# Chapter 4. China

Chapter 4 presents a detailed CropWatch analysis for China, focusing on the seven most productive agro-ecological regions of the east and south. After a brief overview including a production outlook for 2014, detailed analysis including maps and profiles for NDVI, VCIx, CALF, and BIOMSS are provided for the individual regions. Additional information on the agroclimatic indicators for agriculturally important Chinese province are provided in table A.11 in Annex A.

## 4.1 Overview

Figures 4.1-4.6 illustrate the distribution and profiles of rainfall (RAIN) and temperature (TEMP) indicators, as well as the fraction of cropped arable land (CALF), maximum Vegetation Condition Index (VCIx), cropping intensity, and minimum Vegetation Health Index (VHIn). Indicator values are provided in table 4.1.

Generally favorable conditions prevailed over the monitoring period with 14% above average RAIN, 0.7°C degree above average TEMP, and average radiation (RADPAR), resulting in a 12% rise over average biomass (BIOMSS). Without exception, TEMP increased in all seven regions in China, with the lowest increase (0.1°C) in the North-east region) and the most significant increase in Southwest China (1.2°C degree). RAIN in Huanghuaihai, Northeast, and Southwest China slightly decreased (6%, 3%, and 3%, respectively). RAIN remained average throughout the year for most regions north of Yangtze River (58% of the country), while it was above average in Guangdong and the east of Guangxi province. Temperature fluctuated widely from January to June; it was below average in mid-February and May and above average in late October.

High VCIx values occurred mostly in Southern China and in the Northeast region. Low VCIx values are mainly located in central and eastern China, particularly in southern Jiangsu and western Henan provinces. Crop condition in the northeast is above the thirteen-year average (VCIx is 0.92), though agro-climatic conditions are at an average level. At the regional and provincial scale, BIOMSS is above average, except for the Southwest regions and corresponding provinces.

During the monitoring period the cropped arable land fraction (CALF) did not change; for all seven monitored regions, CALF is about the five-year average; only slightly decreased values are recorded for the Loess and Huanghuaihai regions (-1% and -3%, respectively). Cropping intensity increased by 4% and 5% in the Inner Mongolia and Loess region and is at average levels in the Northeast; it decreased in the other four regions.

Minimum VHI indicates that almost all regions in central and eastern China suffered from water stress, including the east of Sichuan, western and southern Henan, south of Jiangsu, and south of Hubei provinces (figure 4.6).

**Figure 4.1. China spatial distribution of rainfall profiles, July-October 2014**

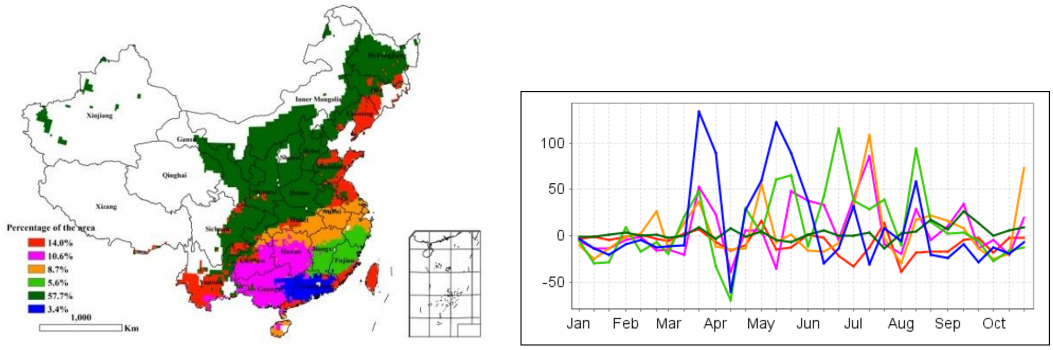



**Figure 4.2. China spatial distribution of temperature profiles, July-October 2014**

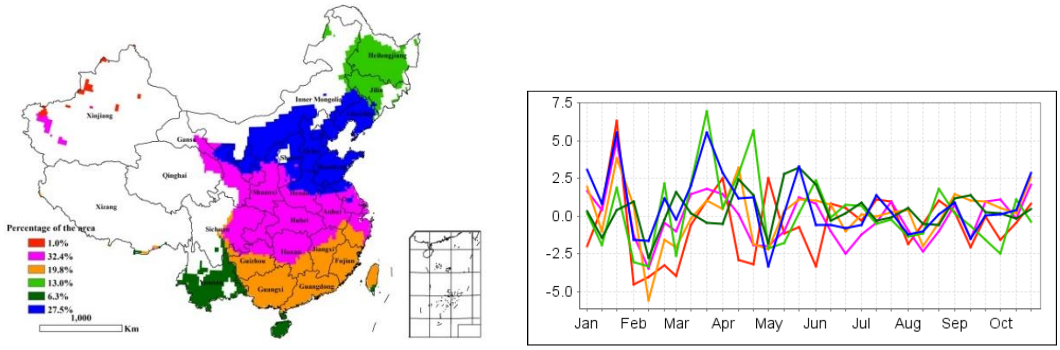



**Figure 4.3. China cropped and uncropped arable land, by pixel, July-October 2014**

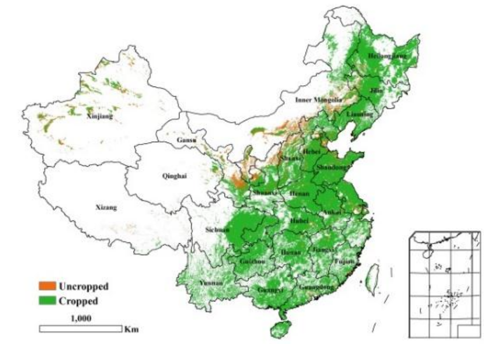



**Figure 4.4. China maximum Vegetation Condition Index (VCIx), by pixel, July-October 2014**

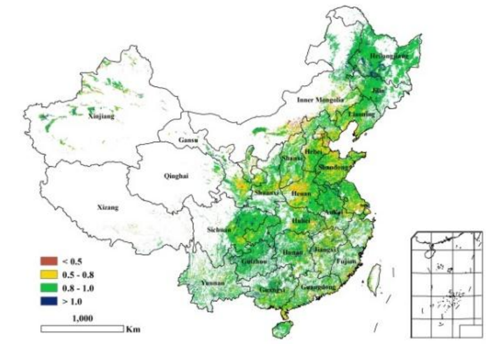



**Figure 4.5. China Cropping Intensity, by pixel, July-October 2014**

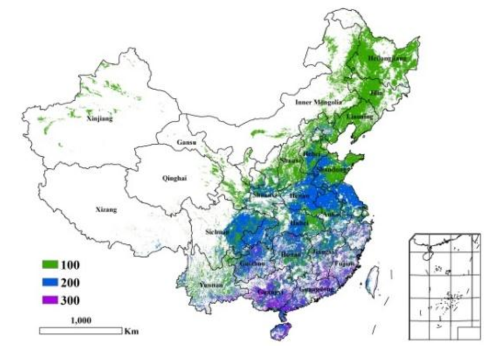



**Figure 4.6. China minimum Vegetation Health Condition Index (VHIn), by pixel, July-October 2014**

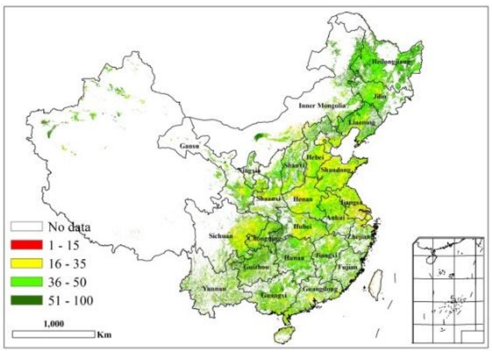


**Table 4.1. CropWatch agroclimatic and agronomic indicators for China, July-October 2014, departure from 5YA and 13YA**

| Region | Agroclimatic indicators | | | Agronomic indicators | | | |
|---|---|---|---|---|---|---|---|
| | departure from 13YA (2001-2013) | | | departure from 5YA (2009-2013) | | | Current |
| | RAIN (%) | TEMP (°C) | RADPAR (%) | BIOMSS (%) | CALF (%) | Cropping Intensity (% points) | Maximum VCI |
| Huanghuaihai | -6 | 0.5 | 0 | 8 | -3 | -2 | 0.83 |
| Inner Mongolia | 39 | 0.3 | -1 | 25 | 0 | 4 | 0.79 |
| Loess region | 10 | 0.6 | 0 | 10 | -1 | 5 | 0.81 |
| Lower Yangtze | 28 | 0.5 | -5 | 13 | 0 | -7 | 0.86 |
| North-East | -3 | 0.1 | 3 | -3 | 0 | 0 | 0.92 |
| Southern China | -3 | 1.2 | 1 | 0 | 0 | -13 | 0.87 |
| South West | 21 | 0.8 | -1 | 14 | 0 | -11 | 0.90 |

Note: Departures are expressed in relative terms (percentage) for all variables, except for temperature, for which absolute departure in degrees Celsius is given. Zero means no change from the average value; Relative departures are calculated as (C-R)/R*100, with C=current value and R=reference value, which is the five (5YA) or thirteen-year average (13YA) for the same period (July-October). VCI=Vegetation condition index.

### China production outlook

At the time of reporting, the bulk of the maize, rice, wheat, and soybean harvest is over. Table 4.2 lists the estimated production numbers for maize, rice, wheat, and soybean in China for 2014, with estimates based on remote sensing, agricultural statistics, and other ground data. Details for China's rice production—distinguishing single, early, and late rice—are provided in table 4.3. Single-crop rice (one crop per year) is mainly located in the Northeast, Central, and Eastern China and Sichuan province, while double-crop rice is found in Southern China. Areas with three crops occur in the south of China, such as Guangdong and Guangxi provinces.

The production of maize and soybean in China is estimated to decrease in 2014 compared with the previous season, while wheat production (including winter wheat and spring wheat) is estimated to increase by 1%. Maize production is expected to reach 201 million tons, which represents a decrease of 1% when compared to 2013, mainly due to a decrease in yield. Soybean production will reach 13.1 million tons, with a drop of 1% because of the decrease in harvested area compared to last year's. Rice production is stable: the production of single rice increases, while the production of early rice falls (table 4.3).

Out of seventeen monitored provinces, only Chongqing, Guizhou, Heilongjiang, Jiangsu, and Ningxia have an estimated increase in maize production above 2%. On the contrary, Gansu, Yunnan, and Inner Mongolia record the largest decreases in maize production because of a combination of reduced area and decreased yield due to drought. Liaoning and Henan are the two provinces with the largest decreases (-4%) in maize yield due to the severe drought in August.

Soybeans in Henan show the largest drop in production, as both area and yield are low. Due to an increase in area, soybean production in Jilin rises by an estimated 2%.

**Table 4.2. China, 2014 production (thousand tons) and difference with 2013 (percentage)**

| | Maize | | Rice (paddy) | | Wheat | | Soybean | |
|---|---|---|---|---|---|---|---|---|
| | 2014 | Δ% | 2014 | Δ% | 2014 | Δ% | 2014 | Δ% |
| Anhui | 3632 | -4 | 17151 | 3 | 11375 | -2 | 1098 | 0 |
| Chongqing | 2099 | 3 | 4785 | 1 | 1119 | -2 | | |
| Fujian | | | 2812 | 1 | | | | |
| Gansu | 4604 | -7 | | | 4490 | -4 | | |
| Guangdong | | | 11073 | 2 | | | | |
| Guangxi | | | 10983 | 2 | | | | |
| Guizhou | 5004 | 6 | 5148 | 1 | | | | |
| Hebei | 16237 | -2 | | | 10609 | -2 | 172 | -1 |
| Heilongjiang | 26303 | 3 | 20231 | 4 | 1460 | -7 | 4586 | -1 |
| Henan | 16008 | -4 | 3895 | 1 | 25747 | -1 | 737 | -5 |
| Hubei | | | 15912 | 3 | 4450 | -3 | | |
| Hunan | | | 25394 | 5 | | | | |
| Inner Mongolia | 14360 | -5 | | | 5762 | -2 | 836 | -1 |
| Jiangsu | 2227 | 3 | 16569 | 3 | 9501 | 1 | 781 | -2 |
| Jiangxi | | | 17365 | 4 | | | | |
| Jilin | 24032 | 0 | 5022 | 1 | | | 660 | 2 |
| Liaoning | 12889 | -3 | 4709 | 1 | | | 511 | -2 |
| Ningxia | 1797 | 7 | 545 | 0 | 2315 | 5 | | |
| Shaanxi | 3870 | -3 | 1040 | 0 | 3953 | -8 | | |
| Shandong | 18356 | -1 | | | 21886 | 1 | 659 | -5 |
| Shanxi | 9593 | -2 | | | 2095 | -5 | 187 | -3 |
| Sichuan | 7101 | 1 | 14676 | 3 | 4596 | 2 | | |
| Yunnan | 5613 | -5 | 5332 | 1 | | | | |
| Zhejiang | | | 2786 | 1 | | | | |
| **Sub-total** | 173725 | -1 | 185430 | 0 | 96393 | 1 | 10227 | -1 |
| Other 12 provinces | 18226 | 0 | 15740 | 1 | 19140 | 3 | 2852 | -1 |
| **China total** | 191952 | -1 | 201167 | 1 | 119735 | 1 | 13079 | -1 |

Note: Δ%=percentage difference with 2013.

As shown in table 4.3, the single-crop rice production decreases in Shaanxi (-1%) and Henan province (-5%) due to drought. Yield dropped in both provinces due to drought, while in Henan, areas were affected as well. In Ningxia, the single rice production increases by 18% due to an increase in cultivated area and yield.

Overall, CropWatch puts the combined production of the main cereals (wheat, rice, and maize) in China for 2014 at 513 million tons. Combined with an estimated 51 million tons of other crops including tubers, legumes (including 13 million tons of soybean), and other minor cereals such as millet, the total estimated production for China is 564 tons—a modest decrease compared to 2013 (-0.1%). The total output for summer crops is projected at 405 million tons, a decrease of 1.8 million tons (-0.5%) compared with 2013. The main decease comes from the decreased yield of maize due to the severe drought developed in July and August, particularly in Liaoning, Henan, and Inner Mongolia.

**Table 4.3. China, 2014 single rice, early rice, and late rice production and difference with 2013, by province (thousand tons).**

| | Single rice | | Early rice | | Late rice | |
|---|---|---|---|---|---|---|
| | **2014** | **Δ%** | **2014** | **Δ%** | **2014** | **Δ%** |
| Anhui | 13448 | 3 | 1910 | -1 | 1792 | 1 |
| Chongqing | 4785 | -2 | | | | |
| Fujian | | | 1680 | 0 | 1132 | -1 |
| Gansu | | | | | | |
| Guangdong | | | 5207 | -1 | 5866 | 1 |
| Guangxi | | | 5428 | -1 | 5556 | 2 |
| Guizhou | 5148 | 0 | | | | |
| Hebei | | | | | | |
| Heilongjiang | 20231 | 1 | | | | |
| Henan | 3895 | -5 | | | | |
| Hubei | 10688 | 1 | 2399 | -2 | 2826 | -1 |
| Hunan | 8338 | 3 | 8278 | -3 | 8777 | -1 |
| Inner Mongolia | | | | | | |
| Jiangsu | 16569 | -1 | | | | |
| Jiangxi | 2876 | 3 | 7297 | 2 | 7192 | -1 |
| Jilin | 5022 | -1 | | | | |
| Liaoning | 4709 | 0 | | | | |
| Ningxia | 545 | 18 | | | | |
| Shaanxi | 1040 | -1 | | | | |
| Shandong | | | | | | |
| Shanxi | | | | | | |
| Sichuan | 14676 | 1 | | | | |
| Yunnan | 5332 | 5 | | | | |
| Zhejiang | | | 1509 | -1 | 1277 | -1 |
| **Sub total** | 117302 | 1 | 33708 | -1 | 34418 | 0 |
| Other provinces | 12865 | 3 | 1679 | -1 | 1196 | 8 |
| **China** | 130167 | 1 | 35387 | -1 | 35614 | 0 |

Note: Δ%=percentage difference with 2013.

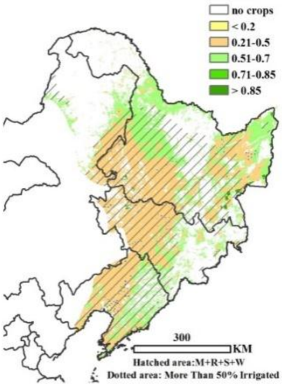
## 4.2 Regional analysis

Figures 4.7 through 4.13 present crop condition information for each of China's seven regions. The provided information is as follows: (a) General setting: NDVI background; combined maize, rice, soybean and wheat cultivation area, and areas where more than 50 percent of the land is irrigated; (b) Crop condition development graph based on NDVI, comparing the January-October 2014 period to the previous season, to the five-year average (5YA), the five-year maximum; (c) Spatial NDVI patterns from July to October 2014 (compared to the (5YA); (d) NDVI profiles associated with the spatial patterns under (c); (e) maximum VCI (over arable land mask); (f) Cropped arable land fraction (CALF); and (g) biomass for July-October. Additional information about agroclimatic indicators and BIOMSS for China is provided in Annex A, table A.11.

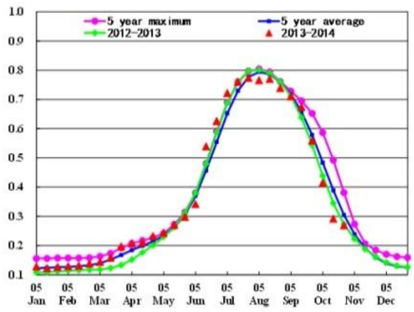
# North-east region

CropWatch agro-climatic and agronomic indicators indicate generally average conditions over most of the north-east region during the reporting period. Harvest of spring crops was concluded in October. “Single crops” including maize, rice, and soybean reach the grain-filling to maturity stages in August to late September. As shown in the spatial NDVI patterns, compared to their recent five-year average and the corresponding cluster profiles, crop condition was above average from May (early growing stage) up to mid-July. However, significant below average rainfall in August stressed crops in western Liaoning province where NDVI was well below the five-year average. Below average BIOMSS confirms the unfavorable conditions in Liaoning. The maximum VCI map still shows above average conditions, but not as good as other places in the region. In the south of Heilongjiang, NDVI was continuously above the five-year average and actually exceeded the recent thirteen-year record (VCIx>1). Overall, the increased maize production in Heilongjiang is due to farmers switching from less profitable crops such as spring wheat and soybean to maize; this offsets the decreased production brought about by the Liaoning drought: the global outputs from the region are slightly above those of the previous year.

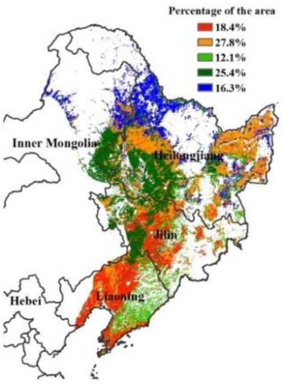
**Figure 4.7. Crop condition China North-east region, July-October 2014**



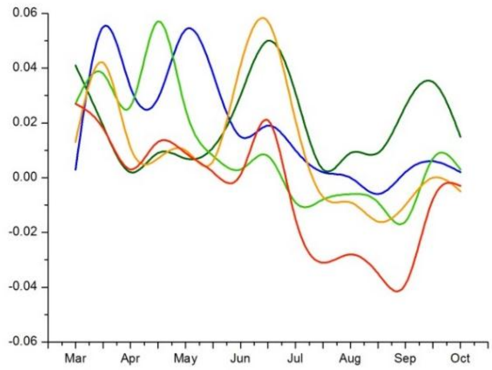

(a) NDVI background



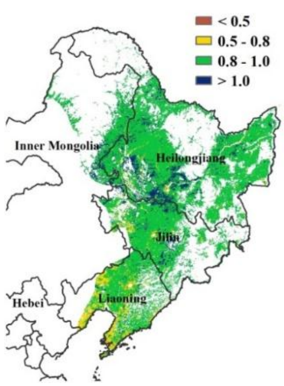

(b) Crop condition development graph based on NDVI



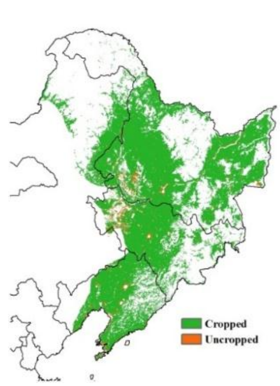

(c) Spatial NDVI patterns compared to 5YA



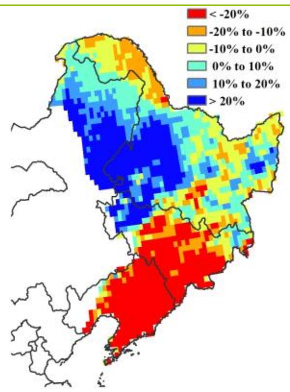

(d) NDVI profiles




(e) Maximum VCI




(f) Cropped arable land fraction

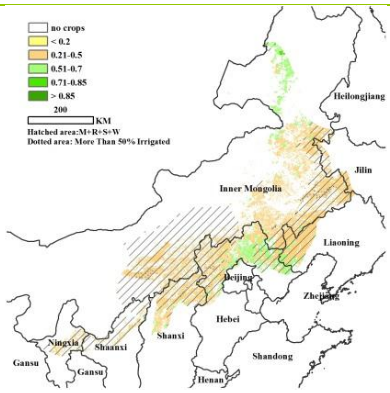



(g) Biomass

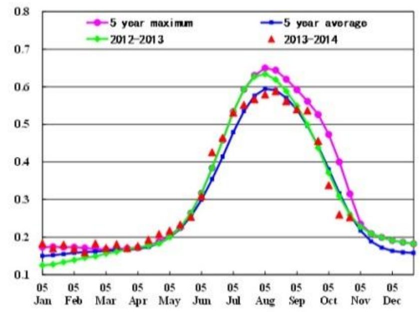
# Inner Mongolia

The condition of maize and soybean, the main summer crops in Inner Mongolia, was generally unfavorable during the reporting period. Rainfall for the region was above average (+39%). The crop condition development graph shows slightly below average condition from August. In late July and August, dry weather in the center and hail in the north and west have affected crop growth, with sharp drops in the NDVI profiles starting in July in about 33% of the region. Western Liaoning, western Hebei, northern Shanxi, and central and southeastern Inner all have poor vegetation condition according to the VCIx map, including some areas that have uncropped land. In partly cropped land, the potential biomass was poor due to drought. According to the CropWatch indicators, maize and soybean production decreased in varying degrees compared with the previous season (see also table 4.2).

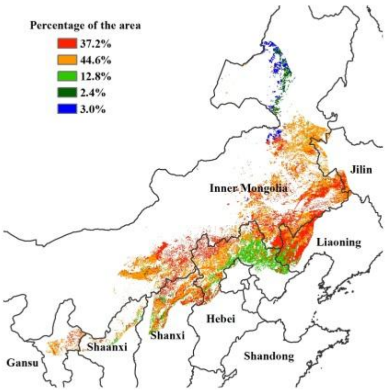
**Figure 4.8. Crop condition China Inner Mongolia region, July-October 2014**



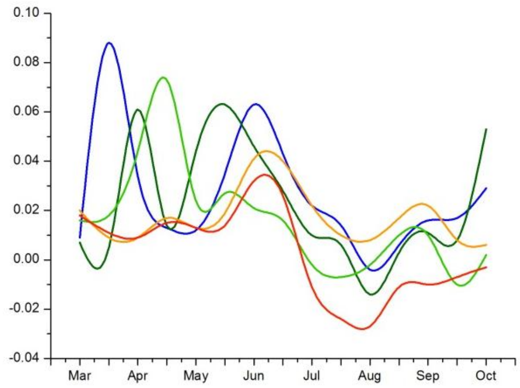

(a) NDVI background



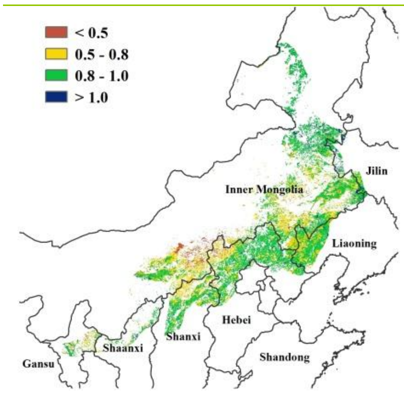

(b) Crop condition development graph based on NDVI



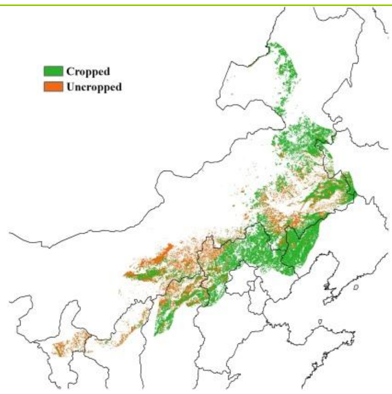

(c) Spatial NDVI patterns compared to 5YA



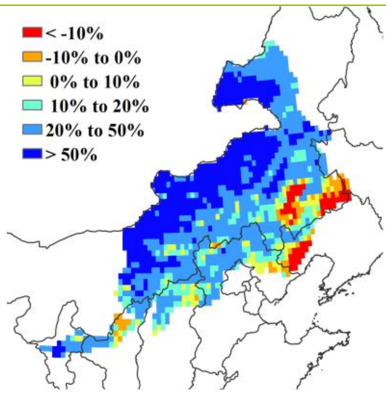

(d) NDVI profiles




(e) Maximum VCI




(f) Cropped arable land fraction

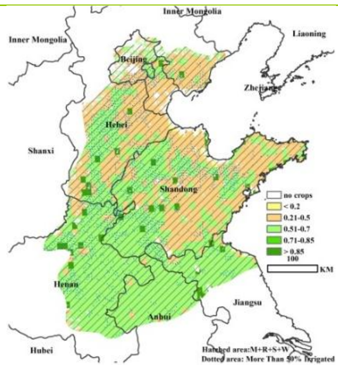



(g) Biomass

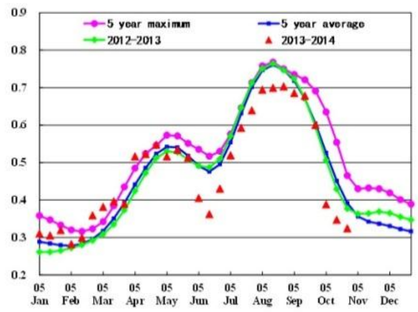
# Huanghuaihai

Crop condition was generally average from July to October with unfavorable conditions in August and favorable condition from September on forward. The harvesting of summer crops (mainly maize, rice, and soybean) concluded in early October. Currently, winter wheat is in tillering to wintering stage. Huanghuaihai experienced generally below average precipitation and above average temperature, but an 8% increase in BIOMSS. The most severe decline in BIOMSS was observed in eastern Shandong province due to the below normal rainfall (figure 4.1), while maximum VCI shows above average crop condition in the area. According to the spatial NDVI patterns (compared to the recent five-year average) and the corresponding NDVI profiles, NDVI was continuously below average for Bohai Bay west coastal regions as well as central Shandong. Overall, the spatial average NDVI development graph reveals that summer crops condition is below both average and the previous years' condition. The below average CALF and cropping intensity is the combined effect of poor weather conditions and low earnings from farming.

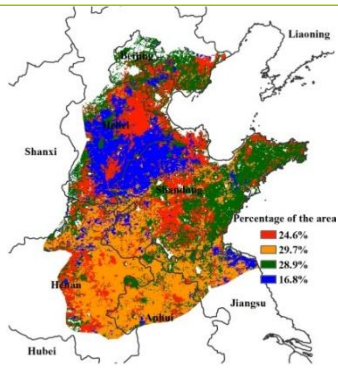
**Figure 4.9. Crop condition China Huanghuaihai region, July-October 2014**



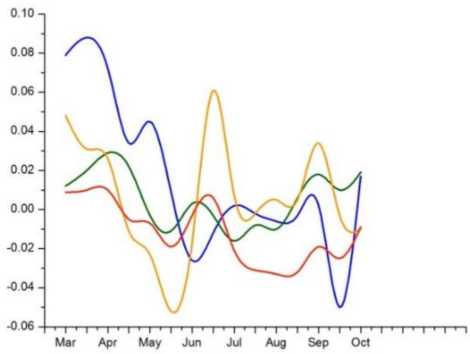

(a) NDVI background



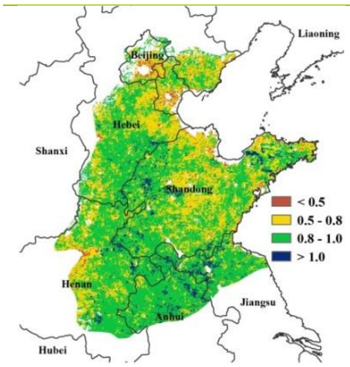

(b) Crop condition development graph based on NDVI



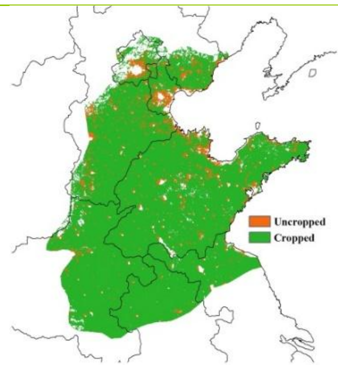

(c) Spatial NDVI patterns compared to 5YA



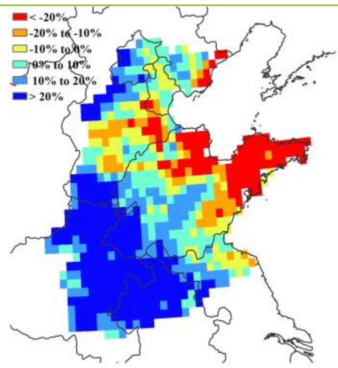

(d) NDVI profiles




(e) Maximum VCI




(f) Cropped arable land fraction



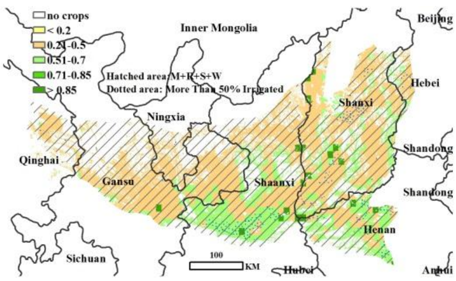

(g) Biomass

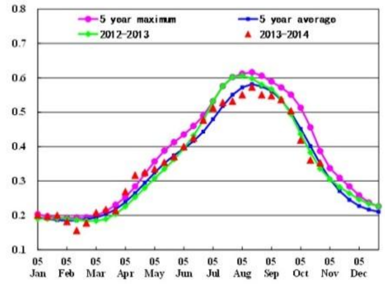
# Loess region

In spite of crop condition being below last year's in the Loess region from June to September, at the time of harvest the maize crop condition was slightly better than last year's and as good as the five-year average. When compared to the thirteen-year average, temperature and precipitation increased by 0.6°C and 10%, resulting in a potential biomass of 10% above average.

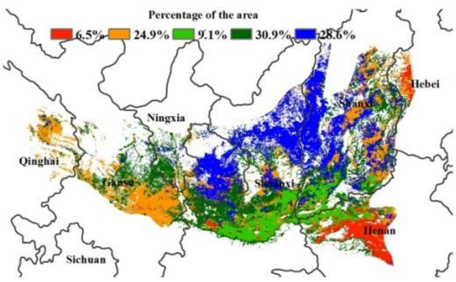
The analysis of spatial NDVI clusters and profiles indicates that crop condition is favorable in the east of Gansu, north of Shaanxi, and in most parts of Shanxi, due to the abundant rainfall and suitable temperature and sunlight. That crops are better than the historical average is also confirmed by VCIx in central Anhui province. On the contrary—and mostly because of drought in August (as confirmed by the maps of potential biomass), crops are in poor condition (compared to the five-year average) in the northwest of Henan and west of Hebei. At the beginning of September, however, crop condition had recovered (it was better than the five-year average) because of the suitable temperature and rainfall. The fraction of arable land actually cropped increased 4% due to suitable temperature and PAR; uncropped arable land is mainly located in Gansu, north of Shaanxi, and scattered areas of Henan, Shanxi, and Henan provinces.

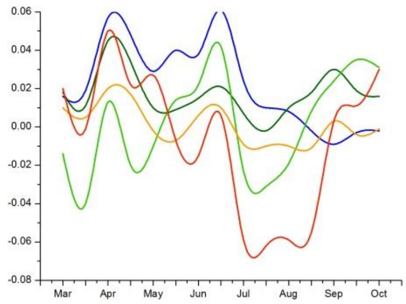
**Figure 4.10. Crop condition China Loess region, July-October 2014**



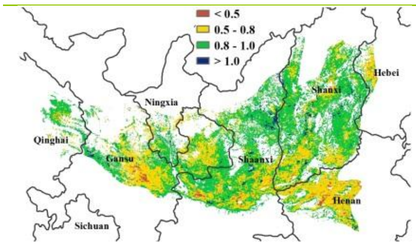



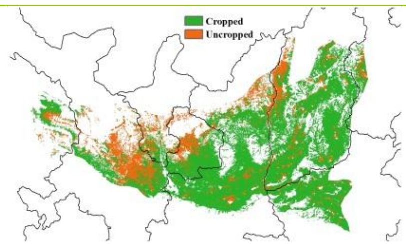

(a) NDVI background (b) Crop condition development graph based on NDVI

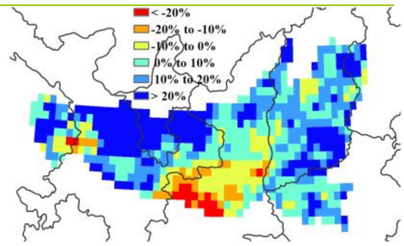



(c) Spatial NDVI patterns compared to 5YA (d) NDVI profiles



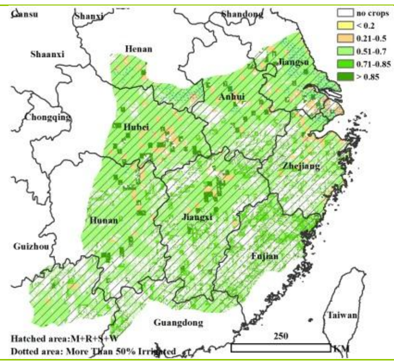



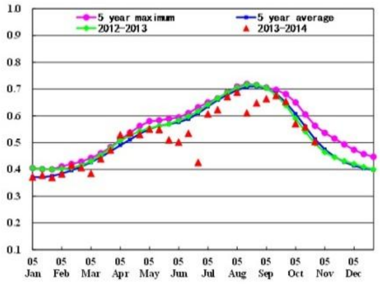

(e) Maximum VCI (f) Cropped arable land fraction (g) Biomass

# Lower Yangtze region

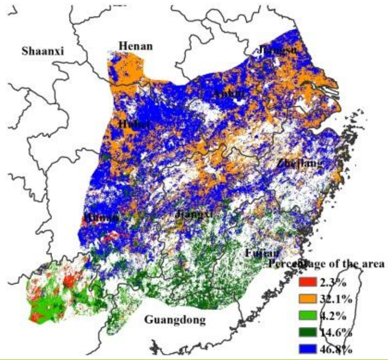
Although the crop condition has fluctuated over the growing cycle, by October it was comparable to last year's condition and the average of the last five years. The main crops in this region (single rice and late rice) have already been harvested between late-August and mid-October. The analysis shows that TEMP and RAIN are above average, while RADPAR is below average by 5%. Potential biomass (BIOMSS) shows an increase of 13% when compared to the five-year average. Although NDVI fluctuated widely, crop condition in the central and north of the region remained above average, which is confirmed by the average VCIx value of 0.89 and the VCIx map. In late May and June, crop condition in the south of the region (in particular in northeast Guangxi, northern Guangdong, and most parts of Fujian province) dropped sharply because of heavy rainfall. As the Lower Yangtze region is the main producer of rice in China, almost all the arable land in this region is cropped except for some areas scattered along the Yangtze River; the fraction of cropped arable land (CALF) in this region is similar to its five-year average. The map of the potential biomass also shows that crop condition in most parts is better than the five-year average, with a spectacular BIOMSS increase of 10 percent when compared to the five-year average.

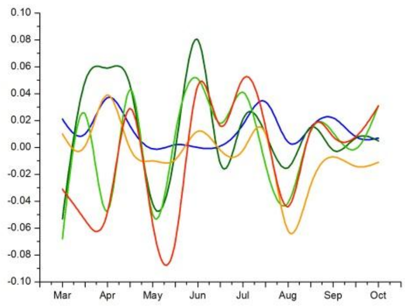
**Figure 4.11. Crop condition Lower Yangtze region, July-October 2014**



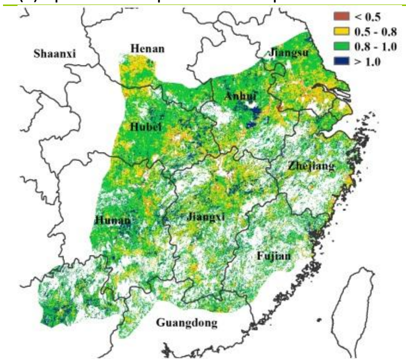




(a) NDVI background (b) Crop condition development graph based on NDVI

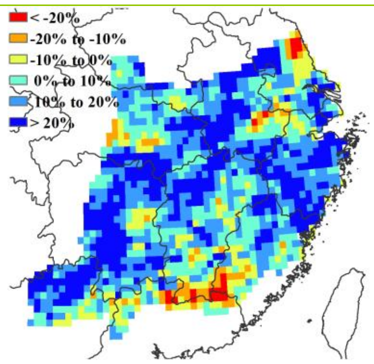



(c) Spatial NDVI patterns compared to 5YA (d) NDVI profiles





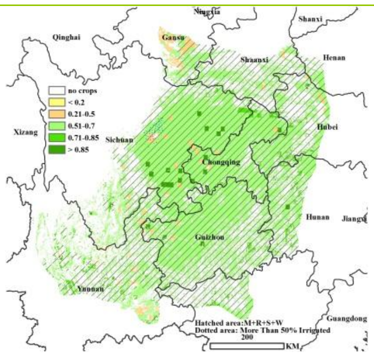



(e) Maximum VCI (f) Cropped arable land fraction (g) Biomass

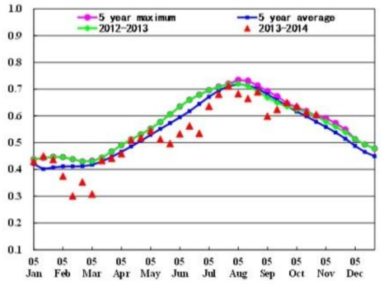
# South-west China

The overall condition of crops was close to average in South-west China between July and October. The period coincides with the region's harvest season for maize and single cropping rice and its planting season for winter wheat. The spatial NDVI patterns and profiles, as well as a VCIx in the range of 0.8 to 1.0, indicate favorable harvest prospects; crops in most of the region (82% of the area) were at an above average level. However, the NDVI profiles were below average in northern Yunnan and northwestern Guangxi, indicating a less favorable condition of maize in Yunnan and rice in Guangxi (as it is the harvest season there). Nearly all arable land was cropped, although the cropping intensity decreased by 11%, compared to the five-year average.

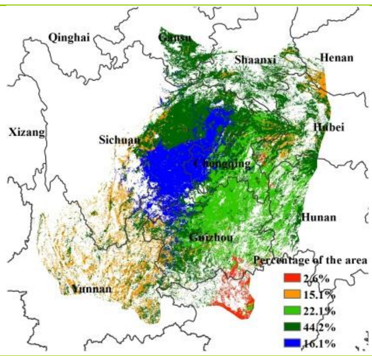
**Figure 4.12. Crop condition Southwest China region, July-October 2014**



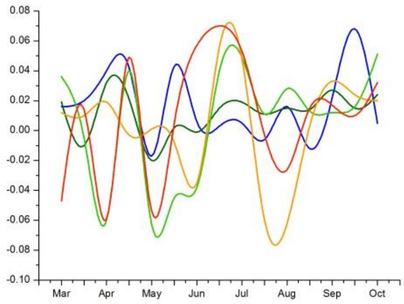

(a) NDVI background



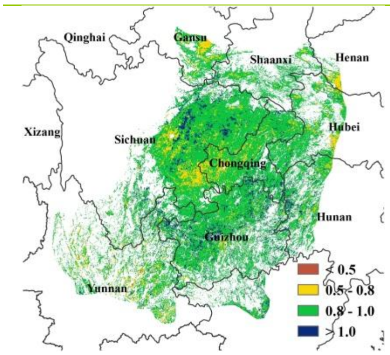

(b) Crop condition development graph based on NDVI

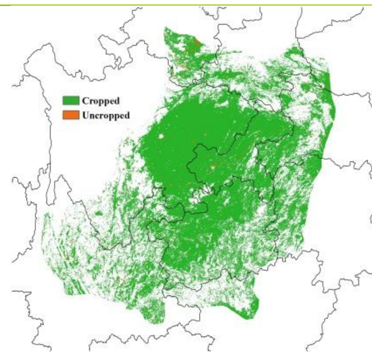


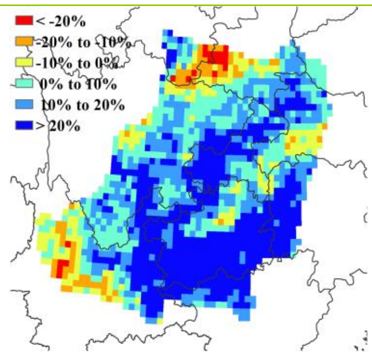

(c) Spatial NDVI patterns compared to 5YA




(d) NDVI profiles




(e) Maximum VCI

(f) Cropped arable land fraction

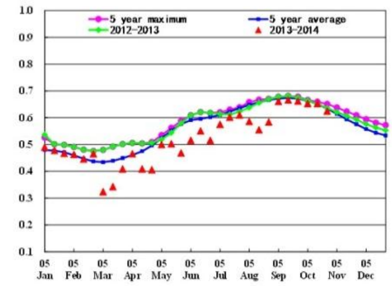
(g) Biomass

# Southern China

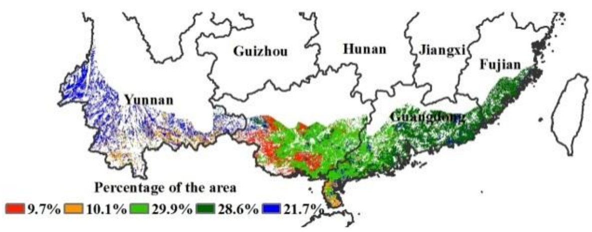
Average crop conditions prevailed in southern China during most of the reporting period, which covered the end of the early rice harvest and the planting and harvest period of late rice. Overall, the region's maximum VCI was between 0.5 and 0.8 with no change in the cropped arable land fraction; cropping intensity decreased by 13%, compared to the five-year average. In southern Fujian and central and southern Guangdong, NDVI was slightly above average during the growing and harvesting of rice, indicating favorable crop condition brought about by increased precipitation (RAIN +21% for Fujian and +12% for Guangdong). The double-crop late rice was below average in south Guangxi in August, especially in southwestern Guangxi, but recovered after September. In southern Yunnan, the spring maize and early rice were below average at the time of harvest; however, late rice improved to slightly above average, rising the prospects for a fair rice crop.

**Figure 4.13. Crop condition Southern China region, July-October 2014**

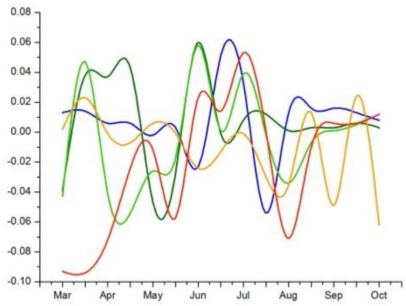

(a) NDVI background




(b) Crop condition development graph based on NDVI

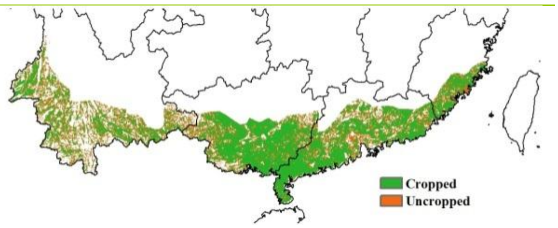



(c) Spatial NDVI patterns compared to 5YA

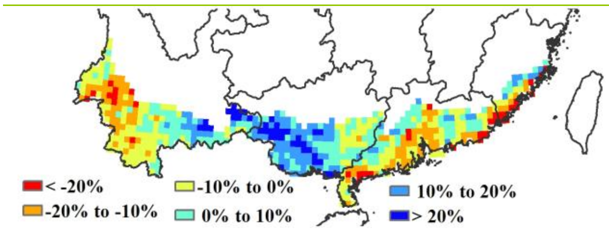



(d) NDVI profiles


(e) Maximum VCI




(f) Cropped arable land fraction




(g) Biomass