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 agroecological 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 is listed in table A.11 in Annex A.

4.1 Overview

Agro-climatic conditions were slightly below average in China from October 2019 to January 2020, with rainfall and radiation deficits by 4% and 1%, respectively. Temperature was 0.8℃ above the average. Low rainfall but relative high temperatures and close to average radiation resulted in the average potential biomass. Due to the complexity and variability of climatic conditions in China, weather conditions vary over different agroecological zones. Temperatures in seven agroecological zones of China were all above average, ranging from 0.6℃ to 1.2℃. Lower Yangtze and Southern China suffered from water shortage, with 17% and 31% lower rainfall compared to average. Drier conditions may potentially hamper the sowing and early growth of crops after winter. Since potential biomass is a synthetic indicator taking rainfall, radiation, and temperature into consideration, potential biomass in Lower Yangtze was still above average due to the agreeable conditions of radiation and temperature, while potential biomass in Northeast China was still above average due to the relatively high temperatures.

Rainfall departure clustering and temperature departure clustering show detailed spatial and temporal patterns. Rainfall in 58% of the total agricultural area was generally average, and mainly located in Northern China, Northeast China, and western parts of Southwest China. Other regions in China went through some fluctuation in rainfall. Excessive rainfall occurred mainly in early October, early January, and late January mainly in Central China, Southern China, southern parts of Northern China and eastern of Southwest China. Interestingly, the variations of temperature were quite consistent in the three clustered regions, with temperatures above the average in most of the time during the monitoring period.

More than ten provinces had large rainfall anomalies such as Henan (+54%), Guangdong (-53%), and Chongqing (+52%). The largest positive temperature anomalies (in excess of 1.0°C) were recorded in eleven provinces such as Jiangsu (+1.6℃), Jiangxi (+1.5℃) and Anhui (+1.4℃). If the situation of above average temperature still continues into the next monitoring period (January to April), snow may melt early and facilitate early sowing of spring crops.

Winter wheat cultivated across northern China is going through the hibernation period, while there was nearly no crop in Northeast China and Inner Mongolia. The significantly above average CALF in Huanghuaihai and Loess Region could be a result of advanced development of winter crops thanks to the higher than average temperature. CropWatch will keep watching at the agro-climatic and agronomic conditions in the following bulletins.

Table 4.1 CropWatch agroclimatic and agronomic indicators for China, October 2019 - January 2020, departure from 5YA and 15YA

Region	Agroclimatic indicators				Agronomic indicators		
	Departure from 15YA (2004-2018)				Departure from 5YA (2014-2018)		Current period
	RAIN (%)	TEMP (°C)	RADPAR (%)	BIOMSS (%)	CALF (%)	Cropping intensity (%)	Maximum VCI
Huanghuaihai	37	1.2	-7	7	10	-	0.91
Inner Mongolia	21	0.7	-2	7	-	-	0.91
Loess region	37	0.8	-7	-5	21	-	0.99
Lower Yangtze	-17	1.2	2	7	-1	-	0.89
Northeast China	-3	0.7	0	7	-	-	0.76
Southern China	-31	0.8	11	-3	0	-	0.96
Southwest China	25	0.6	-7	-12	1	-	0.97

Figure 4.1 China spatial distribution of rainfall profiles, October 2019 - January 2020

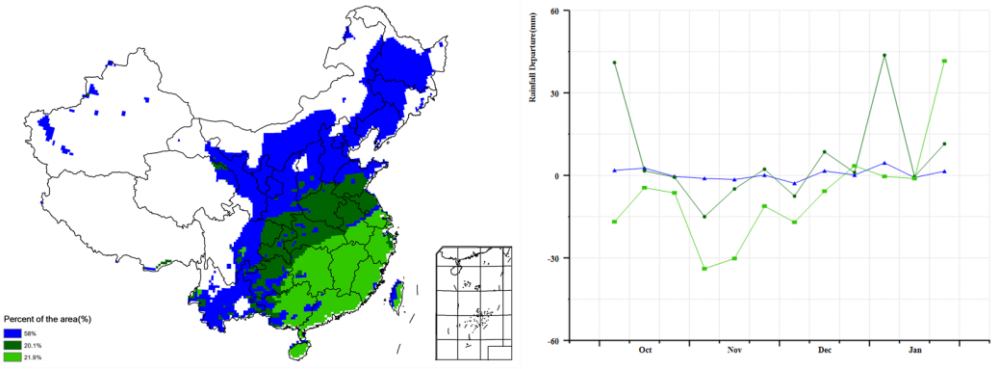


Figure 4.2 China spatial distribution of temperature profiles, October 2019 - January 2020

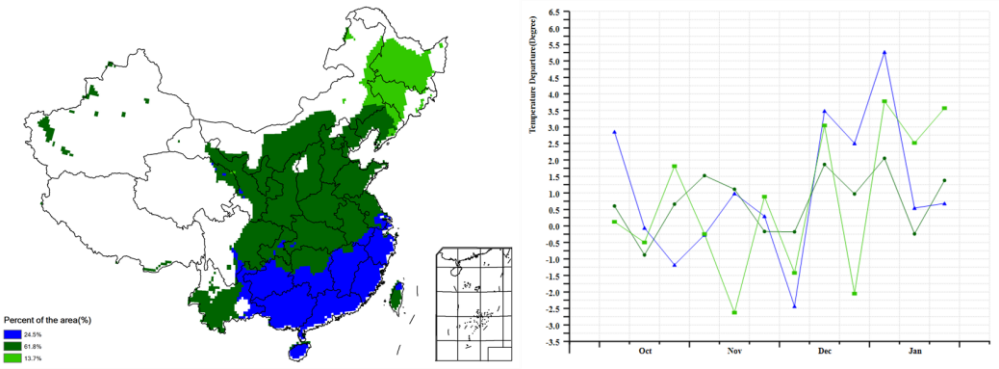


Figure 4.3 China cropped and uncropped arable land, by pixel, October 2019 - January 2020

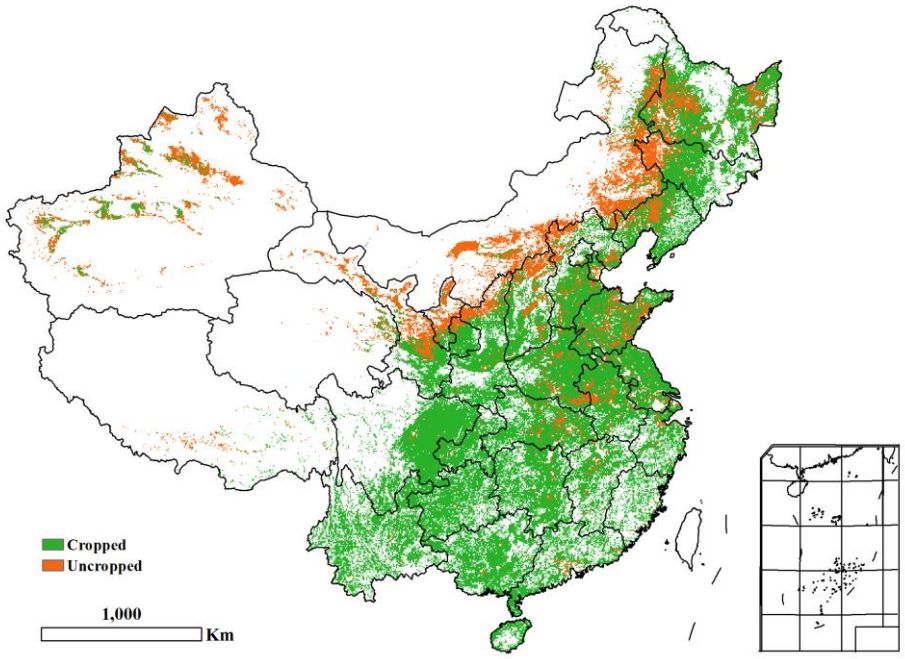
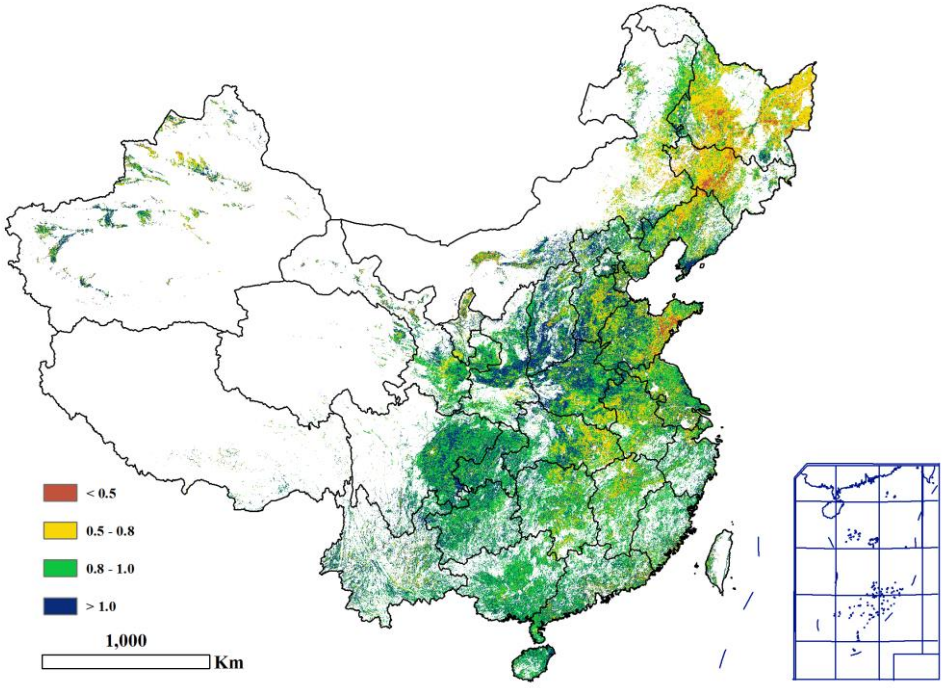


Figure 4.4 China maximum Vegetation Condition Index (VCIx), by pixel, October 2019 - January 2020



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 to the previous season, to the five-year average (5YA), and to the five-year maximum; (c) Spatial NDVI patterns (compared to the (5YA)); (d) NDVI profiles associated with the spatial patterns under (c); (e) maximum VCI (over arable land mask); and (f) biomass

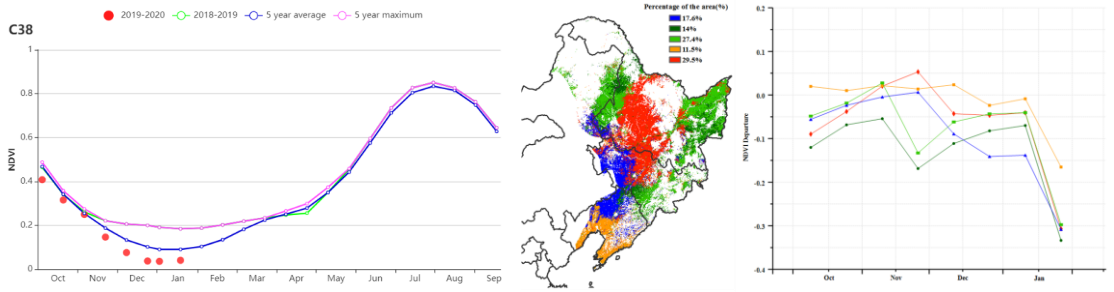
for October 2019 - January 2020. Additional information about agro-climatic indicators and BIOMSS for China is provided in Annex A.

Northeast region

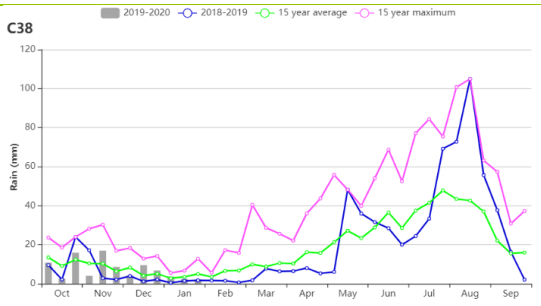
Due to the cold weather, no crops were growing in the northeast of China during this monitoring season (October 2019 to January 2020). CropWatch Agroclimatic Indicators (CWAIs) showed that all agricultural meteorological indicators were close to average level. Overall precipitation decreased by 3%, but was significantly above average in late October, mid-November and mid-December. The photosynthetically active radiation decreased by 1%, and temperature decreased by about 0.7°C. The temperature was close to average level in October and November, and increased to above average level in January 2020.

For the potential biomass, most areas are above average in the northeast China. Since the potential biomass is the result of the synthesis of agricultural meteorological conditions, the higher potential biomass indicates favorable agricultural meteorological conditions during this monitoring season in northeast China. If the rainfall and temperature remain appropriate until the sowing period, it will also be conducive to the emergence and early growth of crops.

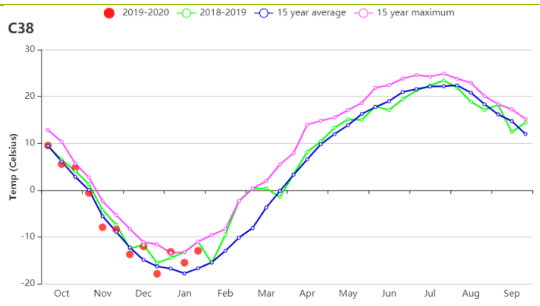
Figure 4.5 Crop condition China Northeast region, October 2019 - January 2020



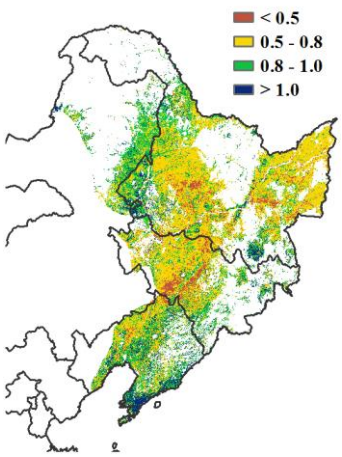
(a) Crop condition development graph based on NDVI (b) Spatial NDVI patterns compared to 5YA (c) NDVI profiles



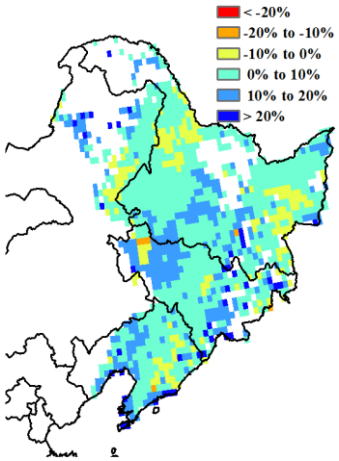
(d)Time series rainfall profile



(e)Time series temperature profile



(f) Maximum VCI



(g) Biomass departure

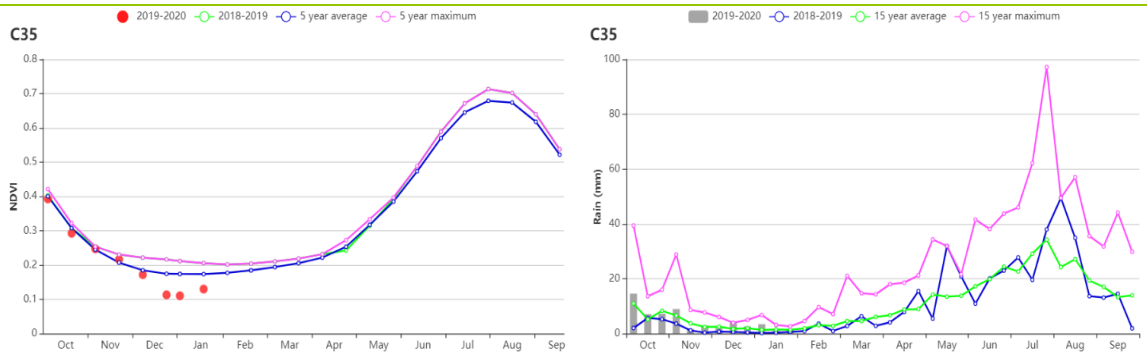
Inner Mongolia

From late October 2019 to January 2020 in Inner Mongolia, there were no crops in the field due to low temperatures. However, weather conditions in this period were relevant, particularly rainfall, as it controlled soil moisture availability for spring sown crops. In October, slightly below average conditions had almost no effect since the crops had reached maturity or were harvested already.

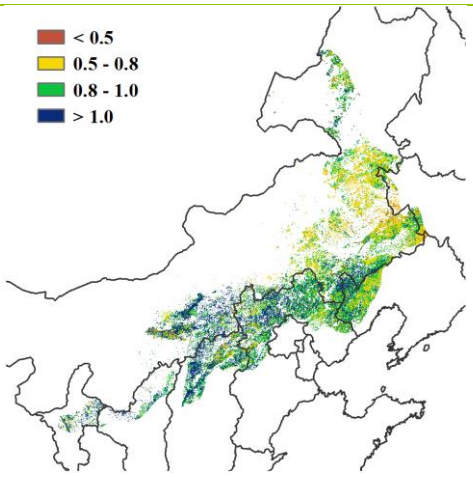
The reporting period recorded 57 mm of precipitation, which was 21% above the average. The rainfall profile showed that rainfall was above average in each month during this reporting period. Together with above temperature average (TEMP, +0.7°C) and close to average radiation (2% below average), potential biomass accumulation was simulated at 7% above average level.

Though the average of VCIx was above 0.9 and below 0.5 in the southeast, as well as lower BIOMASS in central Ningxia, north of Shanxi, Shaanxi and Hebei, it was not vital as no crop existed in the field. In general, above average snow and rainfall may be able to provide adequate soil moisture for the land preparation and early growth of 2020 spring crops.

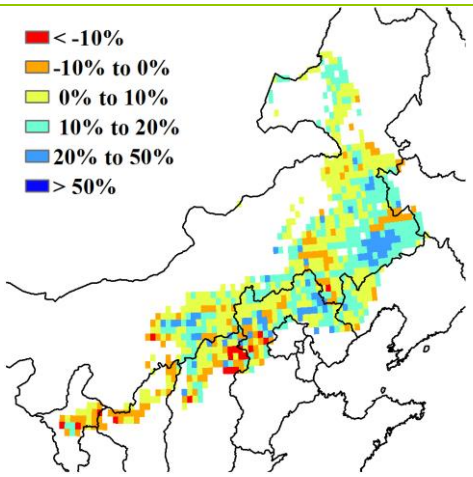
Figure 4.6 Crop condition China Inner Mongolia, October 2019 - January 2020



(a) Crop condition development graph based on NDVI (left) and rainfall profiles (right)



(b) Maximum VCI



(c) Biomass departure

Huanghuaihai

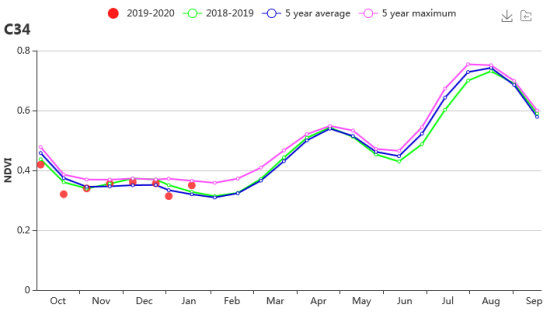
This monitoring period (October 2019 to January 2020) covers the planting and early growth stages of winter wheat in Huanghuaihai.

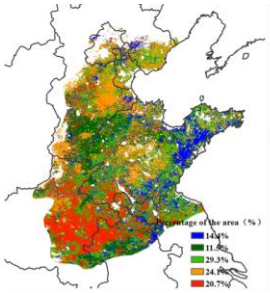
Precipitation in this area increased by 37% from the average, temperature increased by 1.2℃, and photosynthetically active radiation decreased by 7%. Good climatic conditions caused a 7% increase in biomass over the average level and were beneficial to the growth of winter wheat. Favorable climatic conditions also advanced the development of winter crops before wintering as reflected by 10% above 5YA CALF.

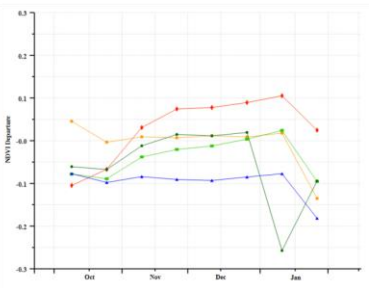
The NDVI profiles showed that crop growth in the Huanghuaihai region was slightly above average level for most of the monitoring period. There is some spatial variation of the crop growth conditions within this region. From mid to late October to January, NDVI anomalies in central and eastern Henan and northwestern Anhui were positive, whereas in the central and southern Jiaozhou Peninsula and northeastern Anhui Province they were negative, indicating that the crops in this area were in poorer condition.

The maps of maximum VCI showed a similar trend to the spatial NDVI patterns. Overall, crop conditions in the Huanghuaihai region during the monitoring period were generally favorable, with an average VCIx of 0.91.

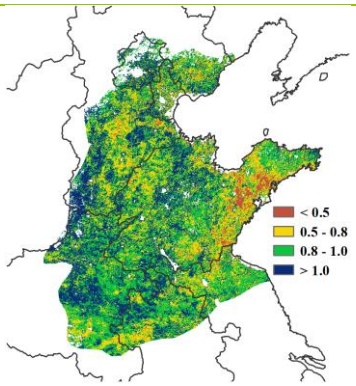
Figure 4.7 Crop condition China Huanghuaihai, October 2019 - January 2020



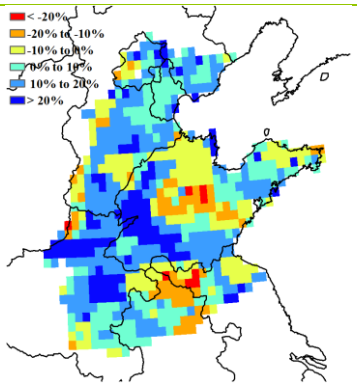




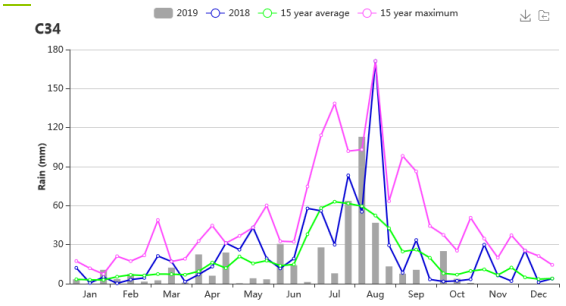
(a) Crop condition development graph based on NDVI (b) Spatial NDVI patterns compared to 5YA (c) NDVI profiles



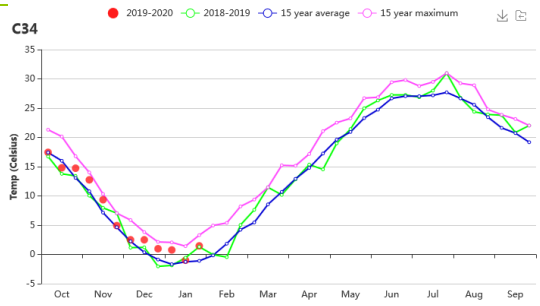
(d) Maximum VCI



(e) Biomass departure



(f) Time series rainfall profile

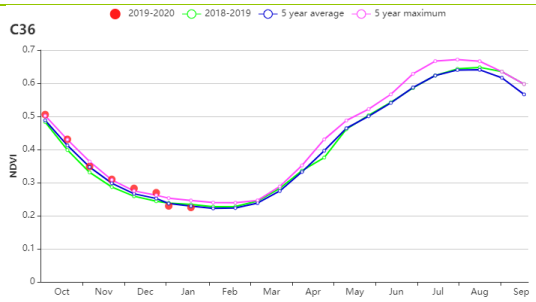


(g) Time series temperature profile

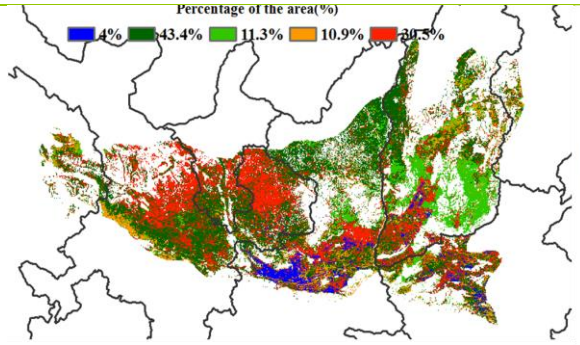
Loess region

In this region, the most important crop in the field is winter wheat, which is currently hibernating. Crop condition was generally superior to last year's and the five year average from October to December, but dropped to below average in January. Precipitation (RAIN +37%) was above average, and so was temperature (TEMP +0.8°C); radiation (RADPAR -7%) was below average. Although significant above average rainfall was received in the region, low radiation resulted in 5% below average BIOMSS compared with the 15-year average. In most of the region, spatial patterns of NDVI departure clustering and the profiles are consistent with VCIx: the most favorable conditions prevail in the center of Gansu province and south-central Ningxia, and some parts in south-central Shaanxi, due to the relatively abundant rainfall. The cropped arable land fraction (CALF) increased by 21% compared with recent years and VCIx averaged at 0.99 in the region, showing a favorable crop prospect in the region.

Figure 4.8 Crop condition China Loess region, October 2019 - January 2020

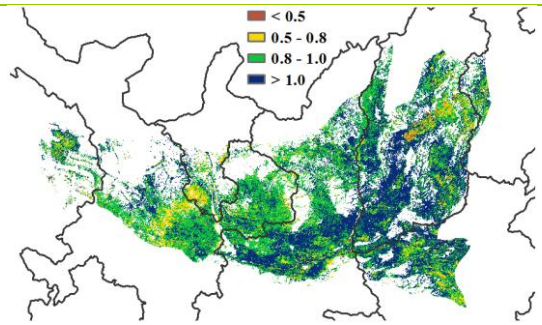


(a) Crop condition development graph based on NDVI

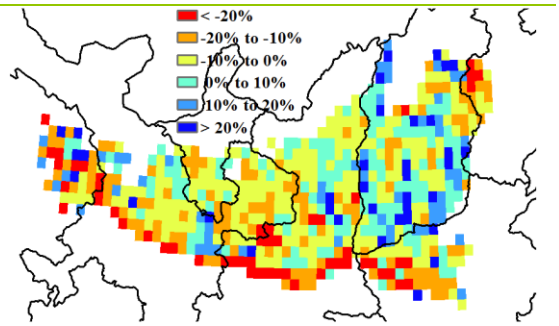


(b) Spatial NDVI patterns compared to 5YA

(c) NDVI profiles



(d) Maximum VCI



(e) Biomass departure

Lower Yangtze region

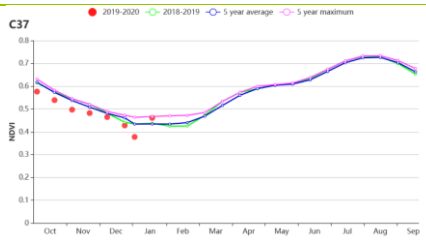
During this monitoring period, only winter crops like wheat and rapeseed were in the field, mostly in the north of the region, including parts in Hubei, Henan, Anhui and Jiangsu provinces. There were basically no crops in Fujian and the southern Jiangxi and Hunan provinces. The overall crop condition is estimated to be unfavorable.

According to the CropWatch agro-climatic indicators, Lower Yangtze region experienced a warmer and drier winter compared to the 15YA with temperature at 1.2 ℃ above average and photosynthetically active radiation at 2% above average. The accumulated precipitation, however, was significantly below average (RAIN,-17%). Even so, the warmer weather and above average radiation still led to a 7% increase in potential biomass compared to the 15YA. Potential Biomass departure map shows the spatial variation of the weather impact on crops. Most parts of Jiangxi, Fujian and Southern Hunan had large positive anomalies up to 20% above average. This was due to the above average radiation in Jiangxi and Fujian and slightly above average rainfall in Hunan.

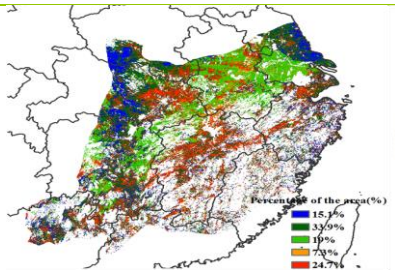
As shown in the NDVI development graph, crop conditions were below the 5-year average. Only 15.1% of the area, mostly distributed in the northwest and northeast of this region including Jiangsu, Hubei and Henan provinces, had slighthly better crop conditions as compared to the five-year average. NDVI in the remaining areas presented below average patterns, presumably due to below average rainfall. The red and orange areas concentrated in Jiangxi, Zhejiang and western Hubei, which account for 32% of the total area, were significantly below average.

The crop condition in the lower Yangtze region is currently assessed as close to but below average.

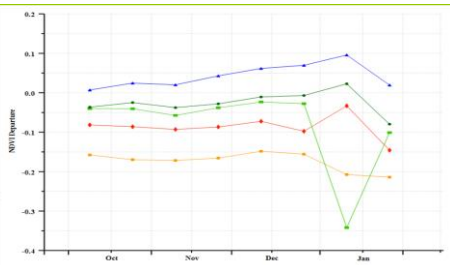
Figure 4.9 Crop condition Lower Yangtze region, October 2019 - January 2020



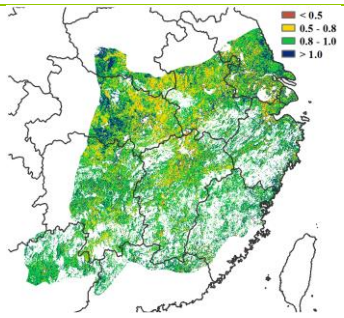
(a) Crop condition development graph based on NDVI



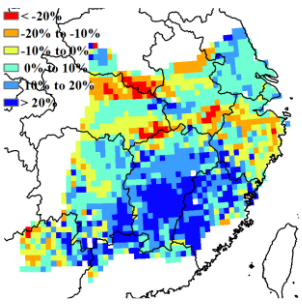
(b) Spatial NDVI patterns compared to 5YA



(c) NDVI profiles



(d) Maximum VCI



(e) Biomass departure

Southwest China

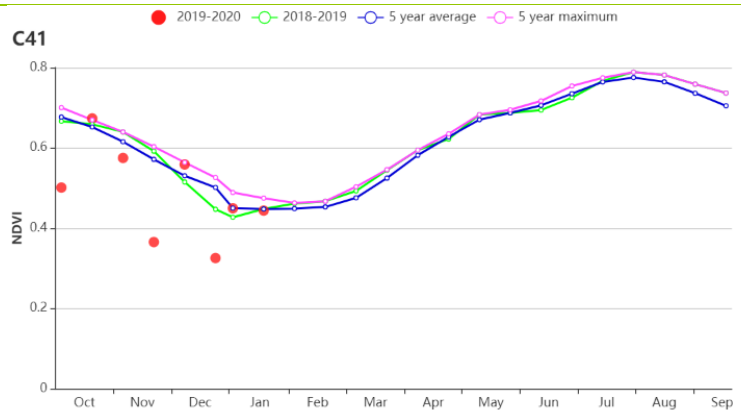
The reporting period covers the wintering period of winter crops. According to the regional NDVI profile, crop conditions were generally below the 5-year average, but above the average in October and mid-December 2019.

On average, rainfall was above the fifteen-year average (Rain +25%), whereas radiation was below average (RADPAR -7%). Temperature was close to average as well (TEMP + 0.6 °C). The resulting BIOMSS was 12% below average mainly due to the less radiation.

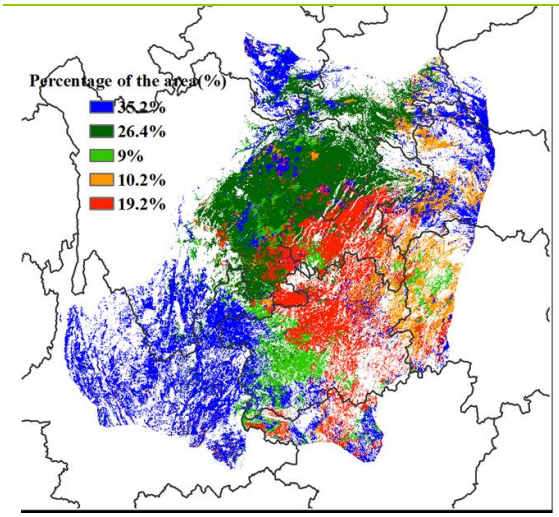
According to the NDVI departure clustering map and the profiles, values were fluctuating throughout the monitoring period. In general, they were below average. Average NDVI throughout the monitoring period was observed in Yunnan, in spite of both precipitation and radiation being significantly above average (See Annex A.11). The cropped arable land fraction for the whole region remained at the same level as in the previous five years. The maximum VCI reached 0.97 at the peak of the growing season. The value was comparable with those of the previous five years.

Overall, the mixture of agroclimatic and agronomic indicators show generally average crop condition.

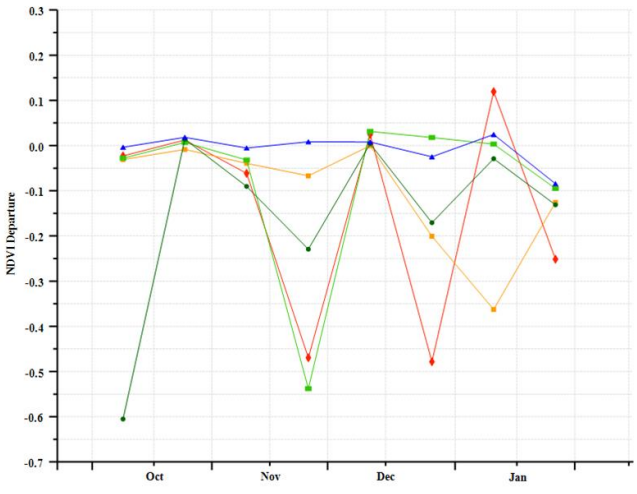
Figure 4.10 Crop condition Southwest China region, October 2019 - January 2020



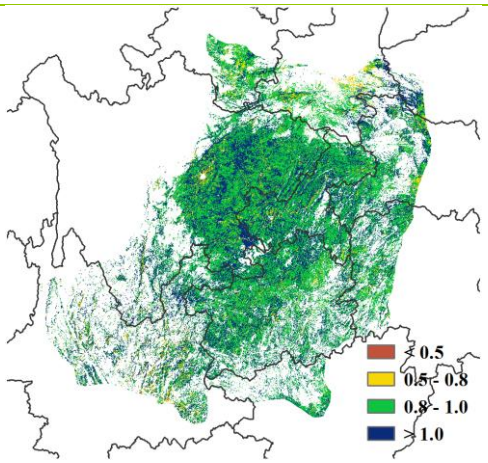
(a) Crop condition development graph based on NDVI



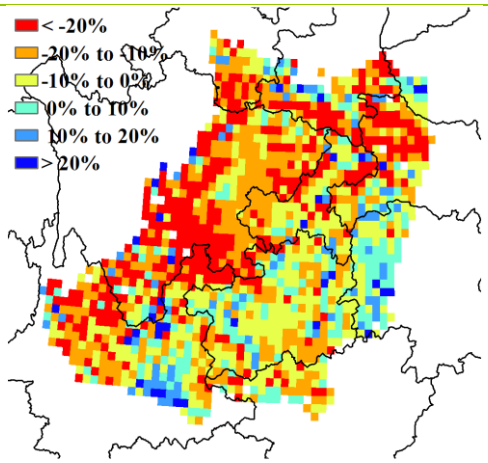
(b) Spatial NDVI patterns compared to 5YA



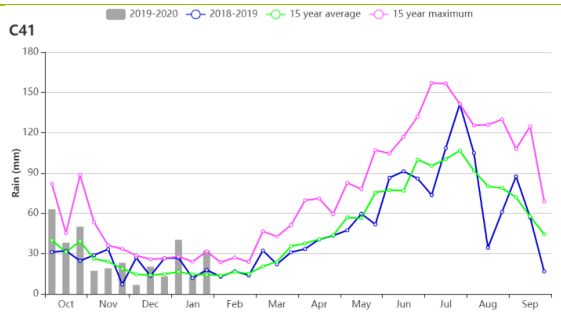
(c) NDVI profiles



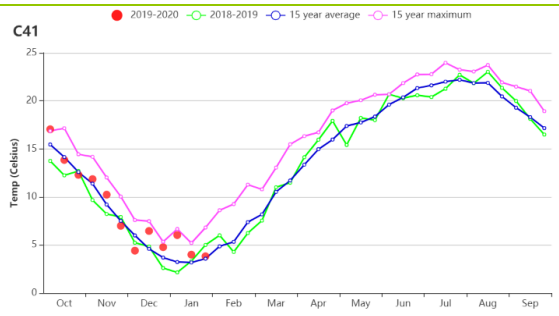
(d) Maximum VCI



(e) Biomass departure



(f) Time series rainfall profile



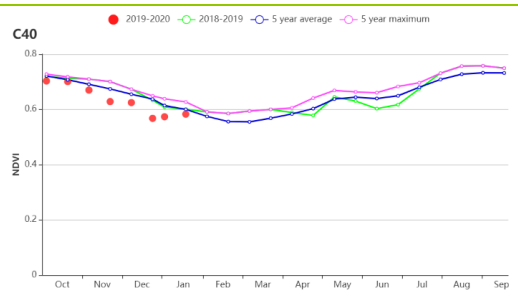
(g) Time series temperature profile

Southern China

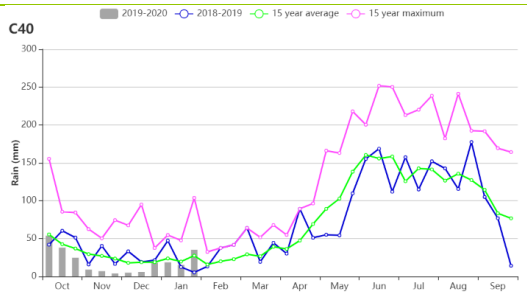
During the reporting period, the main crop in Southern China was late rice, which was harvested in November. Regionally, rainfall reached 234 mm, 31% lower than the average. The temperature and the radiation rose by 0.8℃ and 11% compared to the 15YA, respectively. The resulting BIOMSS was close to average (-3%). Since rainfall, temperature and radiation are non-linearly integrated into the BIOMSS model, the departures are not always consistent with sunlight (RADPAR), RAIN and TEMP departures at provincial level. Among those indicators, precipitation changes the most. In Guangdong and Fujian, precipitation dropped by 53% and 47% respectively compared to the 15YA.

The cropped arable land fraction (CALF) in this region was 97%, which was close to average. The average VCIx of the Southern China region during the monitoring period was 0.96, and almost all regions presented above 0.80 VCIx. According to the spatial clusters of NDVI departure from average, most areas in southern China were slightly below average except for scattered areas in Yunnan province accounting for 18.2% of the total cropland area in the region. The spatial distribution of biomass departures displayed a drop in this region, more significant reductions were noted in Guangxi. The conditions were mixed in the Yunnan province. Increases occurred in Guangdong, Fujian and some scattered areas in Yunnan and Guangxi. Overall, the mixture of positive and negative departures of indicators discussed above show generally unfavorable crop condition.

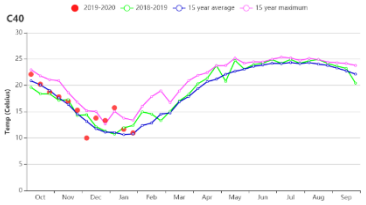
Figure 4.11 Crop condition Southern China region, October 2019 - January 2020



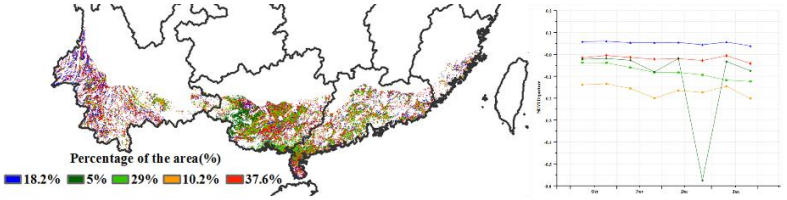
(a) Crop condition development graph based on NDVI



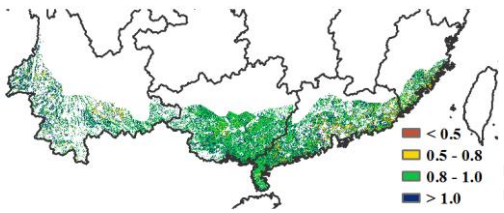
(b) Rainfall profiles



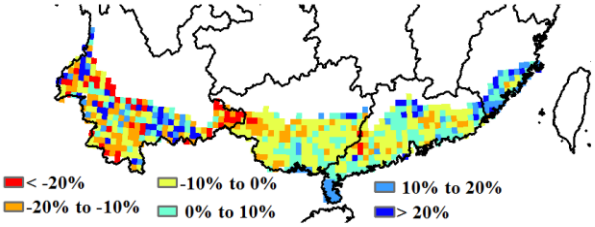
(c) Temperature profiles



(d) Clustering analysis of NDVI departure from 5 years average



(d) Maximum VCI



(e) Biomass departure