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 presents a revised estimate of major cereals and soybean production at provincial and national level as well as summer crops production and total annual outputs (4.2) and describes the situation by region, focusing on the seven most productive agro-ecological regions of the east and south: Northeast China, Inner Mongolia, Huanghuaihai, Loess region, Lower Yangtze, Southwest China, and Southern China (4.3). Section 4.4 describes trade prospects of major cereals and soybean. Additional information on the agro-climatic indicators for agriculturally important Chinese provinces are listed in table A.11 in Annex A.

4.1 Overview

From the perspectives of agroclimatic indicators, the overall conditions were generally favorable in China from July to October 2021, with rainfall, temperature and radiation all above average by 13%, 0.2°C and 2%, respectively. As a result, the potential biomass was 11% higher than the 15YA. The maximum Vegetation Condition Index (VCIx) was rather high at 0.95. The national Cropping Intensity (CI) was 5% above 5YA. Moreover, the mean of CALF for the whole country was at an average level compared to the 5YA.

Over the entire growing period, all of the main agricultural regions of China except Southern China (-3%) recorded above-average rainfall, with the largest positive departure occurring in Huanghuaihai (+75%). According to the spatial distribution of rainfall profiles, both above-average and below-average rainfall was observed during the monitoring period. In some provinces of the lower Yangtze River Basin (most parts of Zhejiang, southern Jiangsu, southern Anhui, northeastern Jiangxi, marked in dark green) rainfall per dekad exceeded the 15YA by 150 mm in mid-August. Regions along the Yellow River including some parts in Shandong, Hubei, Shaanxi, Shanxi, Henan, Beijing and Tianjin also experienced excessive rainfall. It exceeded the average of the mid-July dekad by 90 mm. Heavy rainfall in July in Henan caused severe flooding and led to the crop failure of maize in Hebi and other regions, and several rounds of heavy rainfall weather, continued flooding and low sunshine led to a 3.4% year-on-year decline in maize production in Henan province. Shanxi was also affected by excessive rainfall (such as heavy rain in early October), and the maize production fell 4.1%. Moreover, the excessive soil moisture due to excessive rainfall resulted in the delayed sowing of winter wheat for parts of the provinces along the Yellow river in Henan and Shandong.

Four of the main agricultural region in China recorded above-average temperatures ranging from +0.1℃ (Loess region) to +0.5℃ (Lower Yangtze region), while the other regions recorded below-average temperatures with negative departures ranging from -0.5°C (Inner Mongolia) to -0.1°C (Northeast China). The map of the spatial distribution of temperature profiles indicates that temperatures fluctuated during the monitoring period as follows: 40.8% of cultivated regions (marked in blue) in most parts of Southern China, Lower Yangtze region and Southwest China had positive temperature anomalies by more than 2.5°C in late September and early October, while 37.6% of the cultivated regions (marked in dark green) in most parts of Inner Mongolia, Loess region and Huanghuaihai had positive temperature anomalies by more than 2.0°C in late September. The blue and dark green marked regions also experienced negative temperature anomalies by more than 2.0°C in mid-October.

As for RADPAR, four of the seven regions in China (Huanghuaihai, Loess region, Inner Mongolia and Northeast China) received less radiation as compared to the 15YA, while the other regions received above-average radiation. In respect to BIOMSS, most parts of China had positive departures, including all of the AEZs with a range from +4% (Southern China) to +28% (Huanghuaihai). As can be seen in the spatial distribution of potential biomass departure from the 15YA, most of China had positive departures, but there were areas with negative departures and for very few of them, mainly concentrated in some parts in Shanxi, Shaanxi, Ningxia and Inner Mongolia where crops suffered from drought, BIOMSS was even 20% below average.

The VCIx values were mostly quite high in all of the main producing regions of China, with values between 0.89 (Loess region) and 0.98 (North-east China) except for the northern Shaanxi, central and sourthern Ningxia and part of Gansu. This coincided with the below-average BIOMSS pattern because those reigons are dominated by rainfed crops. Accordingly, not all of the cropland was cultivated, or rather crops were lost due to excessive rainfall, as shown on the CALF map. Nationally, CALF was average in all AEZs of China as compared to the 5YA. Among them, Inner Mongolia recorded slightly below-average CALF (-1%) while all the remaining regions showed an average CALF. When it comes to the cropping intensity (CI), values of 200% are mainly observed in the North China Plain with the wheat-and-maize rotation system while values of 300% are sparsely distributed in Southwestern and Southern China. The largest CI departure occurred in Southwest China (+14%), while all the other AEZs in China had the CI departure ranging from -1% to +8%.

Table 4.1 CropWatch agroclimatic and agronomic indicators for China, July - October 2021, 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	75	-0.4	-6	28	0	8	0.93
Inner Mongolia	58	-0.5	-4	21	-1	0	0.97
Loess region	53	0.1	-1	12	0	3	0.89
Lower Yangtze	4	0.5	5	6	0	8	0.96
Northeast China	36	-0.1	-2	22	0	0	0.98
Southern China	-3	0.4	7	4	0	-1	0.94
Southwest China	18	0.3	2	7	0	14	0.97

Figure 4.1 China crop calendar

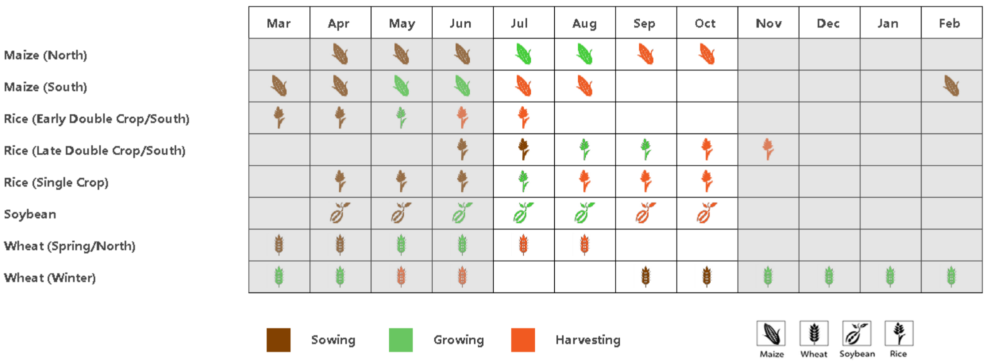
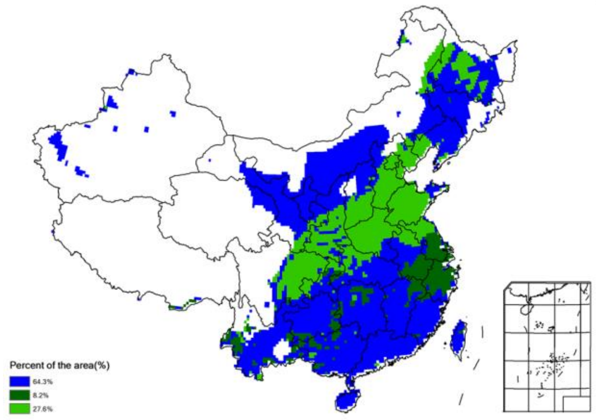


Figure 4.2 China spatial distribution of rainfall profiles, July to Oct 2021



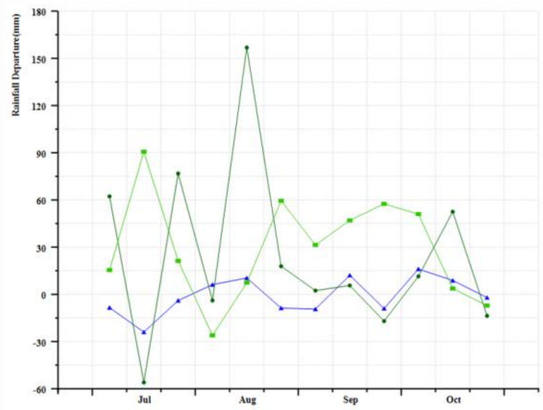
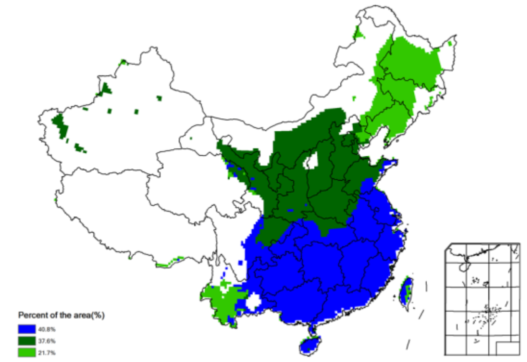


Figure 4.3 China spatial distribution of temperature profiles, July to Oct 2021



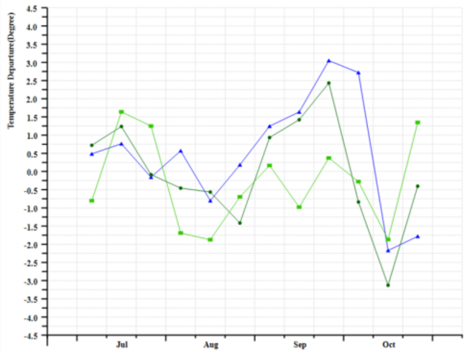
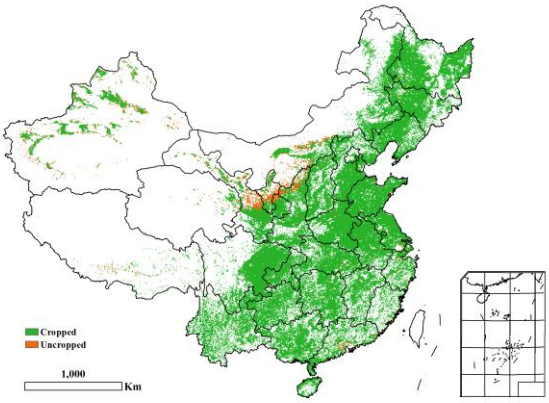


Figure 4.4 China cropped and uncropped arable land, by pixel, July to Oct 2021

Figure 4.5 China maximum Vegetation Condition Index (VCIx), by pixel, July to Oct 2021



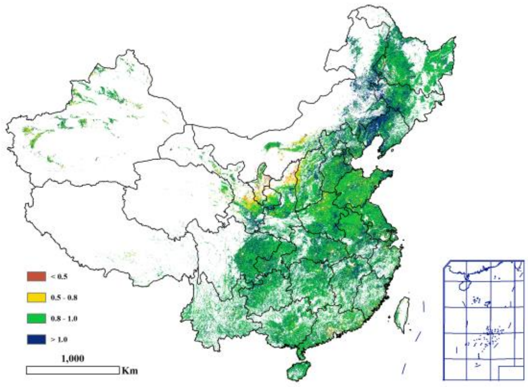
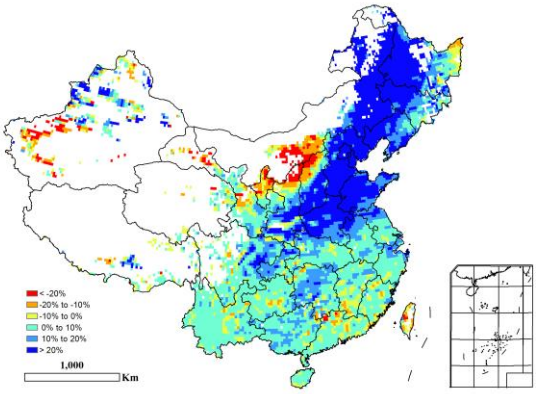


Figure 4.6 China biomass departure map from 15YA, by pixel, July to Oct 2021

Figure 4.7 China minimum Vegetation Health Index (VHIn), by pixel, July to Oct 2021



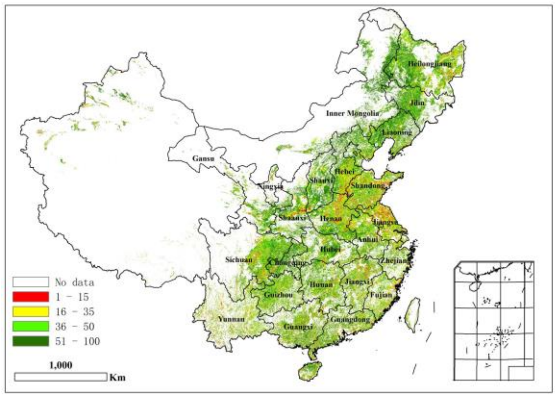
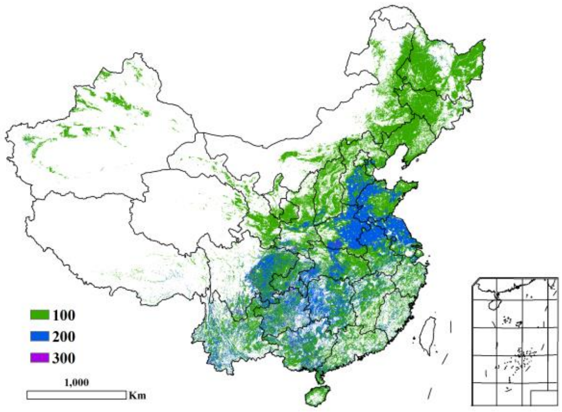


Figure 4. 8 China Cropping Intensity (CI), by pixel, July to Oct 2021



4.2 China's winter crops production

In 2021, the agro-meteorological conditions at national scale were generally favorable for crops, with the north dominated by rainy weather, leading to regional flooding in the HuangHuaiHai region, the Yangtze River basin, the southwest and the western part of the northeast. High temperature and low precipitation dominated in southern China, leading to meteorological drought in Guangdong and Fujian.

Based on multi-source remote sensing data including Sentinel 1/2, Landsat 8, in combination with the latest agro-meteorological information and ground truth samples, as well as 10m resolution cropland mask, a remote sensing-based crop yield model and big data method for crop planted area estimation method were used to monitor and review the national maize, rice and soybean production as well as the total production of summer crops and annual total outputs in 2021.

Total grain production for the year was 636.86 million tonnes, an increase of 5.42 million tonnes or 0.9% over the same period last year. The total output of summer crops (including maize, medium rice, late rice, spring wheat, soybeans, tuber crops and some other minor crops) was 470.82 million tonnes, an increase of 4.34 million tonnes, or up by 0.9% over 2020. Northeast China recovered from the 2020 disaster years, and the total annual crop production increased significantly. Annual total crop production in Heilongjiang, Inner Mongolia and Jilin increased by 2.57 million tonnes, 1.91 million tonnes and 1.17 million tonnes, respectively. Shandong, Liaoning and Hebei provinces benefited from favorable weather conditions and annual total crop production increased by 1.39 million tonnes, 0.88 million tonnes and 0.87 million tonnes, respectively. Henan Province encountered several disasters in 2021, with winter crops affected by hailstorms at the maturity stage of the winter crops. Summer crops were affected by several rounds of heavy precipitation, resulting in flooding, and destroyed part of the summer crop. The total summer crops production in Henan decreased by 0.99 million tonnes. The rest provinces and regions presented limited annual crop production year-on-year changes.

Maize

Total maize production is estimated at 229.70 million tonnes in 2021, an increase of 3.63 million tonnes or up by 1.6% from 2020 (Table 4.2). The increase is mainly due to market factors such as maize prices, which have remained at a high level since 2020, prompting a 1.8% increase in maize planted area. As China's largest maize producing region, maize in the northeast received abundant precipitation during the growing season, and agro-meteorological information were significantly better than in the disaster year of 2020 when several typhoons passed through. The favorable weather conditions provided suitable water and heat conditions for maize production in Heilongjiang, Jilin, Liaoning and Inner Mongolia. Meanwhile, the maize planted area in those provinces also increased, maize production in the four provinces and regions increased by 6.1%, 3.2%, 4.3% and 6.7% respectively, which in total produced 5.81

million tonnes more maize production than the previous year. Maize production increased in Shandong (+2.5%), Hebei (+1.1%), Xinjiang (+3.9%) and Yunnan (+1.1%) compared with 2020. Maize production in Gansu (-2.9%), Ningxia (-2.1%) and Shaanxi (-4.1%) decreased as a result of low precipitation during the monitoring period, which resulted in water deficit during the grain-filling period. In Henan Province, heavy precipitation in July caused flooding, leading to crop failures in Hebi and some other places. Besides, Henan also suffered several rounds of heavy rainfall. All those negative factors led to a 2.6% drop in maize yield in Henan, and the province's corn production decreased by 3.4%. Shanxi Province suffered from heavy rainfall and flooding at the end of summer crops harvesting period, with maize production dropped by 4.1%. Anhui was affected by continuous rain and other adverse weather, with maize production reduced by of 1.5%.

Table 4.2 China 2021 production (thousand tonnes) of maize, rice, wheat, and soybean, and percentage change from 2020, by province

	Maize		Rice		Wheat		Soybean	
	2021	△(%)	2021	△(%)	2021	△(%)	2021	△(%)
Anhui	3,551	-1.5	17,685	1.9	11,679	1.3	1,074	0.8
Chongqing	2,119	-0.4	4,724	0.5	1,146	0.3		
Fujian			2,755	-2.4				
Gansu	5,562	-2.9			3,077	-1.7		
Guangdong			11,368	-0.7				
Guangxi			10,713	0.4				
Guizhou	5,185	0.2	5,324	1.1				
Hebei	19,219	2.5			12,341	2.6	196	4.3
Heilongjiang	43,488	6.1	22,015	1.4	451	3.4	4,792	-6.5
Henan	15,356	-3.4	3,819	-0.5	27,694	-1	808	-1.4
Hubei			15,798	1.7	3,904	-1		
Hunan			25,607	1.4				
Inner Mongolia	24,637	6.7			1,938	2.1	1,210	2.2
Jiangsu	2,191	0.4	16,407	2	9,867	-1.2	768	2.7
Jiangxi			16,541	0.7				
Jilin	30,718	3.2	5,923	2.9			819	2.8
Liaoning	18,912	4.3	4,463	1.4			437	4.5
Ningxia	1,694	-2.1	442	0.2	752	-0.8		
Shaanxi	3,809	-4.1	1,052	0.7	4,053	-2.1		
Shandong	19,215	1.1			26,554	4.5	714	2.2
Shanxi	9,184	-0.8			2,197	-3.5	158	0.5
Sichuan	7,210	0.7	15,167	2.6	5,004	1.3		
Xinjiang	6,948	3.9			5,052	-1.6		
Yunnan	6,422	1.1	5,827	1.7				
Zhejiang			6,565	0.6				
Sub total	225,419	2.7	192,194	1.3	115,711	0.9	10,976	-2
China*	229,703	1.6	202,956	0.9	127,981	0.7	14,346	-1.6

* Production of Taiwan province is not included.

Rice

Total national rice production was 202.96 million tonnes, an increase of 0.9% and 1.78 million tonnes. Early rice production was 33.55 million tonnes, an increase of 0.3%; Semi-late or single rice production was 133.85 million tonnes, an increase of 1.1%, and late rice production was at 35.56 million tonnes, an increase of 0.8% (Table 4.3). Agro-meteorological conditions in the main production areas have been generally normal since the sowing of semi-late or single rice, and it's estimated that rice yield increased by 0.9% and total rice production increasing by 1.4 million tonnes. Most of the main rice-producing provinces in the southwest and the Yangtze River Basin and Huai River basin have experienced high precipitation and insufficient light since August, narrowing the increase in rice yields. Moderate rice production increased in Hubei (+2.9%), Sichuan(+2.6%), Jiangsu(+2.0%), Zhejiang(+1.9%), Hunan (+1.9%) and Anhui (+1.8%) provinces ; Agricultural weather conditions in the single rice producing areas in the northeast were better than last year. With rice production increased in Heilongjiang(+1.4%), Jilin (+ 2.9%) and Liaoning (+1.4%) . During the late growing stages of late rice, Guangdong, and Fujian's precipitation was more than 10% lower from 15YA, but irrigation and other management measures somehow compensate the impact of water shortage. As a result, late rice production in Guangdong and Fujian reduced by 1.1%and 0.3%; Hubei Province, affected by continuous heavy precipitation, is estimated to generate 3.5% year-on-year increase of maize.

Soybean

Total soybean production in 2021 was 14.35 million tonnes, a year-on-year decrease of 0.23 million tonnes, or up by 1.6% from 2020. The main reason for the year-on-year reduction is the decline in planted area, which is concentrated in the northeast. The two major producing provinces of Heilongjiang and Inner Mongolia putout a reduced soybean planted area by 6.7% and 1.1% respectively. Since July, despite local flooding in Heilongjiang's soybean-producing areas, the province's soybean yields only increased slightly by 0.2% and the soybean production decreased by 6.5% mainly due to the reduced planted area. In contrast, Inner Mongolia Soybean production increased by 2.2 per cent from 2020 thanks to well-matched rain and heat conditions during the podding and grain-filling period of soybean, The increase in yields compensated the impact of reduced planted area. Other soybean producing provinces had limited changes in production.

Table 4. 3 Production of early rice, semi-late or single rice and late rice by province in China in 2021 (thousand tonnes) and variation (%)

	Early rice		Semi-late or single rice		late rice	
	2021	Variation (%)	2021	Variation (%)	2021	Variation (%)
Anhui	1,983.6	3.8	13,973	1.8	1,728	0.2
Chongqing			4,724	0.5		
Fujian	1,499.3	-4.1			1,256	-0.3
Guangdong	5,048.3	-0.2			6,320	-1.1
Guangxi	5,247.0	2.1			5,466	-1.3
Guizhou			5,324	1.1		
Heilongjiang			22,015	1.4		
Henan			3,819	-0.5		
Hubei	2,135.6	2.8	10,885	2.9	2,777	-3.5
Hunan	8,527.0	1.5	8,844	1.9	8,236	0.6
Jiangsu	-	-	16,407	2		
Jiangxi	7,160.5	-0.6	2,986	-0.7	6,395	2.8
Jilin			5,923	2.9		
Liaoning			4,463	1.4		
Ningxia			442	0.2		
Shaanxi			1,052	0.7		
Sichuan			15,167	2.6		
Yunnan			5,827	1.7		
Zhejiang	794.3	-0.9	4,939	1.9	875	
Subtotal	32,395.5	0.8	126,789	1.8	33,053	
China*	33,549.3	0.3	133,852	1.1	35,555	0.8

* Production of Taiwan province is not included.

4.3 Regional analysis

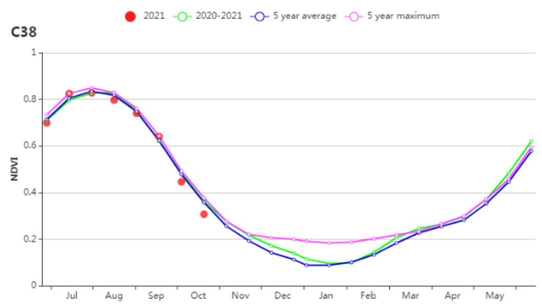
Figures 4.9 through 4.15 present crop condition information for each of China's seven agricultural regions. The provided information is as follows: (a) Phenology of major crops; (b) Crop condition development graph based on NDVI, comparing the current season up to October 2021 to the previous season, to the five-year average (5YA), and to the five-year maximum; (c) Spatial NDVI patterns for July to October 2021 (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 July to October 2021. Additional information about agro-climatic indicators and BIOMSS for China is provided in Annex A.

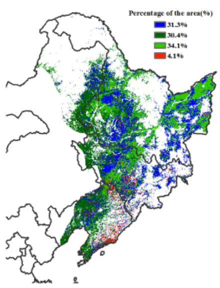
Northeast region

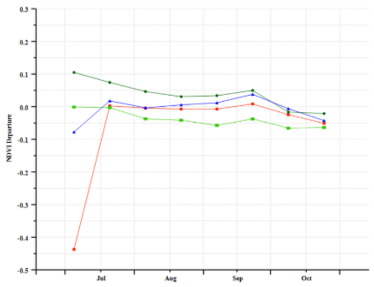
The current monitoring period (July to October) covered the peak of the summer crops in July until the harvest in September and October in northeast China. The crops including maize, rice and soybeans, reached maturity stage in August to September in Heilongjiang, Jilin and Liaoning provinces, and the harvest was mostly completed by the end of October. Overall, crop growth in northeast China was normal. Precipitation in northeast China was 36% higher than the average level, the average temperature was 0.1 °C lower, and the photosynthetic effective radiation was 2% lower. Temperatures in mid-July and late July were higher than the average level, and after August they were in line with the average. During the monitoring period, the potential biomass in northeast China was 22% above the fifteen-year average. The eastern parts of northeast China were slightly lower than average, while the western parts of northeast China were significantly above average. This could be attributed to the abundant rainfall and moderate temperature in northeast China during the current monitoring season.

The spatial distribution map of the VCI shows that the crops in the whole northeast region were in good conditions, with VCIx values higher than 0.8 in almost all areas, except for small parts near the rivers. In general, crops in northeast China grow well in 2021, with good prospects for crop yield.

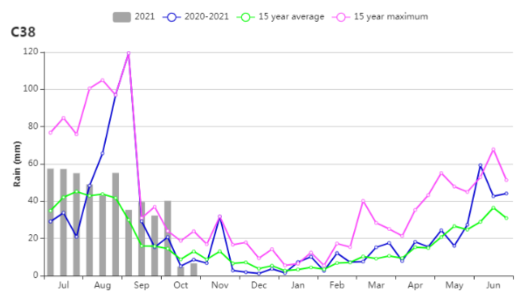
Figure 4.9 Crop condition China Northeast region, July-October 2021

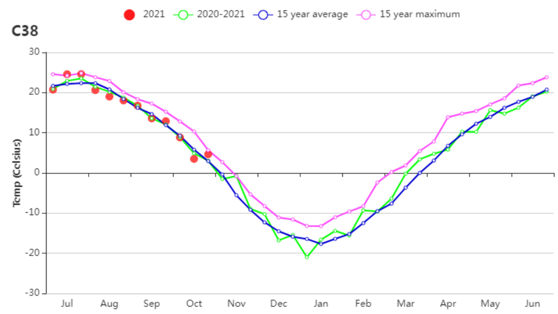






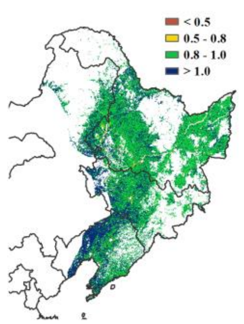
(a) Crop condition development graph based on NDVI (b) Spatial NDVI patterns compared to 5YA(c) NDVI profiles

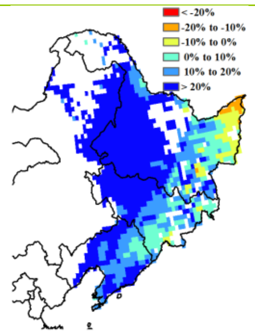




(d)Time series rainfall profile

(e)Time series temperature profile





(f) Maximum VCI

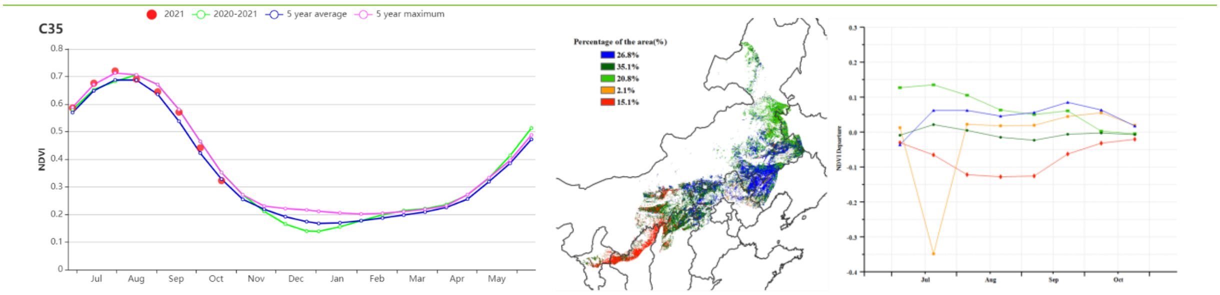
(g) Biomass departure

Inner Mongolia

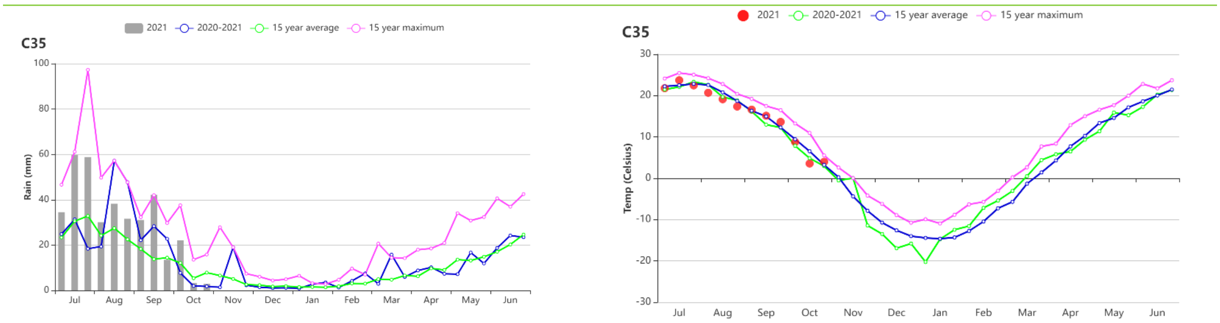
During this monitoring period, maize and soybean are the main summer crops grown in Inner Mongolia.

CropWatch Agroclimatic Indicators (CWAIs) show that rainfall was above average (+58%). TEMP (-0.5°C) and RADPAR (-4%) were both below average. Abundant rainfall resulted in a higher-than-average BIOMSS estimate (+21%). But, drought in northern Shaanxi during the monitoring period and heavy rain in Shanxi in October resulted in below-average BIOMASS in both areas. The NDVI development graph indicates above-average crop conditions during the whole period and they even exceeded the maximum of the 5YA in July. The spatial NDVI pattern shows that more than 80% of the crops were close to the 5YA, mainly distributed in Western Liaoning, northern Hebei and eastern Inner Mongolia. 2.1% of the cropped areas had a big drop in July and 15.1% of the region was below average throughout the season, mostly in the north of Shannxi, which suffered from severe drought. The fraction of cropped arable land (CALF) reached 95% and VCIx was above average (0.97). Generally favorable crop production is expected for Inner Mongolia.

Figure 4.10 Crop condition Inner Mongolia, July - October 2021



(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

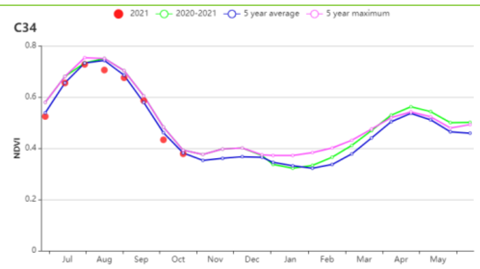
(f) Maximum VCI (g) Biomass departure

Huanghuaihai

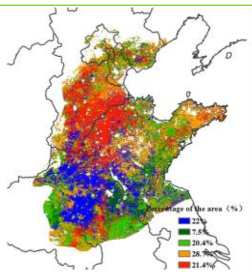
The main crops in Huanghuaihai region are summer maize and winter wheat. The whole cycle period of summer maize is from July to September and the winter wheat is sown in early October during this monitoring period. Agroclimatic indicators illustrate that the precipitation increased by 75% dramatically, the temperature and radiation decreased by 0.4 degree and 6% respectively. Abundant rainfall brings a good growth environment for plants, and the potential biomass is 28% higher. As shown on the biomass departure map, most areas presented significant above average level. The cultivated area was equal to the 5YA, and the maximum VCI value was 0.93.

The crop growth condition was lower than the 5YA in mid-August, and was generally close to the average level or the same as the average level in other periods of the monitoring period, which based on the NDVI-based crop growth profile. As it showed in NDVI cluster nad profiles, Zhengzhou City in Henan Province and Suzhou City in Anhui Province (accounting for 7.5% of the total area) were affected by local floods caused by continuous heavy rainfall in mid-July. NDVI was significantly lower than the average level, but it started to improve in August and after September Above average. In central Henan and northern Anhui (accounting for 20.4% of the total area), the NDVI value of early crop growth was slightly lower than the average level, due to abundant rainfall, the crop growth began to improve after August and was higher than the average level. Besides, 28,7% of cropland in Southeastern Hebei, Central and Eastern Shandong presented positive NDVI departures. Only a small part of the area has been showed the poor growth of crop in the map of maximum VCI, even the crop conditions in Southern Henan and Eastern Shandong exceeded the optimal level in recent five years. Due to the impact of flood disasters in some parts of Henan, the sowing of wheat this year has been delayed by 10-15 days compared with previous years. Generally, the crop condition in whole area seems optimistic.

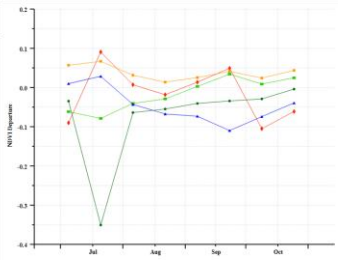
Figure 4.11 Crop condition China Northeast Huanghuaihai, July - October 2021



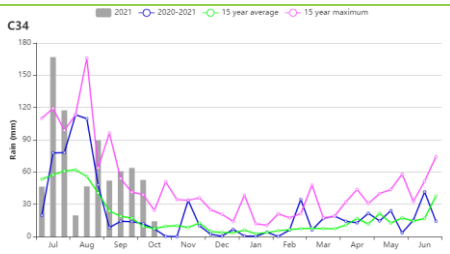
(a) Crop condition development graph based on NDVI



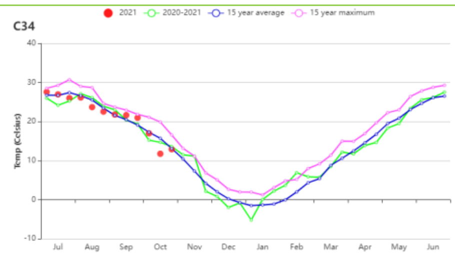
(b) Spatial NDVI patterns compared to 5YA



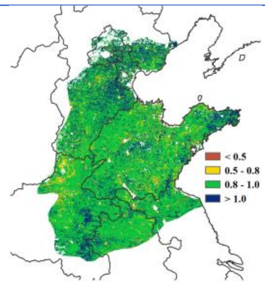
(c) NDVI profiles



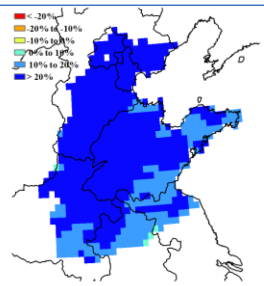
(d)Time series rainfall profile



(e)Time series temperature profile



(f) Maximum VCI



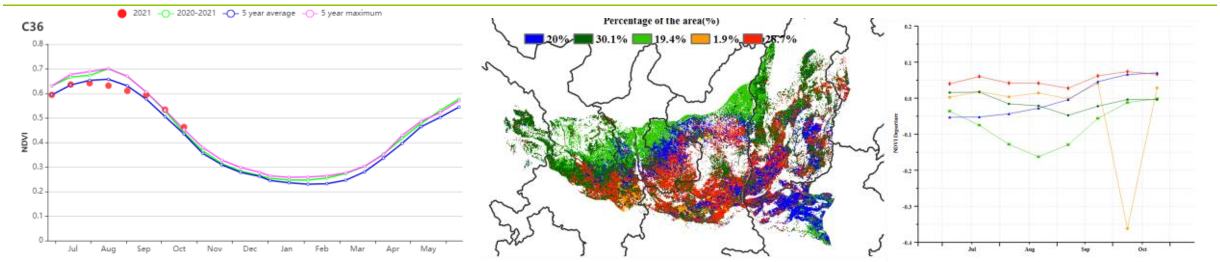
(g) Biomass departure

Loess region

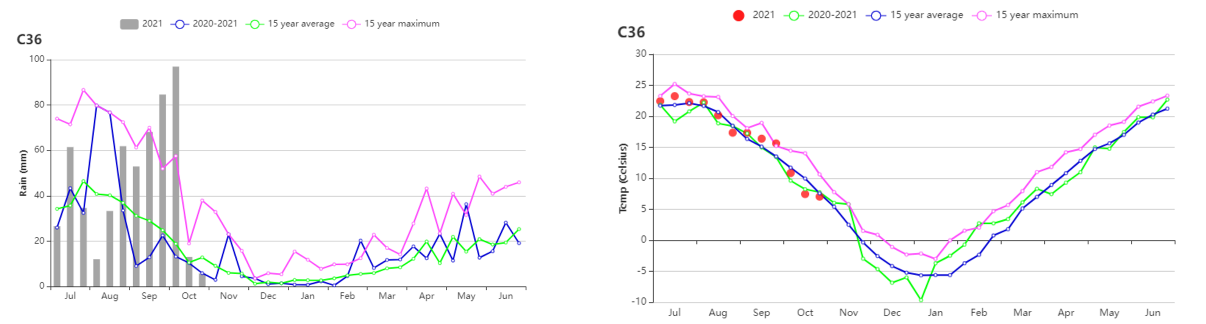
During the reporting period, maize was harvested in late September and early October, and winter wheat was planted in October.

Crop conditions in the Loess Region were close to the 5YA from July to early September and close to the 5-year maximum in late September and October. The CropWatch Agroclimatic Indicators (CWAIs) show that rainfall (RAIN) increased by 53%, temperature (TEMP) was above average by 0.1°C, and radiation (RADPAR) was reduced by 1% compared to the 15 YA. The potential biomass (BIOMSS) was above average by 12%. However, the precipitation was decreased in western Gansu province, northern Shaanxi Province and northwest Shanxi Province resulted in lower potential biomass. According to the regional NDVI development graph, the crop conditions were significantly higher than the 5YA in late September and October. Precipitation also exceeded the maximum of the past 15 years by far from late September to early October. The heavy rainfall during the harvest season in late September and early October caused delays in harvest and impacted the quality of maize. NDVI clusters and profiles show that crop conditions in most parts of the region were close to average. The Maximum VCI map shows high VCIx average values with 0.89 in most cropped areas of the region. CALF was at 96% which is in line with the 5YA. Cropping intensity (CI+3%) was above the 5YA. All in all, during the monitoring period, the Loess Region's overall crop conditions were favorable.

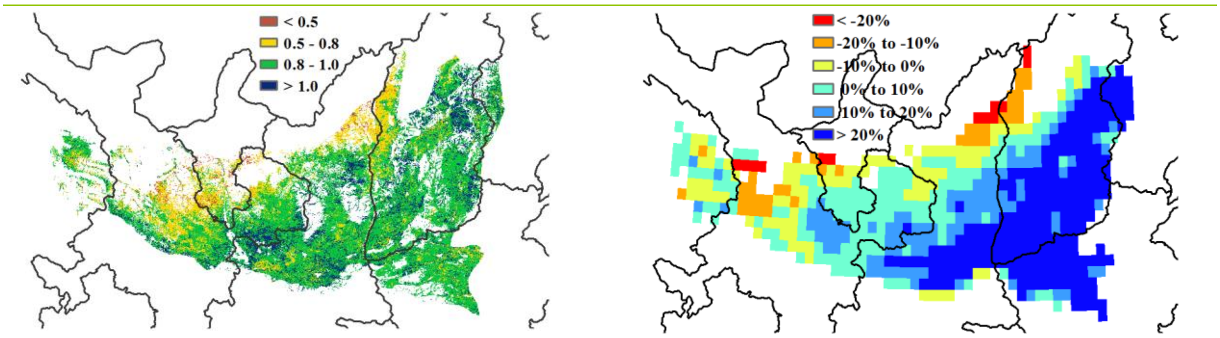
Figure 4.12 Crop condition China Loess region, July - October 2021



(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



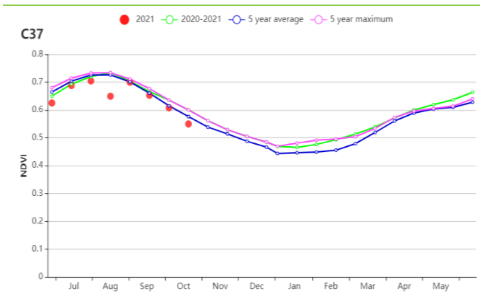
(f) Maximum VCI (g) Biomass departure

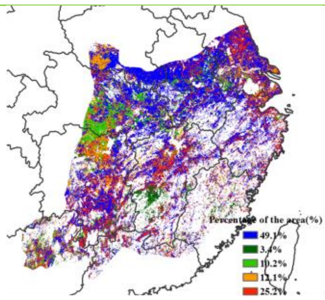
Lower Yangtze region

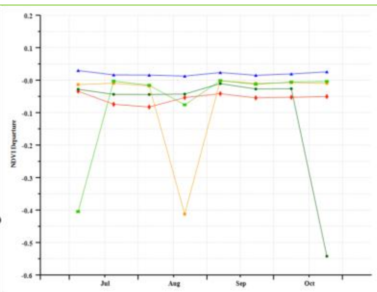
By October, the late rice had matured in the center of Lower Yangtze region including Hubei, Hunan, Jiangxi and Fujian provinces. The harvest of semi-late rice and maize had been completed in Jiangsu, Anhui and Zhejiang provinces by then.

The comparison of the current crop NDVI development curve with the 5YA indicates that the crop conditions were slightly below average. According to CropWatch agro-climatic indicators, the accumulated precipitation, photosynthetically active radiation and temperature were 4%, 5% and 0.5℃ higher than the 15-year averages, respectively. The above-average agro-climatic conditions resulted in an estimate of the potential biomass that was 6% higher than the 5-year average. The biomass departure also shows that the potential biomass in most areas of the region was above the average level, up to a maximum of 20%. As shown in spatial NDVI patterns, 49.1% of the area, mostly distributed in the north of this region including Jiangsu, Anhui and Hubei provinces, presented better crop conditions compared to the five-year average. The remaining areas had slightly below average crop conditions. This was basically consistent with the spatial distribution of potential biomass departure, indicating that there were better agro-climatic conditions in the north of the region during this monitoring period. The average VCIx of this region was 0.96, and most area had VCIx values ranging from 0.8 to 1. Overall, the crop conditions in the lower Yangtze region were normal.

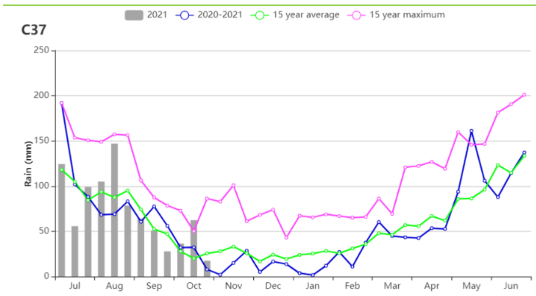
Figure 4.13 Crop condition China Lower Yangtze region, July - October 2021

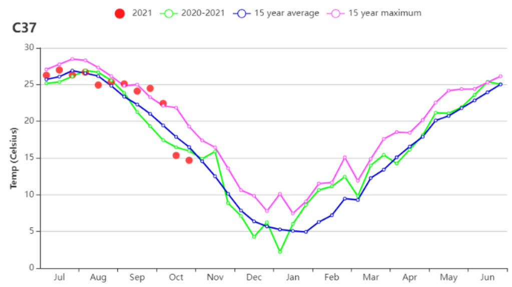




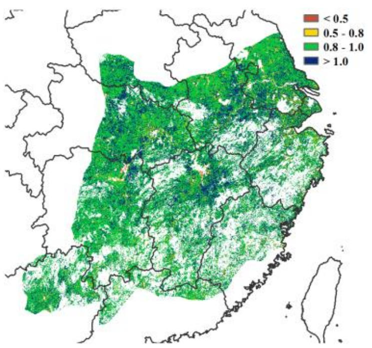


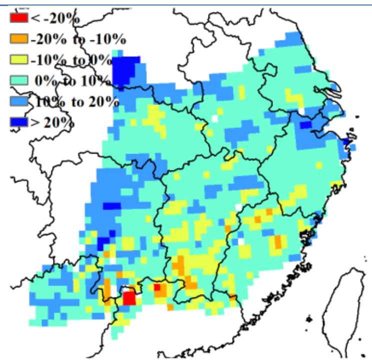
(a) Crop condition development graph based on NDVI (b) Spatial NDVI patterns compared to 5YA (c) NDVI profiles





(d)Time series rainfall profile (e)Time series temperature profile





(f) Maximum VCI (g) Biomass departure

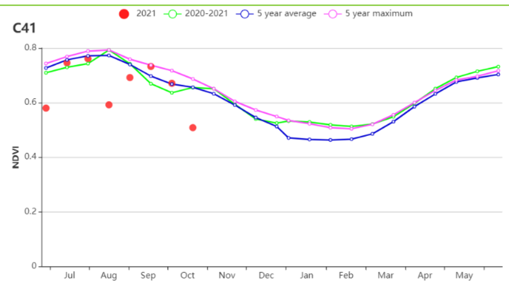
Southwest region

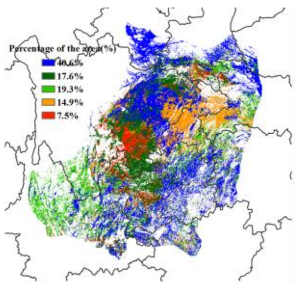
The reporting period covers the growth and maturity stages of summer crops, including late rice, semi-late rice and maize. Their harvest was followed by the sowing of winter wheat on some fields. Overall, crop condition was almost close to or above the 5-year average except for a few periods.

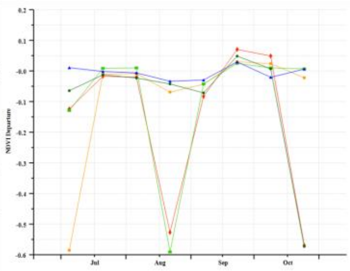
On average, rainfall and solar radiation were above the 15-year average (RAIN +18%, RADPAR +2%). Temperature was close to average (TEMP +0.3°C). The resulting BIOMSS was 7% above average mainly due to the above-average rainfall. The cropped arable land fraction remained at the same level as in the last five years, which indicated the crops planted area was generally normal for this period.

According to the NDVI departure clustering map and the profiles, NDVI values were close to average in most regions. In northeastern Sichuan and eastern Guizhou, the NDVI values were average during the monitoring period. Chongqing experienced similar conditions, except for July. Rainfall was significantly above average in Chongqing and Sichuan (RAIN +30%) which benefited crops there. Average to above-average NDVI values in September and October were observed in Yunnan, where radiation and precipitation were both above average (See Annex A.11). The maximum VCI reached 0.97, indicating that peak conditions were comparable to the last five years. All in all, crop condition was generally average.

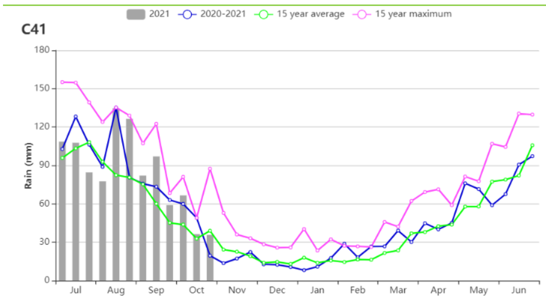
Figure 4.14 Crop condition China Southwest region, July - October 2021

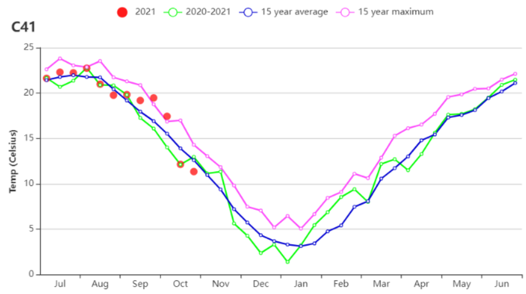




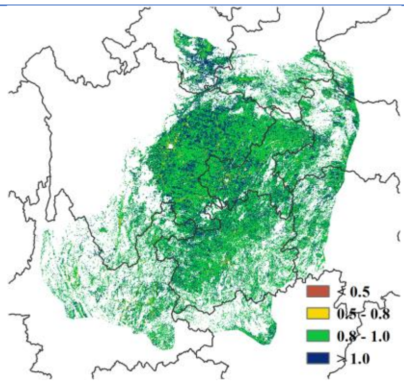


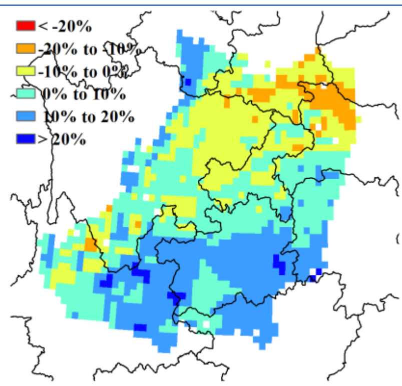
(a) Crop condition development graph based on NDVI (b) Spatial NDVI patterns compared to 5YA (c) NDVI profiles





(d)Time series rainfall profile (e)Time series temperature profile





(f) Maximum VCI (g) Biomass departure

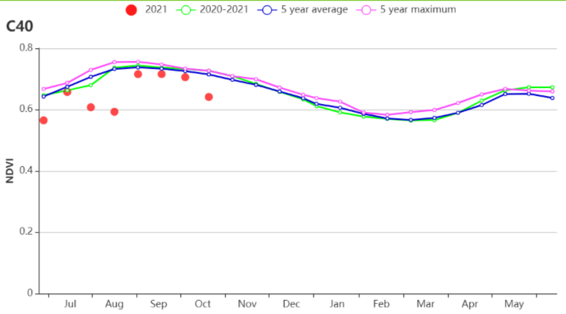
Southern China

By October, late rice was maturing in Southern China. The average VCIx of the Southern China region during the monitoring period was 0.94. According to the regional NDVI profile, crop conditions were generally below the 5-year average, but reached close to average levels in September and early October during the peak season of late rice.

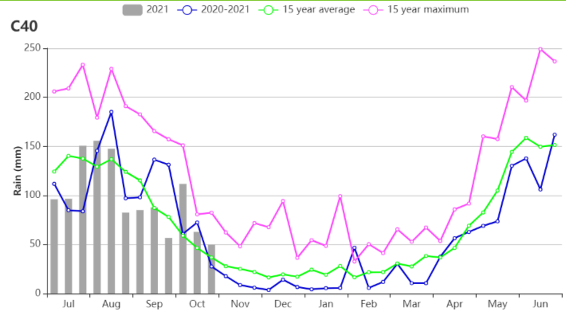
On average, rainfall reached 1183 mm, which was 3% lower than the average. Provincial departures were as follows: +12% in Yunnan, +1% in Guangxi, -22% in Guangdong, and -11% in Fujian. The average temperature during the monitoring period in Southern China was 23.0°C, which was above average by 0.4°C. Radiation (RADPAR) exceeded the average by 7%. BIOMSS was 4% above average mainly due to the favourable weather conditions with high rainfall and sufficient radiation during the heading and grain filling stages of late rice。 As shown by NDVI clusters and profiles, 45.2% of cropland of Southern China did not have significant tendency of variation during the monitoring period. In August, almost all cropland presented negative NDVI departures. In early August, 16.6% of cropland in Eastern Guangxi and Western Guangdong fell to below average levels, but conditions improved subsequently. At the end of the monitoring period, only 8.3% of the cropland in southern Yunnan presented negative NDVI departures.

Overall, the crop conditions during the monitoring period were close to normal.

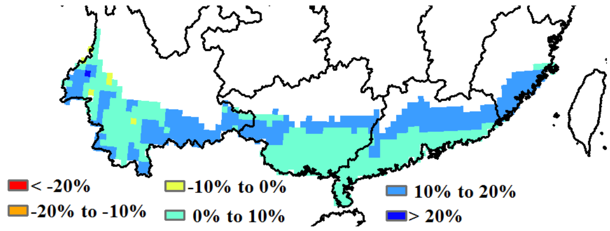
Figure 4.15 Crop condition Southern China region, July - October 2021



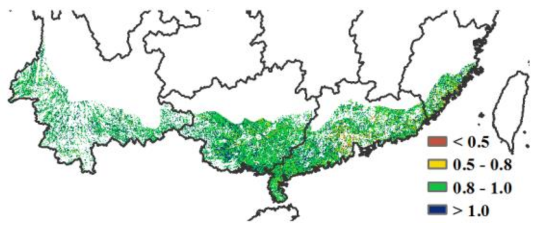
(a) Crop condition development graph based on NDVI



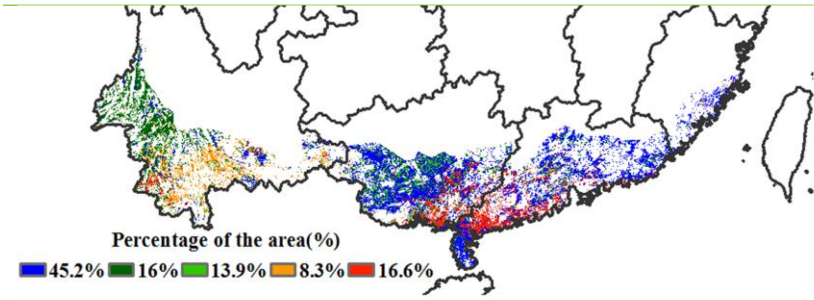
(b)Time series rainfall profile



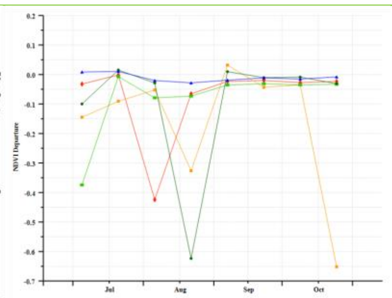
(c)BIOMSS departure from 15YA



(d) Maximum VCI



(e) Spatial patterns of NDVI departure from 5YA



(f) NDVI departure profiles

4.4 Major crops trade prospects

Import and export of major crops in the first three quarters of 2021

Maize

In the first three quarters, China imported 24.93 million tonnes of maize, nearly four times of the same period last year. The main import sources were the United States (70.7%) and Ukraine (29%), with an import value of US $6.929 billion. The export of maize was 4.4 thousand tonnes, with an export value of US $2.37 million.

Rice

China imported 3.58 million tonnes of rice, more than double of the same period last year, with the main source countries being India, Vietnam, Pakistan, Myanmar and Thailand, accounting for 23.8%, 22.9%, 18.8%, 16.8% and 10.2% of total import, respectively. The total imported rice valued at US$1.63 billion. The export of Rice was 1.85 million tonnes, a decrease of 1.2% over the same period last year. It was mainly exported to Sierra Leone (accounting for 9.1% of the total export), South Korea (8.8%), Egypt (8.5%), Niger (6.7%) and Papua New Guinea (6.6%), with a total export value of US $760 million.

Wheat

China imported 7.60 million tonnes of wheat, an increase of 25.5% over the same period last year. The main import sources were Canada, the United States and Australia, accounting for 32.2%, 30.4% and 24.7% of total import, respectively and the total import wheat valued at US$2.346 billion. The export of wheat was 54.1 thousand tonnes, a significant decrease of 66.4% over the same period last year.

Soybean

China imported 73.99 million tonnes of soybeans, an increase of 0.7% over the same period last year. The main source countries were Brazil (66.2% of the total imports), the United States (29.5%) and Argentina (2.0%), with an import value of US $25.435 billion. Soybean experts were at 44.8 thousand tonnes, a decrease of 21.3% over the last year.

Trade prospects for major cereals and oil crop in China for 2021

On the basis of remote sensing-based production prediction in major agricultural producing countries in 2021 and the Major Agricultural Shocks and Policy Simulation Model, it is predicted that the import of major crops will increase and the export will decrease in 2021. The details are as follows:

Maize

Due to the structural change of domestic maize supply and demand and the adjustment of market price, it is expected that China's maize import will increase significantly by 258% from 2020, and export will decrease by 1.5% in 2021.

Rice

The global rice market maintains a loose supply and demand pattern, and the price difference at home and abroad continues. It is expected that China's rice import will increase by 121% and export will decrease by 1.1% in 2021.

Wheat

Affected by natural disasters such as drought, the global wheat output has declined and the price is bullish. However, wheat production in China's wheat import source countries is relatively stable. It is expected that China's wheat import will increase by 27.5% and export will decrease by 32.4% in 2021.

Soybean

Due to sufficient global soybean supply and stable domestic soybean consumption demand, it is expected that China's soybean import will be basically the same as last year (+1%) and export will decrease by 15.2% in 2021.

Figure 4.16 Rate of change of imports and exports for rice, wheat, maize, and soybean in China in 2021 compared to those for 2020(%).