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 then presents China's crop prospects (section 4.2), 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 (section 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 is listed in table A.11 in Annex A.

4.1 Overview

Most of the summer crops, such as semi-late rice, maize, and soybean, were in the field during the reporting period. This period also covers the harvest of early rice and winter wheat. The sowing of late rice was completed in July. The agro-climatic conditions were near average, with rainfall below average (-10%), temperature (+0.5°C) and RADPAR (+1%) slightly above average. On the combined effects of agroclimatic indicators, BIOMSS was close to the 15YA. National crop area land fraction (CALF) was average, the national maximum Vegetation Condition Index (VCIx) was 0.88, and the national Crop Production Index (CPI) was 1.06, indicating an overall favorable crop condition.

According to the time series rainfall profile, above-average rainfall was observed nationwide in early April and late July. Three of the main agricultural regions of China recorded above-average rainfall, with the largest positive departure occurring in Huanghuaihai (+27%), while another three regions recorded below-average rainfall, with the largest negative departure occurring in southern China (-21%). At the country level, rainfall anomalies fluctuated largely over time and space. As can be seen from the spatial distribution of rainfall profiles, 68.3% of the cropped areas (marked in blue) recorded near-average precipitation. 18% of the cropped areas (marked in deep green) experienced slightly below average rainfall during most of the monitoring period, mainly distributed in some parts of Yunnan, Guizhou, Guangdong, Guangxi, Fujian, and Jiangxi. The remaining 13.8% of the cropped areas (marked in light green), mainly located in Beijing, Hebei, some parts of Shandong, Liaoning, and the eastern part of Lower Yangtze region, received around average rainfall except for late July. As influenced by the super typhoon Doksuri, extreme rainfall (more than 135mm/dekad) fell over the Lower Yangtze region and Huanghuaihai in late July, causing some damage to summer crops. Fujian and Hebei were among the most severely affected provinces, and the area of flooded cropland was reported to be 37,396 and 319,700 hectares, respectively. Persistent heavy rainfall has not only led to flooded cropland and crop lodging but also to urban flooding, and mudslides, resulting in large economic losses. Apart from late July, Henan Province also experienced continuous heavy rainfall in late May. Starting from May 23rd, efforts were made to swiftly harvest crops in the mature wheat-growing areas of southern Henan.

In terms of temperature conditions, all of the main agricultural regions in China recorded average to above-average temperatures, with the largest positive departure occurring in Southern China (+0.9°C). Temperatures fluctuated during the monitoring period as follows: 39.3% of the cultivated regions, marked in blue, had relatively small temperature fluctuations, with the largest absolute temperature anomalies less than 1.5℃. 34.1% of the cultivated regions (marked in deep green), mainly distributed in most parts of Huanghuaihai, central and northeastern Lower Yangtze region, saw above-average temperatures in the middle of April with an anomaly of more than 4.0°C. The remaining 26.6% of the cultivated areas (marked in light green) encountered the largest below-average temperatures, exhibiting an anomaly exceeding

4.5℃, mainly distributed in the Loess region, the northern part of South West China, and the northwestern part of Lower Yangtze.

When it comes to RADPAR, Huanghuaihai (-3%), Loess region (-2%), and Inner Mongolia (-1%) all had negative RADPAR anomalies, whereas the largest positive departure was recorded for southern China (+6%). As for BIOMSS, the situation was quite different among all the main producing regions, with departures between -5% (Inner mongolia) and +11% (Huanghuaihai). With regard to VHIn, high values (above 35%) were widespread in China, indicating limited water deficit effects on most of the summer crops. CALF was average in all of the main agricultural regions as compared to the 5YA. The VCIx values were higher than 0.8 in almost all the main producing regions of China, with values between 0.83 (Huanghuaihai) and 0.94 (North East China), except for Inner Mongolia (0.79).

Table 4.1 CropWatch agroclimatic and agronomic indicators for China, April - July 2023, departure from 5YA and 15YA

Region	Agroclimatic indicators				Agronomic indicators	
	Departure from 15YA				Departure from 5YA	Current period
	RAIN (%)	TEMP (°C)	RADPAR (%)	BIOMSS (%)	CALF (%)	Maximum VCI
Huanghuaihai	27	0.6	-3	11	0	0.83
Inner Mongolia	0	0.6	-1	-5	0	0.79
Loess region	11	0.0	-2	4	0	0.84
Lower Yangtze	-8	0.5	2	6	0	0.91
Northeast China	1	0.2	0	-2	0	0.94
Southern China	-21	0.9	6	-2	0	0.93
Southwest China	-12	0.6	1	0	0	0.91

Figure 4. 1 China crop calendar

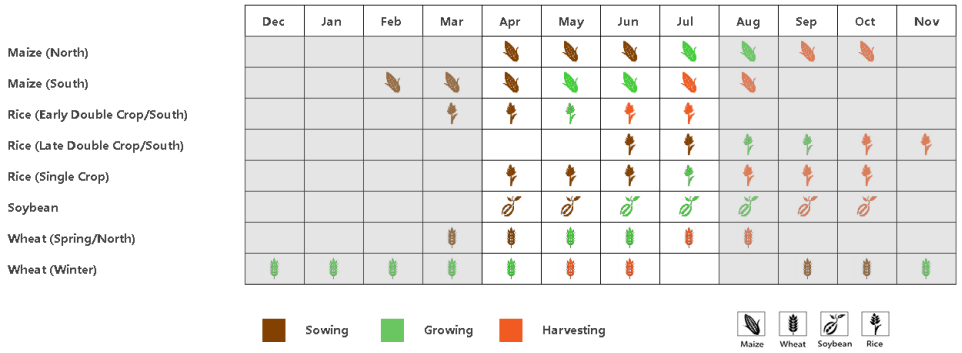


Figure 4.2 China spatial distribution of rainfall profiles, April to July 2023

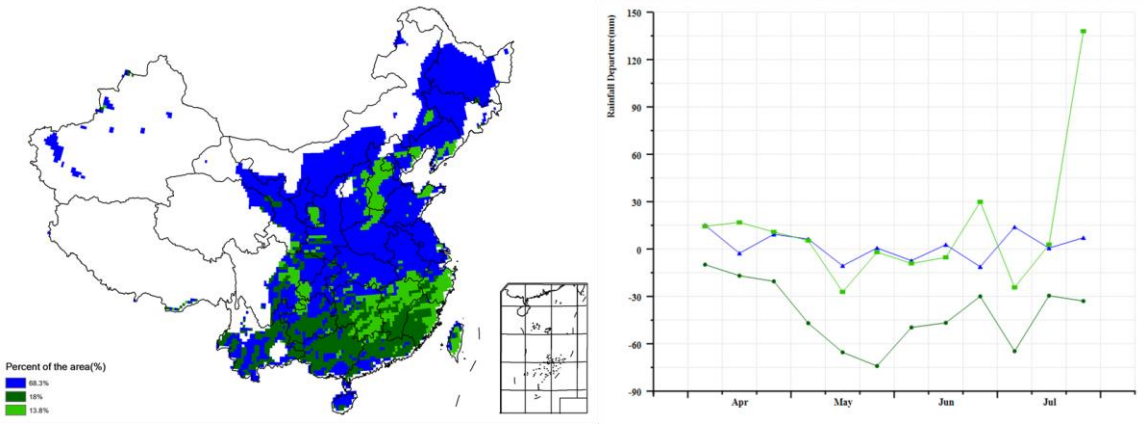


Figure 4.3 China spatial distribution of temperature profiles, April to July 2023

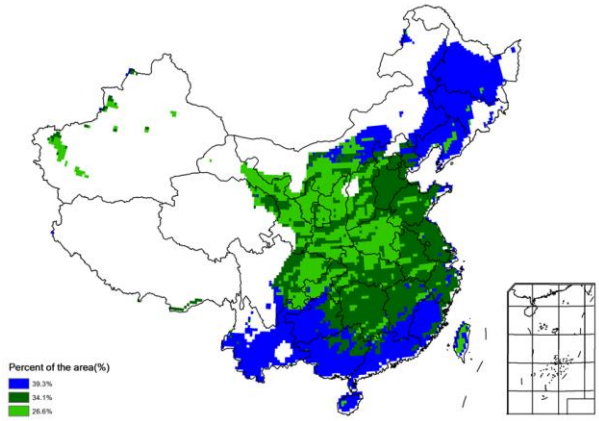


Figure 4.4 China cropped and uncropped arable land, by pixel, April to July 2023

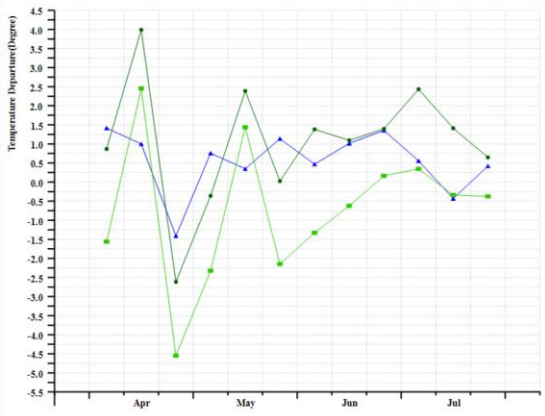


Figure 4.5 China maximum Vegetation Condition Index (VCIx), by pixel, April to July 2023

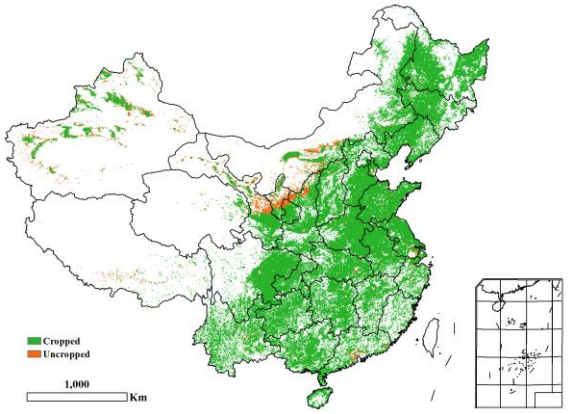


Figure 4.6 China biomass departure map from 15YA, by pixel, April to July 2023

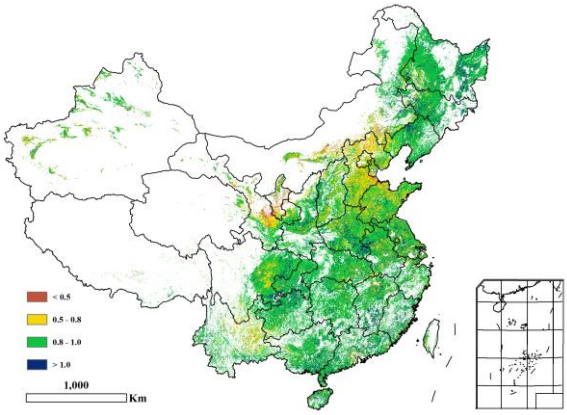
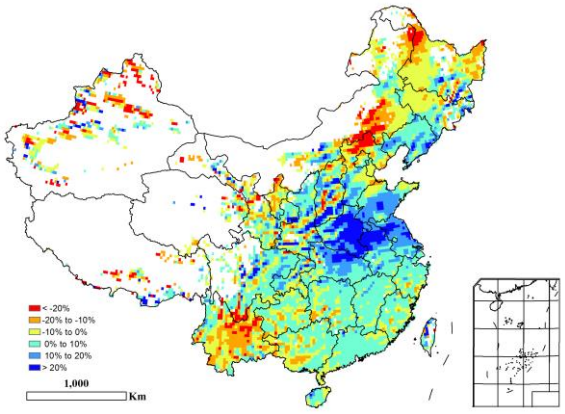


Figure 4. 7 China minimum Vegetation Health Index (VHIn), by pixel, April to July 2023



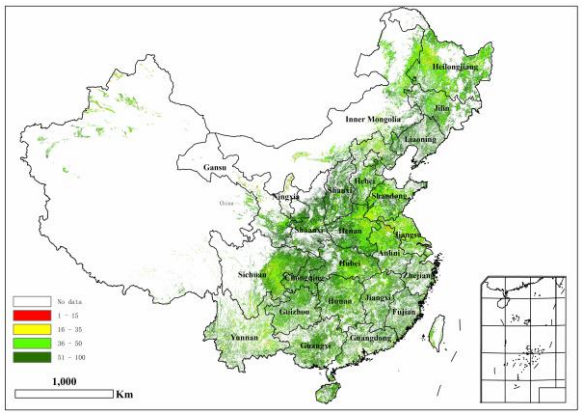
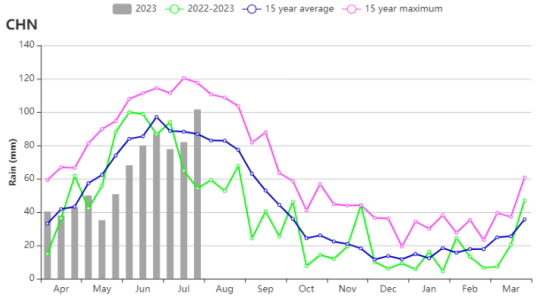


Figure 4. 8 China time series rainfall, April to July 2023



4.2 China's crop production

Utilizing a comprehensive fusion of remote sensing data from diverse sources including Fengyun-3, European Space Agency Sentinel-1/2 satellites, and the US Landsat 8 satellite, and incorporating ground-truth measurements from nearly a million sample points across major agricultural regions such as Northeast, North China, Northwest, and Southwest China, the present study undertook the monitoring of sowing areas and crop conditions for China's major staple crops in the year 2023. By integrating nationwide 10-meter resolution arable land data, agricultural meteorological information, and crop yield monitoring models, a meticulous analysis was conducted. This analysis encompassed a thorough re-evaluation of the 2023 summer grain and winter wheat yields, and entailed the projection of yields for key crops including maize, rice, soybean, autumn grains, and the aggregate annual cereal output for China.

(1) Annual Grain Production Forecast
The total annual grain production for the year 2023 (comprising autumn grains, summer grains, and early rice) is projected to reach 648.42 million tons, indicating an increase of 1.709 million tons, representing a growth rate of 0.3% compared to 2022 (Table 1). Notably, the top five grain-producing provinces, namely Heilongjiang, Henan, Shandong, Jilin, and Anhui, have all achieved year-on-year production increments, thus laying a robust foundation for a bountiful annual grain harvest.

Employing the latest remote sensing data, a reassessment of the total summer grain production for 2023 yields a figure of 142.405 million tons, marking a year-on-year augmentation of 1.79 million tons. Within this context, the increase in the planted area for summer grains is noted at 1.6% compared to the previous year. However, a persistent series of precipitation events during the maturation and harvest phase of summer crops led to a decline of 1.4% in the yield per unit area. Consequently, the total summer grain production registers a marginal increment of 0.1% year-on-year.

In the initial stages of summer grain cultivation, favorable hydrothermal conditions prevailed, and field moisture content remained conducive, resulting in superior crop growth in comparison to typical years. Nonetheless, a substantial and prolonged period of precipitation coupled with overcast skies prevailed across multiple major provinces in North China during late May to early June, coinciding with the maturation and harvest phase of summer grains. This meteorological pattern proved unfavorable for the grain filling process of winter wheat, and the provinces of Henan and Anhui experienced prolonged precipitation during their wheat harvesting period, further contributing to the occurrence of "sprouting wheat" in certain regions. As a consequence, the yield per unit area of summer grains was compromised, exhibiting a decline of 1.4% compared to initial estimates made in May, resulting in an equivalent year-on-year drop in yield for both provinces.
The total production of early rice in 2023 is estimated at 27.393 million tons, reflecting a decrease of 1.57 million tons, corresponding to a decline of 0.6% compared to the preceding year. Within this context, the cultivated area for early rice witnessed a year-on-year reduction of 23.2 thousand hectares (approximately 348 thousand mu), marking a decrease of 0.4%. Concurrently, the average yield per unit area exhibited a slight year-on-year decrease of 0.1%.

During the initial growth stages of early rice, the synchronous occurrence of favorable rainfall and warmth within the primary cultivation regions yielded meteorological conditions conducive to the developmental progress and yield formation of early rice. However, commencing from the middle to late June, a pronounced period of heavy rainfall prevailed over the middle and lower reaches of the Yangtze River and the southern regions of China. This temporal alignment coincided with the heading and flowering phase of early rice, hindering the process of pollination and adversely affecting the yield formation. Additionally, during the maturation and harvest phase of early rice, the primary producing regions were confronted with the impact of Typhoon "Taili", resulting in a composite effect on yield. As a result, provinces such as Guangxi, Hubei, Hunan, and Jiangxi experienced respective year-on-year declines in early rice yield by 1.1%, 4.3%, 1.8%, and 0.9%. Consequently, the nationwide average yield of early rice underwent a minor year-on-year reduction.

The aggregate production of autumn crops (encompassing maize, medium-season rice, late-season rice, spring wheat, soybeans, coarse grains, and tuber crops) is projected to reach 478.621 million tons in 2023, marking an increase of 1.688 million tons, corresponding to a growth rate of 0.4% compared to 2022. Throughout the growth phase of autumn crops, the agricultural meteorological conditions have, on the whole, favored crop growth and yield formation, resulting in a more favorable crop production scenario compared to the previous year.

The impact of Typhoon "Dusurei" led to the impairment of autumn crops such as maize and first-season rice in certain regions within Beijing-Tianjin-Hebei and parts of the Northeast. Consequently, the total autumn crop production in Hebei registered a year-on-year decrease of 2.5%. However, the noticeable increase in maize planting area within the Northeastern region mitigated the effects of flood-related damage, thereby not yielding a decline in autumn crop production. Simultaneously, Typhoon "Dusurei" furnished water replenishment to major producing regions, which overall resulted in a positive net effect on the nationwide production of major autumn crops such as maize and rice.

Table 4.2 Projected Production and Year-on-Year Changes in Major Grain-Producing Provinces for 2023

province	Winter crops		Early rice		Summer crops		Annual food	
	Production（million tons）	Variation (%)	Production（million tons）	Variation (%)	Production（million tons）	Variation (%)	Production（million tons）	Variation (%)
Anhui	14.821	1.1	1.123	6.2	20.987	4.1	36.931	2.9
Chongqing					7.992	1.7	7.992	1.7
Fujian			0.890	1.0	5.156	-0.7	6.046	-0.4
Gansu	3.376	-5.3			6.914	1.0	10.289	-1.1
Guangdong			4.340	4.5	7.603	-3.0	11.943	-0.4
Guangxi			4.690	-1.0	9.314	-0.8	14.004	-0.9
Guizhou					12.303	-2.9	12.303	-2.9
Hebei	12.566	0.5			20.726	-2.5	33.293	-1.4
Heilongjiang					79.812	4.3	79.812	4.3
Henan	32.897	0.7			25.018	2.6	57.915	1.6
Hubei	5.985	-3.2	0.821	-5.2	18.491	-0.6	25.297	-1.4
Hunan			8.795	-1.8	18.554	-1.9	27.349	-1.9
Inner Mongoria					32.515	-2.7	32.515	-2.7
Jiangsu	13.970	-0.1			20.287	-0.2	34.257	-0.2
Jiangxi			5.754	-1.9	9.864	-0.9	15.618	-1.3
Jilin					44.411	8.9	44.411	8.9
Liaoning					20.622	-3.3	20.622	-3.3
Ningxia					2.709	-3.1	2.709	-3.1
Shaanxi	3.861	-5.0			7.520	-1.4	11.380	-2.6
Shandong	27.278	0.5			20.410	-0.5	47.688	0.1
Shanxi	2.336	-0.1			8.798	-5.9	11.134	-4.7
Sichuan	5.813	-2.4			26.024	-1.7	31.837	-1.8
Xinjiang	5.264	2.8			9.683	-3.1	14.947	-1.1
Yunnan					14.635	-4.6	14.635	-4.6
Zhejiang			0.564	-3.9	6.248	-0.7	6.812	-1.0
Subtotal	128.167	0.0	26.977	-0.5	456.595	0.6	611.739	0.4
Other	14.238	1.4	0.417	-6.4	22.027	-4.0	36.681	-2.0
National	142.405	0.1	27.393	-0.6	478.621	0.4	648.420	0.3

(2) Forecast for Production of Major Grain and Oil Crops

The production of major grain and oil crops in China for the year 2023, including maize, rice, wheat, and soybeans, is anticipated to be 577.465 million tons, denoting an increase of 2.555 million tons, corresponding to a growth rate of 0.4% year-on-year. Within this context, maize and wheat are expected to achieve year-on-year increases, while rice and soybeans are predicted to undergo decreases (Table 2).

China's maize cultivation area is projected to expand by 1,234 thousand hectares, leading to an estimated yield augmentation of 5.049 million metric tons. The total maize production for the year 2023 is forecasted to reach 232.24 million metric tons, representing a notable year-on-year growth rate of 2.2%. Remote sensing monitoring indicates that the maize cultivation area for China in 2023 encompasses 42,096 thousand hectares, demonstrating a year-on-year increase of 3.0%. Within this, Heilongjiang Province exhibits the most pronounced expansion in maize cultivation area, with an increase of 564 thousand hectares year-on-year, corresponding to a concurrent reduction in soybean planting area. Likewise, Jilin Province records a year-on-year increase of 522 thousand hectares in maize cultivation area. Changes in maize cultivation area for other provinces are all below 50 thousand hectares.
Throughout the maize growing season, several major production regions experienced adverse agricultural weather conditions such as extreme high temperatures, excessive rainfall, and localized flooding. The nationwide average maize yield is projected to be 368 kilograms per mu (approximately 2,448 kilograms per mu), representing a year-on-year reduction of 0.8%. In the early to mid-July period, the Huang-Huai regions of North China witnessed a phase of heatwaves, leading to the widespread curling of maize leaves. However, due to timely irrigation practices in the region, the impact of high temperatures remained relatively limited. Towards the end of July and the beginning of August, Typhoon "Dusurei" brought about extreme heavy rainfall to areas such as Zhuozhou in the Beijing-Tianjin-Hebei region, resulting in maize damage. This contributed to a year-on-year decrease of 4.1% in the average maize yield across Hebei Province. The same typhoon induced significantly above-average precipitation in the northeastern region, affecting crops in areas such as Wuchang, Shangzhi, Mudanjiang in southern Heilongjiang Province, and Shulan in eastern Jilin Province. However, the impact on maize production in these provinces was relatively minor. While the average maize yield in Heilongjiang and Jilin experienced slight decreases of 0.2% and 0.4% year-on-year, respectively, due to increased planting area, maize production in these two provinces saw respective year-on-year increases of 8.3% and 11.3%. Overall, the impact of Typhoon "Dusurei" on the national maize production remained limited.

Impacted by the reduction in national rice planting area, the total rice production is expected to decrease by 1,988,000 metric tons. The projected nationwide total rice production is 193.346 million tons, signifying a year-on-year reduction of 1.0%. Within this context, early rice is expected to decrease by 0.6% year-on-year. The production of medium-season rice/first-season rice is forecasted to be 132.069 million tons, marking a year-on-year reduction of 1.68 million tons, corresponding to a decrease of 1.3%. The projected production of late-season rice is 33.884 million tons, indicating a decrease of 151 thousand tons, roughly a decline of 0.4% year-on-year.

In northern regions where first-season rice is cultivated, a period of consecutive heavy rainfall during the heading and flowering phase adversely affected pollination and yield formation of rice. Furthermore, this weather pattern led to flooding of 207.6 thousand mu of rice fields in Heilongjiang and Jilin provinces. Consequently, rice production in Heilongjiang, Jilin, and Liaoning provinces saw respective year-on-year reductions of 0.2%, 3.4%, and 0.9%.

In the Yangtze River Basin, the agricultural weather conditions were better than the previous year, yet the reduction in planting area led to marginal year-on-year decreases in rice production for provinces such as Jiangxi, Hunan, Hubei, and Sichuan. On the other hand, Anhui and Henan provinces witnessed substantial increases in rice production, with increments of 1.57 billion catties (78.5 million kilograms) and 350 million catties (17.5 million kilograms) respectively, representing year-on-year growth rates of 4.9% and 4.8%.

The soybean planting area has decreased by 618 thousand hectares year-on-year, leading to a projected reduction in production of 1.03 million metric tons. The total national soybean production for 2023 is estimated to be 17.156 million metric tons, reflecting a year-on-year decline of 5.7%. However, this

production figure remains notably higher than that of 2021. The nationwide soybean planting area is 9,233 thousand hectares, which is a reduction of 618 thousand hectares (or a decrease of 6.3%) compared to 2022. Despite this reduction, it still stands as the second largest planting area since the implementation of the soybean revitalization plan. The average yield per unit area for soybeans is projected to increase by 0.7%, reaching 1,867 kilograms per hectare.

The decrease in soybean planting area in 2023 can be attributed to two main factors. Firstly, due to comparable profitability between soybeans and maize, some farmers still opt to cultivate maize. Secondly, the reduction in soybean planting area is related to the annual rotation of maize and soybeans in Heilongjiang, a major soybean-producing province. The soybean planting area in Heilongjiang has decreased to 4,642 thousand hectares, marking a year-on-year reduction of 320 thousand hectares, a decline of 6.4%. This reduction in planting area has led to a year-on-year decrease of 470 thousand tons in soybean production in the province. Meanwhile, the soybean planting area in Inner Mongolia has further increased to 1,520 thousand hectares, representing a year-on-year increase of 34 thousand hectares or 2.3%. However, due to drought conditions affecting soybean-producing regions, the yield per unit area has decreased by 2.4% year-on-year, resulting in a marginal reduction of 0.1% in soybean production for the autonomous region. Changes in soybean production for other provinces and regions are relatively minor year-on-year.

The maturation phase of winter wheat was impacted by continuous rainfall, leading to the emergence of sprouted wheat and mold in some production areas, which resulted in a decrease in yield per unit area. However, the total production of wheat still increased by 525 thousand tons year-on-year. By employing remote sensing data covering the entire growth cycle of wheat and ground observation data, a reassessment of the nationwide wheat production for 2023 yields a figure of 134.723 million tons, indicating a year-on-year growth rate of 0.4%. Within this context, the total winter wheat production amounts to 128.958 million tons, marking an increase of 442 thousand tons, corresponding to a growth rate of 0.3%. Concurrently, the total spring wheat production is 5.765 million metric tons, reflecting an increase of 82 thousand tons, denoting a growth rate of 1.4% year-on-year.

Table 4.3 China Corn, Rice, Wheat and Soybean Production (Tons) and Variation (%), 2023

province	Maize		Rice		Wheat		Soybean	
	2023 (million tons)	Variation (%)	2023 (million tons)	Variation (%)	2023 (million tons)	Variation (%)	2023 (million tons)	Variation (%)
Anhui	3.719	3.6	16.873	4.9	14.347	1.2	1.018	-5.0
Chongqing	2.022	1.9	4.695	1.6				
Fujian			2.251	0.0				
Gansu	5.573	1.4			2.623	0.5		
Guangdong			10.320	0.0				
Guangxi			9.866	-0.9				
Guizhou	4.949	-3.8	5.369	-2.0				
Hebei	18.822	-2.5			12.200	0.0	0.194	-3.6
Heilongjiang	47.518	8.3	22.727	-0.2			6.301	-6.9
Henan	15.567	2.1	3.877	4.8	32.751	0.7	0.857	2.7
Hubei			14.777	-0.9	4.484	0.3		
Hunan			24.574	-1.9				
Inner Mongoria	22.712	-3.1			1.980	0.2	1.704	-0.2
Jiangsu	2.135	-0.1	1.607	-0.3	13.667	0.7	0.832	0.8
Jiangxi			14.410	-1.3				
Jilin	35.693	11.3	5.688	-3.4			0.725	0.7
Liaoning	15.760	-4.2	4.606	-0.9			0.453	5.1
Ningxia	1.640	-2.9	0.463	-3.7				
Shaanxi	3.714	-2.4	1.004	2.7	3.816	-4.7		
Shandong	19.281	-0.4			26.948	0.1	0.702	-2.4
Shanxi	8.796	-5.9			2.313	2.1	0.159	-4.0
Sichuan	6.415	-1.8	14.616	-1.6	1.940	-1.6		
Xinjiang	7.141	-3.9			5.164	2.9		
Yunnan	6.399	-3.5	5.399	-5.9				
Zhejiang			6.154	-1.0				
Subtotal	227.856	1.9	183.768	-0.5	122.233	0.5	12.944	-3.7

province	Maize		Rice		Wheat		Soybean	
	2023 (million tons)	Variation (%)	2023 (million tons)	Variation (%)	2023 (million tons)	Variation (%)	2023 (million tons)	Variation (%)
National	232.240	2.2	193.346	-1.0	134.723	0.4	17.156	-5.7

4.3 Regional analysis

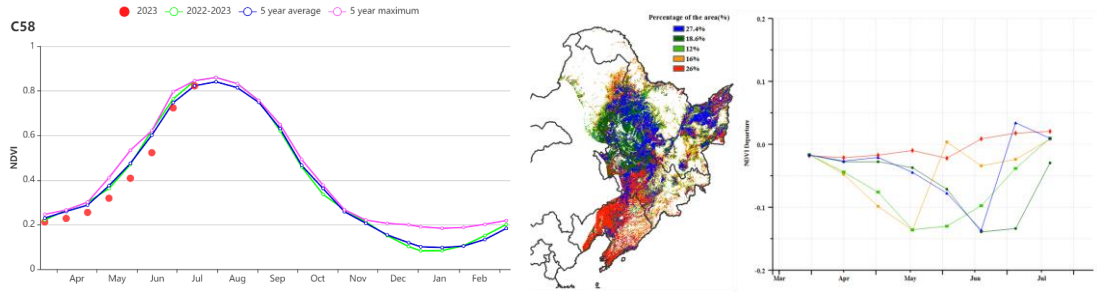
Figures 4.9 through 4.15 present crop condition information for each of China's seven agricultural regions. The provided information is as follows: (a) Phenology of major crops; (b) Crop condition development graph based on NDVI, comparing the current season up to July 2023 to the previous season, to the five-year average (5YA), and to the five-year maximum; (c) Spatial NDVI patterns for April to July 2023 (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 April to July 2023. Additional information about agro-climatic indicators and BIOMSS for China is provided in Annex A.

Northeast region

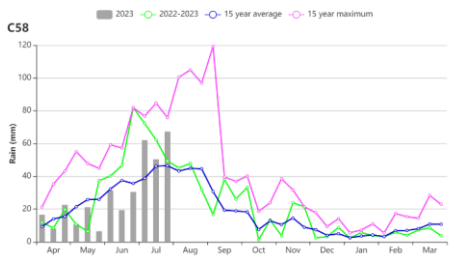
This current monitoring period covers the sowing and the first half of the growing season of main crops in the Northeast of China (April to July 2023). CropWatch Agroclimatic Indicators (CWAIs) show that precipitation was slightly above average. The total precipitation increased by 1%. It was below the average level in May and June, and above the average level in July. The photosynthetically active radiation was close to average, and the temperature was below average (TEMP 0.2℃). This resulted in a potential biomass estimate that was 2% below the fifteen-year average level. Most parts of Heilongjiang province and the western part of Jinlin province were below average due to low precipitation, causing a mild drought.

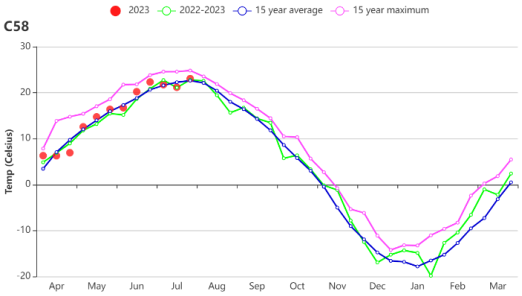
The crop conditions during the monitoring period were slightly below average before July and recovered to average levels till the end of July. Meanwhile, great spatial variations existed in the region. As shown by NDVI clusters and profiles, 27.4% of cropland experienced a steady decline until mid June and then increased to average levels. This area was mostly distributed in Heilongjiang province and western Jilin province. About 18.6% of cropland in the region was mostly below average. It was mainly located in western Heilongjiang province, indicating that crops in this area were in relatively poor condition. About 26% of cropland was slightly negative, mainly concentrated over Liaoning province. Most parts of the Northeast of China were below average from April to June and improved in July, and this is due to a slight drought caused by below average precipitation in the early stage. In addition, the maximum VCI shows that all provinces of the Northeast of China were above 0.8, except for a small part of western Heilongjiang province due to drought and western Jilin province due to local drought and floods in the early stage. On the other hand, flooding that occurred in early August negatively affected crops locally in Wuchang, Shangzhi and Mudanjiang in central southern Heilongjiang province and Shulan in eastern Jilin province, accounting for about 4% of the cropland area in the region. All in all, crop development until June was below average but recovered to average levels in July. Prospects for crop production are average.

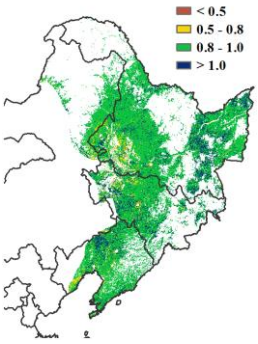
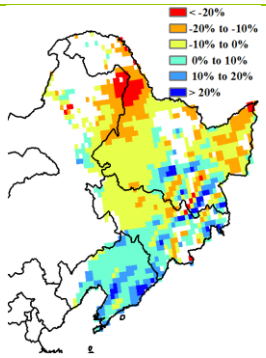
Figure 4. 9 Crop condition China Northeast region, April - July 2023



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



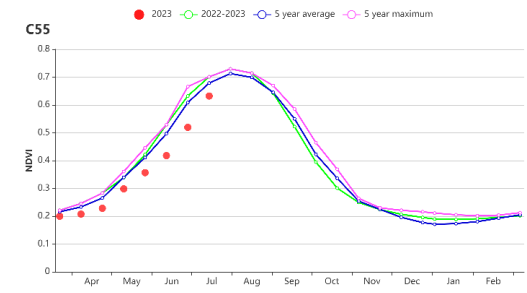


(d)Time series rainfall profile	(e)Time series temperature profile
	
(f) Maximum VCI	(g) Biomass departure

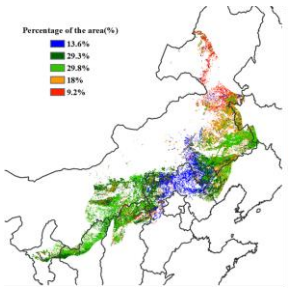
Inner Mongolia

During the reporting period, single season crops (maize, wheat, and soybean) were grown in Inner Mongolia. Overall, RAIN was close to the 15YA. TEMP (+0.6°C) was slightly above average, while RADPAR was slightly below average (-1%). BIOMASS (-5%) was also below 5YA. The temporal distribution for these indicators was very uneven. Precipitation was insufficient in May and June, which may have a negative impact on the rain-fed crops. As illustrated in the crop development graph from April to July, almost all cropped areas displayed consistently below-average NDVI, and more than 70% of the area had a sustained decrease in northern Hebei, central and eastern Inner Mongolia. This is confirmed by VCIx values being lower than 0.8 in these areas, where the biomass accumulation potential (BIOMSS) was also well below average. In July, crop conditions returned to the average for most areas due to the increasing precipitation, but excessive precipitation in late July may have affected crop growth. The fraction of cropped arable land (CALF) was 95%, and VCIx was 0.79. Crop conditions were slightly below average during the reporting period, which is consistent with the agricultural production situation index (0.94). The season's final outcome will depend on weather conditions in August and September.

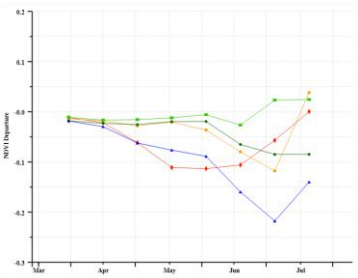
Figure 4. 10 Crop condition China Inner Mongolia, April - July 2023



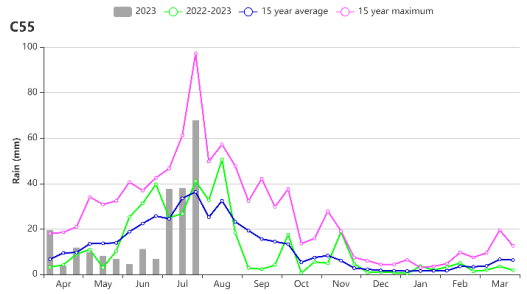
(a) Crop condition development graph based on NDVI



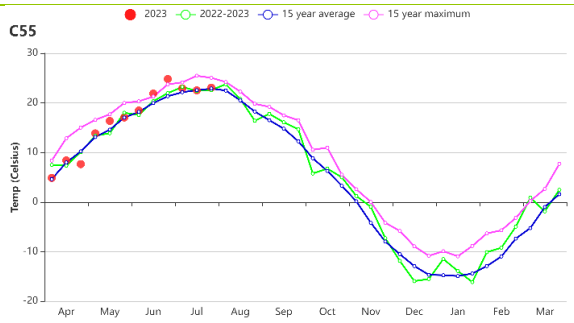
(b) Spatial NDVI patterns compared to 5YA



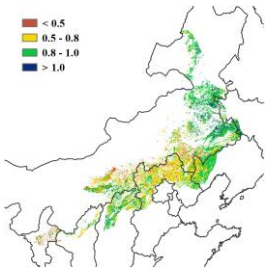
(c) NDVI profiles



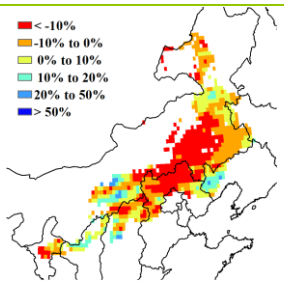
(d) Time series rainfall profile



(e) Time series temperature profile



(f) Maximum VCI



(g) Biomass departure

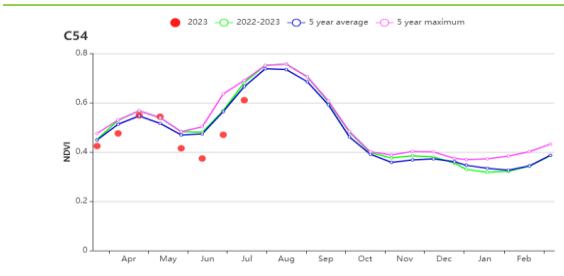
Huanghuaihai

Winter wheat, maize, peanut and soybean are the main crops that grew in this monitoring period (April to July 2023) in Huanghuaihai. Agro-climatic indicators showed that precipitation (+27%), and temperature (+0.6°C) in this area were above the 15YA, but radiation (-3%) was below. As a result of these indicators, an increase in crop biomass production potential was estimated (BIOMSS+11%). Below-average BIOMSS was located in northern Shandong and eastern Hebei. The CALF was unchanged in 5YA.

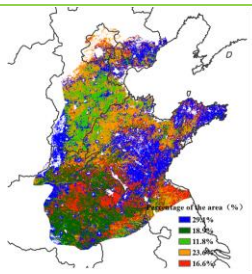
According to the NDVI development graph, crop growth was favorable since April, and even exceeded the maximum in mid-May due to sufficient rainfall and above-average temperatures. Continuous rain led to a serious deterioration in crop conditions after June. As the NDVI departure clustering map showed, the whole region generally experienced poor conditions after June. 23.6% of the cropland was always below the average, widely located in western and northern Shandong, and northern Anhui (yellow color in the NDVI departure clustering map), especially cropland in Beijing was severely affected by flooding in late July. Only 11.8% of the cropped area concentrated in eastern Hebei trended above average before June. Crop conditions in eastern Henan and northern Anhui (accounting for 18.9% of the total area) began to improve starting mid-April due to the abundant rainfall and were higher than the average. However, the harvest of winter wheat in late May and early was negatively affected by frequent rainfall. This caused a drop in wheat quality.

The maximum VCI value was 0.83, and the Crop Production Index (CPI) is 1.0. Overall, crop conditions were average during the period.

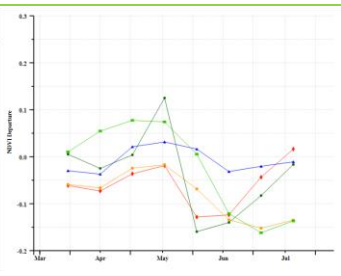
Figure 4. 11 Crop condition China Huanghuaihai, April - July 2023



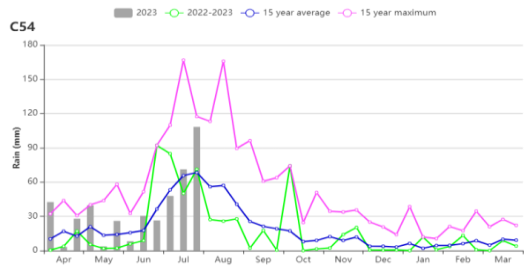
(a) Crop condition development graph based on NDVI



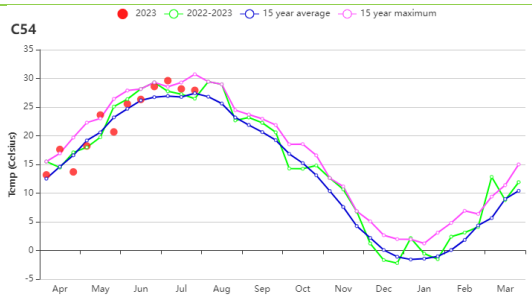
(b) Spatial NDVI patterns compared to 5YA



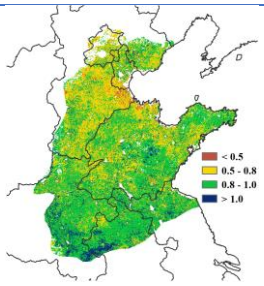
(c) NDVI profiles



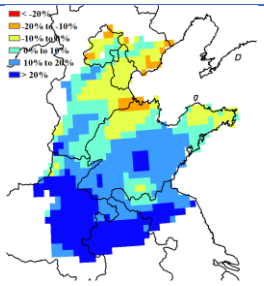
(d)Time series rainfall profile



(e)Time series temperature profile



(f) Maximum VCI



(g) Biomass departure

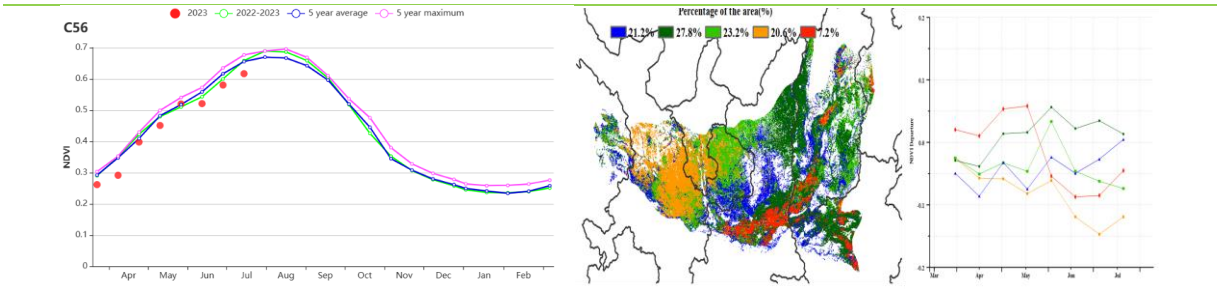
Loess region

During the reporting period, winter wheat was harvested from early to mid-June, while summer maize was planted in late June.

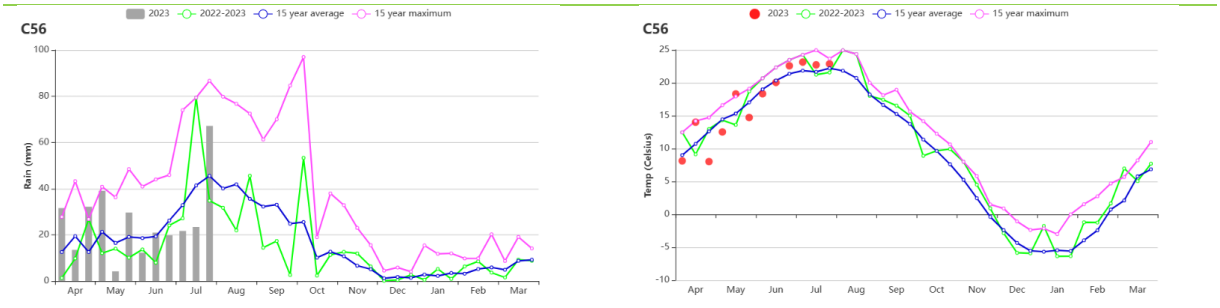
The CropWatch Agroclimatic Indicators (CWAIs) show that radiation in this area was below average (RADPAR -2%), and the average temperature was unchanged(TEMP +0.0℃), but precipitation was above average (RAIN +11%), which brought the potential biomass above the 15YA by 4%. During the monitoring period, precipitation exceeded the 15-year maximum in early and late April, while the precipitation remained below average from early June to mid-July . According to the regional NDVI development map, the overall crop condition in the Loess region was slightly below the 5YA.

The NDVI departure cluster profiles indicate that crop conditions in most regions were below average in April. But approximately 50% of the regions recovered to close to average in late July. These regions are mainly distributed in most parts of northwestern Henan, Shaanxi and Shanxi provinces. About 7.2% of the region had above-average crop growth from April to May but it subsequently declined below the average in June. These regions are primarily concentrated in southwestern Shanxi and southern Shaanxi Province. The Maximum VCI map shows high VCIx values in most cropped areas of the region, with an average value of 0.84. The fraction of cropped arable land under cultivation is 96%, which remains consistent with the average of the 5YA. The CPIx in the region was 0.96, which is less than 1, and the crop production situation was generally normal.

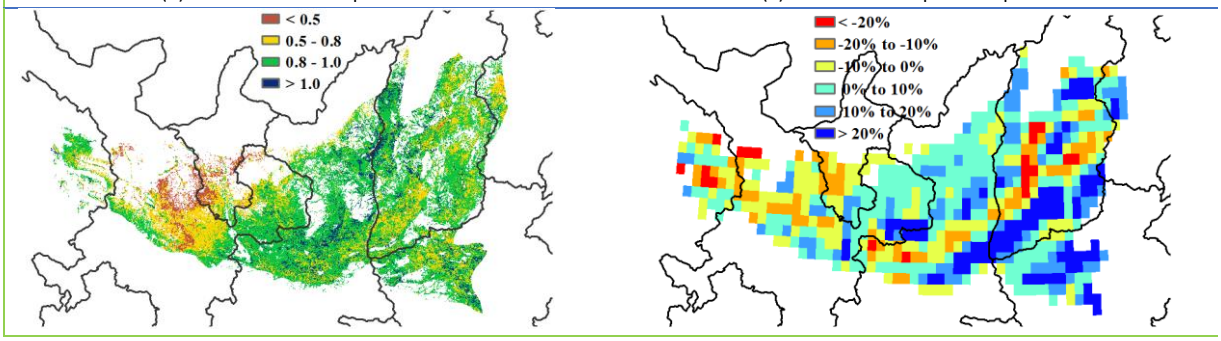
Figure 4. 12 Crop condition China Loess region, April - July 2023



(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

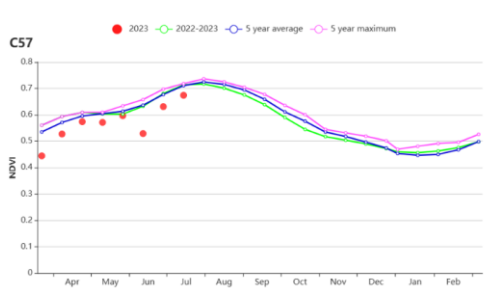
During this monitoring period, winter wheat and rapeseed had reached maturity by June in Hubei, Henan, Anhui and Jiangsu provinces. The semi-late and late rice crops are still growing in the south and the center of the region including Jiangsu, Fujian, Jiangxi, Hunan, and Hubei provinces, while early rice has been harvested.

According to the CropWatch agro-climatic indicators, the accumulated precipitation was 8% below the average. Temperature and photosynthetically active radiation were 0.5℃ and 2% higher than the 15-year averages, respectively. The agro-climatic condition with abundant sunlight resulted in an increase of biomass potential production by 6%. The rainfall profile indicates that late June and late July precipitation exceeded the 15-year average.

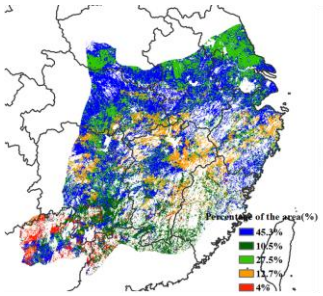
As shown in the NDVI development graph, crop conditions were slightly below the 5-year average. 45.3% of the monitoring area, including the northern parts of the region such as Anhui, Henan, southern Jiangsu, and Hubei, as well as Hunan, and central Jiangxi, showed crop conditions close to average. The crop conditions in other parts were slightly below average. The potential biomass departure indicates that the agro-climatic conditions were generally above average in most areas, with potential biomass departure values mostly in the range of 0-20%. The potential biomass in the northern part of this region was slightly better than the other regions, which was generally consistent with the NDVI distribution. The average VCIx of this region was 0.90, and most of the area had VCIx values ranging from 0.8 to 1.

In general, the crop conditions in the Lower Yangtze region were close to average.

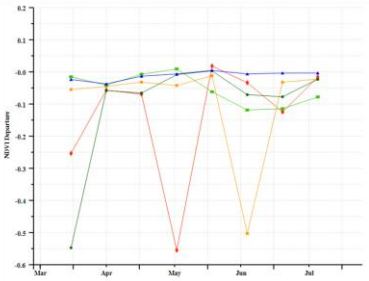
Figure 4. 13 Crop condition China Lower Yangtze region, April - July 2023



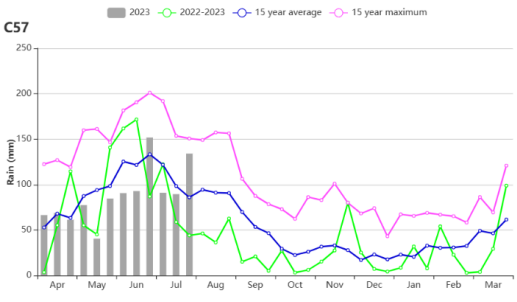
(a) Crop condition development graph based on NDVI



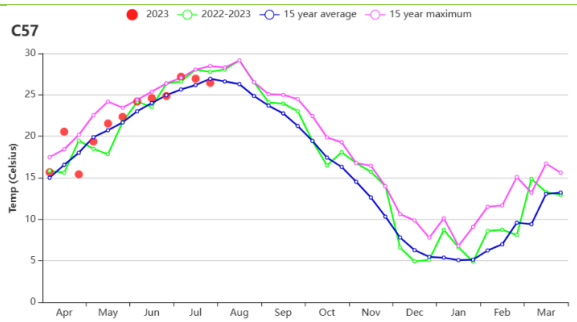
(b) Spatial NDVI patterns compared to 5YA



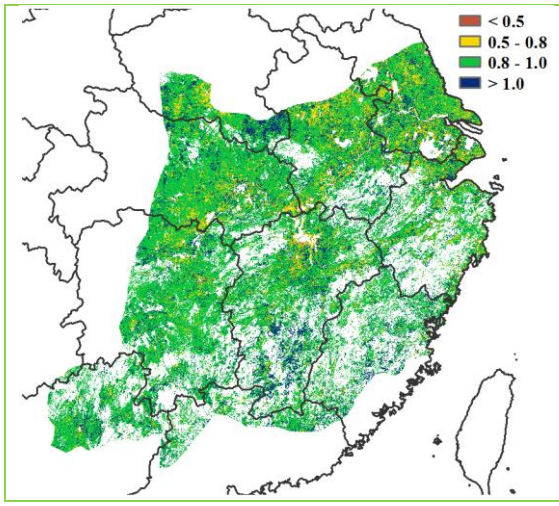
(c) NDVI profiles



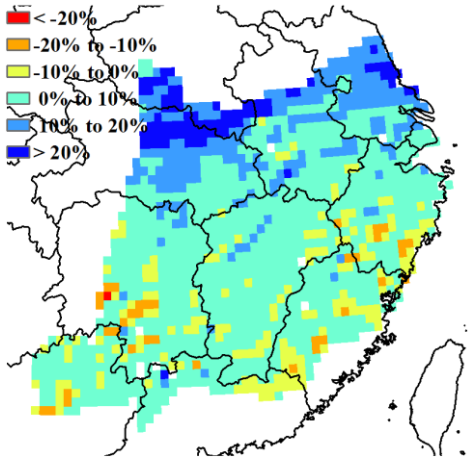
(d)Time series rainfall profile



(e)Time series temperature profile



(f) Maximum VCI



(g) Biomass departure

Southwest region

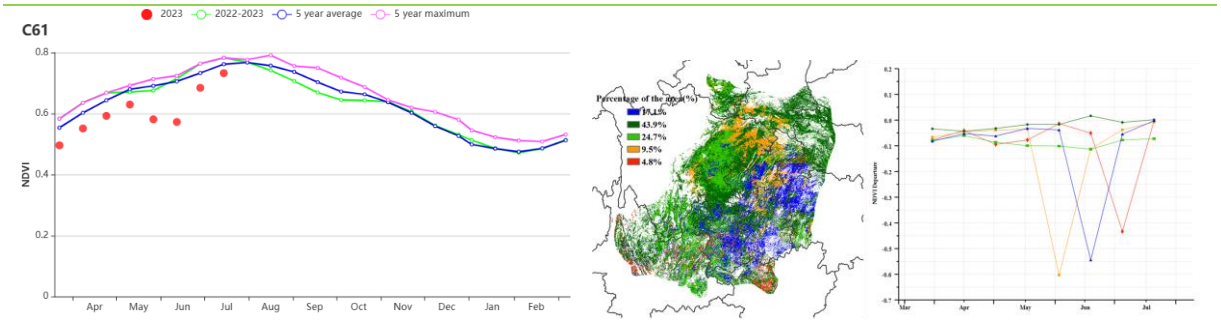
The reporting period covers the harvest of winter wheat in southwestern China, which was concluded by late April. Summer crops (including semi-late rice, late rice, and maize) are still growing. In general, crop conditions in the southwest region were slightly below the average of the last five years.

According to the CropWatch agro-climatic indicators, the drier and warmer than usual weather continued from the previous reporting period, with precipitation of 790 mm (-12%), and the TEMP was 0.6℃ higher than 15YA， RADPAR was close to the average (+1%). The higher temperatures and lower rainfall led to a slight decrease in potential biomass. The maximum Vegetation Condition Index (VCI) was 0.91, lower than 0.94 in the same period of last year. The CALF was similar to previous years, indicating full utilization despite the less favorable weather conditions.

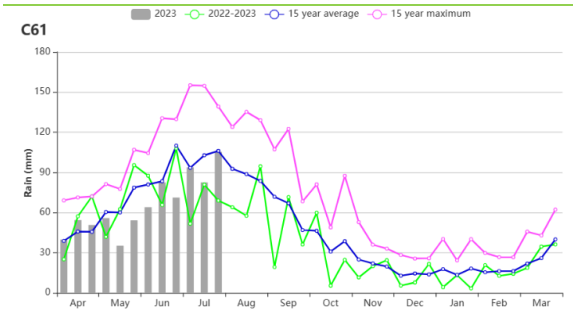
The NDVI-based crop condition profiles continued below the 5-year average throughout the reporting period. The crop condition development graph based on NDVI shows that crop conditions were slightly below average in almost all regions during this monitoring period, especially in the light green areas (about 24.7% of the region) located mainly in the eastern part of Sichuan and the northern part of Yunnan. The Maximum VCI map also shows this phenomenon. This was mainly due to the drier and warmer weather. The potential biomass map shows that northern Yunnan has been particularly affected.

In summary, due to the lasting warmer and drier than usual weather, crop conditions in Southwest China were slightly poorer than average.

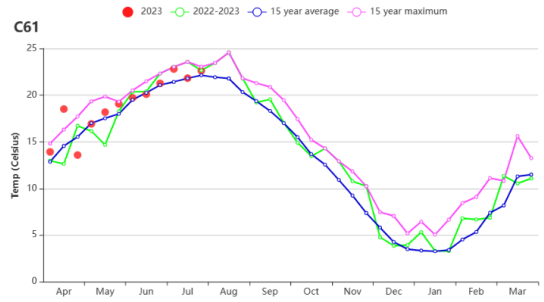
Figure 4. 14 Crop condition China Southwest region, April - July 2023



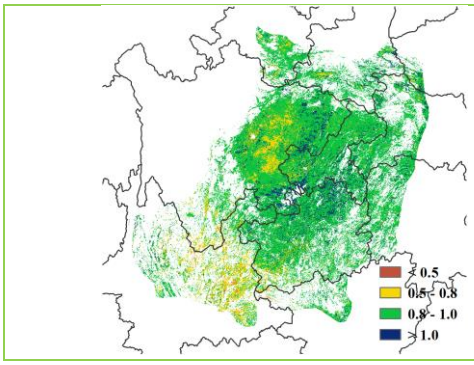
(a) Crop condition development graph based on NDVI (b) Spatial NDVI patterns compared to 5YA(c) NDVI profiles



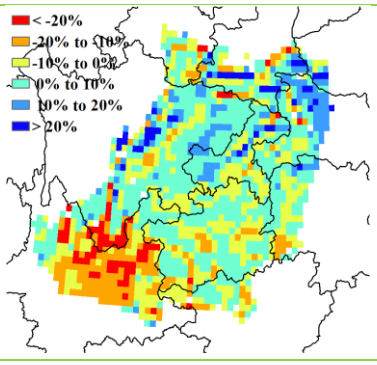
(d)Time series rainfall profile



(e)Time series temperature profile



(f) Maximum VCI



(g) Biomass departure

Southern China

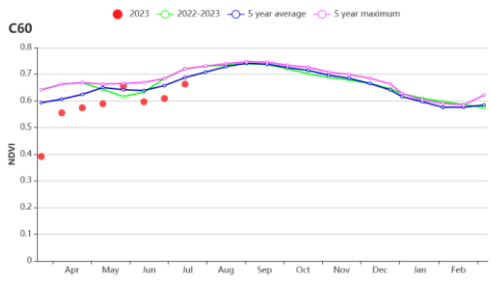
During the monitoring period, the harvest of early rice had been completed. In July, late rice was partially transplanted. The crop condition development graph based on NDVI showed that the crop conditions were below the five-year average.

According to the CropWatch agro-climatic indicators, the accumulated precipitation during this period was 1063 mm (-21%), which was lower than the average for the same period in the past 15 years. The temperature was 23.5℃ (+0.9℃), which was higher than the average, and RADPAR was 6% higher. The potential biomass was 2% lower due to the lower precipitation. CALF was slightly above the average for the same period in the past 5 years.

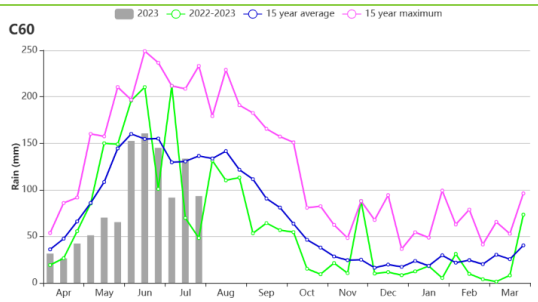
According to the NDVI departure clustering map and the profiles, crop condition in 41.1% of the region's cropland was close to the average throughout the monitoring period. Due to insufficient precipitation, the crop conditions in the eastern part of Guangxi and Guangdong experienced a significant decrease in the first half of April. However, it approached average thereafter. Crop conditions in certain areas of Yunnan and the western and southeastern parts of Guangxi experienced a significant decline in June and July. BIOMSS shows below-average biomass in Yunnan and Western Guangxi, which may be associated with a decrease in precipitation. The VCIx for the whole region was 0.93.

In general, crop condition in Southern China was slightly below average in the monitoring period.

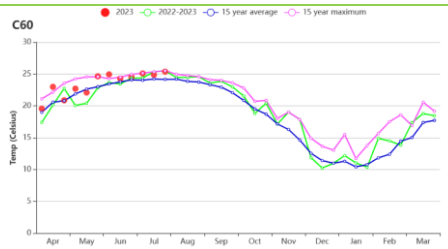
Figure 4. 15 Crop condition Southern China, April - July 2023



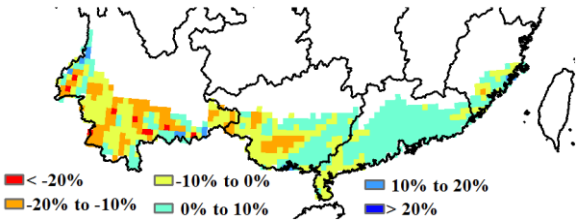
(a) Crop condition development graph based on NDVI



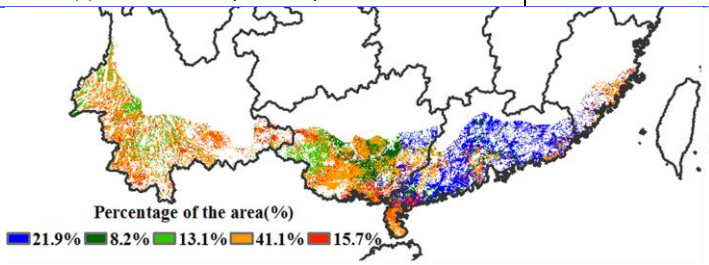
(b)Time series rainfall profile



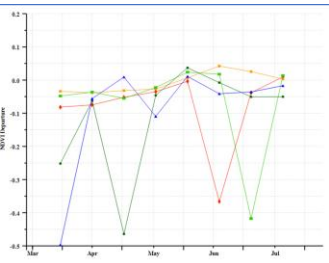
(c)Time series temperature profile



(d) Biomass departure



(e) Spatial NDVI patterns compared to 5YA



(f) NDVI profiles

4.4 Major crops trade prospects

Maize

In the first half of the year, China imported 12.033 million tonnes of maize, a decrease of 11.5% compared to the previous year. The main source countries for corn imports were the United States, Ukraine, and Brazil, accounting for 39%, 36%, and 18.4% of the total imports, respectively.

Rice

In the first half of the year, China imported 1.806 million tonnes of rice, a decrease of 49.6% compared to the previous year. The main source countries for rice imports were Vietnam, Myanmar, Thailand, India, and Pakistan, accounting for 38.1%, 21%, 12.8%, 11.8%, and 8.1% of the total imports, respectively.

Wheat

In the first half of the year, China imported 8.011 million tonnes of wheat and wheat products, a growth of 62.1% compared to the previous year. The primary source countries for wheat imports were Australia, Canada, and France, accounting for 63.2%, 16.6%, and 10.2% of the total imports, respectively.

Soybean

In the first half of the year, China imported 52.575 million tonnes of soybeans, an increase of 13.6% compared to the previous year. The primary source countries for soybean imports were Brazil, the United States, Argentina, and Canada, accounting for 56.5%, 37.5%, 2.7%, and 1.8% of the total imports, respectively.

Trade prospects for major cereals and oil crop in China for 2023

On the basis of remote sensing-based production prediction in major agricultural producing countries in 2023 and the Major Agricultural Shocks and Policy Simulation Model, it is predicted that the import of major grain crops will decrease in 2023. The details are as follows:

In 2023, China's maize imports will decrease by 2.7%, and exports will reduce by 1.9%. Influenced by the international wheat-maize price ratio, maize's utilization for livestock feed in the first half of the year has been partially replaced by wheat. This has led to a decrease in maize imports. However, with positive factors such as the opening of the Brazilian maize export channel to China, maize imports are expected to increase in the latter half of the year. It is projected that China's maize imports will decrease slightly in 2023.

In 2023, China's rice import will decrease by 25.4%, while exports will decrease by 5.6% in 2023. Factors such as India's new export restrictions have contributed to increased variability in global rice trade. Coupled with production reductions due to disasters and other factors, China's demand for rice imports has weakened. It is anticipated that China's rice imports will decrease in 2023.

In 2023, China's wheat imports will increase by 12.4%, while exports will decrease by 2.3% in 2023. The main driving factors behind China's wheat imports include strong demand for high-quality specialized wheat domestically and an increase in consumption for livestock feed. With economic recovery post the COVID-19 pandemic, China's wheat imports are expected to remain at a relatively high level in 2023.

In 2023, China's soybean import will increase by 10.2%, while exports will remain relatively stable. Despite vigorous efforts to enhance domestic soybean oilseed production capacity, imported soybeans remain the primary raw material for soybean processing. Countries like Brazil and the United States continue to be the main sources of soybean imports for China. It is anticipated that China's soybean imports will increase in 2023.

Figure 4. 16 **Rate of change of imports and exports for rice, wheat, maize, and soybean in China in 2023 (%)**