Chapter 3. Core countries

Chapter 1 has focused on large climate anomalies that sometimes reach the size of continents and beyond. The present section offers a closer look at individual countries, including the 41 countries that together produce and commercializes 80 percent of maize, rice, wheat, and soybean. As evidenced by the data in this section, even countries of minor agricultural or geopolitical relevance are exposed to extreme conditions and deserve mentioning, particularly when they logically fit into larger patterns.

3.1 Overview

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

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

1. 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: Among the 14 countries that export more than 1 million tonnes of maize, four recorded precipitation exceeding average by 20% or more. They include the USA (+29%), Hungary (+35%) and Serbia (+34%) in the northern hemisphere, where the reporting period covers most of the main maize growing season, and where the harvest is about to start. Although weather was cool and wet in the USA, the biomass production potential dropped just 1%, with the Cropped Arable Land Fraction indicator (CALF) up 3% and the maximum Vegetation Condition Index VCIx indicator showing values associated with favorable crop condition (0.93). The largest positive increases in the BIOMSS index occur in Ukraine (+6%), India (+7%) and France (+9%) in spite of relatively dry conditions in some of them (e.g. France). In India VCIx is moderate (0.83) with a low CALF (55%) resulting from a 5% drop compared with previous years.

In the southern hemisphere, Argentina (20% excess precipitation) harvested maize during the first half of the AMJJ period. In the province of Cordoba, the major maize producing area, the excess was just 6%. VCIx indicates below average conditions and the BIOMSS potential indicator is down due to poor sunshine (-9%). In Brazil and Paraguay all indicators show favorable environmental and agronomic conditions. In South-Africa, where the main maize crop was harvested during the reporting period,

cropland increased (CALF up 5%) but VCIx is just fair and BIOMSS potential fell 10% due to drought (RAIN down 30%).

Rice: The top 3 rice exporters in Asia (India, Thailand and Vietnam) experienced very similar weather conditions at the national scale: mostly dry and warm, reaching heatwave proportions in some areas (India). The RAIN deficit varies from -13% to -23% and TEMP is up 0.4℃ to 0.7℃. Mostly driven by favorable sunshine, the biomass production potential is up 8%. CALF is down 8% in India and in Pakistan, where prevailing weather conditions were wet and (+53%) and cool (0.7 ℃ below average). In the USA, the 5th exporter, conditions were roughly average for rice.

Wheat: Twenty countries in both hemispheres export more than 1 million tonnes of wheat. The top five exporters each market more than 10 million tonnes internationally, including the USA, Canada, Russia, France and Australia. 13 out of twenty exporters had below average rainfall. Few countries had large precipitation excesses, the main exception being the USA where the reporting period witnessed most of the nationwide winter wheat harvest, which mostly ends in July in the northern States. As such, the indicators are very relevant for wheat. The countries with the largest positive BIOMSS departures from average are all located in north-eastern Europe (Latvia and Poland, +11%; Lithuania +16%). All of them also experienced positive sunshine departures (5% to 10%), full cropping (CALF at 100%) and favorable VCIx.

In Australia, the JFMA period covers the end of the 2018-2019 harvest (up to January) and the early stages of the 2019-2020 crops (from April). Very dry conditions have affected the period (RAIN down 17% below average) with a marked drop in CALF (-38%) and unfavorable VCIx (0.42), the lowest value by far among the 20 top exporters. The 2018-2019 crops are unlikely to have been satisfactory, but the impact on the ongoing wheat season is still open.

As already mentioned under maize, Argentina had a marked biomass production potential drop of 9%. Considering, however, that wheat was in early vegetative stages in June and July, the crop is unlikely to have been seriously affected.

Soybean: among the eight countries that export more than one million tonnes of soybean only seven need to be considered as the Netherlands is a Soybean product re-exporter. Above average biomass production potential occurred in Brazil and Ukraine (+4% and +6%); the soybean harvest extends to the first half of the reporting period and somewhat beyond in south America, and is still to take place in the northern hemisphere. Some damage to soybean due to poor sunshine may have occurred in Argentina (-9%) and in Uruguay (-6%) as both countries also show drops in BIOMSS and extremely low VCIx of 0.45 and 0.39, respectively. The situations seem to be significantly better in Paraguay.

2. Weather anomalies and biomass production potential changes

A. A Caveat

Figure 3.1 sometimes shows “very dry” and “very wet” conditions in areas that are currently transitioning from dry season to wet season (e.g. the west African Sahel) or from wet season to dry season (e.g. the Brazilian Nordeste). Such locations typically have low precipitation values which do not allow computing meaningful percentages. In Botswana, for instance, the rainfall deficit reaches 67%, i.e. 11 mm were recorded over the AMJJ period instead of 34 mm, which is about 0.3 mm per day on average (assuming 120 days for the AMJJ period). Clearly, when average amounts are very low, large negative departures are meaningless. Large positive departures are sometimes more relevant, tough, as they may indicate an early start of the season, or late floods. 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 is Myanmar during the current reporting period: average rainfall reaches 1331 mm, so that the amount recorded (1020 mm) is 23% below average. 1020 mm, however, corresponds to about 8.5 mm per day, which is sufficient to cover the requirements even of water demanding crops. In fact, the biomass production potential is up 2%, because the available water was still sufficient to satisfy crop water demand expressed by RADPAR, which is up 7%. In fact, the deficit in Myanmar probably corresponds to a slightly delayed beginning of the rather long monsoon season (6 months) and does not raise any concern.

B. Rainfall

Dry conditions

Among the countries that did expect significant amounts of rainfall during the reporting period (amounts larger than 100 mm over AMJJ), several areas suffered marked deficits in excess of 25% with the largest national values occurring in the Gambia and in New Caledonia, with deficits reaching 63% in both areas.

Close to Gambia, several other west-Africa countries deserve mentioning because they suffered deficits between 27 and 40% at the time when the rainy season is starting, indicating a delay in the season. Close to Gambia in the western tip of the Sahel, this applies to Senegal and Guinea Bissau. It also applies to Benin and Togo where the north has a Sahelian-type climate, i.e. semi-arid with the rainy season starting around May.

Although technically New Caledonia is not part of Oceania, it shared rather dry conditions with two of its Oceanian neighbors during the current reporting period: New Zealand experienced a 32% precipitation deficit and the nationwide value for Australia reaches 29%. Values for Queensland were close to the national average but the northern Territory and New South Wales had deficits just under 50%. The island of Timor Leste (-39%) in maritime South-East Asia can be assigned to the same group of countries.

In Asia, drought affected the Korean DPR (-52%), which has repeatedly suffered from water shortage over the recent years. Adjacent areas in China suffered as well, including Anhui (-39%), Henan (-43%), Jiangsu (-53%), Liaoning (-47%) and Hubei (-52%).

In Europe, northern and Baltic countries are the most concerned (Estonia -39% with the following countries in the range from -25% to -29%: Lithuania, Latvia, Sweden, Denmark and the Netherlands). The water deficit area extends west and south to France (-11% nationwide, but drier in isolated regions, such as Normandie at -33%) and east into Russia, with several regions in the range from 30% to 40%, including the Republics of Chuvashia and Mari El and the Oblasts of Kemerovo, Orenburg, Tambov and Ulyanov.

In Latin America, the driest areas are concentrated in the Caribbean and Central America and include the Dominican Republic (-49%), Belize (-42%), Dominica (-36%), Honduras (-30%) and Panama (-26%). The drought combined with the Venezuelan crisis is one of the root causes of the displaced persons in the region (refer to Chapter 5.2)

Wet conditions

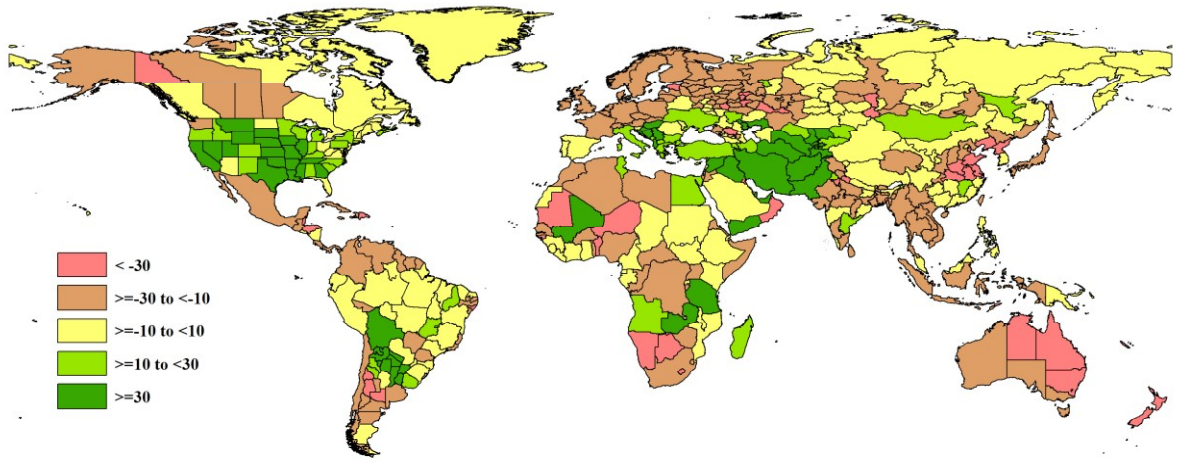
Wet conditions need to be reported most from the large polygon including Serbia (+34%) and Bosnia-Herzegovina (+35%), the Middle-East including Syria (+99%, from 103 mm instead of the average of 52 mm), Pakistan (+53%) and Kazakhstan, especially the region of Jambyl (+53%) and Yujno kazachstanskaya (+98%). The largest rainfall anomalies occur in this bloc of countries with Afghanistan (+67%), Tajikistan (+72%) and Uzbekistan (+195%, with 208 mm recorded when the average is 101 mm).

The second “wet bloc” covers essentially the United States where the largest excesses pertain to Wyoming +41%, Louisiana +42%, California +45%, Missouri +45%, Illinois +46%, Oklahoma +48%, Kansas

+50%, Nevada +52%, Arkansas +53%, Mississippi +54%, Utah +59%, Nebraska +66% and North Dakota +89%

The third, smaller, wet bloc stretches from Bolivia (+34%) to the Argentinian provinces of Entre Rios (+31%) and Santa Fe (+41%) also including the Chaco (+51%) and Santiago (+60%).

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



C. Temperature anomalies

There is relatively little spatial coherence between RAIN and TEMP anomaly patters, with the exceptions of low temperature in North American high rainfall areas and minor rainfall deficits associated with a positive temperature anomaly in southern and south-east Asia. The observation results from the visual examination of Figures 3.1 and 3.2 rather than from a statistical analysis (at the national scale, the correlation between rainfall and temperature anomalies reaches -0.27).

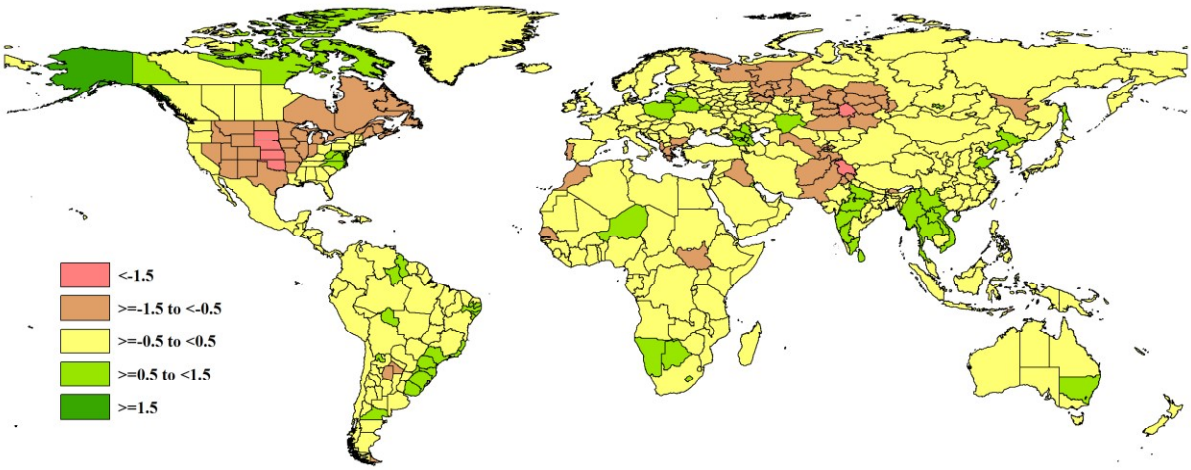
Low temperature

Negative temperature anomalies are usually rather moderate at the national and sub-national level and do not reach -1.0℃, with three exceptions: (1) Pavlodar region in Kazkhstan, which is surrounded by less intense anomalies extending in a northeastern direction up to Baltic countries; (2) Indian Kashmir, extending south and west to include Uzbekistan, Pakistan and Afghanistan with smaller departures and (3) four States in the USA: S Dakota (-2.3℃), Nebraska (-2.1℃), Kansas (-1.7℃) and Oklahoma (-1.6℃).

High temperature

At the national level, positive anomalies are of the same order of magnitude as negative anomalies, and do not exceed 1.0℃ (one occurrence, in Namibia). Considering the whole set of administrative units for which CropWatch computes TEMP departures, only two exceed an anomaly of 2.0℃: the Canton of Obwalden in Central Switzerland and the Dzong of Punakha in Bhutan (+2.2℃ and +2.3, respectively). Other areas with very localized temperatures anomalies exceeding +1.5℃ occur in Burundi, Bhutan, near and in central America (Colombia, Dominican Republic, Ecuador, Honduras), south and south-east Asia (Sri Lanka, Myanmar, Thailand and Vietnam) and in the USA (Alaska).

Figure 3.2. Global map of temperature anomaly (as indicated by the TEMP indicator) by country and sub-national areas, departure from 15YA between April and July 2019



D. RADPAR anomalies

RADPAR anomaly patterns are rather close to rainfall patterns (compare Figure 3.1 with Figure 3.3), and the correlation between sunshine departures and rainfall departures (at the national level: -0.44) is stronger than the link between temperature and rainfall.

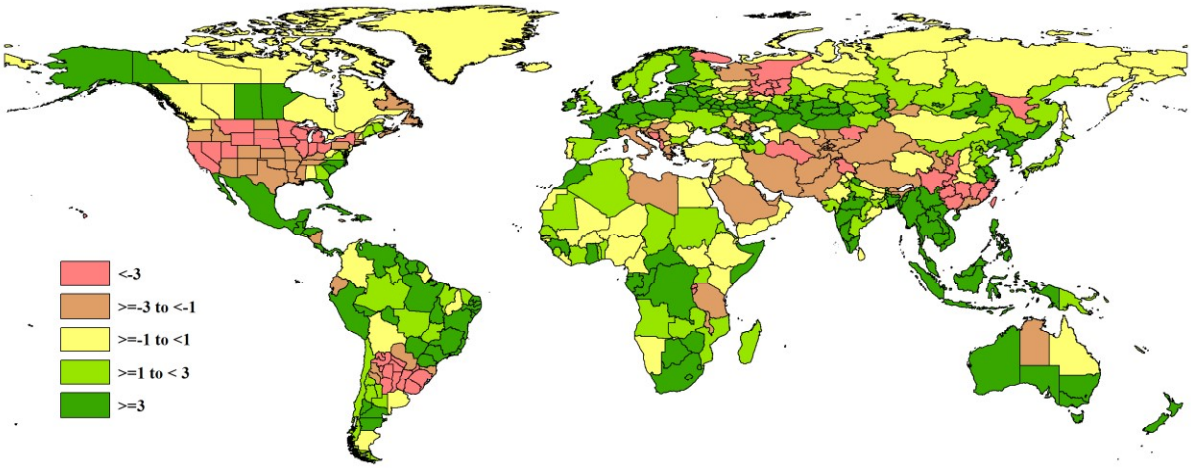
Below average sunshine

Negative sunshine departures were generally moderate, with absolute values larger than 5% occurring only in Uruguay (-6%) and in Argentina (-9%). This is just two countries and both are major agricultural exporters; they will be mentioned again below in the section on BIOMSS.

Above average sunshine

33 countries experienced above average sunshine departures of +5% and above. They are located in: (1) Europe and central Asia, with the highest values in Belgium and Lithuania (+10%) and extending as far as Korea DPR; (2) South and South-East Asia including Malaysia, Brunei Darussalaam, Myanmar, Cambodia and Vietnam, with the largest departure in Thailand (+8%); (3) New Zealand (+7%); (4) several patches in Africa: Congo democratic republic and the Congo, Botswana and the highest values (+6%) in Somalia and Zimbabwe; (5) central America, the Caribbean and northern South America: Suriname, French Guiana, Guyana, Panama, Cuba, Haiti and the largest departures (+7%) in Honduras and Belize and in Guatemala (+8%).

Figure 3.3. Global map of photosynthetically active radiation anomaly (as indicated by the RADPAR indicator) by country and sub-national areas, departure from 15YA between April and July 2019



E. Biomass accumulation potential BIOMSS

The biomass accumulation potential indicator (BIOMSS) largely synthesizes the combined effect of the three previous indicators. It will be discussed below and compared to the agronomic indicators for the spatial units for which they are available. Remember, however, that RAIN, TEMP, RADPAR and BIOMSS are compared against their 2004-2018 average, while CALF departures result from the comparison with 2014-2018. As a result, global correlations between the two groups of variables are difficult to interpret, especially because of recent global climate trends.

Regional groups of similar behavior are easily identified in Figure 3.4. They overlap with those described in Chapter 1 (Figure 1.5) and will not be repeated here. Instead, the focus will be on individual national and sub-national units for the largest countries. Additional and separate information by major agro-ecological zones (AEZ) is given later in this chapter for individual countries.

At the national level, four out of the five largest BIOMSS drop occurred in Africa, starting with Gambia (-17%), Morocco (-13%), Guinea Bissau (-13%) and South Africa (-10%). All experienced below average precipitation and slightly above average sunshine. All also had low VCIx, which confirm the negative impact of the weather conditions. In Lebanon, the fifth country, BIOMSS was 12% below average. Both Morocco and Lebanon were at the end of the winter cropping season. While in Morocco the BIOMSS behavior can be assigned to low rainfall, it is cool weather and reduced sunshine that account for the situation of Lebanon.

Countries where BIOMSS decreases below average range from -7% to -5% include Tajikistan, Sao Tome and Principe, Kyrgyzstan, Bhutan, Lesotho and Argentina. With the exception of Argentina, their VCIx exceeds nevertheless 0.9, a favorable value, and most of them increased their CALF values, sometimes significantly as Tajikistan (+10%) and Lesotho (+18%). The low VCIx in Argentina was already mentioned above. In fact, the country experienced spatially very diverse conditions which are not easy to interpret as AMJJ covers the harvest of summer crops (mostly maize and soybean during AM) and the planting of winter wheat and barley (during JJ). The main agricultural provinces include Buenos Aires recorded the following BIOMSS departures: +5% in Buenos Aires, the main wheat growing area; average values (+0%) in Cordoba (main producer of maize) and -13%, mostly due to low sunshine and excess precipitation in Santa Fe, which produces about one fifth of the national output of maize and soybeans.

As exemplified above with Argentina, low and high BIOMSS departure values do occur in countries which are doing relatively well on average. This includes the USA and Russia where the national BIOMSS is down 1% in both countries. Particularly in the USA, this includes some major agricultural states ranging from South Dakota (-17%) to Iowa, Nebraska, Montana and Wyoming (-10%). Biomass losses between 5% and 10% occurred in Colorado (-5%), Kansas, Indiana, Wisconsin, North Dakota, Illinois, Michigan and Minnesota (-10%). As already mentioned, all the listed States are characterized by high rainfall, low sunshine and cool weather.

The situation is more mixed in Russia, where negative BIOMSS anomalies in excess of 5% occurs in 18 areas (out of a total of 96 sub-national units) where precipitation covers the whole spectrum from below average (Republic of Mariy El, -37%; Oblasts of Kirov and Vologda, -29%), average (Oblast of Perm, +2%) to well above average (Komi-Permyak Okrug, +28%). In all areas the temperature was low, and so was sunshine (except in the Altai Krai, the Oblast of Novosibirsk and the Republic of Tatarstan, where it was average or slightly above).

While 12 countries, all mentioned above, recorded low BIOMSS compared with average at the national level, positive departures exceeding +5% occur in 55 countries out of 166. As shown in Figure 3.4, high values predominate in South America, AFRICA, Europe, the Middle-East , Southern AND Southeast Asia,

as already shown in Chapter 1. The largest BIOMSS departures in excess of +10% above average were brought about by several factors:

• Favorable precipitation (Mali, RAIN +33%, BIOMSS +11%; Madagascar +15% and +12%; Iran +63% and +12%; and Pakistan +53% and +18%, the largest national BIOMSS increase for the AMJJ period);

• Favorable sunshine and average temperature, even in the presence of a precipitation deficit in Guatemala (BIOMSS +10%), Latvia, Poland and Luxembourg (all +11%), Belgium +13% and Lithuania +16%. In Asia, the only country with a BIOMSS increase above 10% was Laos (+11%).

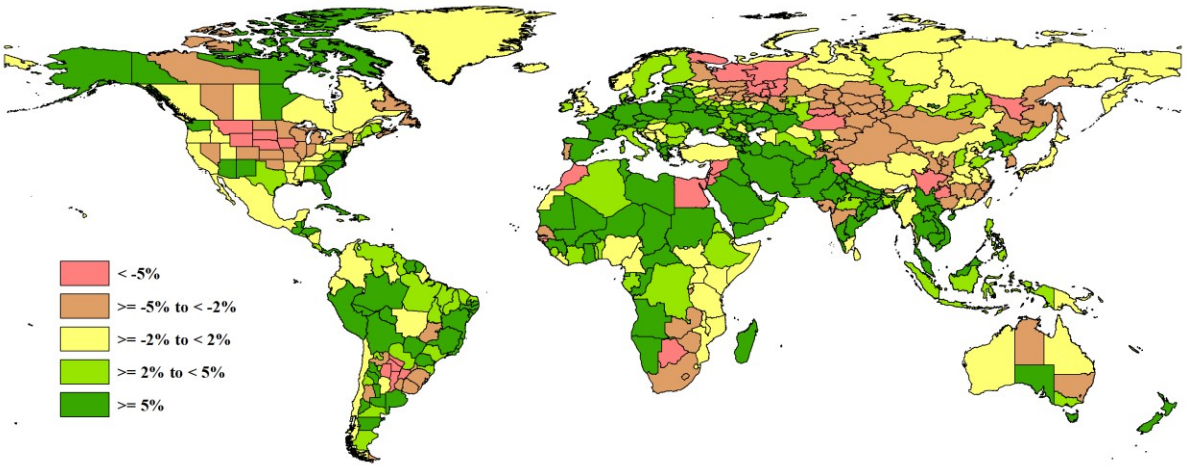
All countries enjoy VCIx values above 0.9 with the exceptions of Mali (0.69) and Pakistan (0.79). In Mali, the rainy season starts in May (south) or June (north), while Pakistan practices typical northern hemisphere winter and summer crops, most of them irrigated; in Mali, on the other hand, irrigation is limited and confined to the Niger valley, especially the "Inner Delta" region. In both countries, CALF was low (54% and 35%, respectively) and dropped compared to the recent past (-16% and -8%, respectively). Refer to chapter 5.2 (disasters) for likely explanations about the results above.

Very favorable BIOMSS increases (>+10%) at the sub-national are often more relevant for range-land and pastures than for crops, according to local conditions. This applies, for instance, to three provinces in Argentina: Chubut with BIOMSS up 12%, La Pampa +15% and San Luis +15% as well. In Brazil, high values occur in Rio de Janeiro (+11%), Acre (+11%), Sergipe (+12%) and Alagoas (+14%) in the presence of low rainfall and high sunshine in mostly Amazonian areas where sunshine of limiting. In Canada, the largest increases occur at high latitudes in areas of very limited relevance for cropping and livestock. In India, 8 States had large BIOMSS rises: from Orissa (+11%) through Punjab, Haryana, Rajasthan, and Uttar Pradesh, Bihar and Jharkhand (+ 19%) to Delhi (+22%). The increase was brought about through a variety of mechanisms. In Kazakhstan, a large precipitation excess in the oil-rich Atyrau region led to a BIOMSS increase of 11%.

In Russia, the most favorable BIOMSS situations occur in the Baltic region (Kaliningrad Oblast, +16%, adjacent to the already mentioned Poland and Latvia) and the Caucasus (Republics of Chechnya +11%, Ingushetiya +13% and Kabardino-Balkaria +14%).

In the United States, only Alaska (+24%) and Arizona (+24%) need mentioning. Rainfall was about average in Arizona and the BIOMSS increase is probably explained by lower than average sunshine and temperature, which have reduced crop water demand.

Figure 3.4. Global map of biomass production potential anomaly (as indicated by the BIOMSS indicator) by country and sub-national areas, departure from 15YA between April and July 2019



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: Phenology of major crops; Crop condition development based on NDVI over crop areas at national scale, comparing the April - July 2019 period to the previous season and the five-year average (5YA) and maximum; Maximum VCI (over arable land) for April - July 2019 by pixel; Spatial NDVI patterns up to April - July 2019 according to local cropping patterns and compared to the 5YA; NDVI profiles associated with the spatial pattern; time series profiles of precipitation and temperature, and crop condition development graphs based on NDVI average over crop areas for different regions within the country, again comparing the April - July 2019 period to the previous season and the five-year average (5YA) and maximum.

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

Figures 3.5 - 3.45.; Crop condition for individual countries ([AFG] Afghanistan to [ZMB] Zambia) including agroecological zones (AEZ) from April to July 2019.

[AFG] Afghanistan

Wheat, barley, maize and rice are the main cereals grown in Afghanistan. Most winter wheat is grown in the northern border provinces and harvested in May. Spring wheat was planted between March and April, while maize and rice were planted in June and July respectively. The precipitation in Afghanistan was 67% higher than the average level. Both temperature and sunshine were below average (TEMP 18.6℃, down 0.6℃; RADPAR: 1578MJ/m², down 2%). Adequate precipitation made potential biomass 8% higher than average. The cropped arable land fraction (CALF) increased by 93%, and the maximum vegetation condition index (VCIx) was 0.87. According to crop condition development graphs based on NDVI, the national crop growth was exceeded the average level in the past five years. Crop condition was better than average throughout the reporting period in 8% of crop lands, mainly in the northern part of Badghis. Crop condition exceeded average between April and June, in 17.5% of crop land mainly in the northwestern part of Faryab, the north-central part of Sari Pul and the border areas of Baghlan, Kunduz and Takhar provinces. Below average NDVI is scatted in I5.9% of crop land. According to the best vegetation condition index (VCIx), the vegetation in the north was better than that in the south. Wheat grew well during the monitoring period and average output is expected.

Regional analysis

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

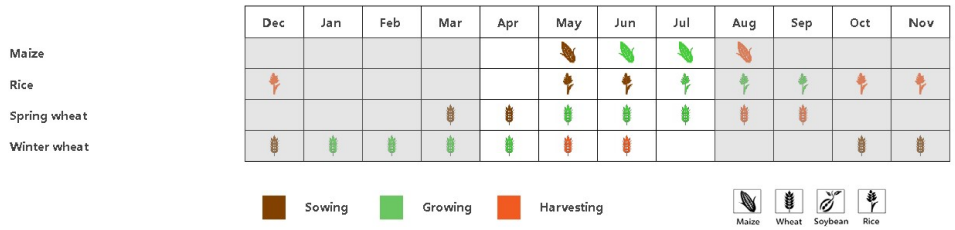
The RAIN in the **Central region** with sparse vegetation was 207 mm, +68%; The TEMP was 14℃, -0.6℃, and the RADPAR was 1598 MJ/m2, -2%. According to crop condition development graph based on NDVI, NDVI was slightly higher than the average level, and the potential biomass decreased by 3%. CALF had increased substantially (+52%), and VCIx was 0.95.

Mixed dry farming and grazing region recorded 111 mm of RAIN, 90% above average, TEMP was 19.7℃, 0.9℃ lower average, and the RADPAR was 1616 MJ/m2, 2% below average. According to the NDVI development graph, crop condition was higher than the five-year average and reached the maximum five years value during the monitoring period. CALF in this region more than doubled by remained nevertheless at a very low 21%. VCIx reached 0.98. Crop output will be fair, i.e. average for local conditions but, more importantly, range-land had benefited from the unexpectedly high rainfall.

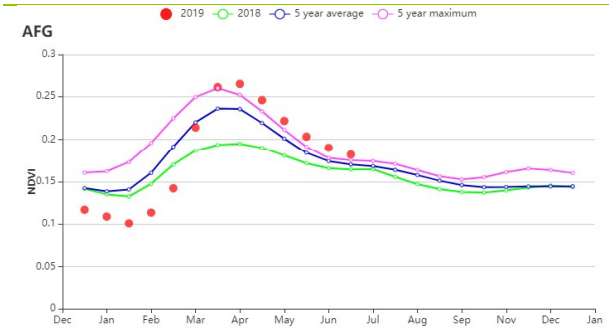
In the **Mixed dry farming and irrigated cultivation region** the following indicator values were observed: RAIN 431 mm, +63%; TEMP 16.5℃, -0.6℃; RADPAR 1511MJ/m2, -3%. Potential biomass and CALF in this area were the highest among the four regions. CALF was 76% higher than average. Abundant rainfall and higher CALF improved production prospects in this AEZ, where VCIx reached 1. An excellent crop is expected.

Dry region recorded 99 mm of RAIN, 75% above average, TEMP was 22.6℃, 0.5℃ below average, and the RADPAR was 1639MJ/m2, 2% below average. The CALF was 42% higher than the average. VCIx was 0.6, and the potential biomass increased by 25%. Although RAIN in this area was higher than the average level, the rainy season of the Dry region ends in April and the additional water supply has benefited mostly the southern range-land directly or through runoff.

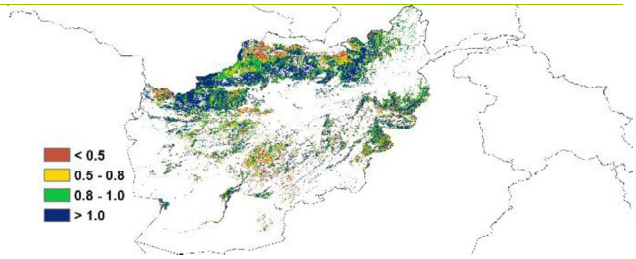
Figure 3.5. Afghanistan's crop condition, April -July 2019



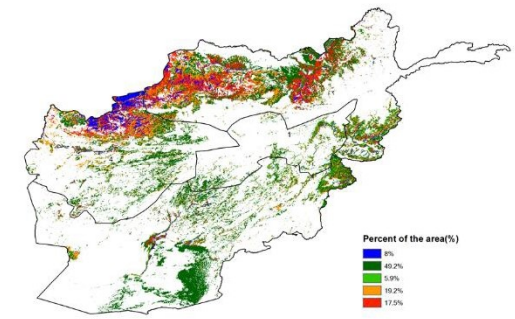
(a) Phenology of major crops



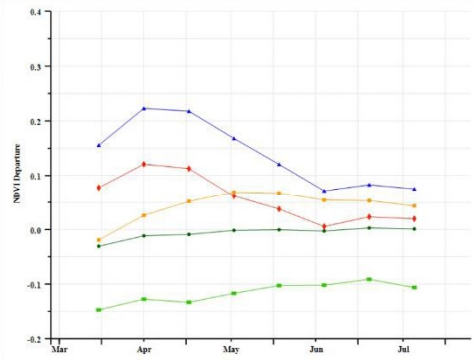
(b) Crop condition development graph based on NDVI



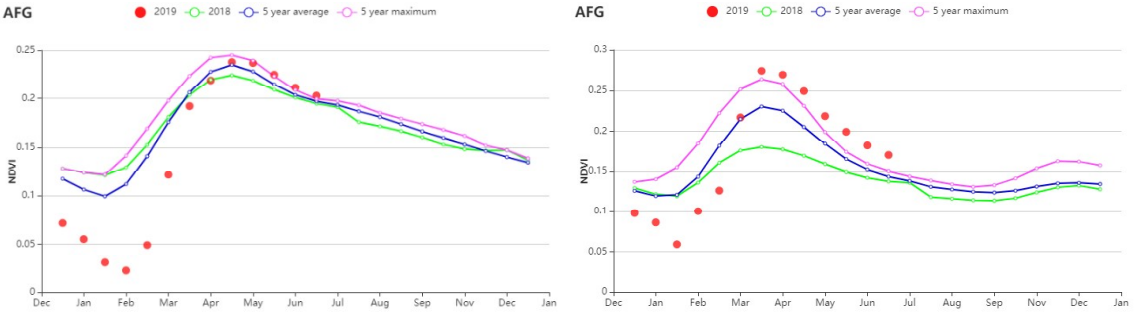
(c) Maximum VCI



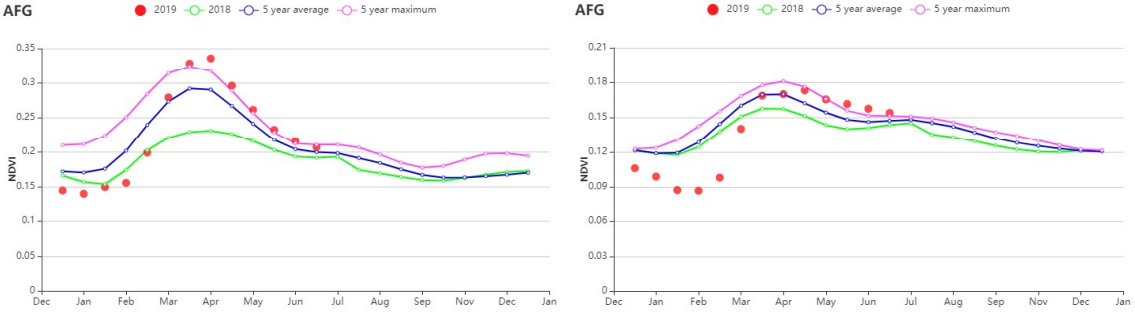
(d) Spatial NDVI patterns compared to 5YA



(e) NDVI profiles



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



(g) Crop condition development graph based on NDVI (Mixed_Dry_IrrigatedRegion (left) and Dry (right))

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

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (℃)	Departure from 15YA (℃)	Current (MJ/m^2)	Departure from 15YA (%)
Central region	207	68	14	-0.6	1598	-1.8
Dry region	99	75	23	-0.5	1639	-1.7
Dry and irrigated cultivation region	431	63	17	-0.6	1511	-3.3
Dry and grazing region	112	90	20	-0.9	1616	-1.9

Table 3.2. Afghanistan's agronomic indicators by sub-national regions, current season's values and departure, April -July 2019

Region	BIOMSS		Cropped arable land fraction		Maximum VCI
	Current (gDM/m^2)	Departure from 15YA (%)	Current (%)	Departure from 5YA (%)	Current
Central region	341	-3	12	52	1.0
Dry region	460	25	6	42	0.6
Dry and irrigated cultivation region	407	-2	34	76	1.0
Dry and grazing region	350	4	21	205	1.0

[AGO] Angola

The monitoring period covers the sowing and growing stages of Wheat and the harvesting stage of Rice and Maize. Nationwide, agro-climatic indicators for this departed from average: rainfall, temperature and radiation increased by 15%, 0.1℃ and 1% respectively.

The rainfall profile indicates high rainfall over the country in mid-May. The total amount of rain recorded is comparable with 2018. BIOMASS recorded an increase of about 9%, but CALF fell by about 7%. VCIx was 0.81.

The NDVI development graph and VCIx indicate below-average crop condition during the entire monitoring especially in the province of Cunene: the area suffered from drought from early May. This also shows in the NDVI spatial clusters: 49.3% of cropland is average or just below average. More unfavorable crops (though not exceptionally so: -0.15 NDVI units) occur mostly in the South. This is corroborated by the VCIx map.

Mixed crop condition prevailed during AMJJ in Angola, but prospects are at least average in major agricultural areas.

Regional analysis

In the Arid Zone, the crop condition was unfavorable during the entire monitoring period compared to average. The region enjoyed average conditions: RAIN down by just 4%, TEMP up 0.3℃ and RADPAR up 2%. BIOMASS rose by about 16% while CALF decreased by 28%. The Maximum VCI recorded for this region was 0.68. Crops are fair at best.

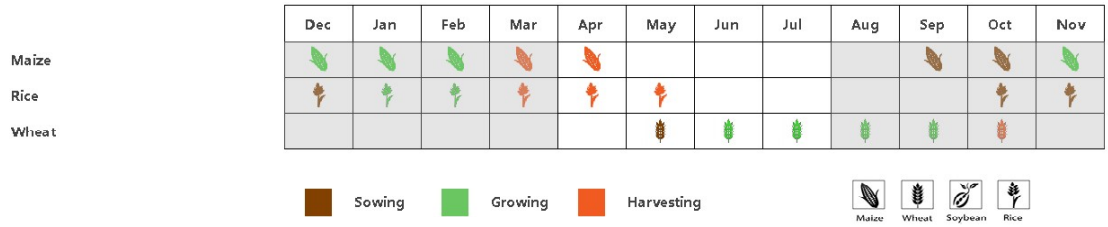
With a significant increase in rainfall (RAIN +69%) and average radiation (RADPAR +1%) and temperature (TEMP -0.5℃), the crop condition in the Central Plateau was close to average in early April. From May to July below-average NDVI prevailed. However, BIOMSS is up 13% with almost full cropping (CALF 99%) and VCIx at 0.93: crop condition is assessed as at least average.

The Humid Zone registered increases on both rainfall and radiation (RAIN +19% and RADPAR +3%). Temperature slightly decreased by 0.6℃. Favorable crop conditions prevailed throughout the entire monitoring period. BIOMASS decreased by 7% but CALF reaches 100%. With VCIx at 0.94, crops are assessed as at least average.

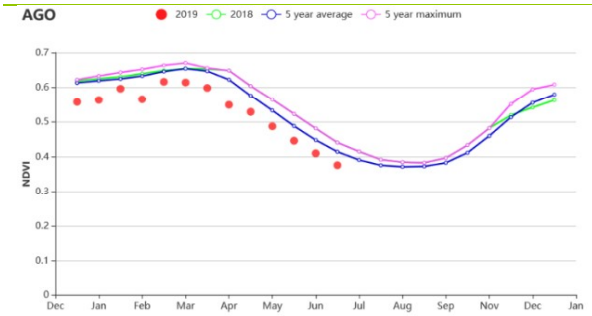
Positive departures of rainfall (RAIN +10%), temperature (TEMP +0.6℃) and radiation (RADPAR + 1%) were recorded in the Semi-arid Zone. These increases contributed to the large rise in BIOMASS (+19%) even though CALF decrease by about 15% to 82%. The reduction on CALF impacted the likely crop output. NDVI shows unfavorable crop condition during the entire monitoring period; VCIx which reached 0.68. Crop prospects are average for the local conditions, i.e poor.

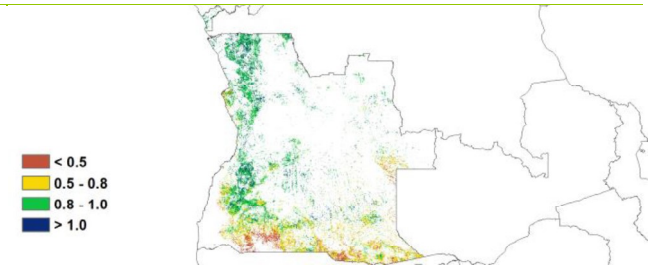
In the Sub-humid Zone, the NDVI development graph reveals unfavorable crop condition during the entire monitoring period. TEMP decreased by 0.2℃ but both rainfall, radiation and the biomass potential were up (RAIN +11%, RADPAR +1%, BIOMASS +4%). CALF fell 1% to 98% and the maximum recorded VCI was 0.90. Crops are promising.

Figure 3.6. Angola's crop condition, April - August 2019



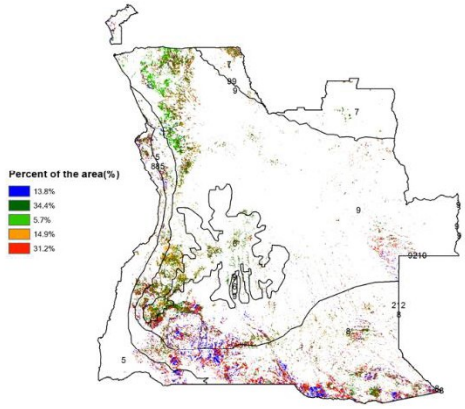
(a) Phenology of major crops

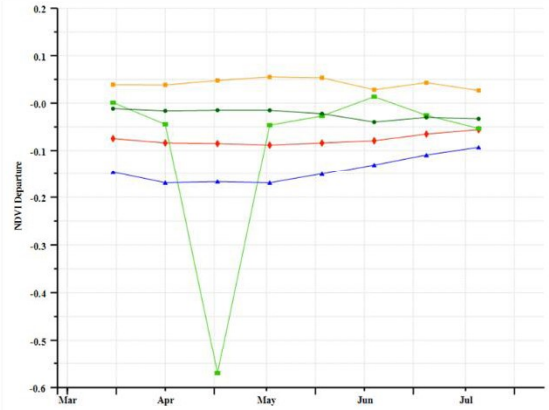




(b) Crop condition development graph based on NDVI

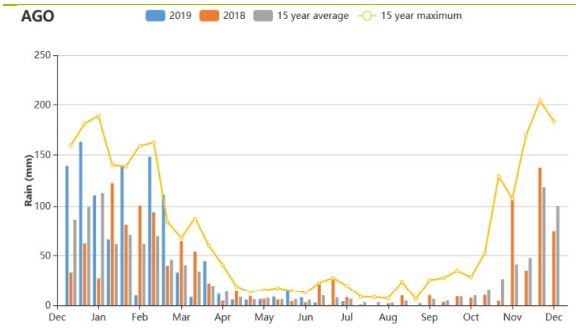
(c) Maximum VCI

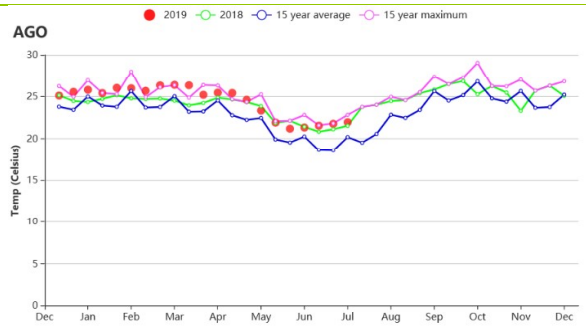




(d) Spatial NDVI patterns compared to 5YA

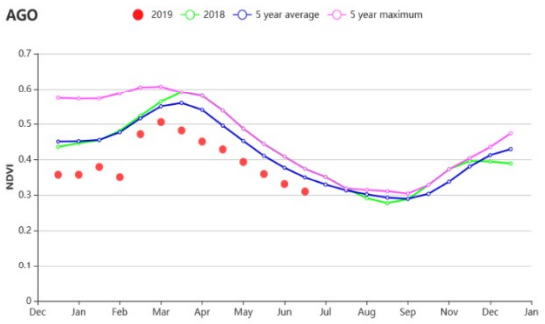
(e) NDVI profiles

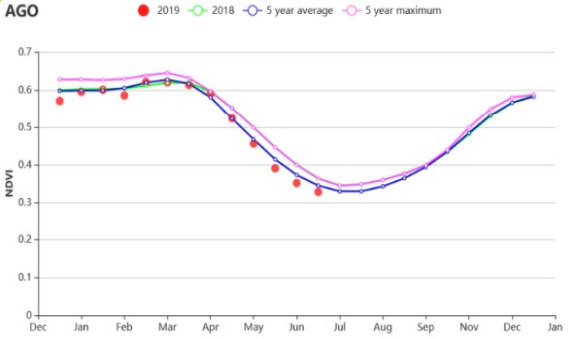




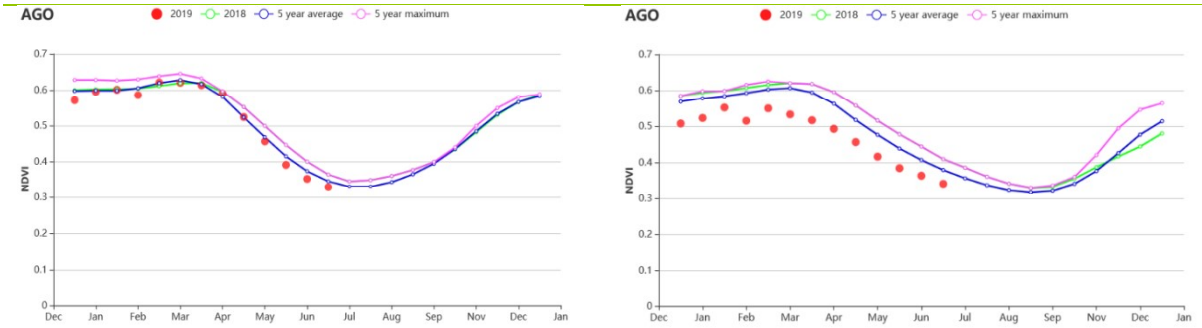
(f) National time-series rainfall profiles

(g) National time-series temperature profile

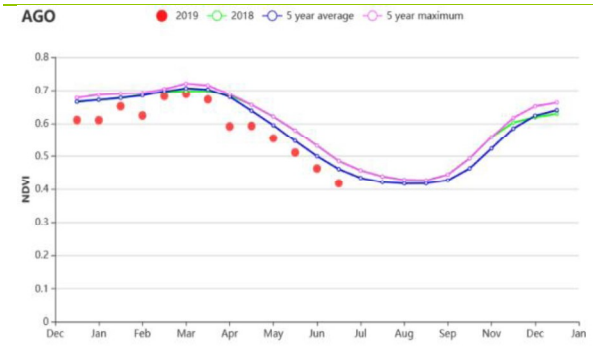




(h) Crop condition development graph based on NDVI (Arid zone (left) and Central Plateau (right))



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



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

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

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (℃)	Departure from 15YA (℃)	Current (MJ/m^2)	Departure from 15YA (%)
Arid Zone	120	-4	22.6	0.3	1202	2
Central Plateau	195	69	15.6	-0.5	1243	1
Humid zone	459	19	22.0	-0.6	1265	3
Semi-Arid Zone	72	10	19.2	0.6	1193	1
Sub-humid zone	271	11	20.3	-0.2	1230	1

Table 3.4. Angola agronomic indicators by sub-national regions, current season's values and departure, April -July 2019

Region	BIOMSS		Cropped arable land fraction		Maximum VCI
	Current (gDM/m^2)	Departure from 15YA (%)	Current (%)	Departure from 5YA (%)	Current
Arid Zone	498	16	61	-28	0.68
Central Plateau	243	13	99	1	0.93
Humid zone	481	-7	100	0	0.94
Semi-Arid Zone	252	19	82	-15	0.68

[ARG] Argentina

The spatial distribution of NDVI profiles shows complex patterns with a stable negative anomaly in the south-western Pampas, and a continuous decrease of NDVI below average from May in the flooded Pampas. These patterns can be associated to frost events observed during this reporting period. The rest of the country does not show homogenous spatial patterns, with a mixture of positive, negative and average values.

Nationwide, the crop condition development graph based on NDVI shows values close to the 5 years average with a slight negative anomaly at the beginning and slight positive one at the end of this reporting period. Main agricultural regions of Argentina showed in general satisfactory conditions. The Humid Pampas showed higher than average values throughout the reporting period with a higher positive anomaly during recent months. The Chaco region also showed positive anomalies during the reporting period with values similar to those of 2018. Mesopotamia showed positive values, except for the last observation. Subtropical highlands showed good close to average conditions.

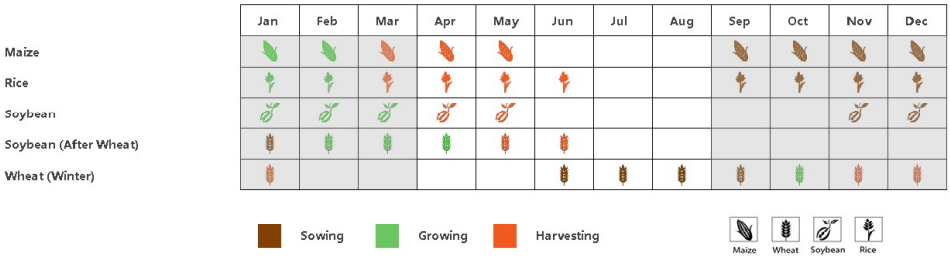
The VCIx map shows quite good conditions (higher than 0.8) for the Central Pampas and the Subtropical Highlands. Lower values were observed in the South-western Pampas and the Flooded Pampas in association with the observed negative NDVI anomalies in these areas.

RAIN showed high positive anomalies in **Chaco** (+51 %), **Mesopotamia** (+28 %) and **Subtropical highlands** (+40 %), while **Humid Pampas** showed a 6% reduction in this variable. A negative anomaly (-0.6℃) was observed in TEMP for the Chaco region. Mesopotamia and Pampas showed positive anomalies of 0.3℃ and 0.1℃ respectively. No TEMP anomaly affected the Subtropical highlands. RADPAR showed negative anomalies for these regions: Chaco (-20 %), Mesopotamia (-15 %), Subtropical Highlands (-9 %) and the Pampas (-3 %).

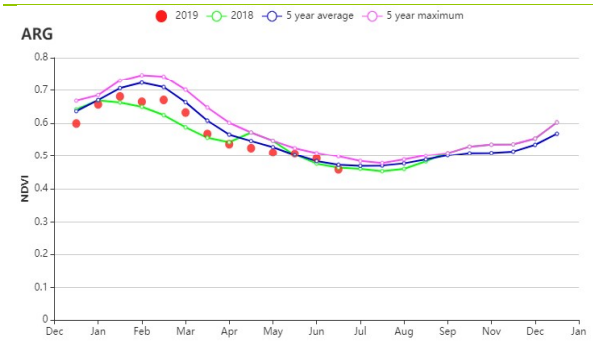
BIOMSS anomalies where negatively associated with precipitation anomalies: negative values in the Chaco (-19 %), Mesopotamia (-11 %) and Subtropical Highlands (-5%), and positive in the Humid Pampas (+3 %). Maximum VCI values were higher where negative BIOMSS anomalies were observed: Subtropical highlands (0.94), Chaco (0.92) and Mesopotamia (0.90). Low Maximum VCI values were observed in the Pampas (0.27). According to CALF almost all land was cultivated, showing slight positive changes related to average conditions for all the regions: Humid Pampas (+2.8 %), Mesopotamia (+0.8 %), Subtropical highlands (+0.2 %) and Chaco (+0.1 %).

This period covers the harvest and fallow stage of summer crops that represent most of the planted area in the country. For winter crops it is a mixture picture: some indices (e.g. positive NDVI anomalies), while others (such as low Maximum VCI values) show poor conditions particularly in South Pampas were the relative importance of winter crops is higher.

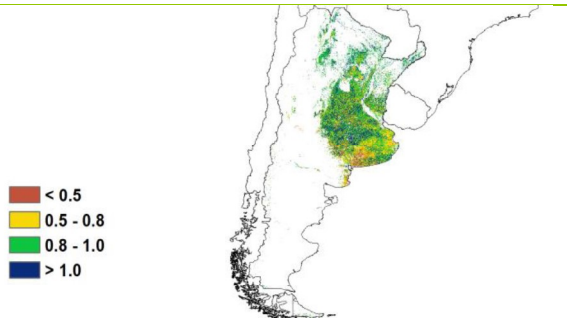
Figure 3.7. Argentina's crop condition, April-July 2019



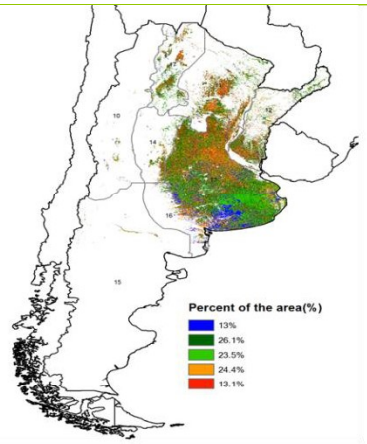
(a) Phenology of major crops



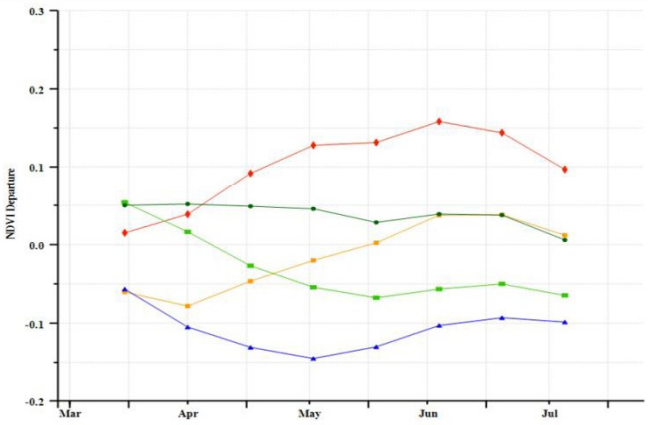
(b) Crop condition development graph based on NDVI



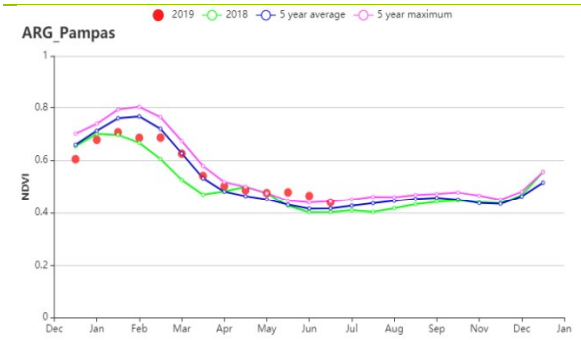
(c) Maximum VCI

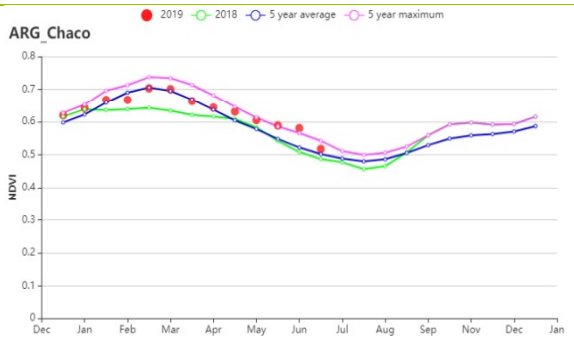


(d) Spatial NDVI patterns compared to 5YA

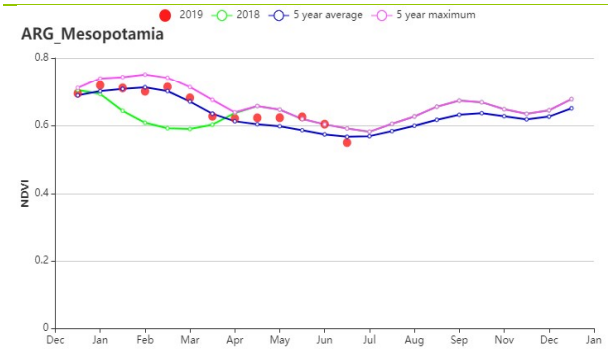


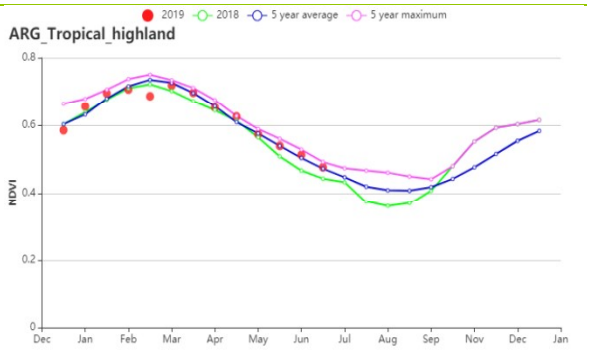
(e) NDVI profiles





(f) Crop condition development graph based on NDVI (Humid Pampas (left) and Chaco region (right))





(g) Crop condition development graph based on NDVI (Mesopotamia (left) and Subtropical highlands region (right))

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

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (℃)	Departure from 15YA (℃)	Current (MJ/m^2)	Departure from 15YA (%)
Chaco	413	51	15.8	-0.6	507	-20
Mesopotamia	562	28	15.4	0.3	509	-15
Humid Pampas	185	-6	12.4	0.1	578	-3
Subtropical_highland	226	40	14.1	0.0	722	-9

Table 3.6. Argentina's agronomic indicators by sub-national regions, current season's values and departure, April - July 2019

Region	BIOMSS		Cropped arable land fraction		Maximum VCI
	Current (gDM/m^2)	Departure from 15YA (%)	Current (%)	Departure from 5YA (%)	Current
Chaco	211	-19	99	0	0.92
Mesopotamia	210	-11	100	1	0.90
Humid Pampas	202	3	95	3	0.27
Subtropical_highland	263	-5	100	0	0.94

[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 beginning of the sowing season with few or no crops in the field for most of the reporting period.

The national NDVI profile shows overall average conditions with average temperature (TEMP +0.4℃) and sunshine (RADPAR +3%). Although the rainfall decreased by 29% compared to average, it did not affect the sowing of wheat and barley possibly due irrigation. The VCIx was rather low at 0.29 during the planting season. The Cropped Arable Land Fraction (CALF) decreased by 11%, compared to the five-year average.

The spatial NDVI pattern further shows that southern New South Wales, northern Victoria, and the south-eastern part of South Australia experienced below-average conditions throughout the monitoring period, compared to the last 5 years due to the poor rainfall (RAIN, -49% for New South Wales and -13% for Victoria and -18% for South Australia).

Regional analysis

Based on cropping systems, climatic zones, and topographic conditions, five sub-national regions can be distinguished for Australia, which are relevant for crops cultivation: the Arid and semi-arid zone, the South-eastern wheat zone, Sub-humid subtropical zone, South-western wheat zone, and the Wet temperate and subtropical zone.

The **South-eastern wheat zone** showed average to above-average conditions, which closely followed the national NDVI profile. The region recorded rises in temperature (+0.5℃) and RADPAR (+4%). Although rainfall experienced a severe 24% deficit, BIOMSS was average. CALF decreased by 6% compared to the 5-year average.

The **south-western wheat zone** showed below-average condition throughout the monitoring period according to the regional NDVI profile. The region had a weak rainfall deficit (-15%), above average RADPAR (+5%) and a negative TEMP anomaly (-0.5℃) which led to the below-average crop condition. CALF decreased by 9%, compared to the 5-year average. The situation is confirmed by the NDVI cluster maps in the Western Australia region.

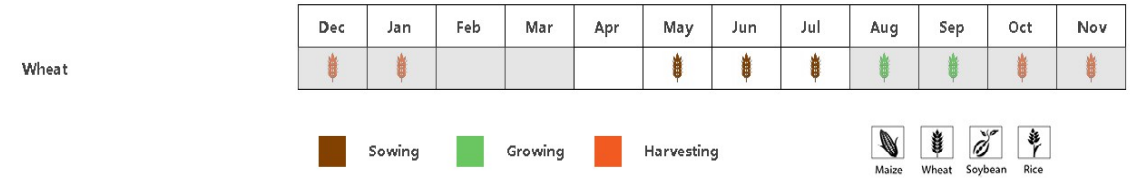
The crop condition in the country's **arid and semi-arid zone** displayed average values during the whole time period. The region experienced insufficient rainfall (-37%), again combined with average TEMP (+0.2℃) and RADPAR (0%). However, the CALF was 76%, and VCIx reached 0.83, indicating that lower rainfall has not caused apparent adverse effect on the crops.

The crop condition in the **wet temperate and subtropical zone** appeared marginally above average according to the regional NDVI profile during the current monitoring period: below average in April but quickly rising to exceed the 5-year average from May to July. The region was 28% short in rainfall with marginally above average temperature (TEMP +0.3℃) and radiation (+2%). The area had high CALF (98%) with low VCIx (0.38), indicating a stable cropped area but moderate prospects.

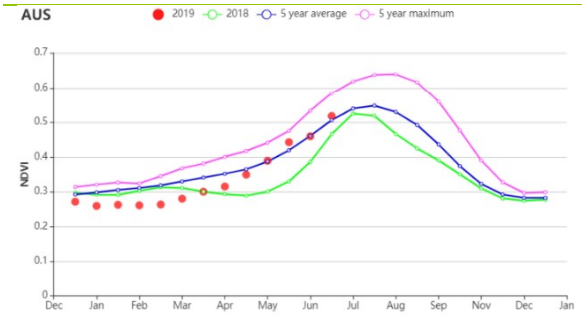
Crops in Australia's **sub-humid subtropical zone** showed generally below average condition during the whole monitored period, which was possibly related to the extreme drought, reflected by the following agro-climatic conditions: rainfall deficit of 52% with high temperature (+0.8℃) and RADPAR (+4%), resulting in BIOMSS falling 6%. The area also experienced low CALF (45%), indicating below-average cropped area and unfavorable production prospects, which deserves close monitoring in the coming months.

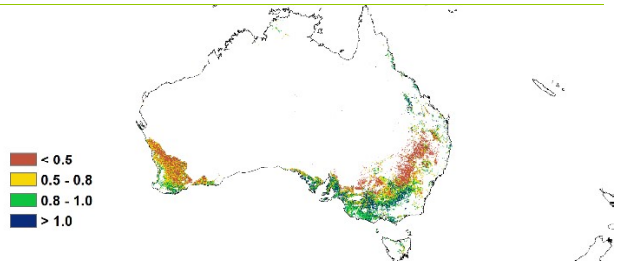
On the whole, CropWatch estimates the prospects of wheat and barley in Australia will be average at this sowing stage.

Figure 3.8. Australia's crop condition, April -July 2019



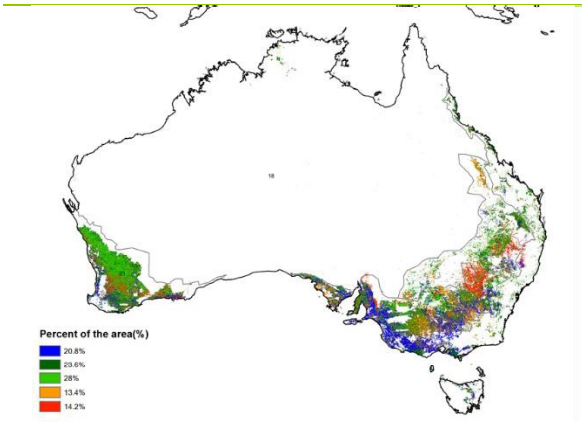
(a) Phenology of major crops

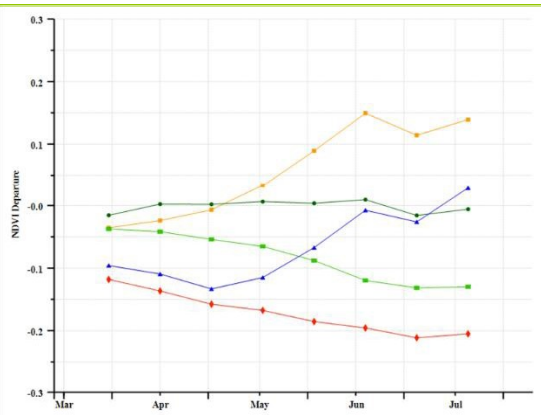




(b) Crop condition development graph based on NDVI

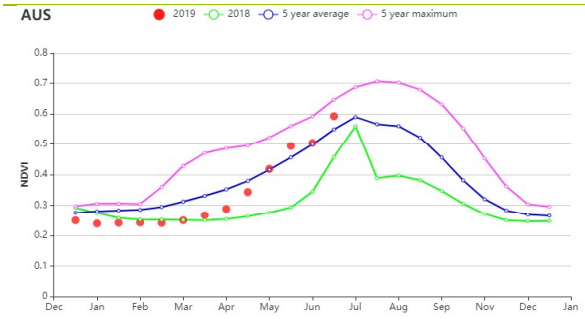
(c) Maximum VCI

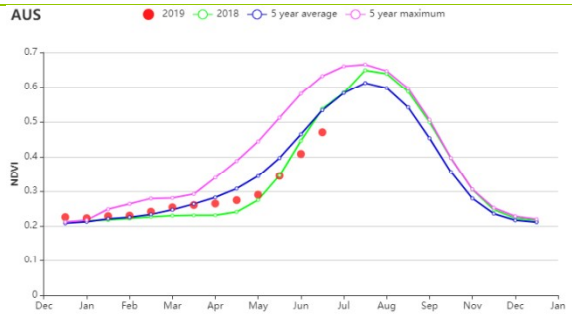




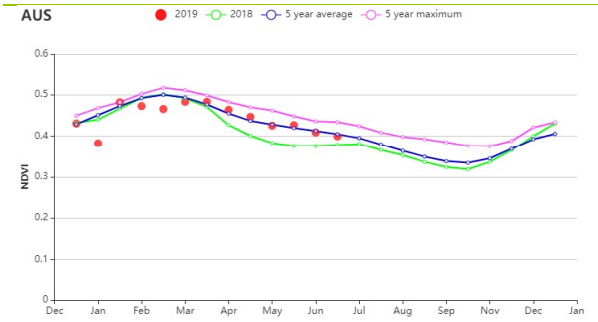
(d) Spatial NDVI patterns compared to 5YA

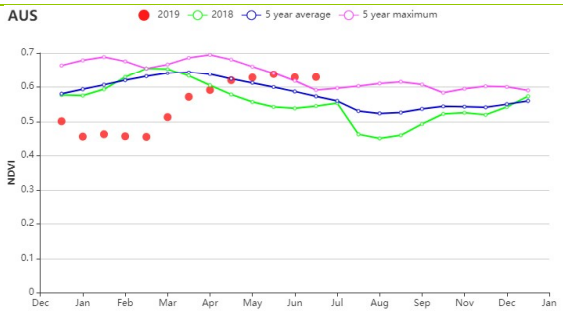
(e) NDVI profiles



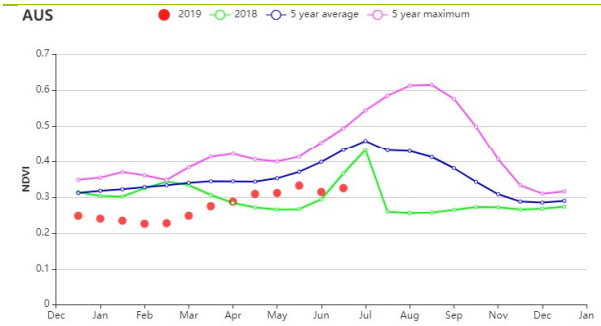


(f) Crop condition development graph based on NDVI (South-eastern wheat zone (left) and South-western wheat zone (right))

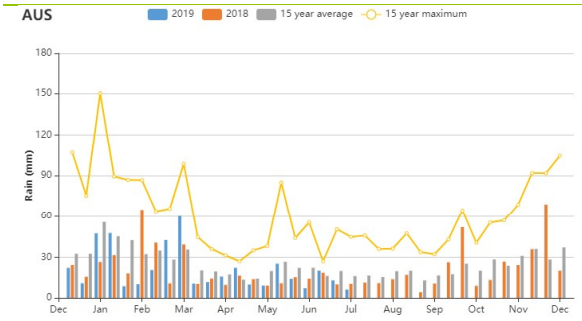




(g) Crop condition development graph based on NDVI (Arid and semi-arid zone (left) and Wet temperate and sub-tropical zone (right))



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



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

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

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (℃)	Departure from 15YA (℃)	Current (MJ/m^2)	Departure from 15YA (%)
Arid and semiarid zone	75	-37	22.7	0.2	1058	0
Southeastern wheat area	150	-24	12.6	0.5	581	4
Subhumid subtropical zone	67	-52	15.1	0.8	809	4
Southwestern wheat area	190	-15	13.4	-0.5	650	5
Wet temperate and subtropical zone	167	-28	13.2	0.3	680	2

Table 3.8. Australia's agronomic indicators by sub-national regions, current season's values and departure, April - July 2019

Region	BIOMSS		CALF		Maximum VCI
	Current (gDM/m^2)	Departure from 15YA (%)	Current	Departure from 5YA (%)	Current
Arid and semiarid zone	321	-6	76	0	0.83
Southeastern wheat area	194	0	88	-6	0.12

Region	BIOMSS		CALF		Maximum VCI
	Current (gDM/m^2)	Departure from 15YA (%)	Current	Departure from 5YA (%)	Current
Subhumid subtropical zone	256	-6	45	-30	0.45
Southwestern wheat area	239	2	79	-9	0.42
Wet temperate and subtropical zone	248	3	98	0	0.38

[BGD] Bangladesh

During the monitoring period, rice was the most important crop, followed by wheat. Rainfall reached 1263 mm, which was 15 mm lower than the 15-year average. The average temperature reached 28.8 ℃, and the photosynthetically active radiation was 1298 MJ/m2 (4% higher than average). The national NDVI development curve shows that crop condition across the country was slightly higher than the 5-years average in April but below from mid-May to July. The spatial NDVI pattern shows that 38.8% of the crops were above than the 5-year average throughout the season. Other areas were above average until mid-May when they adopted a downward trend. The best Vegetation Condition Index (VCIx) ranged from 0.8 to 1, indicating good crop growth prospects in the whole country.

Regional Analysis

Bangladesh is divided into four agricultural sub-regions, including the coastal region, the Ganges region, the mountain region, and the Sylhet region.

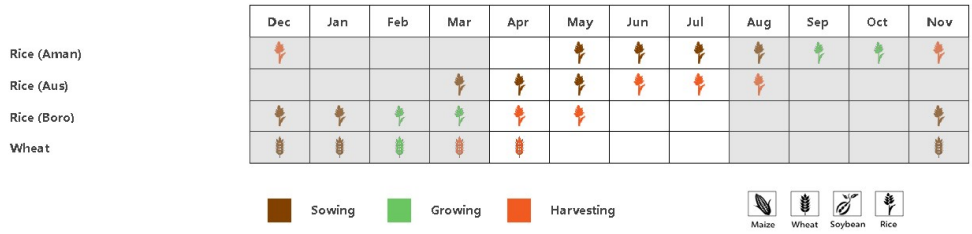
The **coastal areas** precipitation reached 1028 mm, 27% lower than the average, and the temperature was 29.8℃, which was 0.2℃ higher than the average. The cumulative photosynthetically active radiation value was 1364 MJ/m2, up 5%. With the decrease in precipitation, there was no potential biomass increase but the VCIx of 0.98 indicates that the crop grown was good.

Precipitation in the **Ganges plain** was 6% lower than the 15-years average, and the temperature was 0.2℃ lower. Cumulative photosynthetically active radiation was 3% higher. During the monitoring period, VCIx reached 1.01, and the potential biomass increased by 6%, indicating that the crops were doing well.

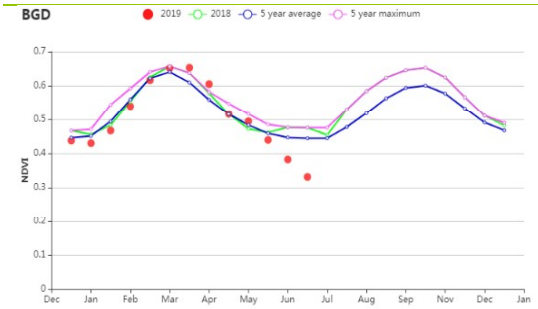
Compared with the average, the **Hills area** had the highest precipitation in the four agro-ecological zones, (1665 mm, 16% lower than average), while the temperature and RADPAR were 0.4℃ and 4% higher, respectively. The potential biomass and CALF were average. VCIx at 0.96 indicates a good crop.

Sylhet region had the second highest precipitation among all regions, which was 19% below average. The temperature was 28.2 ℃ (-0.1℃). The cumulative photosynthetically active radiation was 1290 MJ/m 2, up 6% compared to average. BIOMSS and CALF increased by 6% and 2%, respectively. Moreover, the optimal vegetation condition index was 0.99, indicating that the crop prospects are good.

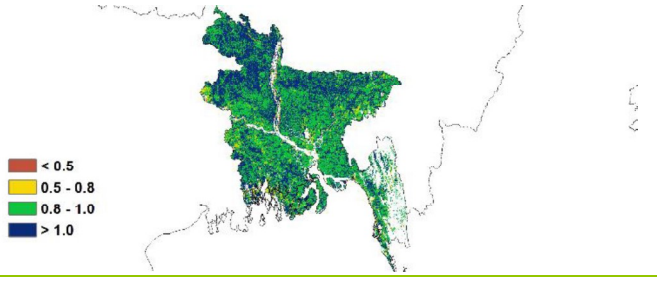
Figure 3.9. Bangladesh's crop condition, April-July 2019



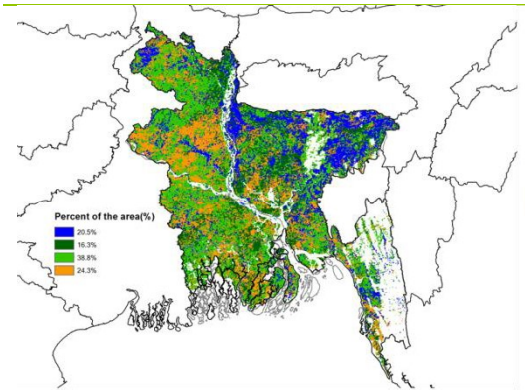
(a) Phenology of major crops



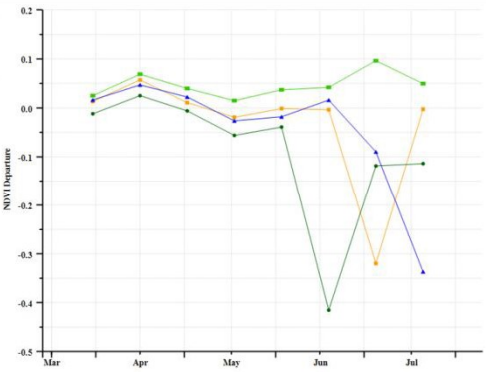
(b) Crop condition development graph based on NDVI



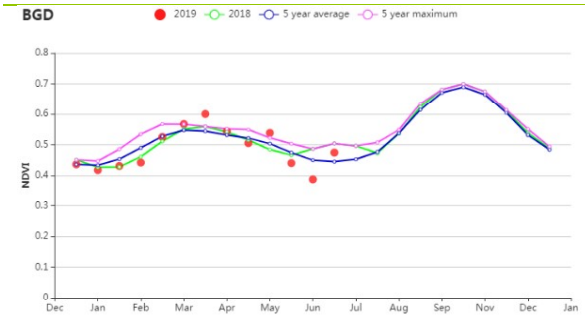
(c) Maximum VCI

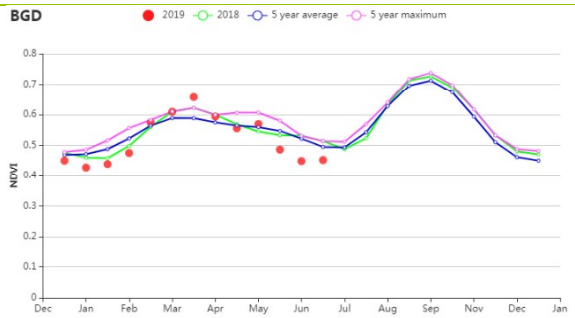


(d) Spatial NDVI patterns compared to 5YA

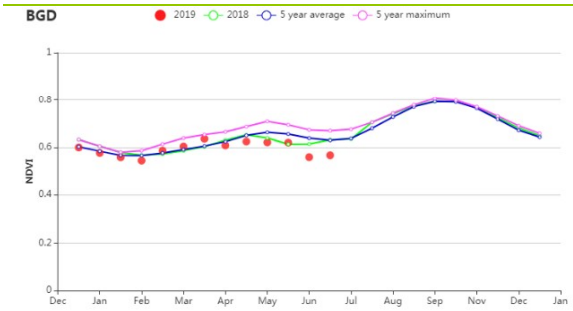


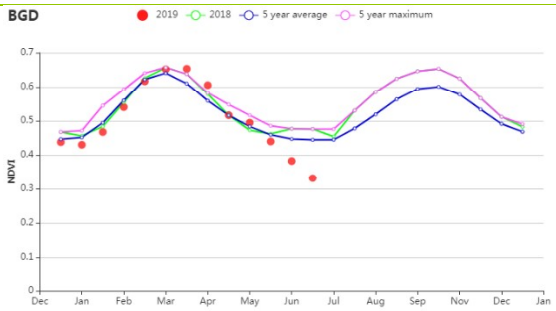
(e) NDVI profiles





(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 April-July 2019

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (℃)	Departure from 15YA (℃)	Current (MJ/m^2)	Departure from 15YA (%)
Coastal region (Bangladesh)	1028	-27	29.8	0.2	1364	5

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (℃)	Departure from 15YA (℃)	Current (MJ/m^2)	Departure from 15YA (%)
Gangetic plain (Bangladesh)	1125	-6	29.5	-0.2	1285	3
Hills (Bangladesh)	1665	-16	27.6	0.4	1306	4
Sylhet basin (Bangladesh)	1313	-19	28.2	-0.1	1290	6

Table 3.10. Bangladesh's agronomic indicators by sub-national regions, current season's values and departure, April-July 2019

Region	BIOMSS		CALF		Maximum VCI
	Current (gDM/m^2)	Departure from 15YA (%)	Current (%)	Departure from 5YA (%)	Current
Coastal region (Bangladesh)	862	0	89	7	0.98
Gangetic plain (Bangladesh)	873	6	98	1	1.01
Hills (Bangladesh)	838	-1	98	0	0.96
Sylhet basin (Bangladesh)	880	6	99	2	0.99

[BLR] Belarus

In Belarus the reporting period includes the planting of spring wheat and summer crops until June and the harvest of winter wheat from July.

In spite of a deficit in May and June, the nationwide rainfall amount reached 305 mm, which was just (3%) below average. May was warm with mid-May temperature exceeding average (18℃) by as much as 7℃. As a result, for the AMJJ period temperature was 0.6℃ above average; sunshine (RADPAR) was 5% higher average. BIOMSS increased by a spectacular 9% above average. Agronomic condition was favorable as well: very good values of VCIx (0.96) and cropped arable land fraction (CALF, 100%) were observed.

The NDVI development graph was generally near the 5-year average with some fluctuation in May and June. The spatial pattern showed diverse patterns. In about 66.4% of cropped area crop condition was close to or above 5-year average. Only 13.6% of cropped areas were 0.1 NDVI units below the average, mostly scattered in the south-east and along the western border. Average national VCIx exceeded 0.8, indicating fair crop prospects in most crop area. Overall, both agro-climatic and agronomic conditions were satisfactory and ensured good winter wheat production and summer crop development.

Regional analysis

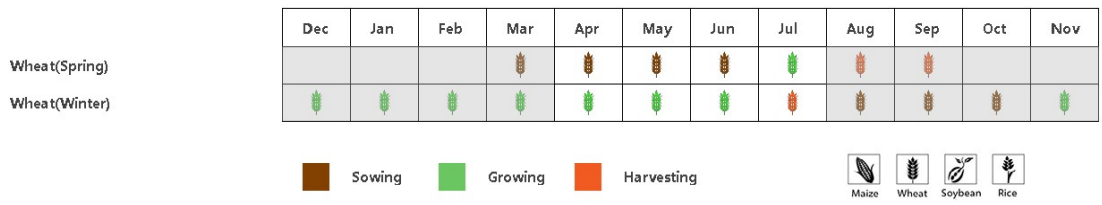
Based on cropping system, climatic zones and topographic conditions, regional analyses for four agro-ecological zones (AEZ) are provided, including North Belarus (28), Center Belarus (27) and South-west Belarus (29).

North Belarus (Vitebsk, northern area of Grodno, Minsk and Mogilev) recorded a minor rainfall deficit (-8%) combined with higher temperature (+0.5℃) and radiation (+5%). BIOMSS improved 7% above average. The NDVI development curve was above or close to average in April and early May but slightly lower in June. Crop condition is favorable.

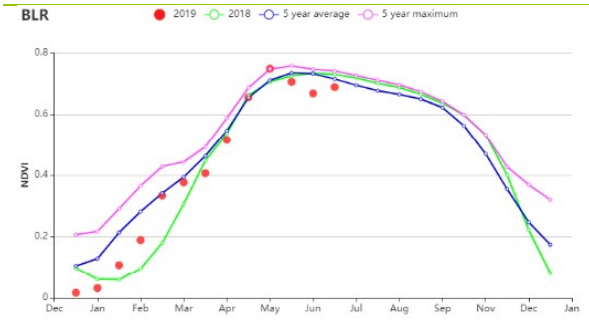
The **Center Belarus** (Grodno, Minsk and Mogilev) experienced average rainfall but higher temperature (0.6℃) and abundant sunshine (+5%). Potential biomass was up 10%. High CALF (100%) and VCIx (0.96) were also recorded. NDVI curve showed a sudden decrease in early June but quick recovery thereafter. Crop prospects are promising.

All agro-climatic indicators were above-average in **South-west Belarus** (southern halves of Brest and Gomel regions): rainfall (+4%), temperature (+0.6℃) and radiation (+4%). Agronomic conditions were favorable as well (CALF, 100%. VCIx, 0.97) with biomass estimated to increase by 9% above average. The average NDVI development curve suggests the crop condition was fair the output will be at least average.

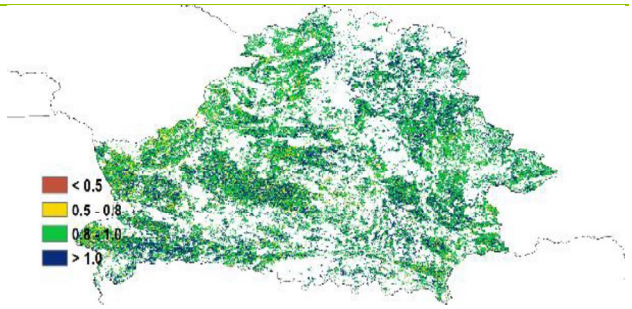
Figure 3.10. Belarus's crop condition, April-July 2019



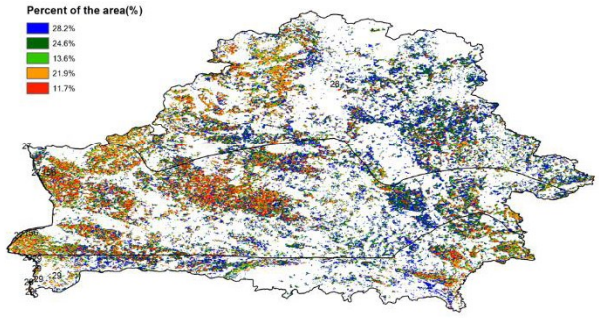
(a) Phenology of major crops



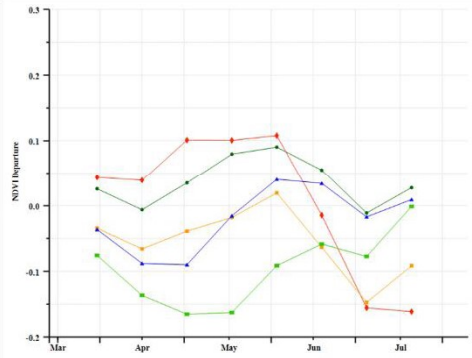
(b) Crop condition development graph based on NDVI



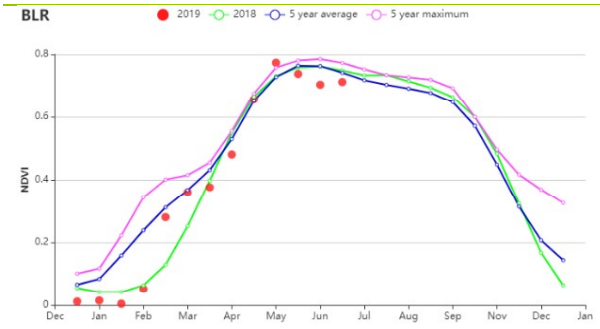
(c) Maximum VCI



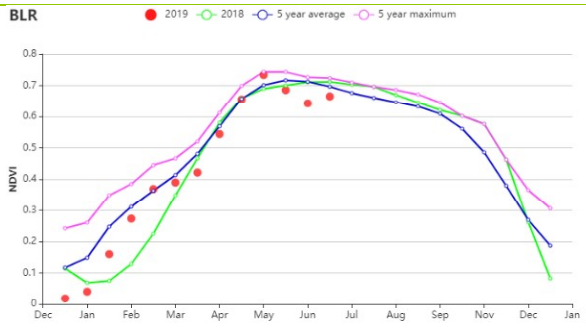
(d) Spatial NDVI patterns compared to 5YA



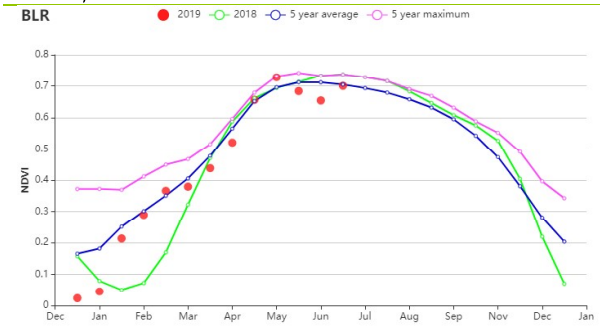
(e) NDVI profiles



(f) Crop condition development graph based on NDVI (Northern Belarus)



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



(h) 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 April-July 2019

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (℃)	Departure from 15YA (℃)	Current (MJ/m^2)	Departure from 15YA (%)

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (℃)	Departure from 15YA (℃)	Current (MJ/m^2)	Departure from 15YA (%)
Northern Belarus	311	0	15.0	0.6	1166	5
Central Belarus	298	-8	13.7	0.5	1137	5
Southern Belarus	308	4	15.7	0.6	1175	

Table 3.12. Belarus's agronomic indicators by sub-national regions, current season's values and departure, April-July 2019

Region	BIOMSS		CALF		Maximum VCI
	Current (gDM/m^2)	Departure from 15YA (%)	Current (%)	Departure from 5YA (%)	Current
Northern Belarus	10	100	0	0.96	10
Central Belarus	7	100	0	0.96	7
Southern Belarus	9	100	0	0.97	9

[BRA] Brazil

The harvest of summer crops (maize, soybean and rice) was almost concluded except for maize in north-eastern regions. Wheat was sown in April to May and was approaching peak growing stage. Overall crop condition in Brazil remained average compared to the previous five years.

Nationwide, all agro-climatic indicators present generally average conditions with rainfall 2% below average, temperature 0.5℃ above average and radiation 3% above average. Altogether, the potential BIOMSS was 4% above 15YA. According to the seasonal rainfall profile, there was no significant departure either from 15YA often-day rainfall but cumulative rainfall (387mm) was much less than during the previous period (January to April). However, contrasted situations were observed among the nine major agricultural states in the country. Goias, Ceara and Rio Grande Do Sul received above average rainfall (+16%, +8% and +7%, respectively). Parana, Mato Grosso Do Sul and Santa Catarina recorded a precipitation shortfall with 21%, 12% and 9% negative departures of rainfall. Rainfall in Mato Grosso, Minas Gerais and Sao Paulo was close to average. Most of the states presented above average temperature except for Ceara where TEMP was 0.2 degree lower than 15YA. Temperature was significantly above average (+0.9 to +1.2 degree) for the three states southernmost State. Most States recorded above average radiation except for Rio Grande Do Sul and Santa Catarina. Large positive departure of BIOMSS from 15YA (between 6% and 9%) was observed in Parana, Minas Gerais and Mato Grosso Do Sul.

The national NDVI development profile for Brazil presented slightly above average values since April. The peak value for 2019 was also above 5YA and 2018, reflecting likely favorable conditions of the crops. The VCIx map showed high values (>0.8) in most regions of the country except for scattered farmlands in Nordeste and western Rio Grande Do Sul. Nationally, the average VCIx was 0.98 which confirms the favorable conditions assessed based on NDVI profiles. Detailed variations of the crop condition is shown in spatial and temporal pattern of NDVI departures. Below average conditions prevailed in two AEZs: North-eastern mixed forest and farmland and Mato Grosso. Significantly below average NDVI was also observed at some areas in Parana River Basin. Most areas in central to southern Brazil presented above average conditions throughout the monitoring period, indicating favorable output of summer crops. Wheat production offers good prospects in Rio Grande Do Sul considering the favorable agro-climatic conditions as well as the above average agronomic indicators. Almost 100% of the farmland was cultivated according to CALF which is 1% above average.

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 current reporting period, two zones recorded large departures of rainfall: Southern Subtropical rangelands (+23%, same departure amplitude as the JFMA period) and Coast (-16%). Rainfall for remaining zones was generally less than during the previous reporting period (JFMA) with the Central Savanna receiving the lowest rainfall at 202 mm, which is still 7% above 15YA. Temperature was close to average except for Coast (+0.7℃), Parana Basin (+0.6℃) and Southern subtropical rangelands (+1.0℃). The Southern Subtropical rangelands was the only zone with below average radiation (-7%), following the same pattern as during JFMA. Although rainfall in Southern subtropical rangelands was at 642 mm and 23% above average, insufficient radiation hampered the photosynthetic process of the crops. As a result, BIOMSS was 3% below 15YA in in Southern subtropical rangelands while all other zones presented above average BIOMSS.

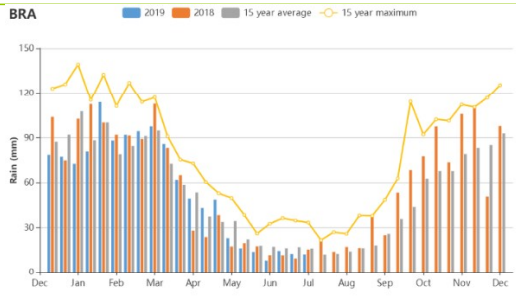
As reflected by the regional NDVI profiles, generally above average crop condition was observed in Central Savanna, Coast, Nordeste, Parana basin and Southern subtropical rangelands. The NDVI peaks of those zones exceeded both 5YA and 2018 values. The above average NDVI profiles in Nordeste, Parana

basin and Southern subtropical rangelands in April to July were also an indication of more late crops being cultivated. Crop condition was below average in Amazonas due to below average rainfall. Significantly below average conditions were also observed in the North-eastern mixed forest and farmland before early May, but crops recovered to average condition thanks to above-average rainfall in May. Mato Grosso presented average agro-climatic and agronomic conditions throughout the monitoring period according the CWAIs and NDVI development profiles. CALF was close to 100% in all zones, indicating high intensity of cropland utilization. Above average CALF compared to 5YA was observed in Central Savanna, Nordeste and Southern subtropical rangelands while all other zones remained stayed at average level. VCIx for each zone was close to national average value except for Southern subtropical rangelands where average VCIx was at 0.91, the lowest value among the zones.

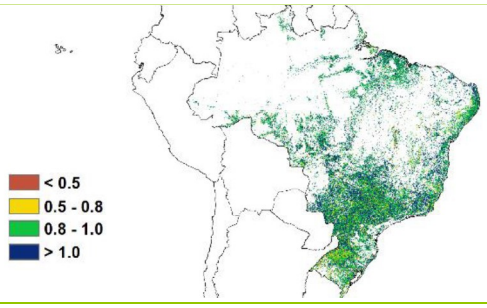
Figure 3.11. Brazil's crop condition, April - July 2019

(a) Phenology of major crops

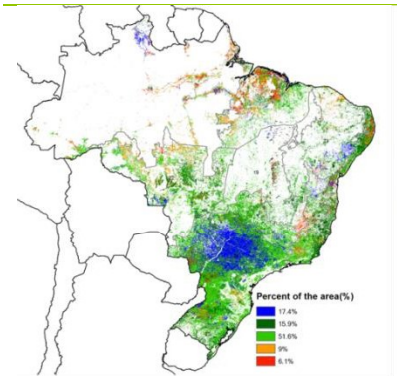
(b) Crop condition development graph based on NDVI



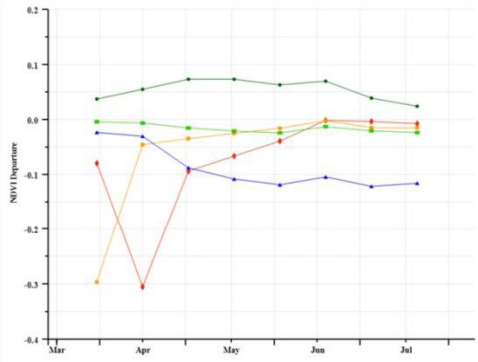
(c) time series rainfall profile



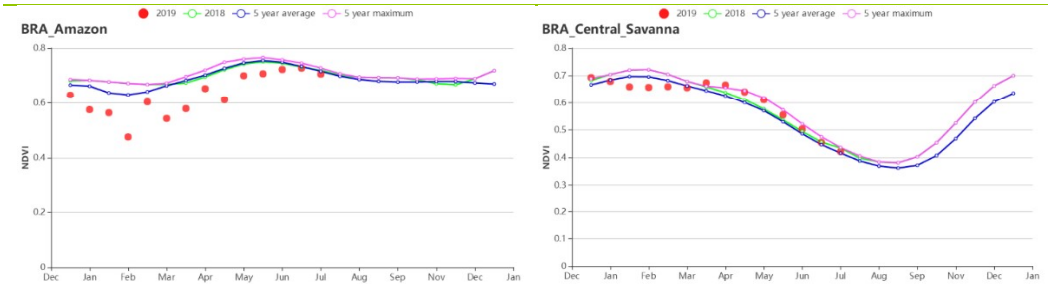
(d) Maximum VCI



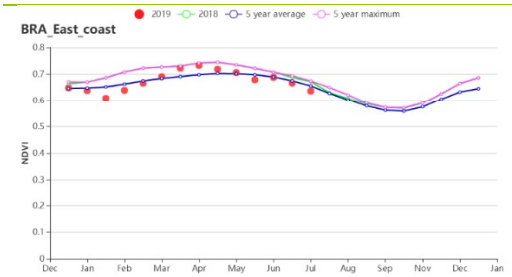
(e) Spatial NDVI patterns compared to 5YA



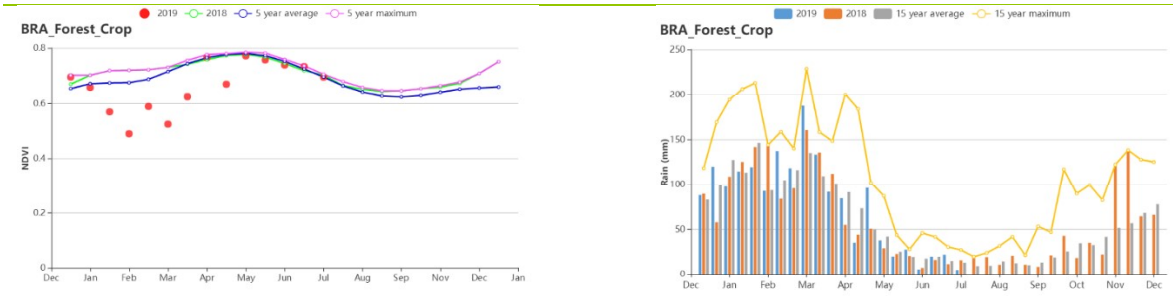
(f) NDVI profiles



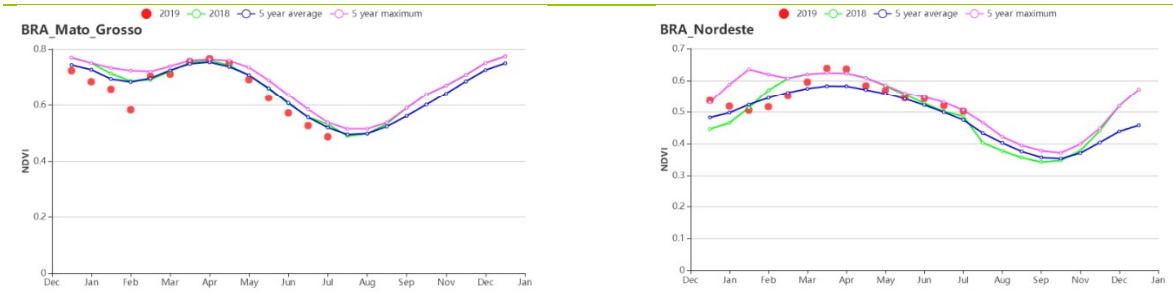
(g) Crop condition development graph based on NDVI ((Amazonas) (left) and (Central Savanna) (right))



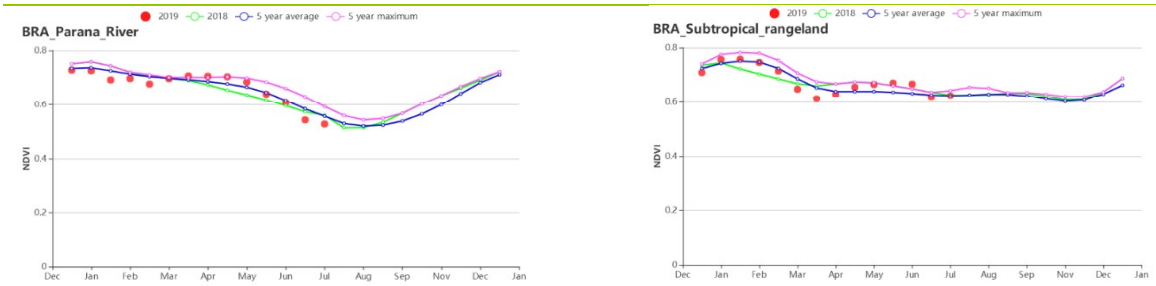
(h) Crop condition development graph based on NDVI (Coast)



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



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



(k) Crop condition development graph based on NDVI (Parana River (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, April - July 2019

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (℃)	Departure from 15YA (℃)	Current (MJ/m2)	Departure from 15YA (%)
Amazonas	780	-7	25.2	0.3	1104	2
Central Savanna	202	7	22.4	0.3	1113	4
East coast	275	-16	21.2	0.7	924	7
Northeastern mixed forest and farmland	576	0	25.3	0.3	1167	3
Mato Grosso	265	1	23.8	0.4	1087	3
Nordeste	216	8	24.2	0.3	1088	4
Parana basin	346	-5	18.8	0.6	854	3

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (℃)	Departure from 15YA (℃)	Current (MJ/m2)	Departure from 15YA (%)
Southern subtropical rangelands	642	23	16.0	1.0	573	-7

Table 3.14. Brazil's agronomic indicators by sub-national regions, current season's values and departure, April - July 2019

Region	BIOMSS		Cropped arable land fraction		Maximum VCI
	Current (gDM/m^2)	Departure from 15YA (%)	Current (%)	Departure from 5YA (%)	Current
Amazonas	699	3	100	0	0.97
Central Savanna	519	5	98	4	0.98
East coast	533	11	100	0	0.99
Northeastern mixed forest and farmland	708	5	100	0	0.98
Mato Grosso	494	1	100	0	0.98
Nordeste	667	6	98	6	0.98
Parana basin	392	4	100	0	0.98
Southern subtropical rangelands	243	-3	99	1	0.91

[CAN] Canada

The current reporting period covers both the late growth and harvest of winter wheat and the early development of summer crops.

Compared to the recent 15-years average, the rainfall was low (RAIN -9%) and the temperature was slightly below (-0.4℃), while the radiation was almost average (RADPAR, +1%). The maximum VCI value was 0.94, and the CALF was equal to the recent 5-years average. Due to the drop in rainfall, the potential biomass was slightly below the recent 15-years average (BIOMSS, -1%).

Time series analysis shows that the dekad rainfall was mostly below the average from April to July, which was unfavorable for the growth of winter wheat, while the temperatures were mostly average. NDVI profiles and crop growth were slightly below those of both the last year and recent 5-years average from April to June but equal in July. This could point at poor growth conditions of winter wheat. The VCIx map and spatial NDVI clusters show large areas of low values in the Prairies which could result from poor rainfall in the three main winter wheat production provinces (Alberta -13%; Manitoba -26% and Saskatchewan -24%).

Fortunately, following the average values of agro-climatic and agronomic indicators in July, the growth of summer crops was average as well. As a result, the overall condition of winter wheat in Canada was hardly average, and the summer crops, including the spring wheat, had average early stages.

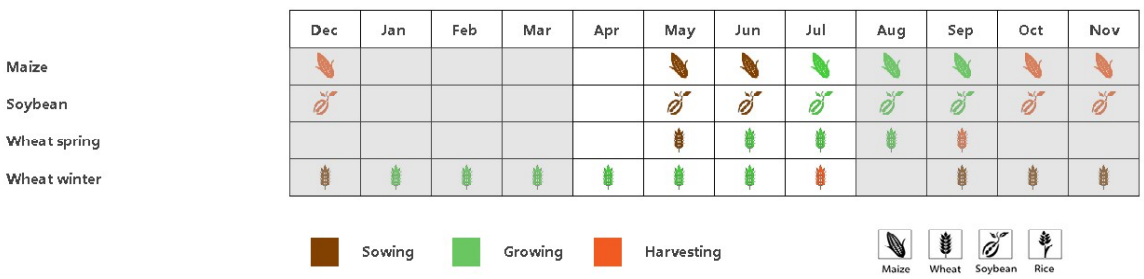
Regional analysis

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

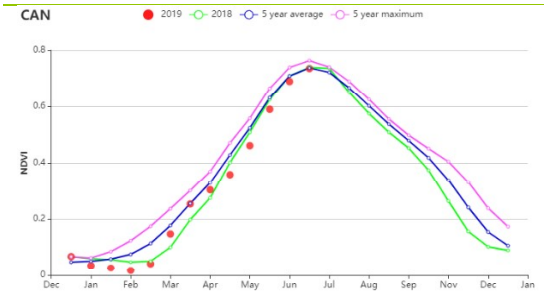
The rainfall in the **Prairies**, the main food production area in Canada, was below average (RAIN 290 mm, -18%), the temperature was somewhat low (TEMP, -0.2℃) and radiation was above average (RADPAR, +3%). According to the NDVI profiles, following a very good start, the condition of winter wheat fell the 5YA in the current reporting, which is likely to lead to a reduction in production. At the same time, the summer crops experienced an average start. These conditions led to the potential biomass being just slightly below the recent 15-years average (BIOMSS -1%).

The agro-climatic indicators in the **Saint Lawrence basin** were almost average (RAIN, +2%; RADPAR, -1%) or slightly below for temperature (TEMP, -1.0℃). The potential biomass was also somewhat below the average (BIOMSS, -3%). The NDVI profiles indicated that the crop condition was similar to the 2018 crop. As in the Prairies, the growth of winter wheat was poor, while the summer crops had an average start too.

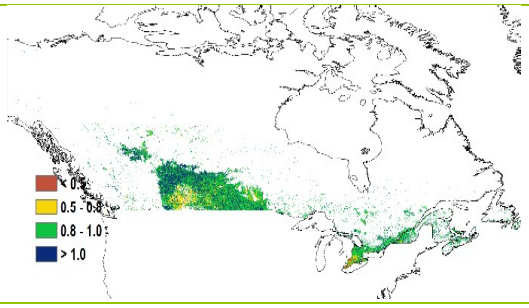
Figure 3.12. Canada's crop condition, April - July 2019



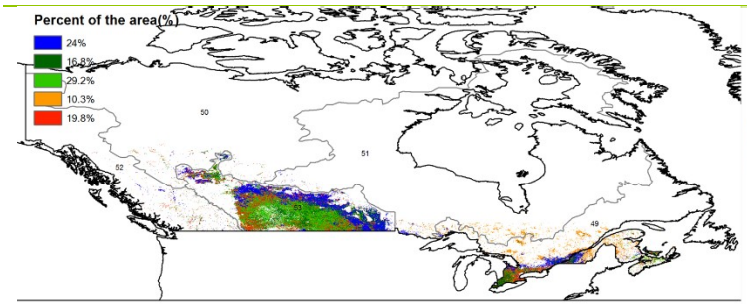
(a) Phenology of major crops



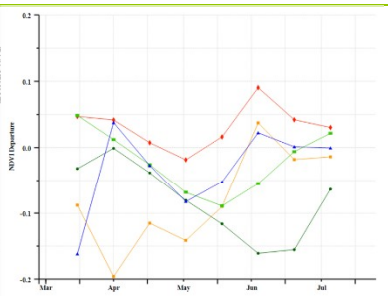
(b) Crop condition development graph based on NDVI



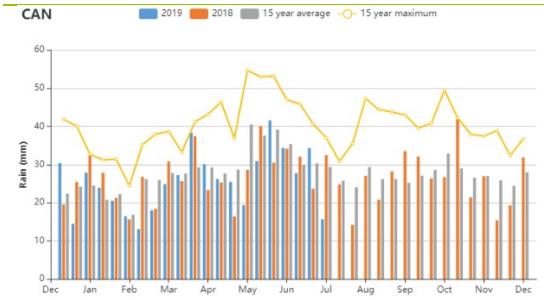
(c) Maximum VCI



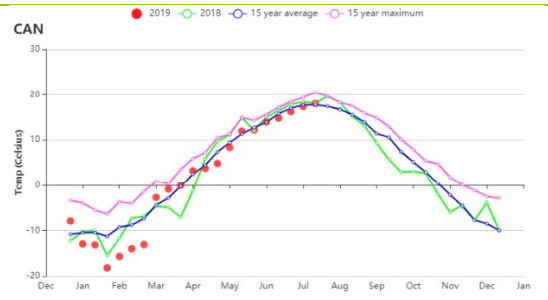
(d) Spatial NDVI patterns compared to 5YA



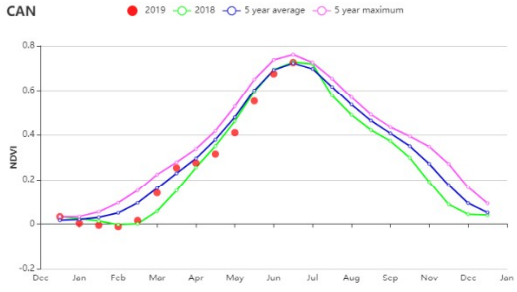
(e) NDVI profiles

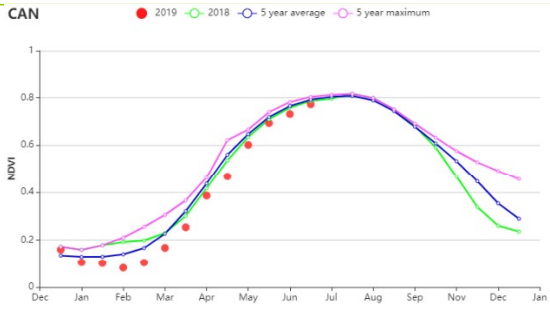


(f) Rainfall time series



(g) Temperature time series





(h) 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, April - July 2019

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (℃)	Departure from 15YA (℃)	Current (MJ/m^2)	Departure from 15YA (%)
Prairies (Canada)	290	-18	11.5	-0.2	1268	3
Saint Lawrence basin (Canada)	460	2	10.4	-1.0	1091	-1

Table 3.16. Canada agronomic indicators by sub-national regions, current season's values and departure, April - July 2019

Region	BIOMSS		CALF		Maximum VCI
	Current (gDM/m^2)	Departure from 15YA (%)	Current (%)	Departure from 5YA (%)	Current
Prairies (Canada)	439	-1	98	0	0.94
Saint Lawrence basin (Canada)	373	-3	100	0	0.94

[DEU] Germany

From April to July, the condition of crops in Germany was generally below both average and the situation in 2018. This applies to already harvested winter wheat and spring wheat and maize which are nearing harvest.

At the national level, total precipitation was significantly below average (RAIN, -18%), temperature was slightly above (Temp, +0.2℃) and radiation more significantly above (RADPAR, +4%). Significantly above average precipitation occurred in most of Germany from late-April to mid-May, mid-June and mid-July, except in Mecklenburg-Vorpommern, Schieswig-Holstein, Niedersachsen, Nordrhein-Westfalen, Baden-Wurttemberg in mid-May and mid-July. Warmer-than-usual conditions prevailed over the entire country during late June and late July. Due to favorable temperature and radiation conditions, the biomass production potential (BIOMSS) is expected to increase 8% over average nationwide.

As shown by the NDVI development graph at the national scale, the reporting period experienced crop condition that was below both the average and the same period last year mostly in June and July. These observations are confirmed by the spatial NDVI profiles. Over more than 62.5% of cropland condition was below average at some time between April and July and only 17.1% had crop that were above average during the entire monitoring period. On about 80% of arable land summer crops were below average after June according to the NDVI, as a result of warm temperature coupled with a persistent rainfall deficit. Areas where crop growth is less than average are mostly distributed in Brandenburg, Saxony-Anhalt and Saxony, which had low VCIx value. Overall, the above-mentioned spatial pattern of crop growth is also reflected by VCIx, the value of which reaches 0.93 countrywide. CALF during the reporting period was the same as the recent five-year average.

Generally, the values of agronomic indicators somewhat unfavorable condition for winter crops and the sowing of summer crops in the northern-east of the country, with a rather favourable situation in remaining areas, especially the south.

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 are among the major winter wheat zones of Germany. The region experienced warm weather (TEMP, +0.3℃), above average radiation (RADPAR, +2%) and severe rainfall deficit (RAIN, -28%). BIOMSS is expected to increase by 6% compared to average. Two heat waves affected this region in late June and late July, and the highest temperature was close to or exceeded the historical maximum temperature. As shown in the crop condition development graph based on NDVI, the values were close to or below average during the whole reporting period. The area had a high CALF (100%) as well as a favorable VCIx (0.93), indicating a high cropped area.

Wheat and sugar-beets are major crops in the **Mixed wheat and sugar-beets zone** of the north-west. Compared to average, this area showed a serious precipitation deficit (RAIN, -25%), temperature was slightly above average (TEMP, +0.3℃) and well above average radiation (RADPAR +5%) led to a BIOMSS increase reaching +9%. Due to the two heat waves, the NDVI values were below average during this monitoring period based the crop condition development graph. The area had a high CALF (100%) and a high VCIx (0.90).

Central wheat zone of Saxony and Thuringia is another major winter wheat zone. RAIN was below average (RAIN, -19%), temperature was slightly above average (TEMP, +0.3℃) and radiation was above average (RADPAR, +4%). Mostly due to favorable temperature and radiation, and adequate precipitation

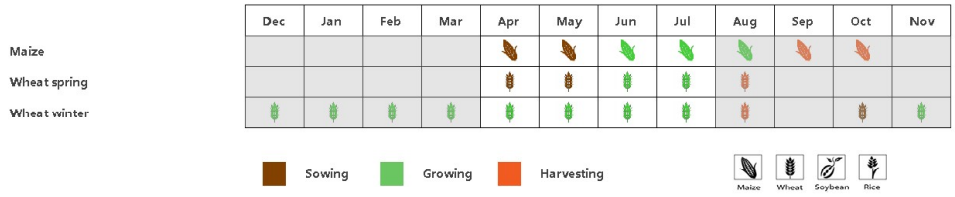
in mid-April and mid-July, the biomass potential (BIOMSS indicator) increased by 9% above average. The mentioned heat waves led NDVI values to be below average during this monitoring period based the crop condition development graph. The area had a high CALF (100%) and the VCIx of 0.92.

Crop condition was fair in the **East-German lake and Heathland sparse crop area**, with a serious rainfall deficit (RAIN, -27%) but with above average temperature (TEMP, +0.5℃), radiation (RADPAR,+6%) and BIOMSS (+12%). The heat wave changed the NDVI values from average to below average. The area had a high CALF (100%) and a high VCIx (0.89).

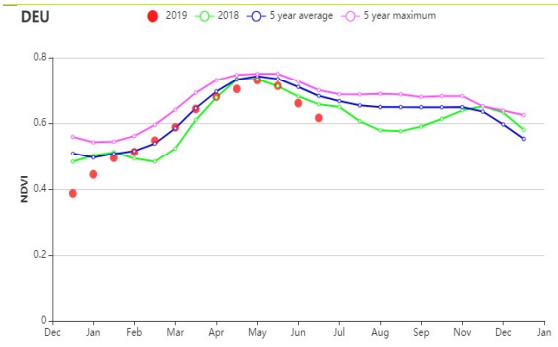
In the **Western sparse crop area of the Rhenish massif**, CropWatch agroclimatic indicators show average precipitation, slightly above average temperature (TEMP +0.1℃), above-average radiation (RADPAR, +5%) and BIOMSS (+10%). Significantly above average precipitation in affected this region in early-April, from late-April to mid-May and mid-June, while the heatweaves occurred in late June and late July. As in the previous AEZ, NDVI changed from above average (winter crop harvest) to below average (summer crop time). The area had a high CALF (100%) and a high VCIx (0.97).

Next to wheat, two summer crops (maize and potato) are the major crops on the **Bavarian Plateau**. The CropWatch agroclimatic indicators showed that close to normal weather was recorded for RAIN (-14%), TEMP (+0.1℃) and RADPAR (+3%). Compared to average, BIOMSS increased 6%. In spite of the two heat waves The area had a high CALF (100%) as well as a favorable VCIx (0.95) with equally favorable crop prospects.

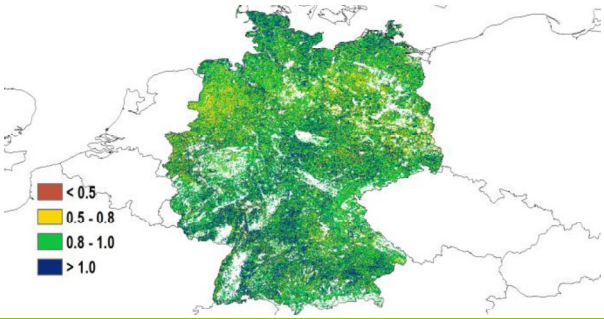
Figure 3.13. Germany's crop condition, April -July 2019



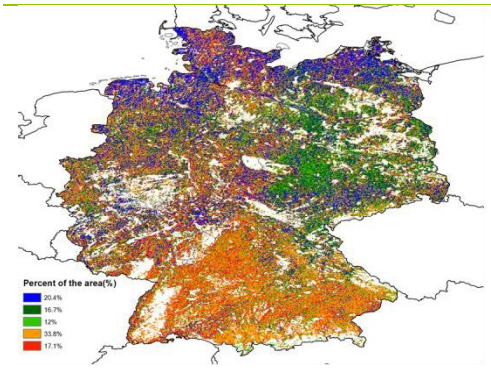
(a) Phenology of major crops



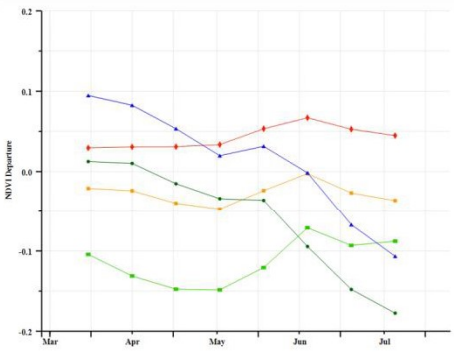
(b) Crop condition development graph based on NDVI



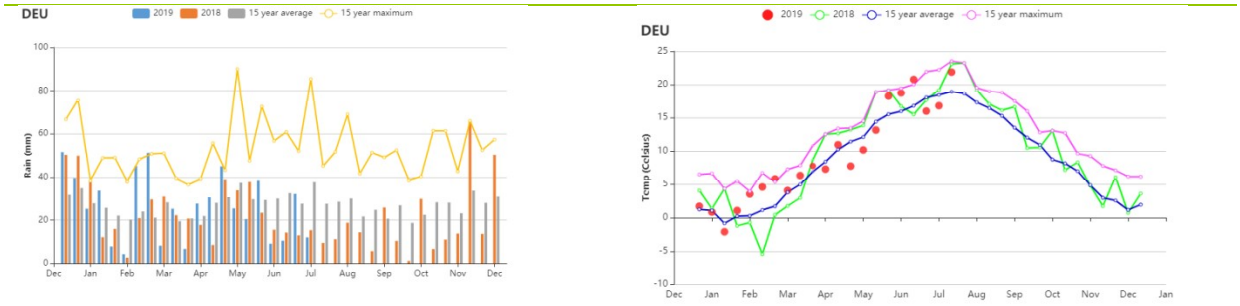
(c) Maximum VCI



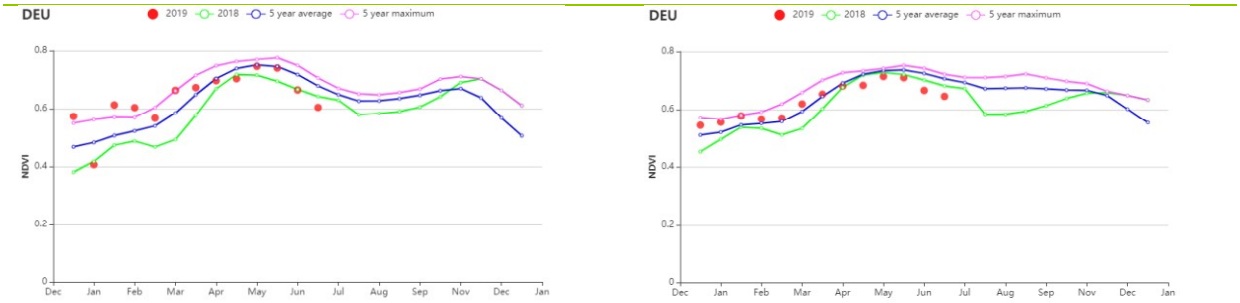
(d) Spatial NDVI patterns compared to 5YA



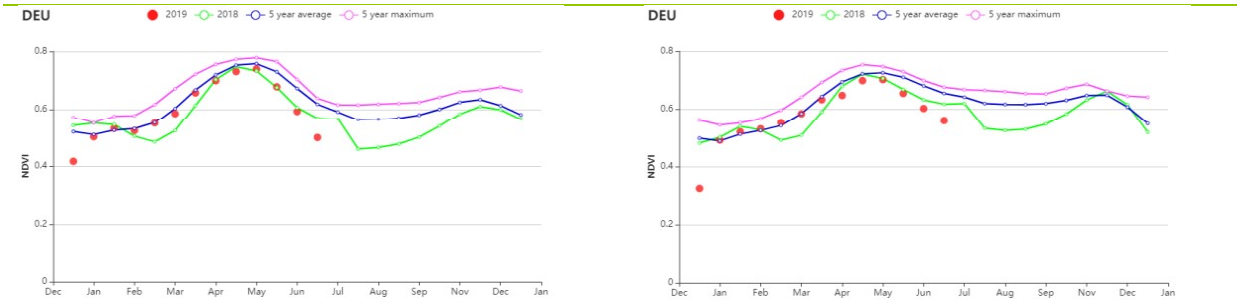
(e) NDVI profiles



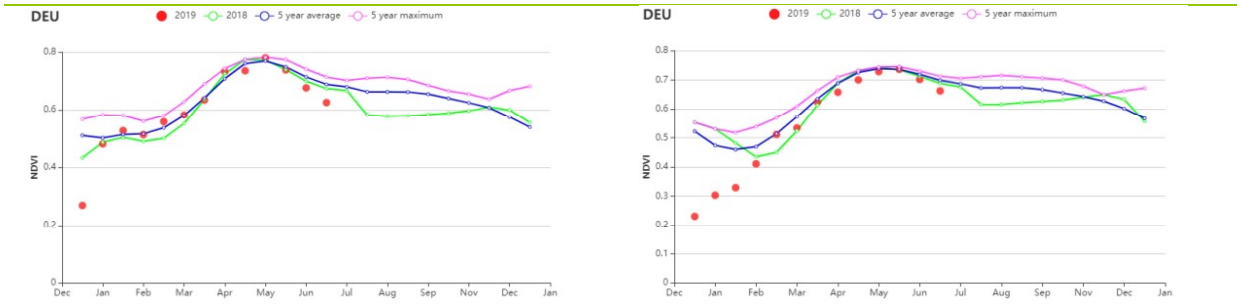
(f) Time series rainfall profiles (left) and temperature profiles (right)



(g) 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))



(h) 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))



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

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

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (℃)	Departure from 15YA (℃)	Current (MJ/m2)	Departure from 15YA (%)
Wheat zone of Schleswig-Holstein and the Baltic coast	216	-28	14.2	0.3	1150	2
Mixed wheat and sugar beets zone of the north-west	223	-25	14.2	0.3	1172	5
Central wheat zone of Saxony	222	-19	14.2	0.3	1234	4

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (℃)	Departure from 15YA (℃)	Current (MJ/m2)	Departure from 15YA (%)
and Thuringia						
Sparse crop area of the east-German lake and Heathland	218	-27	14.9	0.5	1240	6
Western sparse crop area of the Rhenish massif	277	0	14.0	0.1	1255	5
Bavarian Plateau	403	-14	13.7	0.1	1261	3

Table 3.18. Germany's agronomic indicators by sub-national regions, current season's value and departure, April -July 2019

Region	BIOMSS		Cropped arable land fraction		Maximum VCI
	Current (gDM/m^2)	Departure from 15YA (%)	Current (%)	Departure from 5YA (%)	Current
Wheat zone of Schleswig-Holstein and the Baltic coast	461	6	100	0	0.93
Mixed wheat and sugarbeets zone of the north-west	471	9	100	0	0.90
Central wheat zone of Saxony and Thuringia	504	9	100	0	0.92
Sparse crop area of the east-German lake and Heathland	530	12	100	0	0.89
Western sparse crop area of the Rhenish massif	507	10	100	0	0.97
Bavarian Plateau	498	6	100	0	0.95

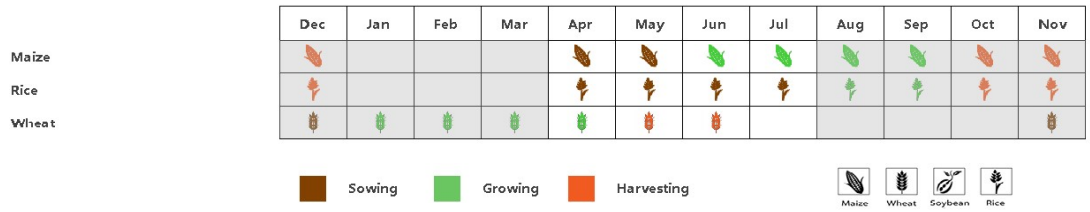
[EGY] Egypt

During the April-July monitoring period, winter wheat reaches maturity (harvest or about harvest), while summer crops (rice and maize) are in their growing season. The cumulative rainfall reached 7 mm, a seasonably low value for Egyptian conditions. The average temperature reached 23.8 ℃ (0.3 ℃ up), and the photosynthetically active radiation was 1573 MJ/m2 (1% down). The NDVI spatial pattern shows that 25.9% of the cultivated area had above the 5-year average crop condition, 50.9% fluctuated around the 5-year average and 23.2% were below. The best Vegetation Condition Index (VCIx) map shows that the condition of the current crops, mainly wheat, maize, and rice, is good. This agrees with the whole country VCIx value (0.89). CALF exceeded the 5-years average by 7%. Overall, the crop condition is favorable.

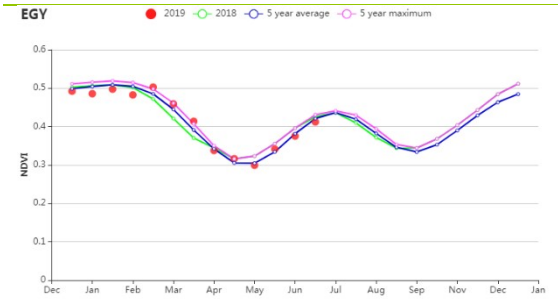
Regional Analysis

Based on crop planting systems, climate zones and topographical conditions, Egypt can be divided into three agro-ecological zones (AEZ), two of which are suitable for crop cultivation, namely the **Nile Delta** and the **southern coast of the Mediterranean** and the **Nile Valley**. In the Nile Delta and Mediterranean coast the average rainfall was 10mm, while in the Nile Valley recorded only 1 mm. Since virtually all crops in Egypt are irrigated agriculture, the impact of precipitation on crop yield is limited but additional precipitation is nevertheless always useful. Although the cumulative photosynthetically active radiation in both regions was slightly below the average (-1%), BIOMSS fell 30% increased by 58% for the first and second regions respectively. The NDVI development graph shows that crop condition fluctuated about the average in the first AEZ from April to May; in the second zone, it was first close to average but fell below by the end of the season.

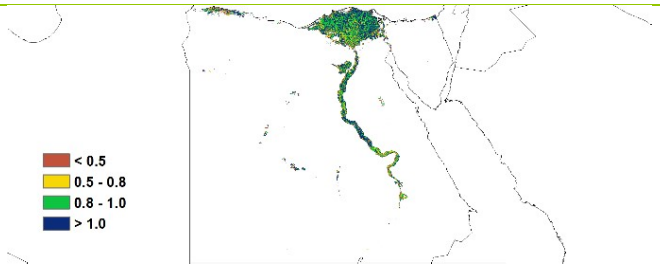
Figure 3.14. Egypt's crop condition, April -July 2019



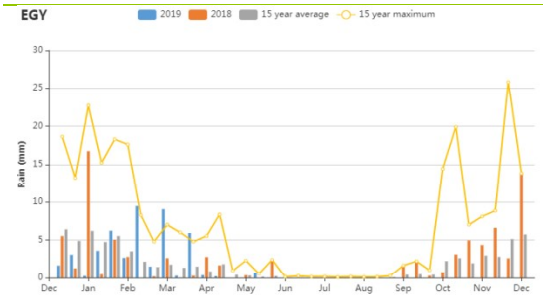
(a) Phenology of major crops



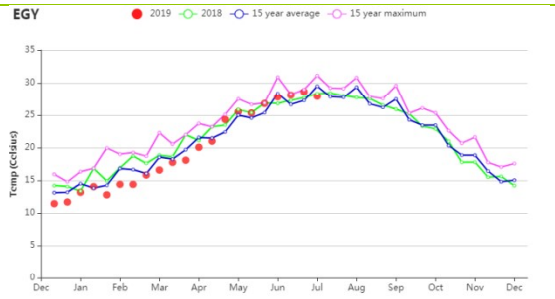
(b) Crop condition development graph based on NDVI



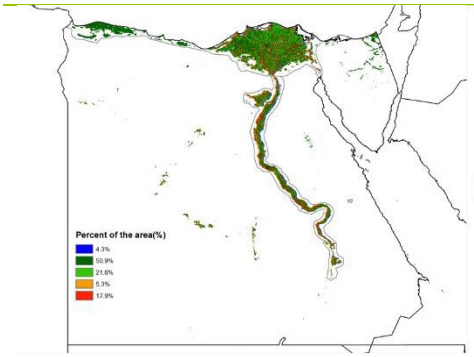
(c) Maximum VCI



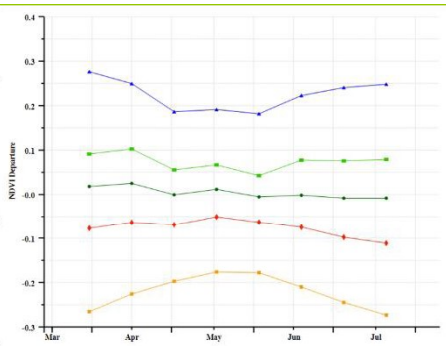
(d) Rainfall Index



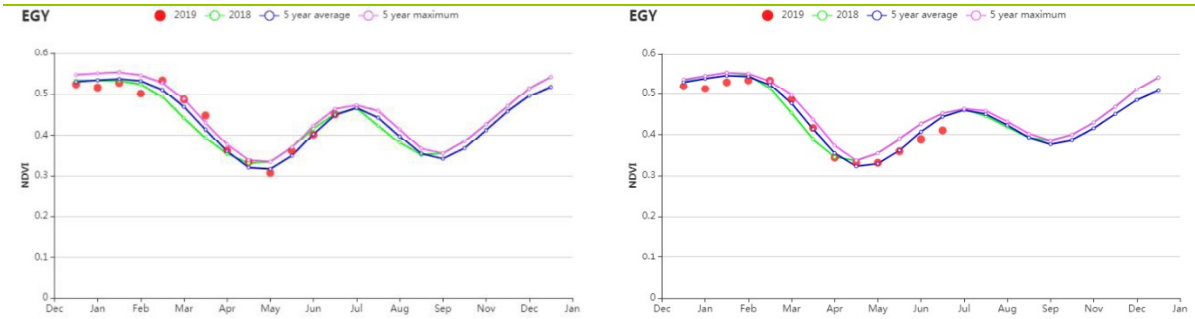
(e) Temperature Index



(f) Spatial NDVI patterns compared to 5YA



(g) NDVI profiles



(h) Crop condition development graph based on NDVI (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, April -July 2019

	RAIN		TEMP		RADPAR	
Region	**Current (mm)**	**Departure from 15YA (%)**	**Current (℃)**	**Departure from 15YA (℃)**	**Current (MJ/m2)**	**Departure from 15YA (%)**
Nile Delta and Mediterranean coastal strip	10	38	23.8	0.3	1563	-1
Nile Valley	1	3	27.4	0.6	1612	-1

Table 3.20. Egypt's agronomic indicators by sub-national regions, current season's values and departure, April -July 2019

	BIOMSS		CALF		Maximum VCI
Region	**Current (gDM/m^2)**	**Departure from 15YA (%)**	**Current (%)**	**Departure from 5YA (%)**	**Current**
Nile Delta and Mediterranean coastal strip	311	-30	68	8	0.93
Nile Valley	183	58	72	9	0.90

[ETH] Ethiopia

Ethiopia experiences two main agricultural seasons referred to as Meher and Belg. This reporting period corresponds to late Belg which covers all crops harvested before August. Some part of the country use the AMJJ period for land preparation and soil moisture harvesting for the Meher crops. Meher maize is still growing, and other cereal crops such as wheat, teff, and barley have been sown. At the national level, all the agro-climatic indicators and CALF were close to average. However, the total biomass production was slightly above average: BIOMASS +2%. According to the NDVI-based season development graph, crop condition was above the five years average. The maximum VCI value was recorded at 0. 94. According to NDVI clusters and profiles, 32.7% of the country experienced favorable crop condition, mostly around the central and northern part of the country which is commonly used for Belg crops. In addition, this area had a favorable maximum VCI ranging from 0.8 to 1.0. Low VCIx and low NDVI indicate that some parts of the southern region suffered unfavorable conditions. In general, the CropWatch indicators point at good Belg crops and favorable early Meher conditions.

Regional analysis

The semi-arid pastoral zone, south-eastern Mendebo highlands, south-eastern mixed-maize zone, western mixed maize regions, and central-northern maize teff highlands are the major cereal and grain-producing areas of Ethiopia reported in the analysis below.

The **Semi-arid pastoral zone** favors livestock over crops. RAIN and RADPAR dropped below average (RAIN −10%, RADPAR -1%) while the temperature was increased (TEMP +0.3℃). Even though the rainfall decreased the total biomass production increased 13%, possibly due to reduced water demand. Cropped arable land fraction (CALF) decreased -69% below the recent five −year average. The maximum VCIx was recorded as 0.66 and NDVI −based Crop condition development graphs were below average conditions during the reported period. Farmers in this zone rely on livestock production more than on crops and the increase in BIOMSS is associated with satisfactory range-land.

The **South-eastern Mendebo highlands** are major maize and teff producing areas. During the reported period, it received 524 mm, below average of rainfall (RAIN, -12%). The temperature remained constant. There was a slight increase in RADPAR and total biomass production by 2% and 4% respectively. The Cropped arable land fraction (CALF) remained constant compared to the five −year average. Even though during the reported period the NDVI crop condition development graph was below the five years average, the zone had maximum VCIx of 0.92. In this highland zone, crop prospects are just average.

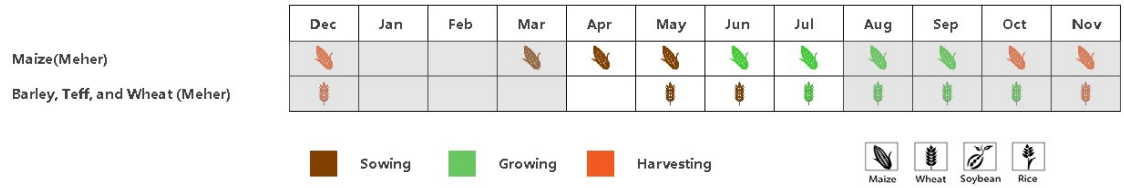
The **South-eastern mixed maize zone** recorded slightly below the average precipitation (RAIN at 427 mm, down 9%) and average temperature (TEMP +0.1℃). The RADPAR for this zone was by 2% above average and the BIOMASS index shows an increase of 3%. In central Oromia and eastern Amhara the NDVI development graphs indicate below average crop condition from April to June. However, during July, values rose above average. VCIx averaged 0.92 and CALF increased by 3%. In general, the crop condition and expected output for this zone are fair.

Maize is the most cultivated crop during the Belg and early Meher seasons in the **Western mixed maize zone**. Belg maize is still growing and early Meher maize is being planted. The total amount of rainfall reached 1138 mm, which corresponds to a drop of RAIN 9% below average. TEMP was below average as well (-0.2℃) and RADPAR decreased 2%. Expected BIOMSS output is unaffected. The NDVI profiles were below average from April to June but improved slightly in July. Based mainly on the rather high VCIx at

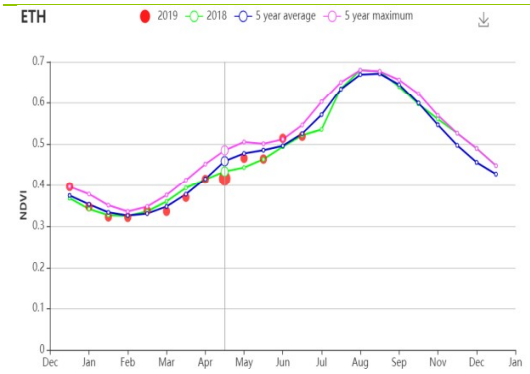
0.96%, crop condition is assessed as average.

During the reporting period, some of the CropWatch agronomic indicators were below average or average in the **Central-northern maize-teff highlands** (RAIN -11%, RADPAR -1%, TEMP average). However, the total biomass production underwent a slight increase. The total arable land fraction dropped slightly compared to the average (CALF, -2). NDVI was above average during April and May and below-average from Mid-May to June, after which it rose during July. Combined with a VCIx value of 0.93, the indicators describe fair crop prospects.

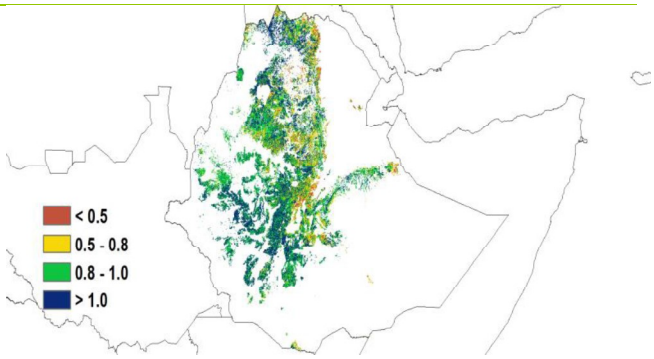
Figure 3.15. Ethiopia's crop condition, April -July 2019



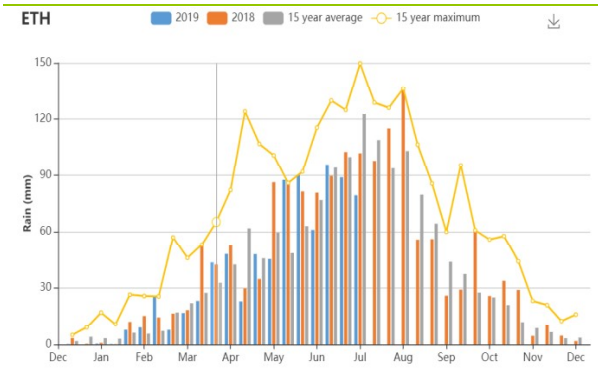
(a) Phenology of major crops



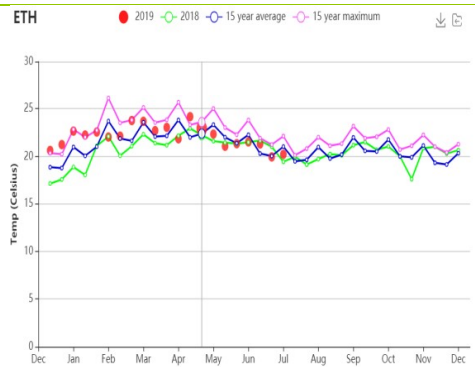
(b) Crop condition development graph based on NDVI



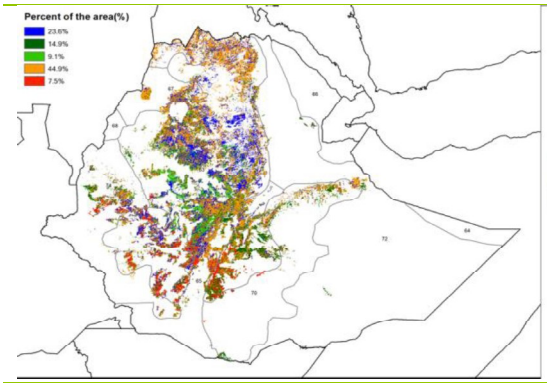
(c) Maximum VCI



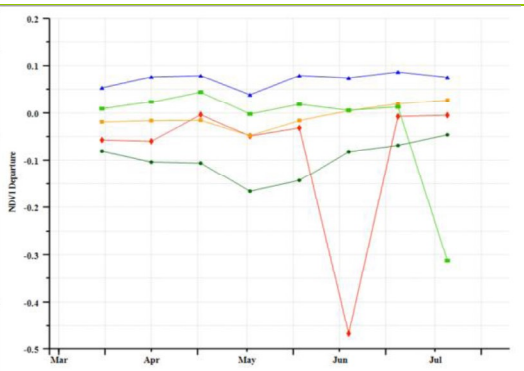
(d) Rainfall index



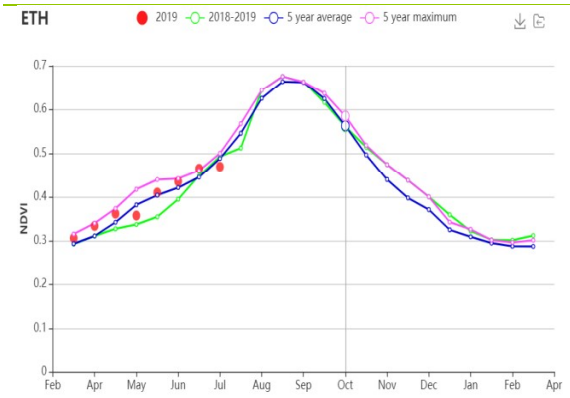
(e) Temprature index

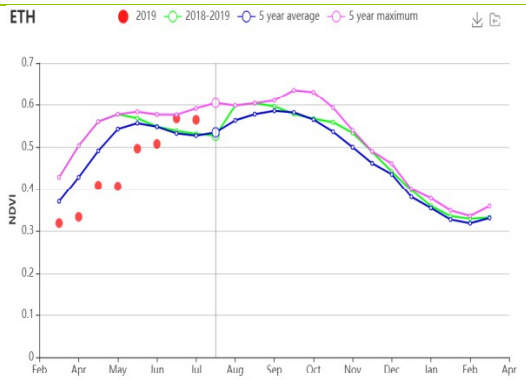


(f) Spatial NDVI patterns compared to 5YA

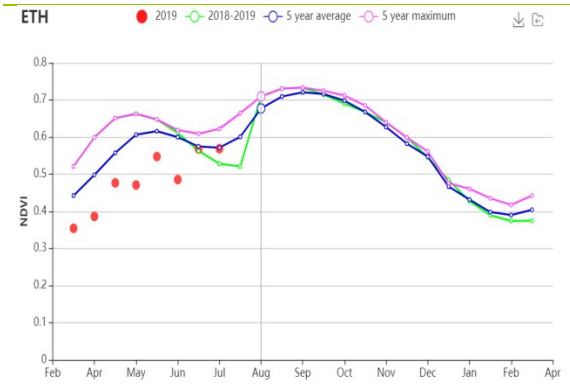


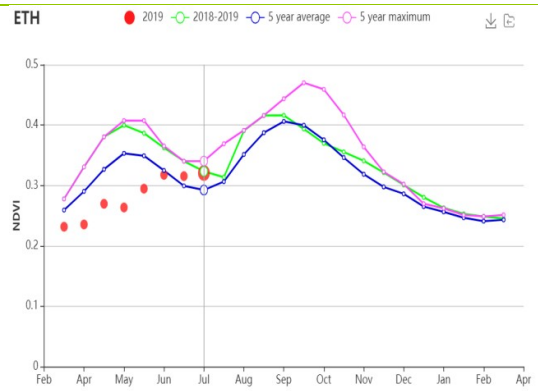
(g) NDVI profiles



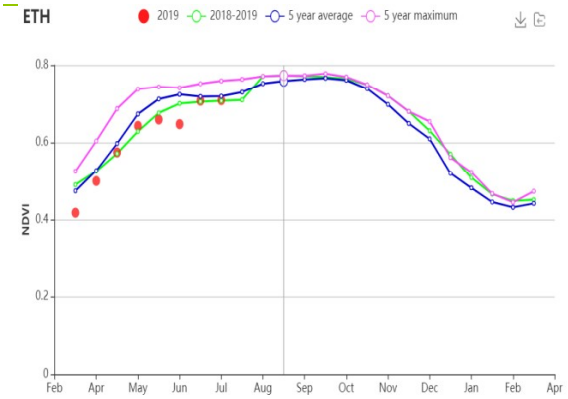


(h) Crop condition development graph based on NDVI (Semi-arid pastoral region (left) and South-eastern Mendebo highlands region(right))





(i) Crop condition development graph based on NDVI (South-east mixed-maize region (left) and Western mixed-maize region (right))



(j) Crop condition development graph based on NDVI (Central −northern maize −teff highlands)

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

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (℃)	Departure from 15YA (℃)	Current (MJ/m2)	Departure from 15YA (%)
Central-northern maize-teff highlands	636	-11	19.3	0.0	1289	-1
South-eastern mixed maize zone	427	-9	19.5	0.1	1232	2
South-eastern Mendebo highlands	524	-12	14.9	0.0	1172	2
Semi-arid pastoral	137	-10	26.0	0.3	1403	-1
Western mixed maize zone	1138	-9	21.1	-0.2	1082	-2

Table 3.22. Ethiopia's agronomic indicators by sub-national regions, current season's values and departure April -July 2019

Region	BIOMSS		CALF		Maximum VCI
	Current (gDM/m^2)	Departure from 15YA (%)	Current (%)	Departure from 5YA (%)	Current
Central-northern maize-teff highlands	556	3	80	-2	0.93
South-eastern mixed maize zone	620	3	94	3	0.92
South-eastern Mendebo highlands	441	4	98	0	0.92
Semi-arid pastoral	751	13	25	-69	0.66
Western mixed maize zone	602	0	100	0	0.96

[FRA] France

Winter wheat had reached maturity by July while the planting of maize and spring wheat was completed in May. Their harvest of the three crops starts in July and extends into September for summer crops such as maize, rice, potatoes and sunflower. CropWatch agro-climatic indicators show an 11% drop in RAIN compared to average, about average temperature, and a 5% increase in RADPAR at the national level.

Based on NDVI, crop condition was slightly below average. Values were mostly below those for 2018, but close to the five-year average from April to May. The national NDVI values began to drop slightly below average from Jan to Feb, at a time which recorded abundant of rainfall. NDVI was consistently above average in 35.9% of cropped areas. This spatial pattern is reflected by VCIx, which reached 0.94 on average. Generally, despite a decrease in rainfall, RADPAR increased in most regions and the resulting BIOMSS is up 9%.

Regional analysis

Considering cropping systems, climatic zones, and topographic conditions, additional sub-national detail is provided for eight agro-ecological zones. They were identified as Northern barley region; Mixed maize, barley and rapeseed zone from the Center to the Atlantic Ocean; Maize, barley and livestock zone along the English Channel; Rapeseed zone of eastern France; Dry Massif Central zone; South-western maize zone; Eastern Alpes region and the Mediterranean zone.

In the **Northern barley region** both RAIN and TEMP were below average (27% and 0.2℃, respectively), while RADPAR 14% above. Although rainfall was below normal, VCIx was high (0.99), land was fully cropped (100%) and BIOMSS increased, pointing at favorable crops.

The **Mixed maize, barley and rapeseed zone** RAIN was 17% below average, temperature about average and RADPAR up 8%. According to the NDVI profile and VCIx map, crop condition was good in the region. Overall, the situation is considered to be close to average.

Mostly unfavorable climatic conditions dominated the **Maize, barley and livestock zone**. Rainfall was 22% below average. Temperature and radiation (RADPAR) were normal. The dry conditions have hampered crop growth.

The **Rapeseed zone** recorded 309 mm of rainfall over four months (RAIN -27%).Temperature was average but RADPAR was 7% above. The increase in BIOMSS was 12% compared to the five-year average. The NDVI profile confirms the condition of crop was close average.

The **dry Massif Central zone** had a light rainfall deficit (RAIN -7%), with above average values for both RADPAR and TEMP. BIOMSS for the region was 8% above the five-year average, and a high VCIx value reflected the generally favorable crop condition. That overall crop condition was generally comparable with the previous five years, as confirmed by the crop condition development graph, in this minor agricultural region.

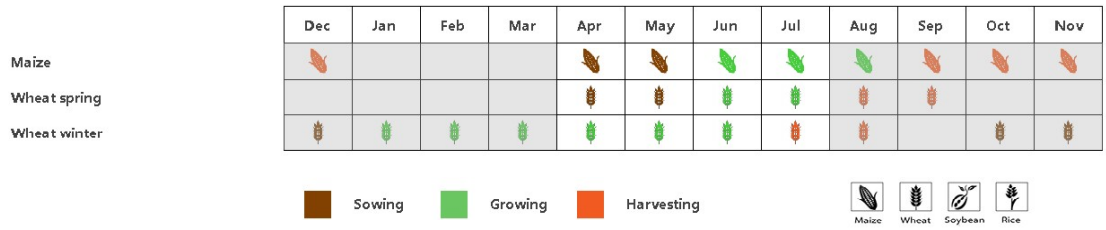
The **Southwestern maize zone** is one of the major irrigated maize regions in France. Rainfall increased by 5%, temperature was average, but radiation was above expectations. Crop condition was below average according to the NDVI development graph, in spite of an observation confirmed by the increase of BIOMSS by 3% compared to average. The VCIx map, however, showed that the crop condition was unsatisfactory, in spite of a high VCIx value recorded for the region as a whole (0.92).

Generally, crop condition for the **Alpes region** was above average with the following agro-climatic indicator values: RAIN +8%, TEMP -0.4℃, and RADPAR, +2%. Almost all arable land in this region was cropped during the monitoring period, and the average VCIx is 0.90. The NDVI profile confirmed the favorable crop.

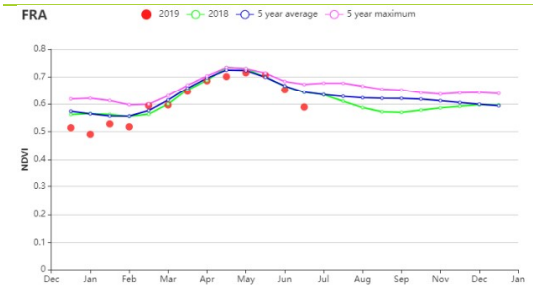
Finally, the best weather conditions were observed in the Mediterranean zone (RAIN +13%) even if other

indicators remained close to average. According to the NDVI profiles, crop condition has been continuously deteriorating since June. BIOMSS was 4% above its five-year average.

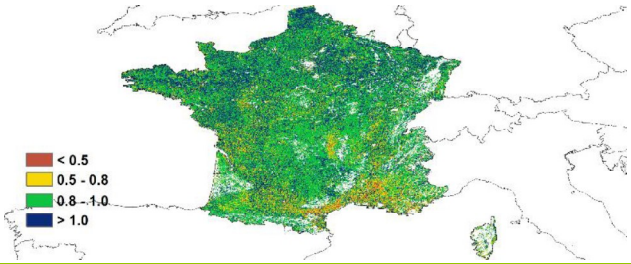
Figure 3.16. France's crop condition, April - July 2019



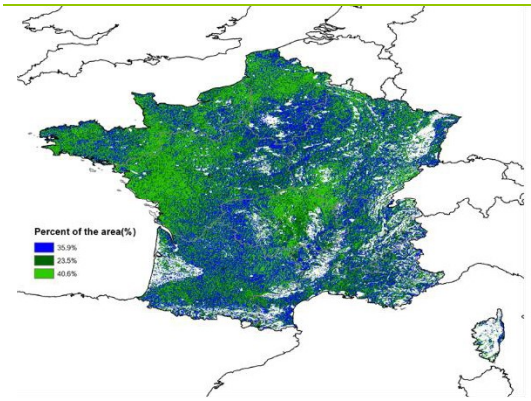
(a) Phenology of major crops



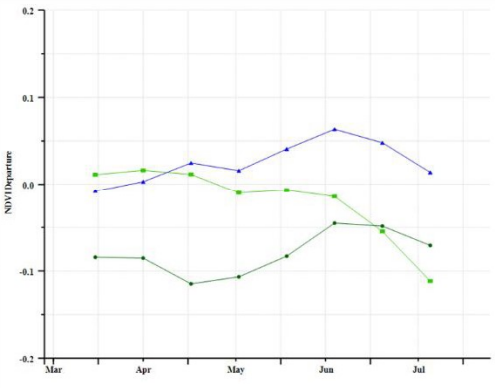
(b) Crop condition development graph based on NDVI



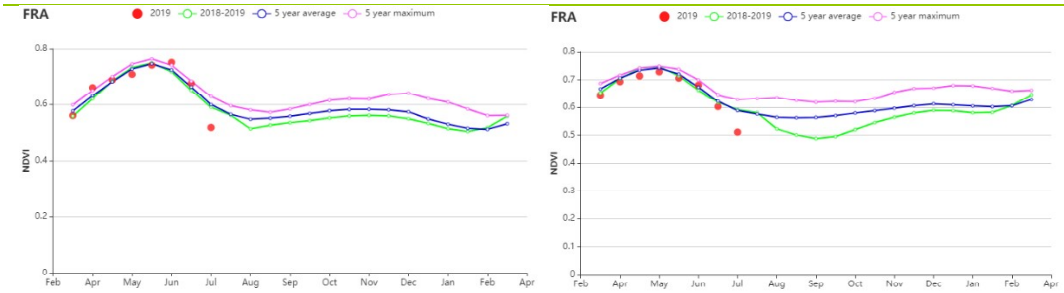
(c) Maximum VCI



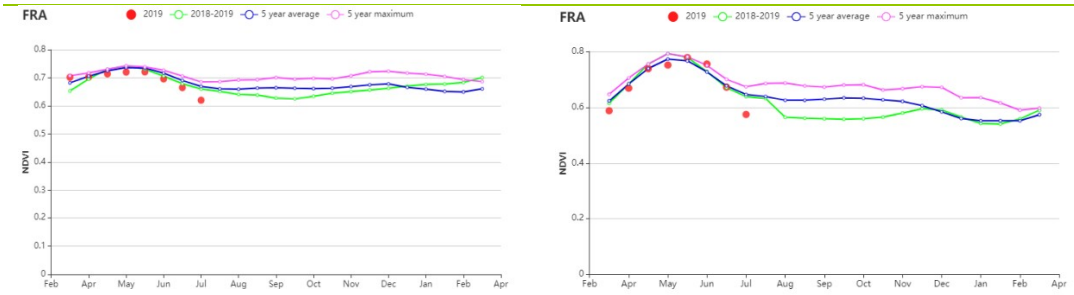
(d) Spatial NDVI patterns compared to 5YA



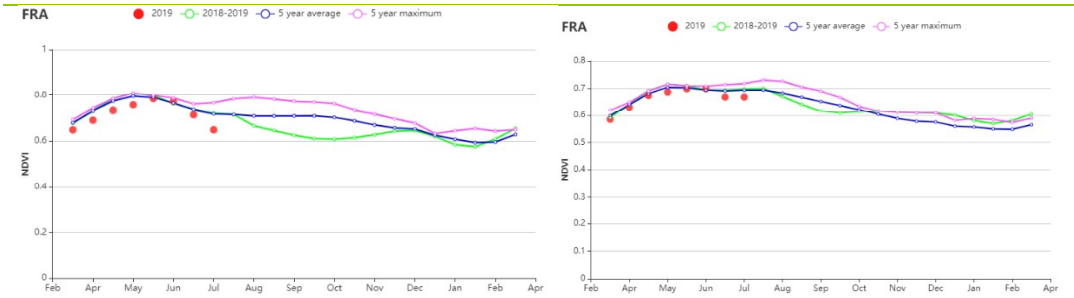
(e) NDVI profiles



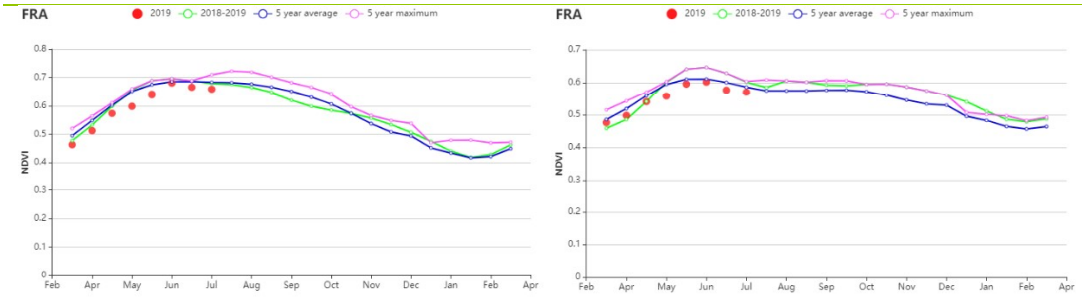
(f) Crop condition development graph based on NDVI (Northern barley region (left) and Mixed maize, Barley and Rapeseed zone (right))



(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



(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, April - July 2019

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (℃)	Departure from 15YA (℃)	Current (MJ/m^2)	Departure from 15YA (%)
Northern barley zone(France)	231	-27	14.4	0.2	1291	14
Mixed maize/barley and rapeseed zone(France)	268	-17	15.5	0.2	1291	8
Maize_barley and livestock zone (France)	226	-22	13.9	0.1	1231	9
Rapeseed zone (France)	309	-27	14.5	0.1	1279	7
Dry Massif Central zone(France)	395	-7	13.8	0.0	1267	3
Southwestern maize zone (France)	431	5	15.5	-0.1	1290	2
Eastern Alpes region (France)	530	8	13.2	-0.3	1340	2
Mediterranean zone(France)	346	13	15.5	-0.3	1406	-0.4

Table 3.24. France's agronomic indicators by sub-national regions, current season's values and departure, April - July 2019

Region	BIOMSS		Cropped arable land fraction		Maximum VCI
	Current (gDM/m^2)	Departure from 15YA (%)	Current (%)	Departure from 5YA (%)	Current
Northern Barley zone (France)	522	17	100	0	0.99
Mixed maize/barley and rapeseed zone (France)	565	13	100	0	0.94
Maize_barley and livestock zone(France)	470	11	100	0	0.98
Rapeseed zone (France)	535	12	100	0	0.96
Dry Massif Central zone (France)	514	8	100	0	0.92
Southwestern maize zone (France)	565	3	100	0	0.92
Eastern Alpes region(France)	512	4	98	0	0.90
Mediterranean zone(France)	611	4	95	0	0.83

[GBR] United Kingdom

Crops showed unfavorable condition during this reporting period. Summer crops have been harvested, while winter wheat and barley started to be sown in October. According to the crop condition graph, NDVI values were below average from April to early July. Agro-climatic indicators show that rainfall was below average (RAIN, -10%), radiation and biomass were above average (RADPAR, +2%; BIOMSS, +2%) and temperature close to average. The NDVI departure cluster profiles indicate above average values in 39.8% of arable land including East Anglia (Suffolk and Norfolk), South-east (Kent and Sussex), West (Gloucester, Oxford) and East Scotland (Moray, Banff and Aberdeen). The national VCIx (0.97) was normal and the CALF is unchanged compared to its five-year average.

Regional analysis

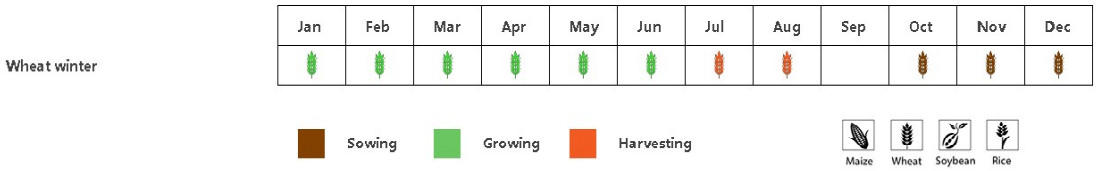
Based on cropping systems, climatic zones, and topographic conditions, three sub-national regions can be distinguished: Central sparse crop region, Northern barley region, and Southern mixed wheat and barley region. All three sub-regions characterized by unchanged fractions of arable land (CALF) compared to 5 years average.

The **Central sparse crop region** is one of the country's major agricultural regions in terms of crop production. Crop condition was below the five-year average according to NDVI development graph in May to June. Agroclimatic conditions including rainfall was below average (RAIN -12%) with close to average temperature and radiation (TEMP +0.1℃, RADPAR +2%). Biomass was about average (BIOMSS, +1%). The VCIx was at 1.00.

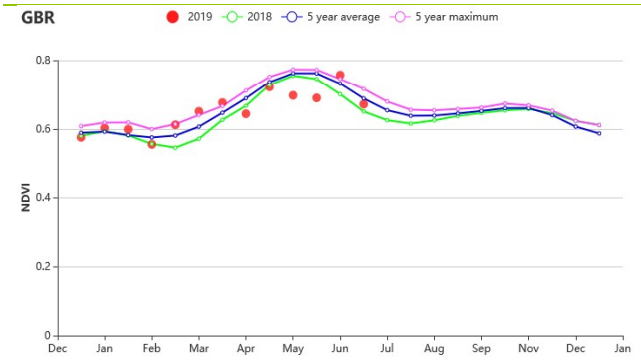
In the **Northern barley region** NDVI was below average from April to late May and above the five-year maximum in June and July. RADPAR (+1%) and TEMP (+0.2℃) were close to average BIOMSS increased 2% in spite of the 16% drop of RAIN compared to average. The national VCIx with 0.98.

In the **Southern mixed wheat and barley zone**, NDVI was below average according to the crop condition graph. All indicators were close to average: RAIN -3%), RADPAR +3%, TEMP -0.2℃ and biomass is up 1%. The region had above average VCIx (0.97).

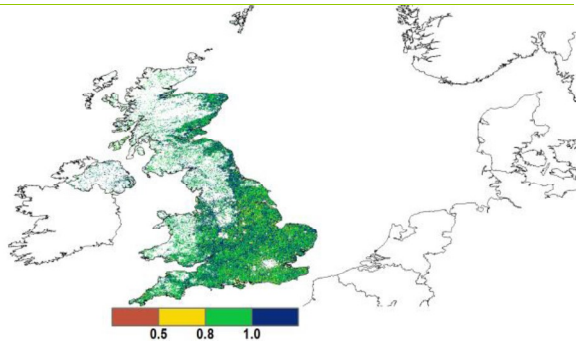
Figure 3.17. United Kingdom crop condition, April - July 2019



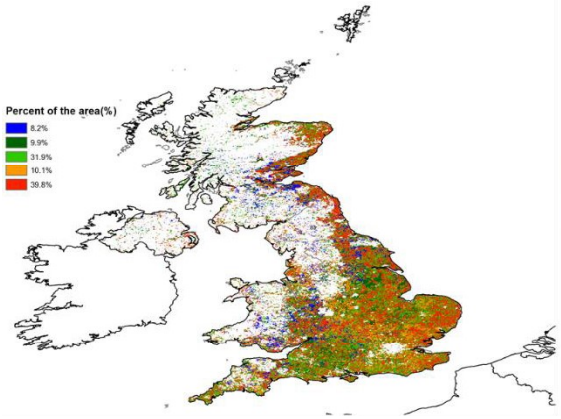
(a) Phenology of major crops



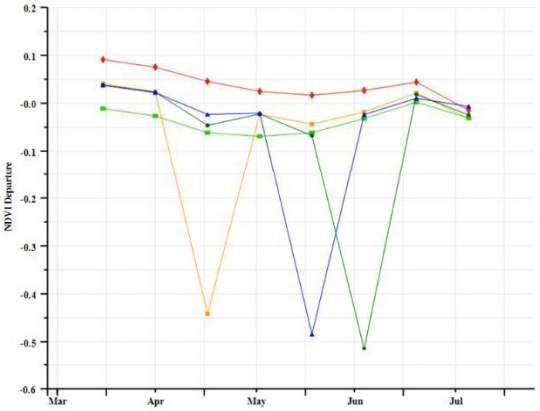
(b) Crop condition development graph based on NDVI



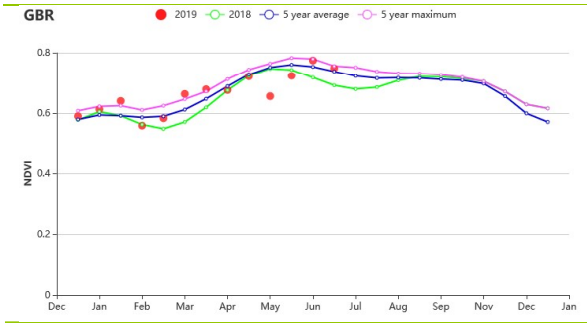
(c) Maximum VCI

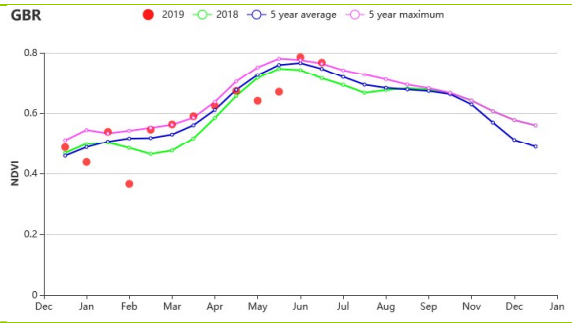


(d) Spatial NDVI patterns compared to 5YA

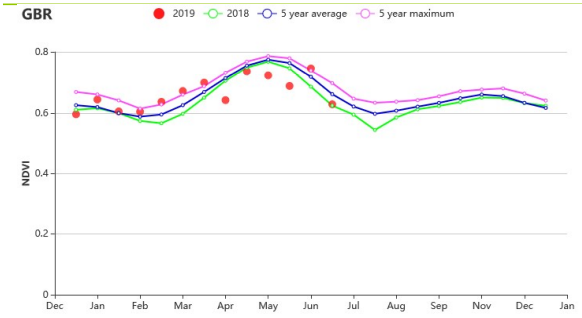


(e) NDVI profiles





(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, April - July 2019

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (℃)	Departure from 15YA (℃)	Current (MJ/m^2)	Departure from 15YA (%)
Northern Barley area (UK)	390	-16	10.1	0.2	886	1.2
Southern mixed wheat and Barley zone (UK)	312	-3	12.4	-0.2	1051	2.7
Central sparse crop area (UK)	365	-12	11.1	-0.1	956	1.5

Table 3.26. United Kingdom's agronomic indicators by sub-national regions, current season's values and departure, April - July 2019

Region	BIOMSS		Cropped arable land fraction		Maximum VCI
	Current (gDM/m^2)	Departure from 15YA (%)	Current (%)	Departure from 5YA (%)	Current (%)
Northern Barley area (UK)	263	2	100	0	0.98
Southern mixed wheat and Barley zone (UK)	364	1	100	0	0.97
Central sparse crop area (UK)	304	1	100	0	1.00

[HUN] Hungary

Winter wheat has been harvested in June and July and summer crops are growing. Accumulated rainfall and biomass were above average (RAIN +35%, BIOMSS +3%) while temperature and radiation were slightly below (TEMP -0.3℃, RADPAR -1%). BIOMSS is up 1%. According to the national NDVI development graphs, crop condition was generally above average. Some spatial and temporal detail is provided by NDVI clusters: NDVI was above average throughout the reporting period in 37.9% of arable land, in the Western Transdanubia; it was below average from April to early June in 62.1% of cropland. About 59.5% of arable land was above average from early June to late July. With the maximum VCI value at the national level reaching 0.98 and the cropped arable land fraction (CALF) at 100% (unchanged compared to the recent five-year average) crop condition is assessed as favorable.

Regional analysis

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

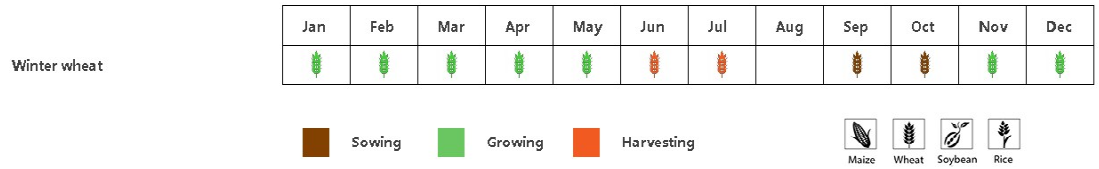
Central Hungary is one of the major agricultural regions in terms of crop production. A sizable share of winter wheat, maize and sunflower is planted in this region. The NDVI was below average from April to May, above and close to average from late May to July. Agro-climatic conditions include slightly below average radiation (RADPAR -0.9%), temperature (TEMP -0.5℃) and above average rainfall (RAIN, +40%). The biomass production is unchanged and VCIx was just fair at 0.95. According to the NDVI development graphs, NDVI was below average in May and June, above average from late June to July.

Northern Hungary is another important winter wheat region. During this reporting period crops showed favorable conditions according to the crop condition graph. Temperature and radiation had slight negative anomalies (TEMP, -0.3℃, RADPAR, -0.5%) while rainfall and biomass both increased (RAIN +24%, BIOMSS, +1%). The VCIx was favorable at 0.98.

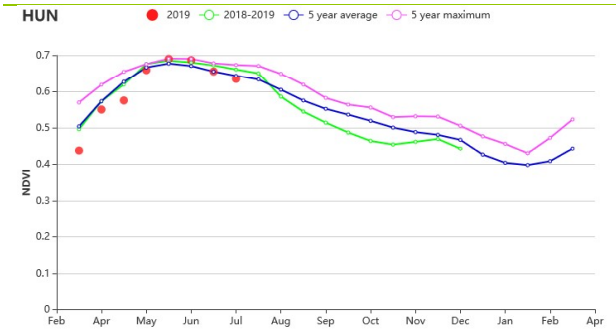
The Puszta region grows mostly winter wheat, maize and sunflower especially in the counties of Jaz-Nagykum-Szolnok and Bekes. According to the NDVI development graph, crop condition was above average from May to July. The biomass is unchanged in spite of the precipitation excess reaching 45%. Temperature and radiation were average (TEMP -0.4℃, RADPAR -1%). The maximum VCI was a favorable 0.99.

Southern Transdanubia cultivates winter wheat, maize, and sunflower, mostly in Somogy and Tolna counties. Crop condition was generally above average from April to July in this region. The RAIN was above average (+28%) with both temperature and radiation below average (TEMP -0.3℃, RADPAR -2%). The biomass increased by 1%. The maximum VCI was favorable at 0.97.

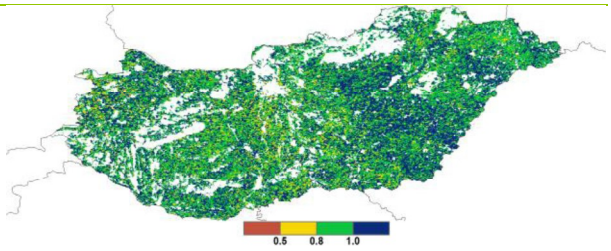
Figure 3.18. Hungary's crop condition, April - July 2019



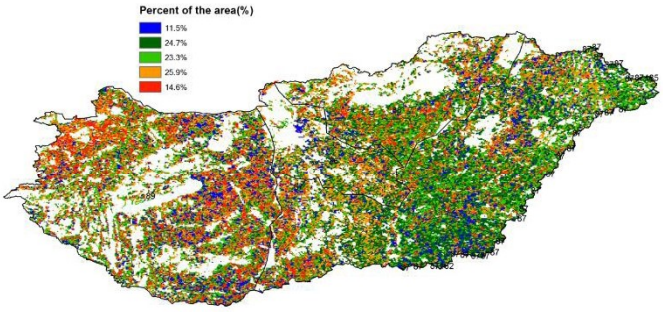
(a) Phenology of major crops



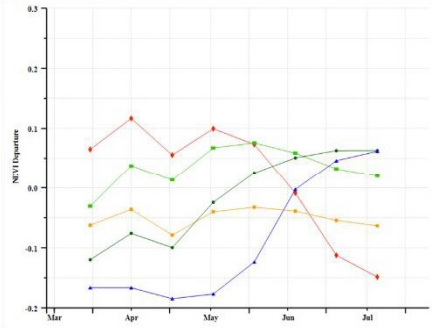
(b) Crop condition development graph based on NDVI



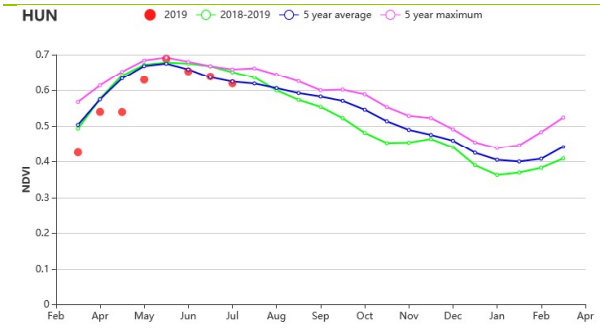
(c) Maximum VCI

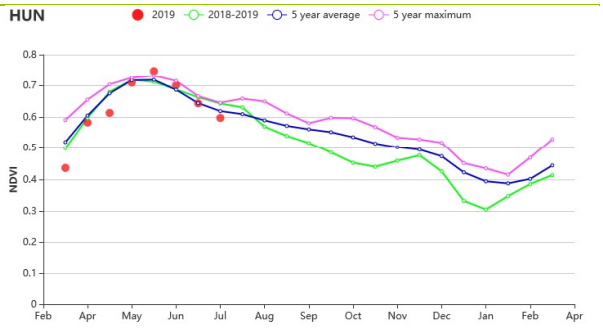


(d) Spatial NDVI patterns compared to 5YA

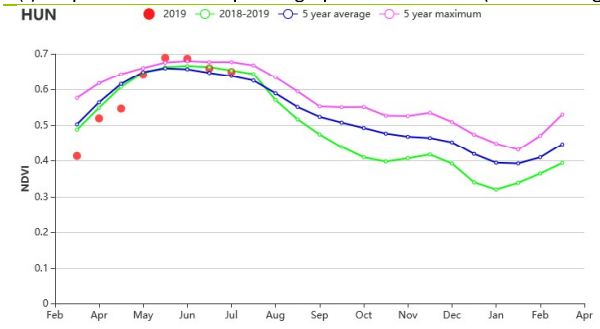


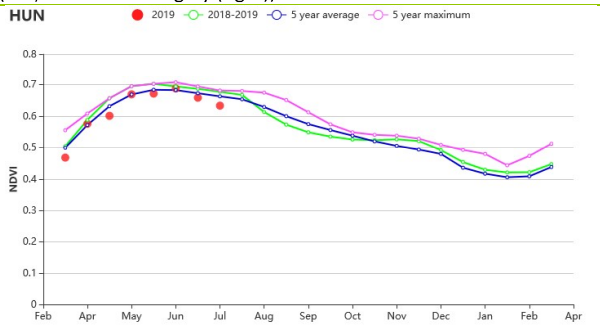
(e) NDVI profiles





(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, April -July 2019

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (℃)	Departure from 15YA (℃)	Current (MJ/m^2)	Departure from 15YA (%)
Northern Barley area (UK)	304	-13	11.2	1.0	981	2.9
Central Hungary	343	28	19.5	1.3	1236	2.5
North Hungary	287	1	18.9	1.4	1216	2.5
Great Plain	333	23	19.8	1.3	1244	3.0
Transdanubia	372	26	19.2	1.3	1235	2.9

Table 3.28. Hungary's agronomic indicators by sub-national regions, current season's values and departure, April -July 2019

Region	BIOMSS		CALF		Maximum VCI
	Current (gDM/m^2)	Departure from 15YA (%)	Current (%)	Departure from 5YA (%)	Current
Central Hungary	1234	17	100	0	0.94
North Hungary	1145	3	100	0	0.91
Great Plain	1188	11	100	0	0.91
Transdanubia	1313	16	100	0	0.95

[IDN] Indonesia

The secondary rice crop is grown from April to August, while the harvest of main rice and maize crops was completed in March. Indonesia experienced comparatively clear weather during this period: temperature was average but rainfall (RAIN -11%) was below average. Radiation (RADPAR +4%) was slightly above average, which increased the crop production potential by about 3%. According to the NDVI development graphs, crop condition was not favorable, especially in mid-May, during the planting season of the 2nd rice crop. On 45.4% of the arable land, crop condition was slightly above average. In 25.7% of the cropped area, mostly located in patches on Riau, Sumatra Selatan, Lampung, Kalimantan Barat, Kalimantan Timur and Kalimantan Selatan, crop condition was slightly below average. Negative departures from long-term trends of NDVI were mostly concentrated in West Papua. The area of cropped arable land (CALF) in the country is comparable to the five-year average. Considering the favorable maximum VCIx value of 0.98, the national production is anticipated to be close to the average.

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 the former three are relevant for crop cultivation. The numbers correspond to the labels in the VCIx and NDVI profile maps.

In all regions, NDVI was below the 5 year average in May, but recovered to close to normal values by late June, except for Java.

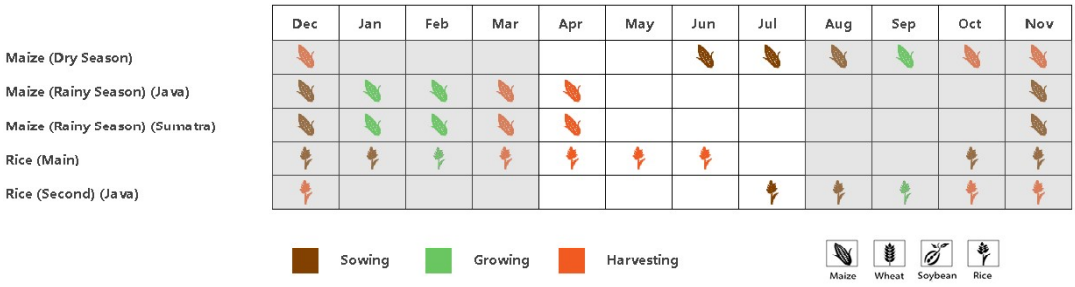
The agro-climatic conditions for **Java** indicate a significant drop in accumulated rainfall (RAIN -43%) and temperature (TEMP -0.4℃) while radiation (RADPAR +8%) was above average, resulting in a decrease of the biomass production potential in this region (BIOMSS -4%). According to the NDVI development graph, crop condition was below average starting in May, but comparable to last year.

Rainfall (RAIN -12%) was below average in **Kalimantan and Sulawesi**, whereas no departure from the 15YA temperature was observed. Radiation (RADPAR +5%) was above average, leading to a slight increase of biomass production potential (BIOMSS +5%). The NDVI development curve shows that crop conditions had recovered to close to average by late June.

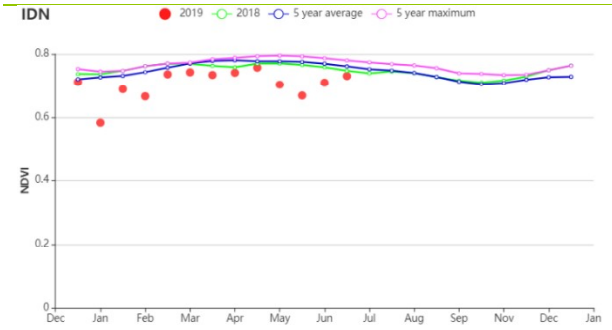
Sumatra experienced average agro-climatic conditions, though rainfall was reduced by 9% compared to average. The radiation and temperature increased 3% and 0.1 ℃, respectively. Biomass production potential (BIOMSS +4%) in this region was close to average. According to the NDVI development graph, crop condition was below the 5-year reference but had recovered by the end of June. Overall, the crop condition in Sumatra was below but close to average.

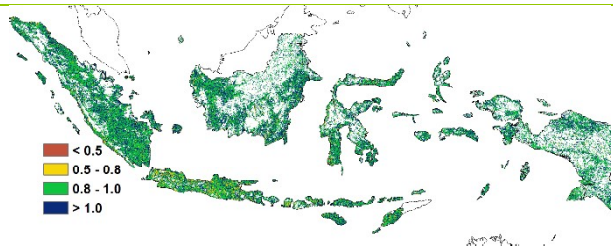
Considering that all the arable land was cultivated, CropWatch anticipates crop production will be slightly below but close to the average.

Figure 3.19. Indonesia's crop condition, April - July 2019



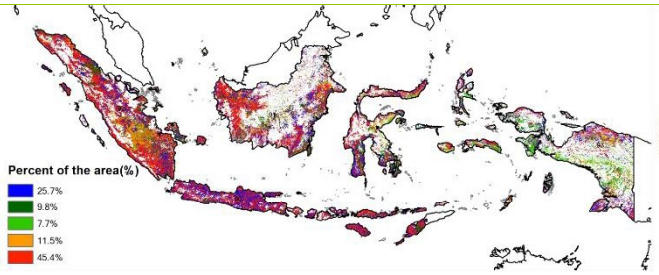
(a) Phenology of major crops

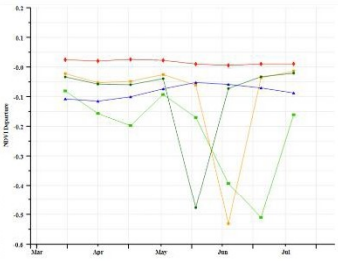




(b) Crop condition development graph based on NDVI

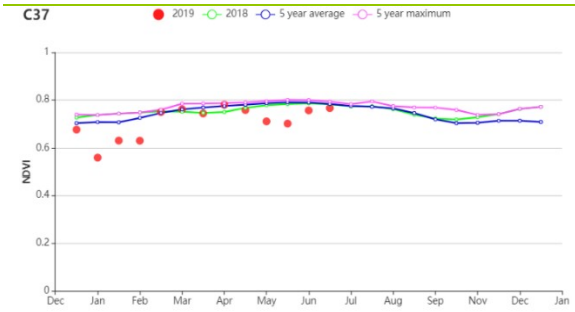
(c) Maximum VCI

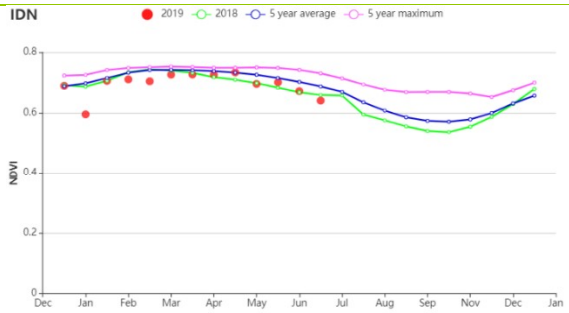




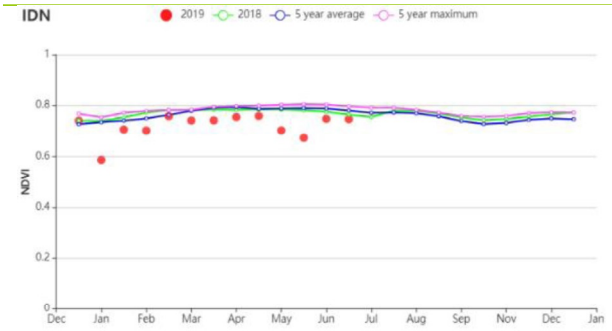
(d) Spatial NDVI patterns compared to 5YA

(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, April - July 2019

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (℃)	Departure from 15YA (℃)	Current (MJ/m^2)	Departure from 15YA (%)
Java	406	-43	24.1	-0.4	1198	8
Kalimantan and Sulawesi	1031	-12	24.3	0.0	1148	5
Sumatra	915	-9	24.5	0.1	1154	3
West Papua	1532	-7	22.8	0.0	877	1

Table 3.30. Indonesia's agronomic indicators by sub-national regions, current season's values and departure, April - July 2019

Region	BIOMSS		Cropped arable land fraction		Maximum VCI
	Current (gDM/m^2)	Departure from 15YA (%)	Current (%)	Departure from 5YA (%)	Current
Java	674	-4	99	0	0.95
Kalimantan and Sulawesi	740	5	100	0	0.98
Sumatra	750	4	100	0	0.98
West Papua	550	2	100	0	0.99

[IND] India

The current monitoring period covers the harvest of rabi rice and wheat in April and May, as well as the sowing of maize, kharif rice and soybean. Crop condition as assessed by NDVI dropped below average starting mid-May, but recovered to average values in July.

At the national scale, compared to average, rainfall decreased by 13% while temperature increased by 0.4℃ and radiation (RADPAR) by 3%. According to the temperature profiles, values were obviously above average from early May to early June, which was associated with a big heatwave, affecting almost half of the country. BIOMSS was above average (+7%). The VCIx was moderate, with a value of 0.83. However, the values of this indicator vary spatially, with the lowest values (less than 0.5) appearing in northwest and southeast of India (i.e. Rajasthan, Andhra Pradesh and Tamil Nadu) and the highest values (greater than 0.8) in the western and northern parts of the country (such as Madhya Pradesh, Uttar Pradesh and Gujarat). According to the graph of spatial NDVI patterns, about 59.4% of cultivated areas showed below-average crop condition, mainly located in the southeast and central India, including Andhra Pradesh, Tamil Nadu and Maharashtra. The remaining areas, depicting above average conditions, were located in western and northern India (i.e. Madhya Pradesh, Uttar Pradesh, Gujarat and Rajasthan). These patterns were generally consistent with those of VCIx. While wheat condition was more than satisfactory, the establishment of the kharif (monsoon) season crops suffered from the erratic and delayed start of the season. Considering the above in combination with below-average CALF (-8%), the production of the current kharif crop is estimated to be below average.

Regional analysis

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

The **Deccan plateau** received below-average rainfall (-15%) and above-average temperature (+0.7℃) and radiation (+4%). According to the NDVI time series graph, crop condition was generally below average from April to early July and improved to above average by late July. The BIOMSS increased by 5% as compared to the average. The VCIx was moderate, with a value of 0.84. As CALF significantly declined by 14% compared to average, the crop production is expected to be below average.

The **Eastern coastal region** recorded near average precipitation (-5%), temperature (+0.4℃) and radiation (+2%). As shown by the NDVI profile, crop condition was generally below average and got worse between April and early July. Fortunately, crop condition improved to average by late July. The VCIx was relatively low (0.72) and the CALF decreased by 16% compared to average. Therefore, the crop output is estimated to be below average.

In the **Gangetic plains**, rainfall decreased by 14% but temperature and radiation increased by 0.4℃ and 2%, respectively, compared to average. Crop condition was generally average over the monitoring period. The BIOMSS was above average (+15%). The VCIx was high at 0.92. On the contrary, the CALF declined significantly by 23%, compared to average.

The **Assam and North-eastern region** received below-average rainfall (-8%) and temperature (-0.2℃) and above-average radiation (+2%). According to the graph of the NDVI development, crop condition fluctuated largely during this monitoring period. The BIOMSS and CALF were average but VCIx was high (0.98).

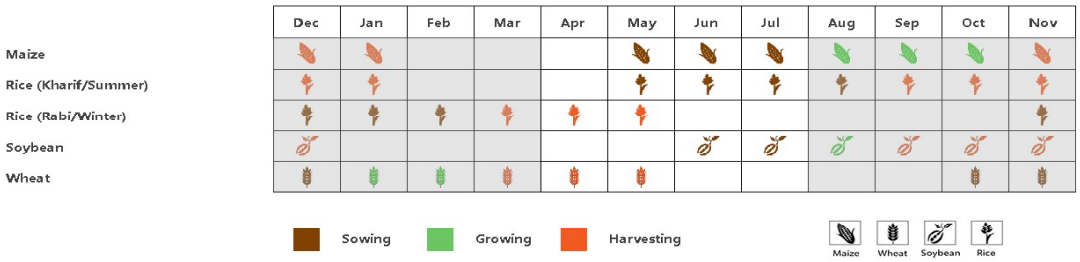
In the **Agriculture areas in Rajasthan and Gujarat**, rainfall decreased 5% compared with average, whereas temperature and sunshine (RADPAR) increased by 0.4℃ and 1%, respectively. Crop condition was average from April through early July and improved to be above average after late July, as implied by the NDVI profile. This favorable condition was also confirmed by a very high VCIx (0.96). Based on the above analyses, the crop production of this season is expected to be above average.

The **Western coastal region** recorded below-average rainfall (-13%), warmer temperature (+0.6℃) and higher radiation (+5%), which led to unfavorable crop condition in the region, as indicated by the graph of NDVI development. The VCIx was moderate (0.80). Considering that CALF declined by 7%, crop production in this region is expected to be below average.

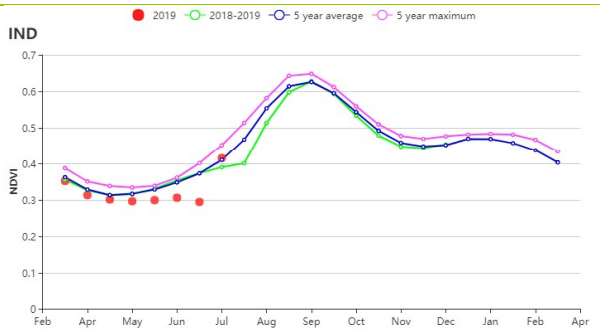
In the **North-western dry region**, rainfall dropped significantly below average (-65%), while temperature and radiation were average. As shown by the graph of NDVI development, crop condition was generally below average. The VCIx was just 0.37. Additionally, the CALF fell by 93%. The crop production of this season is expected to be well below average.

The **Western Himalayan region** received below-average precipitation (-17%) and average temperature and radiation. Crop condition was overall average over the reporting period. The BIOMSS was above average (+8%) and the VCIx was relatively high (0.89). However, the CALF declined by 5% compared to average. Overall, the crop production in this region is expected to be average.

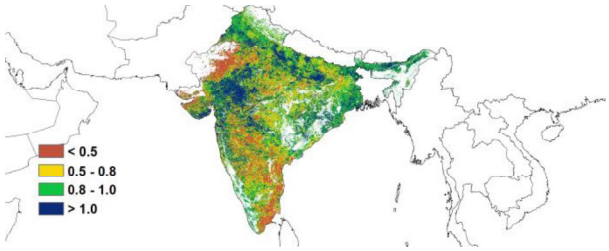
Figure 3.20. India's crop condition, April - July 2019



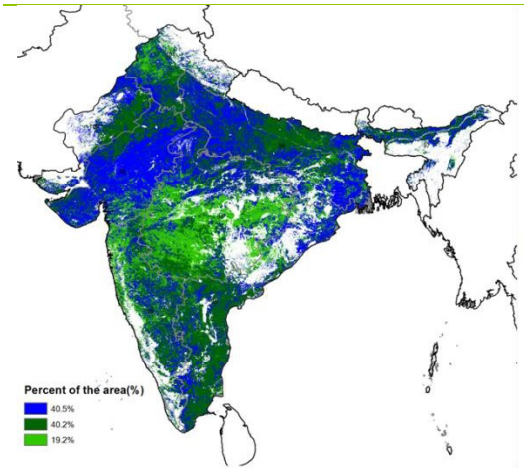
(a). Phenology of major crops

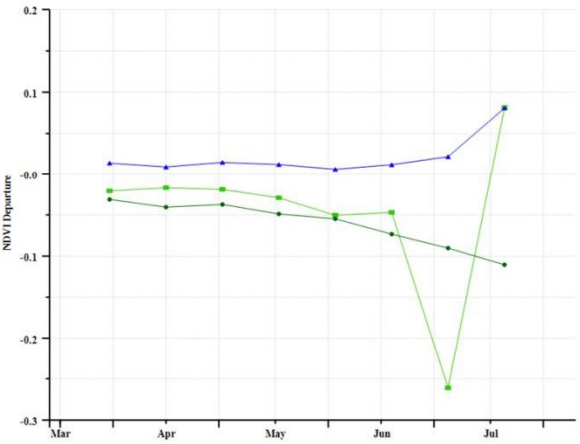


(b) Crop condition development graph based on NDVI

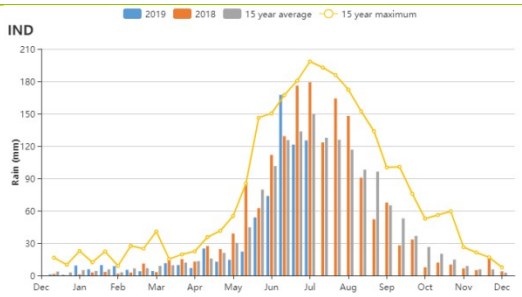


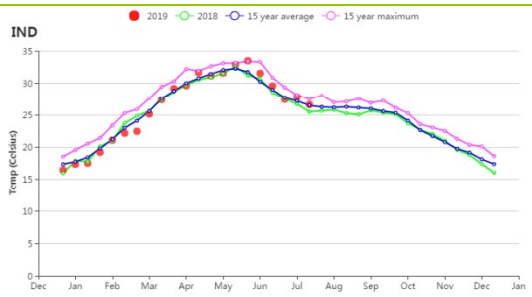
(c) Maximum VCI



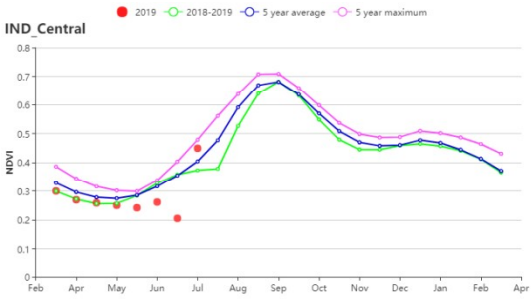


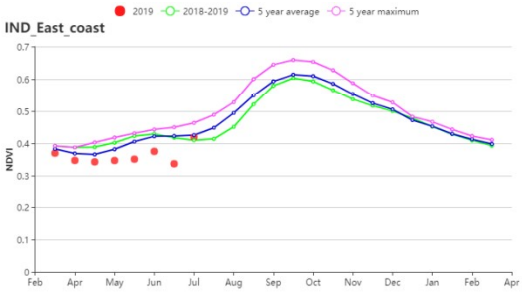
(d) Spatial NDVI patterns compared to 5YA (e) NDVI profiles



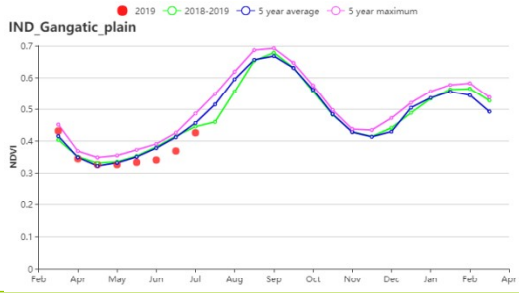


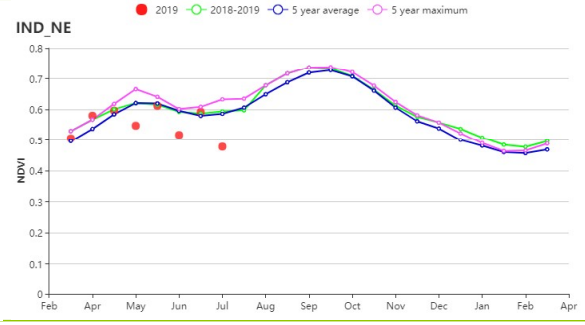
(f) Rainfall profiles (g) Temperature profiles



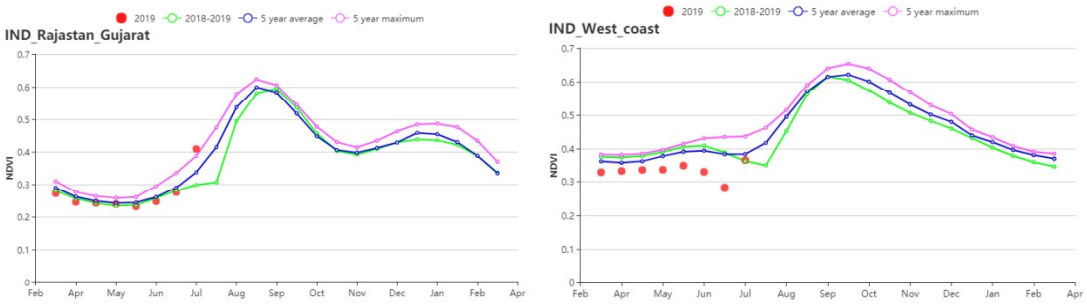


(h) Crop condition development graph based on NDVI (Deccan Plateau (left) and Eastern Coastal Region (right))

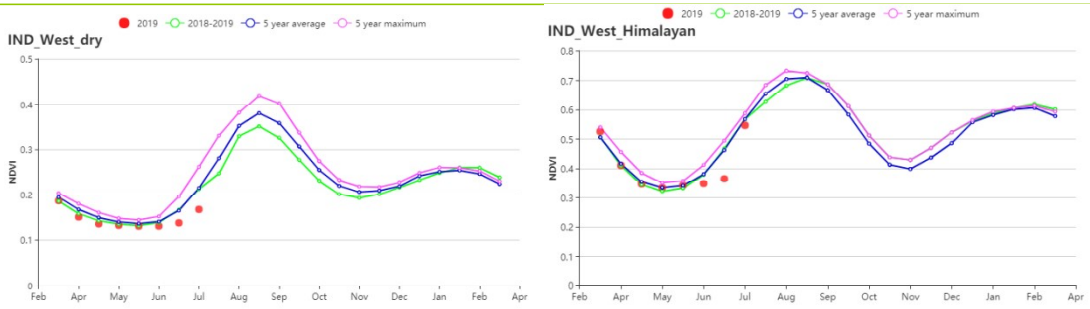




(i) Crop condition development graph based on NDVI (Gangatic Plains (left) and Assam and north-eastern regions (right))



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



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

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

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (℃)	Departure from 15YA (℃)	Current (MJ/m^2)	Departure from 15YA (%)
Deccan Plateau	509	-15	31.9	0.7	1293	4
Eastern coastal region	510	-5	30.5	0.4	1230	2
Gangatic plain	527	-14	32.5	0.4	1361	2
Assam and north-eastern regions	1808	-8	24.2	-0.2	1144	2
Agriculture areas in Rajastan and Gujarat	435	-14	32.3	0.4	1360	1
Western coastal region	837	-13	27.3	0.6	1212	5
North-western dry region	45	-65	33.9	0.4	1494	0
Western Himalayan region	365	-17	24.6	-0.4	1456	1

Table 3.32. India's agronomic indicators by sub-national regions, current season's values and departure, April - July 2019

Region	BIOMSS		Cropped arable land fraction		Maximum VCI
	Current (gDM/m^2)	Departure from 15YA (%)	Current (%)	Departure from 5YA (%)	Current
Deccan Plateau	637	5	56	-14	0.84
Eastern coastal region	767	6	55	-16	0.72
Gangatic plain	823	15	60	-23	0.92
Assam and north-eastern	713	2	96	1	0.98

Region	BIOMSS		Cropped arable land fraction		Maximum VCI
	Current (gDM/m^2)	Departure from 15YA (%)	Current (%)	Departure from 5YA (%)	Current
regions					
Agriculture areas in Rajastan and Gujarat	531	2	45		0.96
Western coastal region	648	1	52	-7	0.8
North-western dry region	623	13	3	-93	0.37
Western Himalayan region	703	8	91	-5	0.89

[IRN] Iran

This monitoring period covers the grain filling period and harvest of winter wheat, as well as the planting and early establishment of the rice crop. The cumulative rainfall was 135 mm, which was 63% above average. The average temperature was 21.1℃ (0.2 ℃ below average), whereas the photosynthetically active radiation was 1609 MJ/m2 (down 1%). The potential biomass was 12% higher than the 15-year average. The national maximum vegetation condition index (VCIx) was1.07, while the cropped arable land fraction (CALF) was 45% higher than the average of the past 5-years. The NDVI spatial patterns show that from April to May, 50.4% of the crops in the cultivated area were above the 5-year average. 37.4% were below the average and 12.2% fluctuated around the average. Iran was hit by flooding in late March and early April. This presumably caused VCIx conditions below 0.5 in some parts of the country. In general, growth conditions were favorable, especially when the agronomic indicator values and the fact that the rainy season had ended or was about to end at the beginning of the AMJJ period.

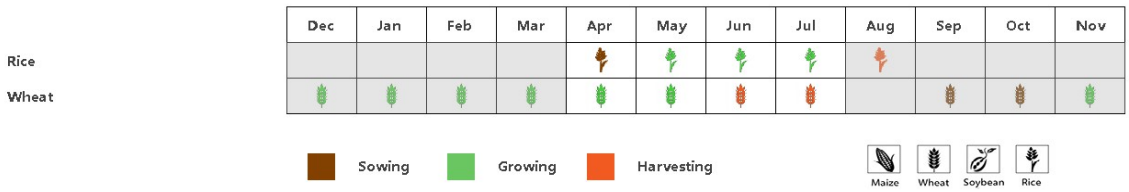
Regional Analysis

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

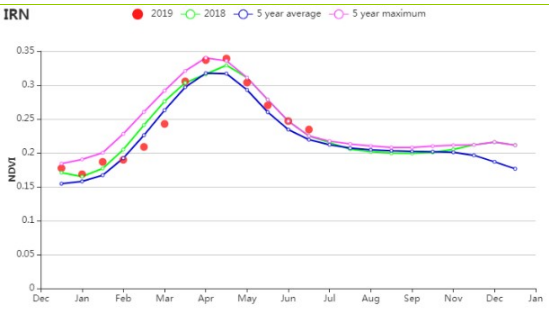
In the **western and northern semi-arid subtropical hilly areas**, the cumulative precipitation during the monitoring period was 162 mm, 4% higher than the average, while the temperature was 18.6℃ (-0.3℃) and photosynthetically active radiation (-1%) were both below the 15-years average. The potential biomass was 45% higher than average. The proportion of cultivated land is 41% higher than the average. The average VCIx for this region was 1.06, indicating better than normal crop conditions.

In the **coastal lowland and plain areas of the arid Red Sea**, the accumulated precipitation 44mm (more than twice the average), while the temperature was 32.1℃ (-0.3℃) and photosynthetically active radiation (-1%) was also below the 15-years average. During the monitoring period, CALF was 117% higher than the average of the last 5-years, and the maximum vegetation condition index (VCIx) was very high, as it reached 1.24; the potential biomass was 45% higher than the 15-year average.

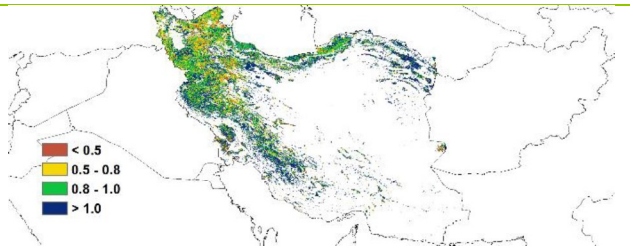
Figure 3.21. Iran's crop condition, April - July 2019



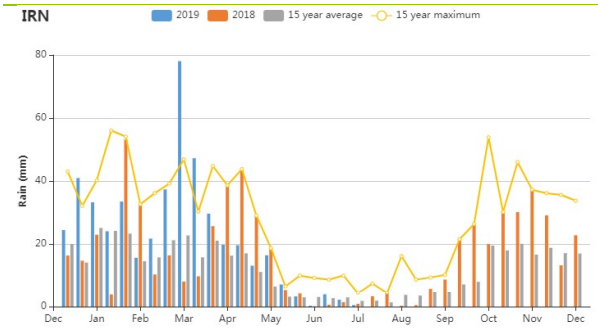
(a) Phenology of major crops



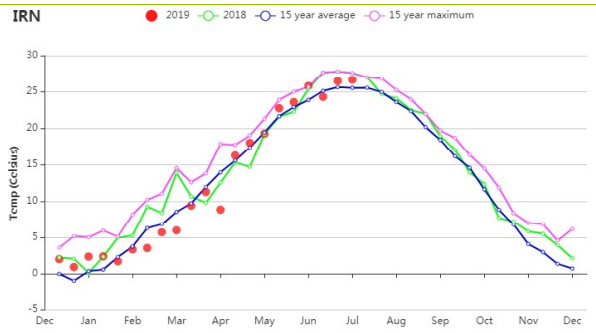
(b) Crop condition development graph based on NDVI



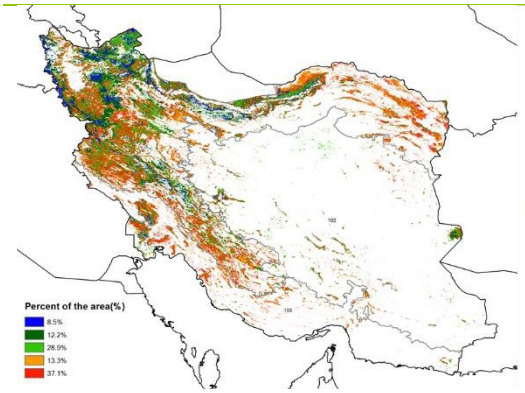
(c) Maximum VCI



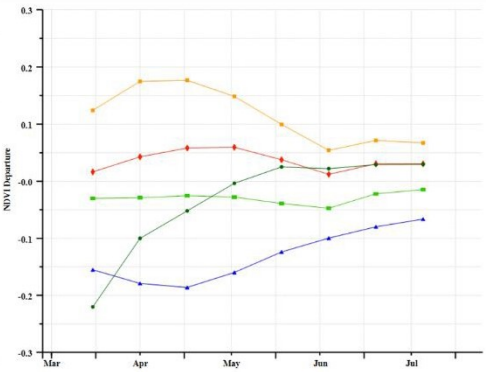
(d) Rainfall Index



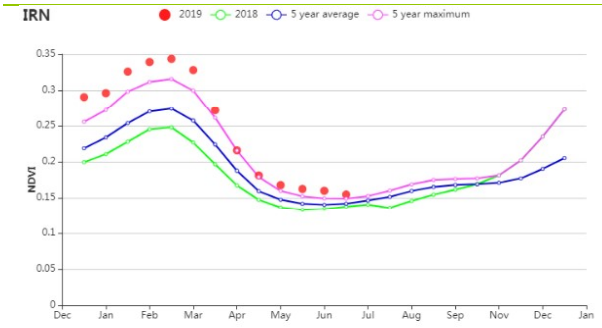
(e) Temperature Index

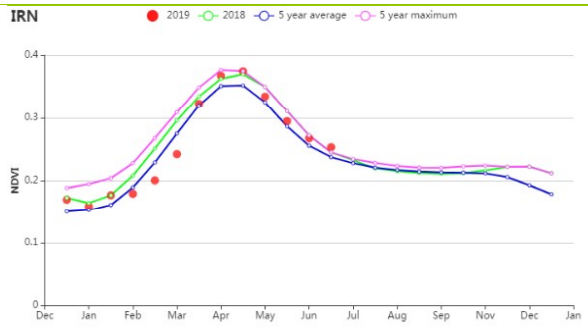


(f) Spatial NDVI patterns compared to 5YA



(g) NDVI profiles





(h) Crop condition development graph based on NDVI (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, April - July 2019

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (℃)	Departure from 15YA (℃)	Current (MJ/m^2)	Departure from 15YA (%)
Arid Red Sea coastal low hills and plains	44	102	32.1	-0.3	1616	-1
Semi-arid to sub-tropical western and northern hills	162	57	18.6	-0.3	1598	-1

Table 3.34. Iran's agronomic indicators by sub-national regions, current season's values and departure, April - July 2019

Region	BIOMSS		Cropped arable land fraction		Maximum VCI
	Current (gDM/m^2)	Departure from 15YA (%)	Current (%)	Departure from 5YA (%)	Current
Arid Red Sea coastal low hills	433	45	18	117	1.24

Region	BIOMSS		Cropped arable land fraction		Maximum VCI
	Current (gDM/m^2)	Departure from 15YA (%)	Current (%)	Departure from 5YA (%)	Current
and plains					
Semi-arid to sub-tropical western and northern hills	480	4	42	41	1.06

[ITA] Italy

Winter wheat was harvested in June and July while summer crops, especially maize, rice, sunflower and soybeans are still in the field. According to the NDVI development graph, crop condition was generally close to the average of the past five years, with some fluctuations. About 11.3% crop in the Northeast showed a deterioration after June, which agrees with the low VCIx in this area.

The rainfall profile indicates high rainfall over the country in mid-May; nationwide, rainfall (405 mm) was above average (+13%), but it still insufficient from May to June. Temperature peaked from mid-June to July, when it reached the 15Y maximum. For the whole reporting period, however, temperature (17.0℃) was slightly below the average (by 0.3℃) and RADPAR was down 3% at 1366 MJ/m². CALF was 100%, BIOMSS increased 4% over average and VCIx was high (0.94). Overall crop condition in the country is satisfactory.

Regional analysis

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

On the **East coast**, with the exception of abundant precipitation (RAIN up 12%) and low TEMP (-0.8℃), overall conditions were close to average and favorable for wheat: RADPAR down 3% but BIOMSS up 5%, VCIx at 0.95 and high CALF (0.99) indicating full cropping. According to the NDVI development graph crop condition surpassed the 5 years average and even the maximum value in April. Average output is expected.

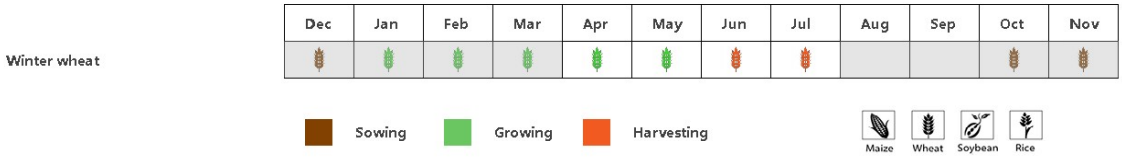
The **Po Valley** initially recorded low precipitation which delayed Rice planting due to insufficient water for irrigation. For the whole reporting period, however, rainfall exceeded the average (RAIN 13%) with below average temperature (TEMP -0.4℃) and sunshine (RADPAR -2%), favorable agronomic indicators (VCIx 0.91 and CALF 100%) and average BIOMSS. The NDVI development graph indicates crop condition below the 5 years average after April, especially from May to June. Based on agro-climatic indicators, close to average output is expected, except in the East where crop condition is unsatisfactory.

In the **Islands**, with the exception of high RAIN (15%), weather was about average with somewhat low TEMP (-0.4℃) and RADPAR (-2%). BIOMSS nevertheless increased by 11% and the overall condition of wheat was average: VCIx was 0.91 and CALF reached 0.98. About average output is expected.

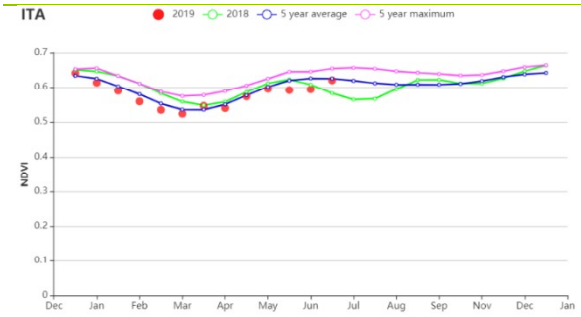
The situation in **Western Italy** is close to the situation in the Po valley (RADPAR -3%, TEMP -0.4℃, VCIx 0.99 and CALF 100%) except for a small BIOMSS increase (+4%) brought about by a 12% increase in RAIN. The crop condition development graph based on NDVI also indicates mostly above average crop condition and values around the 5 years maximum in April and May. CropWatch expects average production.

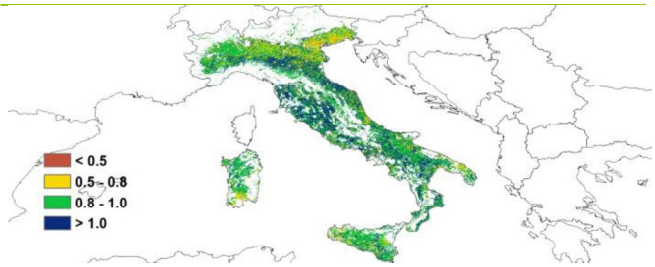
With the mentioned situations, prospects are generally favorable for summer crops due to favorable rainfall. Production of winter wheat may exceed the recent average.

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



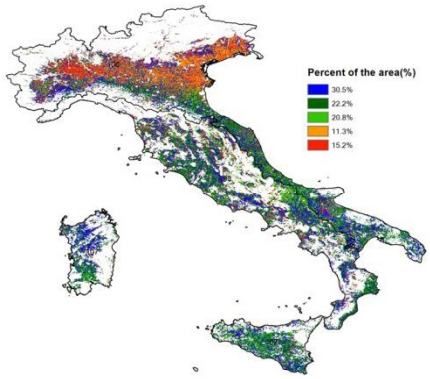
(a) Phenology of major crops

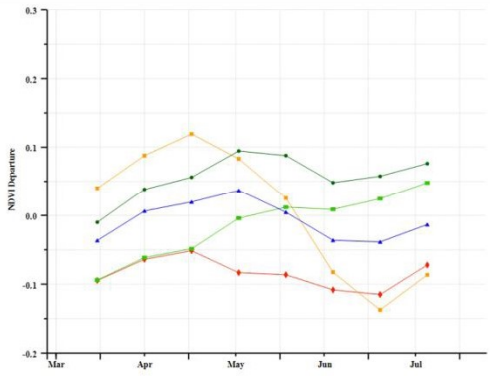




(b) Crop condition development graph based on NDVI

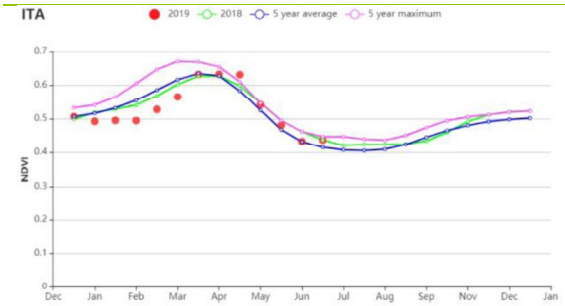
(c) Maximum VCI

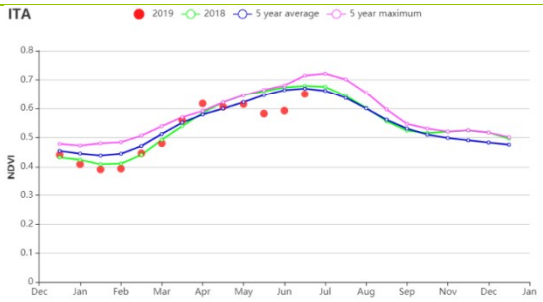




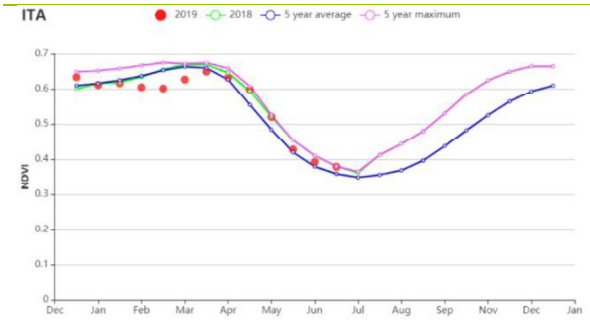
(d) Spatial NDVI patterns compared to 5YA

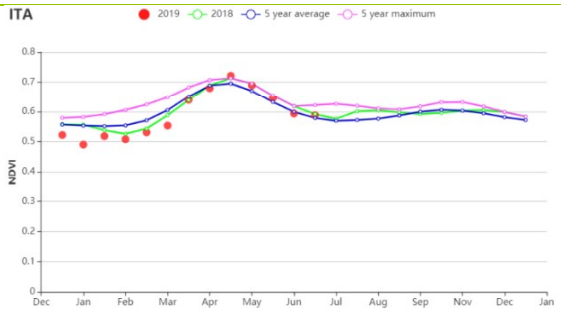
(e) NDVI profiles





(f) Crop condition development graph based on NDVI (East coast (left) and Po Valley (right))





(g) Crop condition development graph based on NDVI (Islands (left) and Western Italy (right))

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

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (℃)	Departure from 15YA (℃)	Current (MJ/m^2)	Departure from 15YA (%)
East coast	263	12	20	-0.8	1408	-3
Po Valley	594	13	18	-0.4	1308	-2
Islands	140	15	19	-0.6	1490	-2

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (℃)	Departure from 15YA (℃)	Current (MJ/m^2)	Departure from 15YA (%)
Western Italy	320	12	18	-0.4	1380	-3

Table 3.36. Italy's agronomic indicators by sub-national regions, current season's value and departure, April -July 2019

Region	BIOMSS		Cropped arable land fraction		Maximum VCI
	Current (gDM/m^2)	Departure from 15YA (%)	Current (%)	Departure from 5YA (%)	Current
East coast	714	5	99	-0.3	0.95
Po Valley	603	0	100	0.04	0.91
Islands	692	11	98	1.6	0.91
Western Italy	643	4	100	0.2	0.99

[KAZ] Kazakhstan

This monitoring period covers sowing in May and the main growth period of wheat in Kazakhstan. The national average VCIx was 0.81 and CALF was 6% below the five-year average. At the national scale, RAIN (+3%) and RADPAR (+2%) were above average, while TEMP was below (-0.7℃. However, July was warmer and drier than usual. The combination of these factors resulted in lower BIOMSS (-4%). As shown by the NDVI development graph, crop condition was generally below the five-average during the entire monitoring period. The NDVI cluster graphs and profiles show that 68.4% of the cropped areas were above average in early June, whereas in July, the best clusters (38.1%) had dropped to close to normal. They are concentrated in East and North Kazakhstan, Almaty, northern parts of West Kazakhstan, northeastern parts of Qaraghandy, southern parts of Zhambyl and South Kazakhstan, as well as small parts of Aqmola and Qyzylorda provinces. Overall, crop condition was close to normal, but not as good as during 2018.

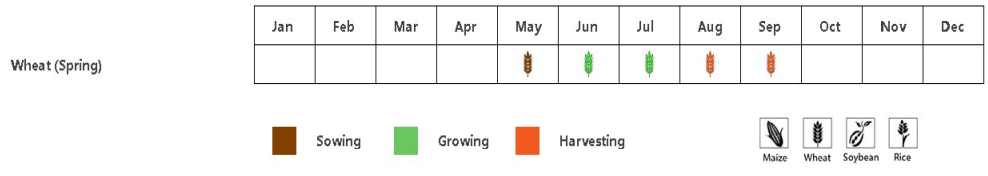
Regional analysis

NDVI for the **Northern region** was below the five-year average during the reporting months. Among the CropWatch agro-climatic parameters, RAIN (-8%) and TEMP (-0.7℃) were below average, whereas RADPAR was above (+4%). The agronomic indicators show a drop in the BIOMSS index by 3% relative to average. The maximum VCI index was 0.76 and CALF had decreased by 9% in this region. Overall crop prospects are unfavorable.

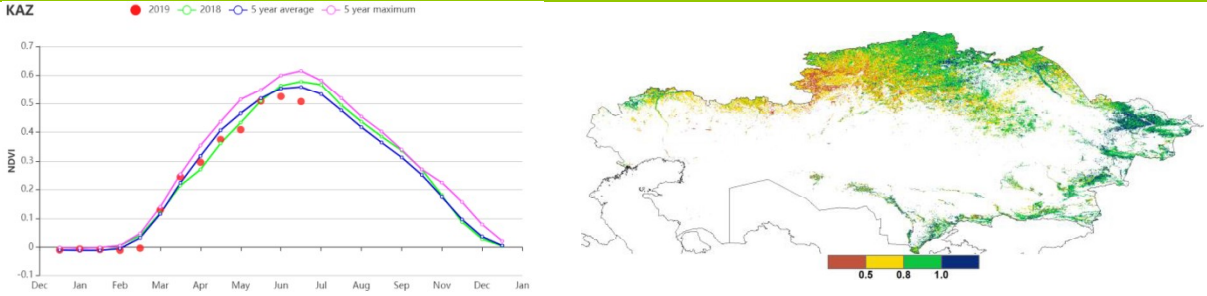
In the **Eastern plateau and southeastern region** crop condition was better than the five-year average in late May and close to the average in June and July. RAIN was above (+16%), while TEMP (-0.7℃) and RADPAR (-1%) were below the fifteen-year average. BIOMSS had decreased by 7% and CALF increased by 4%. The maximum VCI index was 0.95 in this region. Overall, crop conditions are favorable.

Crop condition in the **South region** was slightly better than the five-year average from late May to July. RAIN was higher than the recent fifteen-year average (+35%), whereas TEMP (-0.3℃) and RADPAR (-1%) were slightly below the fifteen-year average. The agronomic indicators resulted in an increase of the BIOMSS index by 2% and CALF increased by 19% in this region. The maximum VCI index was 0.90. Crop prospects average or better.

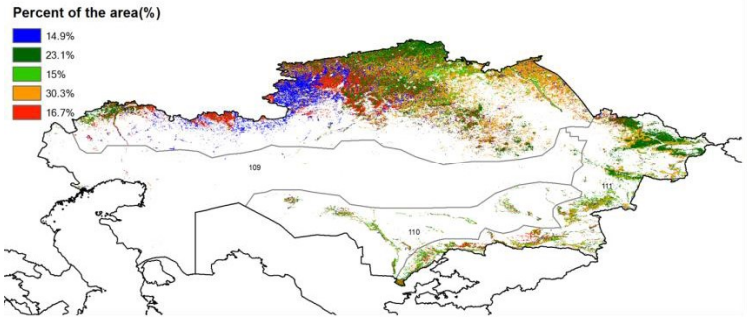
Figure 3.23. Kazakhstan's crop condition, April - July 2019



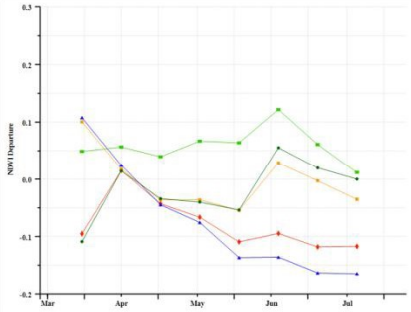
(a) Phenology of major crops



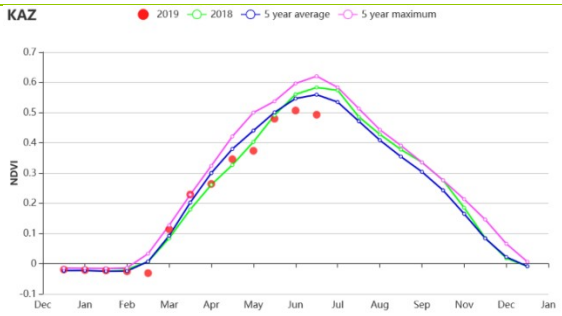
(b) Crop condition development graph based on NDVI



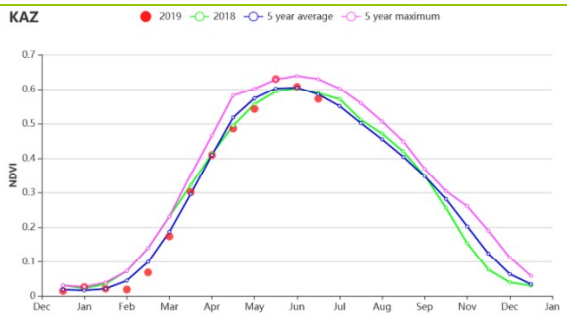
(c) Maximum VCI



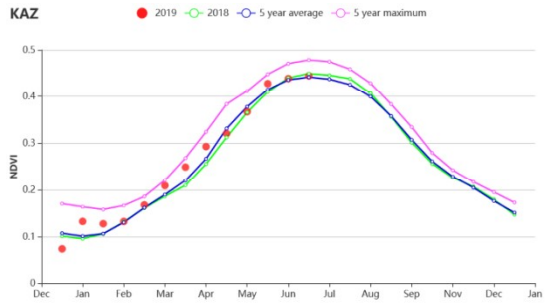
(d) Spatial NDVI patterns compared to 5YA

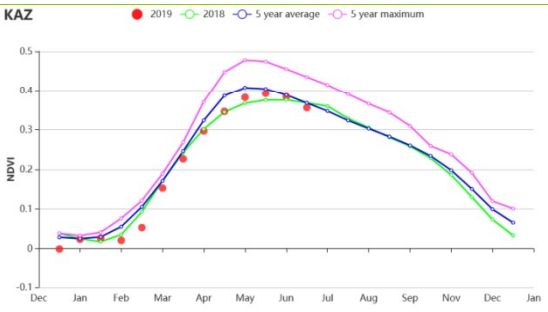


(e) NDVI profiles



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





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

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

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (℃)	Departure from 15YA (℃)	Current (MJ/m^2)	Departure from 15YA (%)
Northern region	182	-8	14.6	-0.7	1299	4
Eastern plateau and southeastern region	357	16	14.4	-0.7	1406	-1
South region	94	35	22.5	-0.3	1498	-1
Central non-agriculture region	166	34	17.4	-0.4	1379	1

Table 3.38. Kazakhstan's agronomic indicators by sub-national regions, current season's values and departure, April - July 2019

Region	BIOMSS		Cropped arable land fraction		Maximum VCI
	Current (gDM/m^2)	Departure from 15YA (%)	Current (%)	Departure from 5YA (%)	Current
Northern region	525	-3	81	-9	0.76

Region	BIOMSS		Cropped arable land fraction		Maximum VCI
	Current (gDM/m^2)	Departure from 15YA (%)	Current (%)	Departure from 5YA (%)	Current
Eastern plateau and southeastern region	524	-7	96	4	0.95
South region	713	2	68	19	0.90
Central non-agriculture region	649	2	59	6	0.74

[KEN] Kenya

The country has a "short rains" and a "long rains" season. The long-grain crops (mostly maize and wheat) are planted from March to April (late sowing windows) to be harvested in October and November.

The AMJJ period recorded a slight increase in rainfall, temperature and Biomass (RAIN +5%, TEMP 0.2℃, and BIOMASS +0.2%, respectively). The cropped arable land fraction remained constant and the CALF recorded a slight drop (-4%). The national graph of NDVI development stayed below average until the end of the reporting period. According to NDVI clusters and the map of NDVI profiles, 32.4% of the country experienced favorable crop condition from May to July. The spatial NDVI patterns indicate that NDVI was below average in many central areas. This spatial pattern is only partially reflected by VCIx, the national average of which reached 0.85, 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 areas (for instance from Bungoma, where maize and cattle are the mainstays of the agricultural economy). Generally, even though the NDVI was below average, crop condition is assessed as favorable.

Regional analysis

Considering the cropping systems, climatic zones and topographic conditions we divided Kenya into four agro-ecological zones (AEZ): The Coast, Highland agriculture zone, Northern range-lands, and South-west.

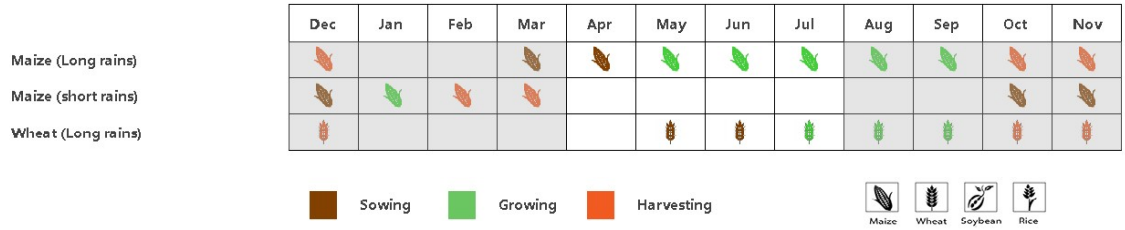
The **Coast** includes the districts of Kilifi, Kwale, and Malindi. During the reported period, all indicators were above average. The total rainfall was recorded as 435 mm, up by 35% compared to average. TEMP and RADPAR were also above average, albeit slightly (0.1℃ and +2%). Because of increased rainfall, the total biomass production was also above average by 2%. The NDVI profile was also below average, with marked fluctuations. Throughout the reporting period, maximum VCIx was 0.89 with CALF up 3%. Overall condition was favorable for both livestock and crops in the coastal areas.

In the **Highland agriculture zone**, the total rainfall during the reported period was recorded at 577 mm. The rainfall and temperature were above average by (RAIN +4%; TEMP 0.2℃) respectively. However, the RADPAR remained constant and the total Biomass production decreased by 1%. The maximum VCIx value was recorded at 0.82. The NDVI development curve shows that crop condition was below the five years average with the maximum VCI value at 0.82. Large portions of the arable land in this region have high VCIx values of 0.82 indicating relatively good crop condition. Overall the outlook in the region is favorable.

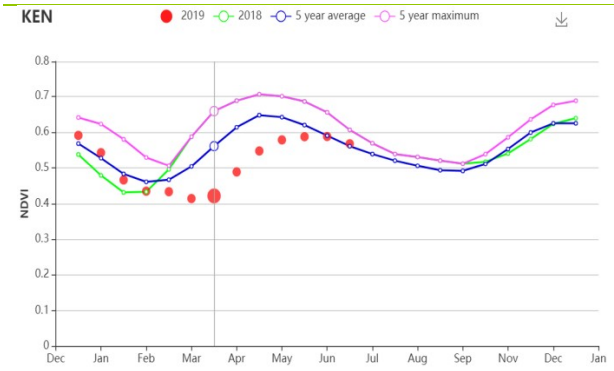
The **Northern range-lands** include districts such as Turkana, Samburu, and Baringo. They recorded 302 mm of RAIN, -5% below average, while the temperature slightly rose by 0.3℃. The BIOMASS is up 4% and RADPAR by 2%. The NDVI development curve shows values below the five-year average during the entire monitoring period. The maximum VCI was low compared to other regions at 0.62. The cropped arable land fraction decreased by -13%. Overall, even though it recorded a low VCIx, since the region is mostly pastoral and the total biomass production was increased, prospects are average.

The **South-west** districts include Kisumu, Migori, Siaya, and Busia. Those districts are major producers of wheat and maize, still growing at the time of reporting. In the south-west, the total amount of rainfall was high (909 mm) which represents, however, a modest increase of 5% above average and led ton even smaller increment in total biomass production (1%). The temperature was just above average by 0.1℃ and radiation was average The cropped arable land fraction increased by 4%. The NDVI time profile showed fluctuations during the monitoring period: below average during April to June and above average during July. The maximum VCI reached 0.95. The expected production is high.

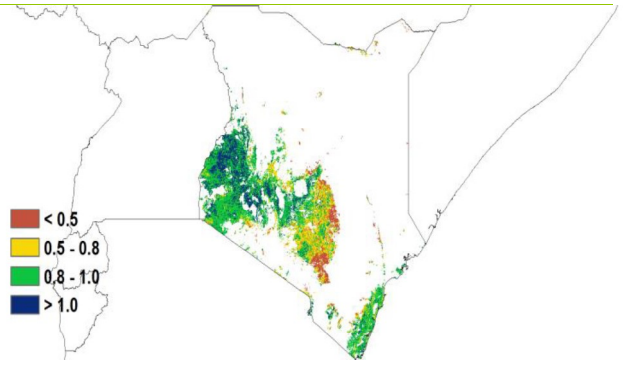
Figure 3.24. Kenya's crop condition, April - July 2019



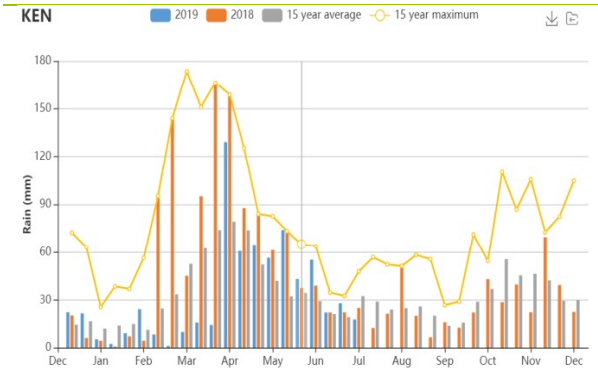
(a) Phenology of major crops



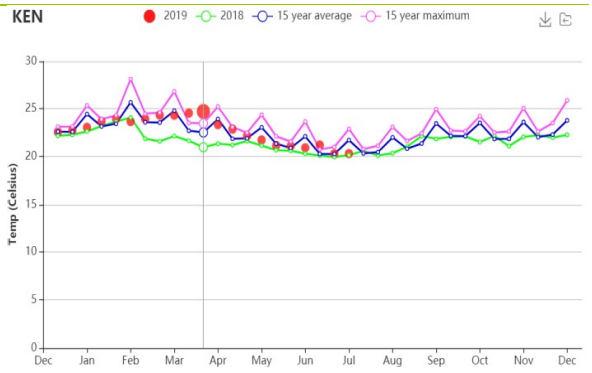
(b) Crop condition development graph based on NDVI



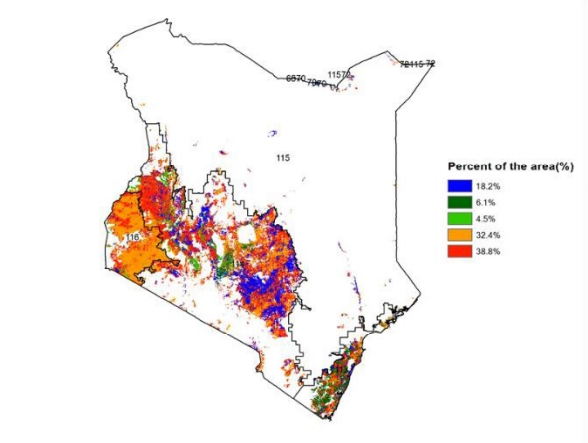
(c) Maximum VCI



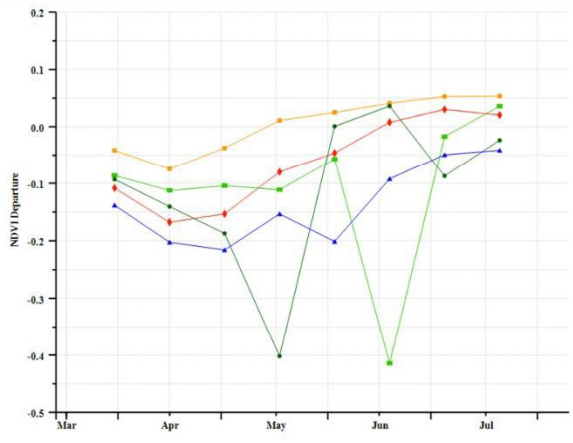
(d) Rainfall profiles



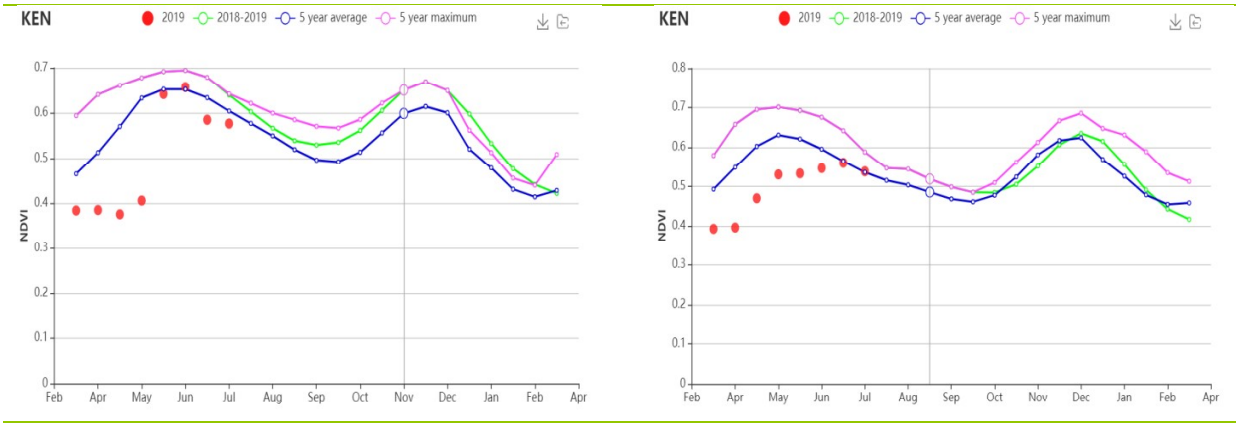
(e) Temperature profiles



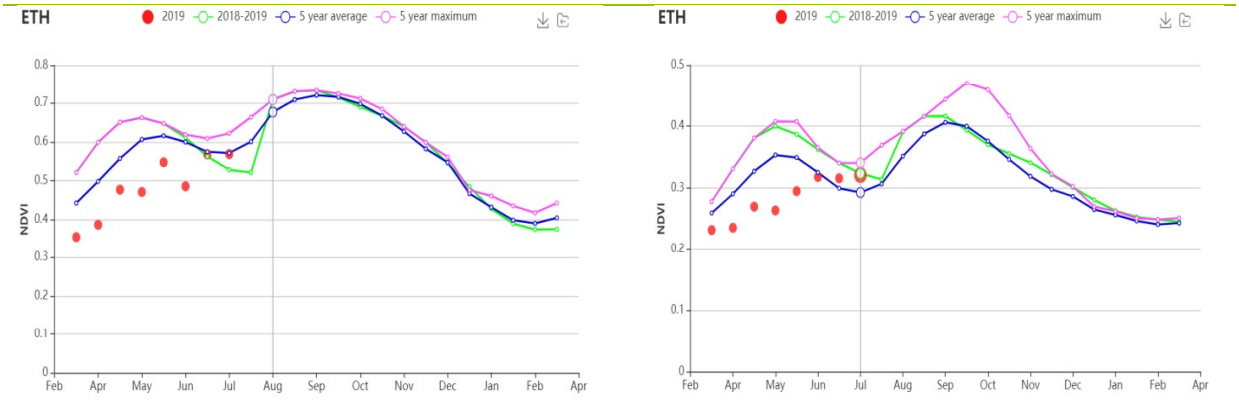
(f) Spatial NDVI patterns compared to 5YA



(g) NDVI profiles



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



(i) Crop condition development graph based on NDVI (Northern range-lands (left) and South-west (right))

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

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (℃)	Departure from 15YA (℃)	Current (MJ/m^2)	Departure from 15YA (%)
Coast	435	35	25.1	0.1	1162	2
Highland agriculture zone	577	4	18.3	0.2	1079	0
Nothern range-lands	302	-5	24.3	0.3	1197	2
South-west	909	5	19.2	0.1	1176	0

Table 3.40. Kenya's agronomic indicators by sub-national regions, current season's values and departure, April -July 2019

Region	BIOMSS		CALF		Maximum VCI
	Current (gDM/m^2)	Departure from 15YA (%)	Current (%)	Departure from 5YA (%)	Current
Coast	761	2	99	3	0.89
Highland agriculture zone	503	-1	90		0.82
Northern range-lands	740	4	65	-13	0.62
South-west	600	1	100	4	0.95

[KHM] Cambodia

This reporting period covers the end of harvest of dry season rice in April, sowing of maize in May and June, as well as the beginning of the planting period of the main wet season rice crop starting in June. The dry season rice suffered from El Niño, causing drought conditions in some parts of the country. El Niño, which was officially declared to be over in early August, continued to have a negative impact on rainfall during this monitoring period: Compared to the 15 year average, CropWatch agro-climatic indicators show a sharp drop in rainfall (RAIN -19%), warmer temperatures (Temp +0.2ºC) and higher radiation (RADPAR +7%). The cropped arable land fraction (CALF) was 89%, down 1% from the 5 year average, and the maximum VCI value for the whole country was at 0.85.

Nationwide, the condition of crops is above the reference 5YA in 55% of croplands (mainly in the Mekong valley between Tonle-sap and Vietnam border and Northern plain and northeast of the country) where a VCIx above 0.8 confirms the favorable situation. The biomass production potential was up 11% above average, with normal CALF and a very favorable VCIx reached 0.95.

Regional Analysis

Based on climate differences and topography four agro-ecological regions (AEZs) can be distinguished for Cambodia, starting with the Tonle Sap lake area where the seasonally inundated freshwater lake 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 important regions east of the Lake. In the last zone, the "South-western Hilly region" long coast at the Gulf of Thailand and with the mountain range small and large, monsoon plays a larger part than in the other regions where the Mekong supplies most water to farming.

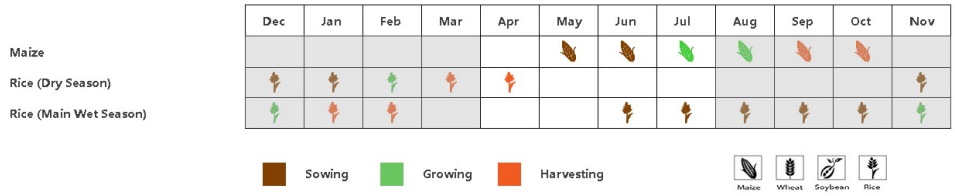
In the **Tonle-sap region** rainfall and sunshine were below average (RAIN -18%, RADPAR -2%) with higher then average temperature (TEMP, +0.4℃). With below CALF (85%, -4%), the BIOMSS significantly increased (+5%) compared to 15year average. The NDVI development graph indicates crop condition values that are below the 5 years average, even after they increased in June. CropWatch expects below average production in the area.

The **Mekong valley between Tonle-sap and Vietnam border**, the main rice growing area in Cambodia was affected by low precipitation (RAIN, -12%) with above average RADPAR (+6%) and below average temperature (TEMP -0.1℃). CALF was (3%) below the 5-years average and the biomass potential rose 7% compared to average. The condition of crops is fair with a maximum VCI of 0.87.

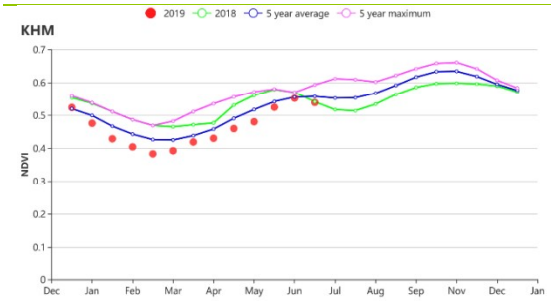
The **Northern plain and northeast** recorded a drop of rainfall below average by 22%, temperature was normal and radiation significantly exceeded average (RADPAR, +10%). CALF was normal compared to the 5-year average. Crop condition is also above average for the region, where the biomass potential displays an increase of 11% over average while the maximum VCI reached 0.89. The condition of crops is fair.

The **Southwest Hilly region** had favorable VCIx (0.95) accompanied by increased BIOMSS (+8%) resulting from the increase in radiation (RADPAR +9%) and above average temperature (TEMP, +0.4℃). The 22% precipitation drop from 1101 mm (average) to 859 (current season) did not significantly affect crops as the recorded amount is still more than sufficient to sustain crop growth. The NDVI development graph displays values that are below the 5 years average but in April and June crop condition was average.

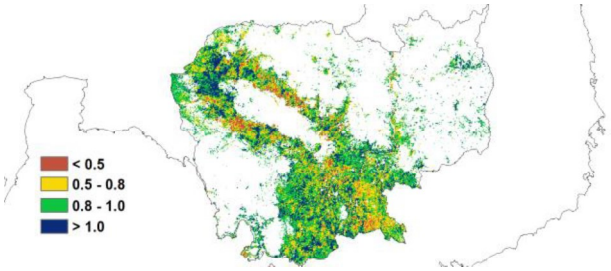
Figure 3.25. Cambodia's crop condition, April - July 2019



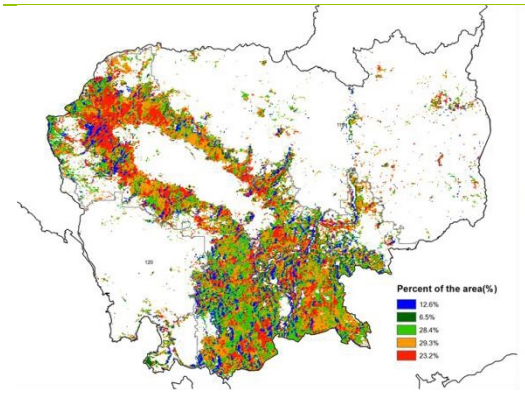
(a) Phenology of major crops



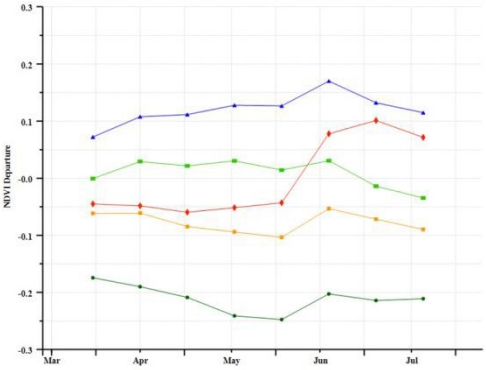
(b) Crop condition development graph based on NDVI



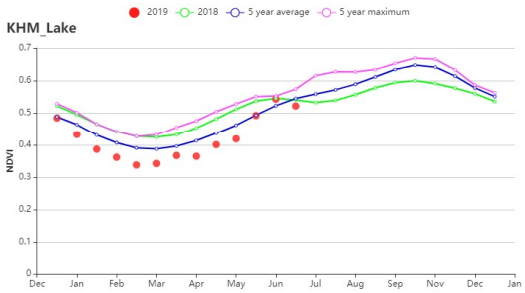
(c) Maximum VCI

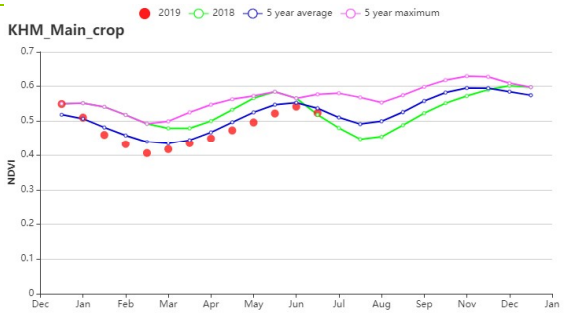


(d) Spatial NDVI patterns compared to 5YA

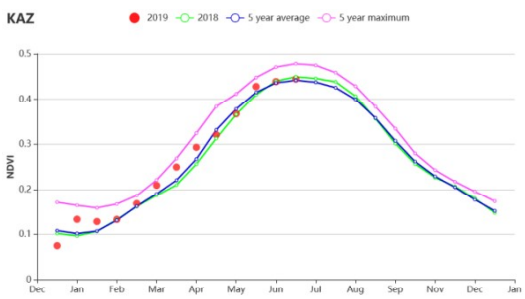


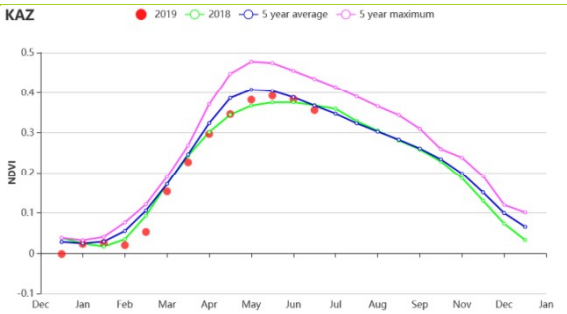
(e) NDVI profiles



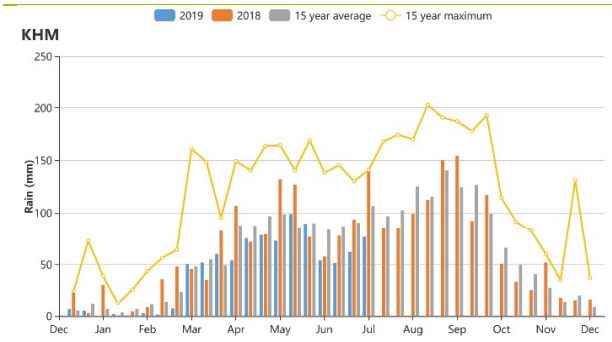


(f) Crop condition development graph based on NDVI (Tonle-sap (left) and Mekong valley between Tonle-sap and Vietnam border (right))





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



(h) Rainfall profiles

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

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (℃)	Departure from 15YA (℃)	Current (MJ/m^2)	Departure from 15YA (%)
Tonle-sap	650	-18	27.8	0.4	1216	4.2
Mekong valley between Tonle-sap and Vietnam border	835	-12	27.3	-0.1	1230	6.0
Northern plain and northeast	982	-22	26.9	0.0	1218	10.1
Southwest Hilly region	859	-22	25.1	0.4	1236	8.6

Table 3.42. Cambodia's agronomic indicators by sub-national regions, current season's values and departure, April - July 2019

Region	BIOMSS		Cropped arable land fraction		Maximum VCI
	Current (gDM/m^2)	Departure from 15YA (%)	Current (%)	Departure from 5YA (%)	Current
Tonle-sap	831	5	87	-4	0.85
Mekong valley between Tonle-sap and Vietnam border	840	7	88	-3	0.87
Northern plain and northeast	828	11	98	0	0.89
Southwest Hilly region	847	8	99	0	0.95

[LKA] Sri Lanka

The monitoring period covers the entire cycle of Yala rice (second rice) and maize, which are planted in April and May. According to the CropWatch monitoring results, crop condition was generally below average for the whole period.

At 689 mm, rainfall was 20% below average, while temperature was up by 0.6℃ and radiation was average. The fraction of cropped arable land (CALF) remained comparable to the 5-year average. BIOMSS slightly increased (up 1% above average) as the recorded rainfall is sufficient to sustain crop growth. The NDVI development graph displayed unfavorable crop condition throughout the period. Crop condition deviated below average since April and has remained so. Similar conditions also occurred in three AEZs as described below. Poor performance of NDVI profiles may result from the effect of relatively "dry" weather on natural vegetation more than on crops.

Spatial heterogeneity of crop condition was significant throughout the country's cropland according to NDVI clusters map and profiles. 25.1% area of cropland distributed in some scattered areas over Trincomalee, Polonnaruwa, Badulla, Hambantota, Galoya and Amparai, displayed positive NDVI departure values for the whole period. 11.8% of cropland in the South-east and East displayed below-average crop condition since April and but changed to above-average after June. 14.6% of cropped areas mostly in the North-Central and North-western Provinces had consistently low NDVI at -0.15 units below average. Remaining areas are close to average. The VCIx only partially confirms NDVI clusters because of the very scattered distribution of all the indicators.

Regional analysis

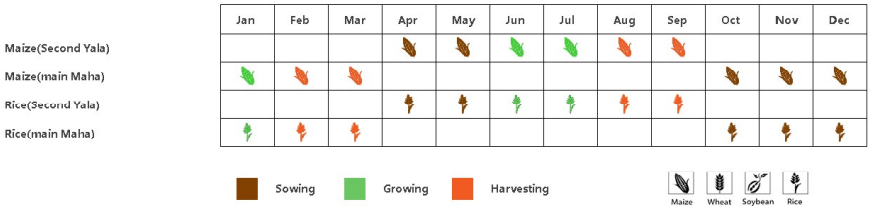
Based on the cropping system, climatic zones and topographic conditions, three sub-national agroecological regions can be distinguished for Sri Lanka. They are the Dry zone, the Wet zone, and the Intermediate zone.

The **Dry zone** plants mainly maize next to rice. The rainy season lasts from September to January in the north and from September to March in the south, with rainy seasons lasting between 120 days and 300. The monitoring period is out of the rainfed season; the recorded RAIN (278mm) was 31% below average, and amounts to just over 2mm per day, which is insufficient for rainfed crops, and needs to be supplemented by irrigation. TEMP was 0.7℃ up and RADPAR was near average (-2%), with BIOMASS average. Overall, crop condition was not as good as the average of the previous five years.

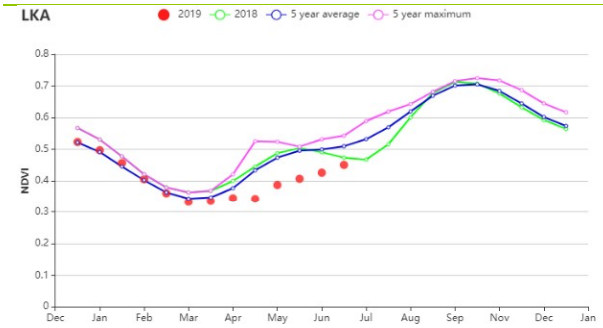
The **Intermediate zone** has two long rainy seasons in the west (March-June and September- December) and one in the east (September-April) and last between 300 and 365 days. During the monitoring period, RAIN reached 676mm, equivalent to about 6mm per day and sufficient for all crops, even though RAIN was 25% below average. RADPAR and BIOMASS were both average while TEMP increased by 0.5℃. Condition of rice was generally normal for the zone.

The **Wet zone** has almost no dry season, and provides ideal conditions for the cultivation of rice. RAIN was 1662mm (14 mm/day) and 13% down compared to average. RADPAR and BIOMASS both increased by 7% with 0.6℃ up in TEMP. Crop condition for the zone does not raise any concerns.

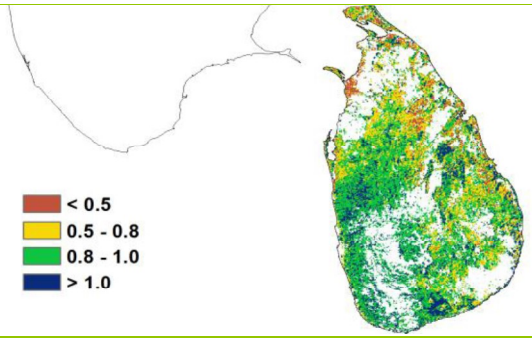
Figure 3.26. Sri Lanka's crop condition, April - July 2019



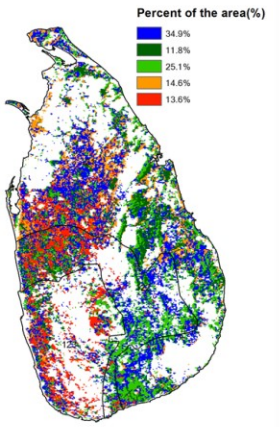
(a) Phenology of major crops

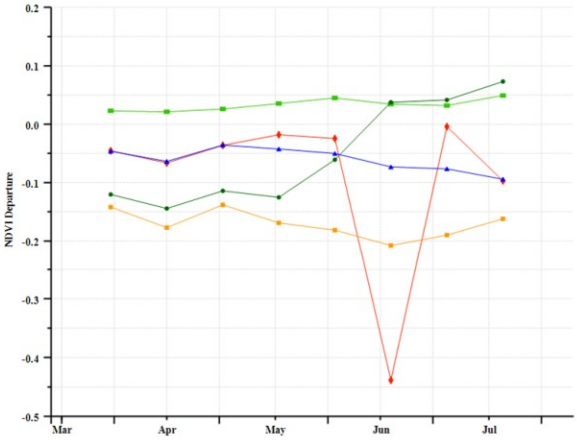


(b) Crop condition development graph based on NDVI



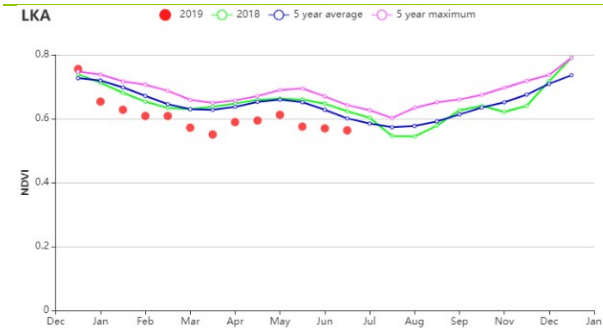
(c) Maximum VCI

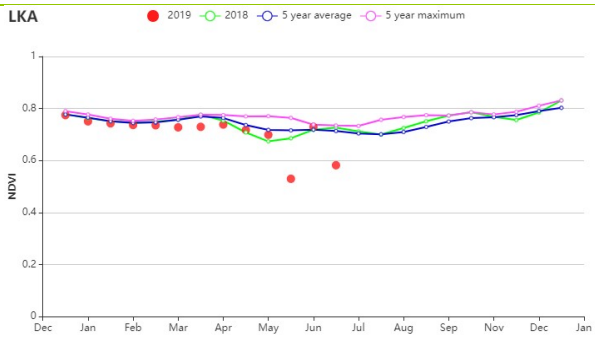




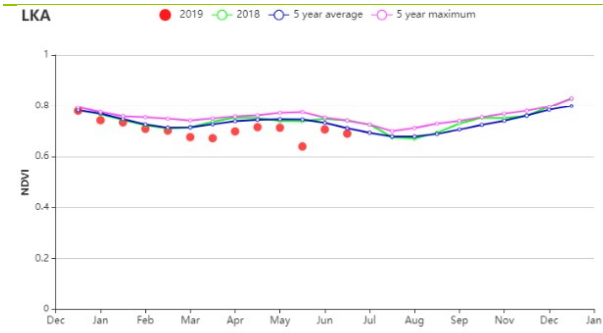
(d) Spatial NDVI patterns compared to 5YA

(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, April -July 2019

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (℃)	Departure from 15YA (℃)	Current (MJ/m^2)	Departure from 15YA (%)
Dry zone	278	-31	28.8	0.7	1297	-2
Wet zone	1662	-13	24.8	0.6	1200	7
Intermediate zone	678	-25	25.8	0.5	1207	0

Table 3.44. Sri Lanka's agronomic indicators by sub-national regions, current season's values and departure, April -July 2019

Region	BIOMSS		CALF		Maximum VCI
	Current (gDM/m^2)	Departure from 15YA (%)	Current (%)	Departure from 5YA (%)	Current
Dry zone	846	0	97	-1	0.81
Wet zone	785	7	100	0	0.96
Intermediate zone	781	0	100	0	0.90

[MAR] Morocco

During the monitoring period, both maize and wheat were either at the end of their growing period or had already been harvested. The rainfall time profile indicates that amounts were persistently below average, which resulted in a nationwide negative rainfall anomaly of 16%. The temperature was 0.9℃ below average, in spite of an abnormally warm spell during mid-May when the maize was at the end of its growing period and the harvest of wheat had started. BIOMSS dropped 13% below average due to below average rainfall combined with high RADPAR (up 3% above average). The estimated CALF was 32% below the average, which is very significant.

The NDVI development graph indicates below-average crop conditions during the whole monitoring period. Only one third of arable land (33.1%) has average or slightly above-average NDVI. Remaining cultivated areas had lower than average NDVI, mostly clustered in Souss-Massa and Guelmim-Oued Noun regions in the central and the coastal part of Oriental region. The same regions suffered low VCIx (below 0.5), while the nationwide value was just 0.6.

One fifth of agricultural land is irrigated in Morocco, but it produces about half the output. Therefore, the description above - which applies basically to rainfed crops - points at predominantly unfavorable crops, fodder and rangeland production.

Regional analysis

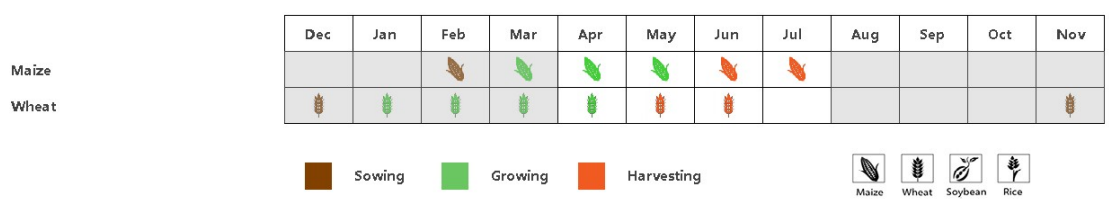
CropWatch adopts three agro-ecological zones (AEZs) relevant for crop production in Morocco: The Sub-humid northern highlands, the Warm semiarid zone and the Warm subhumid zone.

In the **Sub-humid northern highlands**, rainfall and temperature were both below average (RAIN -9%, TEMP -0.8 ℃). This led to a drastic reduction in BIOMSS (20%), mostly due to increased water demand associated high RADPAR (4% above average). As a result, CALF fell 25% (only 44% of cropland was cultivated). NDVI profiles also indicate below average crop conditions throughout the monitoring period. The maximum VCI estimated for this zone was moderate (0.7) and prospects are below average for rainfed crops

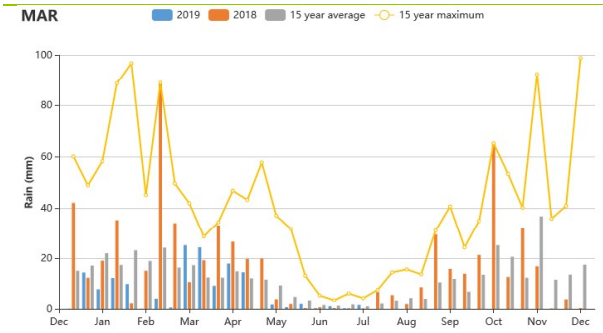
In the **Warm semiarid zone**, the rainfall was 26% less than the average and temperature was below average by 0.9 ℃ as well; RADPAR was 3% above average. The resulting reduction in BIOMSS was 11%. The CALF was just 10%, down 64% from the 5-year average; the maximum VCI for this zone was the lowest (0.5) among the other zones. The NDVI profiles confirm the generally poor or very poor crops.

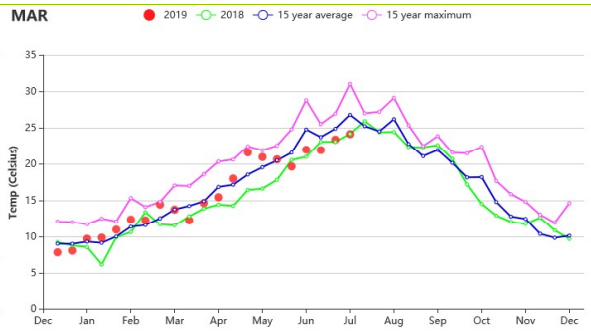
The **Warm subhumid zone** recorded a drop below average of rainfall (-14%) and temperature (-1.1℃). The RADPAR was 3% above average, while the BIOMSS was 17% below the average. The CALF was also below the average by 19%. The crop condition development graph based on NDVI indicated below-average conditions along the growing period and the VCIx estimated was moderate (0.7).

Figure 3.27. Morocco's crop condition, April-July 2019

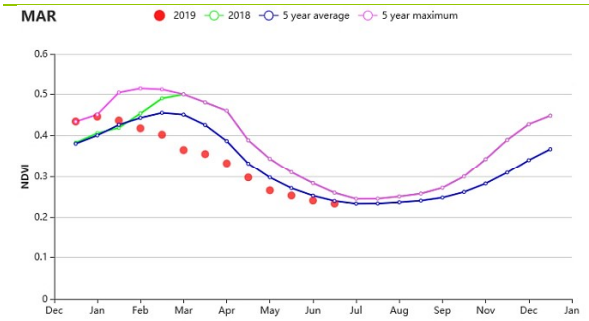


(a) Phenology of major crops

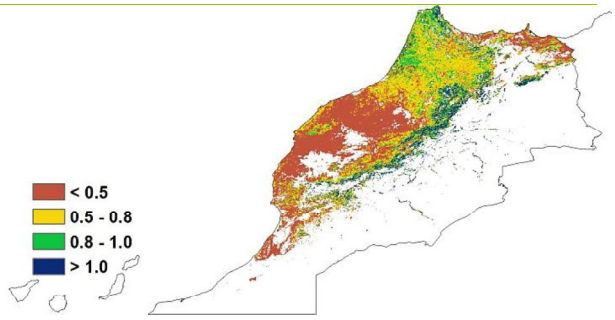




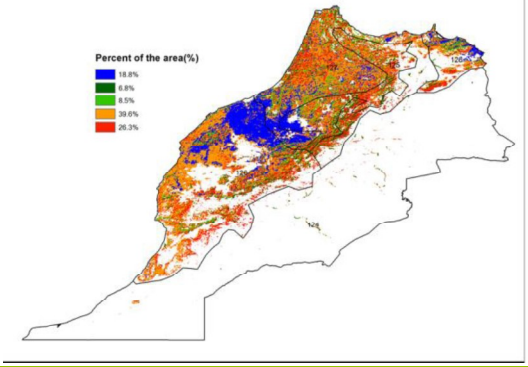
(b) Time series profiles of precipitation (left) and temperature (right)



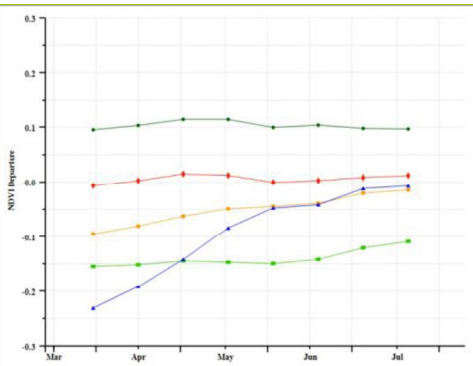
(c) Crop condition development graph based on NDVI



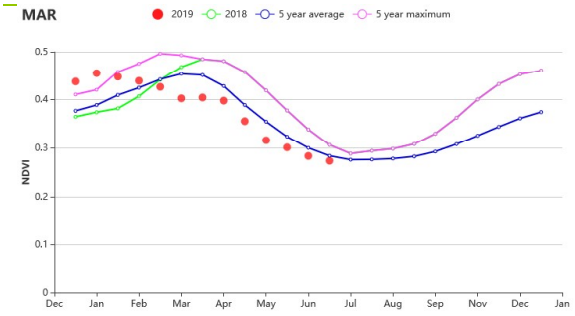
(d) Maximum VCI

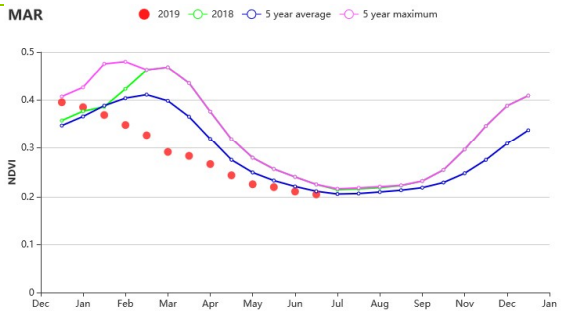


(e) Spatial NDVI patterns compared to 5YA

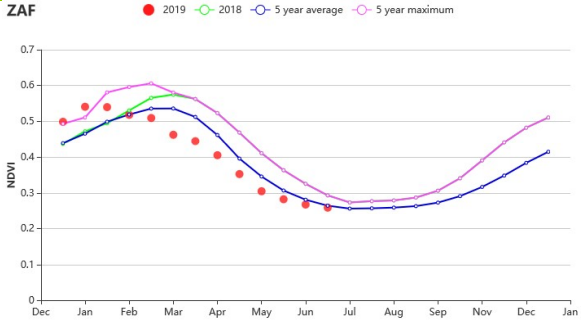


(f) NDVI profiles





(g) crop condition development graph based on NDVI for Sub-humid northern highlands(left) and Warm semiarid zone(right)



(h) Crop condition development graph based on NDVI for Warm subhumid zone

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

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (℃)	Departure from 15YA (℃)	Current (MJ/m^2)	Departure from 15YA (%)
Sub-humid northern highlands	113	-9	18.8	-0.8	1619	4
Warm semiarid zones	43	-26	19.9	-0.9	1658	3
Warm subhumid zones	89	-14	19.1	-1.1	1614	3

Table 3.46. Morocco's agronomic indicators by sub-national regions, current season's values and departure, April -July 2019

Region	BIOMSS		CALF		Maximum VCI
	Current (gDM/m^2)	Departure from 15YA (%)	Current (%)	Departure from 5YA (%)	Current
Sub-humid northern highlands	518	-20	44	-25	0.7
Warm semiarid zones	564	-11	10	-64	0.5
Warm subhumid zones	556	-17	58	-19	0.7

[MEX] Mexico

This reporting period covers the harvest of wheat (April and May), as well as the planting of maize (e.g. in the North-West), rice and soybean, starting in April and May.

The NDVI time series shows below average crop condition at the national scale. RAIN fell 13% compared to average while temperature (+0.1℃) and RADPAR were slightly up (+3%). Rainfall was generally below average from April to July, except for spikes in mid and late May and during late June. Temperature followed the long-term average during the monitoring period. The BIOMSS was below average (-2%). Moreover, the VCIx was relatively low at the national level, with a value of 0.73. Low VCIx values (below 0.5) were distributed in northern and central Mexico (such as Sonora, Chihuahua, Durango and Zacatecas), whereas high values (above 0.8) appeared in the northeastern, southern and southeastern parts of the country, including Coahuila, Oaxaca, Chiapas, Tabasco and Yucatan. Consistent with the pattern of VCIx, 15.6% of cropped areas recorded continuously above average NDVI, mainly over north-eastern and south-eastern Mexico (Coahuila and Yucatan). On the other hand, about 42.8% of the cropped areas displayed below-average conditions in northern and central Mexico: Sonora, Chihuahua, Sinaloa, Durango, Nayarit and Zacatecas. Considering the above analyses and below-average CALF (-5%), the crop production of this season in Mexico was assessed to be below 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).

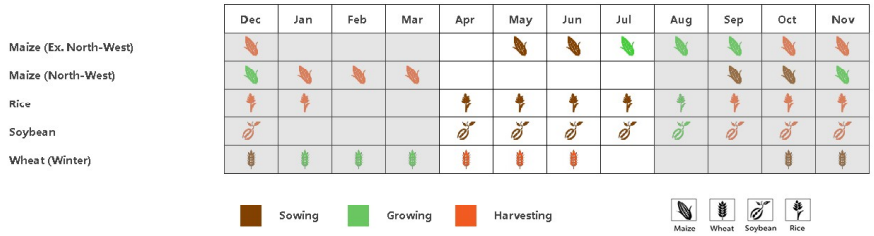
In the **Arid and semi-arid regions**, the agroclimatic conditions were average (rainfall -2%; temperature -0.3℃; radiation +3%). According to the NDVI time profile, crop condition was below average, especially from mid-June. This is corroborated by below-average BIOMSS (-4%) and a rather low value of VCIx (0.60). As the CALF was 15% lower than average, the crop production during this monitoring period for this region is expected to be well below average.

The **Sub-humid temperate region** recorded average rainfall, temperature and radiation (-1%, +0.1℃ and +2%, respectively). However, as indicated by the NDVI time series, crop condition was below the 5YA but improved towards the end of this monitoring period. The average VCIx of the regions was 0.80 and CALF was 3% lower than the average. The crop production in this region is expected to be below but close to average.

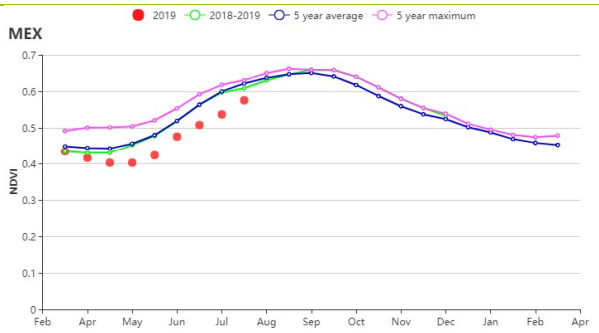
In the **Sub-humid hot tropics with summer rains**, rainfall was significantly below-average (-16%) while temperature and radiation were near average (+0.3℃ and +4%, respectively). The NDVI development graph differs little from the one in the two regions above, with continuously below-average crop condition. The BIOMSS and CALF slightly decreased separately by 2% and 1%, respectively, compared to average. The average VCIx in these areas was 0.79. Crops are assessed as just fair.

The **Humid tropics with summer rainfall** suffered from a 24% decline in rainfall as compared to average. Average temperature was 0.8℃ warmer and radiation up 5%. As shown in the NDVI development graph, crop condition was below average and worsened during April through early May, and improved to be average since late June. Considering the above analyses and average CALF, the production outlook for these regions is estimated to be close to average.

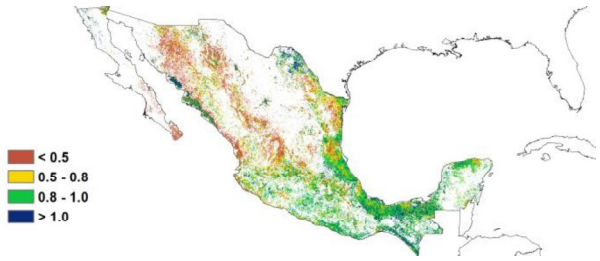
Figure 3.28. Mexico's crop condition, April - July 2019



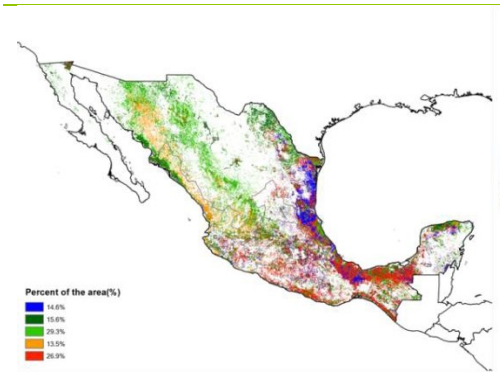
(a) Phenology of major crops



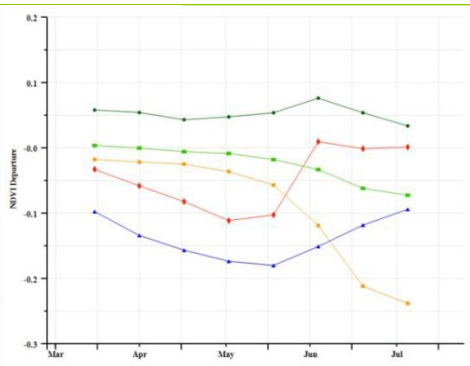
(b) Crop condition development graph based on NDVI



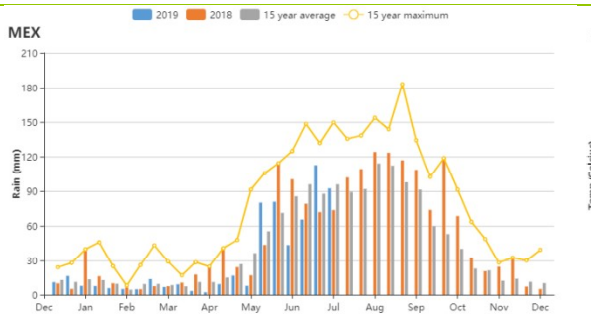
(c) Maximum VCI



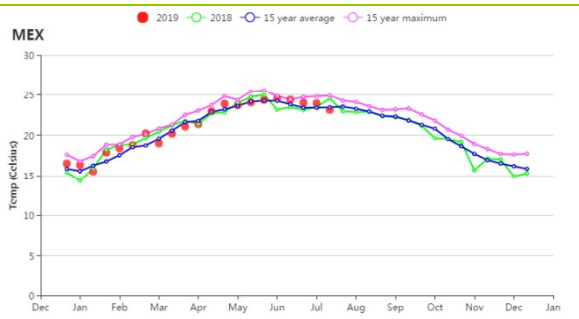
(d) Spatial NDVI patterns compared to 5YA



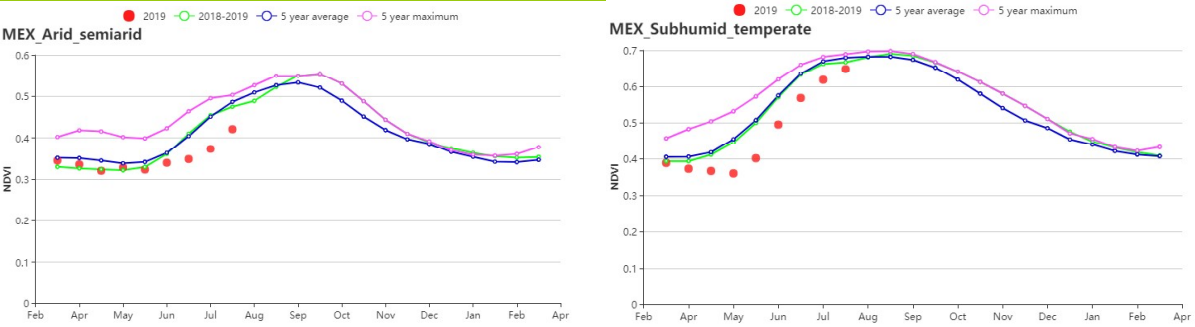
(e) NDVI profiles



(f) Rainfall profiles

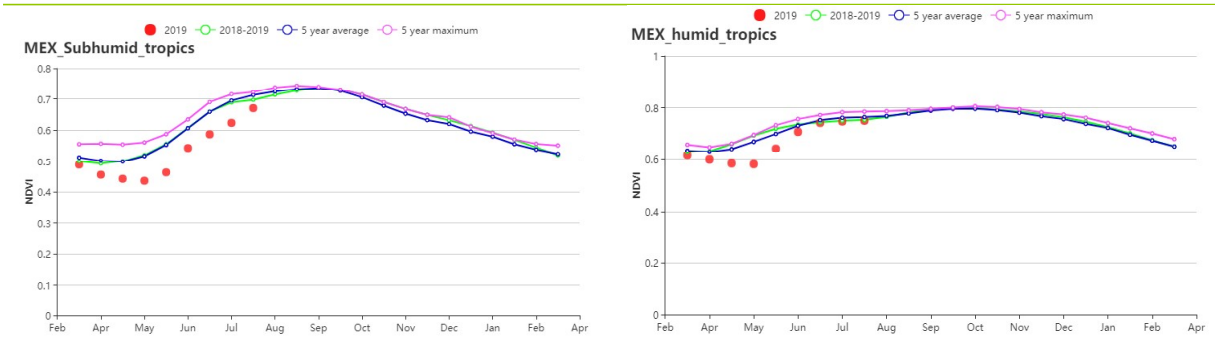


(g) Temperature profiles



(h) Crop condition development graph based on NDVI (Arid and semi-arid regions (left) and Sub-humid temperate region with summer

rains (right))



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

Table 3.47. Mexico's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, April - July 2019

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (℃)	Departure from 15YA (℃)	Current (MJ/m^2)	Departure from 15YA (%)
Arid and semi-arid regions	344	-2	22.6	-0.3	1599	3
Sub-humid temperate region with summer rains	725	-1	20.3	0.1	1461	2
Sub-humid hot tropics with summer rains	586	-16	23.7	0.3	1489	4
Humid tropics with summer rainfall	639	-24	26.6	0.8	1415	5

Table 3.48. Mexico's agronomic indicators by sub-national regions, current season's values and departure, April - July 2019

Region	BIOMSS		Cropped arable land fraction		Maximum VCI
	Current (gDM/m^2)	Departure from 15YA (%)	Current (%)	Departure from 5YA (%)	Current
Arid and semi-arid regions	649	-4	59	-15	0.60
Sub-humid temperate region with summer rains	646	0	94	-3	0.80
Sub-humid hot tropics with summer rains	700	-2	96	-1	0.79
Humid tropics with summer rainfall	911	5	100	0	0.91

[MMR] Myanmar

Myanmar produces maize, rice (two seasons) and wheat as its main crops. They are predominantly grown across the eastern mountains, central plains and the western coastal areas. This monitoring period covers the harvest seasons of maize (April), second rice (April to June) and wheat crops (April to May), as well as the sowing and early growing season of the main rice crop. CropWatch assesses crop condition during this monitoring period as generally fair but below that of 2018 and the average of the previous five years.

Temperature (TEMP) was somewhat above average (+0.8℃) but more significant departures affected RADPAR (+7%) and precipitation (RAIN 23% below average). Reduced precipitation caused below average crop conditions during the whole period: NDVI was below the 5YA average, as shown in the crop condition development graph. However, insufficient precipitation may have had little impact on the yields of rice, maize and wheat, as they had reached their harvest periods. Biomass actually slightly increased by 2% and crop arable land fraction (CALF) decreased just 1% as compared to their averages. During the monitoring period, the maximum VCI value for the whole country was 0.87.

The spatial distribution of crop condition can be divided into two periods according to the NDVI cluster and profile maps: Before mid-May, the crop condition displayed a consistently declining trend from the average. The condition became mixed after that, when 27.8% of cropland improved to above average. This was for the following States: Northern and southern Mandalay, eastern Magwe, Bago, Yangon and Ayeyarwady. The center of Mandalay State, which accounts for 18.4% of the cropland, deteriorated in June but recovered to average in July. Within the northern Bago State, 15.2% of the cropland displayed negative departure values in mid-June, but had positive values in the other periods. Some scattered cropland over Shan State suffered from bad crop condition during the whole period. The VCIx map shows low values in the central part of the country, which is in accord with the NDVI cluster map.

Regional analysis

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

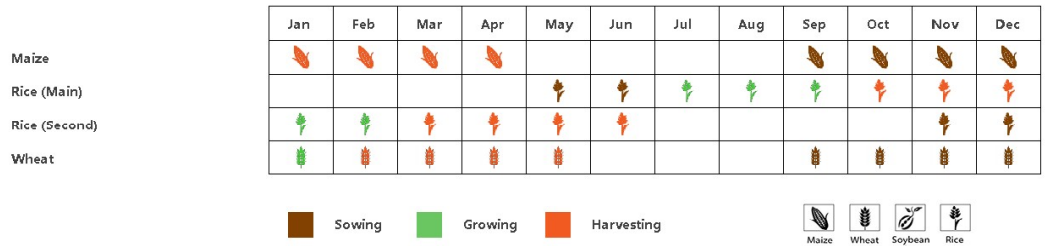
The three AEZs experienced similar agro-climatic condition as the whole country. Rainfall dropped by 27%, 32%, and 18% for the Coast, the Central Plain and the Hills regions, respectively, while temperature was warmer and radiation (RADPAR) between 5% and 8% higher than the 15YA.

The **Coastal region** experienced mixed crop condition. NDVI was below average in April and June, but had recovered to normal values by late June. Dry weather may have caused a 5% decrease in biomass of maize. CALF is 6% above the 5YA average and the maximum VCI value is 0.97 for this region.

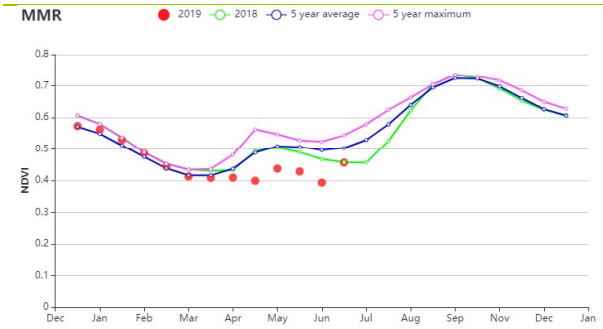
As compared to the 15YA, the **Central plain** had 1.2℃ warmer temperatures. The biomass was 2% higher as compared to the 5YA average, whereas CALF was down 8%. NDVI was also below average throughout the entire monitoring period. The average VCIx value is 0.81 for the region.

The **Hills region** experienced the most favorable conditions among the three AEZs with the smallest drop in precipitation and a temperature increase by 0.7℃ and rather high radiation (RADPAR +8%). As a result, the biomass increased by 3% with a full utilization of crop arable land (95% CALF). The maximum VCI value is 0.89 for the region.

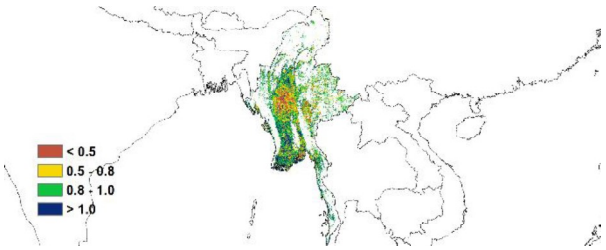
Figure 3.29. Myanmar's crop condition, April - July 2019



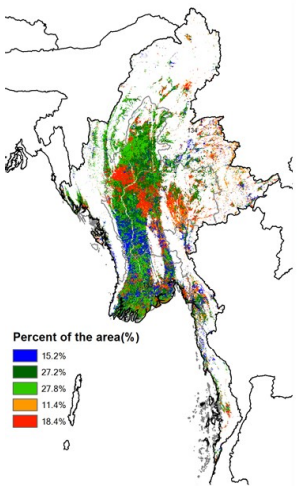
(a) Phenology of major crops



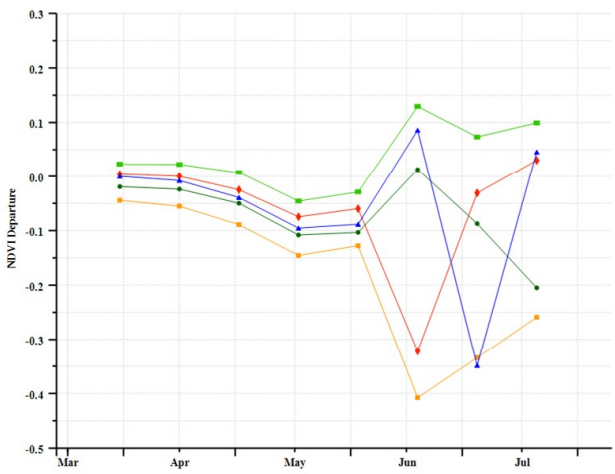
(b) Crop condition development graph based on NDVI



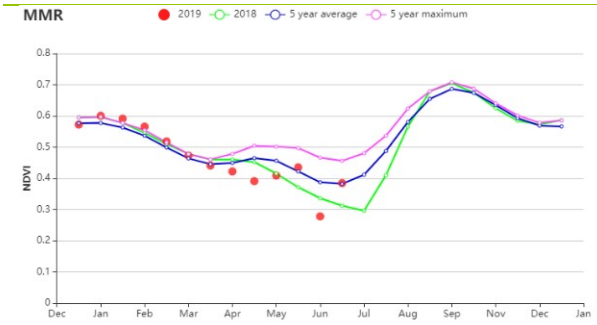
(c) Maximum VCI

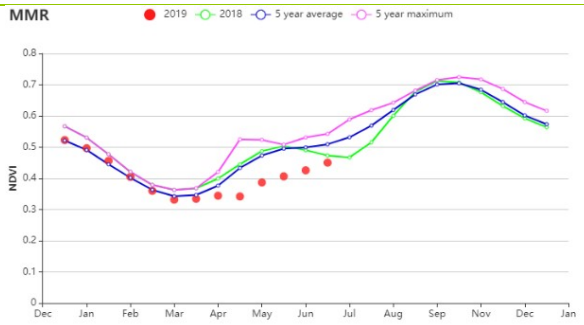


(d) Spatial NDVI patterns compared to 5YA

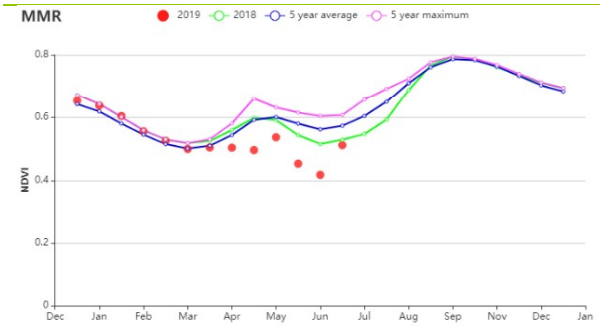


(e) NDVI profiles





(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, April - July 2019

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (℃)	Departure from 15YA (℃)	Current (MJ/m^2)	Departure from 15YA (%)
Coastal region	1283	-27	28.1	0.7	1248	5
Central plain	611	-32	27.5	1.2	1254	7
Hill region	1248	-18	24.3	0.7	1201	8

Table 3.50. Myanmar's agronomic indicators by sub-national regions, current season's values and departure, April - July 2019

Region	BIOMSS		Cropped arable land fraction		Maximum VCI
	Current (gDM/m^2)	Departure from 15YA (%)	Current (%)	Departure from 5YA (%)	Current
Coastal region	707	-5	81	6	0.97
Central plain	753	2	76	-8	0.81
Hill region	693	3	95	0	0.89

[MNG] Mongolia

The monitoring period covers the sowing and growing stages of summer wheat. Summer wheat is generally sown during the first dekad (10-day period) of May. Peak biomass is reached from June to August.

Crop condition in the country was favorable and the national VCIx reached 0.91. At 291 mm RAIN was above average (+28%) and TEMP was slightly below (-0.2℃). RADPAR was low but close to average (-2%). The combination of factors resulted in low BIOMSS (-3%). As shown by the NDVI development graph, crop condition was above average from June to July and below average from April to May (when planting starts). In June and July wheat reaches heading and flowering. NDVI cluster graphs and profiles show that 67.5% of arable lands were above average from June to July, mostly in Khentii, Selenge, Tuv, Bulgan, Hovsgol, the East of Dornod and patches in some cropped western provinces. Overall, the outcome of the agricultural season is projected to be favorable.

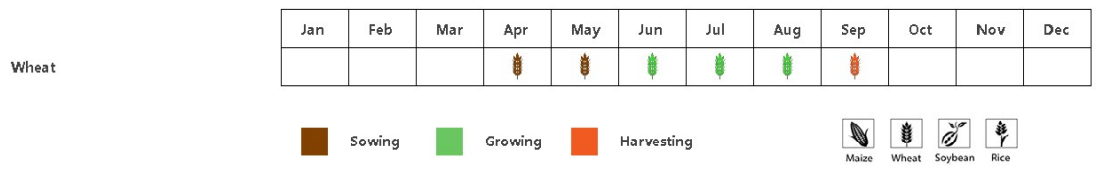
Regional analysis

Crop condition was close to the five-year maximum from June to July in **Hangai Khuvsgul region**. Accumulated rainfall was well above average (RAIN +73%); TEMP and RADPAR were below average (-0.4℃ and -3%, respectively) and the resulting BIOMSS index is up 7%. The maximum VCI index was 1.01 and the cropped arable land increased by 2% compared to the five-year average. Overall crop prospects are favorable in this region.

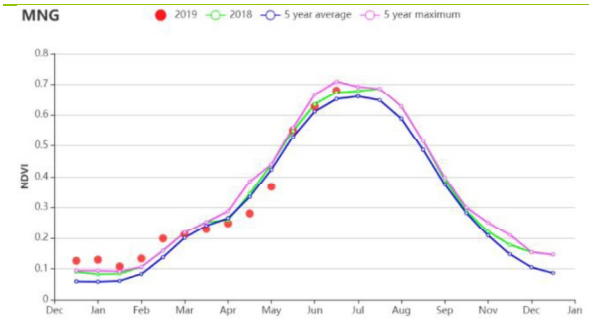
In the **Selenge-Onon region** NDVI was above the five-year average from June to July. RAIN was above average (+11%), while TEMP and RASPAR were substantially average. The BIOMSS index decreased by 3% compared with the five-year average. The maximum VCI index was 0.88 and the cropped arable land increased by 4% compared to the five-year average. Overall crop outcome will normal or just below.

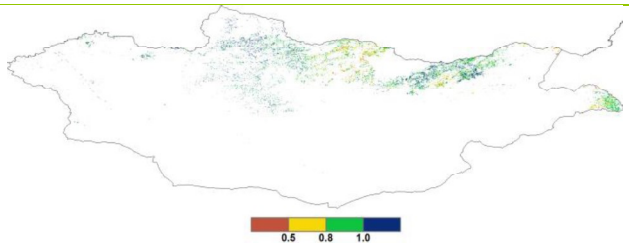
According to the NDVI development graph, crop condition in the **Central and Eastern Steppe Region** was below the five-year average, because of insufficient rainfall. Accumulated RAIN was below average (-23%) and TEMP and RADPAR were slightly above average (0.5℃ and +2%, respectively). The BIOMSS index increased by 4% and VCIx was 0.82. The cropped arable land increased by 2% compared to the five-year average. In general, the overall outcome for the crops of this region will depend on mid-season (August) climate, especially rainfall.

Figure 3.30. Mongolia's crop condition, April -July 2019

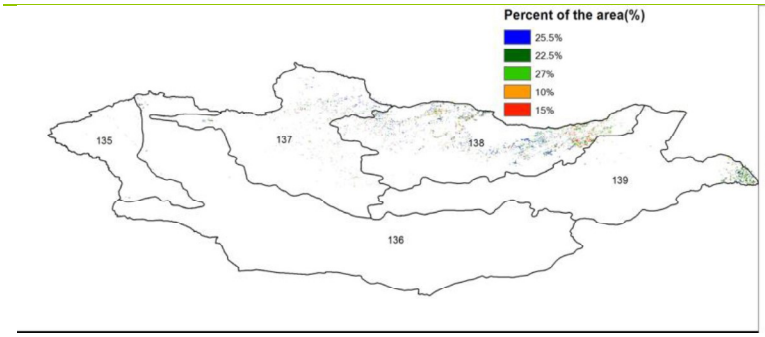


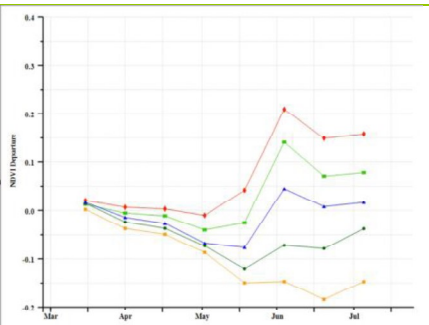
(a) Phenology of major crops



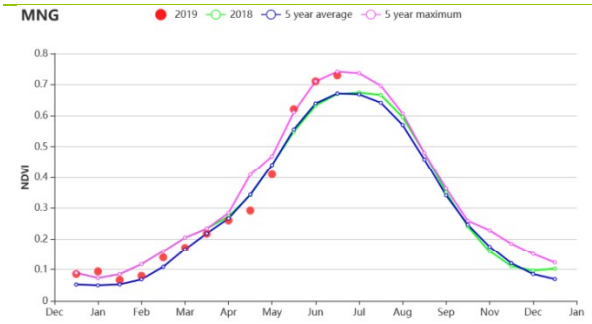


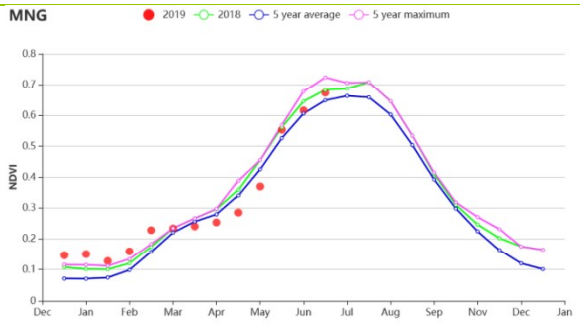
(b) Crop condition development graph based on NDVI (c) Maximum VCI



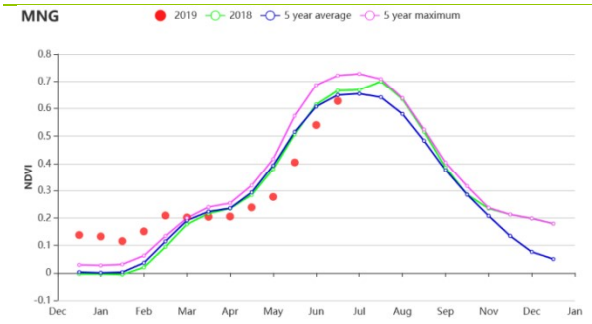


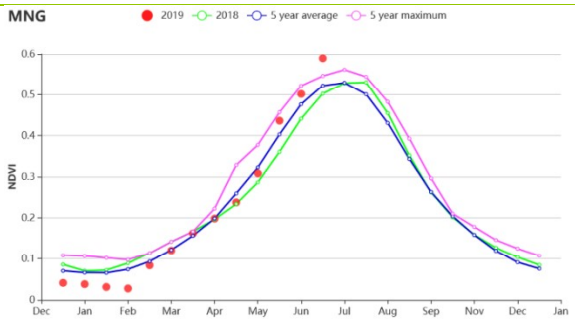
(d) Spatial NDVI patterns compared to 5YA (e) NDVI profiles



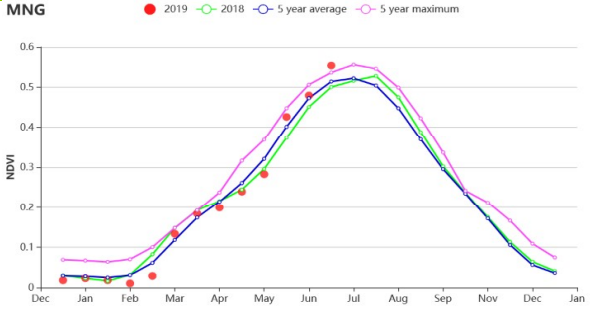


(f) Crop condition development graph based on NDVI (Hangai Huvsgul Region (left) and Selenge-Onon region (right))





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



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

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

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (℃)	Departure from 15YA (℃)	Current (MJ/m^2)	Departure from 15YA (%)
Hangai Khuvsgul Region	437	73	7.6	-0.4	1346	-3
Selenge-Onon Region	253	11	11.1	-0.1	1370	0
Central and Eastern Steppe Region	148	-23	14.1	0.5	1377	2
Altai Region	291	-20	8.9	-0.7	1313	-3

Table 3.52. Mongolia's agronomic indicators by sub-national regions, current season's values and departure, April -July 2019

Region	BIOMSS		CALF		Maximum VCI
	Current (gDM/m^2)	Departure from 15YA (%)	Current (%)	Departure from 5YA (%)	Current
Hangai Khuvsgul Region	352	-7	100	2	1.01
Selenge-Onon Region	449	-3	100	4	0.88
Central and Eastern Steppe Region	557	4	97	2	0.82
Altai Region	401	-7	80	12	1.00

[MOZ] Mozambique

Recovering from the floods which occurred after the Cyclone IDAI in March in the central provinces of Sofala and Manica and Cyclone Kenneth in April in northern of Cabo Delgado province, during the April-July monitoring period, Mozambique was characterized by the growing stages of maize and rice in the Northern region and growing stage of wheat in the south. During the same period, maize and rice for both northern and central regions and wheat were completely harvested by June.

Both Agro-climatic and agronomic indicators did not have significant departures from their averages. After the heavy rain in March and April, both rainfall (-2% below average) and temperature (up 0.3ºC above average) were close to average during the monitoring period. The radiation increased by 1%. Both Biomass and Cropped arable land fraction were at average levels. The maximum VCIx recorded for this period was 0.90.

Nationwide, except for early April, the NDVI development graph indicates above-average crop condition during the entire monitoring period. About average VCIx was observed almost all over the country. Favorable VCIx values are concentrated in the provinces of Nampula, Zambézia, Tete, and northern Inhambane. According to the NDVI departure clustering analysis, this area corresponds to 52.5% of the total cropped arable land. Crop condition in central provinces of Sofala and Manica was below average due to the effects of the March floods event, amounting to 47.5% of the national cropland area.

Generally, the condition of crops remains favorable in most areas in spite of adverse conditions.

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 River Basin (4) Northern Coast and (5) Southern Region.

During the monitoring period, in the **Buzi basin**, while the radiation increased by about 4%, both rainfall and temperature decreased by 22% and 0.6ºC respectively. The BIOMASS in this region decreased by 5% but CALF remained at 100%. Due floods, crop condition was unfavorable in March, but it recovered in early-April. Nevertheless, below average crop conditions persisted for the entire monitoring period. The maximum VCI recorded for this region was 0.88, a fair value.

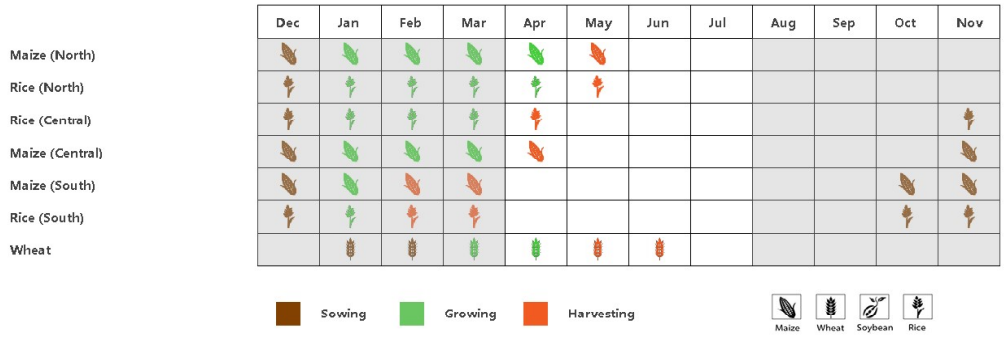
Both rainfall and temperature decreased from the past fifteen-years average by about 5% and 0.3ºC and the radiation registered a slight increase of 1% in the **Northern High-altitude Areas**. The BIOMASS and CALF were about average. With the NDVI graph indicating unfavorable crop condition during the entire monitoring period, a maximum VCI of 0.92 was nevertheless observed.

With the decreases on rainfall and temperature (RAIN -8% and TEMP -0.6ºC) and 1% increase in radiation, the **Low Zambezi River** Basin recorded favorable crop condition throughout the monitoring period. Both BIOMASS and CALF were close to average and the maximum recorded VCI was 0.89.

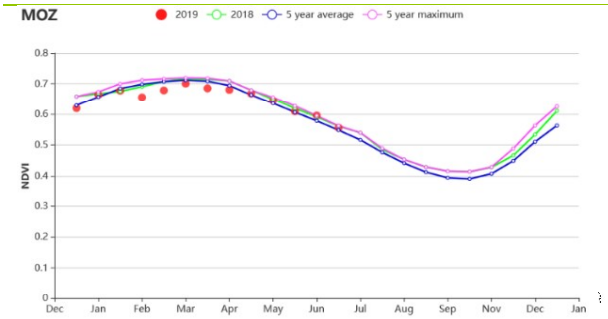
The **Northern Coast Zone** registered an increase RAIN by about 16%. The high value was recorded during the month of April. The rainfall profiles for this region show that the amount of rainfall recorded (77 mm) in April was above both average, the fifteen-years maximum as well as above the recorded rainfall in the same period during the year 2018. The temperature underwent a drop of about 0.4ºC. These conditions did not impact the BIOMASS which registered a slight decrease of about 1%. The CALF increased by 1%. A satisfactory maximum VCI of 0.92 was observed.

Significant decrease in rainfall (RAIN -39%) was verified in the **Southern Region**. In his region, both temperature and radiation increased slightly by about 0.2ºC and 4%. A BIOMASS fell by about 2%. CALF was about average and the maximum recorded VCI was 0.86. For this region, the crop conditions development graph based on the NDVI indicates about average crop conditions compared to the past five-years.

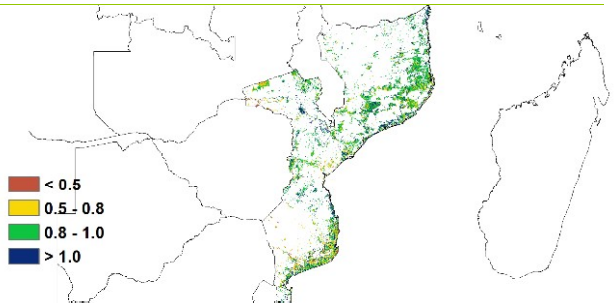
Figure 3.31. Mozambique's crop condition, April -July 2019



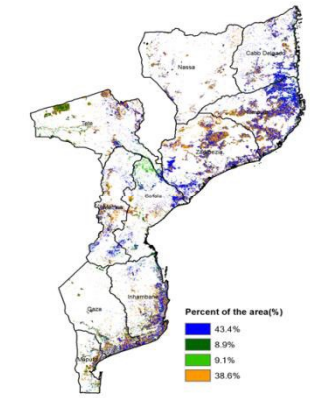
(a) Phenology of major crops



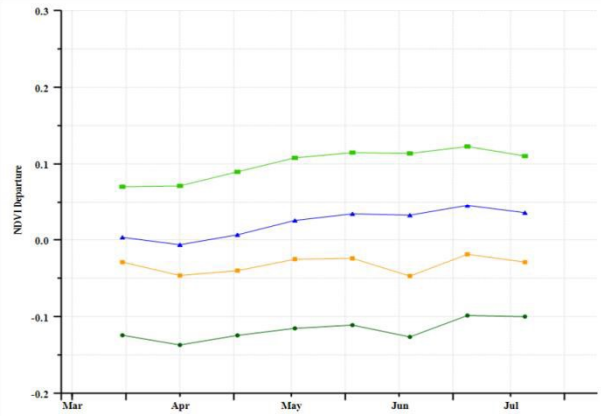
(b) Crop condition development graph based on NDVI



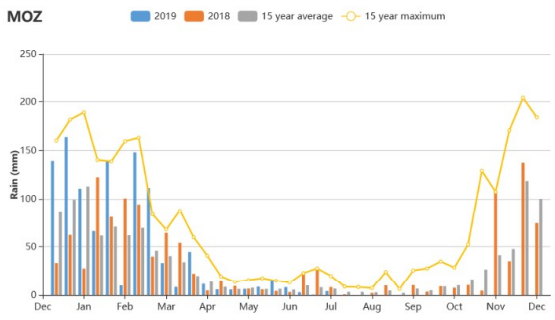
(c) Maximum VCI



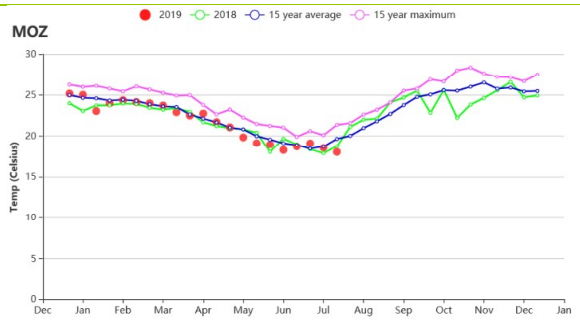
(d) Spatial NDVI patterns compared to 5YA



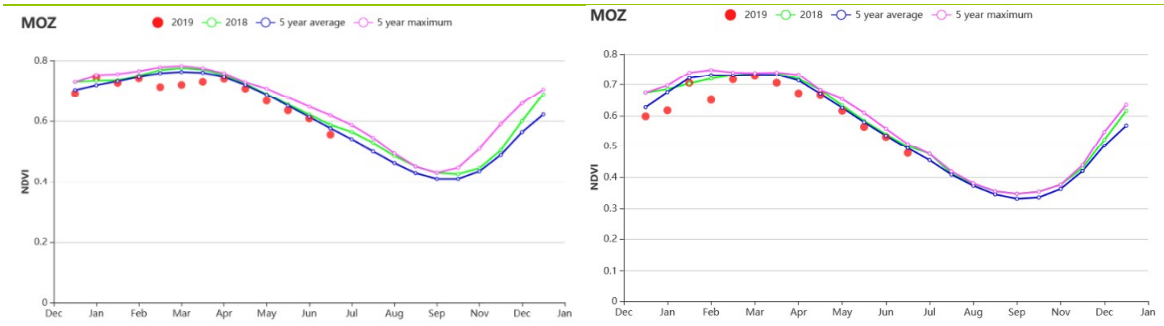
(e) NDVI profiles



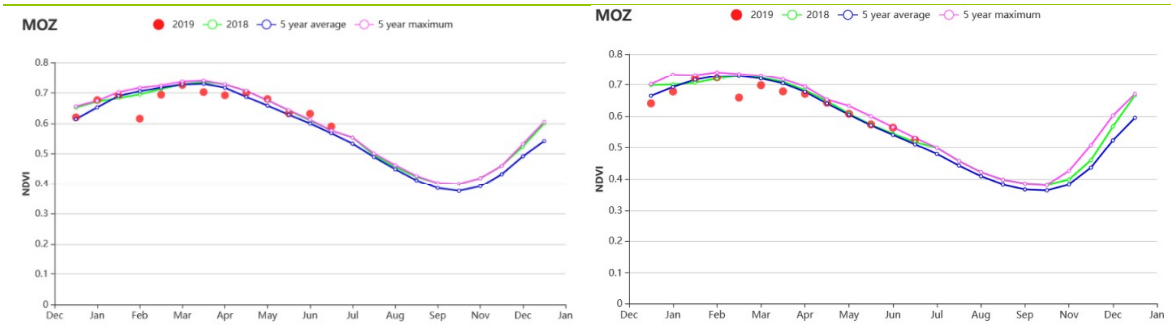
(f) National time-series rainfall profiles



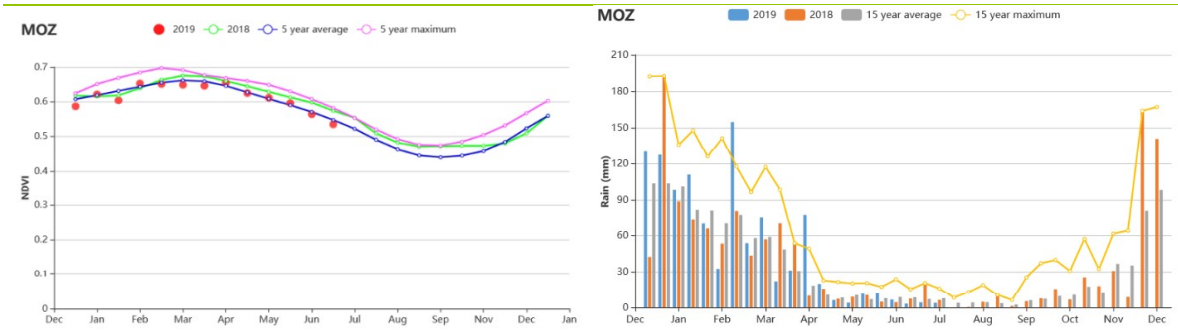
(g) National time-series temperature profiles



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



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



(j) Crop condition development graph based on NDVI Southern region (left) and time-series rainfall profiles - Northern Coast zone (right)

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

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (℃)	Departure from 15YA (℃)	Current (MJ/m^2)	Departure from 15YA (%)
Buzi basin	86	-22	16.9	-0.6	1032	4
Northern high-altitude areas	118	-5	18.9	-0.3	997	1
Low Zambezia River basin	120	-8	19.4	-0.6	957	1
Northern coast	200	16	20.6	-0.4	975	0
Southern region	64	-39	20.8	0.2	914	4

Table 3.54. Mozambique's agronomic indicators by sub-national regions, current season's values and, April -July 2019

Region	BIOMSS		CALF		Maximum VCI
	Current (gDM/m^2)	Departure from 15YA (%)	Current (%)	Departure from 5YA (%)	Current
Buzi basin	400	-5	100		0.88
Northern high-altitude	495	0	100	0	0.92

Region	BIOMSS		CALF		Maximum VCI
	Current (gDM/m^2)	Departure from 15YA (%)	Current (%)	Departure from 5YA (%)	Current
areas					
Low Zambezia River basin	472	-1	98		0.89
Northern coast	544	-1	100	1	0.92
Southern region	456	-2	99		0.86

[NGA]Nigeria

This monitoring period covers the sowing and growing seasons of main maize in the South and in the North. Both rain-fed and irrigated rice are grown during this period as well. Compared to average, rainfall (RAIN) was 12% lower, whereas the temperature (TEMP) was 0.1ºC warmer and radiation was average. The average of the maximum vegetation condition index VCIx was 0.87. Although there was less rainfall, there was a slight increment of biomass production potential by 1%. The cropped arable land fraction decreased by 3%. NDVI levels over the reporting period stayed below the five-year average until July, by when they had increased to above average conditions. Based on the maximum vegetation condition index (VCIx), the northwest had unfavorable conditions (especially in Borno and Yobe States), while in the north-eastern region (particularly in Zamfara, Sokoto and Katsina States) and in the South conditions were more favorable. According to the NDVI profiles, 33.3% of the cropped area was above the five-year average. Overall, based on CropWatch agro-climatic and agronomic indicators, the crop conditions is assessed as below average during most of the monitoring period, although conditions greatly improved in July.

Regional analysis

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

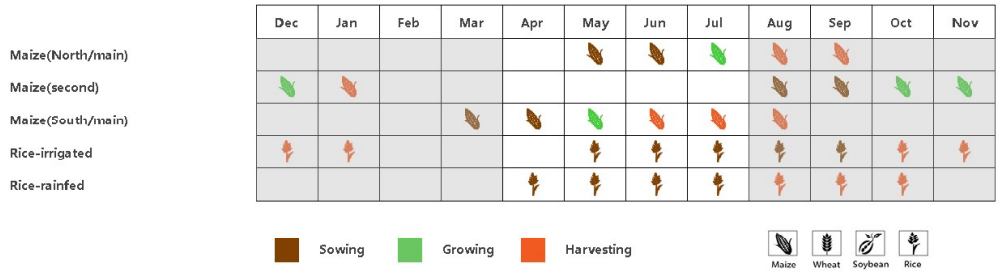
The **Sudano-Sahelian zone** is the driest one out of the four AEZs. It recorded an average amount of 187 mm of rainfall. Temperature was up 0.2ºC and radiation 1% higher than average. The total estimated biomass production increased by 6%. CALF dropped by -17% as compared to the five-year average. According to the NDVI crop condition development graph, the conditions were above the five-year average. Overall, based on these indicators, the crop condition in this zone is average.

The **Guinean savanna** recorded 355 mm of rain, 22% less than the 5-year average. Both temperature (+0.1ºC) and radiation (+1%) were slightly above average. With CALF reduced by -2%, the biomass registered a slight decrease by 1%. The NDVI graph indicates that crop conditions tended to be below average, but recovered to average conditions by July. The maximum VCI for this region was 0.87. Overall, the crop condition for the Guinean savanna was average or just below.

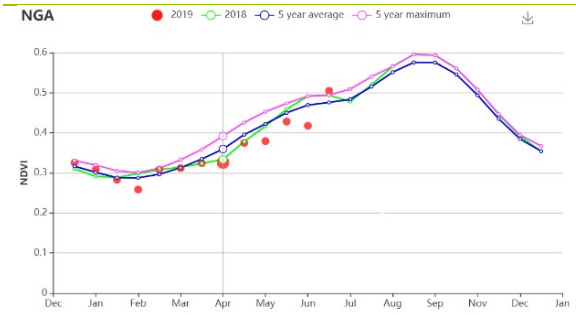
The rainy season in the **Derived savanna** usually starts between late April (west) and May (east). The main maize growing season of this AEZ falls into this monitoring period (April to July). The total amount of rainfall was 638 mm (-10%) and the average temperature was 0.1ºC warmer. Even though there was less rainfall, the calculated total biomass production stayed close to the 5 year average (+2%). CALF remained constant compared to the five-year average. The maximum VCIx was 0.95. However, the NDVI values were below the average for the previous 5 years. Overall, based on the indicators and the NDVI development graph, the crop outlook for the AEZ is about average.

In the **Humid forest zone**, maize is sown in March, whereas rain-fed rice is planted in March and April. Compared to other regions, the humid forest zone, as indicated by its name, is the wettest one. It recorded 1101 mm of rain (-11%). Temperature did not deviate from the long-term average, but radiation was 4% less, resulting in a slight decrease of biomass production (-3%). CALF (99%) and VCI (0.95) were high. However, the NDVI trend was below average until late June. We therefore expect that the crop conditions were sub-optimal throughout most of the monitoring period.

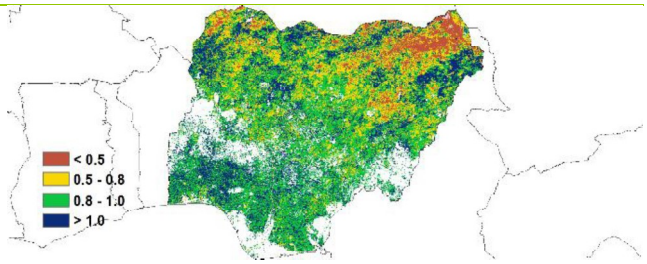
Figure 3.32. Nigeria crop condition, April-July 2019



(a) Phenology of major crops

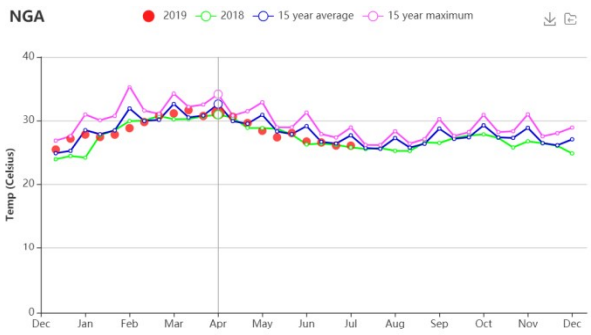


(b) Crop condition development graph based on NDVI

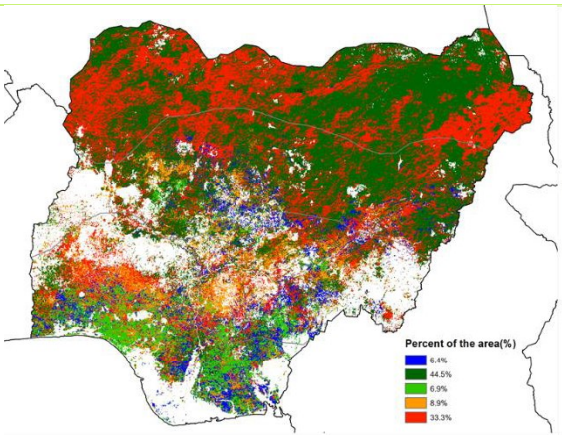


(c) Maximum VCI

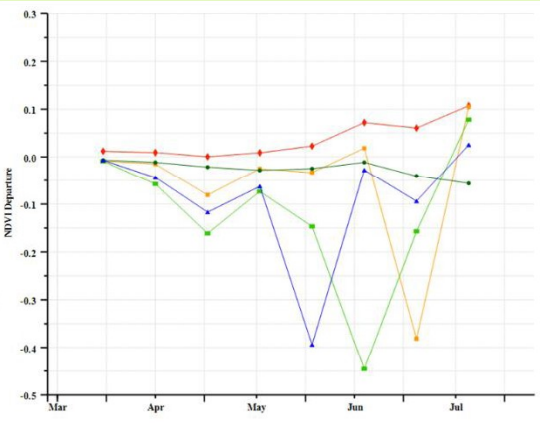
(d) Rainfall index



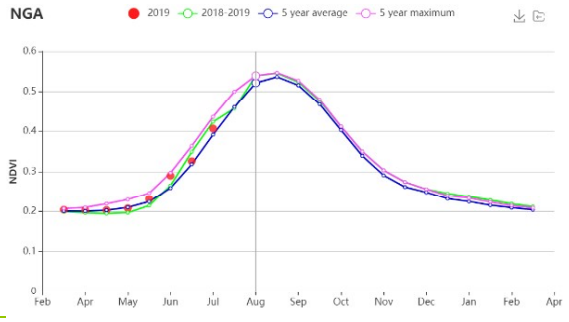
(e) Temprature index

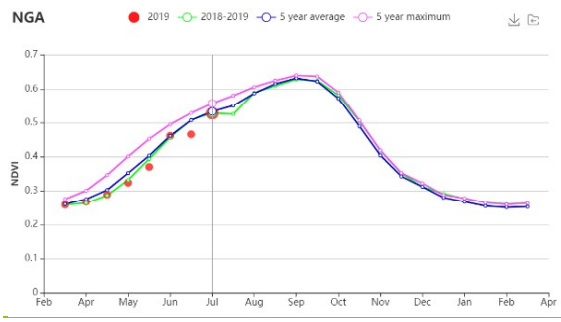


(f) Spatial NDVI patterns compared to 5YA

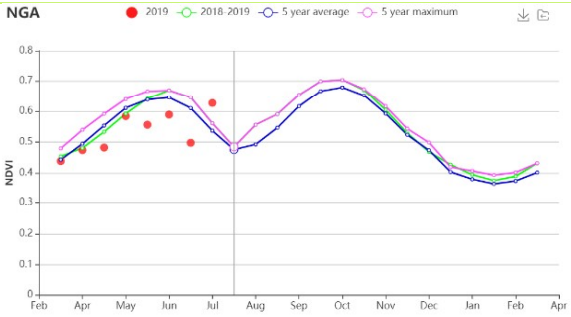


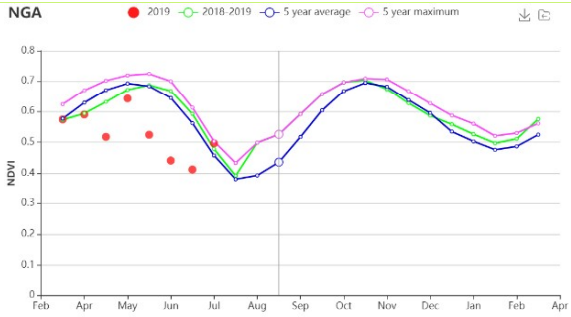
(g) NDVI profiles





(h) Crop condition development graph based on NDVI (Soudano –Sahelian region (left) and Guinean savanna (right))





(i) Crop condition development graph based on NDVI (derved(left) and Humid forest zone (right)

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

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (℃)	Departure from 15YA (℃)	Current (MJ/m^2)	Departure from 15YA (%)
Soudano-Sahelian zone	187	-1	31.3	0.2	1326	1
Guinean savanna	355	-22	28.0	0.1	1247	1
Derived savanna zone	638	-10	26.7	0.1	1161	1
Humid forest zone	1101	-11	25.5	0	1016	-4

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

Region	BIOMSS		Cropped arable land fraction		Maximum VCI
	Current (gDM/m^2)	Departure from 15YA (%)	Current (%)	Departure from 5YA (%)	Current
Soudano-Sahelian zone	679	6	43	-17	0.81
Guinean savanna	746	-1	90	-2	0.87
Derived savanna zone	777	2	99	0	0.95
Humid forest zone	687	-3	99	0	0.95

[PAK] Pakistan

This reporting period corresponds to the sowing of summer maize and the planting of rice crops, as well as to the harvesting of winter wheat. Crop condition was generally favorable.

For the whole country, RAIN was 53% above average, while TEMP and RADPAR were below (-0.7℃ and -1% respectively) . The combination of all the agro-climatic indicators resulted in BIOMSS exceeding the 15YA by 18%. Next to drought in Sindh and Balochistan, heavy rainfall caused floods and unfavorable conditions during the harvest period of wheat, for instance in Punjab. So far, summer maize and rice have benefited from the favorable weather conditions, although the fraction of cropped arable land (CALF) decreased significantly by 8% compared with 5YA, which may have a negative effect on summer crop production.

As shown by the NDVI development graph at the national level, following their favorable condition during the last reporting period, crop conditions were generally above average until late May. The spatial NDVI patterns and profiles show that 52.5% of the cropped areas were above or on average, whereas only 5.8% were consistently below average during the monitoring period. The below average areas were not concentrated in any particular region. However, the trends showed a general negative departure starting in June for all classes. Sowing of maize has started and germination of the crop is satisfactory in Punjab. The Indus river basin (the rice producing areas) has reached average or above average NDVI after transplantation in June. Though below average crop conditions were observed in the three main agricultural areas in July, above average rainfall in the Northern Highland (+44%) and Punjab (+77%) regions, together with irrigation of lower Indus river basin might be beneficial for the development of maize and rice during the growing season.

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.

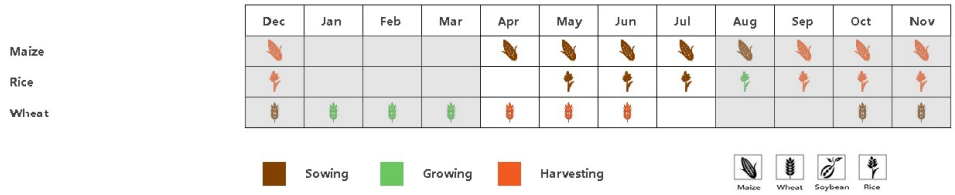
In the **Northern highlands**, the NDVI development graph shows above average crop condition from April to June. RAIN was 44% above average. RADPAR and TEMP were below average (-3% and -1.2℃ respectively) between April and July. The resulting BIOMSS exceeded the fifteen-year average by 5%. The region achieved a rather low CALF of 52%, but it still is 2% above 5YA. Wheat condition was satisfactory but the harvest may have suffered from heavy rainfall or storms; weather was favorable for the establishment of maize.

Northern Punjab, the main agricultural region in Pakistan recorded very abundant RAIN (77% above average). TEMP was below average by 1.2℃, and the RADPAR departure was -2%. The estimated BIOMSS departure of +10% as compared to the fifteen-year average is probably not so relevant, since this period covers the harvest of wheat and establishment of the maize and rice crops. For wheat, the entire growth period, except for January, had above average NDVI values. But this may not have resulted in higher yields because of high rainfall during harvest. Together with the large VCIx (0.94) and high CALF (72% with an increase of 3%), maize production is promising.

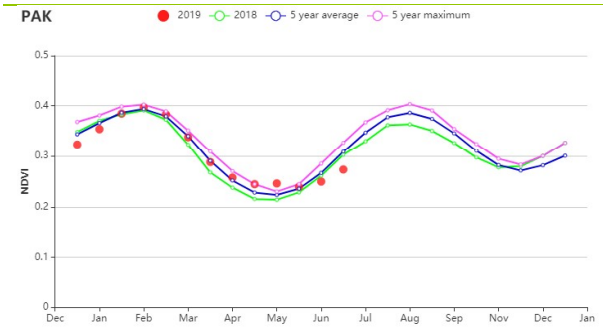
In the **Lower Indus river basin** in south Punjab and Sind, RAIN was slightly above average by 1%, while TEMP was below average by 0.7℃. RADPAR was on average. Estimated BIOMSS was 24% higher. The VCIx at 0.77 indicates not so favorable crop conditions, but this is to be expected for this period between

the harvest of wheat and the establishment of the new crops. Considering that vast majority of land in this region is irrigated, prospects for the newly established crops are promising. But the low CALF (31%), which decreased sharply from the recent 5YA by 21%, may indicate a drop in production.

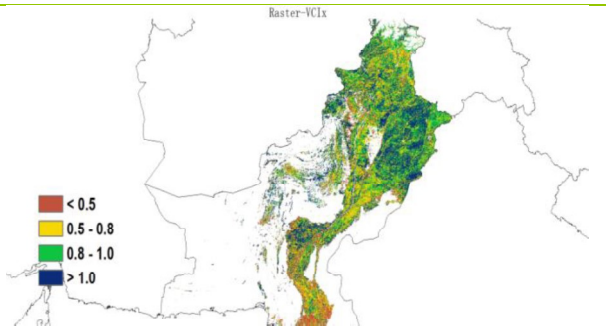
Figure 3.33. Pakistan's crop condition, April -July 2019



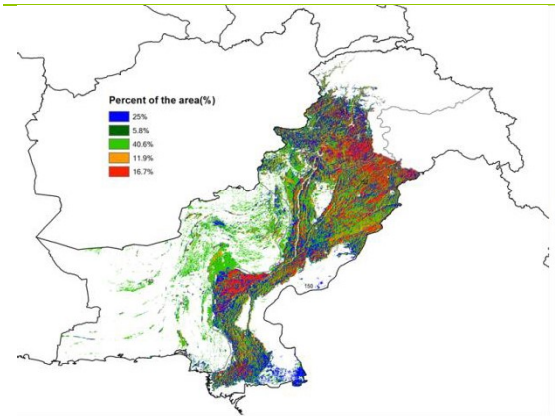
(a) Phenology of major crops



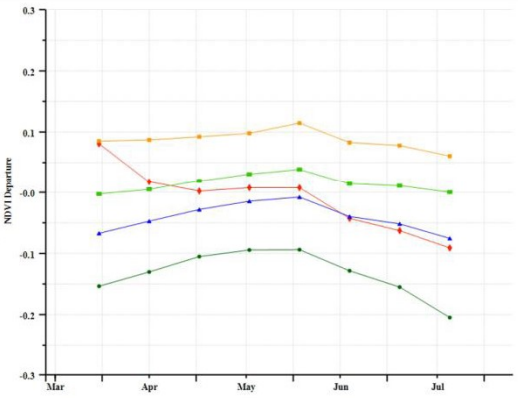
(b) Crop condition development graph based on NDVI



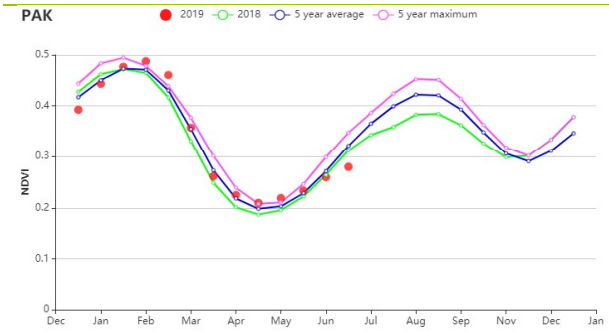
(c) Maximum VCI

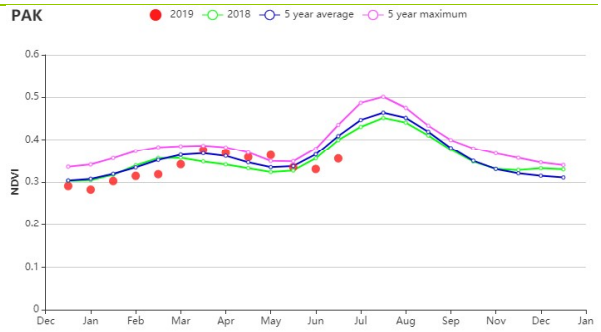


(d) Spatial NDVI patterns compared to 5YA

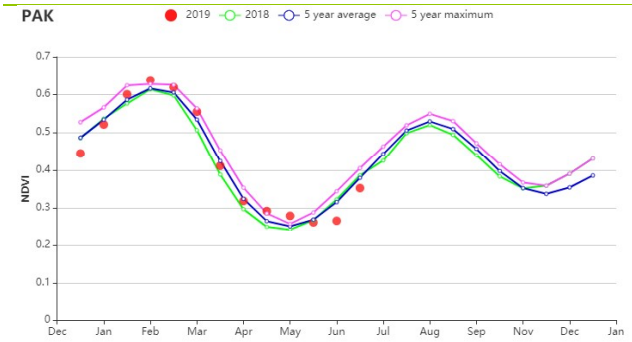


(e) NDVI profiles





(f) Crop condition development graph based on NDVI for Lower Indus river basin (left) and Northern Highland (right))



(g) Cop condition development graph based on NDVI for Northern Punjab

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

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (℃)	Departure from 15YA (℃)	Current (MJ/m^2)	Departure from 15YA (%)
Lower Indus river basin	64	1	34.9	-0.2	1558	0
Northern Highland	478	44	20.4	-1.2	1516	-3
Northern Punjab	291	77	32.1	-1.2	1490	-2

Table 3.58. Pakistan's agronomic indicators by sub-national regions, current season's values and departure, April -July 2019

Region	BIOMSS		CALF		Maximum VCI
	Current (gDM/m^2)	Departure from 15YA (%)	Current (%)	Departure from 5YA (%)	Current
Lower Indus river basin	737	24	31	-21	0.77
Northern Highland	691	5	52	2	0.89
Northern Punjab	932	10	72	3	0.94

[PHL] Philippines

The main rice growing season is in full swing on the Philippines. Maize has reached the stage of maturity and is about to be harvested, while harvest of the secondary rice and maize crops was completed in April and May. According to the NDVI profiles for the country, crops generally experienced below average conditions, but they recovered to close to normal in July. Rain was 9% below the 15-year average, radiation was 4% higher and temperature was close to normal (+0.1℃). The higher radiation resulted in above average BIOMSS (+4%) estimates.

The cropped arable land fraction (CALF) was almost 100% in all regions. The spatial patterns of NDVI profiles show that: (1) 46.5% of the cropped areas experienced average or slightly above average conditions in most of the country; (2) 34.5% experienced slightly below average conditions, mostly in the Center, from Negros and Cebu to Luzon; (3) 19.0% had slightly below average condition before a marked drop in June, and recovered to slightly below average conditions in July. This was the case for the regions in the Center and South.

In spite of the below average rainfall and NDVI, the assessment of the crop situation on the Philippines is less straightforward than it seems, especially when considering that solar radiation often is a limiting factor for crop production in tropical areas. Solar radiation was above average, CALF reached 100% and VCIx was unusually high in all agro-ecological zones. We therefore conclude that overall, crop conditions are favorable.

Regional analysis

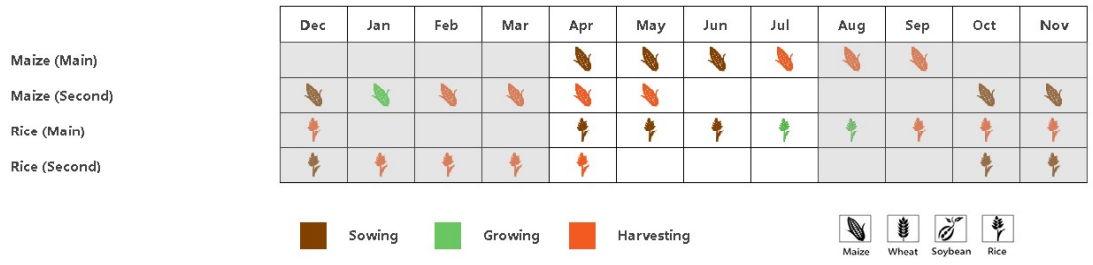
Based on cropping systems, climatic zones and topographic conditions, three main agro-ecological regions can be distinguished for the Philippines. They are the Northern lowlands of Mindanao to western Visayas region, the Negros and central Visayas Islands region and the Forest islands region (mostly southern and western islands). All regions recorded full cropping and VCIx above 0.95, confirming the positive assessment provided above.

The Northern lowlands of Mindanao to western Visayas region experienced a rainfall deficit (RAIN -8%), slightly above average temperature (TEMP +0.2℃), and well above average radiation (RADPAR +5%). BIOMSS was up by 5% as compared to the 5-year average.

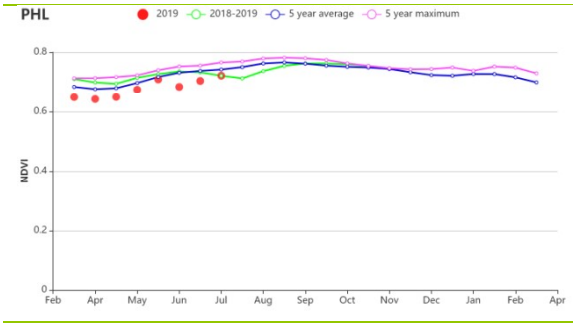
The Negros and central Visayas Islands region had the largest rainfall deficit (RAIN -11%), slightly above average temperatures (TEMP +0.2℃) and the largest positive departure of radiation (RADPAR +8%). BIOMSS was 8% above average.

The Forest islands region experienced a rainfall deficit (RAIN -9%), average temperatures and above average radiation (RADPAR +2%). BIOMSS was up 2% from the average.

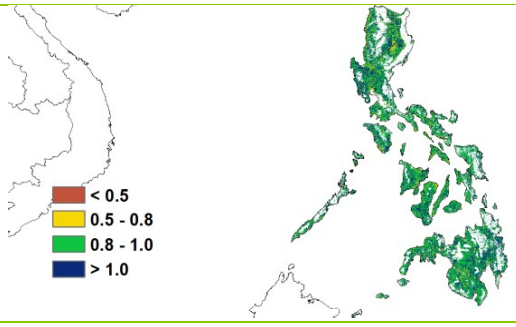
Figure 3.34. Philippines's crop condition, April - July 2019



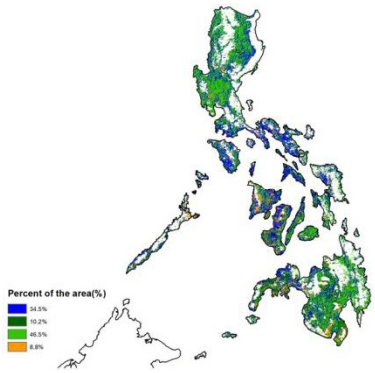
(a) Phenology of major crops



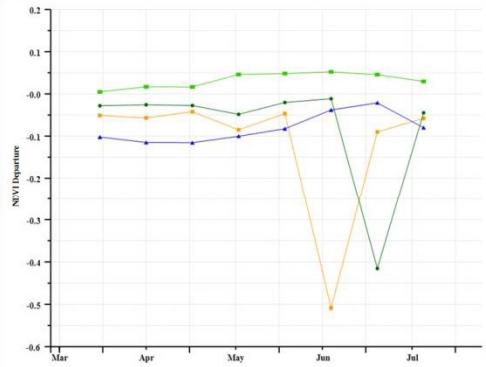
(b) Crop condition development graph based on NDVI



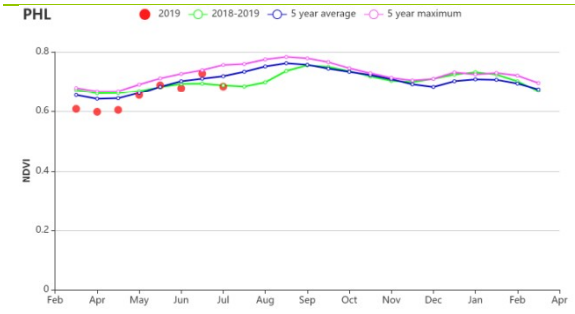
(c) Maximum VCI

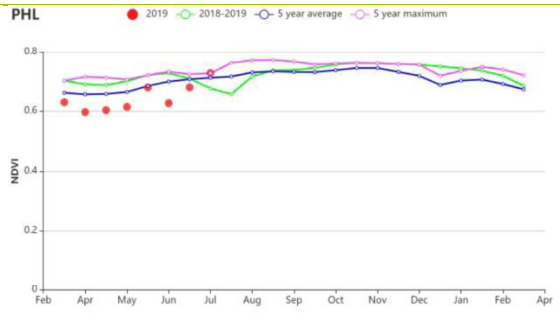


(d) Spatial NDVI patterns compared to 5YA

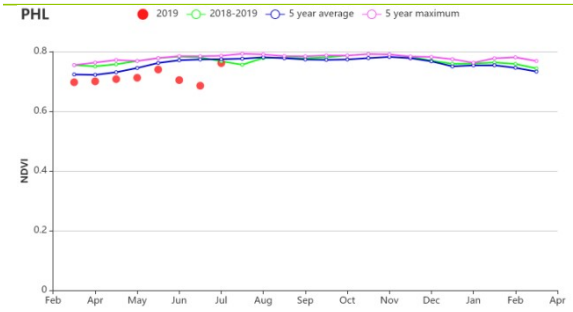


(e) NDVI profiles





(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, April - July 2019

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (℃)	Departure from 15YA (℃)	Current (MJ/m^2)	Departure from 15YA (%)
Northern lowlands of Mindanao to western Visayas region	1358	-8	26.0	0.25	1330	5
Negros and central	1279	-11	26.9	0.15	1381	8

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (℃)	Departure from 15YA (℃)	Current (MJ/m^2)	Departure from 15YA (%)
Visayas Islands region						
Forest islands region	1272	-9	24.8	0	1236	2

Table 3.60. Philippines's agronomic indicators by sub-national regions, current season's values and departure, April - July 2019

Region	BIOMSS		Cropped arable land fraction		Maximum VCI
	Current (gDM/m^2)	Departure from 15YA (%)	Current (%)	Departure from 5YA (%)	Current
Northern lowlands of Mindanao to western Visayas region	884	5	100	0	0.97
Negros and central Visayas Islands region	940	8	100	0	0.96
Forest islands region	814	2	100	0	0.98

[POL] Poland

The monitoring period covers the growth of winter wheat until harvest, as well as the sowing and growth of summer crops, including spring wheat and maize.

During the monitoring period, compared with the average, Poland experienced dry and warm weather, with abundant sunshine (+5%) and the average temperature at 0.6℃ above average. However, Poland had little rain in June and TEMP exceeded the recent maximum, which has stressed crops, particularly when considering that, in addition, the cumulative precipitation during the monitoring period dropped is significantly below average (-22%). Both drought and high temperature occurred mainly from June to early July as shown in the TEMP and RAIN profiles. Initially, soils had favorable moisture contents due to the abundant precipitation in May, and timely rains during mid-July helped recover from the adverse crop growth conditions, resulting in high VCIx at 0.96 and Biomass above the average by 11%. However, NDVI dropped significantly below average in July and returned close to the average at the end of the monitoring period. Cropped land fraction was high at 100% in the whole country. In general, the state of crops in Poland needs close monitoring to assess whether the June drought and temperature records had any lasting effect on production.

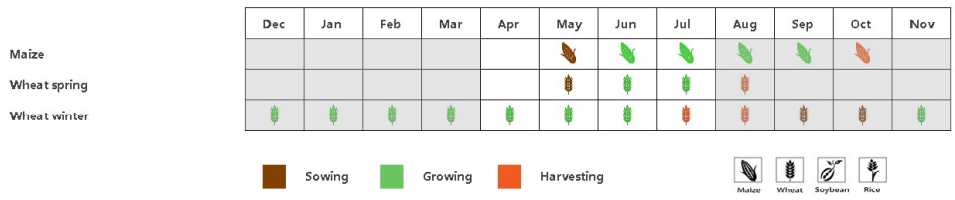
Regional analysis

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

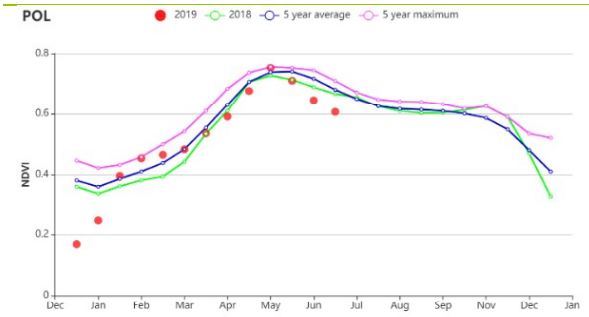
Compared to last 15 years, the **Northern oats and potatoes area**, **Northern-central wheat and sugar-beet area** and **Central rye and potatoes area** recorded much drier and slightly warmer conditions (RAIN: -25%, -24% and -29%; TEMP: +0.7℃, +0.6℃ and +0.7℃). After sufficient precipitation in May, the three sub-regions entered an intensely dry and warm spell. During the initial stage of crop growth, due to sufficient soil moisture during the planting period, the crops grew well, which is also reflected by higher BIOMSS (+15%, +13% and +12%, respectively) and favorable VCIx (0.95, 0.94, 0.95, respectively). After the water stressed period of June-July, crop condition recovered due to rainfall during mid and late July, but the extent of the recovery is difficult to assess.

Different from the central and northern zones, the drought and high temperature conditions were less severe (RAIN -10%, TEMP +0.4℃) in the **Southern wheat and sugar-beet area**. Precipitation at early crop stages was lower than in the above three sub-regions, but BIOMSS is nevertheless up above average by 7% and VCIx was rather satisfactory at 0.98. The AEZ enjoys the most favorable crop condition in the country and summer crop prospects are promising.

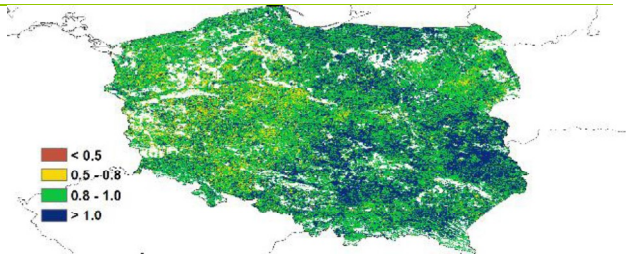
Figure 3.35. Poland's crop condition, April-July 2019



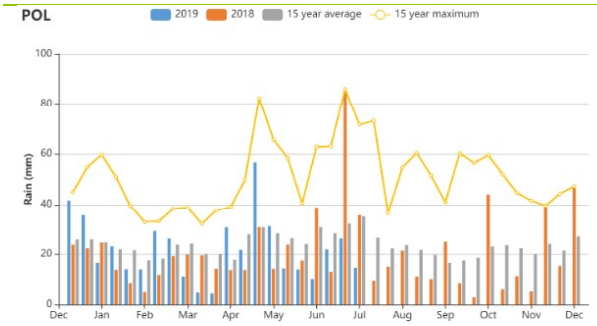
(a) Phenology of major crops



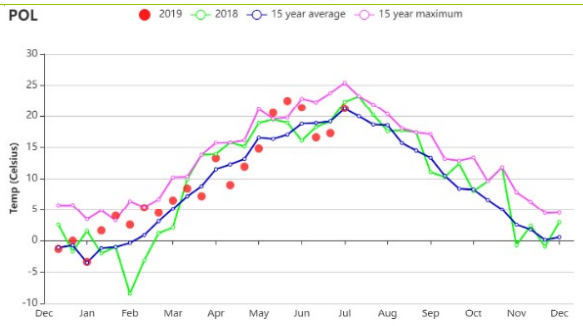
(b) Crop condition development graph based on NDVI



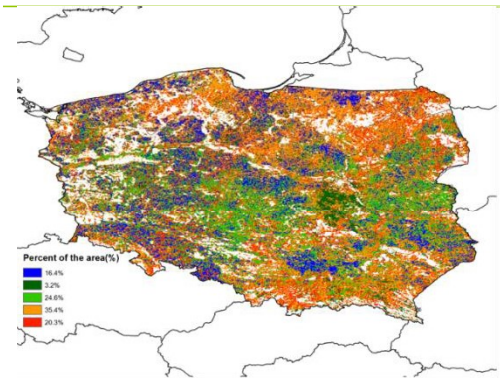
(c) Maximum VCI



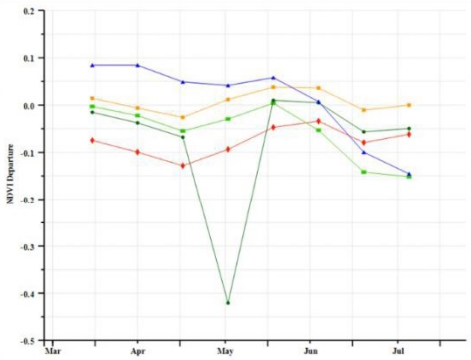
(d) Time series of rainfall for Poland



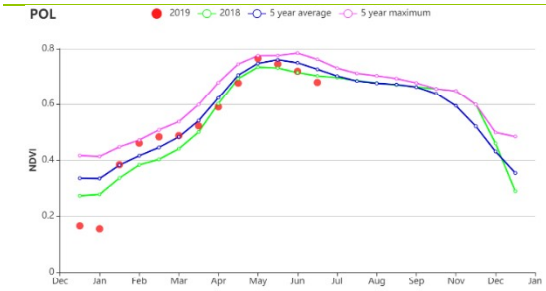
(e) Time series temperature profile for Poland

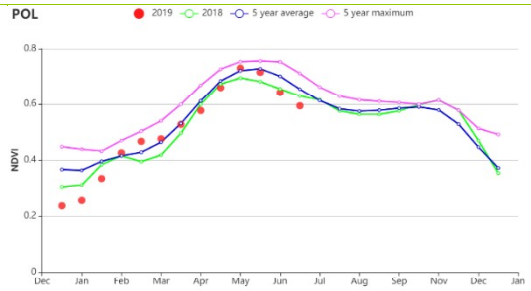


(f) Spatial NDVI patterns compared to 5YA

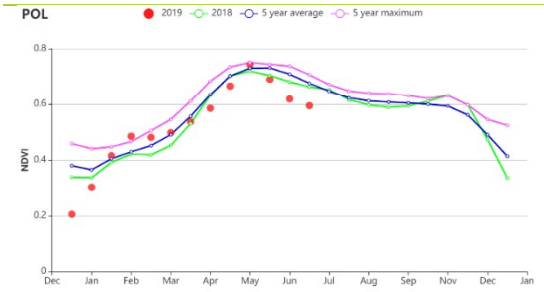


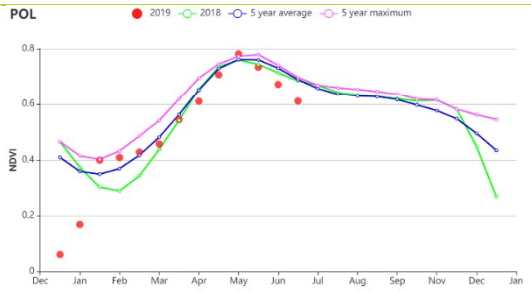
(g) NDVI profiles





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





(i) Crop condition development graph based on NDVI, Central rye and potatoes 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, April-July 2019

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (℃)	Departure from 15YA (℃)	Current (MJ/m2)	Departure from 15YA (%)
Northern oats and potatoes areas	246	-25	14.5	0.7	1201	7
Northern-central wheat and sugarbeet area	227	-24	14.8	0.6	1209	6
Central rye and potatoes area	217	-29	15.6	0.7	1202	5
Southern wheat and sugarbeet area	321	-10	14.7	0.4	1188	2

Table 3.62. Poland's agronomic indicators by sub-national regions, current season's values and departure, April-July 2019

Region	BIOMSS		Cropped arable land fraction		Maximum VCI
	Current (gDM/m^2)	Departure from 15YA (%)	Current	Departure from 5YA (%)	Current
Northern oats and potatoes areas	494	15	100	0	0.95
Northern-central wheat and sugarbeet area	511	13	100	0	0.94
Central rye and potatoes area	531	12	100	0	0.95
Southern wheat and sugarbeet area	504	7	100	0	0.98

[ROU] Romania

The reporting period includes the harvest of winter wheat, which started in July, and the growth of spring wheat and maize, sown in April. Overall, crop condition in Romania was fair. The maximum VCI was 0.98 and the current cropped arable land fraction was 100%. Rainfall was 8% higher than average; TEMP was lower than average by 0.5℃ , radiation was around average and BIOMASS increased by 3%. Crop condition development graphs based on NDVI shows that condition was better than average in May to June, but below average in April and July. The temperature profile indicates that during the reporting period, temperature fluctuated about the average. According to the rainfall time series profile, rainfall was close to average during April to June, which belongs to the growing season of winter wheat. We note a sharp decrease of rainfall in July which was the last month of reporting period. Additional attention is needed in next bulletin concerning the influence of the July rainfall decrease.

Regional analysis

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

The CALF index of three sub-regions was close to 100% during the reporting period and the maximum VCIx was also close to 1.0, indicating that the crop condition was satisfactory in all three regions.

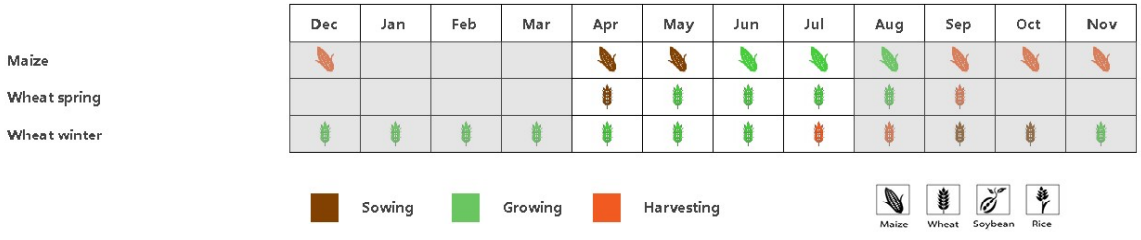
For the **Central mixed farming and pasture Carpathian hills**, rainfall increased 12% compared with average while temperature and radiation were around average (TEMP -0.4℃ , RADPAR +0) and BIOMSS increased 3%. According to the crop condition graph, crop condition in this sub-region was close to average from May to July. The maximum VCI map showed that most area of this sub-region was close to 1.0. The NDVI spatial distribution shows that NDVI was good throughout the reporting period.

For the **Southern maize, wheat and sugar beet plains**, rain increased 7%, temperature decreased 0.6℃, radiation decreased 1% and biomass increased 1%. The NDVI development graph shows that crop condition was higher than average during May to July, but lower. VCI values of this region were higher than 1.0 in most of the central and southern region and lower than 0.8 only in the southeast area of this sub-region (counties of Tulcea and Constanta), representing about 14.3% of national cropland.

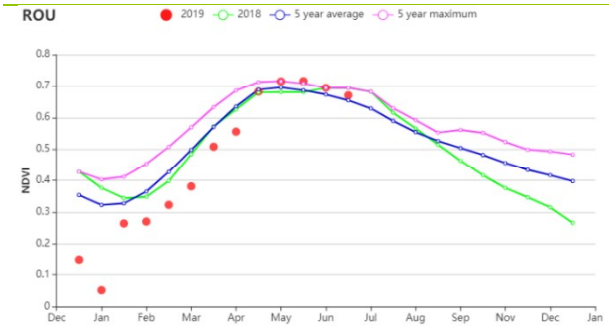
For the **Western and central maize, wheat and sugar beet plateau**, rainfall was higher than average by 5%, temperature and radiation were close to average and biomass increased 5%. Spatial NDVI profiles show that crop condition was close to average during the report period. Maximum VCI of this region was between 0.8 and 1.0 and NDVI development normally from May to July

Overall, crop condition was satisfactory in Romania, with the exception of the extreme south-east. Additional monitoring is needed to assess the effect of the rainfall decrease during July.

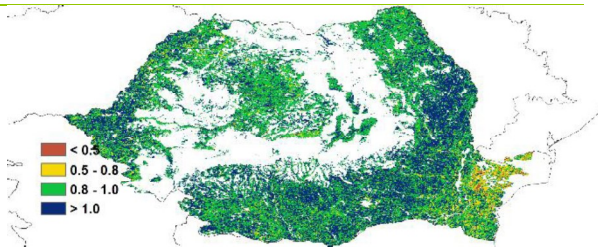
Figure 3.36. Romania's crop condition, April - July 2019



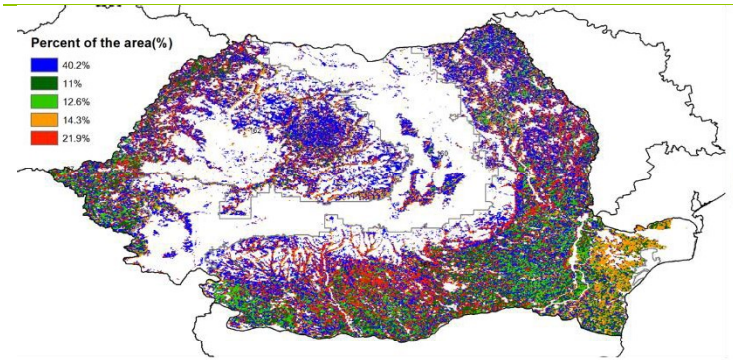
(a) Phenology of major crops



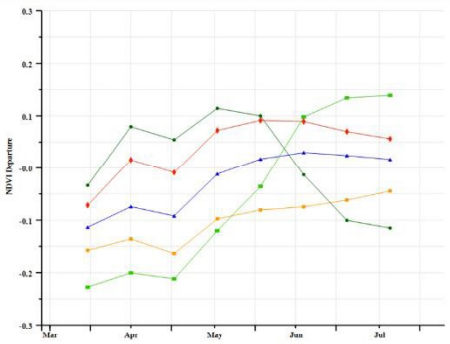
(b) Crop condition development graph based on NDVI



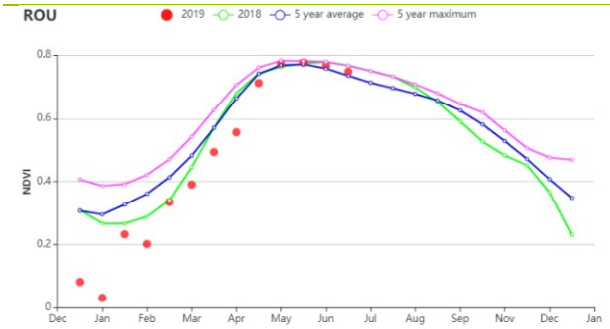
(c) Maximum VCI

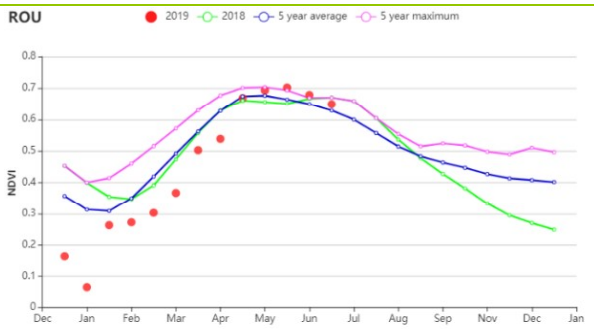


(d) Spatial NDVI patterns compared to 5YA

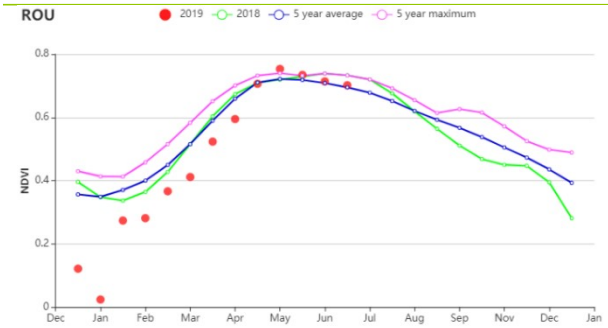


(e) NDVI profiles





(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 sugarbeet plateau)

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

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (℃)	Departure from 15YA (℃)	Current (MJ/m^2)	Departure from 15YA (%)
Central mixed farming and pasture Carpathian hills	539	12	13.4	-0.4	1265	0
Eastern and southern maize, wheat and sugar	344	7	17.5	-0.7	1296	-1

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (℃)	Departure from 15YA (℃)	Current (MJ/m^2)	Departure from 15YA (%)
beet plains						
Western and central maize, wheat and sugar beet plateau	410	5	16.2	-0.2	1325	2

Table 3.64. Romania’s agronomic indicators by sub‐national regions, current season's values and departure from 15YA or 5YA, April - July 2019

Region	BIOMSS		Cropped arable land fraction		Maximum VCI
	Current (gDM/m^2)	Departure from 15YA (%)	Current (%)	Departure from 5YA (%)	Current
Central mixed farming and pasture Carpathian hills	489	3	100	0	0.98
Eastern and southern maize, wheat and sugar beet plains	642	1	100	0	0.99
Western and central maize, wheat and sugar beet plateau	602	5	100	0	0.98

[RUS] Russia

The period from April to July is a time of active crop growth in Russia. Winter crops go through the main development stages. They are usually harvested by the end of July when spring crops and crops with long growing period reach their green biomass peak in July.

Rainfall was mostly below average (-13% nationwide) and stayed below its 2018 level. There was a significant increase in rainfall in the middle of June when it temporarily exceeded the 15-year maximum. At the national level, TEMP was 0.2℃ below average during AMJJ. It increased from early to mid-April when it exceeded average but stayed close to its level of 2018. At the end of April, it dropped below average but rose in the middle of May to reach the 15-year maximum then returning to average. From June to July temperature stayed below average at the level of the previous year. RADPAR was 2% above average and the global BIOMSS is down 1% compared with average.

At the national level NDVI was below its 5-year average from April to May, but above the previous year's values. In June NDVI fell below corresponding 2018 values. The main causes for the observed NDVI behavior may be prevailing shortage of rainfall which was worsened in June and July by the drop of temperature below average. Positive NDVI departures are observed on 33.7 % of the area mainly in Middle and Western Siberia, Middle Volga, Central and Central Black Earth regions. In 9.1 % of croplands NDVI fell below well below average after June, corresponding mostly to the main area of winter wheat production. 27.7 % of the area show positive NDVI departures in June and July, mainly in Eastern Siberia and parts of Middle Siberia. 24.7 % of the cropland experienced average conditions throughout the reporting period. This type of NDVI profile is evenly distributed along Russia. The largest negative NDVI departure is observed in 13.9 % of cropland, corresponding mainly to the South Caucasus region and the Ural-Volga-Vyatka area, where the lowest VCIx values occur. Over most of Russian cropland VCI values fall into the range of 0.8-1.

Generally, poor rainfall combined with below average temperature resulted in the shortening of the peak season and general reduction in the biomass production potential. This reflected in the observed decrease of NDVI values in June and July in the main crop growing regions. With close to full cropping (98%) but VCIx at 0.92, CropWatch currently foresees a drop in winter crop output.

Regional analysis

The rainfall shortage is well reflected in regional data. **West Subarctic, Middle Volga, North-western, Middle Siberia, Ural-Volga-Vyatka, South Caucasus** and **Central regions** experienced a rainfall shortage with values 14% to 28% below average. The temperature in all these regions (except South Caucasus, Central and North-western regions) was also below average by values between by 0.1℃ and 0.6℃) with the largest departures recorded in West Subarctic and Ural-Volga-Vyatka regions. RADPAR in all considered regions was 1% to 4% above average except in the West Subarctic region where a negative departure of 3% was observed. Due to a combination of low rainfall, low temperature and low RADPAR, the West Subarctic region showed the largest drop in biomass (down 12%). However, VCIx for this region was rather high (0.97), with CALF at 100 %. Similar to the 2018 situation, NDVI fluctuated around the 5-year average. In May it was close to 5-year maximum, but in June it dropped below the 5-year average returning to the 5-year average level in July. Despite average biomass and low RADPAR (3% above average) registered in the Ural-Volga-Vyatka region, rainfall shortage combined with the decrease in temperature resulted in NDVI staying mainly below 5-year average but above the level of the previous year. at the beginning of May NDVI reached 5-year average but then dropped below the level of the previous year. VCI was rather high (0.90). CALF was about 99%. The Middle Volga region showed a 2% drop below average in BIOMSS. This region had the lowest VCIx at 0.88. CALF was about 97 %. After a slight drop at the beginning of May, NDVI stayed below 5-year average but above the level of the previous year. In June it dropped slightly below the 2018 value. The Central region demonstrated average biomass resulting from average temperature (+0.1℃ above average) and RADPAR (up 2%). NDVI in April

was above 5-year maximum dropping below 5-year average and the level of previous year in June (Figure 9). VCI was 0.97. CALF was about 100 %. Remaining rainfall deficit areas demonstrated an increase in BIOMSS (+1% to +8%) with the highest positive departure in South Caucasus region. VCI varied from 0.89 in South Caucasus region up to 0.98 in North-western region. CALF varied from 97 % in South Caucasus region to about 100 % in North-western and Middle Siberia region. In spite of the positive BIOMSS departure in the South Caucasus region, NDVI stayed below average and reached the level of the previous year only in the second half of May. In the North-western region, NDVI reached the 5-year maximum from April to June. It subsequently dropped slightly below 5-year average and the level of 2018. In Middle Siberia the rainfall deficit was accompanied by average temperature (0.1℃ below average) and RADPAR (+3%). Despite largely unfavorable climatic conditions, biomass remained average, increasing 1% over average. This is reflected in NDVI, which was below 5-year average and the level of the previous year from April till June, reaching the 5-year maximum later in the month and staying above 5-year average in July.

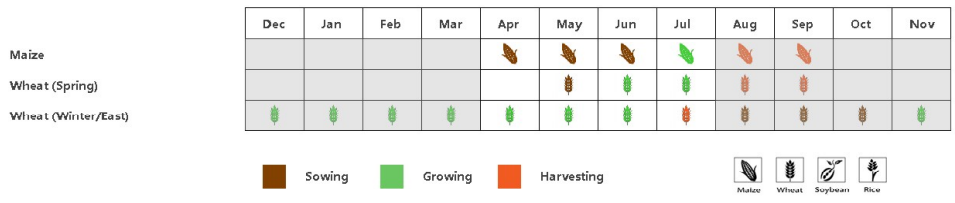
Central Black Soil and **Western Siberia** regions showed a rainfall shortage of about 8%, VCIx about 0.95 and CALF of 100 %. Positive anomalies of temperature (+0.3℃ above average) and RADPAR (+3%) in the Central Black Soil region resulted in BIOMSS up 4% compared to average. In contrast, Western Siberia region showed negative temperature departure (1.1℃ below average) and a BIOMSS reduction reaching 6%. RADPAR was 1% above average. NDVI of the Central Black Soil region in May was above 5-year maximum dropping below 5-year average and the level of the previous year in June. The behavior is reminiscent of the Central region with a two times higher rainfall shortage and a negative temperature departure. In the Western Siberia region from April till the beginning of May NDVI was below 5-year average and previous year level. In May it increased reaching 5-year maximum. By the end of July NDVI was at 5-year average level. This pattern is close to the Middle Siberia region with higher rainfall shortage and positive biomass departure.

In **Amur Krai, North Caucasus** and **Eastern Siberia** regions the rainfall was up to 11% above average. The RADPAR shortage (-1% compared to average) combined with lower temperature (-0.4℃) and excessive rainfall resulted in 8% biomass reduction in Amur Krai. VCI was 0.97. CALF was about 100 %. From April till May NDVI in the Amur Krai was below 5-year average and previous year level. Then it increased up to 5-year average dropping again slightly in June.

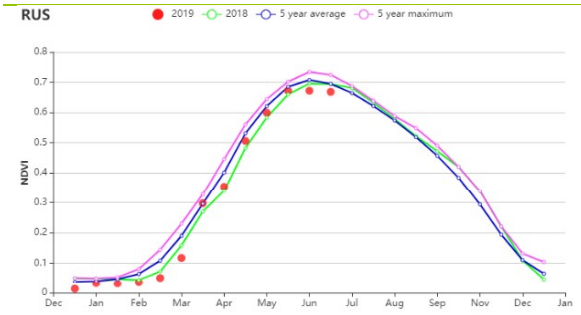
In the Northern Caucasus a weak temperature anomaly (+0.3℃) an average RADPAR (-1%) combined with higher rainfall resulted BIOMSS exceeding average by 4%. VCI was 0.89. CALF was 95 %. NDVI increased from the previous year level in April, which was slightly below 5-year average, to above 5-year average in May. By the end of May it dropped back to the level of the previous year and below 5-year average.

In Eastern Siberia RADPAR was 2% above average and BIOMSS was 3% below. VCIx reached 0.97 accompanied by full cropping (CALF about 100 %). NDVI was generally close to the level of previous year coinciding with 5-year average except in May. at the beginning of May it dropped below previous year's level and in July it reached 5-year maximum.

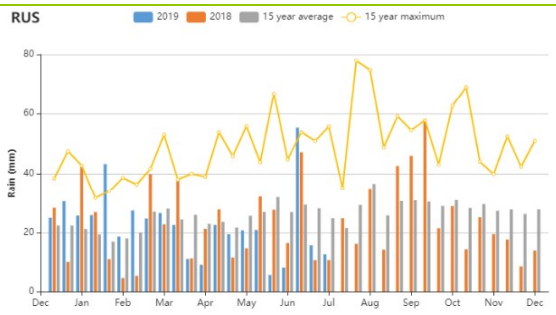
Figure 3.37. Russia's crop condition, April-July 2019



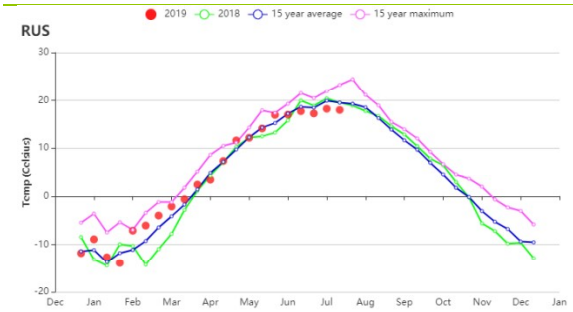
(a) Phenology of major crops



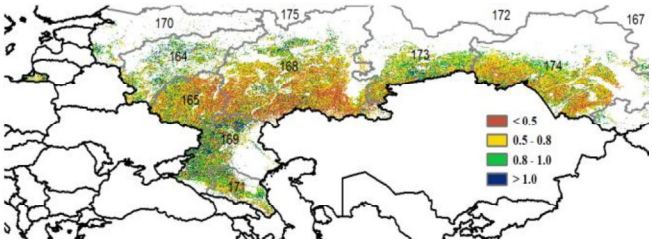
(b) Crop condition development graph based on NDVI



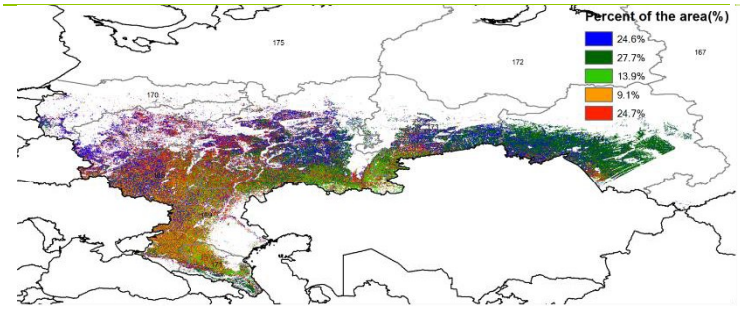
(c) Time series of rainfall for Russia



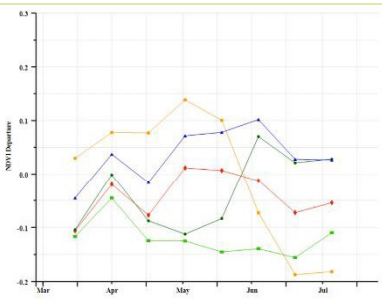
(d) Time series temperature profile for Russia



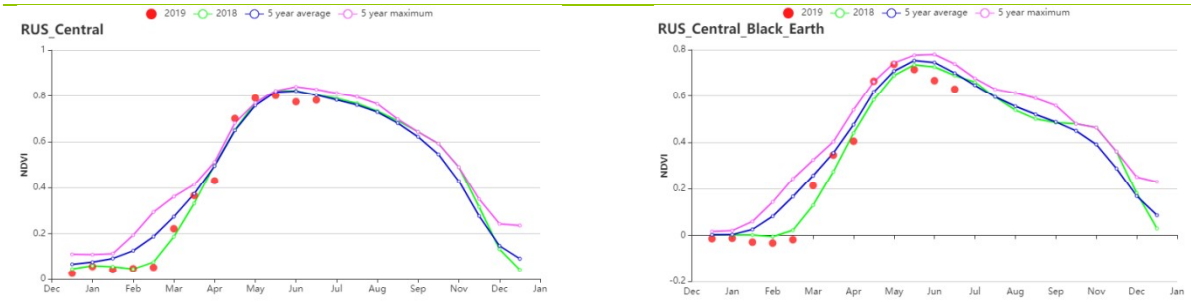
(e) Maximum VCI



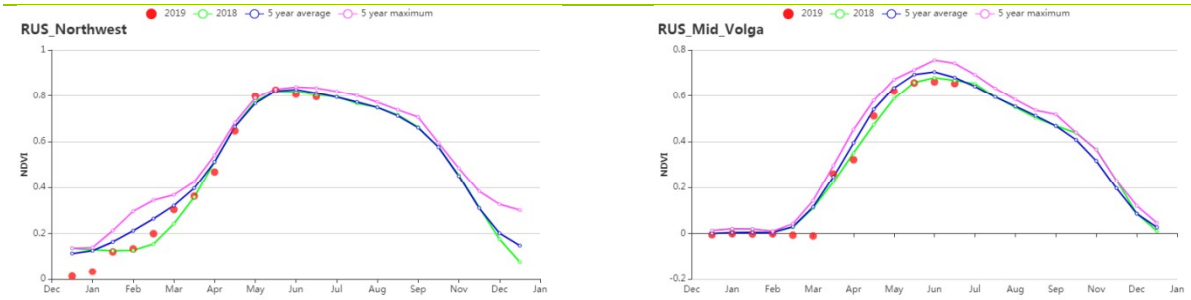
(f) Spatial NDVI patterns compared to 5YA



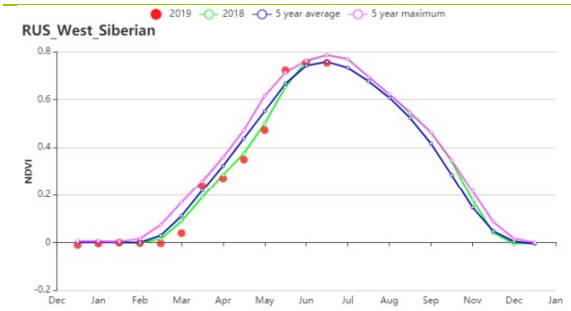
(g) NDVI profiles

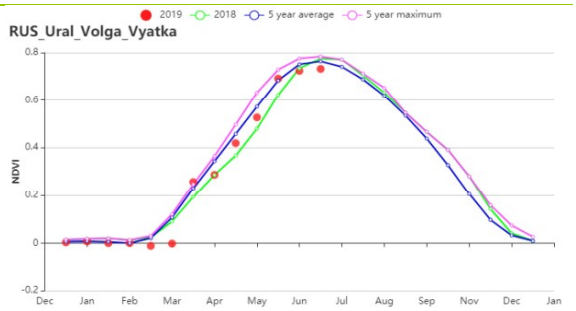


(h) Crop condition development graph based on NDVI in Central Russia (left) and the central Black Soils area (right))

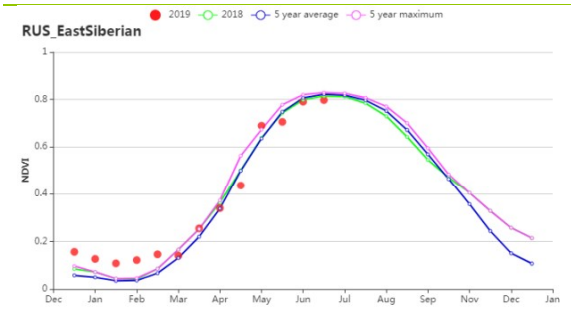


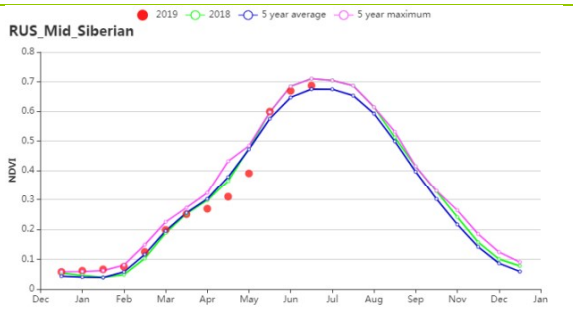
(i) Crop condition development graph based on NDVI the north-western Region including Novgorod (left) and the Middle Volgan (right))



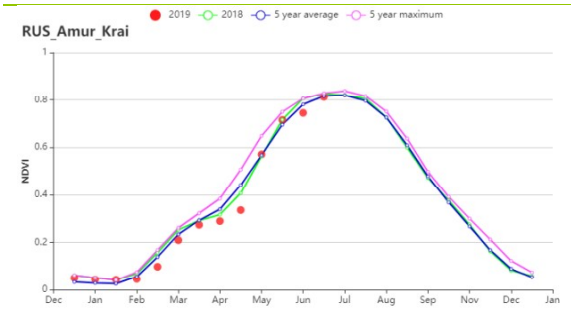


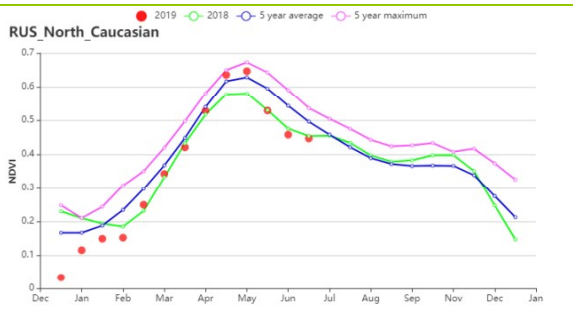
(j) Crop condition development graph based on NDVI in the Western Siberia (left) and the Ural-Volga-Vyatka region (right)



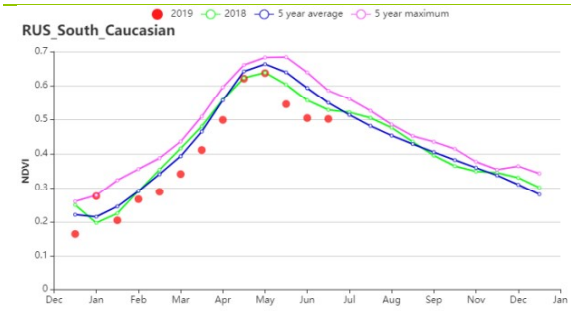


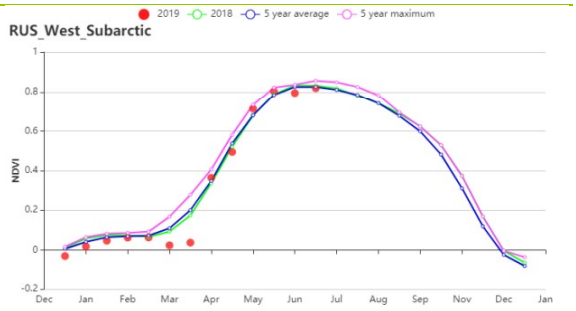
(k) Crop condition development graph based on NDVI in the Eastern Siberia (left) and the Middle Siberia (right)





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





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

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

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (℃)	Departure from 15YA (℃)	Current (MJ/m^2)	Departure from 15YA (%)
Amur and Primorsky Krai	375	11	12.9	-0.4	1183	-1
Central Russia	291	-15	12.8	0.1	1096	2
Central black soils area	283	-8	14.9	0.3	1202	3
Eastern Siberia	440	0	11.7	0.2	1142	2
Middle Siberia	227	-18	10.3	-0.1	1280	3
Middle Volga	242	-21	13.2	-0.3	1145	1

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (℃)	Departure from 15YA (℃)	Current (MJ/m^2)	Departure from 15YA (%)
North-west Region including Novgorod	253	-20	12.1	0.1	1104	4
Northern Caucasus	300	2	17.9	0.3	1299	-1
South Caucasian	428	-17	15.7	0.8	1312	3
Subarctic region	-	-	-	-	-	-
Ural and western Volga region	233	-18	12.1	-0.5	1113	3
Western Siberia	262	-8	11.5	-1.2	1154	1
West subarctic region	225	-28	9.7	-0.6	933	-3

Table 3.66. Russia's agronomic indicators by sub-national regions, current season's values and departure, April-July 2019

Region	BIOMSS		Cropped arable land fraction		Maximum VCI
	Current (gDM/m^2)	Departure from 15YA (%)	Current	Departure from 5YA (%)	Current
Amur and Primorsky Krai	432	-8	100		0.97
Central Russia	407	0	100		0.97
Central black soils area	509	4	100		0.95
Eastern Siberia	389	-3	100		0.97
Middle Siberia	416	1	97		0.93
Middle Volga	451	-3	97		0.88
North-west Region including Novgorod	390	2	100	0	0.98
Northern Caucasus	648	4	95		0.89
South Caucasian	583	8	97		0.89
Subarctic region	-	-			
Ural and wetsrn Volga region	419	0	99		0.90
Western Siberia	413	-6	100		0.94
West subarctic region	292	-12	100		0.98

[THA] Thailand

During this monitoring period, the main rice was sown, and the harvest of the second rice was completed in June. Nationwide Thailand suffered a stressful period due to significantly below-average rainfall (RAIN, -23%), warm temperature (TEMP, +0.4℃), and increased sunshine (RADPAR, +8%). This led to a significant increase in biomass production potential (BIOMSS up 8%) as sunshine is often limiting for irrigated crops. As shown in the profile of rainfall, the deficit of rainfall mostly occured in June and July. The NDVI development graph shows that crop condition was slightly below average. According to the NDVI departure clustering map, 40.4 % of cropland was slightly above average mostly located in northern, central and eastern areas. 7.2% of cropped area mostly located in south (including Krabi, Trang, Satun, Nakhon Si Thammarat and Surat Thani) was slightly below average except abnormal low values in June. Crop condition in rest of cropland in Thailand was slightly below average. Altogether, the crop condition is anticipated to be slightly below but close to average.

Regional analysis

The regional analysis below focuses on some agro-ecological zones of Thailand, mostly defined by the rice cultivation typology. They include the 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.

The situation in the **Central double and triple-cropped rice lowlands** follow the same patterns as those for the country as a whole: temperature (TEMP +0.6ºC) and radiation (RADPAR +6%) were above average, and accumulated rainfall was significantly below (RAIN -22%), nevertheless resulting in above average biomass production potential (BIOMSS +8%). According to the NDVI development graph, crop condition fluctuated around the 5-year average. Considering the favorable maximum VCIx value of 0.83, the situation is assessed as slightly below but close to average.

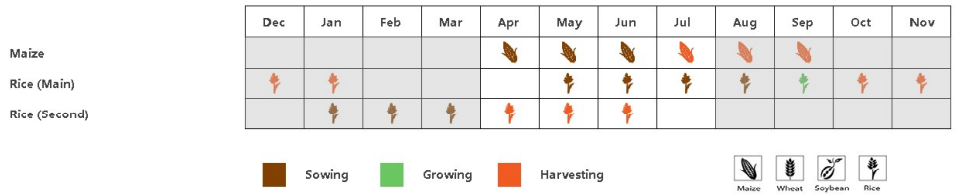
According to agro-climatic indicators for the **South-eastern horticulture area**, accumulated rainfall (RAIN -16%) was below average, while temperature (TEMP +0.4 ºC) and sunshine radiation (RADPAR +3%) were slightly above average, resulting in a slightly above-average biomass production potential (BIOMSS +4%). Crop condition was slightly below average but above average in the middle of May and June according to the NDVI development graph. Considering the favorable VCIx value of 0.94, the crop condition in this area was slightly below average.

The **Western and southern hill area** suffered drier weather than the country as a whole. The rainfall significantly decreased by 34% compared with average, while temperature (TEMP +0.8ºC), radiation (RADPAR +8%) were above average, leading in a slightly above-average biomass production potential in Thailand (BIOMSS +6%). Nonetheless, according to the NDVI development graph, the crop condition in this area was below average. Altogether, the situation in this area was unfavorable

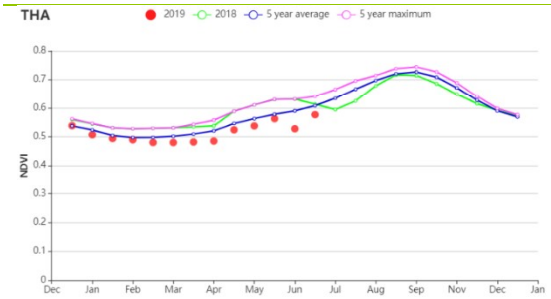
Indicators in the **Single-cropped rice north-eastern region** follow the same patterns as those for the country as a whole: temperature (TEMP +0.5ºC) and radiation (RADPAR +11%) were above average, and accumulated rainfall was significantly below (RAIN -14%), resulting in biomass production potential increase (BIOMSS +11%). According to a fair VCIx value of 0.88, the crop condition was slightly below but close to average, which is confirmed by the NDVI profiles and development graph.

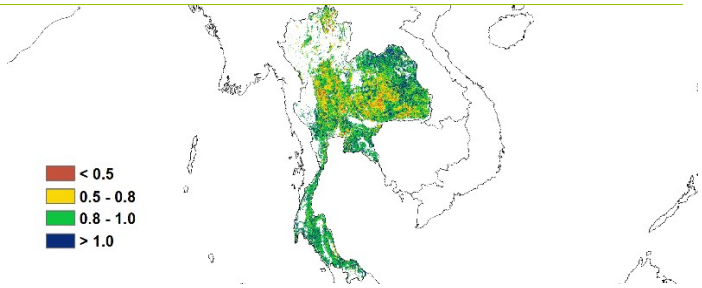
At the national level, most arable land was cropped during the season and had favorable VCIx values around 0.89. CropWatch anticipates that crop condition was slightly below but close to average.

Figure 3.38. Thailand's crop condition, April - July 2019

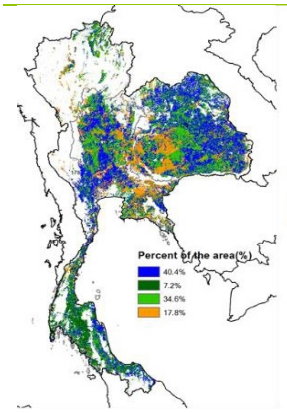


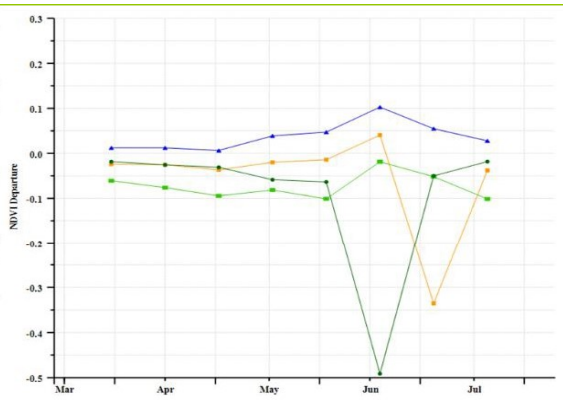
(a) Phenology of major crops



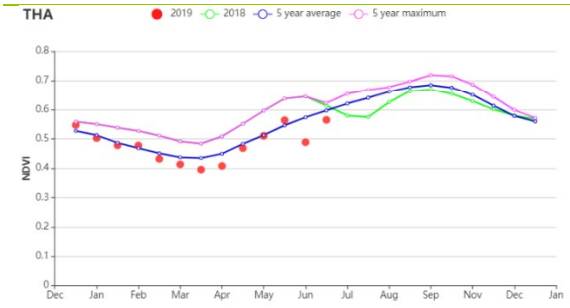


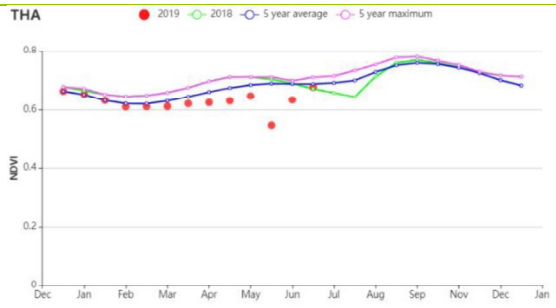
(b) Crop condition development graph based on NDVI (c) Maximum VCI



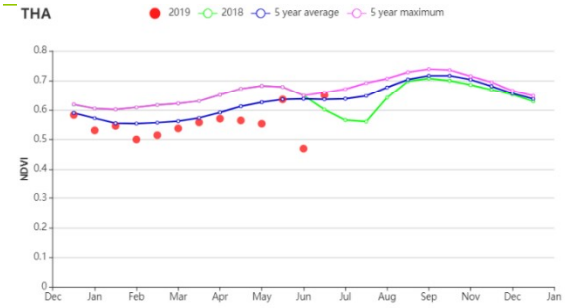


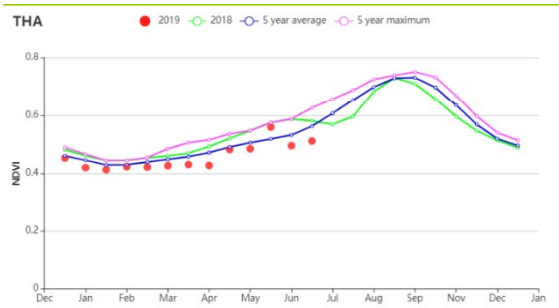
(d) Spatial NDVI patterns compared to 5YA (e) NDVI profiles





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





(g) 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, April - July 2019

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (℃)	Departure from 15YA (℃)	Current (MJ/m^2)	Departure from 15YA (%)
Central double and triple-cropped rice lowlands	557	-22	28.7	0.6	1221	6
South-eastern horticulture area	902	-16	27.6	0.4	1272	3
Western and southern hill areas	591	-34	26.5	0.8	1289	8
Single-cropped rice north-eastern region	848	-14	28.2	0.5	1232	11

Table 3.68. Thailand's agronomic indicators by sub-national regions, current season's values and departure, April - July 2019

Region	BIOMSS		Cropped arable land fraction		Maximum VCI
	Current (gDM/m^2)	Departure from 15YA (%)	Current (%)	Departure from 5YA (%)	Current
Central double and triple-cropped rice lowlands	828	8	98	0	0.83
South-eastern horticulture area	872	4	98	0	0.94
Western and southern hill areas	833	6	99	-1	0.92
Single-cropped rice north-eastern region	840	11	97	-1	0.88

[TUR] Turkey

The monitoring period covers the sowing and growth of maize and rice, while the harvesting of wheat was almost concluded by the end of July. Nationwide, RAIN was above average (+17%), and both TEMP and RADPAR were slightly below. The favorable agro-climatic conditions led to average BIOMSS. The NDVI profiles indicate below average crop condition in the whole country, after an early decrease due to the high temperature in late May to June. High temperature accelerated the maturity of winter crops and may have affected yield formation. The national average VCIx was 0.86, but northern coastal and south-eastern provinces like Mardin and Sanliurfa experienced very promising VCIx values above 1.0: crops over those regions outperformed the best recent conditions. Central and eastern provinces such as Ankara, Konya and Nevsehir presented low VCIx (< 0.5) which indicates below average crop condition. NDVI spatial departure clustering analysis confirms the spatial pattern of the above mentioned crop condition. Below average NDVI concentrated in central and Eastern regions, while above average NDVI occurred mainly in central and southeastern regions. Overall crop condition did not reach the same level as the previous years.

Regional analysis

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

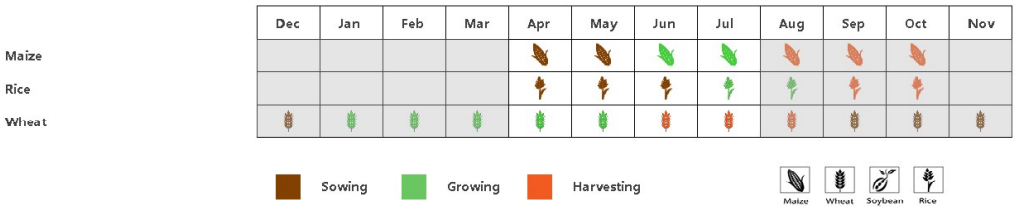
In **the Black Sea zone**, crop condition was generally below average except for late June. The temperature and rainfall were close to and above average, respectively (TEMP +0.1℃, RAIN +22%), and the radiation (RADPAR) decreased by 1%. The cropped arable land fraction was 0.98. The average value of VCIx was high at 0.95. The VCIx map shows that most of this region enjoyed VCIx higher than 1.0. The excellent crop condition is also confirmed by the spatial NDVI patterns map.

During this reporting period, the crop condition was below average until middle July in **the Central Anatolian plateau**. The rainfall （RAIN, +21%）was abundant, but TEMP was 0.2℃ below the average, resulting in a slight decrease of BIOMSS index (-1%). The average VCIx for this region was 0.83. The cropped land increased (CALF up 4%); condition is assessed as fair to average.

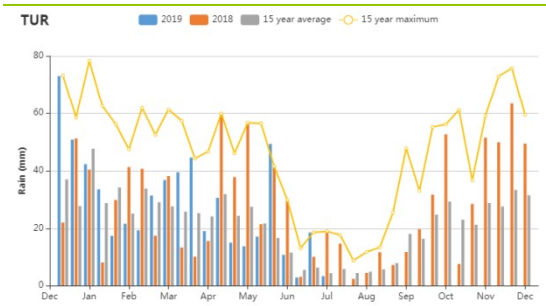
In **Eastern Anatolia**, crop condition was generally below average. TEMP was 0.2℃ below the average. Although rainfall was slightly above average (RAIN +1%), but accumulated rainfall during the monitoring period was only 296 mm, the amount of which wasn't sufficient for the normal growth and development of crops. The unfavorable climate condition led to the decrease of biomass (BIOMSS -1%). The CALF decreased slightly compared to the average. With VCIx at 0.83, crops are average at best.

As indicated by the NDVI profile, in **the Marmara Aegean Mediterranean lowland zone**, the crop condition was the best compared to the 5-year average among the four AEZs. The temperature was slightly below average (TEMP -0.4℃), and so was sunshine (RADPAR −1%). VCIx was 0.88 and CALF is up 5%, the largest increase among the four AEZs. Output is expected to be average.

Figure 3.39. Turkey's crop condition, April - July 2019

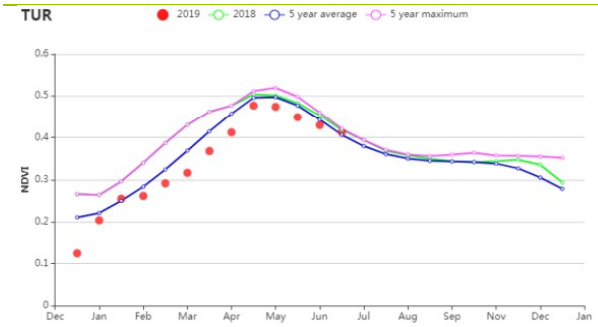


(a) Phenology of major crops



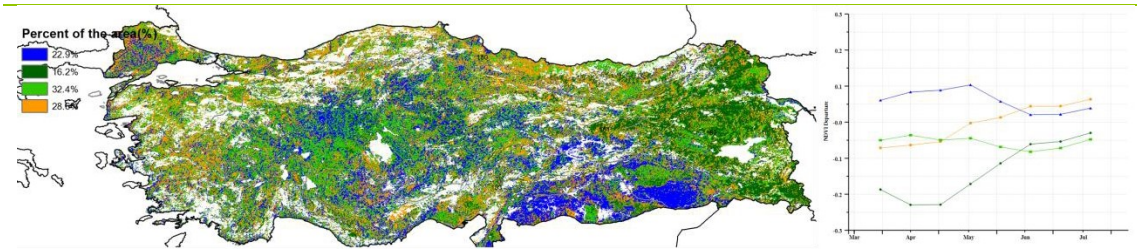
(b) Time series of RAIN

(c) Time series of TEMP



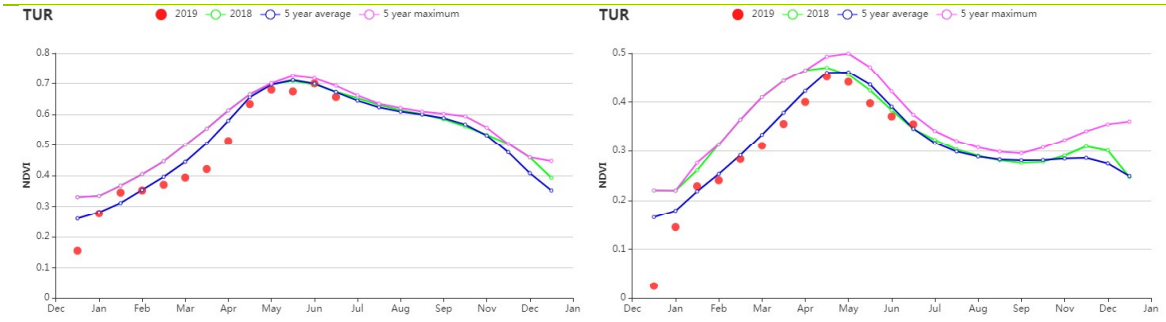
(d) Crop condition development graph based on NDVI

(e) Maximum VCI

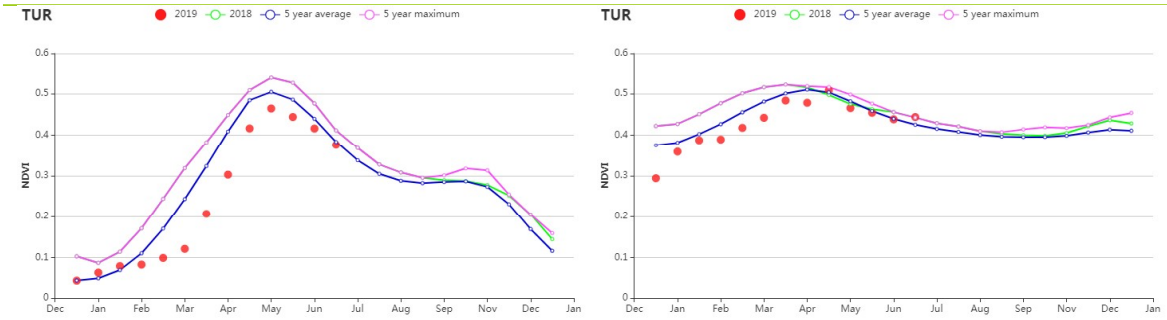


(f) Spatial NDVI patterns compared to 5YA

(g) NDVI profiles



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



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

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

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (℃)	Departure from 15YA (℃)	Current (MJ/m^2)	Departure from 15YA (%)
Black Sea region	448	23	13	0.1	1305	-1
Central Anatolia region	241	21	15	-0.2	1464	-1
Easternl Anatolia region	296	1	14	-0.2	1542	2
Marmara Agean Mediterranean lowland region	212	25	19	-0.4	1515	-1

Table 3.70. Turkey's agronomic indicators by sub-national regions, current season's values and departure, April - July 2019

Region	BIOMSS		Cropped arable land fraction		Maximum VCI
	Current (gDM/m^2)	Departure from 15YA (%)	Current (%)	Departure from 5YA (%)	Current
Black Sea region	480	2	98	0	0.95
Central Anatolia region	559	-1	65	4	0.83
Easternl Anatolia region	453	-1	80	0	0.85
Marmara Agean Mediterranean lowland region	593	1	82	5	0.88

[UKR] Ukraine

Between April and July, maize and winter wheat are the major crops in the field. Maize was planted in May and winter wheat was harvested in July.

Rainfall was above average (338 mm, +15%) with both TEMP and RADPAR approximately average. Most cropland was cultivated (CALF 100%) and maximum vegetation condition index (VCIx) reached to 0.96. As a result, potential biomass increased to 584g DM/m², 6% above average.

At the national level, NDVI was generally close to 5-year-average, even if June and July were slightly below. 18.7% of cropland concentrated in the South and East dropped dramatically in June and July. Mostly in the West, NDVI rose in June (24.3% of cropland). VCIx was above 0.8 in most areas with low values below 0.5 occurring only around Odessa. On the whole, crop condition was favorable.

Regional analysis

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

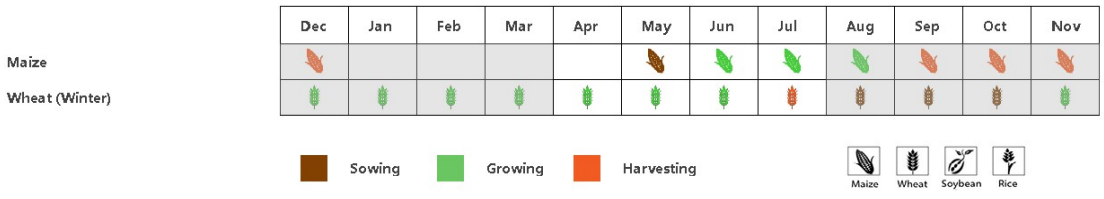
The **Central wheat area** had sufficient rainfall (327mm,+16% compared with average) while no significant change occurred for temperature (16.4℃,+0.4℃) and radiation (RADPAR 1250MJ/m2,+2%). The BIOMASS (587 g DM/m2) increased 6%, and the CALF reached 100% with a favorable VCIx (0.96).

The **Northern wheat area** received 398 mm of rainfall, +27% compared to but both TEMP and RADPAR were closer to average (15.5℃, up 0.3℃; 1210 MJ/m2, 3% higher than the average). Because of favorable conditions, the BIOMASS indicator reached 538 g DM/m2, 7% above average. The CALF was 100% and maximum VCIx was 0.97. Overall crop prospects are favorable.

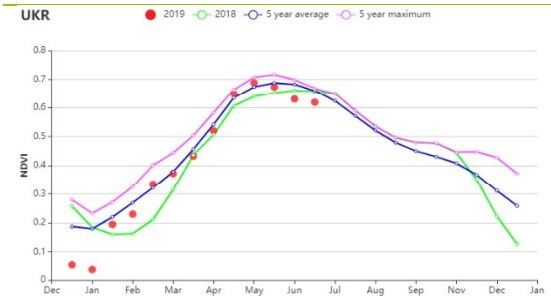
The conditions in the **Eastern Carpathian hills** differed little from those in the previous two AEZs: adequate rainfall (474mm,+12%), normal temperature (14.3℃, +0.1℃) and RADPAR (1203MJ/m2, 0%), good CALF (100%) and VCIx at 0.96. Resulting from favorable agro-climatic and agronomic condition, BIOMASS reached 523g DM/m², +4% above average.

The **Southern wheat and maize area** had normal rainfall (243mm) and RADPAR (1283MJ/m2,+1%) and slightly above average temperature (17.8℃, +0.5℃) and RADPAR. With CALF at 100%, favorable VCIx value at 0.95 and a biomass production potential up 6%, a good crop is expected.

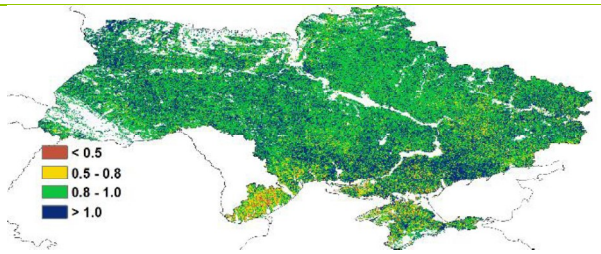
Figure 3.40. Ukraine crop condition, April - July 2019



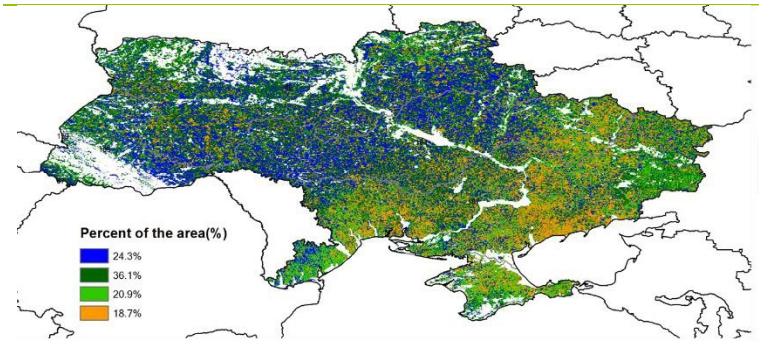
(a) Phenology of major crops



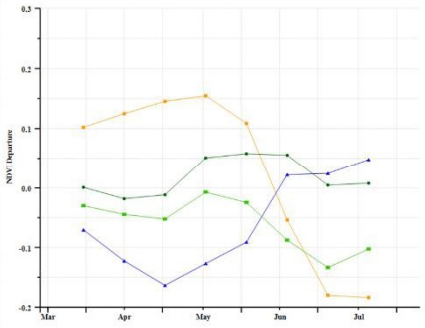
(b) Crop condition development graph based on NDVI



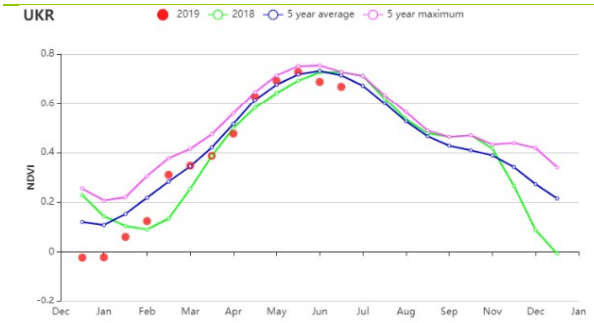
(c) Maximum VCI

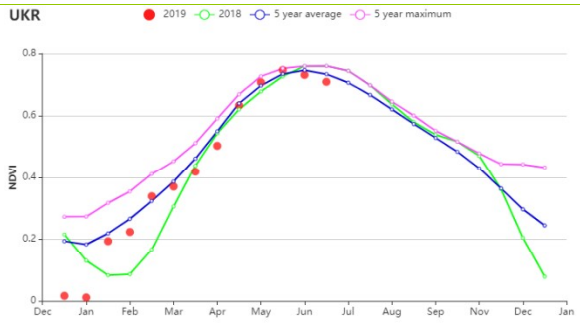


(d) Spatial NDVI patterns compared to 5YA

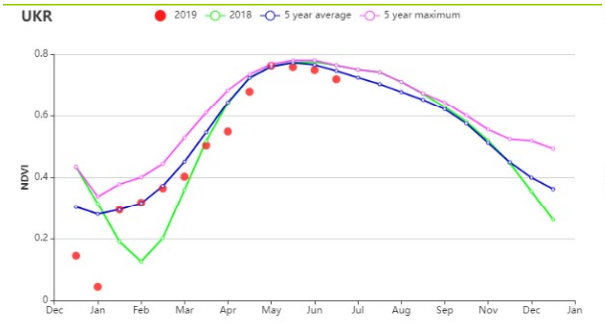


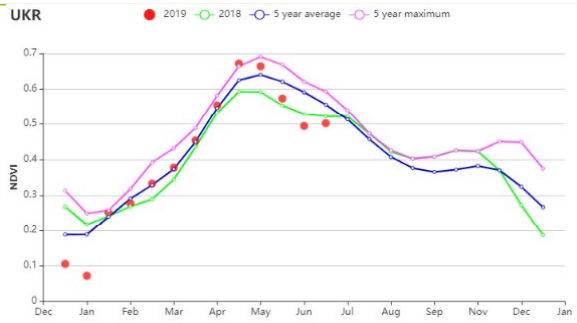
(e) NDVI profiles





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





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

Table 3.71. Ukraine agroclimatic indicators by agroecological zones, current season values and departure from 15YA, April- July 2019

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (℃)	Departure from 15YA (℃)	Current (MJ/m^2)	Departure from 15YA (%)
Central wheat area (Ukraine)	327	16	16.5	0.4	1250	2
Northern wheat area (Ukraine)	398	27	15.5	0.3	1210	3
Eastern Carpathian hills (Ukraine)	474	12	14.3	0.1	1203	0

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (℃)	Departure from 15YA (℃)	Current (MJ/m^2)	Departure from 15YA (%)
Southern wheat and maize area (Ukraine)	243	0	17.8	0.5	1283	1

Table 3.72. Ukraine agronomic indicators by agroecological zones, current season values and departure from 5YA/15YA, April- July 2019

Region	BIOMSS		Cropped arable land fraction		Maximum VCI
	Current (gDM/m^2)	Departure from 15YA (%)	Current (%)	Departure from 5YA (%)	Current
Central wheat area (Ukraine)	587	6	100	0	0.96
Northern wheat area (Ukraine)	538	8	100	0	0.97
Eastern Carpathian hills (Ukraine)	500	4	100	0	0.96
Southern wheat and maize area (Ukraine)	645	6	100	0	0.95

[USA] United States

April to July covers the late growth and harvesting season of winter wheat, the whole cycle of spring wheat and the key growing stages of maize, soybean, rice and cotton. In general, above average crop growth conditions were observed in the Great Plains, while expectations in the corn belt are significantly below the average due to fallowed cropland.

Globally, the indicators describe wet and cool conditions, with 29% above average rainfall, 0.5℃ lower temperature and 2% below average radiation. Maize, soybean, spring wheat, and rice benefited from replenished soil moisture. With the exception of dry conditions in Washington State (RAIN down 12%), the precipitation was above average in other major crop producing states, especially in Corn Belt: Indiana (+25%), Illinois (+46%), Iowa (+40%), Michigan (+16%), Minnesota (+30%), Missouri (+45%), Ohio (+8%) and Wisconsin (+21%). Abundant precipitation was accompanied by low temperature and a decrease in the amount of photosynthetically active radiation. The temperature drop exceeded 0.5℃ in many states the sunshine deficit varied between 1% and 6%.

The USA displays a complex mix of crop condition when assessed by the maximum vegetation condition index (VCIx) and spatial distribution of NDVI profiles. Above average crop condition with high value of VCIx and positive departure of NDVI was observed in the Great Plains, covering major winter wheat and sorghum zones in the southern Great Plains and spring wheat zones in Northern Great Plains. Some important maize and soybean zones of the United States had significantly below average crop development (VCIx lower than 0.5), including the eastern Corn Belt (from Illinois to Ohio) and Arkansas. The area most affected from May to July covers central Indiana to north-west Ohio. CropWatch compared the NDVI difference between June to July in 2018 and 2019 based on sentinel-2 data: most fallow land was distributed in Indiana and Ohio, with limited patches in north-eastern Illinois (Naperville) and SW Illinois.

CropWatch estimates that 2019 wheat production will increase, while corn and soybean production will be down in 2019.

Regional analysis

Crop condition in the most important maize and soybeans production area of United States was obviously below average. High rainfall (34% above average) combined with low sunshine (RADPAR down 6%) and temperature (1.0℃ below average) resulted in a potential biomass drop of 9%. In addition, a lot of fallow land was to be found in the eastern of **Corn Belt**, especially in the region from Illinois and Indiana to Ohio, an important soybean production zone. The combination of poor yield with reduced is bound to result in a large loss of crop production in this year.

Mississippi, the major rice producer in the USA is also an important maize and soybeans supplier. Crop condition was below average. The rainfall was significantly above average (up 51%), while temperature and radiation were below average (-0.5℃ and -3%, respectively). Changes in precipitation, temperature and radiation result in 1% reduction in potential biomass. In this the maximum vegetation index reached to 0.93, indicating satisfactory crop condition. Some fallow land was observed from the north to the south along the Mississippi river, especially in the region between the **southern part of Illinois and eastern part of Arkansas**. Considering the increase of fallow land, below average production can be expected in this region.

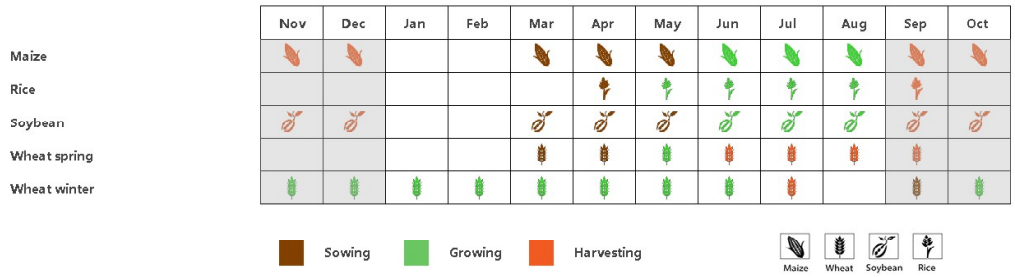
Northern Plains is the most important spring wheat producer of the United States, with crop condition significantly above the maximum of the last 5 years. During the growing season, rainfall was 40% above average, while the temperature and radiation were down 1.6℃ and 5%, respectively. The NDVI profile indicates the reached its best condition in June, especially in the region from Dickinson to Bismarck in North Dakota. VCIx at 0.96 confirms the favorable crop condition. Since spring wheat has now reached maturity and CropWatch assesses the crop as above average.

Southern Plains is one of the main winter wheat, cotton, and sorghum producers of the United States.

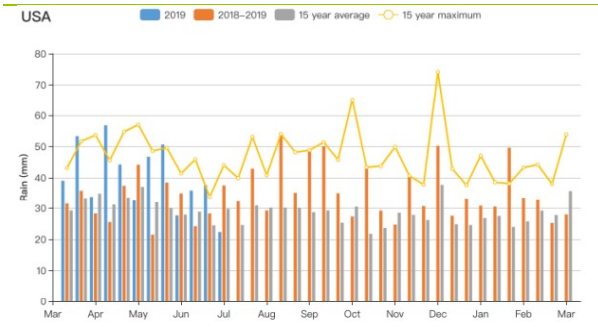
Crop condition significantly exceeded the 5 years average. Rainfall was 43% above average, while the temperature and radiation were 1.1℃ and 2% below, respectively, resulting in average BIOMSS (-1%). The above 5YA NDVI dropped below average at the time of harvest. The maximum vegetation index was 0.95, confirming the favorable crop condition. In the region of Northwest part of Texas, the major cotton zone of United States, VCIx was below average. Winter wheat, however, is nearing completion and above average crop production can be expected in 2019 in the Southern Plains.

The **South-east region** is another major cotton zone of United States, and crop condition is close to average. Wet and sunny conditions prevailed over the area with 23% above average rainfall, 0.4℃ higher temperature and 3% above average radiation. The good weather resulted in a potential biomass increase of 6%, with most crops in good condition (VCIx at 0.91). CropWatch assessed the production in the South-East as average.

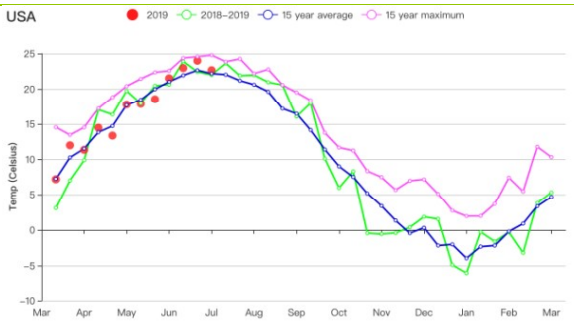
Figure 3.41. United States crop condition, April - July 2019



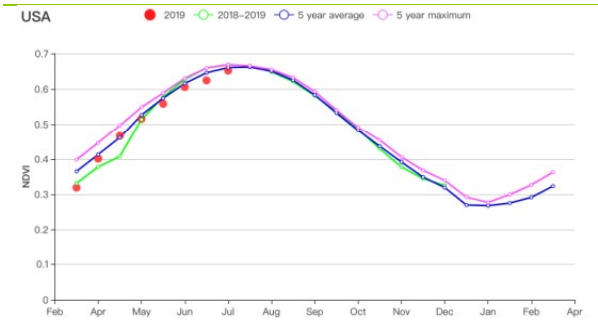
(a) Phenology of major crops



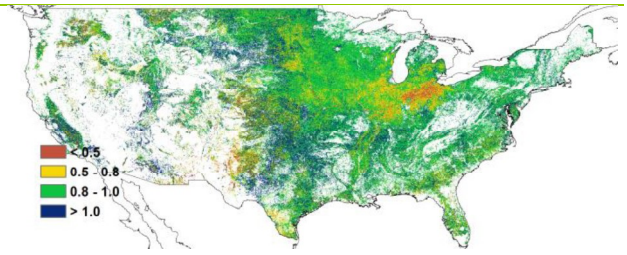
(b) Time series of RAIN



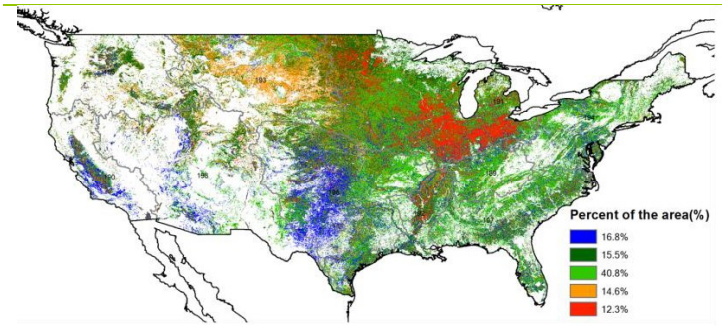
(c) Time series of TEMP

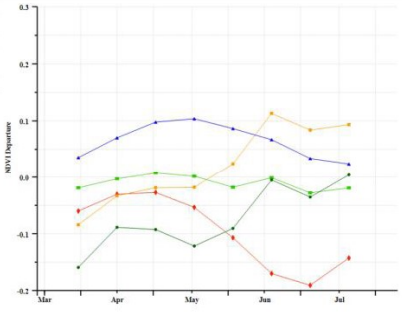


(d) Crop condition development graph based on NDVI



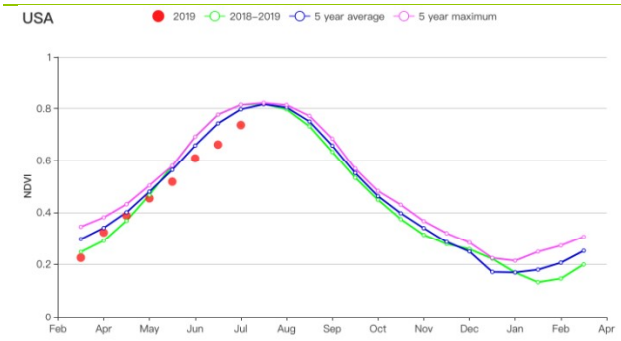
(e) Maximum VCI



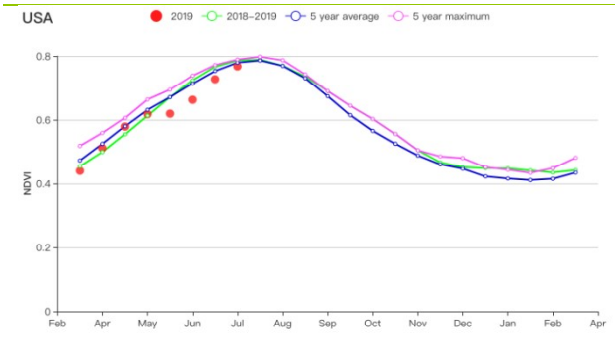


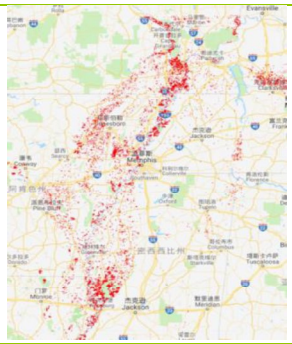
(f) Spatial NDVI patterns compared to 5YA

(g) NDVI profiles

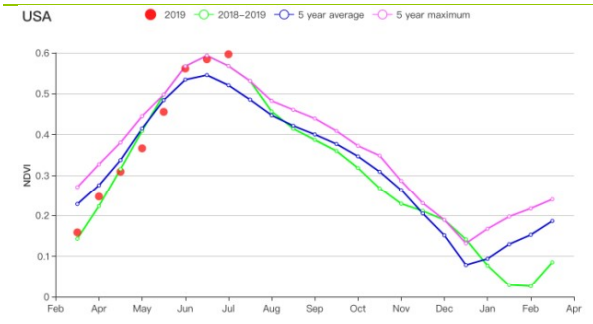


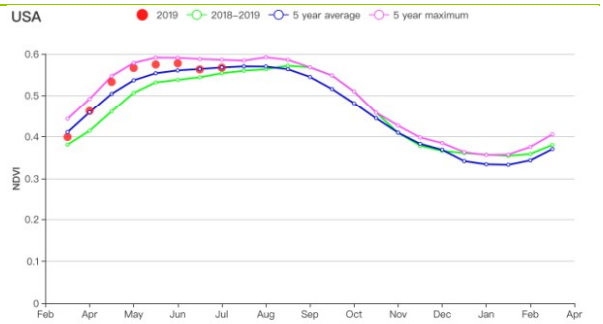
(h) Crop condition development graph based on NDVI of Corn Belt (left) and fallow land distribution (right))



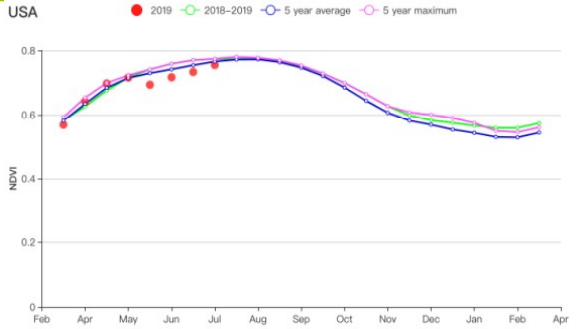


(i) Crop condition development graph based on NDVI of Lower Mississippi (left) and fallow land distribution (right)





(g) Crop condition development graph based on NDVI of Northern Plains (left) and Southern Plains (right)



(k) Crop condition development graph based on NDVI of South-east

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

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (℃)	Departure from 15YA (℃)	Current (MJ/m^2)	Departure from 15YA (%)
Blue Grass region	560	30	20.2	0.1	1332	-2
California	143	43	17.0	-0.3	1572	-3
Corn Belt	534	34	16.0	-1.0	1215	-6
Lower Mississippi	709	51	23.1	-0.5	1342	-3
North-eastern areas	480	9	16.3	0.2	1219	-1
Northwest	282	15	12.2	-0.2	1371	-2
Northern Plains	455	43	12.8	-1.6	1315	-5
Southeast	606	23	23.6	0.4	1423	3
Southwest	218	25	16.9	-1.0	1558	-2
Southern Plains	464	40	21.9	-1.1	1399	-2

Table 3.74. United States' agronomic indicators by sub-national regions, current season's values and departure, April - July 2019

Region	BIOMSS		Cropped arable land fraction		Maximum VCI
	Current (gDM/m^2)	Departure from 15YA (%)	Current (%)	Departure from 5YA (%)	Current
Blue Grass region	732	1	100	0	0.95
California	474	-2	83	18	1.05
Corn Belt	556	-9	100	0	0.86
Lower Mississippi	820	-1	100	0	0.93
North-eastern areas	555	2	100	0	0.96
Northwest	498	1	87	5	0.91
Northern Plains	509	-12	95	11	0.96
Southeast	879	6	100	0	0.91
Southwest	629	7	48	20	1.04
Southern Plains	800	-1	89	4	0.95

[UZB] Uzbekistan

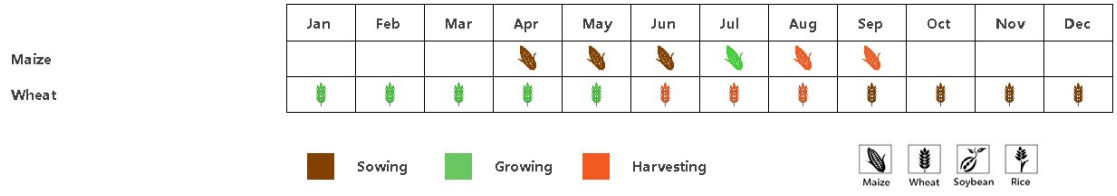
The reporting period covers the sowing and growing stages of maize and the growth and harvest of wheat. Crop condition was favorable. The national average VCIx was 0.99, and the cropped arable land fraction increased by 18%. Among the Crop Watch agro-climatic indicators, RADPAR was below average (-3%). TEMP was above average in late April and July and generally below during other months, resulting in a 0.5℃ drop for the whole period. RAIN reached 208 mm, more than double (+105%) the average (101mm). The BIOMSS index rose just 5%, being limited by sunshine. As shown by the NDVI development graph, crop condition was above the five-year average in April and slightly lower than average and close to the last year from late May to July. NDVI cluster graphs and profiles show that 57.2% of the agriculture areas had above five year average condition from April to May in most parts of the four eastern provinces (Namangan, Andijon, Quqon and Farghona), where most wheat is produced and in some parts of Guliston, Tashkent, Jizzakh, Samarqand, Nawoiy, Qarshi, Termez, Bukhoro, Urganch and Nukus provinces. Overall, crop condition was favorable.

Regional analysis

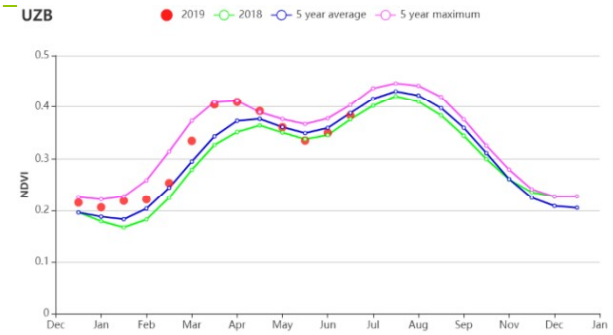
In the **Eastern hilly cereals region**, NDVI was above the five-year maximum in April and slightly below from June to July. RAIN was up 107% while TEMP and RADPAR were below average (-0.6℃ and -3%, respectively). The combination of the factors resulted in a small BIOMSS increase (+2%). The maximum VCI was 1.02, and the cropped arable land fraction increased by 24% compared to the recent five-year average. Overall crop prospects are favorable.

The **Aral Sea cotton region**, Crop condition was close to the five-year average in early April and late June and slightly below in other period. Accumulated rainfall and TEMP were above average (37% and 0.6℃) but sunshine dropped (RADPAR -2%). The BIOMSS index increased by 16% compared to average. The maximum VCI index was 0.89 and the fraction of cropped arable land (CALF) dropped 15% compared to the previous five years. Yields may be fair but production is down due to low CALF.

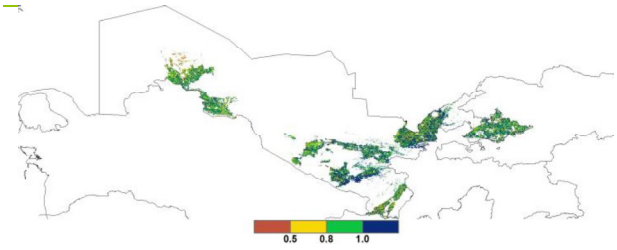
Figure 3.42. Uzbekistan's crop condition, April - July 2019



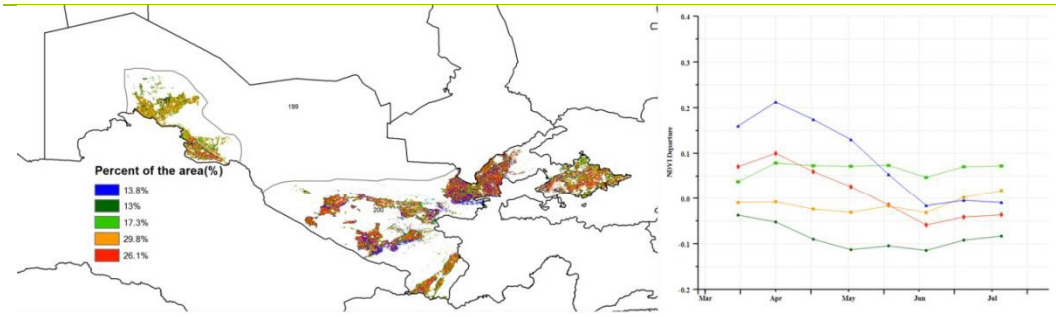
(a) Phenology of major crops



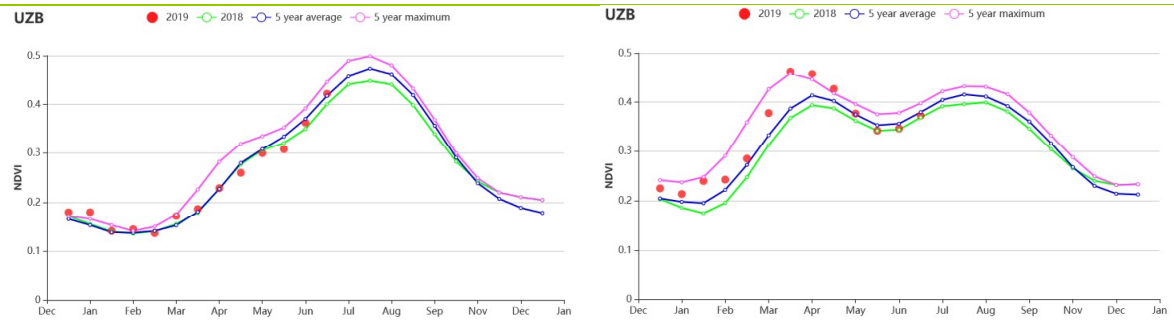
(b) Crop condition development graph based on NDVI



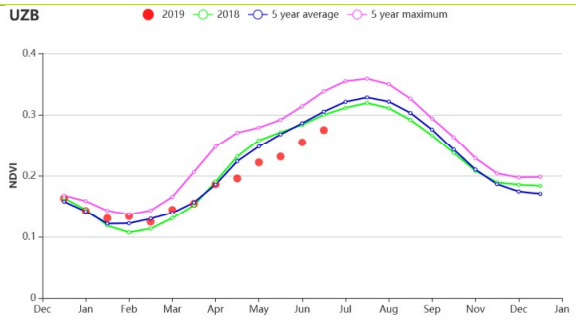
(c) Maximum VCI



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



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



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

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

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (℃)	Departure from 15YA (℃)	Current (MJ/m^2)	Departure from 15YA (%)
Eastern hilly cereals zone	228	107	22.0	-0.6	1525	-3
Aral Sea cotton zone	36	37	25.4	0.6	1501	-2
Central region with sparse crops	46	38	24.9	0.1	1483	-4

Table 3.76. Uzbekistan's agronomic indicators by sub-national regions, current season's values and departure, April - July 2019

Region	BIOMSS		Cropped arable land fraction		Maximum VCI
	Current (gDM/m^2)	Departure from 15YA (%)	Current (%)	Departure from 5YA (%)	Current
Eastern hilly cereals zone	532	-2	79	24	1.02
Aral Sea cotton zone	745	16	51	-15	0.89
Central region with sparse crops	634	6	5	-12	0.72

[VNM] Vietnam

The monitoring period includes the sowing of the 10th month rice and the harvesting of winter and spring rice; most rice is cultivated in the Red River Delta (north) and in the Mekong Delta in the south. Generally, compared with the average of the past five years and the average of the same period last year, the crop condition in Vietnam was significantly lower, except in May and June. The initial NDVI value was close to the average, but was affected by large fluctuations after May. CropWatch agro-climatic indicators show reduced precipitation (-18%), average temperature (0.6℃), but with enough RADPAR (+7%), high CALF (97%) and VCIx (0.95), the BIOMSS (+8%) showed a marked increase. Overall crop condition in the country is average or above.

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.

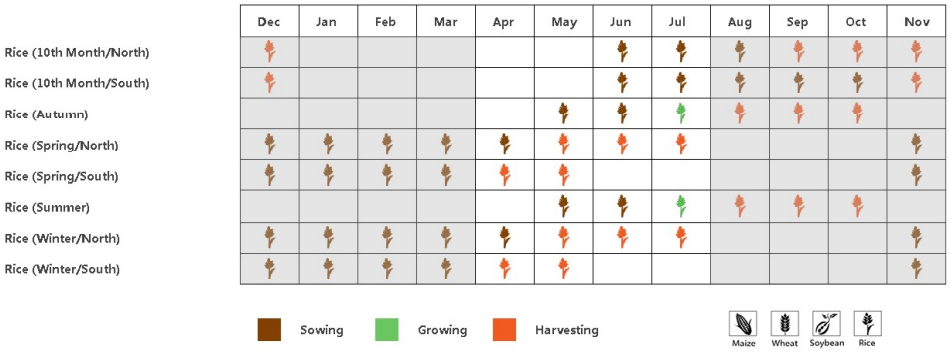
The **Northern zone with Red river Delta** recorded below average - but still largely sufficient rainfall - (RAIN -22%) while sunshine increased (RADPAR +3%). With high temperature (TEMP +0.9℃ anomaly), CALF at 99% and VCIx at 0.95, the BIOMSS increased 6% compared to the average. The NDVI development graph showed an unstable trend with all values below the 5 years average. Based on the agro-climatic indicators and NDVI development graph, output is likely to be average or below.

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 -22%), high temperature (TEMP +1.1℃) and abundant sunshine (RADPAR +12%). BIOMSS is up 12% and VCIx (0.94) and CALF (+1.2%) describe fair to good condition. The crop condition development graph based on NDVI was below the 5 years average and close to 2018 values. Output is likely to be about average.

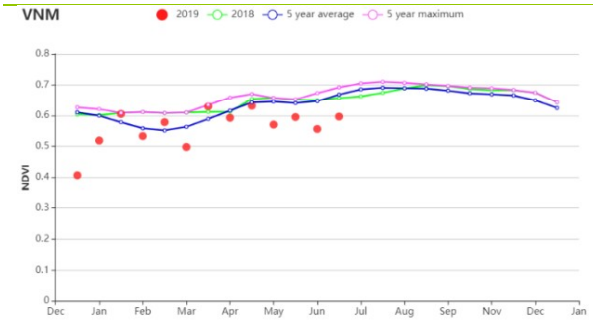
The **Southern zone with the Mekong Delta** recorded low RAIN (-12%) and above average RADPAR (+8%) and TEMP (+0.1℃). As a result BIOMSS increased by 8% compared with averages. VCIx was high (0.96) with CALF up 2% above the average. The crop condition development graph of NDVI also indicates mostly below average crop condition but above the value of 2018 in July. CropWatch expects about average production.

With crop condition in over 30.4% of the croplands about the average, crop prospects are expect to be close to average.

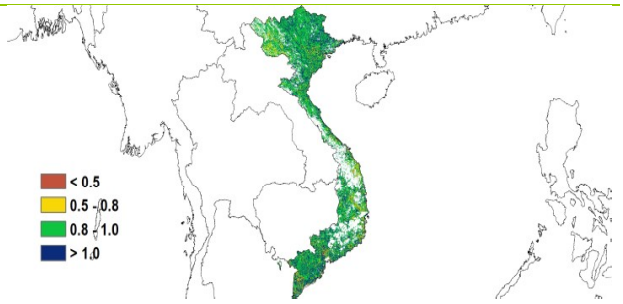
Figure 3.43. Vietnam's crop condition, April - July 2019



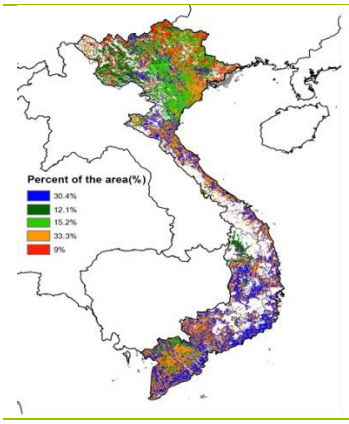
(a) Phenology of major crops

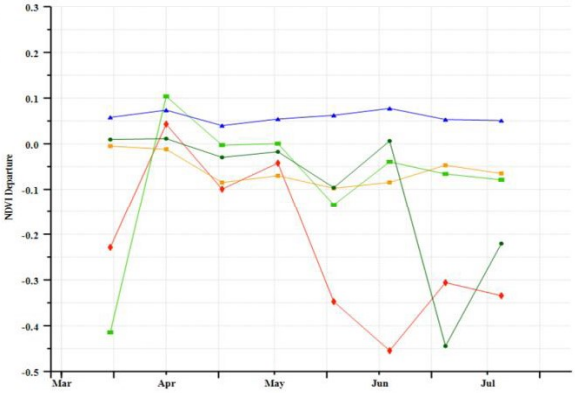


(b) Crop condition development graph based on NDVI



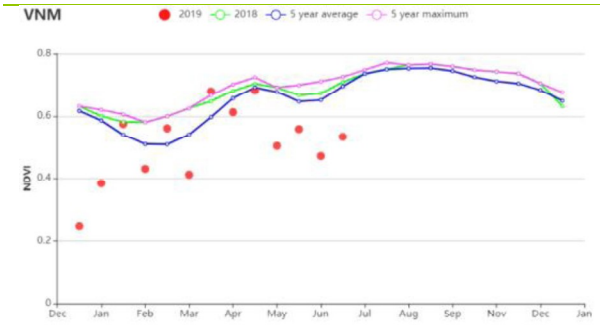
(c) Maximum VCI



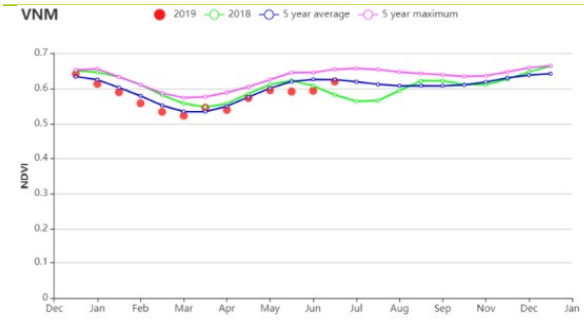


(d) Spatial NDVI patterns compared to 5YA

(e) NDVI profiles



(f) Crop condition development graph based on NDVI (Northern Vietnam (left) and Central Vietnam (right))



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

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

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (℃)	Departure from 15YA (℃)	Current (MJ/m^2)	Departure from 15YA (%)
North_Vietnam	1020	-22	25.0	0.9	1191	3
Central_Vietnam	672	-22	26.2	1.1	1326	12

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (℃)	Departure from 15YA (℃)	Current (MJ/m^2)	Departure from 15YA (%)
South_Vietnam	997	-12	25.9	0.1	1267	8

Table 3.78. Vietnam's agronomic indicators by sub-national regions, current season's values and departure, April - July 2019

Region	BIOMSS		Cropped arable land fraction		Maximum VCI
	Current (gDM/m^2)	Departure from 15YA (%)	Current (%)	Departure from 5YA (%)	Current
North_Vietnam	780	6	99	0.04	0.95
Central_Vietnam	860	12	98	1.2	0.94
South_Vietnam	838	8	93	2.0	0.96

[ZAF] South Africa

Summer crops such as maize and soybean were either at the end of their growing period or had already been harvested, while wheat was at sowing and early growth. The nationwide rainfall was 30% below the 15-year average except at the end of April, corresponds to the end of maize growing period, where the rainfall amount reached the maximum 15-year rains. The temperature was 0.4℃ above the 15-year average during the monitoring period and reached the maximum 15-year temperature in May and Jul, the beginning of the wheat season. The RADPAR was 4% above average and the BIOMSS potential fell 10% due to the reduction in rainfall. However, the NDVI graph indicates that the crop condition was above-average and at maximum 5-years values nationwide. The map of NDVI spatial distribution indicates in more details that the condition of only 46% of the cultivated area was above-average. 20% of cultivated areas were below the average at the end of April and then turned to be above the average. These regions were mostly located in Gert Sibande District in Mpumalanga province and Dr Ruth Segomotsi Mompati District in North West province.

The end of April also witnessed the change from above-average to below-average in 24% of the cultivated area; low values persisted until the end of July. These regions are mainly located in the west coast district in Western Cape province. 10% of sparse cultivated areas suffered below average NDVI values throughout the season. The maximum VCI map shows both moderate and satisfactory pixels, corresponding to 0.8 nationwide.

While little can be said for wheat at this early stage, maize suffered water stress and reduced output will ensue.

Regional analysis

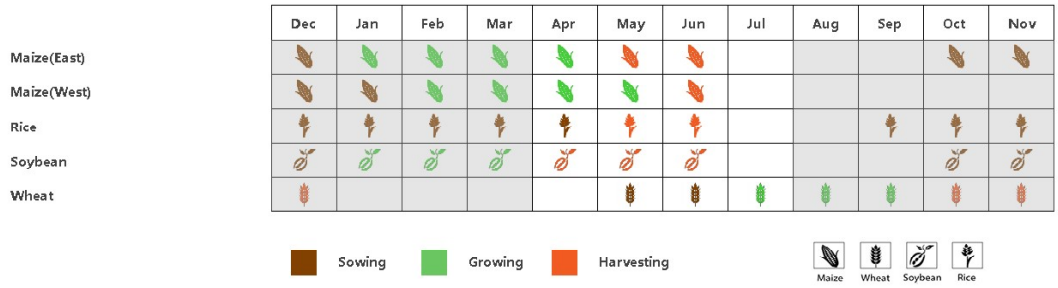
CropWatch adopts three agro-ecological zones (AEZs) relevant for crop production in South-Africa. The first zone is the **Humid Cape Fold mountains**; the second zone is the **Mediterranean zone**, while the third zone is the **Dry Highveld and Bushveld maize areas,** by far the most relevant zone in terms of food supply.

In the **Humid Cape Fold mountains,** the rainfall was 24% below average and the temperature was 0.6℃ above average. The time series rainfall profile of the zone confirmed the below-average rains along the monitoring period except at the end of April when the rainfall was above average. The time series profile of temperature indicated that values reached the 15-year maximum at the beginning and the end of the monitoring period. NDVI was above the 5-year average along the monitoring period. The estimated BIOMSS was 3% above the average and the CALF was up 2%. In addition, the maximum VCI was high (0.9).

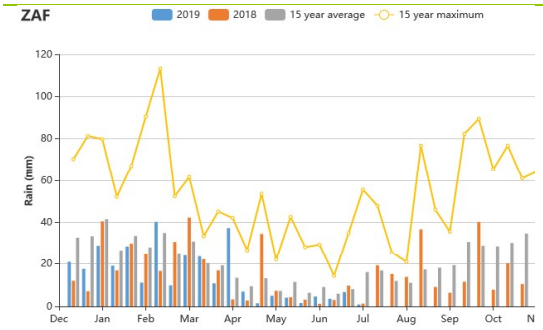
In the **Mediterranean zone,** the average rainfall was 17% below average except in some days between June and mid-July, when the rainfall was above-average according to the time series rainfall profile. This period corresponds to the sowing and starts growing of the wheat. Both RADPAR and BIOMSS were above average (+3% and +2%, respectively. Temperature was average (13.4℃) crop conditions as assessed by NDVI were above the average. Maximum VCI was low (0.4). While it is still early in the wheat season, the current wheat situation does not look promising.

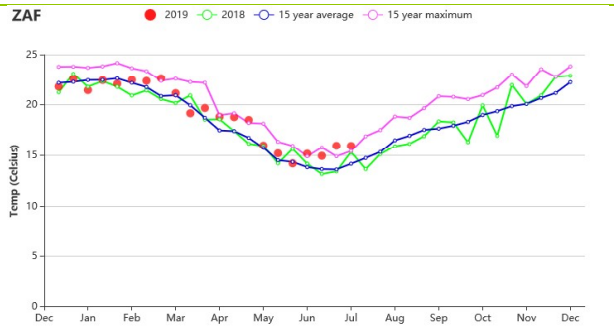
In **Dry Highveld and Bushveld maize areas**, the rainfall was 36 % below average with temperature up 0.3 ℃. The NDVI-based crop development graph for this zone showed above-average conditions during the period (April-July). The RADPAR was 5% above the average, while the BIOMSS was 16% below the average. The maximum VCI for the zone was high (0.9). Since crops have mostly been harvested by April, the current indicators apply but for sparse irrigated crops.

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

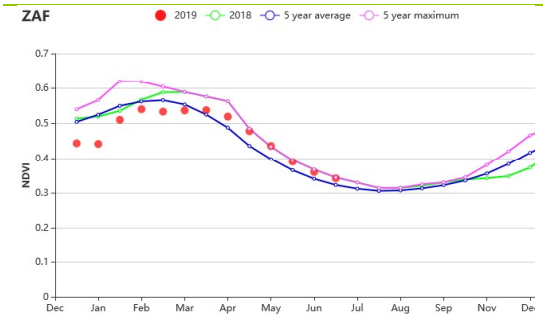


(a) Phenology of major crops

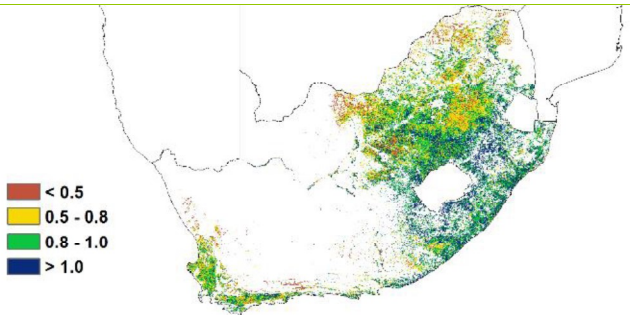




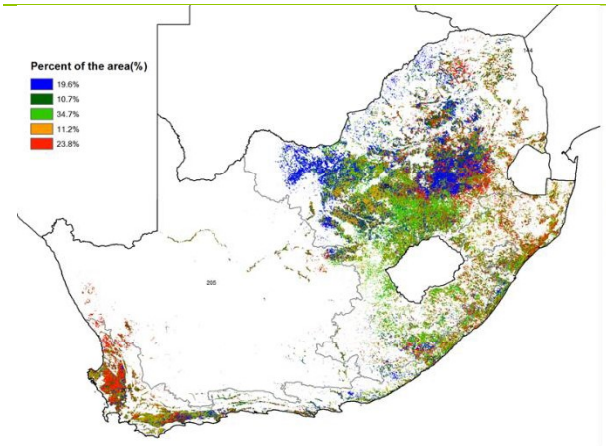
(b) Time series profiles of precipitation (left) and temperature (right)



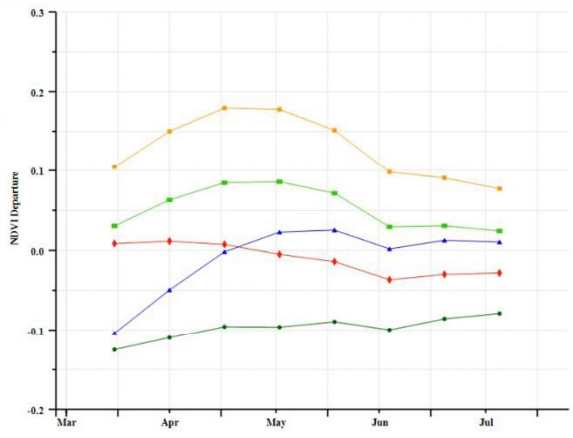
(c) Crop condition development graph based on NDVI



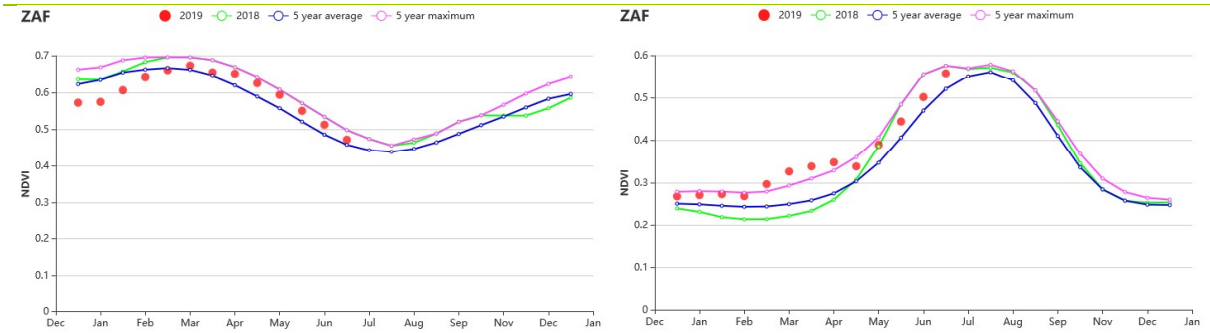
(d) Maximum VCI



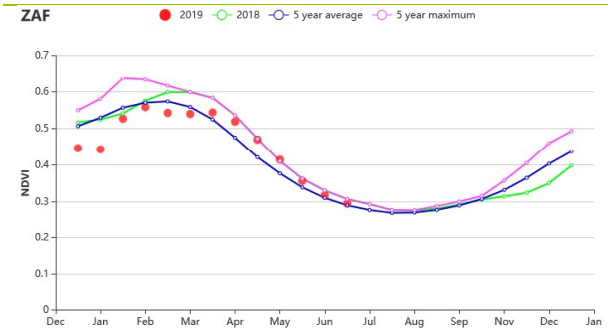
(e) Spatial NDVI patterns compared to 5YA



(f) NDVI profiles



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



(h) Crop condition development graph based on NDVI for Dry Highveld and Bushveld maize areas

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

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (℃)	Departure from 15YA (℃)	Current (MJ/m2)	Departure from 15YA (%)
Humid Cape Fold mountains	106	-24	15.8	0.6	801	4
Mediterranean zone	218	-17	13.4	0	694	3
Dry Highveld and Bushveld maize areas	41	-36	12.7	0.3	958	5

Table 3.80. South Africa's agronomic indicators by sub-national regions, current season's values and departure, April - July 2019

Region	BIOMSS		Cropped arable land fraction		Maximum VCI
	Current (gDM/m2)	Departure from 15YA (%)	Current (%)	Departure from 5YA (%)	Current
Humid Cape Fold mountains	310	3	97	2	0.9
Mediterranean zone	253	2	83	0	0.4
Dry Highveld and Bushveld maize areas	208	-16	86	7	0.9

[ZMB] Zambia

The report covers the end of the rainy season and the transition into the irrigated season when the main crops are wheat and horticultural crops. The rainy season cereal harvests (maize, sorghum and millet) were severely affected by water stress due to rainfall deficits as reflected by the reduced NDVI and VCI values over the entire country. Currently grown irrigated crops develop well under low temperatures experienced during this reporting period.

Based on the NDVI profiles, crop development was below the 5-year average during this reported period indicating that the rain-fed crops were seriously affected; as a result the expected national cereal production is down to 2.3 million tonnes, according to national projections. The temperature profile from April to July was below average which was conducive for irrigated winter crops. The maximum Vegetation Condition Index (VCIx) was below 50% mostly in Southern and Western provinces while Eastern, Muchinga, Northern and North Western Provinces experienced VCIx between 0.8 to 1.0. During the peak of the growing season (up to February) rainfall was far below average and insufficient water was available for crop growth. Based on the NDVI departures, Southern, Lusaka, Central and Southern provinces were severely affected. During JFMA, basically after the rain-fed season, the country has experienced a significant excess of unseasonable precipitation as it recorded 109 mm instead of 65, a 69% increase which has benefited grasslands and irrigated crops.

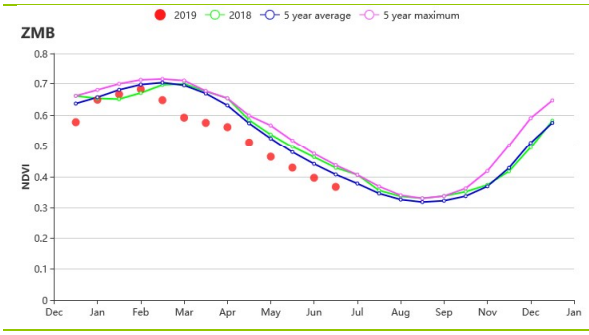
Regional analysis

Luangwa and Zambezi Valleys and the **Western Semi-Arid Plain** received less than 50 mm rainfall during the reported period, representing close to 30% increase over average rainfall. Northern High Rainfall Zone received 100% more rain than the average. Though there was increased rainfall during the reported period, the damage to crop growth was already severe due to the earlier experienced rainfall deficits in February and March as reported in the previous bulletin. The Cropped Arable Land Fraction (CALF) was above 80% in all the AEZs; however the highest was in the **Northern high rainfall zone**, as mentioned above, where the Maximum Vegetation Condition Index (VCIx) reached (0.88) while Luangwa and Zambezi Valleys had the lowest VCIx (0.52).

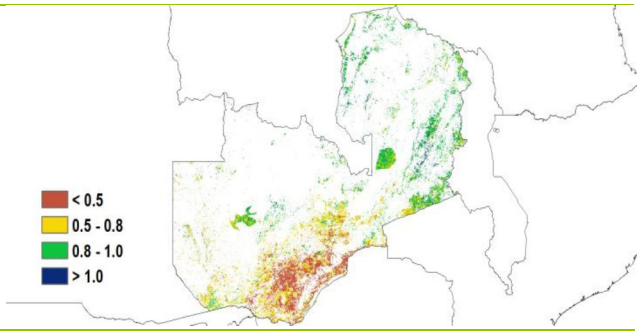
The CropWatch indicators show a poor expected cereal harvest which will severely affect national food security especially in the **Southern Province**, rural Lusaka and western parts of the country, thereby requiring interventions.

Figure 3.45. Zambia's crop condition, April -July 2019

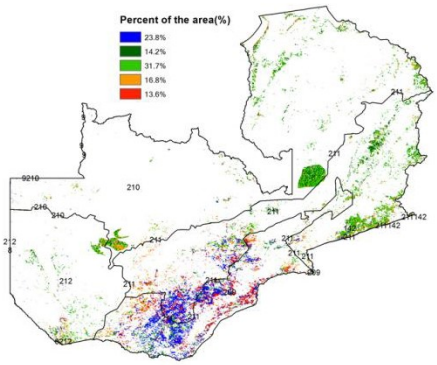
(a) Phenology of major crops



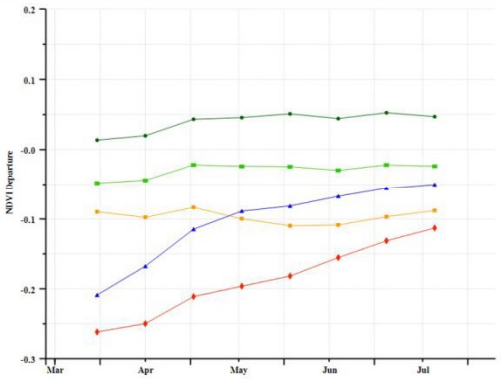
(b) Crop condition development graph based on NDVI



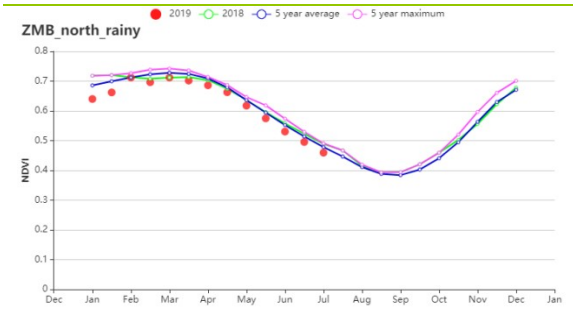
(c) Maximum VCI

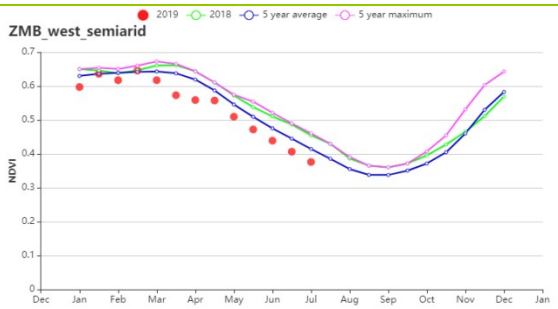


(d) Spatial NDVI patterns compared to 5YA

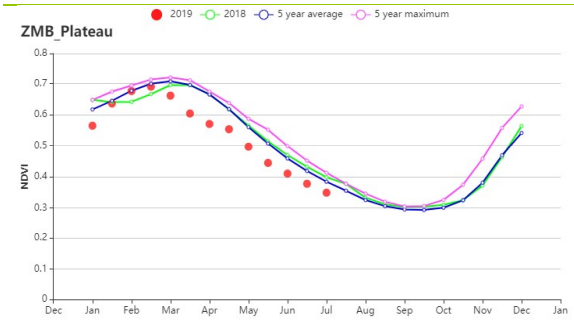


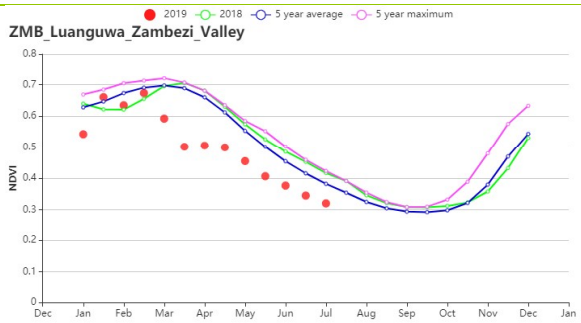
(e) NDVI profiles





(f) Crop condition development graph based on NDVI (Northern high rainfall zone (left) and Western semi-arid plain (right))





(g) Crop condition development graph based on NDVI (Central (Eastern and Southern Plateau) zone (left) and Luanguwa Zambazi rift valley (right))

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

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (℃)	Departure from 15YA (℃)	Current (MJ/m^2)	Departure from 15YA (%)
Luanguwa Zambazi rift valley	49	24	18.5	0.4	1131	2
Central (Eastern and Southern Plateau)	87	49	18.2	0.0	1099	1
Western semi-arid plain	42	26	19.3	0.6	1193	2
Northern high rainfall zone	200	100	17.9	-0.2	1171	0

Table 3.82. Zambia's agronomic indicators by sub-national regions, current season's values and departure, April-July 2019

Region	BIOMSS		Cropped arable land fraction		Maximum VCI
	Current (gDM/m^2)	Departure from 15YA (%)	Current	Departure from 5YA (%)	Current
Luanguwa Zambazi rift valley	276	-16	81	-19	0.52
Central (Eastern and Southern Plateau)	356	-11	91	-9	0.73
Western semi-arid plain	217	8	97	-2	0.71
Northern high rainfall zone	360	-8	99	-1	0.88