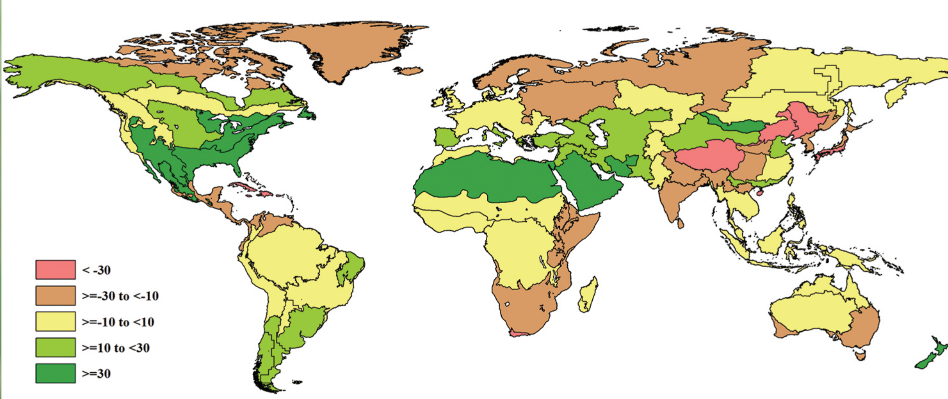

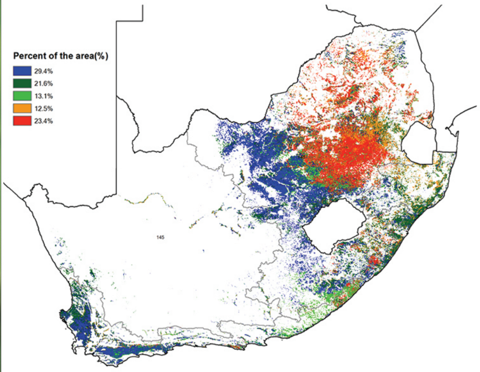

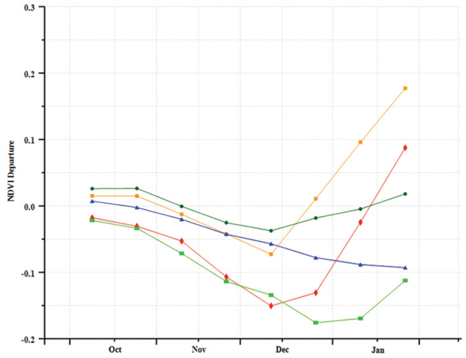

CropWatch bulletin

QUARTERLY REPORT ON GLOBAL CROP PRODUCTION

Monitoring Period: October 2018-January 2019

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

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Abbreviations

5YA	Five-year average, the average for the four-month period for October from 2013 to 2017 to January next year; one of the standard reference periods.
15YA	Fifteen-year average, the average for the four-month period from October from 2003 to 2017 to January next year; one of the standard reference periods and typically referred to as “average”.
AEZ	Agro-Ecological Zone
BIOMSS	CropWatch agroclimatic indicator for biomass production potential
BOM	Australian Bureau of Meteorology
CALF	Cropped Arable Land Fraction
CAS	Chinese Academy of Sciences
CWAI	CropWatch Agroclimatic Indicator
CWSU	CropWatch Spatial Units
DM	Dry matter
EC/JRC	European Commission Joint Research Centre
ENSO	El Niño Southern Oscillation
FAO	Food and Agriculture Organization of the United Nations
GAUL	Global Administrative Units Layer
GVG	GPS, Video, and GIS data
Ha	hectare
Kcal	kilocalorie
MPZ	Major Production Zone
MRU	Monitoring and Reporting Unit
NDVI	Normalized Difference Vegetation Index
OISST	Optimum Interpolation Sea Surface Temperature
PAR	Photosynthetically active radiation
PET	Potential Evapotranspiration
RADI	CAS Institute of Remote Sensing and Digital Earth
RADPAR	CropWatch PAR agroclimatic indicator
RAIN	CropWatch rainfall agroclimatic indicator
SOI	Southern Oscillation Index
TEMP	CropWatch air temperature agroclimatic indicator
Ton	Thousand kilograms
VCIx	CropWatch maximum Vegetation Condition Index
VHI	CropWatch Vegetation Health Index
VHIn	CropWatch minimum Vegetation Health Index
W/m^2	Watt per square meter

Bulletin overview and reporting period

This CropWatch bulletin presents a global overview of crop stage and condition between October 2018 and January 2019, a period referred to in this bulletin as the ONDJ (October, November, December and January) period or just the “reporting period.” The bulletin is the 112nd such publication issued by the CropWatch group at the Institute of Remote Sensing and Digital Earth (RADI) of the Chinese Academy of Sciences, Beijing.

CropWatch indicators

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

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

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

CropWatch analysis and indicators

The analyses cover large global zones; major producing countries of maize, rice, wheat, and soybean; and detailed assessments for Chinese regions, 41 major agricultural countries, and 190 Agro-Ecological Zones (AEZs).

This bulletin is organized as follows:

Chapter	Spatial coverage	Key indicators
Chapter 1	World, using Monitoring and Reporting Units (MRU), 65 large, agro-ecologically homogeneous units covering the globe	RAIN, TEMP, RADPAR, BIOMSS
Chapter 2	Major Production Zones (MPZ), six regions that contribute most to global food production	As above, plus CALF, VCIx, and VHIn
Chapter 3	41 key countries (main producers and exporters) and 190 AEZs	As above plus NDVI and GVG survey
Chapter 4	China and regions	As above plus high resolution images;
Chapter 5	Production outlook, and updates on disaster events and El Niño.	

Regular updates and online resources

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

Executive summary

The current CropWatch bulletin describes world-wide crop condition and food production as appraised by data up to the end of January 2019. It is prepared by an international team coordinated by the Insitute of Remote Sensing and Digital Earth, Chinese Academy of Sciences.

The period from October 2018 to January 2019 (ONDJ) is a relatively quiet period from an agricultural point of view. In the temperate northern hemisphere summer crops have been harvested, while winter crops have been were planted and are now mostly dormant. In some tropical and equatorial countries, including the Philippines, Thailand, Vietnam and Brazil, planting of the second maize and rice generally starts around January, while in the southern hemisphere summer crops are at advanced development stages and nearing flowering, for example maize and soybean in Argentina, Brazil and South Africa.

Special attention is paid to the major producers of maize, rice, wheat and soybean throughout the bulletin. The assessment is based mainly on remotely sensed data. It covers prevailing weather conditions, including extreme factors, at different spatial scales, starting with global patterns in Chapter 1. Chapter 2 focuses on agro-climatic and agronomic conditions in major production zones in all continents. Chapter 3 covers the major agricultural countries that, together, make up at least 80% of production and exports. Each country is the object of a detailed analysis and Chapter 3 constitutes the bulk of the Bulletin. Chapter 4 zooms into China. The bulletin also presents early production estimates for selected countries, mostly in the southern hemisphere in chapter 5.

Agro-climatic conditions

Globally, rainfall over agricultural areas was close to average (4% above) during the ONDJ monitoring period. Temperature was just below average by 0.2°C and sunshine was above average in 69% of arable land, even if the average departure was just +1%.

Some large positive and negative precipitation anomalies occurred essentially in Asia (East and south, -17% and -9%, respectively) and Oceania (-10%) and in North America (+33%). The globally average rainfall contrasts with the situations that prevailed during the previous reporting (JASO, +12%) and the corresponding period in 2017-18 (+8%).

Although experts currently debate whether El Niño conditions are developing again just three years after it's previous occurrence in 2015-16, most below average rainfall areas are consistent with El Niño patterns with deficits more severe than 20% occurring in Western Cape in South Africa (-58%), Australia (Nullarbor to Darling, -23%), maritime Southeast Asia (-29%) and the Caribbean (-36%). Eastern Asia and China had several areas with unfavorable precipitation, including Southern Japan and the southern fringe of the Korean peninsula (-47 %), Inner Mongolia (-42%) and North-east China (-34%). Several of the listed areas practice winter crop cultivation and will start their growing season with insufficient soil moisture storage if rainfall will be short in February and subsequent months.

At the national level, low rainfall affected several countries of which some are listed here. Chapter 3 has additional detail, country by country and including sub-national data. In Asia, drought affected Japan (-53%), India (-35%), the Philippines (-25%) and some Chinese provinces (Liaoning, -37%; Hebei -45 %.); in southern and eastern Africa: Namibia (-44%), Botswana (-33%), Zimbabwe (-32%) and Somalia (-40%). Four European countries recorded a deficit between 20 and 30%, but raise little concern in view of the limited importance of winter crops at high latitudes: Denmark, Sweden, Finland and the Netherlands. The same applies to a long list of Oblasts in Russia centered around the Republic of Mordovia

Excess precipitation resulting in floods, destruction and loss of life are reported from all continents and are described in detail in the section on disasters in Chapter 5. For America we need to mention some important agricultural areas such as the Northern Great Plains, the Corn Belt and the Cotton Belt.

As mentioned, TEMP was close to average but significant negative (cold) departures occurred in the American continent and positive ones in Oceania. Unseasonably high temperature occurred in the Caucasus, in north-eastern China and in some agriculturally less important areas. The last six months constitute the first close to average sunshine period after a run of negative departures. Unusually low values do occur in some of the mentioned cold areas.

In terms of biomass accumulation potential, the most favorable values occur in Europe (+6%), central Asia (+9%) and western and southern North America (+12%).

Agronomic indicators

The impact of extreme weather conditions, especially drought, is directly assessed by the two main agronomic indicators used by CropWatch i.e. Cropped Arable Land Fraction, CALF, which measures how much arable land is actually cropped, and Maximum Vegetation Condition Index, VCIx, which assesses local yield on a scale from 0 (“same as lowest ever”) to 1 (“same as highest ever”).

Romania suffered the largest decrease in CALF among the monitored countries (-35%). Large increases between 10% and 20% occurred in Zambia, Mozambique, Ukraine, Kazakhstan, Turkey and Pakistan (19%); between 25% and 30% in Afghanistan, Morocco and Mongolia.

The lowest VCIx values between 0.45 and 0.72 were observed in Afghanistan (0.45), Australia, South Africa, Romania, Canada and Pakistan (0.72). High VCIx occurs mostly in Asia, starting with Sri Lanka (0.98), Indonesia and Vietnam (0.96), and the Philippines (0.95); in Brazil (0.95) and Mexico (0.93); in Belarus (0.94) and Poland (0.91).

China

Agro-climatic conditions were generally below average in China from October 2018 to January 2019, with sunshine deficits of 6% although temperature was average. The rainfall deficit reached 7% nationwide, affecting mostly Inner Mongolia (-42%), the Loess region (-18%), North-east China (-34%) and Southwest China (-18%). The largest positive temperature anomalies (in excess of 1.0°C) were recorded in Inner Mongolia, Heilongjiang, Jilin and Liaoning.

Nationwide CALF was low 2% compared with the previous seasons, indicating reduced planted area of winter crops. The drop was 1% in Huanghuaihai, Loess region, and Lower Yangtze which are the main winter crops producing zones. The average national VCIx value was 0.88 with limited variability among the agricultural regions, ranging from 0.83 in Inner Mongolia to 0.93 in southern and south-west China.

Production estimates

The production outlook for the current bulletin includes only the major producers in the southern hemisphere and some isolated northern hemisphere countries where crop development is sufficiently advanced to ensure that estimates are reliable.

Argentina, the third global exporter of Maize did well (production up 9% compared with the previous season) while the CropWatch estimate for Brazil, the second exporter is 1% down. Maize available for export should not be affected by the current situation. Mexico’s good performance (+21%) will allow the country to reduce imports. In South Africa (-14%) the production shortfall is likely to increase imports from outside the region as most countries in the region suffered from a poor rainfall season.

None of the important Asian rice producers is covered in the current estimates. For Brazil and Argentina, which rank about 10th among exporters the production is up by 4% and 16%, respectively.

Australia, one of the top wheat exporters suffered a marked production drop (-13%) that is, however, in line with the very large historical variability of national wheat production. A negative value in Argentina (-3%) is also consistent with the recent behavior of wheat in the country. Exports are unlikely to be affected. Similarly, although the production is up 7% in Brazil, this will not affect international markets as the country exports virtually no wheat. The Bulletin presents wheat production estimates for several other countries which all underwent an increase of their production compared with 2018. They are either self-sufficient (India, Pakistan) or net importers (Mexico, Morocco, South Africa and especially Egypt). The improved productions will them countries to reduce imports.

Brazil and Argentina, which both increased their soybean production, are the second and third exporters for the commodity. The extra production of 2019 over 2018 is about 4.7 million tonnes in Argentina and about 2 million tonnes in Brazil. When taking into account the recent reversal of the negative trend of Chinese soybean production, and correlated reduced imports, the data suggest that the current soybean glut is unlikely to improve.

Chapter 1. Global agroclimatic patterns

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

1.1 Overview

CropWatch Agroclimatic Indices (CWAIs) are averages of climatic variables over agricultural areas only (refer to Annex A for definitions and to table A.1 for October 2018 to January 2019 (JASO) numeric values.) Although they are expressed in the same units as the corresponding climatological variables, they are spatial averages, weighted by the agricultural production potential. For instance, in the "Sahara to Afghan desert" area, only the Nile valley and other cropped areas are considered. "Sahara to Afghan desert" is one of the 65 CropWatch Mapping and Reporting Units (MRU), which are the largest monitoring units adopted to identify global climatic patterns. They are listed in annex C.

We also stress that the reference period, referred to as "average" in this bulletin covers the 15 year period from 2004 to 2018. Although departures from the 2004-2018 are not anomalies (which, strictly, refer to a "normal period" of 30 years), we nevertheless use that terminology. The listed departures from average differ from but are consistent with other sources such as NOAA or COPERNICUS which use longer and less recent reference period of 30 or 100 years. The specific reason why CropWatch refers to the most recent 15 years is our focus on agriculture, as already mentioned in the previous paragraph. 15 years is deemed an acceptable compromise between climatological significance and agricultural significance: agriculture responds much faster to persistent climate variability than 30 years, which is a full generation. For agronomic indicators (such as BIOMSS and other indicators used in subsequent chapters) we adopt an even shorter reference period of 5 years (i.e. 2014-2018). This makes provision for the fast response of markets to changes in supply but also to the fact that in spite of the long warming trend, some recent years (e.g. 2008 or 2010-13) were below the trend.

Correlations between variables (RAIN, TEMP, RADPAR) at MRU scale derive directly from climatology. For instance, the positive correlation (R=0.373) between rainfall and temperature results from high rainfall in equatorial, i.e. in warm areas. Therefore, this description of very large global climatic patters focuses on departures from average variables, i.e. anomaly patterns which characterize the current reporting period more meaningfully than the averages themselves (Figure 1.1). During the current ONDJ period, rainfall anomalies show a weak positive correlation with TEMP anomalies (R=-0.211), but a stronger link with RADPAR anomalies (-0.522), indicating the expected association between cool temperature and rainfall and between drought and above average sunshine. For BIOMSS departures the stronger association (R=0.806) results directly from the definition of the indicator. It is noted, however, that only 64% of BIOMSS variability can be assigned to rainfall, which is a relatively low value in comparison to previous monitoring periods.

Figure 1.1. Relations between anomalies over the 65 MRUs

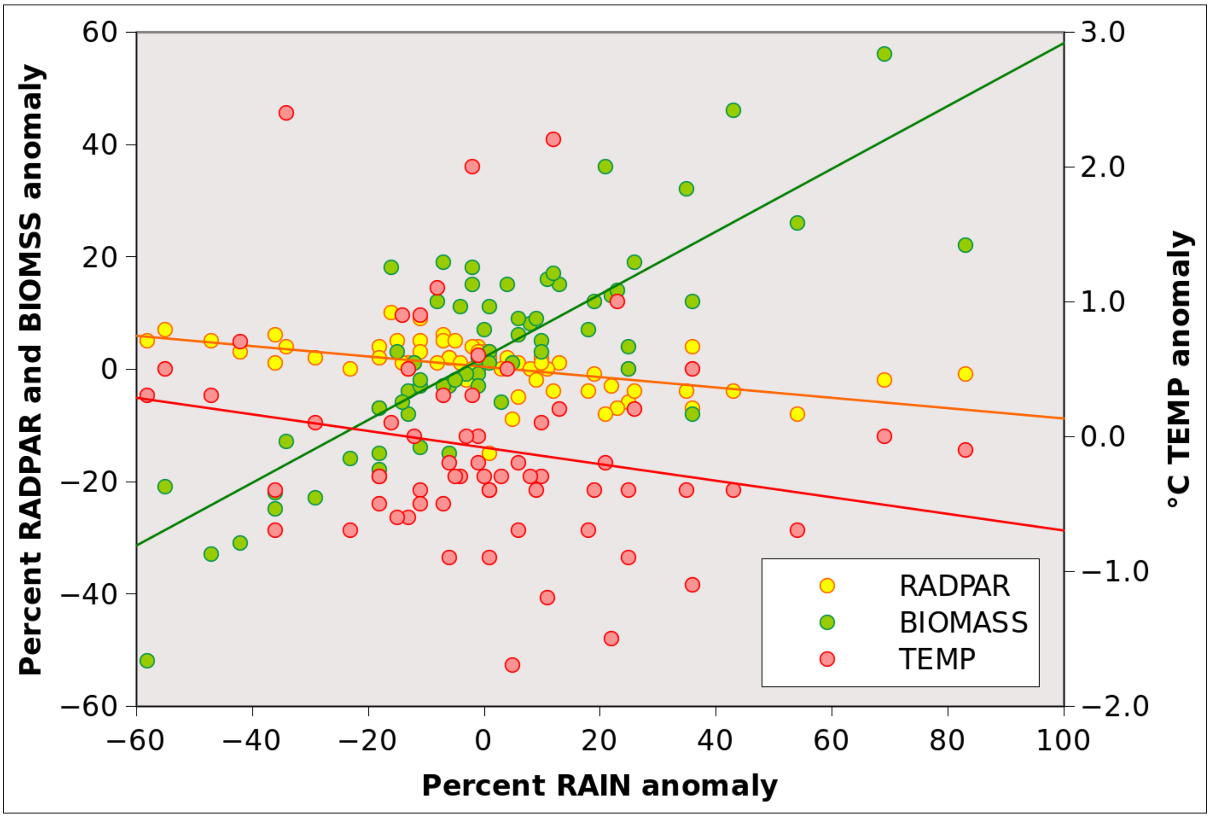
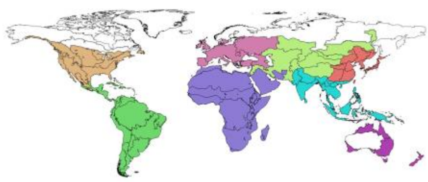


Table 1.1 Departure from recent 15 year average of the RAIN, TEMP and RADPAR indicators over the last year (in % and °C as indicated in the table, average of 65 MRUs, unweighted)

Reporting period	Year	CropWatch indicators		
		RAIN %	TEMP °C	RADPAR %
JFMA	2017	+13	-0.2	-2
AMJJ	2017	+9	-0.1	-2
JASO	2017	+6	+0.1	-3
ONDJ	2017-2018	+8	-0.1	-4
JFMA	2018	+8	-0.1	-5
AMJJ	2018	+5	-0.2	-3
JASO	2018	+12	-0.1	1
ONDJ	2018-2019	+1	-0.1	0

Table 1.2 Departures from the recent 15-year average of CropWatch agroclimatic indicators over regional MRU groups. Within each group, averages are weighted by the agricultural area of individual MRUs. "Others" include five non agricultural areas shown in white in the map.

	RAIN %	TEMP °C	RADPAR %	BIOMSS %
Africa	4	-0.2	2	3
America S+C	-2	-0.5	2	-1
America N	33	-0.5	-5	12
Asia Centre	10	0.2	-1	9
Asia East	-17	0.3	-3	-7
Asia South	-9	-0.1	2	0
Europe	2	-0.2	3	6
Oceania	-10	0.5	1	-7
Others	-1	0.8	0	11
World	**4**	**-0.2**	**1**	**3**



1.2 Abnormal rainfall patterns

RAIN was below average in about 52% of the MRUs, with RAIN being 1% above the average value of the 15-year reference period (2004-2018) over agricultural areas [FOOTNOTE 3] (Table 1.1). The globally average value nevertheless includes some large positive and negative departures, essentially in Asia (East and south, -17% and -9%, respectively) and Oceania (-10%) and in North America (+33%); refer to table 1.2. Additional detail is provided below. The globally average rainfall contrasts with both the situations during the previous reporting period (+12%) and the corresponding period in 2017-18 (+8%).

Most below average rainfall areas are consistent with El Niño patterns (refer to section 5.4) with deficits more severe than 20% occurring in Western Cape in South Africa (MRU 10, -58%), Australia (MRU 55, Nullarbor to Darling at 23%), maritime Southeast Asia (MRU 45, -29) and the Caribbean (MRU 20, -36%). Eastern Asia and China had several areas with unfavourable precipitation, especially the island of Hainan (MRU 33, -55%), Southern Japan and the southern fringe of the Korea peninsula (MRU 46, -47 %), Inner Mongolia (MRU 35, -42%), Qinghai-Tibet (MRU 39, -36%) and North-east China (MRU 38, -34%). Several of the listed areas practice winter crop cultivation and will start their growing season with insufficient soil moisture storage if rainfall will be short in February and subsequent months.

Figure 1.2 shows that some other areas also experienced water deficits, especially central America with northern South America and southern Asia. Although their rainfall deficits were less severe (-11% to -13%) Southern Africa (MRU 44) and especially the East African Highlands (MRU 02) and the Horn of Africa (MRU 04) are also mentioned because of the ongoing humanitarian emergencies which will be made worse in case of poor harvests.

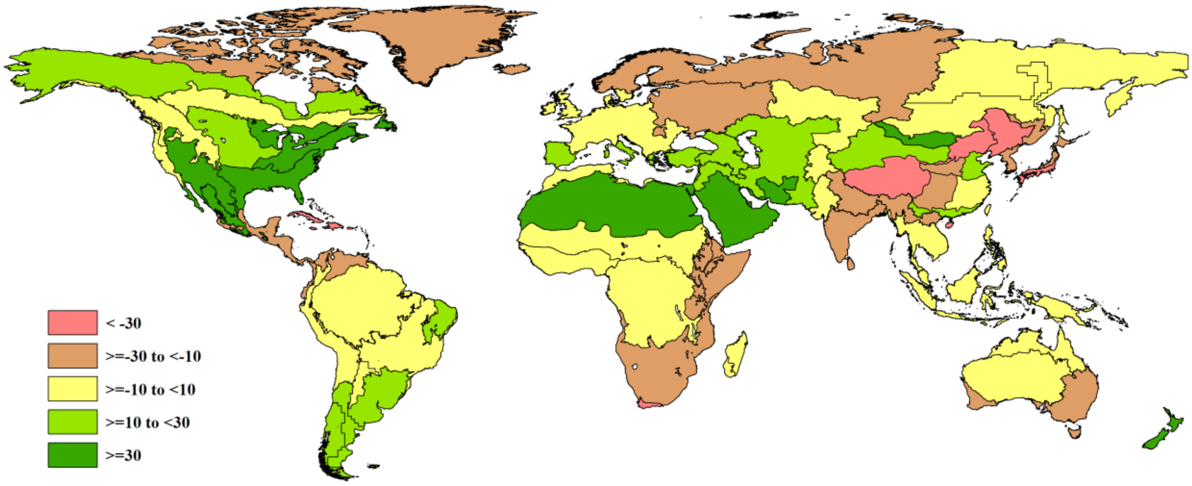
High precipitation volumes sometimes resulting in floods, destruction and loss of life (refer to section 5.3 on disasters) are reported from all continents. In Asia excesses affected Southern China 21% (MRU 40), Gansu-Xinjiang +25% (MRU 32), Western Asia +26% (MRU 31) and MRU 47 (Southern Mongolia) at +83% (175 mm instead of 96 mm). MRU 64 is adjacent to this area and covers the large area from the Afghan desert to the Sahara (+69%).

In America we need to mention some northern continental areas such as MRU 12 (Northern Great Plains +25%), two MRUs with excesses close to 35% (MRU 13, the Corn Belt; MRU 18, SW U.S. and N. Mexican highlands), MRU 17 (Sierra Madre +43%) and MRU 14 (Cotton Belt to Mexican Nordeste with +54%). In the southern continent, the Semi-arid Southern Cone (MRU 28) was at +22%.

Similar values are reported from MRU 29 in Europe (+23%)

Finally, Oceania suffered from both drought and floods, with New Zealand reaching a net excess of +36%, after along run of water deficit periods.

Figure 1.2. Global map of rainfall anomaly (as indicated by the RAIN indicator) by country and sub-national areas, departure from 15YA between between October 2018 and January 2019



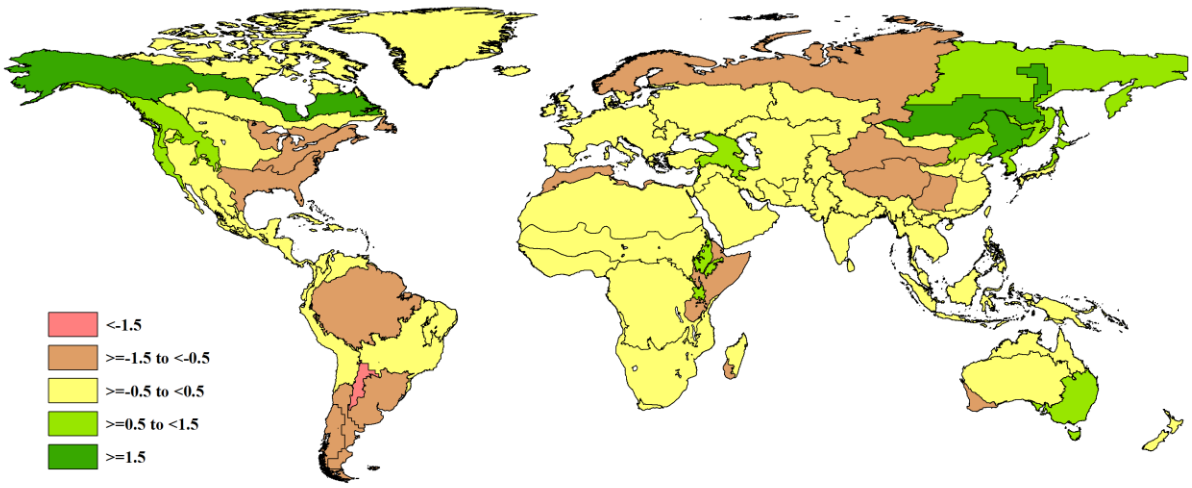
1.3 Abnormal temperature patterns

TEMP was close to average almost everywhere (-0.1°C and -0.2°C, respectively for unweighted and weighted averages; Tables 1.1 and 1.2), showing more significant negative departures in the American continent and positive ones in Oceania. 60% of MRUs had below average temperature.

Lower than normal temperatures concentrate in America, especially central-north Argentina (MRU 25) 1.7°C below average, the semi-arid Southern Cone (MRU 28, -1.5°C), Western Patagonia (MRU 27, 1.2°C) and the Corn Belt (1.1°C below seasonal norms ion MRU 13). Some adjacent areas are affected as well.

Unseasonally high temperature occurred in the Caucasus (MRU 29, +1.0°C), in north-eastern China (MRU 38, +2.4°C) and in some agriculturally less important areas.

Figure 1.3. Global map of temperature anomaly (as indicated by the TEMP indicator) by country and sub-national areas, departure from 15YA between October 2018 and January 2019



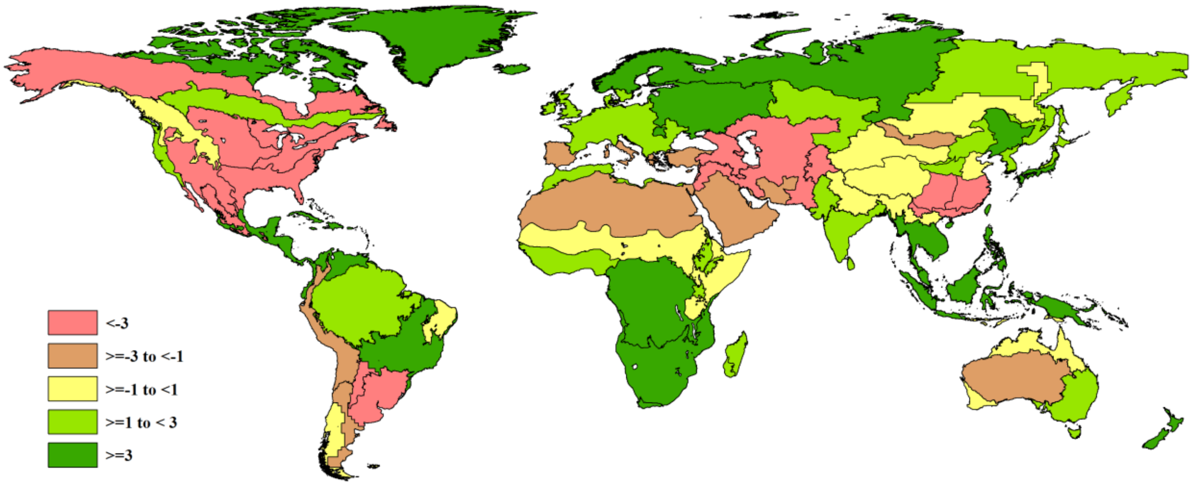
1.4 Photosynthetically Active Radiation (PAR) patterns

RADPAR was above average in 69% of the MRUs. The departures were mostly weak and the global average sunshine departure reaches 0% and 1%, respectively, for unweighted and weighted averages (Tables 1.1 and 1.2). The largest negative departures occurred in North America (−5%) and in eastern Asia (−3%) while Europe recorded the largest positive anomaly (+3%). The previous CropWatch bulletin covering the JASO period stressed that the RADPAR departure was positive after a run of negative values.

Therefore, the last six months constitute the first close to average sunshine period after a run of negative departures. Because MRUs are large areas, and because sunshine tends to be less variable than rainfall or temperature, small departures are more significant than they are for other variables.

Unusually low values in Asia affected MRU 37 (Lower Yangtze, -15%), MRU 40 (Southern China -8%) and MRU 41 (Southwest China -7%). In the American continent, areas with poor sunshine include (in the south) MRU 25 (Central-north Argentina -9%) and MRU 14 (Cotton Belt to Mexican Nordeste -8%) and in the north the Corn Belt -7% (MRU 13) and the Northern Great Plains -6% (MRU 12). In Eurasia low values occur in the Caucasus (-7%, MRU 29) and in the Pamir area (-5%, MRU 30).

Figure 1.4. Global map of PAR anomaly (as indicated by the RADPAR indicator) by country and sub-national areas, departure from 15YA between October 2018 and January 2019.

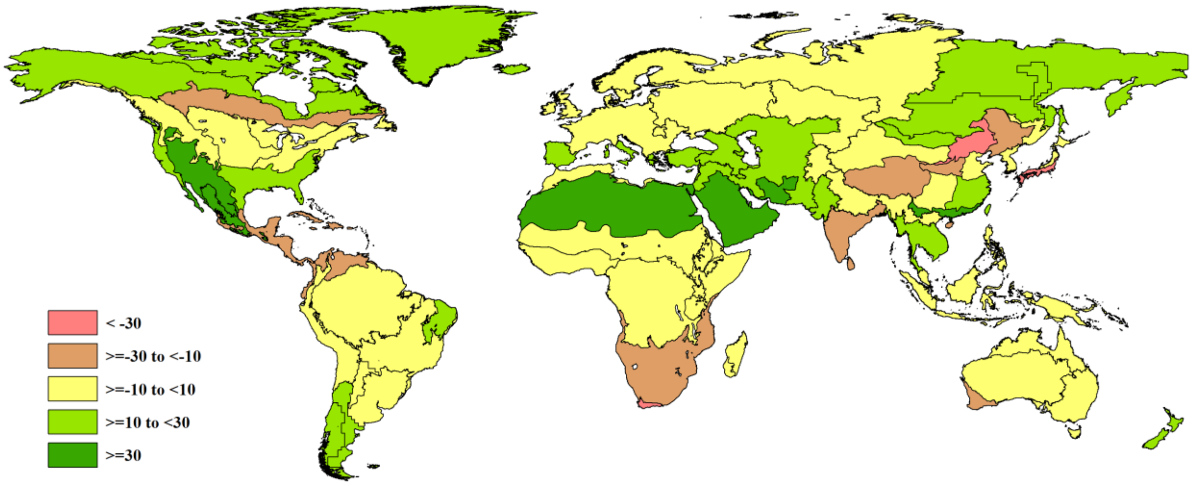


1.5 Biomass Production Potential (BIOMSS) patterns

Contrary to the indicators above, BIOMSS departures refer to the recent 5-year period, as mentioned above. Lower than average values occur in 41% of the monitored MRUs, with the count including the marginally agricultural areas referred to as “others” in Table 1.2. At 7%, both Oceania and East Asia recorded the lowest values. The most favourable values occur in Europe (+6%), central Asia (+9%) and the northern part of the American continent, mostly in the west and south (+12%). Because of the normally close association between RAIN and BIOMSS, the departures from average differ essentially when the recent five years experienced conditions that differ from the recent 15 years average, creating a short-term disruption in farming. Areas BIOMSS and RAIN vary in opposite directions are rare. They include the Corn Belt (MRU 13) where rainfall increased 36% over average (15 years) but the biomass production potential dropped 8% due to a combination of unfavourable conditions compared with recent years, including cold weather (-1.1°C) associated with low sunshine.

The opposite situation (i.e. increased BIOMSS combined with RAIN below average) mostly occurs in Boreal latitudes and, therefore, remains of limited impact on agriculture

Figure 1.5. Global map of October 2018 to January 2019 biomass anomally (as indicated by the BIOMSS indicator) by country and sub-national areas, departure from 5YA



1.6 Combinations of departures

The most notable combination of abnormal4 weather occurred in the already mentioned Corn Belt (MRU 13), one of the major global crop production areas. RAIN, TEMP and RADPAR recorded the following anomalies: +36%, -1.1°C and -7%, respectively. If less severe criteria are adopted, e.g. departures in the top or bottom 20%, additional areas to be listed include the Cotton Belt to Mexican Nordeste (MRU 14; +54%, -0.7°C, -8%, in the same order as above), the Caucasus (MRU 29; +23%, +1.0°C, 7%) and the southern Chinese island of Hainan (MRU 33; 55%, +0.5°C and +7%). When the analysis is limited to just rainfall and temperature, the most abnormal conditions prevailed in north-eastern China (MRU 38; -34%, +2.4°C, +4%). With less stringent criteria (top and bottom 20), four Chinese MRUs need to be added, making the country – together with the US – one of the places with most unusual agro-climate: Gansu-Xinjiang (MRU 32; +25%,-0.9°C, 0%), Qinghai-Tibet (MRU 39; -36%, -0.7°C+1%) , Inner Mongolia (MRU 35; -42%, -0.7°C, +3%) and North-east China (-34%, +2.4°C and +4%).

Exceptional weather also affected the southern hemisphere, in particular Oceania (MRU 55, Nullarbor to Darling in southern Australia with -23%, -0.7°C and 0%; MRU 56, i.e. New Zealand at +36%, +0.5°C and +4%) and south America (MRU 56; +22%, -1.5°C and -3%).

Chapter 2. Crop and environmental conditions in major production zones

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

2.1 Overview

Tables 2.1 and 2.2 present an overview of the agroclimatic (table 2.1) and agronomic (table 2.2) indicators for each of the six MPZs, comparing the indicators to their fifteen and five-year averages, respectively.

Table 2.1. October 2018 to January 2019 agroclimatic indicators by Major Production Zone, current value and departure from 15YA

	RAIN		TEMP		RADPAR	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m^2)	Departure (%)
West Africa	264	10	26.9	-0.3	1250	2
North America	421	41	4.6	-0.6	495	-8
South America	725	2	23.7	-0.5	1358	1
S. and SE Asia	176	-20	22.8	0.1	1044	2
Western Europe	266	-3	6.5	-0.5	316	4
C. Europe and W. Russia	254	-2	-0.4	-0.3	241	6

*Note: Departures are expressed in relative terms (percentage) for all variables, except for temperature, for which absolute departure in degrees Celsius is given. Zero means no change from the average value; relative departures are calculated as (C-R)/R*100, with C=current value and R=reference value, which is the fifteen-year average (15YA) for the same period (October-January) for 2004-2018.*

Table 2.2. October 2018 to January 2019 agronomic indicators by Major Production Zone, current season values and departure from 5YA

	BIOMSS (gDM/m^2)		CALF (Cropped arable land fraction)		Maximum VCI Intensity
	Current	Departure (%)	Current	Departure (% points)	Current
West Africa	654	6	94	1	0.94
North America	839	8	62	-9	0.81
South America	1803	2	100	3	0.75
S. and SE Asia	453	-8	95	1	0.86
Western Europe	917	3	90	0	0.86
Central Europe and W Russia	685	2	71	-2	0.79

Note: See note for table 2.1, with reference value R defined as the five-year average (5YA) for the same period (October-January) for 2014-2018.

2.2 West Africa

The agro-climatic indicators for West Africa show slightly above average conditions for the MPZ in general.

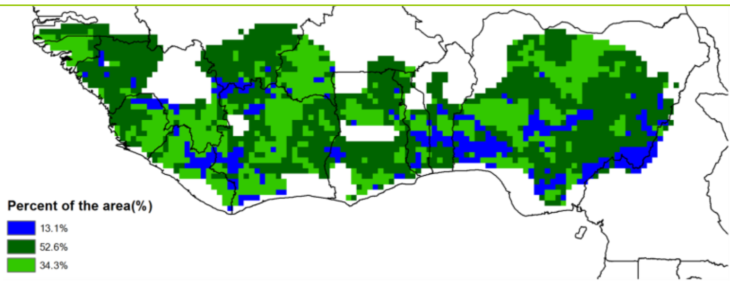
Rainfall was above average (264 mm, with a 10% positive departure) due to a large excess mostly occurring at the beginning of the monitoring period (October) in 47.4% of cropland, well distributed over the MPZ. Remaining areas had average rainfall throughout. Both temperature and sunshine were close to average (average TEMP of 26.9°C, a departure of -0.3°C and average RADPAR of 1249.7 MJ, was slightly above average by 1.8 %).

The resulting accumulated biomass potential is up (BIOMSS +6%). Nigeria experienced positive departure (>20%) mostly from the central to northern regions, while western coastal areas (Gambia, Guinea Bissau, Guinea, Sierra Leone and Liberia) experienced negative BIOMSS departures.

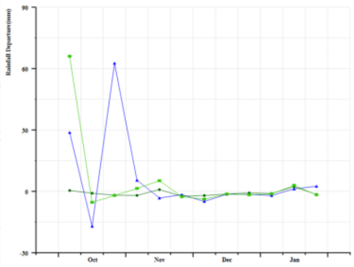
The MPZ showed a marginal increase in cultivated area (CALF: 94%, +1% above average) and a high VCIx (0.94), which indicates good yields except for northern parts of Côte d'Ivoire, Ghana, Guinea and Benin.

Overall, the CropWatch indicators describe favorable crop condition in most parts of the region.

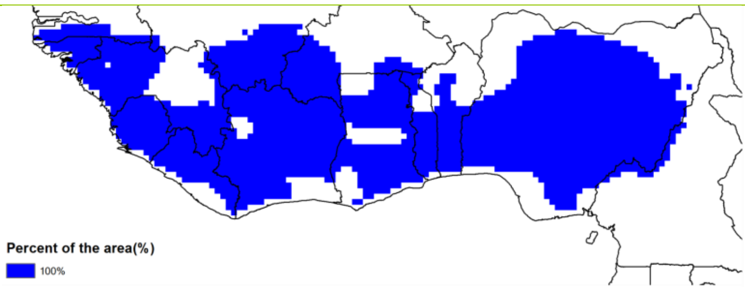
Figure 2.1. West Africa MPZ: Agroclimatic and agronomic indicators, October 2018 to January 2019.



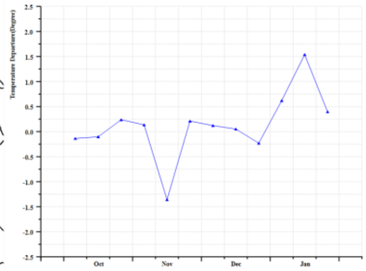
a. Spatial distribution of rainfall profiles



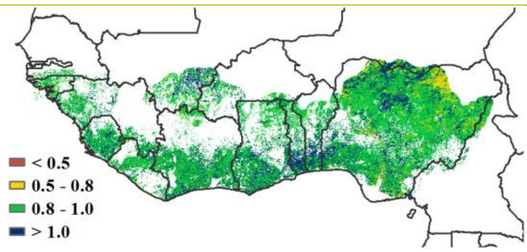
b. Profiles of rainfall departure from average (mm)



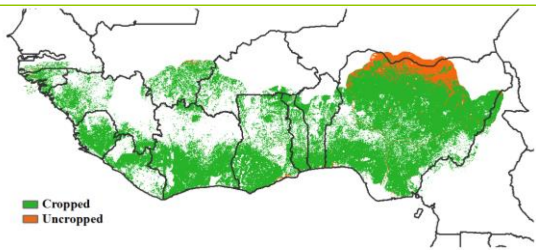
c. Spatial distribution of temperature profiles



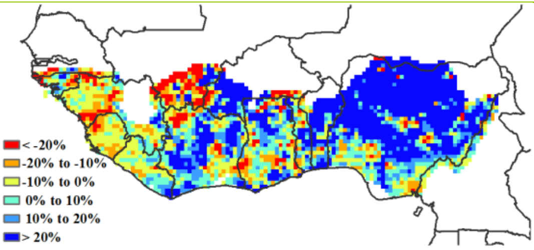
d. Profiles of temperature departure from average (mm)



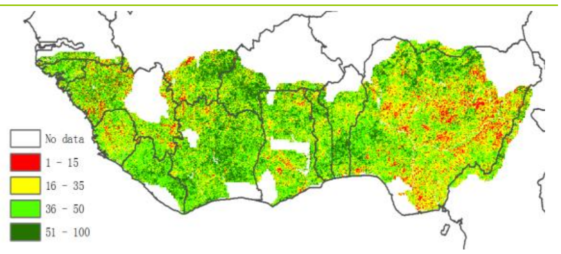
e. Maximum VCI



f. Cropped arable land



g. Biomass accumulation potential departure



h. VHI minimum

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

2.3 North America

Only winter wheat is cultivated during the monitoring period in the North American MPZ.

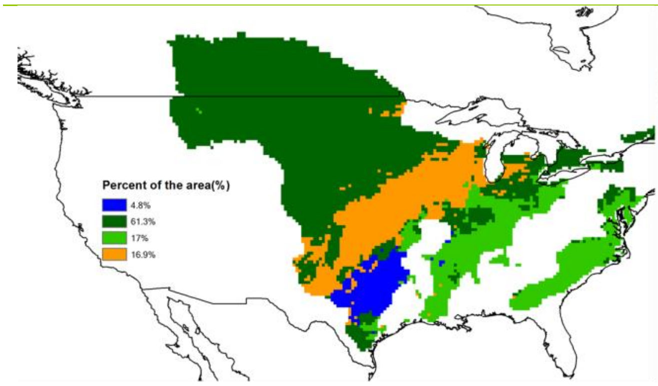
Weather was mostly humid, cold and cloudy. Precipitation was significant above average (up 41%), while TEMP was down just below by 0.6°C; sunshine, however, fell as much as 8%. Two cold waves occurred in the region, one in November and another at the end of January.

The Northern Great Plains, the most important winter wheat zone experienced as well excessive precipitation (RAIN +25%), low temperature (TEMP departure of -0.4°C) and cloudy conditions (RADPAR -6%). In the Corn Belt and the Cotton Belt to Mexican Nordeste, the precipitation anomaly reached 36% and 54%, respectively, providing ample soil moisture for the sowing of summer crops.

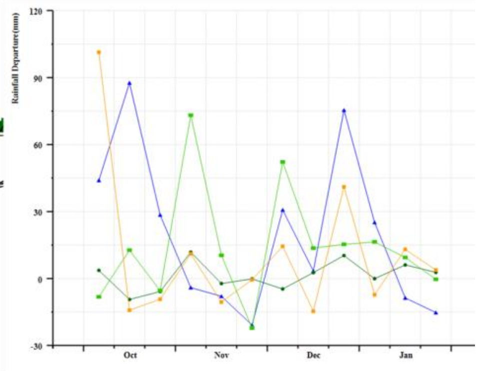
The potential biomass was close to the average of the last five years. The cropped arable land fraction is down 9% below the average value of the previous five years. In the southern Great Plains, potential biomass was favorable (BIOMSS departure larger than +20%) and VCIx above 1.0 indicates very favorable crop condition, especially in Texas.

Altogether, CropWatch assesses the situation in North America as average.

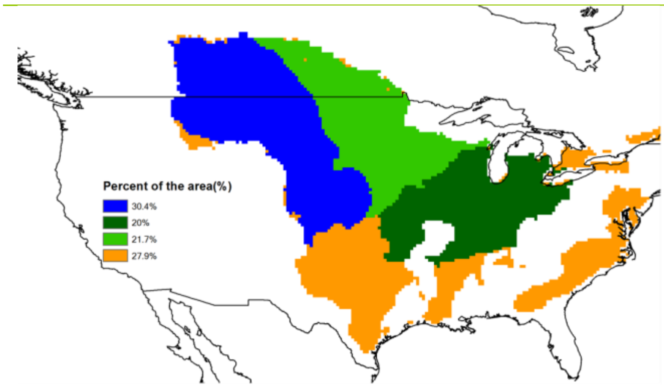
Figure 2.2. North America MPZ: Agroclimatic and agronomic indicators, October 2018 to January 2019.

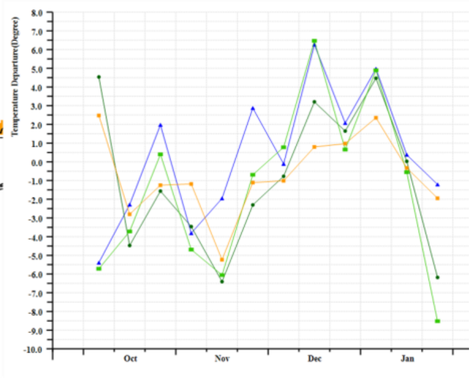


a. Spatial distribution of rainfall profiles



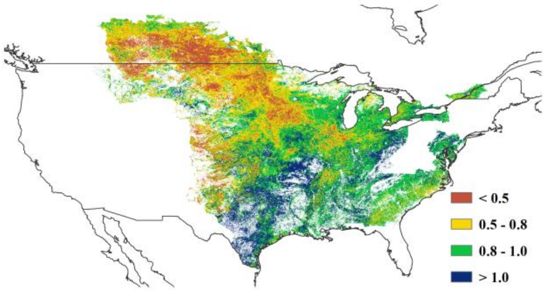
b. Profiles of rainfall departure from average (mm)

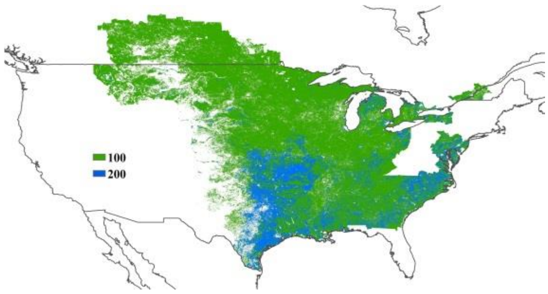




c. Spatial distribution of temperature profiles

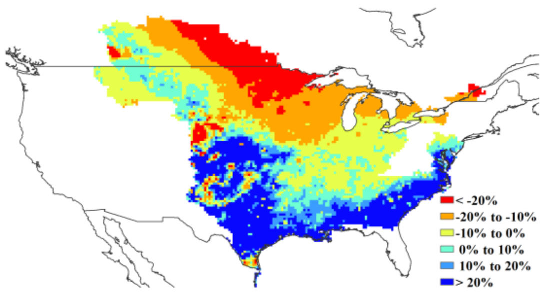
d. Profiles of temperature departure from average (mm)

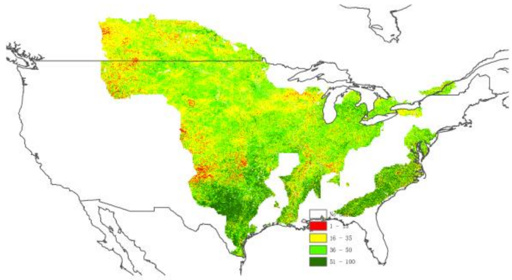




e. Maximum VCI

f. Cropped arable land





g. Biomass accumulation potential departure

h. VHI minimum

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

2.4 South America

The monitoring period covers the main growing season in the MPZ: the harvest of winter crops and the sowing and early growth stages of summer crops.

Although the region recorded close to average rainfall (+2% above average), large spatial and temporal variations were observed. Large precipitation excess affected Central and north-eastern Argentina, Uruguay and the South of Brazil (Figures 2.3.a and 2.3.b).

TEMP was about normal (a slight drop of 0.5 °C below average). The southern areas of the region including Argentina and southernmost Brazil experienced fluctuations from positive to negative while the North showed more stable patterns with some negative anomalies values in the Northwest and positive anomalies elsewhere(Figure 2.3.c and 2.3.d).

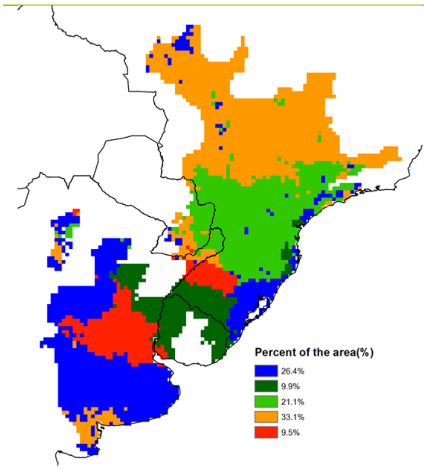
Sunshine was close to average (RADPAR anomaly +1%).

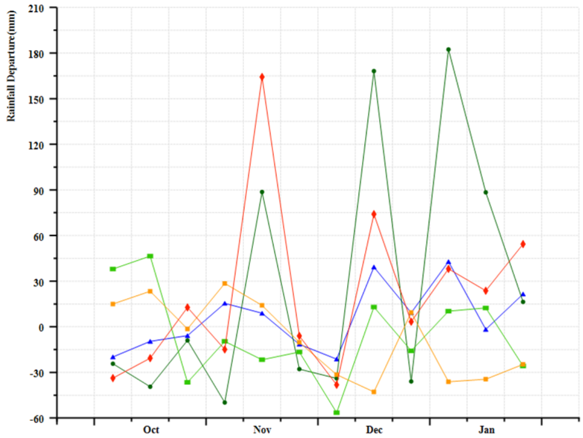
BIOMSS showed on average a slight increment of 2 % compared with the recent average. The largest positive anomalies occurred in Central Pampas and negative ones affected mainly Mato Grosso Do Sul, Parana and Sao Paulo in Brazil.

Almost all cropland was cultivated according to the Cropped Arable Land Fraction value of 100%, showing a 3 % increment compared to 5 years average. VCIx shows an average value of 0.75 for the whole MPZ but values higher than 0.8 are widespread. VHIn map shows in general good conditions too (values higher than 35%). In particular, very low values of VHIn were only observed for Central western Pampas, and scattered pixels in the Argentinian Chaco, Brazil and Paraguay.

Overall crop condition was average in the South-American MPZ.

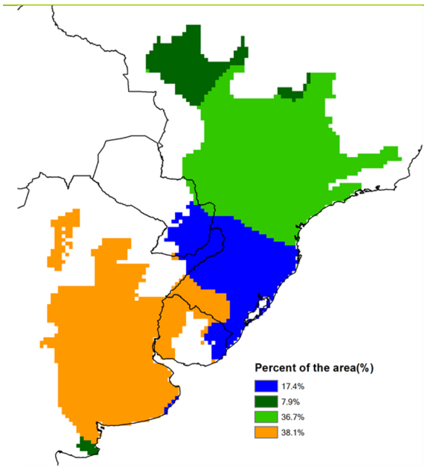
Figure 2.3. South America MPZ: Agroclimatic and agronomic indicators, October 2018 to January 2019.

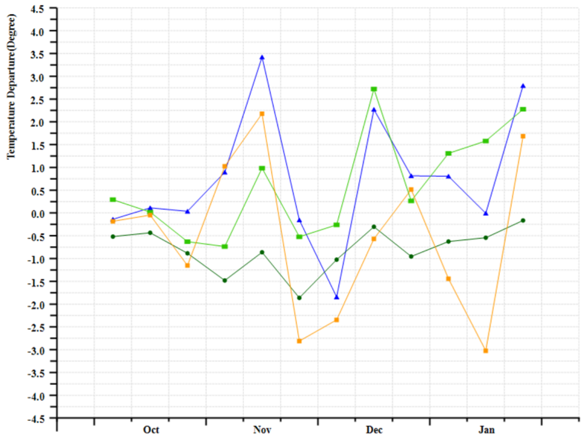




a. Spatial distribution of rainfall profiles

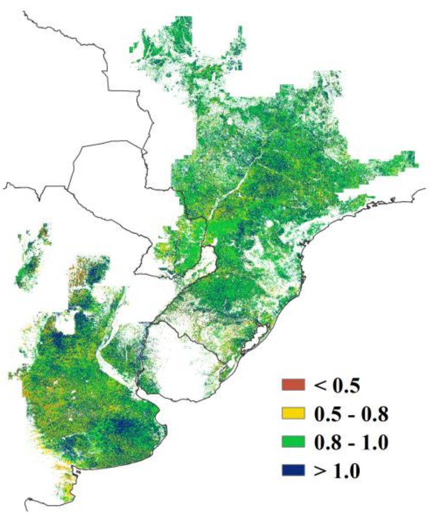
b. Profiles of rainfall departure from average (mm)

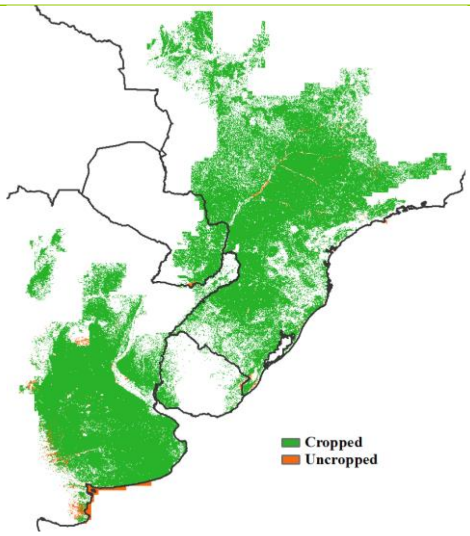




c. Spatial distribution of temperature profiles

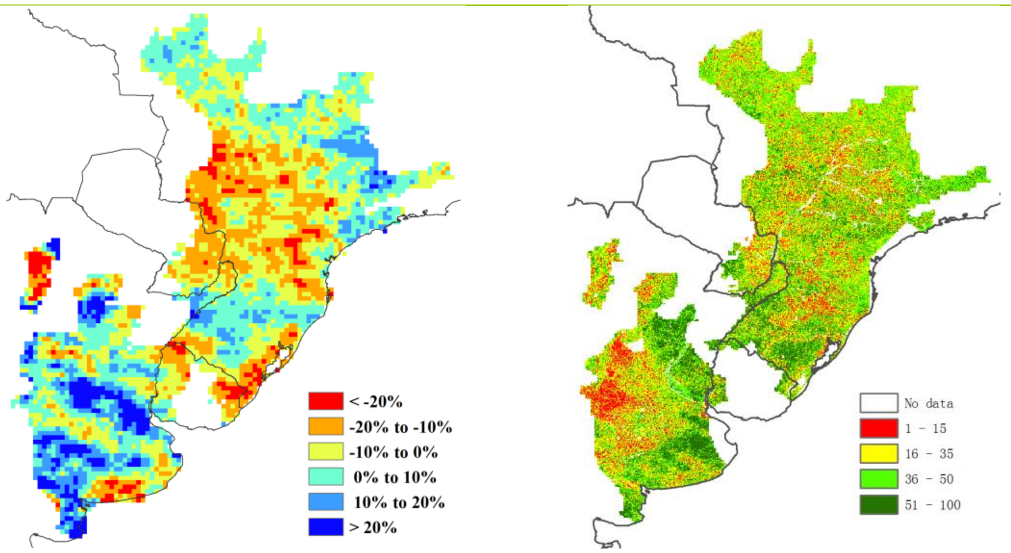
d. Profiles of temperature departure from average (mm)





e. Maximum VCI

f. Cropped arable land



g. Biomass accumulation potential departure h. VHI minimum

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

2.5 South and Southeast Asia

Satisfactory crop condition prevailed over the South and Southeast Asian MPZ during the monitoring period with the maximum Vegetation Condition Index (VCIx) reaching 0.86, even if the biomass production potential (BIOMSS) was 8% lower than the 5-year average. The fraction of cropped arable land (CALF) was average. Most uncropped arable land occurs in India. RAIN was well below average (-20%) but both temperature and photosynthetically active radiation were slightly above average (TEMP +0.1°C, RADPAR +2%).

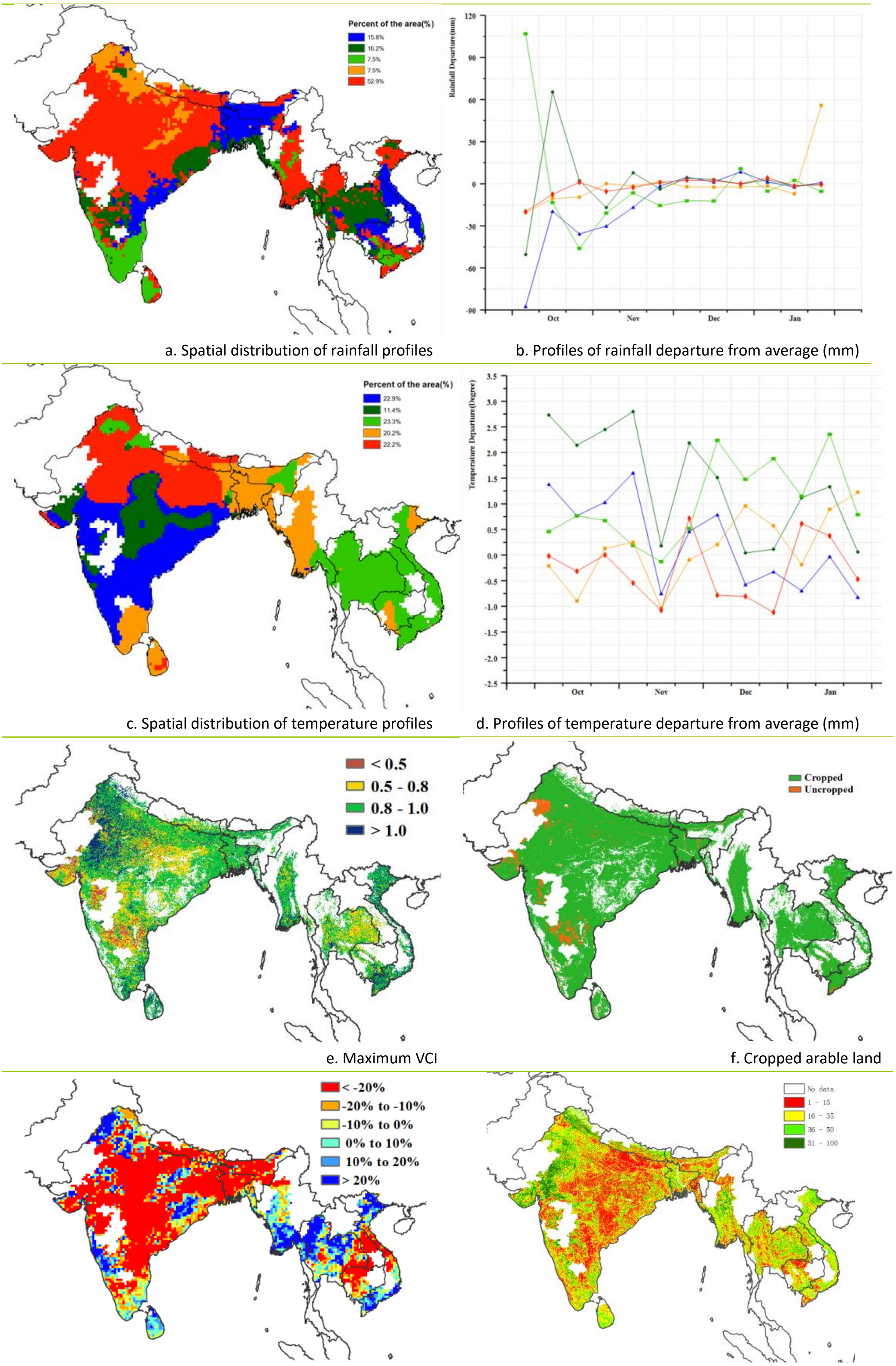
Some national RADPAR values had significant positive anomalies as for instance in the Philippines (+7%) and Cambodia (+6%). Myanmar recorded a slight negative anomaly (RADPAR -1%). Other countries recorded positive values but close to average. TEMP stayed close to average; Sri Lanka and Indonesia recorded negative departures (-0.6°C and -0.4°C respectively), while Vietnam and Thailand were both slightly warmer (0.5°C) than the average. The largest anomalies occurred at the beginning of the reporting in central India (close to +3°C anomaly in and around Madhya Pradesh, about +2.5°C anomaly in and East of Thailand). Close to average temperature prevailed throughout the monitoring period from western Myanmar across Bangladesh to most of northern India.

For RAIN, the largest anomalies were those of Nepal (-48%), Bangladesh (-38%), India (-35%) and the Philippines (-25%) as well as Myanmar where excess precipitation was recorded (+22%). Most anomalies occurred at the beginning of the reporting period in October, with the largest excesses in southern India, Sri Lanka and the Mekong Delta area, and deficits in coastal Andhra Pradesh, Bangladesh and central Vietnam.

As a reflection of the agro-climatic conditions during the reporting period, the biomass accumulation potential fell below the reference of the 5YA. The largest BIOMSS departures are those in India (-24%), Philippines (-18%), Bangladesh (-18%), Myanmar (+24%), Vietnam (+23%) and Thailand (+20%).

Low values of VHI minimum were recorded mainly in India, Cambodia, Thailand, and Myanmar. Maximum VCI appeared mainly in India and Thailand.

Figure 2.4. South and Southeast Asia MPZ: Agroclimatic and agronomic indicators, October 2018 to January 2019



a. Spatial distribution of rainfall profiles

b. Profiles of rainfall departure from average (mm)

c. Spatial distribution of temperature profiles

d. Profiles of temperature departure from average (mm)

e. Maximum VCI

f. Cropped arable land

g. Biomass accumulation potential departure

h. VHI minimum

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

2.6 Western Europe

Crop condition was generally above average in most parts of the continental Western European MPZ during this reporting period. The harvest of summer crops was completed, and winter crops were planted and reached over-wintering stages.

The agroclimatic indicators show that total rainfall across the MPZ (as measured by the RAIN indicator) was 3% below average, resulting from marked negative departures in (1) large parts of Germany, Czech Republic, Slovakia, Austria, Hungary, south of Denmark, Northern and northeastern France from early to mid-October, November, mid-December and after mid-January. The negative departures also cover (2) most of Spain, United Kingdom, north of Denmark, West, South and Southeast of France, central and southeastern Italy in early October, mid-November, after late-December, and (3) north of Italy from early to mid-October, mid-November to early December and after late December. The most severely affected countries were Denmark (RAIN -30%) and United Kingdom (RAIN -13%).Substantially drier than usual conditions in large parts of Western Europe hampered the sowing and emergence of winter crops. However, in northern Italy, the persistent wet weather continued from mid-October to early November and delayed field operations. More rain is needed in the coming months to raise soil moisture levels, and create favorable conditions for the growth of winter crops.

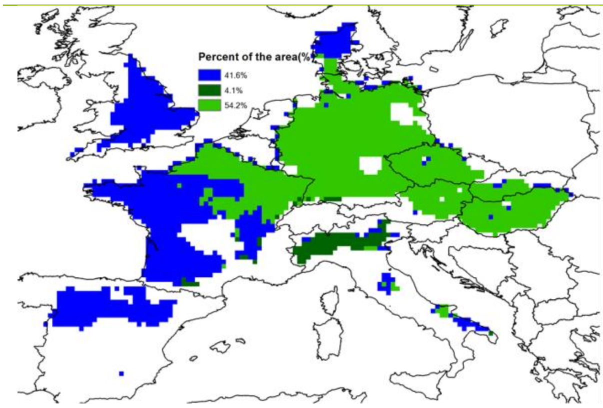
Temperature (TEMP) for the MPZ as a whole was below average (-0.5°C), but radiation was well above average with RADPAR at +4%.Below average temperatures were only observed (1) in the United Kingdom, Spain, France, south of Germany from late October to mid-November and after January; (2) most of Germany and Denmark in late October, late November, mid-December and after late January; (3) Italy, Czech Republic, Slovakia, Austria and Hungary in late November, mid-December and after early January. Sources indicate that no damaging frost has appeared so far.

The biomass accumulation potential was 3% above the recent five-year average. The lowest BIOMSS values (-20% and less) occurred in most of central France and Spain. In contrast, BIOMSS was above average (sometimes exceeding a 10% departure) over western and south-western France, eastern of Spain, eastern Hungary, northern and south-eastern Italy.

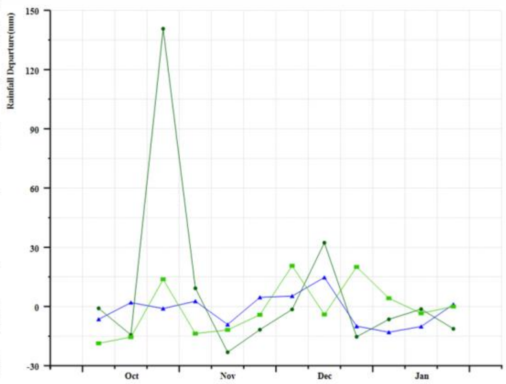
The average maximum VCI for the MPZ reached a value of 0.86 during this reporting period, indicating favorable crop condition in spite of low values in some regions. More than 90% of arable land was cropped, which is the same as the recent five-year average. Most uncropped arable land is concentrated in Spain, and scattered pixels in France, Italy, Slovakia and Hungary.

Generally, the condition of winter crops in the MPZ was above average at the end of the reporting period. However, more rain will be needed to ensure adequate soil moisture supply when the winter crops resume vegetative growth in spring.

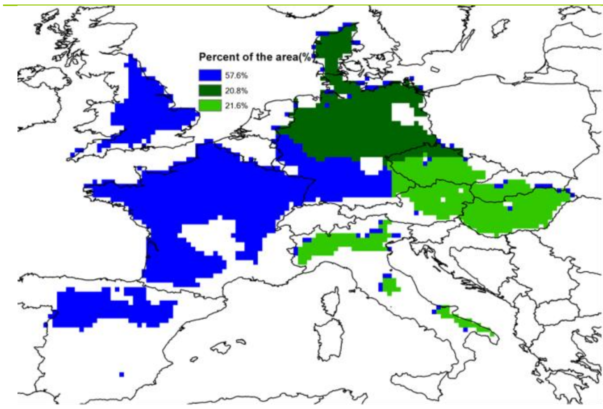
Figure 2.5. Western Europe MPZ: Agroclimatic and agronomic indicators, October 2018 to January 2019.



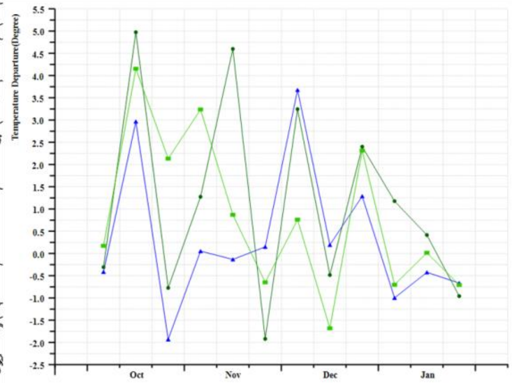
a. Spatial distribution of rainfall profiles



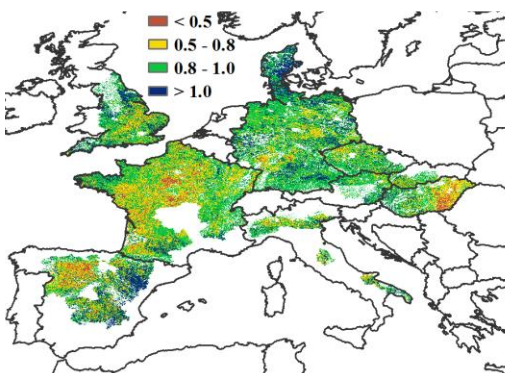
b. Profiles of rainfall departure from average (mm)



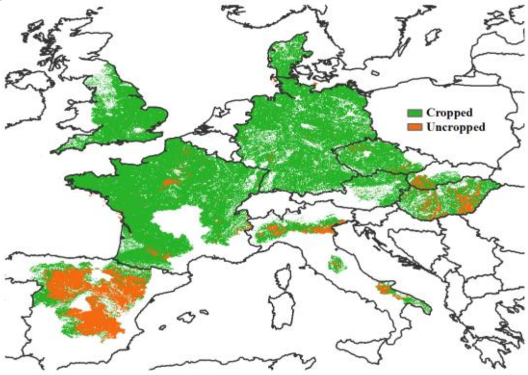
c. Spatial distribution of temperature profiles



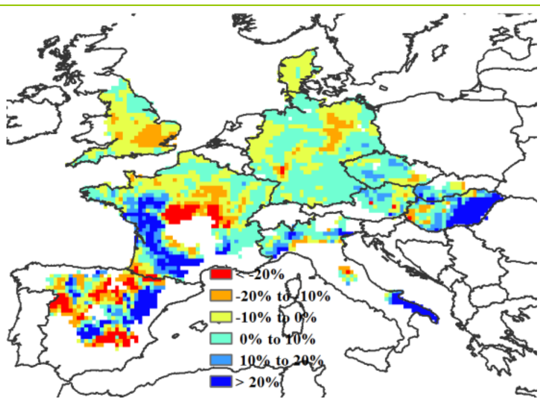
d. Profiles of temperature departure from average (mm)



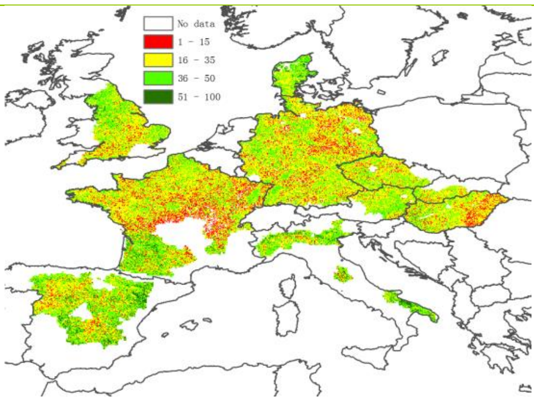
e. Maximum VCI



f. Cropped arable land



g. Biomass accumulation potential departure



h. VHI minimum

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

2.7 Central Europe to Western Russia

The harvest of summer crops was completed at the beginning of the monitoring period, and winter crops were in their early vegetative stages under generally average weather conditions in most parts of the MPZ.

The region experienced above normal radiation conditions, with a 6% increase in RADPAR compared to average, while rainfall slightly decreased 2% and temperature dropped by 0.3°C.

Favorable rainfall occurred in November and December in Romania (RAIN +35%), Moldova, Southern Ukraine (RAIN, +19% for whole country) and Southwestern Russia, including the Krays of Krasnodar and Stavropol, the Oblast of Rostov and the Karachay-Cherkessia Republic. The maximum precipitation occurred in late-December when it reached 75% above average in Romania, Moldova and south-western Ukraine. Below average rainfall affected the MPZ's north-eastern part (almost 34.2% of the MPZ, all in Russia) from mid-October to mid-January, covering the Oblasts of Orenburg, Samarsky and Ulyanov and the Republics of Bashkortostan and Tatarstan.

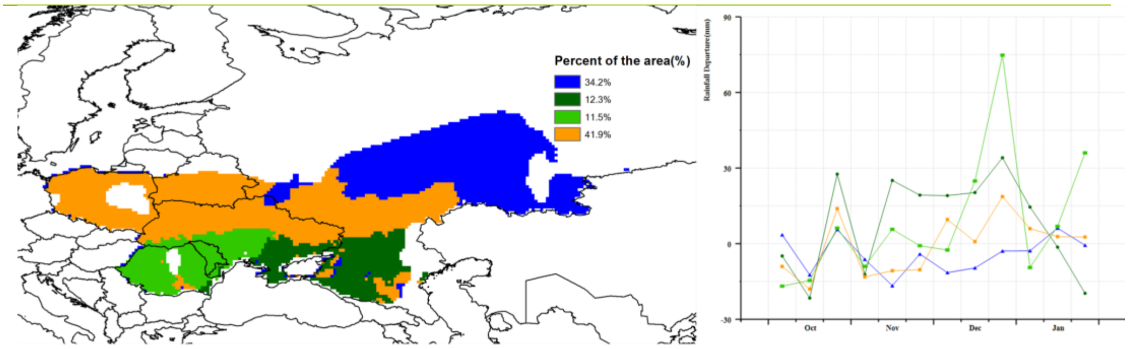
Temperature profiles show correlated variations in the whole MPZ except the eastern part (in Russia) mainly in October and November. Almost all areas of Central Europe to Western Russia enjoyed above average temperature from October to late-November, which benefited the development of winter crops. The coldest area occurred in late-November in southwestern Russia and northeastern Ukraine, with a severe cold spell 4.5°C below average.

Due to overall average rainfall and temperatures during the monitoring period in most parts of central Europe and western Russia, the biomass production potential (BIOMSS) for the MPZ as a whole remained stable with an increase of 2% over average. The BIOMASS map also indicates the average situation in the whole northern MPZ and the above-average condition in southern MPZ. The maximum VCI (0.79) is relatively low among all MPZs.

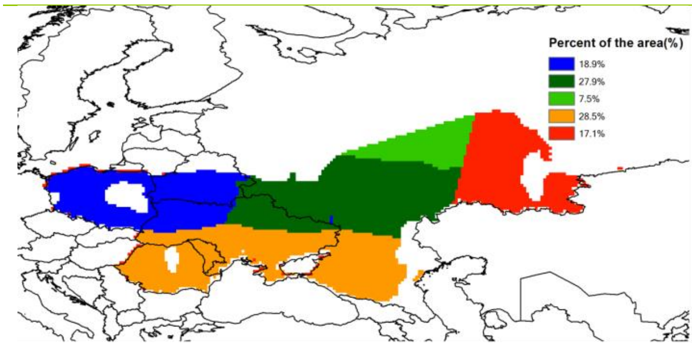
According to the maximum VCI map of this monitoring period, most pixels of the MPZ were in the range of 0.5-0.8 and 0.8-1.0. Uncropped arable land occurs mostly in eastern and southern Ukraine, and southwestern Russia. CALF decreased by 2% over the reference period.

In general, with most parts indicating average crop conditions, prospects for crop production are promising in Central Europe to Western Russia.

Figure 2.6. Central Europe-Western Russia MPZ: Agroclimatic and agronomic indicators, October 2018 to January 2019.

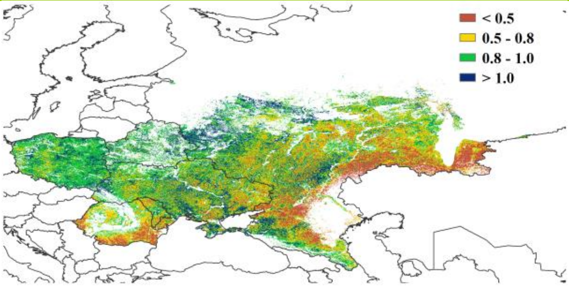


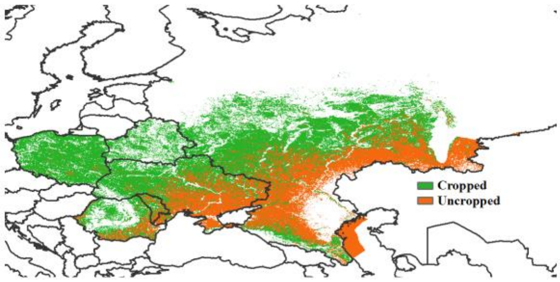
a. Spatial distribution of rainfall profiles b. Profiles of rainfall departure from average (mm)



c. Spatial distribution of temperature profiles

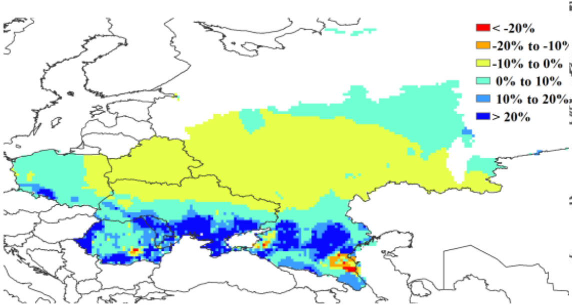
d. Profiles of temperature departure from average (mm)

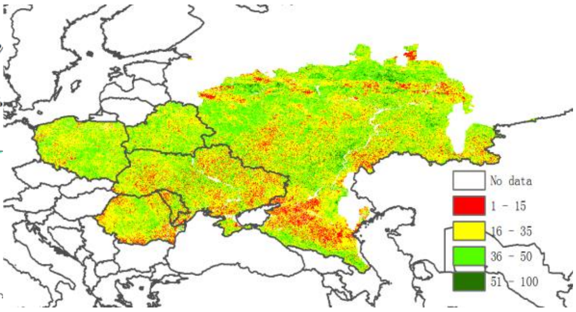




e. Maximum VCI

f. Cropped arable land





g. Biomass accumulation potential departure

h. VHI minimum

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

Chapter 3. Core countries

3.1 Overview

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

1. Introduction

Table 3.1 presents the agroclimatic and agronomic indicators for the period from October 2018-January 2019, showing their departure from the five and fifteen-year averages as applicable. Figures 3.1 through 3.4 show the underlying CWAI indicators. While chapter 1 focuses on global climate patterns that characterize the current ONDJ reporting period using large spatial units, the present introduction to chapter 3 focuses on countries, i.e. it aims at identifying countries that suffered abnormal climatic conditions and resulting abnormal agronomic conditions. 164 countries and territories are included, omitting only those which are too small to yield meaningful results at the spatial resolution (approximately 25 km x 25 km at the equator) adopted for the CropWatch agroclimatic indices (CWAIs). They include mostly small island states.

Only for the 41 major producers and China (41+1 countries), Table 3.1 also lists departures from important agronomic variables including the biomass production potential (BIOMSS), Cropped Arable Land Fraction (CALF) and the maximum Vegetation Condition Index (VCIx). BIOMSS provides the rainfall and temperature limited contribution of the reporting period to annual biomass accumulation. CALF indicates which fraction of arable land was actually cropped. Positive departures mean that cultivated area increased over the average of the previous five years (5YA). VCIx is a measure of yield compared with historical yield for the same locations. High values identify areas where crops performed as well as during the best recent years. Below 0 and above 1 values stand for “worst ever” and “best ever”, respectively.

The major climatic characteristics and anomalies of the reporting period are listed in Chapter 1 and are not repeated in this section which, as mentioned, focuses on countries. Figures 3.1 to 3.4 (RAIN, TEMP, RADPAR and BIOMSS departures, respectively) bear a marked resemblance to the corresponding figures in Chapter 1, although the spatial detail is greater in this chapter where figures include not only countries but also first-level administrative units for the 8 largest countries of the world, of which Kazakhstan is the smallest.

Readers are also invited to consult section 5.2 (Chapter 5) on disasters where additional information is provided for major disasters that occurred during the reporting period, and table 3.1 – mentioned above – which summarizes the indicators for the 41 major agricultural countries.

The section below starts with a list of abnormal conditions among the major exporters

2. Overview of weather conditions in major agricultural exporting countries

The available agronomic indicators do not carry the same statistical weight as the agroclimatic indicators because only selected countries are covered. It is, nevertheless, interesting to compare the countries and to highlight “good” and “bad” performers among the top 10 exporters of maize, rice, wheat and soybean.

In the southern hemisphere, Argentina, Paraguay, Uruguay and southern Brazil are currently in their summer season. All experienced negative temperatures departures increasing from south to north: -1.3°C in Argentina, -0.8°C and -0.9°C in Paraguay and Uruguay, respectively, and -0.5°C in Brazil. In Brazil, the average results from areas cooler than average by 1.0°C to 1.3°C (Tocantins, Mato Grosso, Acre, Maranhao and Para states) and warm areas such as Santa Clara (+0.4°C) and Rio Grande Do Norte (+1.0°C).

Rainfall was close to average in Brazil and Paraguay but excessive (+29%) in Argentina and very excessive (+63%) in Uruguay where rice but especially soybean and maize are likely to have suffered water logging, replaying the scenario of other recent years. Major production areas have been affected in Argentina, including Entre Rios (also referred to as Mesopotamia +78%), Santa Fe, Corrientes and La Rioja (all close to +50%) and, at +25%, La Pampa and Buenos Aires. In Uruguay all Departments had excess precipitation with the lowest values in Treintay Tres (+28%) and Cerro Largo (+30%) and the highest ones, all exceeding +80% in Canelones, Colonia and Paysandú. The precipitation may, however, provide beneficial soil moisture storage for the next winter wheat crop season.

In India, the major rice exporter, the rice season is over in the main northern producing States of West Bengal, Uttar Pradesh, Punjab, Odisha and Andhra Pradesh which output about half the national rice production. The reporting period includes the harvest of late kharif crops, mainly in the south. Nationwide, RAIN was generally in short supply (-35%) during the JASO period but too late to negatively affect crops. In Pakistan, where the crop calendar is similar to India’s, 35% rainfall excess is basically irrelevant for rice exports.

In Thailand, Cambodia and Vietnam, the reporting period covers the harvest of the monsoon season rice as well as the early stages of dry-season rice. Rainfall was generally low in Cambodia (-20%) but closer to normal in Thailand (+10%) and Vietnam (-8%). Especially in Cambodia

Temperature and RADPAR were close to average among the major rice exporters.

Among the main wheat exporters, most are northern hemisphere countries growing winter wheat. The crop is currently in the field after planting from September to December 2018. The most “abnormal” precipitation records include Russia (-10%, a weak deficit) and the United States (+40%). Other countries had close to average precipitation. With the exception of France (1.6°C below average temperature, with CALF about average) all had close to average temperature but variable sunshine (-7% in the United States, +5% in Russia and +7% in Ukraine, where CALF increased by a spectacular 13%). The United States and Canada had among the largest CALF drops among the main agricultural countries (-6% and -15%, respectively). Altogether, wheat prospects are not negatively affected by unfavorable conditions during the current reporting period.

In Romania, one of the major European wheat exporters next to France and Germany, CALF was well below the recent average (-25%), with a modest VCIx value of 0.64.

Australia is one of the main southern hemisphere exporters of wheat; the crop was at harvesting during the first months of the reporting period. Altogether, environmental conditions were unfavorable with drought and floods reported from the country (overall, rainfall was down 7%). Positive values do occur in the south (Tasmania +9%, Victoria +12% and South Australia +24%) while in Queensland (-12%) and western Australia (-25%) the ONFJ balance remained negative.

The national VCIx is just average but CALF is down 20% compared with the previous five years. Altogether, favorable wheat output is unlikely.

3. Agronomic indicators

Romania suffered the largest decrease in CALF among the monitored countries (-35%) without any obvious excessive environmental conditions or disaster reports to explain the reduction. The situation is paralleled by Hungary (-17%) where, however, VCIx reaches 0.78 (as opposed to 0.64, a low value) in Romania.

Next to the already mentioned low CALF values in North America and Australia, unfavorable CALF behavior also occurred in Uzbekistan (-30%).

Large increases between 10% and 20% occurred in Zambia (12%), Mozambique, Ukraine, Kazakhstan, Turkey and Pakistan (19%); between 25% and 30% in Afghanistan, Morocco and Mongolia. Some of the countries (Morocco, Zambia) are in their main growing season and suffered from a precipitation deficit close to 15%. Both have nevertheless very favorable VCIx (0.93 and 1.08, respectively) which should result in fair crops.

The lowest VCIx values between 0.45 and 0.72 were observed in Afghanistan (0.45), Australia, South Africa, Romania, Canada and Pakistan (0.72). While the presence of Romania in the list confirms the somewhat puzzling low CALF, it is in order to highlight the situation in South Africa. While CALF dropped only 3% nationwide, VCIx (0.62) indicates a mediocre maize crop which results from moderately low precipitation (-15%) at country level. Several summer crop areas, however, had more marked precipitation deficits during the current maize season, including the Free State where rainfall was down 26%. Less severe shortfalls affected Kwa Zulu-Natal (-4%) and Limpopo (-9%). The Free State also had a marked increase in sunshine (+10%). Among other major maize growing areas, Mpumalanga seems to be doing fine but the conditions in the North-West closely resemble those of the Free State, with rainfall down 28% and sunshine up 8%, increasing crop water demand.

High VCIx occurs mostly in Asia, starting with Sri Lanka (0.98), Indonesia and Vietnam (0.96), and the Philippines (0.95). All those countries had average CALF and positive RADPAR departures. Rainfall was average or below (Philippines, -25%). All the countries had a crop in the field (mostly rice, but also maize) for which prospects re thus favorable. High values are also observed in Morocco (1.08), Egypt (1.00), Mozambique (0.96) and Iran (0.95) which also recorded CALF increases between 10% (Egypt) and 50% (Iran).

In the American continent, the largest VCIx values occur in Brazil (0.95) and Mexico (0.93); in Europe in Belarus (0.94) and Poland (0.91), two countries with unusually favorable sunshine (+13% and +8%, respectively).

4. Abnormal rainfall

An unusually large number of countries experienced precipitation deficits (larger than 30%), mostly in the Caribbean, Central America and northern South America. They include Guyana (-56%), Jamaica (-52%), Suriname (-52%), French Guyana (-43%), the Dominican Republic (-40%) and Cuba (-38%). Several had deficits in excess of 20%, including Panama, Belize, Venezuela, Costa Rica and Trinidad and Tobago. Amounts recorded were usually around 200 mm when expected amounts are close to 400 mm and more. Most of the listed countries are now in their dry season, so that the deficit mostly corresponds to the end of the previous cropping season. For the southernmost countries, which enjoy mostly equatorial conditions, the deficit may even prove beneficial if it does not extend into the next months as it was generally accompanied by abundant sunshine in countries where cloudiness is a limiting factor.

Low rainfall in Asia affected essentially an isolated country in eastern Asia (Japan, -53%) but mostly the south (Bhutan -49%, Nepal -48%, Bangladesh -328%, India -35%) and – to a lesser extent - the south-east (Laos -22%, Cambodia -20% and the Philippines-25%). New Caledonia, which is part of Oceania, is also mentioned here with -36%. The area also covers north-eastern China including and north of the provinces of Liaoning (-37%) and Hebei (-45%.) They are winter crop areas and the major risk is insufficient snow resulting in frost kill.

In eastern and southern Africa, several countries that suffered from the latest El Niño in 2015-16 are affected by drought again, including – in the south – Namibia (-44%), Botswana (-33%), Zimbabwe (-32%), Lesotho (-28%) and Angola (-21%) and – in the east – Somalia (-40%) and, both about -20%, Kenya and Rwanda. In view of the ongoing main cropping season in the first group, February rainfall will be very critical for the final outcome of the agricultural season.

Finally, four European countries recorded a deficit between 20 and 30%, but raise little concern in view of the limited importance of winter crops at high latitudes: Denmark, Sweden, Finland and the Netherlands. The same applies to a long list of Oblasts in Russia, which are adjacent to Scandinavia, centered around the Republic of Mordovia and the Oblasts of Moscow and Vladimir (all three units at -32%) and extending as far east as western Kazakhstan.

Rainfall excesses are reported from the southern Mediterranean and the Arabian Peninsula where, however, average precipitation tends to be very low during the reporting period (50 mm or less), so that large excess percentages represent relatively modest volumes of water. They do, however, replenish aquifers, boost the growth of rangeland vegetation and generally favorably affect agriculture. This applies to Oman, Yemen, Kuwait and Saudi Arabia. In the Mediterranean and adjacent areas, abundant rainfall affected Turkey, Libya, Lebanon, Iran, Greece and Syria (+26% to +48%) and more significantly Tunisia (+54%), Cyprus (+57%) and Iraq +61%. All those countries are in their main growing seasons and precipitation is welcome. Next to Iran, but further east, Pakistan is one of the countries that recorded the largest positive precipitation anomalies in Asia (+35%). Turkmenistan had a 36% excess of rainfall.

The list includes more countries across all continents, starting with New Zealand (which is also one of the MRUs discussed in Chapter 1, + 36%), Uruguay (+63%), the United States (+40%), the Republic of Korea and Moldova (both at +80%).

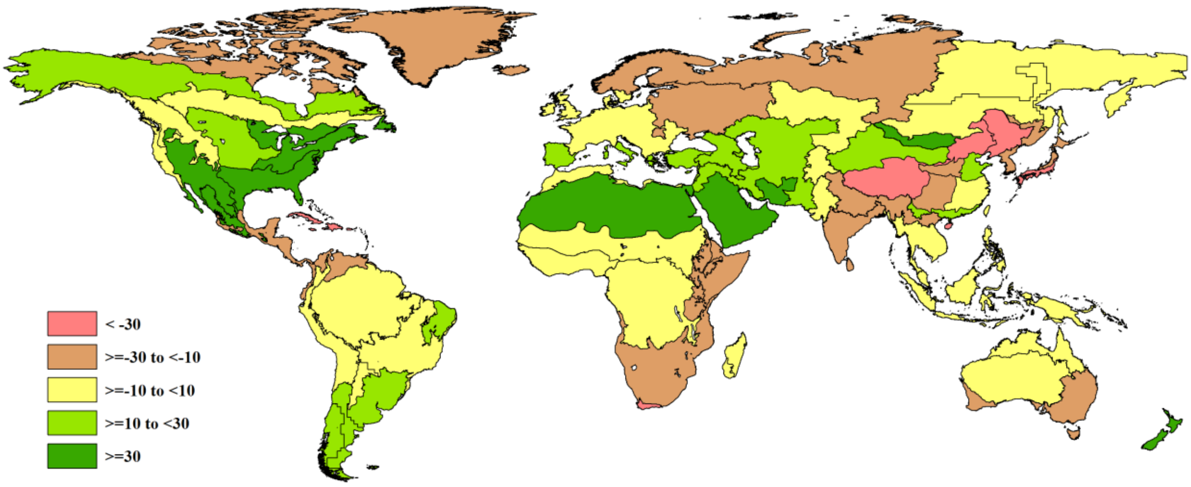


Figure 3.1. Global map of October 2018 to January 2019 rainfall (RAIN) by country and sub –national areas, departure from 15YA (percentage).

5. Abnormal Temperature

The most abnormally low temperatures occurred in Eswatini (-1.7°C) and neighboring Malawi (-1.5°C) and Mozambique (-1.4°C) where average values for the season are close to 25°C. This is unlikely to have created problems, on the contrary: lower than expected temperature has reduced crop water requirements at a time when the main cereal in the region was about to reach flowering.

Europe also experienced some low temperature values with departures ranging from 1.1°C below average in Sweden to 1.6°C below average in France. Tunisia and Portugal, both at -1.2°C compared with average, belong to the same area.

Finally, the two southernmost countries in Latin America, Chile and Argentina, now in their summer season, both had a modest drop in temperature compared with the average of -1.2°C and -1.3°C, respectively.

Relatively warm winter conditions prevailed in the Caucasus (Azerbaijan and Georgia, departure of +1.1°C; Armenia, +1.4°C) and surrounding areas, in southern Africa (Angola and Namibia, +1.4°C and +1.6°C, respectively) and Mongolia (+1.6°C). In Central America both Belize and Guatemala had temperature 1.6°C above average.

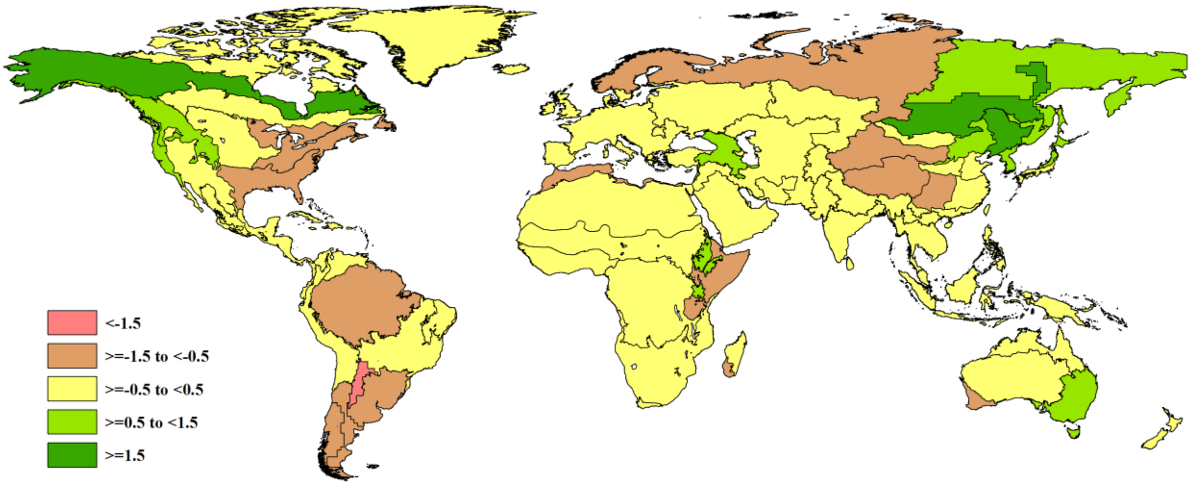


Figure 3.2. Global map of October 2018 to January 2019 temperature (TEMP) by country and sub –national areas, departure from 15YA (degrees C).

6. Sunshine

At the national level, RADPAR was particularly low in the already mentioned cool area centred on the Caucasus and the Middle-East and spanning 4500 km from Bulgaria to the Almaty region in Kazakhstan and Himachal Pradesh in India. This encompasses Iraq (-11%), Syria (-10%), Armenia (-9%), Turkey, and Tajikistan (both a -8%), Uzbekistan (-5%), Iran and Kuwait (-7% both) and Lebanon and Azerbaijan (-6% both).

China, which includes as well areas with large positive RADPAR departures, suffered a 6% deficit nationwide. The largest provincial values include those of Guizhou, Guangxi and Hunan which are close to -20%, which is considerable. Seven provinces have values between -17% and -10%: Jiangxi, Fujian, Zhejiang, Chongqing, Guangdong, Shanghai and Hubei, in increasing order.

In the United States, the globally negative RADPAR values (-6%) results from widespread negative departures in the eastern half of the country. However, deficits were moderate compared with China (lowest values around -10% in Oklahoma, Texas, Kansas, Louisiana and Arkansas).

Low values also affected northern Argentina (-8%), Uruguay (-6%) and across Bolivia (-2%) to Peru (-3%).

Large departures of +10% appear in areas that were already mentioned above, i.e. central America (Belize +10%, Honduras +11%, Costa Rica +14%) and especially Baltic and Scandinavian countries, and the Netherlands: Lithuania +16%, Latvia +17% and Belarus +13%; Sweden +11% and the Netherlands +12%.

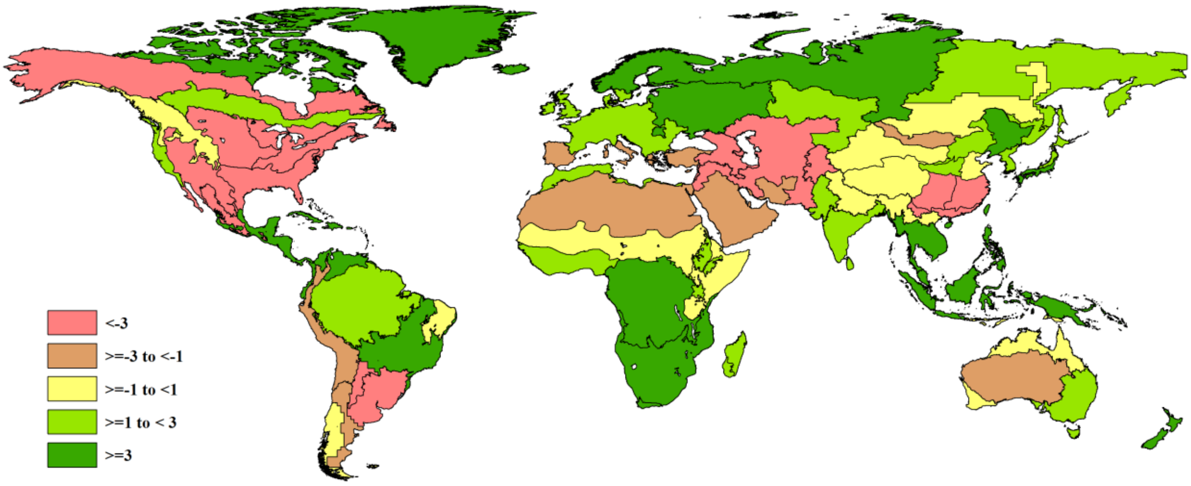


Figure 3.3. Global map of October 2018 to January 2019 photosynthetically active radiation (RADPAR) by country and sub‐national areas, departure from 15YA (percentage).

7. Biomass production potential

The response of BIOMSS to RAIN is very spectacular in semi-arid countries such as Yemen (+84%), Eritrea (+85%) and Saudi Arabia with +168%. Total biomass amounts, however, do not exceed 160 grammes DM m^{-2} (Eritrea). The lowest values are brought about by Caribbean and central American drought (-38% in Guyana).

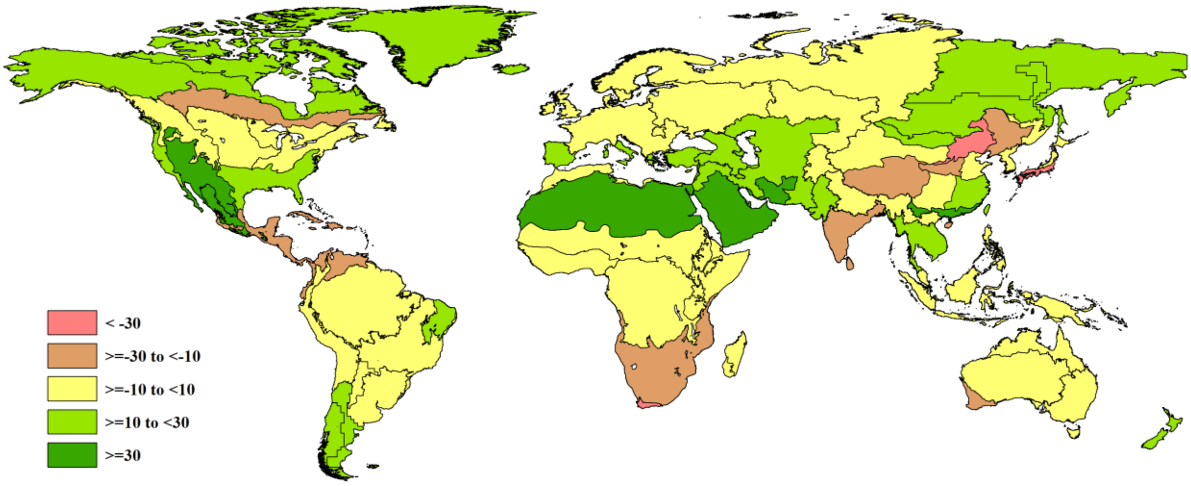


Figure 3.4. Global map of October 2018 to January 2019 biomass production potential (BIOMSS) by country and sub‐national areas, departure from 15YA (percentage).

8. Combinations of extremes

Namibia recorded very unusual data for rainfall (-44%), temperature (+1.6°C), sunshine (+12%) and BIOMSS at -34%, making it probably the most anomalous country, climatically, for the period from October 2018 to January 2019.

In Armenia the corresponding values were +21%, +1.4°C, -9% and +7%. The country is part of a larger Middle-eastern cluster where all countries follow the same pattern (RAIN up, TEMP up, RADPAR down and BIOMSS up). They include Iraq (+61%, +0.8°C, -11% and +64%), Kuwait (121%, +0.6°C, -7%, 63%) and Syria (+48%, +1.0°C, -10% and 43%).

The three remaining countries represent South America with Argentina (+29%, -1.3°C, -8%, 8%) and Guyana (-56%, -0.5°C, 4%, -38%), and the Baltic states in Europe: Latvia (-19%, 0.1°C, 17%, 1%).

Table 3.0. October 2018 - January 2019 agro-climatic and Agronomic indicators by country, current value and departure from average.

Code	Country	Agro-climatic indicators Departure from 15YA (2003-2017)			Agronomic indicators Departure from 5YA (2013-2017)		Agronomic indicators Current
		RAIN (%)	TEMP(°C)	PAR (%)	BIOMSS (%)	CALF (%)	VCIx
AFG	Afghanistan	-6	-0.7	-3	1	25	0.45
AGO	Angola	-21	1.4	9	-16	-1	0.82
ARG	Argentina	29	-1.3	-8	8	8	0.84
AUS	Australia	-7	0.6	1	-7	-19	0.60
BGD	Bangladesh	-38	-0.2	1	-18	3	0.92
BLR	Belarus	-8	-0.3	13	-3	2	0.94
BRA	Brazil	-1	-0.5	4	1	2	0.95
KHM	Cambodia	-20	0.2	6	-2	2	0.88
CAN	Canada	6	-0.2	-1	-11	-15	0.71
CHN	China	-7	0.0	-6	-1	-2	0.88
EGY	Egypt	-3	-0.5	0	23	10	1.00
ETH	Ethiopia	-5	0.9	2	3	0	0.83
FRA	France	1	-1.6	3	5	-1	0.82
DEU	Germany	-6	0.7	6	4	-1	0.91
HUN	Hungary	22	0.7	4	16	-17	0.78
IND	India	-35	0.1	2	-24	0	0.82
IDN	Indonesia	-1	-0.4	4	-1	1	0.96
IRN	Iran	38	1.0	-7	26	51	0.95
ITA	Italy	22	0.2	1	12	5	0.89
KAZ	Kazakhstan	2	-0.4	1	-3	18	0.74
KEN	Kenya	-21	-0.5	1	-13	2	0.87
MEX	Mexico	23	-0.5	-3	36	6	0.93
MNG	Mongolia	-15	1.6	1	11	30	0.84
MAR	Morocco	-17	-0.5	2	-12	29	1.08
MOZ	Mozambique	12	-1.4	0	8	13	0.96
MMR	Myanmar	22	-0.1	-1	24	1	0.92
NGA	Nigeria	16	-0.3	1	13	2	0.91
PAK	Pakistan	35	-0.5	-2	27	19	0.72
PHL	Philippines	-25	-0.2	7	-18	0	0.95
POL	Poland	-1	0.6	8	6	0	0.92
ROU	Romania	35	0.2	1	18	-35	0.64

RUS	Russia	-10	0.0	5	0	8	0.79
ZAF	South Africa	-15	0.1	8	-19	-3	0.62
LKA	Sri_Lanka	2	-0.6	3	2	1	0.98
THA	Thailand	10	0.5	4	20	0	0.84
TUR	Turkey	26	0.9	-8	17	18	0.86
UKR	Ukraine	19	-0.5	7	8	13	0.85
GBR	United Kingdom	-13	-1.4	3	1	0	0.91
USA	United States	40	-0.5	-7	10	-6	0.84
UZB	Uzbekistan	-12	0.5	-5	1	-30	0.82
VNM	Vietnam	-8	0.5	4	23	2	0.96
ZMB	Zambia	-14	-0.7	2	-14	12	0.94

3.2 Country analysis

3.2 Country analysis

This section presents CropWatch analyses for each of 41 key countries (China is addressed in Chapter 4). The maps refer to crop growing areas only and include several graphs: (a) Phenology of major crops; (b) Crop condition development based on NDVI over crop areas at national scale, comparing the October 2018 - January 2019 period to the previous season and the five-year average (5YA) and maximum; (c) Maximum VCI (over arable land) for October 2017 - January 2018 by pixel; (d) Spatial NDVI patterns up to October 2018 - January 2019 according to local cropping patterns and compared to the 5YA; and (e) NDVI profiles associated with the spatial pattern under (d). Next, separate graphs (labeled as figures (f), (g), and subsequent letters) are included to illustrate crop condition development graphs based on NDVI average over crop areas for different regions within the country, again comparing the October 2017 - January 2018 period to the previous season and the five-year average (5YA) and maximum.

Refer to Annexes A and B for additional information about indicator values and production estimates by country. Country agricultural profiles are posted on **www.cropwatch.com.cn/htm/en/bullAction!showBulletin.action**.

Figures 3.5 - 3.45.; Crop condition for individual countries ([AFG] Afghanistan - [ZMB] Zambia) including sub-national regions during October 2018 - January 2019.

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

[AFG] Afghanistan

The reporting period corresponds to the harvest of rice in the irrigated desert areas of the south and the planting of winter wheat.

The country recorded below average rainfall (150mm, -6%), below average TEMP (5°C, -0.7°C) and below average RADPAR (765MJ/m², -3%), which resulted in just above average BIOMSS (460gDM/m², +1%). According to the NDVI profiles for the country, values were very low and below average. The cropped arable land fraction (CALF) was only 3%, which represents a significant rise (25%) above the 5YA. There is only a very limited area that has high VCIx, mainly located in northern central part in the provinces of Kunduz and Takhar. This corresponds to the only area (10.7%) of the arable land where NDVI departure reached positive values just under 0.1, which is significant. About half (46.2%) of cropland in Afghanistan had close to average crops throughout the reporting period.

Winter crop condition is assessed as low to average.

Regional analysis

CropWatch subdivides Afghanistan into four zones based on cropping systems, climatic zones and topography. They are described below as Dry, Central, Dry with irrigated cultivation, and Dry and grazing regions.

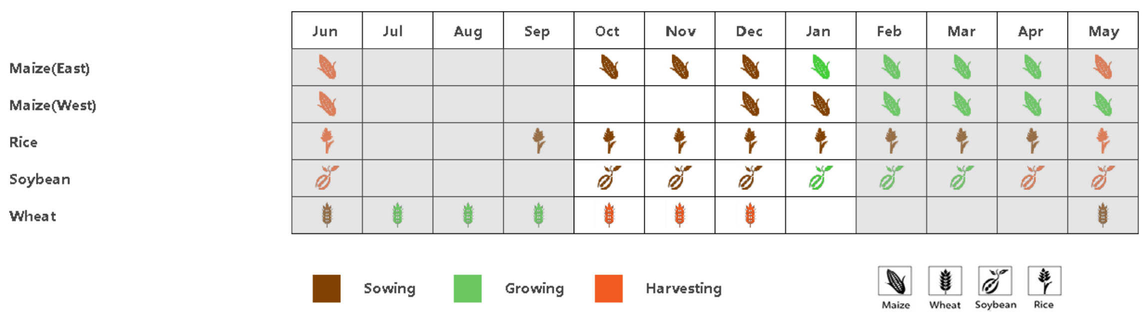
Vegetation is sparse in the Central region. The zone experienced an increase in RAIN of 6% above average with a significant reduction in TEMP (-0.6 °C) and an reduction in RADPAR (-2%). BIOMSS reached 471gDM/m² and was 7% above average. The average VCIx (0.38) and CALF (2%) were low.

The Dry and grazing region with mixed dry farming recorded 125 mm of precipitation, 26% below average, and 4.9°C (-0.9°C). RADPAR was close to the average, at 785MJ/m². The average VCIx for this region was only 0.28.

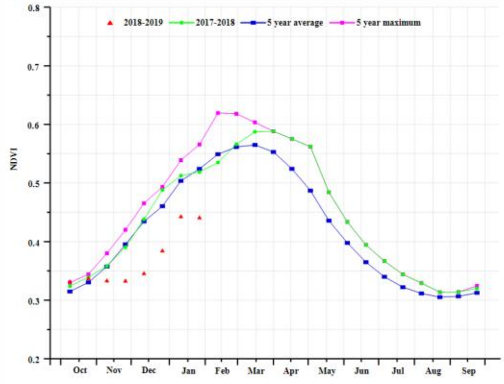
In the arid Dry region RAIN was just 135mm and 19% above average with below average TEMP at 7.9°C (-0.7°C). RADPAR was close to the average, at 874MJ/m². BIOMSS reached 379gDM/m² and was 11% above average. CALF was very low (only 1%).

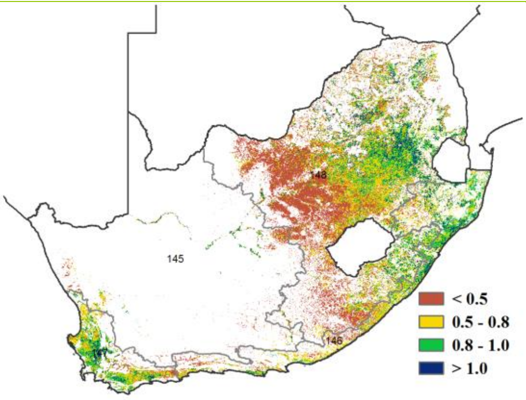
In the Dry and irrigated cultivation region (mixed dry farming and irrigation), precipitation was 9% below average and temperature was below average (TEMP -0.5°C). The region had higher VCIx (0.74) and CALF increased by 28%. However, Crop condition development graph showed that NDVI value during the monitoring period was below 0.2.

Figure 3.5. Afghanistan's crop condition, July -October 2018



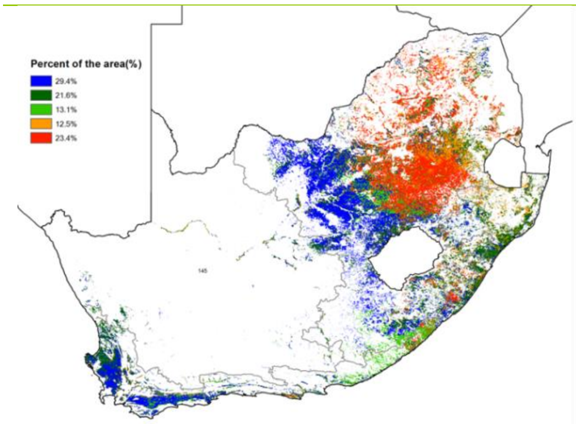
(a). Phenology of major crops

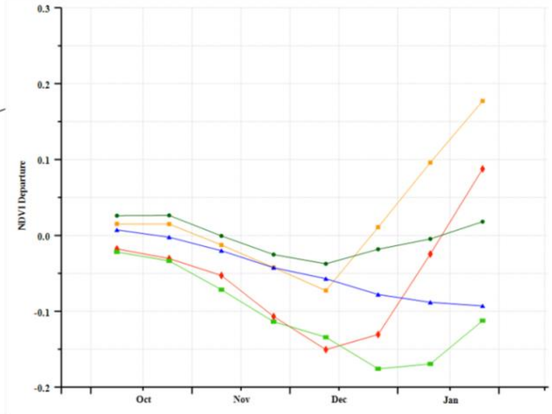




(b) Crop condition development graph based on NDVI

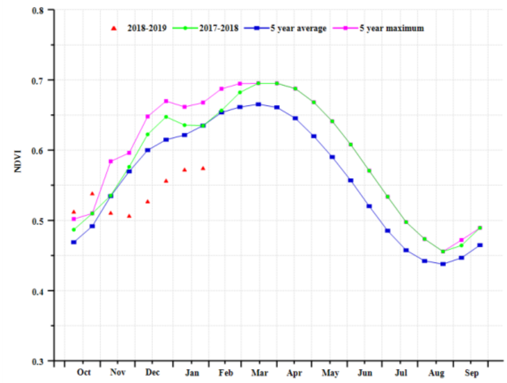
(c) Maximum VCI

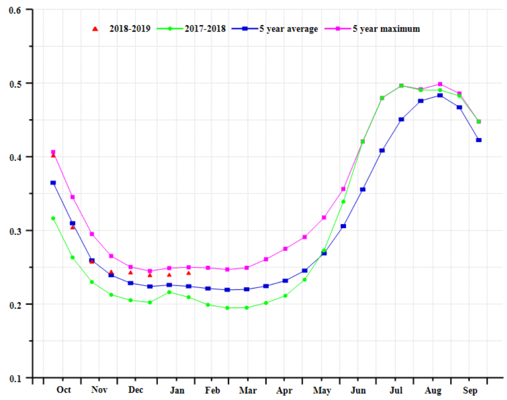




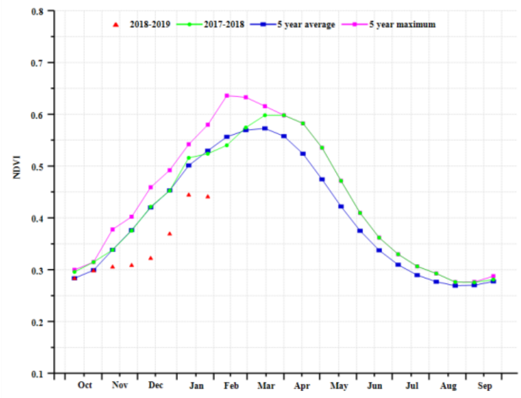
(d) Spatial NDVI patterns compared to 5YA

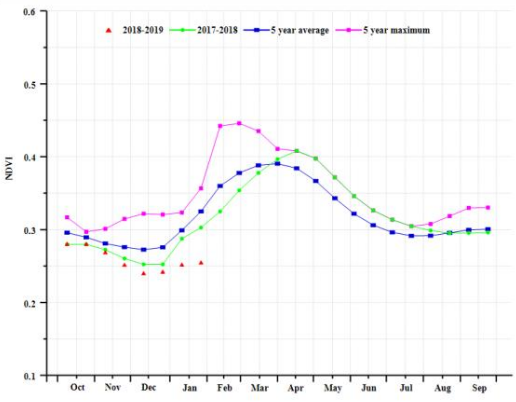
(e) NDVI profiles





(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_Irrigated Region (left) and Dry (right))

Table 3.1. Afghanistan's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, October 2018 - January 2019

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m^2)	Departure from 15YA (%)
Central region	363	-7	20.5	-0.4	1356	7
Dry region	37	-56	18.9	0.2	1632	3
Dry and irrigated cultivation region	352	-15	21.3	0.1	1605	9
Dry and grazing region	71	-58	22.0	0.9	1744	7

Table 3.2. Afghanistan's agronomic indicators by sub-national regions, current season's values and departure from 5YA, October 2018 - January 2019

Region	BIOMSS		Cropped arable land fraction		Maximum VCI
	Current (gDM/m^2)	Departure from 5YA (%)	Current (%)	Departure from 5YA (%)	Current
Central region	1037	-12	0.9	0	0.7
Dry region	164	-51	0.6	3	0.4
Dry and irrigated cultivation region	1101	-17	0.6	-4	0.6
Dry and grazing region	269	-56	0.2	1	0.6

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

[AGO] Angola

Maize and rice were in the sowing and growing season while wheat was harvested in October.

Compared with average rainfall was lower (RAIN -21%) and both temperature and sunshine were up (TEMP 1.4°C, RADPAR 0.3%), marginally so for RADPAR. Mostly due to the drop in precipitation, BIOMASS fell 15% below average. At end of October and the beginning of November, the NDVI development graph shows that crop condition was below the 5 years average and below the corresponding values during the previous years. CALF was about average (1% below the 5YA) and the maximum VCI reached 0.82.

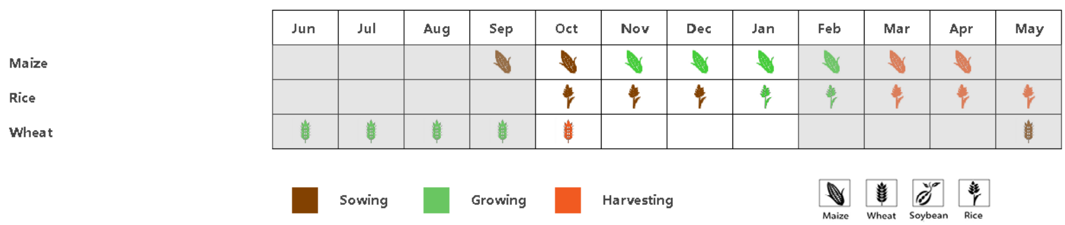
NDVI patterns indicate that a large section of the country (35% of cropped areas), mostly in the Southern regions, experienced below average crop condition. The least favorable condition was recorded at the end of December when about 50% of crop areas were below the 5 years average. Favorable crop condition (maximum VCI between 0.8 and 1.0) was observed in the provinces of Zaire, Uige, Cuanza Norte and Cuanza Sul. In general, however, the country suffered below average crop condition.

Regional Analysis

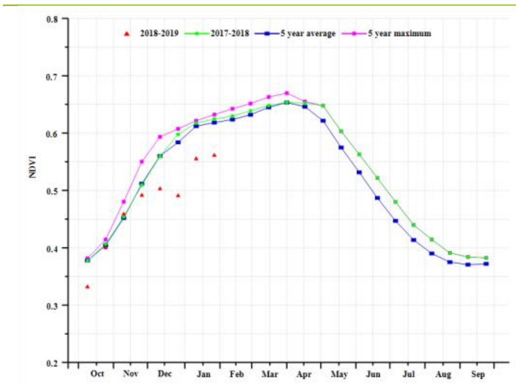
Considering the cropping systems, climatic zones and, and topographic conditions, Angola is divided into five agro −ecological zones (AEZs): Sub-humid, Humid, Arid, Semi-arid and Desert.

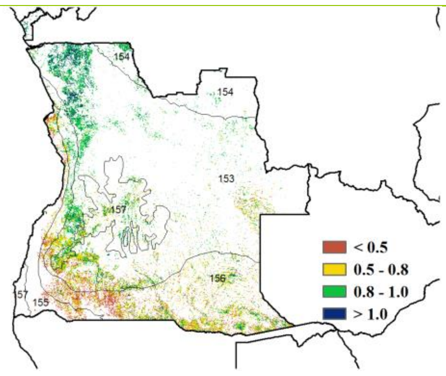
All ago-ecological regions suffered a shortage of rain, but temperature and RADPAR were above average. The most significant decrease in rain was observed in the Arid and Semi-arid zones (RAIN -40% and- 37%, respectively). The Desert zone showed a very large increase in temperature and radiation over the average (TEMP +2.6°C and RADPAR +13%). Biomass and the cropped arable land fraction CALF fell in all regions relative to the average of past 5 years. Again, the most anomalous situations occur in the Arid zone and Semi-arid zones, where BIOMSS decreased 28% (in both regions), and the largest CALF decrease (of about 20%) was observed in the arid zone. The NDVI development graphs for this period indicates that the condition of crops was unfavorable in all agro-ecological zones, especially during the period between December and January.

Figure 3.6. Angola's crop condition, October 2018 - January 2019



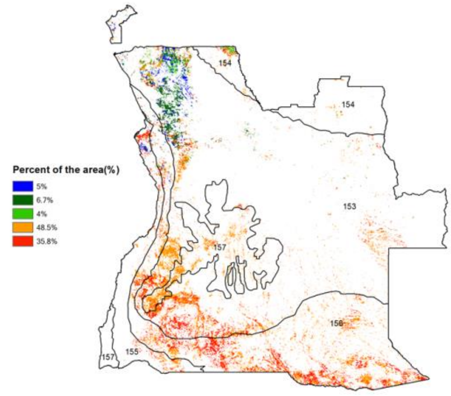
(a). Phenology of major crops



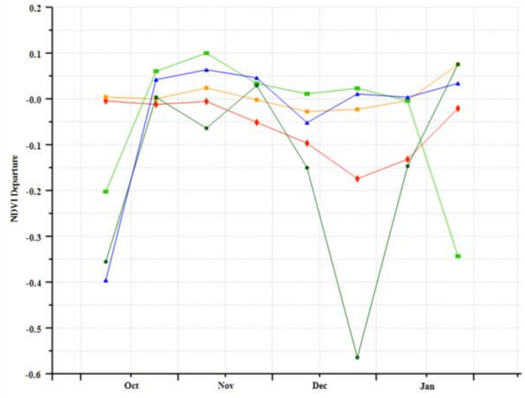


(b) Crop condition development graph based on NDVI

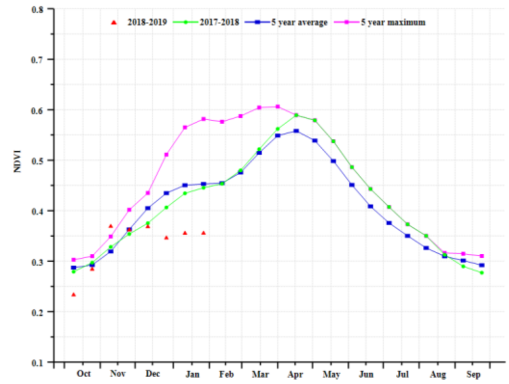
(c) Maximum VCI



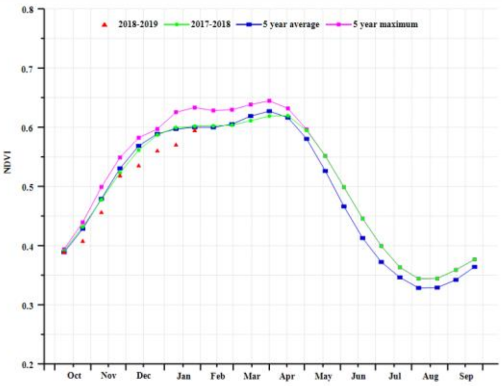
(d) Spatial NDVI patterns compared to 5YA



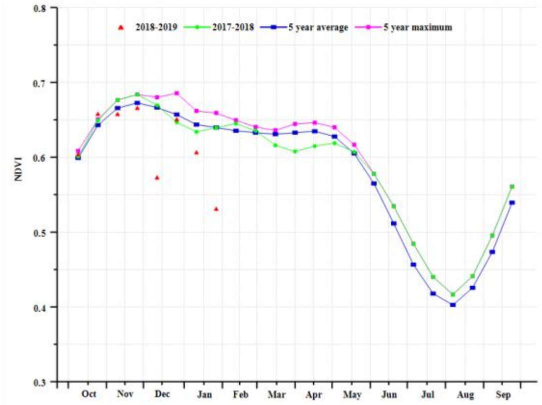
(e) NDVI profiles



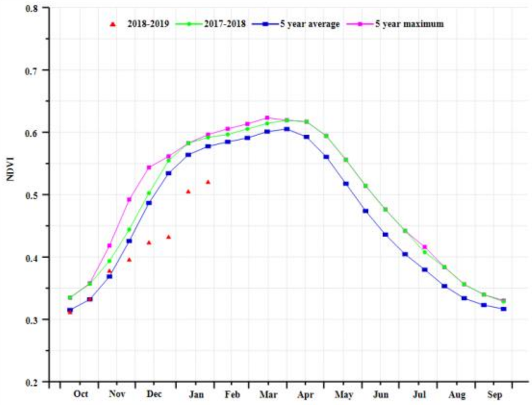
(f) Crop condition development graph based on NDVI - Sub-humid zone



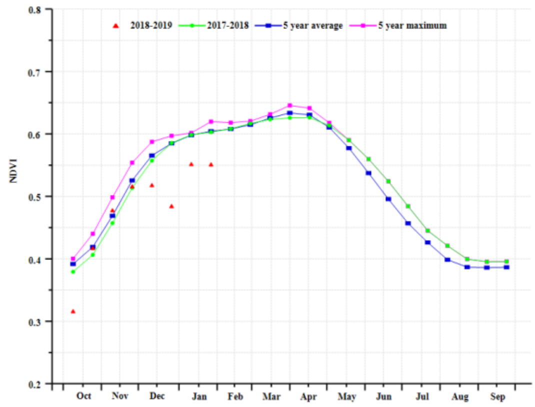
(g) Crop condition development graph based on NDVI - Humid zone



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



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



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

Table 3.3. Angola agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, October 2018 - January 2019

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m^2)	Departure from 15YA (%)
Arid Zone	121	-40	24.9	0.0	1415	3
Desert zone	582	-15	23.5	2.6	1269	13
Humid zone	670	-4	25.4	0.1	1182	4
Semi-Arid Zone	281	-37	27.4	1.6	1453	12
Sub-humid zone	502	-15	25.6	1.3	1248	6

Table 3.4. Angola agronomic indicators by sub-national regions, current season's values and departure from 5YA, October 2018 - January 2019

Region	BIOMSS		Cropped arable land fraction		Maximum VCI
	Current (gDM/m^2)	Departure from 5YA (%)	Current (%)	Departure from 5YA (%)	Current
Arid Zone	521	-28	39	-20	0.59
Desert zone	1617	-12	91	2	0.88
Humid zone	2044	-1	100	0	0.96
Semi-Arid Zone	971	-28	81	-1	0.74

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[ARG] Argentina

The reporting period covers harvesting of wheat, the main growing season of maize and rice, as well as the sowing for early and late soybean. For the whole country rainfall showed a positive anomaly of 29%.Temperature was reduced 1.3°C below average and RADPAR fell 8 %. BIOMSS showed an increment of 8 %. Overall crop condition was favorable during the monitoring period.

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

Spatial distribution of NDVI profiles shows a stable pattern with a low positive anomaly (close to 0.05) for Western Humid Pampas, Mesopotamia and East Chaco. Southern Humid Pampas and Dry Pampas showed no anomalies at the beginning of the reporting period and slight negative anomalies since December. The central and north-western Humid Pampas show an inhomogeneous spatial pattern, alternating areas with positive and negative anomalies in NDVI.

Crop condition development graphs for the whole country based on NDVI show changes from a positive anomaly at the beginning of the reporting period to negative values at the end; this pattern was also observed in the Humid Pampas. On the contrary, Chaco, Mesopotamia and Subtropical highlands showed persistently higher values than the 5 year average NDVI.

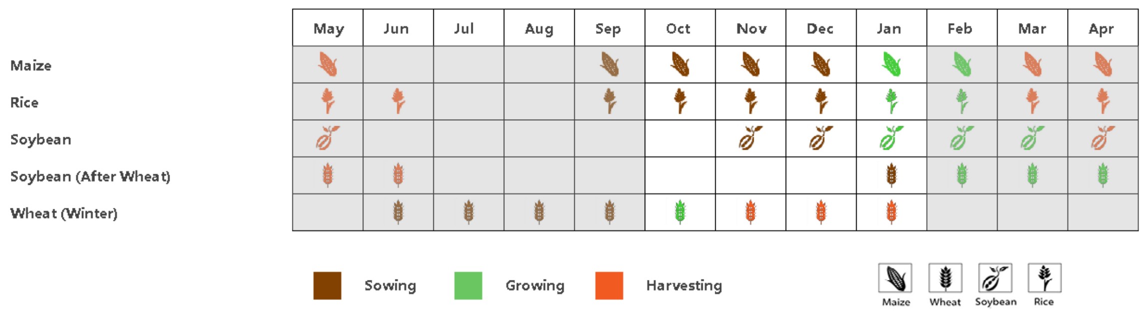
The VCIx map in general shows good crop condition with values above 0.8 in most of the area. Lower values are observed in central and western Humid Pampas, as well as in the western Chaco, Dry Pampas and Pampas hills.

Regional analysis

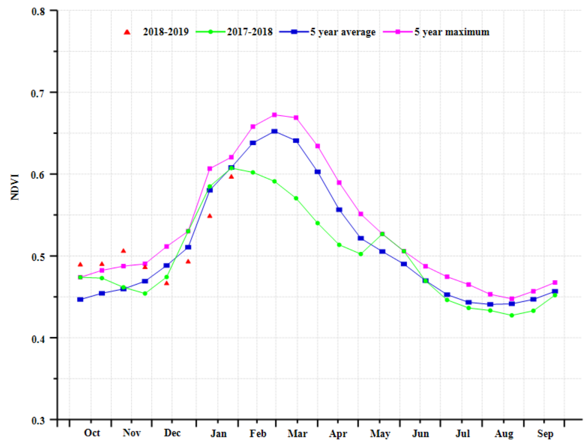
The four zones showed different behavior in RAIN. High positive anomalies were observed in Mesopotamia (+48 %), Humid Pampas (+31 %) and Chaco (+20 %), while a slight negative anomaly was observed in Subtropical highlands (-4 %). TEMP showed negative anomalies in the four zones, Subtropical highlands (-1.8°C), Humid Pampas (-1.5°C), Chaco (-1.1°C) and Mesopotamia (-1.0°C). Negative anomalies were also observed for RADPAR in Subtropical highlands (-13 %), Chaco (-11 %), Mesopotamia (-8 %), and Pampas (-6 %).

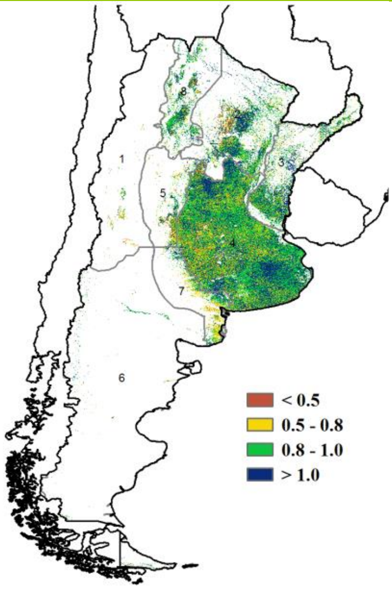
Three regions showed increments in BIOMSS: 10 % in Humid Pampas and Mesopotamia and 8 % in Chaco, while Subtropical highlands showed a reduction of 3 %. Maximum VCIx values were higher in Humid Pampas (0.92), followed by Mesopotamia (0.76), Subtropical highlands (0.75) and Chaco (0.74). According to CALF indicator, the 4 regions showed almost fully cropped areas, representing an increase over the five previous seasons of 16 % for Subtropical highlands, 9 % for Chaco, 7 % for Pampas and no change for Mesopotamia.

Figure 3.7. Argentina's crop condition, October 2018 - January 2019



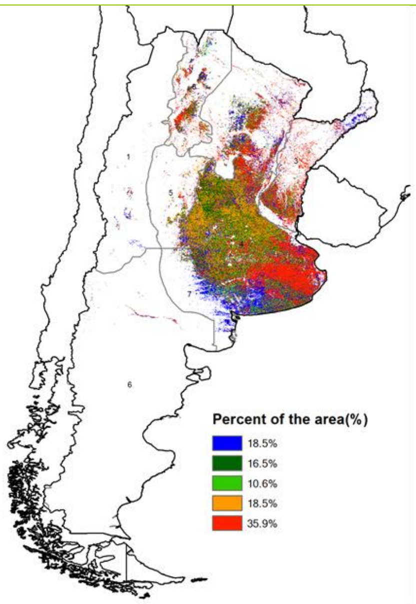
(a). Phenology of major crops

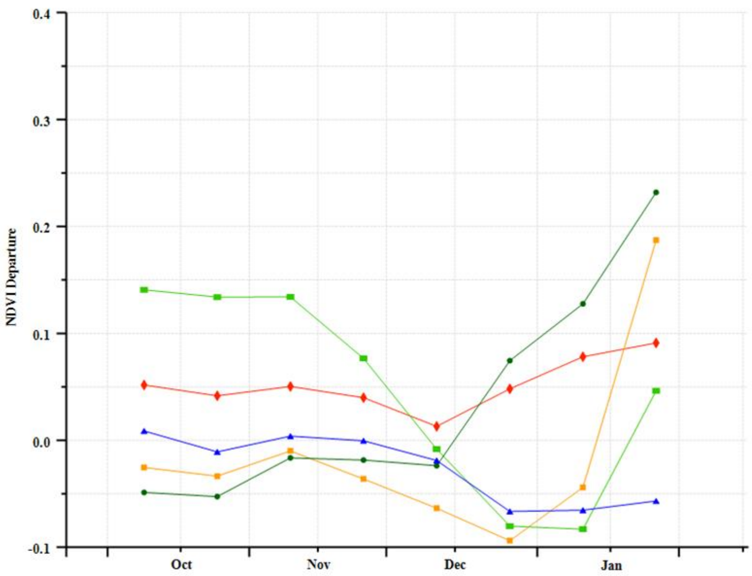




(b) Crop condition development graph based on NDVI

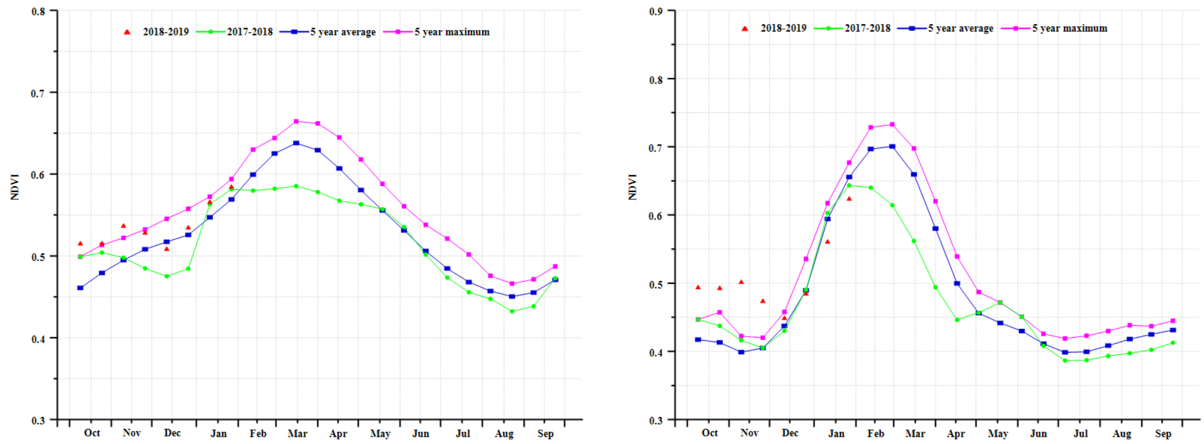
(c) Maximum VCI



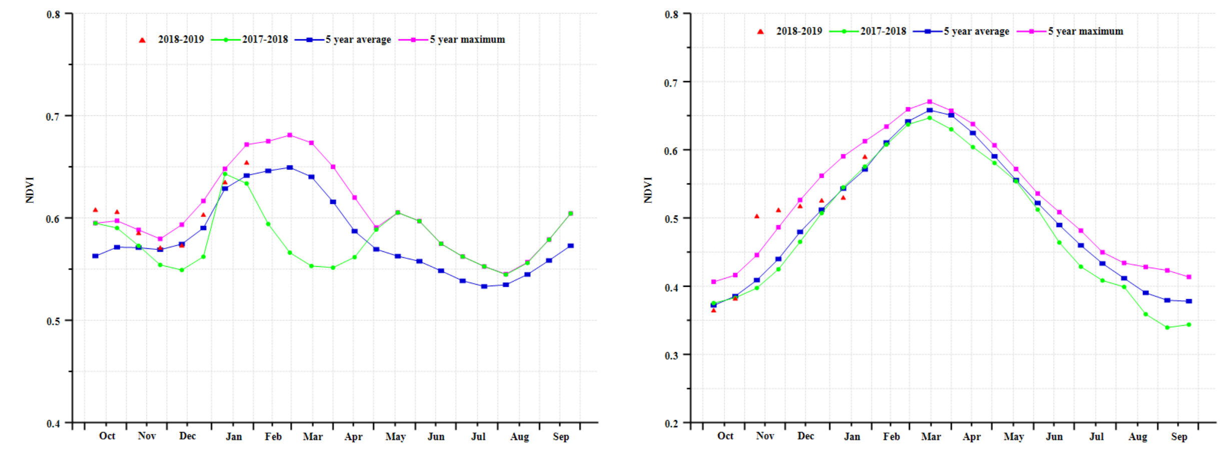


(d) Spatial NDVI patterns compared to 5YA

(e) NDVI profiles



(f) Crop condition development graph based on NDVI (Subtropical highlands (left) and Chaco region (right))



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

Table 3.5. Argentina's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, October 2018 - January 2019

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m^2)	Departure from 15YA (%)
Chaco	637	20	24.9	-1.1	1232	-11
Mesopotamia	1087	48	23.3	-1.0	1314	-8
Humid Pampas	591	31	20.0	-1.5	1432	-6
Subtropical highlands	418	-4	23.6	-1.8	1203	-13

Table 3.6. Argentina's agronomic indicators by sub-national regions, current season's values and departure from 5YA, October 2018 - January 2019

Region	BIOMSS		Cropped arable land fraction		Maximum VCI
	Current (gDM/m^2)	Departure from 5YA (%)	Current (%)	Departure from 5YA (%)	Current
Chaco	1613	8	97	9	0.74
Mesopotamia	1894	10	100	0	0.76
Humid Pampas	1560	10	99	7	0.92
Subtropical highlands	1209	-3	98	16	0.75

[AUS] Australia

The main crops of Australia are wheat and barley, which are planted mainly from May to July and harvested from October to January. The monitored time period thus covers the harvest of wheat and barley. Based on spatial NDVI patterns and profiles, the crop condition was average from October to December, but dropped to below average in January. To be more specific: the south-eastern part of New South Wales and north-eastern part of Victoria show poor crop conditions with VCIx below 0.5, accounting for about 27.3% of the arable land. However, the south-western part of West Australia and the southern part of Victoria show above average condition from October to January with VCIx above 0.8, accounting for about 29.2% of the cropland. The CALF fell significantly by 19% below the last 5-year average. Below average production is expected for Australia in this season.

Regional analysis

This analysis adopts five agro-ecological regions for Australia, namely the South-eastern wheat zone, South-western wheat zone, Arid and semi-arid zone, Wet temperate and subtropical zone, and Sub-humid subtropical zone.

The crop condition in the **South-eastern wheat zone**, especially in the northern part showed below average crop condition at the start of the harvest in October. Most of the VCIx lies in the range below 0.5 with CALF decreasing markedly by 34%. Below average production is likely.

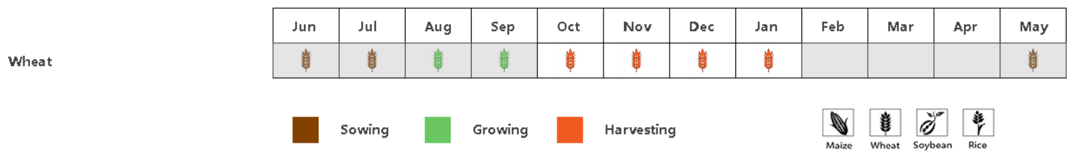
The crops in the **South-western wheat zone** show above average condition at this period of harvesting. The VCIx reaches 0.92 with CALF up 20%. Above average production is expected.

Crop condition in the **Arid and semi-arid zone** is generally average due to the average agro-climatic condition: rainfall +2%, temperature -0.1℃, RADPAR 2%. With VCIx at 0.69 and a CALF increase of 9%, average crop condition is likely.

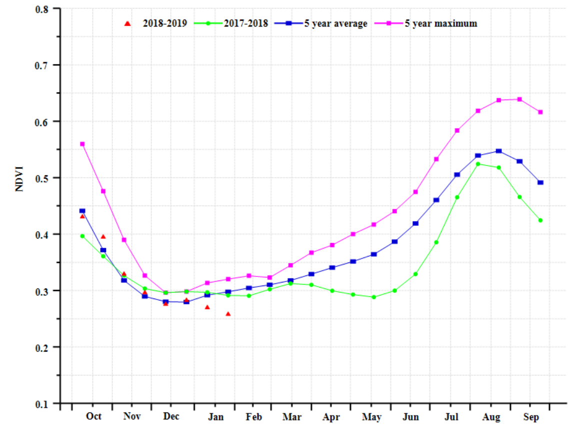
The **Wet temperate and subtropical zone** showed above average crop condition at the time of harvest in October, as rainfall and temperature were close to, but slightly above average (+4% and + 0.6℃, respectively). The VCIx of 0.77 indicates a generally average condition with stable CALF.

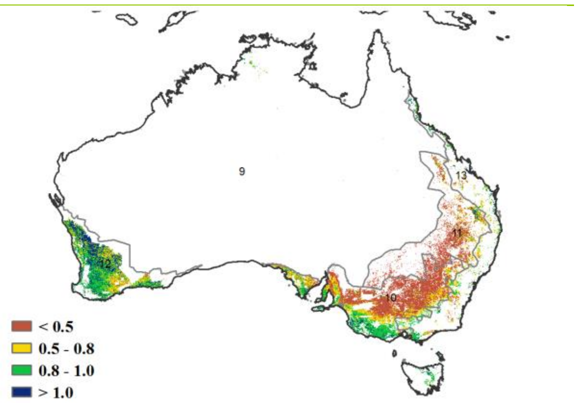
Crop condition in the **Sub-humid subtropical zone** was apparently below average throughout the season, possibly due to below average rainfall (-32%) and hot temperature (1.1℃ above average). Furthermore, CALF dropped significantly (57%) and VCIx of only 0.32, indicating very poor production for this AEZ.

Figure 3.8. Australia's crop condition, October 2018 - January 2019



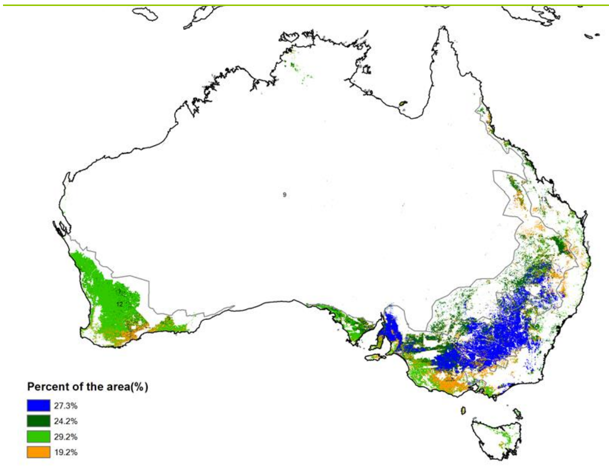
(a). Phenology of major crops

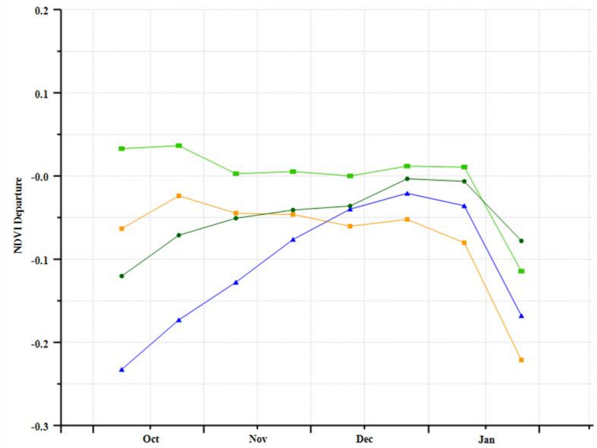




(b) Crop condition development graph based on NDVI

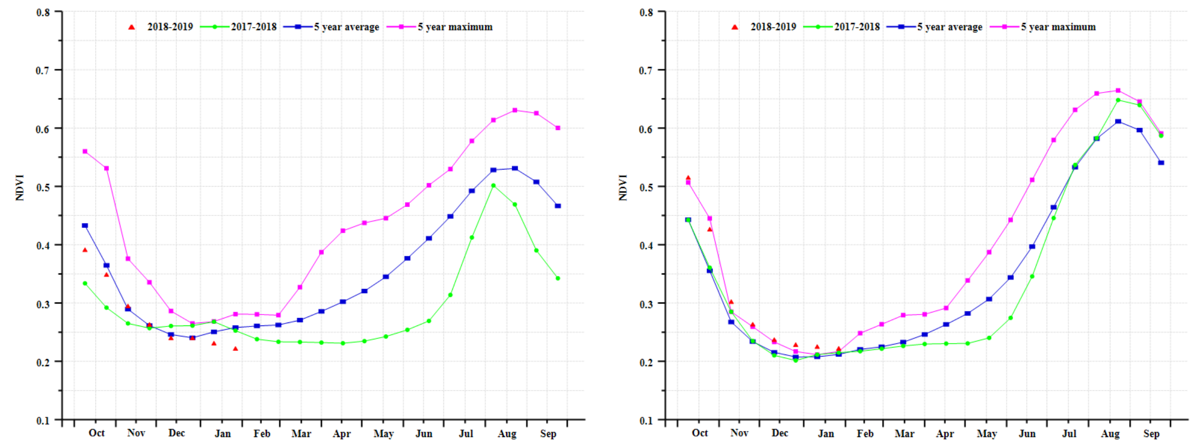
(c) Maximum VCI



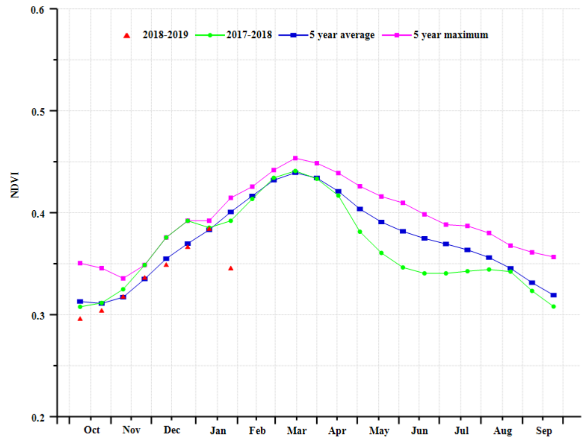


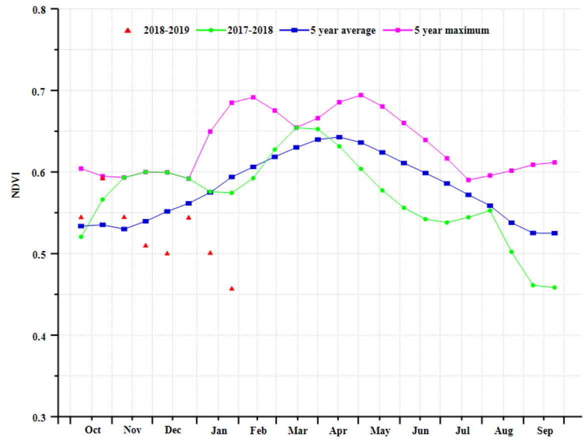
(d) Spatial NDVI patterns compared to 5YA

(e) NDVI profiles

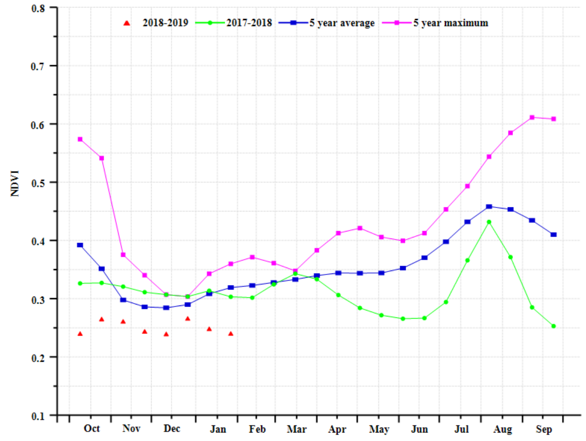


(f) Crop condition development graph based on NDVI (South-eastern wheat zone (left) and South-western wheat zone (right))





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



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

Table 3.7. Australia's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, October 2018 - January 2019

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m^2)	Departure from 15YA (%)
Southeastern wheat zone	157	2	21.1	0.9	1475	-1
Southwestern wheat zone	76	-23	19.1	-0.7	1511	0
Arid and semiarid zone	730	2	28.2	-0.1	1388	2
Wet temperate and subtropical zone	355	4	21.1	0.6	1404	0
Subhumid subtropical zone	192	-32	25.1	1.1	1570	4

Table 3.8. Australia's agronomic indicators by sub-national regions, current season's values and departure from 5YA, October 2018 - January 2019

Region	BIOMSS		CALF		Maximum VCI
	Current (gDM/m^2)	Departure from 5YA (%)	Current	Departure from 5YA (%)	Current
Southeastern wheat zone	692	5	48	-34	0.48
Southwestern wheat zone	353	-16	70	20	0.92
Arid and semiarid zone	1198	-2	61	9	0.69
Wet temperate and subtropical zone	1031	1	96	0	0.77
Subhumid subtropical zone	733	-24	17	-57	0.32

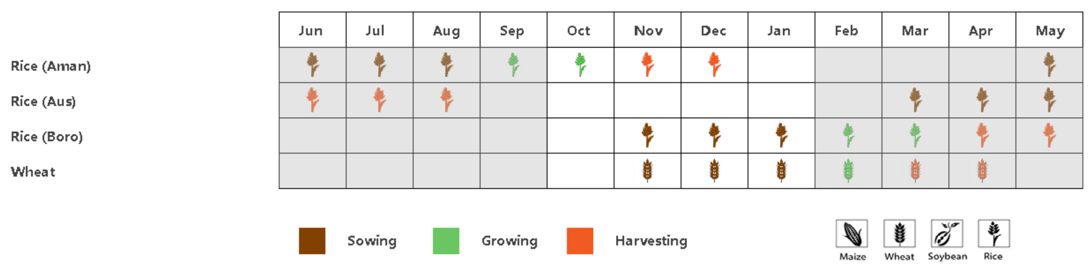
AFG AGO ARG AUS **BGD** BLR BRA CAN DEU EGY ETH FRA GBR HUN IDN IND IRN ITA KAZ KEN KHM LKA MAR MEX MMR MNG MOZ NGA PAK PHL POL ROU RUS THA TUR UKR USA UZB VNM ZAF ZMB

[BGD] Bangladesh

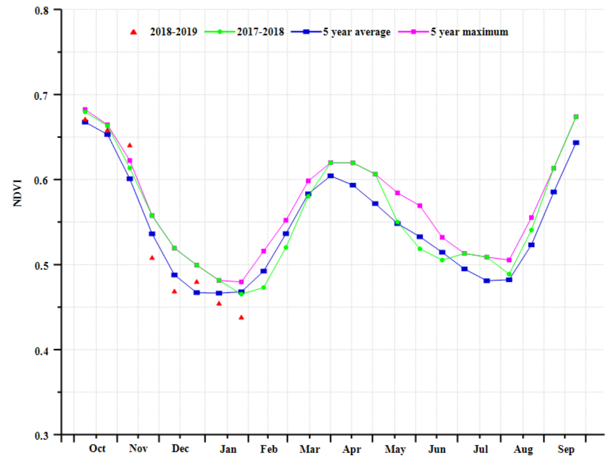
The growing and harvesting of Aman rice and sowing of irrigated dry season Boro rice and wheat were the main farming activities during the reporting period. The CropWatch indicators and overall crop condition were close to average except in January when they were lower than average. The country recorded 153 mm of RAIN, which is significantly below the average by 37 %. Temperature (22.4°C) was just below the average (-0.2°C), while sunshine was average. The overall biomass accumulation potential (BIOMSS) dropped 17% below the five-year average, while the crop arable land fraction (CALF) was close to average. The national NDVI profile was above the recent 5-year average in October, but from November to January, it stayed below the average curve.
In the Sylhet Division, the spatial NDVI profile remained above the average during October but fell below from November. In the other Divisions, the spatial NDVI profile remained below the average during the monitoring period. Over the whole country, the maximum VCI mostly ranged from 0.8 to 1, indicating good crop condition.

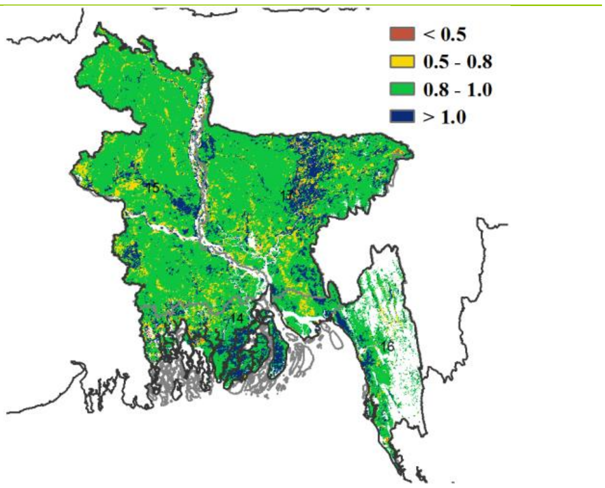
Regional analysis
Bangladesh includes four Agro-ecological zones (AEZ) referred to hereafter as Coastal region, Gangetic plain, the Hills and the Sylhet basin.
The Coastal region recorded 262mm of RAIN, 11% below average and TEMP and RADPAR were average at 23.2°C and 1036MJ/m2, respectively. BIOMASS exceeded the 5YA by 2%. The CALF value was average, and VCIx at 0.9 generally indicates good crop condition.
The Gangetic plain received low rainfall (73mm,64% below average), TEMP stayed average (22.2°C) and RADPAR was up 2 %. The CALF was average. With VCIx at 0.9 and BIOMASS 36% below the 5YA, a drop in production below the average can be expected.
The precipitation in the Hills amounted to 401 mm (9% higher than average). TEMP was cooler by -0.9°C and RADPAR was just below (1% below). The BIOMASS reached 917 gDM/m2 and was 18 % above the 5YA. The CALF did not change relative to the 5YA, and VCIx was as high as 0.9, which indicates good crop condition.
The Sylhet basin recorded 86 mm, 61% below average, with average TEMP at 22.3°C and slightly above average RADPAR (976 MJ/m2 or +1%). The BIOMASS was beneath the average (-30%), but the CALF increased 7% above the 5YA, with the VCIx value at 0.9.

Figure 3.9 Bangladesh's crop condition, October 2018 - January 2019.



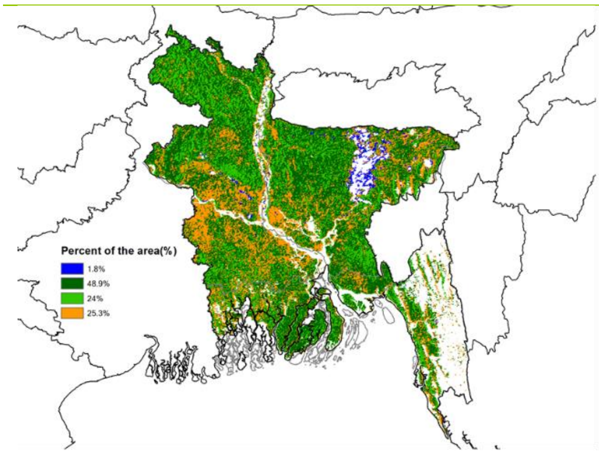
(a). Phenology of major crops

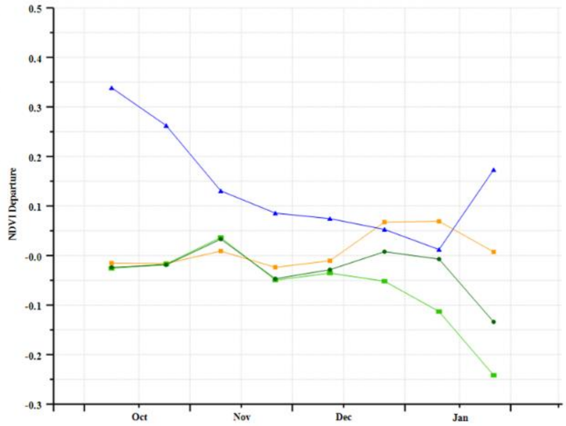




(b) Crop condition development graph based on NDVI

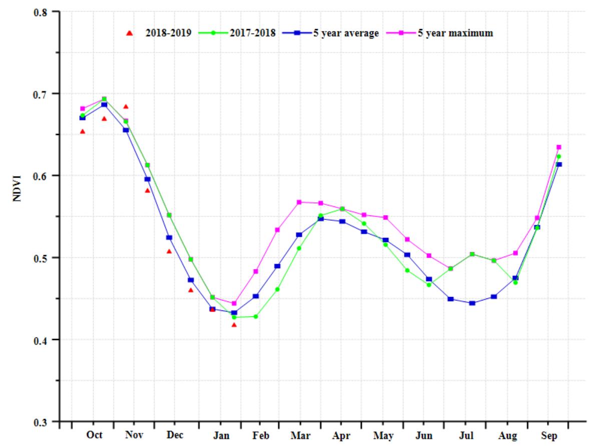
(c) Maximum VCI

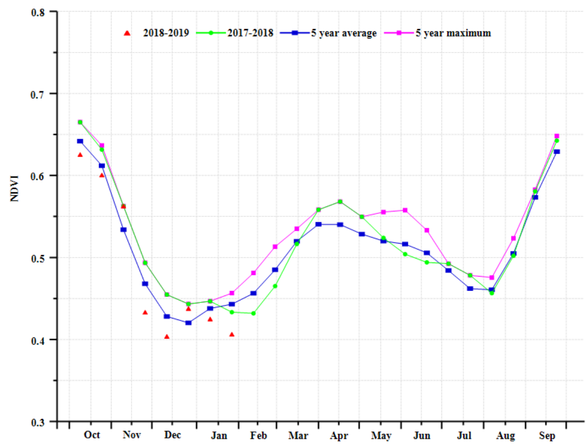




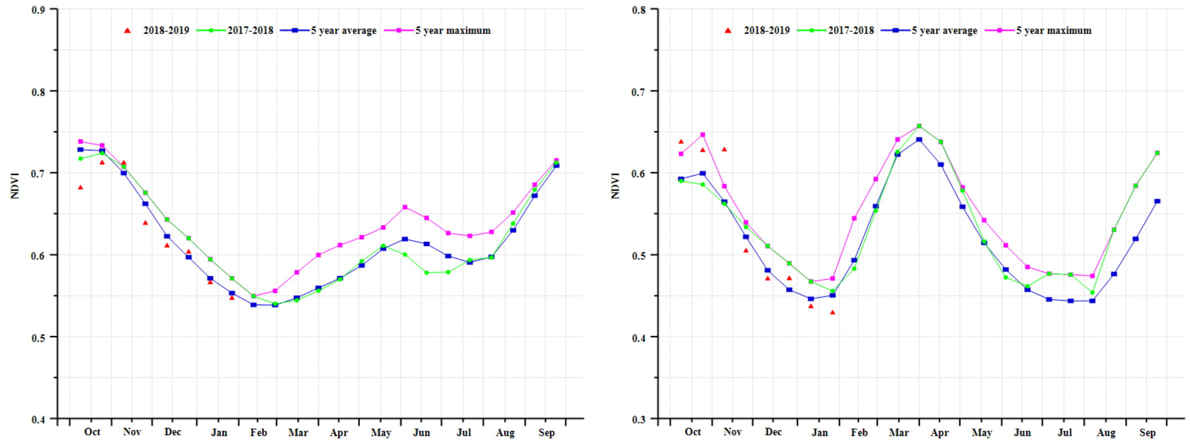
(d) Spatial NDVI patterns compared to 5YA

(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, October 2018 - January 2019

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m^2)	Departure from 15YA (%)
Coastal region (Bangladesh)	262	-11	23.2	0	1036	0
Gangetic plain (Bangladesh)	73	-64	22.2	0	987	2
Hills (Bangladesh)	401	9	22.2	-0.9	1014	-1
Sylhet basin (Bangladesh)	86	-61	22.3	0	976	1

Table 3.10. Bangladesh's agronomic indicators by sub-national regions, current season's values and departure from 5YA, October 2018 - January 2019

Region	BIOMSS		CALF		Maximum VCI
	Current (gDM/m^2)	Departure from 5YA (%)	Current (%)	Departure from 5YA (%)	Current
Coastal region (Bangladesh)	675	2	100	2	0.94
Gangetic plain (Bangladesh)	316	-36	100	2	0.91
Hills (Bangladesh)	917	18	100	0	0.92
Sylhet basin (Bangladesh)	370	-30	100	7	0.93

[BLR] Belarus

Winter wheat, which was sowed in October, is the major crop in the field during this monitoring period.

Agro-climatic conditions were generally stable as compared to average, except for a minor rainfall deficit but very sunny weather (RAIN 260 mm or -8.4%, TEMP 0.8℃ or +0.1℃ above average, RADPAR 181.8 MJ/m2 equivalent to a +12.6% anomaly). All the arable land was cropped (CALF at 100%) and the maximum vegetation condition index (VCIx) was high (0.98). As a result of good crop growth conditions, weather based projected biomass would increase by 7.2%. At the national level, the NDVI based crop condition development graph was gradually recovering to normal in January after a period in December when it was below both the 5-year average and the 2017-18 winter season values. According to the spatial distribution maps, VCIx was satisfactory in most areas of the country (>0.8). NDVI fluctuated very widely over the country; in the West (43.8% of cropped area), the value fell from 0.2 in late November to -0.4 at the end of January, a rather unusual behavior which will need close monitoring during the next reporting period

Regional analysis

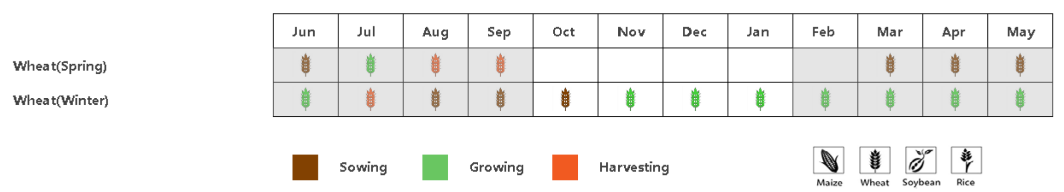
Based on cropping system, climatic zones and topographic conditions, regional analyses for four agro-ecological zones (AEZ) are provided, including Northern Belarus, Central Belarus and Southern Belarus.

Northern Belarus (Vitebsk, northern area of Grodno, Minsk and Mogilev) was short in rainfall (-12%) with normal temperature (+0.0℃) and abundant radiation (+16%). Biomass production should be 7% higher 5YA. Agronomic indicator show very satisfactory values: 100% for CALF and 0.95 for VCIx. Crop condition is good.

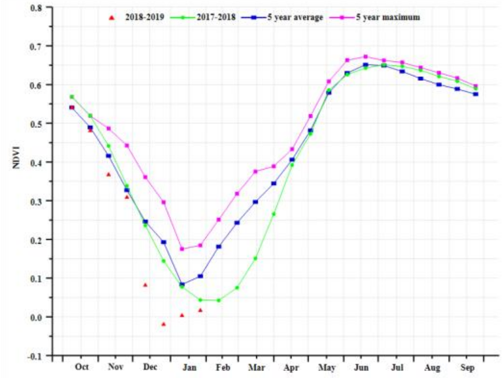
In Central Belarus, the Regions of Grodno, Minsk and Mogilev on average recorded rainfall 3% lower than reference values, but normal temperature (+0.1℃) and higher radiation (+11%). The BIOMSS is projected to increase 7%. Combined with fully cropped arable land (CALF at 100%) a VCIx value of 0.94 shows good prospects for winter crops. NDVI curve also showed a recovering trend since January. In summary overall situation was favorable for winter crops.

The Southern Belarus (southern halves of Brest and Gomel regions) experienced the same agro-climatic condition as Northern and Central area. Slightly low rainfall (-12%) has not adversely affected the crops. Other favorable agro-climatic conditions (TEMP +0.1℃, RADPAR +10%) and favorable agronomic indicators (CALF 99%, VCIx 0.91, BIOMSS up 6%) as well as rapidly recovering NDVI should ensure satisfactory crop production..

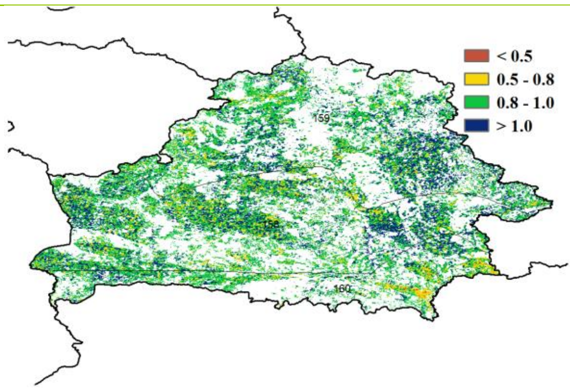
Figure 3.10. Belarus's crop condition, October 2018 - January 2019



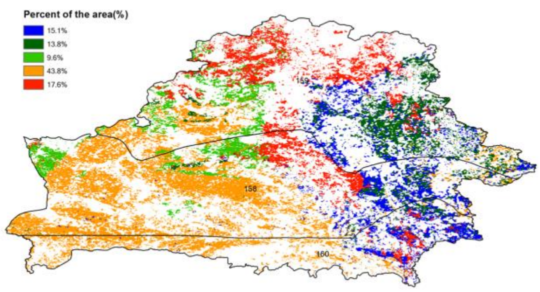
(a). Phenology of major crops



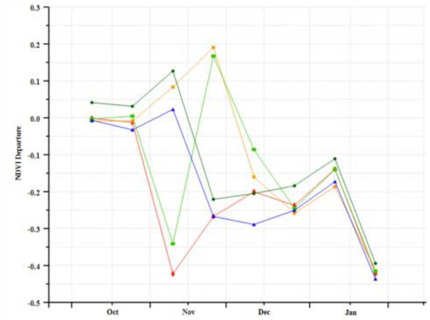
(b) Crop condition development graph based on NDVI



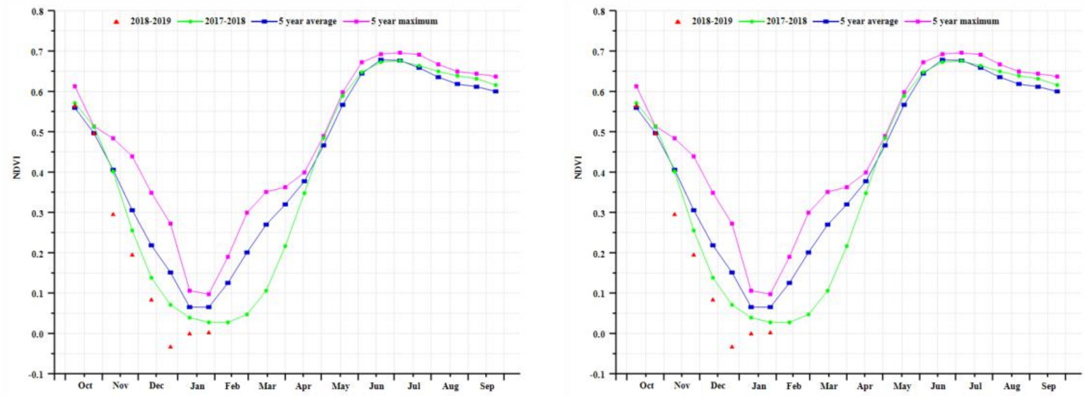
(c) Maximum VCI



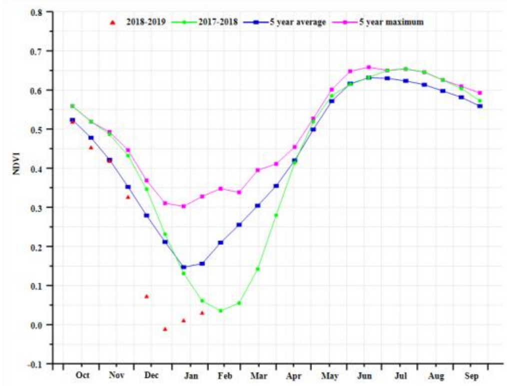
(d) Spatial NDVI patterns compared to 5YA



(e) NDVI profiles



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



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

Table 3.11. Belarus's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, October 2018 - January 2019.

Region	RAIN	TEMP	RADPAR

	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m^2)	Departure from 15YA (%)
Central Belarus	273	-3	1.1	0.1	186	11
Northern Belarus	256	-12	0.2	0.0	168	16
Southern Belarus	237	-12	1.4	0.1	207	10

Table 3.12. Belarus's agronomic indicators by sub-national regions, current season's values and departure from 5YA, October 2018 - January 2019.

Region	BIOMSS		CALF		Maximum VCI
	Current (gDM/m^2)	Departure from 5YA (%)	Current (%)	Departure from 5YA (%)	Current
Central Belarus	273	-3	1.1	0.1	186
Northern Belarus	256	-12	0.2	0.0	168
Southern Belarus	237	-12	1.4	0.1	207

[BRA] Brazil

The reporting period covers the sowing to early growth stages of maize, rice and soybean; in the North-East the harvest of wheat was concluded by the end of December. Generally, crop condition in Brazil was average compared to the previous five years.

Nationwide, agro-climatic indicators show average conditions with 1% lower rainfall, 0.5℃ lower temperature and RADPAR up 4% compared to average. According to the potential biomass model, the indicator is up 1% above average as a result of average meteorological conditions. Seasonal temperature and rainfall profiles also presents close to average values from October to January. Large positive rainfall anomalies and negative temperature departures are observed only during December. However, there are still significant differences between the nine major agricultural states: Rio Grande Do Sul and Ceara received sufficient rainfall at 13% and 67% above average, respectively; five states including Mato Grosso Do Sul, Parana, Sao Paulo, Minas Gerais, and Goias suffered from water shortages, with rainfall deficits of 16%, 14%, 14%, 13%, and 9% respectively. Rainfall in Mato Grosso and Santa Catarina was close to average. A significant anomaly was observed in Mato Grosso where temperature at 26.5 ℃ for the whole state was 1.2°C below average. For the five states with lowere rainfall mentioned above, crops received above average radiation ranging from +4% to +10%. Rainfall was the limiting factors for potential biomass as indicated by the similar amplitude of departures from average between RAIN and BIOMSS for most states.

The national NDVI development profile for Brazil presents close to average values throughout the reporting period. The stable NDVI development profiles confirm the beneficial impact of the abundant rainfall as mentioned in the previous bulletin. According to the NDVI departure clustering maps and profiles, vast areas of cropland in central-south Brazil present lower than average NDVI from December to early January. Those areas coincide with the five states with lower rainfall. However, according to the VCIx map, crops at peak stage during the monitoring period is still comparable to 5YA, reflecting limited effects of low rainfall to overall crop conditions. Another hotspot area is the east coastal areas where VCIx map also shows below 5YA average conditions with VCIx lower than 0.5. National VCIx is 0.95 and CALF is 2% above average which are indications of satisfactory production.

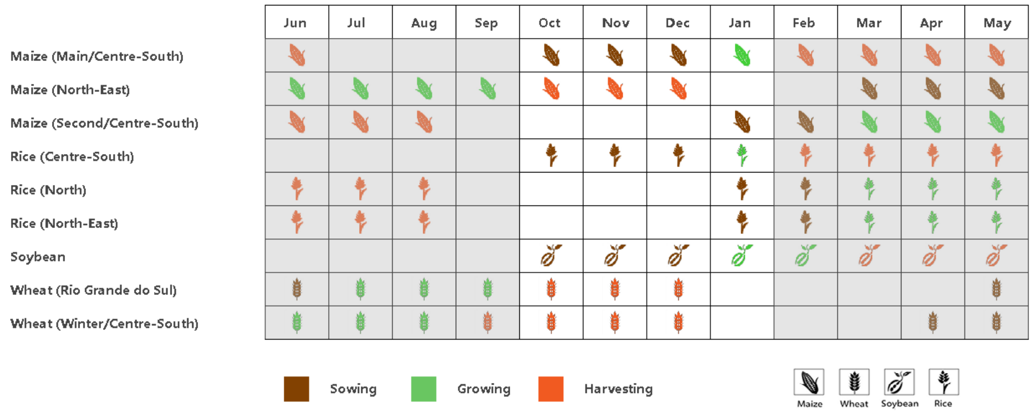
Regional analysis

Based on cropping systems, climatic zones, and topographic conditions, eight agro-ecological regions are identified for Brazil. These include the central savanna, the east coast, Parana river, Amazon zone, Mato Grosso zone, subtropical rangeland zone, mixed forest and farmland, and the Nordeste. Over the recent reporting period, 4 zones received below average rainfall including Central Savanna, Coast, Mato Grosso, and Parana Basin; while other 4 zones including Amazonas, Northeastern mixed forest and farmland, Nordeste, and Southern subtropical rangelands received above average rainfall. Nordeste and Parana Basin are the only two zones with above average temperature. Most zones received average or above average radiation except for southern subtropical rangelands with 4% lower RADPAR. Considering rainfall and temperature, potential biomass is simulated and compared to previous 5YA. Northeastern mixed forest and farmland, Nordeste, and Southern subtropical rangelands presents well above average BIOMSS thanks to the above average rainfall. Coast zone presents largest negative departure from 5YA of BIOMSS and VCIx is also lowest among the eight zones. Also, only Coast zone presents lower than average cropped arable land fraction (CALF) (93%, 2% lower from 5YA).

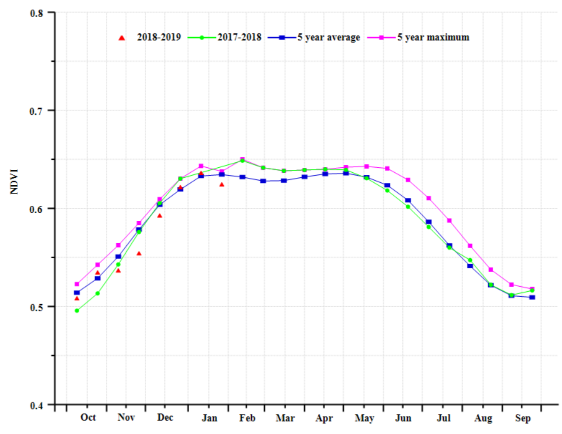
Faovarable conditions in Northeastern mixed forest and farmland, Nordeste, and Southern subtropical rangelands resulted in above average crop condition as indicated by the NDVI based crop development profiles in the three zones. Accordingly, CALF over those zones are 1%, 49% and 1% above 5YA and VCIx are all above 0.9. It need to be highlighted that CALF in Nordeste is lowest at 85% among the zones, but still increases almost half from 5YA. Northeastern mixed forest and farmland zone is the only zone with VCIx higher than 1.02, indicating better than optimal conditions in the previous five years.

Below average crop condition are indicated by the lower than 5YA NDVI in the NDVI based development profiles in Central Savanna, Coast, Mato Grosso, and Parana Basin. Low rainfall potentially hampered the crop developments in those zones. Considering the average or above average CALF and high VCIx values, CropWatch nevertheless assesses production prospects over the four zones as average.

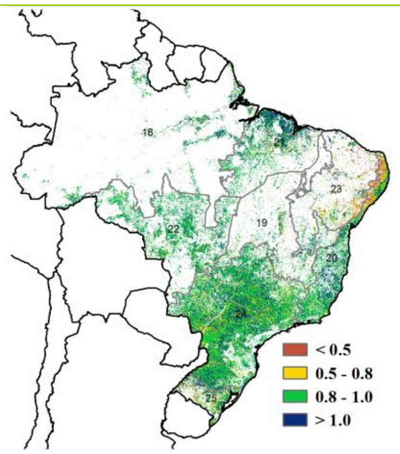
Figure 3.11. Brazil's crop condition, October 2018 - January 2019



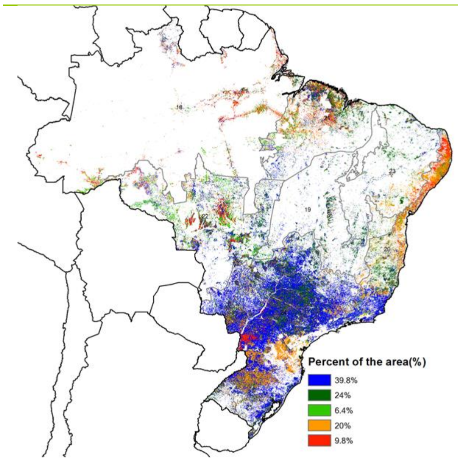
(a). Phenology of major crops



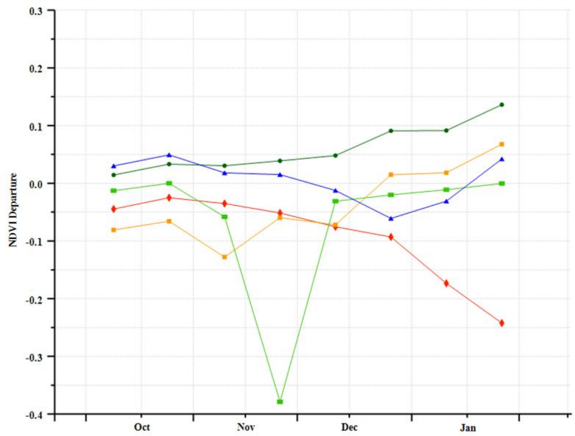
(b) Crop condition development graph based on NDVI



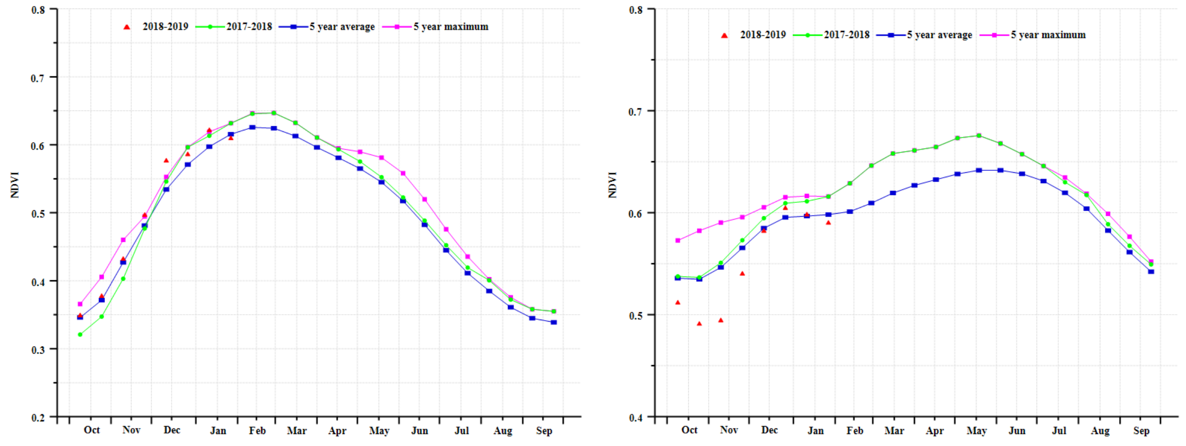
(c) Maximum VCI



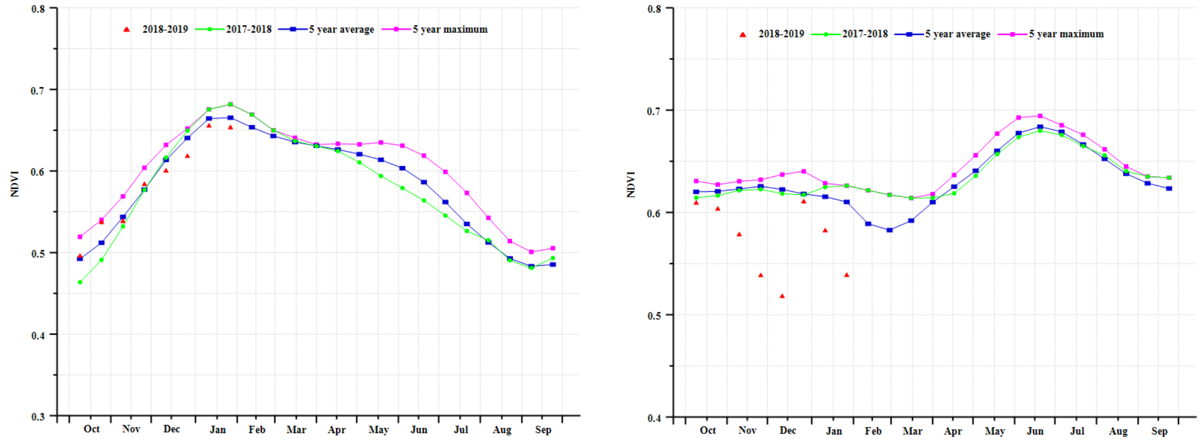
(d) Spatial NDVI patterns compared to 5YA



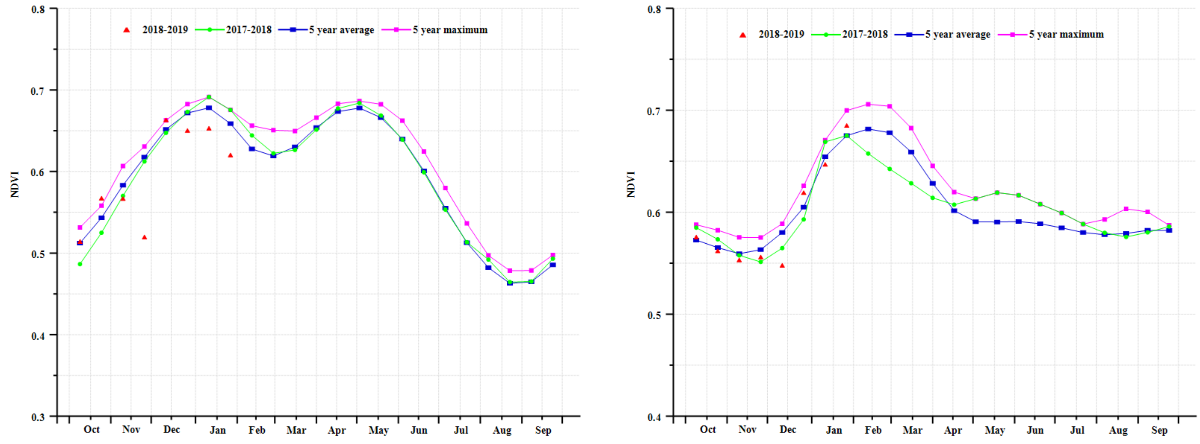
(e) NDVI profiles



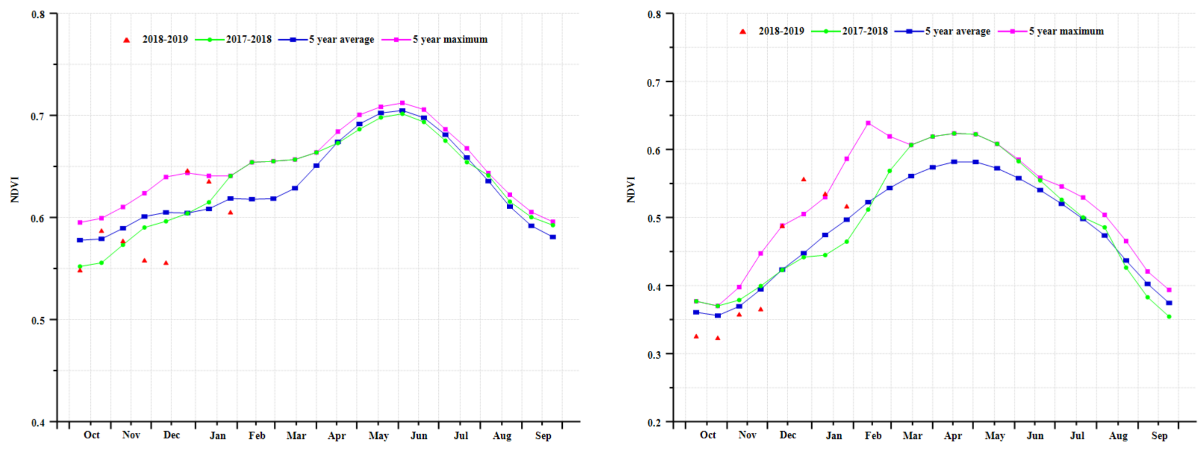
(e) Crop condition development graph based on NDVI ((Central Savanna) (left) and (East coast zone) (right))



(f) Crop condition development graph based on NDVI (Parana River (left) and Amazonas (right))



(g) Crop condition development graph based on NDVI (Mato Grosso region (left) and Sub-tropical rangeland (right))



(h) Crop condition development graph based on NDVI (Mixed forest and farmland (left) and (Brazil Nordeste)(right))

Table 3.13. Brazil's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, October 2018 - January 2019

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m2)	Departure from 15YA (%)
Amazonas	742	7	27.6	-0.8	1167	0
Central Savanna	665	-7	26.2	-0.6	1311	5
Coast	484	-12	25.5	-0.2	1306	4
Northeastern mixed forest and farmland	795	24	27.6	-1.2	1226	3
Mato Grosso	929	-3	26.6	-1.1	1206	7
Nordeste	328	13	28.5	0.3	1354	1
Parana basin	714	-10	24.7	0.1	1360	6
Southern subtropical rangelands	832	18	23.3	-0.4	1350	-4

Table 3.14. Brazil's agronomic indicators by sub-national regions, current season's values and departure from 5YA, October 2018 - January 2019

Region	BIOMSS		Cropped arable land fraction		Maximum VCI
	Current (gDM/m^2)	Departure from 5YA (%)	Current (%)	Departure from 5YA (%)	Current
Amazonas	1754	3	100	1	0.99
Central Savanna	1720	-3	99	7	0.97
Coast	1165	-8	93	-2	0.91
Northeastern mixed forest and farmland	1839	15	100	1	1.02
Mato Grosso	2266	0	100	0	0.97
Nordeste	915	15	85	49	0.93
Parana basin	1926	-2	100	0	0.95
Southern subtropical rangelands	1746	8	100	1	0.94

[CAN] Canada

The current reporting period covers the harvest of summer crops, and the sowing of winter wheat in Canada. Most agricultural areas were covered in snow from November, which limited the relevance of NDVI-based indicators.

Nationwide, rainfall was +6% above average, which has increased soil moisture storage for winter wheat. Both temperature and radiation were slightly below average (TEMP -0.2°C, RADPAR -1%) and the maximum VCI value was 0.71. The potential biomass accumulation index was below the recent five-year average (BIOMSS -12%) as well as CALF (-15%). In the three main winter wheat Provinces, RAIN was below average (Alberta -13%, Manitoba -14%, Saskatchewan -20%), which could lead to drop in the biomass production potential compared to the last 5 years (Alberta -2%, Manitoba -24%, Saskatchewan -14%).

NDVI values from November to January were all lower than 0.15, which was probably caused by the snow, which limits the relevance of NDVI-based indicators for current reporting period.

Although rainfall in the whole country was above the average, the conditions were not favorable in the three main production provinces, which could result in a water deficit to winter wheat. The production may be worse than during 2018 if the low rainfall continues.

Regional analysis

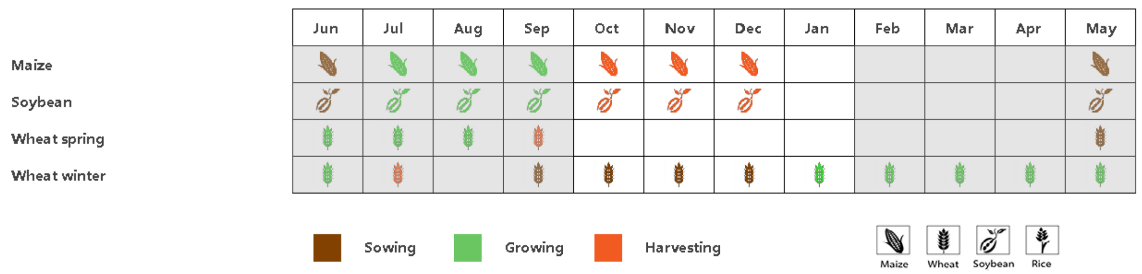
The Prairies (area identified as 30 in the VCIx map) and Saint Lawrence basin (26, covering Ontario and Quebec) are the major agricultural regions.

In the Prairies, the main food production area in Canada, rainfall was below average (146mm or -14%), the temperature was slightly above the average (+0.6°C) while the radiation was average. The potential biomass was below the five-year average (BIOMSS, -10%). Because of snow, the Cropped Arable Land Fraction dropped significantly (CALF, -30%), the VCIx was 0.64, and the NDVI was largely below the average from November to December, while only slight below the average in January. The crop production of 2019 in this region could be unfavorable if deficit rainfall continues.

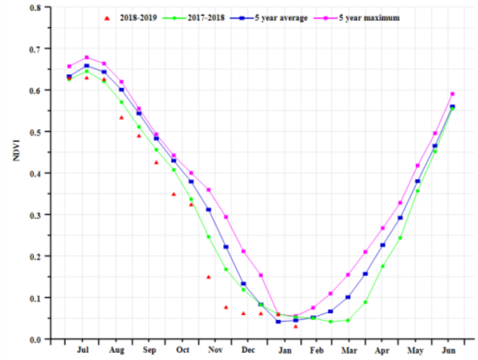
In the Saint Lawrence basin region, rainfall was above average of last 15 years (421 mm equivalent to +32%), both the temperature and radiation were below average (TEMP, -1.5°C; RADPAR, -5%). The potential biomass was largely below the average of last 5 years (BIOMSS, -17%), CALF was average and VCIx was 0.89. The NDVI profiles were similar to the Prairies region. The production of winter wheat in this region could be favorable if the sufficient rainfall continues.

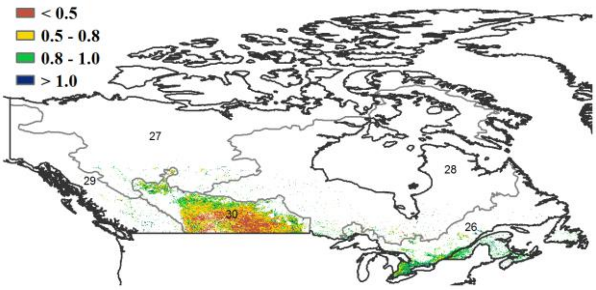
Overall, the large rainfall deficit in the three main production provinces could lead to a drop in crop production if unfavorable environmental conditions continue in Canada.

Figure 3.12. Canada's crop condition, October 2018 - January 2019

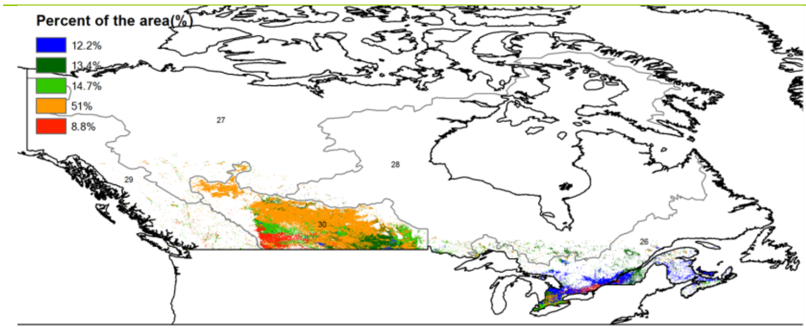


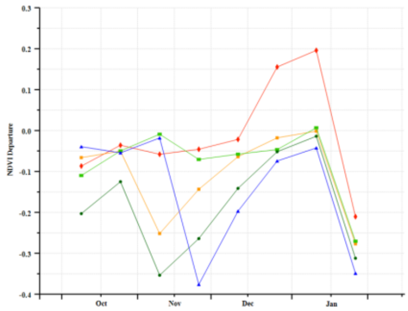
(a). Phenology of major crops



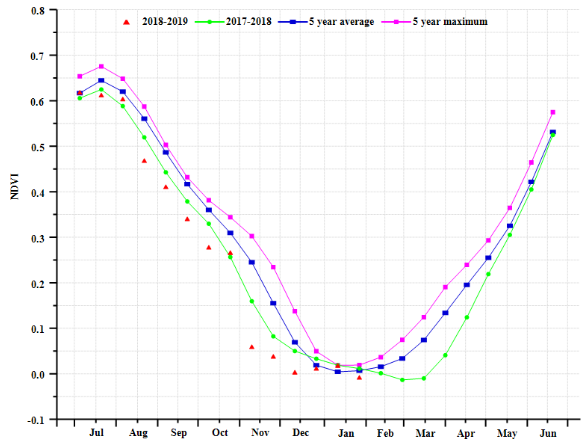


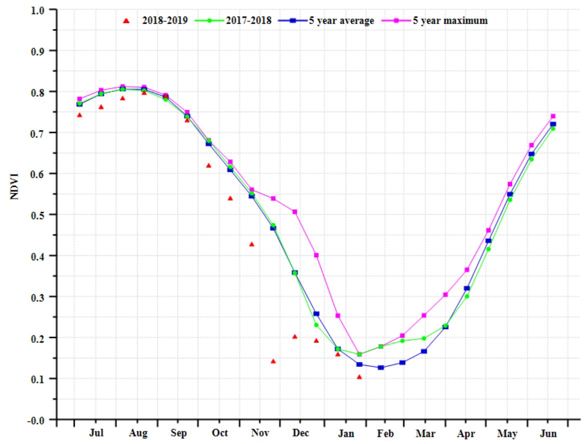
(b) Crop condition development graph based on NDVI (c) Maximum VCI





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





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

Table 3.15. Canada's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, October 2018 - January 2019

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m^2)	Departure from 15YA (%)
Saint Lawrence basin (Canada)	421	32	-3.6	-1.5	304	-5
Prairies (Canada)	146	-14	-6.0	0.6	287	0

Table 3.16. Canada agronomic indicators by sub-national regions, current season's values and departure from 5YA, October 2018 - January 2019

Region	BIOMSS		CALF		Maximum VCI
	Current (gDM/m^2)	Departure from 5YA (%)	Current (%)	Departure from 5YA (%)	Current
Saint Lawrence basin (Canada)	521	-17	99	0	0.89
Prairies (Canada)	408	-10	27	-30	0.64

[DEU] Germany

Crops in Germany showed spatially diverse condition during the reporting period, which covered the late stages of sugar beets (October harvest) and early vegetative stages of winter wheat and winter barley. For the country as a whole, total precipitation (as measured by the RAIN indicator) was 6% below average, temperature was above average (TEMP, +0.7°C), and radiation was above average as well (RADPAR, +6%). Negative rainfall departures occurred mostly from early to mid-October, November, mid-December and after mid-January, while above average rainfall occurred throughout the country in late October, late November and late December. Temperatures were above average over most of Germany (+0.7°C) with peaks in late October, late November, mid-December and late January. Due to favorable temperature, the biomass production potential (BIOMSS) is expected to increase by 4% nationwide compared to the five-year average.

According to the national crop condition development graph, NDVI was affected by snow, resulting in values being below average during the whole reporting period, except in late November. These observations are confirmed by the spatial NDVI profiles. VCIx was low in some regions, but the average for Germany as a whole reached 0.91 over this reporting period. The snow has probably protected crops from cold weather and will continue to provide soil moisture. The outlook of winter crops is above average.

Regional analysis

Based on cropping systems, climatic zones, and topographic conditions, six sub-national regions can be distinguished for Germany. The ones which are most relevant for crops cultivation are the Northern wheat zone, North-west mixed wheat and sugar beets zone, and the Central wheat zone. Numbers identify the areas on the maps.

Schleswig-Holstein and the Baltic coast is the major winter wheat zone of Germany. The CropWatch agroclimatic indicators show that this region experienced a precipitation deficit (-20%) with warm weather (TEMP, +0.9°C) and radiation above average (RADPAR, +9%). With suitable temperature, biomass (BIOMSS) in this zone is expected to increase by 4% compared to the five-year average. Due to snow storms, NDVI started dropping from January. The area has a high CALF (100%) as well as a favorable VCIx (0.97), indicating favorable crop prospects.

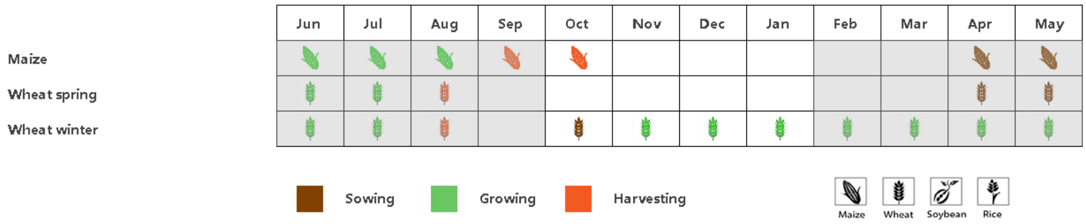
Wheat and sugar-beets are major crops in the **Mixed wheat and sugar-beets zone of the north-west**. The CropWatch agroclimatic indicator RAIN was below average (-11%), temperature was above (TEMP +0.6°C) and so was radiation (RADPAR, +7%). Biomass (BIOMSS) in this zone is expected to increase by 4% compared to the five-year average with suitable temperature and radiation condition. As shown in the crop condition development graph based on NDVI, the values were above average after mid-November. The area has a high CALF (100%) and crop condition for the region is good according to the high VCIx (0.91).

Central wheat zone of Saxony and Thuringia is another major winter wheat zone; it recorded about 11% below average rainfall and experienced warmer than average weather (TEMP +0.7°C) and good sunshine (RADPAR +6%). The biomass production potential (BIOMSS indicator) was average. The area has a high CALF (99%) and the VCIx of 0.85 for this region also shows favorable crop prospects.

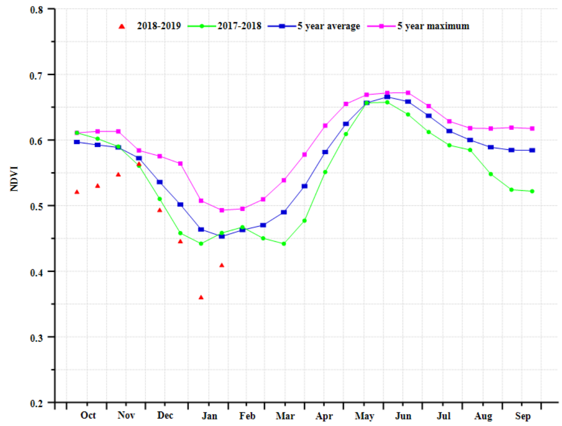
The cropland in the **Sparse crop area of the east-German lake and Heathland** and **Western sparse crop area of the Rhenish massif** was more marginal. Dry weather was recorded in the second (RAIN -3% and -12%, respectively), as well as above average temperatures (+1.0°C and +0.6°C) and radiation (RADPAR +7% and +6%). Compared to the average of the last five years, BIOMSS was higher by 5% and 1%, respectively, while the Cropped Arable Land Fraction was at 99% and 95%. As shown in the crop condition development graph based on NDVI, the values in both regions were all below average during the whole reporting period, showing unfavorable crop prospects for the regions.

Next to wheat, two summer crops (maize and potato) are the major crops on the **Bavarian Plateau**. The CropWatch agroclimatic indicators were slightly above average (RAIN +8%, TEMP +0.6°C, RADPAR +5%). Compared to the five-year average, BIOMSS increased 6%. The area has a high CALF (99%) as well as a favorable VCIx (0.92), indicating high cropped area and favorable winter crop prospects.

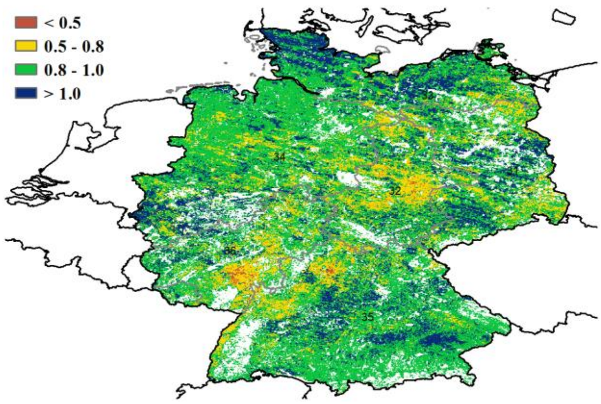
Figure 3.13. Germany's crop condition, October 2018 - January 2019



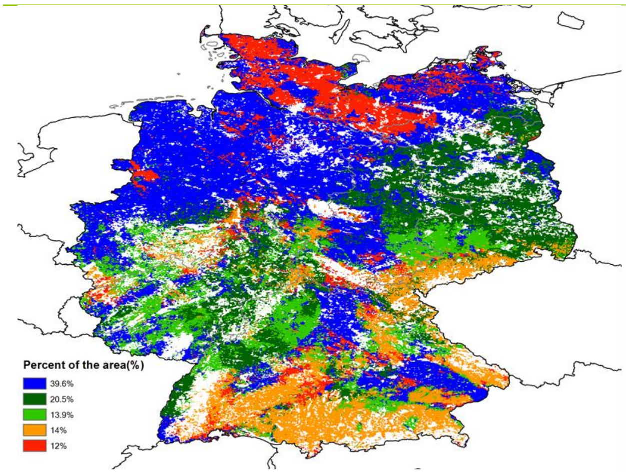
(a). Phenology of major crops



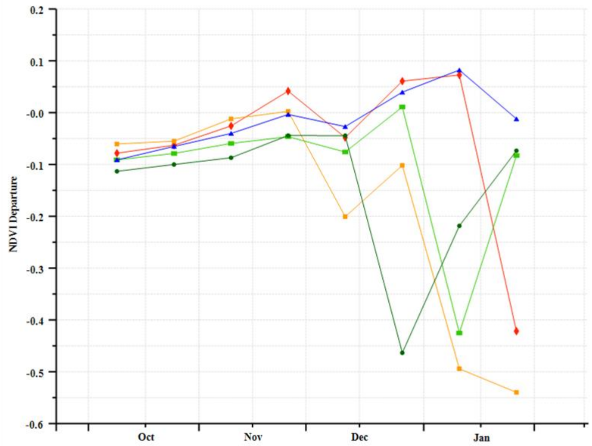
(b) Crop condition development graph based on NDVI



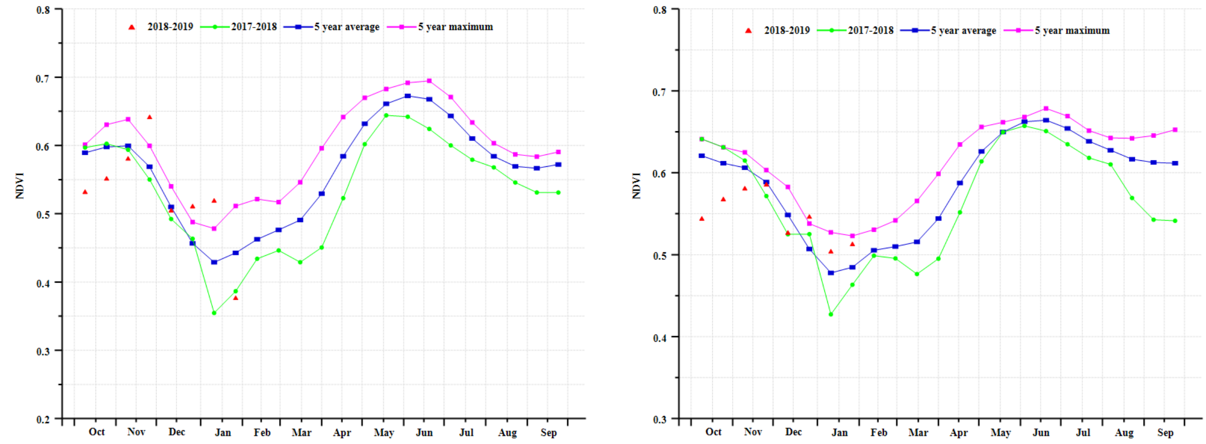
(c) Maximum VCI



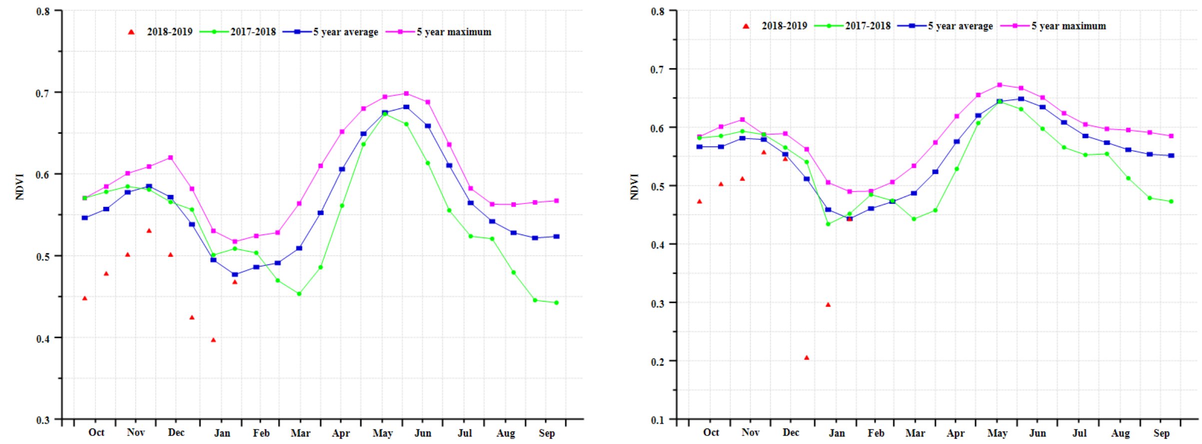
(d) Spatial NDVI patterns compared to 5YA



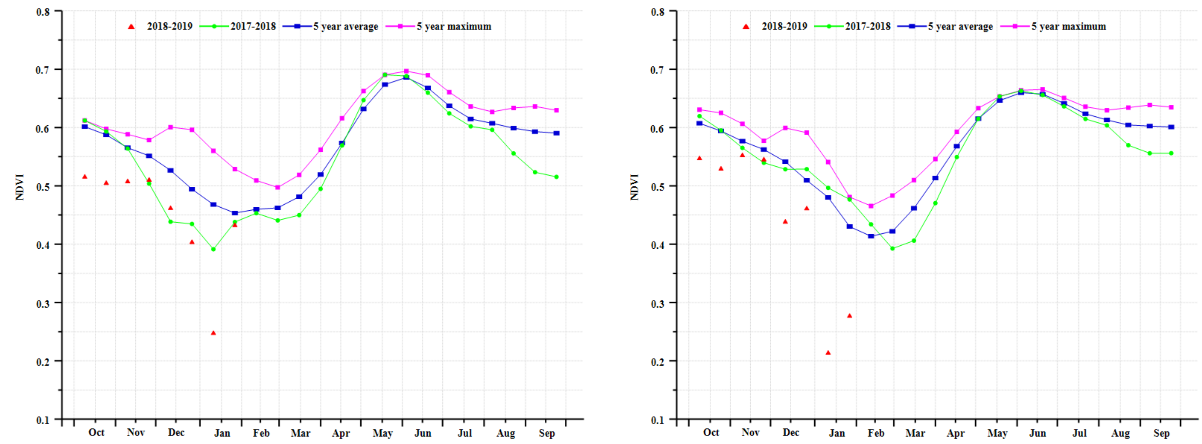
(e) NDVI profiles



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



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



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

Table 3.17. Germany's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, October 2018 - January 2019

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m2)	Departure from 15YA (%)
Wheat zone of Schleswig-Holstein and the Baltic coast	266	-20	6.2	0.9	190	9

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m2)	Departure from 15YA (%)
Mixed wheat and sugarbeets zone of the north-west	304	-11	6.3	0.6	214	7
Central wheat zone of Saxony and Thuringia	251	-11	5.5	0.7	232	6
Sparse crop area of the east-German lake and Heathland	276	-3	5.4	1.0	229	7
Western sparse crop area of the Rhenish massif	253	-12	5.5	0.6	243	6
Bavarian Plateau	315	8	4.2	0.6	302	5

Table 3.18. Germany's agronomic indicators by sub-national regions, current season's value and departure from 5YA, October 2018 - January 2019

Region	BIOMSS		Cropped arable land fraction		Maximum VCI
	Current (gDM/m^2)	Departure from 5YA (%)	Current (%)	Departure from 5YA (%)	Current
Wheat zone of Schleswig-Holstein and the Baltic coast	1069	4	100	0	0.97
Mixed wheat and sugarbeets zone of the north-west	1089	4	100	0	0.91
Central wheat zone of Saxony and Thuringia	955	0	99	-1	0.85
Sparse crop area of the east-German lake and Heathland	1007	5	99	0	0.91
Western sparse crop area of the Rhenish massif	982	1	95	-4	0.86
Bavarian Plateau	946	6	99	-1	0.92

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[EGY] Egypt

During the reporting period the summer crops such as maize and rice were harvested, and the winter wheat was sown and started growing. The CropWatch agro-climatic indicators show that RAIN and TEMP were 3% and 0.5°C below the average, respectively. RADPAR, which is the main limiting factor for crop conditions in Egypt since almost all crops are irrigated, was average. The estimated BIOMSS was 23% above the average and Maximum VCI was 1.

The nationwide NDVI profile shows average crop condition until the end of December; it then dropped to be below the 5 year-average until the end of January. This is confirmed by spatial NDVI patterns: average until the mid of December, a rise above average in 38% of the cropped areas, a drop in 20% of cropland and average condition elsewhere (42%). The change in crop conditions after mid-December corresponds to the switch between winter and summer crops in Egypt. Hence, this change may be due to the annual variation in crops geographical distribution or planting dates between regions. Overall, All CropWatch indicators, as well as the maximum VCI map, indicate favorable crops condition nationwide.

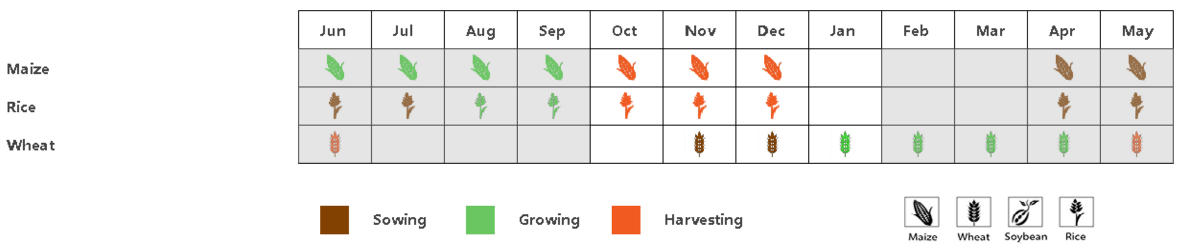
Regional analysis

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

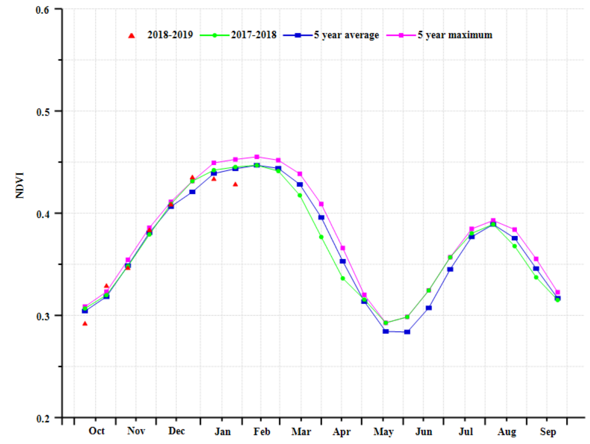
The Rainfall was slightly (4%) below average in the first AEZ, but significantly above (48%) in the Nile Valley. The TEMP in both zones was below average (by 0.6 and 0.4 °C, respectively). RADPAR average in both zones, while the estimated BIOMSS was higher in the Nile Valley (63% above the average) than in the Nile Delta and Mediterranean coastal strip (7% above the average). This increase of BIOMSS in the Nile Valley can be attributed to the increase of the rainfall at this zone during the reporting period. Since most of the agricultural lands in Egypt are irrigated, the rainfall makes little change in the outcome of the season. However, additional water usually has a beneficial effect. Also, both CALF and VCIx estimated for Nile valley were higher (14% above the average and 1.2, respectively) than for the Nile Delta and Mediterranean coastal strip zone (7% above the average and 1 respectively).

The NDVI-based crop condition development graphs indicate average conditions in the Nile Delta and Mediterranean coastal strip zone, and slightly above-average conditions in the Nile valley during the period from mid-October to the end of December. Later in the season, NDVI dropped slightly below the average in both AEZs.

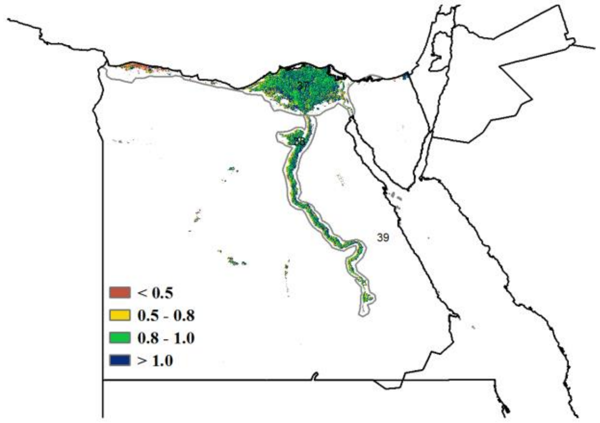
Figure 3.14. Egypt's crop condition, October 2018 - January 2019



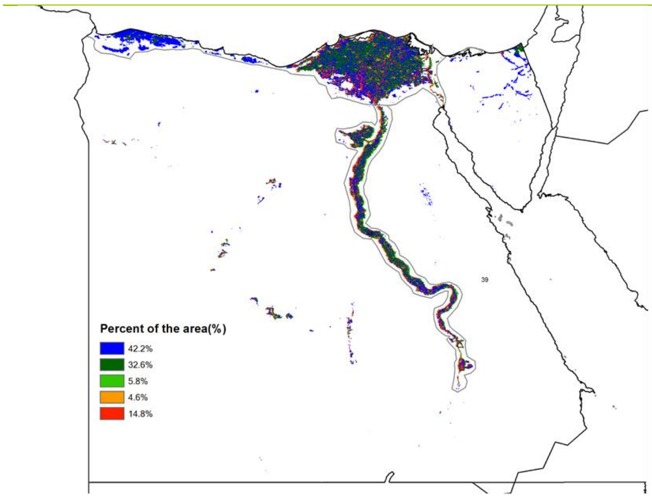
(a). Phenology of major crops



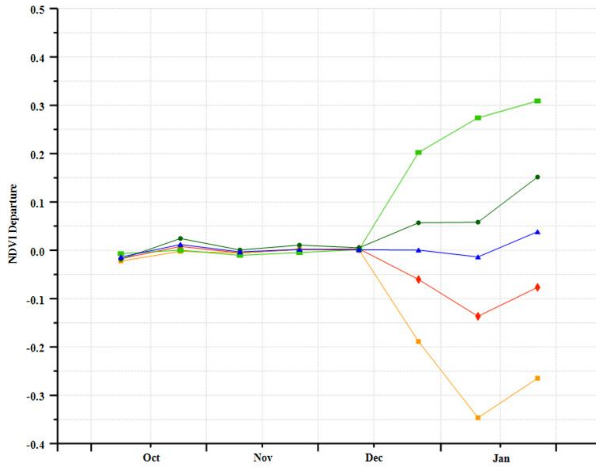
(b) Crop condition development graph based on NDVI



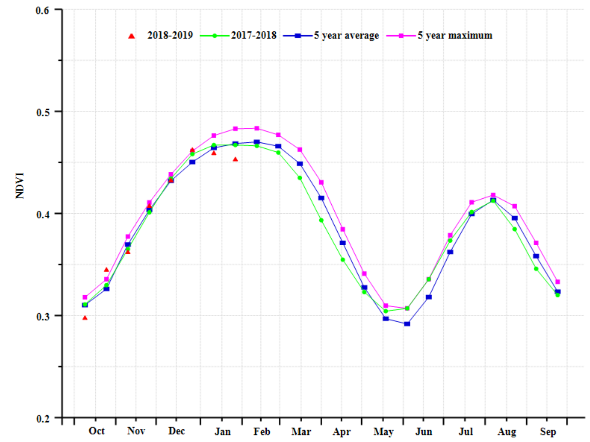
(c) Maximum VCI

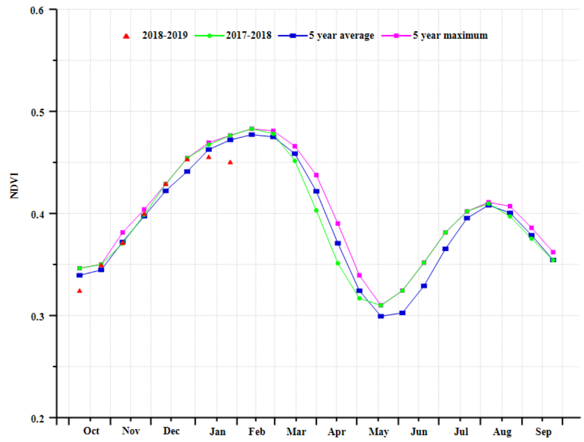


(d) Spatial NDVI patterns compared to 5YA



(e) NDVI profiles





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

Table 3.19. Egypt's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, October 2018 - January 2019

	RAIN		TEMP		RADPAR	
Region	**Current (mm)**	**Departure from 15YA (%)**	**Current (°C)**	**Departure from 15YA (°C)**	**Current (MJ/m2)**	**Departure from 15YA (%)**
Nile Delta and Mediterranean coastal strip	36	-4	17.9	-0.6	757	0

	RAIN		TEMP		RADPAR	
Region	**Current (mm)**	**Departure from 15YA (%)**	**Current (°C)**	**Departure from 15YA (°C)**	**Current (MJ/m2)**	**Departure from 15YA (%)**
Nile Valley	98	48	17.8	-0.4	886	0

Table 3.20. Egypt's agronomic indicators by sub-national regions, current season's values and departure from 5YA, October 2018 - January 2019

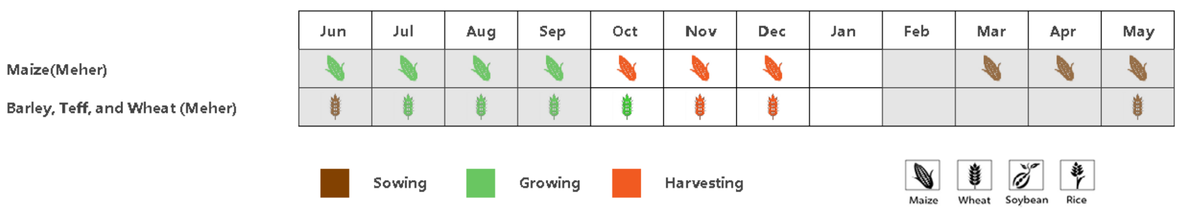
	BIOMSS		CALF		Maximum VCI
Region	**Current (gDM/m^2)**	**Departure from 5YA (%)**	**Current (%)**	**Departure from 5YA (%)**	**Current**
Nile Delta and Mediterranean coastal strip	192	7	71	7	1.0
Nile Valley	215	63	82	14	1.2

[ETH] Ethiopia

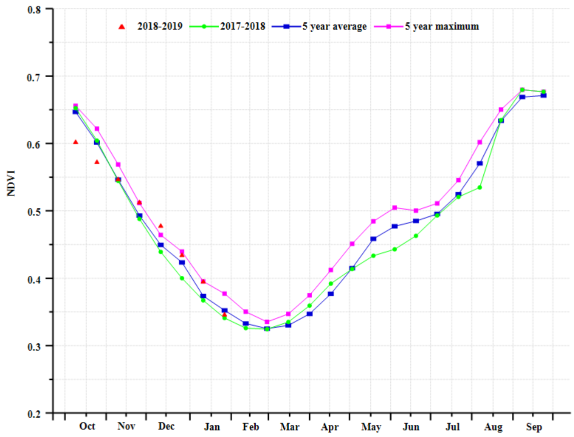
The monitoring period covers mainly the harvest of maize, some wheat, teff as well as other Meher season crops. Although there was a slight drop in rainfall compared to average (5%) and sunshine (as measured by RADPAR) was up 2%, nationwide agro-climatic conditions are best described as average. This resulted in close to average biomass production potential (BIOMASS +3%). The maximum VCI was highest (0.83) in the central and northern parts of the country, including Amhara, central Tigray, Oromia, and northeast SNPP. According to the spatial NDVI clusters and profiles, 64.4% of the cropped area experienced favorable conditions compared to the average.
In general, the indicators show favorable crop output for the Meher season.

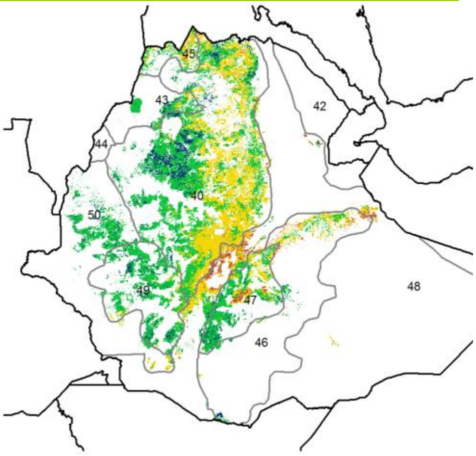
Regional Analysis
For the current monitoring period, the analysis covers three agro-ecological zones, namely the Southeastern mixed-maize zone, Western mixed maize zone, and Central-northern maize-teff highlands zone. The zones extend over Oromia and Dire Dawa, Harari, Amhara, and Tigray where farmers grow mainly rain-fed cereals.
Precipitation recorded over the **Southeastern mixed-maize zone** reached 120 mm, which is 27% below average. Both TEMP and RADPAR were just above average (0.9 °C and 1%, respectively). The BIOMSS fell 18% compared with average, the largest value in the country. The CALF decreased below average and the crop condition development graph based on NDVI was mostly below the five-year average. With the maximum VCI values at 0.75, crop prospects are unfavorable.
In comparison with the previous zone, the **Western mixed maize zone** recorded better rainfall (RAIN 177 mm), 7 % above average. The temperature was slightly below average (TEMP -0.3°C) and the BIOMSS potential is up 11%, which is particularly welcome for range lands and livestock production. The RADPAR increased by 3% while CALF remained constant at 100%, indicating fully cropped arable land. According to the NDVI development graph crop condition was above average. The maximum VCI value was 0.93. All CropWatch Indicators concur in assessing crop and livestock feed condition as favorable.
In the **Central-northern maize-teff highlands zone**, both the agronomic and agro-climatic indicators were above average. Total rainfall (RAIN at 106 mm) was 11% above average, TEMP increased 0.1°C above average and so did RADPAR (1%), BIOMASS (19%) and CALF (1%). Like the western mixed maize zone, this area was favorable for livestock production. VCIx reached 0.8 in this zone which includes Central Amhara, the main teff and wheat producing area in the country. Crop condition exceeded the average of the previous five years based on NDVI profile. Overall, environmental and crop condition were favorable in this zone, and a good harvest is expected.

Figure 3.15. Ethiopia's crop condition, October 2018 - January 2019



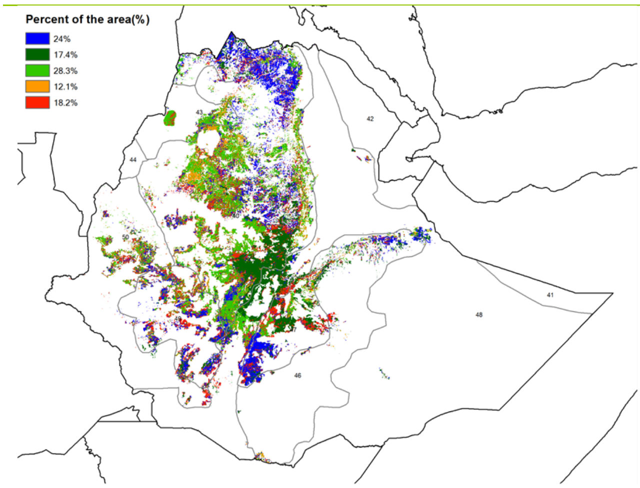
(a). Phenology of major crops

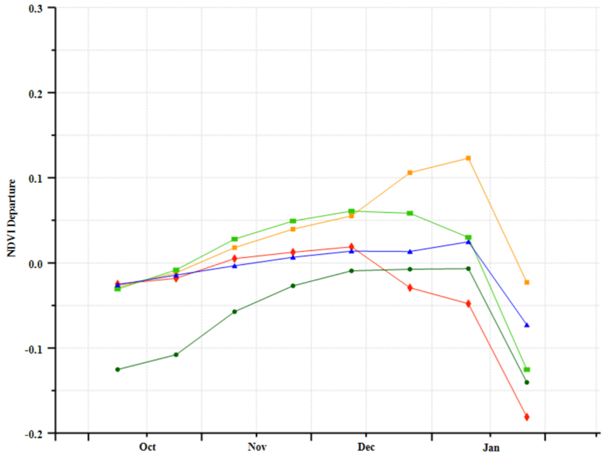




(b) Crop condition development graph based on NDVI

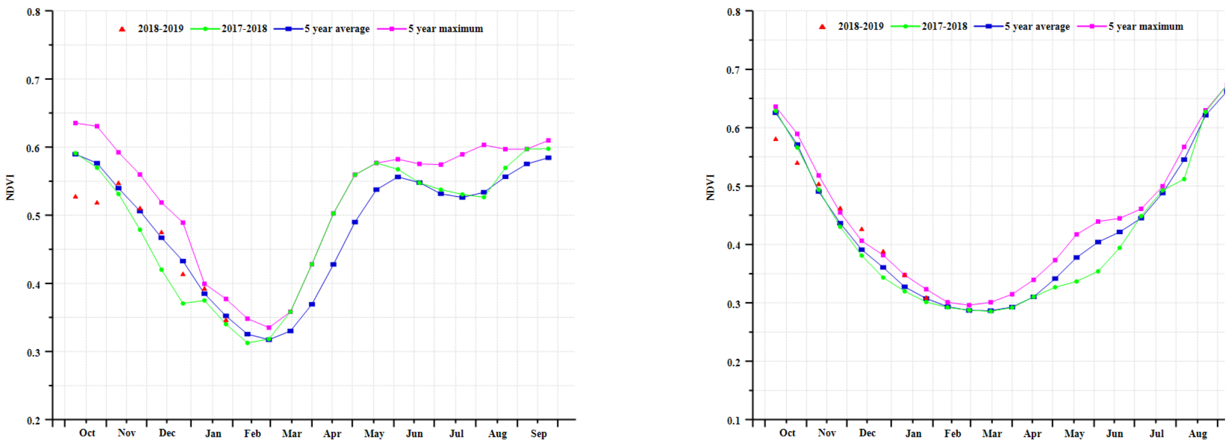
(c) Maximum VCI



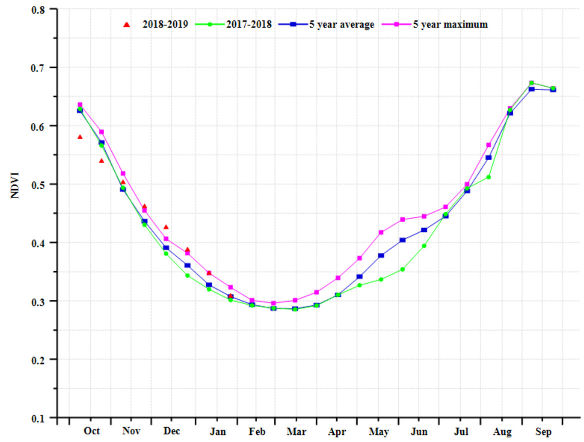


(d) Spatial NDVI patterns compared to 5YA

(e) NDVI profiles



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



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

Table 3.21. Ethiopia's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, October 2018 - January 2019

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m2)	Departure from 15YA (%)
South-eastern mixed maize zone	120	-27	21.0	0.0	1266	1
Western mixed maize zone	177	7	23.2	-0.3	1276	3
Central-northern maize-teff highlands	106	11	18.8	0.1	1382	1
South-eastern mixed maize zone	120	-27	21.0	0.0	1266	1

Table 3.22. Ethiopia's agronomic indicators by sub-national regions, current season's values and departure from 5YA, October 2018 - January 2019

Region	BIOMSS		CALF		Maximum VCI
	Current (gDM/m^2)	Departure from 5YA (%)	Current (%)	Departure from 5YA (%)	Current
South-eastern mixed maize zone	461	-18	90	-3	0.75
Western mixed maize zone	702	11	100	0	0.93
Central-northern maize-Teff highlands	438	19	91	1	0.82
South-eastern mixed maize zone	461	-18	90	-3	0.75

[FRA] France

The monitoring period covers winter wheat sowing and early growth as well as the harvest of spring wheat and maize.

Weather conditions were normal at the national level. This includes a 1% increase in RAIN above average, slightly below average temperature, and an increase in sunshine (RADPAR +3%) and BIOMSS(+4%).

The NDVI development graph for the entire country indicates crop condition below the average of the past five years and 2017-2018. The spatial NDVI patterns show that crop condition was about average in 69.1% of arable land. A drop in NDVI January occured mostly in highlands or areas of marginal agricultural importance and is probably due to snow. This spatial pattern is also roughly reflected by the maximum VCI (VCIx) in the different areas with a surprising discrepancy over the Massif Central where NDVI is very low in January and VCIx exceeds 0.8. Countrywide, however average VCIx was 0.82.

Regional analysis

Considering cropping systems, climatic zones, and topographic conditions, additional sub-national detail is provided for eight agro-ecological zones. They are identified in the maps by the following numbers: (54) Northern barley region, (58) Mixed maize/barley and rapeseed zone from the Center to the Atlantic Ocean, (55) Maize-barley and livestock zone along the English Channel, (56) Rapeseed zone of eastern France, (51) Dry Massif Central zone, (57) Southwestern maize zone, (52) Eastern Alpes region, and (53) the Mediterranean zone.

In the **Northern barley region** both RAIN and TEMP were below average (9% and 1.4°C, respectively), while RADPAR was 10% above. Low VCIx values (0.77) reflect overall unsatisfactory crop condition.

The **Mixed maize/barley and rapeseed zone from the Center to the Atlantic Ocean** experienced average temperature, RAIN was 7% below average, and TEMP very significantly so by -2.1°C. According to the NDVI profile and VCIx map, crop condition was unsatisfactory in the region.

The **Maize/barley and livestock zone along the English Channel** recorded 241 mm of rainfall over four months (RAIN -7%). Temperature was down 1.6°C but RADPAR was 9% above average. The drop in BIOMSS was 2% compared to the five-year average. The NDVI profile confirms the conditions of crop between poor and average.

The **Rapeseed zone of eastern France** recorded an 8% rainfall deficit, with above average values for RADPAR (8%). BIOMSS for the region is 1% below the five-year average, and a low VCIx value reflects the generally unsatisfactory crop and especially pastures condition, as confirmed by the NDVI development graph.

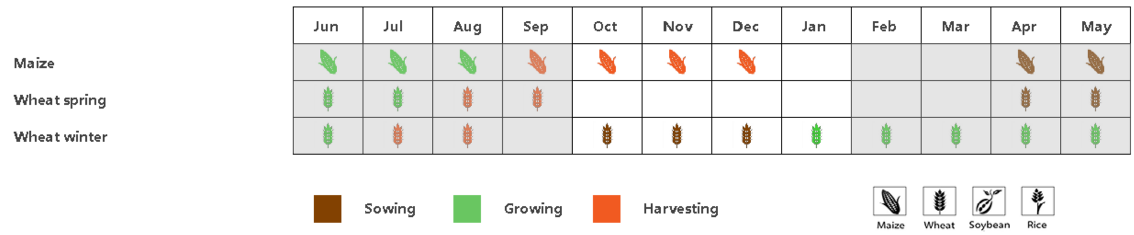
Mostly unfavorable climatic conditions dominated the Dry **Massif Central** zone over the reporting period. Rainfall was 21% below average (212 mm over four months).Temperature was 1.6°C below average. The dry conditions have resulted in a BIOMSS indicator 7% below average for the period.

The **Southwestern maize zone** is one of the major irrigated maize regions in France. Temperature dropped below average by a significant 2.4°C, RADPAR was average, but rainfall was above expectations by +13%. Crop condition was average according to the NDVI development graph, as confirmed by the VCIx map, which shows that crop condition was satisfactory.

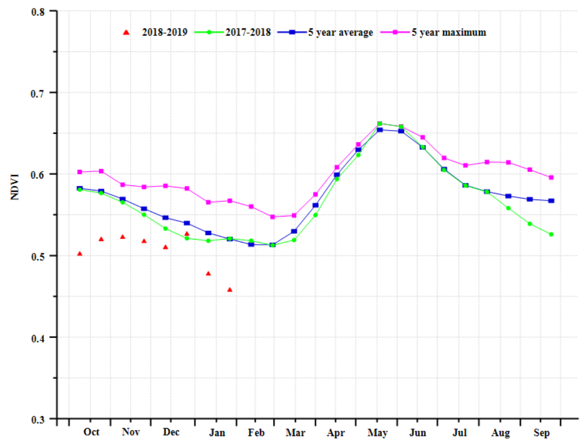
Environmental conditions for the **Eastern Alpes** region were mostly abnormal with the following values: RAIN +7%, TEMP -1.2°C; RADPAR was about average (+2%). Almost all arable land in this region was cropped during the monitoring period, and the average VCIx is 0.87.The NDVI profile confirms the crop condition.

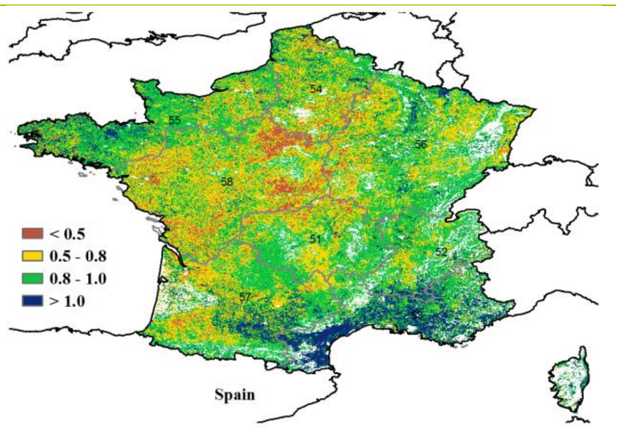
Finally, the most favorable weather conditions were observed in the **Mediterranean zone** (RAIN +33%) even if other indicators remain close to average, except for TEMP (-0.7°C). According to the NDVI profiles, crop condition remained favorable since October. BIOMSS is 28% above its five-year average, and the VCIx value of 1.05 for the region is the highest in the country.

Figure 3.16. France's crop condition, October 2018 - January 2019



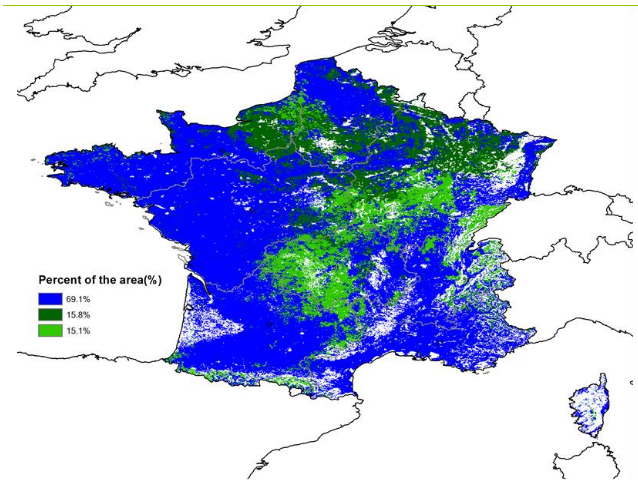
(a). Phenology of major crops

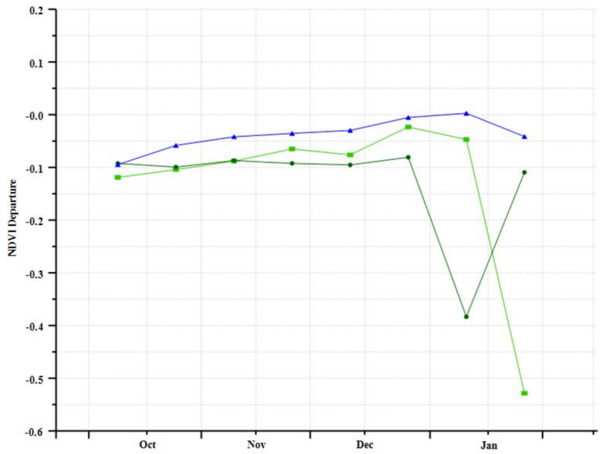




(b) Crop condition development graph based on NDVI

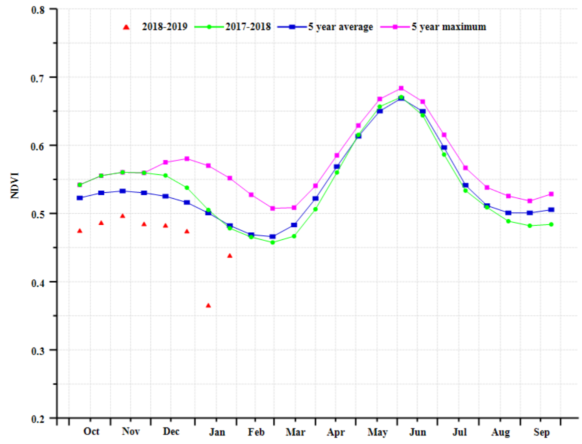
(c) Maximum VCI

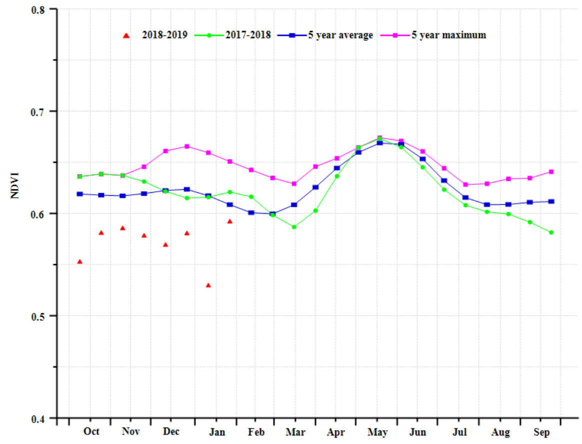




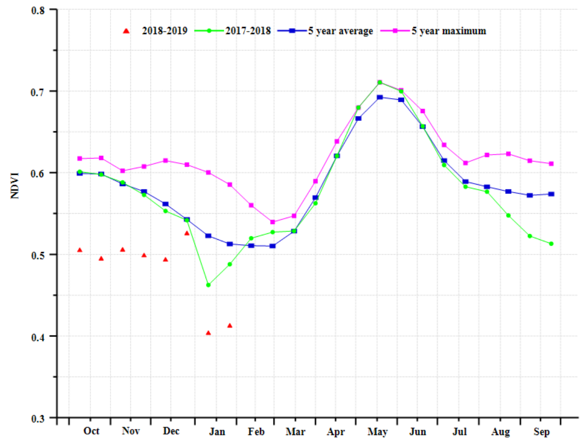
(d) Spatial NDVI patterns compared to 5YA

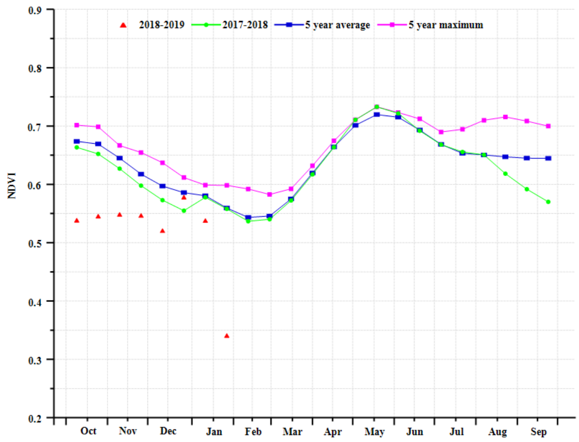
(e) NDVI profiles



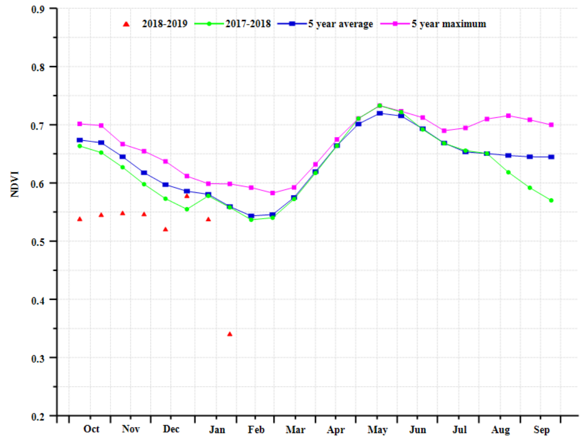


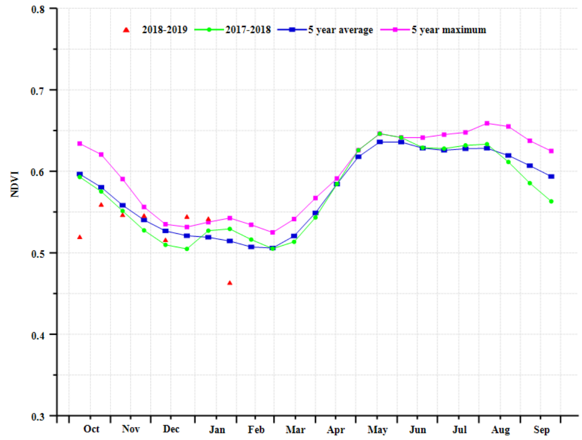
(f) Crop condition development graph based on NDVI (Northern barley region (left) and Mixed maize, Barley and Rapeseed zone (right))



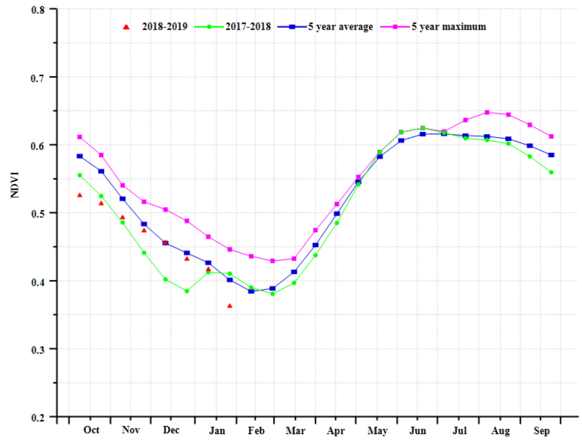


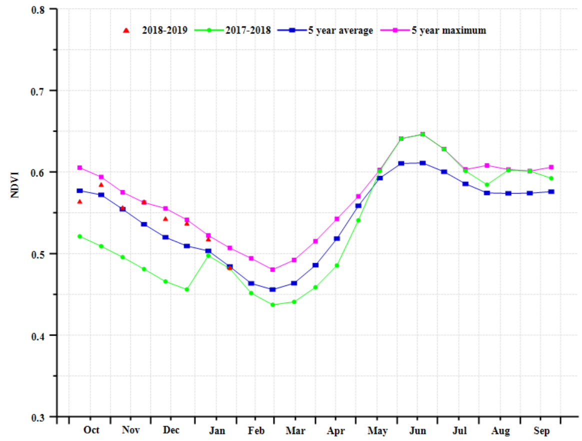
(g) Crop condition development graph based on NDVI (Maize, barley and livestock zone (left) and Rapeseed zone (right))





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





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

Table 3.23. France's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, October 2018 - January 2019

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m2)	Departure from 15YA (%)
Northern Barley zone	266	-9	7.5	-1.4	268	10
Mixed maize/barley and rapessed zone from the Centre to the Atlantic Ocean	164	-7	8.5	-2.1	324	4
Maize barley and livestock zone along the English Channel	241	-7	8.7	-1.6	283	9
Rapeseed zone of eastern France	241	-8	6.3	-1.0	307	8
Dry Massif Central zone	212	-21	6.4	-1.6	354	2
Southwest maize zone	296	13	8.4	-2.4	395	-1
Eastern Alpes region	454	7	4.2	-1.2	400	2
Mediterranean zone	403	33	7.3	-0.7	445	-3

Table 3.24. France's agronomic indicators by sub-national regions, current season's value and departure from 5YA, October 2018 - January 2019

Region	BIOMSS		Cropped arable land fraction		Maximum VCI
	Current (gDM/m^2)	Departure from 5YA (%)	Current (%)	Departure from 5YA (%)	Current
Northern Barley zone	1063	1	96	-3	0.77
Mixed maize /barley and rapessed zone from the Centre to the Atlantic Ocean	738	0	93	-4	0.69
Maize barley and livestock zone along the English Channel	1006	-2	100	0	0.86
Rapeseed zone of eastern France	936	-1	97	-3	0.82
Dry Massif Central zone	844	-7	99	-1	0.78
Southwest maize zone	998	11	99	3	0.82
Eastern Alpes region	891	8	95	1	0.87
Mediterranean zone	1056	28	96	7	1.05

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

[GBR] United Kingdom

Summer crops have been harvested and winter crops (winter wheat, winter barley, and rapeseed) have been planted during the current reporting period. According to crop condition graph, NDVI values were below average from October to end of December. Agroclimatic indicators show that rainfall and temperature for the country were below average (RAIN, -13.2%, TEMP, -1.4°C) and radiation and biomass were slightly above average (RADPAR, +2.8%, BIOMSS, +0.8%). The NDVI departure cluster profiles indicate below average values in 47.7% of arable land including East Midlands (Lincolinshire), East Angelia (Northampton,Bedford, Cambridge, Huntingdon and northern of Norfolk), Southwest (Conrwall),West (Oxford, Wilt), and South (Berk) and slightly above average values in 46.4% Yorkshire and South west (Somerset, Dorset) from November to January. The national average VCIx was good 0.91, and the cropped arable land fraction slightly decreased by 0.4% compared to its five-year average.

Regional analysis

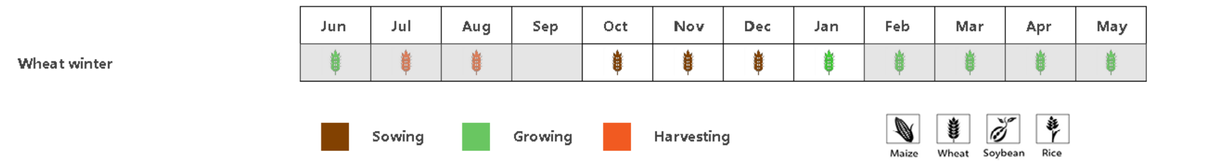
Based on cropping systems, climatic zones, and topographic conditions,three sub-national regions Central sparse crop region, Northern barley region, and Southern mixed wheat and barley region can be distinguished. Central sparse and Southern sub-regions characterized by unchanged fractions of arable land (CALF), and increased by 1% in the Northern Barley region compared to 5 years average.

The central sparse crop region is one of the country's major agricultural regions in terms of crop production. Agroclimatic conditions include rainfall was below average (RAIN -11%),temperature and radiation were slightly below to average (TEMP,-1.3°C,RADPAR, -0.6%), separately. NDVI values were below the five-year maximum according to the region's crop condition development graph in October to late December, above average in January. The VCIx was good at 0.95.

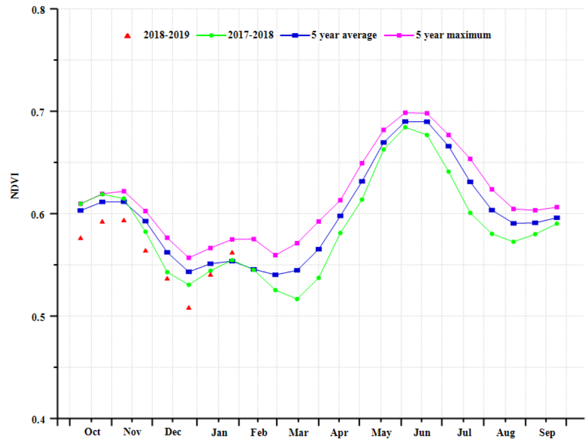
In the main barley region NDVI was above average according to the crop condition graphs in this reporting period. Compared to the fifteen-year average, rainfall (RAIN, -16%) and temperature (TEMP, -1.5°C) were below average, biomass was above average (BIOMSS, +3%), and radiation was unchanged to average. The national VCIx with 0.95.

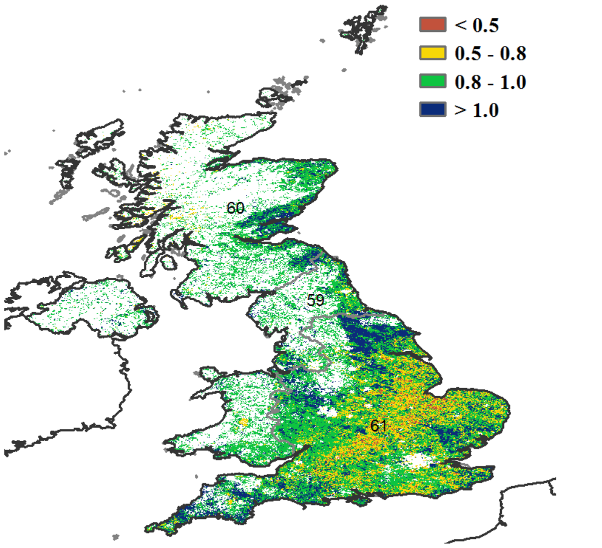
In the southern mixed wheat and barley zone, NDVI was below average according to the crop condition graph in this period. Rainfall, temperature and biomass (RAIN, -12%, TEMP, -1.3°C, BIOMSS, -1%) was below average, radiation (RADPAR, +5.7%) were above average during this reporting period. The region hadabove average VCIx (0.89), although less so than the other regions.

Figure 3.17. United Kingdom crop condition, October 2018 - January 2019

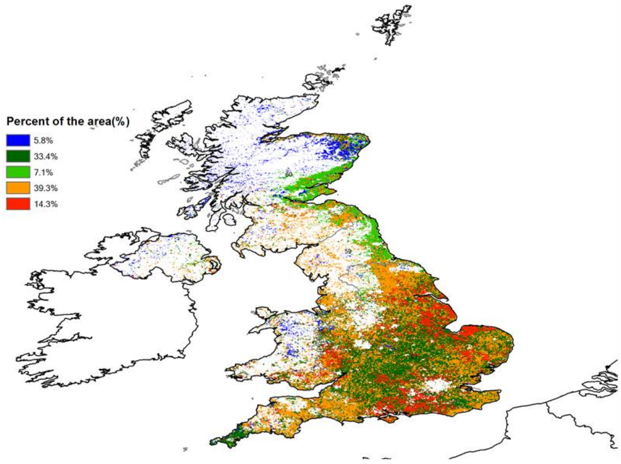


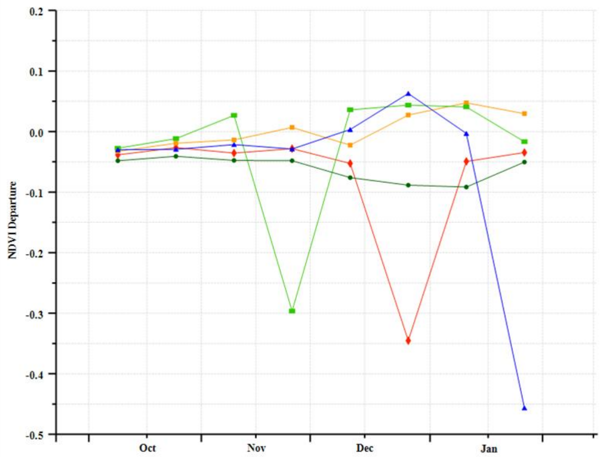
(a). Phenology of major crops



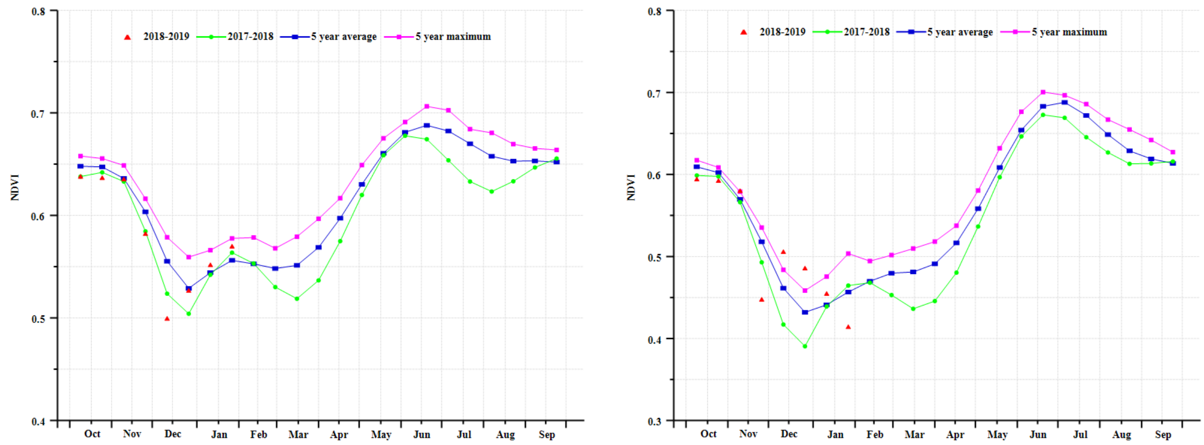


(b) Crop condition development graph based on NDVI (c) Maximum VCI

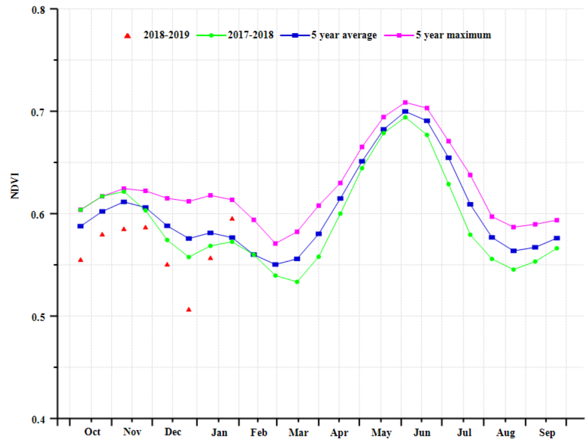




(d) Spatial NDVI patterns compared to 5YA (e) NDVI profiles



(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, October 2018 - January 2019

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m^2)	Departure from 15YA (%)
Northern Barley area (UK)	518	-16	5.6	-1.5	129	0.0
Southern mixed wheat and Barley zone (UK)	319	-12	7.8	-1.3	208	5.7
Central sparse crop area (UK)	466	-11	7.1	-1.3	164	-0.6

Table 3.26. United Kingdom's agronomic indicators by sub-national regions, current season's values and departure from 5YA, October 2018 - January 2019

Region	BIOMSS		CALF		Maximum VCI
	Current (gDM/m^2)	Departure from 5YA (%)	Current (%)	Departure from 5YA (%)	Current
Northern Barley area (UK)	1033	2	100	1	0.95
Southern mixed wheat and Barley zone (UK)	1150	-1	100	0	0.89
Central sparse crop area (UK)	1147	3	100	0	0.95

[HUN] Hungary

Winter wheat is the main crop currently in the field in Hungary.

All agro-climatic indicators were above or close to average: RAIN +21.7%, RADPAR +4.3%, and TEMP +0.7°C, which led to a 16% increase in BIOMSS compared with the five-year average. NDVI values, however, were below average according to the national crop condition development graph. About half the croplands had close to average NDVI (Fejer, Bacskiskun, Csongrad, Tolna, Vas and Zala) while less favorable condition prevailed in the Northern Great Plain such as Helves, Jasz-Nagykun-Szolnok, Bekes, and Szabolcs-Szatmar-Bereg. The national average VCIx was fair (0.78), and the cropped arable land fraction decreased by 17% compared to its five-year average.

Regional analysis

CropWatch has adopted four agro-ecological zones (AEZ) to provide a more detailed spatial analysis for the country. They include North Hungary, Central Hungary, the Puszta and Transdanubia. Specific observations for the reporting period are included for each region.

Cultivated arable land (CALF) decreased in all sub-regions: 14% in North Hungary region, 1% in Southern Transdanubia, and by 7% and 35% in Central Hungary and Puszta sub-regions, respectively.

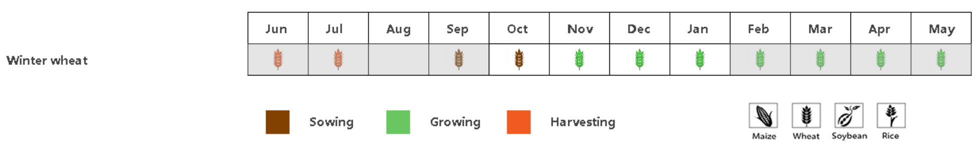
Central Hungary is one of its major agricultural regions in terms of crop production for winter wheat, maize and sunflower are planted in this region. The NDVI was below average. Agro-climatic conditions were above average for rainfall and radiation (RAIN 186 mm or +14%; RADPAR 350 MJ/m2 or +3%), and temperature was close to average (TEMP, +0.6°C). Compared to the 5YA, the biomass production potential was above average (BIOMSS, +12%) while VCIx reached 0.82.

In North Hungary grows 5 to 8% of the national winter wheat, and 1 to 4% of maize. The NDVI was below average from October to January. The accumulated rainfall (RAIN +17%), temperature (TEMP 0.6°C), and radiation (RADPAR +5.3%) were above average, resulting in a biomass production potential increase in this region (BIOMSS +16%).

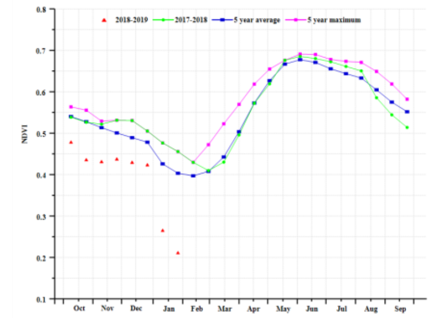
The Puszta region grows mostly winter wheat, maize and sunflower especially in the counties of Jaz-Nagykum-Szolnok and Bekes. According to the crop condition graph, NDVI values were below average. The biomass potential increased by 35% due to high rainfall and radiation (RAIN 53% and RADPAR 2.1%); temperature was close to average (TEMP +0.6°C). The maximum VCIx reached 0.67, indicating a far crop.

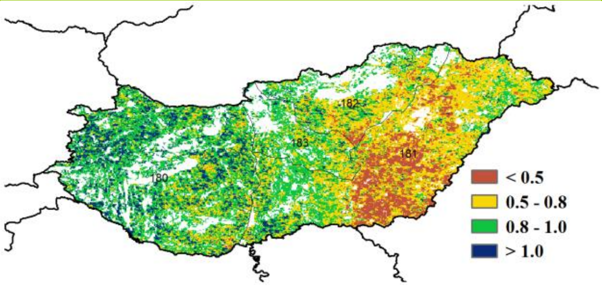
Southern Transdanubia cultivates winter wheat, maize and sunflower, mostly in Somogy and Tolna counties while smaller areas are planted in northern Transdanubia. All agro-climatic indicators were about average: RAIN +3%, TEMP 0.9°C and RADPAR +6.1%. The biomass increased by just 2%. The maximum VCI (0.91) stands for good crops in the Transdanubia region.

Figure 3.18. Hungary's crop condition, October 2018 - January 2019.



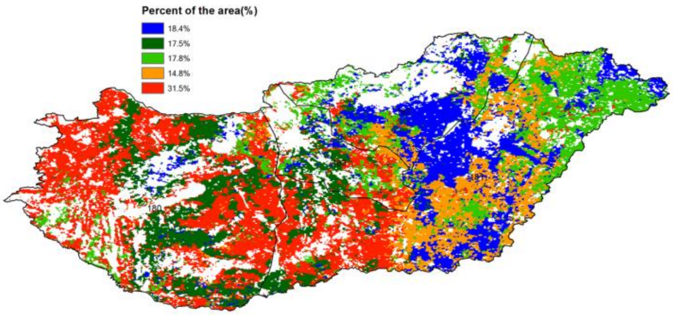
(a). Phenology of major crops

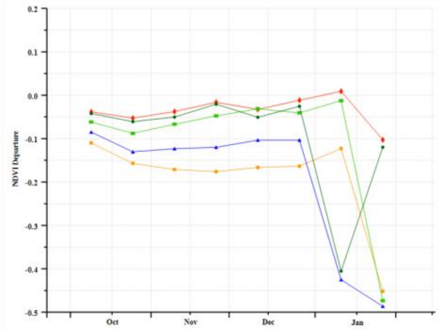




(b) Crop condition development graph based on NDVI

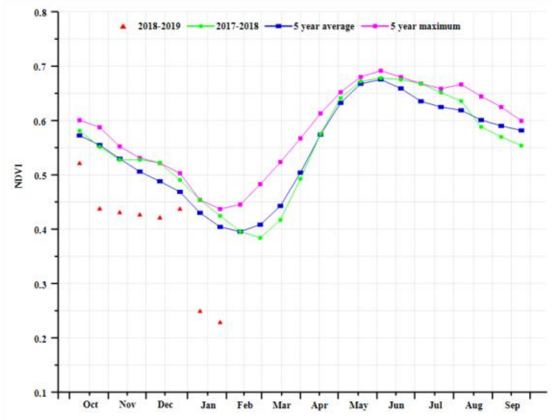
(c) Maximum VCI

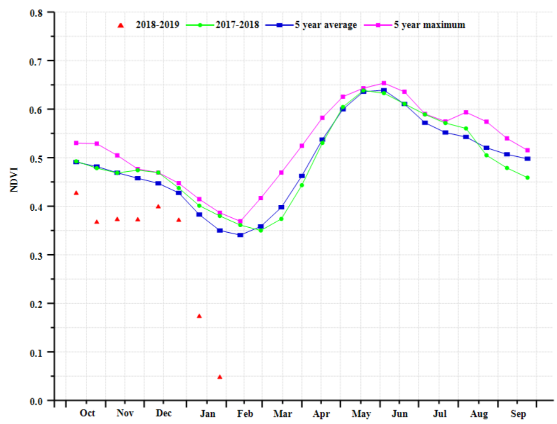




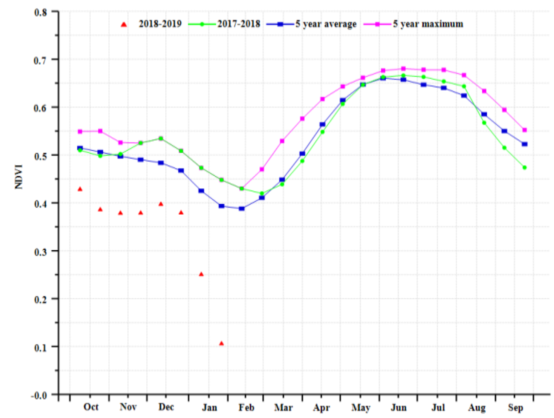
(d) Spatial NDVI patterns compared to 5YA

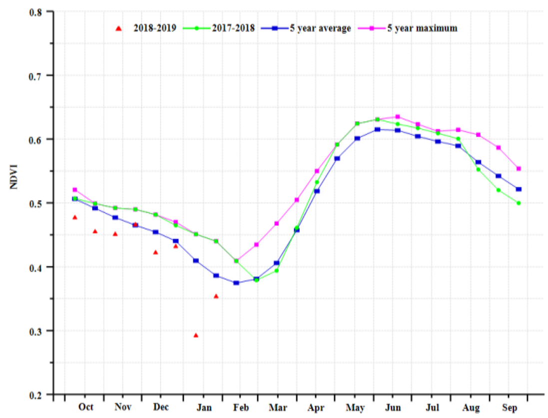
(e) NDVI profiles





(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, October 2018 - January 2019

Region	RAIN	TEMP	RADPAR

	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m^2)	Departure from 15YA (%)
Central Hungary	186	14	5.1	0.6	350	3
North Hungary	186	17	4.7	0.6	328	5
Great Plain	239	53	5.2	0.6	349	2
Transdanubia	202	3	5.6	0.9	373	6

Table 3.28. Hungary's agronomic indicators by sub-national regions, current season's values and departure from 5YA, October 2018 - January 2019

Region	BIOMSS		CALF		Maximum VCI
	Current (gDM/m^2)	Departure from 5YA (%)	Current (%)	Departure from 5YA (%)	Current
Central Hungary	741	12	90	-7	0.82
North Hungary	777	16	83	-14	0.76
Great Plain	889	35	59	-35	0.67
Transdanubia	770	2	95	-1	0.91

[IDN] Indonesia

During this monitoring period, the harvest of the secondary maize was completed and the main season maize was sowed in Java and Sumatra; it is now in vegetative stage. Similarly, main season rice has been sowed while the second rice in Java has reached maturity and was harvested.

Rainfall (RAIN, -1%) and temperature (TEMP, -0.4°C) were average, while radiation (RADPAR +4%) was slightly above, which led to an average of biomass production potential. Crop condition was below average as shown in the NDVI development graph. Spatial NDVI profiles show that crop condition was slightly below average before December but better than average in January 2019 in 36.2% of total cropped areas, mostly following a patchy pattern. In 23.3% of the cropped areas (mostly in Jambi, Sumatera Selatan, Kalimantan Timur, Kalimantan Tengah, and Papua), crop condition was persistently below average in this season. Considering that the area of cropped arable land (CALF) in the country increased by 1% compared with the five-year average and the VCIx value of 0.96, the crop condition is nevertheless anticipated to be close to average.

Regional analysis

The analysis below focuses on four agro-ecological zones, namely Sumatra (64), Java (62, the main agricultural region in the country), Kalimantan and Sulawesi (63) and West Papua (65), among which former three are relevant for crops cultivation. The numbers correspond to the labels in the VCIx and NDVI profile maps.

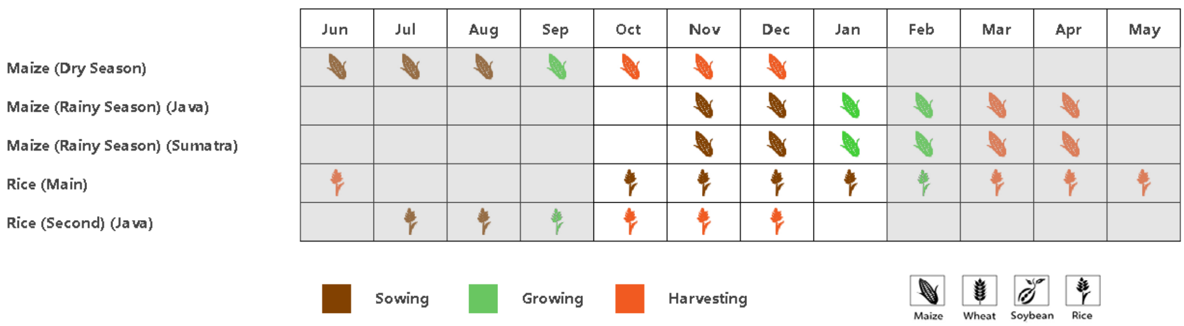
The weather over **Java** was relatively dry compared with average (RAIN, -14%), with above average radiation (RADPAR +7%) and average temperature, resulting in a slight drop (7%) in the biomass production potential. According to the NDVI development graph, crop condition was below the 5-year average. Overall, the crop condition in Java is assessed as fair.

Kalimantan and Sulawesi experienced the same patterns as those for the country as a whole: the average temperature (TEMP, -0.3°C) and radiation (RADPAR +3%) and slightly above average rainfall (RAIN, +9%) which led to a marginal increase of biomass production potential by 2% compared to the recent five-year average. According to the NDVI development graph, crop condition was slightly below the 5-year average. Overall, the crop condition was close to average.

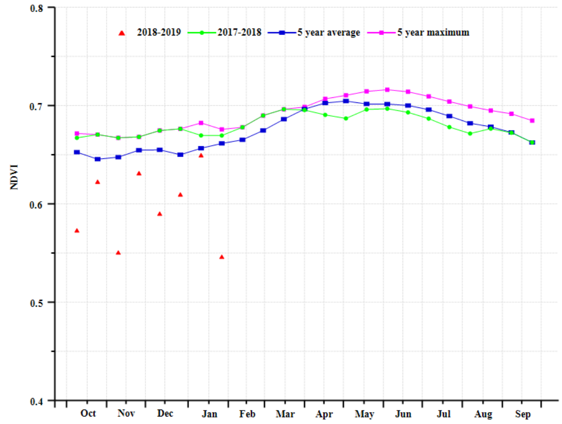
The slightly above average rainfall (RAIN +9%) in **Sumatra** was accompanied by average radiation (+3% departure) and temperature (-0.4°C departure) and resulted in average biomass production potential (BIOMSS +4%). According to NDVI development graphs, crop condition was slightly below the 5-year average. Crop condition in Sumatra was close to average as well.

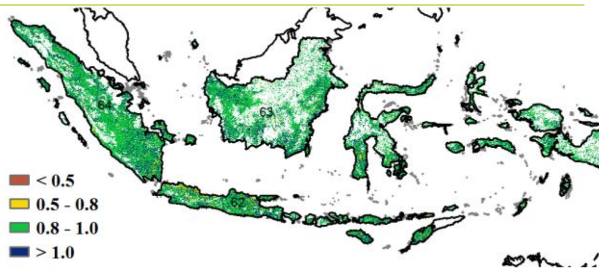
Considering that all the arable land was cultivated and that agro-climatic conditions were fair, CropWatch assesses the condition of crops that were in the field during the reporting period as moderate and satisfactory.

Figure 3.19. Indonesia's crop condition, October 2018 - January 2019

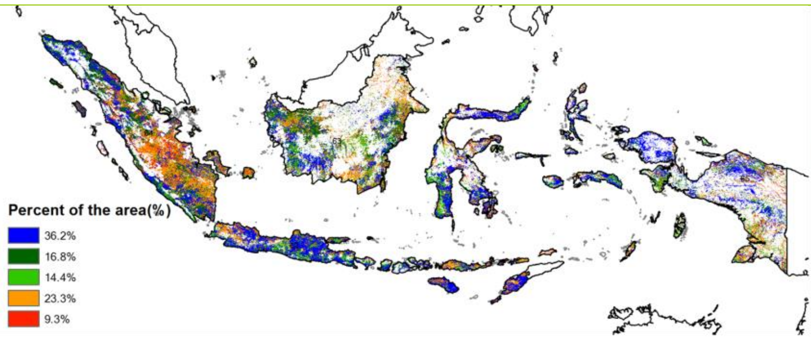


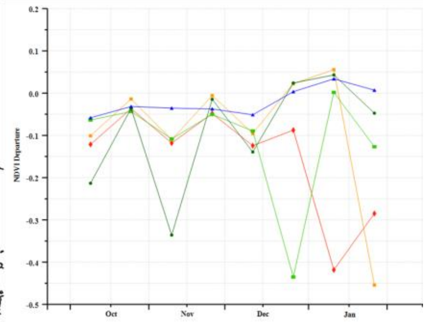
(a). Phenology of major crops



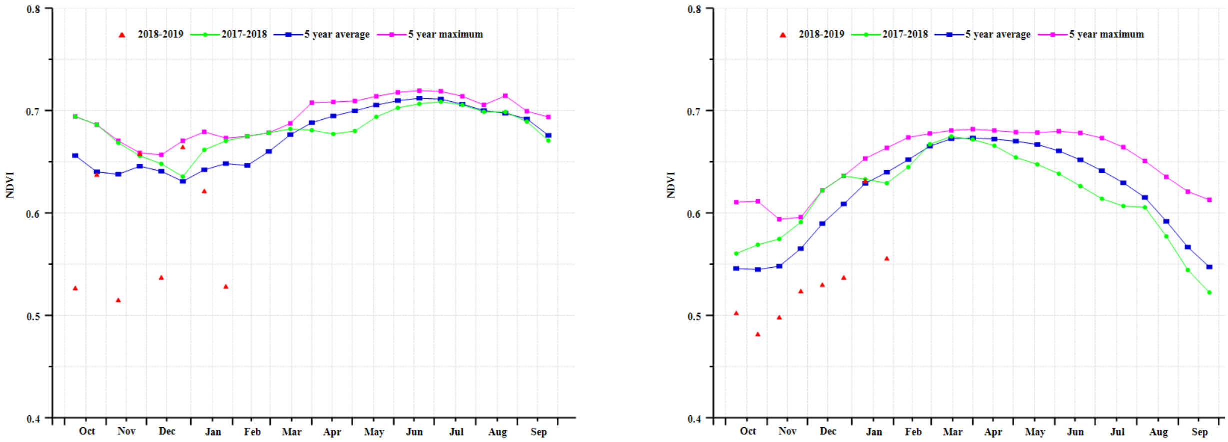


(b) Crop condition development graph based on NDVI (c) Maximum VCI

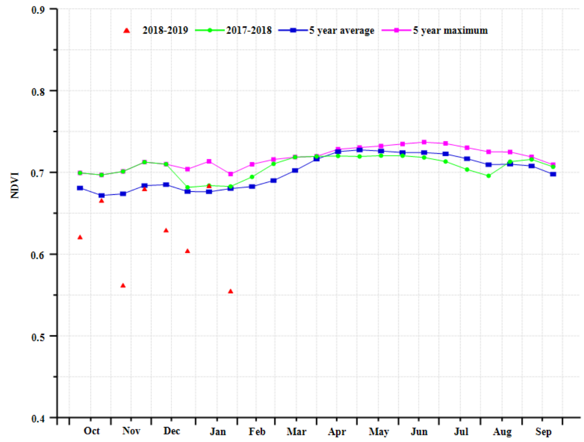




(d) Spatial NDVI patterns compared to 5YA (e) NDVI profiles



(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, October 2018 - January 2019

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure (%)	Current (°C)	Departure (%)	Current (MJ/m^2)	Departure (%)
Java	887	-14	26.2	0.0	1290	8
Kalimantan and Sulawesi	1020	-3	26.0	-0.3	1180	5
Sumatra	1270	9	25.5	-0.4	1070	3
West Papua	1162	-5	25.0	-0.8	1044	2

Table 3.30. Indonesia's agronomic indicators by sub-national regions, current season's value and departure from 5YA, October 2018 - January 2019

Region	BIOMSS		Cropped arable land fraction		Maximum VCI
	Current (gDM/m^2)	Departure (%)	Current (%)	Departure (%)	Current
Java	1758	-7	98	2	
Kalimantan and Sulawesi	2123	-2	100	0	0.97
Sumatra	2372	4	100	1	0.96
West Papua	2210	-2	100	0	0.96

[IND] India

The monitoring period covers the late growth and harvest of Kharif (summer) maize, rice and soybean and the planting and early growth of Rabi (winter) rice and wheat. The crop condition was below average for the country during the period, except for the central northern area where condition improved in December and January.

In general, rainfall was low (RAIN 34% below average) but large differences exist between States. Below average values occurred in Meghalaya (-74%), Nagaland (-68%), Andhra Pradesh (-63%) and Chhattisgarh (-58%). Large positive departures occurred in Punjab (+53%) and Haryana (+23%). Nationwide TEMP remained average. The most significant – but still moderate - TEMP deficits were in Bihar (-0.8°C) and Daman and Diu (-0.7°C). The photosynthetically active radiation (RADPAR) increased slightly by 2% over the recent 5YA but larger departures were recorded in some States such as Manipur (+8%) and Puducherry (+8%).

Crop condition was beneath the previous five-years’average. The least favorable conditions occurred in Chhattisgarh, Gujarat, Rajasthan, Madhya Pradesh and Maharashtra which include areas with poor crop condition identified by VCIx below 0.5.

The biomass accumulation potential (BIOMSS) dropped significantly below average by 24%, nationwide. Overall, as perCropWatch indicators, crop-condition was below average, and reduced BIOMSS output is expected in Nagaland (-50%), Jharkhand (-46%), Madhya Pradesh (-45%), Meghalaya (-43%), and Andhra Pradesh (-42%).The most promising situation (BIOMSS higher than average) occurred inDelhi (36%), Punjab (32%) and Haryana (29%).

Regional analysis

India has been divided into seven agro-ecological zones: the Deccan plateau, the Eastern coastal region, the Gangetic plains, the northeastern region, the Western coastal region, the Northwestern dry region and the Western Himalayan region.

The **Deccan Plateau** region recorded 29 mm of RAIN (-61% relative to average), 22.9°C TEMP (+0.4°C) and 1102MJ/m² RADPAR (+2%). BIOMASS decreased 51% in the region which also recorded low NDVI. The CALF recorded 99% which is close to the 5YA,and VCIx was 0.8.

The **Eastern coastal region** recorded below average RAIN (-33%) and TEMP (-0.2°C). The RADPAR of 1115 MJ/m² was3 % higher than the average and BIOMASS was 19% below the 5YA. The region recorded 3% lower than average cropped area and a VCIx of 0.8 indicating moderate crop condition.

In the **Gangetic region**, precipitation amounts to 52 mm (41% lower than 15YA). TEMP was cooler by 0.3°C, and RADPAR was 2 % higher than average. The BIOMASS reached 202 g DM/m2, which is 28 % below the 5YA. The CALF recorded 98%, just above the 5YA(+3%), and VCIx was high at 0.9.

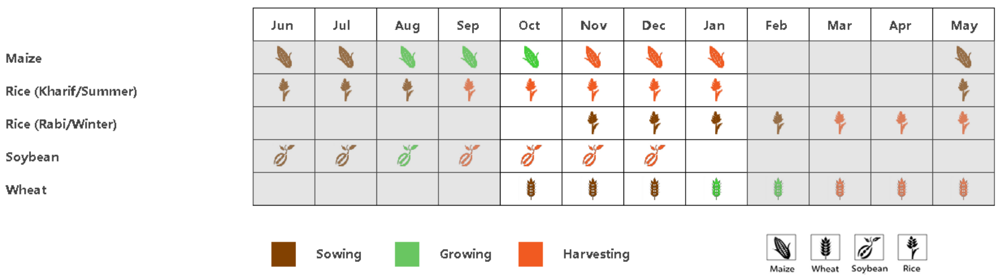
The **Assam and Northeastern region** recorded 110mm rainfall (52% below the average), with slightly higher averageTEMP at 19.6°C (+0.2°C) and RADPAR of 930 MJ/m2 (+3%). The BIOMSS was lower than the average (-29%), and CALF reached 96% which is nearly the 5YA. Crop condition was good with VCIx at 0.9 and good production is expected.

The **Western coastal** region received 18% lower than average rainfall, average TEMP (24.4 °C) and RADPAR of 1177MJ/m² (+3%). This region had 16% lower than average BIOMASS. The CALF was 10% lower than 5YA, but crop condition was satisfactory at 0.8 VCIx.

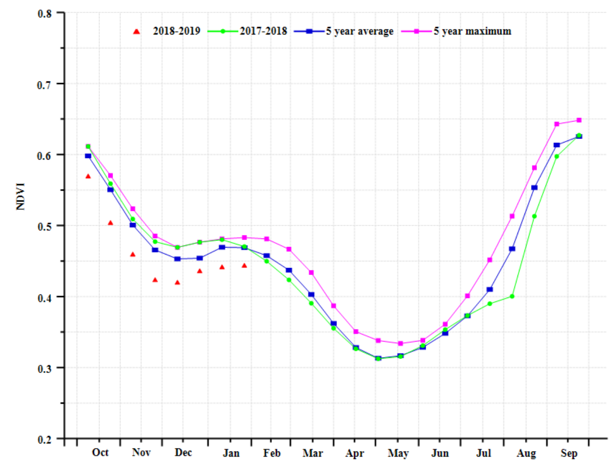
The **Northwestern region** recorded the lowest rainfall value in India (23 mm, lower than average by 28%) and nearaverage TEMP (22.3 °C) and RADPAR (+2%). The BIOMASS was lower than the average (-15%). CALF increased 7% above the 5YA and crop condition was average at 0.8 VCIx.

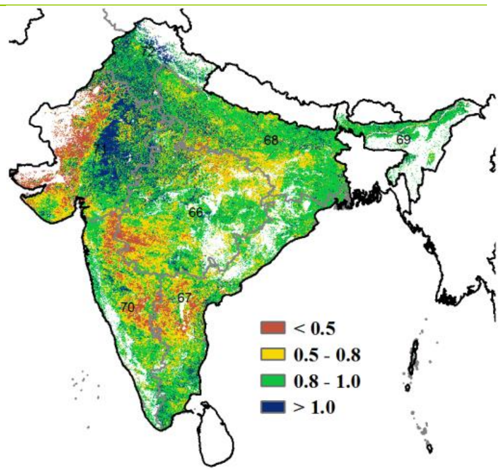
The **Western Himalayan** region received rainfall of 128 mm (12% above average) and just above average TEMP was recorded (0.3℃). RADPAR reached 871 MJ/m2 (-23 %). The BIOMASS exceeded the 5YA by 16%. The CALF was 3% higher than the average and VCIx at 0.97 indicate good production in general.

Figure 3.20. India's crop condition, October 2018 - January 2019



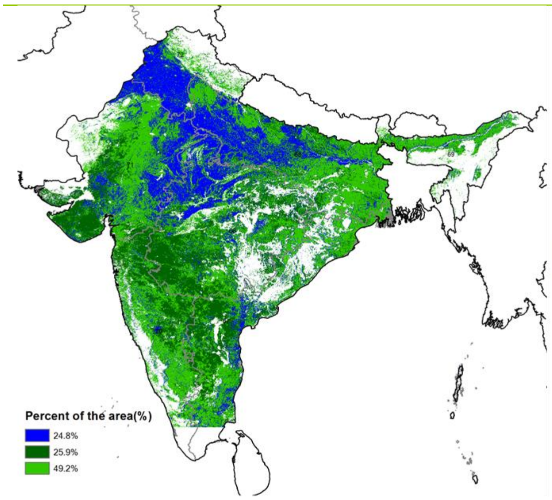
(a). Phenology of major crops

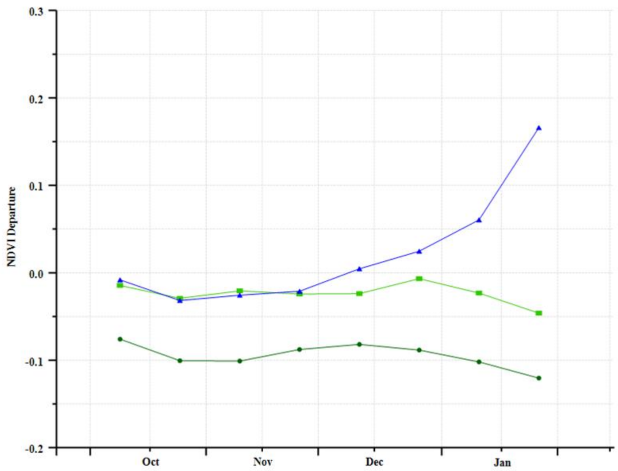




(b) Crop condition development graph based on NDVI

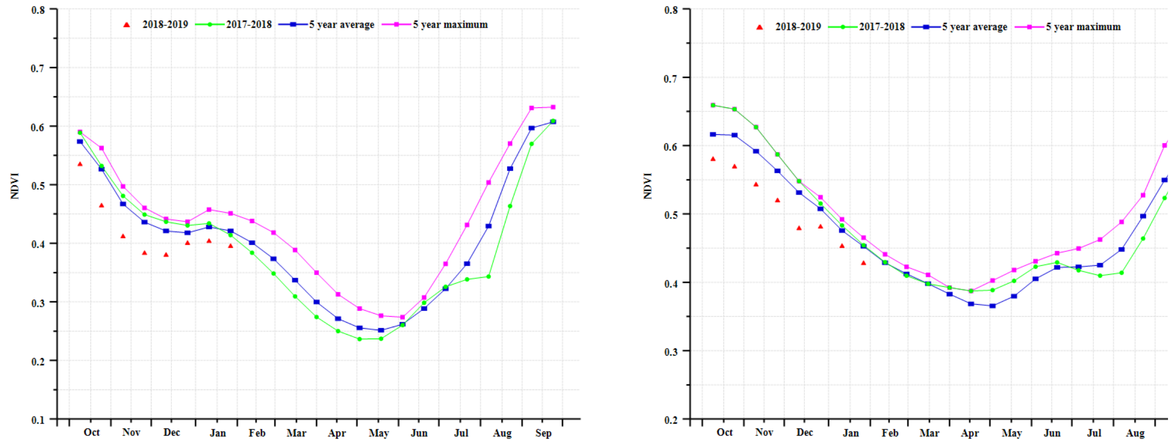
(c) Maximum VCI



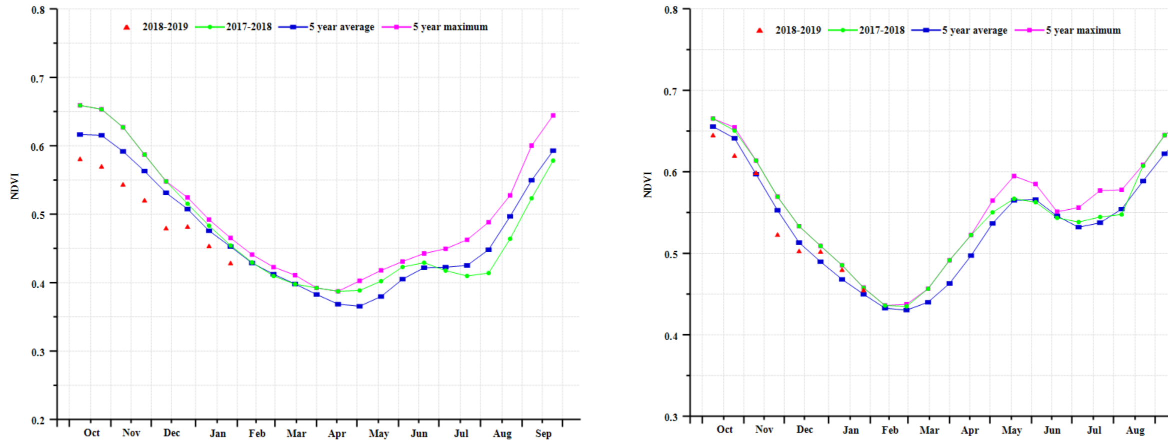


(d) Spatial NDVI patterns compared to 5YA

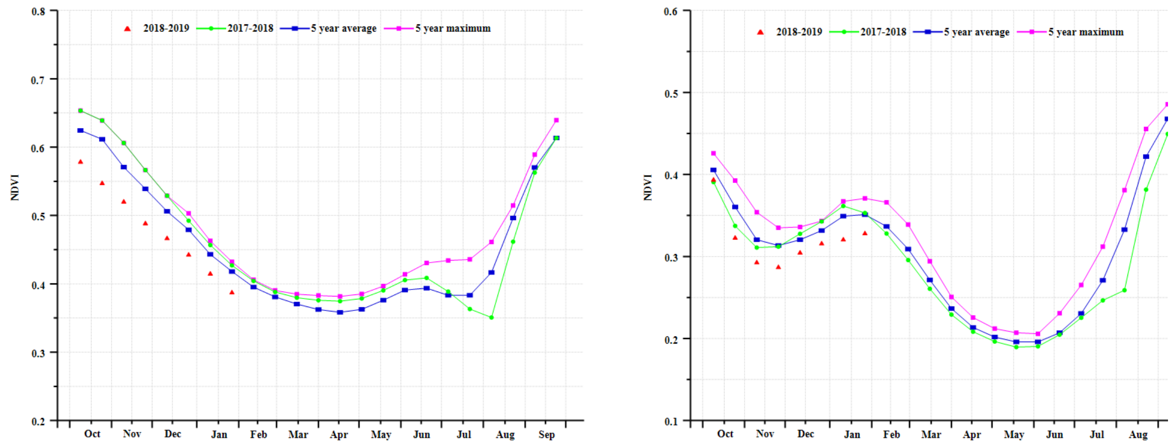
(e) NDVI profiles



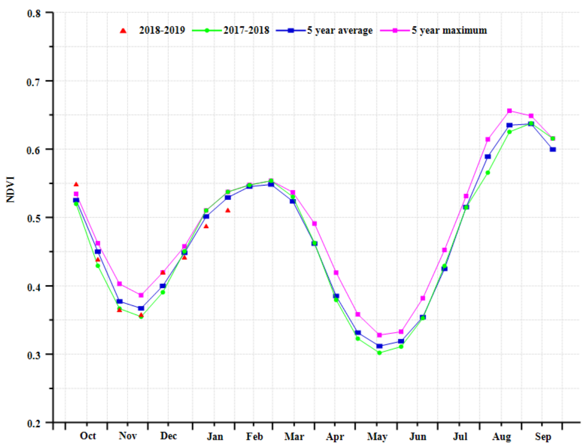
(f) Crop condition development graph based on NDVI (Deccan Plateau (left) and Eastern Coastal Region (right))



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



(h) Crop condition development graph based on NDVI (Western Coastal Region (left) and Western Dry Region (right))



(i) Crop condition development graph based on NDVI (Western Himalayan Region)

Table 3.31. India's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, October 2018 - January 2019

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m2)	Departure from 15YA (%)
Deccan Plateau	29	-61	22.9	0.4	1102	2
Eastern coastal region	198	-33	24.7	-0.2	1115	3
Gangatic plain	52	-41	20.6	-0.3	996	2
Assam and north-eastern regions	110	-52	19.6	0.2	930	3
Western coastal region	192	-18	24.4	0	1177	3
North-western dry region or Rajastan and Gujarat	23	-28	22.3	-0.1	1072	2
Western Himalayan region	128	12	9.8	0.3	871	-3

Table 3.32. India's agronomic indicators by sub-national regions, current season's values and departure from 5YA, October 2018 - January 2019

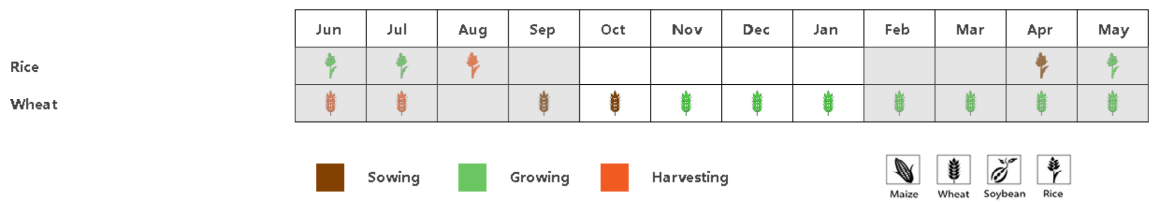
Region	BIOMSS		CALF		Maximum VCI
	Current (gDM/m^2)	Departure from 5YA (%)	Current (%)	Departure from 5YA (%)	Current
Deccan Plateau	127	-51	98	1	0.81
Eastern coastal region	559	-19	92	-3	0.8
Gangatic plain	202	-28	98	3	0.86
Assam and north-eastern regions	412	-29	96	1	0.93
Western coastal region	469	-16	85	-10	0.75
North-western dry region or Rajastan and Gujarat	93	-15	67	7	0.8
Western Himalayan region	356	16	96	3	0.97

[IRN] Iran

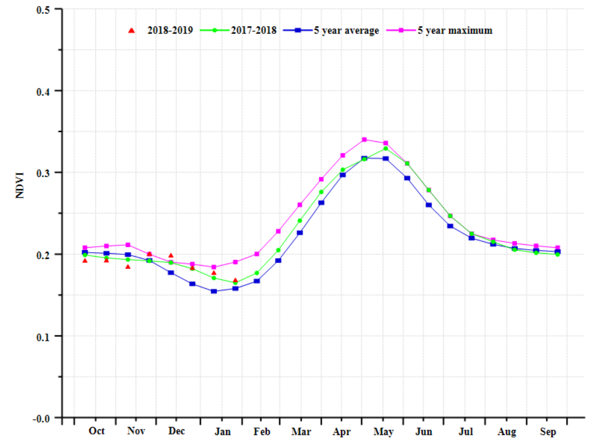
Crop condition was generally below average from October to early November, and recovered to above average values in January. The planting of winter wheat has been completed in October. Accumulated rainfall and temperature were above average (RAIN +38%, TEMP, +1.0°C), while radiation was below (RADPAR, -7%). The favorable agro-climatic conditions resulted in an increase in the BIOMSS index by 26% compared to the five-year average. The national average of maximum VCI index reached 0.95, and the Cropped Arable Land Fraction (CALF) increased by 51% compared to the recent five-year average. According to the national crop condition development graphs, crop condition was below average across the whole country from October to the early November. It was above average from late November to early January in about 44 .6% of croplands, mainly in Khuzestan, Chaharmahal and Bakhtiari Provinces of the southwest area, Luristan, Hamadan Provinces of the central-west area, and Golestan and Mazandaran Provinces of the central-north area. Remaining croplands experienced unfavorable crop condition from December to January, particularly in the north-western Provinces of Ardabil, East Azerbaijan, Zanjan, Kurdistan, as well as most of the north-east area.
Overall, the early crop condition for winter crops is favorable in the current season. The final outcome of the season will be determined by soil moisture in March when vegetative grows will resume.

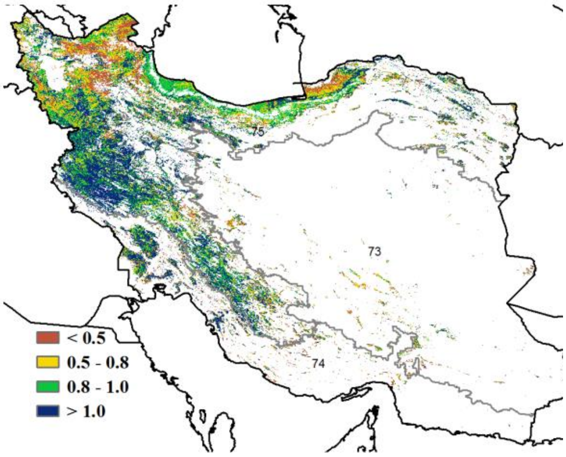
Regional analysis
Based on cropping systems, climatic zones, and topographic conditions, three sub-national agro-ecological regions can be distinguished for Iran, among which two are relevant for crop cultivation. The two regions are referred to as the Semi-arid to sub-tropical hills of the west and north (75), and the Arid Red Sea coastal low hills and plains (74).
In the **Semi-arid to sub-tropical hills of the west and north region**, the accumulated rainfall was 345mm (31% above average), temperature was above average (TEMP +1.1°C), while radiation was below average (RADPAR -8%). The favorable weather conditions resulted in an increase of BIOMSS by 20% compared to the recent five years average. The CALF increased by 28%, and the average VCIx (0.99) was high. NDVI profiles showed that NDVI was above average from later November to January 2019, although the NDVI value was within 0.15-0.22.
Crop condition in the **Arid Red Sea coastal low hills and plains** region was above average from November 2018. The region received 364 mm rainfall during this report period. The far above average (RAIN, +113%) rainfall and warm temperature (+0.4°C) resulted in a significant 83% increase of BIOMSS. The CALF increased by 20% compared to five-year average, and the average VCIx (1.13) reached the five-year maximum. Therefore, the crop condition for this season was expected to be favorable.

Figure 3.21. Iran's crop condition, October 2018 - January 2019



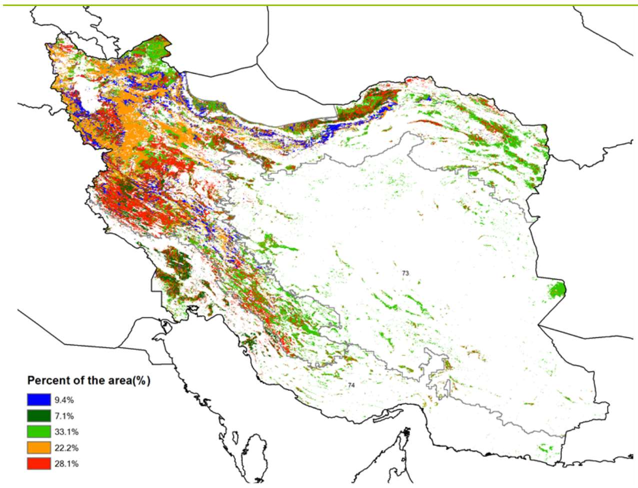
(a) Phenology of major crops

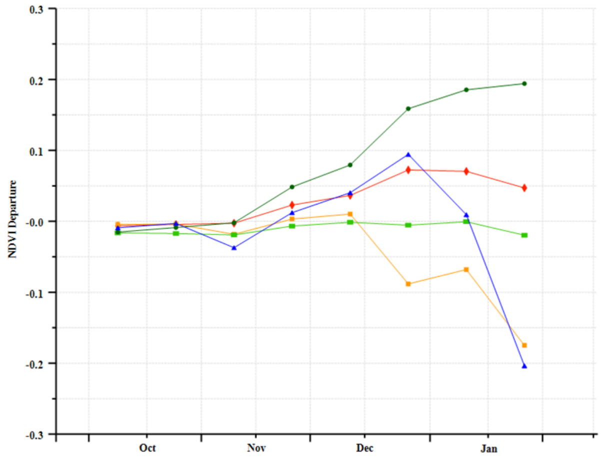




(b) Crop condition development graph based on NDVI

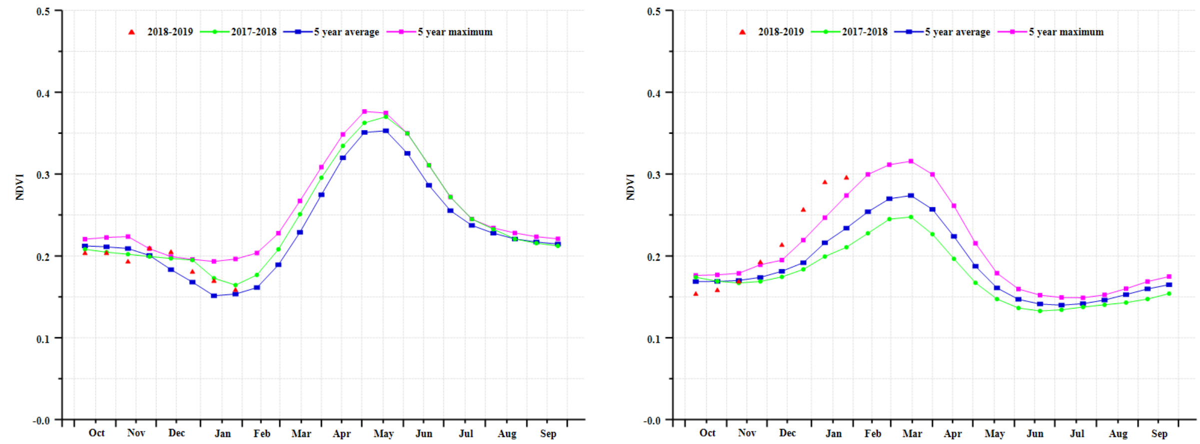
(c) Maximum VCI





(d) Spatial NDVI patterns compared to 5YA

(e) NDVI profiles



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

Table 3.33. Iran's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, October 2018 - January 2019

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m^2)	Departure from 15YA (%)
Semi-arid to sub-tropical hills of the west and north	345	31	6.7	1.1	678	-8
Arid Red Sea coastal low hills and plains	364	113	16.9	0.4	814	-5

Table 3.34. Iran's agronomic indicators by sub-national regions, current season's value and departure from 5YA, October 2018 - January 2019

Region	BIOMSS		Cropped arable land fraction		Maximum VCI
	Current (gDM/m^2)	Departure from 5YA (%)	Current (%)	Departure from 5YA (%)	Current
Semi-arid to sub-tropical hills of the west and north	855	20	10	28	0.99
Arid Red Sea coastal low hills and plains	955	83	27	20	1.13

[ITA] Italy

Winter wheat was sown from September and is still dormant or growing at the end of this monitoring period. Generally, according to the NDVI development graph, crop condition was below the values of the last year, and above the average of the past five years in October and December. CropWatch agro-climatic indicators show above average Rainfall (+22%), average temperature (+0.2°C) and RADPAR (+1%). With CALF up 5%, BIOMSS increased by 12% and VCIx at 0.89, the overall crop condition in the country is assessed as satisfactory.

Regional analysis

Based on cropping systems, climatic zones, and topographic conditions, four sub-national regions can be distinguished for Italy; they include Eastern Italy, Northern Italy, Southern Italy (Sicily) and Western Italy (including Sardinia).

Eastern Italy enjoyed moderately above average rain (RAIN +11%), average TEMP (+0.3°C) and RADPAR (+2%); BIOMSS increased by 9% compared with the averages (5YA). VCIx was 0.87 with a low CALF (0.92). The crop condition development graph indicates that NDVI exceeded the values of last year from November to late December, as well as the 5 years average. After December NDVI dropped below the values of 2017. About average output is expected.

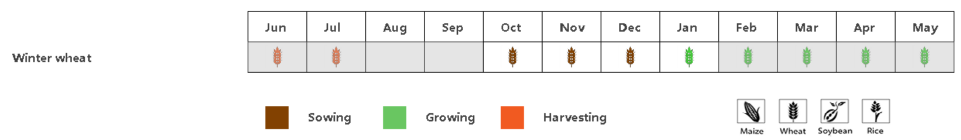
The situation and expected crop production in Northern Italy results from RAIN up 26% compared to average, TEMP up 0.5°C and average RADPAR. BIOMSS exceeds the 5YA by 6%, VCIx reached 0.86 and CALF, 0.88. The crop condition development graph indicates values higher that during last year and reaching the average of 5 years from November to late December. According to the agro-climatic indicators, above average output is expected.

Southern Italy recorded a large excess of precipitation (RAIN +61%), average TEMP (-0.6%) and RADPAR (+1%). BIOMSS increased by 29% compared with the average (5YA). VCIx was the best ever (1.02) and arable land was fully cropped (CALF 0.99). NDVI exceeded the 5 years maximum from October to December. Generally, above average output is expected.

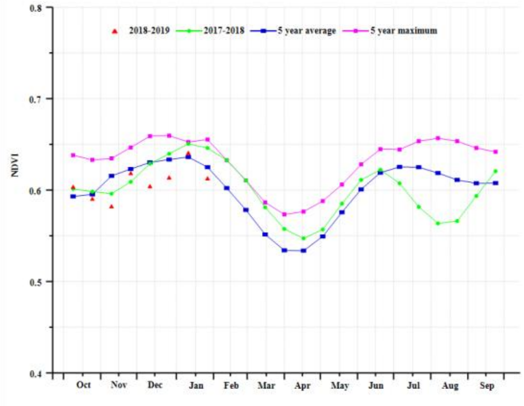
The situation in Western Italy includes precipitation up 22 % above average (RAIN +22%) as well as average RADPAR and TEMP. Compared with the average of the recent five years BIOMSS rose 14%. VCIx reaches 0.88 and CALF is just below 100% (0.98). CropWatch expects above average production.

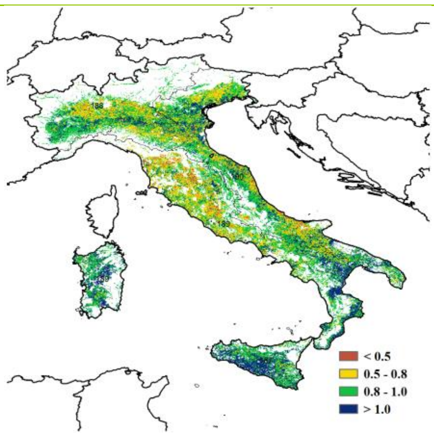
Overall, prospects of winter crops are generally excellent.

Figure 3.22. Italy's crop condition, October 2018 - January 2019.



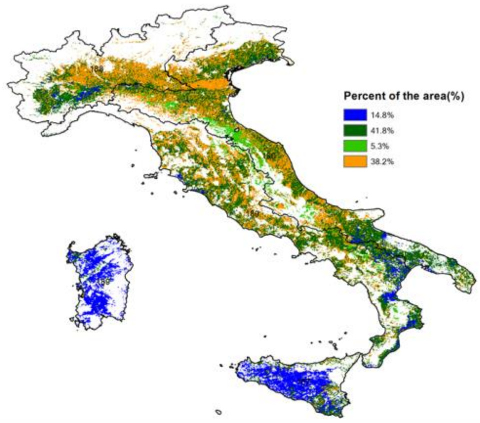
(a). Phenology of major crops

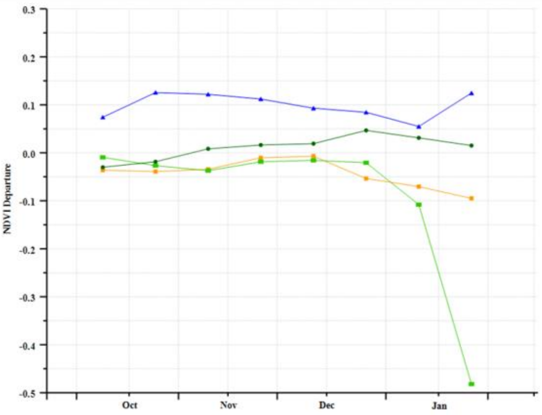




(b) Crop condition development graph based on NDVI

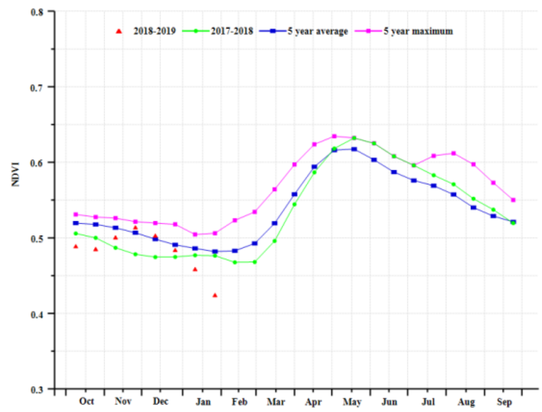
(c) Maximum VCI

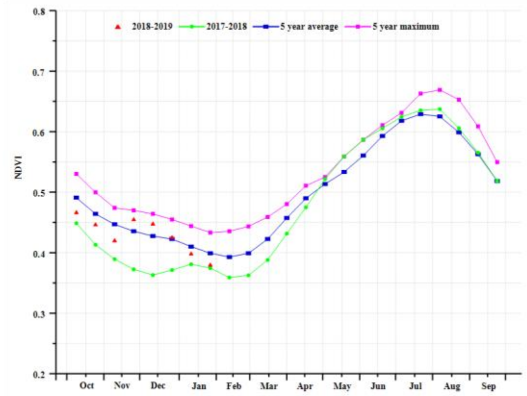




(d) Spatial NDVI patterns compared to 5YA

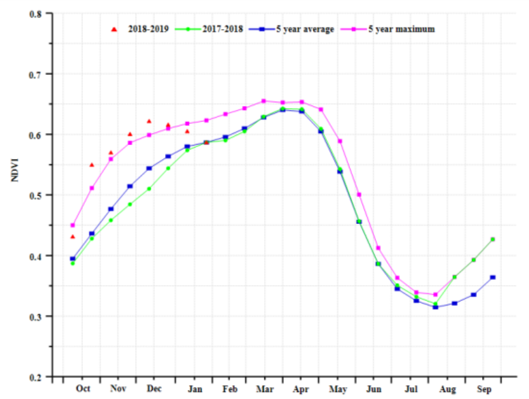
(e) NDVI profiles

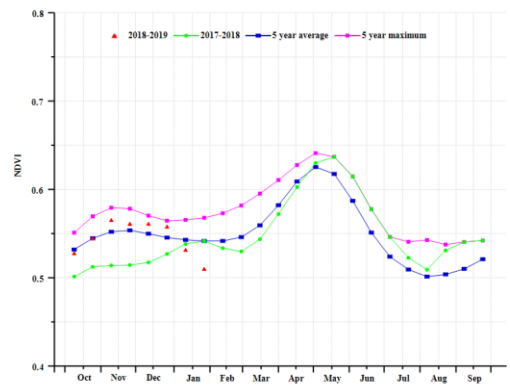




(f) Eastern Italy (Italy) crop condition development graph based on NDVI

(g) Northern Italy (Italy) crop condition development graph based on NDVI





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

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

Table 3.35. Italy's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, October 2018 - January 2019

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m^2)	Departure from 15YA (%)
Eastern Italy	283	11	8.5	-0.3	421	2
Northern Italy	433	26	5.8	-0.1	415	0
Southern Italy	328	61	11.9	-1.1	608	1
Western Italy	319	22	9.3	-0.5	484	0

Table 3.36. Italy's agronomic indicators by sub-national regions, current season's value and departure from 5YA, October 2018 - January 2019

Region	BIOMSS		Cropped arable land fraction		Maximum VCI
	Current (gDM/m^2)	Departure from 5YA (%)	Current (%)	Departure from 5YA (%)	Current
Eastern Italy	926	9	92	7	0.87
Northern Italy	923	6	88	2	0.86
Southern Italy	908	29	99	14	1.02
Western Italy	979	14	98	3	0.88

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

[KAZ] Kazakhstan

Kazakhstan cultivates very few winter crops and almost no wheat was in the field during the current monitoring period. RAIN and RADPAR were above average (+2% and +1%), while TEMP and BIOMSS were below average (-0.4°C and -3%) compared to their respective reference period.

Regional analysis

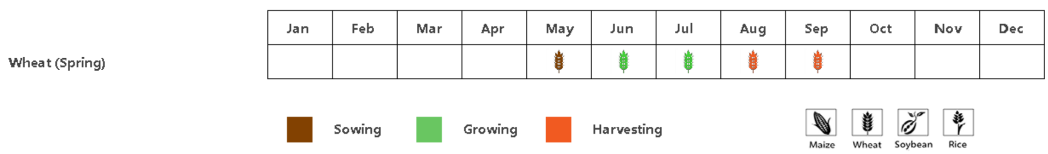
The following regional analysis provides additional detail for three major agro-ecological regions of Kazakhstan: the Northern region, the Eastern plateau and southeastern region and the South region.

In the **Northern region**, NDVI was below the five-year average from November to late December and close to the average in other months. RAIN and TEMP were below average (-1% and -0.5°C), but RADPAR was above (+4%). The agro-climatic indicators also resulted in a decrease of the BIOMSS index by 4%.

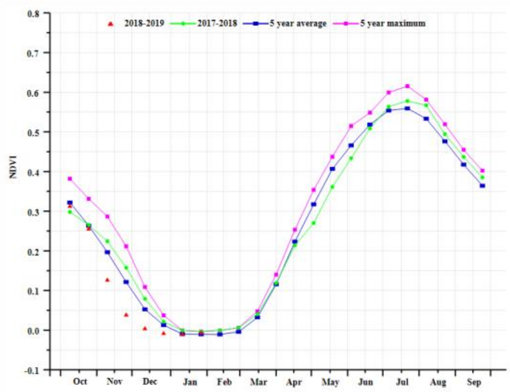
Environmental conditions in the **Eastern plateau and southeastern region** were generally below the five-year average and close to the average only in January. RAIN was above average (3%), and TEMP and RADPAR were below (-0.1°C and -2%, respectively). BIOMSS fell 5%.

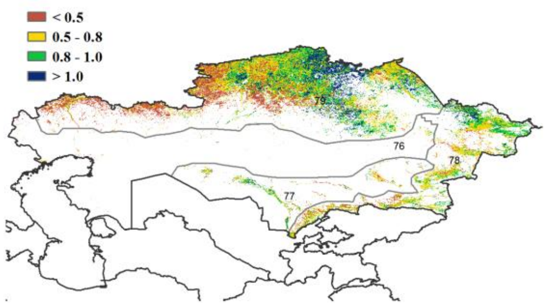
The **South region** experienced above average NDVI in early December and late January and below the five-year average in other months. RAIN was 13% above average, but TEMP and RADPAR were below (-0.2°C and -5%). The agro-climatic indicators also resulted in an increase of the BIOMSS index by 13%, which creates favorable conditions for the forthcoming spring crops.

Figure 3.23. Kazakhstan's crop condition, October 2018 - January 2019



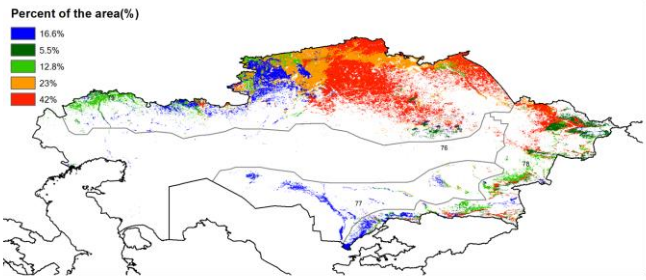
(a). Phenology of major crops

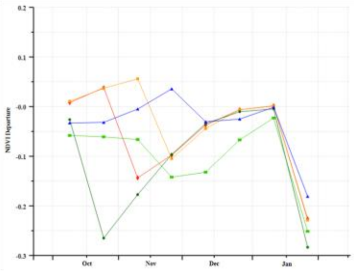




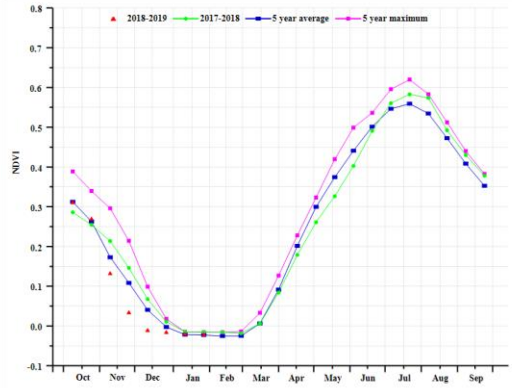
(b) Crop condition development graph based on NDVI

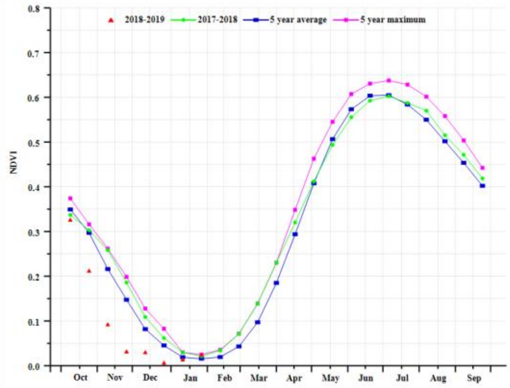
(c) Maximum VCI



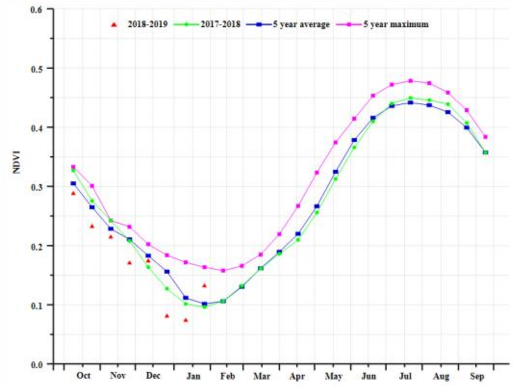


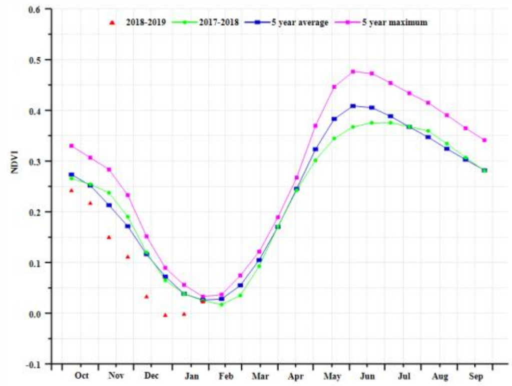
(d) Spatial NDVI patterns compared to 5YA (e) NDVI profiles





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





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

Table 3.37. Kazakhstan agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, October 2018 - January 2019

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m^2)	Departure from 15YA (%)
Northern region	144	-1	-7.6	-0.5	301	4
Eastern plateau and southeastern region	224	3	-5.6	-0.1	462	-2
South region	150	13	0.5	-0.2	468	-5
Central non-agriculture region	196	37	-4.4	-0.4	372	0

Table 3.38. Kazakhstan, agronomic indicators by sub-national regions,current season's values and departure from 5YA, October 2018 - January 2019

Region	BIOMSS		CALF		Maximum VCI
	Current (gDM/m^2)	Departure from 5YA (%)	Current (%)	Departure from 5YA (%)	Current

Region	BIOMSS		CALF		Maximum VCI
	Current (gDM/m^2)	Departure from 5YA (%)	Current (%)	Departure from 5YA (%)	Current
Northern region	420	-5	13	36	0.74
Eastern plateau and southeastern region	457	-5	16	-13	0.75
South region	562	13	4	-24	0.73
Central non-agriculture region	561	7	3	-68	0.55

[KEN] Kenya

The large variety of rainfall patterns in Kenya, usually referred to as long rains (summer) and short rains (winter) defines cropping patterns (long rain maize and wheat, short rain maize). During the monitoring period, the long rain maize and wheat were harvested and the short rain maize was sown and started to grow. CropWatch agro-climatic indicators show that, at the national level, weather conditions were mostly unfavorable. This includes essentially below average RAIN (21%) while TEMP (-0.5°C departure), RADPAR (+1%) and CALF (+2%) were close to average. At the national level, crop condition was below average, which is confirmed by a significant decrease for the BIOMASS indicator (-13%) as direct result of low rainfall.

As shown by the NDVI development graph, national crop condition values were mostly below those for the five-year average. The national NDVI values began to improve during mid of January. NDVI was above average in 19.9% of arable land, mostly around North-west Kitui, Machakos and Kirinyaga, where VCIx mostly exceeds 1.00. Average conditions prevailed in 36.3% of cropland including Nyanza and Western provinces extending east to the previously mentioned area. The westernmost part of this area had satisfactory VCIx in the range from 0.8 to 1. Mostly below average NDVI prevailed, with fluctuations, in the other regions where the lowest VCIx (below 0.5, indicating below-average crops or range-land) occurs mostly in two patches, (1) in north-west Laikipia (24% rainfall deficit) and south-west Samburu (-36% rainfall deficit) as well as (2) in northern Uasin Gishu where the rainfall deficit reached 50%, the most severe in the country.

Country-wide, taking into account that maximum VCI nevertheless reaches 0.87 in the presence of widespread rainfall deficits except in some areas of the south-eastern quadrant of the country including Garissa, Kilifi, Kisumu, Kwale, Machakos, Makueni and Tana River. The largest but still modest departures occur in Kwale (+7%) and Kilifi (+12%) along the coast in the south-east where good soil moisture will be available for range-land growth and planting of crops from late March.

Generally, crop condition is currently assessed as fair to average.

Regional analysis

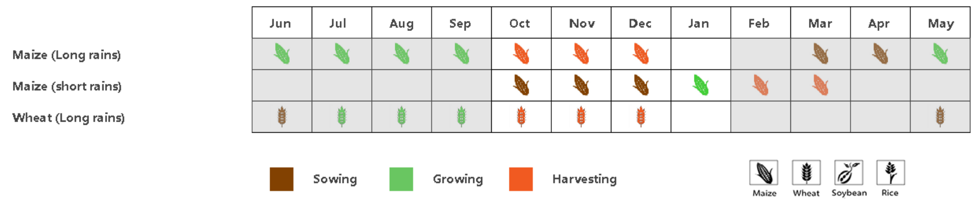
Considering the cropping system, climatic zones and topographic conditions we divided this country into three agro-ecological regions: The Eastern Coastal Area, the Northern region with sparse vegetation and Southwest Kenya.

The northern region with sparse vegetation recorded scarce rainfall (RAIN at 162 mm, or 26% below average), which affects Turkana, Samburu, West Pokot, and Baringo. The deficit leads to a decrease in BIOMASS of 18%. The temperature was below average by -0.1°C and RADPAR was slightly up by 1%. The NDVI development curve shows values below the five years average until mid-December. The maximum VCI was nevertheless high at 0.81 with slightly increased in CALF (CAL, +2%). Overall, based on CropWatch agronomic, agro-climatic indicators and NDVI cluster and profile the condition is assessed as unfavorable. Since the region is mostly pastoral the prevailing conditions had a negative effect on livestock production.

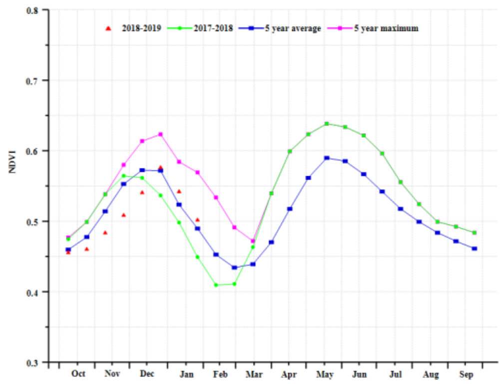
The Eastern Coastal Area includes Mandera, Maralal, Marsabit, Wajir, and Isiolo; unlike the previous region, this area recorded 231 mm (4% above average), whereas TEMP was average (-0.1°C) and RADPAR was above by 3%. Even though the total amount of rainfall was above average, the total biomass production potential was below the five-years average (BIOMASS, -3%). The NDVI profile was above average with marked fluctuations at the start of the reporting period. Throughout the reporting period, maximum VCIx was 0.94 with CALF at 7 %, indicating mostly environmental conditions.

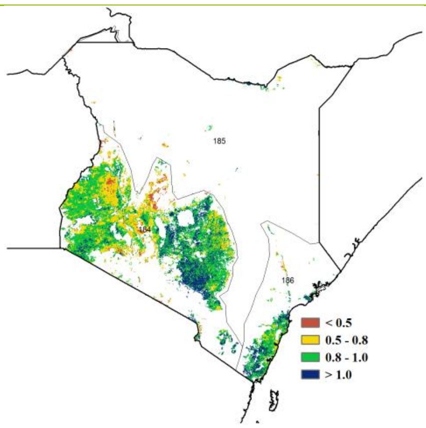
The Southwest of Kenya includes Narok, Kajiado, Kisumu, Nakuru, and Embu, major producers of long rain wheat and maize. From the national crop phenology map, the reported period was harvesting time. Compared to the above two regions this region received high rainfall with higher negative departure (244 mm, 23% below average). The temperature was also below average (-0.6°C departure), which resulted in a reduction of total biomass production (BIOMASS at -14%). CALF increased by 1%. The NDVI based Crop condition development shows values below the five years average from October to December with above-average values in January. VCI reached 0.86. Based on the above indicators and fluctuations of NDVI profile over time, crop condition is assessed as close to but below average.

Figure 3.24. Kenya's crop condition, October 2018 - January 2019.

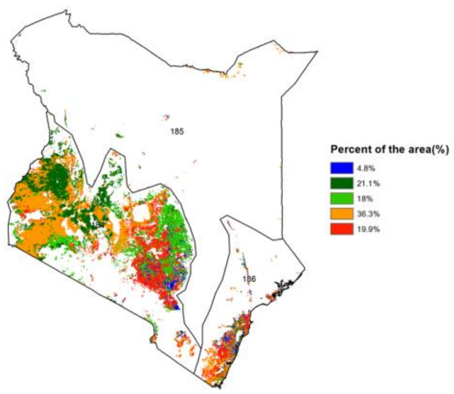


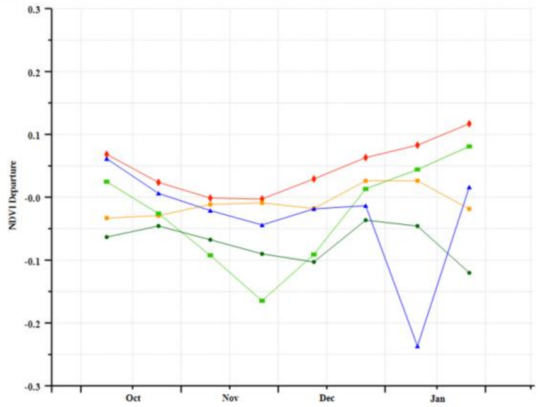
(a). Phenology of major crops



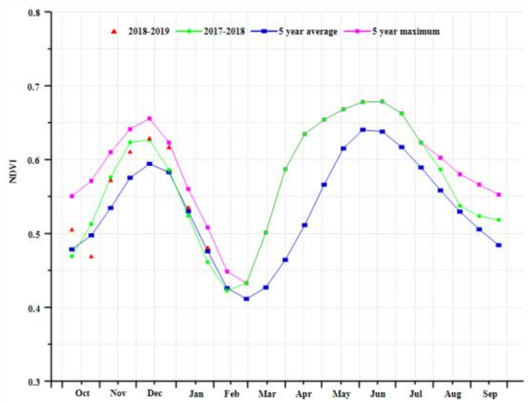


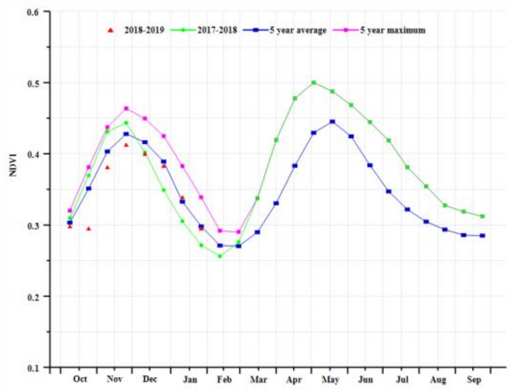
(b) Crop condition development graph based on NDVI (c) Maximum VCI



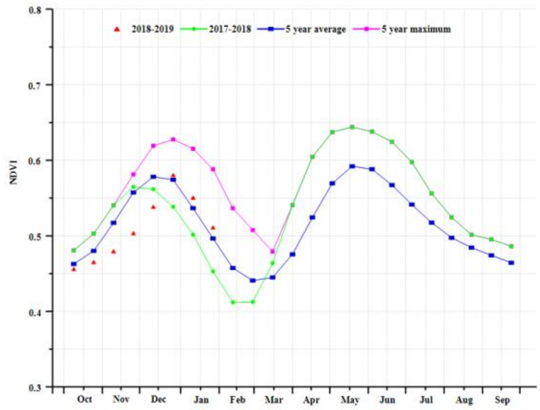


(d) Spatial NDVI patterns compared to 5YA (e) NDVI profiles





(f) Crop condition development graph based on NDVI (Southwest of kenya, and (g) Northern region with sparse vegetation



(g) Crop condition development graph based on NDVI, Eastern Coastal area

Table 3.39. Kenya's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, October 2018 - January 2019

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m^2)	Departure from 15YA (%)
Eastern Coastal Area	231	4	28.0	-0.1	1421	3
Northern region with sparse vegetation	162	-26	25.8	-0.1	1329	1
Southwest of Kenya	244	-23	20.4	-0.6	1279	1

Table 3.40. Kenya's agronomic indicators by sub-national regions, current season's values and departure from 5YA, October 2018 - January 2019

Region	BIOMSS		CALF		Maximum VCI
	Current (gDM/m^2)	Departure from 5YA (%)	Current (%)	Departure from 5YA (%)	Current
Eastern Coastal Area	687	-3	98	7	0.94
Northern region with sparse vegetation	561	-18	72	2	0.81
Southwest of Kenya	855	-14	97	1	0.86

[KHM] Cambodia

October to January covers the growing period of the main (wet season) rice, and the early stage of the second (dry season) rice in Cambodia. Crop condition was globally average. The fraction of cropped arable land was slightly above the average of the previous five years (+2%). Compared to average, the CropWatch agro-climatic indicators describe a relatively dry season with a 20% drop in rainfall. Air temperature was about average and radiation was slightly up (+6%). Environmental indicators mentioned above caused a 2% decrease in the biomass production potential (BIOMSS).

Unsatisfied water requirements did harm crops, especially rice, and resulted in well below average crops over most of the season, which is clearly displayed by the NDVI profile. A small area (6.6% or cropland) near western Tonle Sap suffered a drop in NDVI deficit early of the season, but recovered since December 2019. Vegetation condition indices (VCIx) are high (>0.8) in most parts of the country, which means drought condition influences only part of the entire growing season and might be remedied by sufficient water supplying.

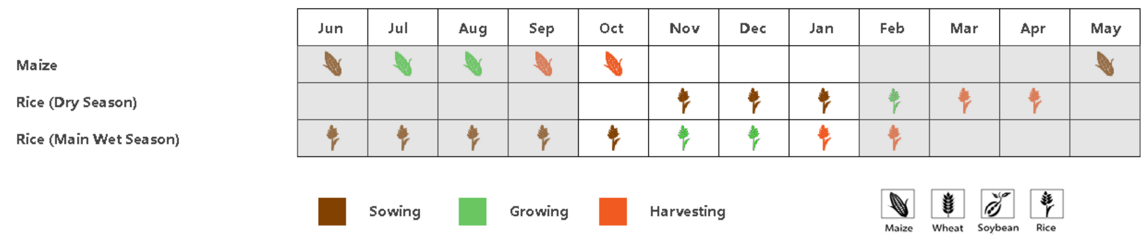
Regional analysis

Based mostly on climate differences, two agro-ecological regions can be distinguished in Cambodia. Weather in the Tonle Sap lake area (especially rainfall and temperature) is mainly influenced by the lake itself. The second area, referred to as the "upland area" covers the region outside the Tonle Sap basin along the border with Thailand and Laos in the north and Vietnam in the east.

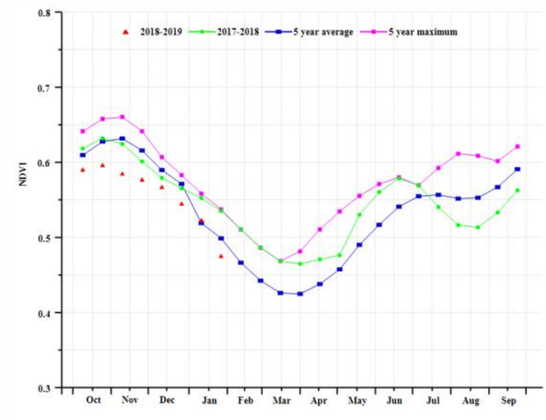
In the **Tonle Sap lake area**, which is mainly affected by upland and Mekong river water supply, NDVI behaved similarly to the entire country. Crop condition went well below average before January but has recovered slightly since then.

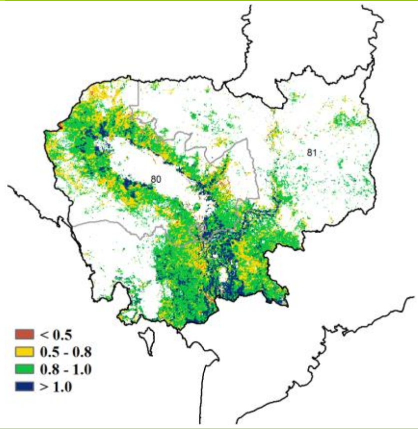
The **Upland Area** differs from the Tonle Sap basin in that it is more directly affected by the monsoon. It recorded 381mm of rainfall, above the Tonle Sap region precipitation, but still 15% below average. The two regions share similar air temperature and radiation. Compared with the average of the previous five years, BIOMSS increased 1%

Figure 3.25. Cambodia's crop condition, October 2018 – January 2019



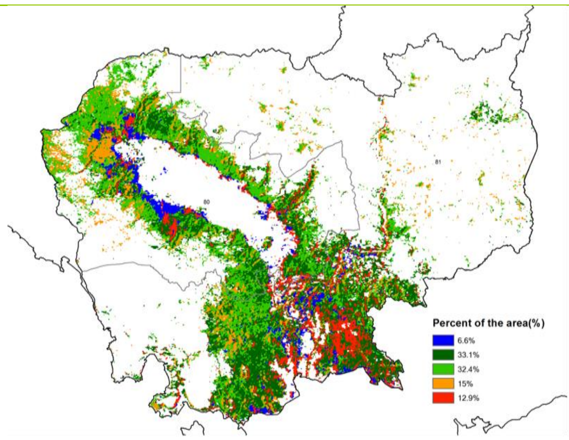
(a). Phenology of major crops

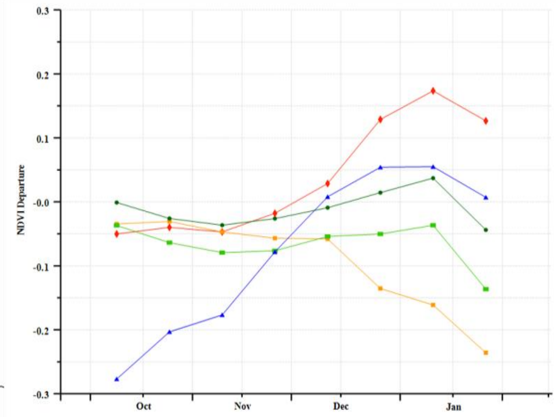




(b) Crop condition development graph based on NDVI

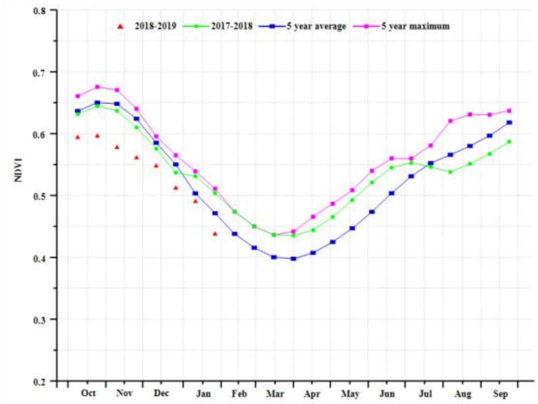
(c) Maximum VCI

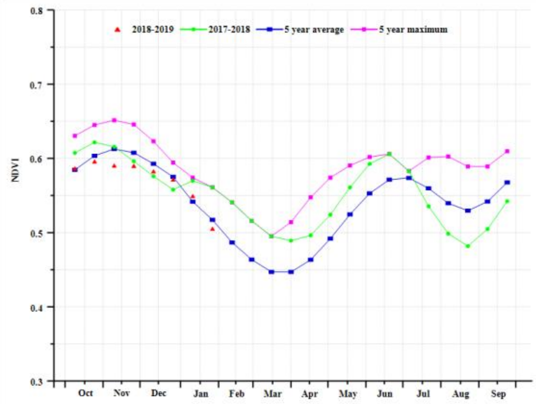




(d) Spatial NDVI patterns compared to 5YA

(e) NDVI profiles





(f) Crop condition development graph based on NDVI_Central Tonle-Sap plain (left) a and Upland areas (right))

Table 3.41. Cambodia agroclimatic indicators by sub-national regions,current season's values and departure from 15YA, October 2018-January 2019

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m2)	Departure from 15YA (%)
Main cropping area (Cambodia)	292	-29	25.5	-2.1	1133	6
Lake plains (Cambodia)	381	-15	25.4	-1.9	1134	6

Table 3.42. Cambodia, agronomic indicators bysub-national regions, current season's values and departure from 5YA, October 2018-January 2019

Region	BIOMSS		Cropped arable land fraction		Maximum VCI
	Current (gDM/m^2)	Departure from 5YA (%)	Current (%)	Departure from 5YA (%)	Current
Main cropping area (Cambodia)	842	-6	99	1	0.86
Lake plains (Cambodia)	1007	1	98	3	0.90

[LKA] Sri Lanka

Maha (October to March) and Yala (April to September) are the main agricultural seasons in the wet areas in Sri Lanka. The driest area (in the east) tends to have only one rain-fed season (Maha) while the south-west enjoys a very long season with bimodal rainfall. Farmers cultivate maize and rice in rotation during both seasons. The monitoring period thus covers sowing and early growth of Maha maize and rice.

Crop condition over Sri Lanka was generally slightly below average.

The agro-climatic indicators showed minor change compared to average. Rainfall and radiation increased by 2% and 3%, while temperature dropped 0.6℃. The cropped arable land fraction (CALF) was 100%, 1% up compared to 5-year average, showing fully utilized cropland. BIOMSS is 2% up compared to 5-year average. According to the national NDVI development graph crop condition was initially low in early October (lower than the 5-year average) but improved, reaching average values by late November and above average and even the 5-year maximum in early January. Values fell again to below average in late January but, at 0.98, maximum VCI stands for unusually good crop condition.

Spatial variability was significant throughout the country according to spatial NDVI patterns and profiles. In 42.5% of cropland, mostly in the south-east (centered around Uva province) , crops were perfectly average throughout the early Maha season. Negative departures occurred at different times and in different areas: (1) early in the season in 19.2% of cropland, located mostly in the districts from Galle to south Puttalam on the western coast; (2) late November in scattered locations in central Sri Lanka (9% of cropped areas, in Polonnarua and south Anradhapura); (3) late January from north Amapara to south Trincomalee districts. The maximum VCI map, however, indicates favorable values over the whole country with values below 0.8 in few areas only (e.g. central Ratnapura district).

Regional analysis

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

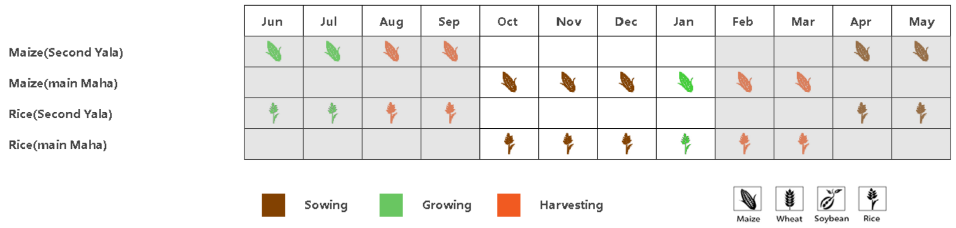
The Dry zone, which is the largest of the three and located in the eastern half of the country (from north to south) showed agro-climatic conditions akin to those of the whole country. Rainfall and radiation increased by 1% and 3% while temperature decreased by 0.6℃, compared to average. Crop condition was also similar to the nationwide situation. The maximum VCI map displays some isolated low values along the coast. Crop condition is satisfactory.

The Wet zone covers the smallest area (in the south-west) as well as the most favorable agro-climatic condition among three sub-national regions. The rainfall and radiation were above average by 11% and 5%, while temperature was below average by 0.5℃. Crop condition is average.

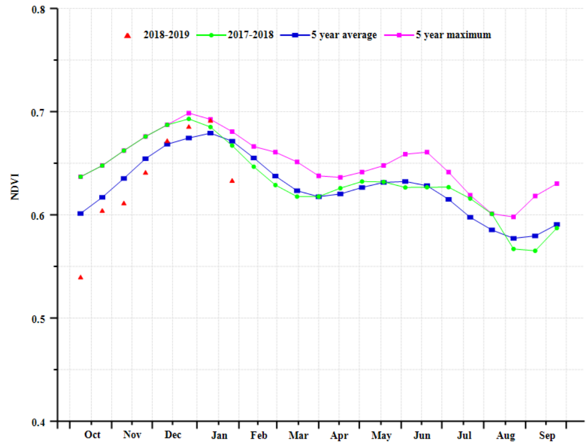
The Intermediate zone is located between Dry zone and Wet zone. Agro-climatic indicators were the “least favorable” among the three sub-national regions, although the wording hides the fact total rainfall was in the range of 900 mm, i.e. amply sufficient for any type of crop. The rainfall and temperature both were slightly below average while radiation increased by 2%. According to the NDVI development graphs, crop condition was average(VCIx at 0.97)

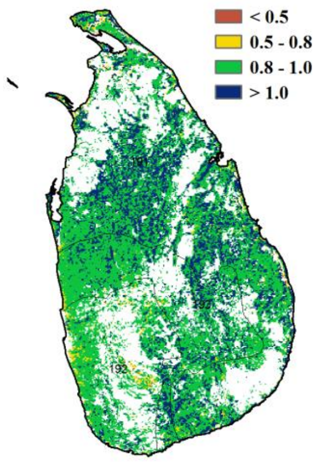
Mostly on the basis of fully utilized cropland, close to average agro-climate and very high VCI (0.99, 0.93 and 0.97 respectively), crop prospects are assessed as fair to good.

Figure 3.26. Sri Lanka’s crop condition, October 2018 - January 2019



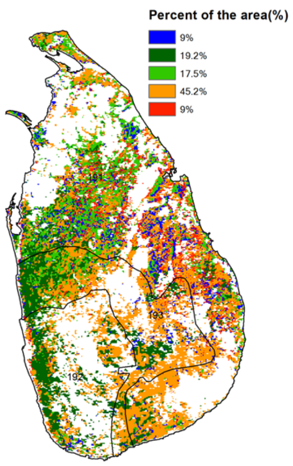
(a). Phenology of major crops

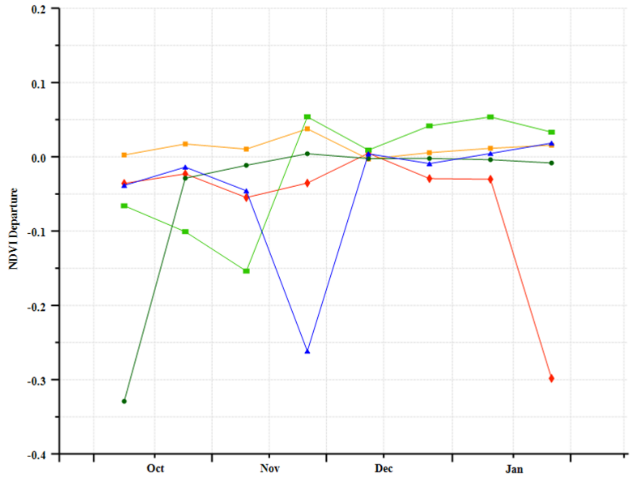




(b) Crop condition development graph based on NDVI

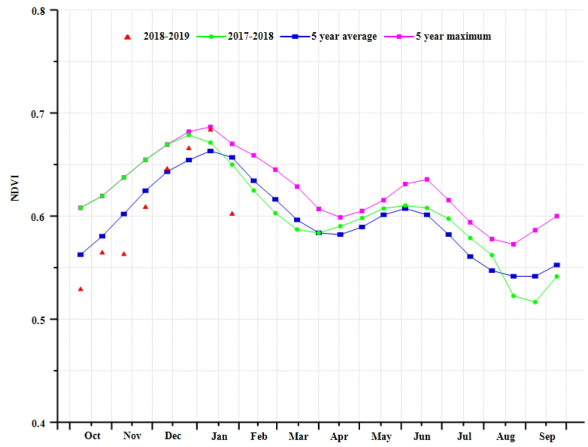
(c) Maximum VCI

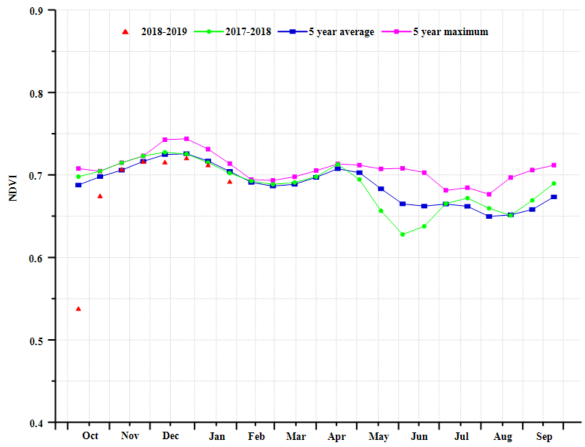




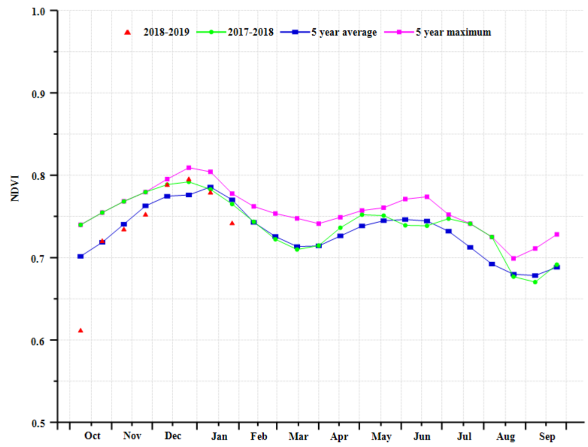
(d) Spatial NDVI patterns compared to 5YA

(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, October 2018 - January 2019

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m^2)	Departure from 15YA (%)
Dry zone	886	1	26.7	-0.6	1129	3
Wet zone	997	11	23.8	-0.5	1070	5
Intermediate zone	908	-5	25.8	-0.6	1031	2

Table 3.44. Sri Lanka's agronomic indicators by sub-national regions, current season's values and departure from 5YA, October 2018 - January 2019

Region	BIOMSS		CALF		Maximum VCI
	Current (gDM/m^2)	Departure from 5YA (%)	Current (%)	Departure from 5YA (%)	Current
Dry zone	1733	3	100	1	0.99
Wet zone	1911	2	100	0	0.93
Intermediate zone	1841	1	100	0	0.97

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

[MAR] Morocco

Winter wheat was sown during the reporting period in Morocco; it is currently in late dormancy or growing. RAIN and TEMP were below the average (by 17% and 0.5 °C, respectively) and so was BIOMASS (-13%) while RADPAR was 2% above average. The estimated nationwide maximum VCI was 1 and CALF was 29% above average. The nationwide NDVI development graph values exceed 5-year maximum condition. The map of VCIx shows that values were high nationwide except for the North coast of Oriental region and the west coast of both Guelmim-Oued Noun and Laâyoune-Sakia El Hamra regions where ranged from low (< 0.5) to moderate (0.5 - 0.8). The spatial NDVI patterns map shows that only 10% of the cropped area experienced below the average condition after mid-December. In general, all CropWatch indicators concur to assess crop condition as about average..

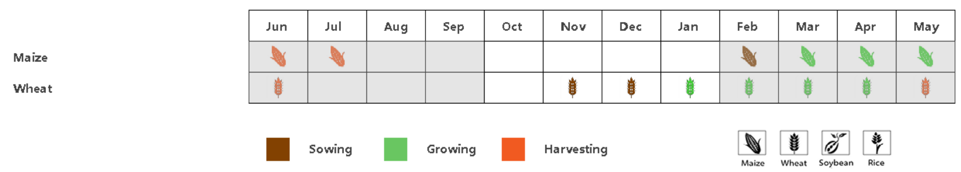
Regional analysis

CropWatch adopts three agro-ecological zones (AEZs) relevant for crop production in Morocco. The first is the Cool sub-humid zone, the second is the Warm semi-arid zone, while the third zone is Warm-sub-humid.

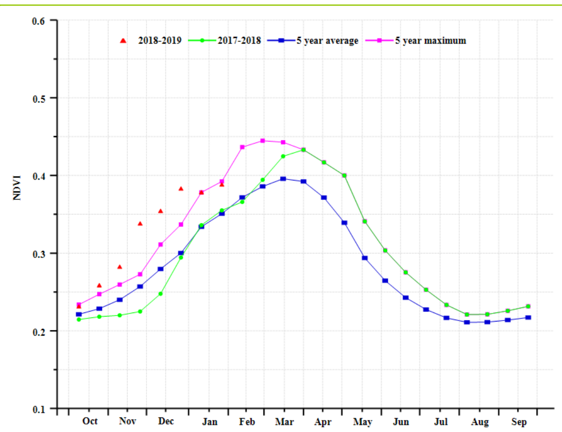
For the three AEZs, the average rainfall (RAIN) was below average (by 20, 23, and 13% respectively). Also, the average TEMP for the three zones was below the average (by 0.4, 0.5, and 0.6 °C, respectively). The drop in average RAIN resulted in a drop in estimated BIOMSS for the AEZs (18, 13, and 12 % below the average, respectively), while the RADPAR was average for first and third zones, the second zone Warm semi-arid zone had 4% above average sunshine.

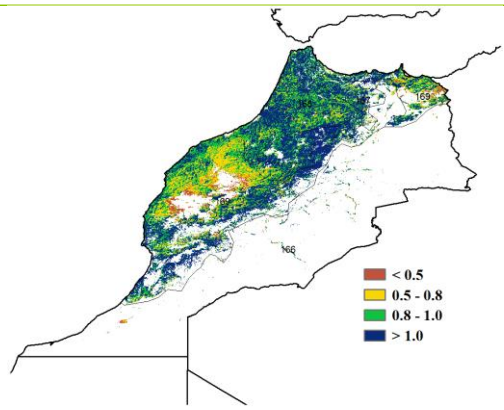
NDVI-based graphs indicating above 5-year maximum conditions for the Cool sub-humid zone and the warm sub-humid zones, and at or above maximum conditions for the Warm semi-arid zone. This is consistent with the VCIx estimates since the highest VCIx (1.22) corresponds to the Cool sub-humid zone. The other two zones had also very high VCIx value (≥1), indicating nationwide favorable crop conditions in spite of the precipitation deficit.

Figure 3.27. Morocco's crop condition, October 2018 - January 2019



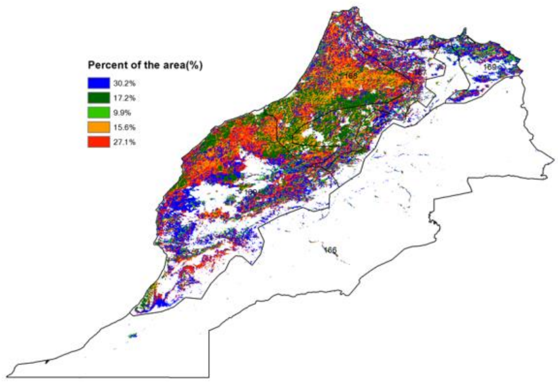
(a). Phenology of major crops

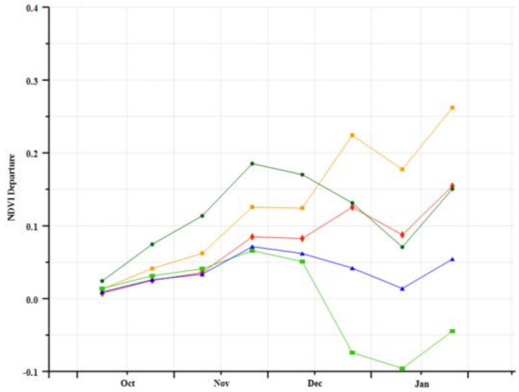




(b) Crop condition development graph based on NDVI

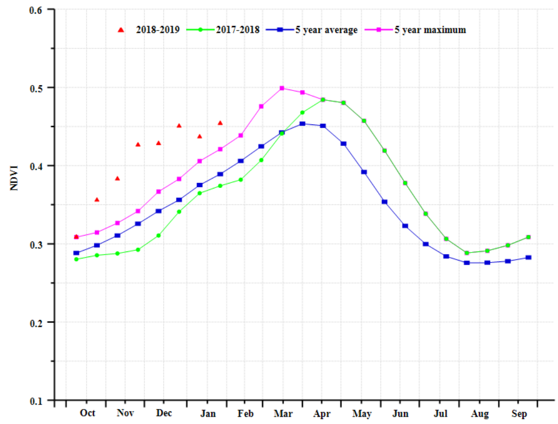
(c) Maximum VCI

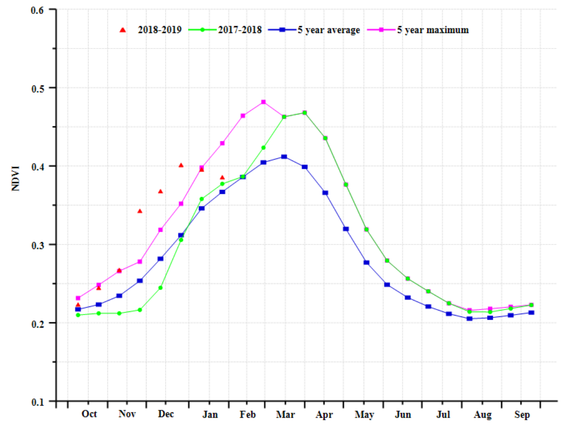




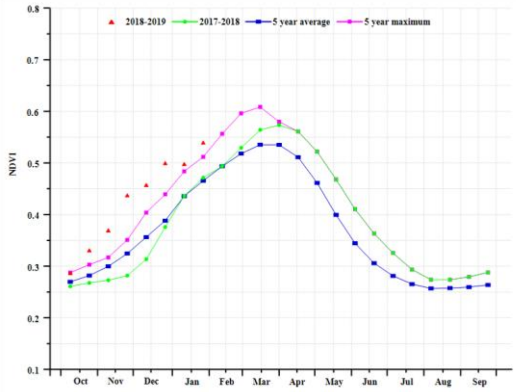
(d) Spatial NDVI patterns compared to 5YA

€ NDVI profiles





(f). Crop condition development graph based on NDVI (warm semiarid zones).and (g). warm sub humid zones)



(h) . crop condition development graph based on NDVI, Cool subhumid zone.

Table 3.45. Morocco's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, October 2018 - January 2019

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m^2)	Departure from 15YA (%)
Warm semiarid zones	154	-20	10.6	-0.4	718	0
Warm sub-humid zones	112	-23	12.7	-0.5	835	4
Cool sub-humid zones	198	-13	13.1	-0.6	720	0

Table 3.46. Morocco's agronomic indicators by sub-national regions, current season's values and departure from 5YA, October 2018 - January 2019

Region	BIOMSS		CALF		Maximum VCI
	Current (gDM/m^2)	Departure from 5YA (%)	Current (%)	Departure from 5YA (%)	Current
Warm semiarid zones	568	-18	64	37	1.22
Warm sub-humid zones	424	-13	42	21	1.00
Cool sub-humid zones	661	-12	82	39	1.11

[MEX] Mexico

During the monitoring period, both maize and rice reached maturity. Maize has been harvested in the north-eastern part of Mexico, while in other areas it was harvested from During the monitoring period, both maize and rice reached maturity. Maize has been harvested in the north-eastern part of Mexico, while in other areas it was harvested from January. Rice was harvested as well, whereas winter wheat, which was planted from October, is still growing. Soybean has been harvested after December. Overall, crop condition was close to average, as shown by the crop condition development graph based on NDVI.

Temperature (-0.5°C from average) and radiation (3% below average) were close to average but rainfall exceeded the average by 23%. This was beneficial for crop growth and is confirmed by a high value of maximum VCI (0.93). CALF increased by 6%, compared with the previous 5-year average.

Regional analysis

Based on cropping systems, climatic zones and topographic conditions, Mexico is divided into four agro-ecological regions. They include Arid and semi-arid regions (82), Sub-humid temperate region with summer rains (84), Sub-humid hot tropics with summer rains (85) and Humid tropics with summer rainfall (83). Regional analyses of crop situation can provide more details for the production situation in Mexico.

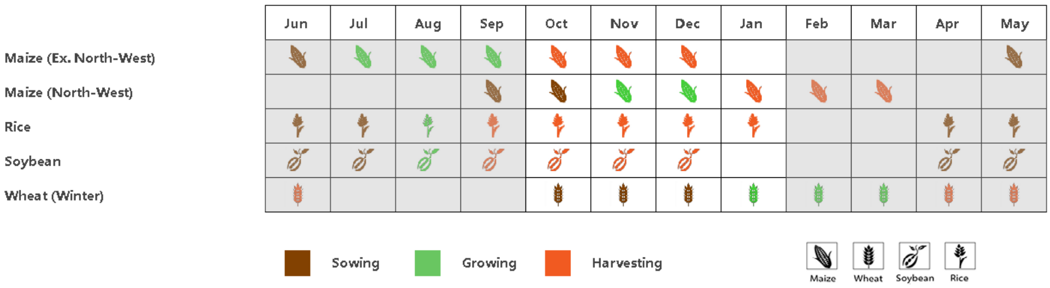
The **Arid and semi-arid regions** are located in northern and central Mexico; they account for about half of planted areas in the country. Agro-climatic conditions were moderate over the reporting period. Rainfall rose 58% above average while temperature declined by 1.0°C. BIOMSS reached 551gDM/m2 and was above average by 58%. Radiation dropped 5%. The maximum VCI was high, with a value of 0.91. Moreover, CALF increased by 15% compared with last 5 years average. The situation of crop production in these regions is promising.

Sub-humid temperate region with summer rains is situated in central Mexico. Crop condition in this region was below average from October to January. The agro-climatic conditions were, however, globally favorable: rainfall was up 54% but temperature and radiation decreased by 0.2°C and 8%, respectively, compared to average. The resulting BIOMSS increase is 51% above the 5YA. Note that the drop in NDVI that occurred in this region and the next at the end of October, which is also very visible in the spatial NDVI profiles (2.6% of arable land is shown as affected) is due to hurricane Willa (20-24 October). Refer to the section on disasters for the context.

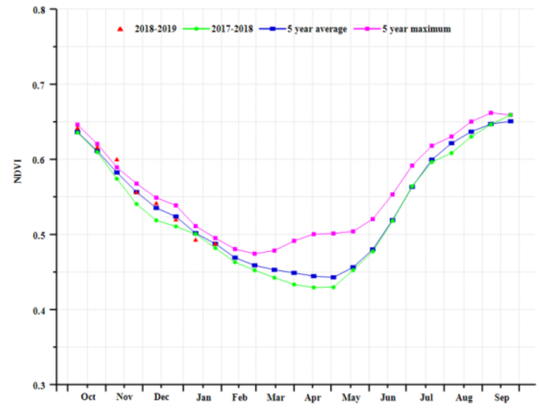
In the **Sub-humid hot tropics with summer rains** (located in southern Mexico) crop condition was continuously below average according to the NDVI time profiles. Agro-climatic conditions were moderate, with a +47% departures from average for rainfall but temperature and radiation deviating only by -0.4°C and -4%, respectively, from the average. BIOMSS increased above average by 43%.

The **Humid tropic with summer rainfall area is** located in southeastern Mexico. Precipitation, temperature and radiation were 355mm, 24.6°C and 1000MJ/m2, respectively. The region is the only one in Mexico with a precipitation deficit, which amounts to 15% of average. Temperature and radiation were average. Biological growth potential fell 10% but nevertheless VCIx reached 0.93.

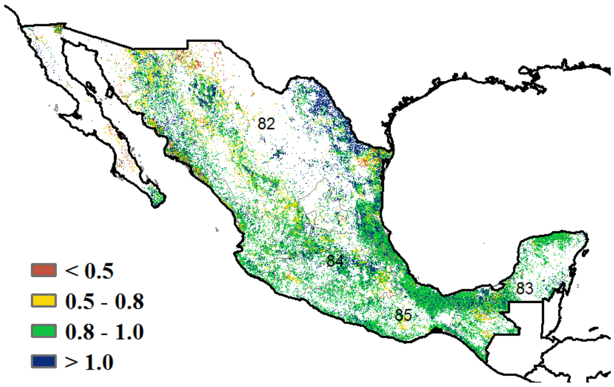
Figure 3.28. Mexico's crop condition, October 2018 - January 2019



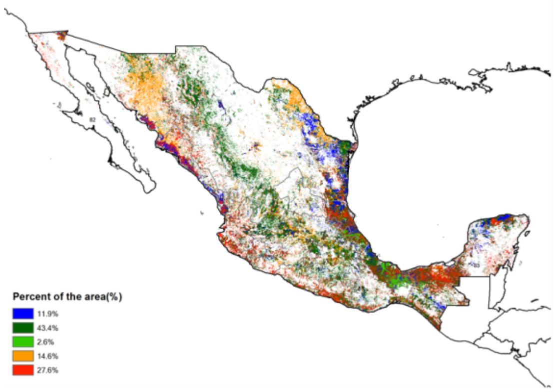
(a). Phenology of major crops



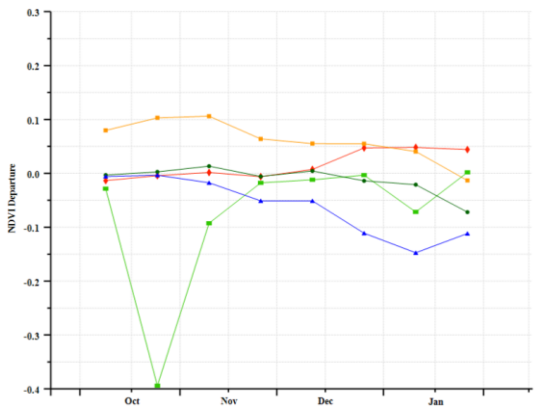
(b) Crop condition development graph based on NDVI



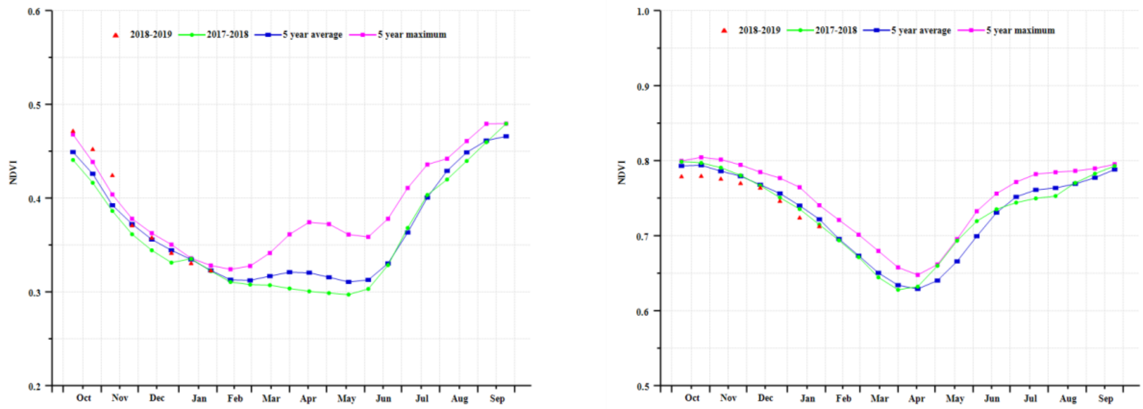
(c) Maximum VCI



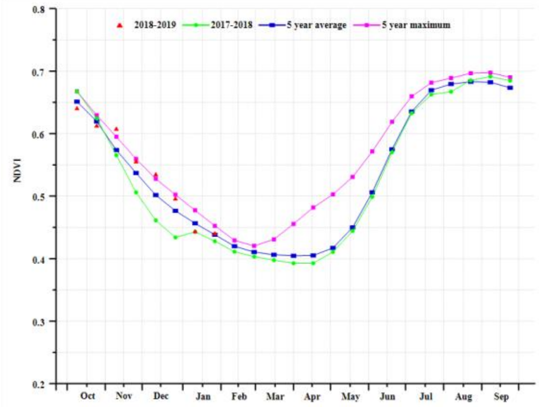
(d) Spatial NDVI patterns compared to 5YA

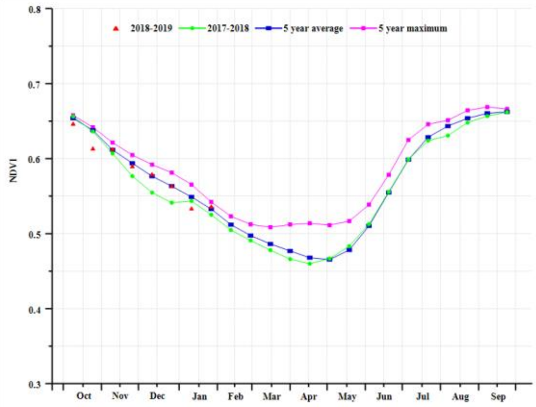


(e) NDVI profiles



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





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

Table 3.47. Mexico's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, October 2018 to January 2019

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m^2)	Departure from 15YA (%)
Arid and semi-arid regions	149	58	14.4	-1	921	-5
Sub-humid temperate region with summer rains	161	54	17.5	-0.2	1010	-8
Sub-humid hot tropics with summer rains	265	47	20.6	-0.4	984	-4
Humid tropics with summer rainfall	355	-15	24.6	-0.1	1000	4

Table 3.48. Mexico's agronomic indicators by sub-national regions, current season's values and departure from 5YA, October 2018 to January 2019

Region	BIOMSS		Cropped arable land fraction		Maximum VCI
	Current (gDM/m^2)	Departure from 5YA (%)	Current (%)	Departure from 5YA (%)	Current
Arid and semi-arid regions	551	58	82	15	0.91
Sub-humid temperate region with summer rains	608	51	97	3	0.93
Sub-humid hot tropics with summer rains	758	43	98	2	0.94
Humid tropics with summer rainfall	850	-10	100	0	0.93

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

[MMR] Myanmar

The monitoring period covers the harvest of the monsoon season rice ("main rice") as well as the irrigated cool season "second rice", maize and wheat. According to CropWatch monitoring results, crop condition was generally close to the 5-year average during the monitoring period.

Compared with average, nation-wide rainfall was up 22%; temperature, sunshine were about average (TEMP -0.1°C, RADPAR, -1%) and the biomass accumulation potential is up (BIOMSS +24%). According NDVI development graphs crop condition was just below average, and exceeding it in January. Together with the high maximum VCI value (0.92) NDVI suggests that crop condition is satisfactory in Myanmar.

With regard to spatial distributions, the whole country went through an unfavorable situation during the monitoring period in terms of spatial NDVI patterns. The NDVI departure values remained negative all the time, while near to zero in late October, late December and early January. The maximum VCI map displays satisfactory condition for Myanmar, with high values in most of the country and relatively low values in a few areas in Sageing, Magwe and Mandalay.

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.

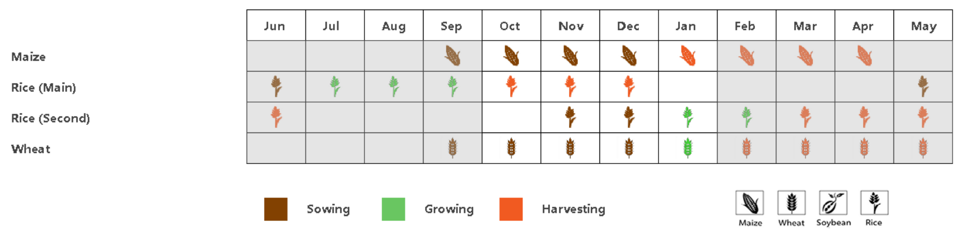
There is little difference between the three AEZ as far as agronomic indices are concerned. The CALF for three sub-national zones is 0.99 and 1% above the average, and VCIx values are above 0.90. The BIOMSS indices, however, displayed different increases over average: 38%, 19% and 22%, respectively.

The Coastal area is located in south-western Myanmar and cultivates mainly maize in Ayeyarwady Region, Yangon Region, Mon State, Tanintharyi Region and southern Bago Region. The Coast experienced the most favorable conditions among the three AEZs. Rainfall exceeded average by 31% and both Temperature and sunshine were average (TEMP up 0.2℃). Crop condition was average.

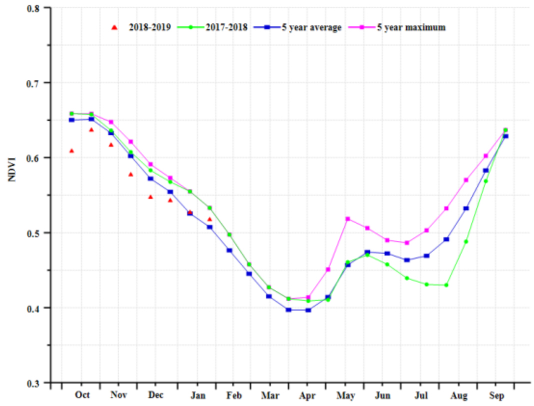
The Central plain covers Magwe Region, Mandalay Region and northern Bago Region, the main rice growing areas in Myanmar. Agro-climatic conditions were not as favorable as in the other AEZs. Rainfall was above average (RAIN +13%) while temperature and sunshine was average (TEMP -0.2℃ and RADPAR -2%). The condition of crops was fair but below average locally.

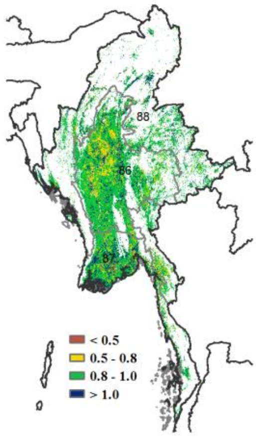
In the West, North and East of Myanmar, the Hills include Shan State, Kachin State, Sagaing Region, Chin State and Rakhing State. Maize is the main crop. Compared with average, rainfall and sunshine logically varied in opposite directions, while temperature was unaffected (RAIN +25%, TEMP -0.2℃ and RADPAR -1%). NDVI was low at the beginning of October, which may result from early harvest or from below average main rice. For the secondary crops, conditions are average..

Figure 3.29. Myanmar's crop condition, October 2018 - January 2019



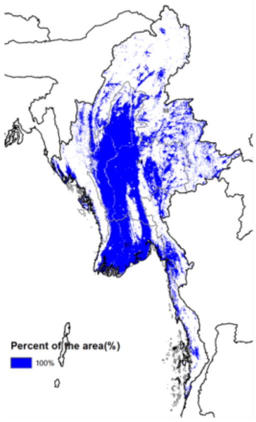
(a). Phenology of major crops

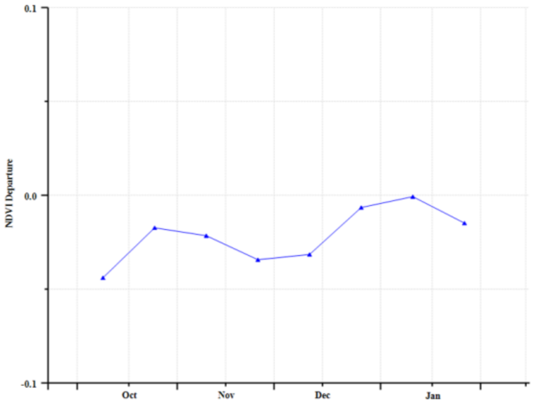




(b) Crop condition development graph based on NDVI

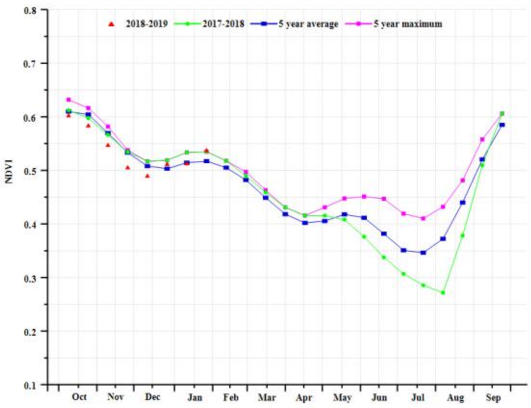
(c) Maximum VCI

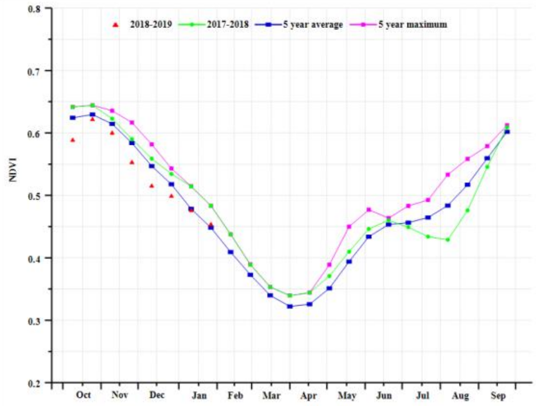




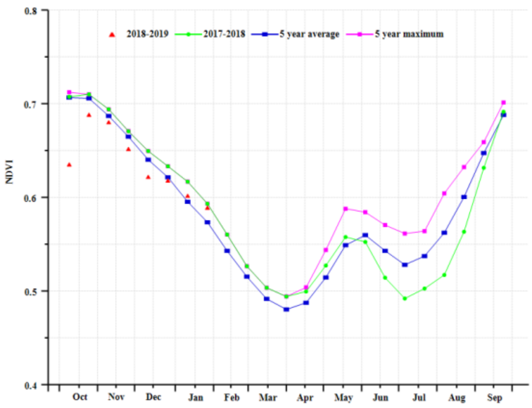
(d) Spatial NDVI patterns compared to 5YA

(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, October 2018 - January 2019

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m^2)	Departure from 15YA (%)
Coastal region	1984	13	27.1	0.3	1085	1
Central plain	913	-5	26.7	-0.6	1046	0
Hill region	1301	2	24.4	-0.5	930	-3

Table 3.50. Myanmar's agronomic indicators by sub-national regions, current season's values and departure from 5YA, October 2018 - January 2019

Region	BIOMSS		CALF		Maximum VCI
	Current (gDM/m^2)	Departure from 5YA (%)	Current (%)	Departure from 5YA (%)	Current
Coastal region	973	38	99	1	0.93
Central plain	731	19	99	1	0.91
Hill region	750	22	99	1	0.93

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

[MNG] Mongolia

The monitoring period covers the late harvesting stage of wheat in October; due to low winter temperature (the national average is -15.1°C) there are no winter crops in Mongolia.

Among the CropWatch agro-climatic indicators, RAIN was below average (-15%); RADPAR and TEMP were above average (1% and 1.6°C). The contribution of the ONDJ period to annual biomass accumulation (BIOMSS) is up 11% compared to average. As shown by the NDVI development graph, values were below average from October to early November and above average from late November to January late. Since Mongolia is a rather dry country with precipitation averages between 30 and 100 mm during the reporting period, snow is infrequent and NDVI can provide information about range-land condition and biomass.

Regional analysis

Of the five agro-ecological zones of Mongolia, three are covered in this bulletin; all are located in the non-Gobi northern half of the country. They are referred to (from central-west Mongolia to the East) as Khangai Khuvsgul region (64 mm of average RAIN, -16.2°C average TEMP), Selenge Onon region (averages: 85 mm, -14.7°C) and the Central and Eastern Steppe Region, the wettest and "warmest" of the three (averages: 104 mm, -14.2°C).

NDVI was below the five year average from October to December and above average from November to January in the Khangai Khuvsgul region. It exceeded the five-year maximum from December to January. RAIN and RADPAR were above average (+10% and 1%) and TEMP was also above average (0.7°C). The combination of the factors resulted in high BIOMSS (+11%) compared to the five −year average. The two southern AEZ, which are not described in detail, experienced above-average rainfall as well (+19% and +33%), which will favor rangeland development.

The Selenge Onon region recorded above average NDVI from November to January and above the five years maximum from December to January. Accumulated rainfall was below average (RAIN -16%) and RADPAR and TEMP were above average (+1% and 1.9°C). The BIOMSS index increased by 15% compared to average.

In the Central and Eastern Steppe Region, NDVI was below the five year average in October and above the five-year maximum from late November to January late. RAIN was below average (-56%) and TEMP was well above average (2.8°C), while BIOMSS index decreased by 12%. Prospects form abundant range-land growth is less favorable than in the two other AEZs.

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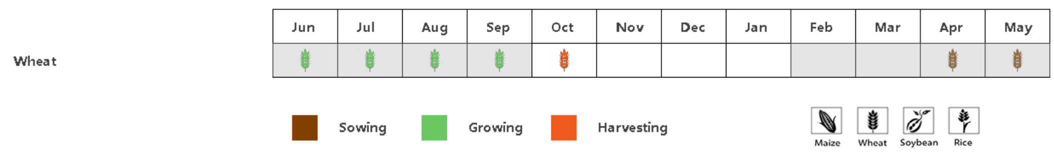
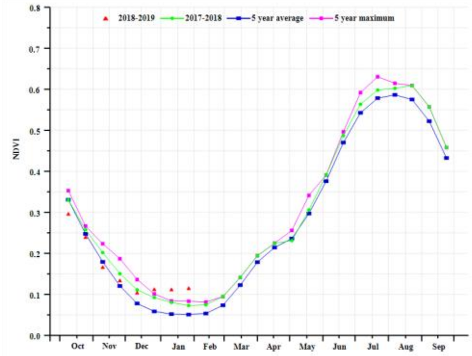
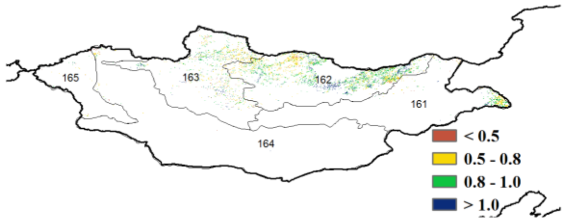
Figure 3.30. Mongolia's crop condition, October 2018 - January 2019

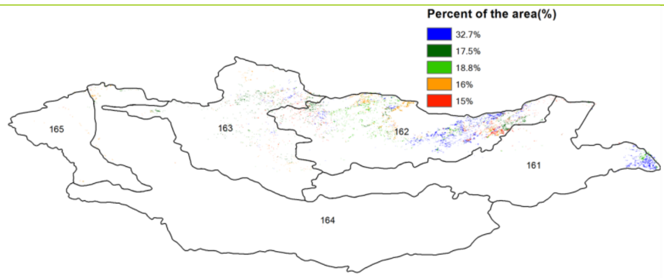


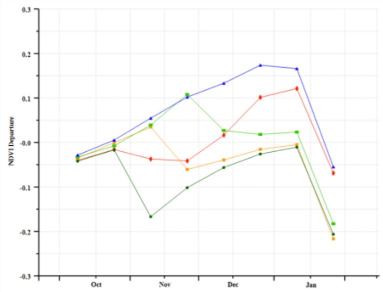
(a). Phenology of major crops



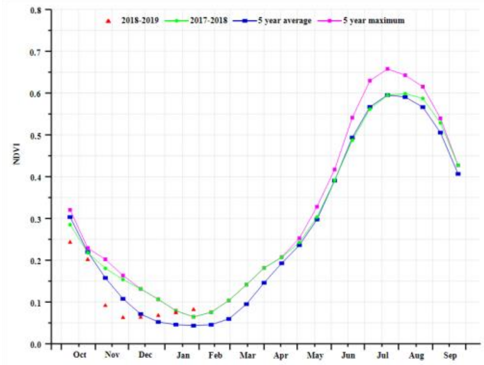


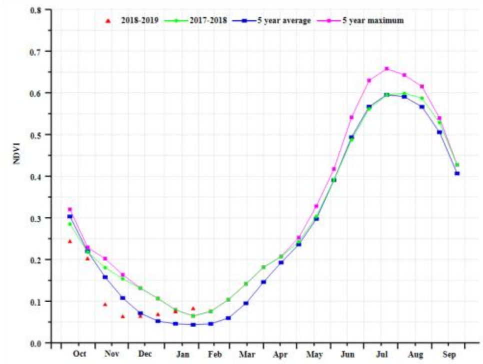
(b) Crop condition development graph based on NDVI (c) Maximum VCI



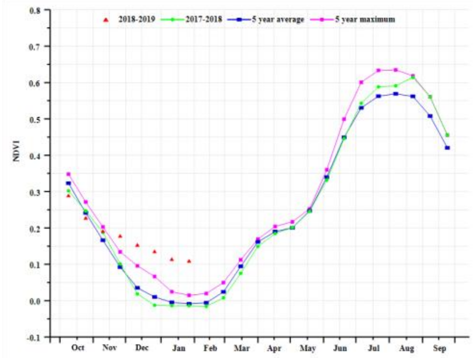


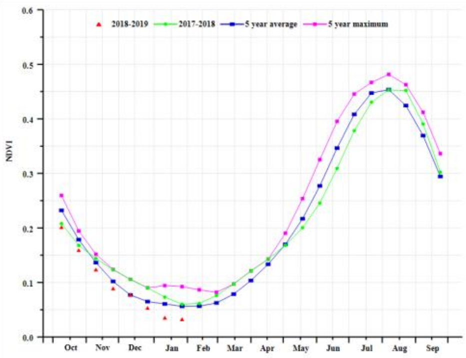
(d) Spatial NDVI patterns compared to 5YA (e) NDVI profiles



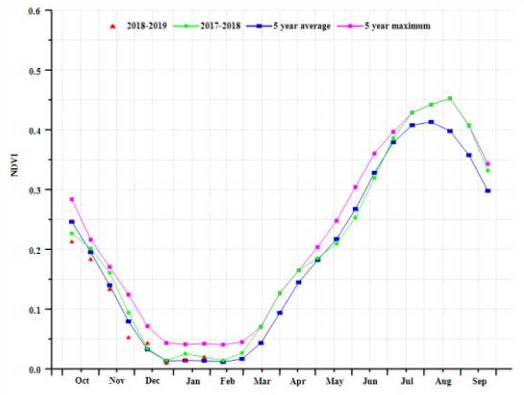


(f) Crop condition development graph based on NDVI Hangai Khuvsgul Region (left), and Selenge −Onon Region (right))





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



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

Table 3.51. Mongolia's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, October 2018 - January 2019

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m^2)	Departure from 15YA (%)
Hangai Khuvsgul Region	70	10	-15.5	0.7	468	1
Selenge-Onon Region	71	-16	-12.8	1.9	460	1
Central and Eastern Steppe Region	46	-56	-11.4	2.8	459	0
Altai Region	90	33	-13.9	0.0	436	1
Gobi Desert Region	45	19	-16.5	0.0	429	0

Table 3.52. Mongolia's agronomic indicators by sub-national regions, current season's values and departure from 5YA, October 2018 - January 2019

Region	BIOMSS		CALF		Maximum VCI
	Current (gDM/m^2)	Departure from 5YA (%)	Current (%)	Departure from 5YA (%)	Current
Hangai Khuvsgul Region	201	11	5	21	0.83
Selenge-Onon Region	263	15	23	36	0.86
Central and Eastern Steppe Region	234	-12	4	-49	0.80
Altai Region	298	29	1	18	0.64
Gobi Desert Region	177	1	4	-22	0.68

[MOZ] Mozambique

The rain season lasts from November till the end of March, which coincides with the growing period of most of the crops over the country. The monitoring period covers the sowing and growth of Maize, Rice and Wheat. While rainfall increased above average (RAIN 12%), the temperature decreased by about 1.4°C. The solar radiation was average. The agronomic indicators registered increases of 8% (BIOMSS) and 13% (CALF) while maximum VCI reached a high value of 0.96. Overall crop condition is favorable.

The NDVI development graphs indicate that the crop condition was favorable during almost the entire monitoring period. Below the 5 years average condition was verified mostly in the south where the provinces of Gaza, Inhambane and Maputo experienced unfavorable crop condition during almost the entire monitoring period. Crop condition also fell rapidly in late January in northern Tete province. Maximum VCI confirms the generally favorable condition of crops nationwide, mostly in the provinces of Nampula, Zambezia, Sofala and Manica. In the province of Zambezia crop condition was favorable throughout the monitoring period.

Compared to 2018, Mozambique recorded a decrease of both rice yield and area of 2.2%, causing a reduction in expected 2019 production which is estimated at 367 thousand tonnes, a 2.3% drop. Maize yield increased 2.2% and cultivated area fell slightly (0.2%). The total maize output is expected to reach 2125 thousand tons in 2019, up 1.9% over 2018.

Regional Analysis

According to cropping system, topography and climate, Mozambique was subdivided into 10 agro-ecological zones (AEZ), listed approximately from south to north: (1) Inland of Maputo and Southern Gaza, (2) Coastal areas and South of Rio Save, (3) North and Central Gaza and Western Inhambane, (4) Central medium altitude areas, (5) Low altitude areas of Sofala and Zambezia, (6) Dry areas of Zambezia and Southern Tete, (7) Mid-altitude areas and (8) northern hinterland of Cabo Delgado, (9) High altitude areas and (10) Northern Coastal areas.

Three regions recorded larger than average precipitation in the range of +10% to +35%: the Low altitude areas of Sofala and Zambezia, Northern Coastal areas and the Northern hinterland of Cabo Delgado. Two regions experienced a marked precipitation deficit, both in the south-west of the country: North and Central Gaza and Western Inhambane (-22%) and Inland of Maputo and Southern Gaza (-26%). The temperature was average or lower than average in all agro-ecological zones with the larges anomalies occurring in two central-western areas along the Zimbabwe border: Dry areas of Zambezia and Southern Tete (-2.3°C) and the Central medium altitude areas (-1.9°C)

As a direct result of the definition of the BIOMSS indicator, the largest BIOMASS anomaly (+ 20%) occurred in Inland of Maputo and Southern Gaza. The largest positive variations in cropped arable land fraction (CALF) where in the Dry areas of Zambezia and Southern Tete (+23%), North and Central Gaza and Western Inhambane (+26%) and in the Northern Coastal areas (+23%).

The maximum VCI for the agro-ecological region varied in the range from 0.77 and 1.00 and indicate mostly favorable crop condition. This is confirmed by the NDVI development graphs. The same indicator shows unfavorable condition during part of the reporting period only in the Northern hinterland of Cabo Delgado, Inland of Maputo and Southern Gaza, Coastal areas and South of Save and Northern hinterland of Cabo Delgado.

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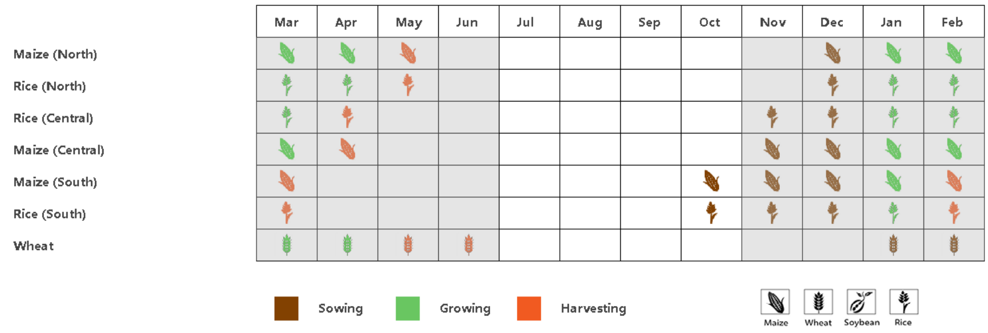
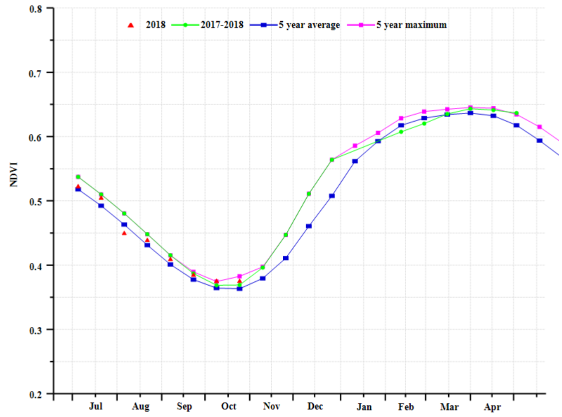
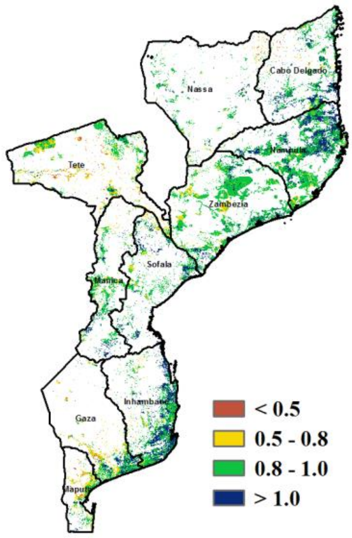
Figure 3.31. Mozambique's crop condition, October 2018 - January 2019

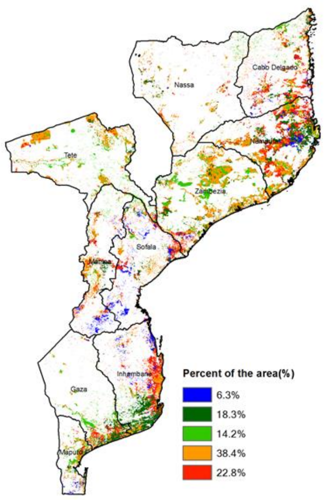


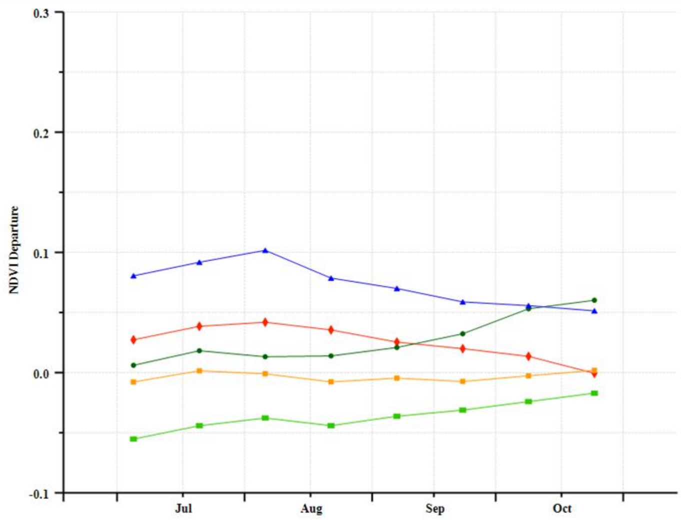
(a). Phenology of major crops



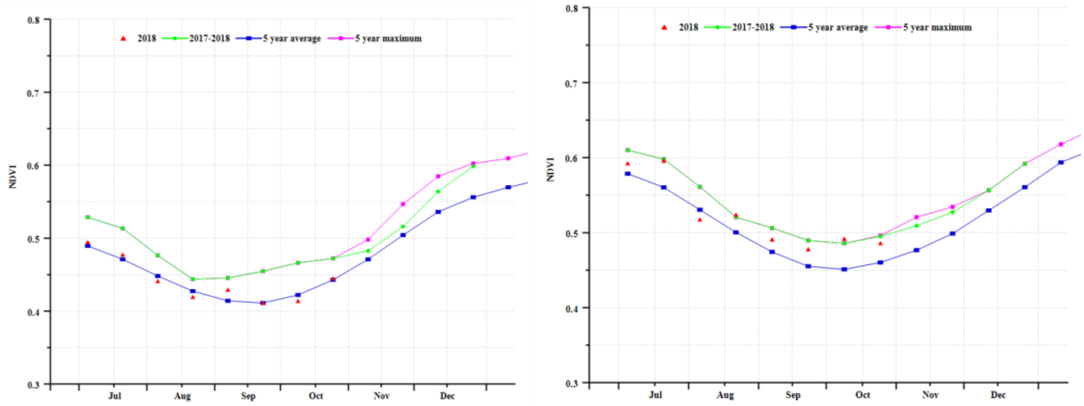


(b) Crop condition development graph based on NDVI (c) Maximum VCI

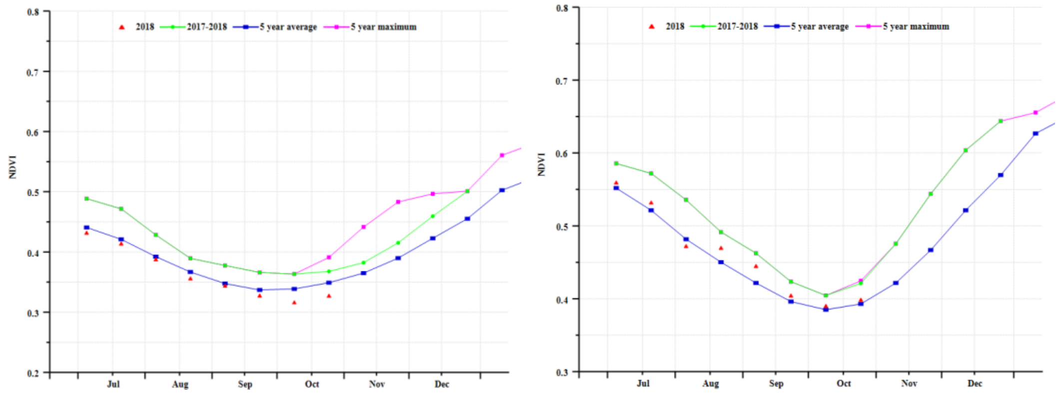




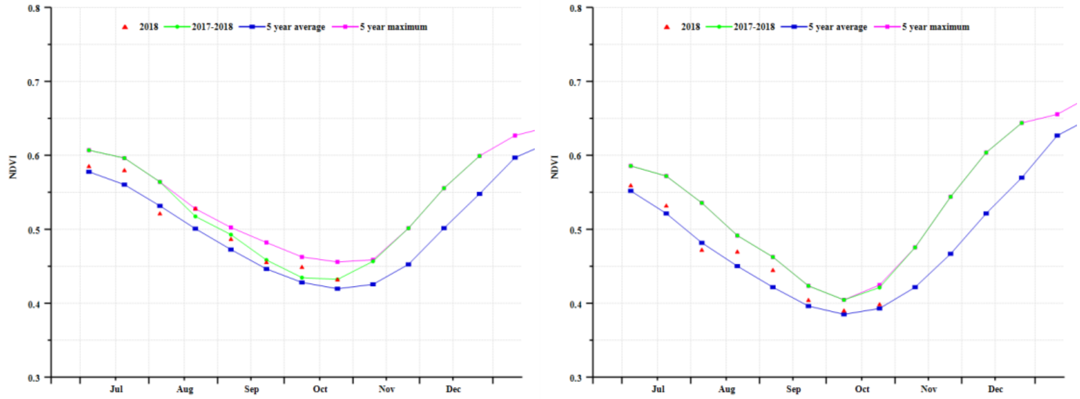
(d) Spatial NDVI patterns compared to 5YA (e) NDVI profiles



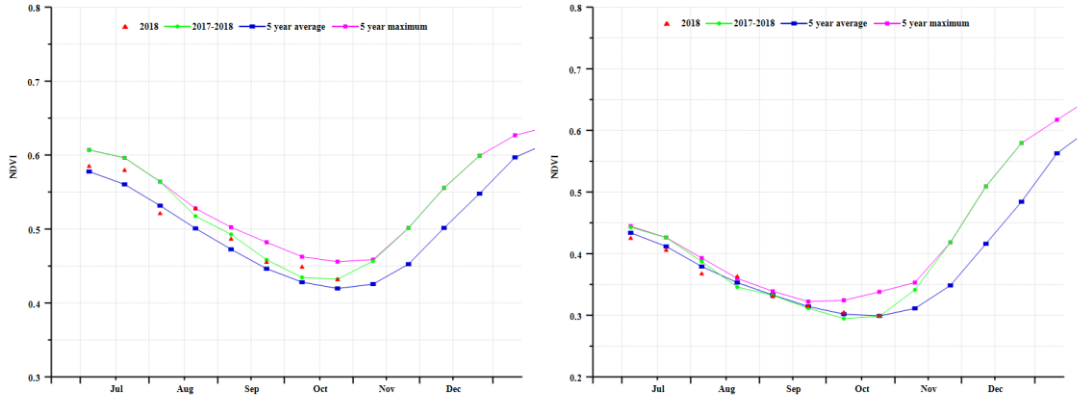
(f) Crop condition development graph based on NDVI (left: Inland of Maputo and Southern Gaza, right: Coastal areas and South of Save)



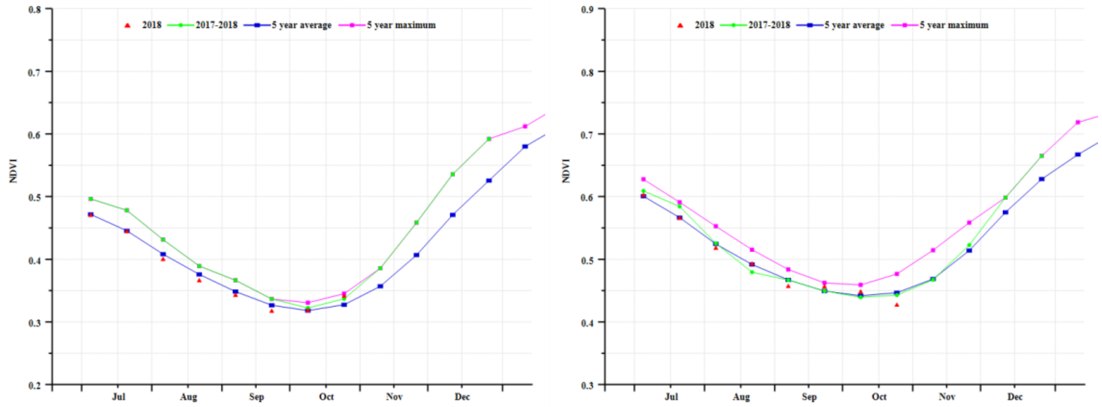
(g) Crop condition development graph based on NDVI (left) North and Central Gaza and Western Inhambane (right) Central medium altitude areas.



(h) Crop condition development graph based on NDVI (left) Low altitude areas of Sofala and Zambezia (right) Dry areas of Zambezia and Southern Tete.



(i) Crop condition development graph based on NDVI (left) Northern coastal areas (right) Mid-altitude areas.



(j) Crop condition development graph based on NDVI (left) High-altitude areas (right) Northern hinterland of Cabo Delgado.

Table 3.53. Mozambique's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, October 2018 - January 2019

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m^2)	Departure from 15YA (%)
Coastal areas and South of Save	429	2	26.0	-1.1	1354	2
Dry areas of Zambezia and Southern Tete	481	0	27.5	-2.3	1346	-2
North and Central Gaza and Western Inhambane	315	-22	26.3	-1.0	1342	7
High altitude areas	694	12	23.3	-1.4	1196	-4
Inland of Maputo and Southern Gaza	294	-26	25.1	-1.2	1287	5
Low altitude areas of Sofala and Zambezia	661	32	27.2	-1.6	1346	-2
Central medium altitude areas	604	0	25.7	-1.9	1410	2
Mid-altitude areas	694	11	26.1	-1.2	1273	0
North Coastal areas	613	26	27.4	-1.3	1352	1

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m^2)	Departure from 15YA (%)
Northern hinterland of Cabo Delgado	**677**	**34**	**25.1**	**-0.9**	**1190**	**3**

Table 3.54. Mozambique's agronomic indicators by sub-national regions, current season's values and departure from 5YA, October 2018 - January 2019

Region	BIOMSS		CALF		Maximum VCI
	Current (gDM/m^2)	Departure from 5YA (%)	Current (%)	Departure from 5YA (%)	Current
Coastal areas and South of Save	1100	2	98	6	0.92
Dry areas of Zambezia and Southern Tete	1318	7	98	23	0.97
North and Central Gaza and Western Inhambane	962	-16	94	26	0.84
High altitude areas	1718	8	100	10	0.95
Inland of Maputo and Southern Gaza	996	-18	89	-1	0.77
Low altitude areas of Sofala and Zambezia	1353	12	100	6	1.00
Central medium altitude areas	1399	1	100	5	0.99
Mid-altitude areas	1608	11	100	14	0.98
North Coastal areas	1372	20	99	23	0.99
Northern hinterland of Cabo Delgado	1589	19	100	3	0.95

[NGA] Nigeria

The beginning of the monitoring period covers the harvest of rain-fed rice (in the south) and early maize and drought staples (millet, sorghum) in central and northern locations. The harvest of irrigated rice and late maize occurred up to January.

Agro-climatic indicators show above average rainfall (RAIN +16%) with close to average temperature and sunshine (TEMP +0.3°C, RAPDAR +1%). Compared to the recent 5YA, the potential biomass production increased 13%. The cultivated arable land fraction (CALF) also rose 2% above the 5YA. The maximum vegetation condition index VCIx reached 0.91. In general, NDVI profiles and spatial clusters and other CropWatch show favorable crop condition.

Regional analysis

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

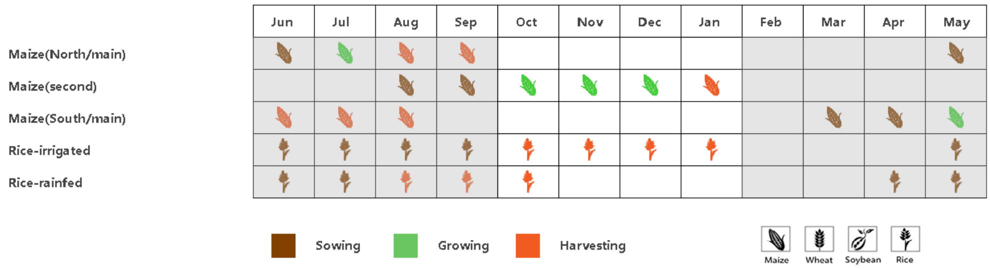
The **Sudano-Sahelian** zone has reached the end of the growing season in September-October and total rainfall was seasonably low (RAIN 61 mm) but nevertheless significantly above average (+59%). The temperature departure was negative by -0.6°C. RADPAR has remained constant and the BIOMSS index increased 45% above average. The arable land fraction (CALF) rose 9% above the recent five-year average. The maximum VCIx reached 0.88. The NDVI development graph shows above average crop condition. The unseasonable late rain has benefited range-lands and irrigated wheat.

The **Guinean Savanna** recorded an NDVI profile almost identical to the average of the previous five years. Rainfall was above average (RAIN +27%) and temperature was average (TEMP -0.3°C), resulting in high total biomass production potential (BIOMASS +19%). Sunshine was average as well (RADPAR +1%) and CALF remained constant. With VCIx at 0.92, crop condition is assessed as fair.

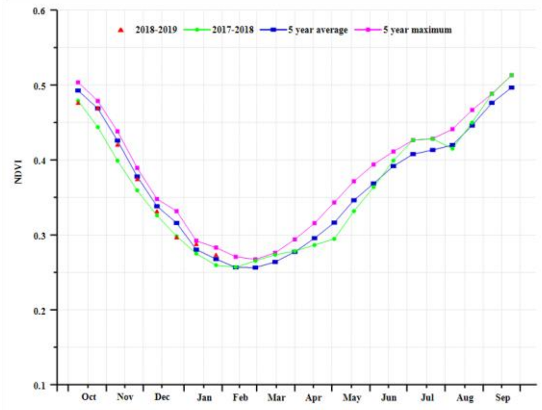
The **Derived savanna** region had mostly above-average agro-climatic indicators: RAIN (271 mm) was up 13% compared to average; RADPAR and BIOMSS increased by 2% and 8%, respectively. Temperature was average (TEMP -0.1°C). The NDVI development graph of this zone shows that from October to Mid-November crop condition was above-average; it was below average from mid- November to December. Irrigated rice is unlikely to have suffered but maize and other crops may have been affected. Altogether, however, with CALF reaching the very high value of 99% (indicating that virtually all land was cultivated) and the maximum VCI value of 0.94 CropWatch assesses the situation as favorable.

The **humid forest zone** is the wettest part of Nigeria, with growing seasons that may reach 365 days in the south. At 528 mm, rainfall was above average (RAIN +12%), and so were sunshine (RAPDAR 3%) and the biomass accumulation potential (BIOMASS +5%). Temperature was somewhat cooler than usual (TEMP -0.4°) and CALF remained constant at the high value of 99%. NDVI curves (both the AEZ average and the spatial profiles) show some fluctuations, including negative values in early October. They may result from very large excess precipitation and floods during the previous reporting period. Maximum VCI was nevertheless fair and CALF was high, which stands for satisfactory crops.

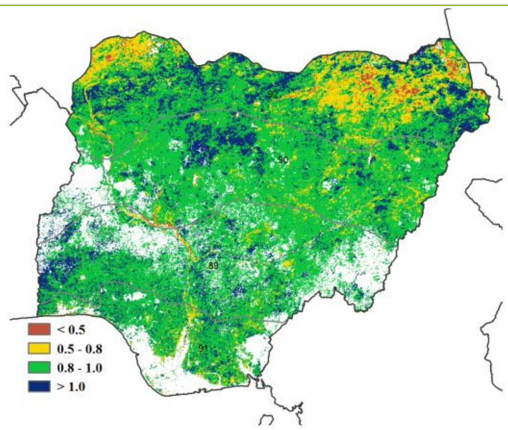
Figure 3.32. Nigeria's crop condition, July -October 2018



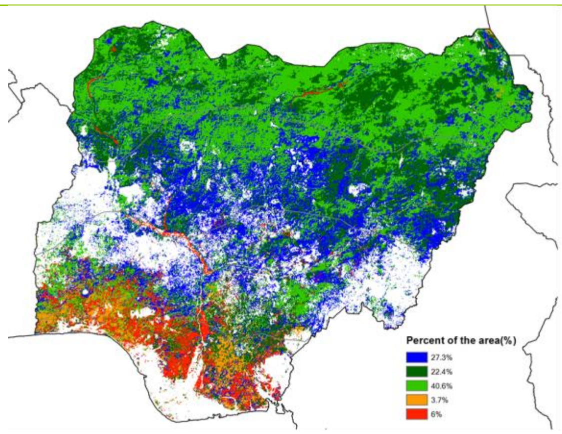
(a) Phenology of major crops



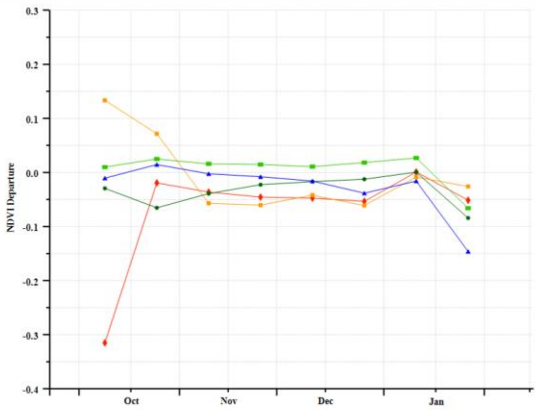
(b) Crop condition development graph based on NDVI



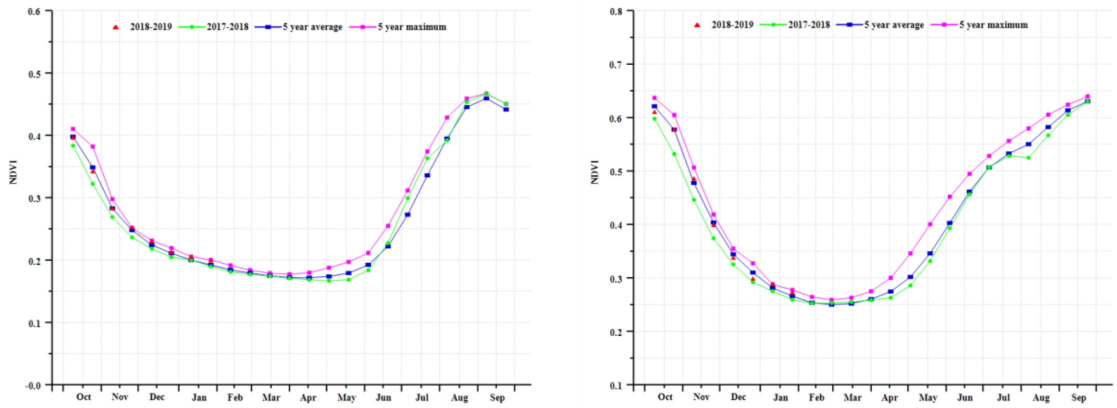
(c) Maximum VCI



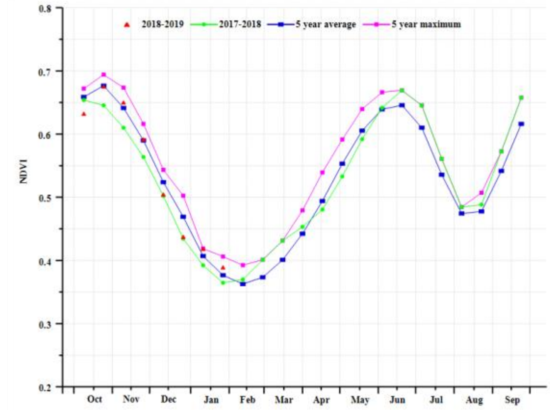
(d) Spatial NDVI patterns compared to 5YA

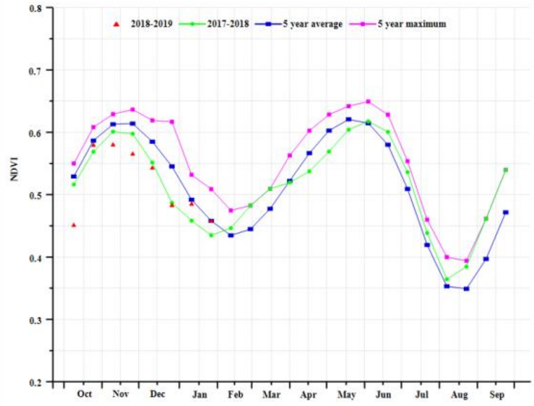


(e) NDVI profiles



(f) Crop condition development graph based on NDVI (Soudano-Sahelian zone (left) and Guinean savanna (right))





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

Table 3.55. Nigeria's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, October 2018-January 2019

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m^2)	Departure from 15YA (%)
Soudano-Sahelian zone	61	59	26.4	-0.6	1260	0
Guinean savanna	117	27	26.3	-0.3	1304	1
Derived savanna zone	273	13	27.4	-0.1	1262	2
Humid forest zone	528	12	27.6	-0.4	1198	3

Table 3.56. Nigeria's agronomic indicators by sub-national regions, current season's values and departure from 5YA, October 2018-January 2019

Region	BIOMASS		Cropped arable land fraction		Maximum VCI
	Current (gDM/m^2)	Departure from 5YA (%)	Current	Departure from 5YA (%)	Current
Soudano-Sahelian zone	200	45	59	9	0.88
Guinean savanna	354	19	98	0	0.92
Derived savanna zone	684	8	99	0	0.94
Humid forest zone	1219	5	99	0	0.92

[PAK] Pakistan

This monitoring period covers the maturity and harvest of summer maize and rice, and the sowing and early growth of winter wheat. Crop condition was generally favorable from October to January. Compared with average, RAIN was 35% above, while TEMP and RADPAR showed decreases (-0.5°C and -2% respectively). The combination of all the agro-climatic indicators resulted in BIOMSS exceeding the recent five-year average by 27%. The national average of VCIx (0.72) was just fair but the fraction of cropped arable land (CALF) increased by a very significant 19%.

Crops condition was close to average in January, as shown by the NDVI development graph at the national level. According to the spatial NDVI patterns and profiles, close to 24% of the cropped areas were below average throughout the period, essentially in the South and north-eastern areas. Punjab and the Indus river basin, two major wheat producing areas present above average NDVI. Considering that weather, in particular rainfall, has been favorable so far, winter wheat prospects are promising.

Regional analysis

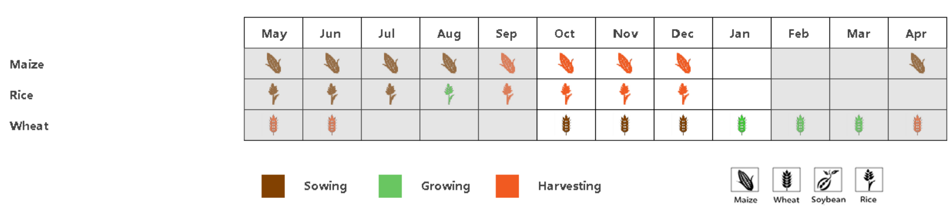
For a more detailed spatial analysis, CropWatch subdivides Pakistan into three agro-ecological regions based essentially on geography and agro-climatic conditions: the Northern highlands, Northern Punjab region and the Lower Indus river basin in south Punjab and Sind.

RAIN in the Northern highland region was 36% above average. RADPAR and TEMP were low compared to average (-4% and -0.7°C respectively). Accordingly, BIOMSS was 22% above average. The region achieved a low CALF of 41%. The NDVI development graph shows below average crop condition in January, especially in the north. This is, however, still early in the growing season and the final outcome of winter crops will depend on soil moisture later in the season.

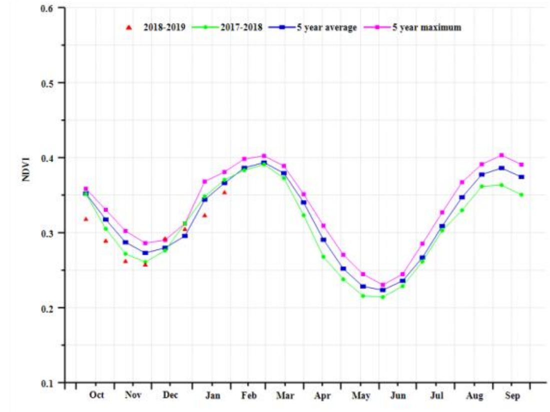
Northern Punjab, the main agricultural region in Pakistan recorded the highest RAIN (+58% above average). TEMP was below average by 0.9°C (which is significant), and the RADPAR departure was -3%. The resulting BIOMSS exceeded the recent five-year average by 48%. The area had a good CALF of 82% (16% above 2018) and a VCIx of 0.90. However, crop condition assessed through NDVI shows low values which could be due to delayed sowing resulting from low temperature or excessive rainfall. Overall, the crop production potential for the region is deemed to be neutral for the time being.

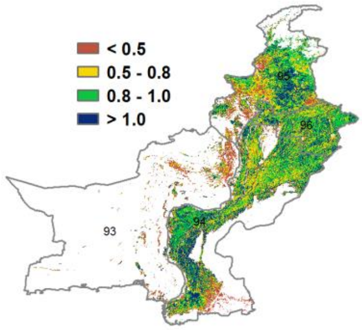
In the Lower Indus river basin in south Punjab and Sind, RAIN was significantly above average (by 48%), while TEMP was below average of 0.3°C and RADPAR was average to the extent that the estimated BIOMSS departure of 66% compared to the five-year average is probably optimistic, even considering that the vast majority of crops is irrigated. January crop condition based on NDVI was below average, but the low CALF (67%) is nevertheless a large increase over the recent 5YA (+22%); VCIx at 0.84 indicates favorable crop condition. Overall, prospects remain favorable for the region.

Figure 3.33. Pakistan's crop condition, October 2018- January 2019



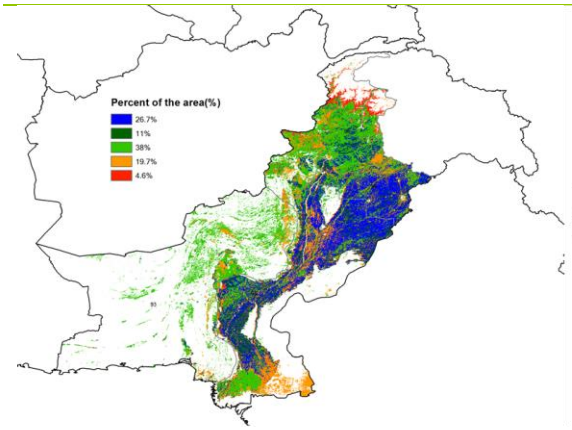
(a). Phenology of major crops

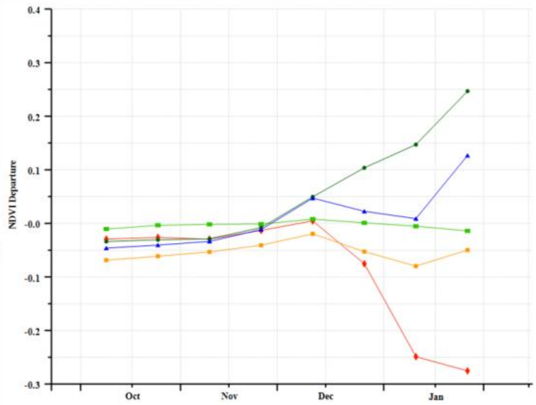




(b) Crop condition development graph based on NDVI

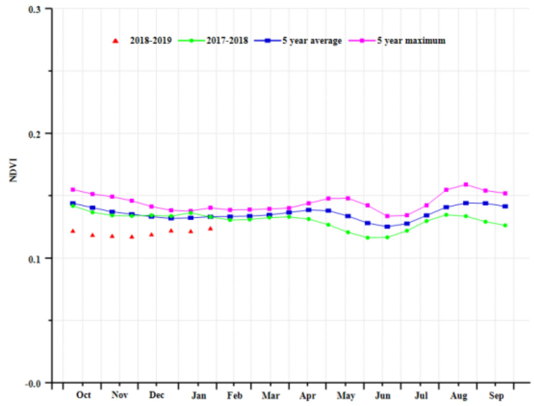
(c) Maximum VCI

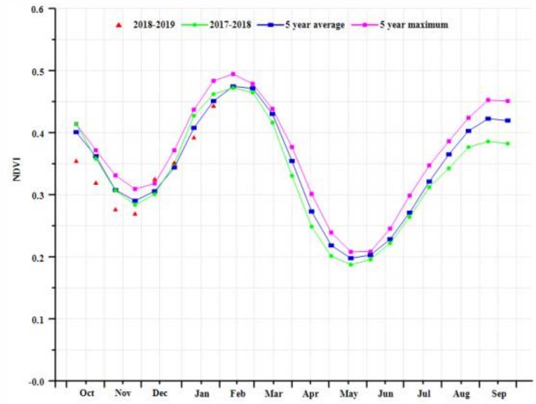




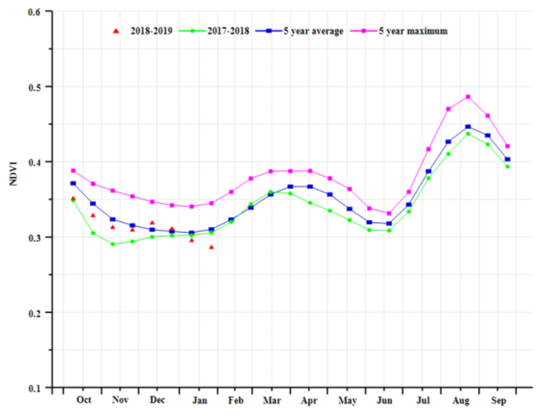
(d) Spatial NDVI patterns compared to 5YA

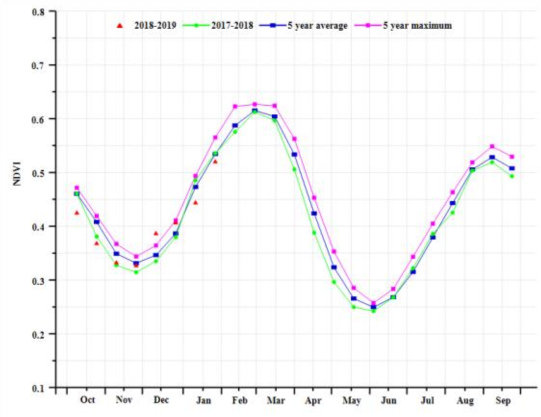
(e) NDVI profiles





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





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

Table 3.57. Pakistan's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, October 2018-January 2019

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m^2)	Departure from 15YA (%)
Balochistan	47	5	14.6	-0.1	982	1.0
Lower Indus river basin in south Punjab and Sind	28	48	20.2	-0.3	966	0
Northern highlands	164	36	9.5	-0.7	774	-4
Northern Punjab	87	58	16.7	-0.9	815	-3

Table 3.58. Pakistan's agronomic indicators by sub-national regions, current season's values and departure from 5YA, October 2018-January 2019

Region	BIOMSS		CALF		Maximum VCI
	Current (gDM/m^2)	Departure from 5YA (%)	Current (%)	Departure from 5YA (%)	Current
Balochistan	168	8	-	-	0.22
Lower Indus river basin in south Punjab and Sind	129	66	67	22	0.84
Northern highlands	476	22	41	17	0.78
Northern Punjab	346	48	82	16	0.90

[PHL] The Philippines

In the Philippines, the monitoring period covers the harvesting stage of last year's main rice, as well as the sowing stage of secondary rice and maize. According to the NDVI profiles for the country, crops generally showed unfavorable condition. Nationwide, precipitation (RAIN) presents a negative departure of 25% compared with average, accompanied by above average radiation (+7%) and slightly below average temperature (-0.2°C). The rainfall deficit resulted in BIOMSS being 18% below average.

However, according to the VCIx indicator, which mostly exceeded 0.80, favorable crop condition prevailed. The cropped arable land fraction (CALF) nation-wide was almost 100%. Considering the spatial patterns of NDVI profiles, 100% of the cropped area experienced average conditions from October to November. Later in the season, however, from December to January four different patterns emerged, （1）29.4% of the cropped area experienced slightly below average condition, from Mindanao to Mindoro; （2）45.3% of the cropped area experienced slightly above average conditions, mostly in the Center and the North, from Negros and Cebu to Luzon; (3) a marked drop in December and a recovery to average condition in January in 13.5% of the cropped areas in patches of Mindanao and Luzon; (4) a marked drop in January in 11.9% of the cropped areas, affecting essentially Samar, Leyte, and about one third of Mindanao. The behavior of NDVI can be explained at least partially by several typhoons that affected the Philippines, such as Pabuk in late December (refer to the section on disasters). Altogether, the outputs for secondary maize and rice in the country are expected to be below average.

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 Lowlands region (northern islands), the Hills region (Islands of Bohol, Sebu and Negros), and the Forest region (mostly southern and western islands).

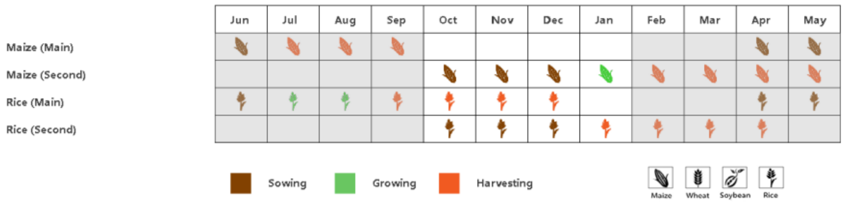
The **Lowlands region** experienced a rainfall deficit (RAIN -27%), slightly low temperature (TEMP -0.1°C)， and well above average radiation (RADPAR +13%). According to the NDVI profiles for the region, crop condition was below the five-year average. BIOMSS was down 25% compared to the average. Altogether, the outputs for secondary maize and rice are expected to be below average.

The **Hilly region** experienced a rainfall deficit (RAIN -27%), average temperature (TEMP +0.1°C)， and above average radiation (RADPAR +5%). According to the NDVI profiles for the region, crop condition was below the five-year average from mid-November in 2018 to January in 2019. BIOMSS was down 10% below average. Altogether, the output for secondary maize and rice are expected to be below average as well.

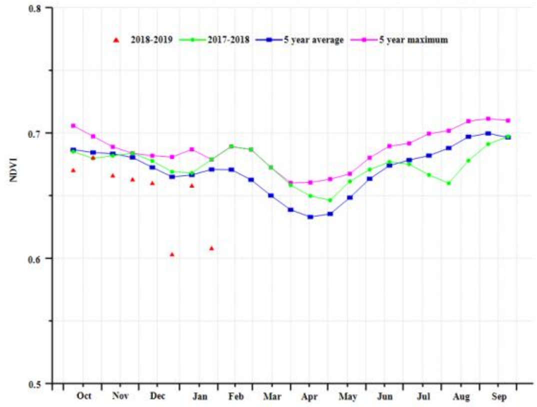
The **Forest region** experienced a rainfall deficit (RAIN -23%), average temperature (TEMP -0.3°C)， and above average radiation (RADPAR +2%). According to the NDVI profiles for the region, crop condition was below the five-year average. BIOMSS was down 13% from average. Altogether, the output of secondary maize and rice are expected to be below average as well.

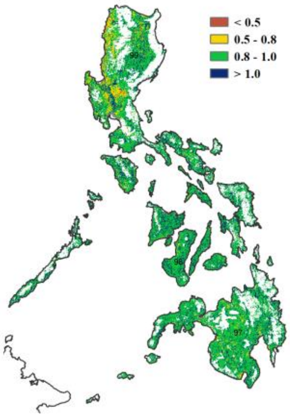
The NDVI-based Crop condition development graphs indicate below average conditions over the monitoring period. Crop prospects are generally below average due to rainfall deficits and cyclone impacts.

Figure 3.34. Philippines's crop condition, October 2018 -January 2019



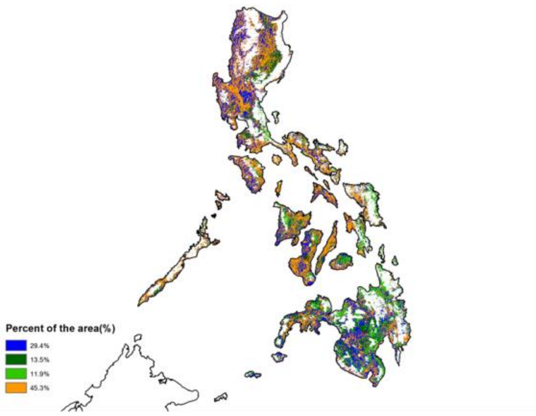
(a). Phenology of major crops

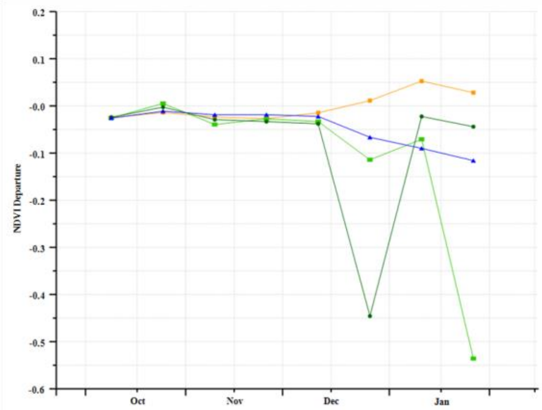




(b) Crop condition development graph based on NDVI

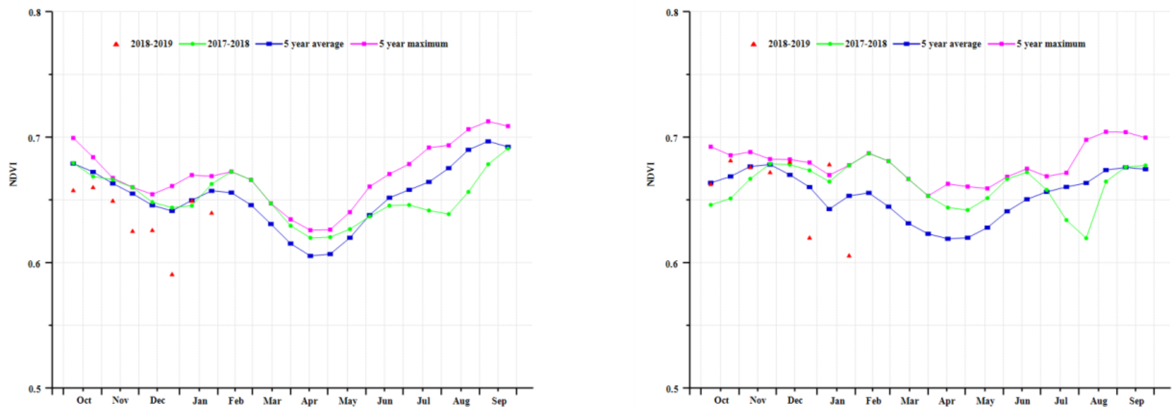
(c) Maximum VCI



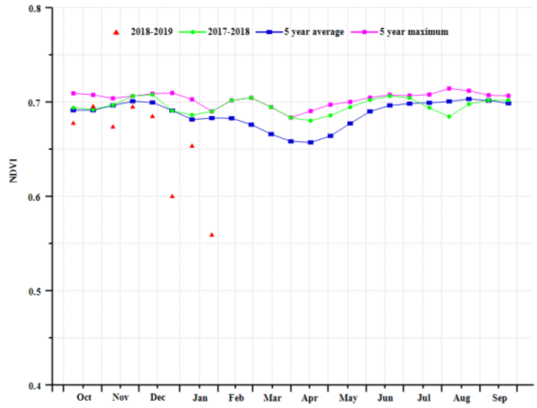


(d) Spatial NDVI patterns compared to 5YA

(e) NDVI profiles



(f) Crop condition development graph based on NDVI (Lowland region (left) and Hilly region (right))



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

Table 3.59. Philippines's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, October 2018 -January 2019

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m^2)	Departure from 15YA (%)
Lowlands region	594	-27	25.2	-0.1	1037	13
Hills region	593	-27	26.4	0.1	1159	5
Forest region	933	-23	25.8	-0.3	1090	2

Table 3.60. Philippines's agronomic indicators by sub-national regions, current season's values and departure from 5YA, October 2018 -January 2019

Region	BIOMSS		Cropped arable land fraction		Maximum VCI
	Current (gDM/m^2)	Departure from 5YA (%)	Current	Departure from 5YA (%)	Current
Lowlands region	1109	-25	100	0	0.93
Hills region	1594	-10	100	1	0.97
Forest region	1742	-13	100	0	0.96

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

[POL] Poland

The monitoring period covers the harvest of late summer crops such as maize (October), and the sowing of the next winter wheat (in September and October). The Cropped Arable Land Fraction (CALF) was high and close to average. Weather conditions were average, just slightly drier and warmer (RAIN -1%, TEMP + 0.6°C), but much more sunny (RADPAR was above the average by 8%). This led to increased potential biomass (BIOMSS +6%). Due to the favorable condition, VCIx in Poland during the reporting period was high at 0.92.

As shown by the crop condition development graph, national NDVI values fell markedly due to snow in late December. Nearly all of the agriculture areas had below average NDVI at that time. This has not affected crop condition, which is currently assessed as favorable.

Regional analysis

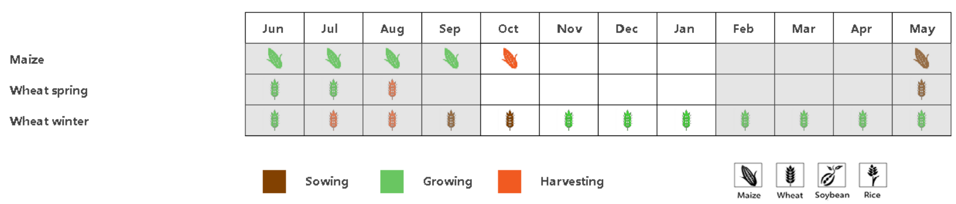
Four agro-ecological zones (AEZ) are examined more closely below. They include the Northern oats and potatoes areas (the northern half of: west Pomerania, eastern Pomerania and Warmia-Masuria), the Northern-central wheat and sugar-beet area (Kuyavia-Pomerania to the Baltic sea), the Central rye and potatoes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

The **Northern oats and potatoes area** and the **Northern-central wheat and sugar-beet area** recorded both drier and warmer conditions compared to the average (RAIN -11% and -9%, TEMP +0.6°C for both AEZs). RADPAR was above average in the two areas (+13% and +12%, respectively). Due to the favorable condition, BIOMSS increased 5% and 6%, respectively. The areas also had high CALF (100% and 99%) and favorable VCIx (0.94 and 0.91). Crop condition is at least satisfactory.

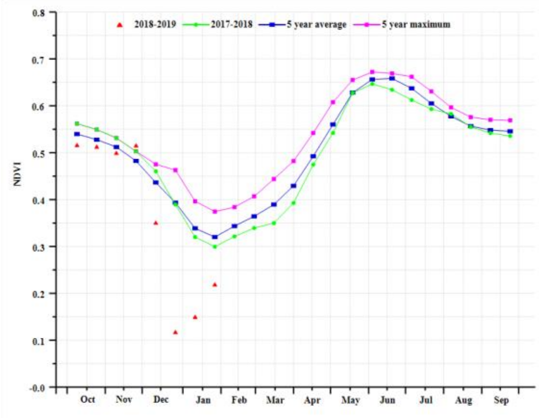
Weather closer to average for precipitation and sunnier prevailed in the **Central rye and potatoes area**: RAIN -1%, TEMP +0.6°C and RADPAR +9%, which accounts for the increase of biomass (BIOMSS +6%) compared to the five-year average. CALF and VCIx in the area were both favorable (CALF 100%, VCIx 0.91). Crop condition is good.

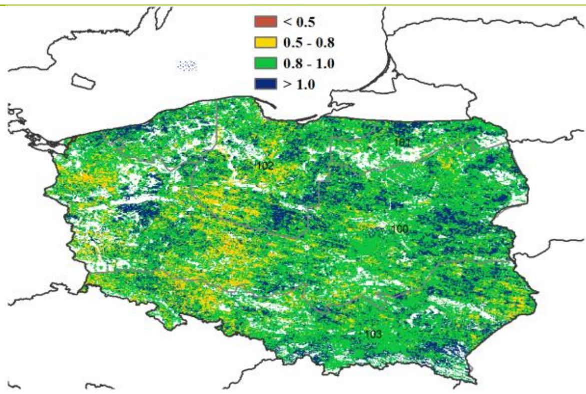
The Southern **wheat and sugar-beet area** was wetter and warmer than average (RAIN +8%, TEMP +0.5°C), but less sunny than the center and the north of the country (RADPAR +5%). The increased biomass (BIOMSS +7%) resulted from the favorable condition. The area had a high CALF (100%) as well as a favorable VCIx (0.92).

Figure 3.35. Poland's crop condition, October 2018-January 2019

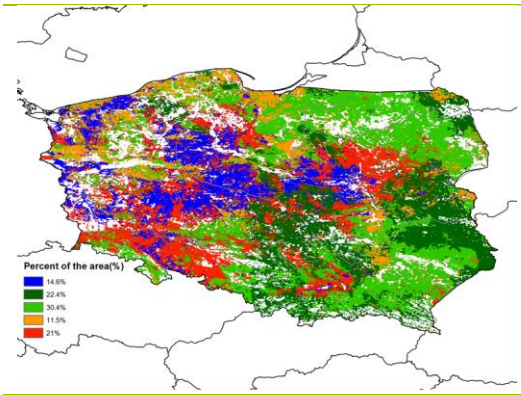


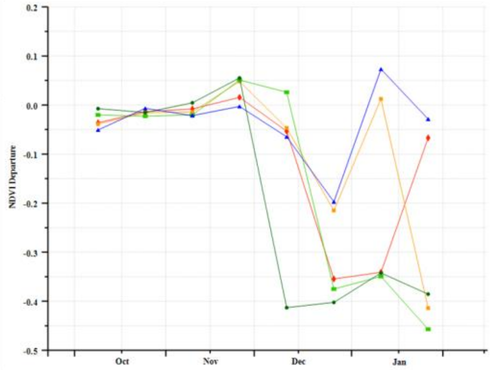
(a). Phenology of major crops



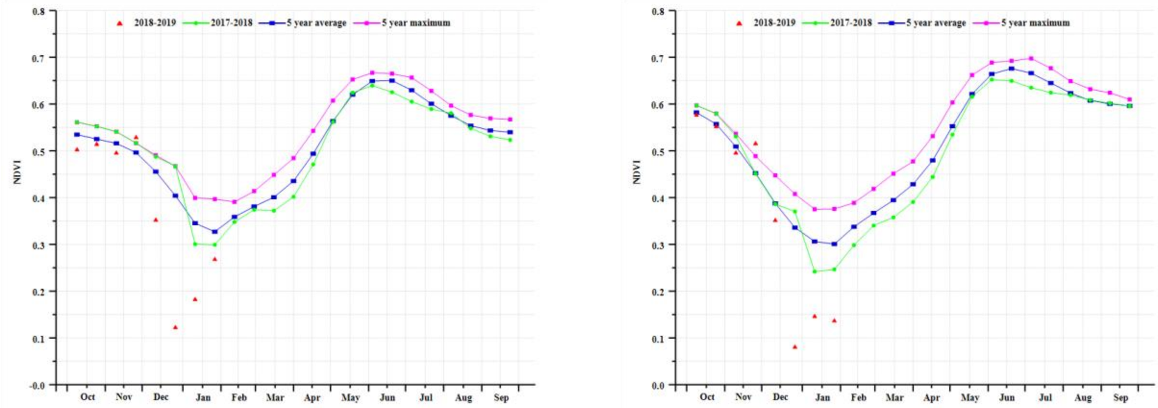


(b) Crop condition development graph based on NDVI (c) Maximum VCI

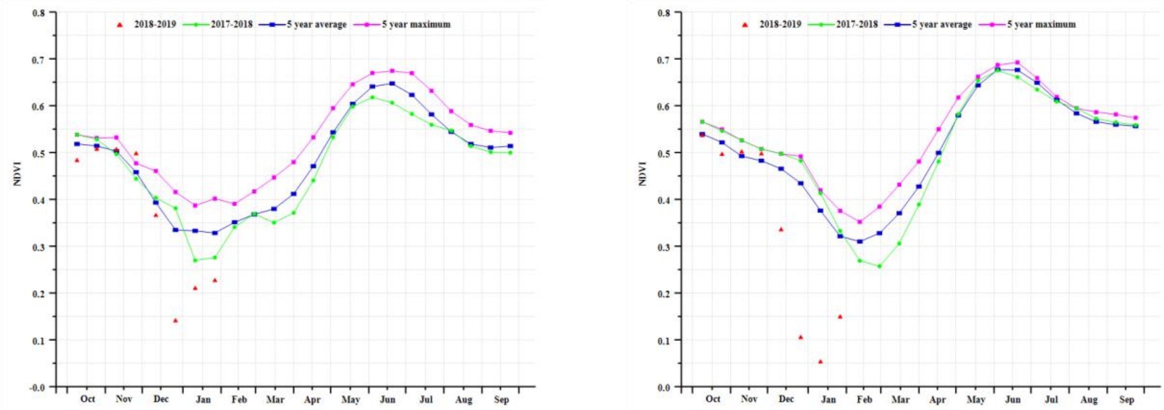




(d) Spatial NDVI patterns compared to 5YA (e) NDVI profiles



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



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

Table 3.61. Poland's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, October 2018- January 2019

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m2)	Departure from 15YA (%)
Central rye and potatoes area	270	-1	3.8	0.6	214	9
Northern oats and potatoes areas	285	-11	3.5	0.6	189	13
Northern-central wheat and sugarbeet area	256	-9	3.9	0.6	202	12
Southern wheat and sugarbeet area	275	8	3.5	0.5	264	5

Table 3.62. Poland's agronomic indicators by sub-national regions, current season's values and departure from 5YA, October 2018- January 2019

Region	BIOMSS		Cropped arable land fraction		Maximum VCI
	Current (gDM/m^2)	Departure from 5YA (%)	Current	Departure from 5YA (%)	Current
Central rye and potatoes area	928	6	100	0	0.91
Northern oats and potatoes areas	906	5	100	0	0.94
Northern-central wheat and sugarbeet area	938	6	99	0	0.91
Southern wheat and sugarbeet area	906	7	100	1	0.92

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

[ROU] Romania

Maize was harvested during the reporting period and winter wheat began vegetative growth after being sown from November. The overall condition of winter wheat was fair at best (VCIx = 0.64). Both rainfall and temperature were higher than average (RAIN +35% and TEMP +0.2°C, a minor anomaly). Sunshine as assessed by RADPAR was just 1% above the reference. Biomass showed better condition than average (BIOMSS +19%) while CALF was lower than average (CALF -35%). The low CALF in this region was correlated with low VCIx values and the NDVI profile showed that crop condition in Romania was lower than average. Spatial NDVI profiles show a diversity of patters. In the Western and central maize, wheat and sugar beet plateau NDVI first increased in November and decreased in December while in the Eastern and southern maize, wheat and sugar beet plains NDVI had a drop in November but recovered later in the season.

Regional analysis

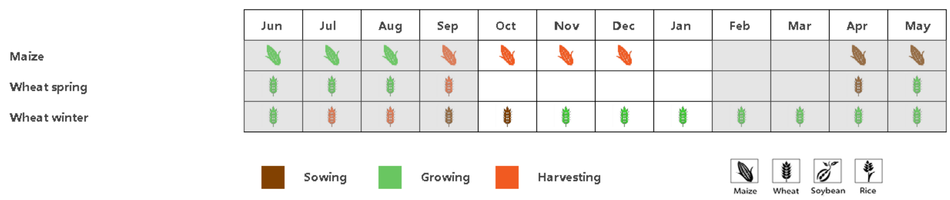
More detail is provided below for three main agro-ecological zones (AEZ) of the country. They include the the Eastern and southern maize, wheat and sugar beet plains (105), the Central mixed farming and pasture Carpathian hills (104) and the Western and central maize, wheat and sugar beet plateau (106).

All AEZs enjoyed an increase of rain over average while temperature and solar radiation were about average. VCIx in all three regions was low. VCIx was lower than 0.5 in most regions of the Eastern and southern plain, somewhat better (at 0.5-0.8) in the Central mixed farming and pasture Carpathian hills. Few regions in Romania have a VCIx exceeding 1.0.

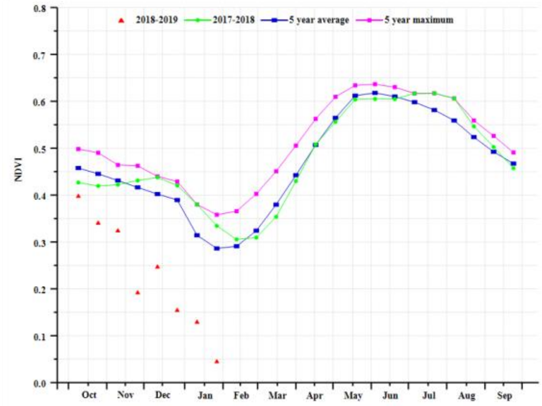
According to NDVI development profile, crop condition was below average in the three regions. In the **Central mixed farming and pasture Carpathian hills** and the **Western and central maize, wheat and sugar beet plateau**, crop condition was near the average during October and November then deteriorated in December. Crop conditions in the **Eastern and southern maize**, **wheat and sugar beet plains** were below average at the beginning of the monitoring period. As for cultivated areas, a decrease of CALF occurred in all three regions compared with average. In the **Eastern and southern maize**, **wheat and sugar beet plains**, CALF fell more than 40% below the 5YA. The CALF of **Western and central maize, wheat and sugar beet plateau** decreased around 20% and the **Eastern and southern maize, wheat and sugar beet plains** decreased 7%. The CALF decrease should be noted as this may influence the final outcome of the season.

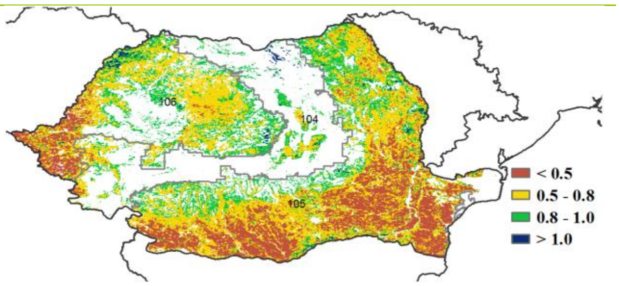
Overall the expectations for winter crops output in Romania are unfavorable.

Figure 3.36. Romania's crop condition, July - October 2018

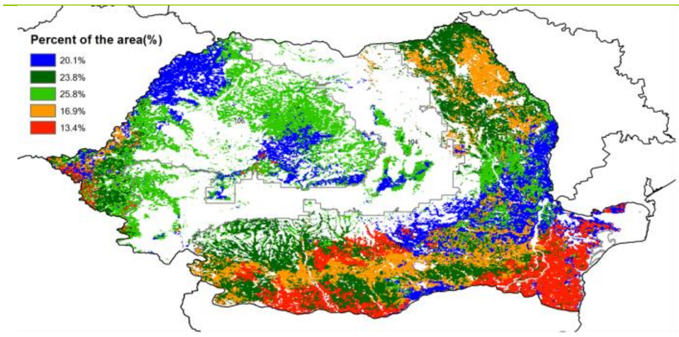


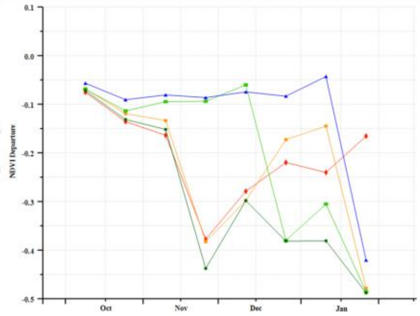
(a). Phenology of major crops



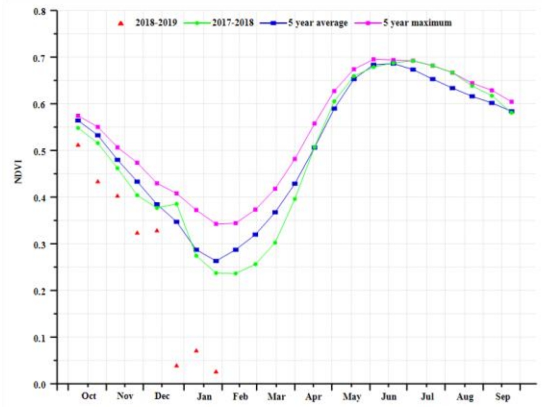


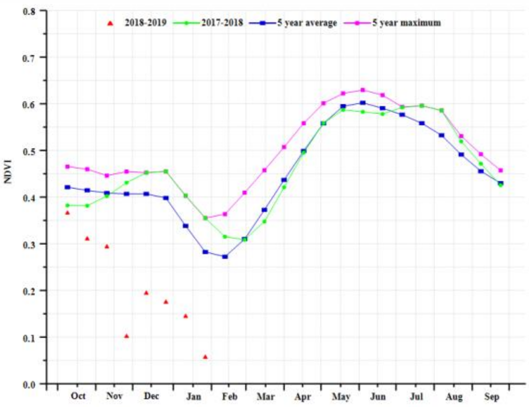
(b) Crop condition development graph based on NDVI (c) Maximum VCI



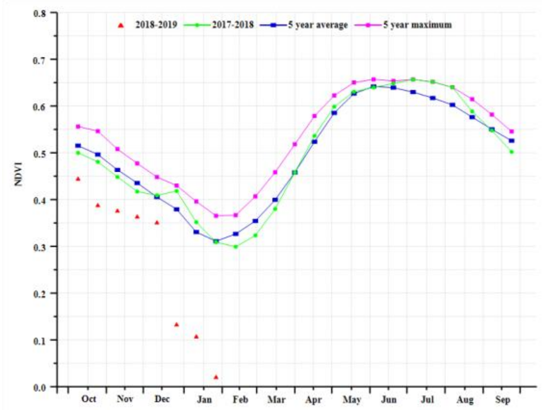


(d) Spatial NDVI patterns compared to 5YA (e) NDVI profiles





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



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

Table 3.63. Romania's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, October 2018-January 2019

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m2)	Departure from 15YA (%)
Central mixed farming and pasture Carpathian hills	313	22	1.5	0.5	380	3
Eastern and southern maize, wheat and sugar beet plains	290	43	3.9	-0.4	388	0
Western and central maize, wheat and sugar beet plateau	325	33	3.8	1.0	375	2

Table 3.64. Romania's agronomic indicators by sub-national regions, current season's values and departure from 5YA, October 2018-January 2019

Region	BIOMSS		Cropped arable land fraction		Maximum VCI
	Current (gDM/m^2)	Departure from 5YA (%)	Current	Departure from 5YA (%)	Current
Central mixed farming and pasture Carpathian hills	796	11	90	-7	0.80
Eastern and southern maize, wheat and sugar beet plains	916	21	45	-46	0.60
Western and central maize, wheat and sugar beet plateau	937	20	77	-19	0.70

[RUS] Russia

Crop phenology is complex in Russia due the large diversity of climatic conditions. Generally, winter wheat is harvested from mid to late summer and planted from August onwards, locally as late as October. Summer crops, especially maize, are harvested up to October or sometimes up to mid-November, well after physiological maturity.

Cropped arable land fraction (CALF) increased by 8% over the average of the previous five years but the nationwide average remains rather low at 63%. The value of VCIx in the country was 0.79, a moderate value which may result from relatively dry and sunny weather (RAIN -10%, RADPAR +5%). Both temperature and the biomass production potential were average.

NDVI development graphs for the country indicate close average to crop condition from October to early November. From late November to early January snow depressed NDVI values which, however, returned to just below average values at the end of the month.

NDVI was above average from October to November and then below average in about 24.4% of arable area of Russia, mainly in central Russia, Central black earth, Caucasus and middle Volga regions. In other 20.3% areas, including many areas of middle and west Siberia, NDVI was above average only from late October to early November. In most area of east Siberia, some areas of west Siberia and southern Caucasus (making up about 25.3% of crop land) NDVI was above average only in late October. In the other 30% areas of Russia, NDVI was below average during the whole period.

Compared to the previous five years, crop condition was globally close to average.

Regional analysis

A more detailed analysis is provided for twelve agro-ecological zones (AEZ), namely the Amur and Primorsky Krai area (110), Central Russia (107), Central Black Earth region (108), East Siberia (109), Middle Siberia (112), Middle Volga (111), Northwest Region including Novgorod (198), Northern Caucasus (202), Southern Caucasus (114), Ural sand west Volga-Vyatka (200), Western Siberia (113) and West subarctic region (199).

In **Amur and Primorsky Krai, Middle Siberian and East Siberian regions**, biomass expectations were above average by 27%, 12% and 19% respectively due to increased temperature (+2.5°C, +1.3°C, +2.4°C), in spite of decreased rainfall in middle Siberia (-9%) and east Siberia (-2%). RADPAR was close to average in the three regions. The cropped arable land fraction in east Siberia was 89% (decreased by 3%), and VCIx was 0.81. VCIx was 0.85 in the other two regions where CALF increased by 4% and 27% respectively, but values were not very high, especially in Amur and Primorsky Krai (only 33%).

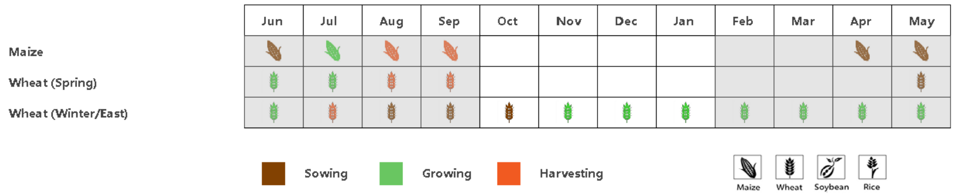
Compared to last 15 years, rainfall and temperature were all below average in **Central Russia** (-27%, -2.4°C), **Central black earth** (-22%, -1.0°C) **and Northwest Region including Novgorod regions** (-21%, -0.1°C), leading to decreased biomass by 6%, 8% and 2% respectively. CALF values were high (99% and 100%, respectively) in Central Russia and Northwest Region where VCIx reached 0.95 and 0.89. In the Central black earth AEZ, CALF was only 75% and VCIx was 0.82.

In the **Southern Caucasus** and **Northern Caucasus regions**, rainfall was up 9% and 38% respectively resulting in above biomass (+8%, +9%). CALF was low (48% and 50%, respectively) and VCIx reached 0.74 and 0.75, respectively.

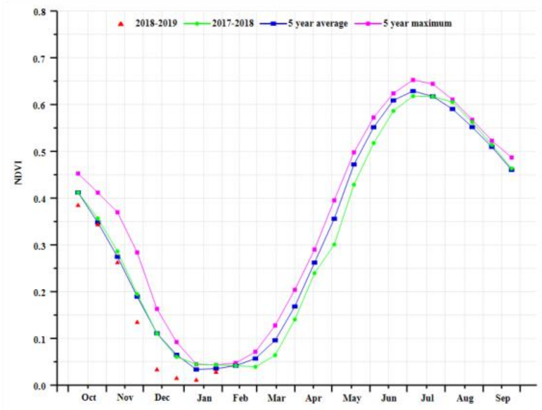
Cropped arable land fraction was between 61% to 65% in **Middle Volga, Ural and west Volga-Vyatka**, and **West Siberian regions**. Due to decreased rainfall (-16% compared to average for middle Volga, -8% for Ural and west Volga-Vyatka) and temperature (-0.6°C in middle Volga and -0.2°C in west Siberian), biomass were all below the average of last 5 years.

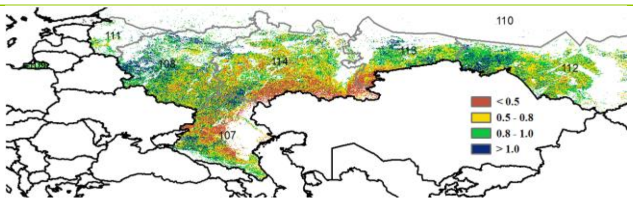
In the **West subarctic region**, cropped arable land fraction increased by 6% to 98%, with a high VCIx value 0.90. Biomass was below average of last 5 years by 2% due to the reduced rainfall (-12%).

Figure 3.37. Russia's crop condition, July - October 2018

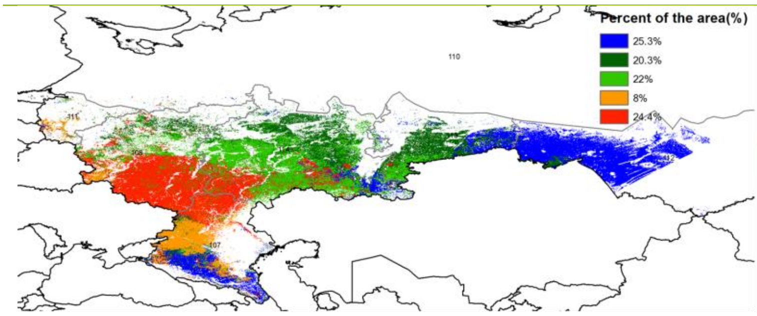


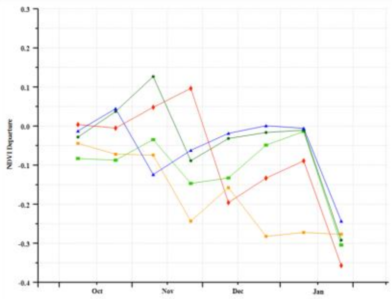
(a). Phenology of major crops



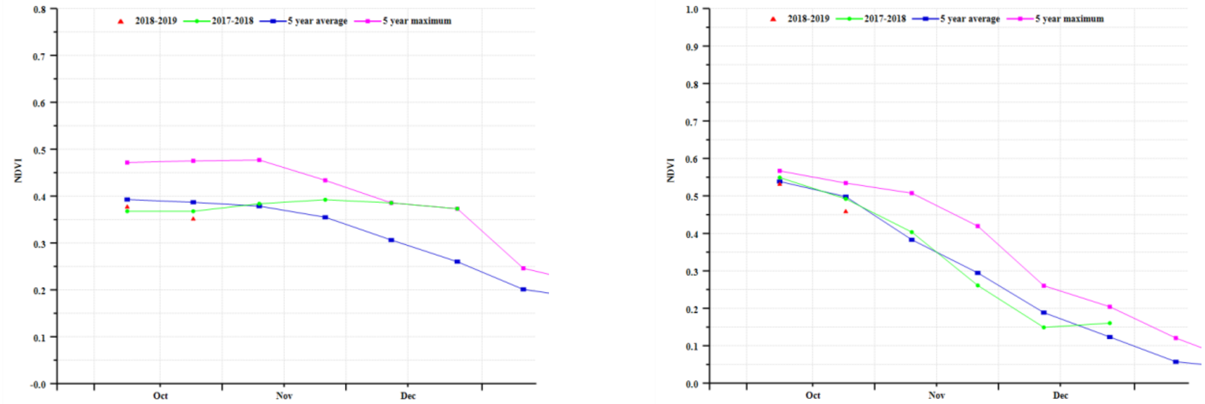


(b) Crop condition development graph based on NDVI (c) Maximum VCI

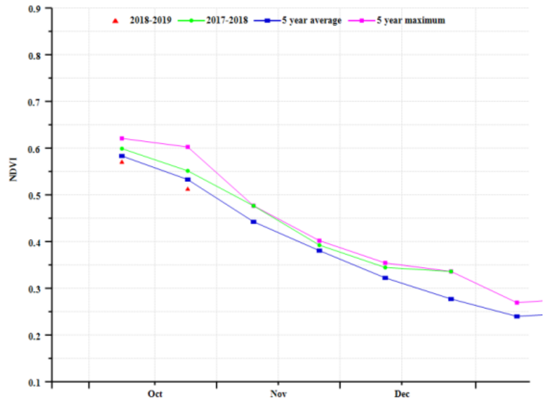


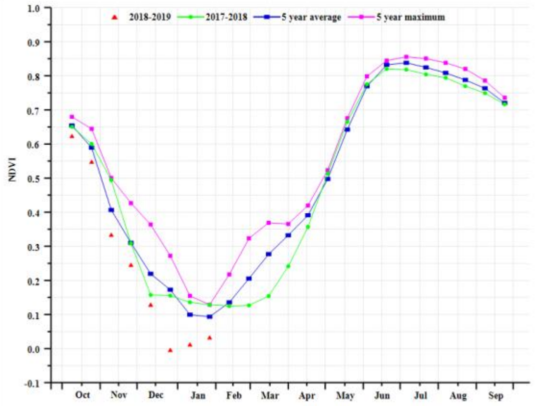


(d) Spatial NDVI patterns compared to 5YA (e) NDVI profiles

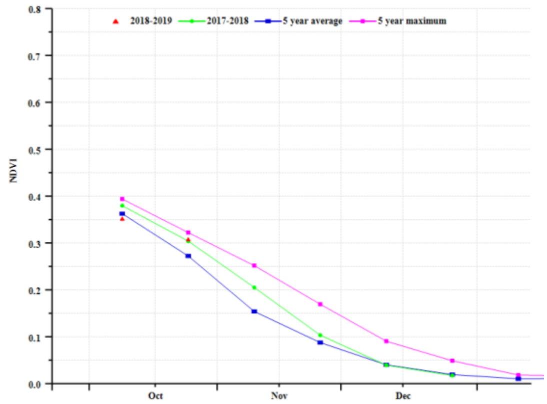


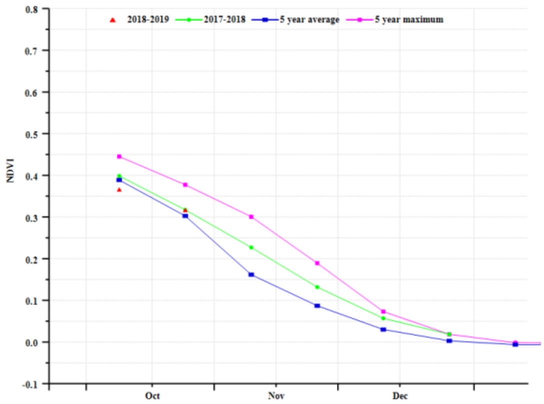
(f) Crop condition development graph based on NDVI (The Caucasus (left) and Central Economic Region (right))



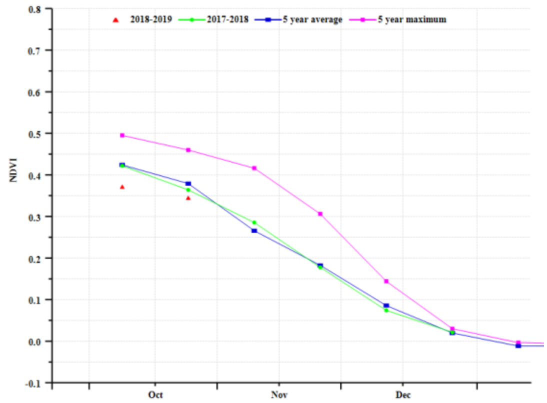


(g) Crop condition development graph based on NDVI (Kaliningrad oblast (left) and Northwest region (right))





(h) Crop condition development graph based on NDVI (Southern Siberian area (left) and Southern Urals (right))



(i) Crop condition development graph based on NDVI (Volga Basin)

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

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m2)	Departure from 15YA (%)
Amur and Primorsky Krai	126	13	-11.0	2.5	377	-1
Central Russia	225	-27	-2.4	-0.6	151	15
Central Black Earth	214	-22	-1.9	-1.0	220	14
East Siberian	179	-2	-9.0	2.4	350	1
Middle Siberian	114	-9	-13.7	1.3	316	1

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m2)	Departure from 15YA (%)
Middle Volga	220	-16	-4.9	-0.6	186	6
Northwest Region including Novgorod	268	-21	-1.2	-0.1	116	12
North Caucasian	304	38	2.3	-0.3	327	0
South Caucasian	374	9	3.6	0.5	422	0
Ural and west Volga-Vyatka	170	-8	-7.6	0.2	177	2
West Siberian	218	0	-9.6	-0.2	220	5
West subarctic region	289	-12	-4.7	0.1	72	1

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

Region	BIOMSS		Cropped arable land fraction		Maximum VCI
	Current (gDM/m^2)	Departure from 5YA (%)	Current	Departure from 5YA (%)	Current
Amur and Primorsky Krai	344	27	77	4	0.85
Central Russia	574	-6	99	1	0.95
Central Black Earth	611	-8	75	3	0.82
East Siberian	396	19	89	-3	0.81
Middle Siberian	249	12	33	27	0.85
Middle Volga	485	-6	61	-7	0.70
Northwest Region including Novgorod	625	-2	100	1	0.89
North Caucasian	808	9	50	8	0.75
South Caucasian	821	8	48	-15	0.74
Ural and west Volga-Vyatka	404	-1	65	25	0.79
West Siberian	364	-2	62	24	0.86
West subarctic region	476	-2	98	6	0.90

[THA] Thailand

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

Regional analysis

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

Compared with average, the rainfall in the **Central double and triple-cropped rice lowlands** was virtually average (RAIN -2%) while temperature was above average (TEMP, +0.6℃) with average sunshine (RADPAR 0%). The biomass production potential increased 22%. The NDVI development graph shows that crop condition was slightly below the five-year average but close to last year's. This is confirmed by a fair VCIx value of 0.85. Overall, the situation was slightly below average.

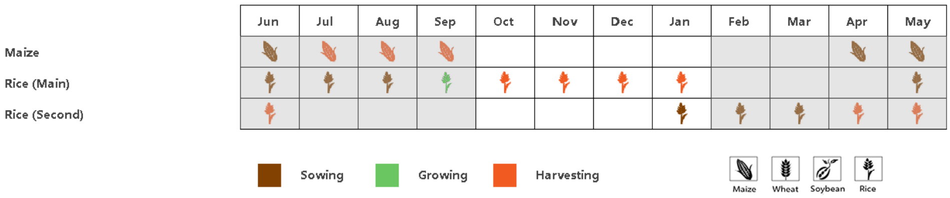
Indicators for the **South-eastern horticulture area** follow the same patterns as those for the country as a whole: rainfall (RAIN, 2%) and radiation (RADPAR +4%), temperature (TEMP, +0.3℃) were above average, resulting in the biomass production potential increase in Thailand (BIOMSS +21%) compared with the 5-year average. According to the NDVI development graph, however, the crop condition was slightly below average during this monitoring period.

Crop condition in the **Western and southern hills areas** were favorable and, again, followed the weather patterns as the whole country: RAIN +16%, TEMP +0.2°C, RADPAR +2%, and BIOMSS +23% when compared to their respective averages. According to the NDVI development graph, crop condition was close to average. Overall, the situation was close to average.

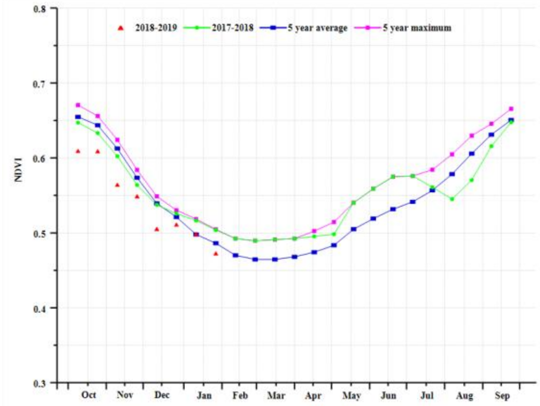
Unlike the country as a whole, the rainfall in the **Single-cropped rice north-eastern region** was virtually average while the temperature (TEMP +0.8°C) and radiation (RADPAR +7%) were above. BIOMSS (+10%) shows above average values. The NDVI development graph shows that crop condition was slightly below average.

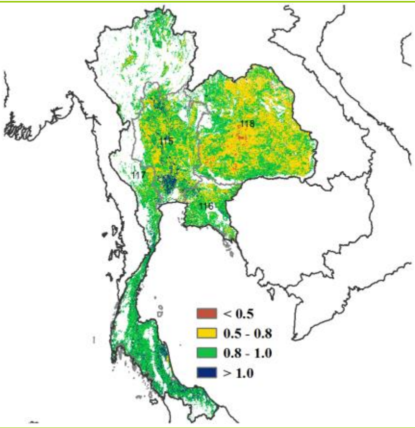
At the national level, most arable lands was cropped during the season and had favorable VCIx values around 0.84. CropWatch projections are that the crop condition during this monitoring period was slightly below average.

Figure 3.38. Thailand's crop condition, October 2018-January 2019



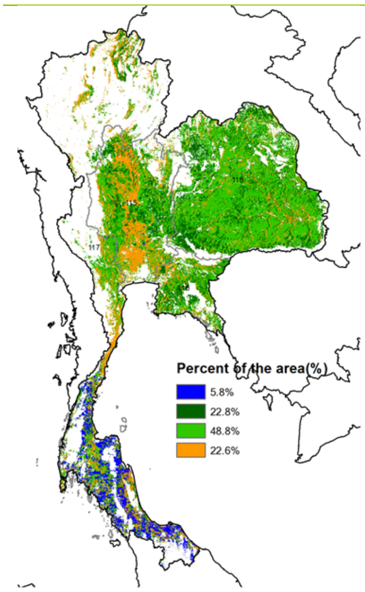
(a). Phenology of major crops

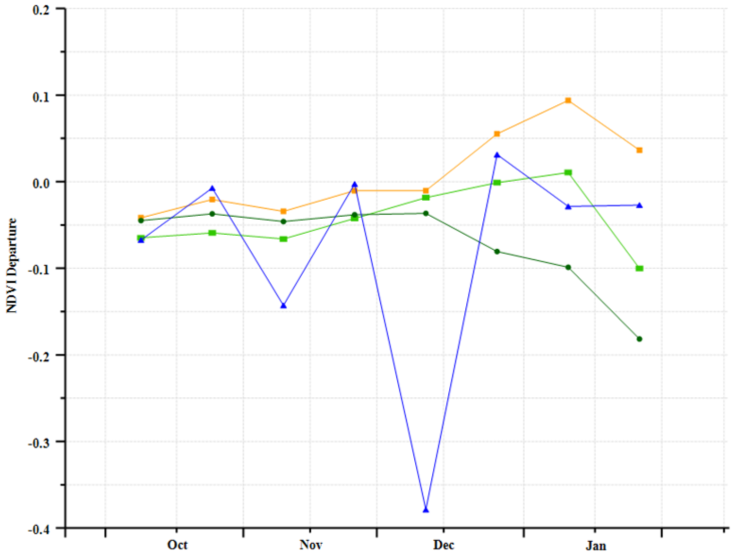




(b) Crop condition development graph based on NDVI

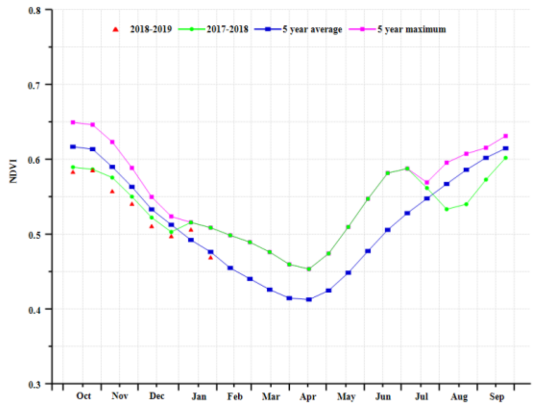
(c) Maximum VCI

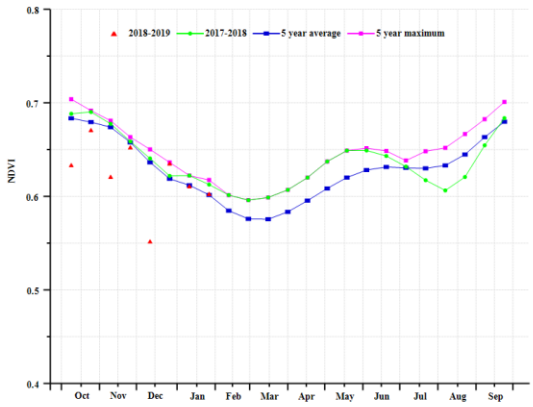




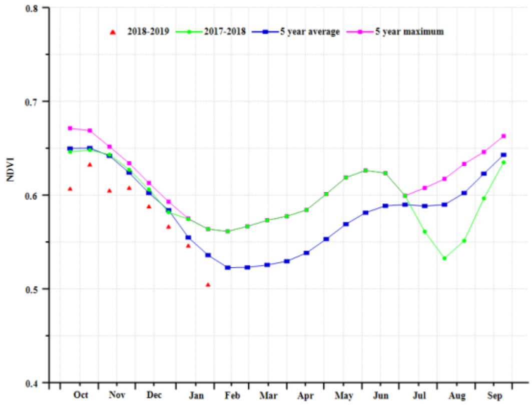
(d) Spatial NDVI patterns compared to 5YA

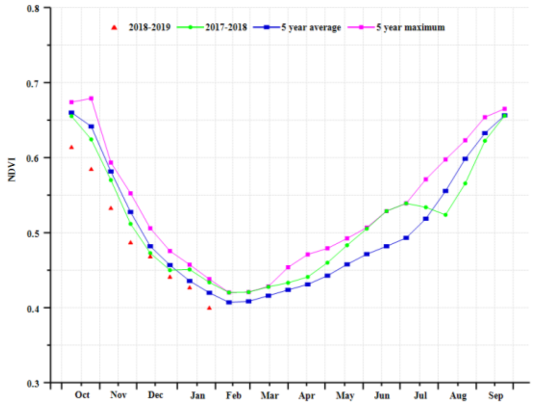
(e) NDVI profiles





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





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

Table 3.67. Thailand's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, October 2018- January 2019

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m^2)	Departure from 15YA (%)
Central double and triple-cropped rice lowlands	232	-2	26.6	0.6	1070	0
South-eastern horticulture area	337	2	26.9	0.3	1129	4
Western and southern hill areas	641	16	25.1	0.2	1094	2
Single-cropped rice north-eastern region	186	0	26.3	0.8	1112	7

Table 3.68. Thailand's agronomic indicators by sub-national regions, current season's values and departure from 5YA, October 2018- January 2019

Region	BIOMSS		Cropped arable land fraction		Maximum VCI
	Current (gDM/m^2)	Departure from 5YA (%)	Current	Departure from 5YA (%)	Current
Central double and triple-cropped rice lowlands	737	22	100	1	0.85
South-eastern horticulture area	979	21	99	0	0.86
Western and southern hill areas	1277	23	100	0	0.93
Single-cropped rice north-eastern region	519	10	100	0	0.78

[TUR] Turkey

Maize and rice harvests were reaching completion at the beginning of the reporting period, while winter wheat planting was underway. NDVI was close to the previous five-year average from October to early December 2018. After a marked dip (0.1 NDVI units) in early January, it returned to average by the end of the month. Both temperature, rainfall and the resulting biomass accumulation potential were above average (TEMP +0.9℃, RAIN +26%, BIOMSS +17%) but sunshine was low (RADPAR -8%). The cropped arable land fraction (CALF) increased by 18% and the maximum VCI was 0.86.

The spatial NDVI patterns almost exactly follow the AEZs decribed in the regional analysis below. For instance, NDVI was close or slightly above average in 21.8% of croplands, mostly in the lowlands along the Syrian border and the Mediterranean, from the Sanliurfa to Antalya to Aydin and Tekirdag in the European part of Turkey. This corresponds to the Marmara Aegean Mediterranean lowland zone and mostly high VCIx.

Regional analysis

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

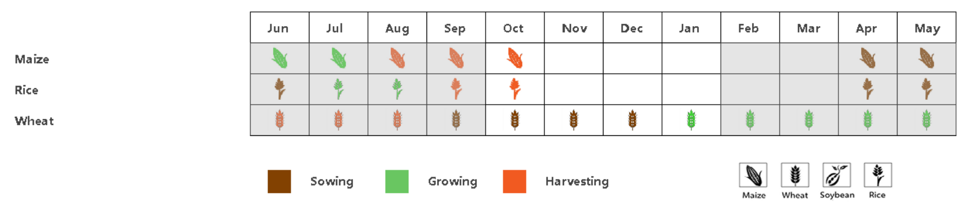
In the **Black Sea zone**, the NDVI was close and above average from October to December, while the NDVI was below average in January. Rainfall and temperature were well above average (RAIN +32%, TEMP +1.1℃) and sunshine was close to average (RADPAR -1%). The biomass was above average (BIOMSS +19%); VCIx reached 0.92 and CALF is up 3%. The tea, not crops, may result high high VCIx and the increasing of biomass. Good climatic conditions were favorable for the crops. The output will be fair.

The **Central Anatolian region** had below average NDVI in late December and January, but average and above average from October to early December. Both temperature and precipitation were above average (TEMP +0.9℃, RAIN +17%), while the radiation was below average (RADPAR,-4%). The biomass production potential was above average (BIOMSS +15%), and CALF increased 4%. The VCIx was 0.80. The condition of crops is assessed as good.

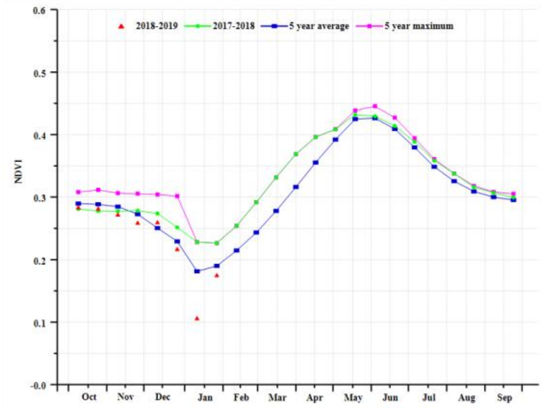
In the **Eastern Anatolian plateau**, the NDVI was below and close to average during the reporting period, but above average on early December and late January. This zone experienced a precipitation excess of the same magnitude as in the two adjacent AEZs (RAIN +31%) but weather was unseasonably warm (TEMP +1.8℃) while sunshine was rather low (RADPAR -11%), a combination that hints at very cloudy conditions (clouds lead to high minimum temperature). Both biomass and the cropped arable land fraction were above average (BIOMSS +18%, CALF +10%), and the VCIx was 0.84. Climatic conditions were favorable for crop production.

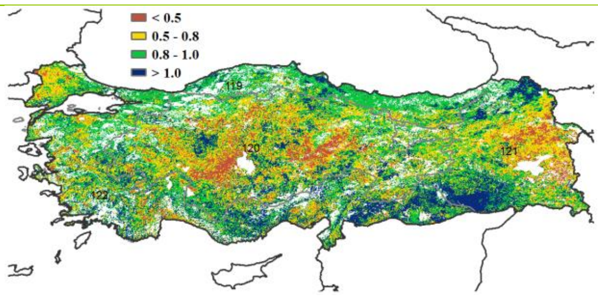
As shown by the NDVI profile in the **Marmara Aegean Mediterranean lowland zone**, the NDVI was below and close average, except during late December. The rainfall was above average (RAIN +29%), while the radiation was below (RADPAR -11%). The temperature was close to average(TEMP, +0.3℃). Both BIOMSS and the CALF are up compared with average, by 18% and 19%, respectively. The VCIx was 0.93. Crop production prospects are estimated to be favorable.

Figure 3.39. Turkey's crop condition, October 2018-January 2019



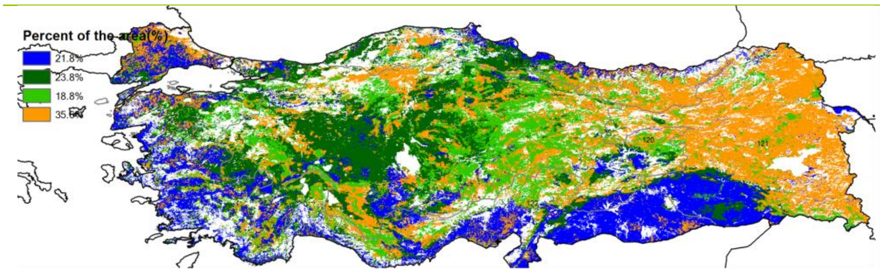
(a). Phenology of major crops

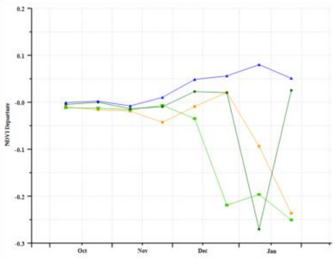




(b) Crop condition development graph based on NDVI

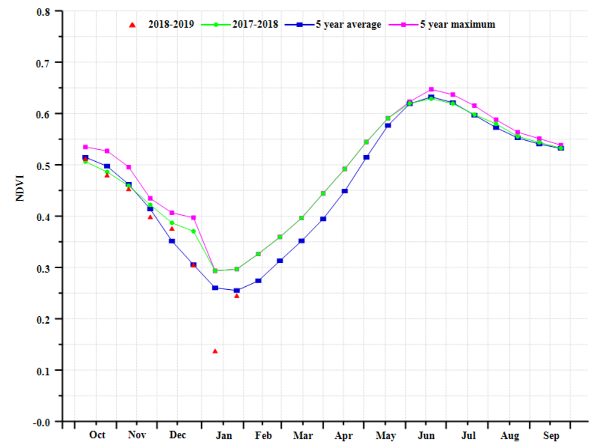
(c) Maximum VCI

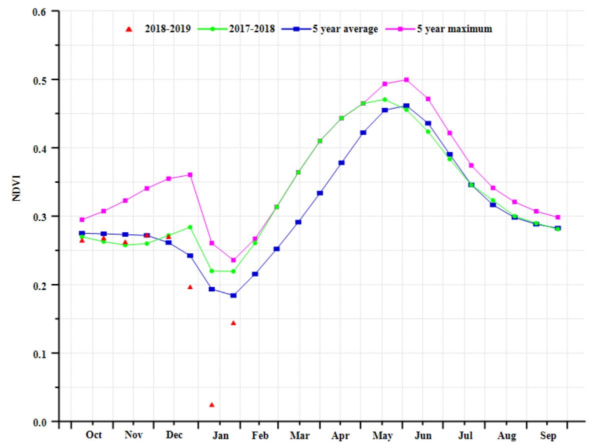




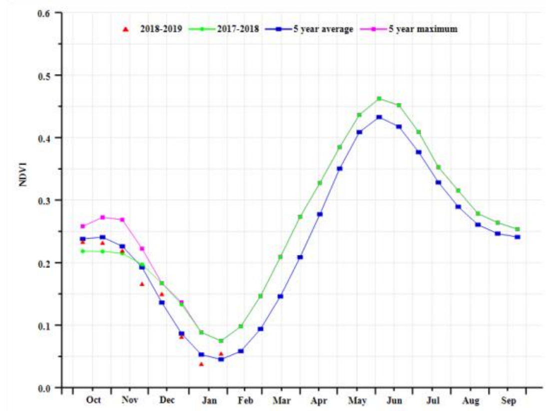
(d) Spatial NDVI patterns compared to 5YA

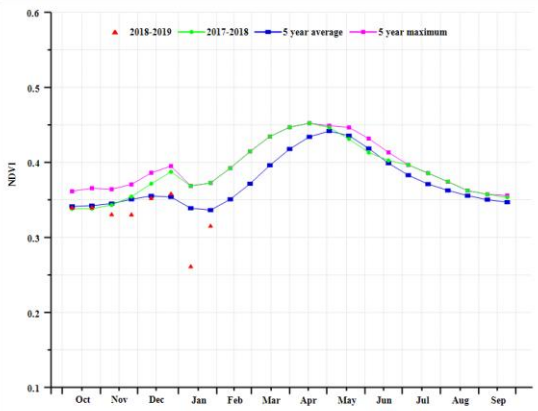
(e) NDVI profiles





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





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

Table 3.69. Turkey's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, October 2018-January 2019

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m^2)	Departure from 15YA (%)
Black Sea region	486	32	7.0	1.1	470	-1
Central Anatolia region	368	17	5.0	0.9	556	-4
Eastern Anatolia region	380	31	2.8	1.8	545	-11
Marmara Agean Mediterranean lowland region	475	29	9.0	0.3	525	-11

Table 3.70. Turkey's agronomic indicators by sub-national regions, current season's values and departure from 5YA, October 2018-January 2019

Region	BIOMSS		Cropped arable land fraction		Maximum VCI
	Current (gDM/m^2)	Departure from 5YA (%)	Current	Departure from 5YA (%)	Current
Black Sea region	1110	19	78	3	0.92
Central Anatolia region	988	15	18	4	0.80
Eastern Anatolia region	783	18	22	10	0.84
Marmara Agean Mediterranean lowland region	1156	18	65	19	0.93

[UKR] Ukraine

This monitoring period covers the harvest of maize from October to December and the early stages of winter wheat and rye which were planted between August and October.

At the national level, rainfall (RAIN 257 mm) and sunshine (RADPAR, 288 MJ/m2) were above average (+19% and +7% higher, respectively). Temperature (TEMP, -0.3℃) was close to the average. As a result of favorable weather, agronomic indicators show satisfactory crop development and condition: maximum vegetation condition index (VCIx) reached to 0.85, cropped arable land fraction (CALF) rose 13% above the 5YA to 72% (a low value!) and the contribution of the period to potential biomass reached 848 g DM/m2, +15% above the reference value.

However, national NDVI has been substantially lower than the 5-year average since mid-November, falling to 0.05 in December and January. As shown in the spatial crop condition development map and curves, NDVI varied widely across the country,, reaching low values almost everywhere except in 7.4% of arable lands in mid-southern and western areas, which stayed above the average during late December and mid-January. Maximum VCI reached at least values in the range from 0.5 to 0.8, with few areas below 0.5.

Regional analysis

Based on cropping system, climatic zones and topographic conditions, regional analyses are provided below for four agro-ecological zones (AEZ), including the Central wheat area, Northern wheat area, Eastern Carpathian hills, and Southern wheat and maize area.

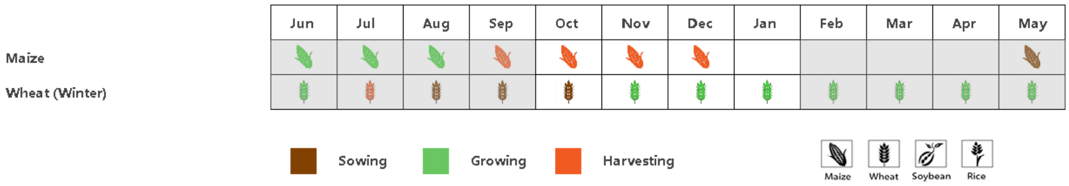
The **Central wheat area** (Poltava,Cherkasy, Dnipropetrovsk and Kirovohrad Oblasts) recorded sufficient rainfall (RAIN 275 mm, +29% compared with average) and radiation (RADPAR, 292 MJ/m2, +11%), but lower temperature (TEMP 1.1 ℃, -0.6℃). The resulting biomass production potential would be up 9% higher than 5-year average (BIOMSS 811 gDM/m2). Agronomic indicators showed a good VCIx (0.84) and moderate CALF (66%). With NDVI consistently lower than the 5-year average, crop prospects are currently unclear and need close monitoring when vegetative growth resumes.

In comparison with average, the **Northern wheat area** (Rivne, Zhytomyr and Kiev oblasts) received 6% lower rainfall,-0.2℃ lower temperature and 11% higher radiation. Generally stable agroclimatic conditions lead to an increase in expected biomass production (BIOMSS +7%). Agronomic indicators showed satisfactory CALF (85%) and VCIx (0.86), indicating satisfactory winter wheat development and condition.

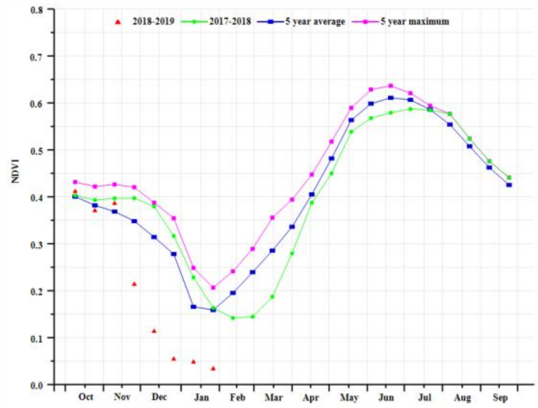
The **Eastern Carpathian hills** (Lviv, Zakarpattia and Ivano-Frankivsk oblasts) experienced abundant rainfall (+15% compared to average), normal temperature (+0℃) and radiation (+2%). Winter weather based biomass projection is 12% higher than average. Agronomic indicators show high CALF (95%) and VCIx (0.9), indicating good crop prospects.

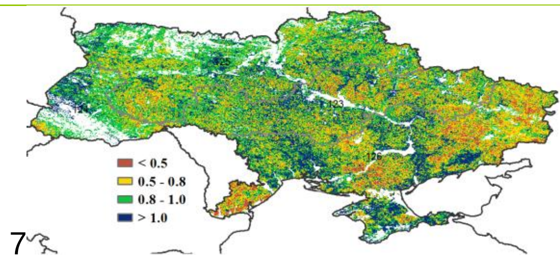
The **Southern wheat and maize area** (Mykolaiv, Kherson and Zaporizhia oblasts) received unusually high rainfall (+48%), while temperature (-0.4℃) and radiation (+4%) were closed to average. As a result of plentiful rainfall, potential biomass was simulated to be 26% higher than 5YA values. A significant increase in CALF (+27%) and relatively high VCIx (0.8) put crop prospects at fair to good.

Figure 3.40. Ukraine's crop condition, October 2018- January 2019



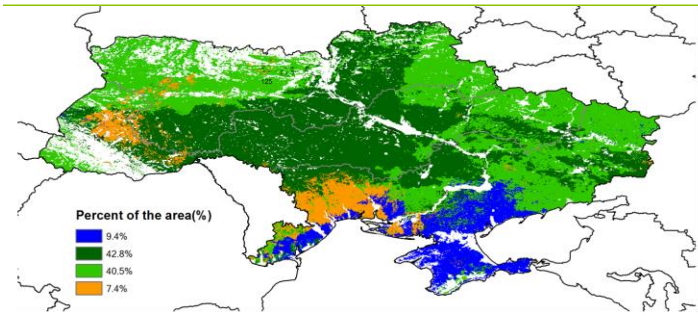
(a). Phenology of major crops

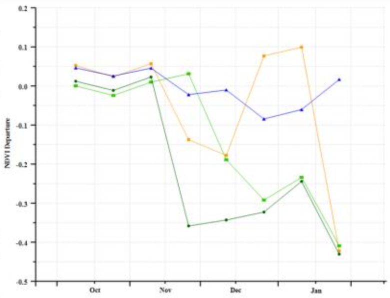




(b) Crop condition development graph based on NDVI

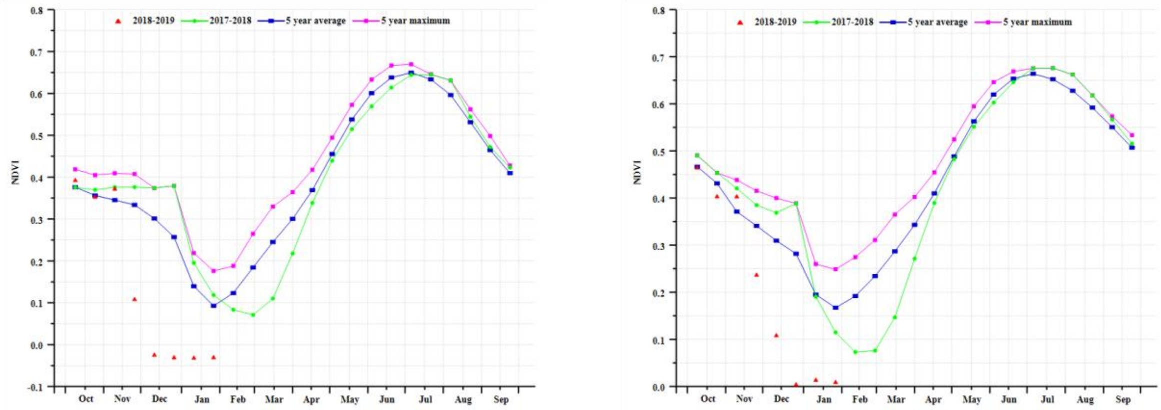
(c) Maximum VCI



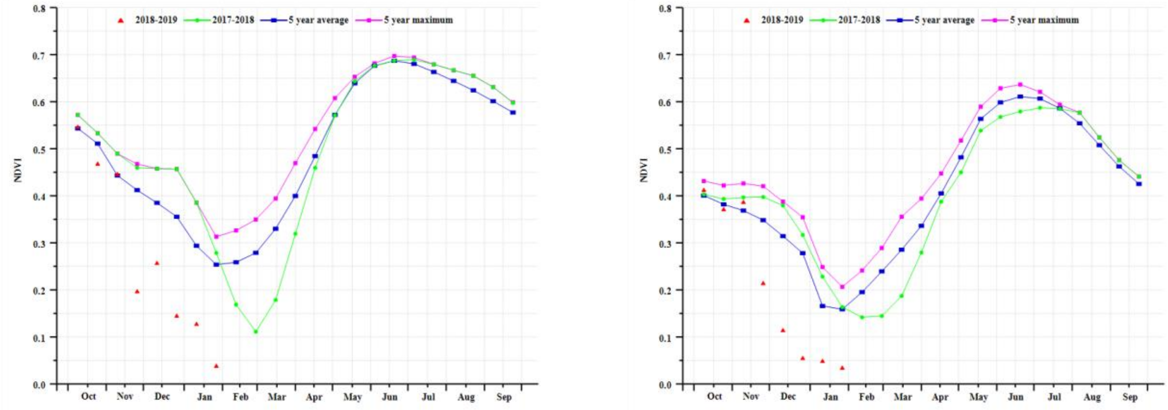


(d) Spatial NDVI patterns compared to 5YA

(e) NDVI profiles



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



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

Table 3.71. Ukraine's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, October 2018- January 2019.

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m^2)	Departure from 15YA (%)
Central wheat area (Ukraine)	275	29	1.1	-0.6	292	11
Northern wheat area (Ukraine)	231	-6	1.3	-0.2	252	11
Eastern Carpathian hills (Ukraine)	280	15	1.8	0.0	300	2
Southern wheat and maize area (Ukraine)	269	48	2.4	-0.4	319	4

Table 3.72. Ukraine's agronomic indicators by sub-national regions, current season's values and departure from 5YA, October 2018- January 2019.

Region	BIOMSS		Cropped arable land fraction		Maximum VCI
	Current (gDM/m^2)	Departure from 5YA (%)	Current	Departure from 5YA (%)	Current
Cebntral wheat area (Ukraine)	811	9	66	19	0.84
Northern wheat area (Ukraine)	824	7	85	3	0.86
Eastern Carpathian hills (Ukraine)	848	12	95	-2	0.90
Southern wheat and maize area (Ukraine)	884	26	58	27	0.81

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

[USA] United States

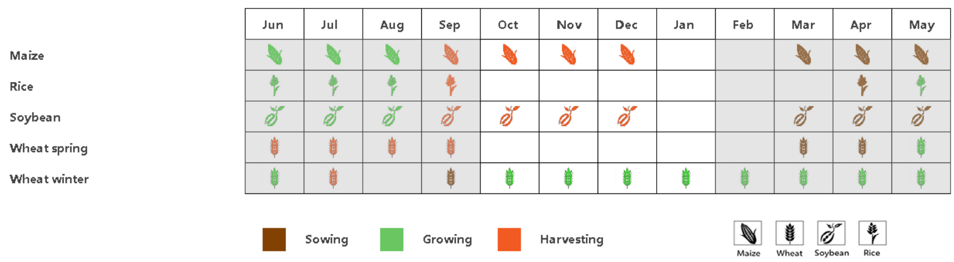
All 2018 crops have now been harvested, up to December for Maize and Soybean. Winter wheat was sown just before the reporting period and is currently mostly dormant.

As a whole, the United States were dominated by "cold and humid" weather: rainfall was above average by 40%, temperature was below by -0.5℃, and sunshine was significantly below seasonal reference values (-7%) due to abundant cloudiness. In most States that recorded abundant precipitation (e.g. Oregon) the accumulated soil moisture will create good initialconditions for the forthcoming summer crops.

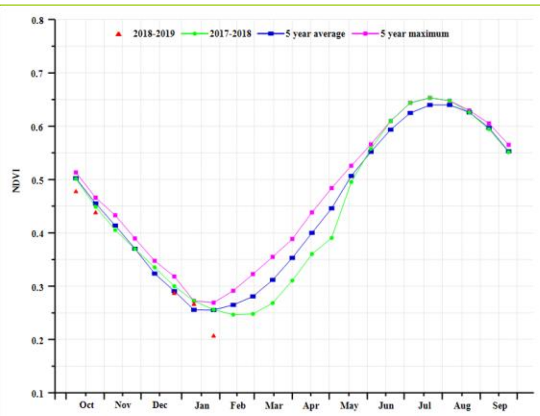
Cold and humid weather prevailed in the Southern Plains, which are the major winter wheat zone in the United States. Precipitation excesses reached 66% in Texas, 51% in Oklahoma, 71% in Kansas and 20% in Nebraska. In those States, temperature and sunshine anomalies (in brackets) reached -1.1℃ (-11%), -1.3℃ (-12%), -1.3℃ (-12%), and -0.6℃ (-6%), respectively. Conditions were more favorable in wheat producers of the North-west: in Washington State, for instance, RAIN and TEMP were slightly above average (+4% and 0.8℃, respectively) but sunshine was more significantly above expected values (RADPAR +8%.)

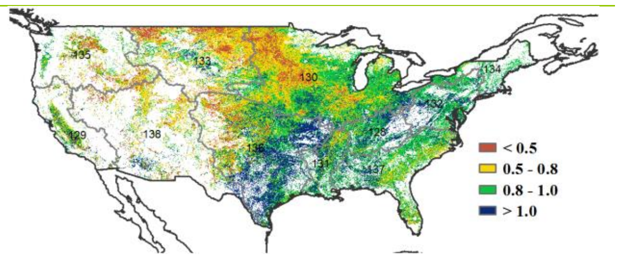
According to NDVI profiles and maximum VCI (0.84 on average), crop growth and development was close to average in the Southern Great Plains and the North-west region. It is worth noting, however, that the fraction of cropped land was down 6% below the average of the recent five years, which was brought about by unfavorable weather; further observations will be required. The maximum VCI map shows above average crop condition (VCIx > 1) in Texas while average or below average crops (VCIx<0.5) occur in Oklahoma, Kansas and Washington. According the NDVI profiles, unsatisfactory crops are more common in Nebraska than in the other four States mentioned. Globally, winter wheat condition is assessed as satisfactory.

Figure 3.41. United States's crop condition, October 2018 -January 2019



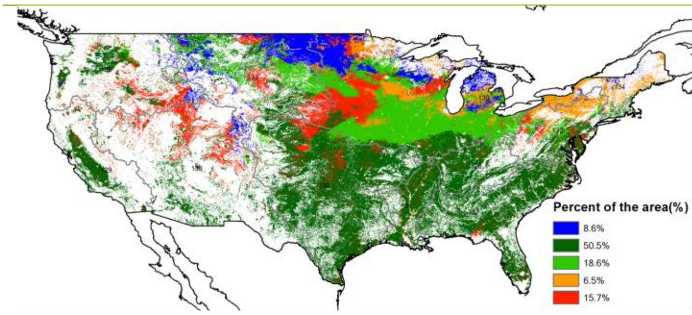
(a). Phenology of major crops



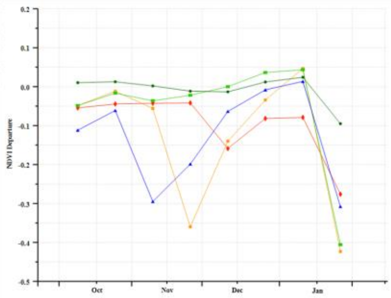


(b) Crop condition development graph based on NDVI

(c) Maximum VCI



(d) Spatial NDVI patterns compared to 5YA



(e) NDVI profiles

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

[UZB] Uzbekistan

The monitoring period covers the sowing, early growth and dormancy of winter wheat.Crop condition was generally unfavorable. The national average VCIx was 0.82, a fair value, but the cropped arable land fraction decreased by 30%. TEMP was above average (by 0.5°C) while RAIN and RADPAR dropped below (-12% and -5%, respectively). The combination of factors resulted in average biomass accumulation potential (BIOMSS +1%) compared to the recent five-year average. As shown by the NDVI development graph, crop condition was below five year average in October and close to the average in November. However NDVI was above average from December to January. For 74.3% of the agriculture areas spatial NDVI clusters and profiles show an above average situation from December to early January. This includes mainly parts of the Guliston, Jizzakh, Qarshi, Kasan, Mubarek, Qunghirot, Altynkul, Samarqand, Termez, Denau and Chimbay provinces. The eastern four provinces (Quqon, Farghona, Namagan and Andijon) has the lowest NDVI.

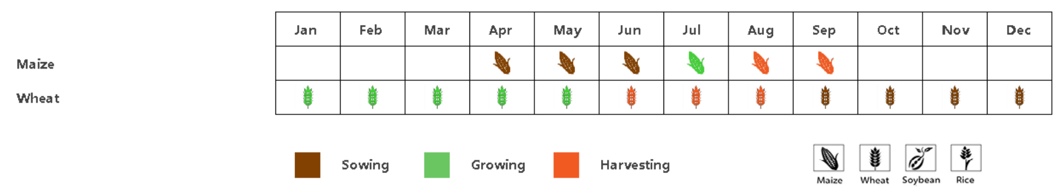
Regional analysis

For the regional analysis, additional detail is provided for two major agro-ecological zones in the country, referred to as the Eastern hilly cereals zone and the Aral Sea cotton zone.

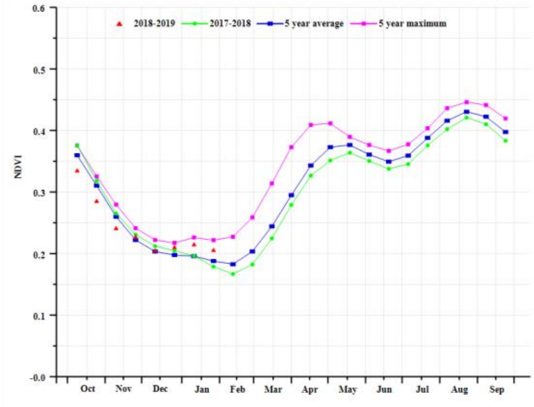
In the Eastern hilly cereals zone, NDVI was below the five-year average from October to November. The RAIN and RADPAR were below average (-13% and -6%) and TEMP was above (+0.5°C). The combination of the factors resulted in high BIOMSS (+3%) compared to the five-year average. The maximum VCI index was 0.83. The cropped arable land fraction decreased by 26%. Overall crop prospects are unfavorable.

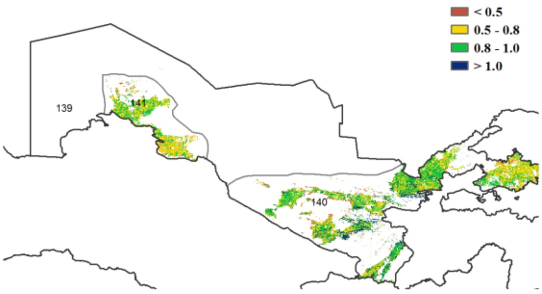
The Aral Sea cotton zone, experienced crop condition below the five years average from October to November and above the average from November to late January. Accumulated rainfall and radiation were below average during the monitoring period (RAIN -2% and RADPAR -3%), temperature was above average (TEMP +0.7°C). The BIOMSS index decreased by 5% compared to the five-year average. The maximum VCI index was 0.76, while the cropped arable land decreased by 82%. Overall crop prospects are unfavorable.

Figure 3.42. Uzbekistan's crop condition, October 2018-January0 2019

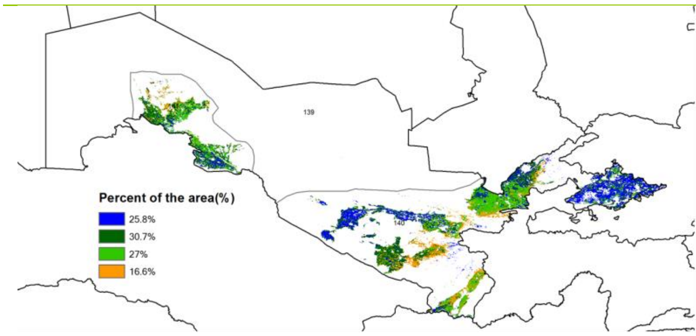


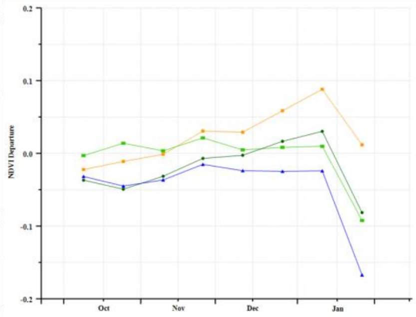
(a). Phenology of major crops



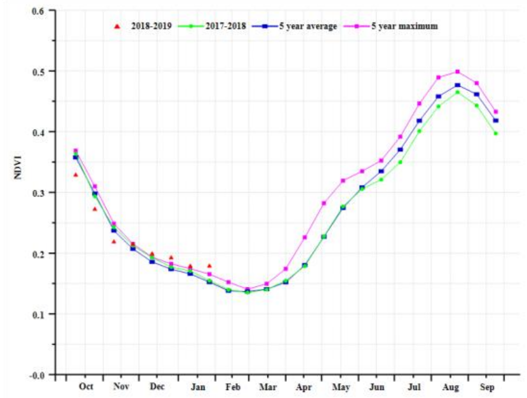


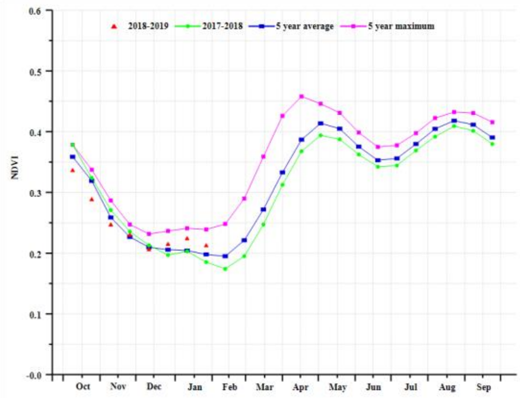
(b) Crop condition development graph based on NDVI (c) Maximum VCI



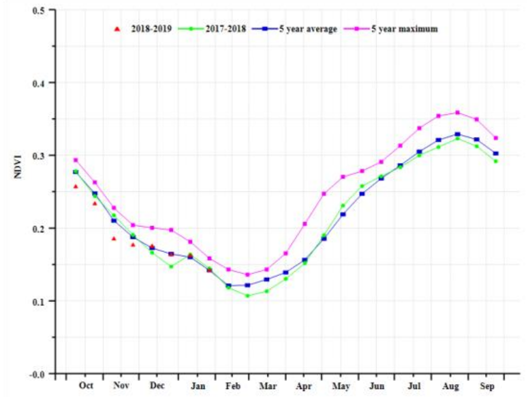


(d) Spatial NDVI patterns compared to 5YA (e) NDVI profiles





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



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

Table 3.73. Uzbekistan's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, October 2018-January0 2019

Region	RAIN	TEMP	RADPAR

	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m^2)	Departure from 15YA (%)
Aral Sea cotton zone	212	-2	3.0	0.7	525	-3
Eastern hilly cereals zone	195	-13	5.3	0.5	584	-6
Central region with sparse crops	263	-5	3.5	0.7	537	-1

Table 3.74. Uzbekistan's agronomic indicators by sub-national regions, current season's values and departure from 5YA, October 2018-January0 2019

Region	BIOMSS		Cropped arable land fraction		Maximum VCI
	Current (gDM/m^2)	Departure from 5YA (%)	Current	Departure from 5YA (%)	Current
Aral Sea cotton zone	560	-5	1	-82	0.76
Eastern hilly cereals zone	621	3	15	-26	0.83
Central region with sparse crops	455	-19	0	-100	0.73

[VNM] Vietnam

The monitoring period covers the growth of the 10th month rice, as well as the sowing of winter and spring rice. Most of the rice cultivation regions are distributed over the northern Red River delta and the Mekong Delta in the south. Overall, crop condition exceeds the 5YA reference in 34.2% of arable lands (mainly in the south of the country) where VCIx values above 0.8 confirm the favorable situation. Unfavorable crops occur in about 39.7% of crop areas (mainly in the north of the country) after November. CropWatch indicators show that sunshine (RADPAR+4%), CALF (0.95), temperature (+0.5°C), BIOMSS (+23%) and VCIx (0.96) were above their respective reference averages (15YA and 5YA). Only precipitation was below the average (-8%). Overall crop condition in the country is unsatisfactory.

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 recorded abundant rainfall (RAIN +39%), about average RADPAR (-4%) and average TEMP (+0.4°C). With high CALF (99%) and VCIx (0.93), the BIOMSS significantly increased (56%) compared to the average (5YA). The NDVI development graph has values above the 5YA only in November, after which the values decreased. Based on the agro-climatic indicators and NDVI development graph, below average output is likely.

The situation and expected impact on crop production in the Central coastal areas is conditioned by low rainfall and average temperature (RAIN -40%, TEMP +0.7°C). Sunshine was abundant (RADPAR +13%). BIOMSS is up just 3% but VCIx (0.98) and CALF (+3%) describe fair to good condition. The crop condition development graph based on NDVI is erratic behavior and its interpretation is inconclusive. According to agro-climatic indicators, below average output is likely for rain-fed crops. Irrigated crops should be doing fine.

The fraction of cropped arable land (CALF) in the Southern zone for the reporting period is similar to the five-year average (+2%). Vegetation condition indices (maximum VCI) are quite favorable (0.95), accompanied by an increase in BIOMSS (+20%) resulting from average rainfall (RAIN, +2%) along with an increase in radiation (RADPAR, +6%) and average temperature (TEMP, +0.4°C). The crop condition development graph of NDVI indicates values that are about the average of 5 years. CropWatch expects good production in the area.

Over 80% of the croplands show average or below average crop condition. Overall, with the mentioned caveats, crop prospects are expect to be just fair.

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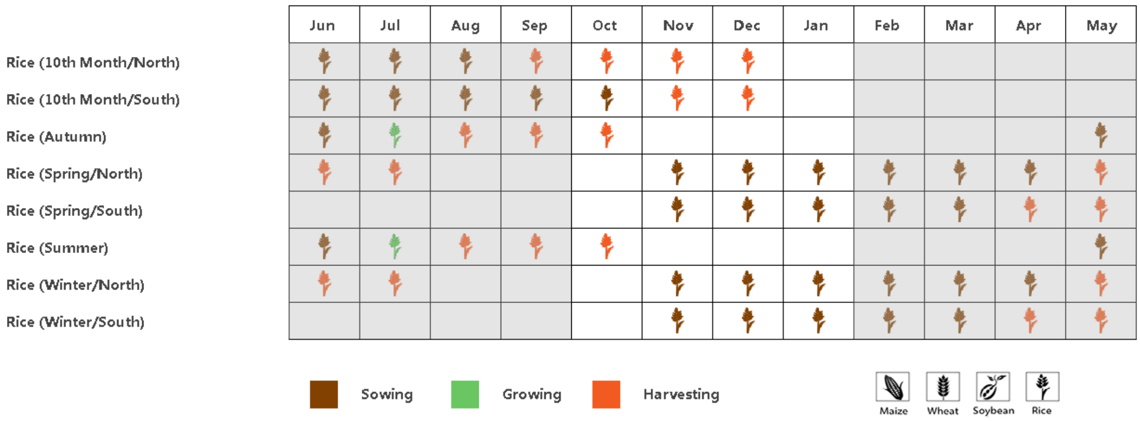
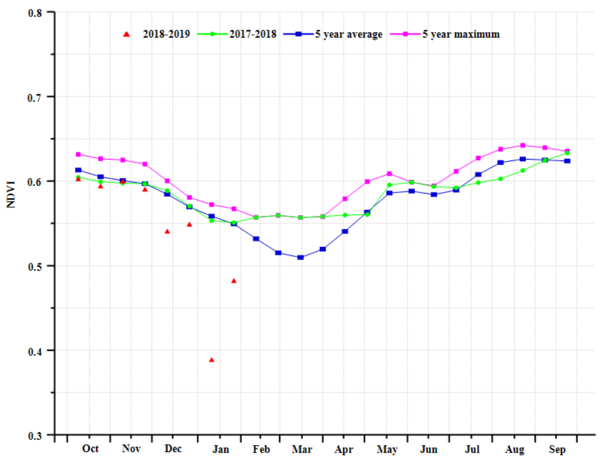
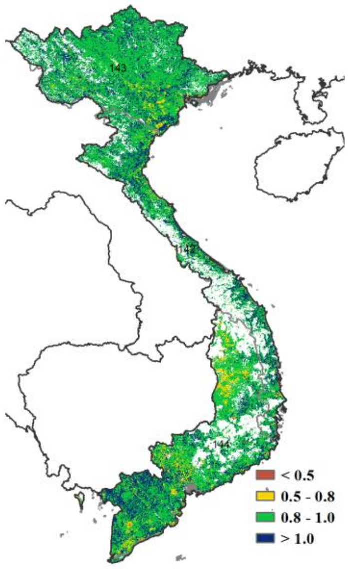
Figure 3.43. Vietnam's crop condition, October 2018 - January 2019



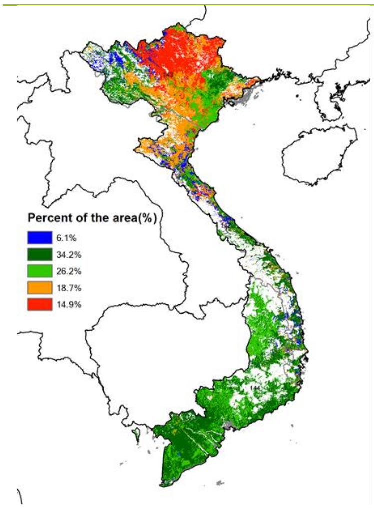
(a). Phenology of major crops

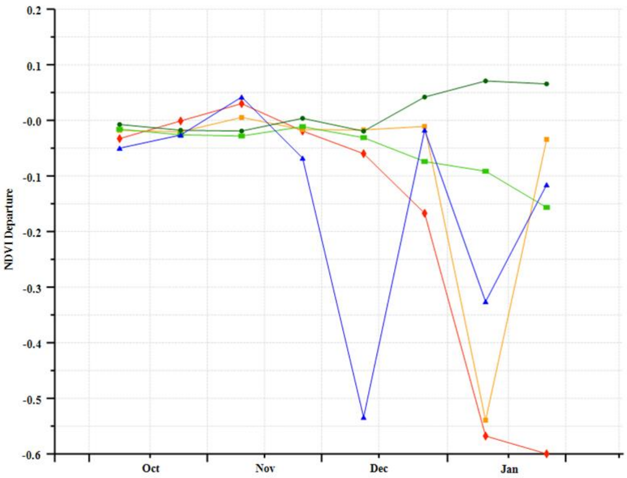




(b) Crop condition development graph based on NDVI

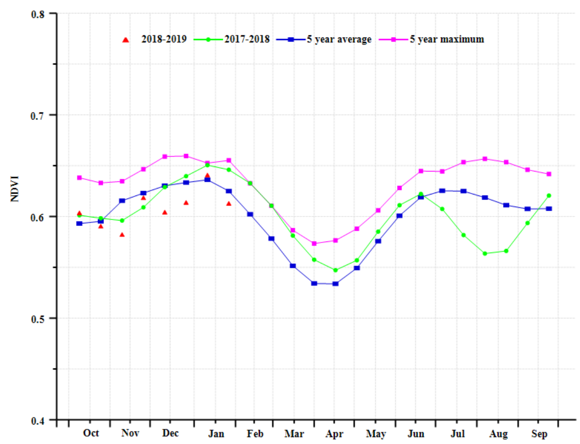
(c) Maximum VCI

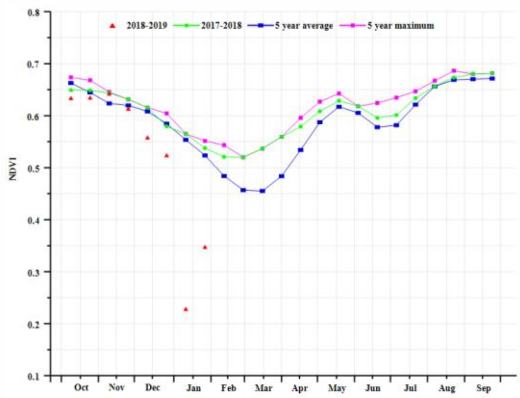




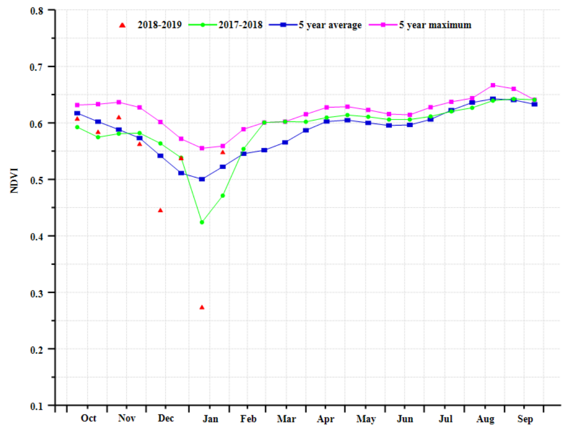
(d) Spatial NDVI patterns compared to 5YA

(e) NDVI profiles





(f) Crop condition development graph based on NDVI(Northern zone), and (Central coastal areas).



(g) Crop condition development graph based on NDVI(Southern zone).

Table 3.75. Vietnam's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, October 2018-January0 2019

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m²)	Departure from 15YA (%)
North_Vietnam	256	39	18.8	0.4	680	-4
Central_Vietnam	384	-40	23.6	0.7	766	13
South_Vietnam	582	2	25.5	0.4	1087	6

Table 3.76. Vietnam's agronomic indicators by sub-national regions, current season's values and departure from 5YA, October 2018-January0 2019

Region	BIOMSS		Cropped arable land fraction		Maximum VCI
	Current (gDM/m²)	Departure from 5YA (%)	Current	Departure from 5YA (%)	Current
North_Vietnam	804	56	99	1	0.96
Central_Vietnam	986	3	97	3	0.98
South_Vietnam	1386	20	96	2	0.95

[ZAF] South Africa

During the monitoring period, winter wheat was harvested and in the summer rainfall areas of the Center and East soybean and especially maize are currently growing and have reached mid-season stages (flowering). Precipitation (RAIN) was 15% below average, TEMP was average (+0.1°C) and sunshine, as estimated by RADPAR, was 8% above the average. Due to the rainfall deficit, the biomass accumulation potential (BIOMSS) fell 19% below the average. Overall, the VCIx value estimated for whole country was 0.62.

The nationwide NDVI-based crop development graph shows unfavorable conditions below the recent five years average at some stage of the season. Average condition characterizes about 21.6% of cropland, mostly in eastern coastal areas of Kwazulu-Natal and north-east Eastern Cape. VCIx is mostly high.

The most unfavorable NDVI values occur in south-western Eastern Cape (13.1% of arable land areas).

Gauteng and the northern province (35.9% of crop land) went through a period with low NDVI in December, but have since reached rather large positive departures up to 0.2 NDVI units. VCIx values tend to be above 0.8, which would indicate favorable crops.

Constantly deteriorating NDVI affects the central Free State and central North-west province. This is also the area where VCIx is lowest, confirming unfavorable crop condition.

Regional analysis

CropWatch adopts four agro-ecological zones (AEZs) relevant for crop production in South-Africa: The Humid Cape Fold mountains, the Dry Highveld and Bushveld maize areas, the Mediterranean zones and the Arid and desert zones.

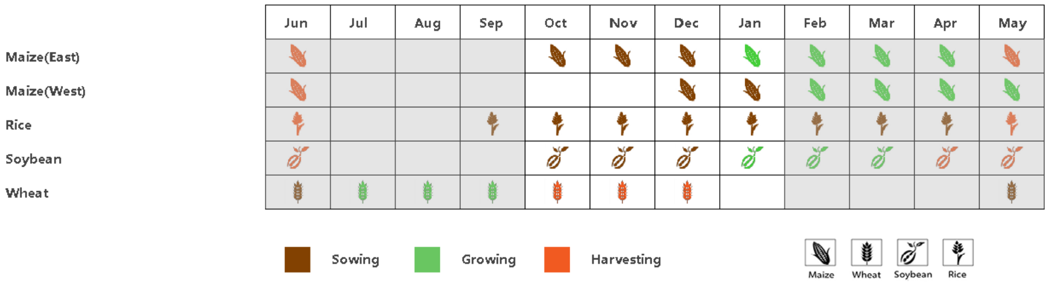
In the Humid Cape Fold mountains, the average rainfall (RAIN) was 363 mm, 7% below the average, while RADPAR was 7% above the average and BIOMSS 12% below. The NDVI-based crop conditions graph show values that are below the 5 years average from October. The VCI value for the whole zone was the highest among the other zones at 0.69. As mentioned above, this covers satisfactory crops in the northern areas of the AEZ.

In the Mediterranean zone, where the agricultural season is now over, the average rainfall (RAIN) was just 37 mm, 56% below the average, leading to a 51% reduction in estimated BIOMSS compared to the average. The TEMP was 18.9°C, 0.2°C above the average, and the estimated RADPAR was 3% above the average. Although the NDVI-based crop conditions graph shows that the conditions were above or at the 5 years average conditions during the reporting period, the maximum VCI for whole zone was low (0.39). The CALF was 0.6, 3% below the average.

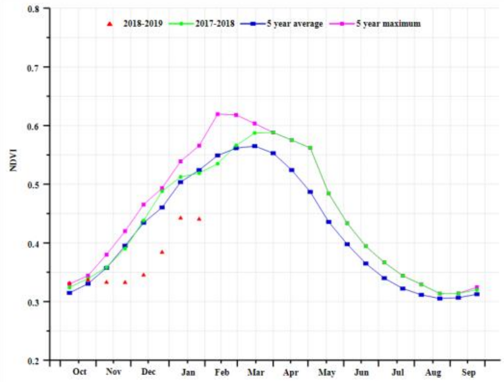
In Dry Highveld and Bushveld maize areas, the rainfall (RAIN) was 352mm, 15% below the average, and the TEMP was 21.3°C, 0.1°C above the average. The estimated RADPAR was 9% above the average, while the BIOMSS was 17% below the average. The CALF was only 0.57, 4% below the average. The maximum VCI was 0.64. The NDVI-based crop conditions graph show is crop condition above 5-year average from November. As mentioned above crops in the northern part are in better shape than in the East.

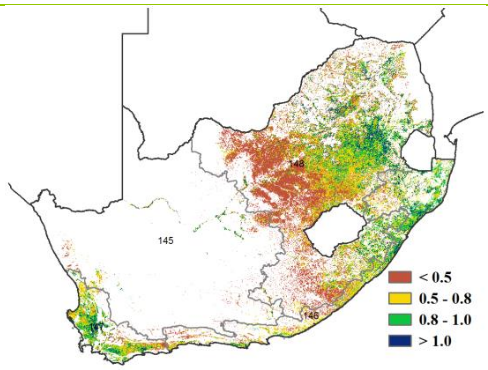
Mostly unfavorable climatic conditions dominated the Arid and desert zones over the reporting period. Rainfall was 58% below average (71 mm over four months). The dry conditions have hampered crop growth, indicated also by a BIOMSS indicator 56% below average for the period. The region is, however, of marginal agricultural importance.

Figure 3.44. South Africa's crop condition, October 2018 - January 2019



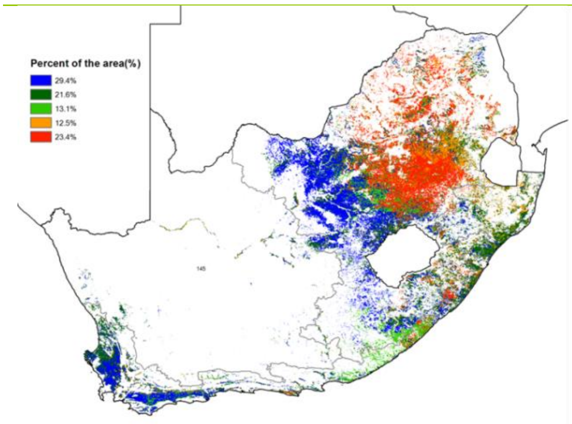
(a). Phenology of major crops

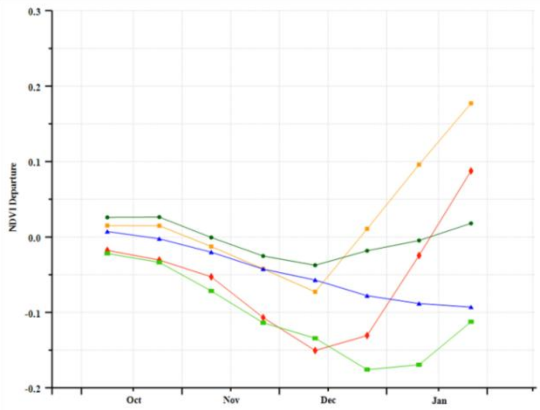




(b) Crop condition development graph based on NDVI

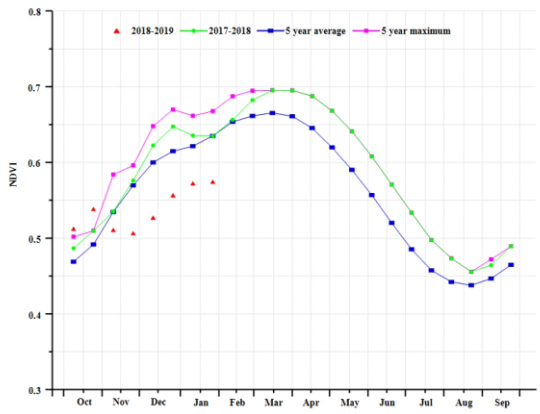
(c) Maximum VCI

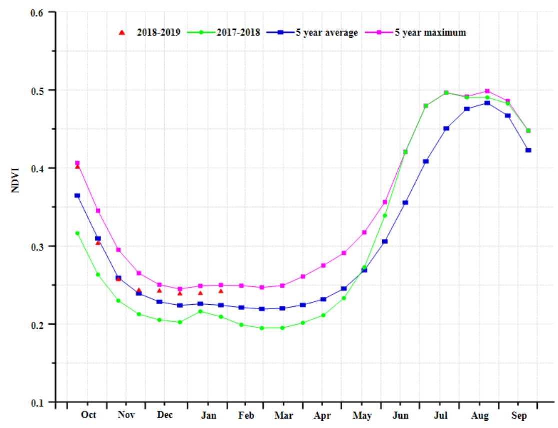




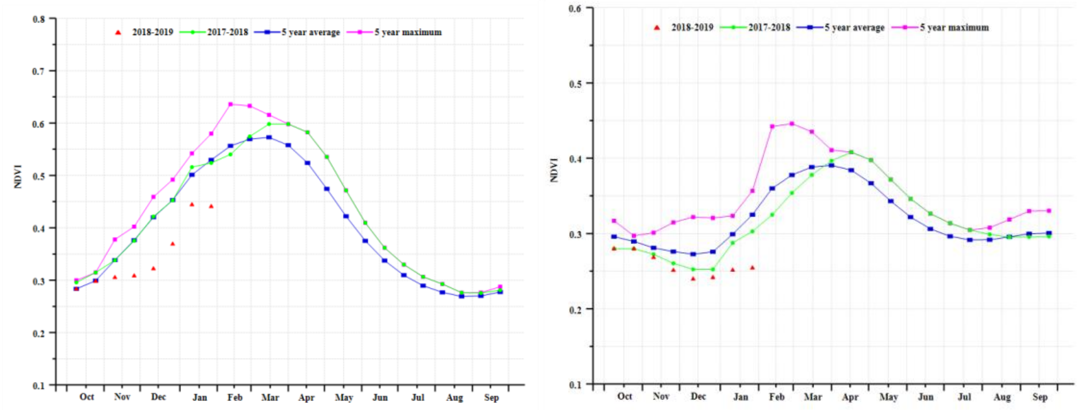
(d) Spatial NDVI patterns compared to 5YA

(e) NDVI profiles





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



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

Table 3.77. South Africa's agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, October 2018 - January 2019

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m^2)	Departure from 15YA (%)
Humid Cape Fold Mountains	363	-7	20.5	-0.4	1356	7
Mediterranean Zone	37	-56	18.9	0.2	1632	3
Dry Highveld and Bushveld	352	-15	21.3	0.1	1605	9
Arid and desert zones	71	-58	22.0	0.9	1744	7

Table 3.78. South Africa's agronomic indicators by sub-national regions, current season's values and departure from 5YA, October 2018 - January 2019

Region	BIOMSS		Cropped arable land fraction		Maximum VCI
	Current (gDM/m^2)	Departure from 5YA (%)	Current	Departure from 5YA (%)	Current
Humid Cape Fold Mountains	1037	-12	0.9	0	0.7
Mediterranean Zone	164	-51	0.6	3	0.4
Dry Highveld and Bushveld	1101	-17	0.6	-4	0.6
Arid and desert zones	269	-56	0.2	1	0.6

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

[ZMB] Zambia

The analyzed period coincides with the onset of the rainy season in the country. Based on the NDVI clusters, the general condition of crops was below average due to rainfall deficits during the establishment of the rainy season. The main cultivated areas had VCIx values between 0.5-1.0. In spite of reduced precipitation (14% below average) this represents much improved condition compared to the previous season where the whole country experienced a severe rainfall deficit leading to poor crop establishment. However, the CALF indicates a stable build up as the season progresses. A 25% below average value in CALF with a corresponding 15% reduction in Biomass were observed. The temperatures dropped slightly across the entire growing areas. RADPAR was average or slightly below average.

Regional analysis

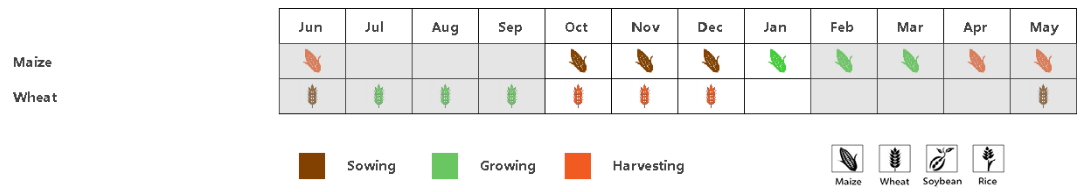
The analysis covers three agro-ecological zones (AEZs): Zone I (<800mm, 80 -120 days) constitutes about 10 percent of the country and covers Luangwa and Zambezi river valleys; Zone II (800 - 1000mm, 100 - 140 days) covers 48 percent of the country, and Zone III (>1000mm, 120 - 180 days) constituting about 42 percent of the total land area. The rainfall is brought by the Inter-tropical Convergence Zone (ITCZ) and is characterized by thunderstorms, occasionally severe, with much lightning and sometimes hail. Most of the agricultural activities occur in Zone II as this zone enjoys relatively good ecological conditions and services.

The reported period was the planting period for rain-fed crops (maize, tobacco, ground nuts, sunflower, soybeans, vegetables, sweet potatoes, cotton) as observed from the VCIx exceeding 0.5. The main cropping season has been generally below average, resulting from dry conditions especially in southern and western parts of the country, i.e. key cereal-producing areas.

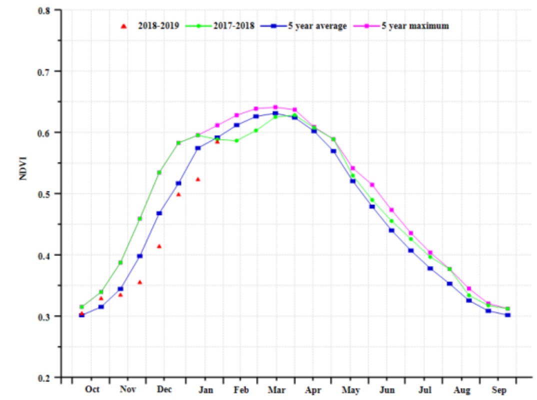
Zone II, the main maize producing area received 8% below average rainfall and 20% increment in RADPAR; NDVI clusters confirm the slightly below average crop conditions experienced in the zone.

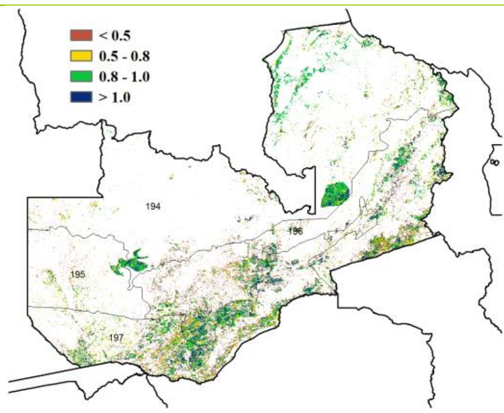
Overall, the crop condition in the main cropping areas is fairly average. Final yields may be affected by dry spells later in the season, most critically at the time of flowering.

Figure 3.45. Zambia's crop condition, July -October 2018



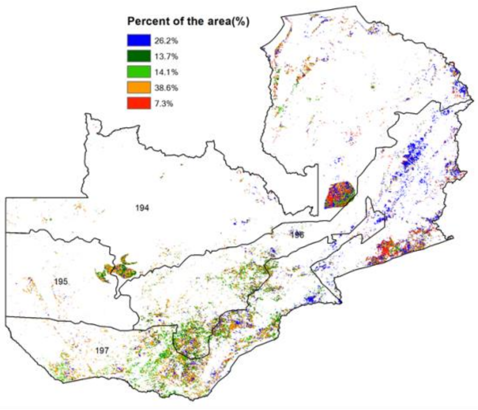
a). Phenology of major crops

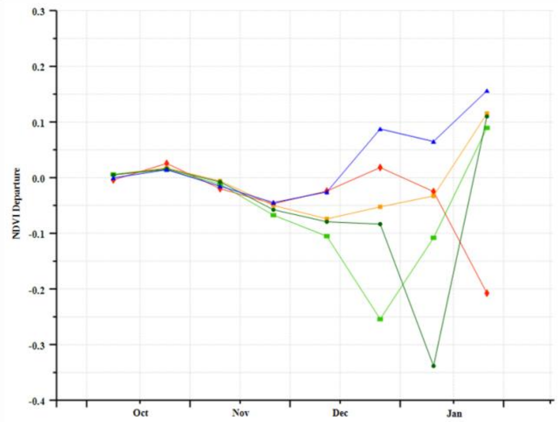




(b) Crop condition development graph based on NDVI

(c) Maximum VCI





(d) Spatial NDVI patterns compared to 5YA

(e) NDVI profiles

Chapter 4. China

After a brief overview of the agro-climatic and agronomic conditions in China over the reporting period (section 4.1), Chapter 4 describes the situation by region, focusing on the seven most productive agro-ecological zones (AEZs) of the east and south (4.2): North-east China, Inner Mongolia, Huanghuaihai, Loess region, Lower Yangtze, Southwest China, and Southern China. Additional information on the agro-climatic indicators for agriculturally important Chinese provinces are listed in table A.11 in Annex A.

4.1 Overview

Agro-climatic conditions were generally below average in China from October 2018 to January 2019, with rainfall and radiation deficits of 7% and 6%, respectively. Temperature was average at 6.8℃. Low rainfall and temperature resulted in a 1% drop of potential biomass. Due to the large diversity of climatic zones in China, weather conditions over different agro-ecological zones or different agriculturally important provinces differ much. Inner Mongolia, Loess region, North-east China and Southwest China suffered from water shortage, with 42%, 18%, 34% and 18% lower rainfall compared to average. Low rainfall will potentially hamper the sowing and early growth of crops after winter. Temperature in Inner Mongolia and North-east China were 0.7℃ and 2.4℃ above average. Below average RADPAR needs to be highlighted in several regions, especially in the Lower Yangtze (-15%), Southern China (-8%) and South-west China (-7%). Even if potential biomass is a synthetic indicator taking into account rainfall and temperature, patterns of biomass departures from average present same pattern of rainfall departures over all the AEZs.

Rainfall departure clustering and temperature departure clustering show detailed spatial and temporal patterns. Rainfall was generally below average across China during the monitoring period except for Yunnan and western Guizhou in early January and an ellipse-shaped areas from Guangxi to Southern Jiangsu in early December. Interestingly, temperature is globally below average in most of China above average in the provinces of the North-east which are the coldest in the country. This behavior exists across other Central Asian areas and is compatible with climate change projections; in other words: it is likely to persist in future seasons.

Other Provinces with large rainfall anomalies include Hebei (-45%), Ningxia (47%), Yunnan (50%) and Shandong (55%). The largest positive temperature anomalies (in excess of 1.0°C) were recorded in Inner Mongolia, Heilongjiang, Jilin and Liaoning. If the above average temperature continue into the next monitoring period (January to April), early snow melt and spring sowing dates are likely.

Table 4.1. CropWatch agroclimatic and agronomic indicators for China, October 2018 to January 2019, departure from 5YA and 15YA

Region	Agroclimatic indicators			Agronomic indicators		
	Departure from 15YA (2004-2018)			Departure from 5YA (2014-2018)		Current
	RAIN (%)	TEMP (°C)	RADPAR (%)	BIOMSS (%)	CALF (%)	Maximum VCI
Huanghuaihai	10	0.1	1	3	-1	0.87
Inner Mongolia	-42	0.7	3	-31	-3	0.83
Loess region	-18	-0.3	2	-18	-1	0.87
Lower Yangtze	1	-0.4	-15	11	-1	0.89
Northeast China	-34	2.4	4	-13	-8	0.85
Southern China	21	-0.2	-8	36	0	0.93
Soutwest China	-18	-0.5	-7	-7	0	0.93

Figure 4.1. China spatial distribution of rainfall profiles, October 2018 to January 2019

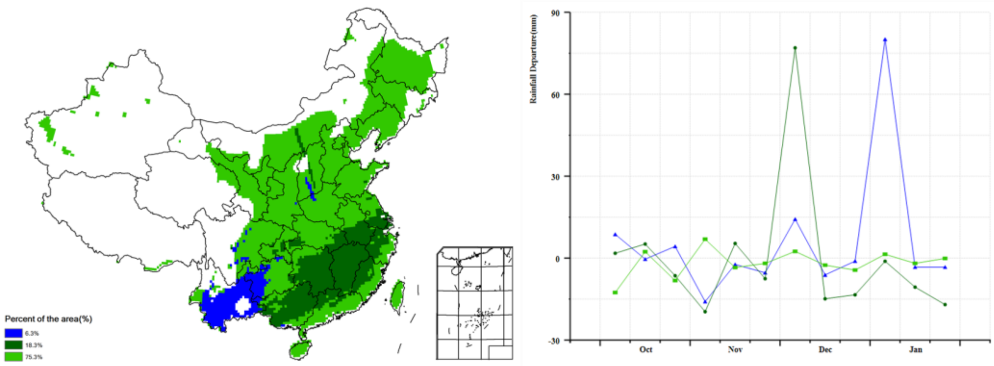


Figure 4.2. China spatial distribution of temperature profiles, October 2018 to January 2019

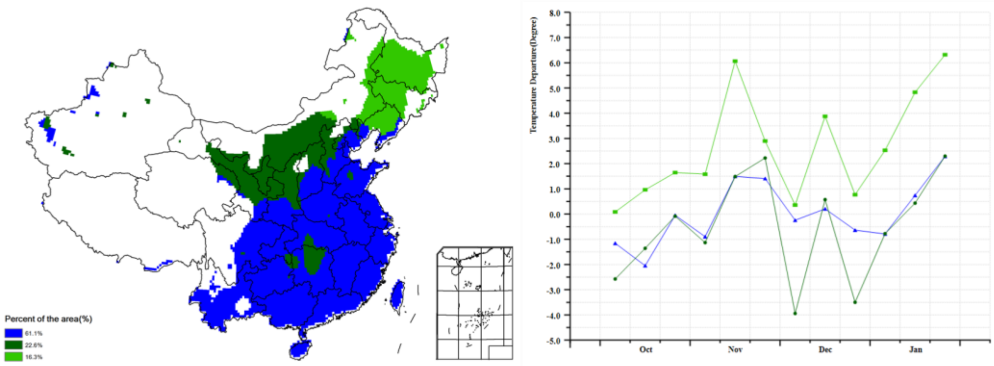


Figure 4.3. Cropped and uncropped arable land over winter crops producing provinces, by pixel, October 2018 to January 2019

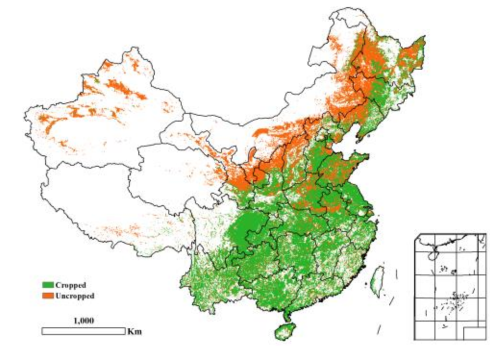
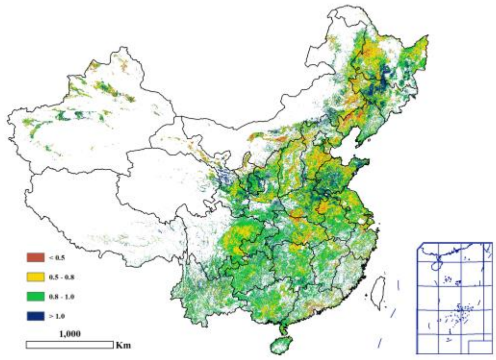


Figure 4.4. China maximum Vegetation Condition Index (VCIx), by pixel, October 2018 to January 2019



4.2 Regional analysis

Figures 4.5 through 4.11 present crop condition information for each of China's seven agricultural regions. The provided information is as follows: (a) Phenology of major crops; (b) Crop condition development graph based on NDVI, comparing the current season up to January 2019 to the previous season, to the five-year average (5YA), and to the five-year maximum; (c) Spatial NDVI patterns for October 2018 to January 2019 (compared to the (5YA)); (d) NDVI profiles associated with the spatial patterns under (c); (e) maximum VCI (over arable land mask); and (f) biomass for October 2018 to January 2019. Additional information about agroclimatic indicators and BIOMSS for China is provided in Annex A.

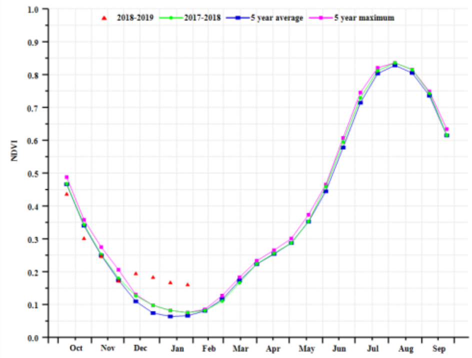
Northeast region

No crops are grown during the current monitoring season in Northeast China due to low temperatures, with nearly all farm land frozen or covered by snow (the average temperature was -5.7°C).

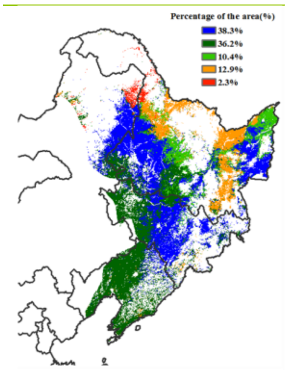
The region suffered a precipitation deficit of 34% (recorded RAIN reached 69 mm instead of 103 mm) but recorded significantly above average temperature (TEMP +2.4°C) and abundant sunshine (RADPAR +4%). A large area in the south of the region suffered a drop in BIOMSS exceeding 20% drop of biomass, directly resulting from the shortage of rainfall. In contrast, regions in northern Heilongjiang and north-east Inner Mongolia present positive BIOMSS departures larger than 20%.

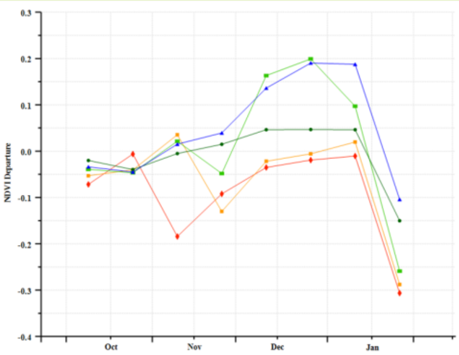
More than abnormal water conditions, it is the relatively warm weather that is likely to affect the forthcoming season through early planting.

Figure 4.5. Crop condition China Northeast region, October 2018 to January 2019

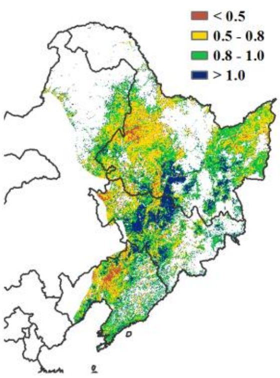


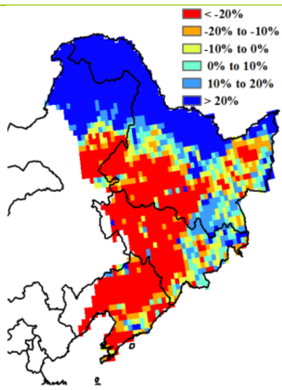
(a) Crop condition development graph based on NDVI





(b) Spatial NDVI patterns compared to 5YA (c) NDVI profiles





(d) Maximum VCI (e) Biomass

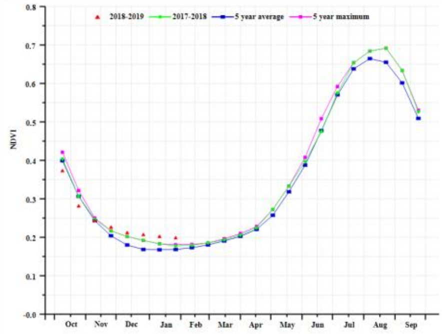
Inner Mongolia

No crops are in the field in Inner Mongolia from late of October to January due to low temperatures. However, weather conditions are relevant, in particular rainfall, as they control initial soil moisture available to spring sown crops. In October, below average conditions had little effect as the crops had reached maturity.

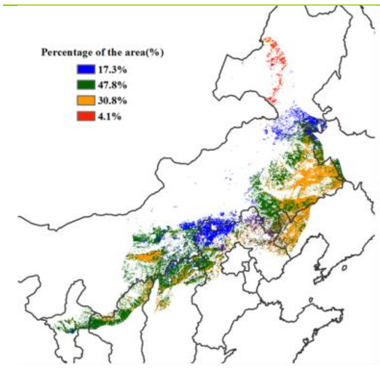
The reporting period recorded 47 mm of precipitation, which is 42% below the average of 82 mm. Although the deficit is large, it is not severe in terms of agricultural impacts, nor is the resulting drop in potential biomass accumulation (BIOMSS -31%.) Both sunshine and temperature were above average (RADPAR 3%, TEMP 0.7 °C.)

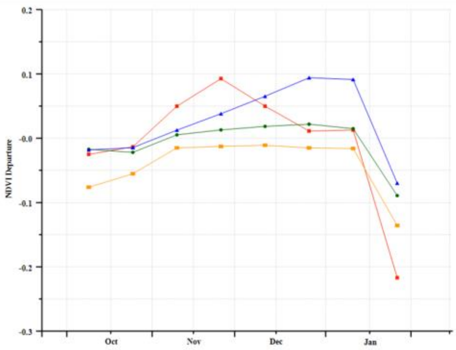
VCIx was below 0.5 in the west and southeast; the observation is consistent with the potential biomass distribution (values more than 10% below average). In general, however, less snow may not be able to provide adequate soil moisture for the land preparation and early growth of 2019 spring crops.

Figure 4.6. Crop condition China Inner Mongolia, October 2018 to January 2019



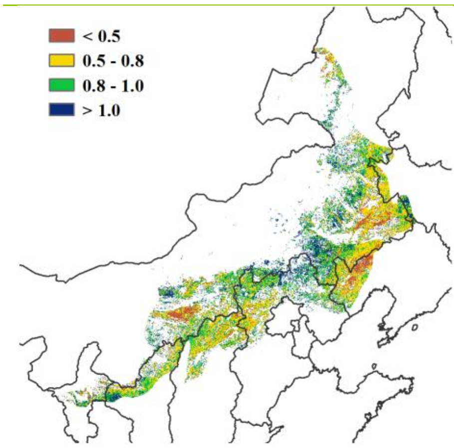
(a) Crop condition development graph based on NDVI

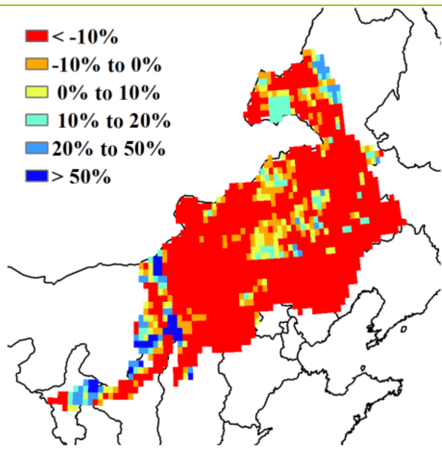




(b) Spatial NDVI patterns compared to 5YA

(c) NDVI profiles





(d) Maximum VCI

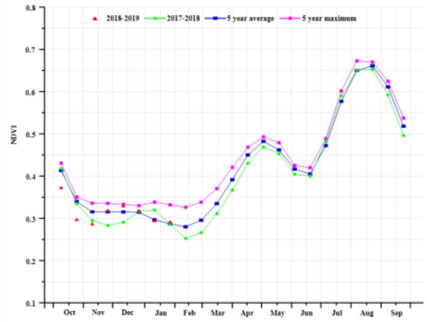
(e) Biomass

Huanghuaihai

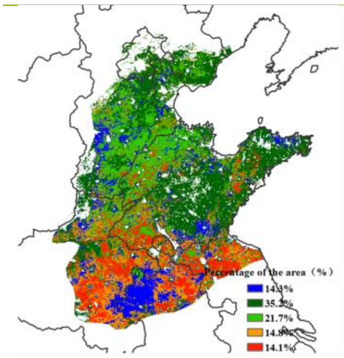
The monitoring period (October 2018 to January 2019) covers the sowing and early growth of winter wheat. Both precipitation and sunshine exceeded average values (RAIN +9%, RADPAR +10%) but temperature was just above (TEMP +0.1 „ƒ). The cropped arable land fraction (CALF) underwent a slight decline of 1% compared to 5-year average. Weather condition led to an increase of 4% of the biomass production potential and were conducive to satisfactory growth of winter wheat.

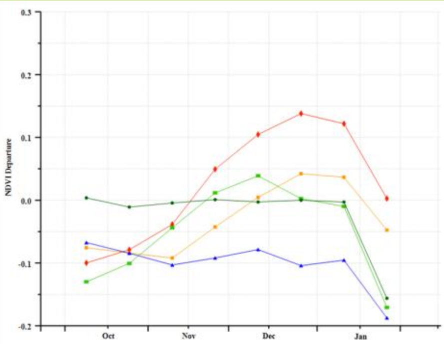
As shown by the NDVI development graph, crop condition was at 5-year average during the monitoring period except for early November. The spatial distribution of crop condition in Huanghuaihai was heterogeneous. During October and mid-November, the NDVI departure values over the region were nearly all negative except for Shandong peninsula and eastern Hebei. The crop condition turned to good in December and the NDVI departure were positive except for a few areas in northwest Anhui. From early January, NDVI of the whole area began to decline, showing poor crop condition in northern Huanghuaihai, including Heibei, Shandong and northwest Anhui. The pattern is confirmed by the maps of maximum VCI and biomass departure. The maximum VCI value for Huanghuaihai is 0.87, which is a fair value that leaves all scenarios open for the final outcome of winter wheat.

Figure 4.7. Crop condition China Huanghuaihai, October 2018 to January 2019



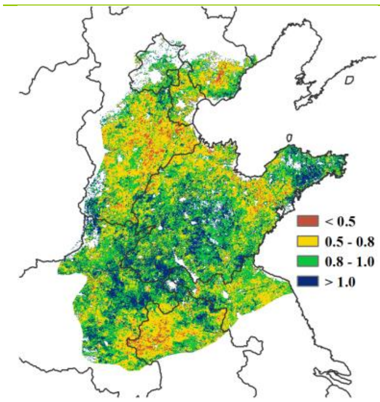
(a) Crop condition development graph based on NDVI

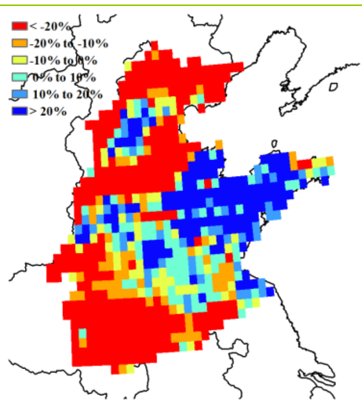




(b) Spatial NDVI patterns compared to 5YA

(c) NDVI profiles





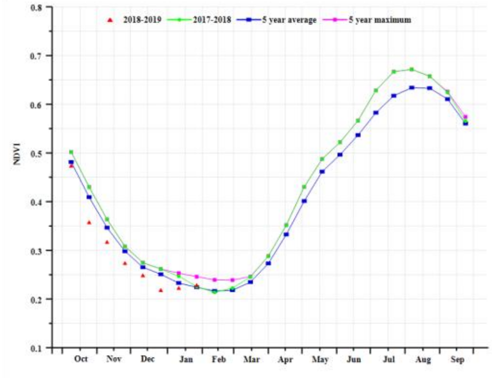
(d) Maximum VCI

(e) Biomass

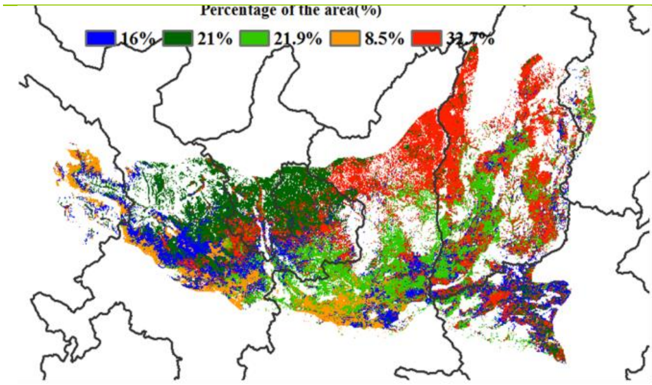
Loess region

The most relevant crop during the monitoring period was the currently hibernating Winter wheat. Crop condition was generally inferior to last year' s and the five year average except for late January. Precipitation (RAIN -18%) was below average, and so was temperature (TEMP -0.3 °C); radiation (RADPAR +2%) was slightly above average. The unfavorable agro-climatic condition resulted in below average potential biomass (BIOMSS, -18%). In most of the region, the analyses based on spatial NDVI clusters and profiles are consistent with VCIx: the most favorable conditions prevail in the center and east of Gansu province, and some parts in southern Ningxia and north-central Shaanxi, due to the relatively abundant rainfall. The cropped arable land fraction (CALF) decreased by 1% compared with recent years, which shows somewhat unfavorable crop prospect in the region.

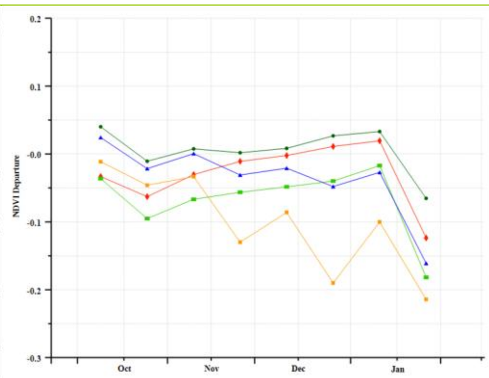
Figure 4.8. Crop condition China Loess region, October 2018 to January 2019



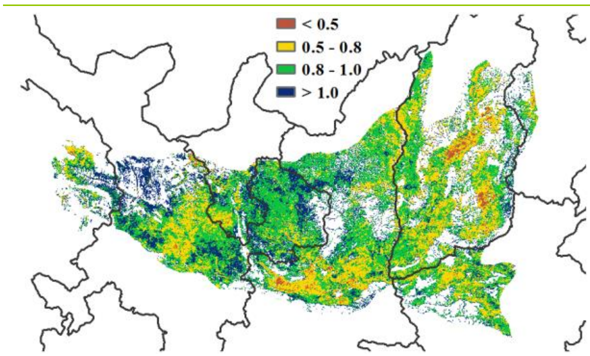
(a) Crop condition development graph based on NDVI



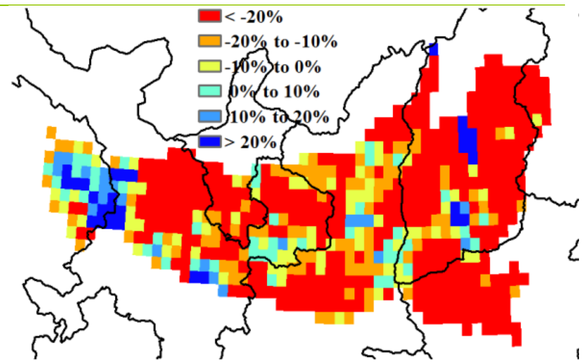
(b) Spatial NDVI patterns compared to 5YA



(c) NDVI profiles



(d) Maximum VCI



(e) Biomass

Lower Yangtze region

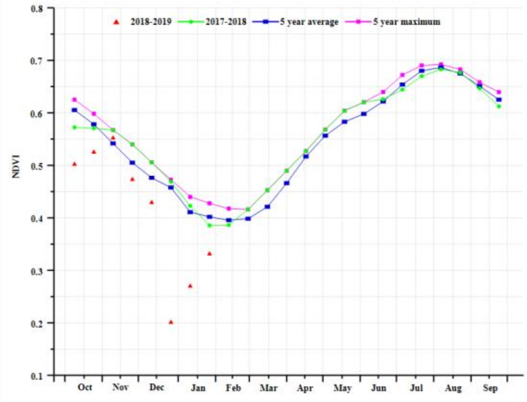
Only winter crops were present in the field during the monitoring period, essentially in the north of the region, including parts in Henan, Anhui and Jiangsu Provinces.

According to the CropWatch agro-climatic indicators, temperature was slightly cooler than average (TEMP -0.4℃) and precipitation was just average (RAIN, +1%); sunshine, however, was significantly below average (RADPAR -15%).

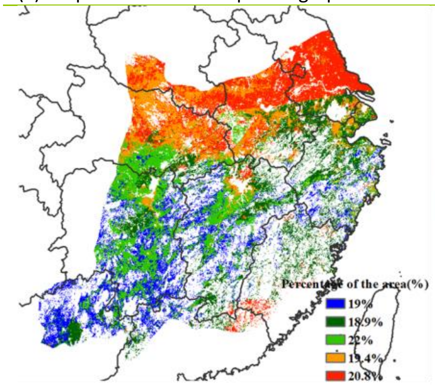
As shown in the NDVI development graph, crop condition was close to average before December when abnormally low values were probably brought about by snow. Although the biomass production potential increased 11% compared with the 5-year average, most of the northern wheat region of the AEZ suffered a significant decrease of BIOMSS (more than 20%) except in the East of Jiangsu and the West of Anhui Provinces.

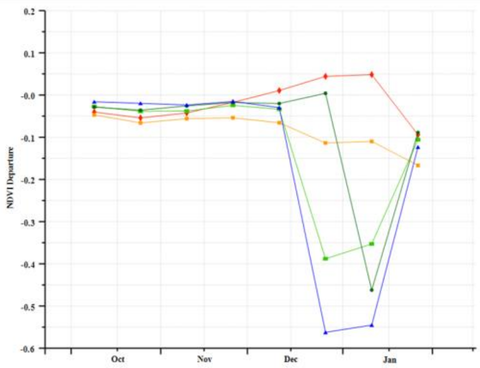
The crop condition in the lower Yangtze region is currently assessed as average.

Figure 4.9. Crop condition Lower Yangtze region, October 2018 to January 2019



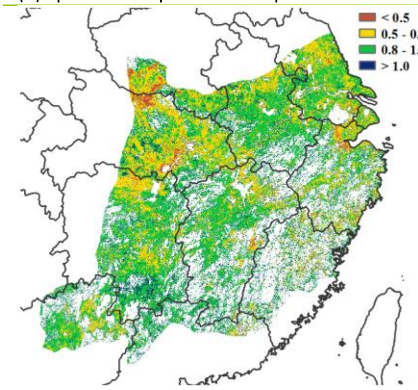
(a) Crop condition development graph based on NDVI

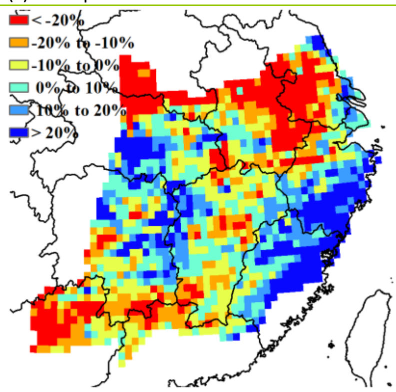




(b) Spatial NDVI patterns compared to 5YA

(c) NDVI profiles





(d) Maximum VCI

(e) Biomass

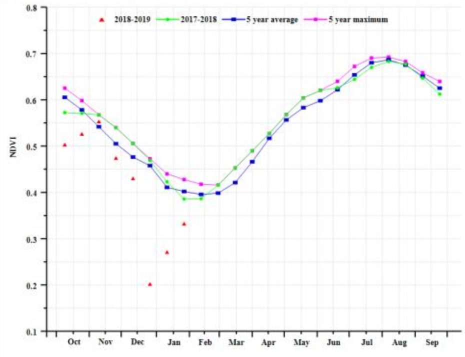
Southwest China

The reporting period covers the dormancy of winter wheat. According to the regional NDVI profile, crop condition was partly below average with a spell of above average values in early November.

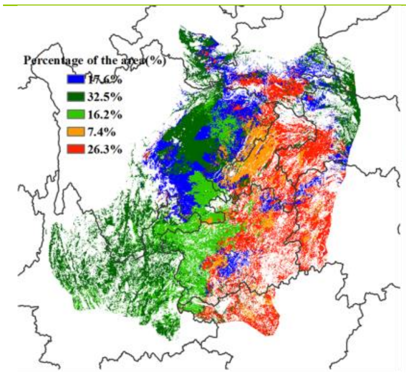
Rainfall was below average (RAIN -18%) and sunshine was low (RADPAR -7%) while the temperature was slightly lower than the average by 0.5 °C. Compared to the average of the past 5 years, the cropped arable land fraction has not changed and the potential biomass production index was low (BIOMSS -7%).

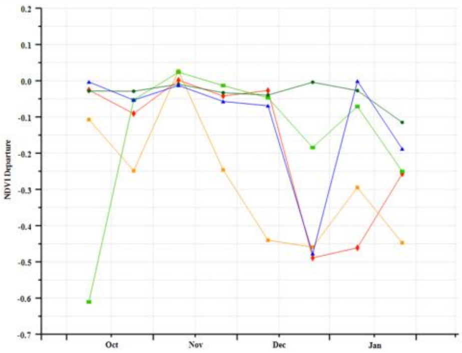
According to the spatial NDVI patterns (profiles and maps) values were usually close to average from late October to late November, except in Chongqing and neighboring areas in Eastern Guizhou. Both recorded very low NDVI due to low RAIN (-32% and -27%, respectively). The indicators of Sichuan Province were all below average but in Yunnan, both precipitation and sunshine were high (RAIN +50%, RADPAR +3%). The maximum VCI reaches at 0.93, indicating the crop growth status at peak of the growing season was still comparable with the previous five years. The mix of positive and negative indicators show an overall unfavorable crop condition.

Figure 4.10. Crop condition Southwest China region, October 2018 to January 2019



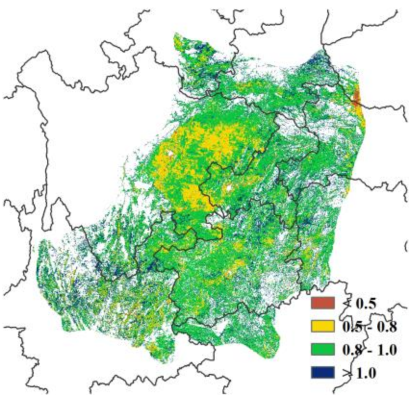
(a) Crop condition development graph based on NDVI

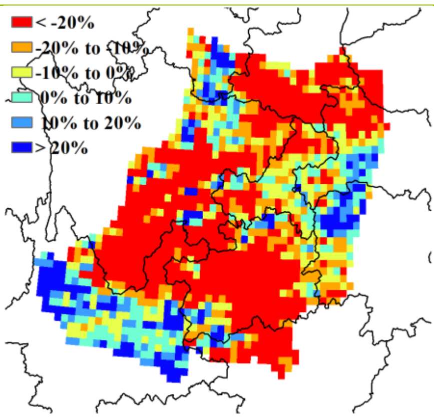




(b) Spatial NDVI patterns compared to 5YA

(c) NDVI profiles





(d) Maximum VCI

(e) Biomass

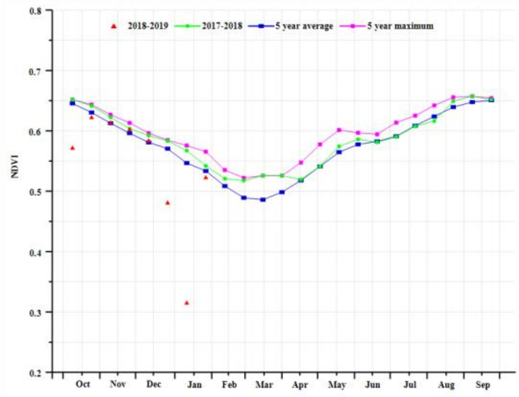
Southern China

During the monitoring period, NDVI was close to the previous five-year average except for early October, late December and early January. The rainfall was above average (RAIN +21%), while the temperature and radiation were below (TEMP -0.2°C, RADPAR -8%). The cropped arable land fraction was well above average (CALF, +29%) and so was the biomass accumulation potential (BIOMSS +36%). The maximum VCI (VCIx) reached 0.93.

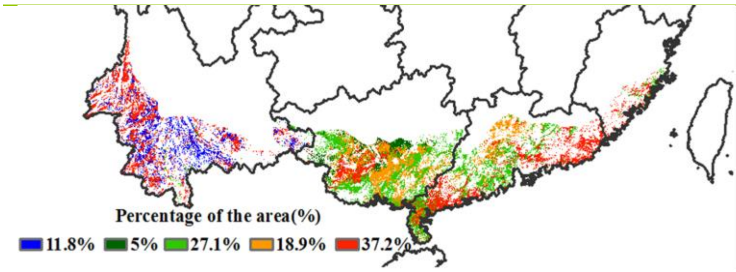
NDVI was close to and above average throughout the reporting period in Yunnan Province. Other Provinces (Guangxi, Guangdong and Fujian) had below average NDVI from late December to 2019. The potential biomass departure map shows below average values exceeding 20% in most of Guangxi and Southwest of Guangdong.

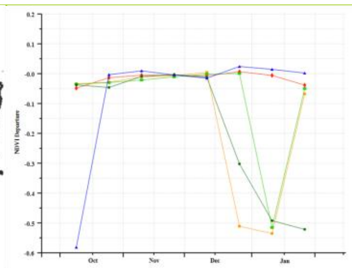
The good climatic conditions were favorable for the crop production.

Figure 4.11. Crop condition Southern China region, October 2018 to January 2019



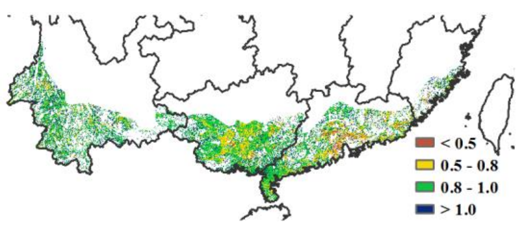
(a) Crop condition development graph based on NDVI

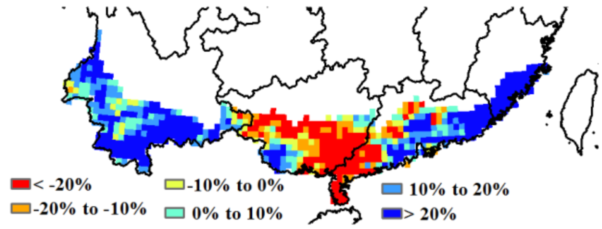




(b) Spatial NDVI patterns compared to 5YA

(c) NDVI profiles





(d) Maximum VCI

(e) Biomass

Chapter 5. Focus and perspectives

Building on the CropWatch analyses presented in chapters 1 through 4, this chapter presents first early outlook of crop production for 2018-2019 for countries in Southern Hemisphere and some isolated northern hemisphere countries (section 5.1), as well as sections on recent disaster events (section 5.2) and an update on El Niño (5.3).

5.1 Production outlook

The production outlook for the current bulletin includes only the major producers in the southern hemisphere and some isolated northern hemisphere countries where crop development is sufficiently advanced to ensure that estimates are reliable. Detailed production estimates for Brazilian States and Argentinian Provinces are listed in Annex B.

CropWatch production estimates differ from most other global estimates by the use of geophysical data in addition to statistical and other reference information such as detailed crop distribution maps. Recent sub-national statistics are used for the calibration of remote-sensing-based models. It is also stressed that the assessments and underlying data are crop-specific, i.e. based on different crop masks for each crop and that, for each crop listed in Table 5.1, both yield variation and cultivated area variation are taken into account when deriving the production estimates.

Maize

Table 5.1 includes the second and third exporters of Maize (Brazil and Argentina) which both export about 20 million tonnes of the commodity annually. Other exporters include South Africa and Mexico which commercialize about 1 million tonnes each, as well as Zambia with less than 500 thousand tonnes. Argentina did well (production up 9%) while the CropWatch estimate for Brazil is 1% down. Brazil exports about 25% of its maize production while the percentage is much higher in Argentina at more than 60%. Maize available for export should thus not be affected by the current situation in Argentina and Brazil. Mexico is net maize importer; it usually exports a very low percentage of its production (around 3%), so that the rather favorable production will merely reduce imports - which are in the range of 12 million tonnes - by about 25%. In South Africa, where exports and imports balance each other out, the production shortfall is likely to increase imports from outside the region as most countries suffered from a poor rainfall season which has reduced their maize output, as shown in the table for Angola and Zambia.

Rice

The rice production of Brazil and Argentina is up by 4% and 16%. Both countries rank about 10th among the rice exporters, more or less at the level of countries such as Uruguay, Paraguay, Italy and Cambodia. Both countries are minor net exporters - they are far behind the major Asian exporters which market about 10 times more - and their output will be neutral as far as international markets are concerned. The same applies to Mozambique which has a net import of rice that varies between 100 thousand tonnes and 150 thousand tonnes.

Wheat

Australia has been one of the top 5 wheat exporters, although the position of the country among exporters varies from year to year because of the inherent variability of wheat output. If the production variability is defined as the ratio between the largest output and the smallest one over the last 10 years, production variability reaches 2.3 in Australia, Argentina and Kazakhstan but only values between 1.2 and 1.5 in India, the United States and France. Similar results are obtained with more complex measures of variability, for instance coefficients of detrended variability, which are close to 1.3 in Australia, Argentina and Kazakhstan, but only 0.5 in India, the United States and France. In short, the wheat production drop in Australia (-13%) may be spectacular, but it is nevertheless in line with the recent history of wheat production in the country.

The other negative value in Argentina (-3%) is also rather consistent with the recent behavior of wheat in the country. Not only: among the top ten wheat exporters, Argentina is the only one where the average production of the last five years (12.2 million tonnes on average between 2013 and 2017, based on FAOSTAT data) is below the production of 2001-2005 (15.0 million tonnes). This is due to a variety of factors but weather variability has played and continues to play a dominant role.

Australia is the major wheat exporter among those listed in Table 5.1. Exports, which have recently been in the range of 17 million tonnes are likely to fall by several million tonnes. Exports of Argentina, the second largest exporter among those listed in the table (5 million tonnes exports) are unlikely to be affected. Nor are those of Brazil as the country exports virtually no wheat.

All the other countries in Table 5.1 produce wheat essentially for domestic consumption. India and Pakistan are basically self-sufficient, with minor imports and exports only. Others, such as Mexico, Morocco and especially Egypt are among the world's top wheat importer. Egypt is actually the world's first wheat importer with a volume in excess of 10 million tonnes annually, less so (around 5 million tonnes) for Mexico and Morocco. The improved production will allow the countries to reduce imports.

The same applies to South Africa. The country used is an exporter of the same importance as Australia, but over the recent two decades South-African farmers have reduced production to grow other, more profitable crops, to the extent that South Africa is now a net importer of about 1.5 million tonnes. The estimated production increase will allow the country to compensate, albeit in a limited way, the reduced output of maize.

Soybean

Brazil and Argentina, which both increased their soybean production, are the second and third exporters for the commodity (about 50 million tonnes and 9 million tonnes, respectively). While first exports about 60% of its production, the second exports about one third. In Argentina, the extra production in 2019 (about 4.7 million tonnes) represents about 50% of average soybean exports of the country. As such, the volume of exportable soybean will increase significantly (by about 50%) in Argentina. This is larger than the increase in Brazil, which exceeds to 2018 output by about 2 million tonnes.

When taking into account the recent reversal of the negative trend of Chinese soybean production, and correlated reduced imports, the data in table 5.1 suggest that the current soybean glut will worsen.

Table 5.1: Preliminary 2019 production estimates in thousands tonnes for selected southern hemisphere countries and early crops in the Northern hemisphere. Δ% stands for the change in % compared with the corresponding season in 2018.

	Maize		Rice		Wheat		Soybean	
	2019	Δ %	2019	Δ %	2019	Δ %	2019	Δ %
Africa								
Morocco					11216	59		
Egypt					11660	8		
Angola	2722	-2						
Mozambique	2125	2	36.7	-2				
Zambia	2151	-9						
South Africa	11368	-14			1792	14		
Asia								
India					92165	1		
Pakistan					26039	8		
Americas								
Mexico	28495	21			4442	24		
Brazil	84325	-1	12173	4	4572	7	98577	2
Argentina	30485	9	1962	16	18009	-3	51220	8
Oceania								
Australia					33104	-13		

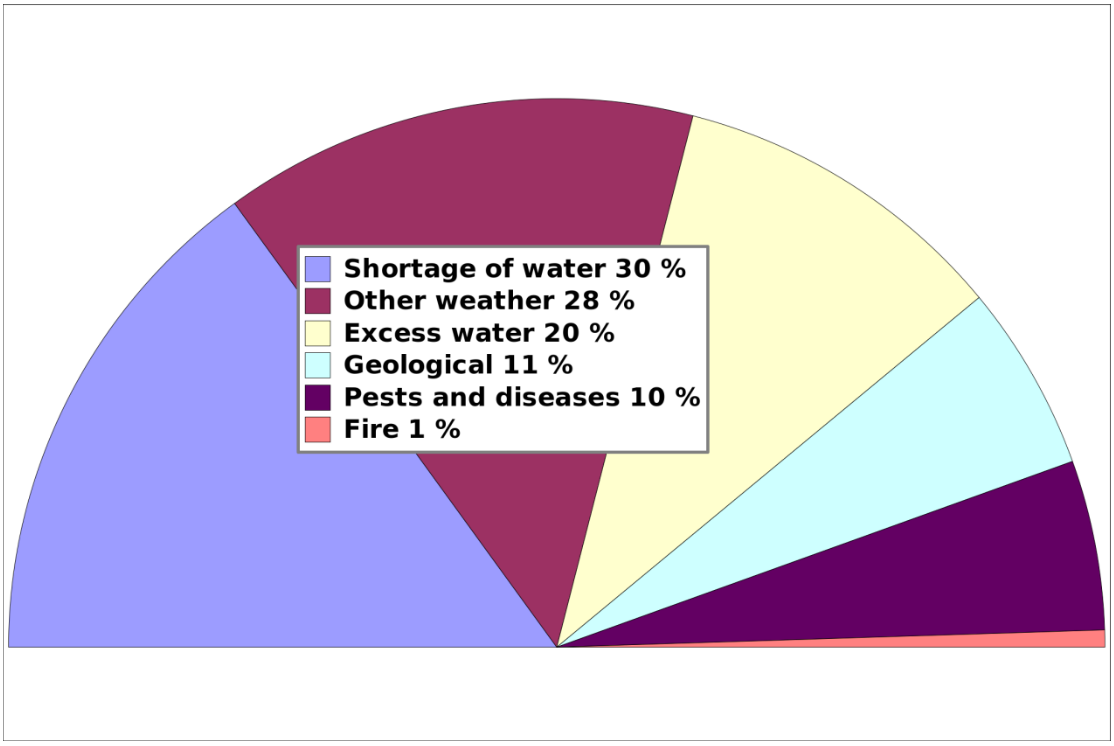
5.2 Disaster events

Introduction

The current section focuses on disasters that are most relevant for agriculture, food production and food security. This generally excludes health emergencies and geological disasters linked with volcanic eruptions.

According to the recent FAO report 2017: The Impact of Disasters and Crises on Agriculture and Food Security (FAO, 2018),the value of crop and livestock losses between 2005 and 2015 due to natural disasters has amounted to US$ 96 billion, of which 29 billion (or 30%) were due to drought (figure 5.1).

Figure 5.1: relative importance of various disasters in agricultural production losses between 2005 and 2015. (Based on data in FAO, 2018)



As we have repeatedly mentioned in previous CropWatch bulletins, the most dramatic humanitarian situations currently include a man-made component. Civil unrest, conflict and war result in large scale population movements and compound negative climatic impacts. The FAO report estimates that the economic loss associated with man-made disasters to be between US$ 250 billion and US$ 300 billion every year, i.e. about thirty times larger than disasters associated with climate.

For more than 20 years, The World Meteorological Organization (WMO) has published official statements about the state of the global climate. The latest report puts 2018 on course to be the 4th warmest year on record. This means that the past four years – 2015, 2016, 2017 and 2018 – are also the four warmest years in the series, with 2018 being the "coolest" of the four. Not only: the 20 warmest years have occurred in the past 22 years! According to Wikipedia, 2018 was also the third in a consecutive series of above-average and damaging Atlantic hurricane seasons, featuring 15 named storms, 8 hurricanes and 2 major hurricanes and a total of US$ just under 34 billion in damages.

Average temperatures around the world in 2018 were nearly 1°C above pre-industrial levels. Extreme weather has affected all continents in early 2019: several weather records broken in January, for instance cold in North America, fires in Tasmania and floods in Queensland, record temperatures and rainfall in parts of South America, and heavy snowfall in the Alps and Himalayas.

The extremes frequently trigger inadequate responses because our societies are ill prepared to handle excessive variability of water supply and temperature. Worldwide, too many financial resources are spent on recovery rather than prevention. According to a study released in December 2018 by the US National Institute of Building Sciences every $1 spent on hazard mitigation in the construction industry saves the about 6$ in future disaster costs, saves lives, reduces physical and psychic trauma and creates jobs. The benefits are largest in the case of water-related disasters and cyclones.

List of main disasters by categories

Tsunamis

At the end of December a tsunami associated with the eruption of Anak Krakatau on Indonesia killed 450 people in Indonesia. Rescue operations were made difficult due to debris and torrential rain. The tsunami was only of a series of disasters that affected Indonesia in 2018, including the Lombok earthquake in August and the earthquake and tsunami that together killed about 5000 people on Sulawesi Island in September. According to FAO, many families in the area of Palu (Sulawesi) are entirely dependent on agriculture and/or fisheries, and they lost considerable assets, including equipment and inputs. The period from August to October corresponds to the “dry” season (a relative concept in equatorial areas!) and the harvesting time. Agricultural land was marginally affected and assistance focused basically on non-food related needs and seeds for the growing season that is currently underway.

Figure 5.2: Stranded boat and destroyed buildings in Palu.

Source: http://www.fao.org/news/story/en/item/1162194/icode/

Cyclones

The section addresses cyclones and related disturbances such as storms of various intensities, basically characterised by the combination of strong wind and abundant precipitation. In all basins, the reporting period covers the end of the season cyclone season in October or November.

In the Atlantic Ocean, several hurricanes were already reported on in the previous bulletin (Michael 7-16 October, the third-most intense Atlantic hurricane to make landfall in the United States). Damage exceeded $15.1 billion over Central and North America, the Caribbean and even the Iberian Peninsula. The last hurricane of the season was Oscar (27-31 October), off the US coast. It neither affected weather as far as Europe but did nor creates major damage.

The eastern Pacific basin (season from June to October) recorded three category 5 cyclones in 2018, of which two occurred in October: Walaka (29 Sep – 9 Oct) with insignificant damage, and Willa (20-24 October) along the western central American coast, Mexico and the USA, killing 6 people and causing losses amounting to 537 million US$ damage.

In the Indian Ocean cyclone Gaja (10-20 Nov) made landfall in southern India on November 26, impacting about 100000 hectares mostly in Tamil Nadu and Kerala States and causing about 50 deaths and damage to about 120000 houses of which about 60000 were destroyed. Perennial fruit crops and shrimp farms suffered most. Many thousands of trees were uprooted, which significantly hindered relief operations. The nationwide damage is estimated at US$ 775 million. According to the Indian Express, 70000 coconut farmers were hit and about 10 million coconut palms were damaged in Tamil Nadu. It is estimated that four to ten years will be needed for the local coconut industry to recover. The Economic Times reported that the impact of Gaja will depress shrimp production in India by 15% this fiscal year. Tamil Nadu is the largest shrimp producer in the country.

Figure 5.3: A family checks the remains of their coconut farm.

Source: http://www.newindianexpress.com/states/tamil-nadu/2018/dec/13/learning-from-gaja-agriculture-department-asks-farmers-to-take-precautionary-measures-to-face-cyclo-1911030.html.

Although it was initially feared that tropical storm Phethai (13-18 December) would make landfall in Tamil Nadu, the event instead affected the states of Andhra Pradesh and Odisha from December 17 to 19. Eight people were reported dead and the agricultural damage in Andhra Pradesh was estimated at US$ 41.1 million. Generally,however,the abundant water supply provided by Phetai is assessed as positive and The Hindu reported on 20 December that “Phethai lifts Prakasam farmers’ spirits” because the weather system has brought much-needed rains to the coastal areas which had been reeling under drought for the fifth year in succession”.

Five events are listed below for the western Pacific cyclone basin although the last (Pabuk) also affected parts of the Indian Ocean. Some of them occurred after the normal end of the Typhoon season in the region, which may be linked with global warming, according to findings by the NOAA Geophysical Fluid Dynamics Laboratory.

Typhoon Yutu (known in the Philippines as Rosita) was the most powerful tropical cyclone worldwide in 2018. It developed between October 21 and November 2, affecting mostly Northern Mariana Islands, but also impacting the Philippines and just grazing southern China. 1-minute sustained winds reached 285 km/h and the damage amounts to US$ 198 million. The damage to agriculture in the Philippines reached US$ 35 million according to Department of Agriculture data reported by ReliefWeb and the Philippines Star, with 150000 tons of crops lost in about 110000 Ha in Northern Luzon. The bulk of the damage (80%) corresponds to rice on

Isabela and Cagayan, and some maize on Isabela and Nueva Vizcaya. Just fewer than 30000 farmers were affected in Apayao, Benguet, Ifugao, Kalinga, Mountain Province, Ilocos Sur, Pangasinan, Isabela, Quirino, Aurora and Pampanga.

Two depressions made landfall in Vietnam, tropical storm Toraji (16-21 Nov) which was followed a week later by Usagi. Each of the events caused about US$ 15 million in total damage. Toraji affected Vietnam and the Malay Peninsula. It caused flooding in Nha Trang, 22 dead and more than US$ 40 million damage.

Usagi (also known as Samuel; 13 Nov- 26 Nov) made landfall in southern Vietnam (Mekong Delta) after crossing the northern Philippines on 20 November. One person died and the damage in the agricultural sector was just under US% 1 million. In Vietnam, Toraji left 19 people dead and flooded Ho Chi Minh City.

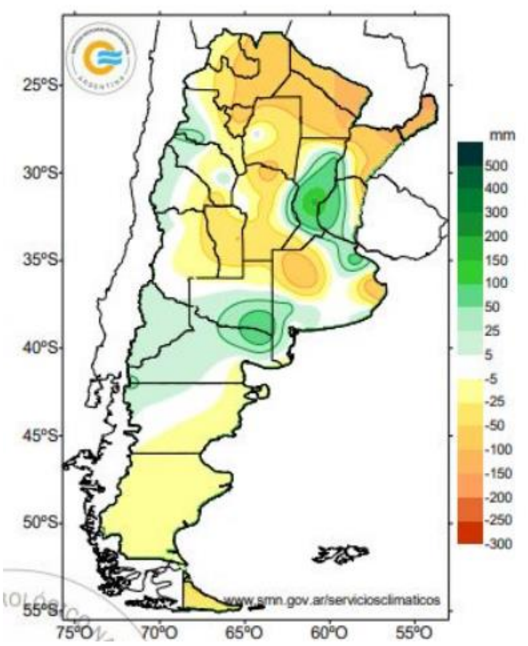
Storm Usman (Dec 25-29) struck the Philippines just before the end of December, killing about 160 people mostly in Regions IV-A (Calabarzon), IV-B (Mimaropa), V (Bicol), and VIII (Eastern Visayas). The mountainous Bicol region, south-east of Manila and in the central island of Samar suffered the largest number of casualties due to landslides and drownings. Damage reached over US$ 100 million, of which 80% in agriculture and infrastructure. About 650000 people were affected. According to CNN Phillippines and the Philippines Star the damage in the agricultural sector (including fisheries) amounts to US$ 15 to 20 million in the Visayas and Bicol regions and US$ 700000 in northern Samar. The total damage to infrastructure exceeds US$ 50 million.

Tropical storm Pabuk developed between 31 December and 4 January over the South China Sea and crossed the Maly Peninsula into the Indian Ocean. Most damage occurred in Thailand where eight people were killed and economic losses reached US$100 million. Minor impacts are also reported from Malaysia, Vietnam and Myanmar.

Floods, landslides and heavy rain, tsunamis

Abundant rainfall throughout October and November caused numerous episodes of flooding throughout the Middle-East. On 22 and 23 November, Iraq suffered from severe floods that have led to several deaths and displaced thousands of people, mostly in the Governorates of Ninewa and Salah-al-Din. 112 people lost their lives due to flash floods in Jordan in early November. While bridges, roads and villages were inundated, more than 30000 people were in need of assistance in Iraq. According to ACAPS, many houses and crops were destroyed, which will have lasting impacts on food security and livelihoods as floods have reduced crop planting that takes normally place at the time. Many germinating crops have been destroyed due to water logging.

Figure 5.4: rainfall anomaly in Argentina during November 2018(mm)



The same period was also exceptionally wet in parts of Italy and Spain Nov according to the AON Global catastrophe recaps. In Italy and Spain, more than 10 people died. The economic damage exceeds US$ 3.4 billion in Italy in Spain; the loss due to destroyed infrastructure and crops in the region of Valencian is put between US$ 100 and 140 million.

Huge agricultural damage close to US$ 200 million was brought about by intense thunderstorms and hailstorms in Central Chile in November, especially in the O'Higgins and Maule regions. In January, floods occurred in north-east Argentina (Chaco, Corrientes, Santiago del Estero, Tucumán, Santa Fe and Entre Ríos), and neighbouring parts of Uruguay and Brazil.

According to the national Disaster Management Center (DMC) of Sri Lanka, floods occurred in five districts of the Northern Province on 22 December, bringing great suffering to nearly 14,000 families. By 25 December, over 75,000 people had been affected.

ReliefWeb reported floods for different parts of Indonesia throughout the reporting period: mid-October in Sumatra; late October in Sulawesi in the midst of the emergency response (including 200000 displaced persons) to the earthquake, tsunami and soil liquefaction; early November in east Java; mid-November in West and North Sumatera provinces. On 13 December landslides due to heavy rain created havoc in Pintu Pohan District, North Sumatera Province. Early January witnessed excess water in several parts of Java and, at the end of the month, in Sulawesi. As of 27 January, still according to ReliefWeb, South Sulawesi Province recorded floods and landslides that affected 188 villages in 13 districts, with 68 people dead and significant damage to transport infrastructure and buildings.

Heat waves

Heat waves occurred in December and January in several areas in the southern hemisphere.

At the end of December, Australian mainland and Tasmanian temperatures exceeded seasonal normals by 10°C to 14°C, accompanied by poor air quality. Australia had its warmest January on record, according to its Bureau of Meteorology.

Several temperature records were exceeded as well in Chile and Argentina, most severely in the southern part of the continent.

Cold wave/ extreme winter conditions

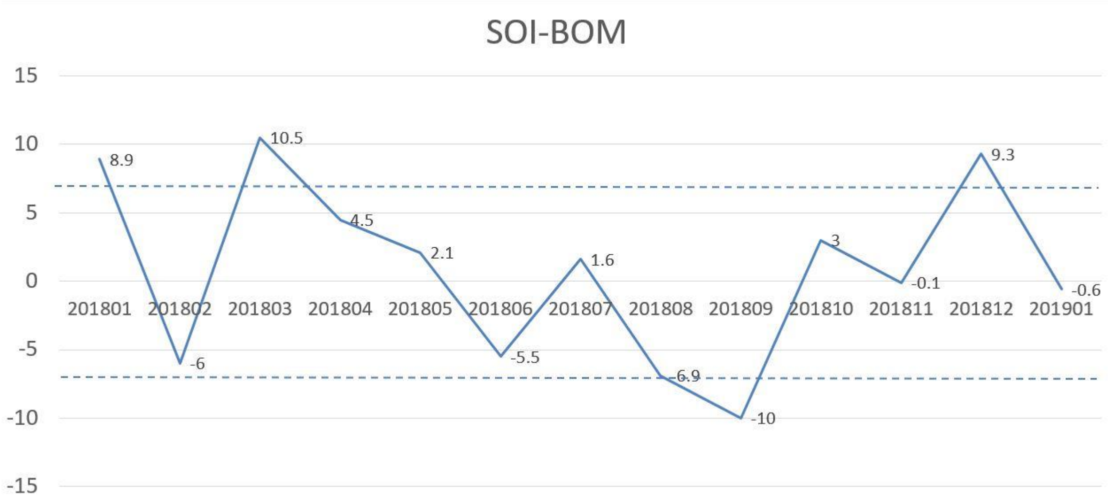
According to the Red Cross, Moldova recorded abundant snow and low temperatures in Moldova, especially on 11 and 12 January. The level of snow throughout the country reached 30 – 190 mm. More than 5000 people were unable to afford the costs of heating, including mainly older people and people with disabilities.

5.3 Update on El Niño

A likely El Nino condition has appeared across the Pacific Ocean during the first month of 2019. Figure 1 illustrates the behavior of the standard Southern Oscillation Index (SOI) of the Australian Bureau of Meteorology (BOM) from January 2018 to January 2019. Sustained positive values of the SOI above +7 typically indicate La Niña while sustained negative values below −7 typically indicate El Niño. Values between about +7 and −7 generally indicate neutral conditions.

During the current season, SOI decreased slightly from +3 in October to -0.1 in November, then increased to +9.3 in December, but dropped to -0.6 again in January 2019, indicating a likely El Nino condition.

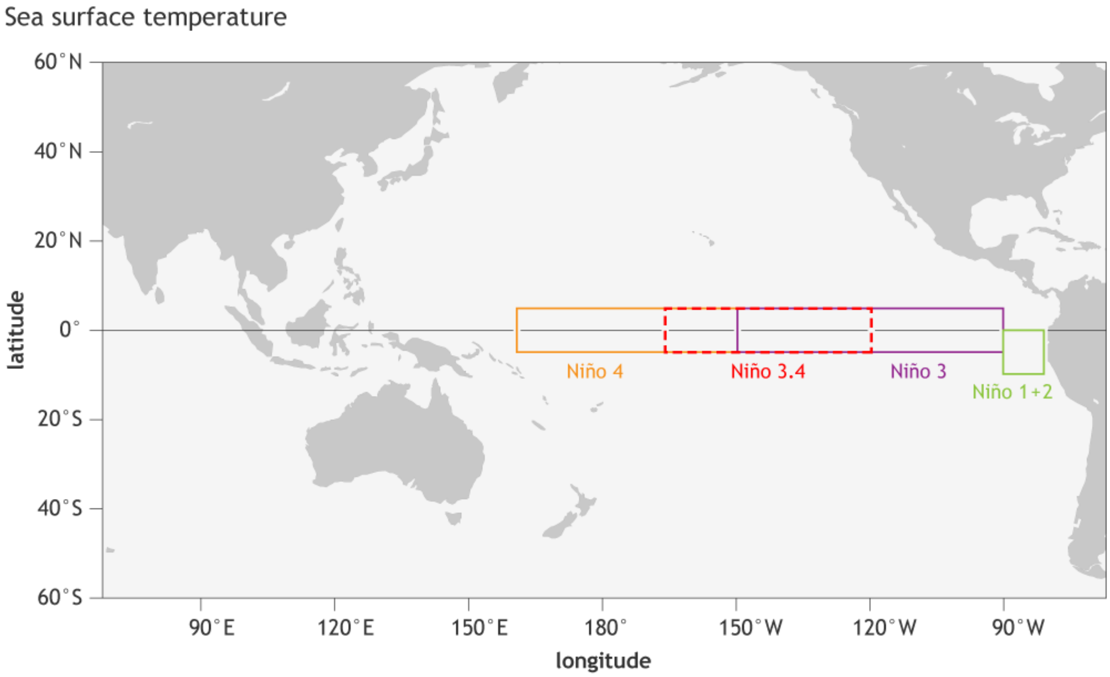
Figure 5.5: Monthly SOI-BOM time series from January 2018 to January 2019



Source: http://www.bom.gov.au/climate/current/soi2.shtml

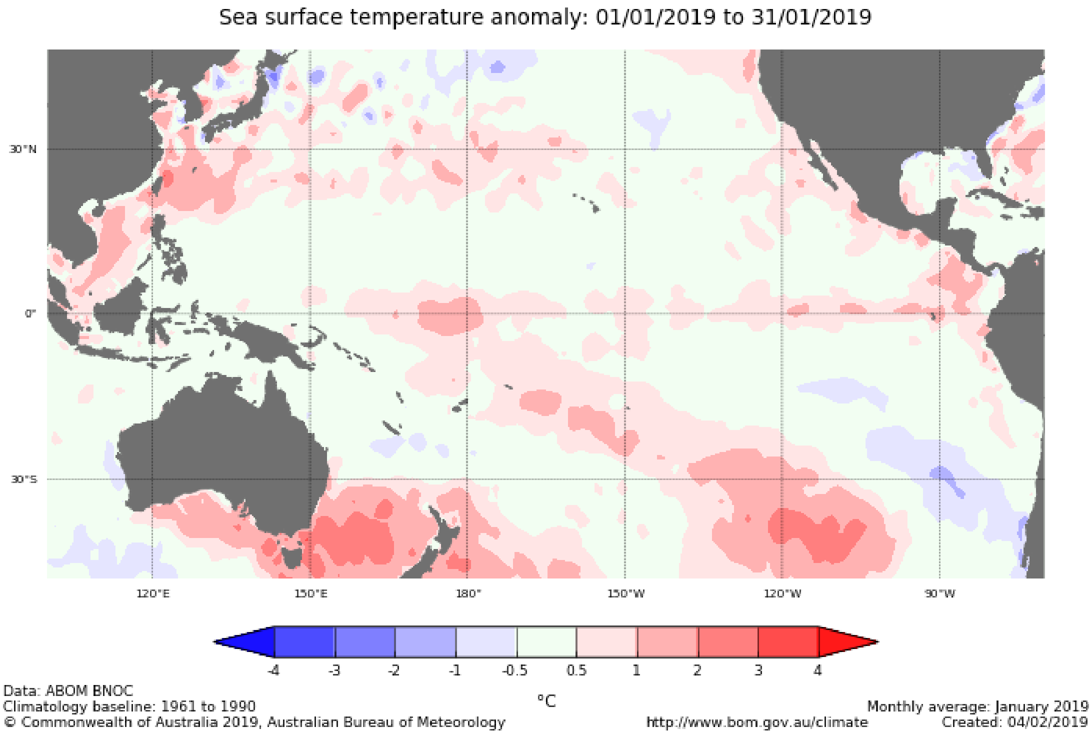
The sea surface temperature anomalies in January 2019 for NINO3, NINO3.4, and NINO4 regions are +0.5°C, +0.5°C, and +0.7°C in sequence, a litter warmer than 1961-1990 average according to BOM monitored (see Figure 5.7). Both of BOM and Japan Meteorological Agency (https://ds.data.jma.go.jp/tcc/tcc/products/elnino/elmonout.html) think that the warmer condition indicates a weak El Niño trend and their ENSO's outlook lies at El Niño Watch in the following spring of Northern Hemisphere. CropWatch will keep on monitoring its condition.

Figure 5.6: Map of NINO Region



Source: https://www.climate.gov/sites/default/files/Fig3_ENSOindices_SST_large.png.

Figure 5.7: January 2019 of sea surface temperature departure from the 1961-1990 average



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Annex A. Agroclimatic indicators and BIOMSS

Table A.1. October 2018 – January 2019 agroclimatic indicators and biomass by global Monitoring and Reporting Unit

65 Global MRUs		RAIN Current (mm)	RAIN 15YA dep. (%)	TEMP Current (°C)	TEMP 15YA dep. (°C)	RADPAR Current(MJ/m^2)	RADPAR 15YA dep. (%)	BIOMSS Current (gDM/m^2)	BIOMSS 5YA dep. (%)
C01	Equatorial central Africa	522	-1	25.5	0	1224	4	1503	-1
C02	East African highlands	151	-13	20.2	0.5	1328	1	581	-4
C03	Gulf of Guinea	285	10	26.9	-0.3	1245	2	731	5
C04	Horn of Africa	268	-13	24.4	-0.6	1284	0	855	-8
C05	Madagascar (main)	756	1	24.5	-0.4	1358	3	1649	3
C06	Southwest Madagascar	365	-6	24.7	-0.9	1415	2	1082	-3
C07	North Africa-Mediterranean	158	6	12.7	-0.7	715	1	535	6
C08	Sahel	59	8	27.5	-0.3	1245	0	192	8
C09	Southern Africa	403	-11	24.9	-0.4	1442	5	1091	-14
C10	Western Cape (South Africa)	44	-58	19	0.3	1592	5	203	-52
C11	British Columbia to Colorado	329	-1	-3	0.6	434	0	516	2
C12	Northern Great Plains	251	25	-0.1	-0.4	453	-6	614	0
C13	Corn Belt	458	36	1.1	-1.1	394	-7	743	-8
C14	Cotton Belt to Mexican Nordeste	527	54	11.4	-0.7	611	-8	1203	26
C15	Sub-boreal America	207	-6	-8	-0.2	244	2	352	-15
C16	West Coast (North America)	287	4	7.5	0.5	542	2	770	15
C17	Sierra Madre	169	43	14.8	-0.4	1000	-4	609	46
C18	SW U.S. and N. Mexican highlands	152	35	7.9	-0.4	751	-4	549	32
C19	Northern South and Central America	362	-18	25.6	-0.3	1070	4	888	-15
C20	Caribbean	204	-36	24.6	-0.4	1050	6	654	-25
C21	Central-northern Andes	593	-3	16.7	0	1139	-2	1259	-1
C22	Nordeste (Brazil)	311	13	28.3	0.2	1356	1	880	15
C23	Central eastern Brazil	684	-7	26.2	-0.5	1318	6	1782	-3
C24	Amazon	851	1	27.2	-0.9	1152	2	1971	1
C25	Central-north Argentina	456	5	24.6	-1.7	1278	-9	1337	1
C26	Pampas	760	18	22.5	-0.7	1365	-4	1715	7
C27	Western Patagonia	100	11	12.2	-1.2	1466	0	450	16
C28	Semi-arid Southern Cone	153	22	17.6	-1.5	1609	-3	521	13
C29	Caucasus	399	23	4.7	1	520	-7	896	14

C30	Pamir area	235	6	2.3	-0.2	691	-5	551	9
C31	Western Asia	192	26	7.2	0.2	649	-4	551	19
C32	Gansu-Xinjiang (China)	150	25	-4.8	-0.9	598	0	355	4
C33	Hainan (China)	170	-55	22.2	0.5	805	7	484	-21
C34	Huanghuaihai (China)	109	10	6.2	0.1	659	1	409	3
C35	Inner Mongolia (China)	47	-42	-5.2	0.7	602	3	220	-31
C36	Loess region (China)	87	-18	1.2	-0.3	719	2	337	-18
C37	Lower Yangtze (China)	222	1	11.1	-0.4	555	-15	785	11
C38	Northeast China	69	-34	-5.7	2.4	504	4	309	-13
C39	Qinghai-Tibet (China)	100	-36	0.7	-0.7	895	1	307	-22
C40	Southern China	193	21	16.3	-0.2	681	-8	697	36
C41	Southwest China	129	-18	8.9	-0.5	549	-7	494	-7
C42	Taiwan (China)	154	-7	18.9	0.3	845	5	640	19
C43	East Asia	133	-11	-0.3	0.9	512	3	470	-3
C44	Southern Himalayas	124	-12	17.9	0	935	1	396	1
C45	Southern Asia	165	-29	24.1	0.1	1117	2	424	-23
C46	Southern Japan and Korea	173	-47	9.5	0.3	603	5	687	-33
C47	Southern Mongolia	175	83	-10.2	-0.1	497	-1	388	22
C48	Punjab to Gujarat	33	-4	21	-0.3	1013	1	134	11
C49	Maritime Southeast Asia	1081	-5	25.6	-0.3	1106	5	2118	-2
C50	Mainland Southeast Asia	379	-2	25.6	0.3	1070	4	928	15
C51	Eastern Siberia	197	-8	-9.7	1.1	275	1	356	12
C52	Eastern Central Asia	82	-2	-13.9	2	372	0	245	18
C53	Northern Australia	657	3	27.2	-0.3	1372	0	1353	-6
C54	Queensland to Victoria	202	-14	21.9	0.9	1486	1	777	-6
C55	Nullarbor to Darling	76	-23	19.1	-0.7	1509	0	353	-16
C56	New Zealand	207	36	14.3	0.5	1301	4	723	12
C57	Boreal Eurasia	321	-15	-4	-0.6	130	5	514	3
C58	Ukraine to Ural mountains	245	-11	-1.4	-0.5	201	9	633	-2
C59	Mediterranean Europe and Turkey	315	19	8.8	-0.4	526	-1	923	12
C60	W. Europe (non Mediterranean)	306	0	5.6	-0.3	304	3	955	7
C61	Boreal America	439	12	-5.9	2.2	130	-4	430	17
C62	Ural to Altai mountains	189	-1	-8.2	-0.2	273	3	397	-3
C63	Australian desert	126	9	21.6	-0.4	1547	-2	558	9
C64	Sahara to Afghan deserts	109	69	17.9	0	962	-2	318	56
C65	Sub-arctic America	92	-16	-18.1	0.1	39	10	169	18

Table A.2. October 2018 – January 2019 agroclimatic indicators and biomass by country

Country code	Country name	RAIN Current (mm)	RAIN 15YA Departure (%)	TEMP Current (°C)	TEMP 15YA Departure (°C)	RADPAR Current (MJ/m^2)	RADPAR 15YA Departure (%)	BIOMSS Current (gDM/m^2)	BIOMSS 5YA Departure (%)
ARG	Argentina	638	29	21.6	-1.3	1355	-8	1487	8
AUS	Australia	233	-7	22.0	0.6	1478	1	724	-7
BGD	Bangladesh	153	-38	22.4	-0.2	994	1	468	-18
BRA	Brazil	721	-1	26.2	-0.5	1283	4	1753	1
KHM	Cambodia	344	-20	27.6	0.2	1133	6	942	-2
CAN	Canada	283	6	-5.6	-0.2	279	-1	412	-11
CHN	China	145	-7	6.8	0.0	601	-6	459	-1
EGY	Egypt	45	-3	17.6	-0.5	775	0	185	23
ETH	Ethiopia	141	-5	20.9	0.9	1348	2	548	3
FRA	France	267	1	7.4	-1.6	344	3	934	5
DEU	Germany	288	-6	5.4	0.7	245	6	1009	4
IND	India	97	-35	21.9	0.1	1063	2	276	-24
IDN	Indonesia	1106	-1	25.7	-0.4	1130	4	2170	-1
IRN	Iran	316	38	8.7	1.0	722	-7	762	26
KAZ	Kazakhstan	168	2	-6.5	-0.4	358	1	443	-3
MEX	Mexico	226	23	18.7	-0.5	967	-3	648	36
MMR	Myanmar	278	22	22.5	-0.1	1006	-1	782	24
NGA	Nigeria	229	16	26.9	-0.3	1263	1	502	13
PAK	Pakistan	92	35	14.3	-0.5	876	-2	231	27
PHL	Philippines	751	-25	25.5	-0.2	1068	7	1442	-18
POL	Poland	271	-1	3.7	0.6	224	8	921	6
ROU	Romania	305	35	3.4	0.2	382	1	893	18
RUS	Russia	217	-10	-5.3	0.0	228	5	471	0
ZAF	South Africa	321	-15	21.1	0.1	1567	8	942	-19
THA	Thailand	395	10	25.9	0.5	1099	4	890	20
TUR	Turkey	421	26	6.2	0.9	533	-8	1010	17
GBR	United Kingdom	417	-13	6.9	-1.4	173	3	1113	1
UKR	Ukraine	257	19	1.6	-0.5	288	7	801	8
USA	United States	417	40	5.1	-0.5	518	-7	816	10
UZB	Uzbekistan	197	-12	5.0	0.5	578	-5	607	1
VNM	Vietnam	412	-8	22.5	0.5	856	4	1076	23
AFG	Afghanistan	150	-6	4.6	-0.7	765	-3	460	1
AGO	Angola	423	-21	26.0	1.4	1326	9	1269	-16
BLR	Belarus	260	-8	0.4	-0.3	182	13	717	-3
HUN	Hungary	212	22	5.3	0.7	356	4	814	16
ITA	Italy	333	22	9.1	0.2	456	1	948	12
KEN	Kenya	238	-21	22.3	-0.5	1300	1	810	-13
LKA	Sri_Lanka	917	2	25.8	-0.6	1095	3	1790	2
MAR	Morocco	151	-17	12.4	-0.5	774	2	505	-12
MNG	Mongolia	68	-15	-13.5	1.6	461	1	239	11
MOZ	Mozambique	603	12	26.3	-1.4	1318	0	1405	8
ZMB	Zambia	489	-14	25.2	-0.7	1340	2	1357	-14

Table A.3. Argentina, October 2018 – January 2019 agroclimatic indicators and biomass (by province)

	RAIN Current (mm)	RAIN 15YA Departure (%)	TEMP Current (°C)	TEMP 15YA Departure (°C)	RADPAR Current (MJ/m^2)	RADPAR 15YA Departure (%)	BIOMSS Current (gDM/m^2)	BIOMSS 5YA Departure (%)
Buenos Aires	547	26	18.7	-1.6	1475	-4	1482	10
Chaco	597	7	25.2	-1	1210	-11	1612	4
Cordoba	524	24	21.4	-1.4	1407	-8	1483	8
Corrientes	1230	48	24.2	-0.8	1268	-10	1966	8
Entre Rios	992	78	22	-1.3	1346	-9	1757	14
La Pampa	506	28	20	-1.5	1498	-5	1583	20
Misiones	905	-4	24.1	-0.5	1369	-1	2127	5

Santiago Del Estero	490	21	24.4	-1.6	1214	-13	1436	12
San Luis	449	16	20.5	-1.5	1451	-7	1456	11
Salta	457	-5	23.4	-1.7	1166	-14	1303	-2
Santa Fe	807	51	22.8	-1.1	1296	-11	1736	11
Tucuman	306	-23	22.5	-1.7	1290	-12	1007	-16

Table A.4. Australia, October 2018 – January 2019 agroclimatic indicators and biomass (by state)

	RAIN Current (mm)	RAIN 15YA Departure (%)	TEMP Current (°C)	TEMP 15YA Departure (°C)	RADPAR Current (MJ/m^2)	RADPAR 15YA Departure (%)	BIOMSS Current (gDM/m^2)	BIOMSS 5YA Departure (%)
New South Wales	219	-10	22.9	1.3	1514	0	812	-6
South Australia	134	25	19.5	0.2	1452	-1	637	24
Victoria	166	12	18.7	0.8	1409	1	735	11
W. Australia	99	-25	19.8	-0.6	1512	0	379	-16

Table A.5. Brazil, October 2018 – January 2019 agroclimatic indicators and biomass (by state)

	RAIN Current (mm)	RAIN 15YA Departure (%)	TEMP Current (°C)	TEMP 15YA Departure (°C)	RADPAR Current (MJ/m^2)	RADPAR 15YA Departure (%)	BIOMSS Current (gDM/m^2)	BIOMSS 5YA Departure (%)
Ceara	303	67	28.8	0.1	1380	0	915	79
Goias	726	-9	25.7	-0.5	1353	8	2045	-1
Mato Grosso Do Sul	611	-16	27.2	-0.3	1438	10	1759	-10
Mato Grosso	927	-5	26.5	-1.2	1219	7	2279	0
Minas Gerais	696	-13	24.9	0.1	1295	4	1744	-6
Parana	667	-14	23.9	0.2	1388	6	1834	-5
Rio Grande Do Sul	880	13	23.1	0	1362	-2	1914	10
Santa Catarina	860	2	21.7	0.4	1279	1	1921	-1
Sao Paulo	644	-14	25.1	0.3	1334	7	1887	-2

Table A.6. Canada, October 2018 – January 2019 agroclimatic indicators and biomass (by province)

	RAIN Current (mm)	RAIN 15YA Departure (%)	TEMP Current (°C)	TEMP 15YA Departure (°C)	RADPAR Current (MJ/m^2)	RADPAR 15YA Departure (%)	BIOMSS Current (gDM/m^2)	BIOMSS 5YA Departure (%)
Alberta	136	-13	-5.1	1.5	275	2	425	-2
Manitoba	174	-14	-8.4	-1.2	277	-2	351	-23
Saskatchewan	132	-20	-7.2	0.1	285	0	377	-13

Table A.7. India, October 2018 – January 2019 agroclimatic indicators and biomass (by state)

	RAIN Current (mm)	RAIN 15YA Departure (%)	TEMP Current (°C)	TEMP 15YA Departure (°C)	RADPAR Current (MJ/m^2)	RADPAR 15YA Departure (%)	BIOMSS Current (gDM/m^2)	BIOMSS 5YA Departure (%)
Andhra Pradesh	82	-63	25.3	0	1128	1	306	-43
Assam	93	-54	22	0.2	909	3	384	-31
Bihar	40	-46	20.8	-0.8	992	2	180	-28
Chhattisgarh	42	-59	22.2	0.1	1092	1	187	-44
Daman and Diu	46	-29	25	-0.7	1197	4	164	-21

	RAIN Current (mm)	RAIN 15YA Departure (%)	TEMP Current (°C)	TEMP 15YA Departure (°C)	RADPAR Current (MJ/m^2)	RADPAR 15YA Departure (%)	BIOMSS Current (gDM/m^2)	BIOMSS 5YA Departure (%)
Delhi	44	3	18.9	-0.3	921	-1	215	36
Gujarat	34	-23	24.8	0.3	1135	3	150	-1
Goa	208	2	25.2	0.4	1218	1	560	4
Himachal Pradesh	153	1	3.8	0.5	864	-4	358	2
Haryana	66	23	17.9	-0.6	911	0	250	29
Jharkhand	41	-56	20.4	-0.4	1023	0	176	-46
Kerala	510	-4	25.1	-0.4	1136	0	1002	-11
Karnataka	160	-26	24.2	-0.1	1174	3	445	-20
Meghalaya	67	-74	18.8	0.7	923	4	311	-43
Maharashtra	59	-44	24.4	0.6	1175	3	183	-40
Manipur	110	-45	16.9	0.7	972	8	395	-34
Madhya Pradesh	25	-51	21.7	0.3	1087	4	110	-45
Mizoram	241	-16	18.1	-0.2	1005	3	663	-4
Nagaland	61	-68	16.2	0.5	865	4	296	-51
Orissa	135	-21	23.1	0.1	1077	1	429	-9
Puducherry	852	-1	26.5	-0.5	1198	8	1459	10
Punjab	104	53	17.4	0.3	851	-1	352	32
Rajasthan	12	-39	20.7	-0.4	1024	2	56	-24
Sikkim	90	-53	4.7	-0.4	1092	4	286	-30
Tamil Nadu	432	-19	26.1	-0.4	1131	6	1062	-5
Tripura	201	-38	21.4	-0.4	967	0	640	-3
Uttarakhand	165	3	9.4	1	949	0	391	5
Uttar Pradesh	53	-26	20	-0.1	984	2	200	-17
West Bengal	79	-55	22.7	0.1	1017	1	291	-34

Table A.8. Kazakhstan, October 2018 – January 2019 agroclimatic indicators and biomass (by oblast)

	RAIN Current (mm)	RAIN 15YA Departure (%)	TEMP Current (°C)	TEMP 15YA Departure (°C)	RADPAR Current (MJ/m^2)	RADPAR 15YA Departure (%)	BIOMSS Current (gDM/m^2)	BIOMSS 5YA Departure (%)
Akmolinskaya	157	11	-8.6	-0.5	307	1	385	-7
Karagandinskaya	143	14	-8.6	-0.8	376	0	372	-9
Kustanayskaya	123	-17	-7.6	-0.5	285	5	429	-3
Pavlodarskaya	124	4	-8.4	-0.3	293	4	400	-4
Severo kazachstanskaya	152	-3	-8.2	-0.1	244	5	395	-4
Vostochno kazachstanskaya	194	-1	-9.9	-0.7	403	1	357	-8
Zapadno kazachstanskaya	206	12	-3.6	-0.8	310	7	563	-5

Table A.9. Russia, October 2018 – January 2019 agroclimatic indicators and biomass (by oblast, kray and republic)

	RAIN Current (mm)	RAIN 15YA Departure (%)	TEMP Current (°C)	TEMP 15YA Departure (°C)	RADPAR Current (MJ/m^2)	RADPAR 15YA Departure (%)	BIOMSS Current (gDM/m^2)	BIOMSS 5YA Departure (%)
Bashkortostan Rep.	201	-20	-6.3	-0.3	195	2	429	-5
Chelyabinskaya Oblast	136	-13	-7.2	-0.3	223	4	417	-2

	RAIN Current (mm)	RAIN 15YA Departure (%)	TEMP Current (°C)	TEMP 15YA Departure (°C)	RADPAR Current (MJ/m^2)	RADPAR 15YA Departure (%)	BIOMSS Current (gDM/m^2)	BIOMSS 5YA Departure (%)
Gorodovikovsk	393	44	3.6	0	320	-3	927	8
Krasnodarskiy Kray	256	5	-3.2	0.2	291	2	543	9
Kurganskaya Oblast	152	-12	-7.6	0.1	193	5	412	-1
Kirovskaya Oblast	268	-14	-5	0.1	105	-7	457	-4
Kurskaya Oblast	221	-21	-1.1	-0.9	226	16	647	-7
Lipetskaya Oblast	207	-24	-2.2	-1.2	214	14	599	-9
Mordoviya Rep.	185	-33	-3.7	-1	186	13	530	-8
Novosibirskaya Oblast	223	3	-10	-0.2	200	5	355	-2
Nizhegorodskaya O.	212	-29	-3.5	-0.5	141	5	528	-7
Orenburgskaya Oblast	176	-16	-6	-0.9	273	9	461	-7
Omskaya Oblast	205	6	-9.3	0.1	179	1	363	-3
Permskaya Oblast	280	-4	-6.5	0.4	111	-10	413	-2
Penzenskaya Oblast	206	-25	-3.8	-1.1	205	12	532	-9
Rostovskaya Oblast	286	42	1.7	-0.3	308	1	805	9
Ryazanskaya Oblast	200	-30	-2.9	-1.1	186	18	564	-9
Stavropolskiy Kray	264	21	4.2	0.3	357	-1	900	16
Sverdlovskaya Oblast	195	-6	-7.1	0.6	137	-3	407	1
Samarskaya Oblast	207	-14	-4.8	-1	226	12	508	-6
Saratovskaya Oblast	240	5	-3.3	-1.2	261	11	574	-6
Tambovskaya Oblast	204	-27	-2.8	-1.2	211	9	572	-10
Tyumenskaya Oblast	197	-3	-8.4	0.4	155	1	382	-1
Tatarstan Rep.	206	-23	-4.7	-0.6	170	10	489	-7
Ulyanovskaya Oblast	207	-15	-4.4	-1.1	207	15	517	-8
Udmurtiya Rep.	253	-13	-5.4	0.1	121	-5	450	-4
Volgogradskaya O.	301	37	-0.8	-0.8	285	3	683	-4
Voronezhskaya Oblast	229	-12	-1.2	-0.7	259	12	649	-6

Table A.10. United States, October 2018 – January 2019 agroclimatic indicators and biomass (by state)

	RAIN Current (mm)	RAIN 15YA Departure (%)	TEMP Current (°C)	TEMP 15YA Departure (°C)	RADPAR Current (MJ/m^2)	RADPAR 15YA Departure (%)	BIOMSS Current (gDM/m^2)	BIOMSS 5YA Departure (%)
Arkansas	704	42	9.2	-0.8	540	-10	1324	5
California	219	13	8.7	0.6	651	0	688	23
Idaho	290	10	-1.9	0	466	2	597	2
Indiana	445	28	4	-0.6	443	-6	953	-4
Illinois	414	26	3.4	-1	466	-4	915	-5

	RAIN Current (mm)	RAIN 15YA Departure (%)	TEMP Current (°C)	TEMP 15YA Departure (°C)	RADPAR Current (MJ/m^2)	RADPAR 15YA Departure (%)	BIOMSS Current (gDM/m^2)	BIOMSS 5YA Departure (%)
Iowa	399	57	0.2	-1.1	446	-7	724	-7
Kansas	277	71	4.2	-1.1	556	-11	748	30
Michigan	367	25	0.1	-1.1	321	-9	703	-9
Minnesota	280	11	-4.2	-1.4	353	-7	503	-17
Missouri	461	31	5	-1	500	-9	1017	3
Montana	258	16	-1.2	0.9	423	-2	615	1
Nebraska	216	20	1.3	-0.6	533	-6	717	6
North Dakota	233	13	-4.4	-0.5	370	-6	491	-11
Ohio	442	39	3.9	-0.5	416	-7	946	-3
Oklahoma	386	51	7.8	-1.3	582	-12	984	20
Oregon	276	-3	3.8	0.4	421	4	808	6
South Dakota	235	17	-1.1	-0.7	465	-4	636	-4
Texas	436	66	12.1	-1.3	641	-12	1028	42
Washington	346	4	3	0.8	353	8	840	11
Wisconsin	350	22	-1.8	-1.1	364	-7	612	-12

Table A.11. China, October 2018 – January 2019 agroclimatic indicators and biomass (by province)

	RAIN Current (mm)	RAIN 15YA Departure (%)	TEMP Current (°C)	TEMP 15YA Departure (°C)	RADPAR Current (MJ/m^2)	RADPAR 15YA Departure (%)	BIOMSS Current (gDM/m^2)	BIOMSS 5YA Departure (%)
Anhui	191	-8	9.6	0	602	-8	667	-8
Chongqing	134	-32	8.2	-1	492	-13	562	-11
Fujian	248	24	13.8	0.3	561	-13	915	50
Gansu	97	-1	-0.3	-0.7	714	0	325	-9
Guangdong	162	-2	17	0	655	-11	639	29
Guangxi	159	-15	15	-0.8	536	-21	614	11
Guizhou	124	-27	9.5	-0.6	389	-21	491	-11
Hebei	35	-45	0.3	0	646	3	172	-38
Heilongjiang	73	-32	-7.2	3	454	3	323	-4
Henan	87	-31	7.5	0	665	-2	391	-25
Hubei	179	-8	8.6	-0.4	588	-11	676	-1
Hunan	213	-2	10	-1	504	-20	774	12
Jiangsu	188	0	9.2	0.1	621	-5	698	1
Jiangxi	262	6	11.7	-0.5	534	-18	833	12
Jilin	66	-38	-4.6	2.1	551	5	305	-23
Liaoning	59	-38	-1	1	603	5	272	-34
Inner Mongolia	51	-38	-6.9	1.5	553	3	239	-21
Ningxia	109	47	-1.3	-0.7	718	-1	338	18
Shaanxi	96	-36	2.9	-0.5	704	2	417	-22
Shandong	159	55	6.1	0.2	667	1	549	34
Shanxi	66	-23	-0.7	-0.1	687	3	261	-27
Sichuan	83	-31	7.4	-0.7	610	-2	335	-21
Yunnan	211	50	12.1	-0.1	755	3	652	35
Zhejiang	256	0	11	0.1	538	-13	962	20

Annex B. 2018-2019 production estimates

Tables B.1-B.2 present 2019 CropWatch production estimates for Argentina, and Brazil.

Table B.1. Argentina, 2019 maize, wheat and soybean production, by province (thousand tons)

	Maize		Wheat		Soybean	
	2019	Δ%	2018-2019	Δ%	2019	Δ%
Buenos Aires	7923	12	7900	4	13944	10
Córdoba	5991	6	4047	-4	9726	5
Entre Rios	1171	1	1178	6	3599	4
San Luis	928	7				
Santa Fe	4330	2	3193	-2	10343	4
Santiago Del Estero	1367	30				
Sub total	23729	18	17434	1	39630	12
Argentina	**30485**	**9**	**18009**	**-3**	**51220**	**8**

Δ% indicates percentage difference with 2018

Table B.2. Brazil, 2019 maize, rice, wheat and soybean production, by state (thousand tons)

	Maize		Rice		Wheat		Soybean	
	2019	Δ%	2019	Δ%	2018-2019	Δ%	2019	Δ%
Goias	8757	0					10515	2
Mato Grosso	20983	4					28313	1
Mato Grosso Do Sul	6948	-3					6793	-2
Minas Gerais	6777	5					3583	4
Parana	15154	-6			2618	10	17110	-6
Rio Grande Do Sul	5202	2	9185	4	1265	-1	15045	2
Santa Catarina	2897	0	1122	-1	221	4	1768	0
Sao Paulo	4009	0					2253	0
Sub total	**70727**	**0**	**10306**	**3**	**4104**	**6**	**85379**	**0**
Brazil	**84325**	**-1**	**12173**	**4**	**4572**	**7**	**98577**	**2**

Δ% indicates percentage difference with 2018

Annex C. Quick reference to CropWatch indicators, spatial units and methodologies

The following sections give a brief overview of CropWatch indicators and spatial units, along with a description of the CropWatch production estimation methodology. For more information about CropWatch methodologies, visit CropWatch online at www.cropwatch.com.cn**.**

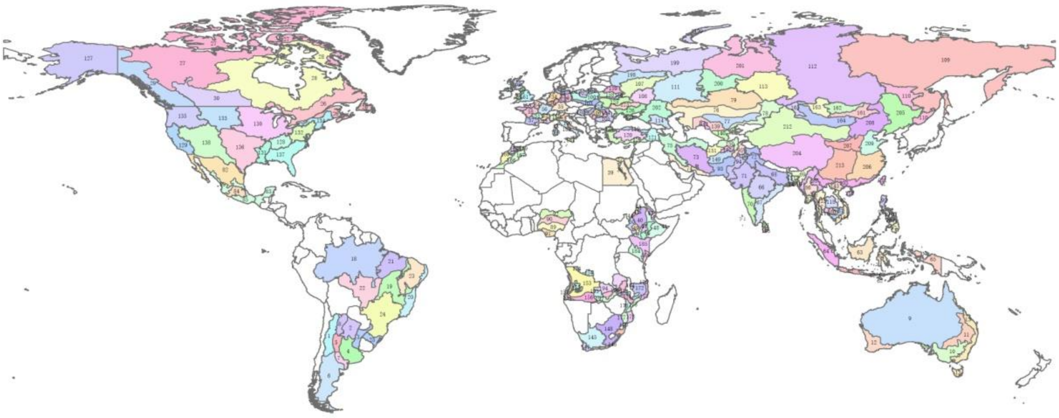
Agroecological zones for 42 key countries

Overview

213 agroecological zones for the 42 key countries across the globe

Description

42 key agricultural countries are divided into 213 agro-ecological zones based on cropping systems, climatic zones, and topographic conditions. Each country is considered separately. A limited number of regions (e.g., region 001, region 027, and region 127) are not relevant for the crops currently monitored by CropWatch but are included to allow for more complete coverage of the 42 key countries. Some regions are more relevant for rangeland and livestock monitoring, which is also essential for food security.



001. Andes
002. Chaco
003. Mesopotamia
004. Humid Pampas
005. Pampas hills
006. Arid part of Patagonia
007. Dry Pampas
008. Subtropical highlands
009. Arid and semiarid zone
010. Southeastern wheat area
011. Subhumid subtropical zone
012. Southwestern wheat area
013. Wet temperate and subtropical zone
014. Coastal region
015. Gangetic plain
016. Hills
017. Sylhet basin
018. Amazonas
019. Central Savanna
020. Coast
021. Northeastern mixed forest and farmland
022. Mato Grosso
023. Nordeste
024. Parana basin
025. Southern subtropical rangelands
026. Saint Lawrence basin
027. Arctic
028. Hudson Bay
029. Western Canada
030. Prairies
031. East-German lake and Heathland sparse crop area
032. Central wheat zone of Saxony and Thuringia
033. Wheat zone of Schleswig-Holstein and the Baltic coast
034. Mixed wheat and sugarbeets zone of the north-west
035. Bavarian Plateau
036. Western sparse crop area of the Rhenish massif
037. Nile Delta and Mediterranean coastal strip
038. Nile Valley
039. Desert
040. Central-northern maize-teff highlands
041. Eastern arid area
042. Northern Arid area
043. North-western cereal-root-sesame lowlands
044. North-western sesame irrigated lowlands
045. North-western semi-arid lowlands
046. South-eastern mixed maize zone
047. South-eastern Mendebo highlands
048. Semi-arid pastoral areas
049. South-western coffee-enset highlands
050. Western mixed maize zone
051. Massid Central dry zone
052. Alpes region
053. Mediterranean zone
054. Northern barley zone
055. Maize_barley and livestock zone along the English Channel
056. Rapeseed zone of eastern France
057. Southwest maize zone
058. Mixed maize_barley and rapeseed zone from the Centre to the Atlantic Ocean
059. North England, Wales and North Ireland sparse crops area
060. Barley area in Scotland
061. South English mixed wheat and Barley zone
062. Java
063. Kalimantan and Sulawesi
064. Sumatra
065. West Papua
066. Deccan Plateau
067. Eastern coastal region
068. Gangatic plain
069. Assam and north-eastern regions
070. Western coastal region
071. North-western dry region or Rajastan and Gujarat
072. Western Himalayan region
073. Central and Eastern wasteland region
074. Arid Red Sea coastal low hills and plains
075. Semi-arid to sub-tropical western and northern hills
076. Central non-agriculture region
077. South zone
078. Eastern plateau and southeastern zone
079. Northern zone
080. Central Tonle-Sap plain
081. Upland areas
082. Arid and semi-arid regions
083. Humid tropics with summer rainfall
084. Sub-humid temperate region with summer rains
085. Sub-humid hot tropics with summer rains
086. Central plain
087. Delta and southern-coast
088. Hills
089. Derived savanna zone
090. Guinean savanna
091. Humid forest zone
092. Soudano-Sahelian zone
093. Balochistan
094. Lower Indus basin in south Punjab and Sind
095. Northern highlands
096. Northern Punjab
097. Southern islands forest region
098. Negros and central Visayas Islands
099. Northern lowlands of Mindanao to western Visayas
100. Central rye and potatoes area
101. Northern oats and potatoes areas
102. Northern-central wheat and sugarbeet area
103. Southern wheat and sugarbeet area
104. Central mixed farming and pasture Carpathian hills
105. Eastern and southern maize wheat and sugarbeet plains
106. Western and central maize wheat and sugarbeet plateau
107. Central Russia
108. Central black soils area
109. Eastern Siberia
110. Amur and Primorsky Krai
111. Middle Volga
112. Middle Siberia
113. Western Siberia
114. South Caucasian
115. Central double and triple-cropped rice lowlands
116. South-eastern horticulture area
117. Western and southern hill areas
118. Single-cropped rice north-eastern region
119. Black Sea region
120. Central Anatolia region
121. Eastern Anatolia region
122. Marmara Agean Mediterranean lowland region
123. Central wheat area
124. Eastern Carpathian hills
125. Northern wheat area
126. Southern wheat and maize area
127. Alaska and Hawaii
128. Blue Grass region
129. California
130. Corn Belt
131. Lower Mississippi
132. Middle Atlantic
133. Northern Plains
134. Northeast
135. Northwest
136. Southern Plains
137. Southeast
138. Southwest
139. Central region with sparse crops
140. Eastern hilly cereals zone
141. Aral Sea cotton zone
142. Central coastal areas from Thanh Hoa to Khanh Hoa
143. Northern zone with Red river Delta
144. Southern zone with Mekong Delta
145. Arid and desert zones
146. Humid Cape Fold mountains
147. Mediterranean zone
148. Dry Highveld and Bushveld maize areas
149. Dry region
150. Mixed dry farming and irrigated cultivation region
151. Mixed dry farming and grazing region
152. Central region with sparse vegetation
153. Sub-humid zone
154. Humid zone
155. Arid Zone
156. Semi-Arid Zone
157. Central Plateau
158. Center
159. North
160. South-west
161. Central and Eastern Steppe
162. Selenge-Onon Region
163. Hangai Khuvsgul Region
164. Gobi Desert
165. Altai Region
166. Desert
167. Sub-humid northern highlands
168. Warm subhumid zones
169. Warm semiarid zones
170. Northern hinterland of Cabo Delgado
171. High altitude areas
172. Mid-altitude areas
173. Northern coast
174. Dry areas of Zambezia and Southern Tete
175. Low altitude areas of Sofala and Zambezia
176. Central medium altitude areas
177. North and Central Gaza and Western Inhambane
178. Coastal areas and South of Save
179. Inland of Maputo and Southern Gaza
180. Transdanubia
181. Puszta
182. North Hungary
183. Central Hungary
184. South-west
185. Nothern rangelands
186. Coast
187. Sicily
188. Northern Italy
189. Western Italy
190. Eastern Italy
191. Dry Zone
192. Wet zone
193. Intermediate Zone
194. Northen high rainfall zone
195. Western semi-arid plain
196. Central-eastern and southern plateau
197. Luanguwa Zambezi rift valley
198. Northwest Region including Novgorod
199. West subarctic region
200. Ural and wetern Volga region
201. Subarctic region
202. Northern Caucasus
203. Southern China
204. Qinghai-Tibet
205. North East China
206. Lower Yangtze rtegion
207. Loess region
208. Inner Mongolia
209. Huang Huaihai
210. Hainan
211. China Taiwan
212. Gansu-Xinjiang
213. South-West China

CropWatch indicators

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

INDICATOR			
BIOMSS			
Biomass accumulation potential			
Crop/ Ground and satellite	Grams dry matter/m^2, pixel or CWSU	An estimate of biomass that could potentially be accumulated over the reference period given the prevailing rainfall and temperature conditions.	Biomass is presented as maps by pixels, maps showing average pixels values over CropWatch spatial units (CWSU), or tables giving average values for the CWSU. Values are compared to the average value for the last five years (2013-2017), with departures expressed in percentage.
CALF			
Cropped arable land and cropped arable land fraction			
Crop/ Satellite	[0,1] number, pixel or CWSU average	The area of cropped arable land as fraction of total (cropped and uncropped) arable land. Whether a pixel is cropped or not is decided based on NDVI twice a month. (For each four-month reporting period, each pixel thus has 8 cropped/ uncropped values).	The value shown in tables is the maximum value of the 8 values available for each pixel; maps show an area as cropped if at least one of the 8 observations is categorized as "cropped." Uncropped means that no crops were detected over the whole reporting period. Values are compared to the average value for the last five years (2013-2017), with departures expressed in percentage.
CROPPING INTENSITY			
Cropping intensity Index			
Crop/ Satellite	0, 1, 2, or 3; Number of crops growing over a year for each pixel	Cropping intensity index describes the extent to which arable land is used over a year. It is the ratio of the total crop area of all planting seasons in a year to the total area of arable land.	Cropping intensity is presented as maps by pixels or spatial average pixels values for MPZs, 42 countries, and 7 regions for China. Values are compared to the average of the previous five years, with departures expressed in percentage.
NDVI			
Normalized Difference Vegetation Index			
Crop/ Satellite	[0.12-0.90] number, pixel or CWSU average	An estimate of the density of living green biomass.	NDVI is shown as average profiles over time at the national level (cropland only) in crop condition development graphs, compared with previous year and recent five-year average (2014-2018), and as spatial patterns compared to the average showing the time profiles, where they occur, and the percentage of pixels concerned by each profile.
RADPAR			
CropWatch indicator for Photosynthetically Active Radiation (PAR), based on pixel based PAR			
Weather /Satellite	W/m^2, CWSU	The spatial average (for a CWSU) of PAR accumulation over agricultural pixels, weighted by the production potential.	RADPAR is shown as the percent departure of the RADPAR value for the reporting period compared to the recent fifteen-year average (2003-2017),

INDICATOR			
			per CWSU. For the MPZs, regular PAR is shown as typical time profiles over the spatial unit, with a map showing where the profiles occur and the percentage of pixels concerned by each profile.
RAIN			
CropWatch indicator for rainfall, based on pixel-based rainfall			
Weather /Ground and satellite	Liters/m^2, CWSU	The spatial average (for a CWSU) of rainfall accumulation over agricultural pixels, weighted by the production potential.	RAIN is shown as the percent departure of the RAIN value for the reporting period, compared to the recent fifteen-year average (2003-17), per CWSU. For the MPZs, regular rainfall is shown as typical time profiles over the spatial unit, with a map showing where the profiles occur and the percentage of pixels concerned by each profile.
TEMP			
CropWatch indicator for air temperature, based on pixel-based temperature			
Weather /Ground	°C, CWSU	The spatial average (for a CWSU) of the temperature time average over agricultural pixels, weighted by the production potential.	TEMP is shown as the departure of the average TEMP value (in degrees Centigrade) over the reporting period compared with the average of the recent fifteen years (2003-17), per CWSU. For the MPZs, regular temperature is illustrated as typical time profiles over the spatial unit, with a map showing where the profiles occur and the percentage of pixels concerned by each profile.
VCIx			
Maximum vegetation condition index			
Crop/ Satellite	Number, pixel to CWSU	Vegetation condition of the current season compared with historical data. Values usually are [0, 1], where 0 is "NDVI as bad as the worst recent year" and 1 is "NDVI as good as the best recent year." Values can exceed the range if the current year is the best or the worst.	VCIx is based on NDVI and two VCI values are computed every month. VCIx is the highest VCI value recorded for every pixel over the reporting period. A low value of VCIx means that no VCI value was high over the reporting period. A high value means that at least one VCI value was high. VCI is shown as pixel-based maps and as average value by CWSU.
VHI			
Vegetation health index			
Crop/ Satellite	Number, pixel to CWSU	The average of VCI and the temperature condition index (TCI), with TCI defined like VCI but for temperature. VHI is based on the assumption that "high temperature is bad" (due to moisture stress), but ignores the fact that low temperature may be equally "bad" (crops develop and grow slowly, or even suffer from frost).	Low VHI values indicate unusually poor crop condition, but high values, when due to low temperature, may be difficult to interpret. VHI is shown as typical time profiles over Major Production Zones (MPZ), where they occur, and the percentage of pixels concerned by each profile.
VHIn			
Minimum Vegetation health index			
Crop/ Satellite	Number, pixel to CWSU	VHIn is the lowest VHI value for every pixel over the reporting period. Values usually are [0, 100]. Normally, values lower than 35 indicate poor crop condition.	Low VHIn values indicate the occurrence of water stress in the monitoring period, often combined with lower than average rainfall. The spatial/time resolution of CropWatch VHIn is 16km/week for MPZs and 1km/dekad for China.

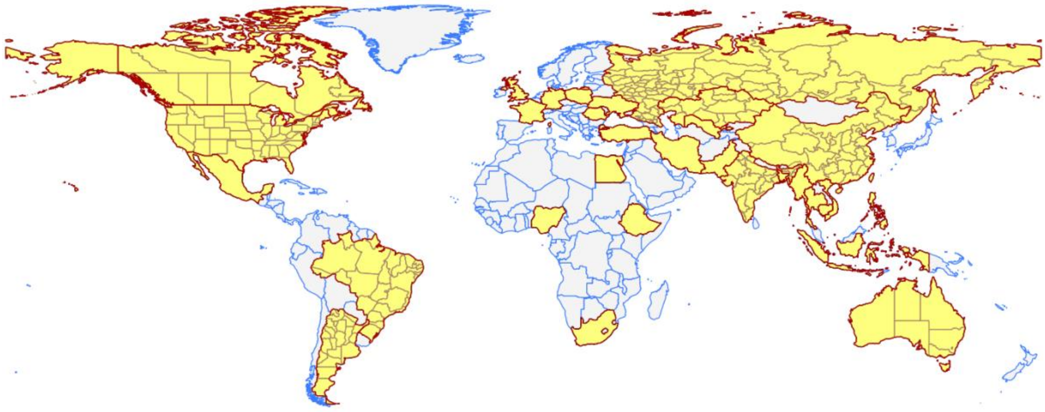
Note: Type is either "Weather" or "Crop"; source specifies if the indicator is obtained from ground data, satellite readings, or a combination; units: in the case of ratios, no unit is used; scale is either pixels or large scale CropWatch spatial units (CWSU). Many indicators are computed for pixels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

CropWatch spatial units (CWSU)

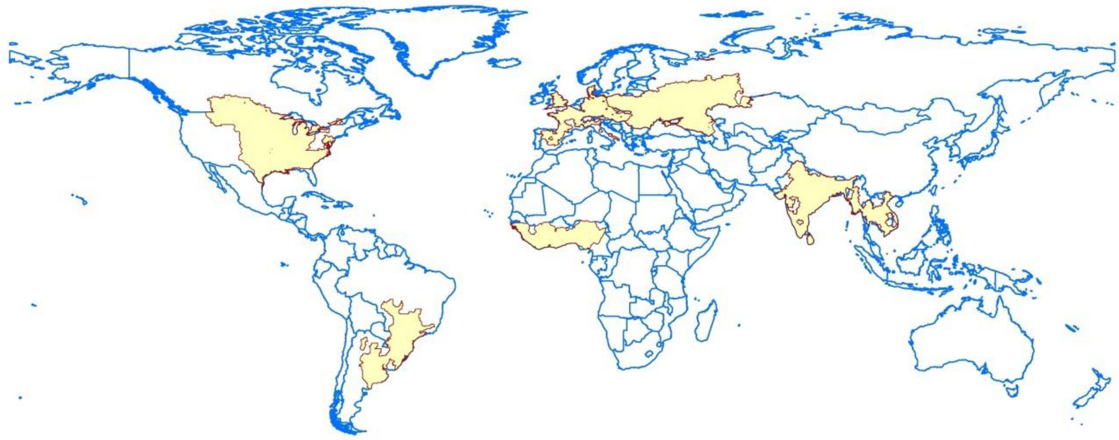
CropWatch analyses are applied to four kinds of CropWatch spatial units (CWSU): Countries, China, Major Production Zones (MPZ), and global crop Monitoring and Reporting Units (MRU). The tables below summarize the key aspects of each spatial unit and show their relation to each other. For more details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

SPATIAL LUNITS	
CHINA	
Overview	*Description*
Seven monitoring regions	The seven regions in China are agro-economic/agro-ecological regions that together cover the bulk of national maize, rice, wheat, and soybean production. Provinces that are entirely or partially included in one of the monitoring regions are indicated in color on the map below.

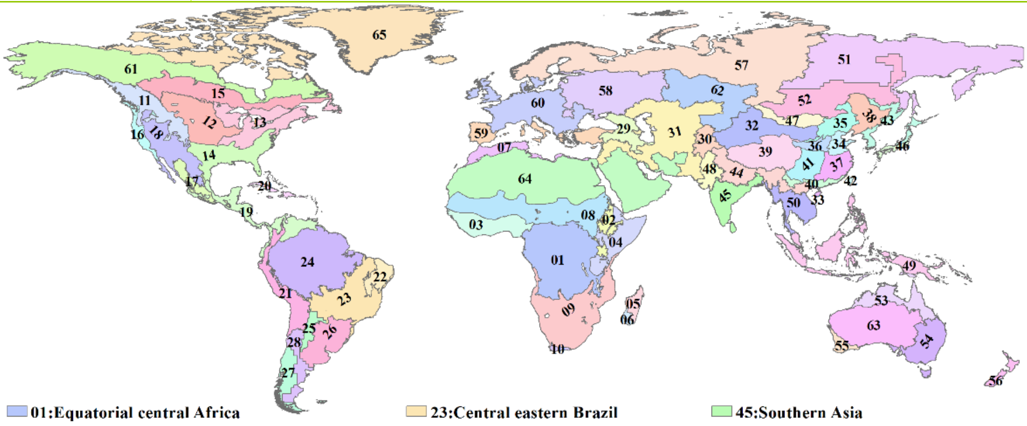
Countries (and first-level administrative districts, e.g., states and provinces)	
Overview	*Description*
42 countries to represent main producers/exporters and other key countries.	CropWatch monitored countries together represent more than 80% of the production of maize, rice, wheat and soybean, as well as 80% of exports. Some countries were included in the list based on criteria of proximity to China (Uzbekistan, Cambodia), regional importance, or global geopolitical relevance (e.g., four of five most populous countries in Africa). The total number of countries monitored is "41 + 1," referring to 41 and China itself. For the nine largest countries—, United States, Brazil, Argentina, Russia, Kazakhstan, India, China, and Australia, maps and analyses may also present results for the first-level administrative subdivision. The CropWatch agroclimatic indicators are computed for all countries and included in the analyses when abnormal conditions occur. Background information about the countries' agriculture and trade is available on the CropWatch Website, **www.cropwatch.com.cn**.



Major Production Zones (MPZ)	
Overview	*Description*
Seven globally important areas of agricultural production	The six MPZs include West Africa, South America, North America, South and Southeast Asia, Western Europe and Central Europe to Western Russia. The MPZs are not necessarily the main production zones for the four crops (maize, rice, soybean, wheat) currently monitored by CropWatch, but they are globally or regionally important areas of agricultural production. The seven zones were identified based mainly on production statistics and distribution of the combined cultivation area of maize, rice, wheat and soybean.



Global Monitoring and Reporting Unit (MRU)	
Overview	*Description*
65 agro-ecological/agro-economic units across the world	MRUs are reasonably homogeneous agro-ecological/agro-economic units spanning the globe, selected to capture major variations in worldwide farming and crops patterns while at the same time providing a manageable (limited) number of spatial units to be used as the basis for the analysis of environmental factors affecting crops. Unit numbers and names are shown in the figure below. A limited number of units (e.g., MRU-63 to 65) are not relevant for the crops currently monitored by CropWatch but are included to allow for more complete coverage of global production. Additional information about the MRUs is provided online under **www.cropwatch.com.cn** .



- 01:Equatorial central Africa
- 02:East African highlands
- 03:Gulf of Guinea
- 04:Horn of Africa
- 05:Madagascar (main)
- 06:Southwest Madagascar
- 07:North Africa Mediterranean
- 08:Sahel
- 09:Southern Africa
- 10:Western Cape (South Africa)
- 11:British Columbia to Colorado
- 12:Northern Great Plains
- 13:Corn Belt
- 14:Cotton Belt to Mexican Noreste
- 15:Sub-boreal America
- 16:West Coast (North America)
- 17:Sierra Madre
- 18:Southwest U.S. and north Mexican highlands
- 19:Northern South and Central America
- 20:Caribbean
- 21:Central-northern Andes
- 22:Nordeste (Brazil)
- 23:Central eastern Brazil
- 24:Amazon
- 25:Central-north Argentina
- 26:Pampas
- 27:Western Patagonia
- 28:Semi-arid Southern Cone
- 29:Caucasus
- 30:Pamir area
- 31:Western Asia
- 32:Gansu-Xinjiang (China)
- 33:Hainan (China)
- 34:Huanghuaihai (China)
- 35:Inner Mongolia (China)
- 36:Loess region (China)
- 37:Lower Yangtze (China)
- 38:Northeast China
- 39:Qinghai-Tibet (China)
- 40:Southern China
- 41:Southwest China
- 42:Taiwan (China)
- 43:East Asia
- 44:Southern Himalayas
- 45:Southern Asia
- 46:Southern Japan and Korea
- 47:Southern Mongolia
- 48:Punjab to Gujarat
- 49:Maritime Southeast Asia
- 50:Mainland Southeast Asia
- 51:Eastern Siberia
- 52:Eastern Central Asia
- 53:Northern Australia
- 54:Queensland to Victoria
- 55:Nullarbor to Darling
- 56:New Zealand
- 57:Boreal Eurasia
- 58:Ukraine to Ural mountains
- 59:Mediterranean Europe and Turkey
- 60:W. Europe (non Mediterranean)
- 61:Boreal America
- 62:Ural to Altai mountains
- 63:Australian desert
- 64:Sahara to Afghan deserts
- 65:Sub-arctic America

Production estimation methodology

The main concept of the CropWatch methodology for estimating production is the calculation of current year production based on information about last year's production and the variations in crop yield and cultivated area compared with the previous year. The equation for production estimation is as follows:

$$Production_i = Production_{i-1} * (1 + \Delta Yield_i) * (1 + \Delta Area_i)$$

Where i is the current year, $\Delta Yield_i$ and $\Delta Area_i$ are the variations in crop yield and cultivated area compared with the previous year; the values of $\Delta Yield_i$ and $\Delta Area_i$ can be above or below zero.

For the 31 countries monitored by CropWatch, yield variation for each crop is calibrated against NDVI time series, using the following equation:

$$\Delta Yield_i = f(NDVI_i, NDVI_{i-1})$$

Where $NDVI_i$ and $NDVI_{i-1}$ are taken from the time series of the spatial average of NDVI over the crop specific mask for the current year and the previous year. For NDVI values that correspond to periods after the current monitoring period, average NDVI values of the previous five years are used as an average expectation. $\Delta Yield_i$ is calculated by regression against average or peak NDVI (whichever yields the best regression), considering the crop phenology of each crop for each individual country.

A different method is used for areas. For China, CropWatch combines remote-sensing based estimates of the crop planting proportion (cropped area to arable land) with a crop type proportion (specific type area to total cropped area). The planting proportion is estimated based on an unsupervised classification of high resolution satellite images from HJ-1 CCD and GF-1 images. The crop-type proportion for China is obtained by the GVG instrument from field transects. The area of a specific crop is computed by multiplying farmland area, planting proportion, and crop-type proportion of the crop.

To estimate crop area for wheat, soybean, maize, and rice outside China, CropWatch relies on the regression of crop area against cropped arable land fraction of each individual country (paying due attention to phenology):

$$Area_i = a + b * CALF_i$$

where a and b are the coefficients generated by linear regression with area from FAOSTAT or national sources and CALF the Cropped Arable Land Fraction from CropWatch estimates. $\Delta Area_i$ can then be calculated from the area of current and the previous years.

The production for "other countries" (outside the 31 CropWatch monitored countries) was estimated as the linear trend projection for 2014 of aggregated FAOSTAT data (using aggregated world production minus the sum of production by the 31 CropWatch monitored countries).

Data notes and bibliography

Notes

[1] Although Yemen is not part of the Horn of Africa (HoA), it is geographically close and maintains close links to the region. The countries of the HoA are grouped in the regional development association IGAD (Inter-governmental Authority on Development, with headquarters in Djibouti). IGAD has recently established the IGAD Drought Disaster Resilience and Sustainability Initiative (IDDRSI, 2016).

[2] Under-investment in agriculture was one of the main drivers of the 2008 crisis of high food prices (Mittal 2009, ATV 2010), even if several other local and global triggering factors can be identified (Evans 2008).

[3] Previous large humanitarian crises were those of the West African Sahel (from the early sixties to the mid eighties), the Ethiopian droughts of the mid-eighties, the Indian Ocean tsunami of 2004, several large earthquakes (for example, Haiti, 2010), and floods and medical emergencies (such as the West African Ebola outbreak, 2013-16).

[4] http://www.agrhymet.ne/eng/index.html

[5] http://www.icpac.net/

[6] Belg is harvested before or during July.

[7] "Purely man-made disasters" is, however, a concept that deserves a closer look, as many wars and insurgencies are partially triggered by shortages of natural resources, including land. As such, most "man-made disasters" do have an environmental component.

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Online resources

Online Resources posted on www.cropwatch.com.cn , http://cloud.cropwatch.com.cn/

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CropWatch bulletins introduce the use of several new and experimental indicators. We would be very interested in receiving feedback about their performance in other countries. With feedback on the contents of this report and the applicability of the new indicators to global areas, please contact:

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