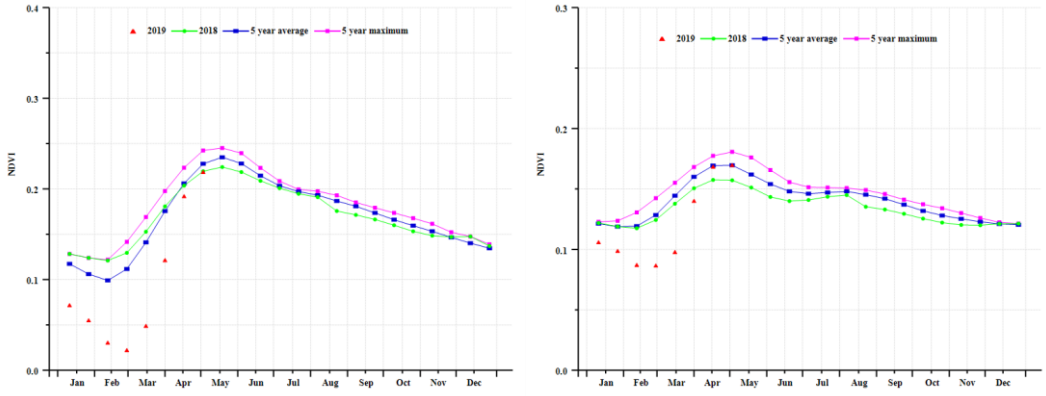
(c) Maximum VCI



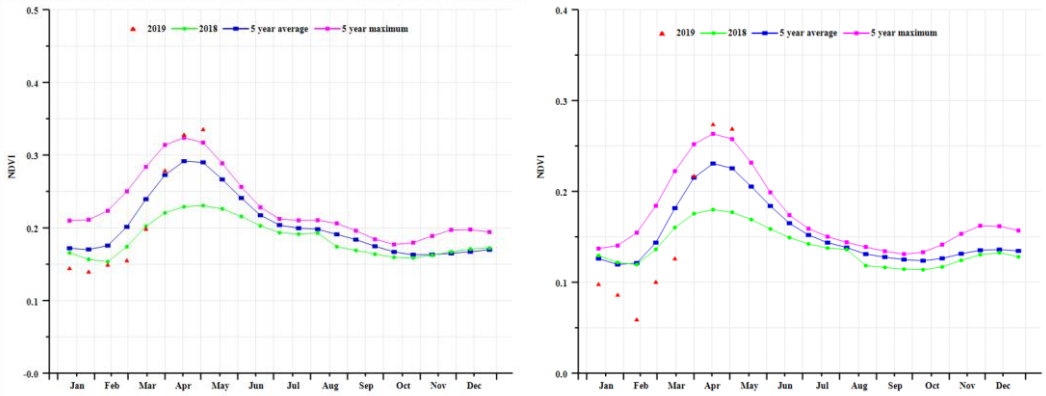
(d) Spatial NDVI patterns compared to 5YA



(e) NDVI profiles



(f) Crop condition development graph based on NDVI (Central region with sparse vegetation (left) and Dry region(right))



(g) Crop condition development graph based on NDVI (Mixed dry farming and irrigated cultivation region (left) and Mixed dry farming and grazing region (right))

Table 3.1 Afghanistan's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, January - April 2019

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m²)	Departure from 15YA (%)
Central region with sparse vegetation	102	-28	1.2	-1.2	960	-5
Dry region	139	-2	8.1	-1.6	1019	-4
Mixed dry farming and irrigated cultivation region	214	-1	3.6	-0.5	824	-8
Mixed dry farming and grazing region	178	7	5.2	-1.8	949	-5

Table 3.2 Afghanistan's agronomic indicators by sub-national regions, current season's values and departure from 5YA/15YA, January - April 2019

Region	BIOMSS		Cropped arable land fraction		Maximum VCI
	Current (gDM/m²)	Departure from 15YA (%)	Current (%)	Departure from 5YA (%)	Current
Central region with sparse vegetation	440	-13	6	21	0.75
Dry region	527	15	4	34	0.44
Mixed dry farming and irrigated cultivation region	687	10	30	79	0.99
Mixed dry farming and grazing region	675	14	21	159	0.83

[AGO] Angola

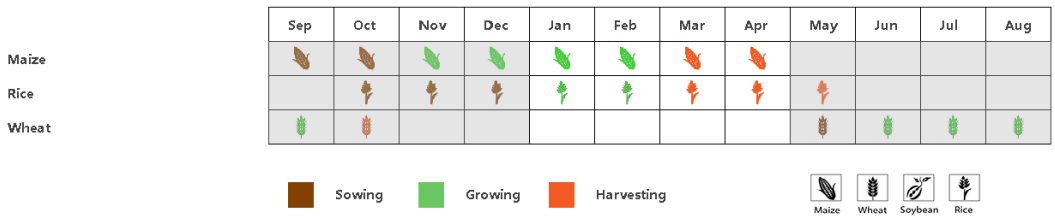
Covering the late growth and harvest of Maize and Rice, the CropWatch agroclimatic indicators inform us that RAIN was below average (-6%) while both temperature and radiation were above (TEMP +1.7°C, RADPAR +6%). The resulting agronomic variables show both decreased, biomass by 2% and the cropped arable land fraction by 4%. According to the NDVI development graph values were below average throughout almost the entire monitoring period. At the end of January, mid-February and mid-April, crop condition was none the less above average. The maximum VCI map shows that the most favorable situation occurred in the north-western areas (especially in the provinces of Zaire, Uíge, Benga and Cuanza Norte). The NDVI profiles indicate that in the provinces of Benguela, Huambo and Huíla, the condition of crops exceeded the previous five-years average. This area corresponds to 30% of the total cropped area. Among the total cropped area, 4.3%, registered below average crop condition during January; however, these areas recovered and kept about the average during the entire monitoring period. In general, crop condition was unfavourable during the monitoring period.

Regional Analysis

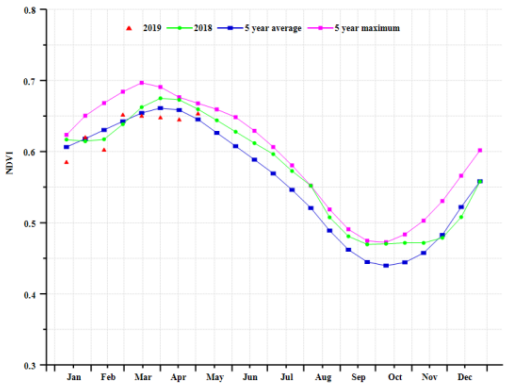
Considering the cropping systems, climatic zones and, and topographic conditions, Angola is divided into six agro-ecological zones (AEZs): the Central Plateau, Humid, Sub-humid, Semi-arid, Arid and Desert.

Excepting the Central Plateau zone, all the agro-ecological zones showed below average crop conditions during the entire monitoring period. The agroclimatic factors have influenced the crop condition in these regions, as all the zones excepting the Sub-humid zone, showed a shortage of rainfall. A significant drop in rainfall was verified in the Semi-arid zone (RAIN down 28%). In this region, both temperature and radiation recorded an increase by about 1.9°C and 9% respectively. It is also important to mention that despite the increase in rainfall (+9%) recorded in the Sub-humid zone, temperature and radiation increased by about 1.6°C and 5%, respectively. The significant increase in temperature and radiation also occurred in the Central Plateau region (TEMP +2.7°C, RADPAR +7%). Biomass and CALF registered decreases in the Arid and Semi-arid zones. In the Arid zone, the Biomass decreased by 10% and the CALF by about 24% while in Semi-arid zone the biomass dropped by 12% and the CALF decreased by 7%. The maximum VCI values recorded during this period were low in the Arid zone, about 0.64.

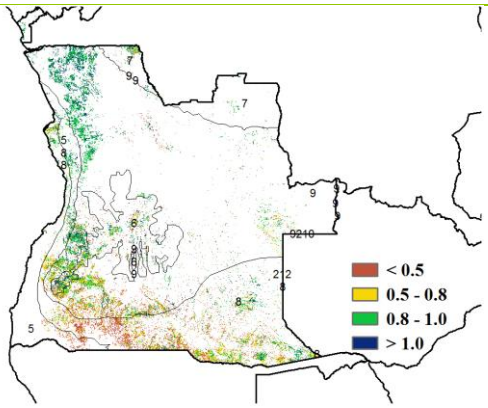
Figure 3.6 Angola's crop condition, January – April 2019



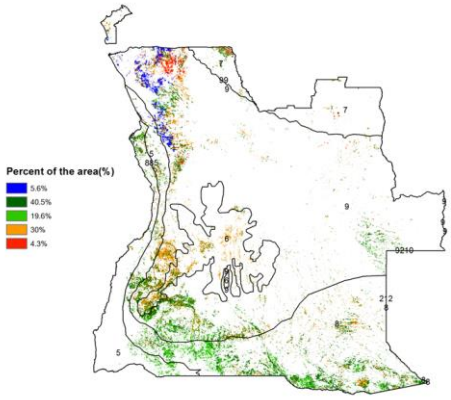
(a). Phenology of major crops



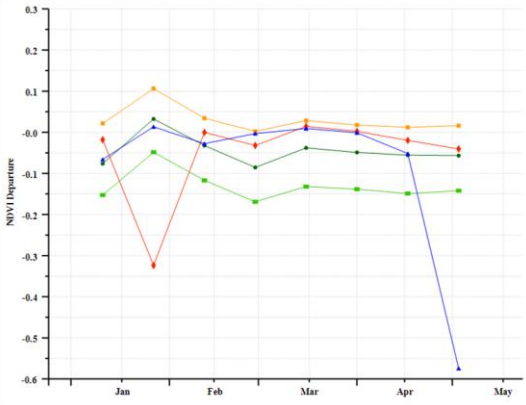
(b) Crop condition development graph based on NDVI



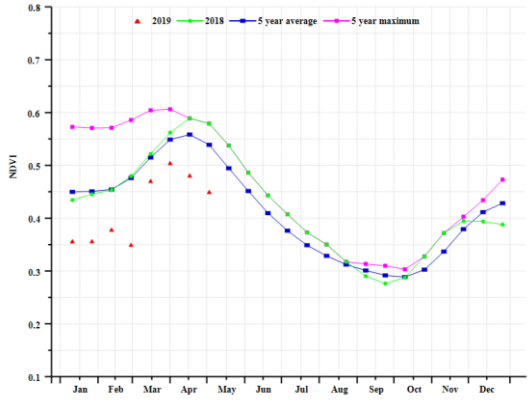
(c) Maximum VCI



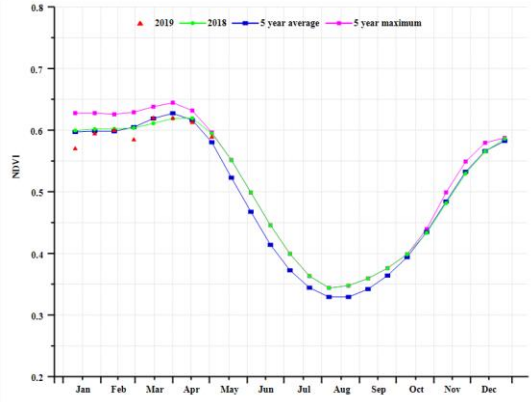
(d) Spatial NDVI patterns compared to 5YA



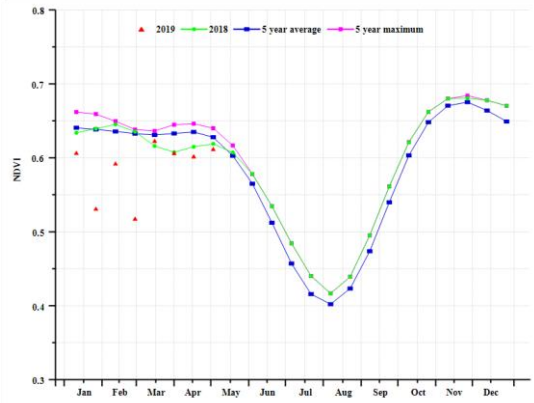
(e) NDVI profiles



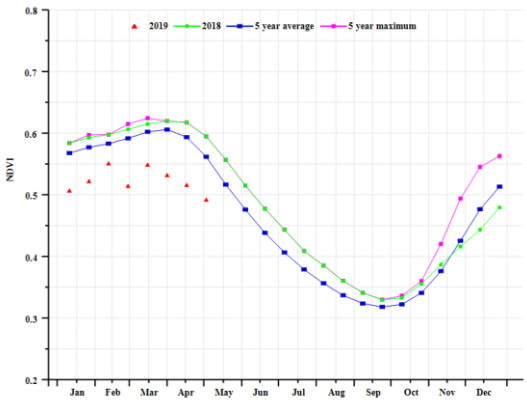
(f) Crop condition development graph based on NDVI- Arid zone



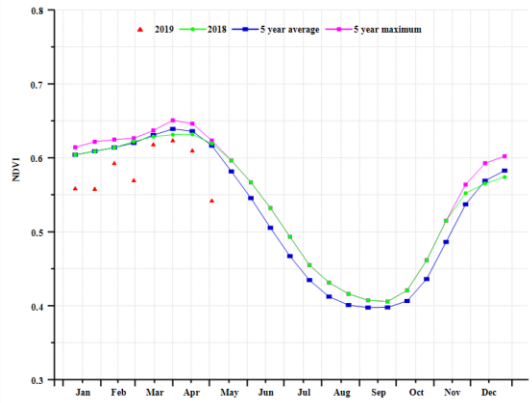
(g) Crop condition development graph based on NDVI - Central Plateau



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



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



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

Table 3.3 Angola agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, January - April 2019

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m²)	Departure from 15YA (%)
Arid Zone	309	-21	25.5	0.2	1257	1
Central Plateau	635	-3	23.1	2.7	1157	7
Humid zone	558	-6	26.0	0.5	1202	6
Semi-Arid Zone	391	-28	26.5	1.9	1284	9
Sub-humid zone	685	9	25.7	1.6	1198	5

Table 3.4 Angola agronomic indicators by sub-national regions, current season's values and departure from 5YA/15YA, January - April 2019

Region	BIOMSS		Cropped arable land fraction		Maximum VCI
	Current (gDM/m²)	Departure from 5YA (%)	Current (%)	Departure from 5YA (%)	Current
Arid Zone	1038	-10	69	-24	0.64
Central Plateau	1800	1	100	0	0.89
Humid zone	1853	0	100	0	0.92
Semi-Arid Zone	1331	-12	91	-7	0.70
Sub-humid zone	1833	7	100	0	0.88

[ARG] Argentina

The reporting period is the main growing season for summer crops: maize, rice and soybean (Figure 3.7.a). Most wheat was harvested during the previous reporting period, after which late soybean was planted. The overall situation was average: Rainfall showed a 14% increment compared to average. Temperature was down 1.2°C and RADPAR showed a reduction of 4.3 %. BIOMSS showed an increment of 0.9% above the average and Maximum VCI reached 0.81; compared to the previous five seasons, CALF was reduced by 1% point.

CropWatch subdivides Argentina into eight agro-ecological zones (AEZ) based on cropping systems, climatic zones, and topography; they are identified by numbers in the NDVI profiles map (Figure3.7 b). Only four of them are found to be relevant for crop cultivation: the Humid Pampas (region 13), the Chaco (region 11), Mesopotamia (region 12) and the Subtropical highlands (region 17) for which the crop conditions will be discussed with some detail in this section.

Spatial distribution of NDVI profiles show better than average conditions for the main agricultural area of the humid Pampas as well as for Subtropical highlands during the critical period of maize and soybean (Figure 3.7 c). A more stable pattern was observed in the Depressed Pampas (also referred to as "Flooded Pampas") that are dominated by grasslands (blue area, 17.3% of agricultural land). In the Southeast of the Humid Pampas, a region dominated by winter crops, negative anomalies were observed for most of the reporting period.

Regional analysis

Crop condition development graphs based on NDVI show below average values for the whole country, but NDVI values where higher than last year for most of the period (Figure 3.7.d). Humid Pampas showed values lower than average from January to March and no anomalies since April. Values were, as for the whole country, higher than last year's for most of the period (Figure 3.7.e). Chaco region didn't show anomalies during most of the reporting period and showed values higher than those observed during last year (Figure 3.7.f). Mesopotamia showed almost no anomalies during the reporting period, but showed values much higher than last year's in particular during end of February and March (Figure 3.7.g). Subtropical highlands showed almost no anomalies and similar values to last year with the exception of a quite high negative anomaly at mid March (Figure 3.7.h).

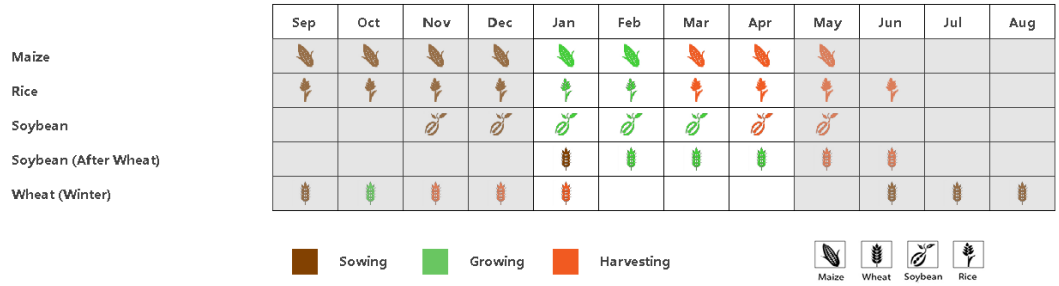
VCIx map showed quite good conditions for the whole country, which is dominated by values higher than 0.8, with the exception of lower values observed over Southwest of Humid Pampas and South Chaco (Figure 3.7.b).

RAIN showed high positive anomalies in Chaco (+44 %) and Mesopotamia (+26 %), while Humid Pampas showed a 7% increment in this variable (Table 3.7). On the contrary, a strong negative anomaly in RAIN was observed in Subtropical highlands (-32 %). TEMP showed negative anomalies for the 4 regions considered, ranging from -1.1 degree in the Pampas to -1.4 degree in Chaco and Subtropical highlands. RADPAR showed negative anomalies for these regions: Pampas (-0.7 %), Subtropical highlands (-7.1 %), Mesopotamia (-8.6 %) and Chaco (-9.9 %).

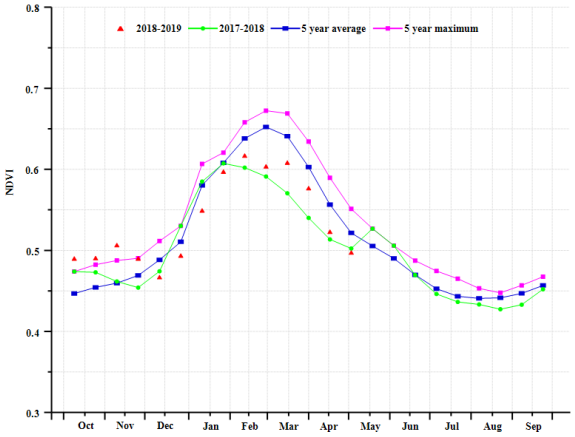
BIOMSS anomalies where associated also in magnitude to precipitation anomalies (Table3.8), being positive in Chaco (+18.8 %), Mesopotamia (+12.4 %) and Humid Pampas (+0.5 %), and negative in Subtropical highlands (-21.8 %). Maximum VCI was quite high for the Humid Pampas (0.88) and almost 0.15 lower for the other regions considered: Subtropical highlands (0.72) and Mesopotamia and Chaco (0.71). CALF was almost average showing slight changes for all the regions: HumidPampas (-0.33 %), Chaco (+0.02 %), Subtropical highlands (+0.04 %) and Mesopotamia (+0.14 %).

The combination of high rainfall, low temperature and low sunshine is likley to have affected crops negatively in some areas, also indirectly through increased incidence of diseases and interference with harvest operations.

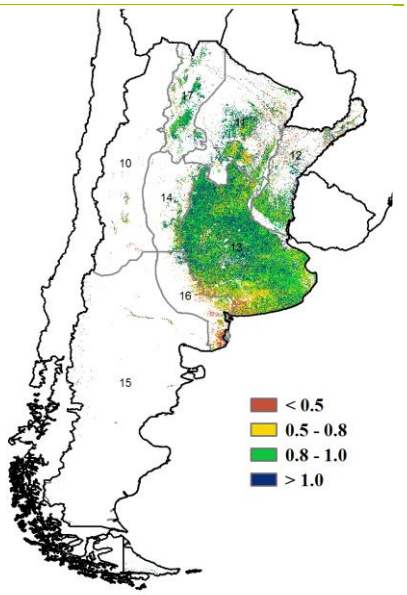
Figure 3.7 Argentina's crop condition, January - April 2019



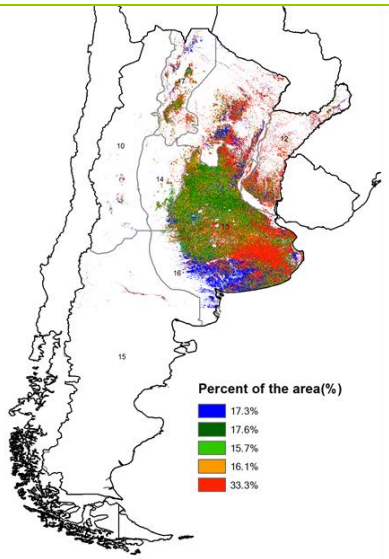
(a). Phenology of major crops



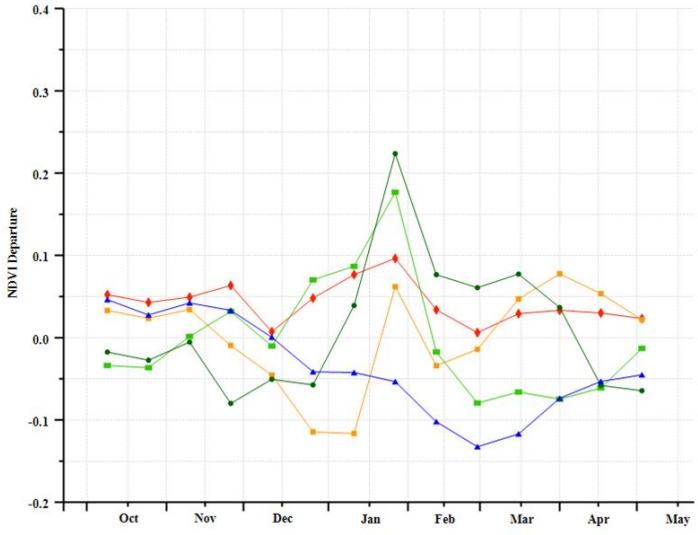
(b) Crop condition development graph based on NDVI



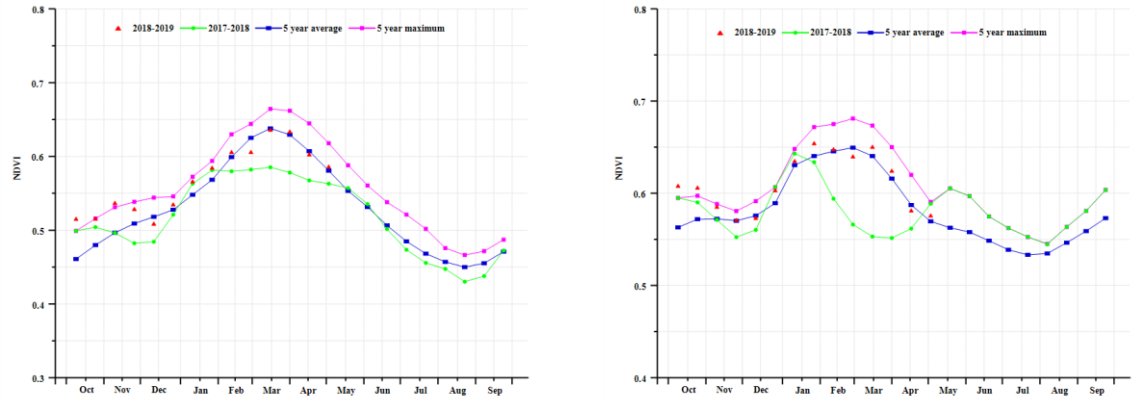
(c) Maximum VCI



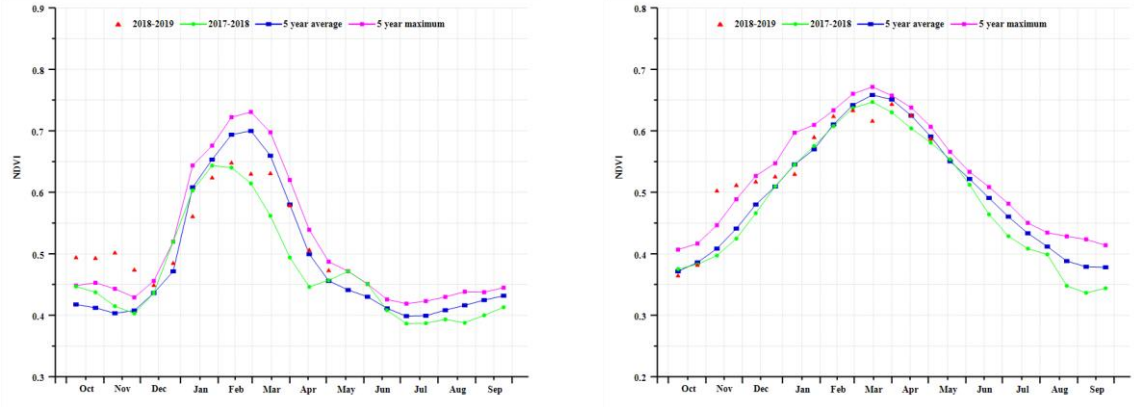
(d) Spatial NDVI patterns compared to 5YA



(e) NDVI profiles



(f) Crop condition development graph based on NDVI (NDVI_Chaco (left) and Mesopotamia (right))



(g) Crop condition development graph based on NDVI (Humid Pampas (left) and Subtropical highlands (right))

Table 3.5 Argentina's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, January – April 2019

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m²)	Departure from 15YA (%)
Chaco	884	44	24.3	-1.4	1036	-10
Mesopotamia	816	26	23.4	-1.2	1083	-9
Humid Pampas	517	7	20.4	-1.1	1206	-1
Subtropical highlands	399	-32	22.8	-1.4	1046	-7

Table 3.6 Argentina's agronomic indicators by sub-national regions, current season's values and departure from 5YA/15YA, January – April 2019

Region	BIOMSS		Cropped arable land fraction		Maximum VCI
	Current (gDM/m²)	Departure from 15YA (%)	Current (%)	Departure from 5YA (%)	Current
Chaco	1857	19	100	0.0	0.71
Mesopotamia	1769	12	100	0.1	0.71
Humid Pampas	1398	1	99	-0.3	0.89
Subtropical highlands	1142	-22	100	0.0	0.72

[AUS] Australia

Wheat and barley, the main cereal crops of Australia, are usually planted from May to July and harvested from October to January. The monitored period thus covers only the end of the last harvesting season with no crops in the field for most of the reporting period. Agro-climatic indicators show below average conditions: RAIN -17%, TEMP +0.5°C, RADPAR 4%. As a result, the biomass accumulation potential shows a decrease of 21% compared with last 15 years. Negative departures of rain were observed in all the states: New South Wales: -16%, South Australia: -24%, Victoria: -33%, and Western Australia: -34%, leading to unfavorable soil moisture conditions for the planting of wheat and barley in the coming months. The maximum VCI is 0.42 all over the region, except for southeastern Queensland (above 0.8), where cotton has reached maturity. Although CALF decreased by 38 percentage points compared with the recent five-year average, this does not necessarily indicate a reduction of the planted area at this stage of the season.

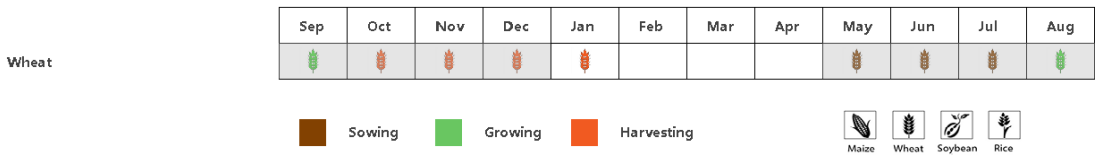
Regional analysis

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

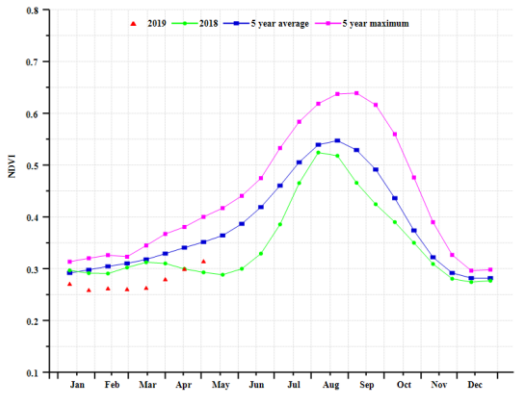
Compared with the last 15 years average, the rainfall for these 5 sub-regions above was as follows: -23%, -39%, -13%, -3% and -34% respectively. Low rainfall, especially for the Southwestern Wheat Zone and Subhumid Subtropical Zone, will possibly have some negative impact on the soil moisture, probably less so in the Wet Temperate and Subtropical Zone which had the least negative departure of rainfall below average. The temperature was above average in Southeastern Wheat Zone, Wet Temperate and Subtropical Zone, and Subhumid Subtropical Zone with 0.8°C, 0.5°C, and 1.2°C, while it was close to average or slightly below for the Arid and Semi-arid Zone and the Southwestern Wheat Zone (0.8℃ drop). RADPAR exceeded average for the 5 sub-regions by, repsctively, 4%, 5%, 3%, 3%, and 7%. As a result, the potential accumulated biomass shows values of -20%, -30%, -6%, -13% and -30%, compared with average.

Due to low rainfall and high temperature and RADPAR, the agroclimatic conditions in Australia have been below average so far, spectaculalrly so when considering record low NDVI curves. Hopefully irrigation can make up for the dry conditions in the coming planting season of wheat and barley. CropWatch will keep on monitoring the crop condition in the next bulletin.

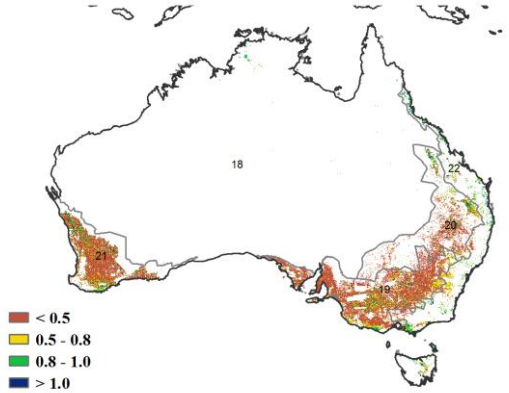
Figure 3.8 Australia's crop condition, January - April 2019



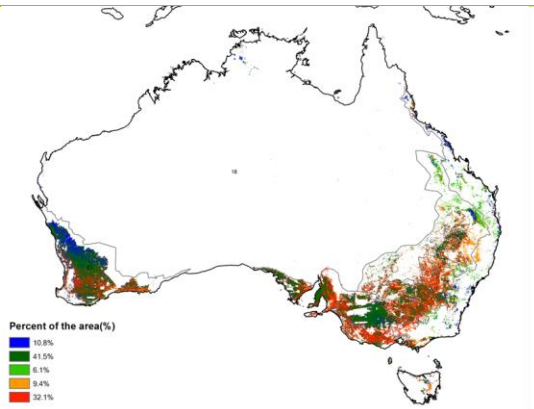
(a). Phenology of major crops



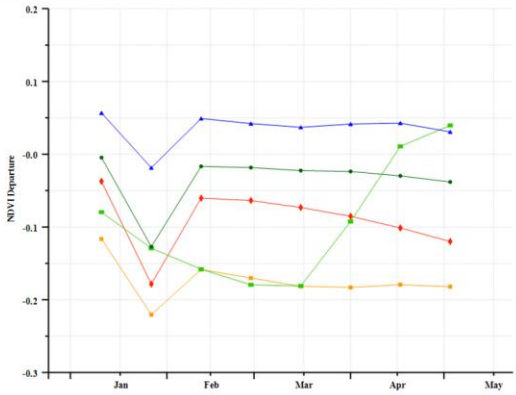
(b) Crop condition development graph based on NDVI



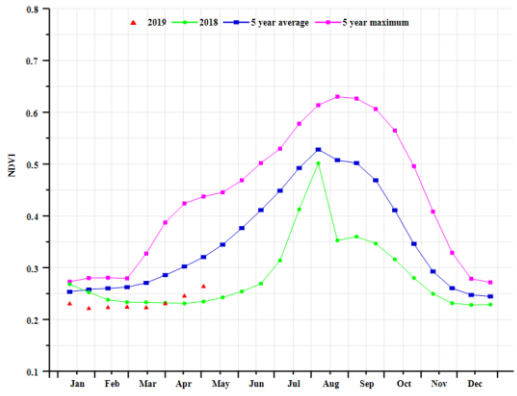
(c) Maximum VCI

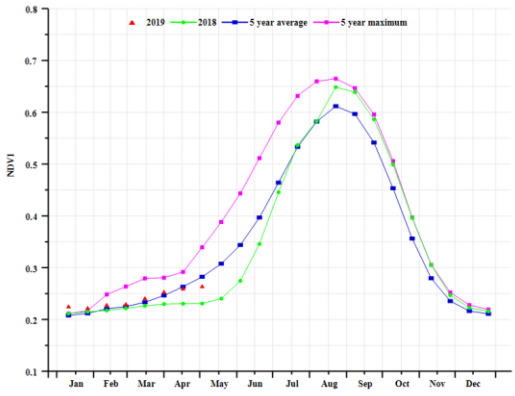


(d) Spatial NDVI patterns compared to 5YA

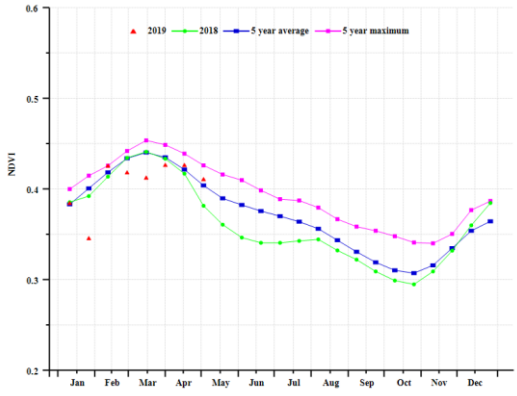


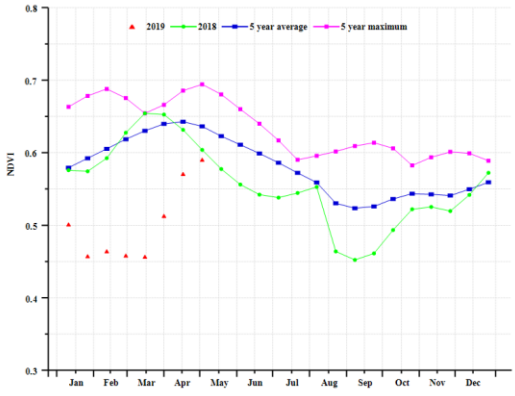
(e) NDVI profiles



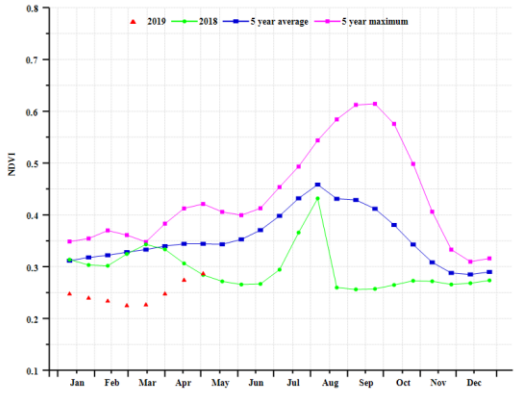


(f) Crop condition development graph based on NDVI (South-eastern wheat zone (left) and South-western wheat zone (right))





(g) Crop condition development graph based on NDVI (Arid and semi-arid zone (left) and Wet temperate and sub-tropical zone (right))



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

Table 3.7 Australia's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, January – April 2019

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m²)	Departure from 15YA (%)
Southeastern wheat zone	110	-23	21.8	0.8	1255	4
Southwestern wheat zone	66	-39	20.7	-0.8	1300	5
Arid and semiarid zone	829	-13	27.7	0.0	1274	3
Wet temperate and subtropical zone	386	-3	21.6	0.5	1170	3
Subhumid subtropical zone	168	-34	25.4	1.2	1340	7

Table 3.8 Australia's agronomic indicators by sub-national regions, current season's values and departure from 5YA/15YA, January - April 2019

Region	BIOMSS		CALF		Maximum VCI
	Current (gDM/m²)	Departure from 15YA (%)	Current	Departure from 5YA (%)	Current
Southeastern wheat zone	473	-20	14	-53	0.35
Southwestern wheat zone	329	-30	11	-45	0.44
Arid and semiarid zone	1322	-6	68	0	0.69
Wet temperate and subtropical zone	874	-13	88	-8	0.69
Subhumid subtropical zone	585	-30	21	-47	0.37

[BGD] Bangladesh

The Reporting period covers the full cycle of dry winter season rice (Boro) and wheat crops; both are irrigated. Although the period between January and April does not correspond to the monsoon the country nevertheless received 299 mm rainfall which is about 32% above average. The temperature at 24.2°C was just 0.3°C above average. The recorded RADPAR of 1174 MJ/m^2 was lower than average by about 1%. Due to good growing environmental conditions CALF reached 97%; NDVI ranged between 0.45 and 0.65 and VCIx reached 1.03, a record high. The avaliable information indicates very good prospects for the current Boro and wheat crops. The NDVI profile map indicates that the conditions were consistently above average in 10% of the crop land but well below throughout the whole reporting period in 4.5% of arable land. REmaing areas fluctuate around the average (below average until March).

Regional analysis

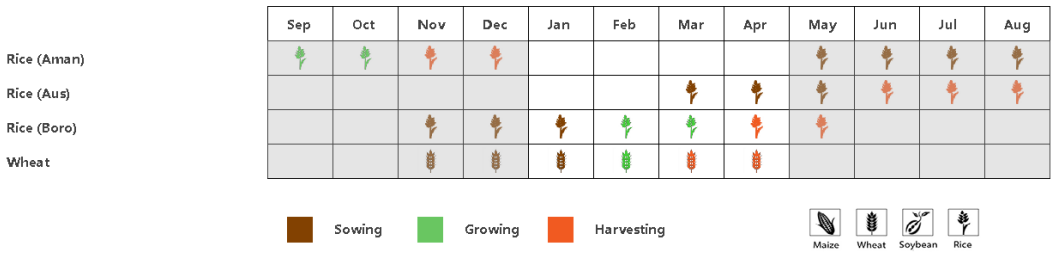
Bangladesh can be subdivided into four regions namely: the Coastal region, the Gangetic plain, the Hills and the Sylhet basin. The Coastal region received excessive rainfall (283 mm, +53% over average) and TEMPwas average at 25.3°C (-0.5°C). RADPAR reached 1206 MJ/m^2 (-1%). The NDVI was initially low in January and February but rose in March and exceed the average in April; CALF at 87% and VCIx at 1.05 indicate good performance.

The Gangetic plains recorded 233 mm (RAIN +56% over average) and TEMP was about average (+0.3°C) while RADPAR was 3% below. The NDVI was similar to the previous zone, starting low and exceeding the average in April. High CALF (97%) and VCIx at 1.05 with BIOMSS up 53% (against 15YA) indicate good prospects.

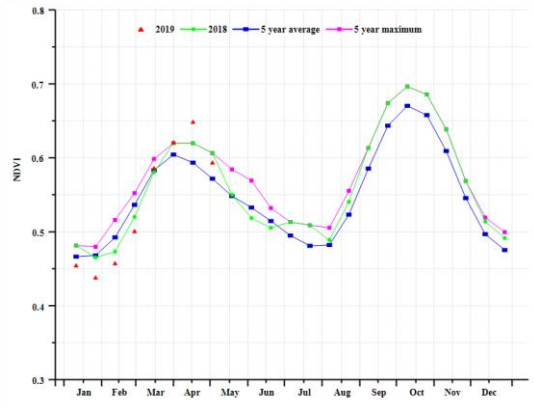
Sylhet Basin received the largest precipitation amount (393mm). TEMP was 0.4°C above the average and there is no difference between RADPAR average and 15Y average. The BIOMSS potential of 1041gDM/m^2 (the highest for any region) is also 30% above the 15YA. NDVI was initially low but exceeded 0.6 in March and early April then decreased to average. With CALF at 99% and VCIx of 0.90 (even higher than1.00 in large patches in the region), crop prospects are probably the most favorable in the country.

The Hills recorded 246mm (+21%), with marginally above average TEMP (24.5°C, an increase of 0.4°C) but favourable sunshine (RADPAR of 661MJ/m2, +7%). NDVI was high in January, decreased to below average from January to February and increased to nearly the 5YA average from March to April. BIOMSS was above average (+7%), CALF as high as 96% and crop condition with good at 0.92 VCIx.

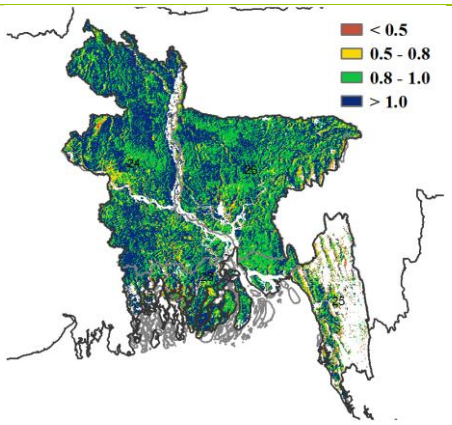
Figure 3.9 Bangladesh's crop condition, January - April 2019.



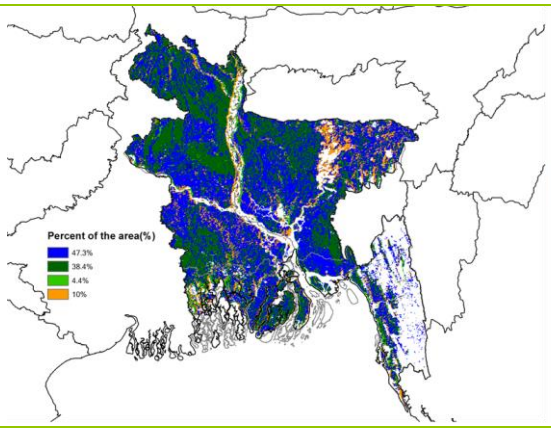
(a). Phenology of major crops



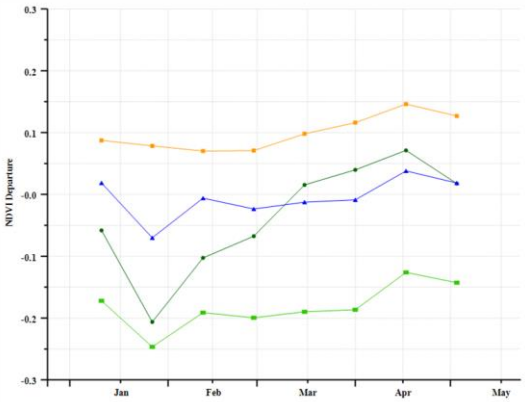
(b) Crop condition development graph based on NDVI



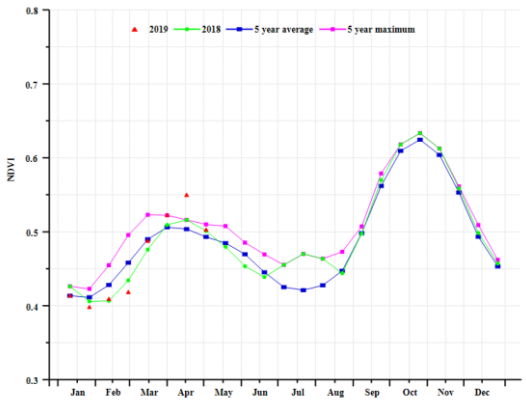
(c) Maximum VCI

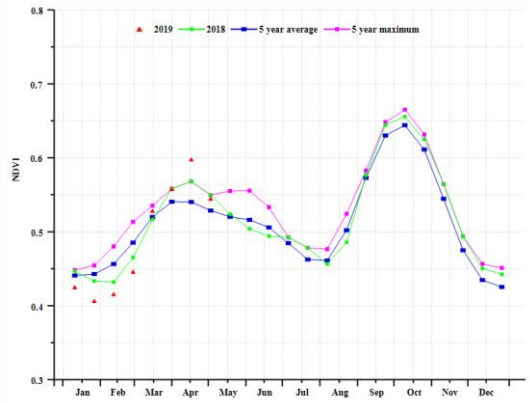


(d) Spatial NDVI patterns compared to 5YA

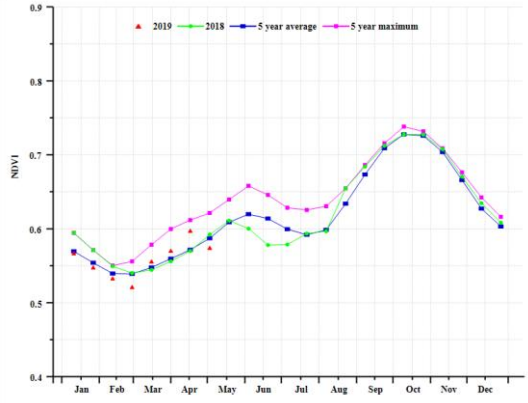


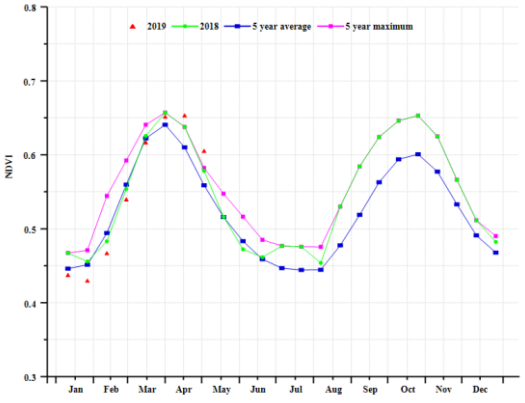
(e) NDVI profiles





(f) Crop condition development graph based on NDVI (Coastal Region (left) and Gangetic Region (right))





(g) Crop condition development graph based on NDVI (Hill Region (left) and Sylhet Basin (right))

Table 3.9 Bangladesh's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, January – April 2019

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m²)	Departure from 15YA (%)
Coastal region	283	53	25.3	0.5	1206	-1
Gangetic plain	244	56	24.0	0.3	1146	-3
Hills	246	21	24.5	0.4	1259	0
Sylhet basin	393	15	23.8	0.4	1159	0

Table 3.10 Bangladesh's agronomic indicators by sub-national regions, current season's values and departure from 5YA/15YA, January - April 2019

Region	BIOMSS		CALF		Maximum VCI
	Current (gDM/m²)	Departure from 15YA (%)	Current (%)	Departure from 5YA (%)	Current
Coastal region	781	29	87	5	1.05
Gangetic plain	848	53	97	1	1.05
Hills	661	7	97	0	0.92
Sylhet basin	1041	30	99	1	1.00

[BLR] Belarus

Wheat was the major crop in the field during the monitoring period and spring wheat was sowed from March.

Rainfall deficit (-13%) with abundant sunshine (+9%) and a significantly increased temperature (+1.9°C) resulted in 13% higher than average potential biomass. Agronomic indicators show a satisfactory maximum vegetation condition index (VCIx 0.8) while the cropped arable land fraction (CALF) deceased 14% to 75%. The nationwide NDVI time plot was marginally higher than last year values from February and close to 5-year average from mid-March. The spatial patterns of NDVI profiles show that around 71% of cropped areas eventually reached 5-year average, except for some places in southeast and middle west (Gomel and Minsk Oblasts). In south-eastern and central areas (Mogilev and Minsk Oblasts) VCIx was between 0.5-0.8, while the value was above 0.8 in the west (Oblats of Grodno and Brest). Overall, both agroclimatic and agronomic conditions were satisfactory, although the impact of warm weather on winter wheat is difficult to assess among others because high temperature has modified phenology and increased water consumption. Spring wheat is probably in good shape, with a risk of moisture deficit for both spring and winter wheat later in the season,

Regional analysis

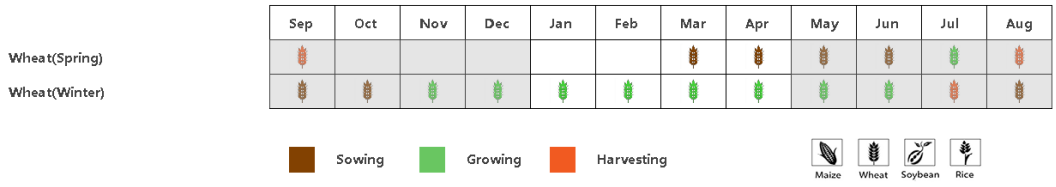
Based on cropping system, climatic zones and topographic conditions, regional analyses are provided for three agro-ecological zones (AEZ), including Northern Belarus (Vitebsk, northern area of Grodno, Minsk and Mogilev), Central Belarus (Grodno, Minsk and Mogilev and Southern Belarus which includes the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

Northern Belarus suffered a deficit in rainfall (-18%), while temperature and radiation were well above average (+2.1°C and +10%, respectively) which resulted in a potential biomass increase of 13%. Agronomic indicators show that CALF fell 20%, while VCIx reached a moderate value (0.78). The Regional NDVI development curve was close to 5-year average since March, indicating moderate crop prospects.

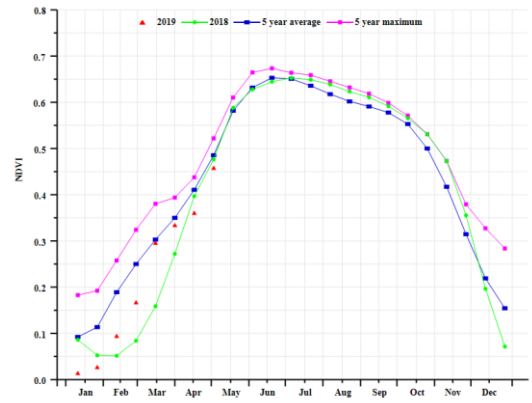
Central Belarus also recorded a rainfall deficit (-12%) combined with abnormally high temperature (+1.8°C) and radiation (+9%), VCIx at 0.83 and high CALF (81%). BIOMSS is up 12%. As in the previous AEZ, NDVI showed a "recovering trend" since March brought about by spring wheat emergence.

The situation in Southern Belarus was similar to the two previous areas, rainfall was below average (8%), while temperature and radiation were 1.8°C and 4.3% above, respectively. Projected biomass would increase by 13%. Normal agronomic indicators (CALF 78%, VCIx 0.8) suggest crop development was fair so far.

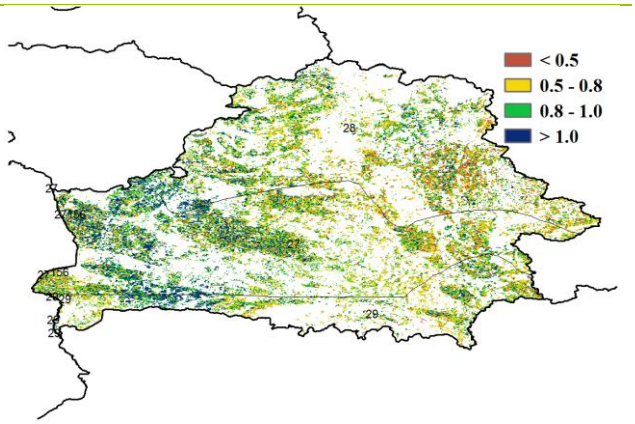
Figure 3.10 Belarus's crop condition, January - April 2019



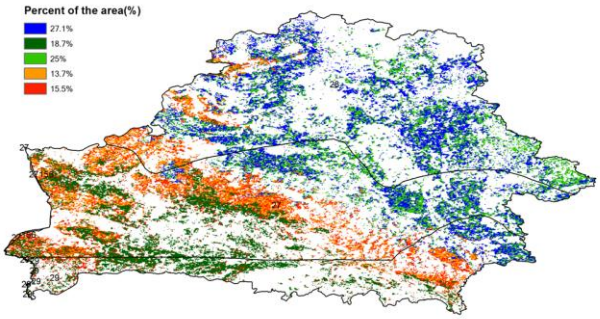
(a). Phenology of major crops



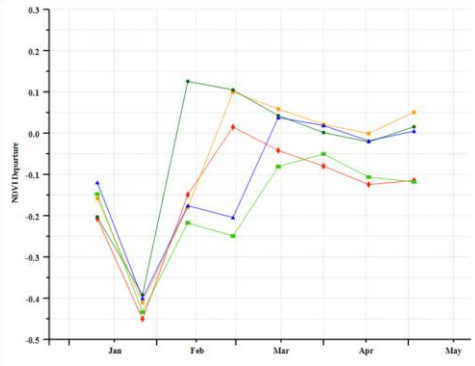
(b) Crop condition development graph based on NDVI



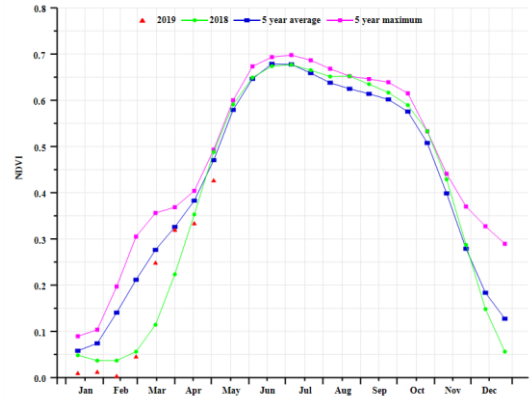
(c) Maximum VCI

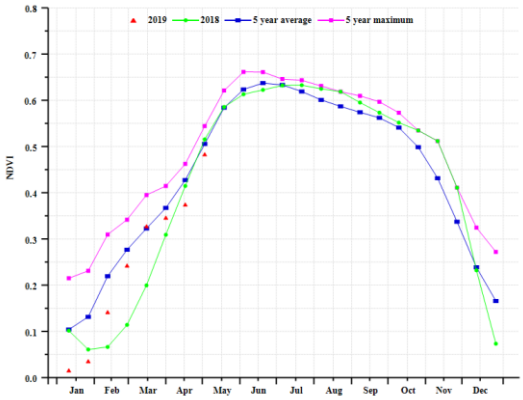


(d) Spatial NDVI patterns compared to 5YA

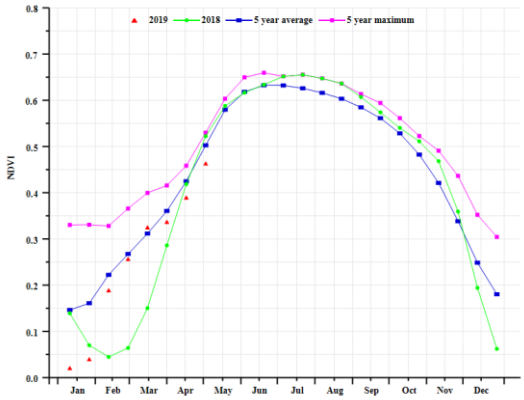


(e) NDVI profiles





(f) Crop condition development graph based on NDVI (Northern Belarus), and (Central Belarus).



(g) Crop condition development graph based on NDVI (Southern Belarus)

Table 3.11 Belarus's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, January - April 2019.

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m²)	Departure from 15YA (%)
Center	235	-12	2.2	1.8	461	9
North	219	-18	1.3	2.1	449	11
South-west	239	-9	2.7	1.8	457	4

Table 3.12 Belarus's agronomic indicators by sub-national regions, current season's values and departure from 5YA/15YA, January - April 2019.

Region	BIOMSS		CALF		Maximum VCI
	Current (gDM/m²)	Departure from 15YA (%)	Current (%)	Departure from 5YA (%)	Current
Center	825	12	81	-11	0.83
North	765	13	67	-20	0.78
South-west	862	13	78	-15	0.81

[BRA] Brazil

This bulletin covers the growth and maturity of summer crops (maize, soybean and rice) in central and south Brazil while crops are still at peak growing period in north and north-east Brazil. Crop condition in Brazil was overall average compared to the previous five years.

All agro-climatic indicators present very average conditions with 1% above average rainfall, 0.1℃ lower temperature and 5% above average radiation. There is also no significant departure from 15YA of ten-day rainfall and temperature according to the seasonal profiles. Normal and stable rainfall and temperature conditions benefited crops and resulted in 3% above average biomass production potential BIOMSS. Among the nine major agricultural states, rainfall patterns were as follows: (1) Rio Grande Do Sul and Ceara received sufficient rainfall 14% and 44% above average, respectively; (2) 5% or 6% negative departures of rainfall were recorded in Mato Grosso Do Sul, Mato Grosso, and Minas Gerais; (3). Rainfall in Goias, Parana and Sao Paulo were close to average. Temperature for all nine states stayed close to average with largest anomaly at 0.6 degree above average in Minas Gerais. Large positive departure of BIOMSS from 15YA were observed in Rio Grande Do Sul, Ceara and Santa Catarina which coincides with the rainfall departure pattern.

The national NDVI development profile for Brazil presents close to average values in early January and exceeded the 5-year maximum during at end of April. However, the NDVI values were obviously lower than 5YA between end of January and early April. The 2019 NDVI profile fluctuates before early March, indicating variable condition. The VCIx map (national average at 0.78) does not show marked spatial variations. However, NDVI departure from average maps and profiles show different patterns from south to north: generally average to above average conditions in central to southern regions while adverse conditions were observed in the north and north-east, particularly in the lower Amazon basin. National CALF is 1% above average, indicating a close to average crop planted area. The great difference of crop condition from central-south to north and north-east indicates a favorable outputs for main summer crops while unfavorable outputs are expected from late planted summer crops.

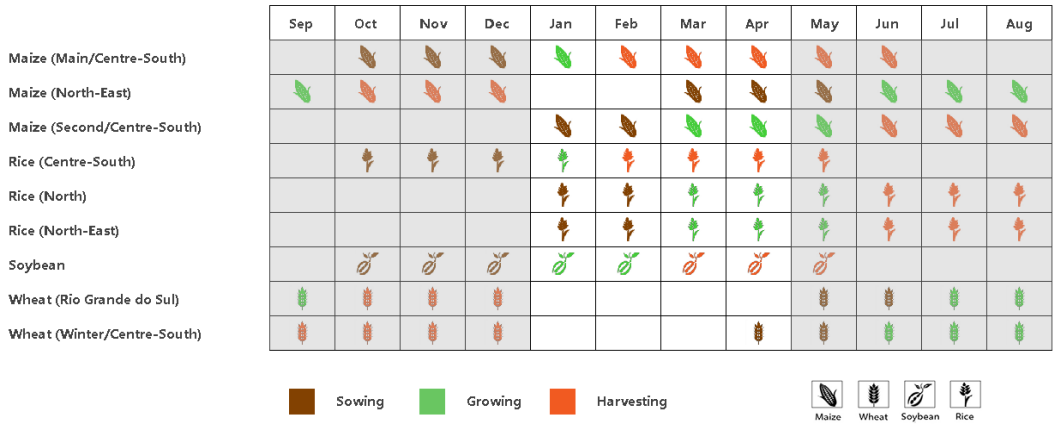
Regional analysis

Based on cropping systems, climatic zones, and topographic conditions, eight agro-ecological regions are identified for Brazil. They include the Amazonas, Central Savanna, Coast, North-eastern mixed forest and farmland, Mato Grosso, Nordeste, Parana basin and Southern subtropical rangelands. Over the recent reporting period, large departures of rainfall were identified in three zones: Amazonas (-13%), Nordeste (-22%) and Southern Subtropical rangelands (+23%). The Coast zone received the least rainfall at 435 mm and North-eastern mixed forest and farmland recorded the largest amount at 1411mm during the last four months, 8% below average and 9% above average respectively. Temperature was close to average except for North-eastern mixed forest and farmland where 1.1 below average temperature was observed. The Southern Subtropical rangelands are the only zone with below average radiation (-9%). Nordeste and Southern Subtropical rangelands presented above average BIOMSS thanks to abundant rainfall while BIOMSS in all other zones presented either average or below average conditions. All zones showed average CALF compared to 5YA except for Coast and Nordeste zone.

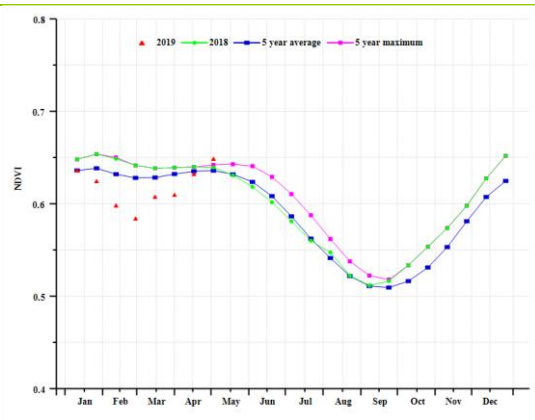
According to the regional NDVI profiles, the eight zones were sorted into three groups: (A) Double cropping pattern in Mato Grosso Zone, (B) single cropping but reaching peak stage in the north and north-east of Brazil, including Nordeste, Amazonas, Coast, and North-eastern mixed forest and farmland, and (C) maturity to harvest at end of May in Central Savanna, Parana basin and Southern subtropical rangelands. For group A, the crop profile follows same pattern as the national profile and the crop condition reached the best condition during the past 5 years at the end of April. For Group B, crop condition was above average in Nordeste zone. Amazonas and North-eastern mixed forest and farmland presented below average crop condition. Significant below average crop condition was observed in Coast region which received the lowest as well as below average rainfall among the zones. In Group C, Southern subtropical rangelands showed average crop condition and the harvesting was almost concluded by the end April. Crop condition was below average in Central Savanna and Parana basin

although the agro-climatic conditions were close average. The major reason is the water shortage during the previous period (October 2018 to January 2019) when crops were at early sowing to early growing stage.

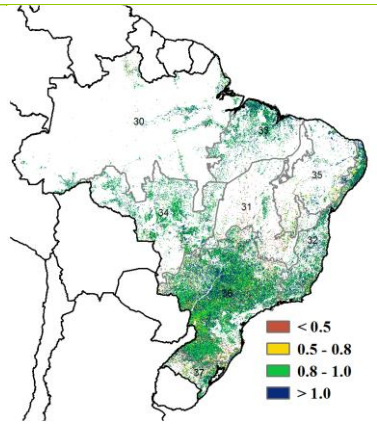
Figure 3.11 Brazil's crop condition, January - April 2019



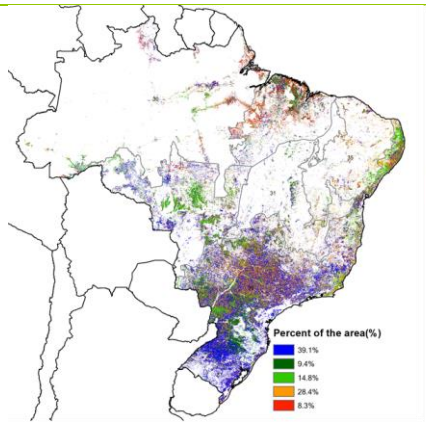
(a). Phenology of major crops



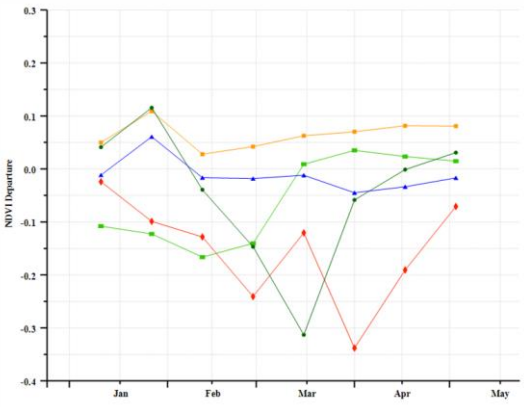
(b) Crop condition development graph based on NDVI



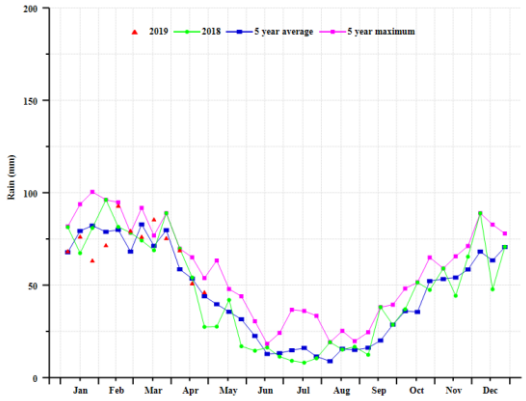
(c) Maximum VCI



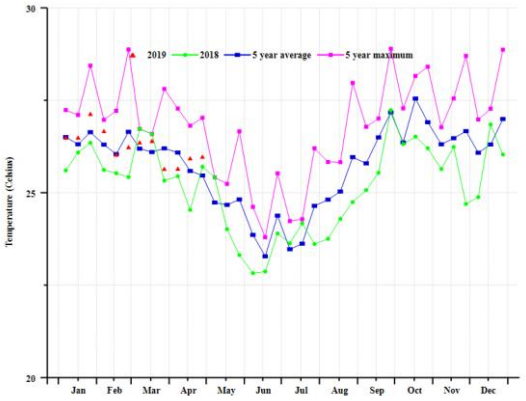
(d) Spatial NDVI patterns compared to 5YA



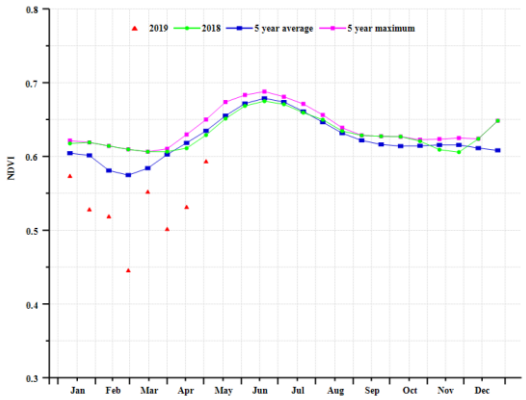
(e) NDVI profiles

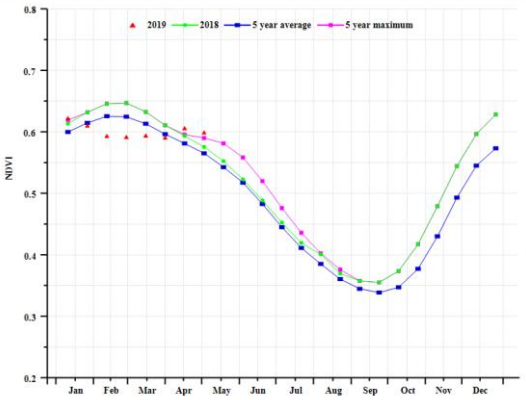


(f) Brazil national rainfall pofile

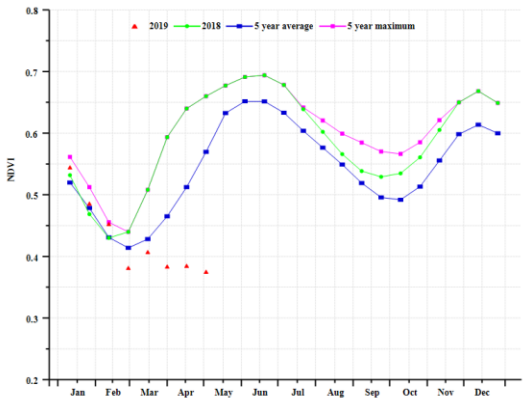


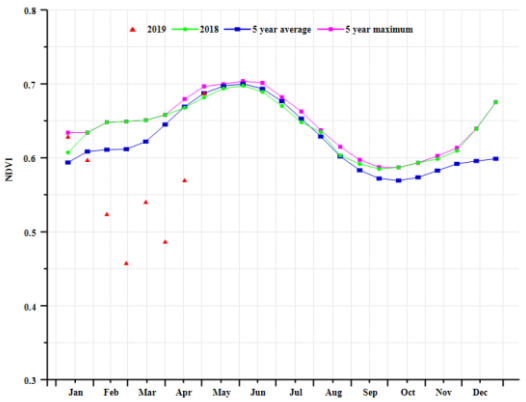
(g) Brazil national temperature pofile



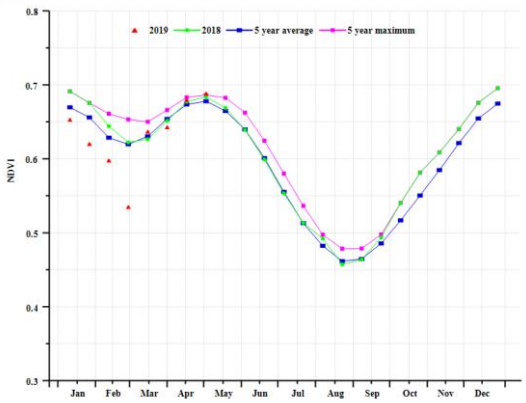


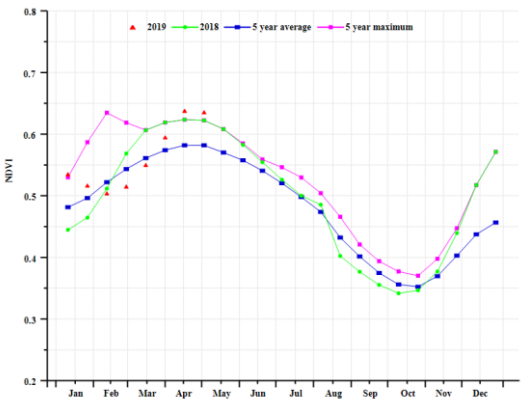
(h) Crop condition development graph based on NDVI ((Amazonas) (left) and (Central Savanna) (right))



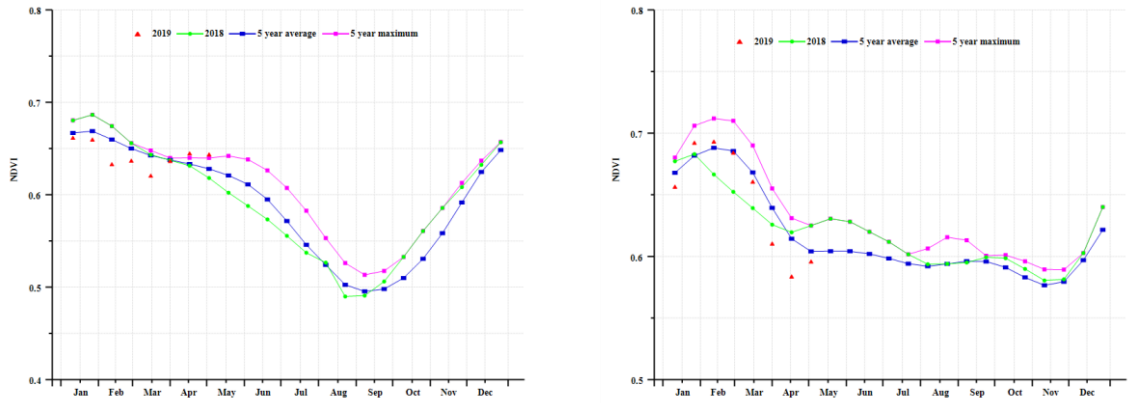


(i) Crop condition development graph based on NDVI (Coast (left) and Northeastern mixed forest and farmland (right))





(j) Crop condition development graph based on NDVI (Mato Grosso region (left) and Nordeste (right))



(k) Crop condition development graph based on NDVI (Parana basin (left) and Southern subtropical rangelands (right))

Table 3.13 Brazil's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, January - April 2019

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m²)	Departure from 15YA (%)
Amazonas	1068	-13	27.1	-0.4	1097	4
Central Savanna	659	-4	26.3	0.0	1320	8
Coast	435	-8	26.6	0.3	1332	9
Northeastern mixed forest and farmland	1411	9	26.7	-1.1	1168	4
Mato Grosso	1029	-4	27.1	-0.2	1164	7
Nordeste	583	22	28.3	0.6	1303	5
Parana basin	685	-1	24.9	0.1	1213	4
Southern subtropical rangelands	741	23	23.7	-0.6	1064	-9

Table 3.14 Brazil's agronomic indicators by sub-national regions, current season's values and departure from 5YA/15YA, January - April 2019

Region	BIOMSS		Cropped arable land fraction		Maximum VCI
	Current (gDM/m²)	Departure from 15YA (%)	Current (%)	Departure from 5YA (%)	Current
Amazonas	2157	-6	99	0	0.66
Central Savanna	1753	2	100	0	0.55
Coast	1220	2	100	1	0.80
Northeastern mixed forest and farmland	2504	4	100	0	0.72
Mato Grosso	2340	1	100	0	0.72
Nordeste	1527	20	97	7	0.53
Parana basin	1853	2	100	0	0.87
Southern subtropical rangelands	1751	10	100	0	0.76

[CAN] Canada

The current reporting period covers winter wheat in Canada. Most agricultural areas were still covered in snow from January to March, which limits the relevance of NDVI-based indicators in the three months leading to April.

Nationwide, rainfall was average (RAIN, 0%), temperature TEMP was below by -1.4°C, while the radiation was slightly above average (RADPAR, +2%). The CALF was markedly below the recent 5-years average (-28%), and VCIx reached 0.80. The potential biomass was below the recent 15-years average (BIOMSS, -7%) due to the low temperature.

Compared to their recent average, the three main wheat provinces had a precipitation shortfall (Alberta -26%, Manitoba –19%, Saskatchewan -29%) and rather low temperature (Alberta -1.9°C, Manitoba -1.7°C, Saskatchewan -1.8°C). Though the radiation were slightly above the average (Alberta +5%, Manitoba +2%, Saskatchewan +7%), the three provinces have below average biomass production potentials (Alberta -4%, Manitoba –7%, Saskatchewan -4%) generally indicating unfavorable growth of winter wheat.

Though the agro-climatic and agronomic indicators were poor, NDVI improved over 2018 in April was close to the recent 5-years average.

Although current indicators are mixed, the overall condition of winter wheat in Canada could turn favorable if conditions (especially rainfall) are favourable from May.

Regional analysis

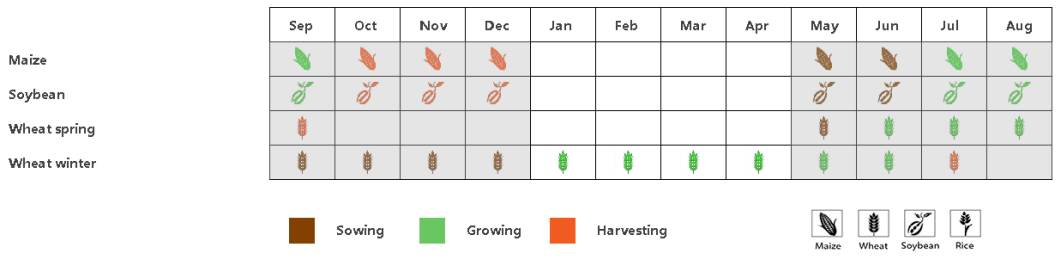
The Prairies (area identified as 53 in the maximum VCI map) and Saint Lawrence basin (49, covering Ontario and Quebec) are the major agricultural regions.

In the Prairies, the main food production area in Canada, rainfall was below average (RAIN 140 mm, -26%), temperature was largely lower than the recent average (-1.9°C), while the radiation was slightly above average (+6%). Due to the rainfall deficit and low temperature, the potential biomass was slightly below average as well (BIOMSS, -5%). The Cropped Arable Land Fraction fell significantly below the 5YA (-50%), and the VCIx was 0.81. The NDVI values from late March to April were better than during 2018 and close to the last 5-years average. Even if winter wheat condition in the region should be favorable, production could be poor due to the low CALF.

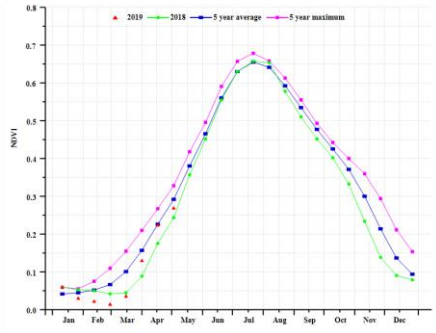
In the Saint Lawrence basin, rainfall was significantly above average (391 mm equivalent to +38%), the temperature and radiation were both slightly below average (TEMP -0.9°C; RADPAR -3%). Both potential biomass and the Cropped Arable Land Fraction were below the average (BIOMSS -10%, CALF -27%), while the VCIx was 0.79. The NDVI profiles also indicate unfavorable conditions. Production of this region is likely to be poor.

Overall, the current wheat production prospects of Canada are unfavourable, but the outcome of the season could still favorable depending on weather from May.

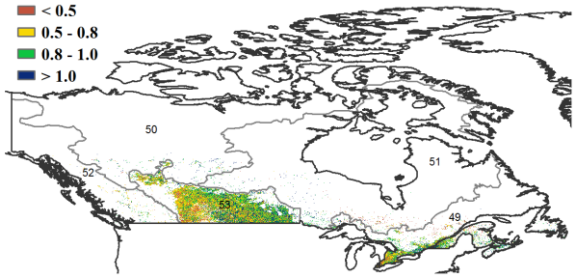
Figure 3.12 Canada's crop condition, January - April 2019



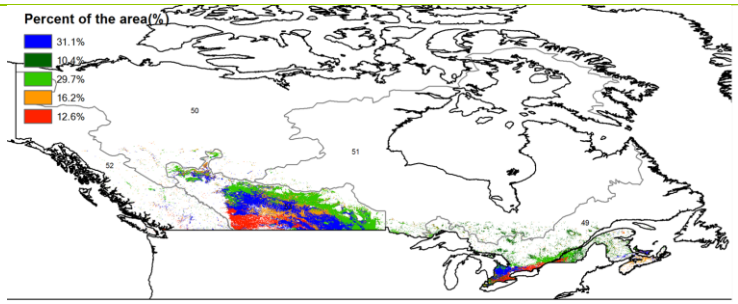
(a). Phenology of major crops



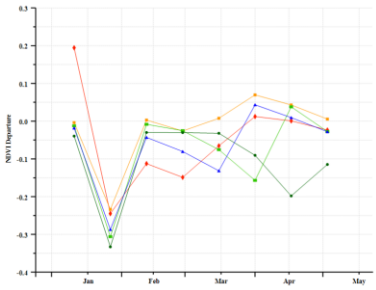
(b) Crop condition development graph based on NDVI



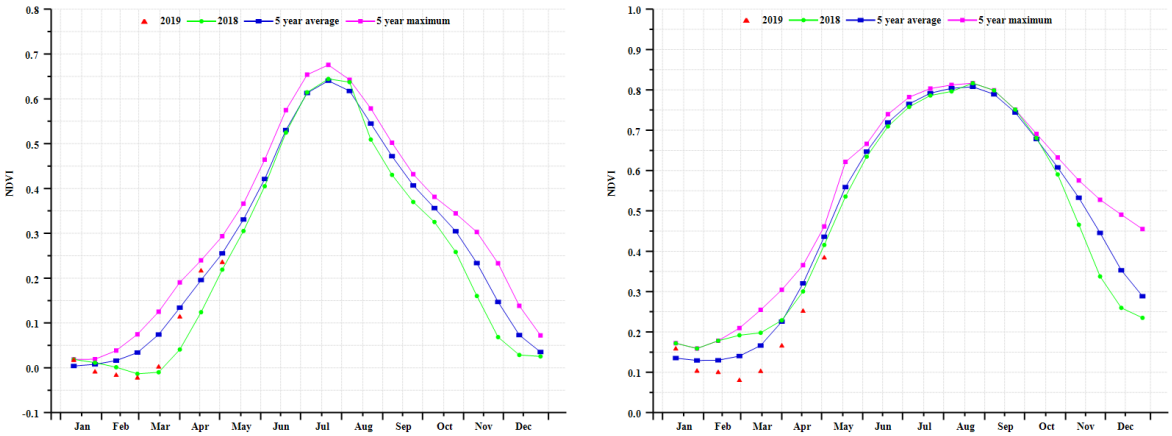
(c) Maximum VCI



(d) Spatial NDVI patterns compared to 5YA



(e) NDVI profiles



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

Table 3.15 Canada's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, January - April 2019

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m²)	Departure from 15YA (%)
Saint Lawrence basin	391	38	-6.0	-0.9	568	-3
Prairies	140	-26	-8.8	-1.9	603	6

Table 3.16 Canada agronomic indicators by sub-national regions, current season's values and departure from 5YA/15YA, January - April 2019

Region	BIOMSS		CALF		Maximum VCI
	Current (gDM/m²)	Departure from 15YA (%)	Current (%)	Departure from 5YA (%)	Current
Saint Lawrence basin	409	-10	36	-27	0.79
Prairies	411	-5	3	-50	0.81

[DEU] Germany

During this reporting period, winter wheat and barley were at the vegetative stage, and maize was being planted. Generally, the crops in Germany showed above average condition in most regions.

For the country, total precipitation (as measured by the RAIN indicator) was 5% above average, temperature was well above average (Temp, +1.2°C) and radiation just above (RADPAR, +1%). Significantly above average precipitation occurred throughout the country from January to early-February, early March to mid-March and after mid-April. In addition to late January and early April to mid-April, warmer-than-usual conditions prevailed over the entire country during this reporting period. Due to favorable temperature and adequate water supply, the biomass production potential (BIOMSS) is expected to increase 9% over average nationwide.

As shown in the national crop condition development graph and the NDVI profiles, national NDVI values were below average before early February, then close to and above the average from mid-February to mid-April, and then again below average after mid-April. These observations are confirmed by the NDVI profiles and 63.9% of regional NDVI values were above average after early February according to the NDVI profiles. The spatial pattern is reflected by VCIx, especially in the southern Bavarian Plateau area, with a VCIx of 0.93 for Germany overall. The outlook of winter crops is above average. CALF during the reporting period was 99%, the same as the recent five-year average.

Generally, the values of agronomic indicators show favorable condition for most winter crops and the sowing of summer crops in Germany.

Regional analysis

Based on cropping systems, climatic zones, and topographic conditions, six sub-national agro-ecological regions are adopted for Germany. They include: The Wheat zone of Schleswig-Holstein and the Baltic coast, Mixed wheat and sugar beets zone of the north-west, Central wheat zone of Saxony and Thuringia, Sparse crop area of the east-German lake and Heathland area, Western sparse crop area of the Rhenish massif, and the Bavarian Plateau.

Schleswig-Holstein and the Baltic coast is among the major winter wheat zones of Germany. The region experienced warm weather (TEMP, +1.8°C) and radiation above average (RADPAR, +1%); RAIN was average. As a result, BIOMSS is expected to increase by 13% compared to average. As shown in the crop condition development graph based on NDVI, the values were above average or over the five-year maximum, except late in January. The area has a high CALF (100%) as well as a favorable VCIx (0.96), indicating high cropped area and favorable crop prospects.

Wheat and sugar-beets are major crops in the **Mixed wheat and sugar-beets zone of the north-west**. Compared to average, RAIN was above (+12%), and so were temperature (TEMP +1.3°C), radiation (RADPAR +1%) and BIOMSS (+12%). As shown in the crop condition development graph based on NDVI, the values were above average or over the five-year maximum during this monitoring period. The area has a high CALF (100%) and crop condition for the region is good according to the high VCIx (0.94).

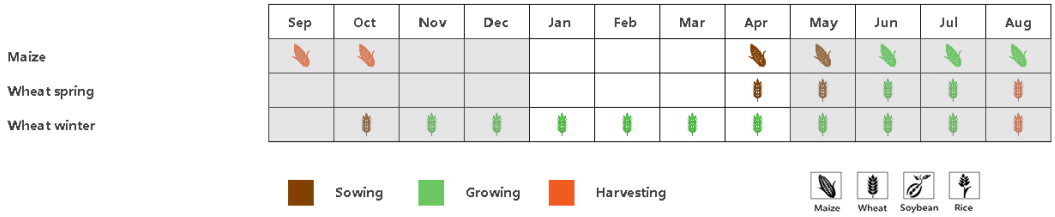
Central wheat zone of Saxony and Thuringia is another major winter wheat zone. RAIN and TEMP were above average (+3% and +1.3°C, respectively) and radiation was average. Mostly due to favourable temperature condition, the biomass potential (BIOMSS indicator) increased by 9% above average. As shown in the crop condition development graph based on NDVI, the values were below average before early February, and above those of 2018 and close to average after early February. The area has a high CALF (99%) and the VCIx of 0.92 for this region also shows favorable crop prospects.

Crop condition was fair in the **East-German lake and Heathland sparse crop area** and **Western sparse crop area of the Rhenish massif**. Adequate rain was recorded in those two regions (RAIN +8% and +18%, respectively), as well as significantly above average temperatures (+1.5°C and +1.0°C). Radiation in East-German lake and Heathland sparse crop area was above average (RADPAR +2%) and below average (-2%) in Western sparse crop area of the Rhenish massif. Due to adequate rain and suitable temperature condition, BIOMSS was higher by 11% and 13%, respectively, compared to the average of the past 15 years, and CALF was at 99% for both. As shown in the crop condition development graph based on NDVI, the

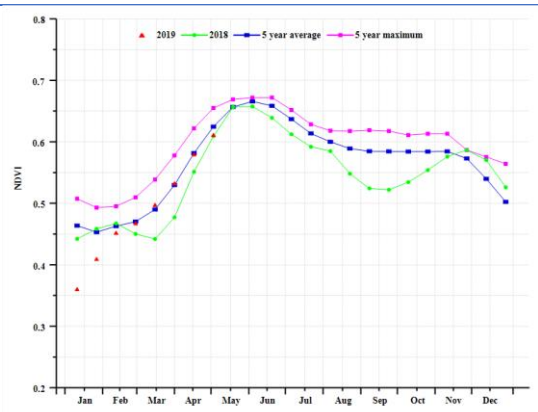
values in East-German lake and Heathland sparse crop area was below average in early January, then above average from mid-January to mid-April, and again below average after mid-April; the values in Western sparse crop area of the Rhenish massif was above those of 2018 during this reporting period, except January. Overall, favorable crop condition was recorded with high VCIx values of 0.89 for the eastern and 0.98 for the western areas, respectively, showing favorable crop prospects for two regions.

Next to wheat, two summer crops (maize and potato) are the major crops on the **Bavarian Plateau**. The CropWatch agroclimatic indicators show that close to normal weather was recorded for RAIN (-7%), TEMP (+0.8°C) and RADPAR (+1%). Compared to average, BIOMSS increased 2%. The area has a high CALF (98%) as well as a favorable VCIx (0.90), indicating high cropped area and favorable winter crop prospects.

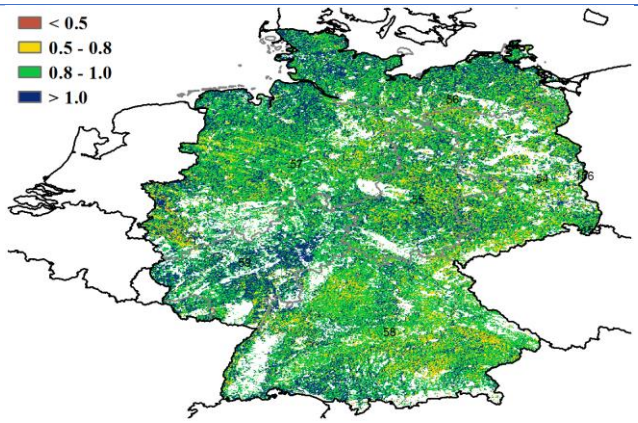
Figure 3.13 Germany's crop condition, January-April 2019



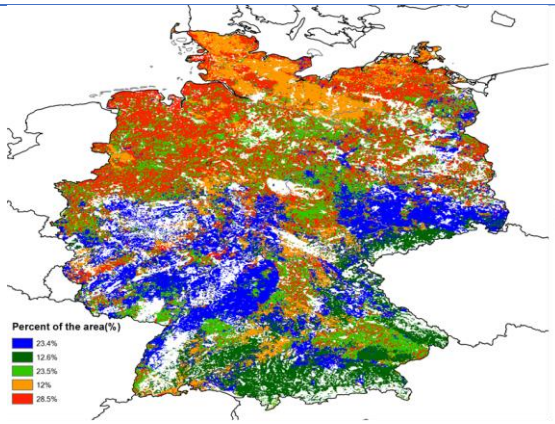
(a). Phenology of major crops



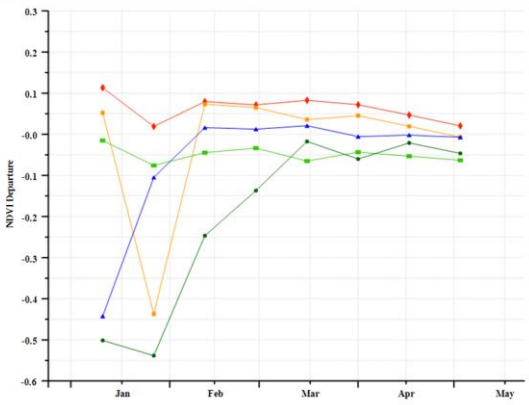
(b) Crop condition development graph based on NDVI



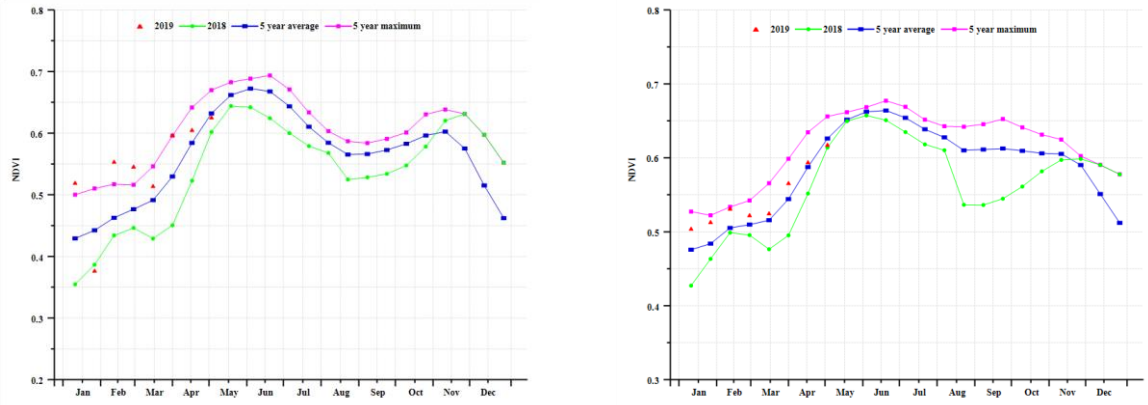
(c) Maximum VCI



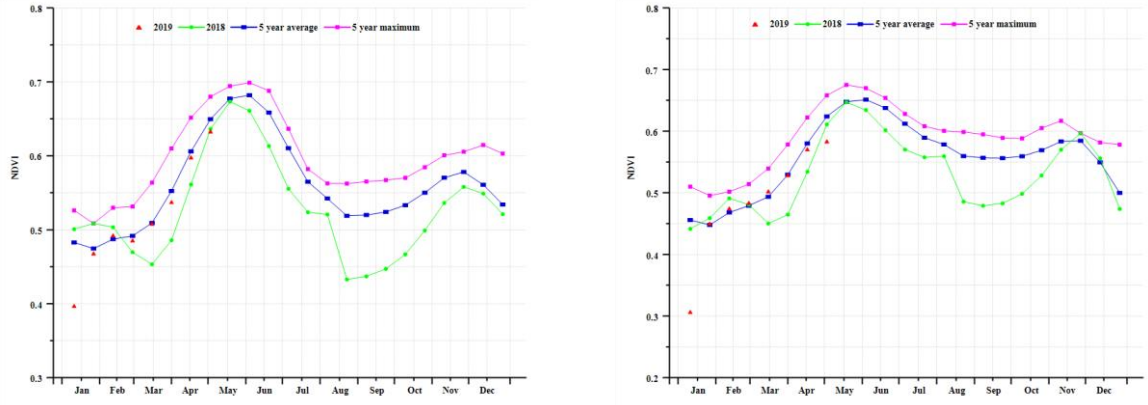
(d) Spatial NDVI patterns compared to 5YA



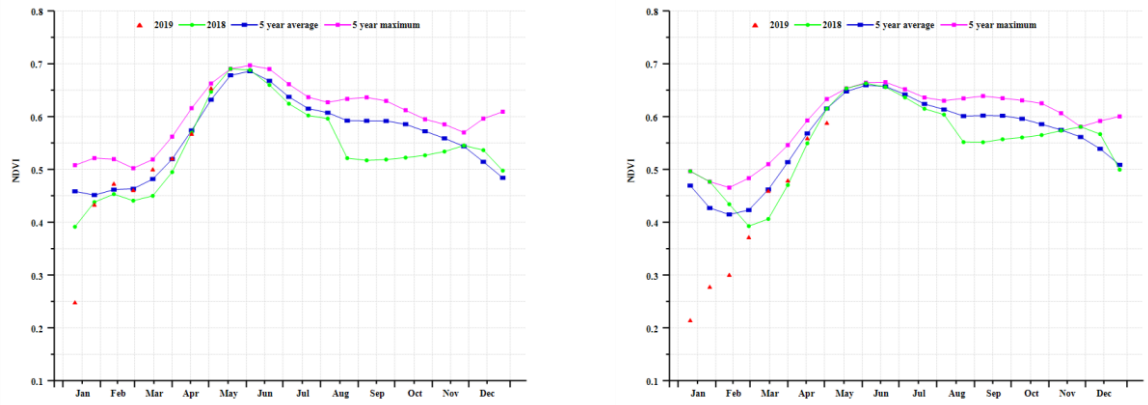
(e) NDVI profiles



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



(g) 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))



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

Table 3.17 Germany agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, January-April 2019

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m²)	Departure from 15YA (%)
Wheat zone of Schleswig-Holstein and the Baltic coast	267	0	5.9	1.8	463	1
Mixed wheat and sugarbeets zone of the north-west	321	12	6.3	1.3	483	1
Central wheat zone of Saxony and Thuringia	249	3	5.7	1.3	508	0
East-German lake and Heathland sparse crop area	267	8	5.5	1.5	508	2
Western sparse crop area of the Rhenish massif	290	18	5.6	1.0	505	-2
Bavarian Plateau	212	-7	4.4	0.8	572	1

Table 3.18 Germany's agronomic indicators by sub-national regions, current season's value and departure from 5YA/15YA, January - April 2019

Region	BIOMSS		Cropped arable land fraction		Maximum VCI
	Current (gDM/m²)	Departure from 15YA (%)	Current (%)	Departure from 5YA (%)	Current
Wheat zone of Schleswig-Holstein and the Baltic coast	1043	13	100	0	0.96
Mixed wheat and sugarbeets zone of the north-west	1096	12	100	0	0.94
Central wheat zone of Saxony and Thuringia	964	9	99	0	0.92
East-German lake and Heathland sparse crop area	1009	11	99	0	0.89
Western sparse crop area of the Rhenish massif	1024	13	99	0	0.98
Bavarian Plateau	847	2	98	-1	0.90

[EGY] Egypt

The reporting period covers the final stages of winter wheat and the start of the sowing of both maize and rice. The recorded rainfall (RAIN) was 42 mm, 20% less than the average (15YA), the average temperature was 15°C (-1.3°C). The radiation (RADPAR) was 1013MJ/m2 (-1%) and the estimated biomass (BIOMSS) was 225gDM/m2 (-19%). The nation-wide NDVI development graph shows that the condition of the crops was below the 5 years average. NDVI profile maps indicate that about 29% of cultivated areas were above average and about 21% of the total cropped area conditions were below average. The rest of the area fluctuated around the average throughout the reporting period. The VCIx map indicates that the condition of the current crops, mainly the winter wheat, is good. This agrees with the whole country VCIx value (0.97). Prospects for winter wheat are favorable.

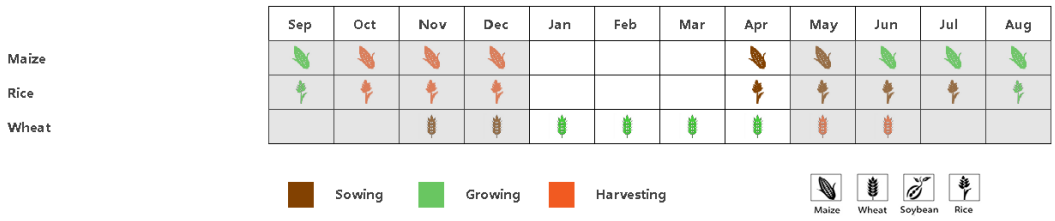
Regional analysis

Egypt can be subdivided into three agro-ecological zones (AEZ) based mostly on cropping systems, climatic zones, and topographic conditions. Only two of them are relevant for crops: the Nile Delta and Mediterranean coastal strip, and the Nile Valley.

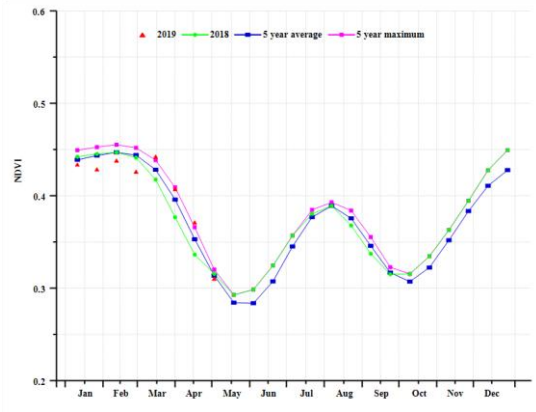
In the first zone, the average rainfall was 30 mm (-29%), while in the Nile Valley zone it reached 128 mm, an increase of 24% over average. Due to most of the Egyptian crop production being irrigated, rainfall makes little change in the outcome of the season. RADPAR for both zones was about -1% below average and the BIOMSS index shows a decrease of -15% in Nile Delta and Mediterranean coastal strip zone, and 38% increase over Nile Valley zone compared to the 15YA.

The NDVI-based Crop condition development graphs indicate below average conditions for both zones but, crop condition was lower in the Nile Delta and Mediterranean coastal strip zone than in Nile Valley zone, in agreement with the VCIx values (0.94 and 1.13, respectively).

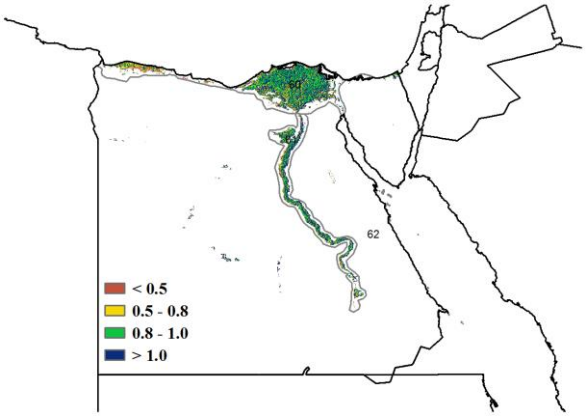
Figure 3.14 Egypt's crop condition, January - April 2019



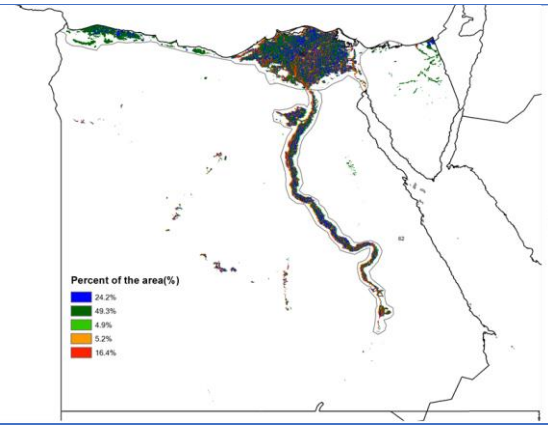
(a). Phenology of major crops

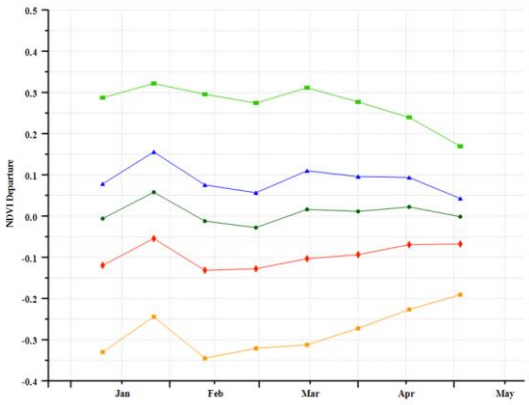


(b) Crop condition development graph based on NDVI

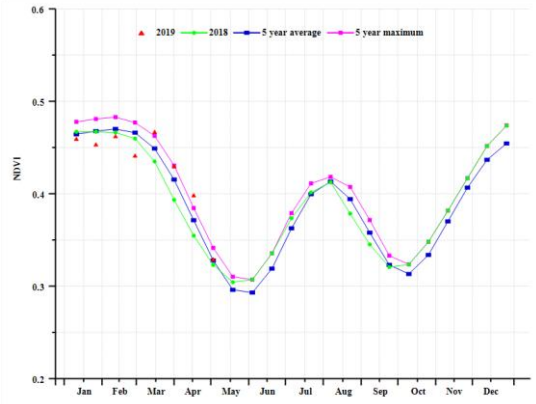


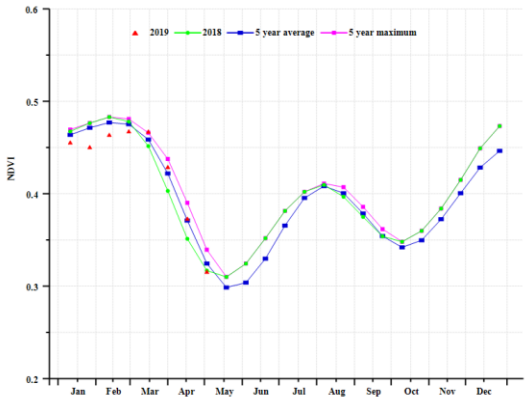
(c) Maximum VCI





(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))

Table 3.19 Egypt's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, January - April 2019

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m²)	Departure from 15YA (%)
Nile Delta and Mediterranean coastal strip	30	-29	15.2	-1.4	994	-1
Nile Valley	128	24	16.0	-1.6	1118	-1

Table 3.20 Egypt's agronomic indicators by sub-national regions, current season's values and departure from 5YA/15YA, January - April 2019

Region	BIOMSS		CALF		Maximum VCI
	Current (gDM/m²)	Departure from 15YA (%)	Current (%)	Departure from 5YA (%)	Current
Nile Delta and Mediterranean coastal strip	188	-15	71	3	0.94
Nile Valley	357	38	81	5	1.13

[ETH] Ethiopia

The reporting period covers the beginning of the early Belg season in bimodal rainfall areas, especially wheat and maize in East and West Hararghe and western SNNPR. It also includes the very first sowing of long maturing Meher crops (maize, barley and sorghum), teff and wheat in central and northern areas, Oromia and Amhara regions.

At the national level, all CropWatch agro-climatic and agronomic indicators were slightly above average: RAIN, +5%, TEMP +0.8°C, RADPAR +2%, BIOMSS +3% and CALF +7%. According to the NDVI-based season development graph, crop condition was below the five years average. The maximum VCI value was 0.85 and recorded as "good". According to NDVI clusters and profiles 47% of the country experienced less favorable crop condition. Other areas (central Oromia, Amhara, and Eastern Tigray) enjoyed favorable condition with the maximum VCI ranging from 0.8 to 1.0. The reported period is till too early for assessing the outcome of the Belg crops but there is currently no reason for concern. In particular, land preparation is for Meher crops (to be harvested from August to December) is taking place under favourable conditions.

Regional Analysis

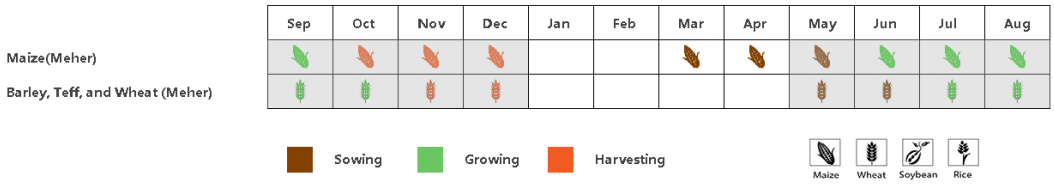
The reporting period covers main rain-fed cereal producer areas found in the South-eastern mixed-maize zone, Western mixed maize zone, and Central-northern maize-teff highlands zone.

The South-eastern mixed maize zone recorded 104 mm of rainfall, a significantly drop of 58% below average. TEMP and the RADPAR were 1.1°C and 8% above average, respectively. The resulting BIOMSS is down 48%, which may affect livestock condition and production. CALF decreased by 40%. NDVI was below the five-year average, accompanied by a recorded low value of maximum VCI 0.54. CropWatch assesses the conditions in the south-eastern mixed-maize zone as unfavorable.

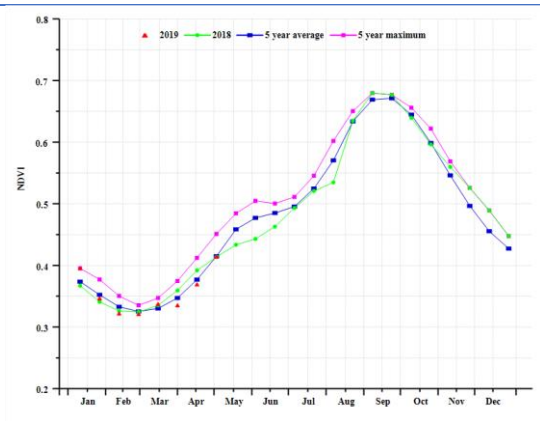
Unlike the South-eastern mixed maize zone, **the Western mixed maize zone** experienced slightly above average or average weather conditions: Rain +10%, TEMP +0.3°C, RADPAR average and BIOMSS +6%. CALF increased 1% but relatively low VCIx prevails (0.75). NDVI was above average from January to Mid- March but then dropped to slightly below average until the end of April. Conditions remain favorable for Meher land preparation and livestock production.

Except for a small drop in sunshine (RADPAR -1%) all indicators were above average in **the Central-northern maize-teff highlands zone**: at 166 mm RAIN was 37% above the average, temperature increased 1.1°C and BIOMSS was up 30%. Like the western mixed maize zone, this zone was favorable for livestock production. CALF showed a significant increase of 30%. This zone contains Central Amhara, the main teff and wheat-producing areas. Based on high NDVI (above the 5YA) and VCIx above 1 conditions were favorable for land preparation and first early planting for the Meher season.

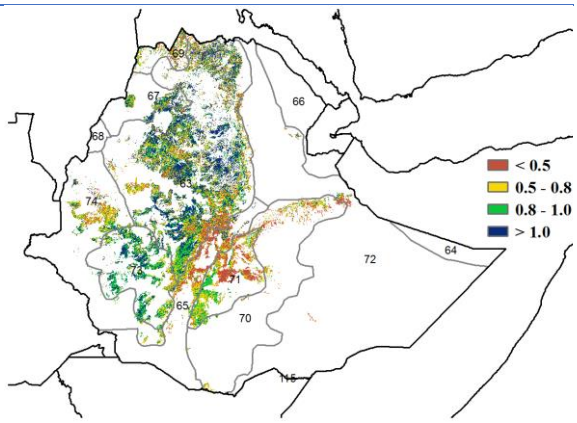
Figure 3.15 Ethiopia's crop condition, January - April 2019



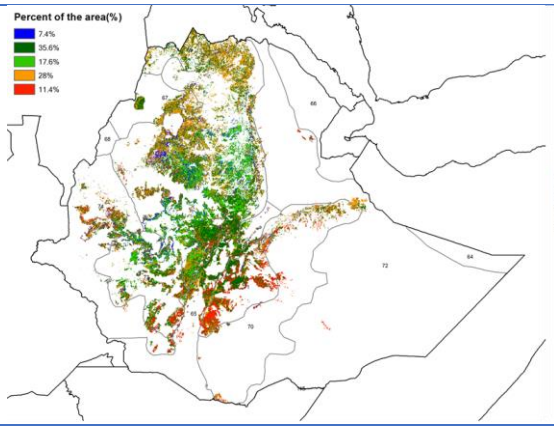
(a). Phenology of major crops



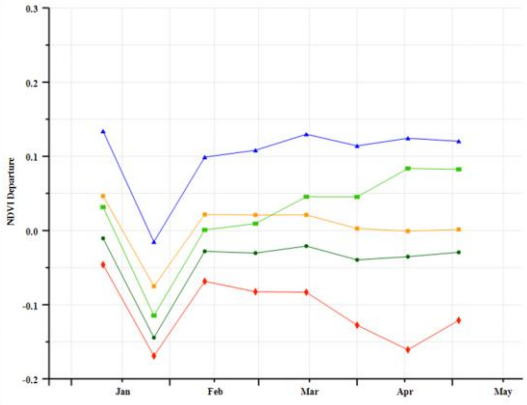
(b) Crop condition development graph based on NDVI



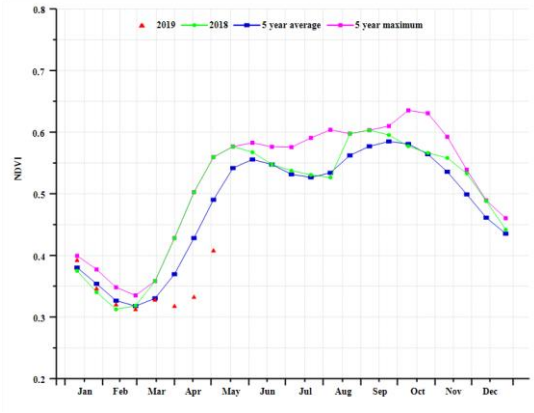
(c) Maximum VCI

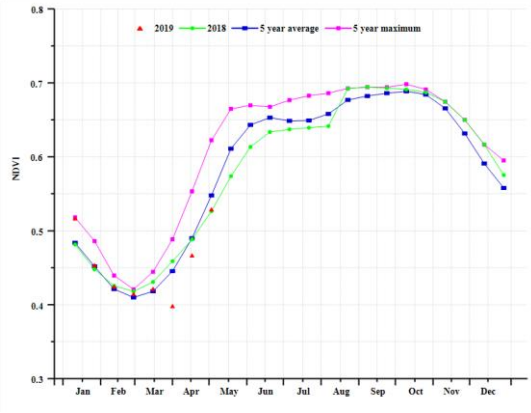


(d) Spatial NDVI patterns compared to 5YA

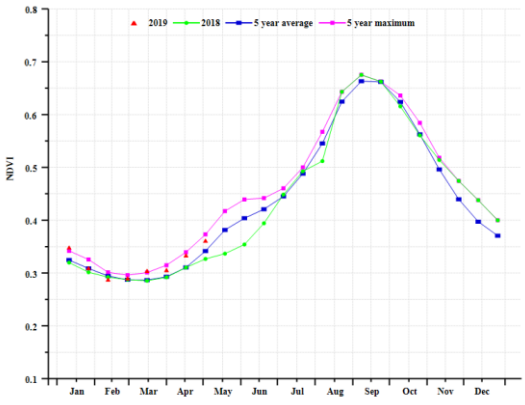


(e) NDVI profiles





(f) Crop condition development graph based on NDVI (south-eastern mixed-maize (left) and western mixed maize zone (right))



(g) Crop condition development graph based on NDVI (Central-northern maize-teff highlands zone)

Table 3.21 Ethiopia's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, January - April 2019

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m²)	Departure from 15YA (%)
South-eastern mixed maize zone	104	-58	23.3	1.1	1395	8
Western mixed maize zone	162	10	25.5	0.2	1291	0
Central-northern maize-teff highlands	166	37	21.2	1.0	1397	-1

Table 3.22 Ethiopia's agronomic indicators by sub-national regions, current season's values and departure from 5YA/15YA, January - April 2019

Region	BIOMSS		CALF		Maximum VCI
	Current (gDM/m²)	Departure from 15YA (%)	Current (%)	Departure from 5YA (%)	Current
South-eastern mixed maize zone	461	-42	38	-40	0.54
Western mixed maize zone	595	6	95	1	0.75
Central-northern maize-Teff highlands	667	30	35	38	0.95

[FRA] France

The monitoring period covers winter wheat growth, as well as the sowing of spring wheat and maize. CropWatch agroclimatic indicators show that the conditions were close to average at the national level only for temperature (-0.5°C compared with average). RAIN was low (down 18%) and sunshine was high (RADPAR +6%). The NDVI development graph for the entire country indicates crop condition below the average of the past five years before March but close to average values in April. The spatial NDVI patterns compared to the five-year average indicate that NDVI was average in 68.4% of arable land, which is also reflected by the maximum VCI (VCIx) in the different areas, with a VCIx of 0.95 for France overall. It is unclear at this early stage whether winter crops will be affected negatively by rainfall or positively by increased sunshine, which is frequently a limiting factor in France.

Regional analysis

Considering cropping systems, climatic zones, and topographic conditions, additional sub-national detail is provided for eight agro-ecological zones. They are identified in 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) South-western maize zone; (76) Alpes region and (77), the Mediterranean zone.

In the **Northern barley region**, RAIN was 9% below average, while RADPAR was 8% above. Biomass were below average 4%, reflecting overall average crop condition.

The Mixed maize/barley and rapeseed zone from the Center to the Atlantic Ocean recorded 85 mm of rainfall over four months (RAIN -26%). Temperature was 0.6°C below, but RADPAR was 8% above. The drop in BIOMSS was 26% compared to the five-year average. The NDVI profile confirms the conditions of crop was average.

The Maize/barley and livestock zone along the English Channel experienced average temperature, RAIN was 23% below average, and biomass 20% below average. According to the NDVI profile and VCIx map, crop condition was not satisfactory in the region.

The Rapeseed zone of eastern France recorded a 12% rainfall deficit, with above average values for RADPAR (3%). BIOMSS for the region is 11% below the five-year average, reflects the generally normal crop and especially pasture condition, as confirmed by the NDVI development graph.

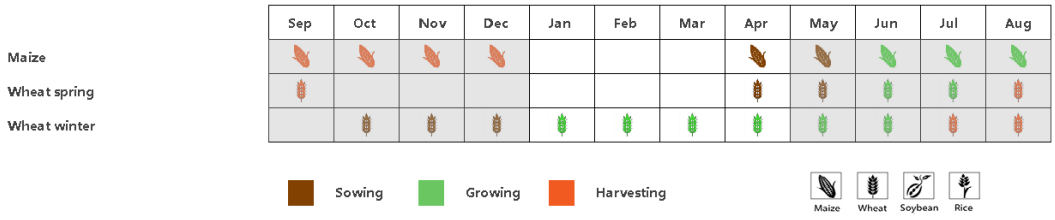
Mostly unfavorable climatic conditions dominated the **Massif Central Dry zone** over the reporting period. Rainfall was 25% below average (159 mm over four months). Temperature was 0.6°C below average. The dry conditions have hampered biomass development (BIOMSS down 21%) which is most relevant for pastures.

The South-western maize zone is one of the major irrigated maize regions in France. Temperature dropped 1.0°C below average. RAIN was average, but radiation was above expectations (RADPAR+2%). Crop condition was average according to the NDVI development graph, as confirmed by the decrease of BIOMSS by 5% compared to the 5YA. The VCIx map, shows that the crop condition was normal.

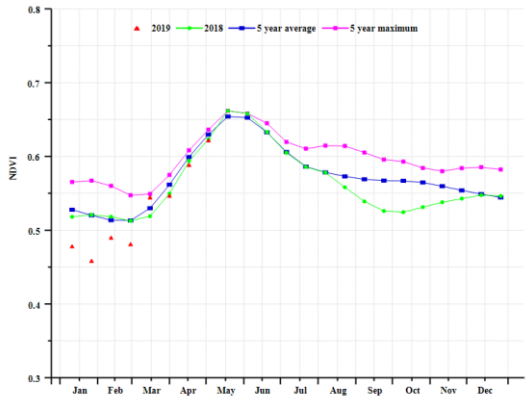
Generally, the most unfavorable weather conditions were observed in the **Alpes region** (RAIN -41%) even if other indicators remain close to average. According to the NDVI profiles, crop condition remained unfavorable before April. BIOMSS is 25% below its five-year average, and the VCIx value of 0.82 for the region is the lowest in the country.

Finally, environmental conditions for the **Mediterranean zone** were unfavorable with the following values: RAIN -35%, TEMP -0.2°C, and RADPAR +8%. Most arable land in this region was cropped during the monitoring period. Despite the VCIx of 0.92, the NDVI profile confirms that crop condition was similar to 2018 and below average.

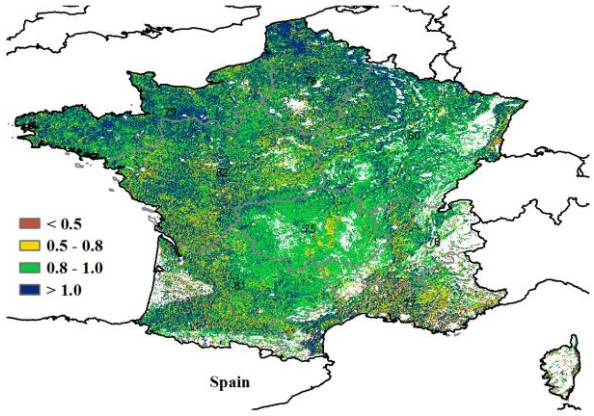
Figure 3.16 France's crop condition, January - April 2019



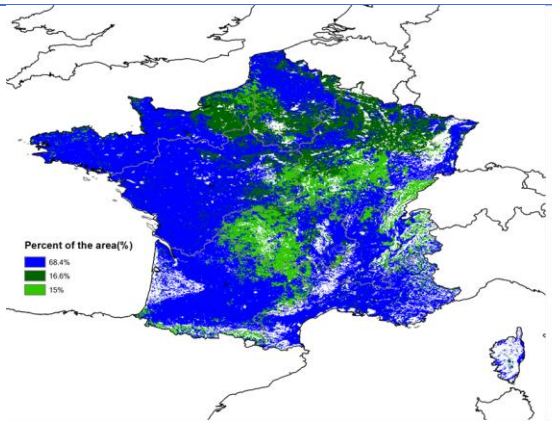
(a). Phenology of major crops



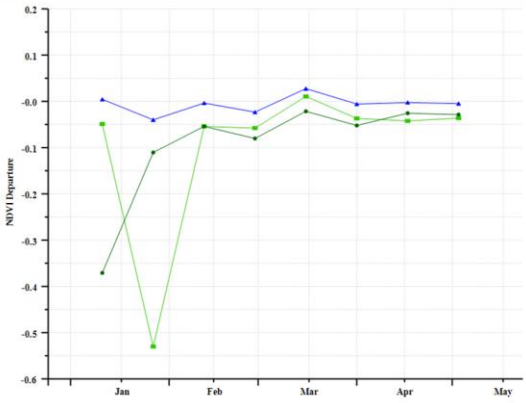
(b) Crop condition development graph based on NDVI



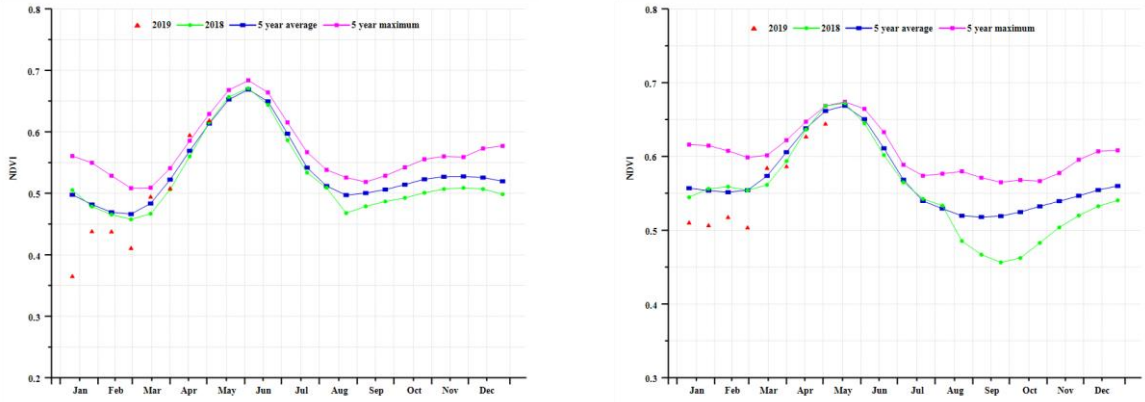
(c) Maximum VCI



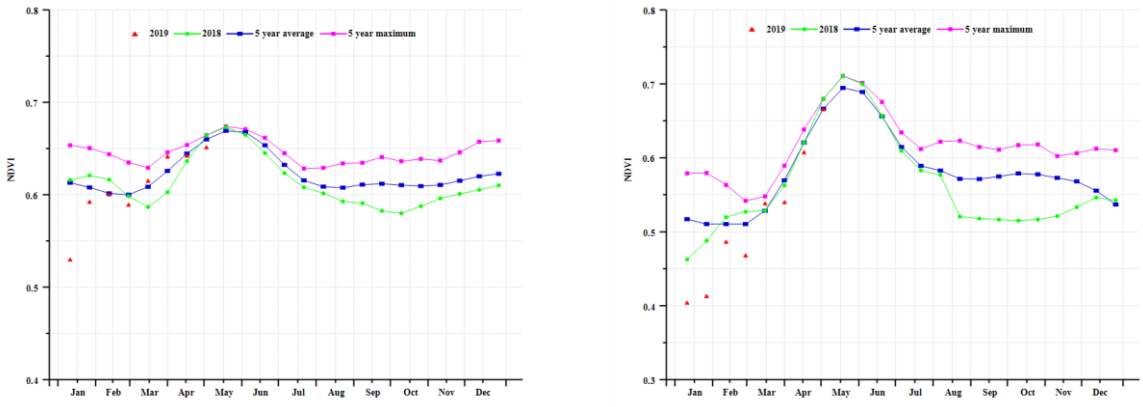
(d) Spatial NDVI patterns compared to 5YA



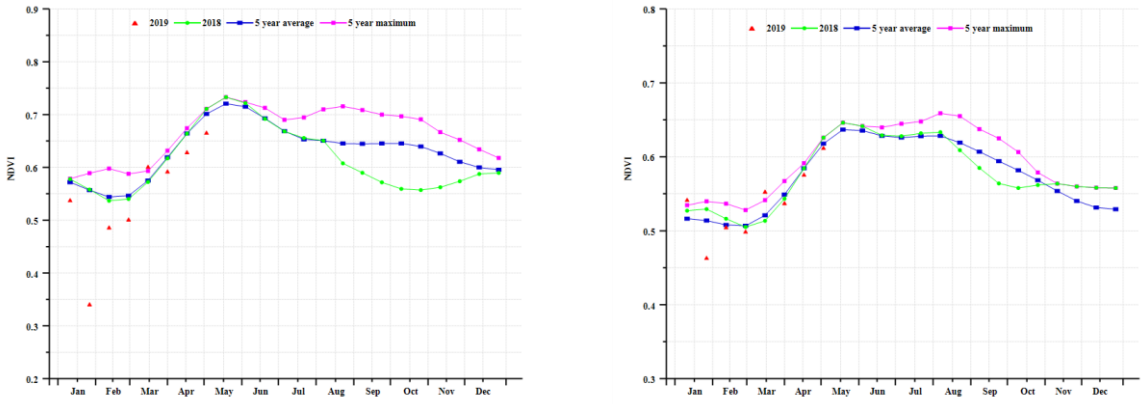
(e) NDVI profiles



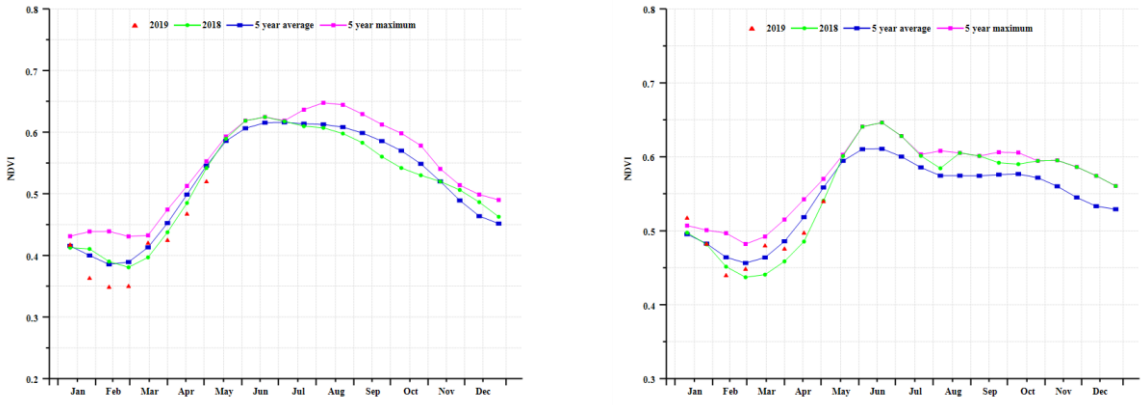
(f) Crop condition development graph based on NDVI (Northern barley region (left) and Mixed maize, Barley and Rapeseed zone (right))



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



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



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

Table 3.23 France's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, January - April 2019

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m2)	Departure from 15YA (%)
Northern Barley zone	220	-7	7.2	0.1	565	8
Mixed maize/barley and rapessed zone from the Centre to the Atlantic Ocean	85	-26	7.9	-0.6	625	8
Maize barley and livestock zone along the English Channel	142	-23	8.0	-0.1	566	5
Rapeseed zone of eastern France	160	-12	6.0	-0.4	571	3
Massif Central Dry zone	159	-25	5.6	-0.6	637	6
Southwest maize zone	243	2	7.8	-1.0	688	6
Alpes region	146	-41	3.7	-0.8	699	5
Mediterranean zone	138	-35	6.3	-0.2	797	8

Table 3.24 France's agronomic indicators by sub-national regions, current season's value and departure from 5YA/15YA, January - April 2019

Region	BIOMSS		Cropped arable land fraction		Maximum VCI
	Current (gDM/m^2)	Departure from 15YA (%)	Current (%)	Departure from 5YA (%)	Current
Northern Barley zone	896	-4	100	0	1.01
Mixed maize /barley and rapessed zone from the Centre to the Atlantic Ocean	396	-26	100	0	0.95
Maize barley and livestock zone along the English Channel	644	-20	100	0	1.00
Rapeseed zone of eastern France	689	-11	99	0	0.97
Massif Central Dry zone	630	-21	100	0	0.92
Southwest maize zone	779	-5	98	0	0.94
Alpes region	536	-25	85	-2	0.82
Mediterranean zone	531	-24	89	2	0.92

[GBR] United Kingdom

Crops showed generally favorable condition during the reporting period. Currently, wheat, winter barley, and rapeseed are in the vegetative stages. Agroclimatic indicators show that rainfall and biomass were below average (RAIN, -15%) and biomass (BIOMSS, -3%) with close to average temperature (TEMP,0.2°C), radiation (RADPAR) is marked increased by 6.2%. Biomass decreased the recent fifteen-year average due to a shortage rainfall. As shown by the NDVI profiles, the national NDVI values were higher than average from late January to February and March and April, but they dropped twice which are late February and late April. According to the crop condition development graph, NDVI values were above average only 37.6% including East Lothian, Berwick, Northumberland, Durham and most of Yorkshire, some area of Lincoln, Suffolk, Essex and Warwick, Worcester, Buckingham, Hertford and Surrey. 62% of the region qualified below average crop condition at the time of reporting in Rutland, Cambridge, southern part of Lincoln, Nottingham, and Fife, Perth, Angus, Kincardine, and South west region (Cornwall, Oxfort, Berk and Wilt). The VCIx was good at 0.99 and area of cropped arable land fraction (CALF) is unchanged compared to its five-year average.

Regional analysis

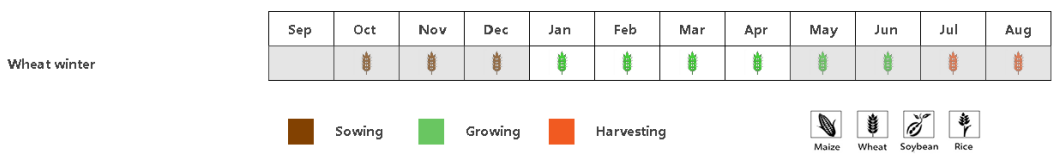
CropWatch has adopted three agro-ecological zones (AEZ) to provide a more detailed spatial analysis for the country; they include the Central sparse crop region (covering northern England, Wales, and Northern Ireland), the Northern barley region (Scotland and northern England), and the Southern mixed wheat and barley region (southern England). The Southern mixed wheat and barley region is characterized by unchanged fraction of cultivated arable land (CALF) compared to average. In the Central sparse crop area and the Northern barley region CALF increased by 1%.

In the **Central sparse crop area and the Northern barley region,** CALF increased by 1%. The area is one of the country's major agricultural regions in terms of crop production. Agroclimatic conditions include below average rainfall (-5%), above average TEMP (+0.2°C) and RADPAR (+3%), which resulted in above average BIOMSS (+4%). NDVI values were above average according to the region's crop condition development graph from January to February but NDVI was below average in late February and March. The VCIx was unusually high at 1.02.

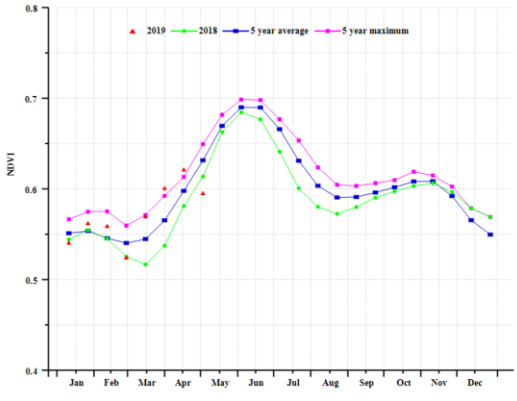
In the **main barley region**, the NDVI was below average according to the crop condition graphs from January to late February, and above average in March to late April. Compared to average, RAIN was low (down 17%), the temperature was close to average (+0.2°C) and radiation was above (+5%). The biomass production potential was up 5% compared to average. The VCIx was very hight at 1.00.

In the third region, **the southern mixed wheat and barley region**, NDVI was close to average but dropped in late April. Agroclimatic conditions include RAIN -21%, relatively close to average TEMP (+0.2°C) and rather high radiation (+8%). The regional VCIx (0.97) was well above average.

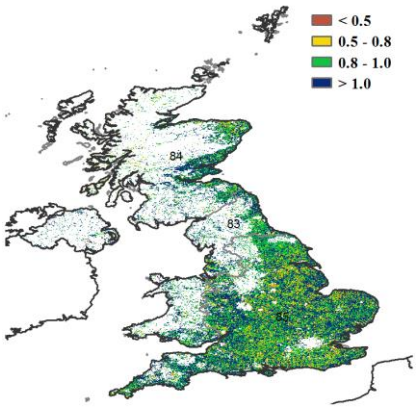
Figure 3.17 United Kingdom crop condition, January - April 2019



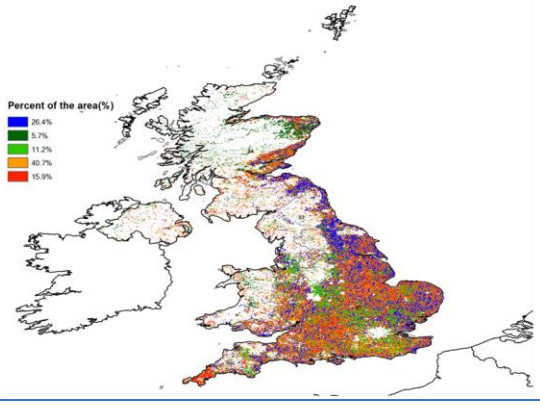
(a). Phenology of major crops



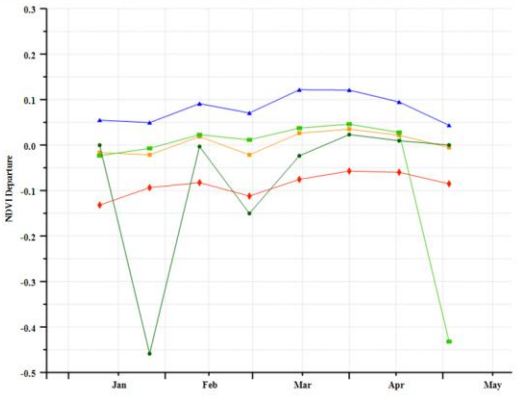
(b) Crop condition development graph based on NDVI



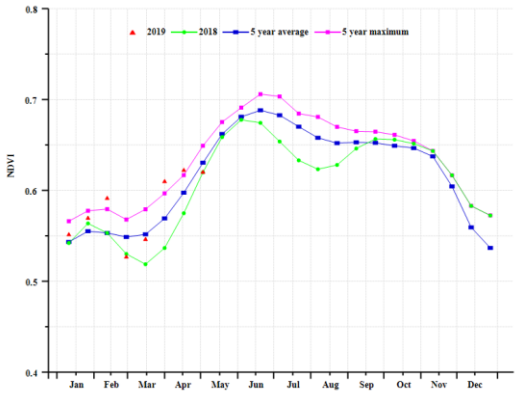
(c) Maximum VCI

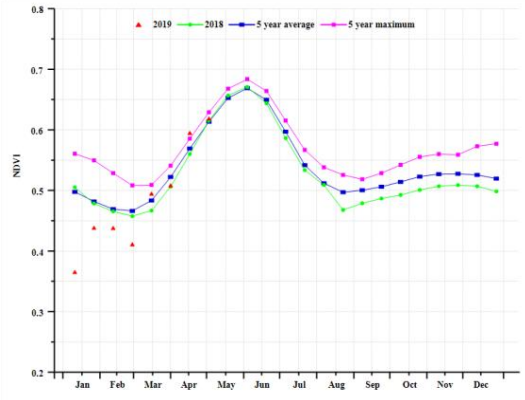


(d) Spatial NDVI patterns compared to 5YA

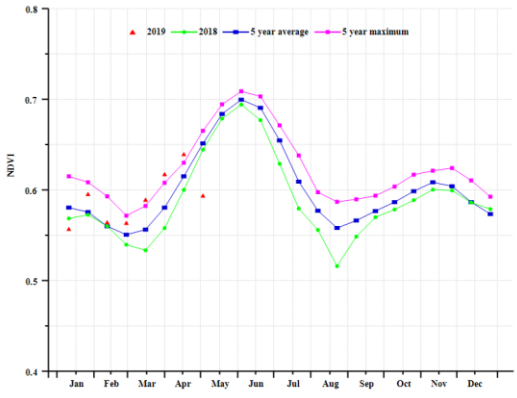


(e) NDVI profiles





(f) Crop condition development graph based on NDVI (Sparse crop area of N England, Wales and N. Ireland (left) and Northern Barley region (right))



(g) Crop condition development graph based on NDVI (Southern mixed wheat and Barley region)

Table 3.25 United Kingdom's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, January - April 2019

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m²)	Departure from 15YA (%)
Northern Barley area (UK)	402	-17	5.2	0.2	381	5
Southern mixed wheat and Barley zone (UK)	235	-21	7.1	0.2	494	8
Central sparse crop area (UK)	384	-5	6.4	0.2	423	3

Table 3.26 United Kingdom's agronomic indicators by sub-national regions, current season's values and departure from 5YA/15YA, January - April 2019

Region	BIOMSS		CALF		Maximum VCI
	Current (gDM/m²)	Departure from 15YA (%)	Current (%)	Departure from 5YA (%)	Current
Northern Barley area (UK)	986	6	96	1	1.00
Southern mixed wheat and Barley zone (UK)	918	-12	100	0	0.97
Central sparse crop area (UK)	1063	4	99	1	1.02

[HUN] Hungary

At the end of dormancy and early spring growth winter wheat showed generally unfavorable condition, at a time when early summer crop (e.g. maize) cultivation is starting. The BIOMSS is down 9.0% due to shortage of rainfall (RAIN -12%). Temperature was close to average and radiation was above by 4%. According to nationwide NDVI graphs, crop condition was below average with the maximum VCI value reaching 0.83 and the cropped arable land fraction (CALF) down at the national level. Crop condition was above average throughout the reporting period in 14.3% of arable land in western Transdanubia, and 85.7% was below average including Puszta, Northern and Central Hungary and central and southern Transdanubia.

Regional analysis

CropWatch has adopted four agro-ecological zones (AEZ) to provide a more detailed spatial analysis for the country. They included Northern Hungary, Central Hungary, the Puszta and Transdanubia. Specific observations for the reporting period are included for each region. In the all sub-regions, the cropped arable land fraction is down below the 5YA: 2% in the North Hungary, 6% in Central Hungary, 10% in the Puszta and just 1% in Transdanubia.

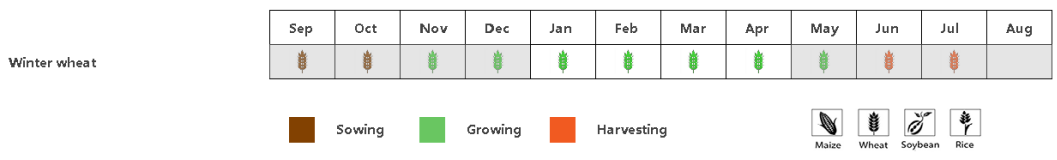
Central Hungary is one of the major agricultural regions in terms of crop production. A sizeable share of winter wheat, maize and sunflower is planted in this region. Agroclimatic conditions include above average radiation (RADPAR +4.5%), slightly above average temperature (TEMP +1.0°C) and below average rainfall (RAIN, -10%). The biomass production potential decreased by 6% and VCIx was just fair at 0.78. NDVI was below average.

Northern Hungary is another important winter wheat region. The NDVI was below average according to the crop condition graph. Compared with the recent average, temperature was about average (TEMP, +0.9°C), radiation was well above (RADPAR, +5.0%) while rainfall and biomass both dropped compared with average (RAIN -16%, BIOMSS, -13%). The VCIx was normal at 0.83.

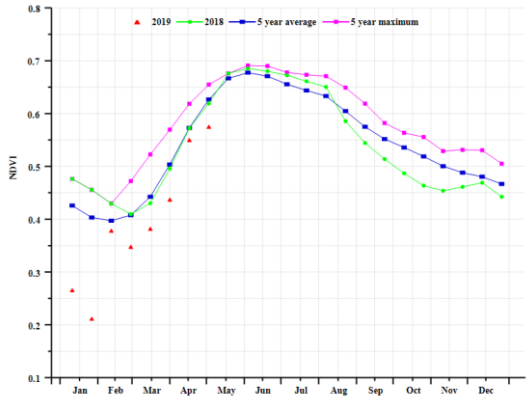
The Puszta region grows mostly winter wheat, maize and sunflower especially in the counties of Jaz-Nagykum-Szolnok and Bekes. According to NDVI development graph, crop condition was below average from January to April. The biomass is decreased by 10% due to low rainfall (RAIN -8%) while temperature was average (TEMP +0.9°C) and radiation was above average (RADPAR 3.0%). The maximum VCI was a normal 0.79.

Southern Transdanubia cultivates winter wheat, maize and sunflower, mostly in Somogy and Tolna counties. The RAIN was below average (-13%) with both temperature and radiation above average (TEMP +1.1°C, RADPAR +4.2%). The biomass decreased by 7% below average in this period. The maximum VCI was normal 0.88. The NDVI values were below average but picked up in February and April.

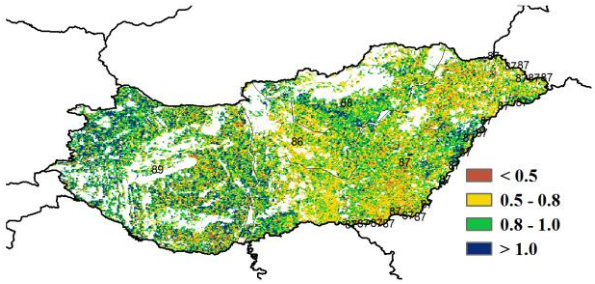
Figure 3.18 Hungary's crop condition, January - April 2019.



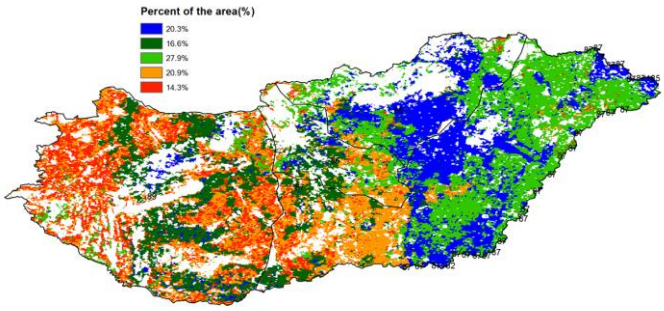
(a). Phenology of major crops



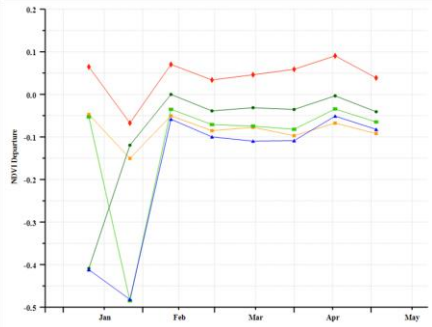
(b) Crop condition development graph based on NDVI



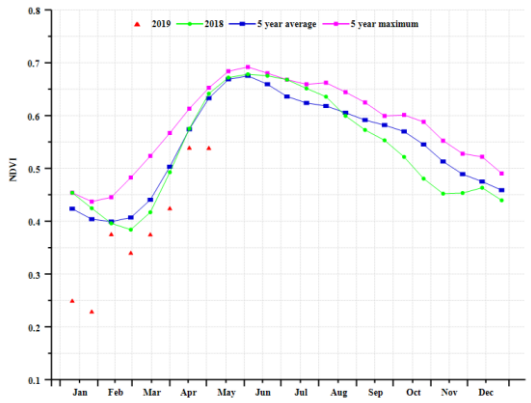
(c) Maximum VCI

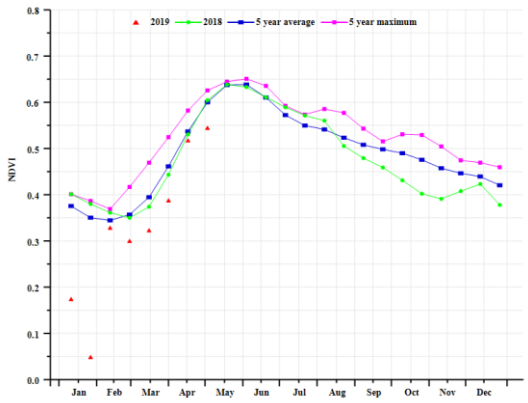


(d) Spatial NDVI patterns compared to 5YA

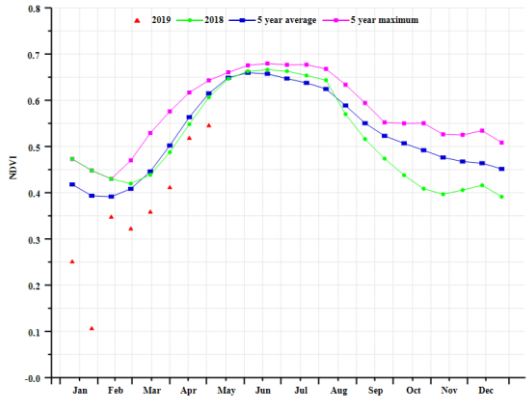


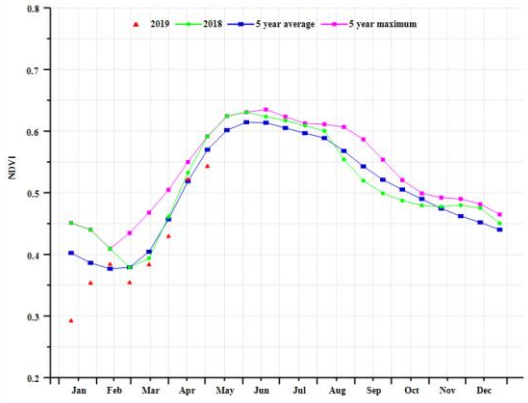
(e) NDVI profiles





(f) Crop condition development graph based on NDVI (Central Hungary (left) and North Hungary (right))





(g) Crop condition development graph based on NDVI (Great Plain (left) and Western Transdanubia (right))

Table 3.27 Hungary's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, January - April 2019

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m²)	Departure from 15YA (%)
Central Hungary	120	-10	6.0	1.0	648	5
North Hungary	118	-16	5.4	0.9	620	5
Great Plain	117	-8	6.1	0.9	633	3
Transdanubia	132	-13	6.3	1.1	666	4

Table 3.28 Hungary's agronomic indicators by sub-national regions, current season's values and departure from 5YA/15YA, January - April 2019

Region	BIOMSS		CALF		Maximum VCI
	Current (gDM/m²)	Departure from 15YA (%)	Current (%)	Departure from 5YA (%)	Current
Central Hungary	555	-6	93	-6	0.78
North Hungary	546	-13	97	-2	0.83
Great Plain	515	-10	86	-10	0.79
Transdanubia	596	-7	94	-1	0.88

[IDN] Indonesia

The harvest of rainy season maize was completed in Java and Sumatra, while the main rice harvest started in March. According to agroclimatic indicators, Indonesia experienced sunny but average weather conditions: rainfall (RAIN -2%) and temperature (TEMP -0.4°C) were slightly below average, while radiation was up 4%. The biomass production potential fell slightly by 2%. Due to unexplained factors, the NDVI values were unrealistically low in the national NDVI development graph compared to the recent five-year average in mid-January and early February. Crop condition was below average from March. According to NDVI profiles, 90.7% of the arable land had around average crop condition, including Java, which has the largest share of cropped areas in the country, Kalimantan and Sulawesi. 9.3% of the arable land of Indonesia (mostly in Papua province) was below average due to cyclone Trevor (refer to Chapter5).

Regional analysis

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

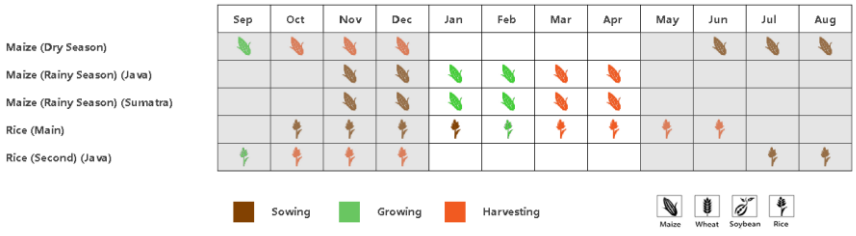
According to agroclimatic conditions of **Java**, rainfall (RAIN +3%) and radiation (RADPAR +5%) were slightly above average, while temperature (TEMP -0.1°C) was average, resulting in a small rise of the biomass production potential (BIOMSS +1%). According to the NDVI development graph, crop condition was below the 5-year average. However, considering that the CALF increased by 27% crop production in Java is likely to be average.

The agro-climatic conditions of **Kalimantan and Sulawesi** follow the same patterns as the country as a whole: accumulated rainfall down (RAIN -8%), temperature about average (TEMP -0.3°C) and radiation up (RADPAR +4%), leading to a 5% decrease of the biomass production potential. According to the NDVI development graph, crop condition was below to 5-year average. Considering the favorable VCIx value of 0.99, the crop condition shown in NDVI development graph maybe underestimated. The fraction of cropped arable land (CALF) also increased by 15% compared with average. Altogether crop production prospects are favorable.

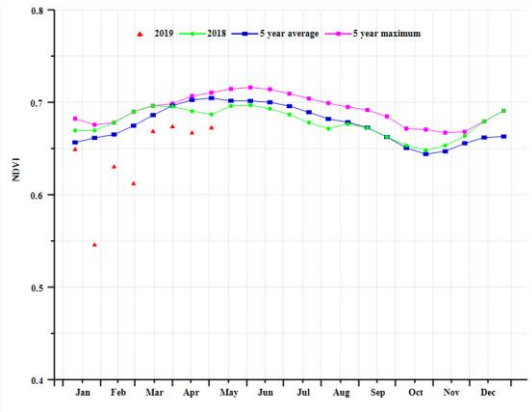
Rainfall (RAIN, +5%) and radiation (RADPAR +5%) were slightly above average in **Sumatra**, while temperature (TEMP -0.3°C) was just below average, leading to a small increase of the biomass production potential (BIOMSS +3%). As shown in the NDVI development graph, crop condition was close to the 5-year average. Considering favorable VCIx value of 0.98 and the 21% rise in CALF crop condition and production may exceed average.

Considering that the fraction of cropped arable land increased 14% over the last five-year average and due to mostly average agro-climatic conditions CropWatch assesses the condition of crops during the reporting period as average to above average.

Figure 3.19 Indonesia's crop condition, January - April 2019

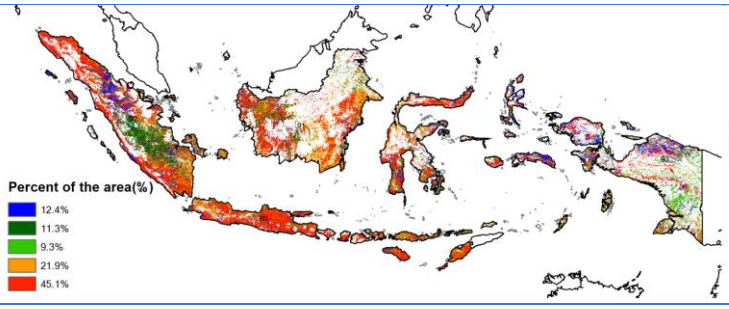


(a). Phenology of major crops

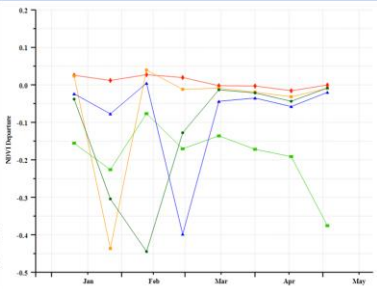


(b) Crop condition development graph based on NDVI

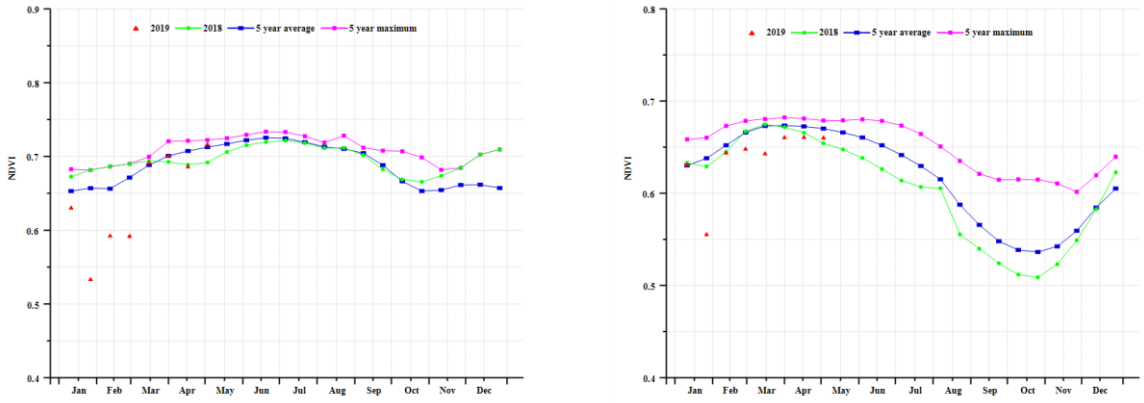
(c) Maximum VCI



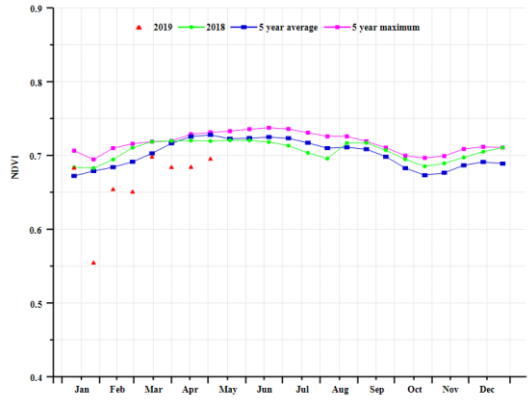
(d) Spatial NDVI patterns compared to 5YA



(e) NDVI profiles



(f) Crop condition development graph based on NDVI (Sumatra (left) and Java (right))



(g) Crop condition development graph based on NDVI (Kalimantan-Sulawesi)

Table 3.29 Indonesia's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, January - April 2019

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA(%)	Current (°C)	Departure from 15YA(%)	Current (MJ/m²)	Departure from 15YA(%)
Java	1150	3	25.8	-0.1	1214	5
Kalimantan and Sulawesi	1019	-8	26.0	-0.3	1153	4
Sumatra	1133	4	25.9	-0.3	1147	5
West Papua	1401	1	24.7	-0.9	976	0

Table 3.30 Indonesia's agronomic indicators by sub-national regions, current season's value and departure from 5YA/15YA, January - April 2019

Region	BIOMSS		Cropped arable land fraction		Maximum VCI
	Current (gDM/m²)	Departure from 15YA(%)	Current (%)	Departure from 5YA(%)	Current
Java	2112	1	99	27	-
Kalimantan and Sulawesi	2142	-5	100	15	0.99
Sumatra	2240	3	100	21	0.98
West Papua	2266	-3	100	-7	0.97

[IND] India

Kharif(summer) maize and rice in India have been harvested in January whereas Rabi (winter) rice and wheat were still growing between January and February; the harvest started in March. Crop condition was slightly below average over the reporting period, as indicated by the graph of NDVI development at the national level.

The CropWatch agroclimatic indicators show that nationwide rainfall, temperature and RADPAR were average (-3%, -0.3°C and 0%, respectively). Moreover, the overall VCIx was moderate, with a value of 0.83. However, the values of this indicator show marked spatial differences, with high values (greater than 0.8) being located in northern and eastern India while low values (less than 0.5) appear in the southern and western parts. As shown by the map ofspatial NDVI patterns compared to 5YA and corresponding NDVI profiles, 23.4% of crops showed above-average condition throughout the monitoring period, which were mainly located in northern India. In contrast, 25.9% of planted areas experienced continuously below-average crop condition, distributed in southern and western India. These spatial patterns of NDVI were thus generally consistent with those of VCIx. Considering the CALF decreased by 3%compared to average, the crop production of this season is estimated to be slightly below average. As shown by the maps in figures 2.4g, 2.4h, 3.1, 3.2 and 3.4, the patterns are directly related to weather, as further described below.

Regional analysis

Building on cropping systems, climatic zones and topographicconditions, India is divided into eight agro-ecological zones:the Deccan plateau (94), the Eastern coastal region (95), theGangetic plains (96), the Assam and north-eastern region (97),Agriculture areas in Rajasthan and Gujarat (98), theWestern coastal region (99), the North-western dry region (100) andthe Western Himalayan region (101).

The **Deccan plateau** recorded 48 mm of rainfall (-20%) and average temperature and radiation, which led to slightly below-average crop condition, as indicated by the graph of NDVI development in this region. The BIOMSS decreased by 11% compared to average. The VCIx was moderate, with a value of 0.81. The crop production is expected to be below average, considering in addition that CALF decreased 7%.

In the **Eastern coastal region**, precipitation and temperature both declined (11% and 0.2°C, respectively) whereas radiation slightly increased by 1%. As shown by the NDVI profile, crop condition was generally below average. This is consistent with a below-average BIOMSS (-10%). The VCIx was 0.80. The CALF slightly declined 1% compared to average.

As a very important crop production zone in India, the **Gangetic plains** received well above-average rainfall (+62%) but below-average temperature and radiation (-1.0 °C and -3%, respectively). Crop condition in this area was below average before early February but improved thereafter to average or above average. The VCIx was high at 0.94. As the CALF increased by 2%, the crop production of this season is estimated to be above average.

The **Assam and north-eastern region** recorded 296 mm of rainfall, with a decrease of 16% compared to average. The radiation was average while the temperature increased 0.5°C. According to the graph of the NDVI development, crop condition in this region was average or above average. This is also corroborated by very high VCIx (0.98). As the CALF was above average (+3%), the outlook of crop production in this region is very promising.

In the Agriculture areas in **Rajasthan and Gujarat,** rainfall increased 5% compared with average, whereas temperature and sunshine (RADPAR) slightly decreased by 0.8°C and 1%, respectively. Average crops prevailed in the region over the reporting period, as implied by the NDVI profile. The VCIx was moderate, with a value of 0.76. As the CALF declined by 10%, the crop production is expected to be below average.

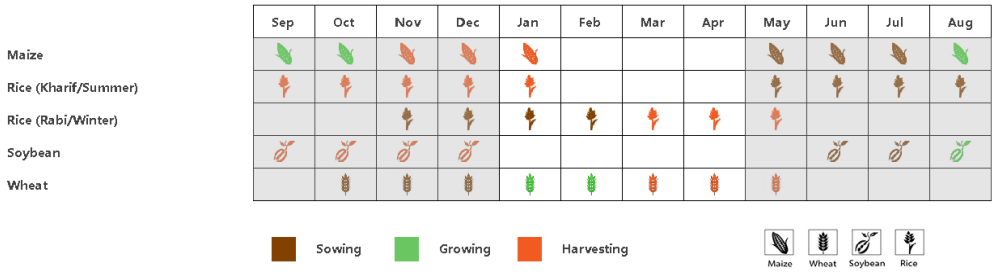
The **North-western dry region** covers northern parts of Rajasthan and Gujarat. Rainfall increased 15% while temperature and radiation fell 1.3°C and 3% compared to average. As shown by the graph of

NDVI development, crop condition was generally average over the monitoring period. The VCIx was 0.74. Considering the spectacular CALF increase by 22%, the larger area may offset mediocre crop condition and the crop production for this region could still be average.

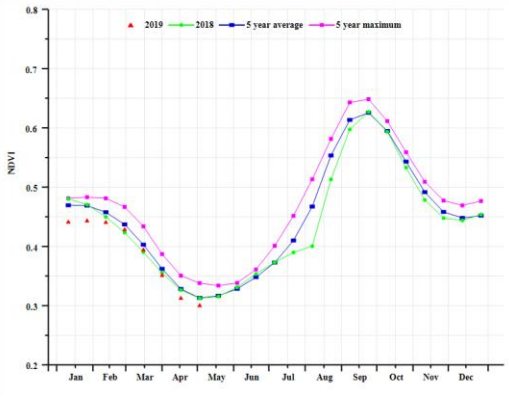
The **Western coastal region** recorded significantly below-average rainfall (-36%) and near average temperature and radiation (-0.1°C and 3%, respectively), which led to poor crop condition in the region, as indicated by the NDVI profile. Additionally, the BIOMSS dropped 25% below average. The VCIx was 0.70, which was the lowest among all the agro-ecological zones. Considering further that CALF decreased by 11%, crop production of this season is expected to be well below average,

In the **Western Himalayan region**, precipitation increased 5% while temperature and radiation declined 0.4°C and 6%, respectively. As shown by the NDVI time profile, crop condition was below average before late February but average or above average since early March. This favorable situation was also confirmed by above-average BIOMSS (+13%) and an impressively high VCIx (0.97). The CALF sightly increased 1% compared to average. Overall, the crop production in this region is expected to be above average.

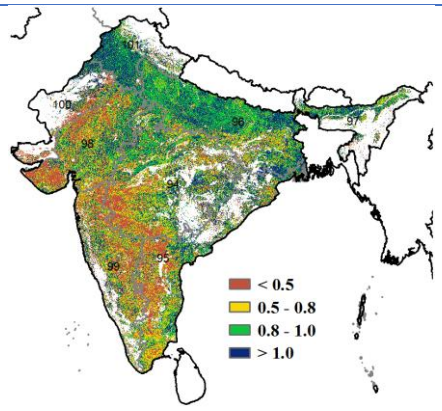
Figure 3.20 India's crop condition, January - April 2019



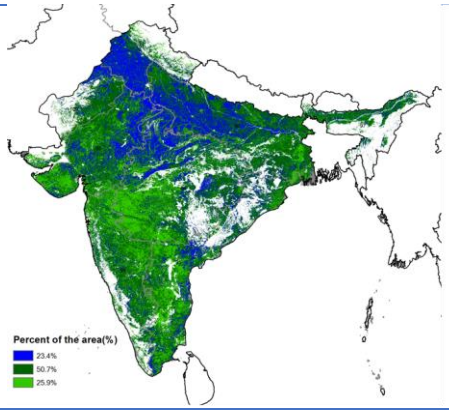
(a). Phenology of major crops



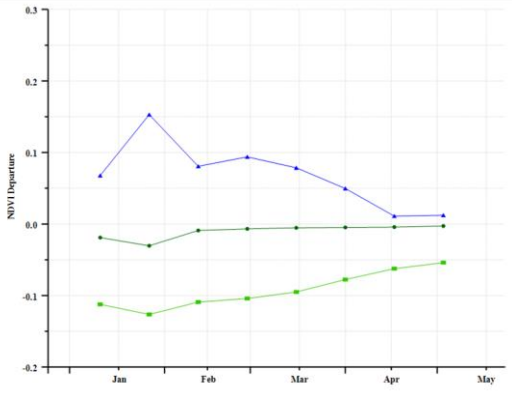
(b) Crop condition development graph based on NDVI



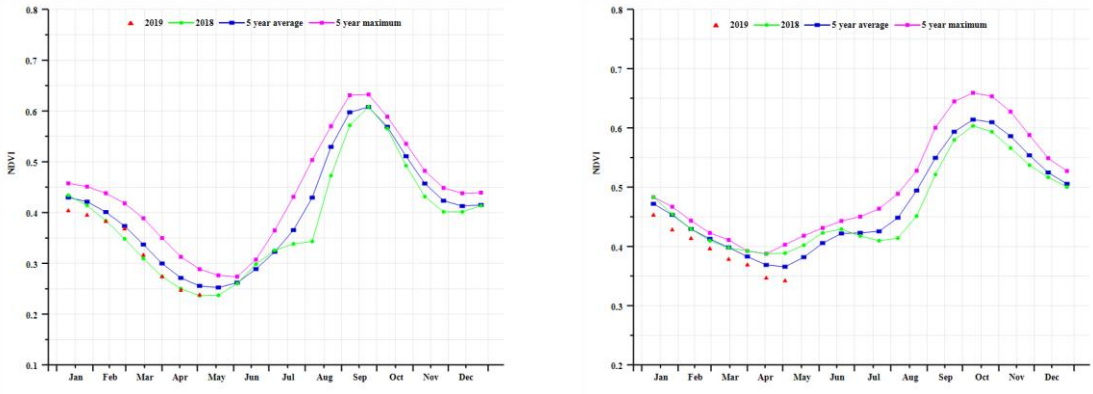
(c) Maximum VCI



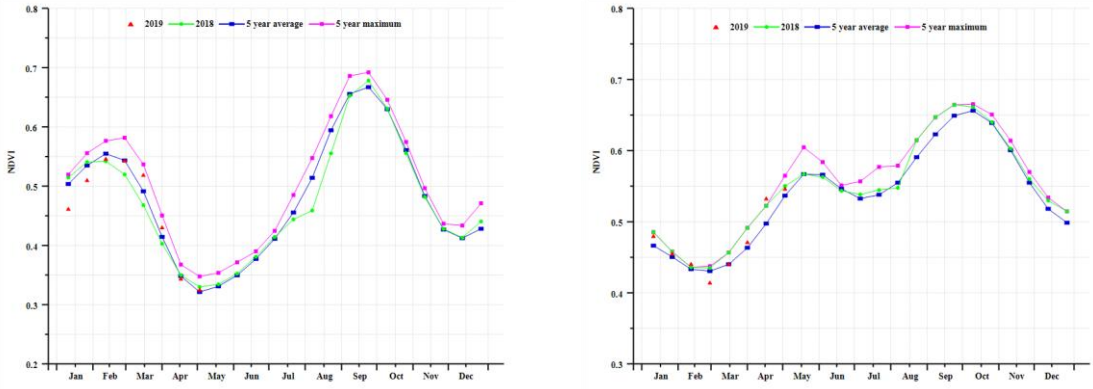
(d) Spatial NDVI patterns compared to 5YA



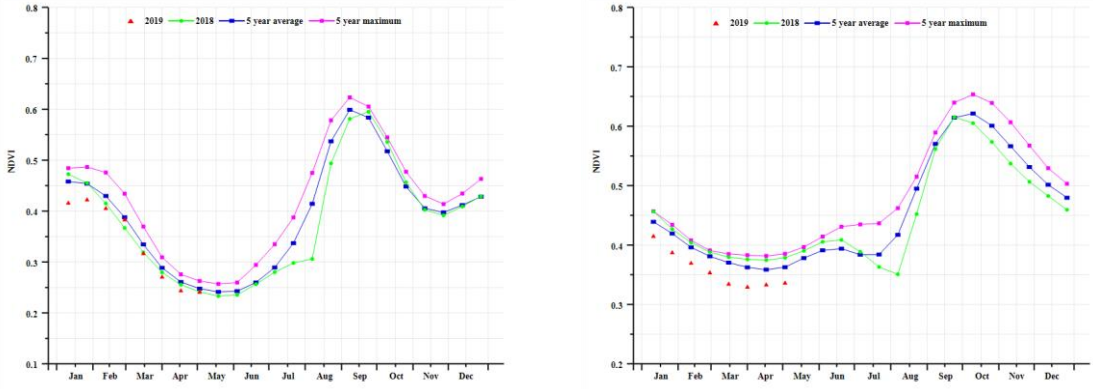
(e) NDVI profiles



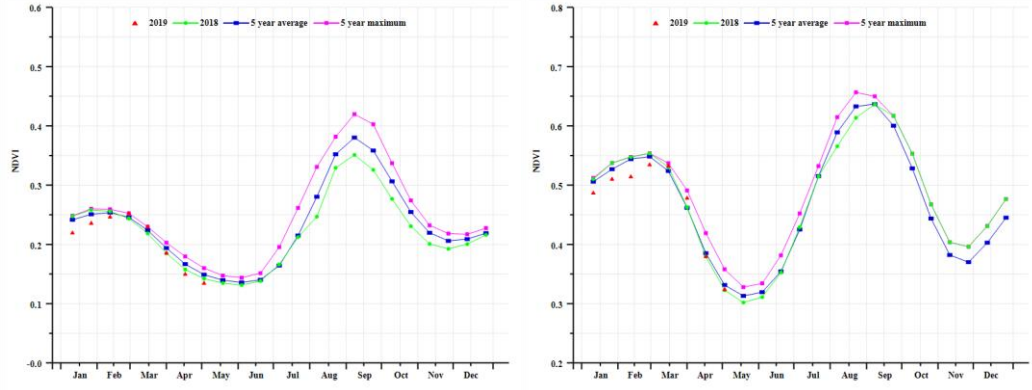
(f) Crop condition development graph based on NDVI (Deccan Plateau (left) and Eastern Coastal Region (right))



(g) Crop condition development graph based on NDVI (Gangatic Plains (left) and North Eastern Region (right))



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



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

Table 3.31 India's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, January - April 2019

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m²)	Departure from 15YA (%)
Deccan Plateau	48	-20	25.9	0.0	1275	0
Eastern coastal region	74	-11	27.2	-0.2	1298	1
Gangatic plain	130	62	22.6	-1.0	1163	-3
Assam and north-eastern regions	296	-16	20.5	0.5	1103	0
Agriculture areas in Rajastan and Gujarat	25	5	24.2	-0.8	1268	-1
Western coastal region	54	-36	26.3	-0.1	1382	3
North-western dry region	27	15	22.5	-1.3	1197	-3
Western Himalayan region	179	5	10.8	-0.4	1007	-6

Table 3.32 India's agronomic indicators by sub-national regions, current season's values and departure from 5YA/15YA, January - April 2019

Region	BIOMSS		CALF		Maximum VCI
	Current (gDM/m²)	Departure from 15YA (%)	Current (%)	Departure from 5YA (%)	Current
Deccan Plateau	217	-11	56	-7	0.81
Eastern coastal region	270	-10	65	-1	0.80
Gangatic plain	202	-28	84	2	0.94
Assam and north-eastern regions	896	1	92	3	0.98
Agriculture areas in Rajastan and Gujarat	121	12	47	-10	0.76
Western coastal region	203	-25	42	-11	0.70
North-western dry region	142	22	15	22	0.74
Western Himalayan region	549	13	93	1	0.97

[IRN] Iran

Crop condition was generally above average, but dropped to below average since March, then recovered to above average during late April. Winter wheat is still growing, and rice was planted from April. Accumulated rainfall (RAIN, 39%) was above average, while temperature (TEMP, -0.7°C) and radiation (RADPAR, -5%) were below average over the last four months. The favorable agro-climatic conditions resulted in an increase in the BIOMSS index by 19% compared to average. However, it is worth noting that from the middle of March to early of April floods hit some parts of northern, western and south-western Iran (refer to the section on disasters in Chapter 5), severely affecting winter crop growth and summer crop planting. The national average of maximum VCI index reached 1.0, and the Cropped Arable Land Fraction (CALF) significantly increased by 47% compared to the recent five-year average.

According to the national NDVI development graphs, crop condition was above average throughout the monitoring period in about 41.7% of cropland, mainly in part of the South-west, Kermanshah and Luristan provinces in the west and central regions, and some areas of Golestan and Razavi Khorasan provinces in the north-eastern region. Remaining croplands experienced unfavorable crop condition during the monitoring period, affecting mainly the north-western region.

Overall, the outcome of winter crops during the current season is expected to be favorable.

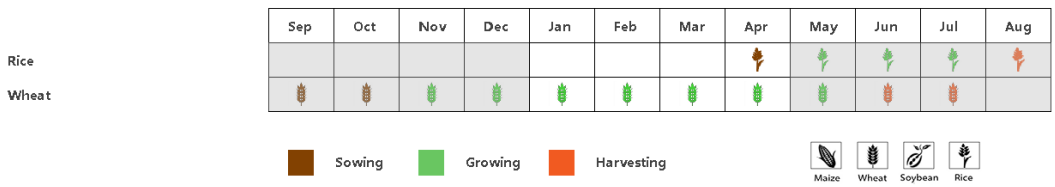
Regional analysis

Based on cropping systems, climatic zones, and topographic conditions, three sub-national agro-ecological regions can be distinguished for Iran, among which two are relevant for crop cultivation. The two regions are referred to as the Semi-arid to sub-tropical hills of the west and north (104), and the Arid Red Sea coastal low hills and plains (103).

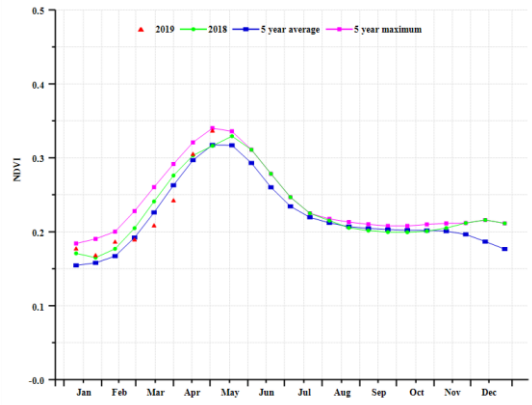
In the **Semi-arid to sub-tropical hills of the west and north region**, NDVI profiles show similar changes as in the whole Iran country. The accumulated rainfall was 309mm (32% above average), while temperature (TEMP -0.6°C) and radiation were below average (RADPAR -6%). The favorable weather conditions resulted in an increase of BIOMSS by 10%. CALF rose 39%, and the average VCIx (1.0) was very and unusually high. The outcome for winter crops of this region is estimated to be favorable.

Crop condition in the **Arid Red Sea coastal low hills and plains region** was above five-year average and five-year maximum during this monitoring season. The region received 296 mm of rainfall. The abundant rainfall (RAIN +82%) resulted in a significant increase of BIOMSS by 56%. The CALF also increased significantly by 124% compared to five-year average, and the national VCIx (1.2) was higher than the best values on record. The outlook for winter crops in this region is highly favorable.

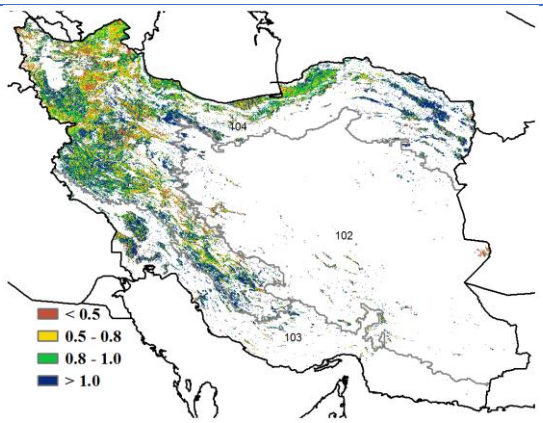
Figure 3.21 Iran's crop condition, January - April 2019



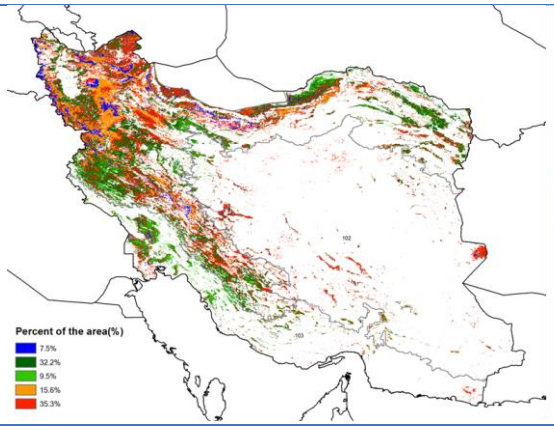
(a) Phenology of major crops



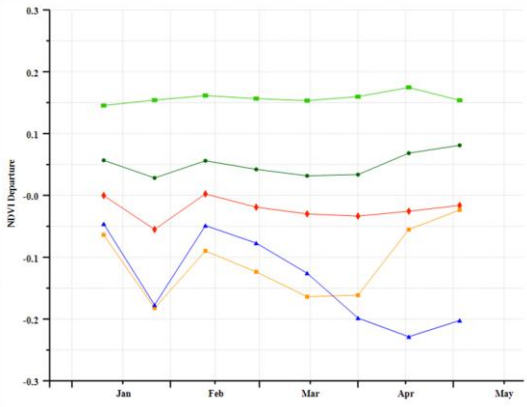
(b) Crop condition development graph based on NDVI



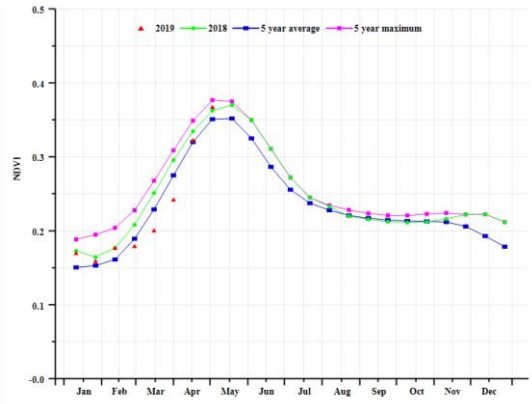
(c) Maximum VCI

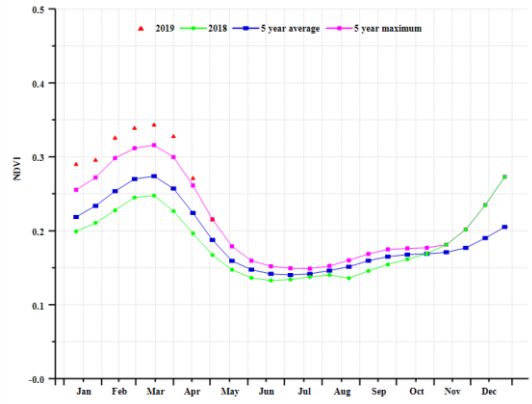


(d) Spatial NDVI patterns compared to 5YA



(e) NDVI profiles





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

Table 3.33 Iran's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, January - April 2019

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m²)	Departure from 15YA (%)
Semi-arid to sub-tropical hills of the west and north	309	32	4.8	-0.6	920	-6
Arid Red Sea coastal low hills and plains	296	82	15.0	-1.3	1006	-6

Table 3.34 Iran's agronomic indicators by sub-national regions, current season's value and departure from 5YA/15YA, January - April 2019

Region	BIOMSS		Cropped arable land fraction		Maximum VCI
	Current (gDM/m²)	Departure from 15YA (%)	Current (%)	Departure from 5YA (%)	Current
Semi-arid to sub-tropical hills of the west and north	794	10	32	39	1.00
Arid Red Sea coastal low hills and plains	871	56	42	124	1.20

[ITA] Italy

This reporting period is the main growing season of winter wheat, sown between October and December. Spring and summer crops, including maize and rice, were planted from the end of April.

Nationwide, early NDVI values were below average (around 0.5) and started increasing after February, a situation similar to what happened in 2018. In April, values started to rise over 2018 and exceeded the average, eventually reaching the maximum of 5 years at the end of the reporting period. NDVI was above average in 25.4% of the arable land, mainly in the south of the country. 20.6% of was below the average and occurred mostly in northern Basilicata and southern Lombardy. Remaining areas were around the average. Rainfall was well below average (-24%), the temperature was average and RADPAR was 9% above average. BIOMSS dropped 19% but VCIx was satisfactory (0.94) with CALF increased about 1.4%. Overall crop condition in the country is about average.

Regional analysis

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

On the **East coast**, RAIN and TEMP were average (+ 3% and -0.2°C compared with average), but RADPAR was high (+8%). Overall condition of wheat was about average with BIOMSS up 3%, VCIx at 0.93 with a high CALF value of 0.99. The crop condition development graph of NDVI indicates that initially poor conditions developed into average ones from April. The output is expected to be average.

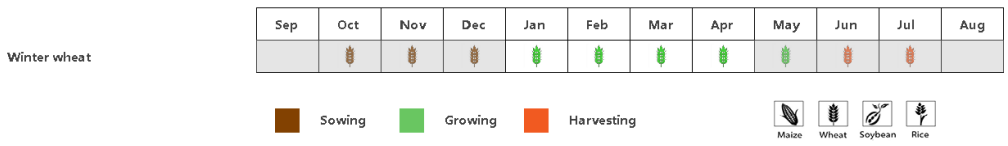
The **Po Valley** recorded insufficient rainfall, average temperature and RADPAR with high VCIx and CALF, resulting in below average biomass production potential: RAIN -29%, TEMP +0.5°C, RADPAR 9%, BIOMSS -24%, VCIx 0.99 and CALF 99%. The crop condition development graph of NDVI indicates condition better than the 5 years average after March and even above the maximum after April. This represents a spectacular recovery considering that initial NDVI values were below 0.4. Below average to average output is expected, depending largely on late spring weather.

In the **Islands**, the combination of a severe precipitation shortage (-38%), average TEMP (-0.6%) and above average RADPAR (+7%) led to a BIOMSS drop of 31% compared with the average. VCIx was satisfactory (0.91) and CALF was high (99%). The crop condition development graph of NDVI indicates below 5YA values. Generally, below average output is expected.

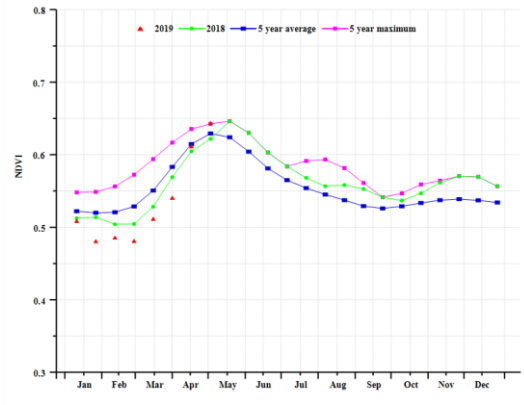
The situation in **Western Italy** was almost normal (TEMP, VCIx 0.90, CALF 99%) but sunshine was high (+9%) and RAIN was low (-20%). BIOMSS fell -16%. NDVI was below average as well and below average production is expected.

If the water supply improves after April, the winter wheat production could be satisfactory.

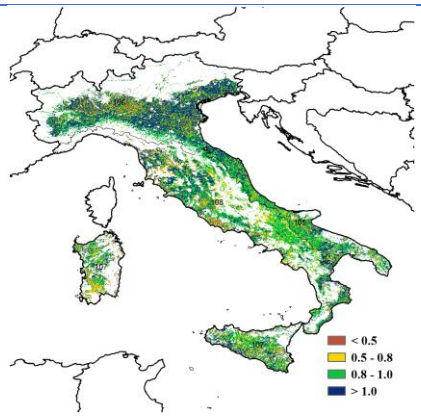
Figure 3.22 Italy's crop condition, January - April 2019.



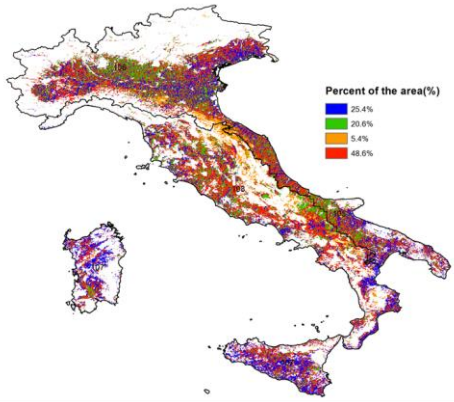
(a). Phenology of major crops



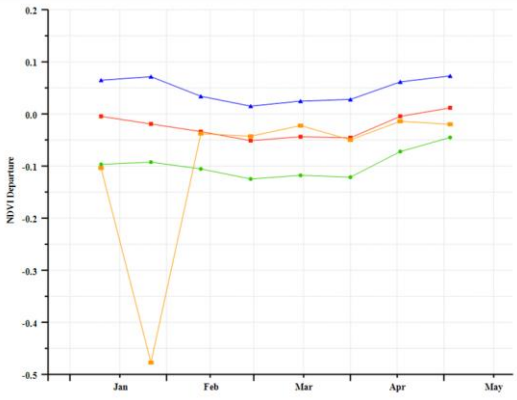
(b) Crop condition development graph based on NDVI



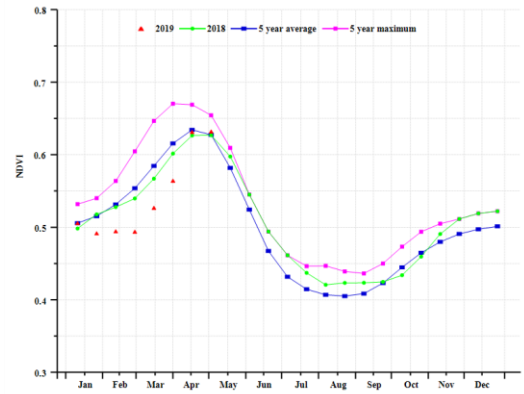
(c) Maximum VCI



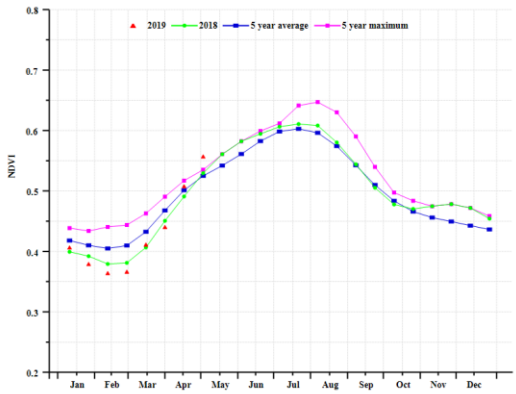
(d) Spatial NDVI patterns compared to 5YA



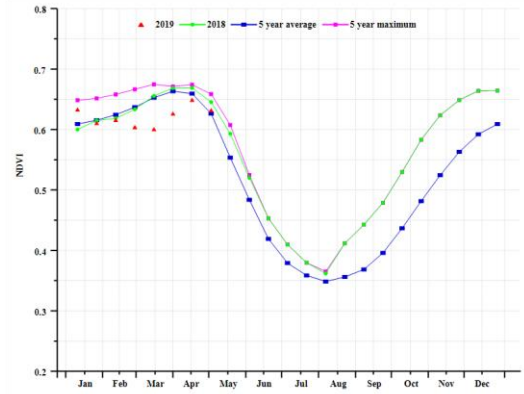
(e) NDVI profiles



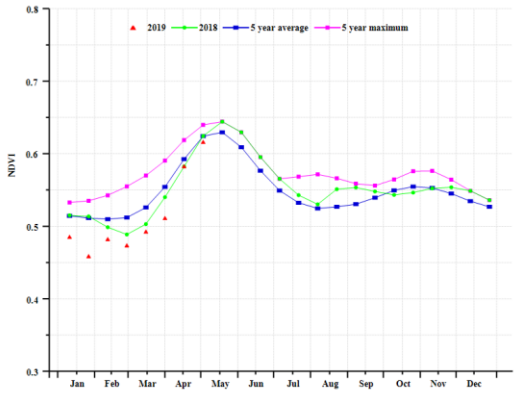
(f) East coast (Italy) crop condition development graph based on NDVI



(g) Po Valley (Italy) crop condition development graph based on NDVI



(h)Islands (Italy) crop condition development graph based on NDVI



(i). Western Italy (Italy) crop condition development graph based on NDVI

Table 3.35 Italy's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, January - April 2019

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m²)	Departure from 15YA (%)
East coast	121	3	10	-0.2	812	8
Po Valley	123	-29	7	0.5	7279	9
Islands	67	-38	10	-0.6	887	7
Western Italy	130	-20	8	-0.02	7869	9

Table 3.36 Italy's agronomic indicators by sub-national regions, current season's value and departure from 5YA/15YA, January - April 2019

Region	BIOMSS		Cropped arable land fraction		Maximum VCI
	Current (gDM/m²)	Departure from 15YA (%)	Current (%)	Departure from 5YA (%)	Current
East coast	554	3	99	0.4	0.93
Po Valley	499	-24	92	4.2	0.99
Islands	321	-31	99	0.1	0.91
Western Italy	545	-16	99	-0.03	0.90

[KAZ] Kazakhstan

The country currently cultivates limited amounts of winter rye and wheat in southern areas, and spring crops will be planted from May. As such, the national average VCIx of 0.76 and the Cropped Arable Land Fraction decrease of 13% apply mostly to rangeland. Among the CropWatch agroclimatic indicators, RAIN and TEMP were above average (+4% and +1.4°C), while RADPAR was below (-4%). The combination of the factors resulted in high BIOMSS (+10%) compared to the fifteen-year average. As shown by the NDVI development graph, the winter vegetation condition was close to average in April, even if value where seasonably low (< 0.2). NDVI cluster graphs and profiles show that southern parts of country were above average from February to April. The spatial NDVI pattern and profile show that the vegetation condition in 59.6% of areas was above average from March to April in parts of Kokshetau, Pavlodar, Kostanay, Nursultan, Karaganda, Kyzylorda, Shymkent and Taraz provinces and some parts of north and east Kazakhstan: Semey, Almaty, Aktobe and Oral provinces. Overall, vegetation condition was normal.

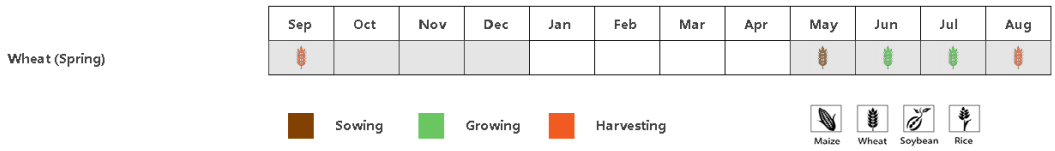
Regional analysis

In the **Northern zone**, NDVI was below the five-year average in March and late April and above or close to the average in other months. RAIN and TEMP were above average (+5% and +1.2°C), but RADPAR was below average (-4%). The agroclimatic indicators also resulted in an increase of the BIOMSS index by 4%. The maximum VCI index was 0.74. Among the CropWatch indicators, agroclimatic condition was favorable in this zone.

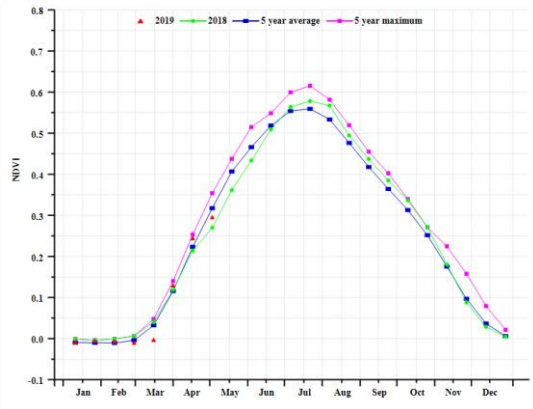
The condition of vegetation and rangelands was generally below the five-year average from late February to late March and close to the average in other months in the **Eastern plateau and south-eastern zone**. RAIN and TEMP were above average (+3% and +2.0°C), RADPAR was below (-4%) and BIOMSS is up 14%. The maximum VCI index was 0.82, and the cropped arable land fraction increased by 3%.

The **South zone** recorded generally above average NDVI from late February to April. RAIN and TEMP were +19% and +1.7°C above average, but and RADPAR was below average (-7%). The agroclimatic indicators also resulted in an increase of the BIOMSS index by 15%. The maximum VCI index was 1.02 due to high and frequently non-freeze temperature.

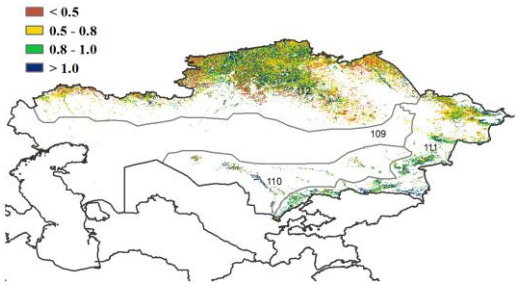
Figure 3.23 Kazakhstan's crop condition, January - April 2019



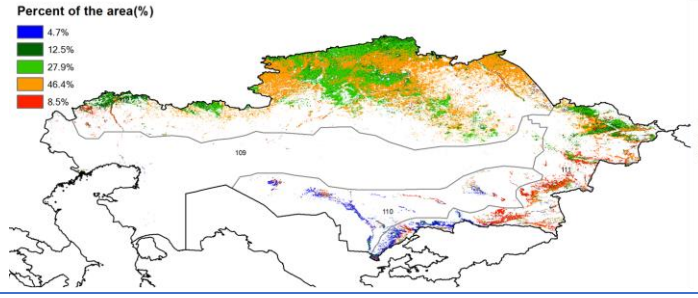
(a). Phenology of major crops



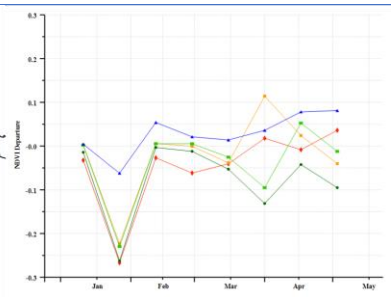
(b) Crop condition development graph based on NDVI



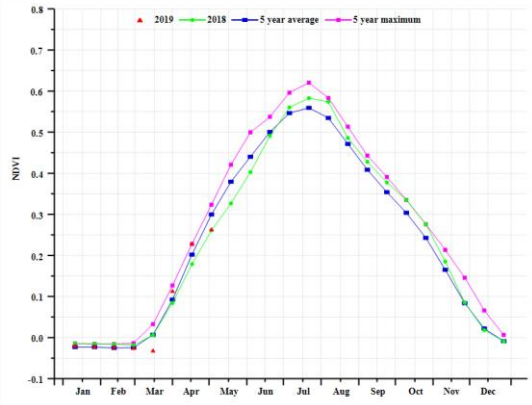
(c) Maximum VCI

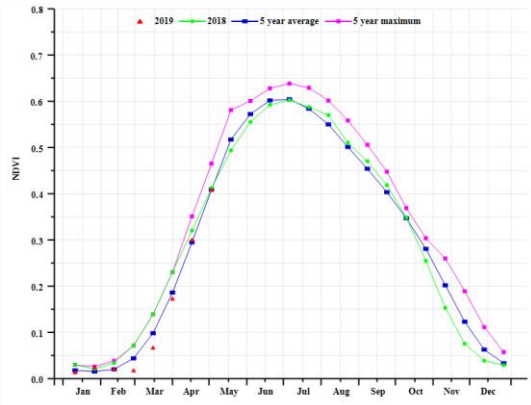


(d) Spatial NDVI patterns compared to 5YA

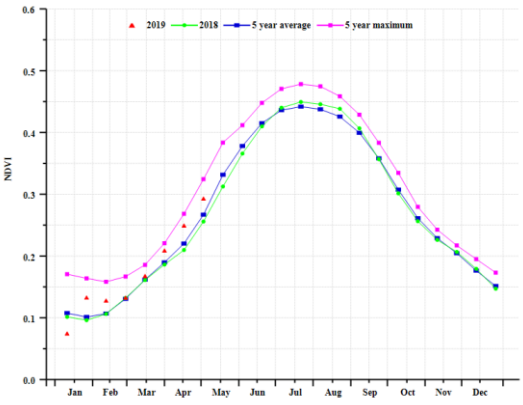


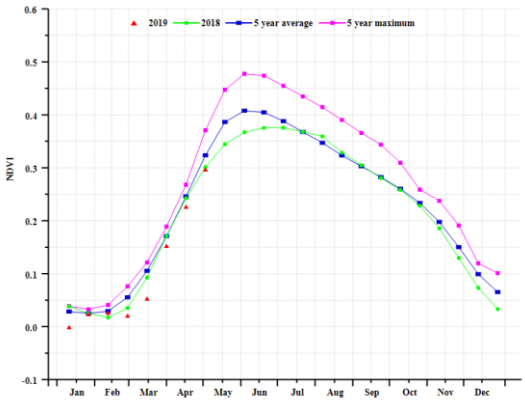
(e) NDVI profiles





(f) Crop condition development graph based on NDVI in Northern region (left) Eastern plateau and southeastern region (right))





(g)Crop condition development graph based on NDVI in South region(left) and Central non-agricultural region (right)

Table 3.37 Kazakhstan agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, January - April 2019

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m²)	Departure from 15YA (%)
Northern region	155	5	-6.6	1.2	573	-4
Eastern plateau and southeastern region	168	1	-2.9	2.0	743	-3
South region	166	19	3.5	1.7	717	-7
Central non-agriculture region	138	-10	-3.0	1.5	663	-2

Table 3.38 Kazakhstan, agronomic indicators by sub-national regions, current season's values and departure from 5YA/15YA, January - April 2019

Region	BIOMSS		CALF		Maximum VCI
	Current (gDM/m²)	Departure from 15YA (%)	Current (%)	Departure from 5YA (%)	Current
Northern region	463	2	-	-	0.74
Eastern plateau and southeastern region	534	13	38	3	0.82
South region	633	15	-	-	1.02
Central non-agriculture region	538	-2	-	-	0.66

[KEN] Kenya

Kenya experiences a large variety of rainfall patterns, mostly referred to as long rain and short rain and resulting in similar cropping patterns: long rain maize and wheat, short rain maize.

Long rain maize was planted during the reporting period while short rain maize reached maturity and harvest. The rainfall recorded nationwide was 184mm, a significant drop of 40% below average. Temperature and RADPAR were above average by 0.1°C and 5%, respectively. The low precipitation led to reduced BIOMASS that dropped 39% below average. The cropped arable land fraction was reduced by 3%. The maximum VCIx value was 0.76. According to clusters and the map of NDVI profiles, crop condition was below average except during mid-January, which indicates a poor short rains crop at the time of harvest. This is confirmed by the national graph of crop condition development which stayed below average until the end of the reporting period. During the reported period, wheat and maize crops are expected from the major production areas. However, the spatial NDVI patterns indicate that NDVI was below average in many central areas. This spatial pattern only partially reflected by VCIx, the national average of which reached 0.87, with low values in pastoral areas of the Rift Valley (Laikipia, Nakuru and Trans-Nzioia, where wheat is an important production) but also some Western area (for instance from Bungoma, where maize and cattle are the main-stays of the agricultural economy).

Generally, due to the rainfall deficit, the agronomic indicators mentioned above show less than average conditions for some important crop areas of Kenya.

Regional analysis

Considering the cropping system, climatic zones and topographic conditions we divided this country into four agro-ecological zones (AEZ): The Coast, Highland agriculture zone, northern rangelands, and south-west.

The **Coast** includes the districts of Kilifi, Kwale and Malindi. It recorded low rainfall, 31 mm, 80% below average while TEMP and RADPAR were above average (0.1°C and +6%). The total biomass production was below average by -71% compared to 5YA. The NDVI profile was also below average with marked fluctuations at the start of the reporting period. Throughout the reporting period, maximum VCIx was 0.79 with CALF at 95%. Overall, the coastal area, where the rainy season is just starting, had conditions unfavorable for livestock and crops.

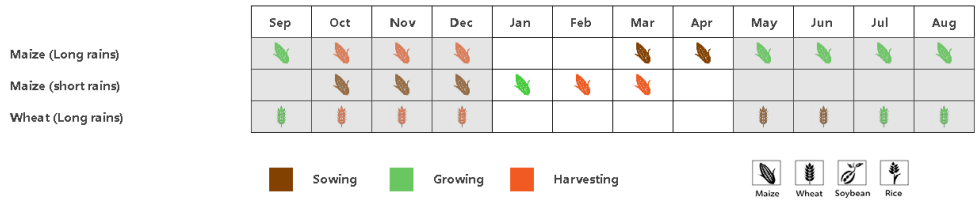
In the mostly temperate **Highland agriculture zone** NDVI was above average during January but then dropped to below average until the end of the reported period. At 187 mm rainfall was 38% below average. The temperature and sunshine were up (TEMP +0.1°C, RADPAR +6%) and BIOMASS was down 41% below average. The CALF (91%) was 4% below average. The maximum VCIx value was recorded at 0.75. In general, based on all CropWatch indicators the crop condition is assessed as unfavorable where VCIx was low.

The **northern rangelands** recorded scarce of rainfall with RAIN at 85 mm, or 51% below average, affecting districts such as Turkana, Samburu, and Baringo. The deficit leads to a decrease in the total biomass production (BIOMASS down 46%). The temperature was above average by 0.6°C and RADPAR slightly up by 3%. The NDVI development curve shows values below the five years average during the entire monitoring period. The maximum VCI was low compare to other regions at 0.58. The cropped arable land fraction also decreased (CALF, -22%). Since the region is mostly pastoral the prevailing conditions had a negative effect on livestock production.

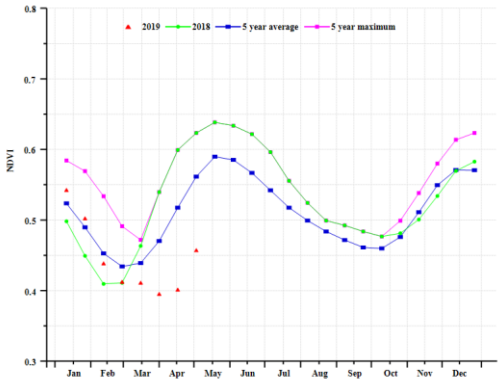
The **South-west** districts include Kisumu, Migori, Siaya, and Busia. Those districts are major producers of wheat and maize, which are in full growth. The total amount of rainfall was high (327 mm) but still 35% below average, leading to a reduction of total biomass production (-24%). The temperature was average (-0.1°C departure) and RADPAR was 3% above. While the Cropped arable land fraction remained constant. The NDVI based crop condition development shows there were fluctuations values during the

monitoring period. The maximum VCI was reached 0.79. The expected production is average at best in the North and still favorable in the South.

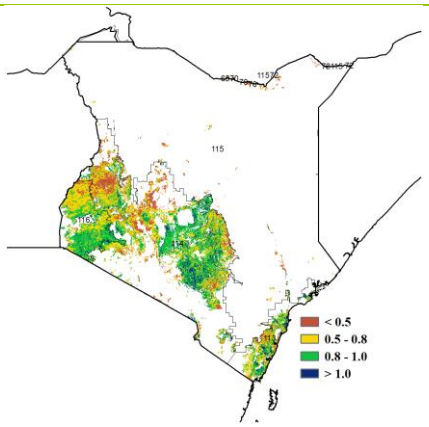
Figure 3.24 Kenya's crop condition, January – April 2019



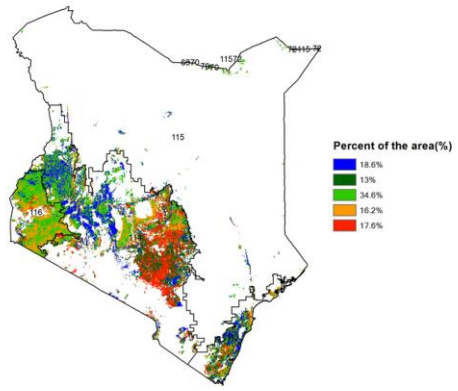
(a). Phenology of major crops



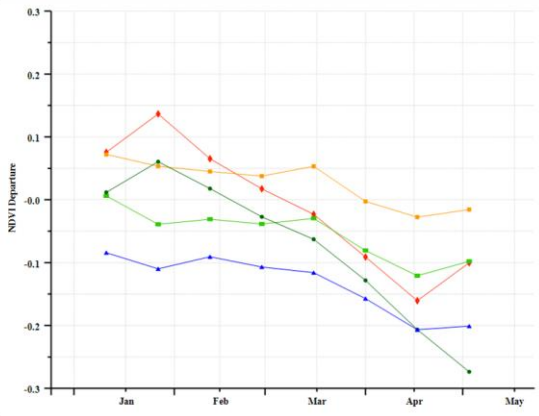
(b) Crop condition development graph based on NDVI



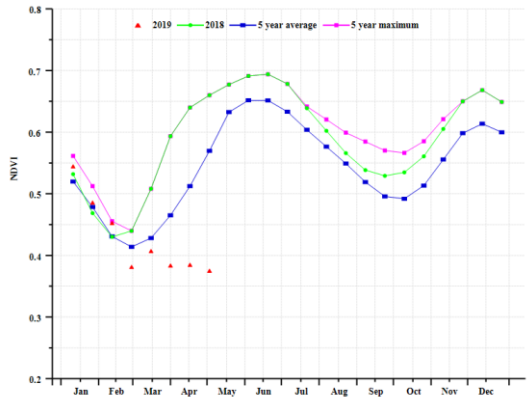
(c) Maximum VCI

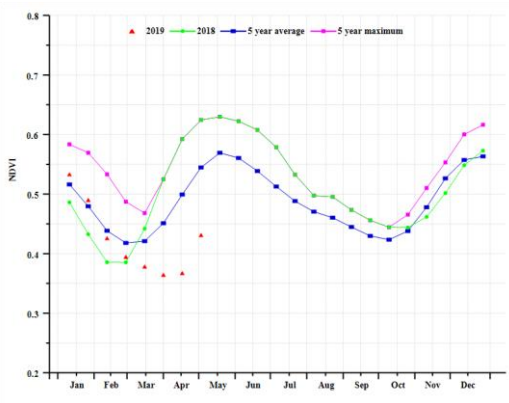


(d) Spatial NDVI patterns compared to 5YA

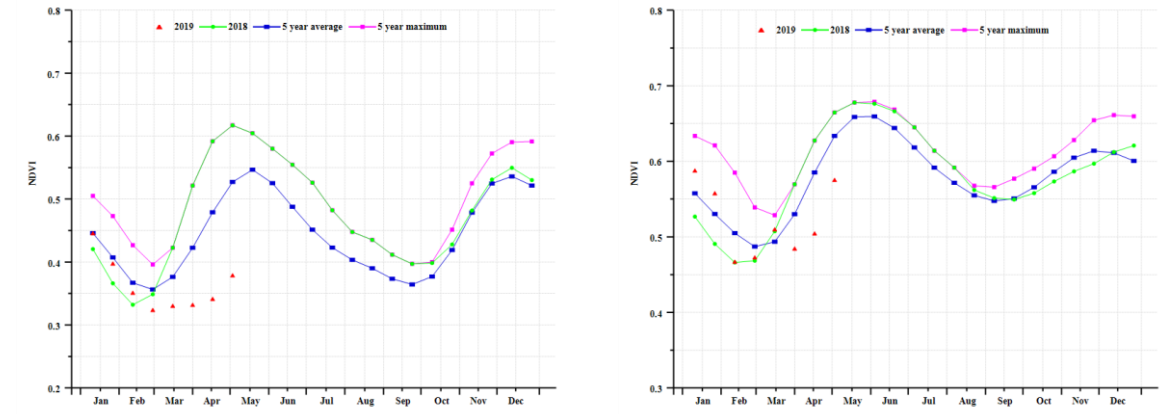


(e) NDVI profiles





(f) Crop condition development graph based on NDVI (Coast(left) and Highland agriculture zone(right))



(g) Crop condition development graph based on NDVI (Northern rangelands (left) and South-west (right))

Table 3.39 Kenya's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, January – April 2019

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m²)	Departure from 15YA (%)
Coastal	31	-80	29.1	0.1	1411	4
Highland agriculture zone	187	-38	22.5	0.1	1407	6
Northern rangelands	85	-51	28.8	0.6	1361	3
South-west	327	-35	22	-0.1	1362	3

Table 3.40 Kenya's agronomic indicators by sub-national regions, current season's values and departure from 5YA/15YA, January – April 2019

Region	BIOMSS		CALF		Maximum VCI
	Current (gDM/m²)	Departure from 15YA (%)	Current (%)	Departure from 5YA (%)	Current
Coastal	151	-71	95	5	0.79
Highland agriculture zone	546	-41	91	-4	0.75
Northern rangelands	306	-46	61	-22	0.58
South-west	1162	-24	99	0	0.79

[KHM] Cambodia

January to April covers the growing period and early harvesting stage of maize, and the harvesting time of rainy season rice. Compared to average, CropWatch agro-climatic indicators show a sharp drop in rainfall (RAIN -26%), no change for air temperature and a slight increase in radiation (RADPAR, +3%), resulting in a sharp drop in biomass production potential (BIOMASS, -17%). Moderate VCIx is observed around the Tongle Sap (<0.8), with lowest values below 0.5 in the western part of the country.

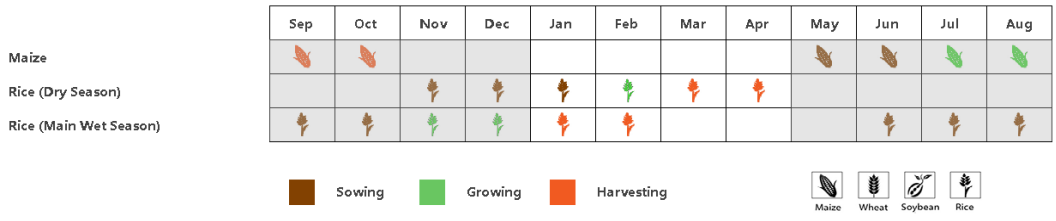
The nationwide NDVI profile displays an obvious deficit compared with 5-year average but spatial NDVI clusters only partially confirm the VCIx distribution. In March and April, 45.4 % of cropped areas display above or near average condition, with 46.2% slightly below average by 0.05 NDVI units and only 8.4% with NDVI 0.2 units below average. No clear spatial patterns emerge although the poorest crops seem to be located along the tributaries of Tonle Sap.

Regional Analysis

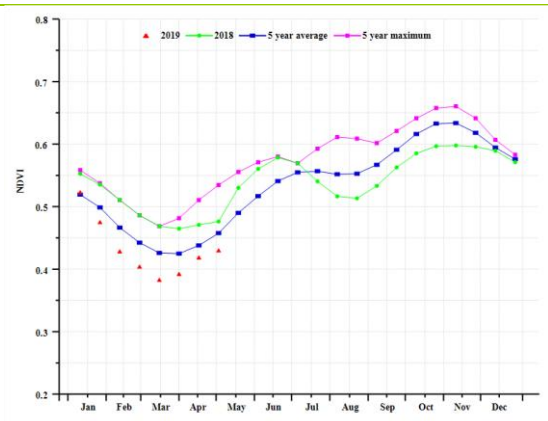
Based mostly on climate differences and topography four agro-ecological regions can be distinguished, starting with the Tonle Sap lake area where rainfall and especially temperature are influenced by the lake itself. The second and the third area, referred to as the "Mekong valley between Tonle-sap and Vietnam border" and "Northern plain and northeast" covers agriculturally less important regions east of the Lake. In the last zone, the "South-western Hilly region" monsoon plays a larger part than in the other regions where the Mekong supplies most water to farming.

All four regions suffered a reduction in rainfall compared with average in the range of 10% (Tonle Sap) to 43% in the Mekong valley between Tonle Sap and the Vietnam border. All regions had about average temperature and a positive RADPAR departure (2 to 3%) which, however, reached 6% in the northern plain and North-east. Drought caused an 8% drop in BIOMSS near Tonle Sap but larger departures from -9% to -25% in other regions. NDVI profiles also display unsatisfactory crops in all four regions. NDVI was persistently below average except in January in the Tonle Sap basin and the Mekong valley between Tonle Sap and the Vietnam border and at the end of April in the south-western Hills.

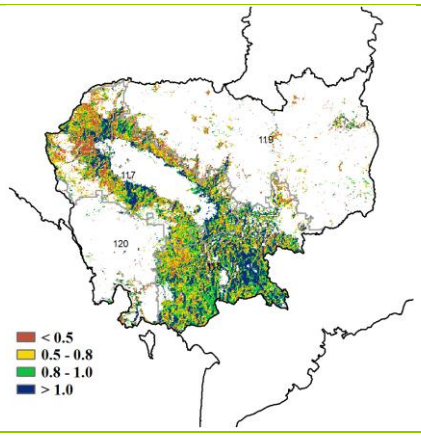
Figure 3.25 Cambodia's crop condition, January – April 2019



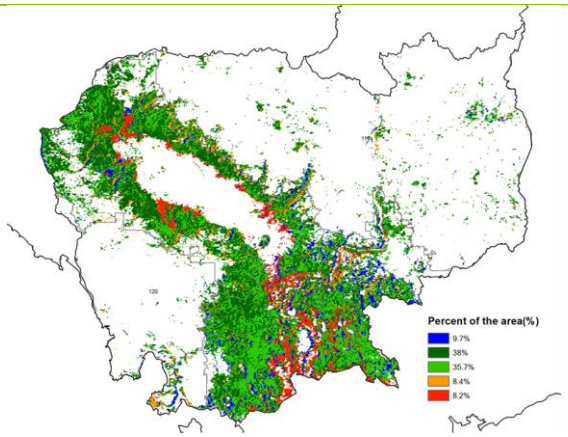
(a). Phenology of major crops



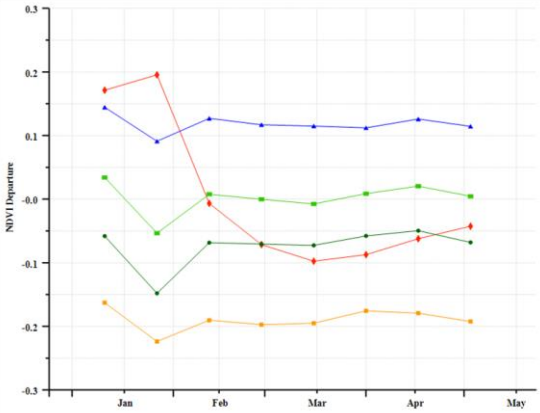
(b) Crop condition development graph based on NDVI



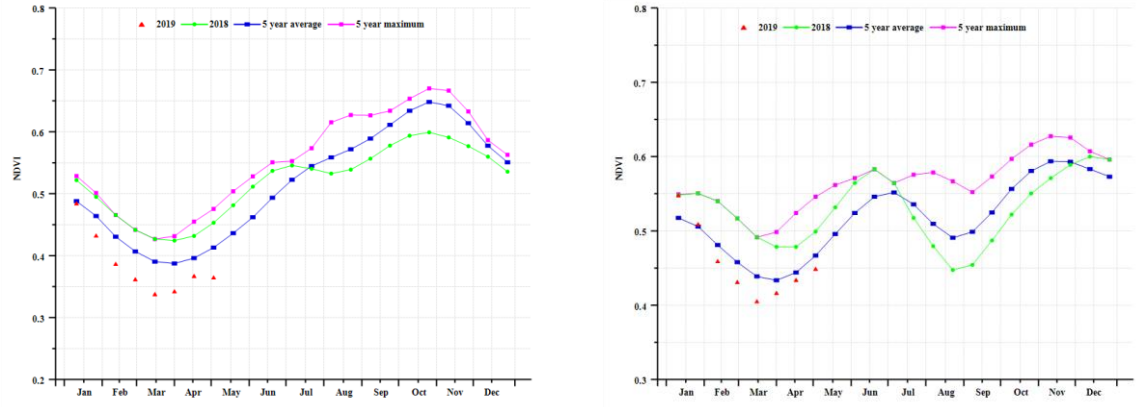
(c) Maximum VCI



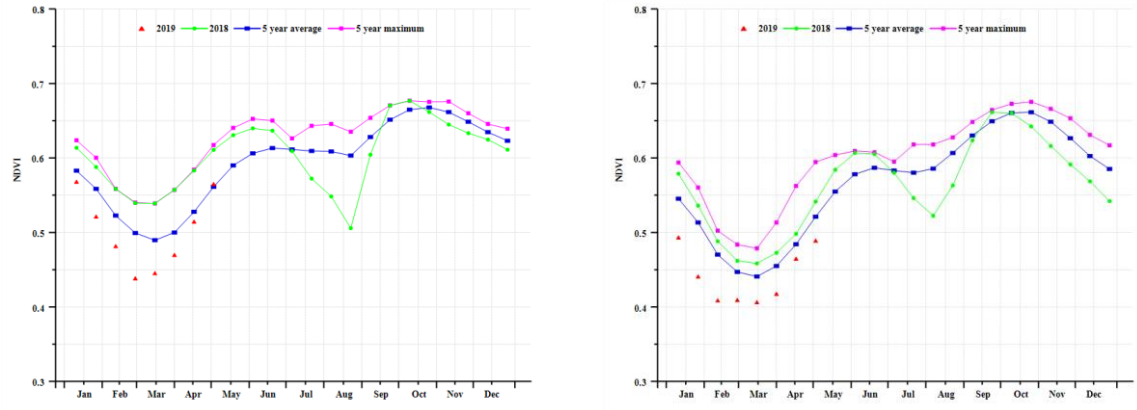
(d) Spatial NDVI patterns compared to 5YA



(e) NDVI profiles



(f) Crop condition development graph based on NDVI_Central Tonle-Sap plain (left) and Mekong valley between Tonle-sap and Vietnam borders (right))



(g) Crop condition development graph based on NDVI_Southwest Hilly region (left) and Northern plain and northeast (right))

Table 3.41 Cambodia agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, January – April 2019

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m2)	Departure from 15YA (%)
Tonle Sap	167	-10	29.2	-0.2	1185	2
Mekong valley between Tonle-sap and Vietnam border	103	-43	29.2	-0.2	1204	3
Northern plain and northeast	125	-33	28.8	0.3	1236	6
Southwest Hilly region	244	-22	26.9	-0.3	1179	3

Table 3.42 Cambodia, agronomic indicators bysub-national regions, current season's values and departure from 5YA/15YA, January – April 2019

Region	BIOMSS		Cropped arable land fraction		Maximum VCI
	Current (gDM/m^2)	Departure from 15YA (%)	Current (%)	Departure from 5YA (%)	Current
Tonle Sap	605	-8	65	-5	0.80
Mekong valley between Tonle-sap and Vietnam border	440	-26	87	8	0.89
Northern plain and northeast	465	-23	88	-7	0.69
Southwest Hilly region	859	-9	98	1	0.86

[LKA] Sri Lanka

Sri Lanka cultivates mainly maize and rice in rotation. The main Maha season extends from October to December or March (depending on location) mostly in the east. Much of the west has bimodal rainfall with the second Yala season centered around March-June. The monitoring period covers the entire growth and harvesting season of main Maha rice and maize, as well as early sowing season of Yala rice and maize. According to the CropWatch monitoring results, crop condition was below average during January to April.

Nationwide, rainfall dropped 31% below average, while temperature and radiation were near average (-0.1°C and 4%, respectively). As shown by agronomic indices, the fraction of cropped arable land (CALF) remained comparable with the 5-year average. Low precipitation in the country may have had a negative influence on Maha crops and resulted in low biomass (BIOMSS -23%). The crop condition development graph based on NDVI displayed an unfavorable situation during the whole period. Crop condition dropped below average since January and reached minimum during mid-April. Similar conditions also occurred in sub-national regions as described below. Poor performance of NDVI profiles may be related to dry climate over the country.

Spatial heterogeneity was significant throughout the country according to NDVI clusters map and profiles. 17.1% area of the cropland displayed good crop condition during January to April, mainly distributed in scattered areas in Colombo to Galla, Kurunegala, Kandy, Nuwara Eliya and Badulla. 45.2% area of the cropland, distributed in the same areas as above, enjoyed average conditions before mid-February and slowly declined since then. The remaining cropland showed negative departures at different times and locations. 21.4% of cropland was below average since mid-February around Puttalam, Anuradhapura, Trincomalee and Polonnaruwa. 7.4%, scattered in north-eastern areas, deviated far from average in February. In addition, 8.9% of the cropland (between Anuradhapura and Trincomalee) showed negative values during the whole period. The maximum VCI map displays a mostly fair situation with low values distributed in south-western regions and high values occurring throughout the country.

Regional analysis

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

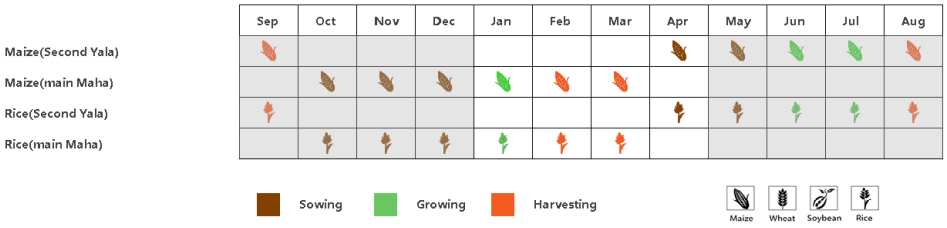
There is little difference between the three AEZs in terms of agronomic indices. The CALF for the three sub-national zones is almost the same and shows full cropping. VCIx values are above 0.95 for the Dry zone and the Intermediate zone, and somewhat lower (0.89) for the Wet zone. The BIOMSS indices, however, displayed different decreases: 28%, 12% and 26%, respectively.

The **Dry zone** is the largest of the three AEZs and located in the eastern half of the country (from north to south). The agro-climatic conditions show that rainfall fell 45% compared with average, while both temperature and radiation were near. Crop condition of the zone was below average during almost the whole period, akin to the nationwide situation

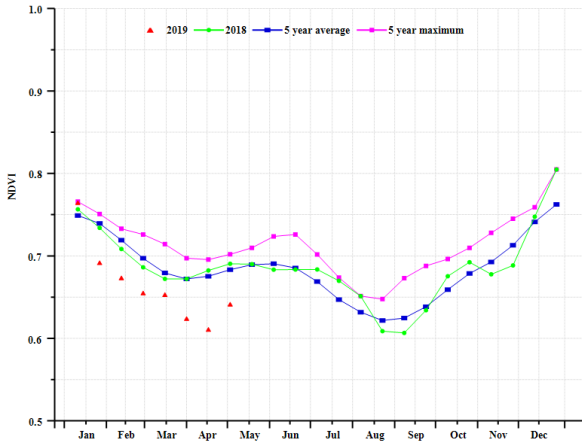
The **Wet zone** covers the smallest area (in the south-west) as well as the “most favorable” agro-climatic condition among AEZs. Rainfall was below average by 9% and temperature and radiation were respectively close to average and above (+0.1℃ and +7%). Indicators were near average before mid-March and deteriorated since then, but crops are nevertheless assessed as average.

In the **Intermediate zone** agro-climatic indicators are close to national values. The rainfall decreased by 32% and both temperature and radiation are slightly above average. According to the NDVI development graphs, crop condition is near average.

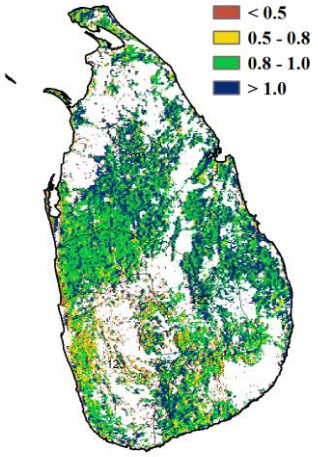
Figure 3.26 Sri Lanka's crop condition, January - April 2019



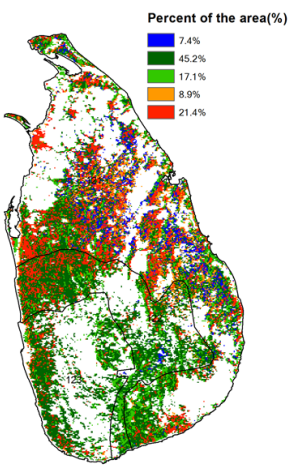
(a). Phenology of major crops



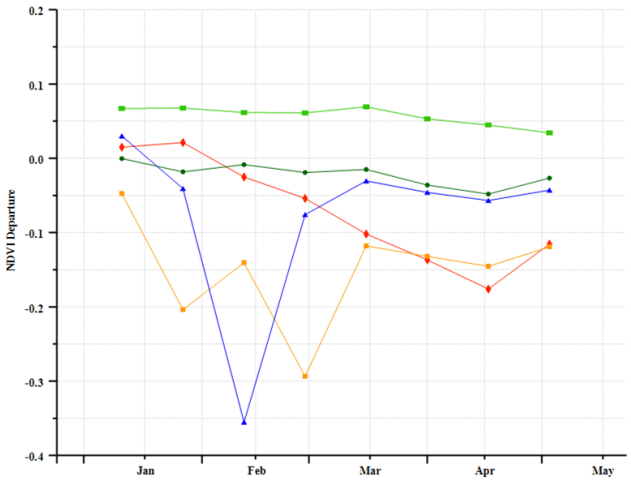
(b) Crop condition development graph based on NDVI



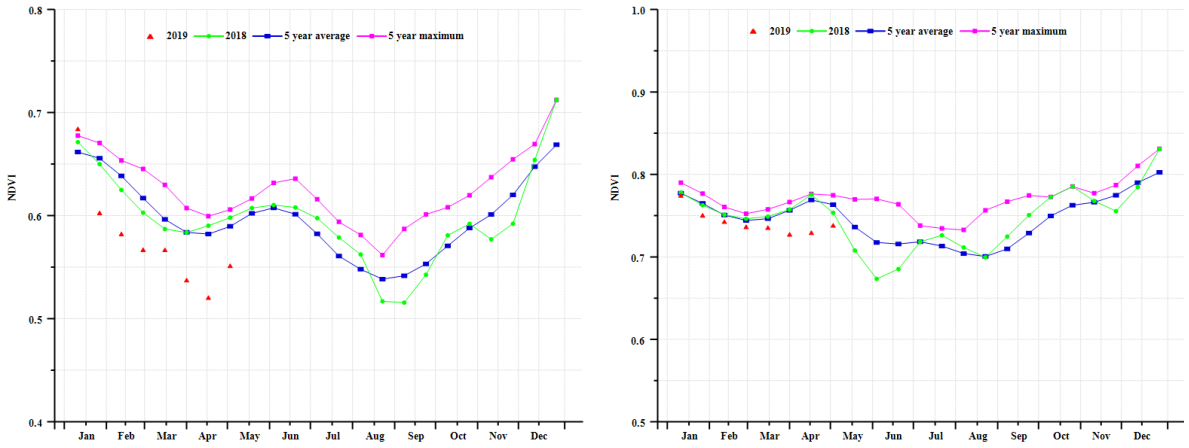
(c) Maximum VCI



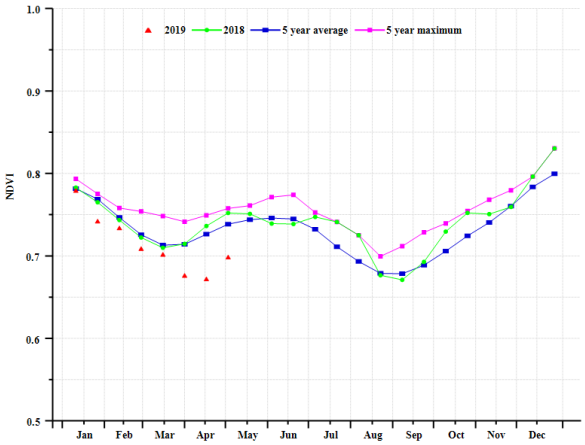
(d) Spatial NDVI patterns compared to 5YA



(e) NDVI profiles



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



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

Table 3.43 Sri Lanka's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, January - April 2019

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m²)	Departure from 15YA (%)
Dry zone	258	-45	28	-0.1	1303	3
Wet zone	698	-9	25	-0.1	1217	7
Intermediate zone	446	-32	27.1	-0.1	1213	4

Table 3.44 Sri Lanka's agronomic indicators by sub-national regions, current season's values and departure from 15YA, January - April 2019

Region	BIOMSS		CALF		Maximum VCI
	Current (gDM/m²)	Departure from 15YA (%)	Current (%)	Departure from 5YA (%)	Current
Dry zone	799	-28	99	1	0.98
Wet zone	1508	-12	100	0	0.89
Intermediate zone	1111	-26	100	0	0.95

[MAR] Morocco

Winter wheat was growing, and maize was planted during the reporting period. The CropWatch agroclimatic indicators show that the rainfall (RAIN) was well 39% below the average with no significant change in the temperature (TEMP) compared with average. The estimated RADPAR was slightly above the average (by 3% increase), while the BIOMSS was significantly down (36%) due to the drop in the rainfall. The CALF was average but low (58%).

Nationwide, NDVI showed above average values until mid-February. Crop condition then dropped below the 5YA until the end of the reporting period. The same pattern is confirmed at the sub-national level: only 13.4% of the total cropped area remained above average during the whole reporting period. The VCIx ranged between moderate (0.5 – 0.8) to high (0.8 -1.0) for most regions except the central part of Souss-Massa and Guelmim-Oued Noun Provinces and the coastal part of the Oriental Province where the VCIx was low (< 0.5). Nationwide, the estimated VCIx was moderate (0.8). Altogether, CropWatch estimates depict fair crop conditions.

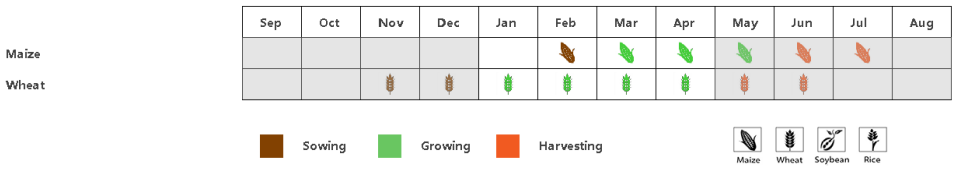
Regional analysis

Based on the cropping system, climatic zones, and topographic conditions, four sub-national agro-ecological regions (AEZs) can be distinguished for Morocco. Only three of them are relevant for crops: **Sub-humid northern highlands** including central Centre-Nord Region and northen Centre-Sud, **Warm semi-arid zone** covering the regions of Nord-Oriental and the broad Tensift TRegion, and **Warm sub-humid zone** of the Nord-Ouest Region.

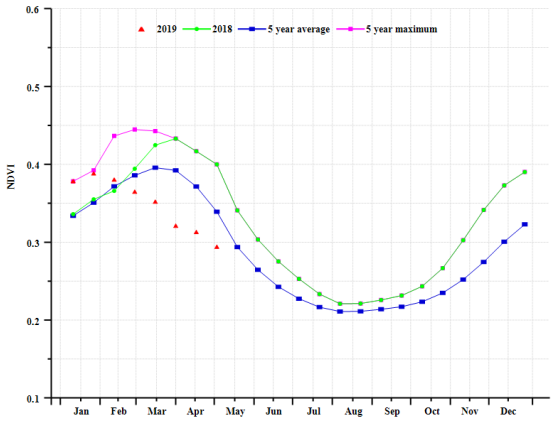
The agroclimatic indicators for the three AEZs show a high reduction in rainfall (-34%, 40% and 43%, respectively) with about average temperature (departures between -0.1°C and +0.1°C). RADPAR was slightly above average (3% to 4%) for the three zones. The agronomic indicators showed a 35% to 40% reduction in the estimated BIOMSS. The CALF was above the average for the first and third zones (5 and 6%, respectively) but 11% below the average for the second zone. Also, the maximum VCI was high (0.9) for the first and the third zone but moderate (0.7) for the second, the Warm semi-arid zone.

The NDVI development graphs follow the same pattern as the nationwide NDVI-based graph: condition of crops was first above average and then dropped to be below average. The difference between zones was in the time when the crop conditions turned to be below average: March for **Sub-humid northern highlands**, end of January for **Warm semi-arid zones**, and end of February for **Warm sub-humid zones**.

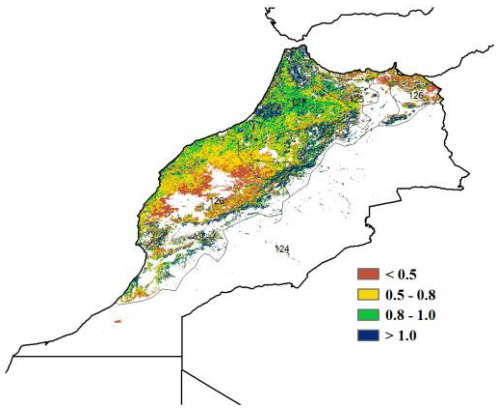
Figure 3.27 Morocco's crop condition, January - April 2019



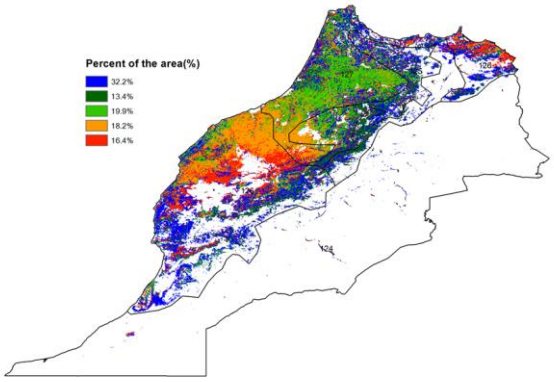
(a). Phenology of major crops



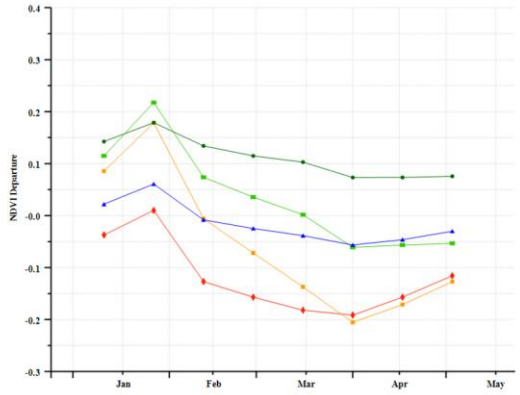
(b) Crop condition development graph based on NDVI



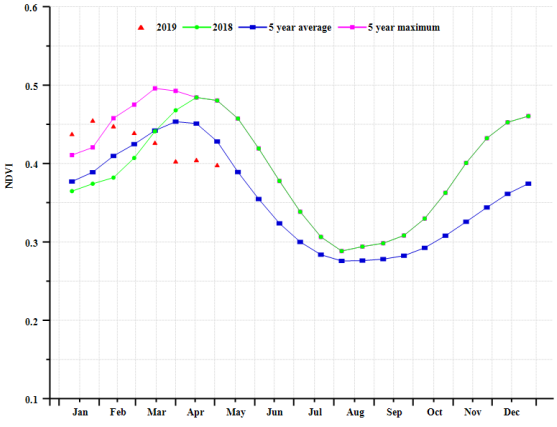
(c) Maximum VCI

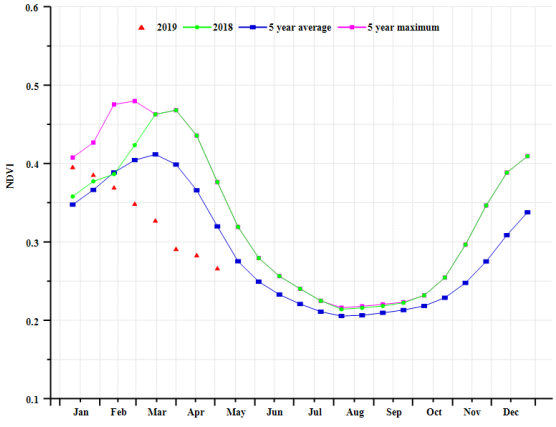


(d) Spatial NDVI patterns compared to 5YA

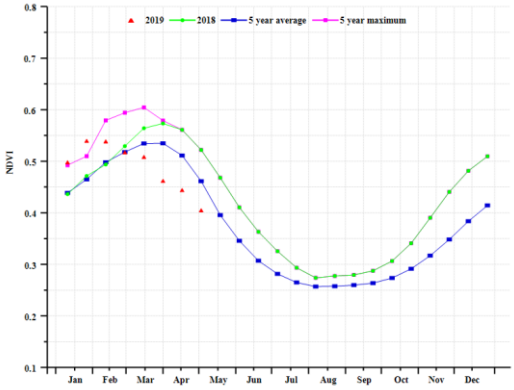


€ NDVI profiles





(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.

Table 3.45 Morocco's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, January - April 2019

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m²)	Departure from 15YA (%)
Sub-humid northern highlands	124	-34	10	0.1	990	3
Warm semi-arid zones	72	-40	12.3	0.1	1112	4
Warm sub-humid zones	116	-43	12.4	-0.1	1003	3

Table 3.46 Morocco's agronomic indicators by sub-national regions, current season's values and departure from 5YA/15YA, January - April 2019

Region	BIOMSS		CALF		Maximum VCI
	Current (gDM/m²)	Departure from 15YA (%)	Current (%)	Departure from 5YA (%)	Current
Sub-humid northern highlands	452	-35	66	5	0.9
Warm semi-arid zones	270	-37	40	-11	0.7
Warm sub-humid zones	440	-39	83	6	0.9

[MEX] Mexico

Maize has reached harvesting from January to March in North-west Mexico; rice and soybean planting started from April. Winter wheat was growing between January and March and matured in April. According to the crop condition development graph based on NDVI, crop condition at the national level was average from early January to early February but deteriorated continuously from late February through April.

The CropWatch agro-climatic indicators show that temperature and RADPAR were average (+0.1°C and +1%, respectively) but rainfall dropped 49%, which might have negatively affected crop growth, as shown by BIOMSS (down 29%) and a relatively low VCIx (0.80). Low VCIx values (below 0.5) were widespread in central and eastern Mexico (such as Durango, Zacatecas, Guanajuato and Nuevo Leon), whereas high values (above 0.8) occurred in the south-eastern and north-western parts of the country, including Veracruz-Llave, Tabasco, Chiapas and Sonara. Consistent with the pattern of VCIx, below-average NDVI, accounting for 21.3% of all arable land, mainly appears in eastern Mexico (i.e., Tamaulipas and Nuevo Leon). In contrast, 22% of cropped areas recorded continuously above average NDVI in north-western, northern and south-eastern parts of the country (covering Sonara, Chihuahua, Coahuila De Zaragoza, Tabasco and Chiapas). Crop production of the current season is assessed as below average, although the average CALF of the country increased 1% compared to the past 5-year average.

Regional analysis

Based on cropping systems, climatic zones and topographic conditions, Mexico is divided into four agro-ecological regions. They include Arid and semi-arid regions (128), Sub-humid temperate region with summer rains (130), Sub-humid hot tropics with summer rains (131) and Humid tropics with summer rainfall (129).

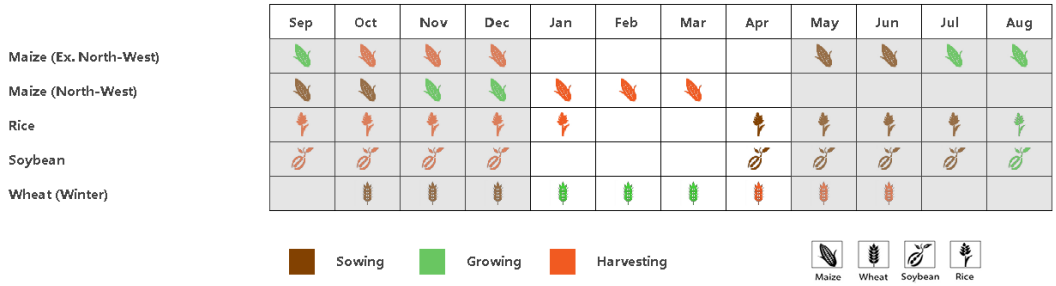
Arid and semi-arid regions are located in northern and central Mexico. During the current monitoring period the regions recorded lower than average precipitation and radiation (-23% and -2%, respectively) but average temperature which, This led to generally below-average crop condition, as indicated by the NDVI time profile.This is corroborated by relatively low values for BIOMSS (5% below average) and VCIx (0.79). Although the CALF was 3% greater than average, the prospects for crop production in these areas are not favourable.

As important crop production regions of southern Mexico, the **Sub-humid temperate region** experienced a very pronounced decline in rainfall, a decrease of 62% compared to average, which resulted in unsatisfactory crop condition, as confirmed by low BIOMSS (-55%) and VCIx (0.75). Moreover, the NDVI values were also generally below average, especially in the late stage of the reporting period. Considering that CALF decreased 1%, the production outlook for these regions is assessed as be below average.

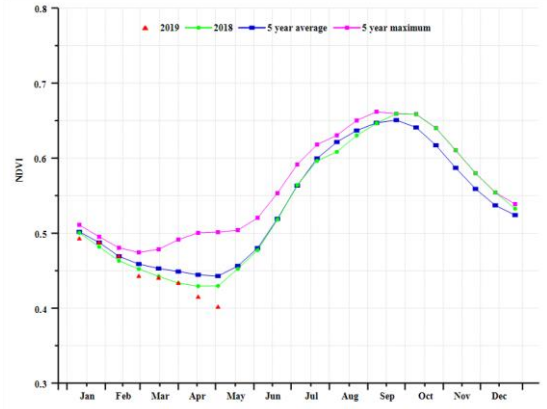
In the **Sub-humid hot tropics with summer rains**, temperature and radiation increased (0.5°C and 2%, respectively) but rainfall declined 60%, which resulted in below-average BIOMSS (-48%). The trend of crop condition development was similar to the previous region, which showed a deterioration during the reporting period. The average VCIx of the regions, remains at 0.87.

The **Humid tropics with summer rainfall** recorded rainfall that was significantly below average (-58%) while temperature and radiation were above average (+0.2°C and +4%). According to crop condition development graph based on NDVI, crop condition was generally below average in these areas, which is consistent with the decreased BIOMSS (-44%). The average VCIx in the areas was 0.89.

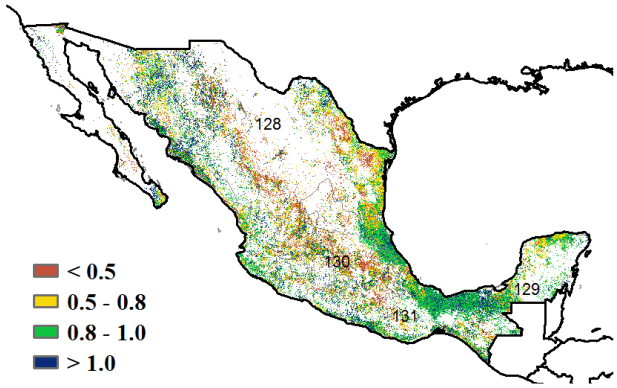
Figure 3.28 Mexico's crop condition, January - April 2019



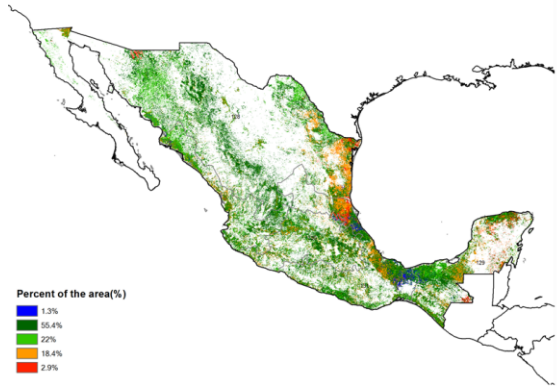
(a). Phenology of major crops



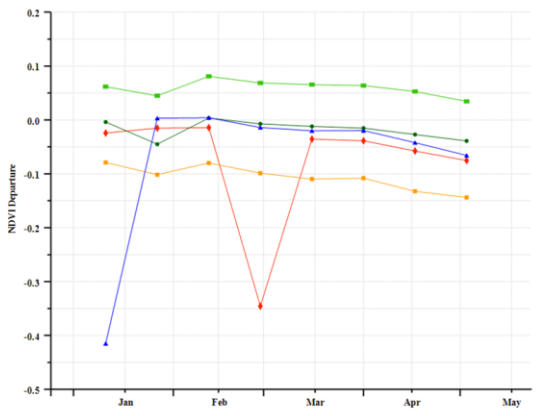
(b) Crop condition development graph based on NDVI



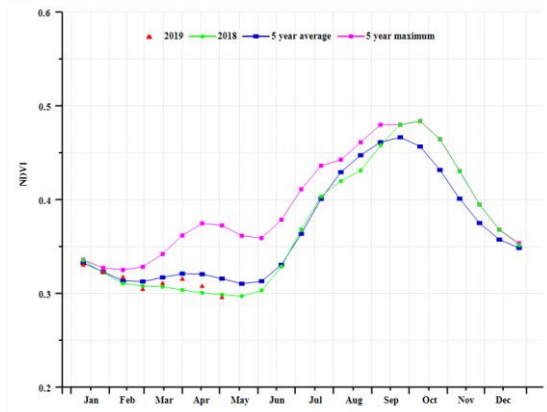
(c) Maximum VCI

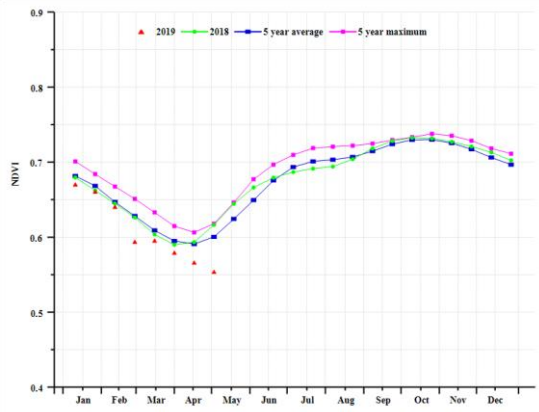


(d) Spatial NDVI patterns compared to 5YA

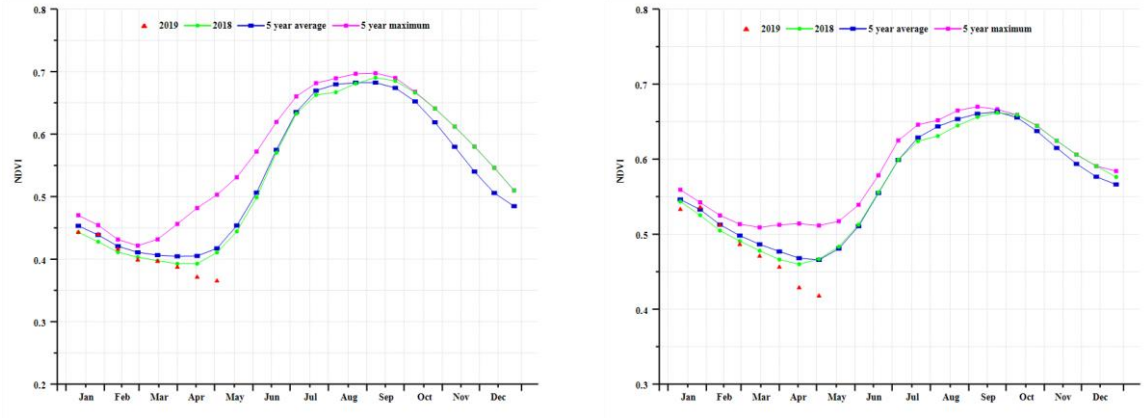


(e) NDVI profiles





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



(g) 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 3.47 Mexico's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, January - April 2019

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m²)	Departure from 15YA (%)
Arid and semi-arid regions	58	-23	16.1	-0.1	1207	-2
Sub-humid temperate region with summer rains	32	-62	19.3	0.5	1351	2
Sub-humid hot tropics with summer rains	34	-60	21.5	0.2	1277	2
Humid tropics with summer rainfall	70	-58	25.6	0.2	1209	4

Table 3.48 Mexico's agronomic indicators by sub-national regions, current season's values and departure from 5YA/15YA, January - April 2019

Region	BIOMSS		CALF		Maximum VCI
	Current (gDM/m²)	Departure from 15YA (%)	Current (%)	Departure from 5YA (%)	Current
Arid and semi-arid regions	259	-5	40	3	0.79
Sub-humid temperate region with summer rains	148	-55	52	-1	0.75
Sub-humid hot tropics with summer rains	163	-48	83	2	0.87
Humid tropics with summer rainfall	324	-44	99	0	0.89

[MMR] Myanmar

Myanmar cultivates maize, rice (two seasons) and wheat as its main crops, which are distributed across the eastern mountains, central plains and the western coastal areas. The monitoring period exactly covers the harvesting season of maize. The second rice was still growing in the first two months and was harvested from March. The wheat maturity was reached in February. CropWatch assesses crop condition throughout the country as generally comparable to the average of the previous five years.

Precipitation (RAIN), temperature (TEMP) and radiation (RADPAR) were all somewhat above average (+1%, +0.3°C and +4%, respectively) with the crop arable land fraction (CALF) increasing by 2% compared to the 5-year average. BIOMSS is up 1%. The crop condition development graph based on NDVI shows a favorable situation: average in January, close to the 5-year maximum in February, followed by a sight decline in March and April. Similar fluctuations of crop condition can also be seen in NDVI profiles of the agro-ecological regions described in the regional analysis below. During the monitoring period, the maximum VCI value for the whole country is 0.94.

In terms of spatial distributions, most of cropland across the country displayed good condition except for several patches in the Central Plain and the western coast of Tanintharyi Region. Arable land with above average NDVI (36.1% of cropland) occurs in northern Ayeyarwady Region, Yangon Region, east of Bago Region and clustered areas around Sagaing Region and Magwe Region. Slightly below average NDVI occurred in southern Sagaing Region, Magwe Region, Mandalay Region and west of Shan State (36.6% of cropland). The VCIx map displays a similar spatial distribution pattern of high values all over the country, accompanied by low values in scattered locations.

Regional analysis

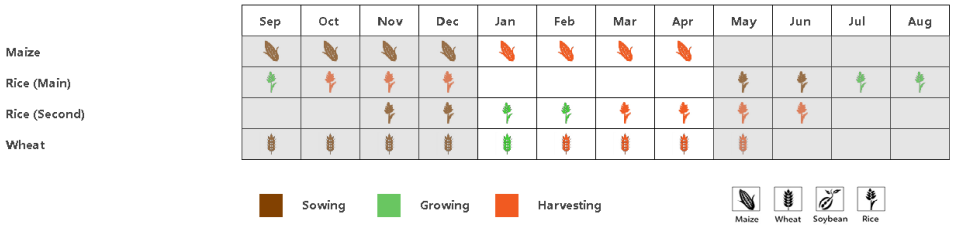
Based on the cropping system, climatic zone and topographic conditions, three sub-national agro-ecological regions (AEZs) can be distinguished for Myanmar. They are the Coastal region, the Central plain, and the Hills region.

The **Coastal region** is located in south-western Myanmar and cultivates mainly maize. The Coast experienced the most favorable conditions among the three AEZs, which was also the case during the previous ONDJ period. Rainfall exceeded average by 22% and both temperature and radiation were slightly above average (TEMP up 0.2°C, RADPAR up 4%). CALF is 4% above the 5-year average. Crop condition is also above average for the region, of which the biomass displays an increase of 13% over average and the maximum VCI value reaches 1.03, indicating outstanding crops.

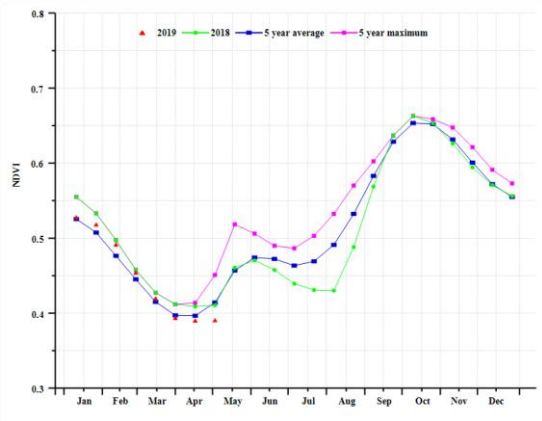
The **Central plain** is the main rice growing area in Myanmar, covering several Regions such as Magwe, Mandalay and northern Bago. Agro-climatic conditions were roughly similar to those in the Coastal region. Rainfall is above average (RAIN +13%) with both temperature and radiation above average as well (TEMP 0.3°C and RADPAR 4%). The CALF reached 70%, 1% over average, and the biomass raises 8% compared to 15-year average. The condition of crops is fair with maximum VCI of 0.88.

Maize is the main crop in the **Hills region** (States of Shan, Kachin, Chin and Rakhing and Sagaing Region). Compared with the other two AEZs, rainfall varies in the opposite direction while temperature and radiation remain comparable: RAIN -11%, TEMP -0.2°C and RADPAR 4%. Affected by relatively poor conditions, the biomass declines by 6%. However, crop condition remains average according to NDVI profiles and the high maximum VCI value (0.99).

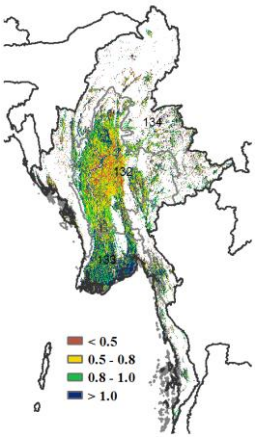
Figure 3.29 Myanmar's crop condition, January - April 2019



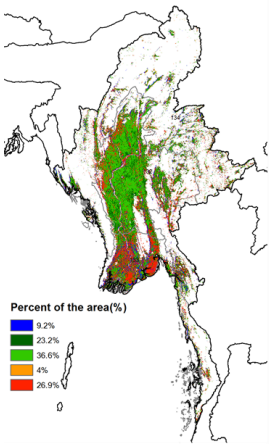
(a). Phenology of major crops



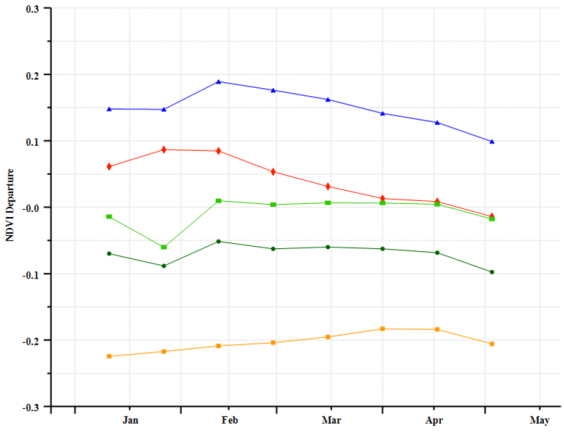
(b) Crop condition development graph based on NDVI



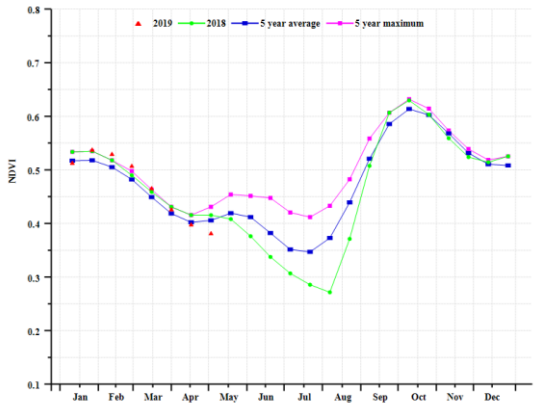
(c) Maximum VCI

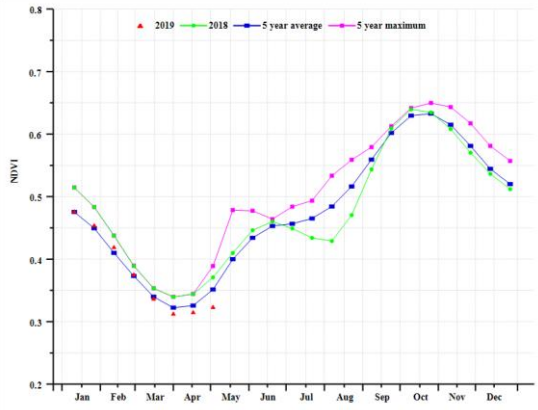


(d) Spatial NDVI patterns compared to 5YA

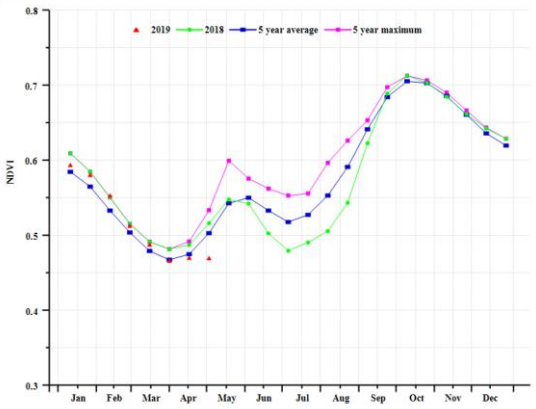


(e) NDVI profiles





(f) Crop condition development graph based on NDVI (Coastal region (left) and Central plain (right))



(g) Crop condition development graph based on NDVI (Hill region)

Table 3.49 Myanmar's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, January - April 2019

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m²)	Departure from 15YA (%)
Coastal region	114	22	28.8	0.4	1332	4
Central plain	60	13	25.8	0.3	1318	4
Hill region	94	-11	21.9	0.2	1267	4

Table 3.50 Myanmar's agronomic indicators by sub-national regions, current season's values and departure from 5YA/15YA, January - April 2019

Region	BIOMSS		CALF		Maximum VCI
	Current (gDM/m²)	Departure from 15YA (%)	Current (%)	Departure from 5YA (%)	Current
Coastal region	361	13	90	4	1.03
Central plain	253	8	70	1	0.88
Hill region	383	-6	94	2	0.99

[MNG] Mongolia

Due to seasonably cold weather, no crops were grown in Mongolia during the monitoring period. The national average VCIx was 0.91. Among the CropWatch agroclimatic indicators, RAIN was below average (-27%) and TEMP and RADPAR were above (+2.2°C and +2%). The combination of factors resulted in low BIOMSS (18% below average). As shown by the NDVI development graph, the vegetation condition was above average from January to late March and below average in April. However, NDVI was lower than 0.2, which is indicates essentially bare soil or dry vegetation, or snow. The national NDVI development graph and the spatial NDVI profiles show that 84.5% of arable lands were above average from February to late March, mostly in Khentii, eastern parts of Dornod, Selenge and patches in Bulgan and Hovsgol provinces. The observation is clearly related to high temperature.

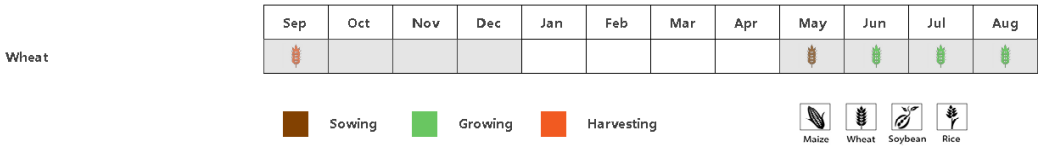
Regional analysis

In the **Khangai Khuvsgul region**, NDVI was above the five-year average from January to March and close to the average in April. RAIN was below average (-7%), while TEMP and RADPAR were above average (+1.4°C and +2%). The BIOMSS index decreased by 11% compared to the fifteen-year average. The maximum VCI index was 1.

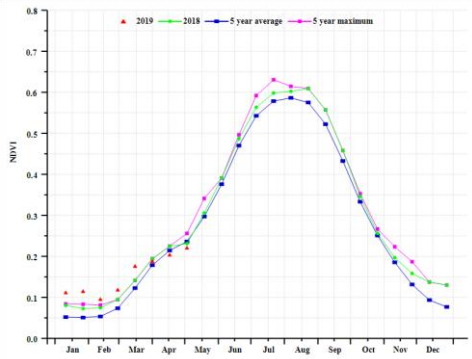
Vegetation condition was above the five years average from January to March and below the five years average in April in the **Selenge-Onon region**. Accumulated rainfall was well below average (RAIN -46%). TEMP and RADPAR were above average (+2.5°C and +3%). The BIOMSS index decreased by 29% compared to fifteen years average. The maximum VCI index was 0.89.

According to the NDVI development graph, vegetation condition in the **Central and Eastern Steppe Region** was above the five-year maximum. RAIN and TEMP were above average (+19% and +3.5°C), while BIOMSS index increased by 15% compared fifteen years average and RADPAR was above five years average (+1%) in this region. The maximum VCI index was 0.80. Unseasonably favourable conditions have benefited grasslands but much water was lost to increased evaporation due to unusually warm weather.

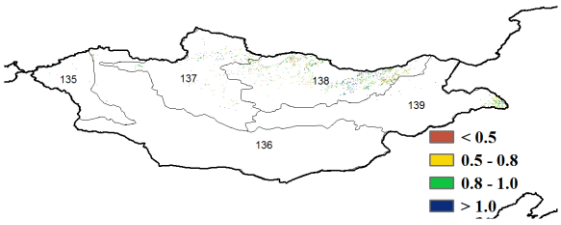
Figure 3.30 Mongolia's crop condition, January - April 2019



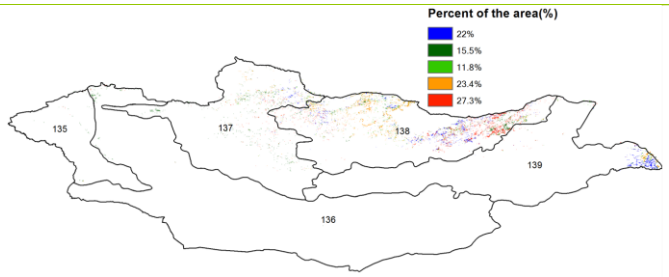
(a). Phenology of major crops

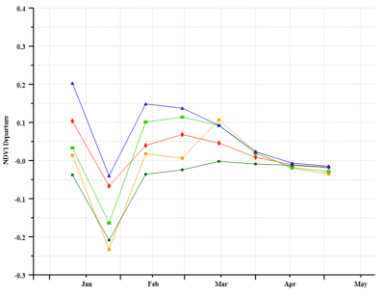


(b) Crop condition development graph based on NDVI

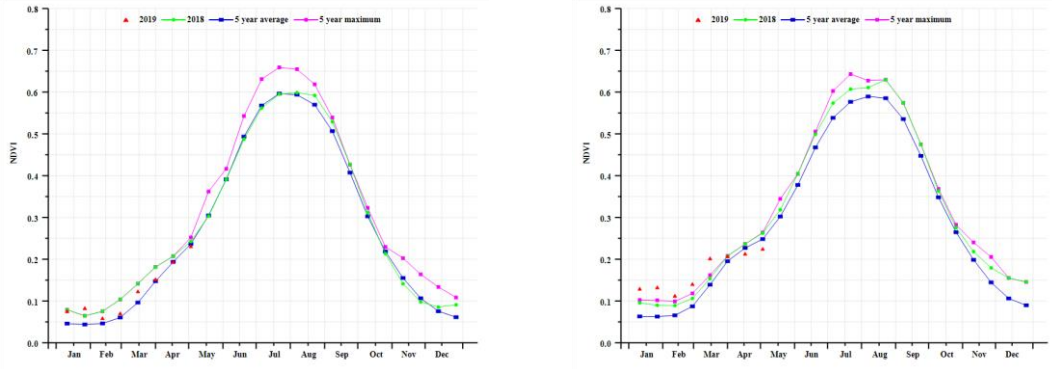


(c) Maximum VCI

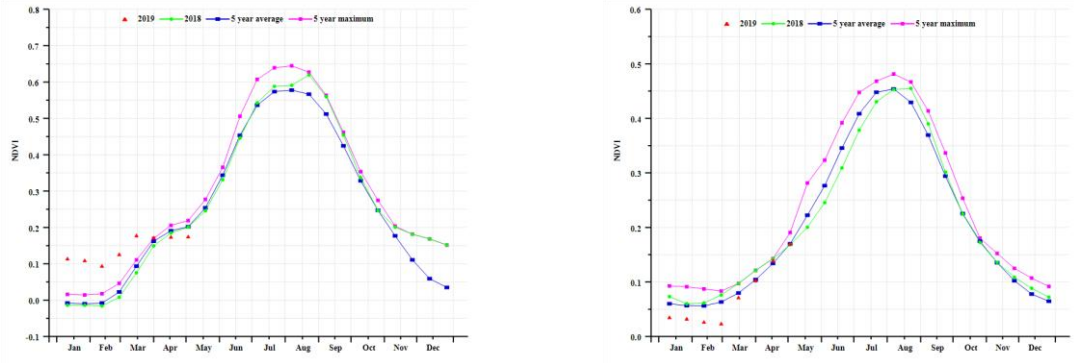




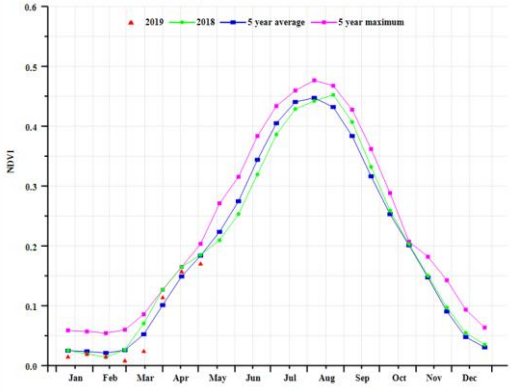
(d) Spatial NDVI patterns compared to 5YA (e) NDVI profiles



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



(g) Crop condition development graph based on NDVI Central and Eastern Steppe Region (left), and Altai Region (right))



(h) Crop condition development graph based on NDVI (Gobi Desert Region)

Table 3.51 Mongolia's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, January - April 2019

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m²)	Departure from 15YA (%)
Hangai Khuvsgul Region	51	-7	-13.2	1.4	821	2
Selenge-Onon Region	36	-46	-10.2	2.5	814	3
Central and Eastern Steppe Region	90	19	-9.4	3.5	819	1
Altai Region	93	-9	-12.8	1.1	768	2
Gobi Desert Region	32	-31	-15.9	0.9	794	3

Table 3.52 Mongolia's agronomic indicators by sub-national regions, current season's values and departure from 5YA/15YA, January - April 2019

Region	BIOMSS		CALF		Maximum VCI
	Current (gDM/m²)	Departure from 15YA (%)	Current (%)	Departure from 5YA (%)	Current
Hangai Khuvsgul Region	212	-5	-	-	1.00
Selenge-Onon Region	195	-29	-	-	0.89
Central and Eastern Steppe Region	313	15	-	-	0.80
Altai Region	342	31	-	-	0.85
Gobi Desert Region	159	-27	-	-	0.84

[MOZ] Mozambique

The monitoring period covers the growth and harvest of Maize and Rice and, the sowing and early growth of Wheat. Compared to average, the agroclimatic indicators for this period showed an increase in rainfall by about 27%. The rainfall profile for this period reveals high values during the end of January and Mid-March. The high rainfall recorded in mid-March is directly related to the IDAI cyclone which overwhelmed the country, particularly in the Buzi and Lower Zambezi river basins. This event caused floods which had a significant impact on crop conditions over these regions. Additional detail is provided in Chapter 5. Both temperature and radiation decreased by about 0.7°C and 1%, respectively. The agronomic indicators show an increase in Biomass (+4%) and the cropped arable land fraction (0.3%) over the country. The maximum VCI recorded for this period was 0.94.

The NDVI development graph indicates unfavourable crop conditions from February till the end of the monitoring period when compared to the past five-years average. According to the spatial NDVI above 5YA crop condition was observed in 24.3% of the total cropped area, most notably in Southern Tete and Northern Sofala. Besides, 14.7% of the cropped area had below average crop conditions during the entire monitoring period, which includes a sudden drop during mid-March, mostly in Sofala and Zambézia Provinces. The observed floods influenced the low crop conditions recorded over these areas. Despite the unfavourable crop conditions in most of the cropped areas, nationwide, better than average (VCIx was observed.

Floods affected mostly the central Provinces of Sofala and Manica. By March 26th, the inundated area was about 251,000 Ha (about 3.6% of the total country's cropland area). By April 9th, 158,000 Ha (corresponding to 1.4% of the total country's cropland area) were still under water with crops completely lost. The floods did not have a significant impact on crop condition nationwide. The CropWatch estimated 2019 production to reach 2044 thousand tons for Maize and 374 thousand tons for Rice. This production corresponds to a variation of -2% and -0.5% for Maize and Rice, respectively, when compared to the year 2018.

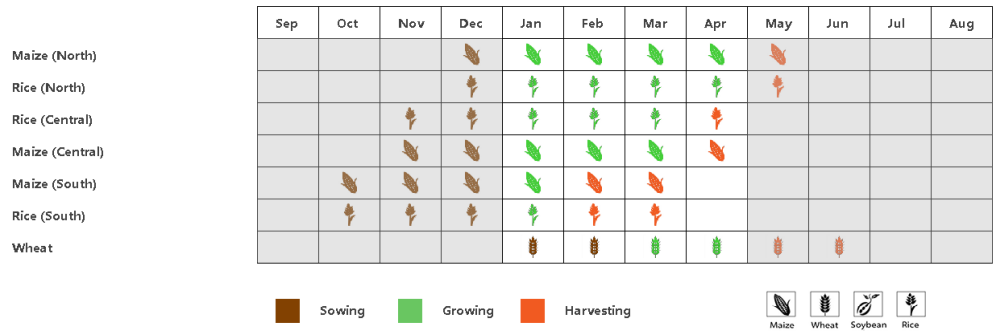
Regional analysis

According to the cropping system, topography and climate, Mozambique is subdivided into five agro-ecological zones (AEZ), listed as follow: (1) Buzi basin (2) Northern high altitude areas (3) Low Zambezi basin (4) Northern coast and (5) Southern region.

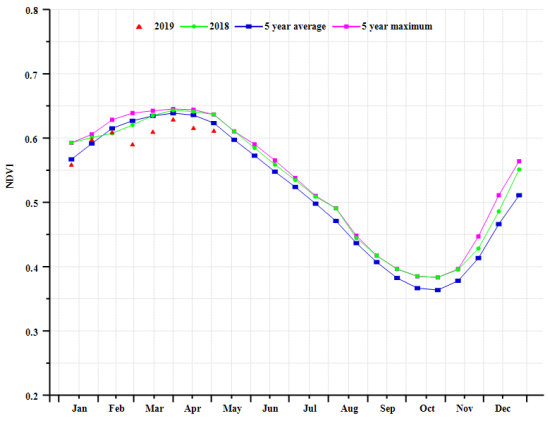
During the monitoring period, except for **Northern high altitude areas**, the agro-ecological zones showed a significant increase in rainfall, and the **Low Zambezi** river basin and **Buzi basin** were the ones that stood out most with an increase in rainfall of about 49% and 52%, respectively. The rainfall profiles indicate that during mid-March, the recorded rainfall exceeded 350mm and 150mm in the Buzi basin and the Lower Zambezi basin, respectively. The temperature patterns recorded indicate a reduction in all agro-ecological zones, varying from -4.0°C to -1.0°C. The radiation has fell in all sub-regions except for the **Northern Coast area**.

The NDVI development graphs indicate that the crop condition was not favourable during almost the entire monitoring period in all agro-ecological zones, most notable in the **Buzi basin** and **Lower Zambezi** river basin which were the regions most affected by the floods. Nonetheless, in the **Southern region**, crop condition recovered at the end of April. The recorded rainfall influenced the Biomass index in these regions and the nearby regions as well. Again, the **Lower Zambezi** river basin is the one that stands out with an increase of about 12% over the average. The cropped arable land area (CALF) was close to the 5YA and VCIx ranges between 0.90 to 0.95.

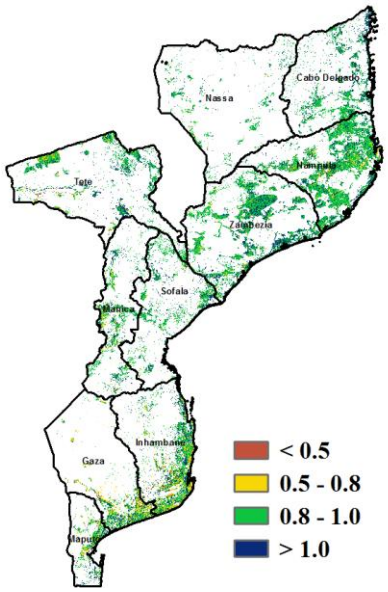
Figure 3.31 Mozambique's crop condition, January - April 2019



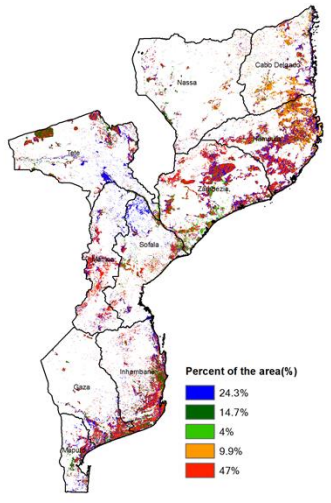
(a). Phenology of major crops



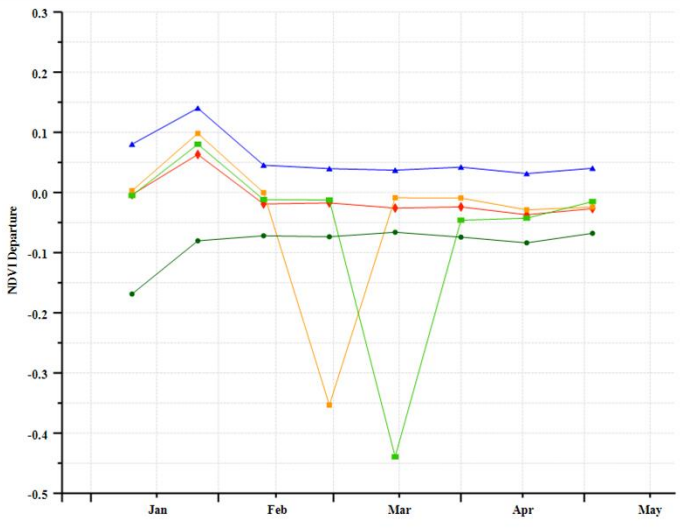
(b) Crop condition development graph based on NDVI



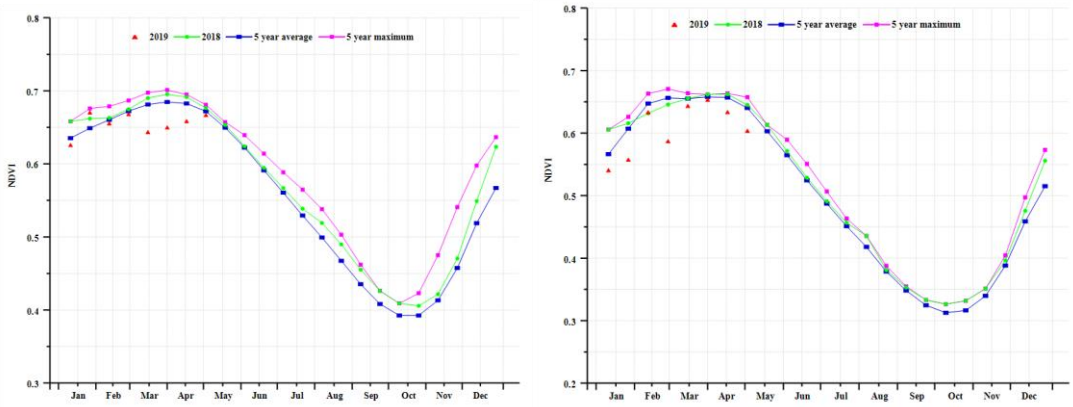
(c) Maximum VCI



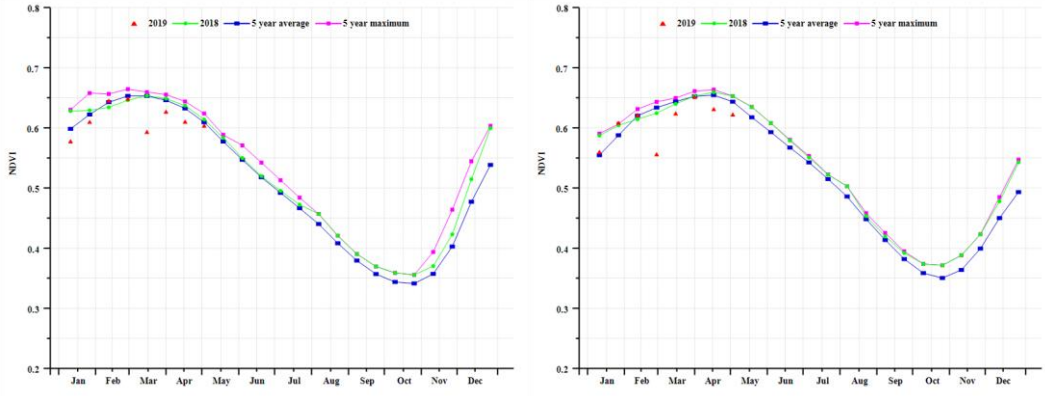
(d) Spatial NDVI patterns compared to 5YA



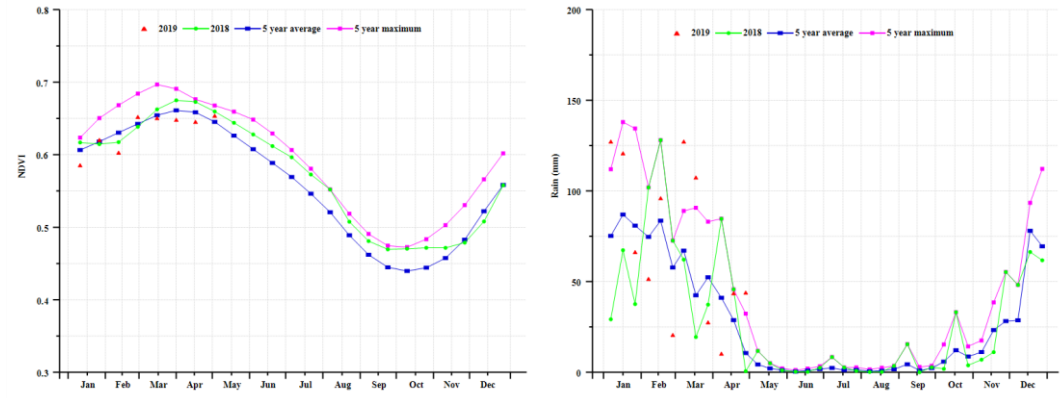
(e) NDVI profiles



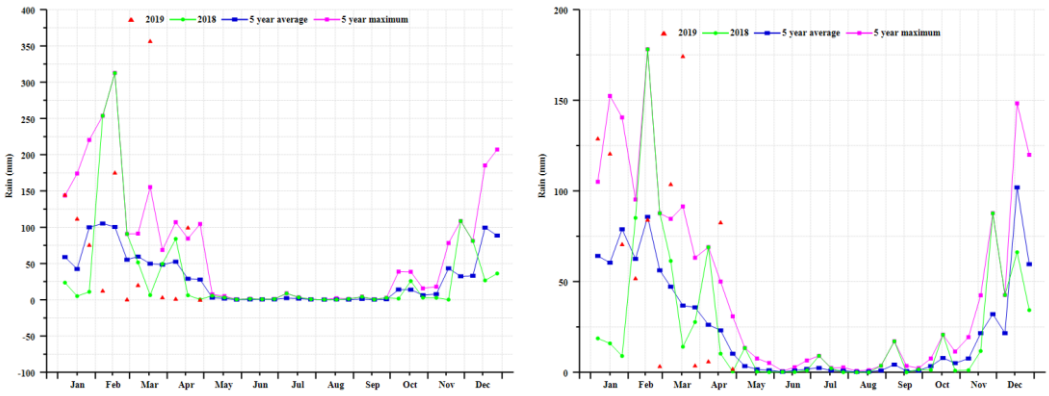
(f) Crop condition development graph based on NDVI- Buzi basin (g) Crop condition development graph based on NDVI- Northern high altitude areas



(h) Crop condition development graph based on NDVI- Lower Zambezi River basin (i) Crop condition development graph based on NDVI- Northern coast region



(j) Crop condition development graph based on NDVI- Southern region (k) National rainfall profiles, January-April 2019



(l) Buzi basin rainfall profile, January-April 2019 (m) Low Zambezi river basin rainfall profile, January-April 2019

Table 3.53 Mozambique's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, January - April 2019

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m²)	Departure from 15YA (%)
Buzi basin	1004	52	25.5	-1.0	1232	-1
Northern high altitude areas	806	4	24.8	-0.4	1099	-3
Low Zambezi River basin	833	49	26.2	-1.0	1173	-3
Northern coast	978	18	26.6	-0.5	1200	0
Southern region	577	36	27.0	-0.5	1188	-1

Table 3.54 Mozambique's agronomic indicators by sub-national regions, current season's values and departure from 5YA/15YA, January - April 2019

Region	BIOMSS		CALF		Maximum VCI
	Current (gDM/m²)	Departure from 15YA (%)	Current (%)	Departure from 5YA (%)	Current
Buzi basin	1488	3	100	0	0.92
Northern high altitude areas	1873	1	100	0	0.95
Low Zambezia River basin	1581	12	99	0	0.94
Northern coast	1879	3	100	0	0.95
Southern region	1101	2	99	1	0.90

[NGA] Nigeria

The reporting period covers the harvest of second maize and of irrigated rice. It also includes the sowing of the main maize crop in the south as well as the rain-fed rice. Rainfall was above average (RAIN +9%). while the temperature and radiation registered a decrease (TEMP -0.3ºC and RAPDAR -1%). The total biomass production potential increased (BIOMASS +8%) although the cropped Arable Land Fraction (CALF) fell 3%. The NDVI development graph shows crop condition to be close to or above average at the end of period, after a below average spell from Mid-February to March. The northern region of the country registered good maximum vegetation condition index (VCIx) above 0.8, while the southern region recorded lower values. The poorest VCIx occurs in the central regions with many patches below 0.5 VCIx, mainly in the States of Niger, Ajbuja and Nassarawa. The maximum VCI was 0.89 countrywide. NDVI clusters and profile graphs show favorable average conditions in 76.6 % of the country, specially the northern part which is currently in the dry, crop-less season, except for some irrigated crops such as wheat. Overall, the outlook for the second maize crop and dry rice is favorable.

Regional analysis

Considering the cropping systems, climatic zones, and topographic conditions, Nigeria is divided into four agro-ecological zones (AEZ). They are referred to (from north to south and by increasing rainfall) as Sudano-Sahelian, Guinean savanna, Derived savanna and Humid forest zone.

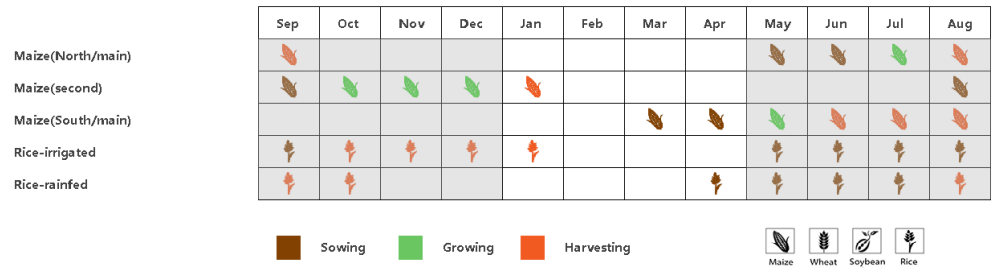
During the reported period, in **Sudano-Sahelian region** was in the middle of its dry season. Rainfall will resume about June. Some irrigated dry season wheat is cultivated in the north-east. According to the NDVI profiles, the situation is normal.

The **Guinean Savanna** compare to the humid forest zone and derived savanna, the recorded total amount of rainfall was seasonably low at 71mm but nevertheless slightly below average (-13%). The rainy season is due to start late May or in June. Temperature and sunshine were close to average (TEMP -0.2°C, RADPAR -3%). The drop in biomass production was 4%, which may have affected rangeland, which plays an important role in the AEZ. The CALF was also decreased by 11% compared to the average. However, NDVI, it was above the five-year maximum and the situation is best described as average.

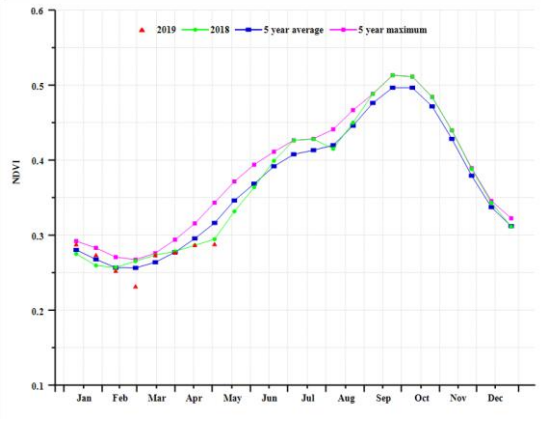
In the **derived Savanna** the rainy season normally starts from late April (west) to May (East) and the reporting period covers early stages of maize. The total amount of rainfall was recorded at 206 mm, which is 7% above average. Temperature and radiation remained constant compared to average. The increase in rainfall led to an 11% increase in total biomass production, while Arable land fraction (CALF) dropped by 4% below the recent five-year average. Maximum VCIx reached 0.84 and NDVI values were above average the previous 5 years. Overall, based on the indicators the conditions were favorable and there is no reason for concern.

In the **Humid forest zone**, crops, including rain-fed rice and maize have been growing since March. The high rainfall (RAIN, 516mm) was 18% above average. TEMP was slightly below average (-0.6°C) but with RADPAR up 3% and favorable precipitation, BIOMASS exceeds average by 14%. The arable land fraction remained constant. In spite of some NDVI fluctuations before or at the beginning of the season, maximum VCI is at 0.91 and crop prospects at average or above. This also applies for other important food crops in Nigeria such as Cassava and Yams.

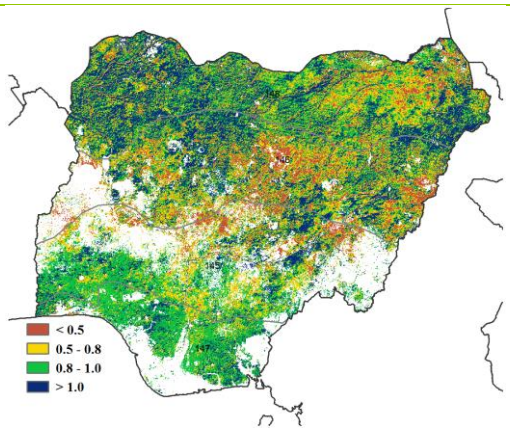
Figure 3.32 Nigeria's crop condition, January - April 2019



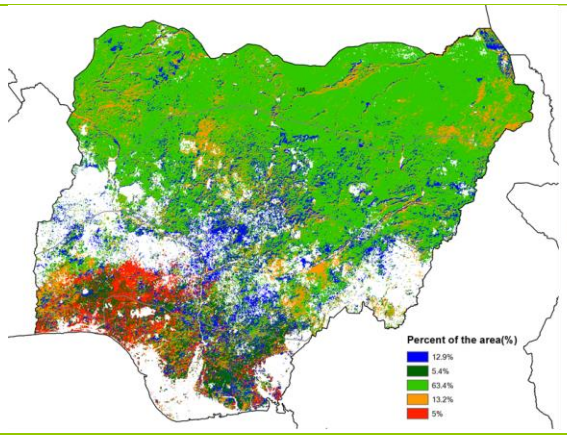
(a) Phenology of major crops



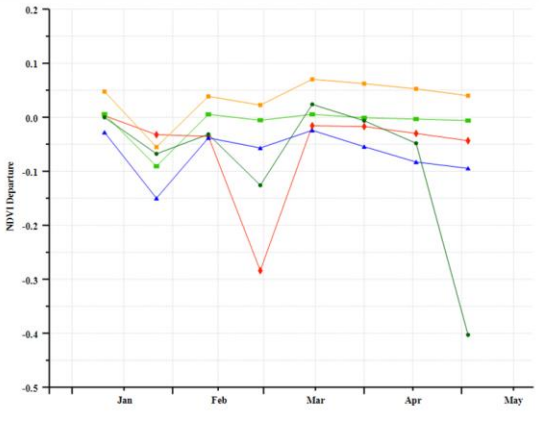
(b) Crop condition development graph based on NDVI



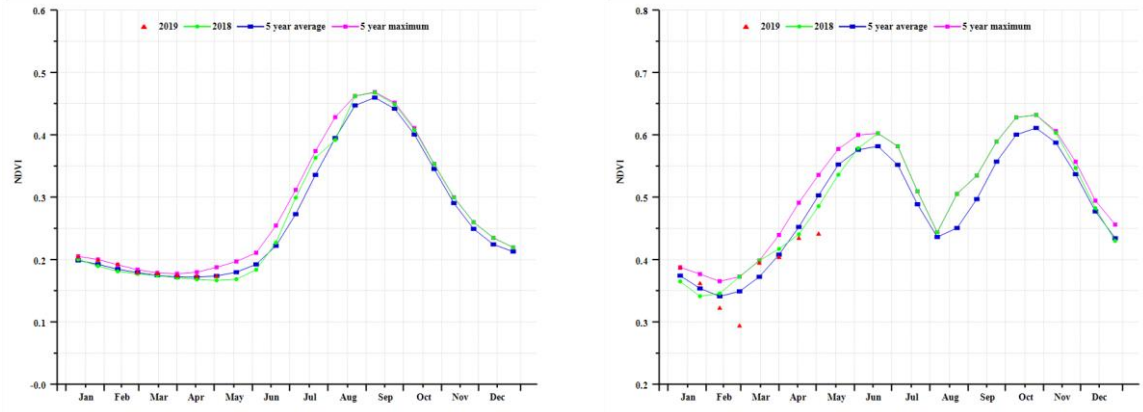
(c) Maximum VCI



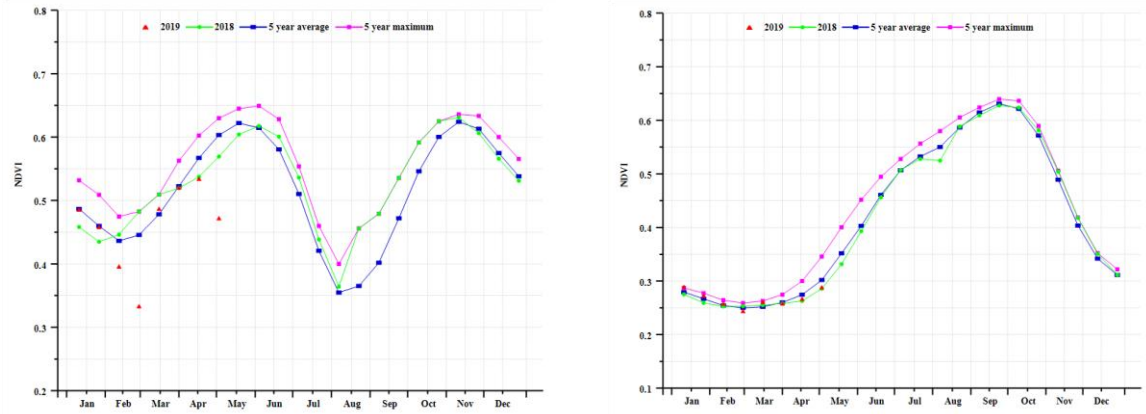
(d) Spatial NDVI patterns compared to 5YA



(e) NDVI profiles



(f) Crop condition development graph based on NDVI (Soudano-sahelian region (left) and Derived savanna zone region (right))



(g) Crop condition development graph based on NDVI (Humid forest zone region (left) and Guinean savanna region (right))

Table 3.55 Nigeria's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, January - April 2019

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m²)	Departure from 15YA (%)
Soudano-Sahelian zone	10	-29	29.2	-0.6	1357	-2
Derived savanna zone	206	7	29.4	0.0	1300	0
Humid forest zone	516	18	28.7	-0.6	1286	3
Guinean savanna	71	-13	29.1	-0.2	1349	-3

Table 3.56 Nigeria's agronomic indicators by sub-national regions, current season's values and departure from 5YA/15YA, January - April 2019

Region	BIOMASS		Cropped arable land fraction		Maximum VCI
	Current (gDM/m²)	Departure from 15YA (%)	Current	Departure from 5YA (%)	Current
Soudano-sahelian zone	50	-17	1	21	0.96
Derived savanna zone	738	11	70	-4	0.84
Humid forest zone	1442	14	97	0	0.91
Guinean savanna	280	-4	8	-11	0.84

[PAK] Pakistan

The reporting period covers most of the winter wheat cycle from vegetative to harvest. It also touches the field preparation and sowing of maize. Crop condition was generally favorable from February to April. Compared with average, RAIN was 6% above, while TEMP and RADPAR showed decreases (-1.0°C and -6% respectively). The combination of all the agro-climatic indicators resulted in BIOMSS exceeding the 15YA by 10%. The fraction of cropped arable land (CALF) increased by a very significant 7%, which supports expectations of favourable winter wheat output.

As shown by the NDVI development graph at the national level, crop condition was low to average in January, and increased to average or above average from February to April. The spatial NDVI patterns and profiles show that 44.8% of the cropped areas were just on the average, and 21.6% were below average, essentially in the north-eastern areas and the South. Punjab and the Indus river basin, two major wheat producing areas present above average NDVI during the key crop growing period from February to April. Considering that weather, in particular rainfall, have been favorable so far, winter wheat prospects are rather promising.

Regional analysis

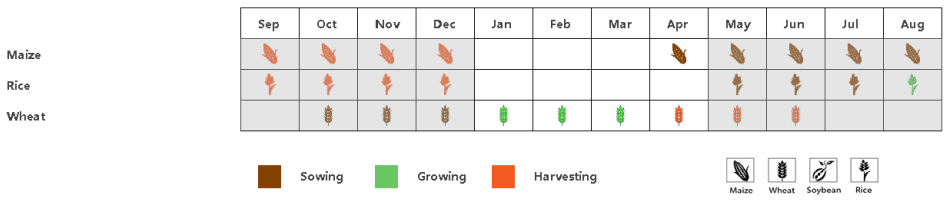
For a more detailed spatial analysis, CropWatch subdivides Pakistan into three agro-ecological regions based essentially on geography and agro-climatic conditions: the Northern highlands, Northern Punjab region and the Lower Indus river basin in south Punjab and Sind.

In the **Northern highlands** RAIN was 17% below average. RADPAR and TEMP were low compared to average (-8% and -1.0°C respectively). Accordingly, BIOMSS was just average. The region achieved a rather low CALF of 51%. The NDVI development graph shows below average crop condition from February to April, especially in the north. CropWatch expects below average production in the area.

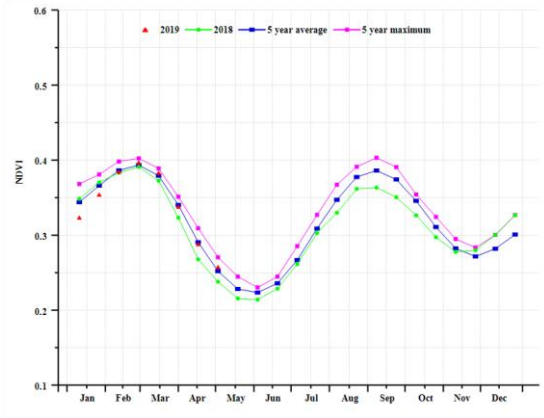
Northern Punjab, the main agricultural region in Pakistan recorded abundant RAIN (33% above average). TEMP was below average by 1.5°C, and the RADPAR departure was -7%. The resulting BIOMSS exceeded the recent fifteen-year average by 35%. The area had a very favorable VCIx of 1.01 and CALF of 89% (3% above 2018). Except for January, crop condition assessed through NDVI shows high values. Overall, the projected wheat output is at least average.

In the **Lower Indus river basin in south Punjab and Sind**, RAIN was significantly above average of 44%, while TEMP was below average by 1.4°C and sunshine was below average as well (RADPAR down 4%). The estimated BIOMSS departure of 58% compared to the fifteen-year average is probably optimistic, even considering that the vast majority of crops is irrigated. January crop condition based on NDVI was below average, but the low CALF (67%) is an increase over the recent 5YA (+7%); VCIx at 0.95 indicates favorable crop condition. Overall, prospects remain favorable for the region.

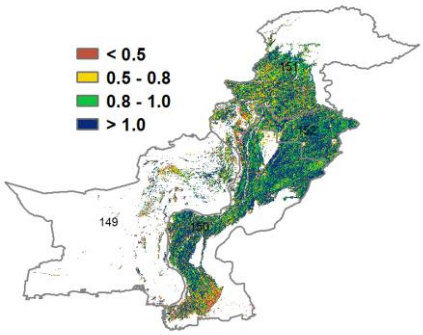
Figure 3.33 Pakistan's crop condition, January - April 2019



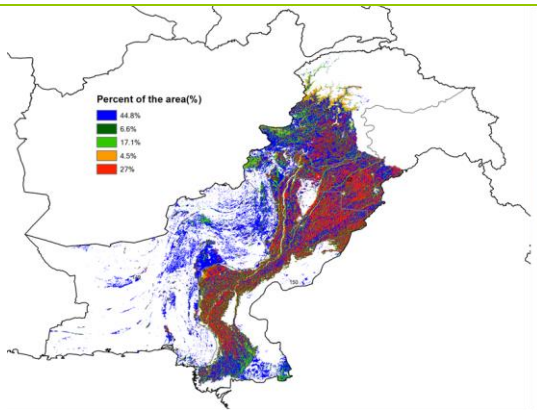
(a). Phenology of major crops



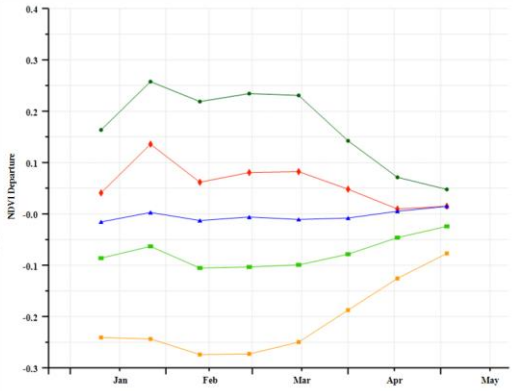
(b) Crop condition development graph based on NDVI



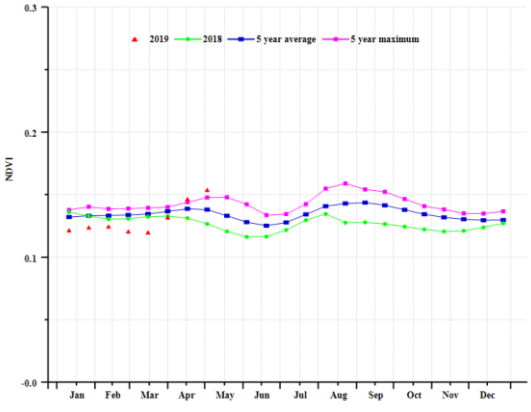
(c) Maximum VCI

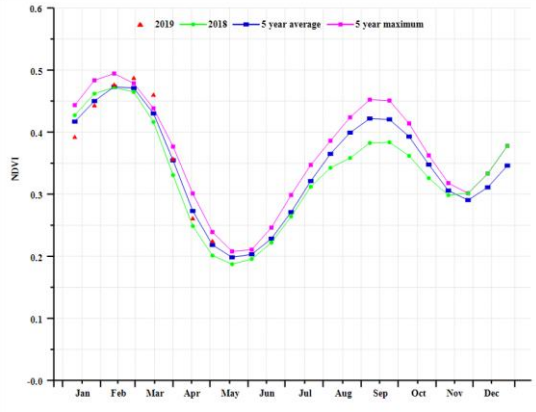


(d) Spatial NDVI patterns compared to 5YA

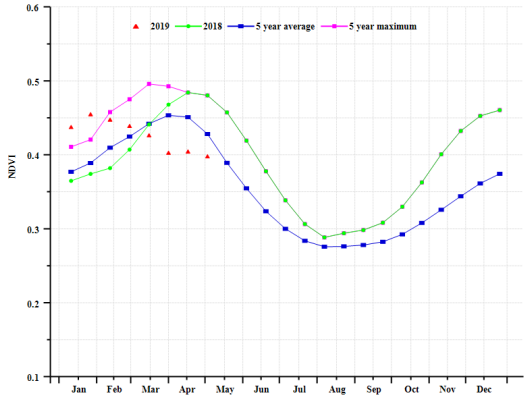


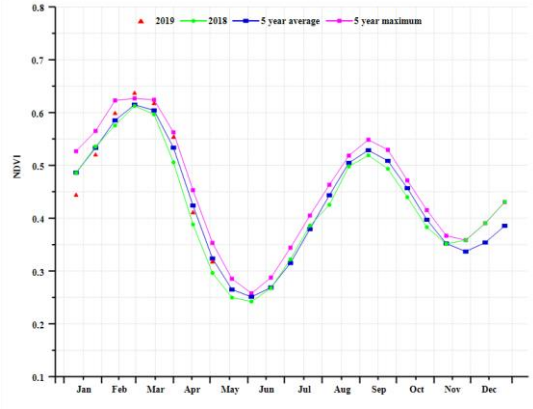
(e) NDVI profiles





(f) Crop condition development graph based on NDVI (Balochistan Non-agricultural Region (left) Lower Indus river basin in south Punjab and Sind (right))





(g) Crop condition development graph based on NDVI (Northern Highlands (left) Northern Punjab (right))

Table 3.57 Pakistan's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, January - April 2019

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m²)	Departure from 15YA (%)
Balochistan	115	33	14.6	-1.3	1118	-4
Lower Indus river basin in south Punjab and Sind	87	44	20.8	-1.4	1132	-4
Northern highlands	193	-17	7.4	-1.0	886	-8
Northern Punjab	185	33	17.7	-1.5	958	-7

Table 3.58 Pakistan's agronomic indicators by sub-national regions, current season's values and departure from 5YA/15YA, January - April 2019

Region	BIOMSS		CALF		Maximum VCI
	Current (gDM/m²)	Departure from 15YA (%)	Current (%)	Departure from 5YA (%)	Current
Balochistan	418	31	1	127	0.64
Lower Indus river basin in south Punjab and Sind	378	58	67	7	0.95
Northern highlands	634	0	51	12	0.94
Northern Punjab	777	35	89	3	1.01

[PHL] Philippines

The monitoring period covers the harvest of secondary rice and maize, as well as the sowing of the main rice and maize crops. According to the NDVI profiles for the country, crops generally showed unfavorable condition. Nationwide, precipitation (RAIN) presents a marked negative departure of 49% compared with average, accompanied by above average radiation (+7%) and below average temperature (-0.5°C). The rainfall deficit resulted in BIOMSS being 28% below average.

The cropped arable land fraction (CALF) nation-wide was almost 100%. The spatial patterns of NDVI profiles show that: (1) 47.0% of the cropped areas experienced average conditions, in patches of the whole country; (2) 22.7% had slightly above average conditions, mostly in the Center and the North, from Negros and Cebu to Luzon; (3) 16.6%, mostly as patches in Mindanao and Luzon experienced below average conditions; (4) 13.7% had average conditions after a marked drop in mid-January that affected essentially Samar, Leyte, and about one third of Mindanao.

Regional analysis

Based on cropping systems, climatic zones and topographic conditions, three main agro-ecological regions can be distinguished for the Philippines. They are the Northern lowlands of Mindanao to western Visayas region, the Negros and central Visayas Islands region and the Forest islands region (mostly southern and western islands).

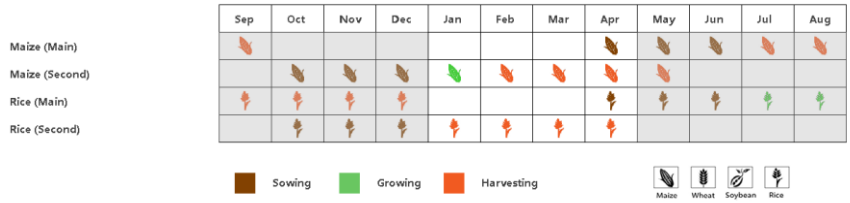
The **Northern lowlands of Mindanao to western Visayas region** experienced a rainfall deficit (RAIN -40%), slightly low temperature (TEMP -0.4°C)，and well above average radiation (RADPAR +12%). According to the NDVI profiles for the region, crop condition was below the five-year average. BIOMSS was down 19% compared to the average.

The **Negros and central Visayas Islands region** experienced a rainfall deficit (RAIN -49%), slightly low temperature (TEMP -0.3°C)，and above average radiation (RADPAR +7%). According to the NDVI profiles for the region, crop condition was above the five-year average from January to February except mid-January, then below five-year average. BIOMSS was down 20% below average.

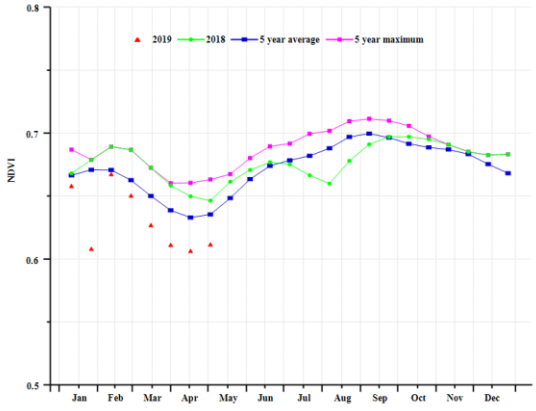
The **Forest islands region** experienced the largest rainfall deficit (RAIN -52%), low temperature (TEMP -0.6°C)，and above average radiation (RADPAR +2%). According to the NDVI profiles for the region, crop condition was below the five-year average. BIOMSS was down 33% from average.

In spite of the poor performance of rainfall and NDVI, the assessment of the crop situation in the Philippines is less straightforward than it seems, especially when considering that sunshine is often a limiting factor for crops in tropical areas. The Forest islands region, for instance, recorded 476 mm against the average of 991 mm, a large deficit. But 476 mm is nevertheless equivalent to 4 mm/day, at a time when potential evapotranspiration is of the same order of magnitude, i.e. generalised water stress is unlikely. In the other zones, however, water supply was possibly insufficient for lowland (i.e. rainfed) rice, but additional sources of water are frequently available and resorted to. Finally, CALF reached 100% and VCIx was unusually high in all agro-ecological zones. Considering that early and late crop stages have limited water requirements compared with full vegetative development, it is very likely that the dry rice and second maize that were harvested in February and March, as well as the wet rice and first maize that have just been planted are doing well, with a national crop condition gradient from north to south.

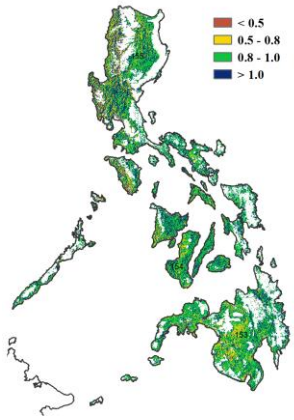
Figure 3.34 Philippines's crop condition, January - April 2019



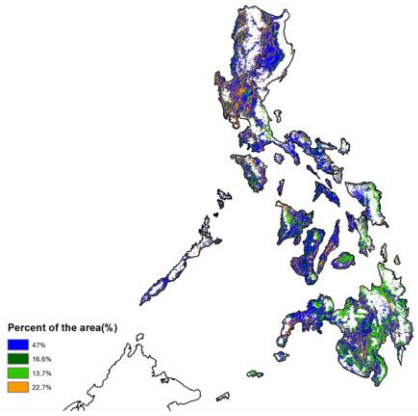
(a). Phenology of major crops



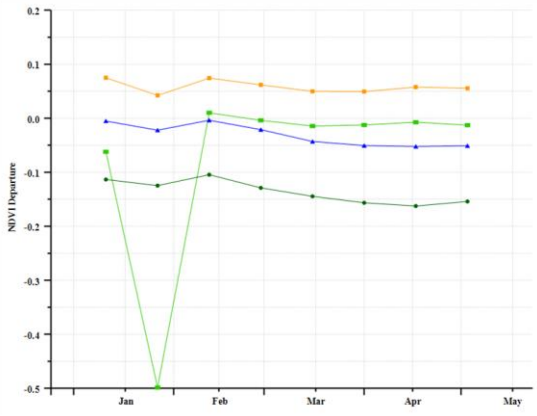
(b) Crop condition development graph based on NDVI



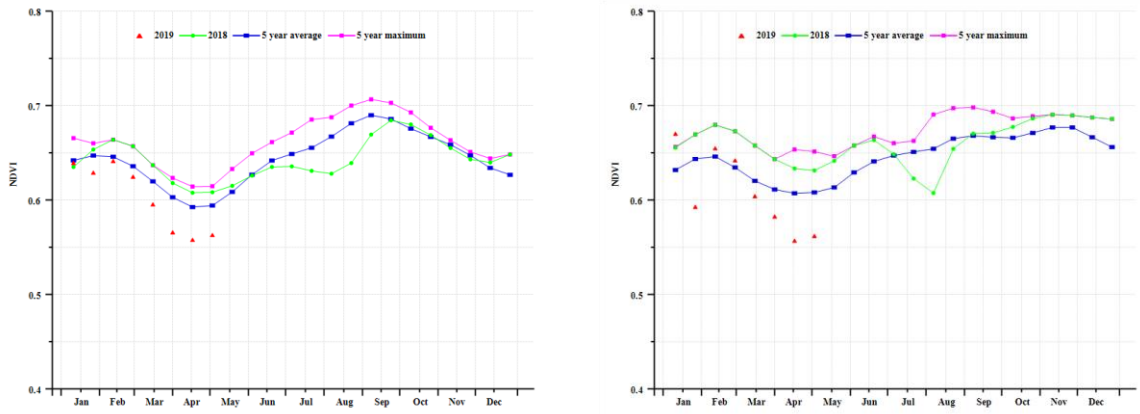
(c) Maximum VCI



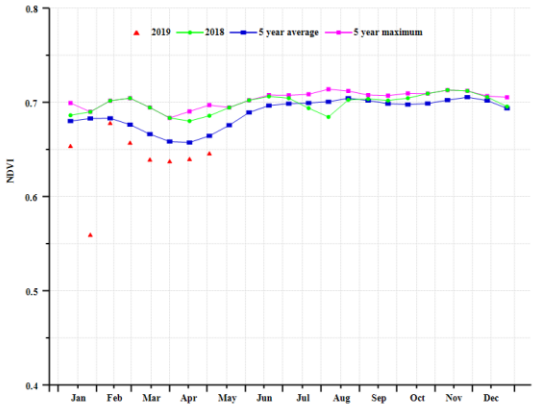
(d) Spatial NDVI patterns compared to 5YA



(e) NDVI profiles



(f) Crop condition development graph based on NDVI (Northern lowlands of Mindanao to western Visayas region (left), Negros and central Visayas Islands region (right))



(g) Crop condition development graph based on NDVI(Forest islands region)

Table 3.59 Philippines's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, January - April 2019

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m²)	Departure from 15YA (%)
Northern lowlands of Mindanao to western Visayas region	188	-40	25.2	-0.4	1209	12
Negros and central Visayas Islands region	253	-49	26.1	-0.3	1300	7
Forest islands region	476	-52	25.7	-0.6	1173	2

Table 3.60 Philippines's agronomic indicators by sub-national regions, current season's values and departure from 5YA/15YA, January - April 2019

Region	BIOMSS		Cropped arable land fraction		Maximum VCI
	Current (gDM/m²)	Departure from 15YA (%)	Current	Departure from 5YA (%)	Current
Northern lowlands of Mindanao to western Visayas region	667	-19	99	0	0.95
Negros and central Visayas Islands region	947	-20	100	0	0.95
Forest islands region	1056	-33	100	0	0.94

[POL] Poland

In Poland, the reporting period covers the dormancy and re-growth of winter wheat. Due to close to average precipitation (-4%), warmer weather and more abundant sunshine than average (TEMP +1.6°C, RADPAR +4%), potential biomass increased by 12%. Additional rain is needed in next months for the growth of crop during spring. Due to the favorable condition, VCIx was high at 0.86. Compared to last 5 years, CALF was decreased by 2% but remains close to full cropping (97% of arable land cropped).

As shown by the crop condition development graph, national NDVI was below average in January as snowfall occurred in winter. From February to March, NDVI was above the average of last 5 years due to sufficient precipitation and heat. However, NDVI was below average in April, possibly because of dry soils affected by more intense that usual evapotranspiration. Sub-national NDVI profiles show very similar condition throughout the country from late February.

Overall, crop condition is satisfactory.

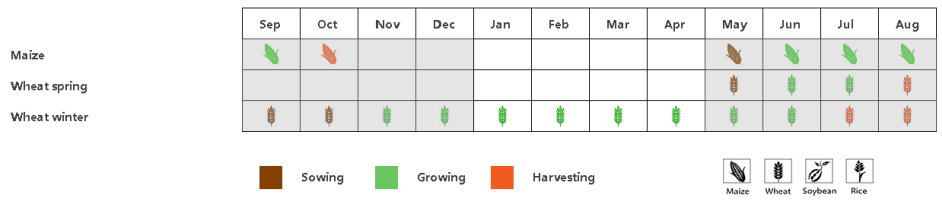
Regional analysis

The country was divided into four zones by agro-ecoligical characteristic 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 Subcarpathia along the Czech and Slovak borders).

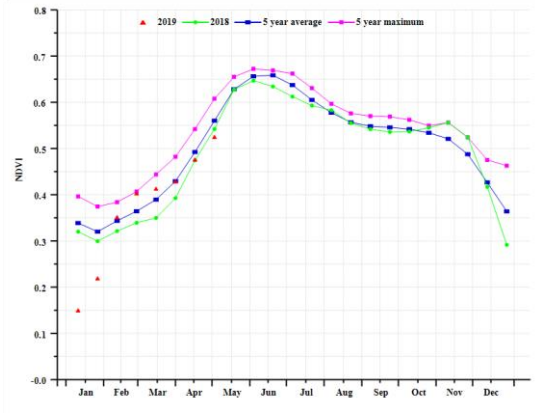
Compared to last 15 years, **the Northern oats and potatoes area**, **Northern-central wheat and sugar-beet area** and **Central rye and potatoes area** recorded somewhat drier but much warmer conditions (RAIN: -5%, -7% and -9%; TEMP: +1.9°C, +1.6°C and +1.7°C). RADPAR was higher than average in three zones (+5%, +5% and +4%, respectively). BIOMSS was significantly higher than average (+14%, +10% and +12%) due to favorable temperatures. In spite of a drop in CALF in the three zones (down 2%), CALF was still high at 96%, 95% and 97%, respectively. Due to the favorable condition, VCIx in three zones reached 0.86, 0.88 and 0.85 respectively.

Different from above three zones, **the Southern wheat and sugar-beet area** was slightly wetter than average (RAIN +2%) but marginally less warm (TEMP +1.4°C). RADPAR was above average (+2%). Compared to last 15 years, BIOMSS increased by 11%. The area had a high CALF (97%) as well as a favorable VCIx (0.84).

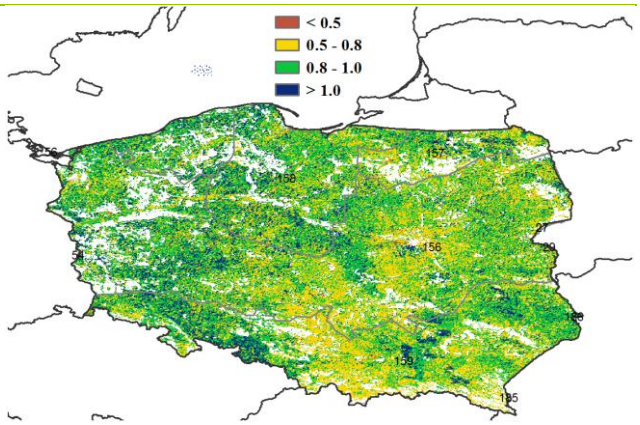
Figure 3.35 Poland's crop condition, January-April 2019



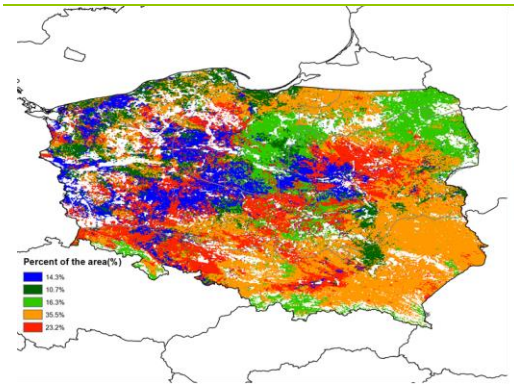
(a). Phenology of major crops



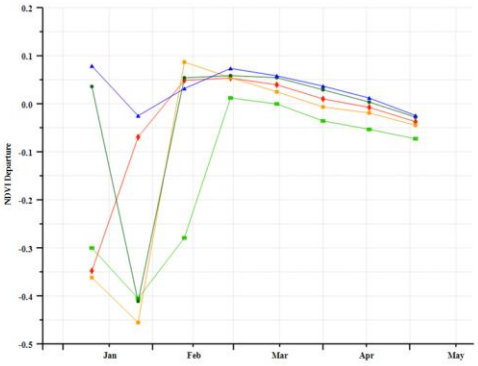
(b) Crop condition development graph based on NDVI



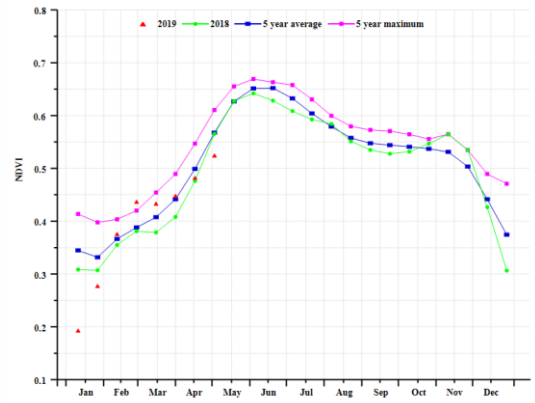
(c) Maximum VCI

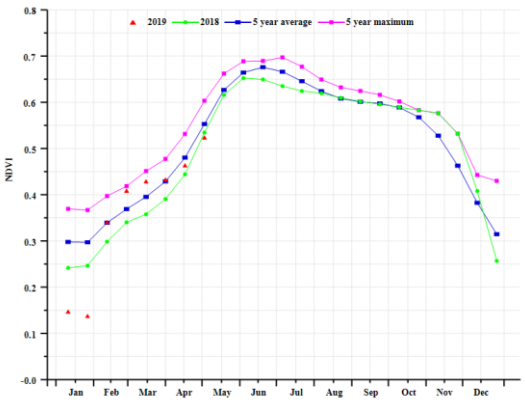


(d) Spatial NDVI patterns compared to 5YA

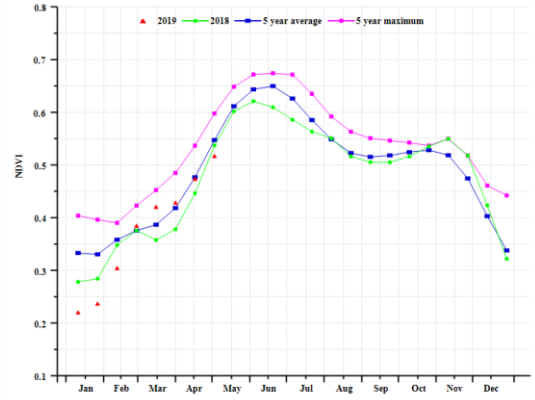


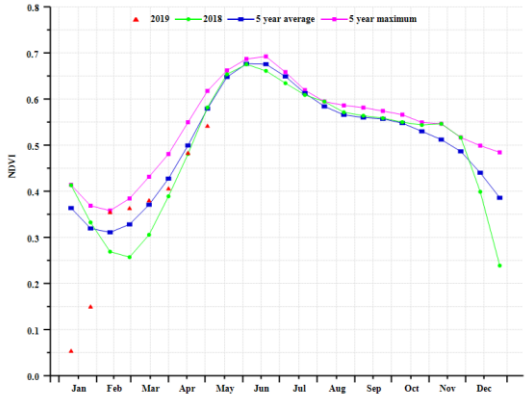
(e) NDVI profiles





(f) Crop condition development graph based on NDVI, Central rye and potatoes area (left) and Northern oats and potatoes area (right).





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

Table 3.61 Poland's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, January-April 2019

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m2)	Departure from 15YA (%)
Central rye and potatoes area	238	-8	4.3	1.7	484	4
Northern oats and potatoes areas	259	-5	3.6	1.9	461	5
Northern-central wheat and sugarbeet area	229	-7	4.0	1.6	484	5
Southern wheat and sugarbeet area	271	2	3.9	1.4	522	2

Table 3.62 Poland's agronomic indicators by sub-national regions, current season's values and departure from 5YA/15YA, January-April 2019

Region	BIOMSS		Cropped arable land fraction		Maximum VCI
	Current (gDM/m²)	Departure from 15YA (%)	Current	Departure from 5YA (%)	Current
Central rye and potatoes area	950	12	97	-2	0.85
Northern oats and potatoes areas	901	14	96	-2	0.86
Northern-central wheat and sugarbeet area	915	10	95	-2	0.88
Southern wheat and sugarbeet area	921	11	97	-2	0.84

[ROU] Romania

Winter wheat began vegetative growth and winter dormancy after being sown from October. The overall condition of the crop just fair (VCIx = 0.76). Rainfall was much higher than average (+35%) and temperature and sunshine were close to average (TEMP +0.3°C, RADPAR +1%). Biomass show betters condition (BIOMSS +18%) while CALF dropped dramatically by 35%. The low CALF indicates below average production prospects due to reduced hectarage.

The nationwide NDVI development graph indicates that crop growth was below average during the reporting period, which is consistent with the decreased CALF and low VCIx.

According to the spatial NDVI profiles, rather low NDVI (0.2 units or more below average) prevailed in 13.3% of cropped areas, mostly in the area referred to below as the Eastern and southern maize, wheat and sugar beet plains.

Regional analysis

More detail is provided below for three main agro-ecological zones (AEZ) of the country. They include the Central mixed farming and pasture Carpathian hills; the Eastern and southern maize, wheat and sugar beet plains; the Western and central maize, wheat and sugar beet plateau.

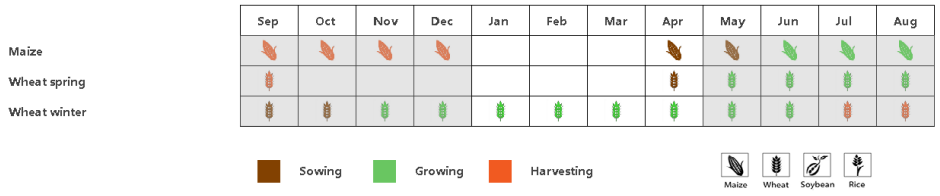
In **the Eastern and southern maize, wheat and sugar beet plains** rainfall increased 3% over average, temperature was up 0.7°C and the sunshine departure was +2%. However, CALF was -15% below the 5YA and the VCIx was low (0.75).

The Western and central maize, wheat and sugar beet plateau had a much larger positive rainfall anomaly (+24%), a temperature increase above average of nearly one degree (0.9°C) and sunshine up 5%. As a result, the biomass potential of this region increased 8%. CALF was somewhat lower than average (-4%). Similar to the Eastern and southern maize, wheat and sugar beet plains, VCIx was low in this region (0.79) but nevertheless the highest in the country.

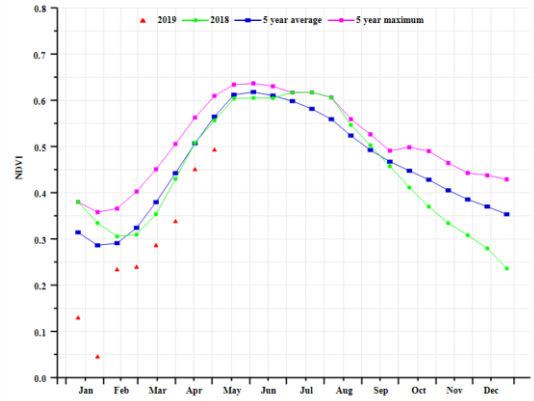
As for **the Central mixed farming and pasture Carpathian hills**, the increase in BIOMSS (+8%) was beneficial to pasture development, as were the moderate rainfall increase (+15% above average), sunshine (+4%) and temperature (+0.7°C). CALF dropped 7% and the VCIx was the lowest in the country (0.73).

Generally, crop condition is just average or below and planted area was well below average. Only about 14.1% of cropland experienced consistently average conditions including the counties of Tulcea and Constanta on the Black Sea; parts of Dolj, Olt and Teleorman in the south and parts of Timis and Caras-Severin in the west. The final outcome of the season will be largely conditioned by agroclimatic conditions in May but a favorable winter wheat season remains unlikely.

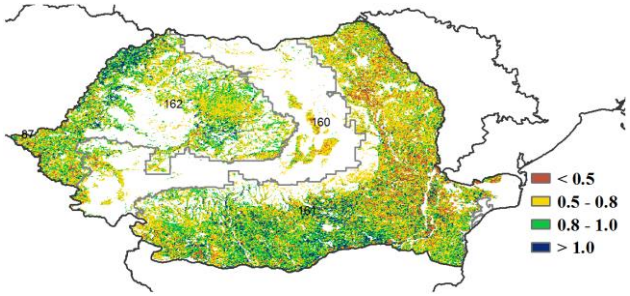
Figure 3.36 Romania's crop condition, January-April 2019



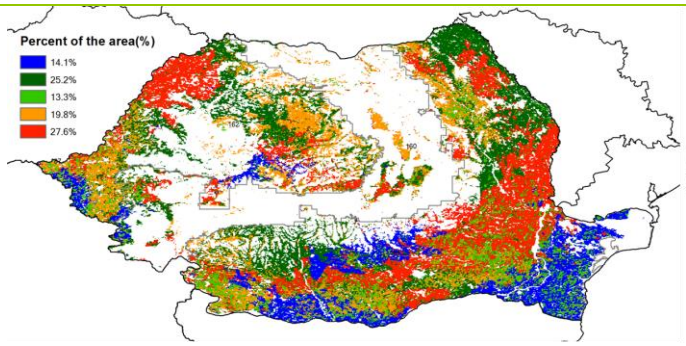
(a). Phenology of major crops



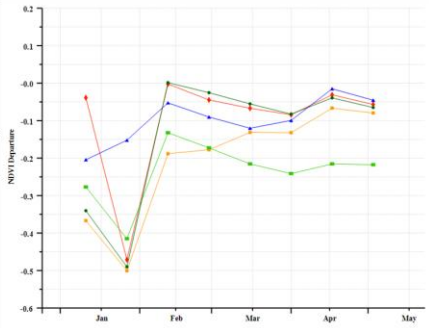
(b) Crop condition development graph based on NDVI



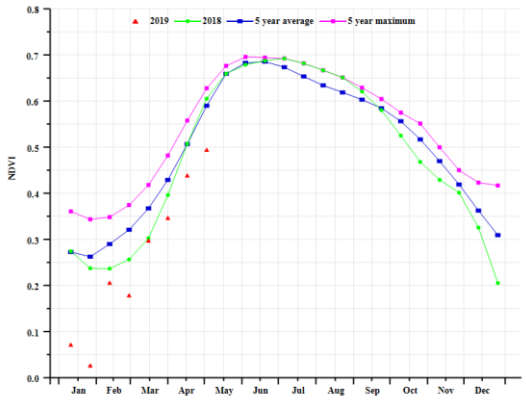
(c) Maximum VCI

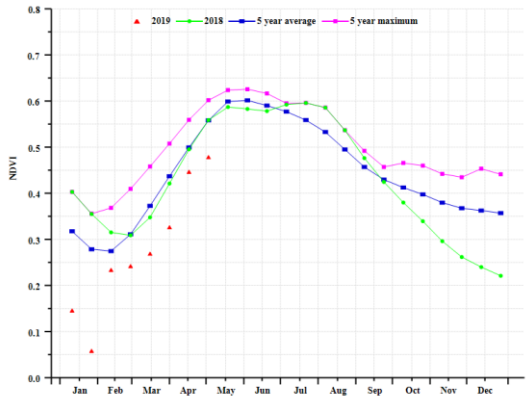


(d) Spatial NDVI patterns compared to 5YA

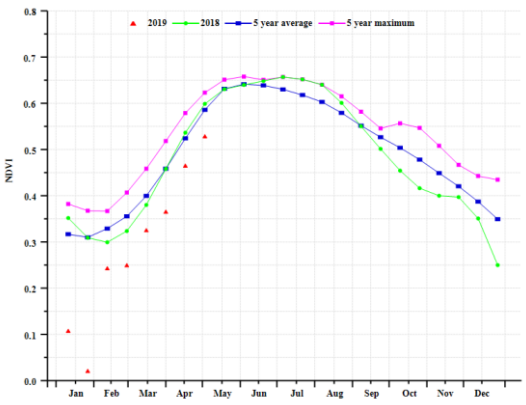


(e) NDVI profiles





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



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

Table 3.63 Romania's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, January-April 2019

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m²)	Departure from 15YA (%)
Central mixed farming and pasture Carpathian hills	276	15	1.6	0.7	643	4
Eastern and southern maize, wheat and sugar beet plains	198	3	4.9	0.7	666	2
Western and central maize, wheat and sugar beet plateau	250	24	4.2	0.9	664	5

Table 3.64 Romania's agronomic indicators by sub-national regions, current season's values and departure from 5YA/15YA, January-April 2019

Region	BIOMSS		Cropped arable land fraction		Maximum VCI
	Current (gDM/m²)	Departure from 15YA (%)	Current	Departure from 5YA (%)	Current
Central mixed farming and pasture Carpathian hills	754	8	100	-7	0.73
Eastern and southern maize, wheat and sugar beet plains	755	2	100	-15	0.75
Western and central maize, wheat and sugar beet plateau	808	8	100	-4	0.79

[RUS] Russia

The period from February to May (i.e. one month after the current reporting period) includes snow-melt and the subsequent crop re-growth after winter dormancy, with large spatial variations depending on geography and spring conditions. The same applies to the phenology of spring crops, of which the first are just being sown.

National NDVI profiles show a delay in the start of the growing period, being close to the previous year but lower than the 5-year average. Temperatures were above both the average and the values of last year until April, when they became close to the previous year's observations. Nationwide, the average temperature departure reached an exceptionally high value of +1.7°C, with even larger anomalies at the local scale. Average Precipitation was first close to average, then close to last year's low values and eventually below both last year and the average.

Regional data on NDVI show that the late crop calendar indicated by national data was observed in most regions of Russia. Since a similar situation was observed during the previous year, it is likely that NDVI development will follow patterns close to those of the 2018.

Lowest VCIx values were observed in Middle Volga, Ural-Volga-Vyatka, Central Black Earth, Middle and East Siberian regions. This situation is mainly due to late start of post-dormancy crop development. In South and North Caucasus regions VCI shows mostly favourable values above 0.8.

The map of spatial NDVI profile clustering confirms VCIx patterns. The most favorable situation with positive departure is observed in 3.6 % of cropped areas and corresponds to regions with highest VCIx. The worst situation with largest negative departure affects 17.8 % of the cropland, mainly in Middle Volga region where VCIx is close to 0.5. Average NDVI occurs in 18.0% of arable lands, mostly located in the Central and Central Black Earth regions.

Generally, the current situation with late start of crop development is similar to the situation during 2018. In most regions of Russia NDVI is close to both 2018 and 5YA values. However, a drop in rainfall at the end of April accompanied by drop in NDVI values in main crop growing regions might be a sign of future decrease in biomass. We stress that the above-average temperature patterns that prevailed in Russia is rather unusual; it is described in some detail in the Overview (chapter 3.1) of the current chapter on "Main producing and exporting countries". The warm wather occurred at the same time as very significant drops in CALF observed in most regions of Russia, in the range from 6% to 74 % below the 5YA. Whether the drop is real and will be confirmed in future reports or whether the observation is due mostly to late phenology need close monitoring in the next CropWatch bulletin.

Regional analysis

In the **Central, Central Black Earth** and **North-western regions** rainfall was close to average but temperature was above by 1.7 to 2.2 °C. NDVI development started late (in March) and was below 5YA but higher than during 2018 and reaching 5YA at the beginning of April. However, at the end of April NDVI dropped below 5YA and its 2018 level. This decrease is not reflected in the modeled biomass which is by 9-14 % higher than 5YA.

A similar NDVI pattern was observed in **Middle Volga, Western Siberia** and **Ural-Volga-Vyatka regions**. In **Middle Volga** and **Ural-Volga-Vyatka regions** rainfall and temperature were above average (by 6% and 1.4°C to 1.6°C, respectively), but RADPAR was below, which could potentially cause the delay in start of the vegetation period. Rainfall shortage (-11%) was the main factor causing the season to be late in Western Siberia. The temperature was slightly above average.

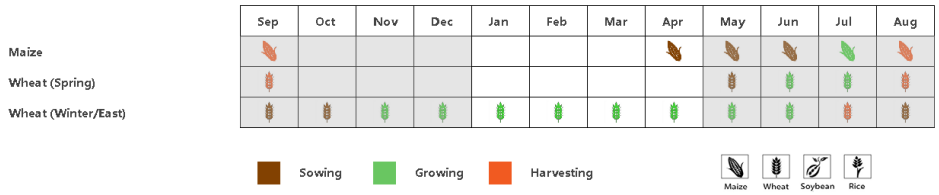
Significant rainfall shortage (26% to 42% below average) was observed in **East Siberia, Middle Siberia, Amur Krai and Primorie regions**. The temperature was well above average by 2.2 °C. Despite the lack of rain, NDVI of **East Siberia** was 5YA values, sometimes rising to 5-year maximum and the level of 2018. In **Middle Siberia** NDVI was near both the 5YA and 2018 values until the end of April when it dropped slightly. **Amur Krai and Primorie zones** were the most affected by rainfall shortage and much higher

temperature (2.7 °C above average), while NDVI stayed below 5YA and the 2018 values. However, the modeled biomass was only slightly above the average.

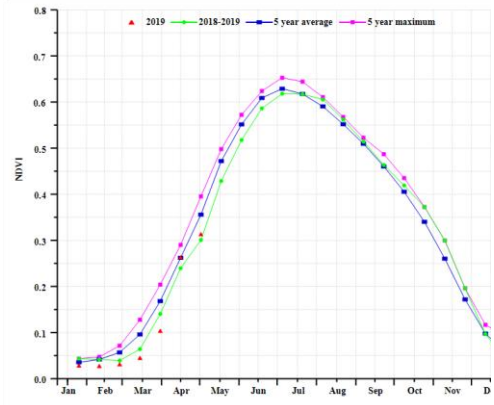
North and South Caucasus regions also experienced rainfall shortage (13-12 % below average) with temperature much higher than by 2.6°C to 3.3°C. In **the Northern Caucasus** this resulted in late crop season and NDVI staying below 5-year average but close to the level of the previous year. In Southern **Caucasus region** the situation was worse as NDVI stayed below 5year average and previous year level. Observed drop in modeled biomass was higher in **Northern Caucasus region**, while in **the Southern Caucasus** modeled biomass was close to 5-year average.

Vegetation season just started in **Subarctic and West Subarctic regions**. NDVI now reached 5-year average level. Despite late start, modeled biomass is above 5-year average.

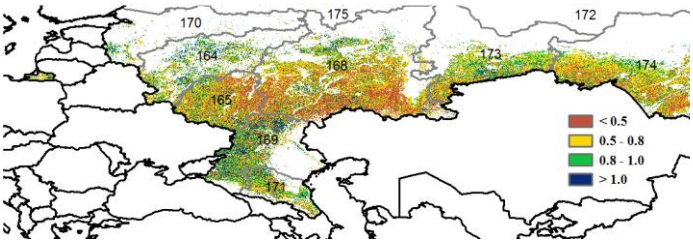
Figure 3.37 Russia's crop condition, January-April 2019



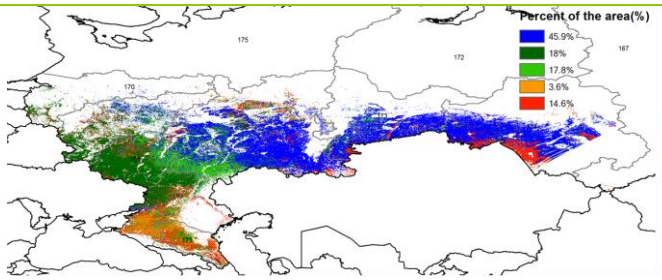
(a). Phenology of major crops



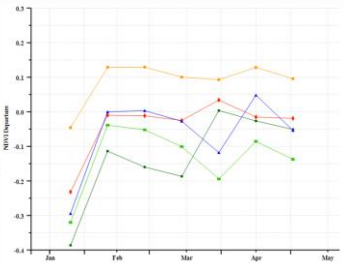
(b) Crop condition development graph based on NDVI



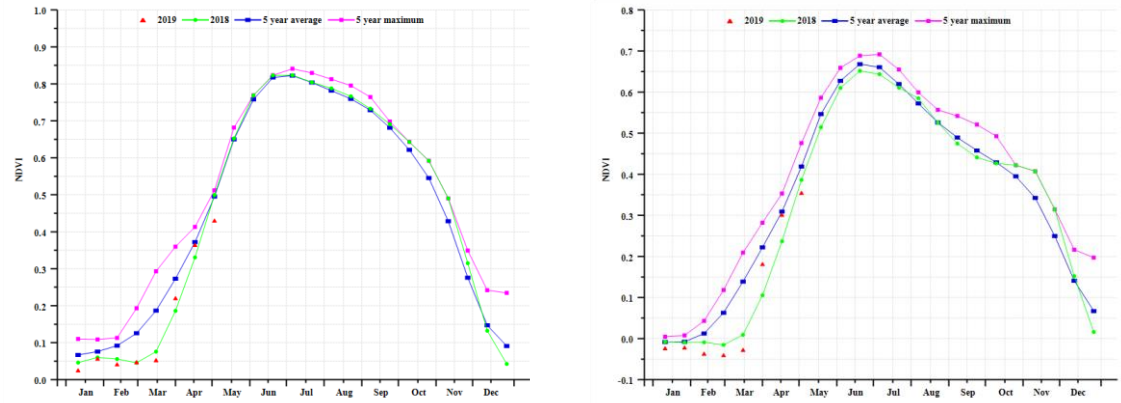
(c) Maximum VCI



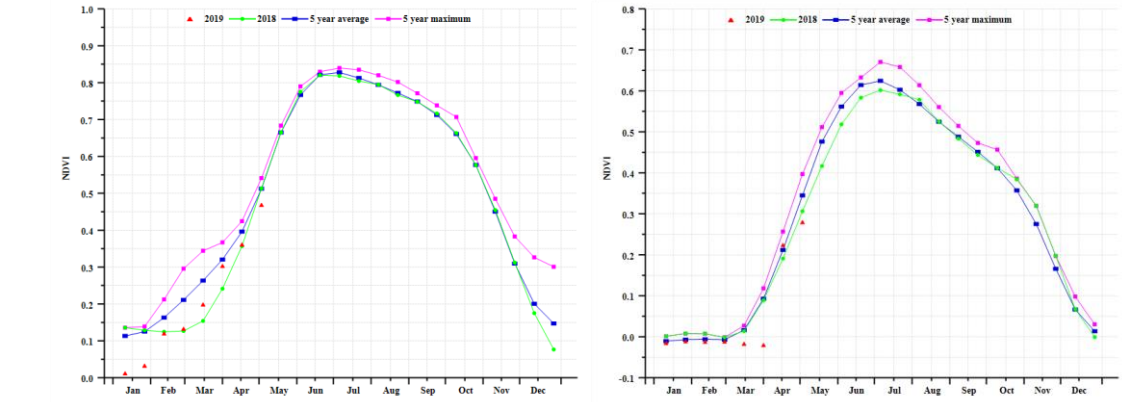
(d) Spatial NDVI patterns compared to 5YA



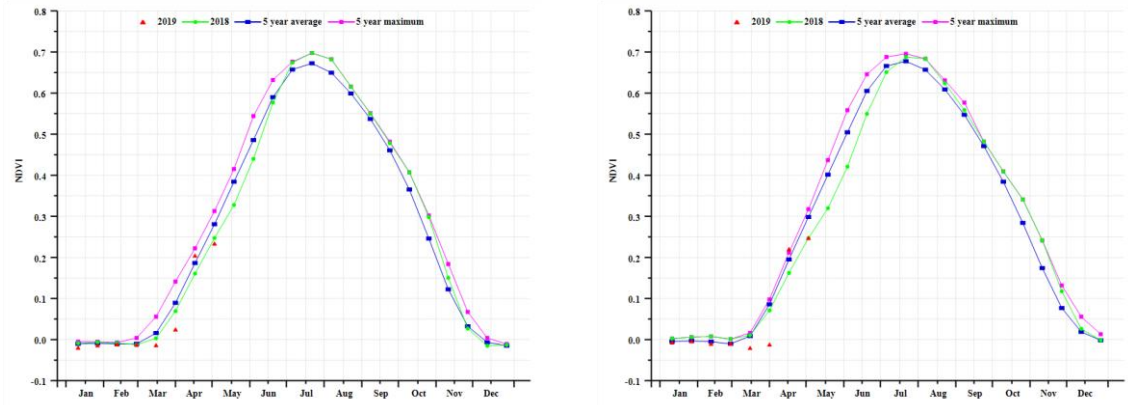
(e) NDVI profiles



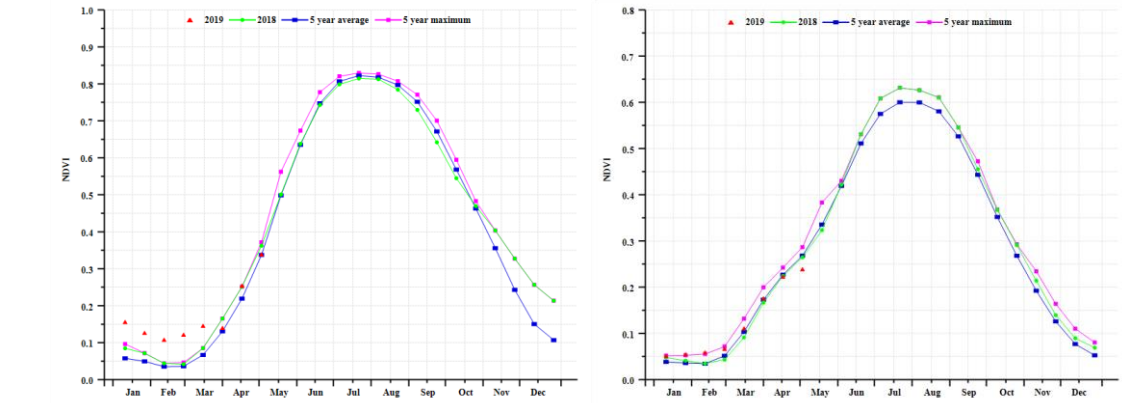
(f) Crop condition development graph based on NDVI in Central Russia (left) and the central Black Soils area (right))



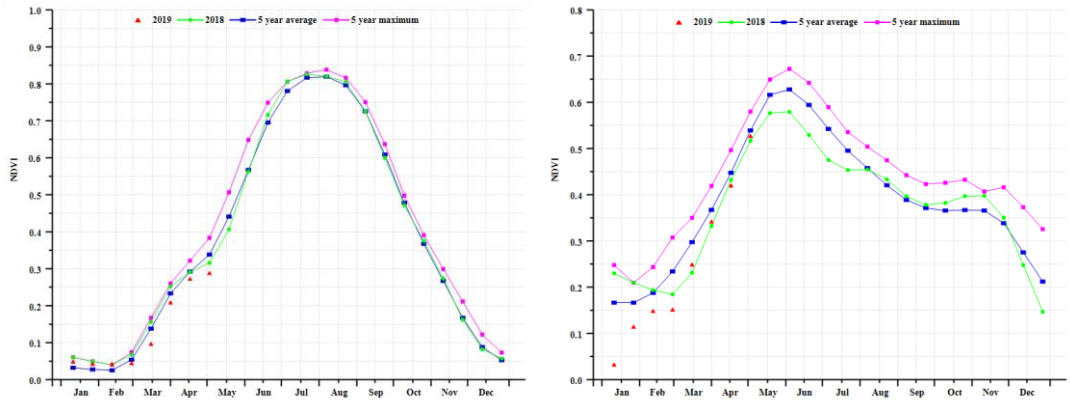
(g) Crop condition development graph based on NDVI the north-western Region including Novgorod (left) and the Middle Volgan (right))



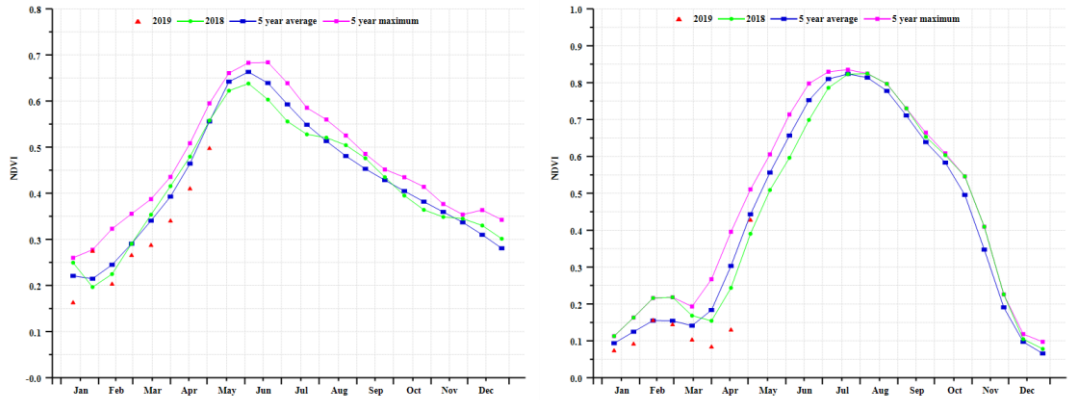
(h) Crop condition development graph based on NDVI in the Western Siberia (left) and the Ural and western Volga region (right))



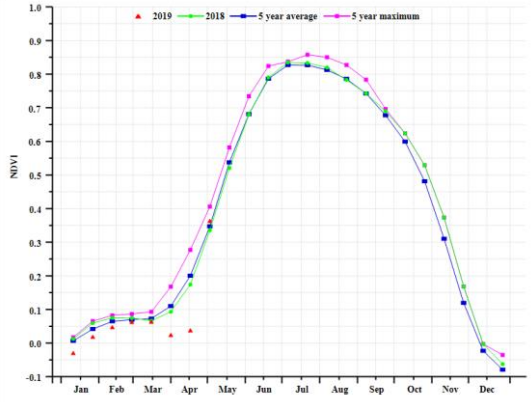
(i) Crop condition development graph based on NDVI in the Eastern Siberia (left) and the Middle Siberia (right)



(j) Crop condition development graph based on NDVI in the Amur and Primorsky Krai (left) and the Northern Caucasus (right)



(j) Crop condition development graph based on NDVI in the southern Caucasus (left) and the Subarctic region (right)



(k) Crop condition development graph based on NDVI in the western subarctic region

Table 3.65 Russia's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, January-April 2019

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m²)	Departure from 15YA (%)
Amur and Primorsky Krai	73	-26	-8.9	2.7	707	3
Central Russia	265	1	-0.9	2.1	379	-3
Central black soils area	261	0	-0.3	1.7	429	-6
Eastern Siberia	88	-42	-9.0	2.2	688	8
Middle Siberia	91	-28	-11.4	2.2	650	3
Middle Volga	264	6	-3.9	1.6	418	-4
Northwest Region including Novgorod	273	2	-0.5	2.2	373	4
Northern Caucasus	184	-13	2.6	0.9	579	-1
Southern Caucasus	223	-12	3.3	1.0	672	0
Subarctic region	-	-	-	-	-	-
Ural and western Volga region	196	6	-6.7	1.4	411	-6
Western Siberia	168	-11	-7.9	1.5	473	-2
West subarctic region	291	8	-4.4	2.1	281	-6

Table 3.66 Russia's agronomic indicators by sub-national regions, current season's values and departure from 5YA/15YA, January-April 2019

Region	BIOMSS		Cropped arable land fraction		Maximum VCI
	Current (gDM/m²)	Departure from 15YA (%)	Current	Departure from 5YA (%)	Current
Amur and Primorsky Krai	306	2	2	-69	0.83
Central Russia	636	11	44	-33	0.84
Central black soils area	687	9	34	-38	0.65
Eastern Siberia	298	-2	20	14	0.98
Middle Siberia	268	0	3	20	0.87
Middle Volga	518	7	9	-68	0.63
Northwest Region including Novgorod	650	14	57	-17	0.84
Northern Caucasus	666	-6	67	-6	0.82
Southern Caucasus	689	-1	63	-17	0.76
Subarctic region	-	-	47	-17	0.90
Ural and western Volga region	427	3	3	-67	0.77
Western Siberia	408	3	1	-74	0.68
West subarctic region	472	11	11	-42	0.90

[THA] Thailand

The planting of the second rice crop started in early January, while the harvest of the main rice has been completed. During this monitoring period, temperature (TEMP +0.5°C), rainfall (RAIN +10%) and radiation (RADPAR +4%) were above average, which led to a 20% increase in BIOMSS. Nationwide, crop condition was slightly below average as shown in NDVI development graph. NDVI departure profiles clustering shows that in 22.6% of the country crop condition was below average before December but it recovered later as the second rice crop was planted. This applies to the center of Central double and triple-cropped rice lowlands and the south of Western and southern hill areas. In the North-eastern single-cropped rice region, which represents 48.8% of arable lands in Thailand, crop condition was slightly below average. Crop condition was persistently below average in 22.8% of arable land, mostly in the form of patches occurring throughout the country). Altogether, considering the favorable VCIx value of 0.84, the crop condition is assessed as average.

The harvest of Thailand's main (monsoon) rice was completely in early January, while the second season rice was ready for harvest in April. Monsoon crops (Maize and rice) are in their very early stages.

According to Agroclimatic indicators, Thailand experienced dry and warm weather compared with average. The rainfall from January to April was below average by 12%, while temperature and radiation were up by 0.6 °C and 6%, which led to a decrease of biomass production potential (BIOMSS) by 10%. As shown in the development of NDVI graph, crop condition was below the 5YA. At the beginning of the monitoring period, crop condition was close to average in January but the difference between current and average condition widened after February. According to the NDVI departure profile cluster map, crop condition was above average in some patches in Nakhon Sawan, Lopburi and Phitsanulok accounting, 11.4% of total arable land. Crop condition in 37.0% of the arable land was close to average, mostly in the south and center of Thailand, which is confirmed by the maximum VCIx map. 40.0% of total arable land was slightly below average, while remaining areas (accounting for 11.6% of total arable land) were significantly below average.

To sum up, the crop condition was "close to average" (between -0.1 and 0.1 from average) in just under 90% of crop land (88.6%), average in 37% of areas. Considering that VCIx reached 0.83 on average and that CALF decreased by just 3% the recently harvested crops are best qualified as "average or below" based mainly on the poor performance of rainfall. The outcome of the current monsoon maize and rice is still open.

Regional analysis

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

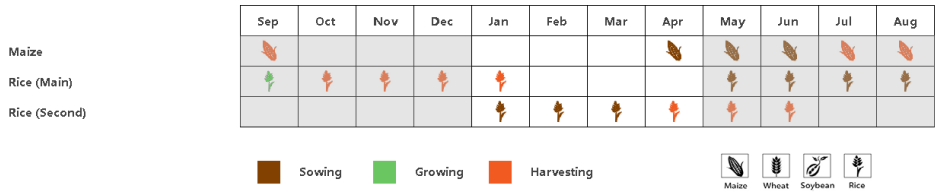
Indicators for **the Central double and triple-cropped rice lowlands** follow the same patterns as those for the country as a whole: temperature (TEMP +0.6C) and radiation (RADPAR +5%) were above average, and accumulated rainfall was significantly below (RAIN -20%), resulting in a biomass production potential decrease (BIOMSS, -9%). According to the NDVI development graph, crop condition was first close to average but deteriorate to below average at the end of the monitoring period. Overall, the situation was below average despite the VCIx value of 0.89 was fair and the fraction of cropped arable land (CALF) slightly increased by 3%.

The rainfall of **the South-eastern horticulture area** suffered a significant decrease of 22%, while temperature (TEMP +0.3°C) and radiation (RADPAR +4%) experienced the same changes as the whole country. The VCIx map, NDVI development graph, and BIOMSS indicators (BIOMSS, -11%) all lead to the conclusion that crop condition was unfavorable.

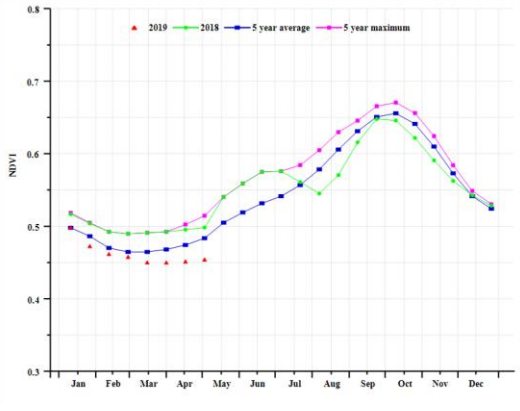
Crop condition in **the Western and southern hill areas** was disappointing according to the Agroclimatic indicators (TEMP +0.3°C, RADPAR +6%, and BIOMSS -17%) when compared to their respective averages due to the deficit of rainfall (-11%). According to the NDVI development graph, crop condition was below average.

Finally, the situation in the **Single-cropped rice north-eastern region** was also less than satisfactory. According to CropWatch indicators rainfall (RAIN -7%) was below average, temperature (TEMP +1.2°C) and radiation (RADPAR +7%) were above average. BIOMSS was just average. NDVI development graph, however, shows that crop condition was below average, which is confirmed by an unfavorable VCIx value of 0.73.

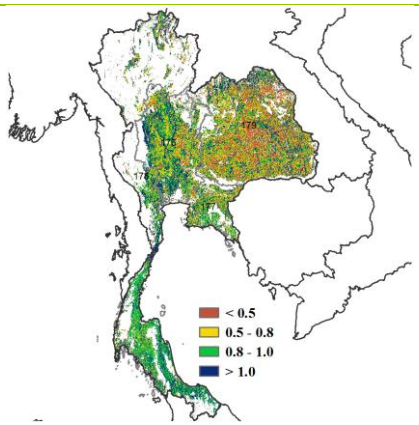
Figure 3.38 Thailand's crop condition, January-April 2019



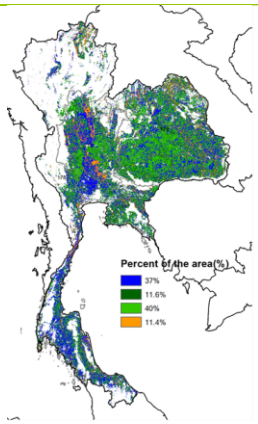
(a). Phenology of major crops



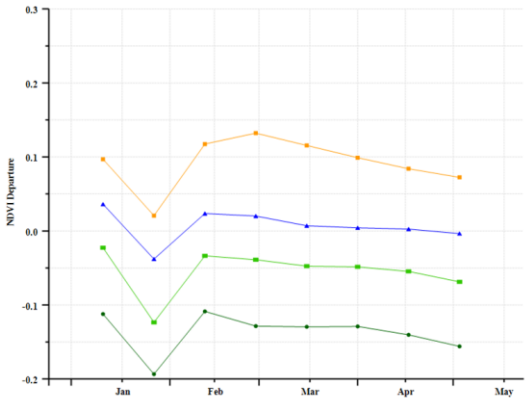
(b) Crop condition development graph based on NDVI



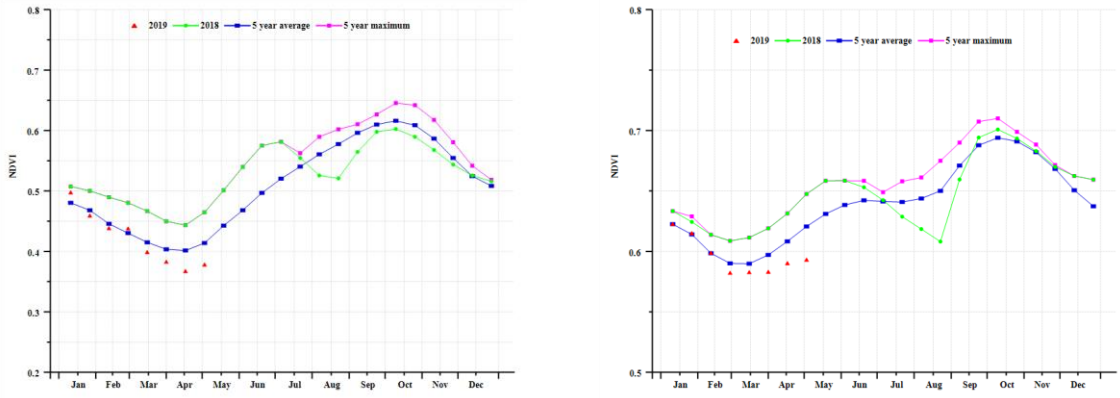
(c) Maximum VCI



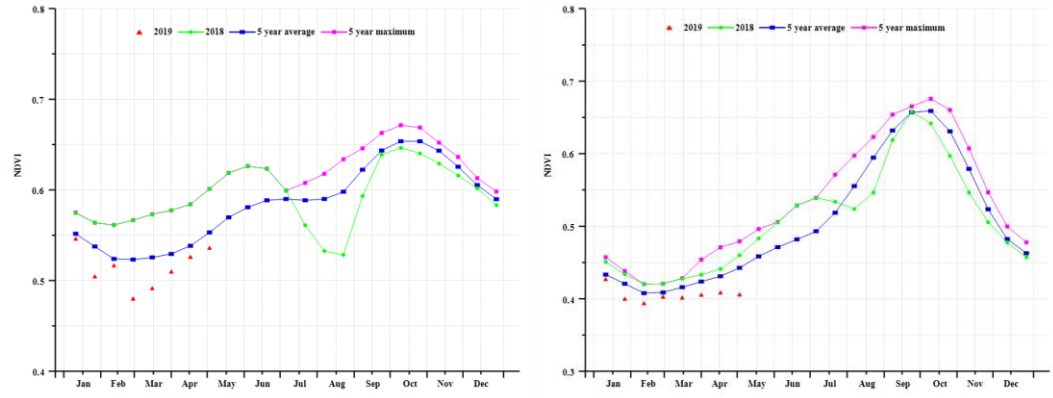
(d) Spatial NDVI patterns compared to 5YA



(e) NDVI profiles



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



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

Table 3.67 Thailand's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, January-April 2019

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m²)	Departure from 15YA (%)
Central double and triple-cropped rice lowlands	108	-20	28.4	0.6	1221	5
South-eastern horticulture area	216	-22	28.2	0.3	1236	4
Western and southern hill areas	223	-11	26.8	0.3	1283	6
Single-cropped rice north-eastern region	149	-7	28.5	1.2	1168	7

Table 3.68 Thailand's agronomic indicators by sub-national regions, current season's values and departure from 5YA/15YA, January-April 2019

Region	BIOMSS		Cropped arable land fraction		Maximum VCI
	Current (gDM/m²)	Departure from 15YA (%)	Current	Departure from 5YA (%)	Current
Central double and triple-cropped rice lowlands	463	-9	89	2	0.89
South-eastern horticulture area	784	-11	94	0	0.84
Western and southern hill areas	555	-17	98	2	0.95
Single-cropped rice north-eastern region	596	0	60	-11	0.73

[TUR] Turkey

Crop condition in Turkey was below average during the whole monitoring period. Maize and rice were planted at the end of the reporting period, while winter wheat was still growing. Rainfall, sunshine and temperature were somewhat below average (RAIN -1%, RADPAR -3%, TEMP -0.1°C), which lead to the average biomass accumulation potential (BIOMSS +1%). The cropped arable land fraction (CALF) decreased by 7% and the maximum VCI was 0.75. According to the spatial NDVI patterns map, crop condition was above average in and around the provinces of Ankara, Eskisehir, Afyon and Konya in the Central Anatolian region and some areas including the provinces of Gaziantep and Mardin in south-eastern Turkey. Consistently low NDVI between 0.1 and 0,.2 units below average prevailed in the east, east of and including the provinces of Diyarbakir and Erzincan. Overall, the output of winter crops will be less than favorable.

Regional analysis

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

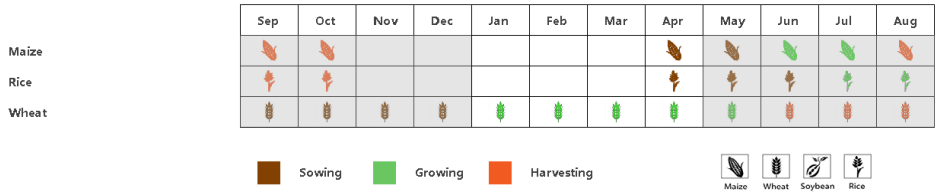
In **the Black Sea zone**, the NDVI was close to and above average in February, but below in other months. Rainfall and sunshine were below average (RAIN -11%, RADPAR -1%). The biomass was average (BIOMSS +1%). VCIx reached 0.78 and CALF is down 7%. The output of crops will average or below.

The Central Anatolian region had below average NDVI during the reporting period, except for mid-February. Both rainfall and sunshine were below average (RAIN -5%, RADPAR -2%). The biomass production potential was average (BIOMSS +2%). CALF fell 8% below average, and the VCIx was 0.78. The condition of crops is assessed as average at best.

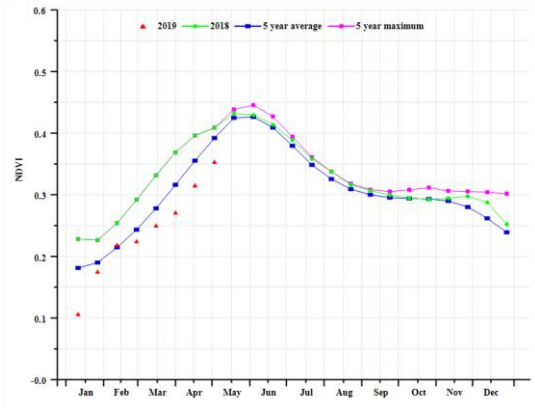
In **the Eastern Anatolian plateau**, the NDVI was above and close to average on the January and February, but below average in March and April. This zone experienced a shortage of rainfall and sunshine (RAIN -11%, RADPAR -6%), which result in a large decrease of CALF (-27%). The VCIx was low at 0.59. All indicators agree in describing crops as poor for this AEZ.

As shown by the NDVI profile in **the Marmara Aegean Mediterranean lowland zone**, the NDVI was below average during the whole reporting period. The temperature and radiation was below average (TEMP -0.3°C, RADPAR -4%) but rainfall exceeded average by 12%. The CALF was average (+1%) and VCIx is the highest in the country. Crop production prospects are estimated to be at least average.

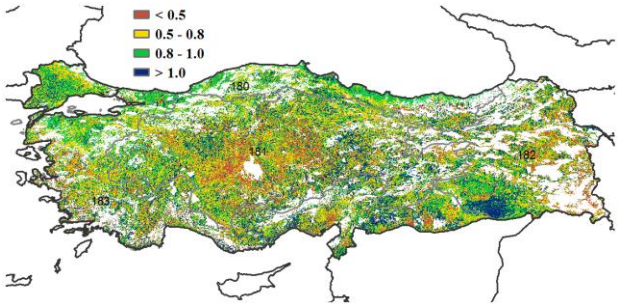
Figure 3.39 Turkey's crop condition, January-April 2019



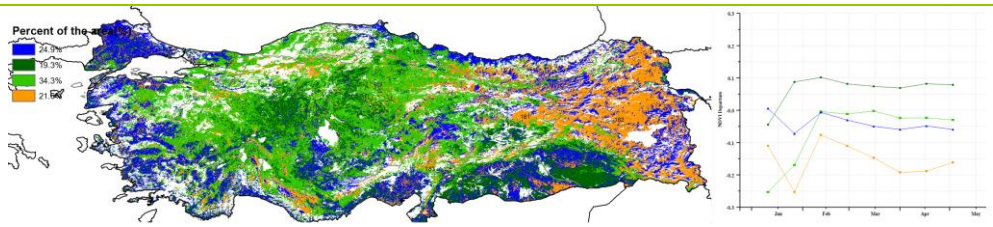
(a). Phenology of major crops



(b) Crop condition development graph based on NDVI

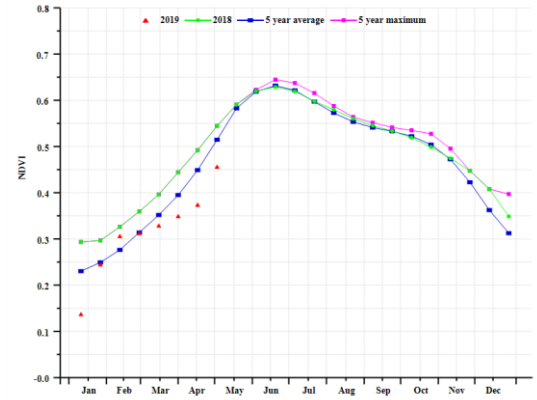


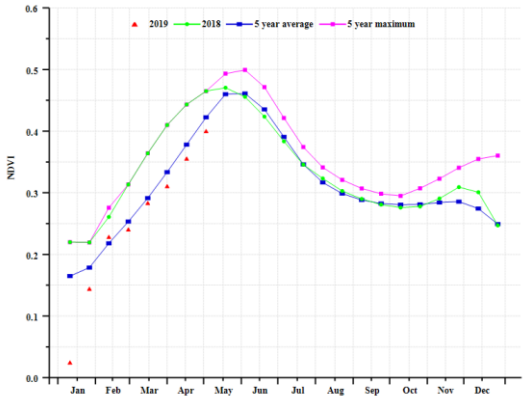
(c) Maximum VCI



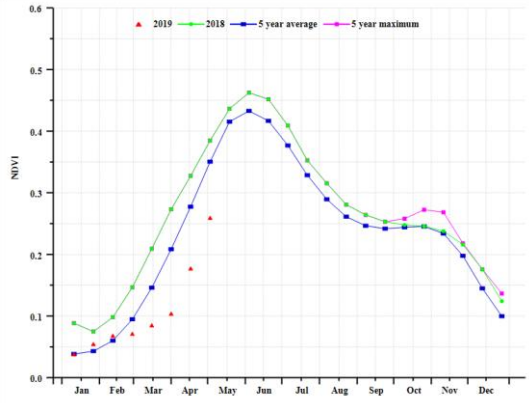
(d) Spatial NDVI patterns compared to 5YA

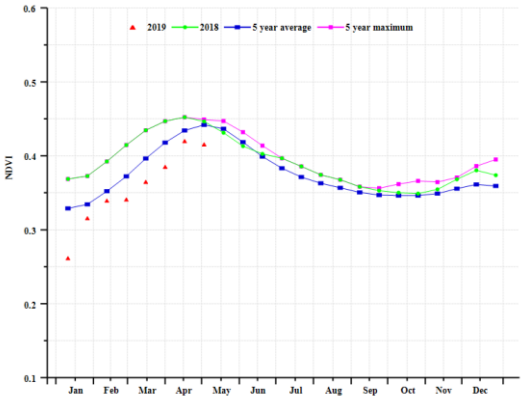
(e) NDVI profiles





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





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

Table 3.69 Turkey's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, January-April 2019

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m²)	Departure from 15YA (%)
Black Sea region	286	-11	4.7	0.4	705	-1
Central Anatolia region	306	-5	3.7	0.0	814	-2
Eastern Anatolia region	231	-11	-0.5	-0.5	780	-6
Marmara Agean Mediterranean lowland region	365	12	7.5	-0.3	801	-4

Table 3.70 Turkey's agronomic indicators by sub-national regions, current season's values and departure from 5YA/15YA, January-April 2019

Region	BIOMSS		Cropped arable land fraction		Maximum VCI
	Current (gDM/m²)	Departure from 15YA (%)	Current	Departure from 5YA (%)	Current
Black Sea region	848	1	71	-7	0.78
Central Anatolia region	874	2	39	-8	0.78
Eastern Anatolia region	608	-5	29	-27	0.59
Marmara Agean Mediterranean lowland region	977	4	74	1	0.84

[UKR] Ukraine

Only winter wheat was in the field during the reporting period since maize was harvested up to December and will be planted in April-May.

As shown by the national agroclimatic indicators, rainfall (RAIN, 210 mm) and radiation (RADPAR, 520 MJ/m^2) were below the average by 4% and 1%, respectively, while temperature (2.9°C, +1.2°C) was much higher than the average. As a result of favorable temperature, potential biomass based on weather condition was forecast to increase to 755 g DM/m^2, 2% above the 15-year average. Agronomic indicators were normal for crop development, although cropped arable land fraction (CALF 72%, 10% below average) showed a decrease. VCIx reached to 0.81, which was a relative high value indicating fair crop condition, with the lowest values occurring in central-northern areas.

The NDVI development curve at the national level suggests crop condition reached close to or above 5YA values after mid-March. In 38.6% of arable land concentrated in north-east and east NDVI was well below average until mid-March. Since then, 68.3% of areas have reached at least average NDVI values with 31.7%, mainly in the west, at moderately low values of -0.1 NDVI units.

In summary overall situation was fair for winter wheat but reduced areas will reduce output.

Regional analysis

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

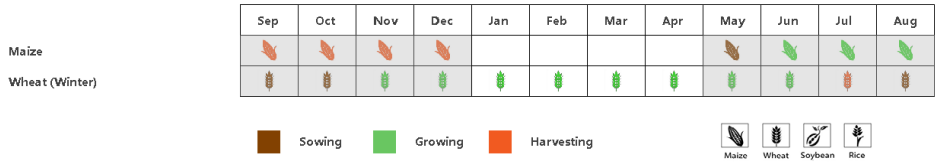
The Central wheat area recorded average rainfall (208 mm, -3%) and radiation (508 MJ/m^2, -2%) but significant increased temperature (2.4°C, +1.1℃). Warm weather condition has benefited wheat growth and the biomass production potential increased by 9% (822 g DM/m^2) as compared to 5-year average. Agronomic indicators show a low CALF (58%, -18%) and fair VCIx (0.75). Similar to national NDVI development trend, crop growth rapidly recovered to 5-year average since middle March. Production prospects are just average or below, mainly due to the drop in CALF.

The Northern wheat area received 2% higher than normal rainfall, normal radiation (-1%) and warmer temperature (2.5°C, +1.5°C), indicating 9% higher potential biomass. It had moderate CALF of only 68% (down 17% below 5YA) a fair VCIx of 0.78. Cropped area was lower but crop condition was fair. The NDVI development curve has reached the 5-year average from mid-February. As in the previous AEZ, production prospects are just average or below.

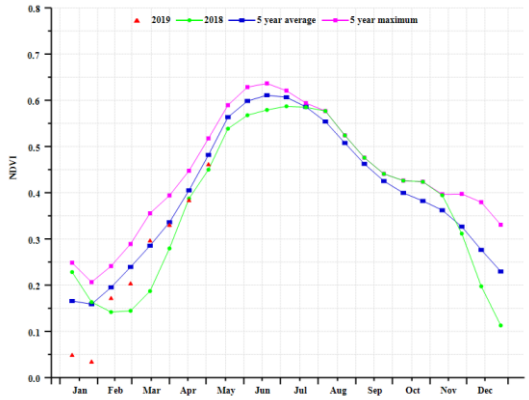
The Eastern Carpathian hills experienced similar agroclimatic and agronomic condition as above two AEZs, normal rainfall (-3%) and radiation (-2%), but higher temperature (+1.2°C). The area had fair VCIx (0.74) and relatively better CALF (87%), a value nevertheless 10% below average. The biomass production potential is up 7% and the NDVI development curve was about average. Crop production prospects are somewhat more favourable than in the two previous AEZs.

The Southern wheat and maize area was deficient in rainfall (-17%) with higher temperature of about 1.1°C and average radiation (-0.3%), which led to 9% reduction in potential biomass. Agronomic indices were favorable with both high CALF (80%) and VCIx (0.88). The NDVI in the area was also marginally higher than last year and 5-year average since February. In spite of low rainfall, the crop condition in the area is assessed as average.

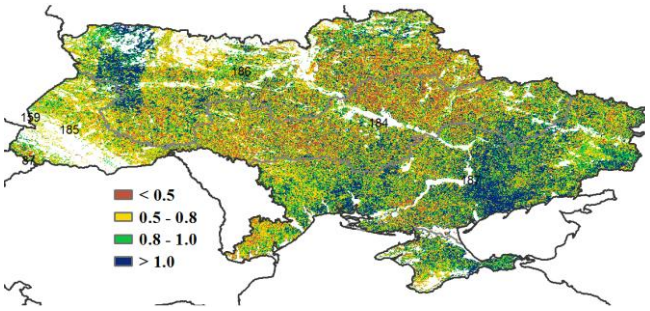
Figure 3.40 Ukraine's crop condition, January-April 2019



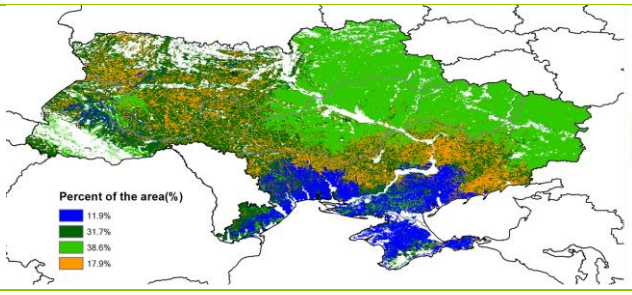
(a). Phenology of major crops



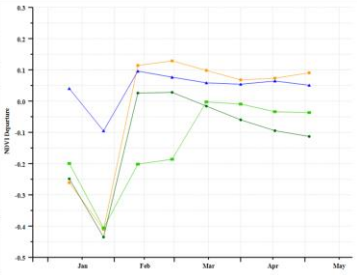
(b) Crop condition development graph based on NDVI



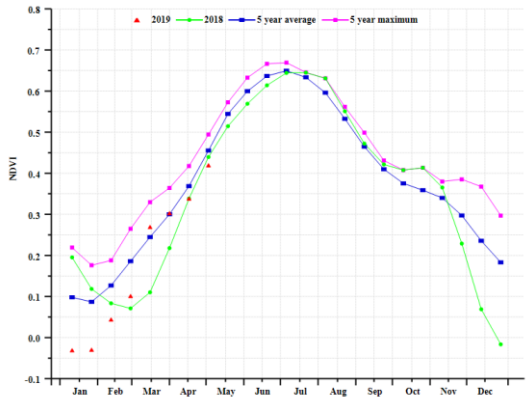
(c) Maximum VCI

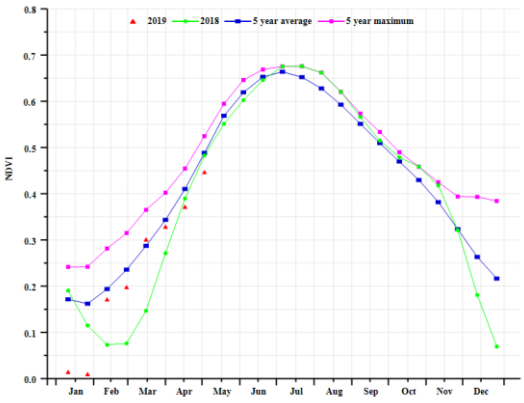


(d) Spatial NDVI patterns compared to 5YA

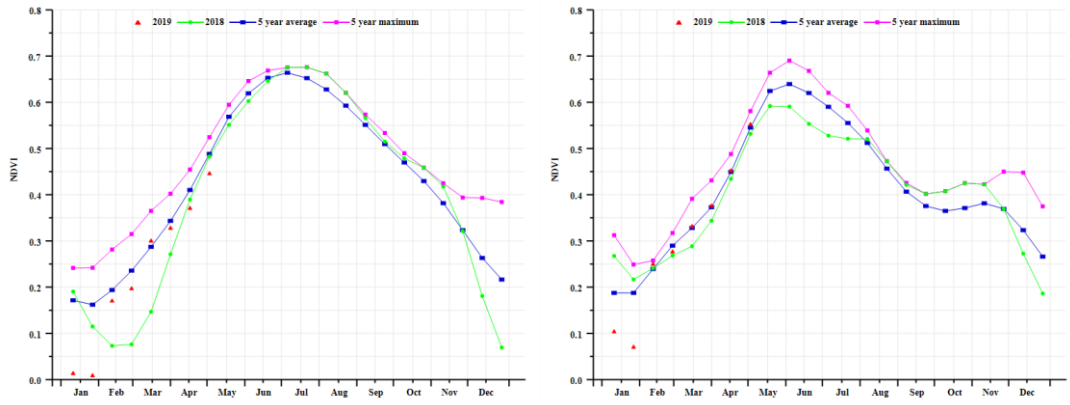


(e) NDVI profiles





(f) Crop condition development graph based on NDVI (Cebntral wheat area (left) and Northern wheat area (right))



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

Table 3.71 Ukraine's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, January-April 2019.

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m²)	Departure from 15YA (%)
Central wheat area	208	-3	2.4	1.1	508	-2
Northern wheat area	256	2	2.5	1.5	472	-1
Eastern Carpathian hills	239	-3	2.9	1.2	539	-2
Southern wheat and maize area	152	-17	3.3	1.1	569	0

Table 3.72 Ukraine's agronomic indicators by sub-national regions, current season's values and departure from 5YA/15YA, January-April 2019.

Region	BIOMSS		Cropped arable land fraction		Maximum VCI
	Current (gDM/m²)	Departure from 15YA (%)	Current	Departure from 5YA (%)	Current
Central wheat area	822	9	58	-18	0.75
Northern wheat area	849	9	68	-17	0.78
Eastern Carpathian hills	838	7	87	-10	0.74
Southern wheat and maize area	624	-9	80	-1	0.88

[USA] United States

The reporting period covers the middle of the growing season of winter crops (winter wheat, rye, oats, canola) and contitutes the early sowing season of maize, soybean, wheat spring and rice. In general, NDVI development graph indicate the condition of current winter crops is more favorable than last year's.

The winter cereals are distributed over the States of Kansas, Oklahoma, Texas, Colorado, Nebraska, Washington, California, Montana and South Dakota. Canola has been planted in North Dakota. In Kansas, South Dakota, Nebraska, North Dakota, California precipitation was well above average by 16%, 41%, 22%, 24%, and 67%, respectively. Among the major winter crop production zones, Oklahoma and Washington suffered precipitation deficits reaching -16% and -12%; both states should be watched for water stresses in the coming months. Below average temperature and RADPAR occurred in all agricultural States, with the coldest weather in North Dakota (-3.0°C below average), Montana (-3.5°C), and South Dakota (-3.5°C).

The favorable crop condition was observed in Abilene in Texas, and Sacramento and Bakersfield of California. Oklahoma City to Wichita is the most important winter wheat producing area in the United States, where crop condition is still below average although it improved since March. Another important winter crop region with far below crop condition before April due to drought covers Spokane to Kennewick in Washington, and the Great Falls region in Montana. Crops have been recovering recently in the area but the most important canola region, North Dakota, remains below average.

The regional differences in crop condition are also confirmed by the maximum VCI (VCIx). Nationwide, VCIx reached to 0.86 in the United States. The highest values (above 1) occur in Abilene (Texas), and Sacramento and Bakersfield (California). Low values were recorded in North Dakota, Montana, and Washington States. The fraction of actually cultivated arable land was average.

In summary, the crop condition in Washington, Montana, North Dakota and Oklahoma still needs close monitoring; good crop production can be expected in California, Texas and Kansas.

Regional analysis

The regional analysis focuses on winter crop producing regions of United States, including California, the Northwest, Northern Plains, and Southern Plains.

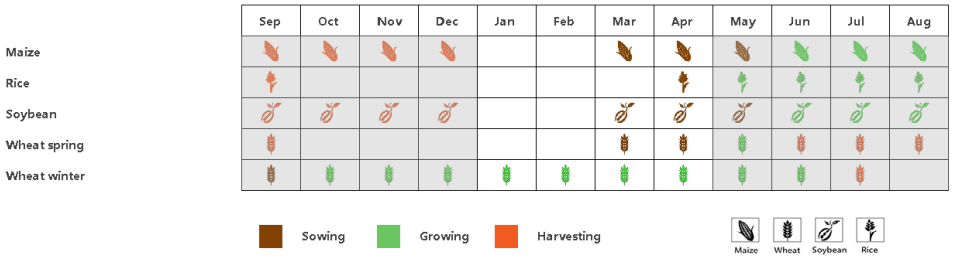
The main agricultural area between Sacramento and Bakersfield had significantly above average crop condition, as indicated by the NDVI development graph. In **California** temperature was close to average (-0.3°C) and precipitation exceeded average by 82%, which replenished much needed soil moisture reserves. The potential biomass is up 38% over average and CALF increased by 9%. VCIx at 0.99 confirms the favourable crop condition.

The **Southern Plains** are the most important winter crops producing zone of the United States; they include Texas, Oklahoma and Kansas. Crop condition reached the 5 year maximum at the end of the monitoring period, in April 2019. CropWatch agro-climatic indicators show average weather condition: precipitation and temperature were 2% and 1.2°C below average. Precipitation was 12% below average in Oklahoma but average or above average in other States. It is worth noting that the CALF in the region has increased significantly, by 10% above the 5YA. The good crop condition was confirmed by VCIx of 0.92 and winter crop production prospects are favorable.

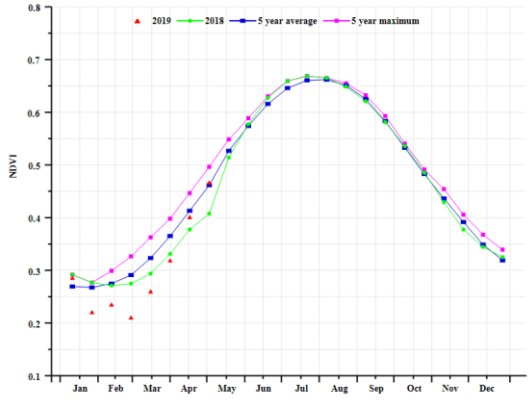
The **Northern Plains** are another important winter crop producing zone of United States, including South Dakota, North Dakota, and Montana. Crop condition was below the 5-year average during the current monitoring period. Precipitation was up 10% compared with average while temperature and RADPAD were significantly lower than average by 3.2°C and 13%, respectively. The sowing, growth and development of crops in this region was blocked by the cold wave and abnormally low RADPAR that resulted in a significant reduction in CALF of 56%. The 0.72 VCIx confirmed the poor crop growth in this monitoring period. Production prospects are unfavorable.

Crop condition was significant below the average in **the North-West**, the fourth major winter crop production zone of the United States. Precipitation was close to average, only slightly higher than average by 4%, while the temperature dropped 1.2°C below average. Washington, the major State of the Northwest region suffered insufficient precipitation (12% below average) The drought led to an 11% reduction in CALF while VCIx was just fair (0.75). Crop prospects are average at best.

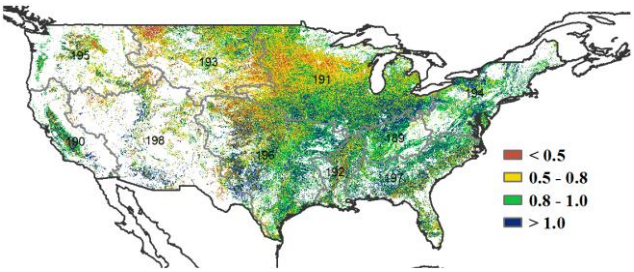
Figure 3.41 United States's crop condition, January-April 2019



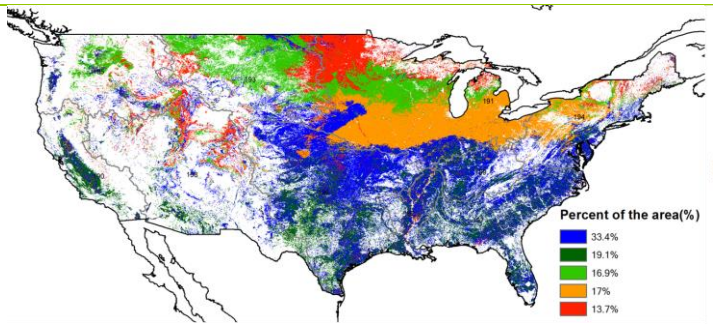
(a). Phenology of major crops



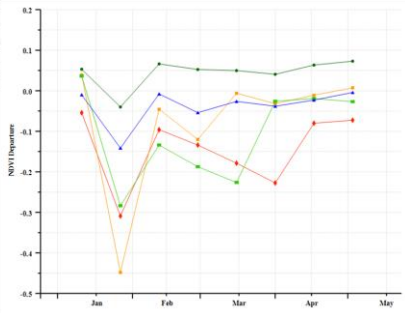
(b) Crop condition development graph based on NDVI



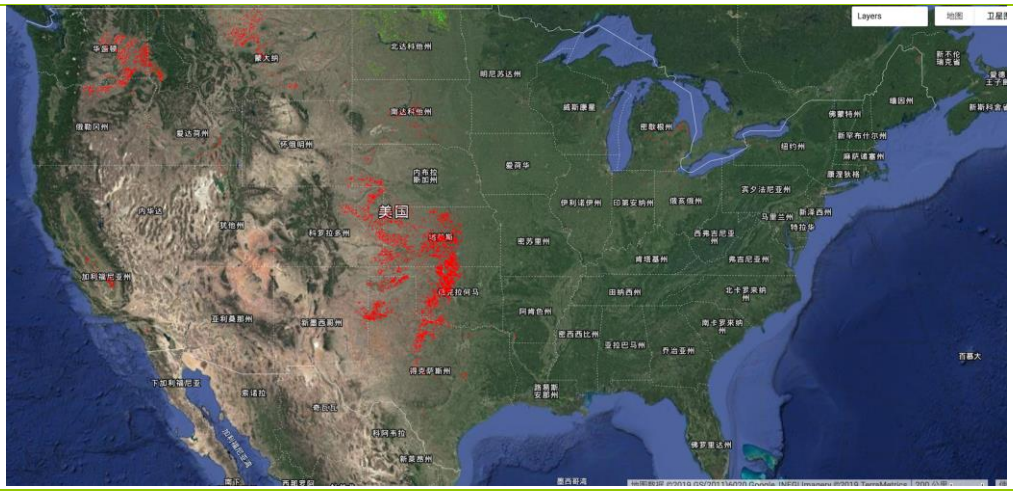
(c) Maximum VCI



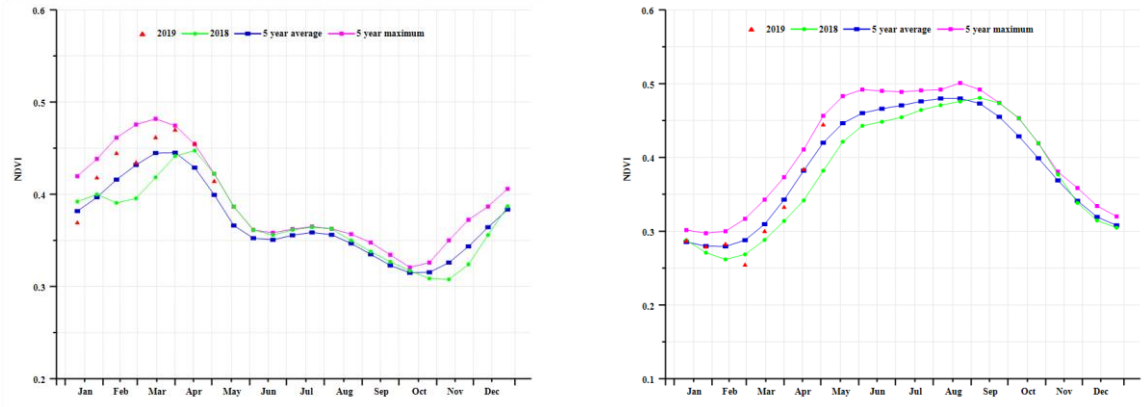
(d) Spatial NDVI patterns compared to 5YA



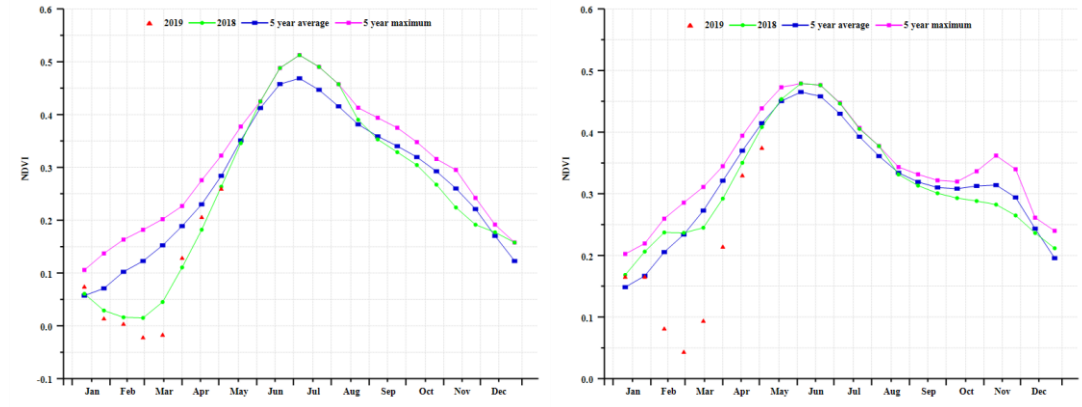
(e) NDVI profiles



(f) Winter crops and canola distribution of United States(red color: winter crops, green color: canola)



(g) Crop condition development graph based on NDVI, California (left) and Southern Plains (right))



(h) Crop condition development graph based on NDVI, Northern Plains (left) and Northwest (right))

Table 3.73 United States's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, January-April 2019.

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m²)	Departure from 15YA (%)
California	315	68	7.5	-0.3	815	-9
Northwest	247	4	0.2	-1.2	643	-3
Northern Plains	212	10	-4.6	-3.2	724	-4
Southern Plains	265	-2	8.8	-1.2	830	-7

Table 3.74 United States's agronomic indicators by sub-national regions, current season's values and departure from 5YA/15YA, January-April 2019.

Region	BIOMSS		Cropped arable land fraction		Maximum VCI
	Current (gDM/m²)	Departure from 15YA (%)	Current	Departure from 5YA (%)	Current
California	784	36.4	79	9	0.99
Northwest	672	2.4	52	-11	0.75
Northern Plains	527	-12.7	5	-58	0.72
Southern Plains	780	5.9	67	10	0.92

[UZB] Uzbekistan

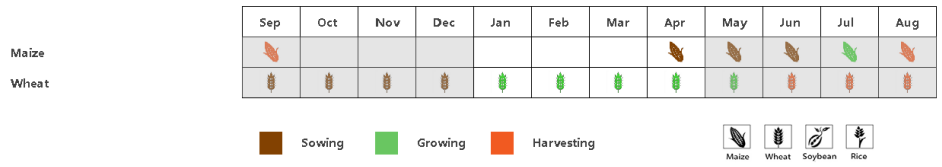
The reporting period covers the sowing of maize at the end of April and the end of winter dormancy and vernal re-growth of winter wheat. The national average VCIx was 1, the highest value on record; the cropped arable land fraction CALF increased by 64%. Among the CropWatch agroclimatic indicators, TEMP and RAIN were above average (1.4°C and 5%), while RADPAR was fell 10%. The combination of factors resulted in increased BIOMSS (9%) compared to the recent average. As shown by the NDVI development graph, crop condition was above the average of the previous five-year average. Spatial NDVI clusters and profiles show that 58.8% of the agricultural areas enjoyed above average condition from February to late March in most parts of the Guliston, Mubarek, Qunghirot, Altynkul, Samarqand, Chimbay, Bekabad, Farish and Kasan provinces, as well as limited areas in the provinces of Kagan, Bukhoro, Quqon, Namangan, Andijon, Farghona and Beruni. Between March and late April, 59.1% of the agriculture areas had above average condition in most of the four eastern provinces, Urganch, Khiva, Tashkent, Gizhduvan, Navoiy, Kattakurgan, Guliston, Jizzakh and Bekabad provinces. Condition was below or average in remaining areas. Overall, crop condition was favorable.

Regional analysis

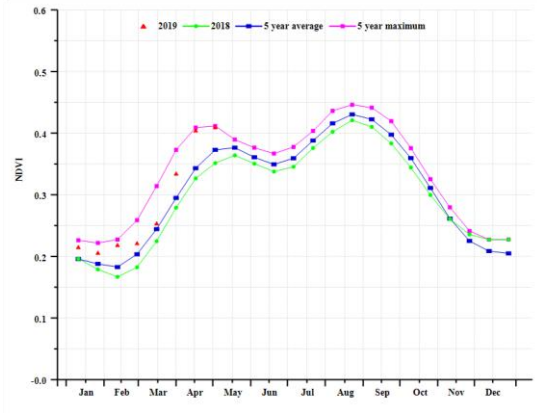
In the **Eastern hilly cereals zone**, NDVI was above the five-year average from January to late April. NDVI exceeded the five-year maximum throughout April. RAIN and TEMP were above average (6% and 1.3°C) and RADPAR was below average (10%). The combination of the factors resulted in high BIOMSS (+11% compared to average). The maximum VCI index was 1.02, and the cropped arable land fraction increased by 64%. The crop condition was favorable during monitoring period in this zone and a bumper crop is expected.

The **Aral Sea cotton zone**, crop condition was above compared with the five years average in January and close to the five averages from February to late April. However, NDVI value was below 0.2 from January to April which indicates the absence of crops in this zone where cotton is the main commodity. Among the CropWatch agroclimatic indicators, accumulated rainfall and radiation were below average during the monitoring period (RAIN -6% and RADPAR -11%) but temperature was significantly above (TEMP +2.0°C). The BIOMSS index increased 2% compared to the fifteen-year average. The maximum VCI index was 0.91.

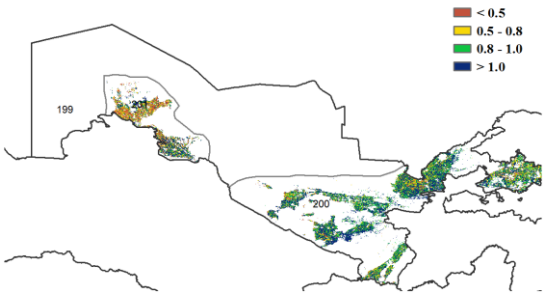
Figure 3.42 Uzbekistan's crop condition, January - April 2019



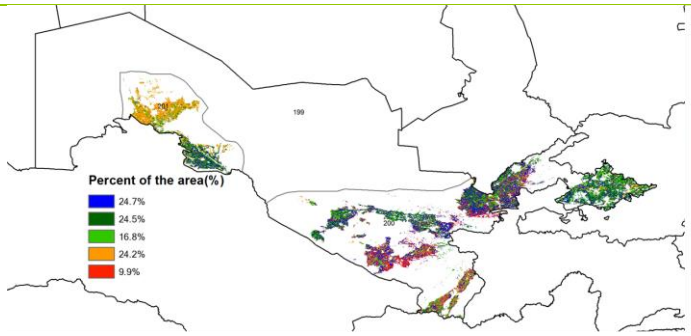
(a). Phenology of major crops



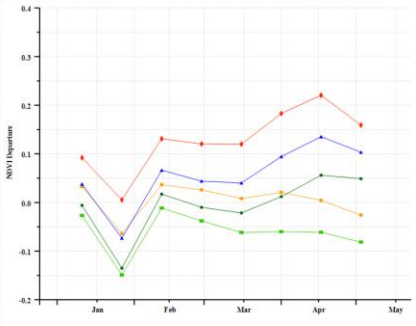
(b) Crop condition development graph based on NDVI



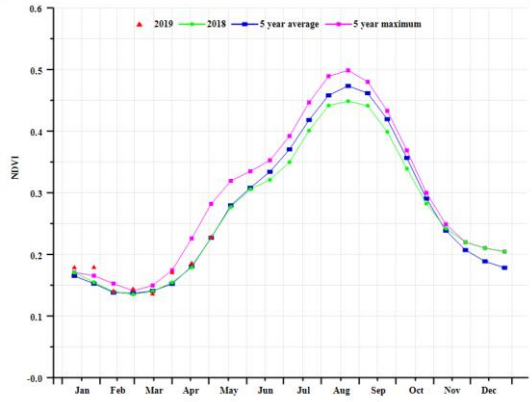
(c) Maximum VCI

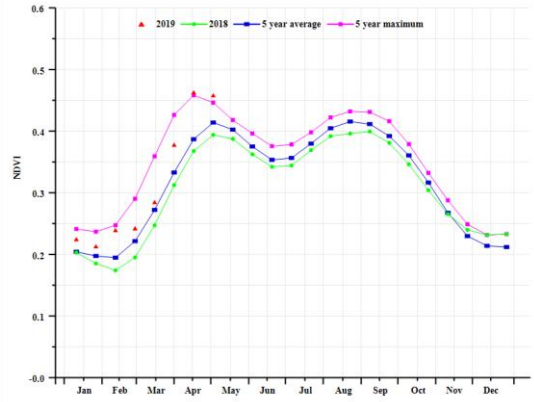


(d) Spatial NDVI patterns compared to 5YA

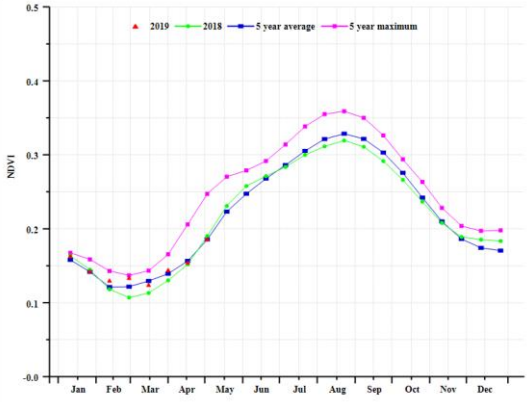


(e) NDVI profiles





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



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

Table 3.75 Uzbekistan's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, January-April 2019

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m²)	Departure from 15YA (%)
Aral Sea cotton zone	141	-6	6.0	2.0	724	-11
Eastern hilly cereals zone	221	6	7.5	1.3	766	-10
Central region with sparse crops	217	-11	6.4	2.0	707	-13

Table 3.76 Uzbekistan's agronomic indicators by sub-national regions, current season's values and departure from 5YA/15YA, January-April 2019

Region	BIOMSS		Cropped arable land fraction		Maximum VCI
	Current (gDM/m²)	Departure from 15YA (%)	Current	Departure from 5YA (%)	Current
Aral Sea cotton zone	584	2	-	-	0.91
Eastern hilly cereals zone	751	11	67	64	1.02
Central region with sparse crops	759	12	-	-	0.57

[VNM] Vietnam

The monitoring period covers the sowing and growth of spring and winter rice in both the north and south of the country, with differences due to altitude. Most rice is cultivated in the Red River Delta (north) and in the Mekong Delta in the south.

Nationwide, the condition of crops is above the reference 5YA in 30.6% of croplands (mainly in the south-east of the country) where a VCIx above 0.8 confirms the favorable situation. Unfavorable crops occur in about 29.2% of the arable land (mainly in the north-west of the country). Due to the erratic behavior of NDVI (possibly due to cloudiness) its interpretation is inconclusive. Compared with average, precipitation decreased 6%, while the temperature (+1.2°C) and RADPAR (+6%) both increased. The biomass production potential was up 3% above average, with high CALF up +1% and a very favourable VCIx of 0.98. CropWatch currently predicts the rice output to be below 2018 values.

Regional analysis

Based on cropping systems, climatic zones, and topographic conditions, several agro-ecological zones (AEZ) can be distinguished for Vietnam, among which three are most relevant for crops cultivation: Northern zone with Red river Delta, the Central coastal areas from Thanh Hoa to Khanh Hoa and Southern zone with the Mekong Delta.

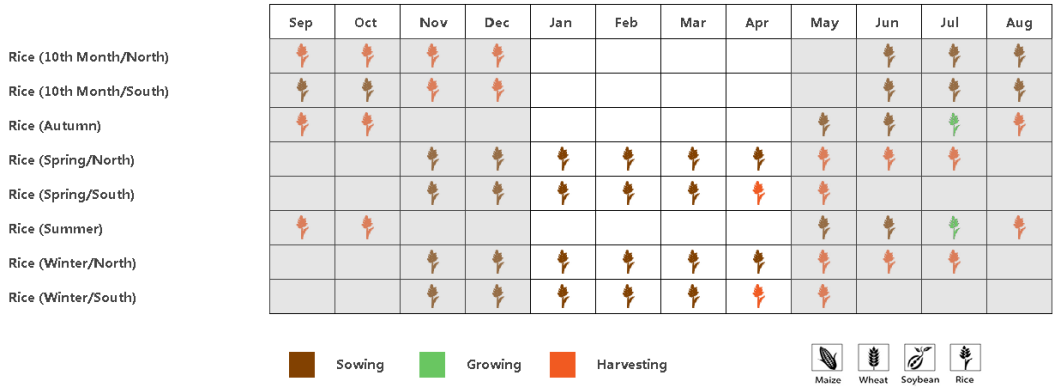
The Northern zone with Red river Delta recorded about average rainfall (RAIN +6%), RADPAR (-2%) but high temperature (TEMP 1.6°C above average). With high CALF (99%) and VCIx (1.00), the BIOMSS significantly increased (+17%) compared to the average. The NDVI development graph showed an unstable trend with values above the 5 years maximum in April. Based on the agro-climatic indicators and NDVI development graph, output is likely to be average or above.

The situation and expected impact on crop production in **the Central coastal areas from Thanh Hoa to Khanh Hoa** is conditioned by low precipitation (RAIN -10%), high temperature (TEMP +1.7°C) and abundant sunshine (RADPAR +16%). BIOMSS is down 2% but VCIx (1.01) and CALF (+1%) describe fair to good condition. The crop condition development graph based on NDVI was above the 5 years maximum during February but decreased after March. Below average output is likely for rain-fed crops but irrigated crops should be doing fine.

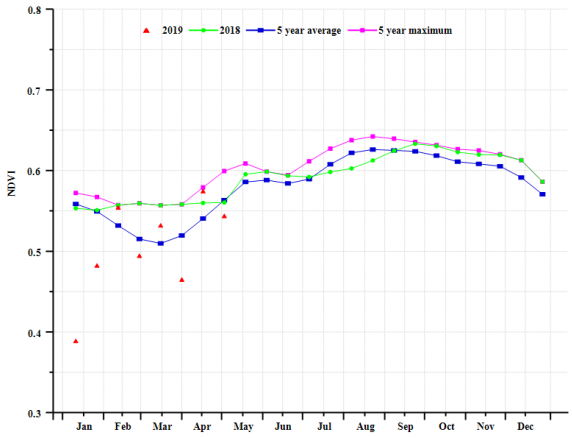
The fraction of cropped arable land (CALF) in **the Southern zone with the Mekong Delta** for the reporting period is close to average (up 1%). Vegetation condition indices (maximum VCI) are favorable (0.94), accompanied by a decrease in BIOMSS (-7%) resulting from the obvious shortage of precipitation (RAIN, -17%) along with an increase in radiation (RADPAR +6%) and average temperature (TEMP +0.5°C). The crop condition development graph of NDVI indicates values that are below the 5 years average and last year's condition. CropWatch expects below average production in the area.

With crop condition in over 60% of the croplands average or below average, crop prospects are expected to be average or below.

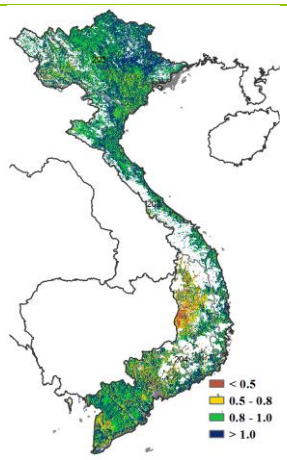
Figure 3.43 Vietnam's crop condition, January -April 2019



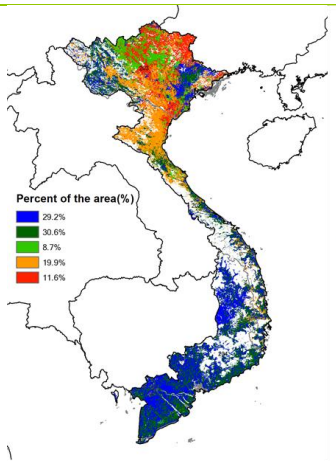
(a). Phenology of major crops



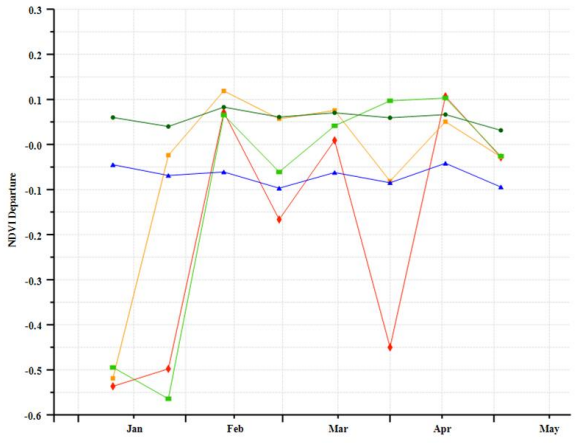
(b) Crop condition development graph based on NDVI



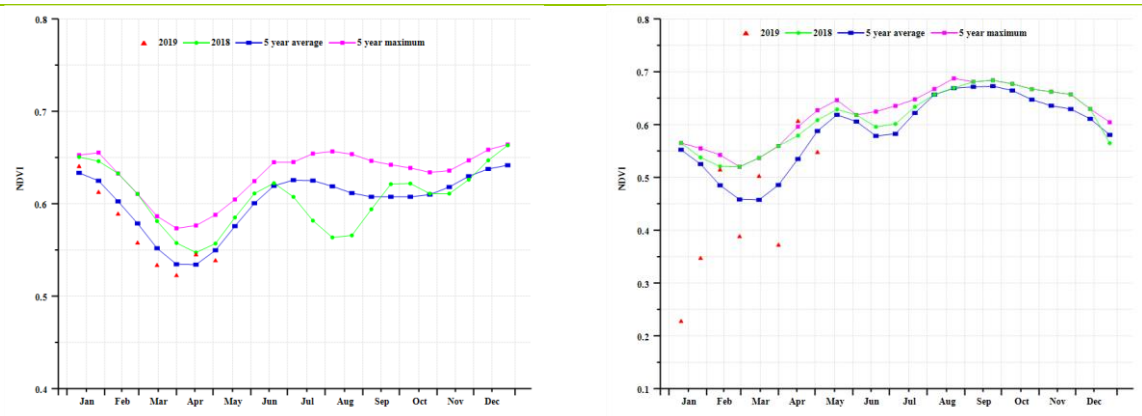
(c) Maximum VCI



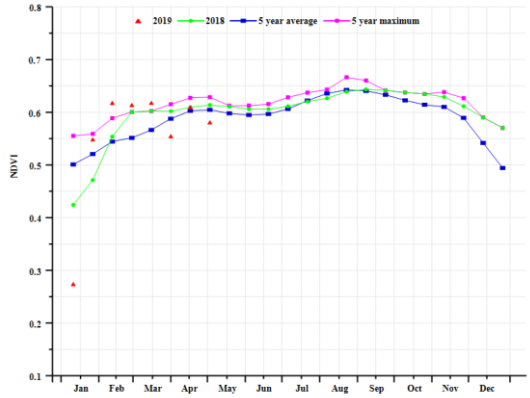
(d) Spatial NDVI patterns compared to 5YA



(e) NDVI profiles



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



(g) Crop condition development graph based on NDVI (Central Vietnam).

Table 3.77 Vietnam's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, January -April 2019

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m²)	Departure from 15YA (%)
North_Vietnam	192	6	20.3	1.6	772	-2
Central_Vietnam	167	-10	24.8	1.7	1061	16
South_Vietnam	143	-17	26.5	0.5	1222	6

Table 3.78 Vietnam's agronomic indicators by sub-national regions, current season's values and departure from 5YA/15YA, January -April 2019

Region	BIOMSS		Cropped arable land fraction		Maximum VCI
	Current (gDM/m²)	Departure from 15YA (%)	Current	Departure from 5YA (%)	Current
North_Vietnam	712	17	99	1	1.00
Central_Vietnam	588	-2	99	1	1.01
South_Vietnam	504	-7	92	1	0.94

[ZAF] South Africa

The reporting period corresponds to the growing of summer crops such as maize, to be harvested from May while the harvest of soybean started in April.

The rainfall (RAIN) increased 14% above the average and the temperature (TEMP) was up just 0.3°C. The estimated RADPAR was 5% above the average with BIOMSS 8% above the average and average CALF at 85%.

80.3% of cropland showed below average NDVI until the end of March, after which values exceeded average. In remaining areas crop condition was above average during the whole period, mostly in the Free State. While the estimated nationwide VCIx value was high (0.8), the maximum VCI map shows large variations in VCIx among provinces. Values were very high (>1) in Mpumalanga and Gauteng provinces, high (0.8 – 1) for most regions except some regions in Western Cape and North West provinces where the VCIx was low (<0.5). In general, all CropWatch estimates indicate fair crop conditions.

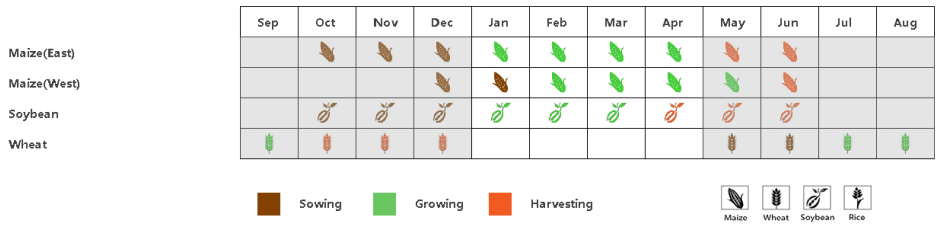
Regional analysis

Based on the cropping system, climatic zones, and topographic conditions, four sub-national agro-ecological regions (AEZs) can be distinguished for South Africa. Only three of them are relevant for crops; **Humid Cape Fold mountains**, **Mediterranean zone**, and **Dry Highveld and Bushveld maize areas**.

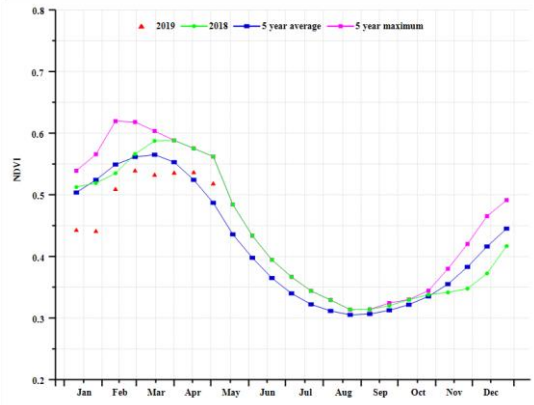
The agroclimatic indicators for the three AEZs show an increase in the rainfall over average by 16, 13, and 15%, respectively, while the temperature was below the average for the first two zones (by 0.2 and 0.5°C, respectively) and 0.4°C above the average for **the Dry Highveld and Bushveld maize areas**. The estimated RADPAR was at average (1133MJ/m^2) for **the Humid Cape Fold mountains** and above average for the other two zones by 1% and 6%, respectively. The CropWatch agronomic indicators show an increase in the estimated BIOMSS for the three zones between 4% and 14%. The CALF was at the average for the first and third zones, but 26% above in **the Mediterranean zone**. The maximum VCI was high (0.83 and 0.89) for the first and the third zone but low (0.38) for **the Mediterranean zone**.

In **Humid Cape Fold mountains**, crop condition started below the average but passed the average after mid-March. In **the Mediterranean zone**, the crop condition exceeded average in early March. **The Dry Highveld and Bushveld maize areas** had above average crop condition only during April.

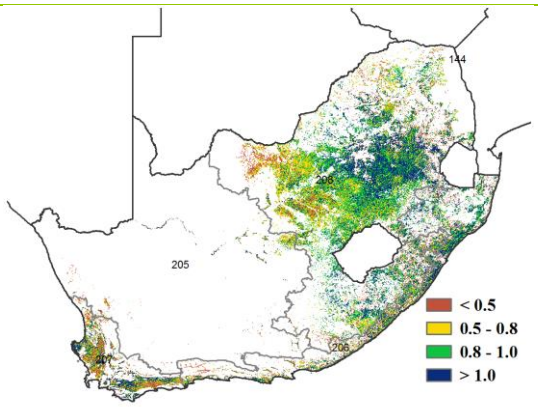
Figure 3.44 South Africa's crop condition, January -April 2019



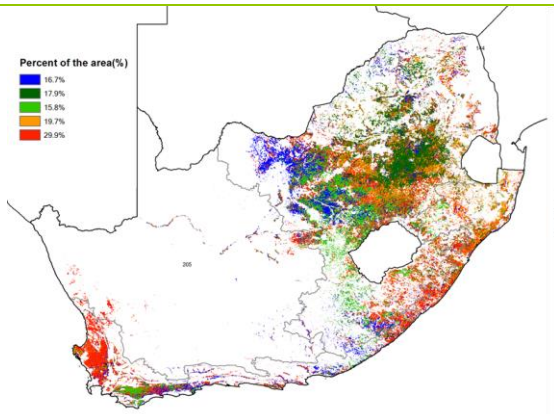
(a). Phenology of major crops



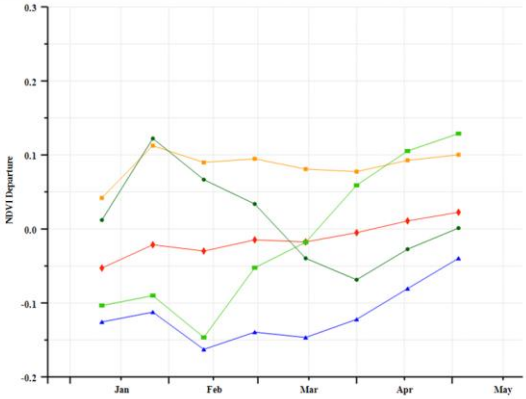
(b) Crop condition development graph based on NDVI



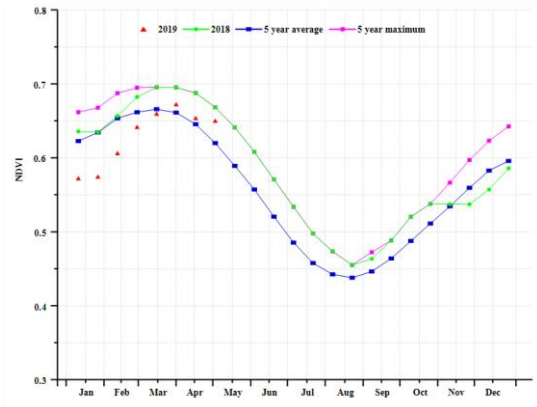
(c) Maximum VCI

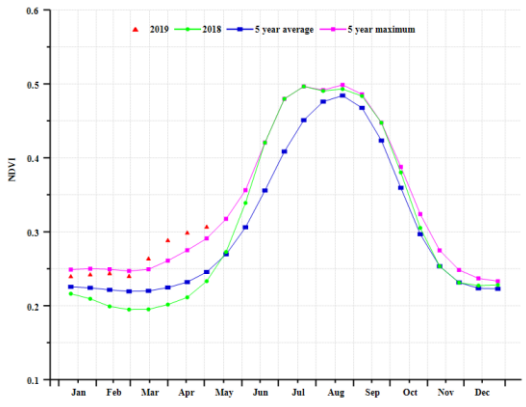


(d) Spatial NDVI patterns compared to 5YA

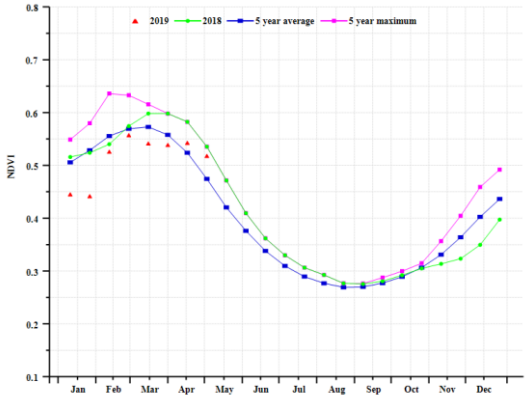


(e) NDVI profiles





(f) Crop condition development graph based on NDVI (Humid Cape Fold Mountains (left) and Mediterranean wheat zone (right))



(f) Crop condition development graph based on NDVI (Dry Highveld and Bushveld maize zone)

Table 3.79 South Africa's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, January -April 2019

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m^2)	Departure from 15YA (%)
Humid Cape Fold Mountains	352	16	21.4	-0.2	1133	0
Mediterranean Zone	97	13	19.0	-0.5	1320	1
Dry Highveld and Bushveld	418	15	20.9	0.4	1331	6

Table 3.80 South Africa's agronomic indicators by sub-national regions, current season's values and departure from 5YA/15YA, January -April 2019

Region	BIOMSS		Cropped arable land fraction		Maximum VCI
	Current (gDM/m^2)	Departure from 15YA (%)	Current	Departure from 5YA (%)	Current
Humid Cape Fold Mountains	1136	14	96	0	0.83
Mediterranean Zone	370	4	28	26	0.38
Dry Highveld and Bushveld	1335	10	92	0	0.89

[ZMB] Zambia

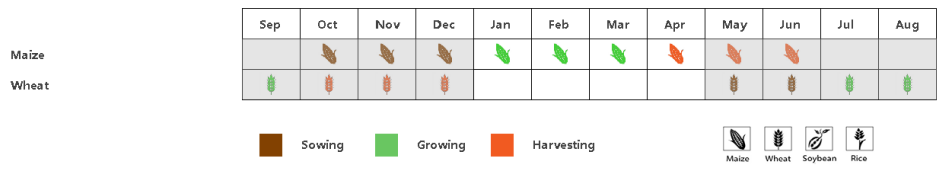
The reported period covers crop establishment, vegetative, reproductive, maturity and harvesting phase under rain-fed conditions for main cereal crops (maize, sorghum, millet). Harvesting of rain-fed crops started in April; their production was severely affected by rainfall deficits mostly during months of February and March. A decrease of cereal production is expected in the Southern, Western and parts of Central Provinces which account for close to one-third of the national cereal output. After harvesting of rain-fed crops in April, large scale (commercial) farms prepare and plant irrigated winter wheat which give approximately 200,000 tonnes national annual production.

Any rainfall deficit during the sensitive phase of crop development greatly reduces agriculture production prospects. According to overall agroclimatic and agronomic indicators, the 2019 season, experienced decreased rainfall (14% below average), increased radiation (+2%) and a marginal temperature decrease (-0.1 degree Celsius) which led to decreased biomass production (-14%). This was reflected in the below average crop development condition throughout this period. This was observed by lower NDVI, despite the increased area under cultivation (CALF +12% 5YA Departure) and maximum VCI of 0.94. However, most of the cultivated area had maximum VCI varying from 0.8 to 1.0 except for the central and southern parts of the country experiencing maximum VCI between 0.5 to 0.8. The spatial distribution of NDVI profiles attest 35% - mainly northern parts which experienced positive NDVI Departures while the rest of the country and predominantly the central and southern parts suffered negative NDVI departures. The seasonal deficits in rainfall are the predominant factor in the unfavourable production as reflected in the NDVI profiles. Most of the cropped land in Southern, Lusaka and Western Provinces experienced stressed vegetation conditions especially in the month of March, hence a high likelihood of reduced crop harvest and yields. The poor rainfall establishment at the start of the season contributed to the reduced cropped land area.

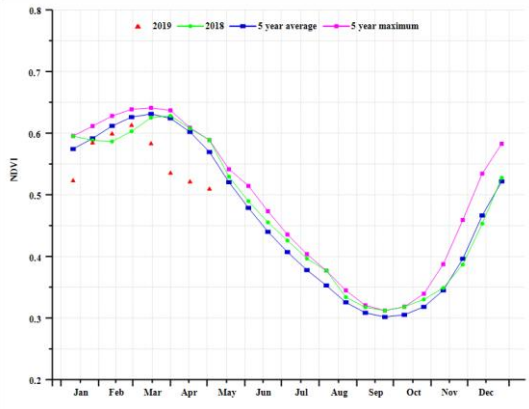
In terms of the agro-ecological region analysis, all the agro-ecological regions received less annual rainfall than the expected 15YA with highest deviations (-26%, 15 YA Dep.) observed for the Luangwa and Zambezi Valleys (AEZ I), followed by Western Semi-Arid Plain (AEZ IIb), Central, Eastern and Southern (AEZ IIa) and minimal deviations (-2%, 15YA Dep.) for Northern High Rainfall Zone (AEZ III). This was reflected in the annual biomass production trends in the regions AEZ I (1131 gDM/m^2: -22% 15YA Dep.) compared to AEZ III (1891 gDM/m^2: +2% 15YA Dep.). However, the Cropped Arable Land Fraction (CALF) remained at 100% with negligible deviation from the 15YA (0%). Both the NDVI and BIOMASS showed a strong departure from 15YA, indicating reduced potential agricultural production in region AEZ IIa, AEZ IIb and AEZ I due mainly the reduced rainfall in these regions.

CropWatch indicators point to the fact that poor harvest will affect food security particularly in the Southern Province, rural Lusaka and western parts of the country. Since it has become more evident that the rainfall received in recent times is lower than the 5YA, and this has caused severe food insecurity, an adaptation strategy would be to investment in water harvesting infrastructures to enable use of harvested rainfall water rationally during farming seasons.

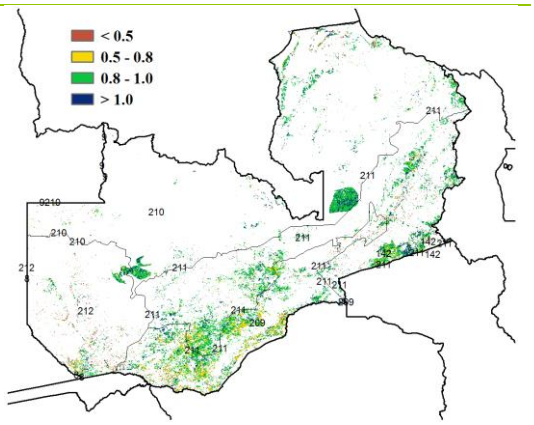
Figure 3.45 Zambia's crop condition, January - April 2019



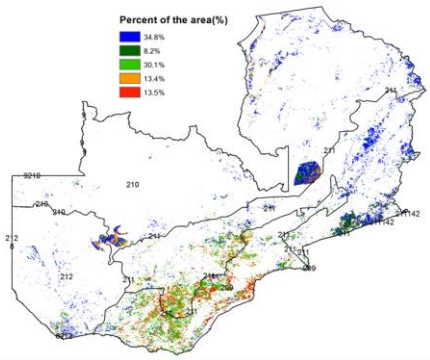
a). Phenology of major crops



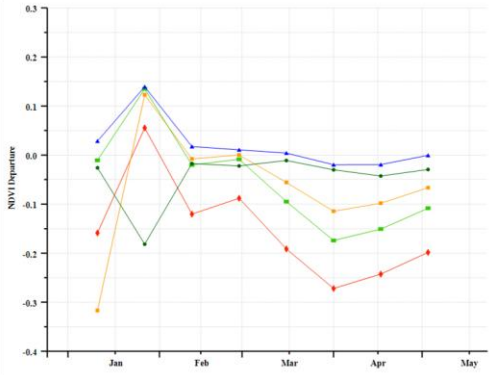
(b) Crop condition development graph based on NDVI



(c) Maximum VCI



(d) Spatial NDVI patterns compared to 5YA



(e) NDVI profiles

Table 3.81 Zambia's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, January -April 2019

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m²)	Departure from 15YA (%)
Luanguwa Zambezi rift valley	375	-26	25.5	0.2	1314	6
Northen high rainfall zone	675	-2	23.1	0.0	1136	2
Central-eastern and southern plateau	517	-11	24.3	-0.2	1198	2
Western semi-arid plain	412	-22	25.2	0.3	1359	13

Table 3.82 Zambia's agronomic indicators by sub-national regions, current season's values and departure from 5YA/15YA, January -April 2019

Region	BIOMSS		Cropped arable land fraction		Maximum VCI
	Current (gDM/m²)	Departure from 15YA (%)	Current	Departure from 5YA (%)	Current
Luanguwa Zambezi rift valley	1131	-22	100	0	0.86
Northen high rainfall zone	1891	1	100	0	0.95
Central-eastern and southern plateau	1503	-7	100	0	0.93
Western semi-arid plain	1226	-19	100	0	0.90