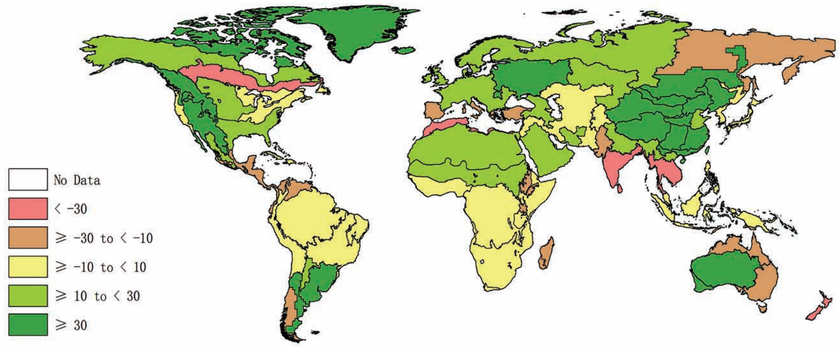

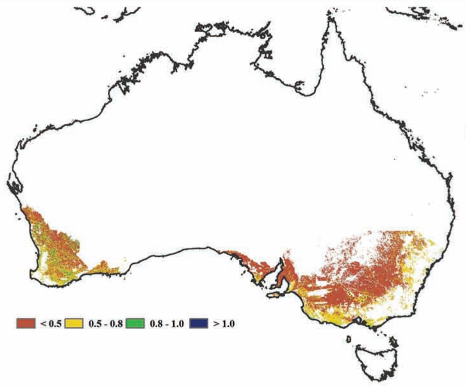

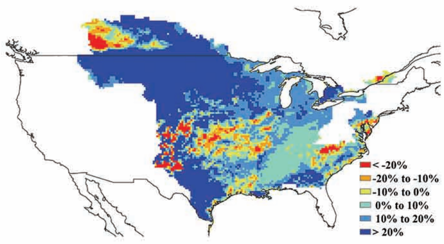

CropWatch bulletin

QUARTERLY REPORT ON GLOBAL CROP PRODUCTION

Monitoring Period: January 2016 - April 2016

May 31, 2016

Volume 16, No. 2 (Total No. 101)

RADI

CropWatch

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Institute of Remote Sensing and Digital Earth
Chinese Academy of Sciences

May 2016

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

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Note: CropWatch resources, background materials and additional data are available online at www.cropwatch.com.cn.

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Abbreviations

5YA	Five-year average, the average for the four month period for January-April from 2011 to 2015; one of the standard reference periods.
15YA	Fifteen-year average, the average for the four month period from January-April from 2001 to 2015; one of the standard reference periods and typically referred to as "average."
BIOMSS	CropWatch agroclimatic indicator for biomass production potential
BOM	Australian Bureau of Meteorology
CALF	Cropped Arable Land Fraction
CAS	Chinese Academy of Sciences
CWAI	CropWatch Agroclimatic Indicator
CWSU	CropWatch Spatial Units
DM	Dry matter
EC/JRC	European Commission Joint Research Centre
ENSO	El Niño Southern Oscillation
FAO	Food and Agriculture Organization of the United Nations
GAUL	Global Administrative Units Layer
GVG	GPS, Video, and GIS data
ha	hectare
kcal	kilocalorie
MPZ	Major Production Zone
MRU	Monitoring and Reporting Unit
NDVI	Normalized Difference Vegetation Index
OCHA	UN Office for the Coordination of Humanitarian Affairs
OISST	Optimum Interpolation Sea Surface Temperature
PAR	Photosynthetically active radiation
RADI	CAS Institute of Remote Sensing and Digital Earth
RADPAR	CropWatch PAR agroclimatic indicator
RAIN	CropWatch rainfall agroclimatic indicator
SOI	Southern Oscillation Index
TEMP	CropWatch air temperature agroclimatic indicator
Ton	Thousand kilograms
VCIx	CropWatch maximum Vegetation Condition Index
VHI	CropWatch Vegetation Health Index
VHIn	CropWatch minimum Vegetation Health Index
W/m^2	Watt per square meter

Bulletin overview and reporting period

This CropWatch bulletin presents a global overview of crop stage and condition between January 1 and April 30 2016—in this report referred to as the “January-April” period. It is the 101thbulletin produced by the CropWatch group at the Institute of Remote Sensing and Digital Earth (RADI) at the Chinese Academy of Sciences, Beijing.

CropWatch analyses are based mostly on several standard as well as new ground-based and remote sensing indicators, following a hierarchical approach. The analyses cover large global zones; major producing countries of maize, rice, wheat, and soybean; and detailed assessments of Chinese regions. In parallel to an increasing spatial precision of the analyses, indicators become more focused on agriculture as the analyses zoom in to smaller spatial units.

CropWatch uses two sets of indicators: (i) agroclimatic indicators—RAIN, TEMP, and RADPAR, which describe weather factors; and (ii) agronomic indicators—BIOMSS, VHIn, CALF, and VCIx, describing crop condition and development. The indicators RAIN, TEMP, RADPAR and BIOMSS do not directly describe the weather variables rain, temperature, radiation, or biomass, but rather they are spatial averages over agricultural areas, which are weighted according to the local crop production potential. For more details on the CropWatch indicators and spatial units used for the analysis, please see the quick reference guide in Annex C, as well as online resources and publications posted at www.cropwatch.com.cn.

This bulletin is organized as follows:

Chapter	Spatial coverage	Key indicators
Chapter 1	World, using Monitoring and Reporting Units (MRU), 65 large, agro-ecologically homogeneous units covering the globe	RAIN, TEMP, RADPAR, BIOMSS
Chapter 2	Major Production Zones (MPZ), six regions that contribute most to global food production	As above, plus CALF, VCIx, and VHIn
Chapter 3	30 key countries (main producers and exporters)	As above plus NDVI and GVG survey data
Chapter 4	China and seven main producing regions	As above + high resolution imageries
Chapter 5	Special topics: Disaster events over the reporting period, agriculture in Central Asia, and an update on El Niño.	
Online Resources	www.cropwatch.com.cn	

Newsletter and online resources

The bulletin is released quarterly in both English and Chinese. To sign up for the mailing list, please e-mail cropwatch@radi.ac.cn or visit CropWatch online at www.cropwatch.com.cn. Visit the CropWatch Website for additional resources and background materials about methodology, country agricultural profiles, and country long-term trends.

Executive summary

The current CropWatch bulletin is based mainly on remotely sensed data. It focuses on crops that were either growing or harvested between January and April 2016. The bulletin covers prevailing weather conditions, including extreme factors, as well as crop condition and size of cultivated areas, paying special attention to the major worldwide producers of maize, rice, wheat, and soybean. The bulletin also describes the current crop condition and prospects in China and presents a global production estimate for crops to be harvested throughout 2016.

Global agroclimatic conditions

Some large scale drought patterns, mostly associated with the currently fading El Niño, were identified in the previous CropWatch bulletin as they started in 2015 and continued into the first quarter of 2016. This includes the following four areas, with varying degrees of impact:

- **South and Southeast Asia.** In this region, the drought situation differs between the continent and the islands. On the continent, drought has affected late stages of winter wheat and rice, as well as the early stages of the spring season planted from January in the warmer areas. The largest national precipitation deficits are close to 70 percent, and several countries underwent a drop in cultivated land, as measured by the CropWatch Cropped Arable Land Fraction (CALF) index, for example a CALF of -1 percentage point in Vietnam and -3 percentage points in Cambodia, when compared to their five-year average. Several major food producers in the region countered negative environmental conditions by increasing CALF: by 3 percentage points in India and by 15 percentage points in Pakistan. Maritime Southeast Asia already experienced drought in 2015. The crops affected include the secondary 2015 rice crop and the early growth of the 2016 maize and main rice season. Impact, however, is less severe than on the mainland, and CALF values are mostly comparable to those of previous seasons.
- **The Mediterranean.** Drought in Mediterranean countries was prolonged and severe in the south, but less marked in the north. Winter crops (wheat, and barley in the south) are the major rainfed cereals throughout the area, and they were exposed to moisture stress during much of their growing season. Interestingly, Turkey was largely unaffected by the drought, but a spectacular drop in CALF (-15 percentage points) is nevertheless bound to affect national winter crop output.
- **East and southern Africa.** This area underwent a relative reduction of the water stress compared with late 2015. In East Africa, the situation remains open as far as the 2016 main season and range-land is concerned. In the south, maize—the main summer crop—suffered badly, leading to widespread food insecurity. CALF dropped 20 percentage points below average in South Africa, and the biomass production potential is down 8 percent compared with recent cropping seasons.
- **Central and northern South America.** Drought has persisted here from 2015, especially in the Caribbean. Impacts on nutrition, however, are less severe than in Africa.

Elsewhere, excess precipitation and local positive temperature anomalies affected a large semi-arid area stretching from West Africa across the Arabian Peninsula and Central Asia as far as East Asia. The abundant precipitation in West Africa coincides with a likely early start of the Sahelian cropping season, even if absolute precipitation amounts are low. In Central Asia, winter is mostly too cold for winter crops, but the abundant rain will benefit summer crops and range-land development. In Kazakhstan, the CropWatch biomass production potential indicator (BIOMSS) increased 27 percent, but CALF fell 5 percentage points in warmer than normal (+3.0°C) and wet weather with low sunshine (-7 percent sunshine compared to average). In China, especially in southern areas, excess rain had a negative impact on crops. Much of Central Asia also recorded above average temperature. The North American continent is mentioned as well for warmer than average weather, with an average CALF of 67 percent, 5 percentage points above average. In South America, two major soybean producers (Argentina and Uruguay) recorded very abundant rainfall, and CALF for the continent reached the very high value of 90 percent (1 percentage point above average), with a stable value for the same index in Brazil and a 3 percentage points increase in Argentina.

Production outlook

China

During early May, most winter wheat in China was between heading and grain-filling stage. CALF increased moderately (between 1 to 4 percentage points) in all areas that cultivate winter crops (thus excluding Northeast China and Inner Mongolia), except in the Lower Yangtze region (CALF, -5 percentage points). Even if the agroclimatic conditions remain average until harvest, the production of winter crops in China will be below the 2015 record. The main cause is a combination of excess rainfall during the winter, a change in the minimum purchasing price policy and severe pest and disease impacts (3percent of areas for wheat sheath blight, 9 percent for powdery mildew and as much as 16 percent for aphids). CropWatch puts the expected wheat production at 111.2 million tons, a decrease of 2.3 million tons or 2.0 percent compared to 2015's bumper crop. Only Jiangsu, Anhui, and Shaanxi provinces show increased production compared to the previous year. In Shandong and Henan—the top two winter wheat producing provinces— expected production drops are to reach 4.4 percent and 3.2 percent, due reduced areas and yield, respectively.

Global

For crops already harvested or still growing, productions are based on hectarages calibrated against CALF and 2016 yield variations compared with 2015 based on remote sensing data up to the end of April; trend-based projections are used for other countries and minor producers. The latest estimates for 2016 depart little from the previous year, with a 1 percent increase for maize, and 2 percent for rice, but 1 percent drop for soybeans. Wheat production is estimated to be almost identical to the 2015 output. For major exporters, the output of maize and rice increased 2 percent, while the volume of wheat and soybean are expected to drop 1 percent and 2 percent respectively compared with the previous year. The major importers are expected to increase their rice production while wheat will stagnate. For both maize and soybeans, the expected drop (-1 and -2 percent, respectively) will be easily met by the increased availability of the major maize exporters and 2015 soybean bumper production. It is also noted, as often happens, that the minor producers grouped as "others" collectively outperform the major players. Both paddy rice and wheat increase 2 percent, and the production of maize—by now the preferred cereal worldwide—grows 3 percent. However, soybean for “others” deceases by 7 percent.

Maize. With the exception of South-Africa (a 32 percent drop due to drought), national production variations stay within the -6 percent and +9 percent (Ukraine) interval. Other large production growths occur mostly in middle-sized tropical countries. CropWatch estimates that Brazil will stay 1 percent below last years' maize production, while the United States will increase 2 percent.

Rice. Most major exporters do well, with India and Vietnam recording a +2 percent growth in output, which is significantly lower than the annual growth rate of rice exports sustained by the two countries over the last decade. Production is expected to stagnate in Pakistan and the United States. A large increase in rice production is conjectured for Brazil (+12 percent).

Wheat. For wheat production, values that are below those of 2015 include -7 percent in Iran, -4 percent in each Argentina, the United States, and Ukraine (where CALF is down 3 percentage points), and -2 percent in China. A production increase of 4 percent is expected in each Brazil, Canada, and Kazakhstan. Among the exporters, Canada (+4 percent) and France (+2 percent, with CALF at +1 percent) compensate the estimated drop of 4 percent in the United States.

Soybeans. Two of the major producers and exporters are expected to drop (-5 percent for United States and -1 percent for Argentina compared to last year) while Brazil is doing well (+2 percent compared to last year). China continues its decade-long negative trend with a 3 percent drop in soybean production compared to last year.

Chapter 1.Global agroclimatic patterns

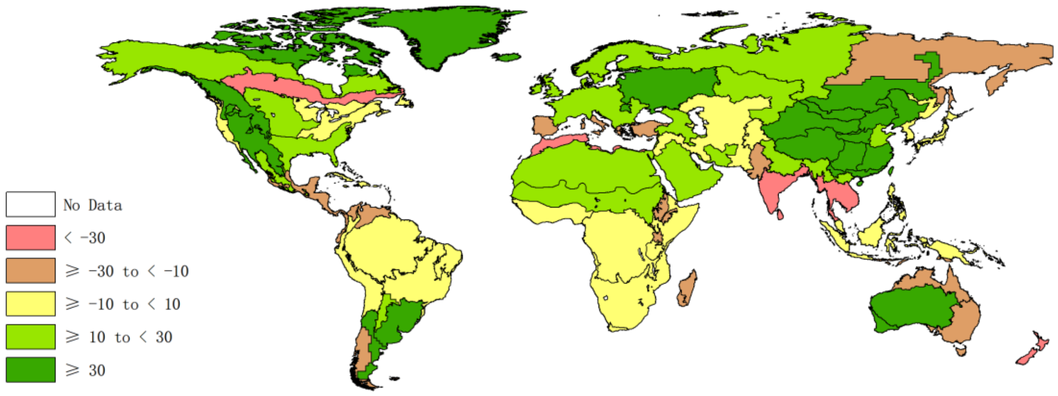
Chapter 1 describes the CropWatch agroclimatic indicators (CWAIs) for rainfall (RAIN), temperature (TEMP), and radiation (RADPAR), along with the agronomic indicator for potential biomass (BIOMSS) for sixty-five global Monitoring and Reporting Units (MRU). Rainfall, temperature, and radiation indicators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

1.1 Overview

A statistical analysis of table A.1 (CWAIs by CropWatch MRU) and tables A.2-A.11 (CWAIs by country and by administrative regions of large countries) in Annex A indicates largely independent variations of RAIN and BIOMSS, and of TEMP and RADPAR. Altogether, RAIN-BIOMSS account for about 80 percent and TEMP-RADPAR for about 20 percent[1] of the climatic variability between January and April 2016. The different patterns also appear when visually comparing figures 1.1 to 1.4.

The correlation between rainfall and rainfall anomalies is weak (-0.137 for MRUs; -0.060 for countries and sub-national areas), indicating independence of anomalies and rainfall amounts; in other words: departures are not specifically associated with high or with low amounts of rainfall. The same applies to BIOMSS (-0.229 for MRUs and 0.077 for countries), but not to TEMP and RADPAR; generally correlations between RADPAR and departure from average are positive: larger departures are more associated with high values than with low values (0.577 and 0.678, respectively for n=165).

Figure 1.1. Global map of January – April 2016 rainfall anomaly (as indicated by the RAIN indicator) by MRU, departure from 15YA (percentage)



[1] As expressed by the share of variance carried by the two first principal components, PC1 and PC2. For MRUs (n=65), the correlation between PC1 and RAIN and BIOMSS is 0.971 and 0.997, respectively. For PC2 against TEMP and PAR we find 0.739 and 0.976. For countries (n=165), the listed correlations become 0.925, 0.996, 0.888, and 0.992. However, for countries the variance carried by the first component drops to a slightly lower value because the third component attracts about 5 percent of the total variance. It is correlated with the departures from average of RAIN and BIOMSS.

Figure 1.2. Global map of January – April 2016 biomass accumulation (BIOMSS) by MRU, departure from 5YA, (percentage)

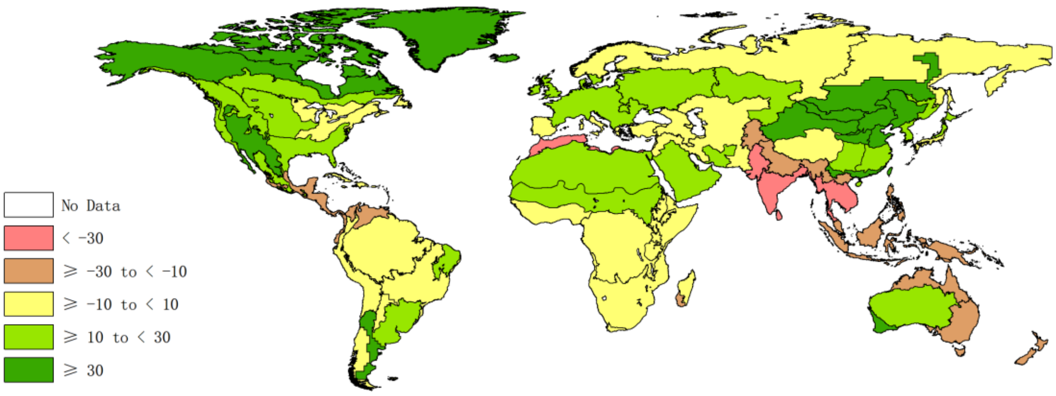


Figure 1.3. Global map of January – April 2016 temperature anomaly (as indicated by the TEMP indicator) by MRU, departure from 15YA (degrees Celsius)

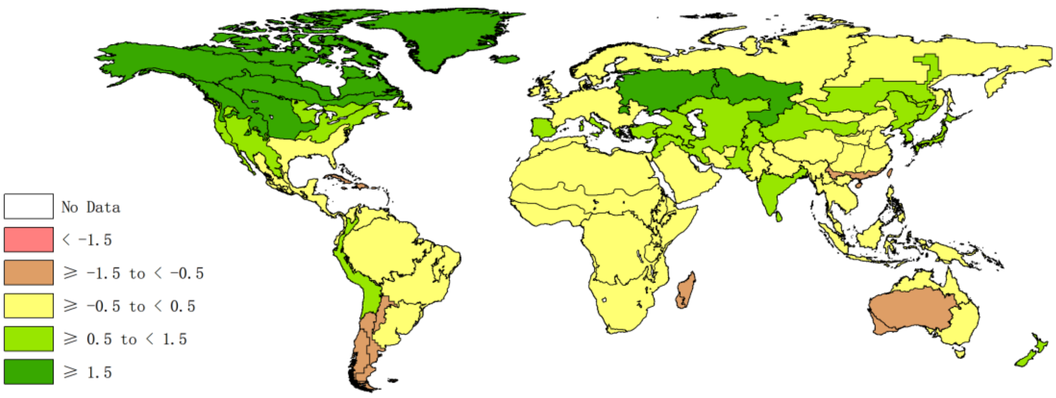
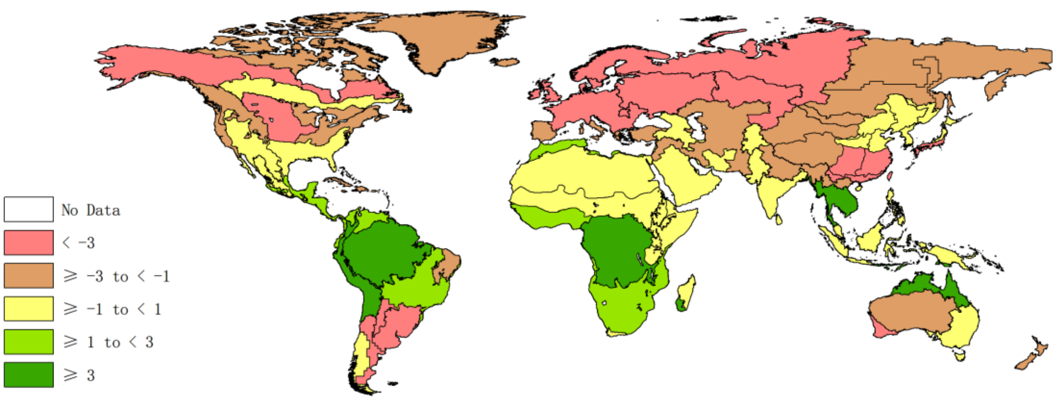


Figure 1.4. Global map of January – April 2016 PAR anomaly (as indicated by the RADPAR indicator) by MRU, departure from 15YA (percentage)



For TEMP, departures tend to be small (and negative) at high temperatures in the tropics and large (and positive) in temperate regions (correlations of -0.616 for 65 MRUs and -0.508 for 165 countries). As was very widely reported in the news,[2] recent months and particularly April 2016 broke several temperature records. The fact that low temperatures increase more than high ones (e.g., at high latitudes, or minimum temperature during the day) is consistent with climate warming scenarios.

1.2 Rainfall and BIOMSS anomalies

Drought

The recent reporting period witnessed both excess rainfall and drought. As mentioned above, anomaly patterns largely overlap for the RAIN and BIOMSS indicators. Drought, mostly associated with the fading El Niño, affected essentially four areas of agricultural relevance. Additional information is provided for some of them in section 5.2 on disasters. Two large drought affected areas are not receiving any specific attention because they are of very limited agricultural importance (Eastern Siberia, MRU-51, RAIN -16 percent, and Sub-boreal America, MRU-15, -58 percent) and because positive temperature anomalies have somehow offset the effect of low water supply. Problems later in the season, including forest fires cannot be excluded.

Mediterranean countries

Mediterranean North Africa (MRU-07) recorded on average 74 mm of precipitation over four months, which is very low in absolute terms and 54 percent below average. The amounts of rainfall are insufficient to cover the water requirements of winter crops. In European countries including Turkey (MRU-59), precipitation amounts were larger (225 mm) but nevertheless below average (-15 percent). In the northern Mediterranean, countries also recorded above-average temperature (close to 1°C), which resulted in a biomass production potential (BIOMSS) drop of 9 percent. In the southern Mediterranean, CropWatch estimates the BIOMSS drop at a significantly higher value of 44 percent.

Punjab and Gujarat to New Zealand

Globally, this is the largest drought affected area, as it extends from southern Asia (Punjab and Gujarat, MRU-48) across India, continental and maritime Southeast Asia (MRU-50, MRU-49) and north and east Australia (MRU-53, MRU-54) to New-Zealand (MRU-56). It is also the one where drought was the most severe, even if, due to normally abundant winter and equatorial rains, the agricultural impact in terms of biomass loss is less severe than in some other, drier locations. In continental Southeast Asia (MRU-50), RAIN and BIOMSS both drop 44 percent compared to average. This is followed, in terms of precipitation deficit, by New Zealand (164 mm, -39 percent) and Southern Asia (MRU-45,67mm and -35 percent). The remaining areas recorded precipitation drops close to 20 percent compared with average (Punjab to Gujarat, MRU-48, with 41mm, -24 percent; Queensland to Victoria, MRU-54, 172mm, -23 percent; and Northern Australia, MRU-53, 685mm, -17 percent). In Maritime Southeast Asia (MRU-49, 1003mm and -7 percent) the impact is expected to be minor, not exceeding 10 percent). In Punjab, shared between Pakistan and India, the BIOMSS drop reaches 35 percent.

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[2]http://berkeleyearth.org/temperature-reports/april-2016/, http://europe.chinadaily.com.cn/world/2016-05/19/content_25364793.htm, http://www.drroyspencer.com/2016/05/uah-v6-global-temperature-update-for-april-2016-0-71-deg-c/.

East and Southern Africa

Compared with the last months of 2015, a relative weakening of the drought occurred in the East African Highlands and southern Africa. The most severe precipitation deficit was recorded in semi-arid southwest Madagascar (MRU-06, 376mm and -28 percent compared to average) and in the East African Highlands (MRU-02, 181 mm and -20 percent) which includes mainly Ethiopia and the beginning of the Belg rains. The main agricultural areas of Madagascar (MRU-05) lost about 13 percent of their average rainfall but nevertheless recorded close to 900 mm of precipitation, which should be adequate to cover crop water. In the Western Cape province in South Africa (MRU-10), rainfall dropped just 7 percent to 102 mm.

Central and South America

This area—Central and South America—includes MRUs that are not adjacent: one in the south (Western Patagonia, MRU-27) and central and northern South America. Patagonia recorded a noteworthy precipitation drop (-28 percent) in an area and at a time when rainfall is low: just over 100mm fell from January to April which, associated with a temperature drop (-0.9°C), results in a close to average biomass production potential. In northern South and Central America (MRU-19), the Caribbean (MRU-20), Central eastern Brazil (MRU-23), and some adjacent areas, the precipitation deficit was close to 10 percent, which is expected to result in a BIOMSS drop between 10 and 15 percent.

Precipitation excess

Abundant precipitation in excess of 20 percent above average occurred in several areas (easily identified in figures 1.1 and 1.2.) They occasionally brought local damage to crops and infrastructure through floods, flash floods, and landslides, but altogether their effect was largely beneficial to crops currently in the field as well as those to be planted on soils with ample moisture storage. As with drought, some areas of minor or no agricultural importance are not included in the list below, such as Boreal (MRU-61, RAIN +26 percent) and Sub-arctic America (MRU-65, +171 percent), as well as the Australian desert(MRU-63, +52 percent with 148mm).

Eastern and Central Asia

This very large area includes much of China as well as some adjacent areas, such as Southern Mongolia (MRU-47, +62 percent precipitation) and Eastern Central Asia (MRU-52, +38 percent). The largest positive anomalies occurred in Inner Mongolia (MRU-35, +163 percent with 111 mm); Southern China (MRU-40, 460 mm, which is about double the average); Northeast China (MRU-38, +84 percent); Gansu-Xinjiang (MRU-32, +83 percent); Taiwan, the Loess region, and Hainan (MRUs-42, 36, and 33; +60 to +80 percent); as well as Huanghuaihai, Qinghai-Tibet, Southwest China, and the Lower Yangtze (MRUs-34, 39, 41, 37) where the excess varies from 25 to 50 percent.

North and Central America

Favorable conditions for winter crops or forthcoming summer crops prevailed in the southern United States and North Mexico (Cotton Belt to Mexican Nordeste, MRU-14, 440mm and +20 percent; Southwest United States and northern Mexican highlands, MRU-18, 107mm and +41 percent), as well as the Northern Great Plains (MRU-12, 207 mm, +24 percent) and British Columbia to Colorado (MRU-11, 275mm and +37 percent).

South America

This includes the Semi-arid Southern Cone (MRU-28, 218mm, +41 percent) as well some of the major soybean and maize producing areas of temperate southern Brazil and Argentina: Central-north Argentina (MRU-25, 583mm, +25 percent) and the Pampas (MRU-26, 789 mm and +39 percent).

Semi-arid Old World

As mentioned in previous bulletins, the current El Niño conditions seem to be associated with above-average rainfall (about +25 percent) in the West African Sahel (MRU-08) as well as the deserts from the Sahara to Afghanistan (MRU-64). The same area needs mentioning because of minor temperature anomalies of -0.5°C (Sahel) and -0.2 (MRU-64).

Caspian, Black Sea and Eastern Europe

The region includes the adjacent area of the Caucasus (MRU-29, RAIN, +22 percent) as well as the stretch from Ukraine to the Ural mountains (MRU-58, +45 percent). The area was also characterized by above average temperature, creating altogether favorable conditions for winter crops.

Temperature and RADPAR anomalies

Significantly above normal temperature in excess of 1.5°Cover average (for the CropWatch TEMP indicator) occurred mostly over northern North America and east and west of the Ural mountains. Although it recorded a lower temperature anomaly of just 0.8°C, India is mentioned because of its agriculture importance. Below average temperature is mentioned for the Caribbean, southern China, Madagascar, and the Southern Cone from Brazil to Patagonia. A very large area of PAR anomalies affected all of Eurasia, northern Africa and northern North America. The largest negative anomalies include the following: non-Mediterranean Western Europe (MRU-60, RADPAR -6 percent), the Ural to Altai mountains (MRU-62, -6 percent), and Ukraine to Ural mountains (MRU-58, -11 percent) in the west, up to Taiwan (MRU-42), Southern China (MRU-40), Southwest China (MRU-41), and the Lower Yangtze (MRU-37), all at -8 percent, in the east.

Ural mountains and adjacent areas in mid-latitude Asia

In this general area, several MRUs are characterized by TEMP anomalies that reach at least +1.5°C, including an increase of as much as 2.8°C in MRU-62 (Ural to Altai mountains), 1.9°C in MRU-58 (Ukraine to Ural mountains), and 1.5°C over an area including Western Asia (MRU-31), the Caucasus (MRU-29), and Eastern Central Asia (MRU-52). The area extends east and reaches East Asia (MRU-43; +0.6°C) and Southern Japan and Korea (MRU-46, +0.9°C).

Northern North America

Sub-boreal America(MRU-15, TEMP +2.8°C), Boreal America (MRU-61, +5.1°C), and Sub-arctic America (MRU-65, +5.9°C) deserve mentioning because of the extremely large positive anomalies (even if some of them nevertheless record freezing temperature, e.g., Sub-arctic America at -18.2°C). Among areas of agricultural relevance, British Columbia to Colorado (+2.0°C) and especially the Northern Great Plains (+2.7°C) need listing.

Caribbean, Southern China, and Madagascar

Although these three listed areas are distant from each other, they are mentioned together because they share some common features, i.e., they are tropical areas and their spatial extension is limited. The Chinese Islands are the locations with the largest negative anomalies recorded for all MRUs (MRU-42, Taiwan, TEMP -1.5°C; MRU-40, Hainan -1.4°C), while on the adjacent mainland Southern China (MRU-33) recorded -1.1°C. Two of the areas (MRU-33 and MRU-42) had record negative RADPAR departures of 8 percent. In the Caribbean (MRU-20), the TEMP departure from average was -0.6°C, while it was-1.2°C in Southwest Madagascar (MRU-06).

Southern Cone in Latin America

The area covers MRUs 25 through 28: Central-north Argentina (MRU-25, -1.0°C), the Pampas (MRU-26,-0.5°C), Western Patagonia (MRU-27, -0.9°C), as well as the Semi-arid Southern Cone (MRU-28, -1.1°C). Most of them were already mentioned among the areas with excess precipitation. The area also suffered a marked RADPAR deficit reaching -5 percent in the Pampas.

Chapter 2.Crop and environmental conditions in major production zones

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

2.1 Overview

Tables2.1 and 2.2present an overview of the agroclimatic (table2.1) and agronomic (table2.2) indicators for each of the six MPZs, comparing the indicators to their fifteen and five-year averages.

Table 2.1. January-April 2016 agroclimatic indicators by Major Production Zone, current value and departure from 15YA

	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m²)	Departure from 15YA (%)
West Africa	176	1	28.7	-0.5	1259	1
South America	751	12	24.1	-0.4	1106	-2
North America	340	15	6	1.4	797	-2
South and SE Asia	108	-13	24.9	0.4	1180	1
Western Europe	246	12	5.6	-0.4	549	-7
C. Europe and W. Russia	241	41	1	1.9	486	-9

Note: Departures are expressed in relative terms (percentage) for all variables, except for temperature, for which absolute departure in degrees Celsius is given. Zero means no change from the average value; relative departures are calculated as (C-R)/R*100, with C=current value and R=reference value, which is the fifteen-year average (15YA) for the same period (January-April) for 2001-15.

Table 2.2. January-April 2016 agronomic indicators by Major Production Zone, current season values and departure from 5YA

	BIOMSS (g DM/m²)		Cropped arable land fraction (CALF)		Maximum VCI Intensity
	Current	Departure from 5YA (%)	Current	Departure from 5YA (%)	Current
West Africa	580	4	72	0	0.73
South America	1795	3	90	1	0.73
North America	844	16	67	5	0.76
South and SE Asia	298	-31	80	3	0.68
Western Europe	881	20	93	0	0.79
C Europe and W Russia	754	23	89	-1	0.75

Note: Departures are expressed in relative terms (percentage) for all variables. 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-year (5YA) average for the same period (January-April) for 2011-2015.

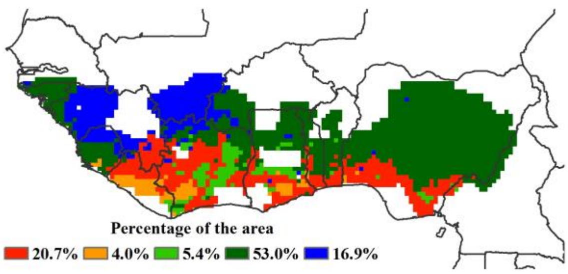
2.2 West Africa

With some minor variations due to elevation and terrain features, most of the West African MPZ was in the dry season in January and February, when the last 2015 crops were being harvested. In March and April, the southernmost areas, particularly in the center and east, have started planting maize and rainfed rice.

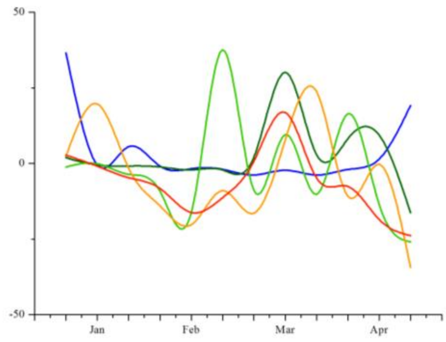
In the Gulf of Guinea region as a whole, temperature was close to average (-0.5°C) but with synchronous fluctuations across the region. The most marked, even if not "extreme" temperature, was recorded in the Nigerian Sahel in late January and early February (-5°C) and at mid-March (+3°C), which is off-season for rainfed crops but in the growing period for irrigated wheat. The indicators for RADPAR, BIOMSS, and cropped arable land fraction (72 percent) were all very close to their averages, and so was RAIN (+1 percent departure on average), for which different patterns do, however, emerge. Some early rainfall was recorded in the western (Guinea Bissau, southwest Sierra Leone) and northern areas (e.g., southern Burkina Faso) in March and in some southern central areas (central Côte d'Ivoire and central Ghana) in February. Nigeria (RAIN, +12 percent), Togo (+15 percent), and Benin (+40 percent) were among the countries where rains exceeded average. VCIx is usually average, with some favorable spots in the southern Sahel in Nigeria and low values in northeast Ghana and north Togo, as well as central-eastern Nigeria where the cereal and especially maize growing season is to start in May.

Altogether, mostly off-season conditions are average for the time being, except in the west of the region (Guinea Bissau), where all indicators point at favorable vegetation and weather over the reporting period.

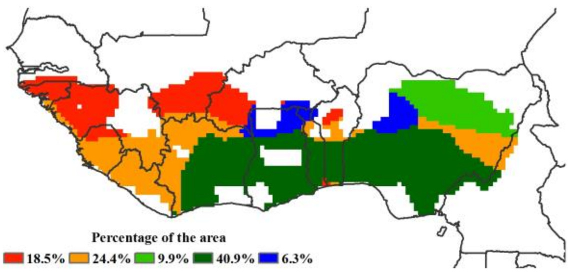
Figure 2.1. West Africa MPZ: Agroclimatic and agronomic indicators, January-April 2016



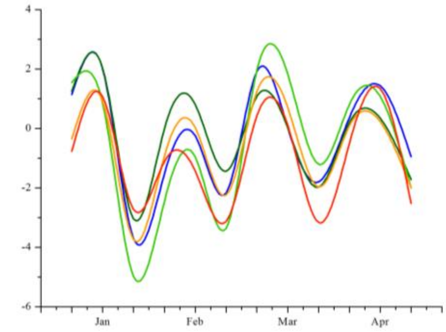
a. Spatial distribution of rainfall profiles



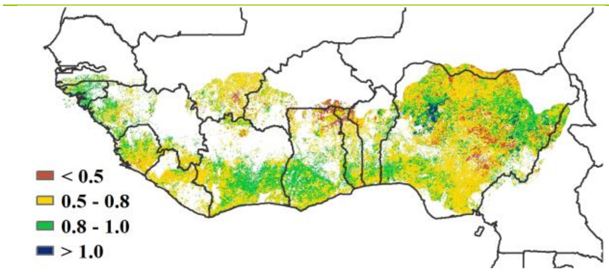
b. Profiles of rainfall departure from average (mm)



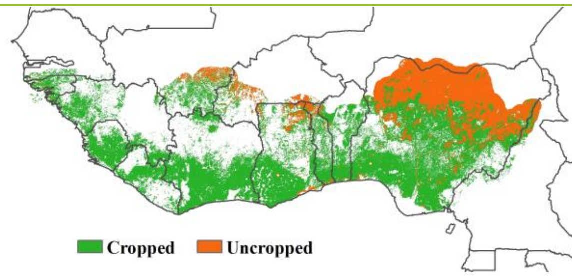
c. Spatial distribution of temperature profiles



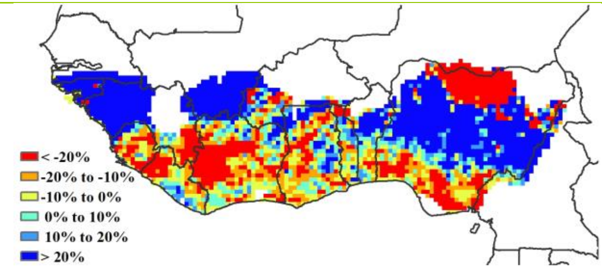
d. Profiles of temperature departure from average (°C)



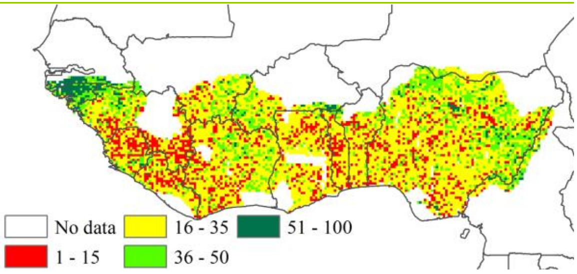
e. Maximum VCI



f. Cropped arable land



g.Biomass accumulation potential departure



h. VHI minimum

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

2.3 North America

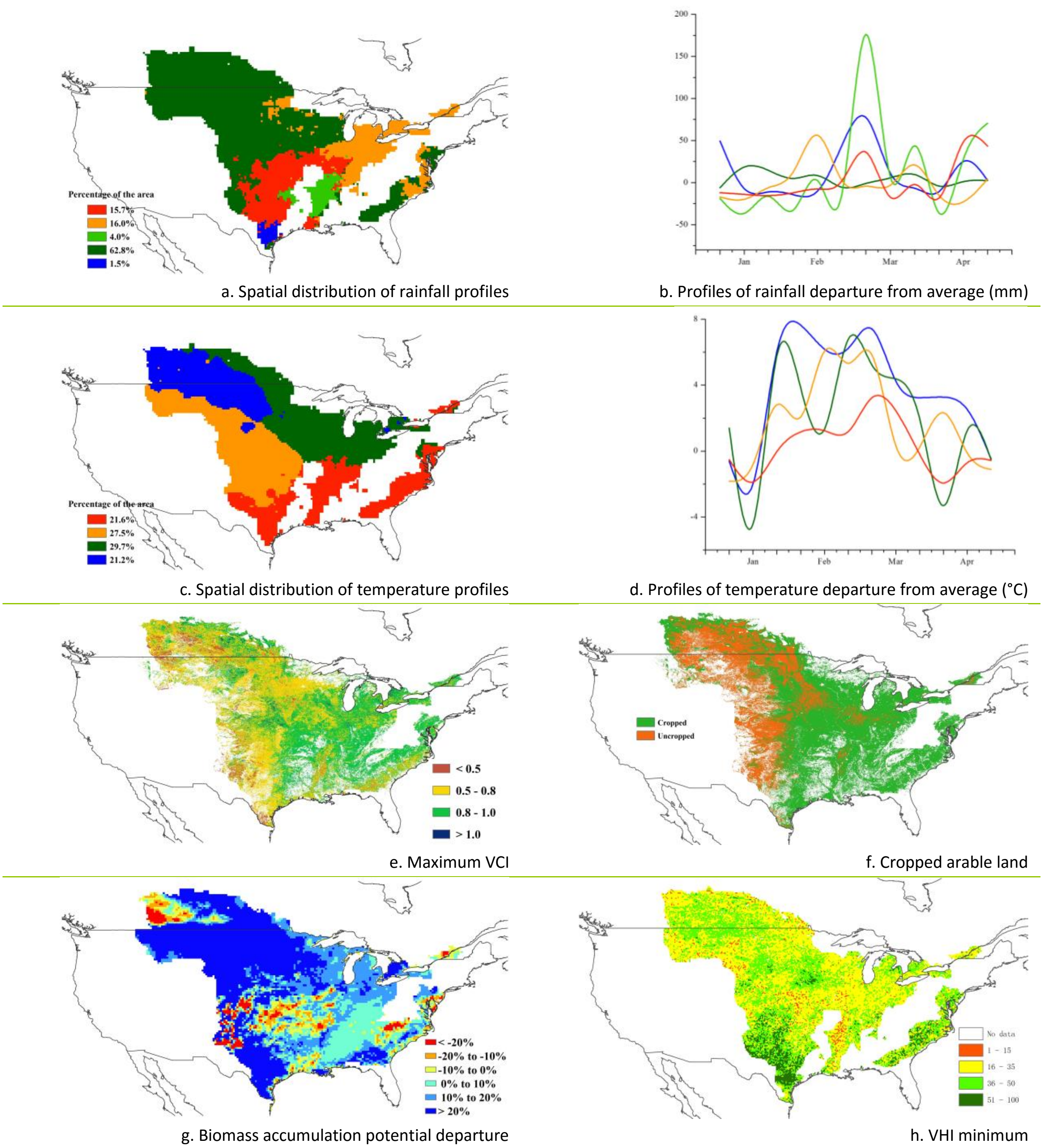
Crops in North America were in better than average condition during the monitoring period, which coincides with the growing season of winter crops, especially wheat, and the sowing season of summer crops. The agroclimatic environment was dominated by moderately warm and rainy weather conditions, with 15 percent above normal rainfall and 1.4°C above average temperature.

According to the temperature departure clusters, temperature was above average from early January to the end of April, sometimes reaching exceptionally warm conditions for the season: 8°C above average from mid-January to mid-March in the south of Alberta and Saskatchewan, north of Montana, and North Dakota. Rainfall was generally close to average except in two areas: the lower Mississippi regions, with significantly high departures of +150 percent, and in the center and south of the great plain, where winter crops received more moderately above-average rainfall (RAIN, +75 percent). At the same time, above average temperature occurred in the center and south of the Great Plains. This region is the main winter wheat zone of the United Stated, and the simultaneous heat and moisture was favorable for the growth of winter crops.

In Canada, a large forest fire disaster occurred at the beginning of May at Fort McMurray (Alberta). As mentioned in the previous CropWatch bulletin, the Canadian Prairies suffered continuous drought that resulted in crop production loss in 2015. Over the first quarter of 2016, the rainfall deficit persisted, though less severely (RAIN, -15 percent in Alberta compared to average). Lack of moisture and abnormally high temperature contributed to the severity of the fire impact.

That the sowing of crops was accelerated by warm and rainy weather is confirmed by the CALF value of 5 percentage points above average. The biomass production potential also increased 16 percent due to good weather. If the favorable weather persists, a fair winter crop can be expected.

Figure 2.2. North America MPZ: Agroclimatic and agronomic indicators, January-April 2016



a. Spatial distribution of rainfall profiles

b. Profiles of rainfall departure from average (mm)

c. Spatial distribution of temperature profiles

d. Profiles of temperature departure from average (°C)

e. Maximum VCI

f. Cropped arable land

g. Biomass accumulation potential departure

h. VHI minimum

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

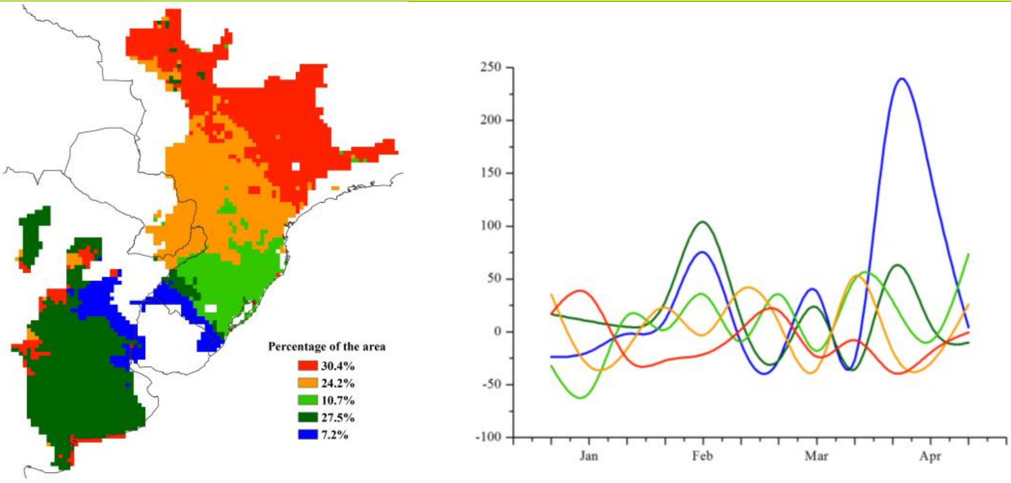
2.4 South America

Crops were generally at average condition during the monitoring period (figure 2.3). Harvesting of winter crops was concluded at the beginning of January, while the harvest of summer crops (maize and soybean) was still ongoing at the end of April. Overall agroclimatic conditions were favorable, with 12 percent above average rainfall and other agroclimatic variables close to average, which all together resulted in slightly above average BIOMSS.

Conditions, however, varied across the region, and two instances of abnormal conditions occurred over this MPZ during the reporting period. The first is the excessive rainfall during April in Santa Fe and Entre Rios in Argentina, as well as in the southernmost part of Rio Grande do Sul in Brazil. Rainfall departure clusters and the corresponding graphs (figures 2.3a and 2.3b) show that rainfall was about 250mm above average in those regions at mid-April; the agronomic indicators in figure 2.3, however, do not show any negative impacts of the abundant rain. Nevertheless, from an agronomic point of view, the heavy rain during the pre-harvesting period may hamper the drying of the beans, and the muddy soil in the fields can make harvesting difficult. The second occurrence of abnormal conditions involved the continuous low rainfall in the most northern part of the MPZ, including Mato Grosso, Goias, Minas Gerais, and Sao Paulo, as shown in rainfall clusters and graphs. The minimum VHI map shows pixel values below 15 in those regions, indicating that crops are suffering from drought. Accordingly, BIOMSS in those regions with low rainfall drops 20 percent or more below average. Well above average (about 4°C) temperature in southern Brazil intensified water stress. Most regions of Argentina inside the MPZ experienced favorable conditions, which resulted in above average BIOMSS and high VCIx.

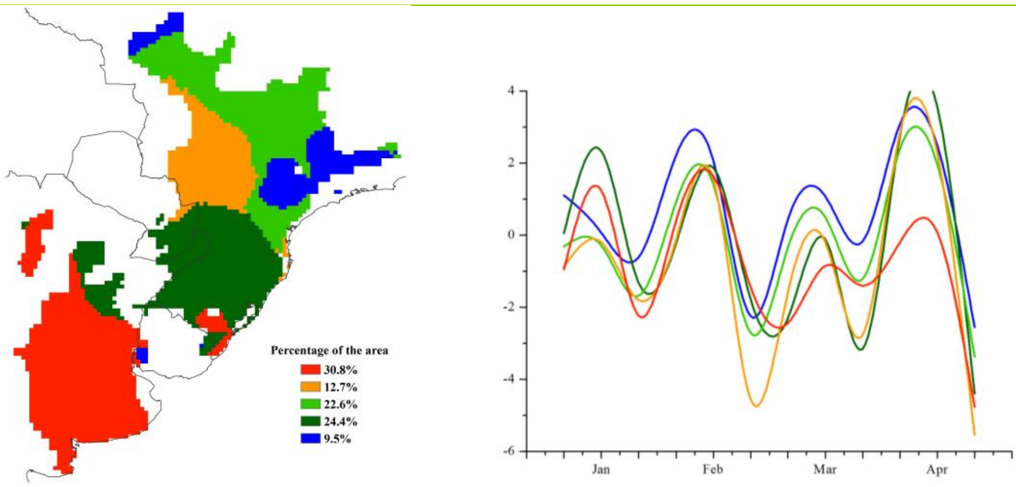
As presented in the VCIx map, the condition of crops in eastern Mato Grosso Do Sul and Sao Paulo is below average, while the VCIx value for the whole MPZ is 0.73. CALF is 1 percentage point above the five-year average, with uncropped arable land mostly situated in southern Buenos Aires, from Bahia Blanca to Santa Rosa.

Figure 2.3. South America MPZ: Agroclimatic and agronomic indicators, January-April 2016



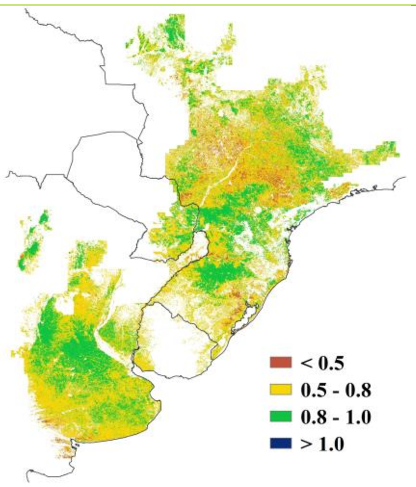
a. Spatial distribution of rainfall profiles

b. Profiles of rainfall departure from average (mm)

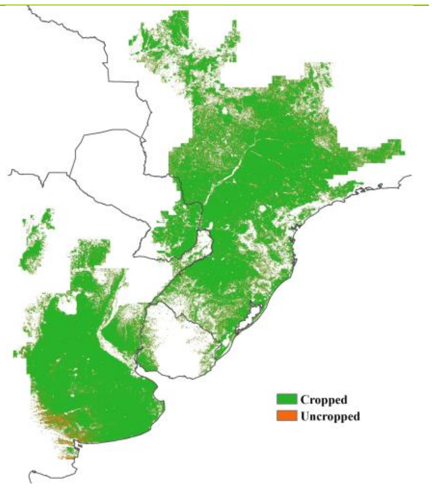


c. Spatial distribution of temperature profiles

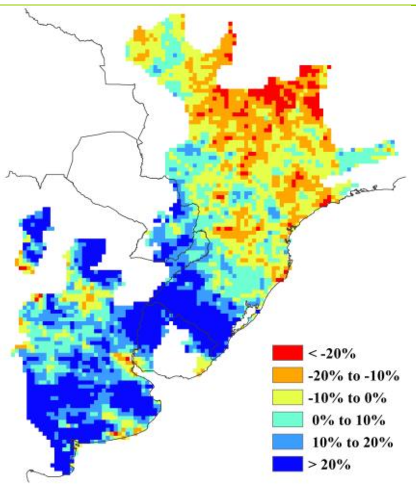
d. Profiles of temperature departure from average (°C)



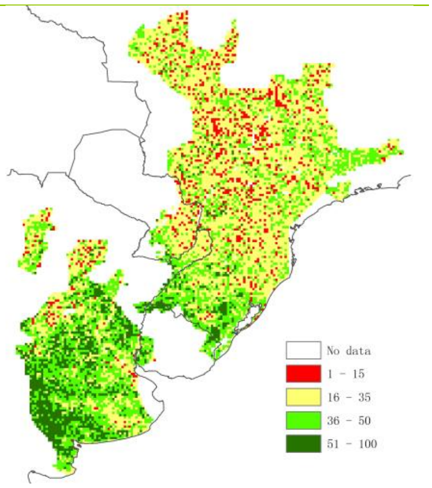
e. Maximum VCI



f. Cropped arable land



g. Biomass accumulation potential departure



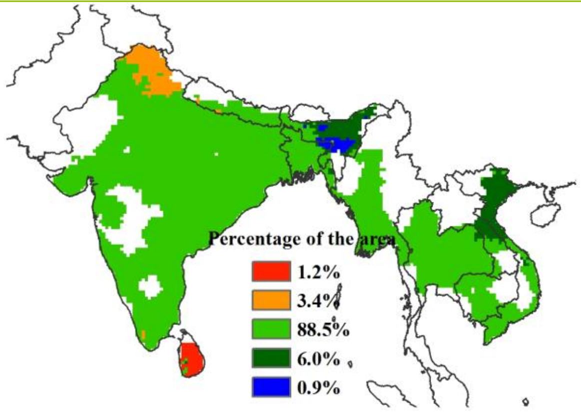
h. VHI minimum

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

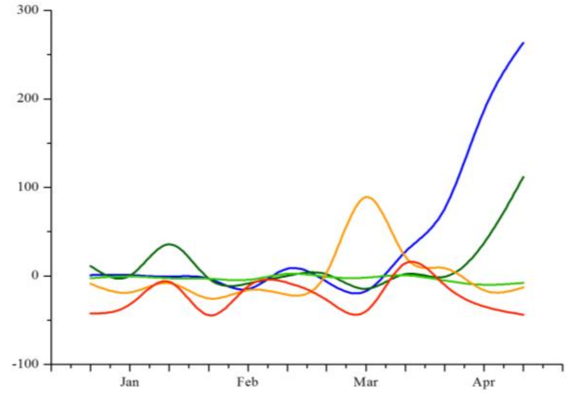
2.5 South and Southeast Asia

Overall, CropWatch assesses the condition of crops in this MPZ as poor. The monitored quarter is the growing and harvesting period of winter season rice, wheat, and maize, and the zone is experiencing drought due to the ongoing El Niño event. The drought affected countries include India, Cambodia, Thailand, and Myanmar. Rainfall was 13 percent below average across the MPZ, mainly in Cambodia (RAIN, -67 percent), Thailand (-54 percent), and Myanmar (-24 percent), while the nationwide deficit in India was 5 percent. The rainfall profiles indicate that during most of the monitoring period, rainfall was evenly distributed over the MPZ, but northern Vietnam and northeast India started receiving excess rainfall after early April. In general for the MPZ, the rainfall deficit triggered low biomass accumulation (BIOMSS, -31 percent). Temperature remained average and photosynthetically active radiation (RADPAR) increased 1 percent over average. The cropped arable land fraction (CALF) increased 3 percentage points over average. Meanwhile, the maximum VCI reached up to 0.68 for the MPZ. VCI values below 0.5 were observed in the Indian states of Rajasthan, Haryana, Karnataka, Andhra Pradesh, and West Bengal, central Thailand, Cambodia, and some parts of Myanmar, pointing at poor crop condition in these regions. Due to low rainfall in southern India, Cambodia, Thailand, Vietnam, and Myanmar, minimum VHI values were low and thereby confirm poor crop condition. Overall, the crop condition of the MPZ is poor, raising concerns due to the drought in India, Thailand, Cambodia, and Myanmar.

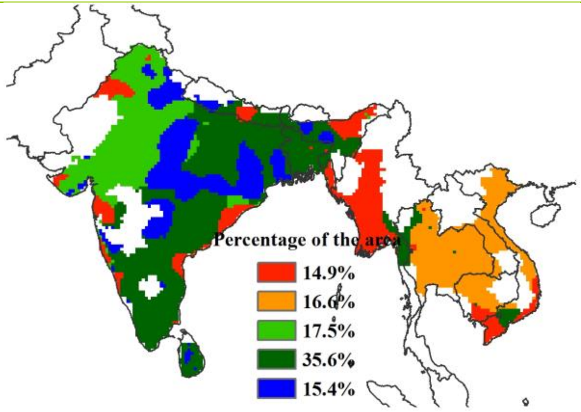
Figure 2.4. South and Southeast Asia MPZ: Agroclimatic and agronomic indicators, January-April 2016



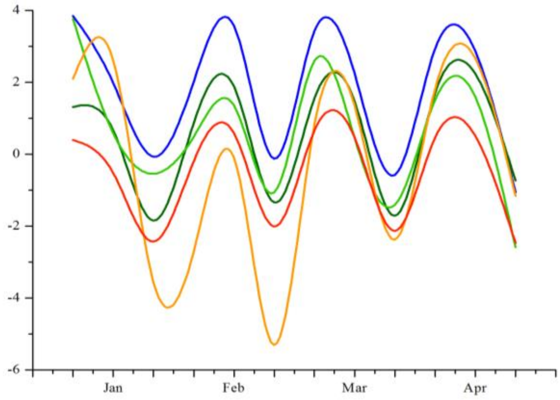
a. Spatial distribution of rainfall profiles



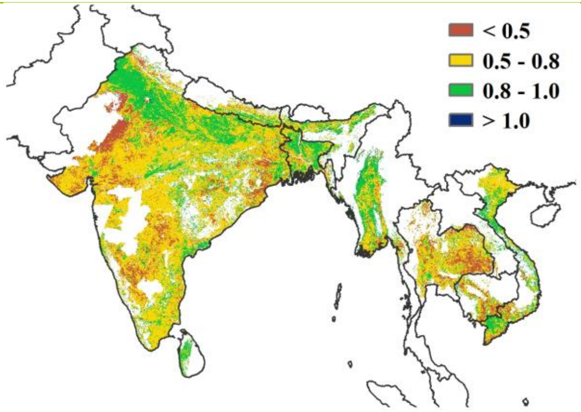
b. Profiles of rainfall departure from average (mm)



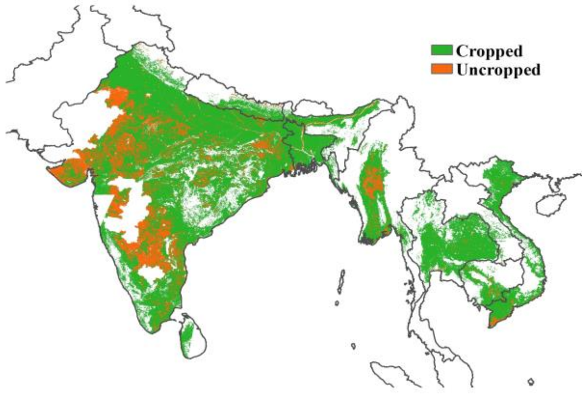
c. Profiles of temperature departure from average (°C)



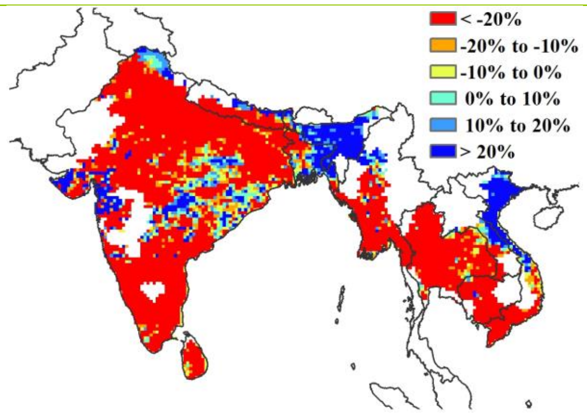
d. Profiles of temperature departure from average (°C)



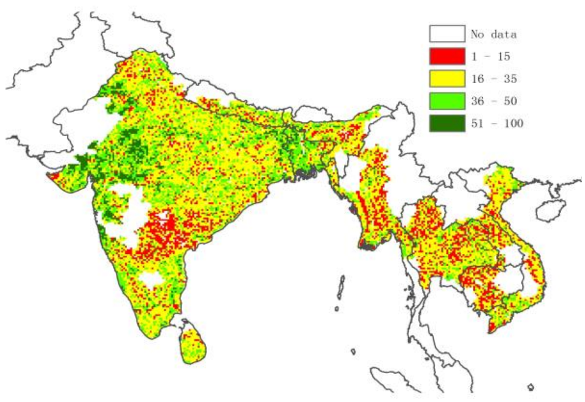
e. Maximum VCI



f. Cropped arable land



g. Biomass accumulation potential departure



h. VHI minimum

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

2.6 Western Europe

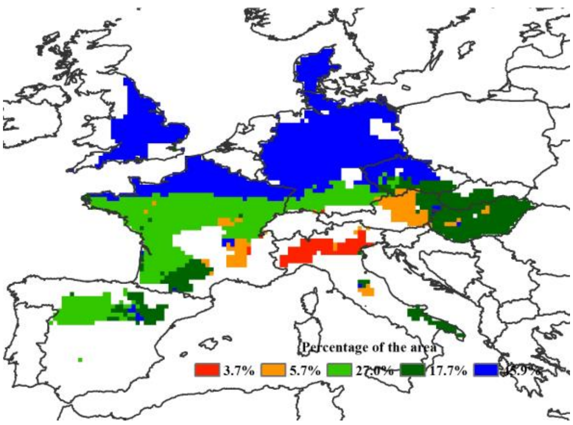
In general, environmental conditions were above average in most parts of the continental Western Europe MPZ during this reporting period, favoring winter crop growth and spring sowings. Figure 2.5 presents an overview of CropWatch agroclimatic and agronomic indicators for this MPZ.

The agroclimatic indicators show that total rainfall was 12 percent above average, with exceptional negative departures over most of Austria, Slovakia, Hungary, and southeast France in early January; from late February to mid-March over most of France, Germany, the Czech Republic, Austria, Slovakia, Hungary, and Spain; and in the north of Italy in late January and after late February. Temperatures over the whole MPZ were just below average (-0.4°C); temperature profiles indicate that below average temperatures were observed in most of France, Spain, and the United Kingdom from the beginning of the year until March, and from February to March in most of Germany, the Czech Republic, and Denmark. Sunshine was significantly below average at -7 percent.

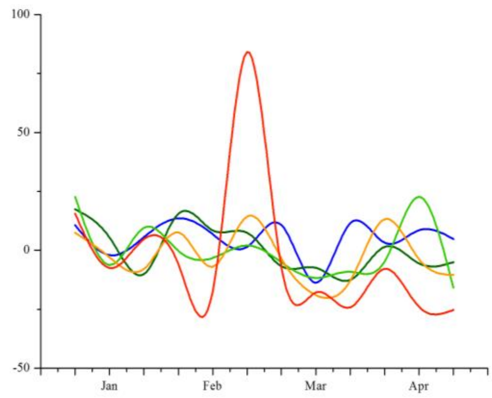
Due to abundant rainfall, the biomass accumulation potential, BIOMSS, was 20 percent above the recent five-year average. The spatial distribution of BIOMSS shows that the lowest values (-20percent and below) occur over most of Spain, southeast France, and northern Italy, as part of a moderate drought pattern that covers most of the Mediterranean countries. In contrast, BIOMSS in most other regions was 10 percent above average.

Across the MPZ, 93 percent of the arable land was cropped during this reporting period, close to the recent five-year average. Most uncropped arable land was concentrated in eastern and southern Spain and also scattered in the north of Italy and southeast of France. Accordingly, maximum VCI values in Spain, southeast of France, and north of Italy were lower compared to other regions in this MPZ. The average VCIx for the MPZ was 0.79.Areas with low minimum VHI values were partially scattered in Spain. Generally, crop condition in Western Europe was favorable.

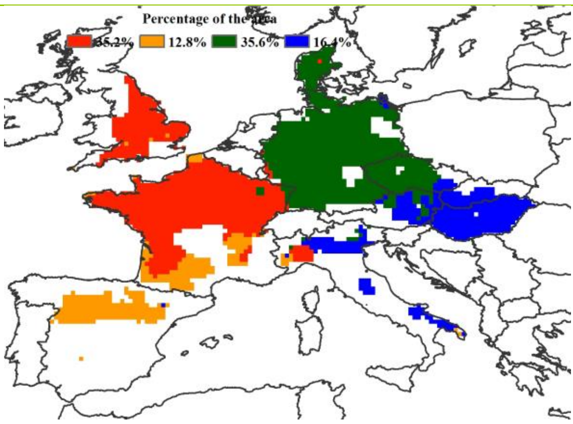
Figure 2.5. Western Europe MPZ: Agroclimatic and agronomic indicators, January-April 2016



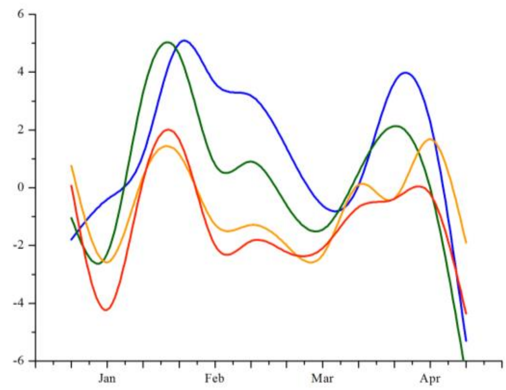
a. Spatial distribution of rainfall profiles



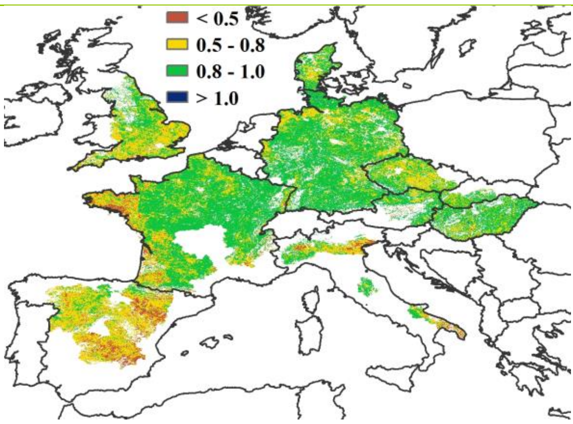
b. Profiles of rainfall departure from average (mm)



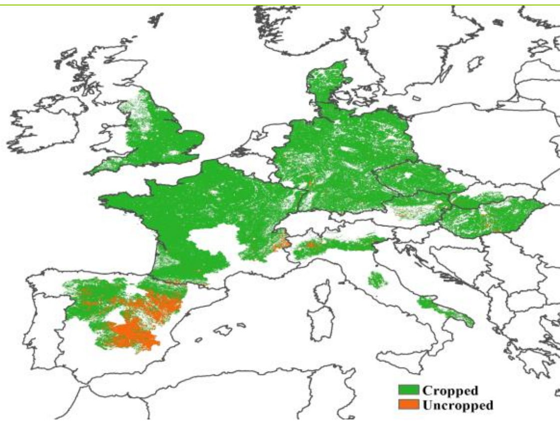
c. Spatial distribution of temperature profiles



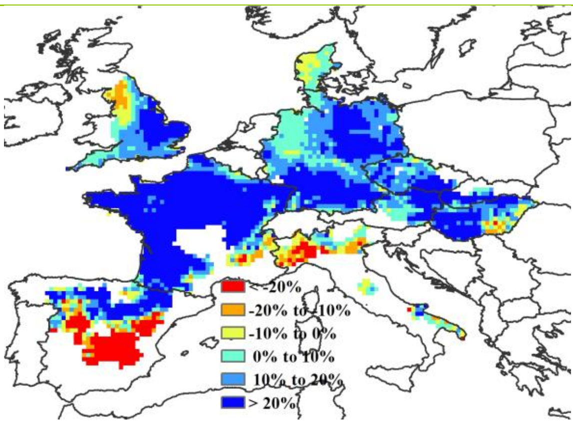
d. Profiles of temperature departure from average (°C)



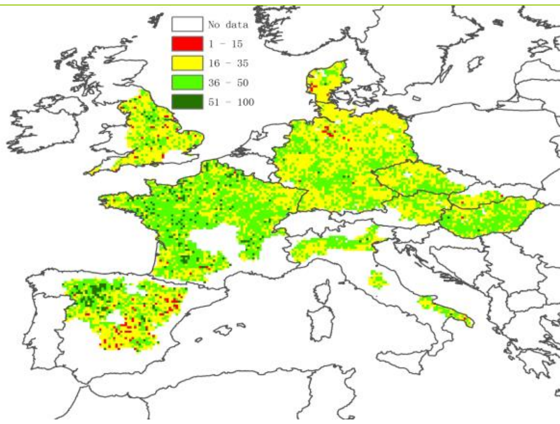
e. Maximum VCI



f. Cropped arable land



g. Biomass accumulation potential departure



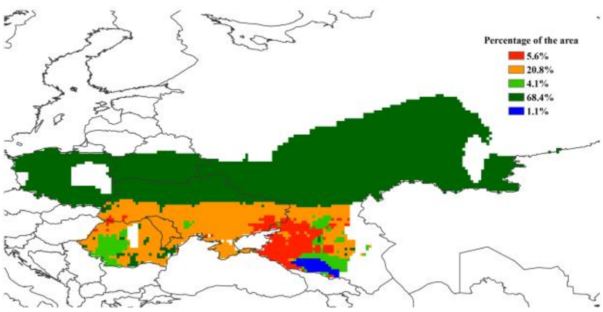
h. VHI minimum

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

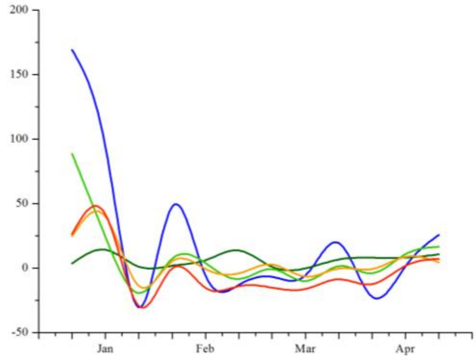
2.7 Central Europe to Western Russia

During the current monitoring period, winter crops in Central Europe to Western Russia were mostly in the vegetative stage. The agroclimatic indicators show favorable condition for winter crops, with a 41 percent increase of rainfall and a 1.9°C increase of temperature compared with average. RADPAR, however, was well below average for the period (-9 percent).Temperature profiles showed correlated variations among most countries of the MPZ. The whole region experienced unseasonably high temperatures from mid-January to February (as much as 9°C above average in the east, including most of Southwestern Russia), followed by low—and locally freezing and damaging—temperature in March. As indicated by the rainfall profiles, the north of Central Europe to Western Russia (about two thirds of the whole area) enjoyed moderately above average precipitation. Other parts (Ukraine and Romania) so far have recorded approximately average precipitation for 2016.As a result of the large precipitation increase and above average temperature, the biomass accumulation potential of the whole MPZ increased by 23 percent compared to the recent five-year average. A decrease in BIOMSS, however, occurred in Krasnodar Kray and the oblast of Rostov in Russia, which suffered a rainfall deficit from January to the end of March. For the MPZ, 89 percent of the arable lands were cropped in January to April in 2016. Most uncropped arable land was scattered in Russia (the eastern part of the MPZ), where irrigation is widespread.

Figure 2.6. Central Europe-Western Russia MPZ: Agroclimatic and agronomic indicators, January-April 2016

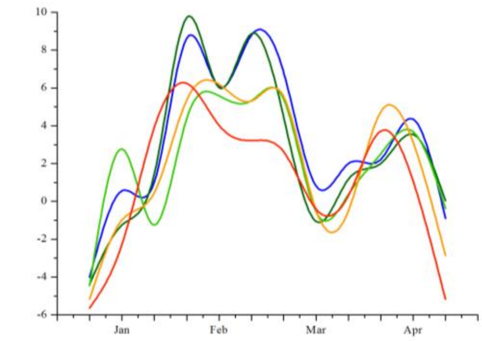


a. Spatial distribution of rainfall profiles

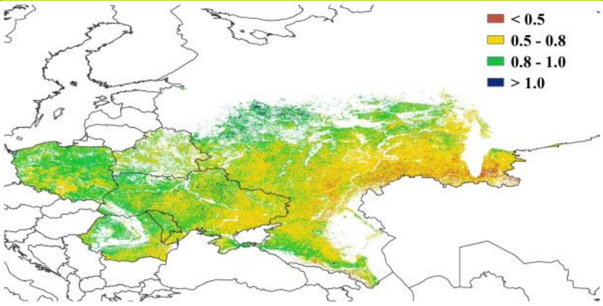


b. Profiles of rainfall departure from average (mm)

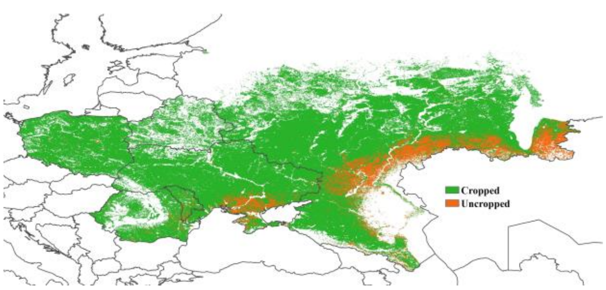
c. Spatial distribution of temperature profiles



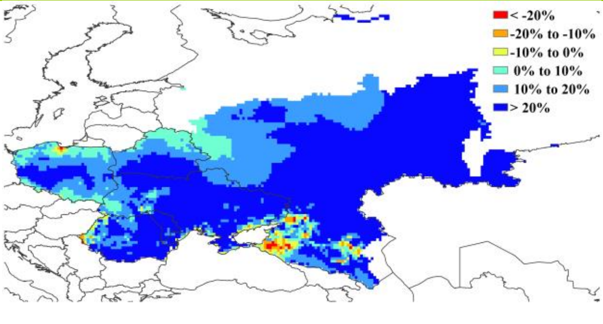
d. Profiles of temperature departure from average (°C)



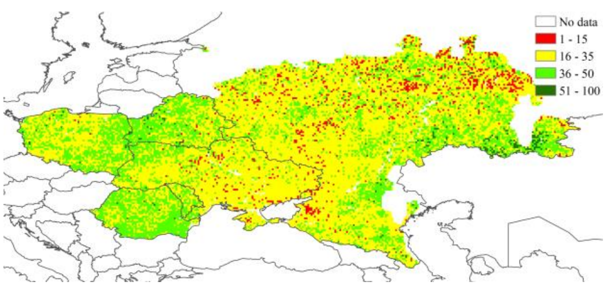
e. Maximum VCI



f. Cropped arable land



g. Biomass accumulation potential departure



h. VHI minimum

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

Chapter 3.Main producing and exporting countries

Building on the global patterns presented in previous chapters, this chapter assesses the situation of crops in 30 key countries that represent the global major producers and exporters or otherwise are of global or CropWatch relevance. After a global overview (section 3.1), individual monitored countries are featured in section 3.2. For each, CropWatch maps and graphs of NDVI-based crop condition development, maximum VCI, and spatial NDVI patterns with associated NDVI profiles are presented. Additional detail on the agroclimatic and BIOMSS indicators, in particular for some of the larger countries, is included in Annex A, tables A.2-A.11. Annex B includes 2016 production estimates for Argentina, Brazil, and the United States.

3.1 Overview

Chapter 1 has focused on large climate anomalies that sometimes reach the size of continents. This section offers a closer look at all countries, including the 30 countries that together produce and commercialize 80 percent of maize, rice, wheat, and soybean. As evidenced by the data in this section, even countries of minor agricultural or geopolitical relevance are exposed to extreme conditions and deserve mentioning.

Figure 3.1. Global map of January-April 2016 rainfall (RAIN) by country and sub-national areas, departure from 15YA (percentage)

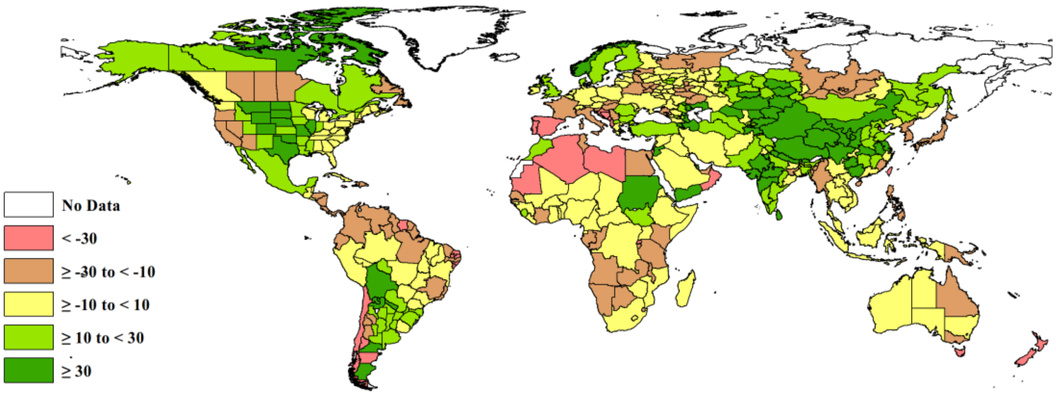


Figure 3.2. Global map of January-April 2016 temperature (TEMP) by country and sub-national areas, departure from 15YA (degrees)

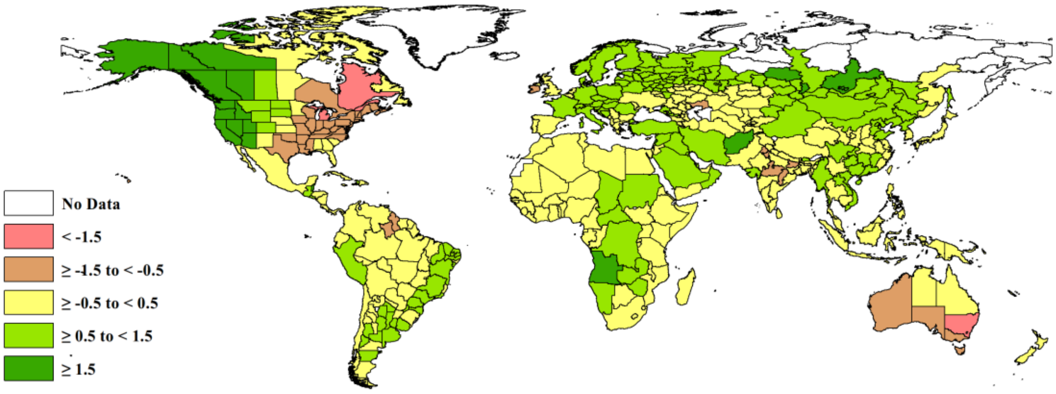


Figure 3.3. Global map of January-April 2016 PAR (RADPAR) by country and sub-national areas, departure from 15YA (percentage)

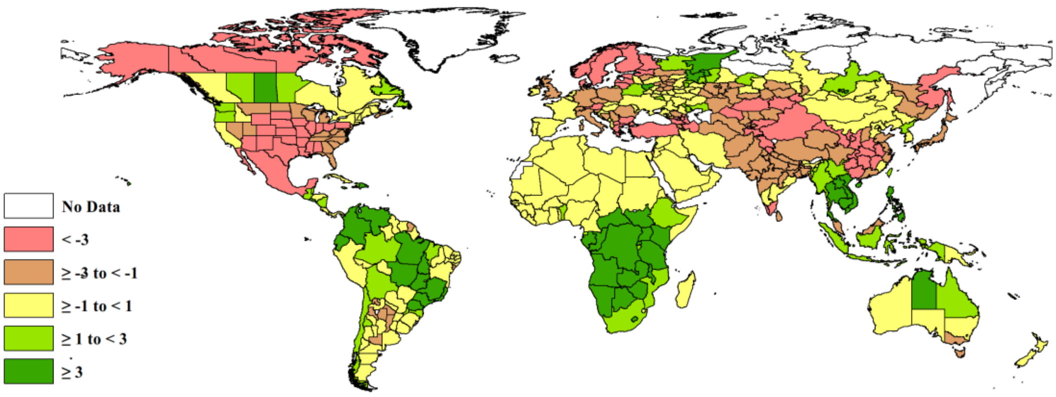


Figure 3.4. Global map of January-April 2016 biomass (BIOMSS) by country and sub-national areas, departure from 5YA (percentage)

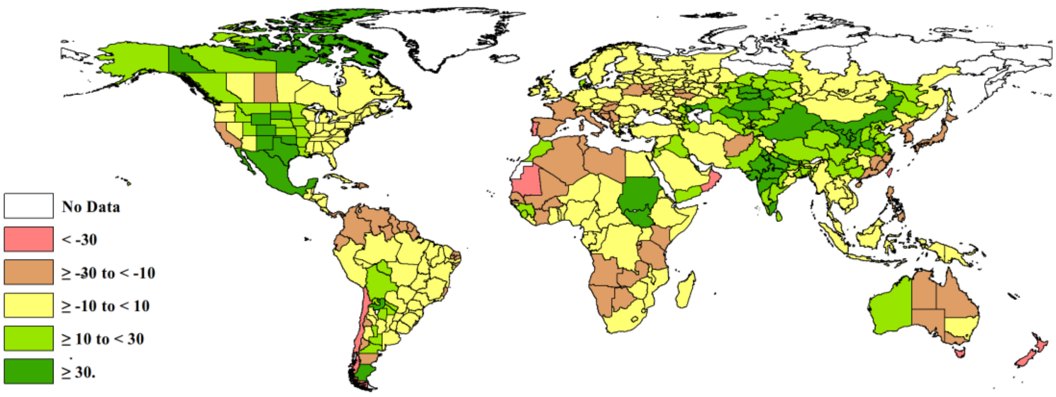


Table 3.1. CropWatch agroclimatic and agronomic indicators for January-April 2016, departure from 5YA and 15YA

Country	Agroclimatic Indicators			Agronomic Indicators		
	Departure from 15YA (2001-2015)			Departure from 5YA (2011-2015)		Current
	RAIN (%)	TEMP (°C)	RADPAR (%)	BIOMSS (%)	CALF (%)	Maximum VCI
Argentina	50	-0.8	-5	16	3	0.74
Australia	-13	0.1	-1	-13	-7	0.46
Bangladesh	23	0.4	-4	3	1	0.74
Brazil	-7	-0.1	1	-5	0	0.72
Cambodia	-67	0.0	8	-60	-3	0.65
Canada	-9	2.7	-2	14	/	0.74
China	55	-0.1	-5	39	3	0.77
Egypt	-28	0.5	-1	2	-2	0.77
Ethiopia	-19	0.2	0	-2	0	0.69
France	2	-1.1	-8	31	1	0.81
Germany	24	0.0	-7	20	0	0.85
India	-5	0.8	0	-31	3	0.67
Indonesia	3	0.0	-1	-4	0	0.78
Iran	-2	0.9	-1	-6	-5	0.66
Kazakhstan	28	3.0	-7	27	-5	0.70
Mexico	35	-0.3	-1	24	7	0.61
Myanmar	-24	-0.6	0	-26	1	0.78
Nigeria	12	-0.4	0	11	0	0.72
Pakistan	-13	-0.1	-1	-27	15	0.64
Philippines	-77	-0.1	9	-62	0	0.74
Poland	25	0.7	-10	17	0	0.82
Romania	38	1.8	-5	28	-1	0.80
Russia	36	2.1	-8	22	4	0.73
S. Africa	-7	0.6	3	-8	-20	0.63
Thailand	-54	-0.1	8	-49	0	0.62
Turkey	13	2.0	2	6	-15	0.66
United Kingdom	49	-1.3	-3	5	0	0.77
Ukraine	35	1.8	-7	29	-3	0.77
United States	14	1.2	-2	19	0	0.76
Uzbekistan	2	2.2	-2	4	/	0.76
Vietnam	28	-0.5	4	2	-1	0.73

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-year (5YA) or fifteen-year average (15YA) for the same period (January-April).

Drought

Several countries suffered a rainfall deficit in excess of 25 percent over their agricultural areas during the reporting period. They are grouped, as far as possible and relevant, by the same geographical areas as in chapter 1.

Mediterranean countries

With the exception of Egypt, where the rainfall deficit over the reporting period was 28 percent but where agriculture depends very little on rainfall for crops, all the countries listed here experienced the second consecutive shortfall in rainfall, as measured by the CropWatch RAIN indicator. For many of them, the drought over the reporting period was even more severe than during the previous October to January months, which were covered in the February 2016 CropWatch bulletin. A well-defined pattern exists of more severe water deficits in the southern Mediterranean than in the north, but inside those groups both east and west suffered equally. Turkey is a conspicuous exception, with a precipitation excess of 13 percent over this January-April period and a very slight deficit (-1 percent) over the previous one.

The country that suffered the most severe and prolonged drought between October and April is Morocco, with a deficit of 68 percent over the reporting period (54 percent during the previous one).[3] For the current period, drought was most intense in Lebanon (-71 percent, -54 percent) and in Cyprus (-68 percent, -44 percent), followed by Libya (-63 percent, -42 percent) and by Israel (-61 percent, -38 percent). Remaining countries all experienced deficits of 42 or 43 percent (Algeria, Tunisia, Syria), between 33 percent and 35 percent (Greece, Slovakia, Portugal),[4] and of 25 percent (Spain and Italy). All countries grow winter crops, especially wheat and barley, which were thus exposed to moisture stress during much of their growing season.

South and Southeast Asia

This area is referred to as "Punjab and Gujarat to New Zealand" in Chapter 1. For many countries, drought set in over the reporting period, after a close to average or excess precipitation spell at the end of 2015. This includes Cambodia (-67 percent, +23 percent), Thailand (-54 percent, 0 percent), Sri Lanka (-50 percent, +9 percent), and Nepal (-43 percent, +92 percent). In maritime Southeast Asia and Oceania, the current period is the second period of relative drought, even if the equatorial areas, which normally record very abundant precipitation (in large excess of crop requirements), did suffer relatively little, for instance in Indonesia (+3 percent, -24 percent).

Decreasing deficits occurred from the Philippines (-77 percent, -18 percent) to New Caledonia (-69 percent, -60 percent), Brunei Darussalaam (-56 percent, -1 percent), Malaysia (-45 percent, -24 percent), New Zealand (-39 percent, -66 percent), and Timor Leste (-39 percent, -66 percent).

East, Southern Africa and Western Africa

East and southern African countries have received a lot of media attention since the middle of 2015 (Ethiopia) or the end of the year (see also section 5.2 on disaster events). In Western Africa, which has not been mentioned so far because, with the exception of the very south, crops are only about to be planted, two countries deserve mentioning, Sierra Leone (RAIN, -30 percent, +9 percent) and Equatorial Guinea (-43 percent, -30 percent).

In the east, in addition to Ethiopia (-19 percent, +2 percent) and some pastoral lowlands in Kenya, below average rainfall values were recorded this monitoring period for northern Sudan (-56 percent, 78 percent), Eritrea (-40 percent, +54 percent), Rwanda (-39 percent, -35 percent), and Somalia (-34 percent, 53 percent). In the south, only Lesotho crosses the -25 percent deficit line (-25 percent, -44 percent).

Central and South America

With the exception of Cuba (-25 percent, 19 percent)—and in a situation similar to that in the Mediterranean—most countries in this area are in their second consecutive drought quarter, with the intensity of the shortage usually decreasing from the Caribbean and Central America to the equatorial

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[3] Throughout this section, the first number is the percentage RAIN shortage during the current period, while the second, which is usually bracketed, refers to the previous CropWatch reporting period for October 2015 –January 2016.

[4] Although strictly speaking not a Mediterranean country, Portugal is included here.

and temperate southern part of the continent: Trinidad and Tobago (-67 percent, -53 percent), Dominica (-66 percent, -49 percent), Panama (-41 percent, -29 percent), Nicaragua (-45 percent, -22 percent), Costa Rica (-44 percent, -23 percent), French Guiana(-29 percent, -82 percent), Colombia (-29 percent, -82 percent) and Chile(-27 percent, -55 percent).

Precipitation excess

This section focuses on precipitation anomalies in excesses of 50 percent (i.e., a RAIN indicator value more than 50 percent above average). The large precipitation anomaly that stretches from the Sahel across the warm and cold deserts of Africa and Asia and as far as eastern central Asia was already noted in the previous CropWatch bulletin. Although less marked because of its close to average rainfall in the eastern Caspian, the same feature persisted into the current reporting period. It is not necessarily associated with El Niño, which usually displays only a weak correlation with the West African and Central Asian climate; it is, however, very compatible with global warming and with a finding that all palaeo-climatological evidence—from Dakar to China—is pointing at: a one-to-one association between high temperatures and wetter conditions, at all time scales (years to geological periods). This is also illustrated by the recent improving rainfall trend observed since 1988 in the Sahel (Petit-Maire, 1990, 1999, 2000).

The countries where this effect is most visible constitute a block that includes Mauritania (RAIN +154 percent, +75 percent), neighboring Mali and Senegal (+155 percent, +102 percent and +238 percent, +119 percent, respectively), Gambia (+360 percent, +193 percent), and Guinea Bissau (+385 percent, +126 percent). All those countries are currently in their dry season (precipitation will peak in July or August, depending on latitude) and even small precipitation amounts (typically 10 mm to 20 mm, but also close to 70 mm in Mali) will result in large excesses. However, because of the consistent spatial patterns, it is likely that the area is actually experiencing an early start of the season, which normally results in rather satisfactory crops.

Many countries of the Arabia Peninsula recorded above average precipitation in the range from +59 percent (Kuwait) to +257 percent (Oman). Except in the United Arab Emirates (UAE, +162 percent) and Oman, where rainfall was average during the last quarter of 2015, the remaining countries had a second consecutive period of abundant rainfall by local standards, including Saudi Arabia (+63 percent, +26 percent), Qatar (+81 percent, +153 percent), and war-torn Yemen (+101 percent, +63 percent).

In Asia, Kyrgyzstan had one of the most anomalous precipitation amounts (+63 percent, +170 percent), followed by Mongolia (+67 percent, +55 percent), Korea DPR (+53 percent, +3 percent), and China (+55 percent, +85 percent), where semi-arid and southern areas were affected. The areas of the Black and Caspian seas can be regarded as transitional between the Arabian Peninsula and Central Asia with rainfall of +85 percent (+131 percent) in Azerbaijan and +79 percent (+170 percent) in Armenia.

For precipitation excess, no country needs mentioning in North and Central America, but two stand out in South America: Argentina (+50 percent, +24 percent) and Uruguay (+70 percent, +38 percent). Finally, the only country with excess larger than 50 percent that still needs mentioning is Luxembourg: +57 percent (-23 percent).

Other agroclimatic indicators

In addition to its well above average rainfall, Luxembourg also recorded below average temperature over the recording period (TEMP, -1.1°C). This drop was similar to those in other western European countries, including France (also -1.1°C), United Kingdom (-1.3°C), as well as Ireland (-1.6°C). Other areas with cold spells in include French Guiana (-2.3°C), Yemen (-1.7°C), and Eritrea (-1.1°C).

Among the countries with large positive (>=2.0°C) temperature departures, only Turkey (+2.0°C), Lebanon (+2.6°C), and Kyrgyzstan (+2.8°C) were mentioned so far in this section. Others include Russia (+2.1°C), Moldova (+2.1°C), Uzbekistan (+2.2°C), Canada (+2.7°C), and Kazakhstan (+3.0°C). All of them are in the northern hemisphere and most cultivate winter crops.

Where warm winter weather was associated with improved precipitation, the biomass production potential has increased, by values that are close to 25 percent, as for instance in Hungary, Russia, and Kyrgyzstan (BIOMSS, +22 percent), Azerbaijan and Kazakhstan (+27 percent), Romania (+28 percent), and Ukraine (+29 percent). The largest biomass production potential increases (>100 percent) logically occurred in the semi-arid areas of the western Sahel and the Arabian Peninsula. Similarly, biomass production drops larger than 40 percent are associated mostly with drops in precipitation in already identified areas, presenting altogether rather consistent and logical patterns in Southeast Asia with the Philippines (BIOMSS, -62 percent), Cambodia (-60 percent), and Thailand (-49 percent), Mediterranean with Cyprus (-60 percent), Morocco (-56 percent), Libya (-51 percent) and Lebanon (-51 percent), Central America and the Caribbean with Panama[5] (-43 percent), Trinidad and Tobago(-55 percent), and east Africa with north Sudan (-59 percent).

Interestingly, RADPAR anomalies (≤-10 percent departure) introduce an additional area of abnormal weather conditions with the “larger Baltic” area including Belarus (RADPAR, -12 percent), Finland and Lithuania (-11 percent), and Poland and Latvia (-10 percent). The same value also occurs in Luxembourg, Switzerland, and Lebanon, of which the last was already mentioned several times. The largest positive sunshine anomalies are mostly associated with El Niño conditions in Southeast Asia. They include Thailand and neighboring Cambodia (+8 percent) and the Philippines and New Caledonia (+9 percent).

3.2 Country analysis

This section presents CropWatch results for each of thirty key countries (China is addressed in Chapter 4). The maps refer to crop growing areas only and include (a) Crop condition development graph based on NDVI average over crop areas, comparing the January-April 2016 period to the previous season and the five-year average (5YA) and maximum. (b) Maximum VCI (over arable land mask) for January-April 2016 by pixel; (c) Spatial NDVI patterns up to April 2016according to local cropping patterns and compared to the 5YA; and (d) NDVI profiles associated with the spatial pattern under (c). See also Annex A, tables A.2-A.11, and Annex B, tables B.1-B.3, for additional information about indicator values and production estimates by country. Country agricultural profiles are postedonwww.cropwatch.com.cn**.**

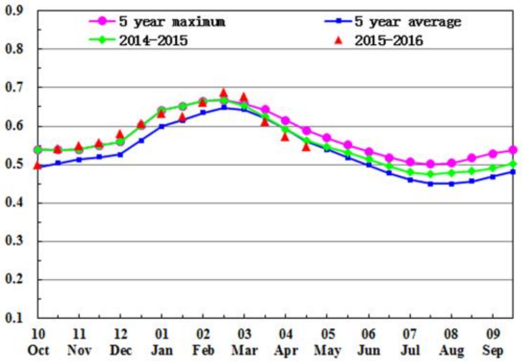
Figures 3.5-3.34. Crop condition for individual countries ([ARG] Argentina- [ZAF] South Africa) for January-April 2016

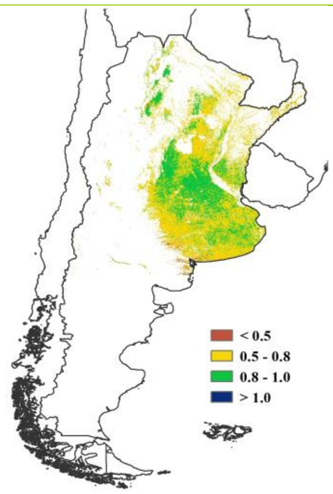
[5] Panama used to be part of Colombia until 1903 and is sometimes assigned to South America for historical reasons.

[ARG] Argentina

Argentina experienced generally favorable conditions during the monitoring period. Wheat harvest ended in early January while harvesting of summer crops (soybean and maize) are still on-going. TEMP and RADPAR were slightly below average while rainfall was 50 percent above, which results in 16 percent above average BIOMSS. According to the NDVI based development profile, the NDVI peak during February and March was higher than that in 2015. Spatial NDVI patterns and the corresponding profiles also appear above average in 90 percent of the arable land during the summer crop season. The VCIx map shows that VCIx values in the major maize and soybean producing areas (including Cordoba, Santa Fe, and northwestern Buenos Aires) was above 0.8, higher than other agricultural regions. Altogether, the indicators show a promising summer season output. However, the 50 percent or more above average rainfall especially in April (refer to section 2.4) may damage the summer crops at harvesting stage due the potential flooding and muddy soil in the fields. CropWatch puts maize production at 25.7 million tons and soybean at 51.1 million tons, which are one percent above and below values for 2015, respectively (see table B.1 in Annex B).

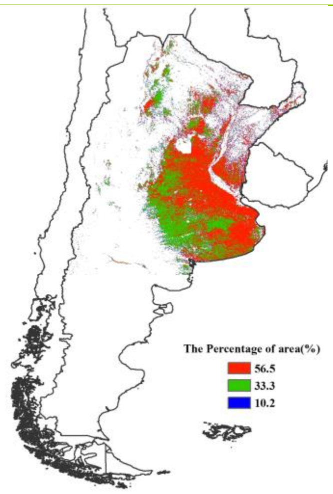
Figure 3.5. Argentina crop condition, January-April 2016

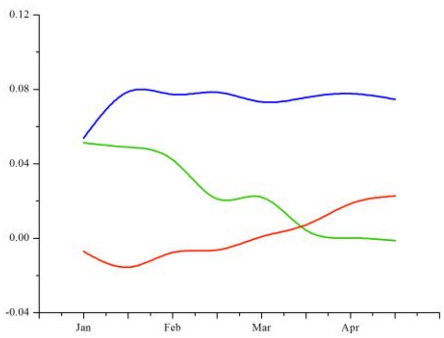




(a) Crop condition development graph based on NDVI

(b) Maximum VCI





(c) Spatial NDVI patterns compared to 5YA

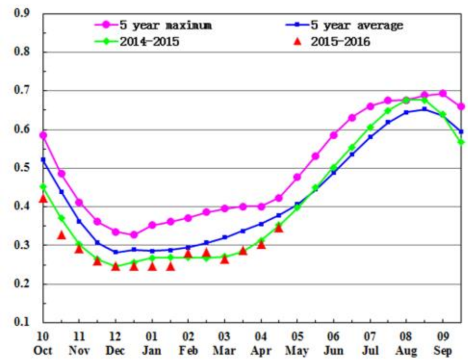
(d) NDVI profiles

[AUS] Australia

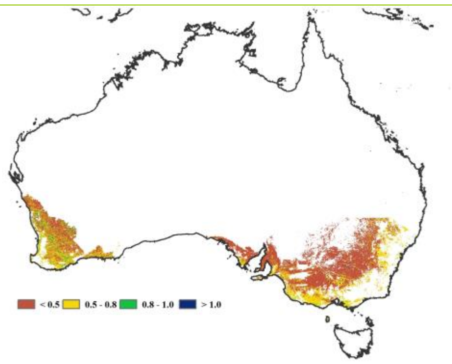
Indicators in Australia show generally below average condition during the period between January and April in 2016, which is out of season for wheat and barley, the main crops for Australia. As a result, it is not surprising that the maximum VCI reaches only 0.46 throughout the region, with a 7 percent decrease of CALF compared with the recent five years.

Compared also to the five-year average, the spatial NDVI patterns and corresponding time profiles show poor conditions in southeastern New South Wales and southern Victoria, resulting from the agroclimatic indicators of the southeastern wheat zone (RAIN, -14 percent; TEMP, +0.7°C; and RADPAR, -2 percent). New South Wales and Victoria recorded "poor" rains (-33and -32 percent, respectively). Nationwide, agroclimatic indicators display average conditions (RAIN, -13 percent; TEMP, +0.1°C; and RADPAR, -1 percent), resulting in below average potential accumulated biomass (-13 percent). Positive departures of rain in South Australia (+34 percent) and West Australia (+72 percent) will lead to favorable soil moisture for the planting of wheat and barley in the coming month.

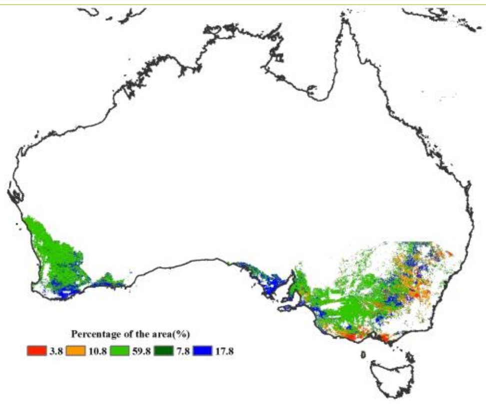
Figure 3.6. Australia crop condition, January-April 2016



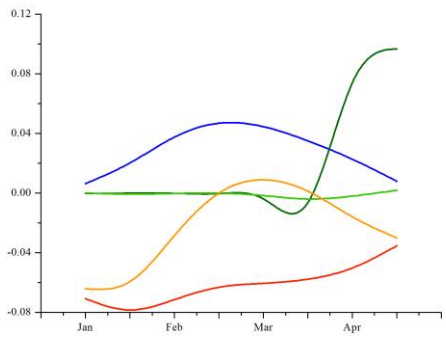
(a) Crop condition development graph based on NDVI



(b) Maximum VCI



(c) Spatial NDVI patterns compared to 5YA

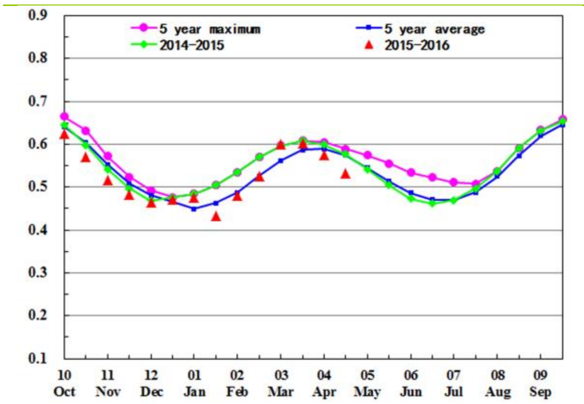


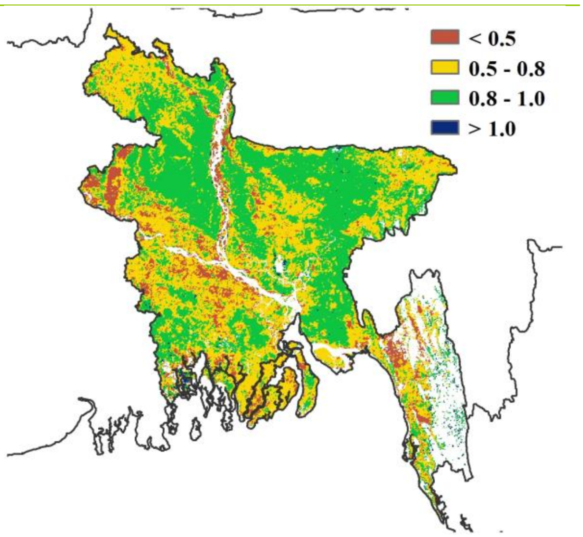
(d) NDVI profiles

[BGD] Bangladesh

The CropWatch indicators show average crop condition during the reporting period. The monitoring period is the growing and harvesting season of irrigated boro rice. Rainfall was 23 percent above the recent average, while temperature was average, photosynthetically active radiation slightly low (-4 percent), and biomass accumulation a bit above (3 percent) average. The cropped arable land fraction (CALF) increased by 1 percent. Crop condition development, as assessed by national NDVI, was below both the previous five-year average and 2015. The recorded maximum VCI value was 0.74. The ranges of the maximum VCI values were between 0.5 and 1, indicating average crop condition for the entire country. However, VCIx values below 0.5 were noticed in Chittagong, western Rajshahi, and northern Khulna, indicating poor crop condition in these areas. In Rangpur, Rajshahi, and Dhaka the NDVI profiles dropped after early February and recovered in mid-March only to drop again in mid-April. On the contrary, other region’s NDVI profiles steadily progressed until early April and started dropping thereafter. Overall, average output is expected for boro rice.

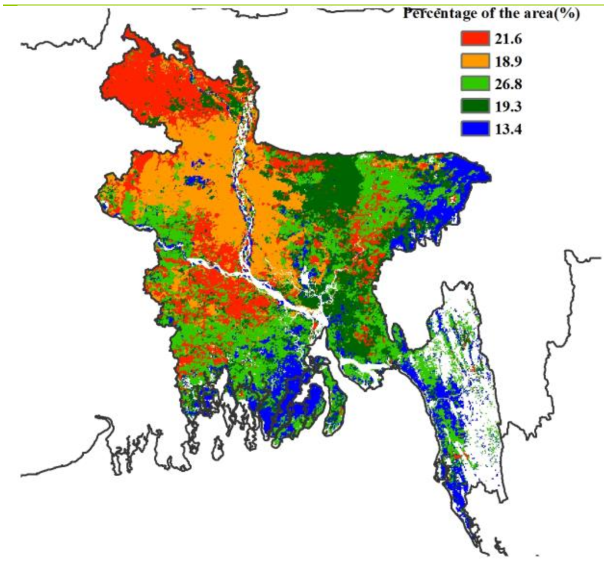
Figure 3.7. Bangladesh crop condition, January-April 2016

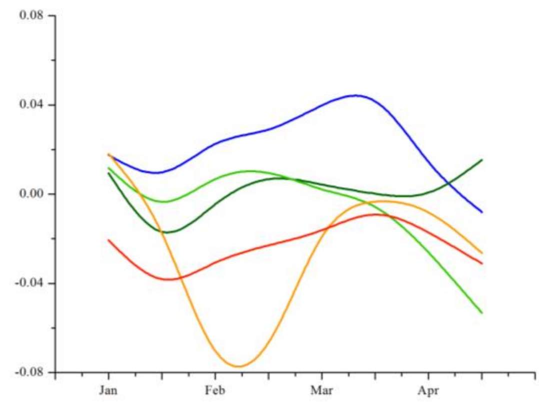




(a) Crop condition development graph based on NDVI

(b) Maximum VCI





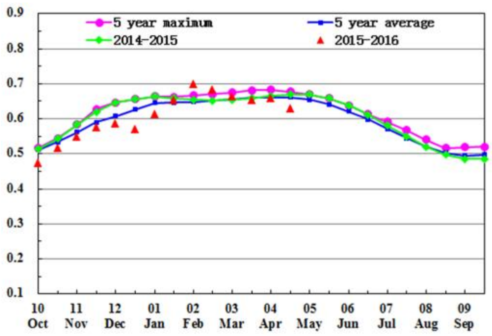
(c) Spatial NDVI patterns compared to 5YA

(d) NDVI profiles

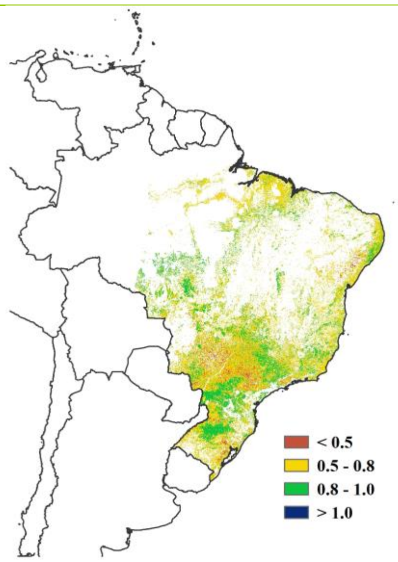
[BRA] Brazil

Crops in Brazil were slightly below average from January to April. Wheat is currently not growing and summer crops are being harvested. Rainfall was 7 percent below average; together with average temperature and radiation this results in 5 percent below average BIOMSS. National NDVI profiles show that crop condition was slightly below average for the whole season, although the NDVI peak in February 2016 is above that of 2015. Spatial patterns and profiles of NDVI departure present above average crop condition in the states of Parana and Minas Gerais. The VCIx map also shows high values (>0.8) in those regions compared with other regions. Low rainfall in Mato Grosso Do Sul and Sao Paulo (refer to section 2.4 and table A.5 in Annex A) resulted in below average crop condition (VCIx < 0.5). Sufficient rainfall in Rio Grande Do Sul (35 percent above average) benefited rice and other crops. Overall, rice production is estimated at 13.2 million tons, 12 percent above 2015, while maize production dropped 1 percent and soybean production increased by 2 percent. Table B.2 in Annex B presents 2016 production estimates for Brazil.

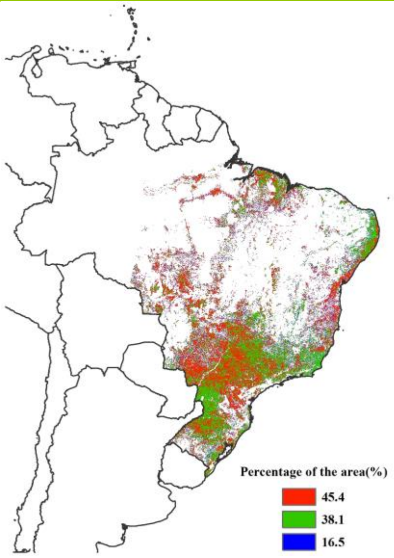
Figure 3.8. Brazil crop condition, January-April 2016



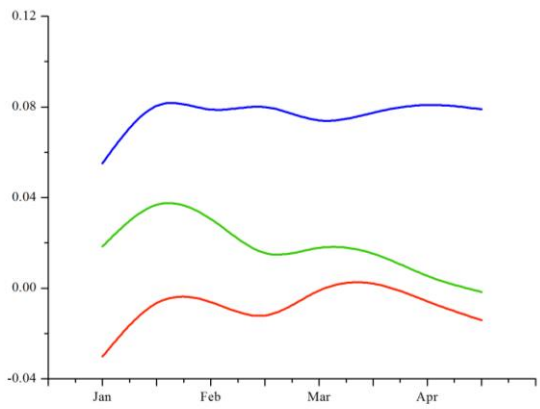
(a) Crop condition development graph based on NDVI



(b) Maximum VCI



(c) Spatial NDVI patterns compared to 5YA



(d) NDVI profiles

[CAN] Canada

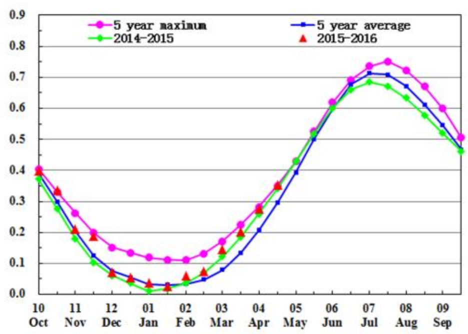
In general, crops in Canada “looked” better than the recent five-year average during the current monitoring period. This is the key growing season for (limited) winter crops and the preparation of sowing for the summer crops season. The agroclimatic variables include below average rainfall (RAIN, -9 percent), a significant positive anomaly of temperature (TEMP, +2.7°C), while radiation was below average (RADPAR, -2 percent).

This was a rather “warm” season and abnormal temperature was monitored in Alberta (+4.2°C), Saskatchewan (+3.9°C), and Manitoba (+2.9°C). Below average rainfall continued from last year in Alberta (-15 percent) and Manitoba (-12 percent). Saskatchewan was the only province with close to average rainfall (+4 percent). As mentioned in the previous CropWatch bulletin, the Canadian Prairies suffered continuous drought that fueled a huge forest fire at the beginning of May at Fort McMurray (Alberta). Fortunately, the main maize production zones recorded above average rainfall, including Quebec (+20 percent) and Ontario (+24 percent).

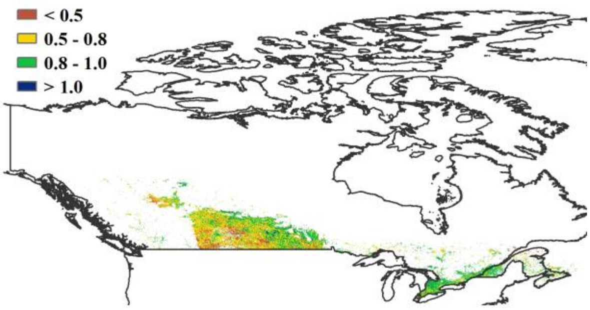
The difference between the Canadian Prairies and the eastern provinces is confirmed by NDVI departure clusters that indicated positive anomaly of NDVI in eastern provinces and close to average NDVI in the Prairies.

If the rainfall deficit continues in the Prairies in the coming months, summer crops sowing will be affected by insufficient soil moisture. In the eastern provinces, good condition of maize is more likely, especially if good weather continues.

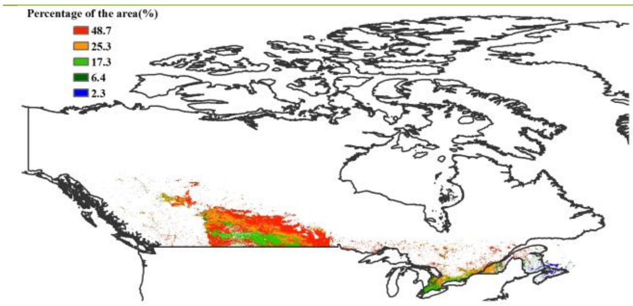
Figure 3.9. Canada crop condition, January-April 2016



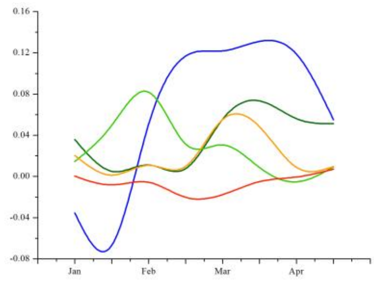
(a) Crop condition development graph based on NDVI



(b) Maximum VCI



(c) Spatial NDVI patterns compared to 5YA



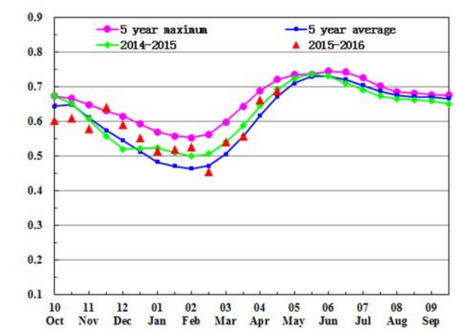
(d) NDVI profiles

[DEU] Germany

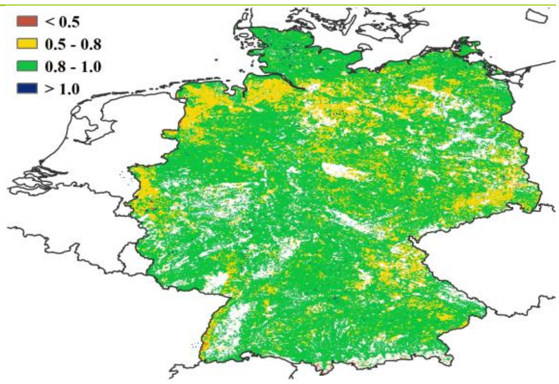
The condition of crops in Germany shows spatially contrasted patterns. Winter wheat and winter barley are currently in the vegetative stages and maize is being planted. The Crop Watch agroclimatic indicators show above average rainfall (RAIN, +24 percent), close to the average temperature (except in the south, where the TEMP anomaly was -1.1°C), and RADPAR at the national level at 7 percent below average. Above average rainfall occurred throughout the country, with the largest positive departure occurring in the west, especially the northwestern mixed wheat and sugar beets zone (RAIN, +36 percent). With favorable moisture and temperature, biomass (BIOMSS) is expected to increase by 20 percent nationwide compared to the five-year average.

As shown by the crop condition development graph, national NDVI values were above average from January to early February due to abundant rainfall and suitable temperature, but below average from mid-February to late February due to lack of rainfall. National NDVI values started well above average and came close to the five-year maximum from early March to April. This observation is confirmed by the NDVI profiles and the country's spatial NDVI patterns, with less promising crops in the north. This spatial pattern is also reflected by the maximum VCI in the different areas, with a VCIx of 0.85 for Germany overall. Generally, the values of agronomic indicators mentioned above resulted in favorable condition for most winter crop areas in Germany.

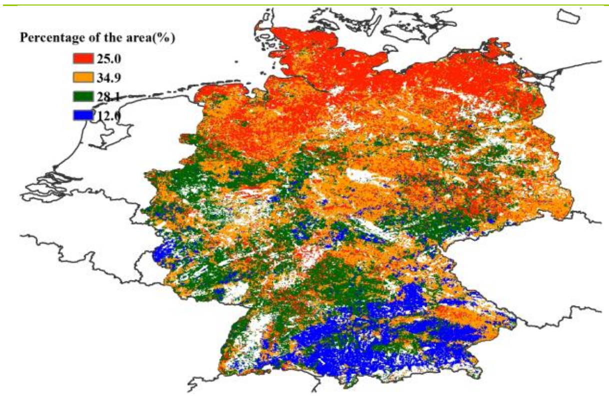
Figure 3.10. Germany crop condition, January-April 2016



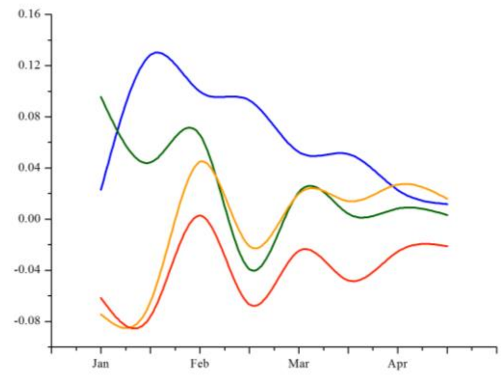
(a) Crop condition development graph based on NDVI



(b) Maximum VCI



(c) Spatial NDVI patterns compared to 5YA



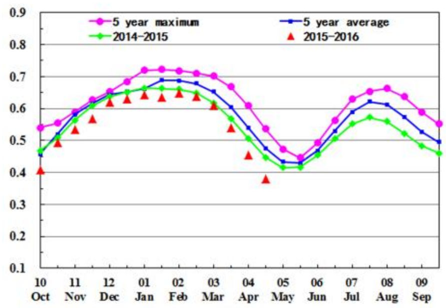
(d) NDVI profiles

[EGY] Egypt

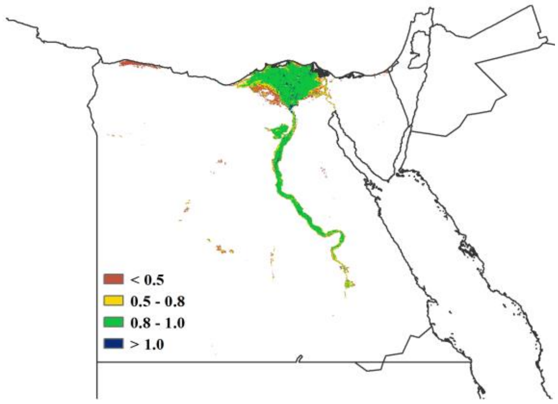
During the monitoring period, harvesting of barley was underway, while wheat was still growing. In general, crop condition in the country is significantly below average and since late March even worse than last year's.

The CropWatch agroclimatic indicators show that rainfall decreased significantly (by 28 percent) compared to average, whereas temperature and radiation were close to average (TEMP, +0.5°C and RADPAR, -1 percent). Affected by rainfall deficit but mostly by a low Nile discharge related to the East African drought, the average national maximum VCI was 0.77. According to the graph for the spatial pattern of maximum VCI, the lowest values (<0.5) occurred in the southwestern and southeastern Nile Delta, as well as in the northwest of the country. Crop condition became worse in all regions of Egypt from January to April, as indicated by the spatial patterns and NDVI departure profiles. About 56 percent of crops were below the recent five-year average condition since early March, with those areas concentrated in the northern and eastern Nile Delta. As the cropped arable land fraction (CALF) decreased by 2 percentage points and crop condition at national scale was poor, Egypt’s output is expected to be below average.

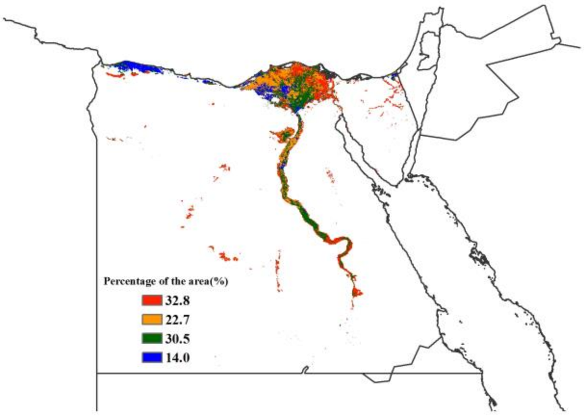
Figure 3.11. Egypt crop condition, January-April 2016



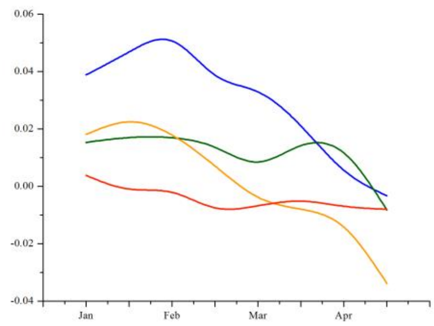
(a) Crop condition development graph based on NDVI



(b) Maximum VCI



(c) Spatial NDVI patterns compared to 5YA



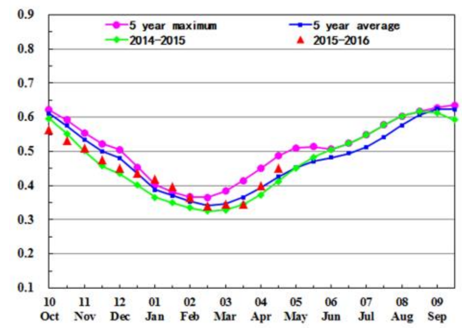
(d) NDVI profiles

[ETH] Ethiopia

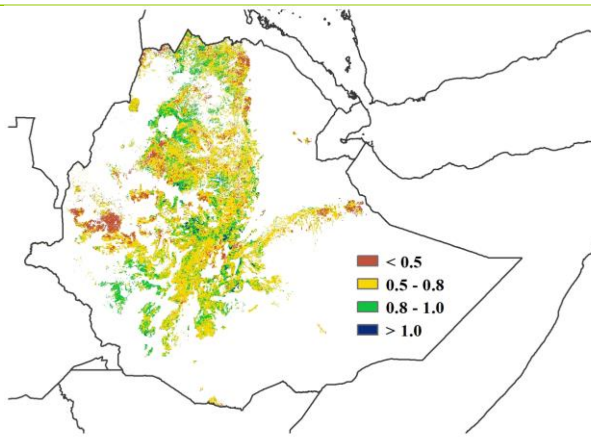
According to the overall NDVI-based season development graph, the condition of crops was above the poor 2015 Belg season. So far, rainfall (which about coincided with Belg rains) was 19 percent below average with an average of about 300mm over the reporting period, which corresponds to water stress conditions. Temperature and sunshine were slightly above average (TEMP, +0.6°C and RADPAR, +3 percent), but not sufficiently so to alter crop water requirements very significantly. The biomass production potential BIOMSS was 2 percent below average, which is consistent with a "normal" cropped arable land fraction and a VCIx value of 0.69.

NDVI clusters and profiles provide additional spatial information about the condition of crops. While all NDVI profiles are currently at least average, they also show patterns of(i) improving situations mostly in Oromia (43.1 percent of croplands); this area has some limited patches of very good VCIx values; (ii) a slight deterioration that started in February in western Oromia and Amhara (18.7 percent of croplands); VCIx in this areas tends to be the lowest, confirming poor crop condition from the early season on forward; and (iii) a more rapid drop in SNPP and adjacent areas in Oromia (10 percent of croplands), where VCIx is still rather high (0.8). Maximum VCI patterns do not really agree with the spatial NDVI distribution because they "remember" favorable conditions that occurred at any time since January. Among the areas that normally expect a fair amount of rainfall (200-250 mm) during the first quarter of the year, such as the Mendebo Highlands and the southeast mixed maize zones, the deficit was low (-10 percent). It was higher (-19 percent) but not excessive in the south-western coffee-enset highlands. In the western mixed-maize zone, where rainfall is usually more marginal (<150mm), the deficit was relatively high at -29 percent. Altogether, the indicators show moderate crop condition; even in areas where crop conditions are poor, crops are less severely impacted when compared to 2015. There are no indications so far that the main Belg season will be poor.

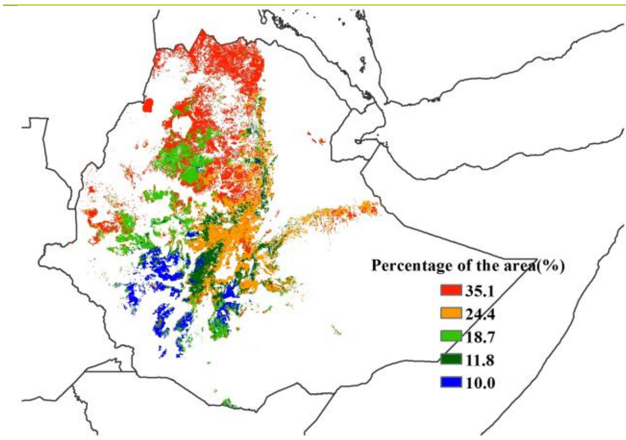
Figure 3.12. Ethiopia crop condition, January-April 2016



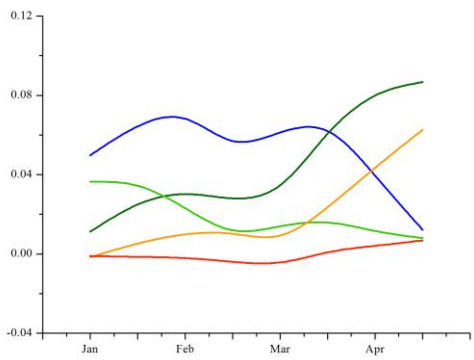
(a) Crop condition development graph based on NDVI



(b) Maximum VCI



(c) Spatial NDVI patterns compared to 5YA

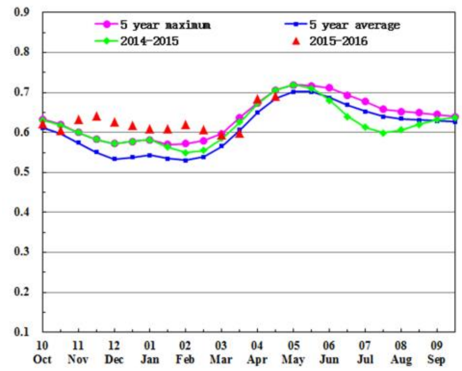


(d) NDVI profiles

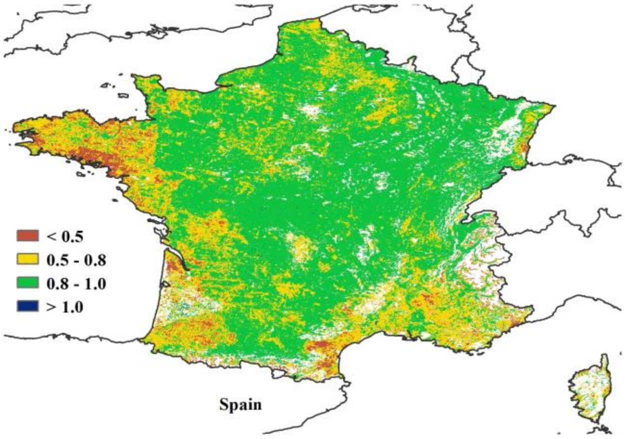
[FRA] France

Crop condition in France was generally favorable over the reporting period. Currently, winter wheat, winter barley, and spring barley are in the vegetative stages. At the national level, compared with average, CropWatch agroclimatic indicators show that the reporting period recorded a 2 percent increase in RAIN, a 1.1°C decrease in TEMP, and 8 percent below average RADPAR. BIOMSS presents a 31 percent increase compared to the five-year average due to favorable rainfall. As shown by the NDVI profiles, however, national NDVI values were well above average and even above the five-year maximum from early January to February, consistent with a maximum VCI of 0.81 for France overall. The spatial NDVI patterns compared to the five-year average indicate that NDVI values were above average from early January to the end of March in many areas. This does not apply to 54.9 percent of agricultural areas, including most of Limousin, Poitou-Charentes, and north of Midi-Pyrenees, most of Lorraine and Alsace and east of Rhone Alpes, where poor conditions occurred during mid-February and mid-March. With the exception of Mediterranean areas, which suffered a 25 percent rainfall deficit, the agronomic indicators mentioned above point at favorable condition for most winter crop areas of France.

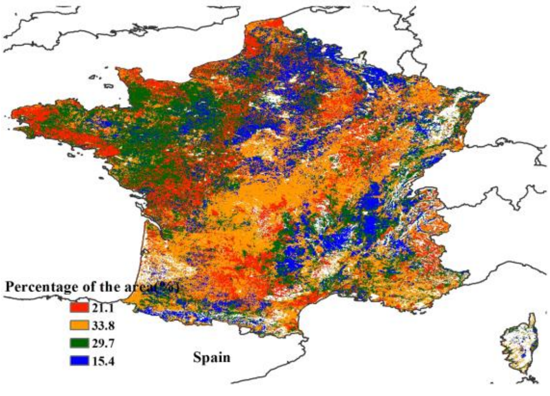
Figure 3.13. France crop condition, January-April 2016



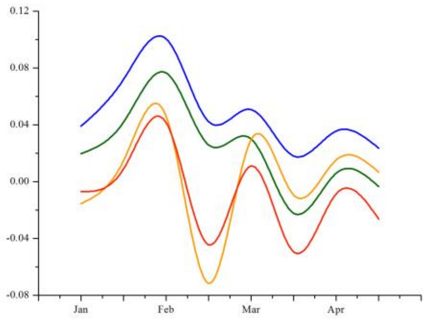
(a) Crop condition development graph based on NDVI



(b) Maximum VCI



(c) Spatial NDVI patterns compared to 5YA

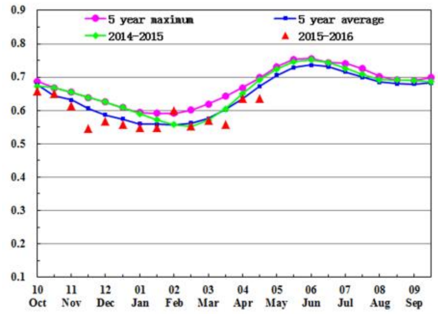


(d) NDVI profiles

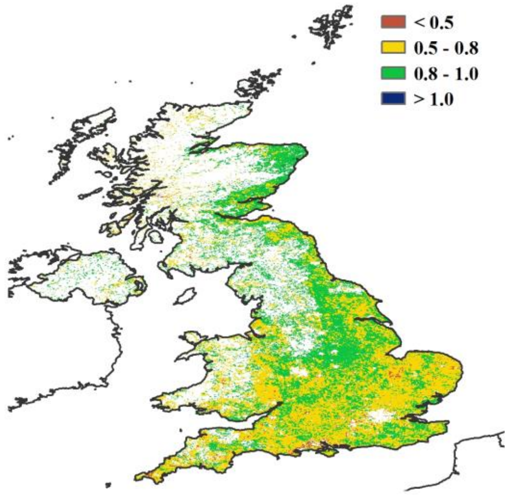
[GBR] United Kingdom

Crops in the United Kingdom showed below average conditions during the period from January to April 2016. Currently, wheat, winter barley, and rapeseed are in the vegetative stages. CropWatch agroclimatic indicators show that rainfall was above average (RAIN, +49 percent), with slightly below average radiation (RADPAR, -3 percent) and temperature (TEMP, -1.3°C). With the positive moisture, BIOMSS is expected to increase by 5 percent compared to the five-year average, in spite of cool temperature. National NDVI values were usually below average according to the crop condition development graph, except in the southeast (22.9 percent of arable land). Altogether, considering the average VCIx value of 0.77, output is expected to be average.

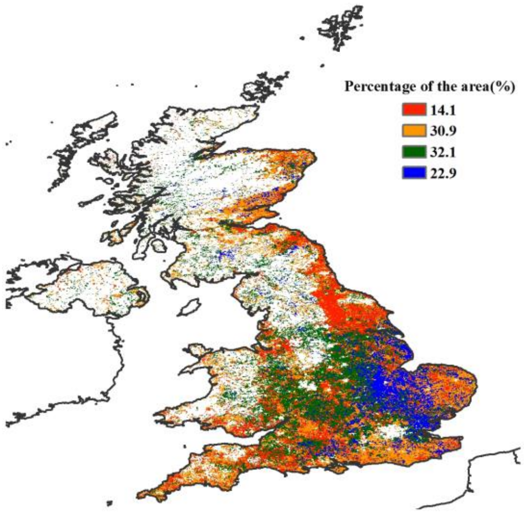
Figure 3.14. United Kingdom crop condition, January-April 2016



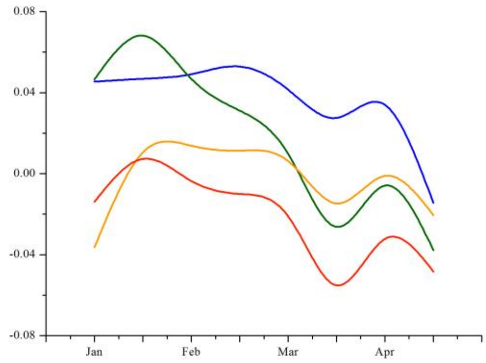
(a) Crop condition development graph based on NDVI



(b) Maximum VCI



(c) Spatial NDVI patterns compared to 5YA



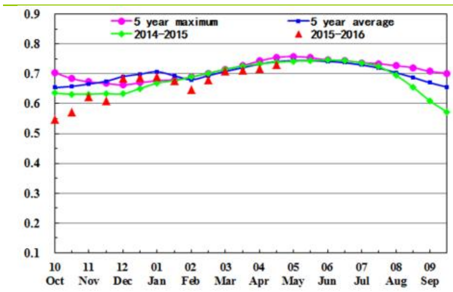
(d) NDVI profiles

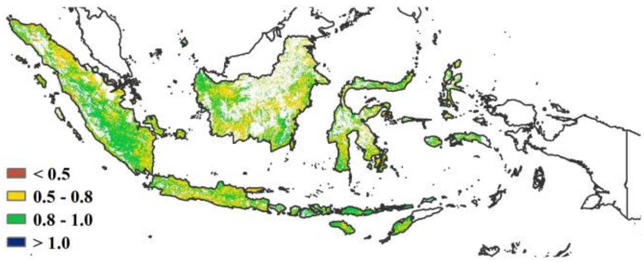
[IDN] Indonesia

The monitoring period covers the growing and harvesting stage of the rainy season maize and rice. Indonesia presented slightly below average crop condition from January to April.

Compared with average, precipitation was slightly above average (RAIN, +3 percent), while RADPAR displayed a decrease of 1 percent. The biomass production expectations were below average (BIOMSS, -4 percent). According to the NDVI clusters, crop condition in Jambi, Kalimantan Timur, and Kalimantan Tengah was below average during most of the period. Kalimantan Selatan, Kalimantan Barat, and Sumatera Selatan showed good crop condition in January, which then dropped below the five-year average from February. National NDVI profiles also show poor crop condition in the monitoring period, with the national NDVI profile below average until April. Altogether, considering a stable value for the cropped arable land fraction and a VCIx of 0.78, Indonesia showed considerable resilience to El Niño conditions, and CropWatch expects average output.

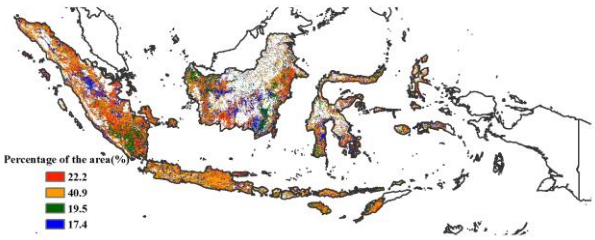
Figure 3.15. Indonesia crop condition, January-April 2016

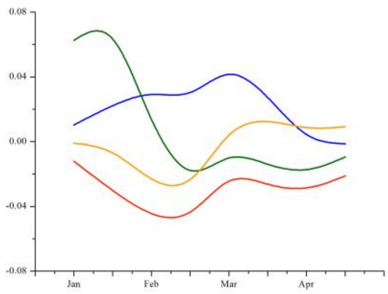




(a) Crop condition development graph based on NDVI

(b) Maximum VCI





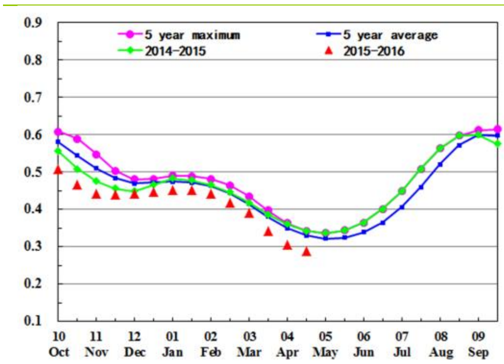
(c) Spatial NDVI patterns compared to 5YA

(d) NDVI profiles

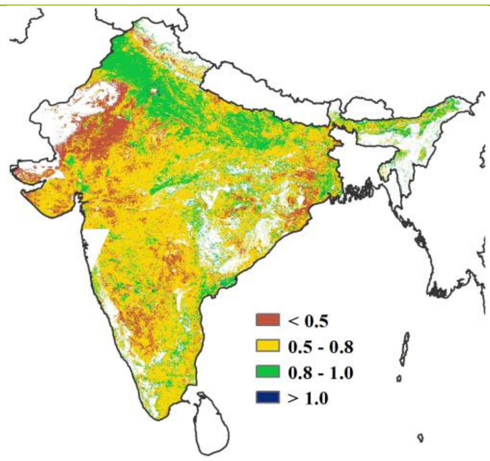
[IND] India

As per CropWatch indicators, the condition of crops was poor during the reporting period, which coincides with the growing and harvesting seasons of rabi crops. The region experienced drought conditions linked to the ongoing El Niño event. The most affected states with low rainfall include: Andhra Pradesh (RAIN, -54 percent), Bihar (-34 percent), Chhattisgarh (-7 percent), Goa(-100 percent), Haryana (-46 percent), Jharkhand (-43 percent), Kerala(-52 percent), Karnataka (-76 percent),Maharashtra(-3 percent), Madhya Pradesh(-14 percent), Punjab(-36 percent), Rajasthan(-58 percent), Tamil Nadu(-79 percent), Uttar Pradesh(-51 percent), Uttarakhand (-33 percent), and West Bengal (-29 percent). Low rainfall also led to negative biomass accumulation (BIOMSS, -31 percent) for the entire country with high decline recorded in Andhra Pradesh (-48 percent), Bihar (-45 percent), Chhattisgarh(-12 percent), Goa(-100 percent), Haryana(-54 percent), Jharkhand (-41 percent), Kerala(-42 percent), Karnataka (-67 percent),Maharashtra(-16 percent), Madhya Pradesh(-33 percent), Punjab(-37 percent), Rajasthan(-59 percent), Tamil Nadu(-71 percent), Uttar Pradesh(-61 percent), Uttarakhand (-45 percent), and West Bengal (-37 percent).Temperature was slightly above average with 0.8°C and RADPAR was average. The fraction of cropped arable land (CALF) for the country, however, increased by 3 percentage points. Crop condition development was below the values for 2014-15 and the average of the previous five years. The maximum VCI value reached 0.67 over the region. Maximum VCI values below 0.5 were recorded in Gujarat, Maharashtra, Andhra Pradesh, Rajasthan, Karnataka, and West Bengal indicating poor crop condition in these areas. The NDVI profile values for the entire country remained favorable through the monitoring period except some areas in Andhra Pradesh, Gujarat and in North East. Overall, with the present nationwide drought condition, which followed widespread floods at the end of 2015, the expected output of rabi crops is not promising.

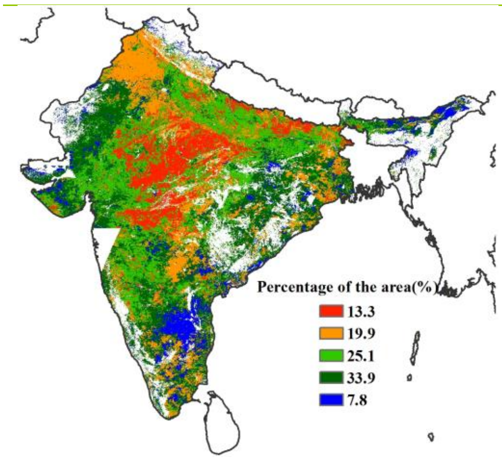
Figure 3.16. India crop condition, January-April 2016



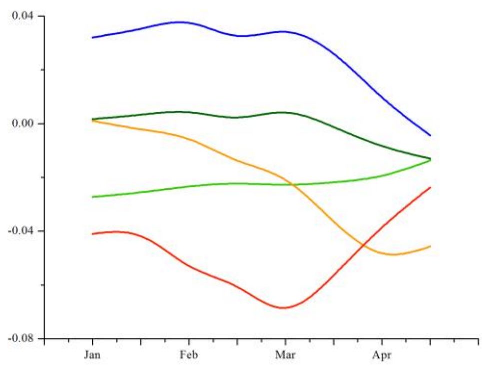
(a) Crop condition development graph based on NDVI



(b) Maximum VCI



(c) Spatial NDVI patterns compared to 5YA



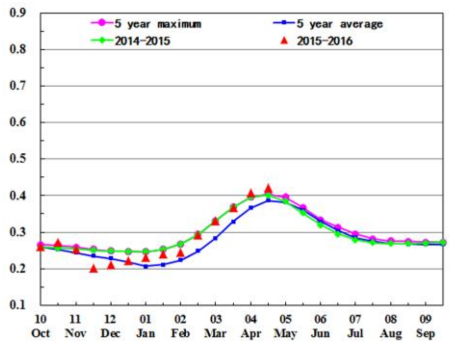
(d) NDVI profiles

[IRN] Iran

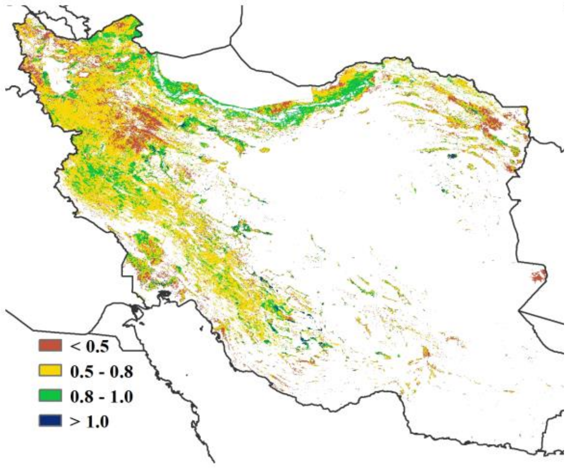
Crop condition from January to April 2016 was generally about average in Iran. During this period, winter wheat was still growing and barley was harvested. Accumulated rainfall (RAIN, -2 percent) and radiation (RADPAR, -1 percent) were just below average, while the temperature (TEMP, +0.9°C) was above average. The agroclimatic indices for the current season result in a decrease of the BIOMSS index by 6 percent compared to average. The national average of the VCIx (0.66) was just above average conditions, and the cropped arable land fraction decreased by 5 percentage points compared to the its five-year average.

Crop conditions above the five-year average are mainly distributed in Ardabil, Golestan, and North Khorasan provinces of the northern region, and the Khuzestan and Bushehr provinces of the southwest area. In the central-northern region from west Azerbaijan to Hamadan, extending south and southeast as far as Fars province, the condition of crops was below or close to the five-year average during the whole monitoring period. CropWatch puts the wheat yield variation with 2015 at +0.4percent. However, cultivated area is estimated to drop 7.1 percent (an estimate based on the CALF value of -5 percent in table 3.1), which will eventually result in a 7 percent winter wheat production drop, in spite of generally fair crops.

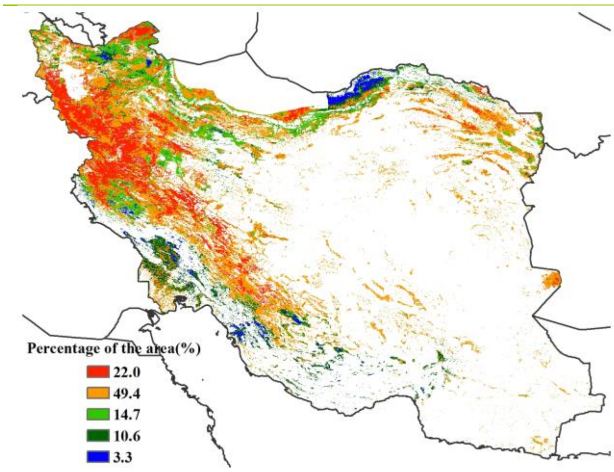
Figure 3.17. Iran crop condition, January-April 2016



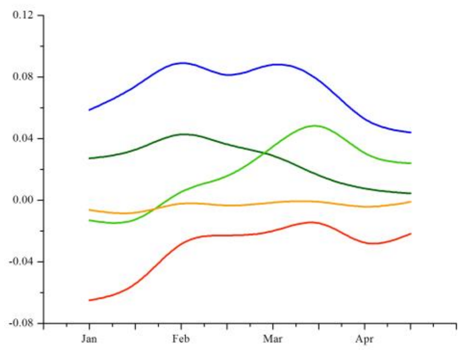
(a) Crop condition development graph based on NDVI



(b) Maximum VCI



(c) Spatial NDVI patterns compared to 5YA



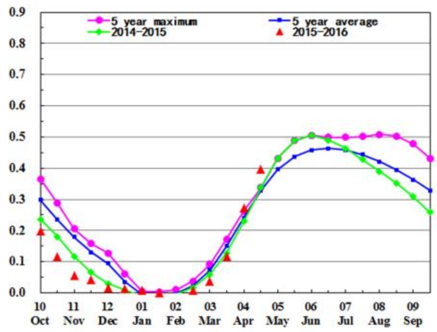
(d) NDVI profiles

[KAZ] Kazakhstan

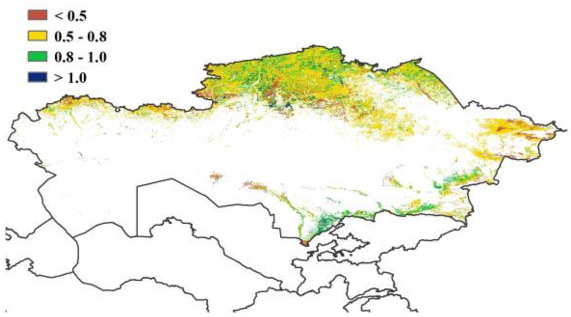
As shown by the national NDVI development graphs, no winter crops are normally cultivated in Kazakhstan from January to early April; spring crops got into the sowing and vegetative stages from late April.

During the reporting period, rainfall was above average by 28 percent, while temperature was above average by 3ºC, and PAR accumulation was 7 percent below average, which led to a large potential biomass increase of 27 percent compared to the recent five-year average. Spatial NDVI patterns compared to the last five years, and NDVI profiles indicate that almost the whole country experienced favorable crops especially in April, which is confirmed by the national NDVI development graphs: In late April, crop condition was above average. Due to the high rainfall, however, current values of VCIx are generally about average, although more favorable in some northern (Severo-kazachstanskaya, Akmolinskaya, and Pavlodarskaya) as well as southern areas (Jambylslkaya, Almatinskaya). Due to stored soil moisture, crop prospects are rather good for the coming cropping period.

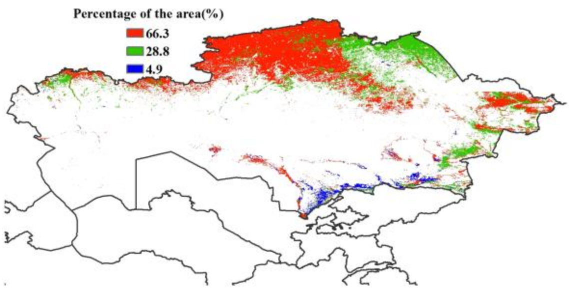
Figure 3.18. Kazakhstan crop condition, January-April 2016



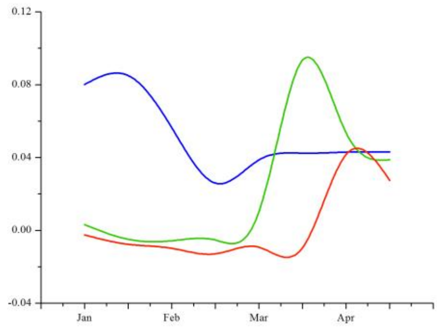
(a) Crop condition development graph based on NDVI



(b) Maximum VCI



(c) Spatial NDVI patterns compared to 5YA



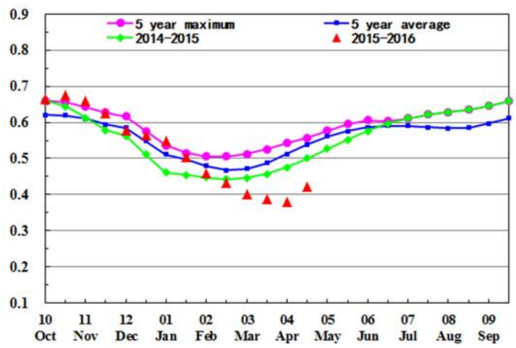
(d) NDVI profiles

[KHM] Cambodia

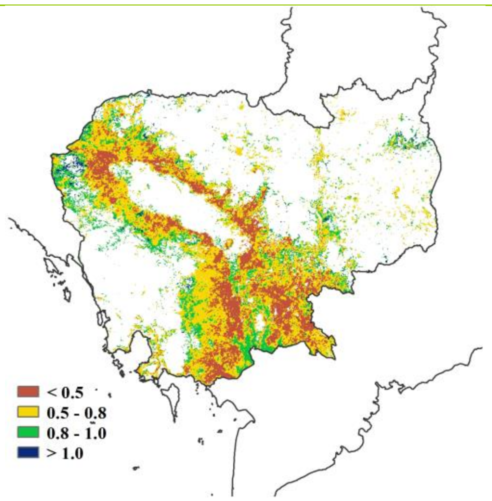
February to May covers the growing stage of the second (dry season) rice in Cambodia. The fraction of cropped arable land (CALF) was comparable to the average of the previous five years.

Compared to average, the CropWatch agroclimatic indicators show markedly below average rainfall (RAIN, -67) and a slight increase in RADPAR (+8 percent). Unfavorable conditions caused the NDVI to be much below the five-year average from February, with a biomass production potential decrease of -60 percent. Moreover, vegetation condition indices (VCIx) are low (<0.5) around Tonle Sap Lake. Overall, the condition of the crops in the country is poor.

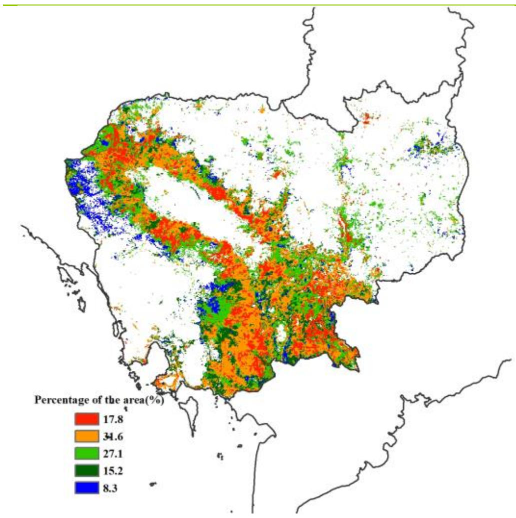
Figure 3.19. Cambodia crop condition, January-April 2016



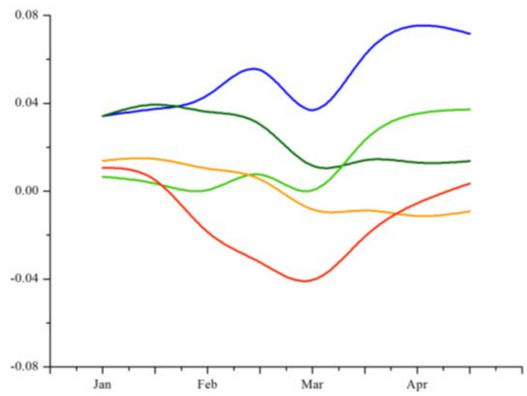
(a) Crop condition development graph based on NDVI



(b) Maximum VCI



(c) Spatial NDVI patterns compared to 5YA



(d) NDVI profiles

ARG AUS BGD BRA CAN DEU EGY ETH FRA GBR IDN IND IRN KAZ KHM **MEX** MMR NGA PAK PHL POL ROU RUS THA TUR UKR USA UZB VNM ZAF

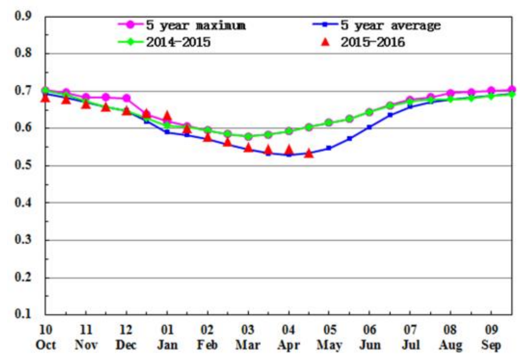
[MEX] Mexico

The 2015 main season wheat and maize crops are being harvested in Mexico, while sorghum is still growing and the planting of the 2016 secondary maize crop is ongoing. Crop condition at the national level is average but below 2015, according to the crop condition development graph based on NDVI.

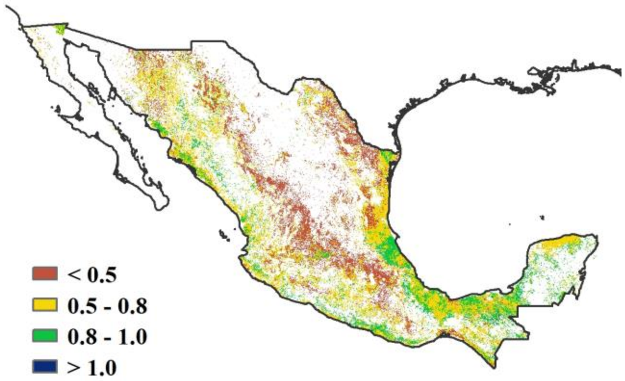
Favorable agroclimatic condition occurred in the country over the reporting period. Rainfall was significantly above average (RAIN, +35 percent) while temperature and RADPAR were slightly below (TEMP, -0.3°C and RADPAR -1 percent). Consequently, BIOMSS was significantly above average (+24 percent). The cropped arable land fraction (CALF) increased by 7 percentage points compared to the recent five-year average level. According to the map of maximum VCI, higher values appear in eastern Mexico while lower values occurred in north and central parts of the country. The spatial pattern and NDVI departure profiles showed that approximately 60 percent of areas were above or close to average in crop condition, mostly in southeastern and northern Mexico. In contrast, poor crop condition occurred in northeastern and southwestern parts of the country.

Altogether, CropWatch estimates crop yields in Mexico will be slightly above average.

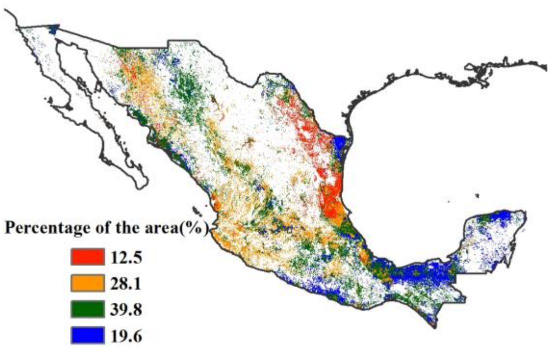
Figure 3.20. Mexico crop condition, January-April 2016



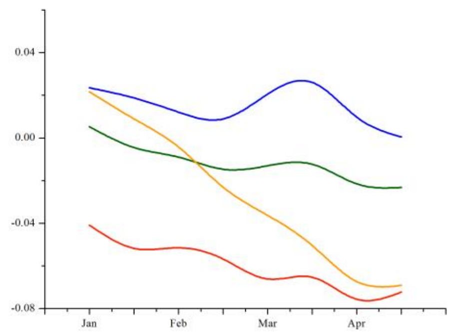
(a) Crop condition development graph based on NDVI



(b) Maximum VCI



(c) Spatial NDVI patterns compared to 5YA

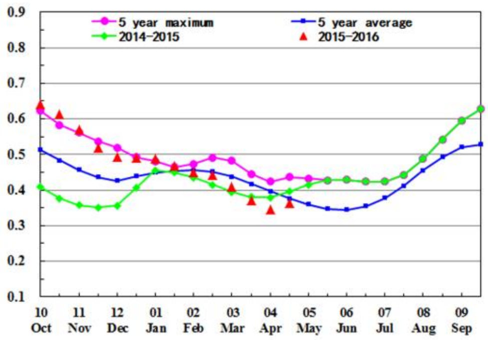


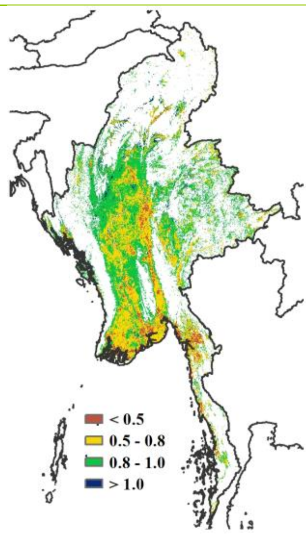
(d) NDVI profiles

[MMR] Myanmar

The reporting period covers the growing and harvesting season of winter rice. Due to El Niño-related drought, the rainfall deficit was -24 percent across the country and -33 percent in the central plain. Temperature (TEMP, -0.6°C) and RADPAR were about average, while the projected biomass accumulation potential was 26 percent below average. Even if cultivated land increased (CALF, 1 percentage point above the last five years' average), the crop condition development was below last year's value as well as the five-year average. The maximum VCI value for the country was 0.78. Poor maximum VCI below 0.5 occurred in central Mandalay and some parts of Mawlamyaing, pointing at poor crop condition. Spatial NDVI profiles are mostly positive (above average) or about average until March, but dropped to below average in April in about 18.4 percent of the country, mostly in the center. As per CropWatch indicators, the overall crop condition in Myanmar is poor.

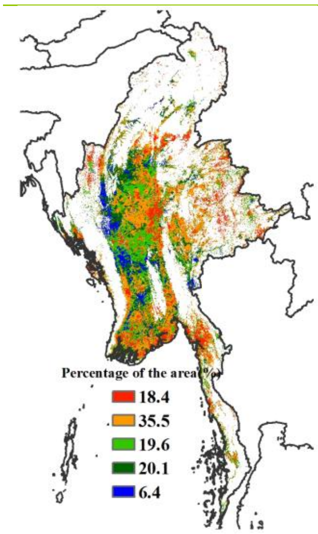
Figure 3.21. Myanmar crop condition, January-April 2016

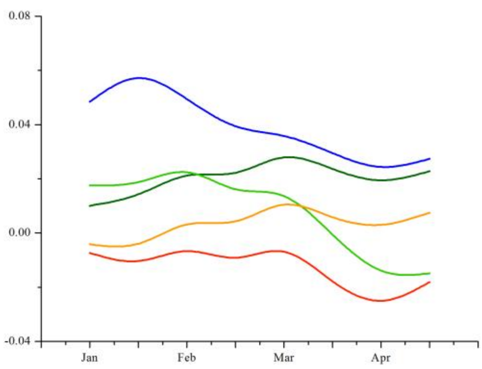




(a) Crop condition development graph based on NDVI

(b) Maximum VCI





(c) Spatial NDVI patterns compared to 5YA

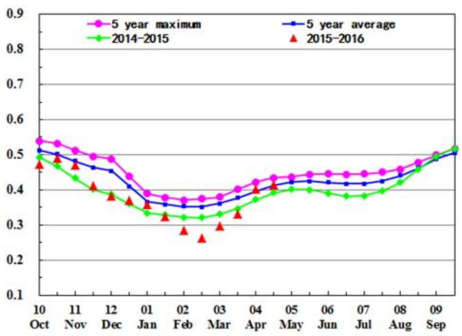
(d) NDVI profiles

[NGA] Nigeria

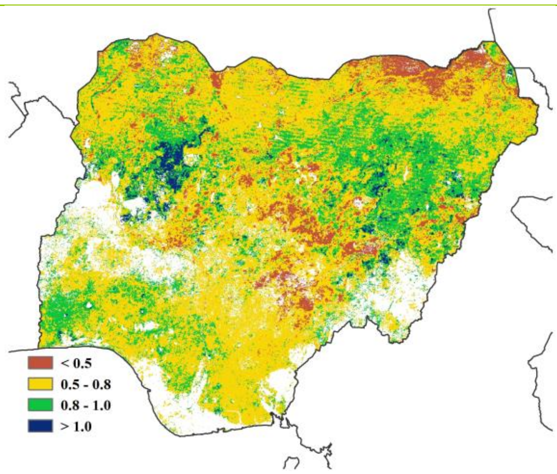
Cassava and yams are dominant crops in Nigeria, especially in the south, but cereals (maize and rainfed rice) play a major role in the southern-central part of the country where planting takes place from the middle of the current reporting period, from the end in March to April.

Compared with the average, country-wide rainfall was slightly above average (RAIN, +12 percent) with average sunshine (RADPAR, +1 percent), and just below average temperature (-0.4°C), generally favorable VCIx (0.72), and average cropped arable land fraction. The biomass production potential (BIOMSS) currently exceeds average by 11 percent. NDVI stayed below average after late January, but turned average and remained so throughout April. Crop condition was very close to average in 58 percent of the areas, i.e., essentially in the north where the season is still to start. As shown in the West African BIOMSS map (figure 2.1g), the central Guinean Savannah belt enjoyed favorable conditions and BIOMSS (at +20 percent) exceeding the national average, especially in the west according to the VCIx values. The area recorded a large excess of precipitation (RAIN, +68 percent) accompanied by reduced sunshine (RADPAR, -2 percent). Less favorable but improving conditions prevail in southern Nigeria, in the humid forest zone where rainfall was 18 percent below average, with a correlated increase in sunshine of 9 percent; BIOMSS dropped 20 percent below average. Considering the very early stage of Sahelian crops and contrasting situations in the central and southern areas, the overall situation is assessed as at least average.

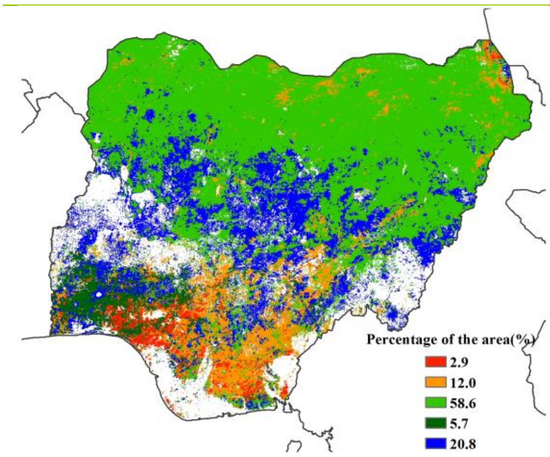
Figure 3.22. Nigeria crop condition, January-April 2016



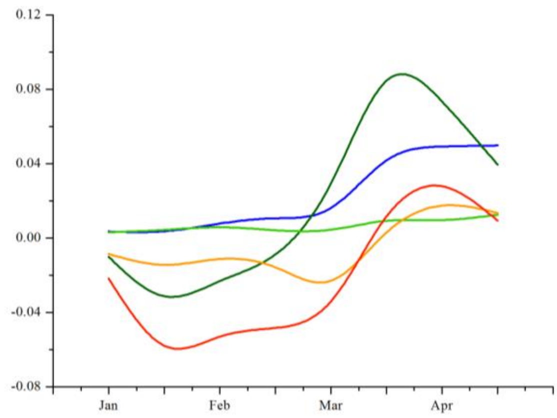
(a) Crop condition development graph based on NDVI



(b) Maximum VCI



(c) Spatial NDVI patterns compared to 5YA



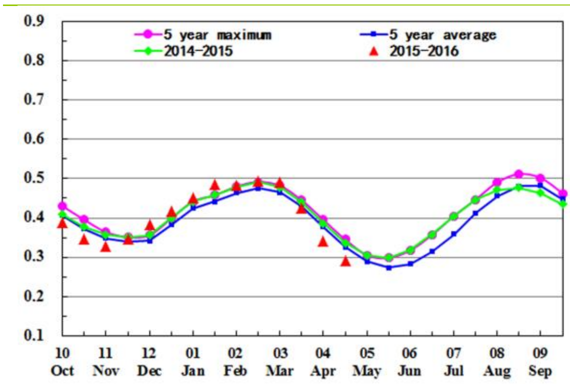
(d) NDVI profiles

[PAK] Pakistan

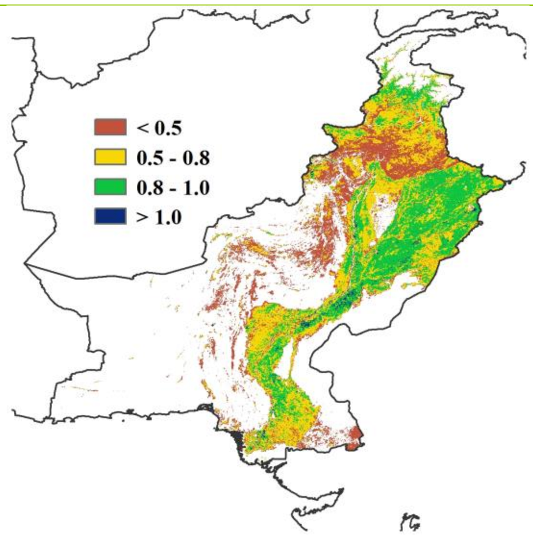
The reporting period coincides with the growing and harvesting stages of rabi (winter) wheat and barley. Except in the lower Indus basin where rainfall exceeded average by 11 percent, agroclimatic indicators show a nationwide drop of rainfall (RAIN, -13 percent), radiation (RADPAR, -1 percent), as well as the biomass production potential (BIOMSS, -27 percent) compared with average. Temperature was close to average (-0.1°C) and cultivated land (CALF) underwent a spectacular increase of 15 percentage points over the recent five-year average.

The national NDVI development graph indicates that crop condition was favorable from the start of January till the end of March, but from the beginning of April crop condition dropped below the average of the past five years. The lowest maximum VCI values (below 0.5) occur in the entire Khyber Pakhtunkhwa, upper Punjab, upper Sindh, as well as most of the areas of Balochistan. According to the NDVI profiles, about 13 percent of the cropped areas display consistently below average conditions from January through the end of April. These areas include the central Khyber Pakhtunkhwa, all of Punjab, and the lower and central Sindh. In addition, 26.1 percent of the cropped areas show above average conditions from January to the start of February, much of it in Punjab. Remaining areas (that is, 60 percent of the country) enjoy above average condition. Altogether, crop condition in Pakistan is estimated to be about average.

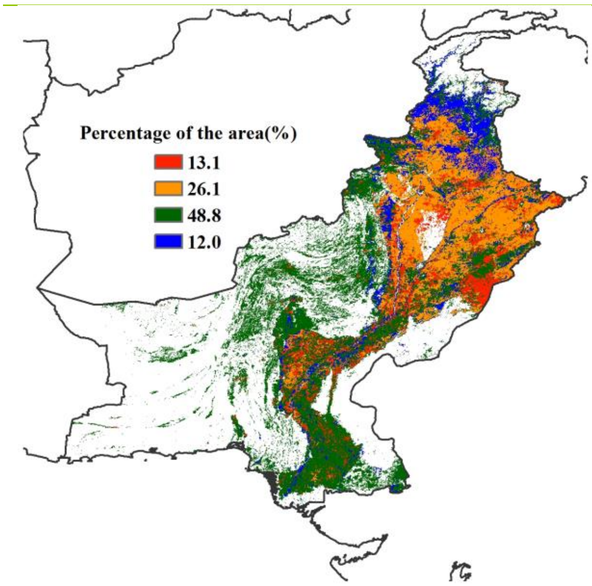
Figure 3.23. Pakistan crop condition, January-April 2016



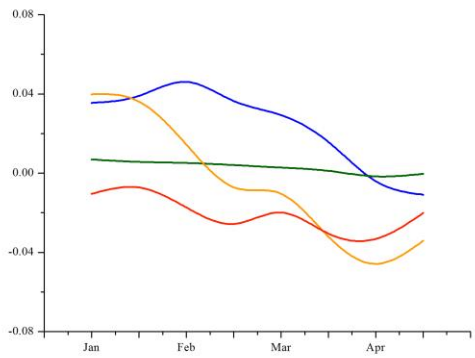
(a) Crop condition development graph based on NDVI



(b) Maximum VCI



(c) Spatial NDVI patterns compared to 5YA



(d) NDVI profiles

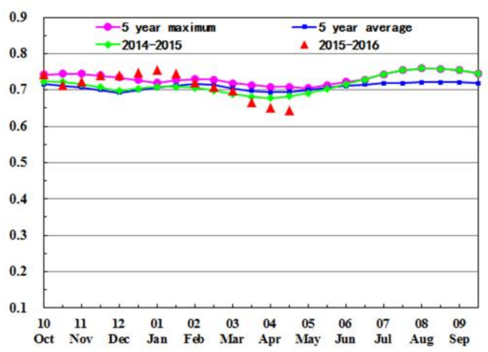
[PHL] The Philippines

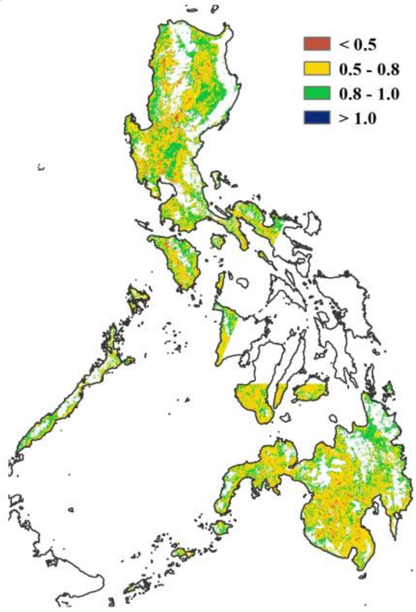
The monitoring period covers the harvesting stage of secondary rice and maize, as well as the sowing stage of the main rice and maize crops in the Philippines. Overall, the condition of crops in the country was well below average from January to April.

The country suffered one of the largest El Niño-related water shortages in the world, with RAIN at 77 percent below average, accompanied by increased RADPAR (+9 percent). As a result of the rainfall deficit, the estimated biomass production potential BIOMSS) decreased by 62 percent compared with the recent five years. The agroclimatic indicators agree with the NDVI development graph, which stayed below the last five-year average and last year's values from March to April. According to the NDVI clusters, the crop condition was bad in central Luzon (the largest and northernmost island in the country), but mostly favorable in the western part of Mindanao.

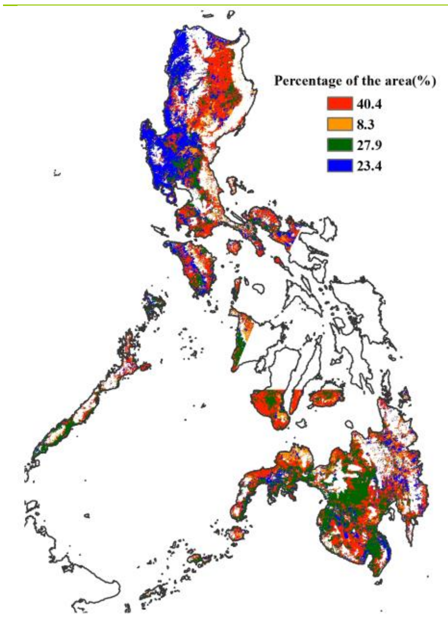
Altogether, the output of the main season is expected to be below average.

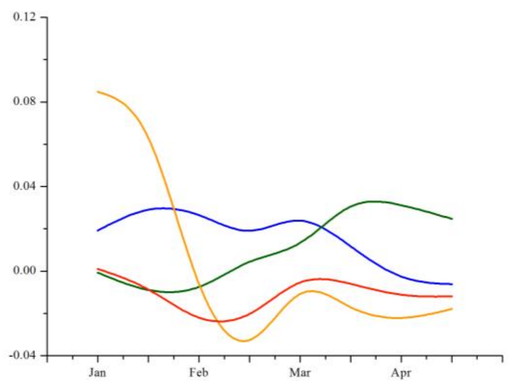
Figure 3.24. Philippines crop condition, January-April 2016





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





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

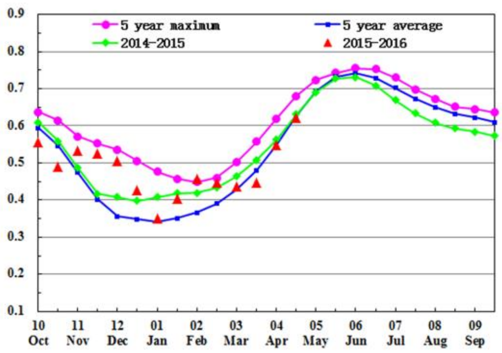
ARG AUS BGD BRA CAN DEU EGY ETH FRA GBR IDN IND IRN KAZ KHM MEX MMR NGA PAK PHL **POL** ROU RUS THA TUR UKR USA UZB VNM ZAF

[POL] Poland

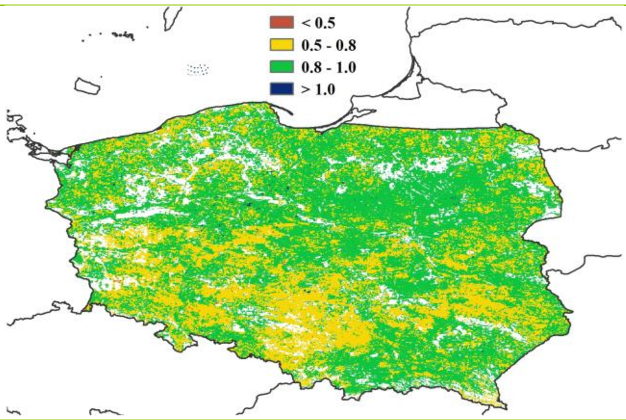
Poland enjoyed mostly favorable conditions during this monitoring period (maximum VCI=0.82), which corresponds with the wintering stage of winter wheat; maize seeding starts in the beginning of April. The cropped arable land fraction (CALF) for the country is the same as the average of the last five years. Weather during January to April was much wetter and warmer than average, with RAIN up 25 percent and TEMP at +0.7°C. RADPAR dropped 10 percent below average, and the potential biomass indicator BIOMSS was 17 percent above average due to the combination of abundant precipitation and mild weather.

The overall crop condition in Poland is close to the last five years' average; after a general NDVI drop at the end of February-early March, crop condition generally recovered in April. Crop condition in the northwest, however, raises concerns, as especially in Gdynia, Gdańsk, and Koszalin NDVI consistently remained below average, possibly due to a cold March after a warm January and February (see also section 2.7). The production of the country's winter crop is predicted to be lower than but close to average.

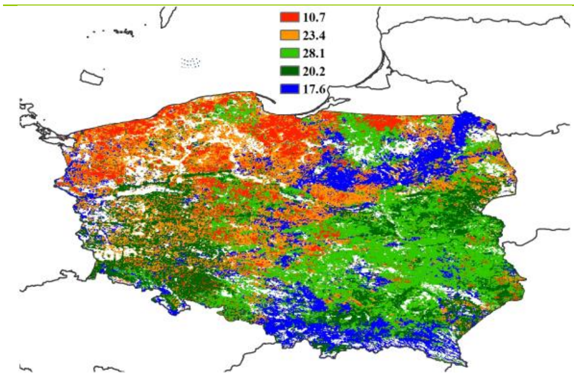
Figure 3.25. Poland crop condition, January-April 2016



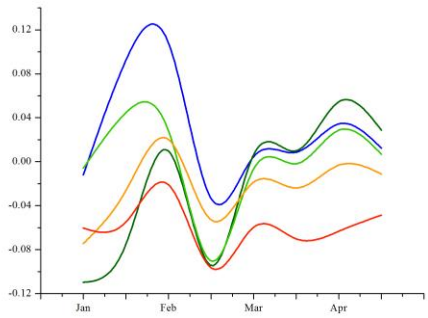
(a) Crop condition development graph based on NDVI



(b) Maximum VCI



(c) Spatial NDVI patterns compared to 5YA



(d) NDVI profiles

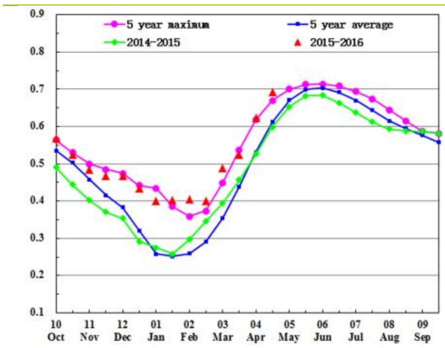
[ROU] Romania

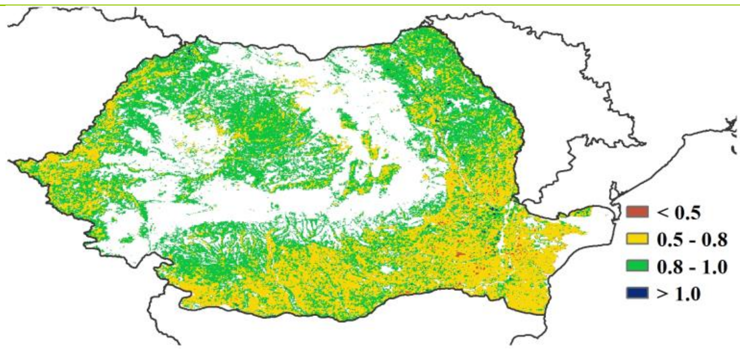
Romania presented above average crop condition during February to Mid-April (VCIx=0.8), a period when winter wheat (to be harvest from July) is normally still dormant. The reporting period also covers the very beginning of summer crop planting, especially maize. Overall, temperature (TEMP) was above average (+1.8°C) with a rainfall (RAIN) anomaly of +38 percent, a positive biomass production potential (BIOMSS, +28 percent), and lower than average RADPAR (-5 percent).

As shown in the national crop condition development graph, NDVI rather closely followed or even exceeded the maximum of the previous five years from February to the end of the reporting period. In most parts of southern Romania, crop condition was average (VCIx 0.5-0.8) while the northeast and center enjoyed above average condition (VCIx 0.8-1.0). Crop condition is more uncertain in some parts of the country, for instance in the southeast where VCIx is in the 0.5-0.8 range, and the NDVI profile was consistently and significantly above average since February, indicating crop growth during the period when the crop is normally dormant (about 10.6 percent of the cropped area).

The west (about 15.5 percent of cropland) had a marked drop of NDVI in late February. This is also the only area, along the Hungarian border (see also the BIOMSS maps in sections 2.6 and 2.7), where the biomass production potential shows low positive and negative departures from the recent average. Considering the rather unusual wintering conditions, the fact that CALF dropped 1 percentage point compared with average, and that sunshine was generally low (-5 percent, as already mentioned), winter crop prospects are normal. Prospects are favorable for summer crops due to stored soil moisture.

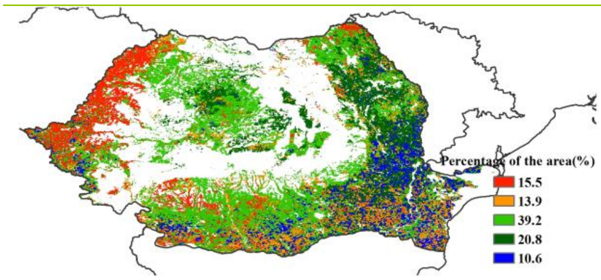
Figure 3.26. Romania crop condition, January-April 2016

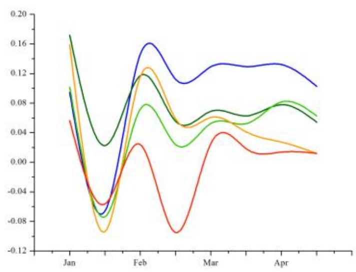




(a) Crop condition development graph based on NDVI

(b) Maximum VCI





(c) Spatial NDVI patterns compared to 5YA

(d) NDVI profiles

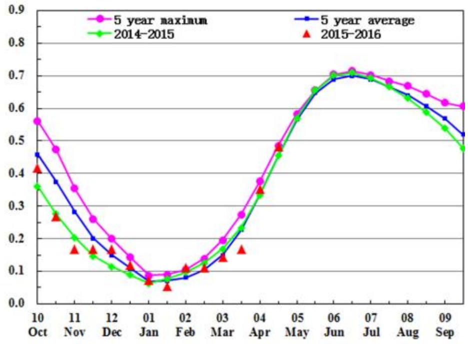
ARG AUS BGD BRA CAN DEU EGY ETH FRA GBR IDN IND IRN KAZ KHM MEX MMR NGA PAK PHL POL ROU **RUS** THA TUR UKR USA UZB VNM ZAF

[RUS] Russia

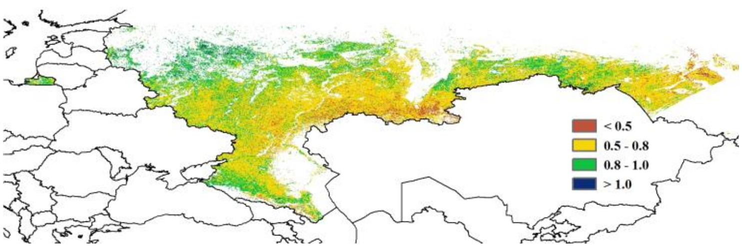
Russia experienced generally favorable crop condition from January to April (VCIx=0.73), which coincided with the wintering stage of winter wheat and early planting of spring wheat. The fraction of cropped arable land (CALF) increased 4 percentage points over the recent five-year average. The country experienced extremely mild conditions (TEMP, 2.1°C above average) in these four months, with precipitation that significantly exceeds the average (RAIN, +36 percent). Due to the joint effect of rainfall and temperature, the BIOMSS indicator rose 22 percent above average.

NDVI in the Southern Federal District (blue color in NDVI cluster figure) consistently exceeded the five-year average during this monitoring period, especially in February. The development of winter crops in this area is well advanced. In the Volga Federal District and northern Far Eastern Federal (green color), the NDVI was close to average till the middle of March, after which it increased. In parts of Central Federal District and North Caucasian Federal District (red color), the NDVI was lower than usual. In other parts of Russia, the NDVI was close to the recent average. In spite of possible frost damage in March (see also section 5.2), CropWatch assesses winter and spring conditions for Russia as favorable to its winter and spring crops.

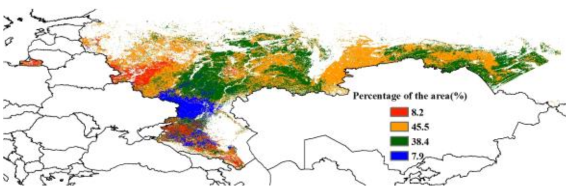
Figure 3.27. Russia crop condition, January-April 2016



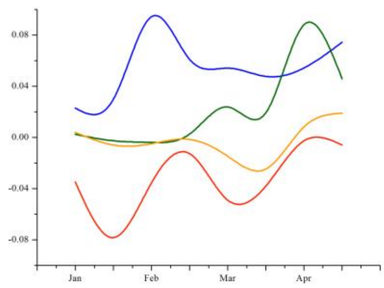
(a) Crop condition development graph based on NDVI



(b) Maximum VCI



(c) Spatial NDVI patterns compared to 5YA



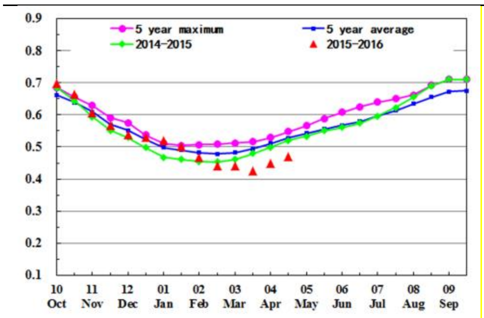
(d) NDVI profiles

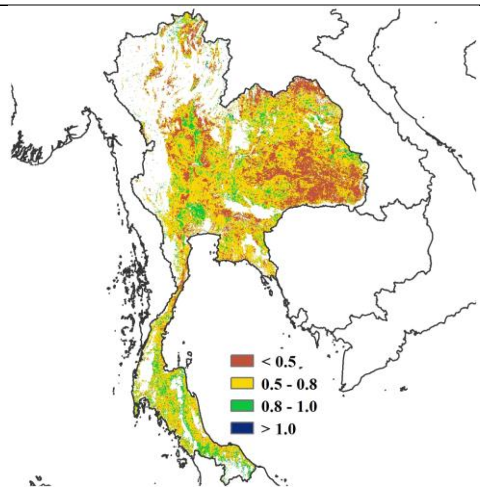
ARG AUS BGD BRA CAN DEU EGY ETH FRA GBR IDN IND IRN KAZ KHM MEX MMR NGA PAK PHL POL ROU RUS **THA** TUR UKR USA UZB VNM ZAF

[THA] Thailand

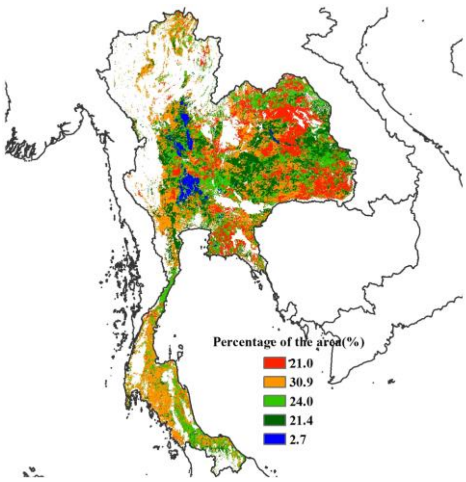
During the monitoring period, the harvest of the main rice crop was completed in January, while the second season rice has reached maturity and was ready to be harvested in April. Due to rainfall dropping below average by 54 percent, crops show below average conditions compared to the last five years, while also the biomass production potential fell 49 percent below that average. Although radiation was abnormally high (RADPAR, +8 percent), temperature remained close to average (TEMP, -0.1°C). The VCIx map shows that crop condition was poor in the northeast, one of the major agricultural areas in the country, with a VCIx value below 0.5. In the growing period of the second rice crop, i.e., from March to April, NDVI profiles also confirm that crop condition was mostly below average.

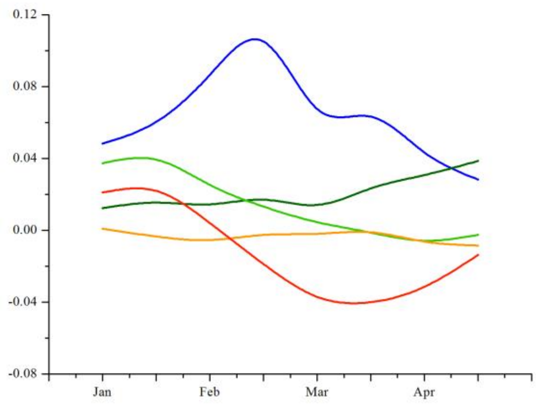
Figure 3.28. Thailand crop condition, January-April 2016





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





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

ARG AUS BGD BRA CAN DEU EGY ETH FRA GBR IDN IND IRN KAZ KHM MEX MMR NGA PAK PHL POL ROU RUS THA **TUR** UKR USA UZB VNM ZAF

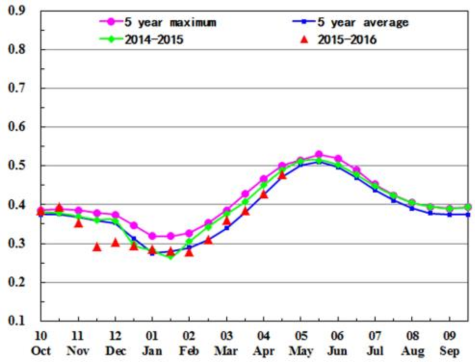
[TUR] Turkey

The crop condition from January to April 2016 was generally close to average in Turkey. Winter crops are grown during this period, and planting of summer crops started in April. Accumulated rainfall (RAIN, +13 percent), temperature (TEMP, +2°C), and radiation (RADPAR, +2 percent) were above average. The favorable agroclimatic conditions resulted in a positive departure of BIOMSS of 6 percent above average. The VCIx (0.66) was just above average condition, while the CALF decreased by 15 percentage points compared to the recent five-year average.

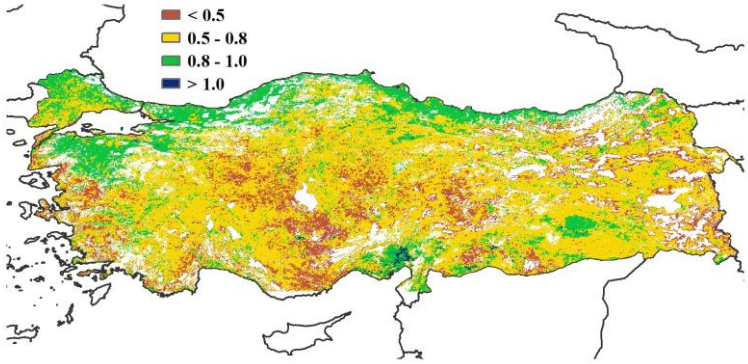
Also compared to the recent five-year average, most areas in the Marmara, Black Sea, and Mediterranean regions enjoyed favorable crop conditions during the monitoring period. Average conditions prevailed from February to April in the Aegean region and in the eastern and southeastern Anatolia region. Crops with poor crop condition were mainly distributed in most of the central Anatolia region and in the Gaziantep and Şanlıurfa provinces in southeastern Anatolia. The map of maximum VCI presents a pattern consistent with the NDVI cluster map.

Overall, the total outcome for the winter crop season is estimated to be average.

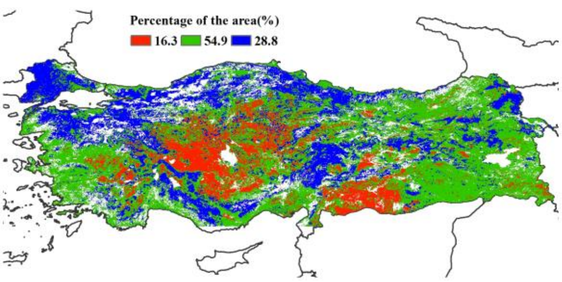
Figure 3.29. Turkey crop condition, January-April 2016



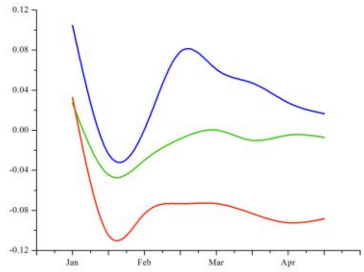
(a) Crop condition development graph based on NDVI



(b) Maximum VCI



(c) Spatial NDVI patterns compared to 5YA



(d) NDVI profiles

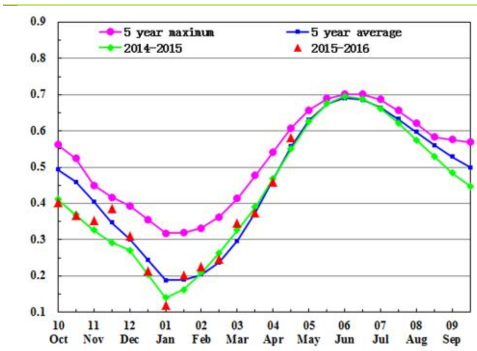
ARG AUS BGD BRA CAN DEU EGY ETH FRA GBR IDN IND IRN KAZ KHM MEX MMR NGA PAK PHL POL ROU RUS THA TUR **UKR** USA UZB VNM ZAF

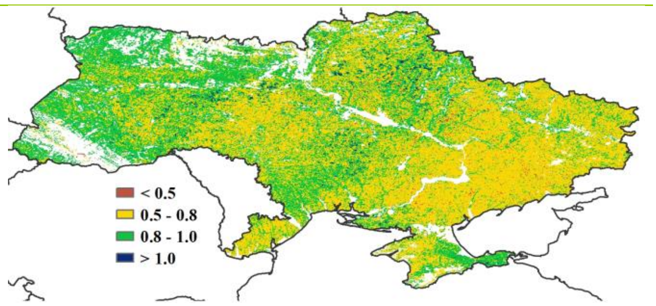
[UKR] Ukraine

The sowing of spring crops (maize, barley, and other cereals) has been started, while fully grown winter wheat and cereals are still in the field. Rainfall was above average (RAIN, +35 percent), while radiation decreased (RADPAR, -7 percent) and an increase of temperature (TEMP, +1.8°C) is seen. As illustrated in the section on the Central Europe to Western Russia MPZ (section 2.7), the increase in biomass potential (as described by BIOMSS) is large (>20 percent) in most parts of the country, while limited parts of eastern, western, and northern Ukraine had lower positive anomalies of 10-20 percent. Overall, most parts of the country enjoyed favorable conditions, and at the national level a biomass increase of 29 percent is expected. According to the national NDVI profile, crop condition in the country is close to the five-year average, while the maximum VCI index is also average at 0.77. According to the spatial NDVI patterns and compared to last five years, especially the northern, eastern, and southwestern parts of the country underwent favorable conditions.

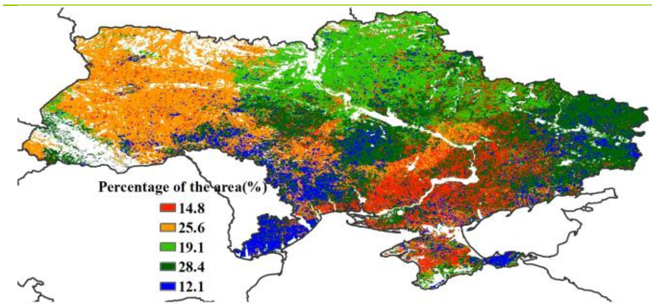
Unfavorable conditions at the time winter crops (mainly wheat) were planted, resulted in a drop of the cultivated area (CALF, -3 percent). This may eventually lead to a reduction in winter crop production. Spring cereal planting got underway in February, and areas are expected to increase from last year because of the additional area vacant after the condensed winter planting of cereal crops. Spring crop is above average and the current expectation is that their production will be above average.

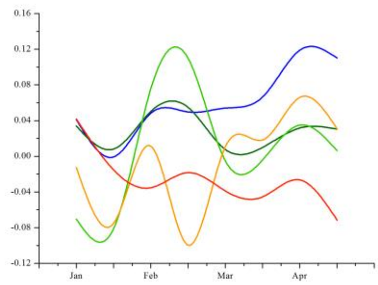
Figure 3.30. Ukraine crop condition, January-April 2016





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





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

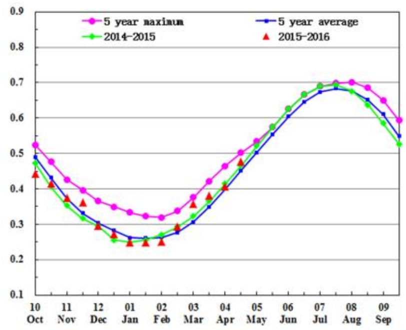
[USA] United States

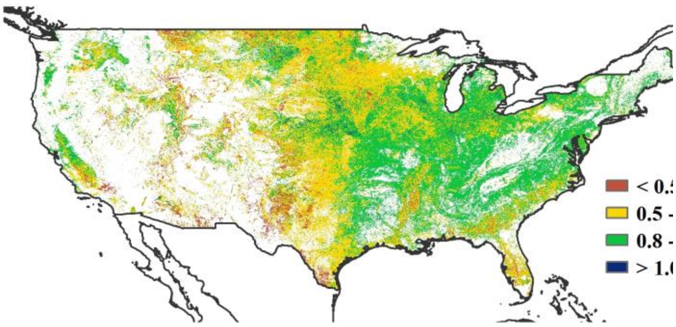
In general, crops in the United States were better than average during the monitoring period. This is the key growing season of winter wheat and sowing season of summer crops. The agroclimatic environmental variables include above average rainfall (RAIN, +14 percent) and temperature (1.2°C), as well as below average radiation (RADPAR, -2 percent).

Almost all main winter wheat production states of the country enjoyed good agroclimatic condition with above average rainfall and temperature: Kansas (RAIN, +7 percent, +1.7°C), Oklahoma (+33 percent, +0.9°C), Texas (+42 percent, +0.3°C), Washington(+24 percent, +1.8°C), California(+16 percent, +1.4°C), and Montana (+116 percent, +3.1°C). The recent grip of drought appears to have receded. The spatial distribution of NDVI profiles indicate that 90.8 percent of crop areas had average NDVI or positive departure before mid-March, while only 9.8 percent of the agricultural areas (north Texas, Oklahoma, and Kansas) were showing slightly negative NDVI departure. As mentioned in the section on disasters (section 5.2), torrential rain occurred in Texas and neighboring areas. With the exception of Illinois (RAIN, -21 percent), Missouri (-6 percent), and Indiana (-5 percent), most of the Corn Belt recorded average or above average rainfall, including Iowa (RAIN, +6 percent), Ohio (+5 percent), Wisconsin (+13 percent), Minnesota (+49 percent), Nebraska (+37 percent), and North Dakota (+113 percent). Abundant rainfall was favorable for summer crops sowing and their early growth stages.

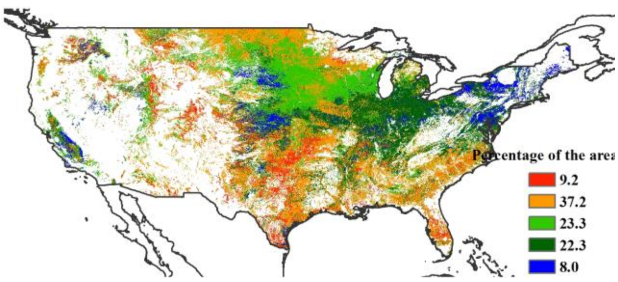
Although agronomic indicators show average CALF (no change compared to the five-year average), the U.S. wheat planted area is still 5.6 percentage points below 2015. The biomass production potential (BIOMSS) was 19 percent above average, and CropWatch forecasts an average winter wheat yield for the United States in 2016, with a yield increase of 1.6 percent compared to the previous year. Altogether, CropWatch puts the country’s wheat production at 54.3 million tons, 4 percent below 2015 output. If the favorable weather continues, final yield is expected to be higher than this forecast. See also table B.3 in Annex B.

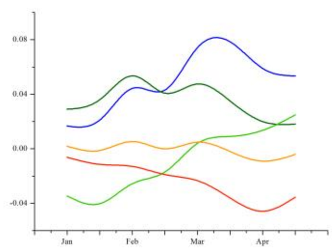
Figure 3.31. United States crop condition, January-April 2016





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





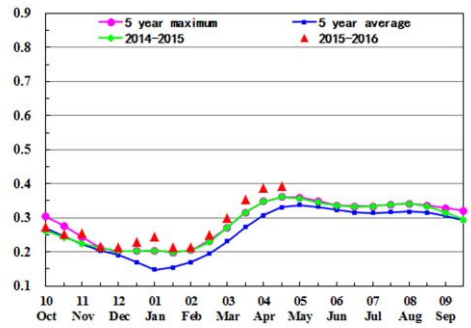
(c) Spatial NDVI patterns compared to 5YA (d) NDVI profiles

[UZB] Uzbekistan

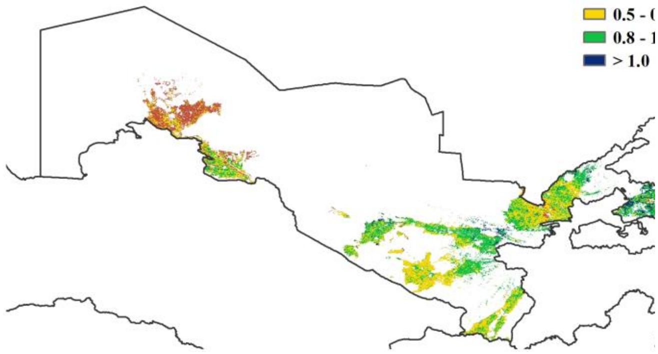
This analysis covers the growing stage of winter cereals and the sowing stage of coarse grains, including maize. Crop condition was generally favorable due to average weather (RAIN, +2 percent; TEMP, a significant +2°C; and RADPAR, -2 percent), which resulted in an equally moderate BIOMASS increase over the recent five-year average of 4 percent.

In contrast, the national NDVI development graph shows rather favorable conditions that, starting in December 2015, exceed the last five year's maximum values. The values of VCIx were average or above average in crop planting areas, except for cotton (an irrigated summer crop) growing in Karakalpakstan. NDVI cluster graphs and profiles show a favorable picture in most parts of the country during the whole period, except for 16 percent of arable cropland distributed in central and south areas (Gulistan, Bukhara, Nawoiy, Kashkadarya, Kagan, Qarshi, and Termez). Current condition and prospects are favorable for the country's food producing areas.

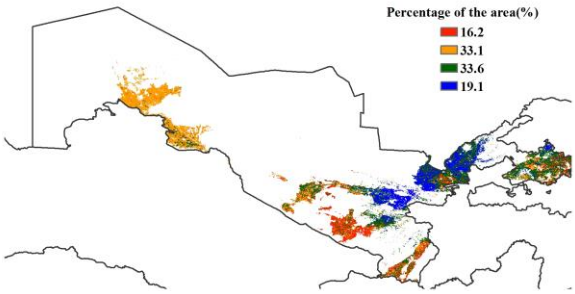
Figure 3.32. Uzbekistan crop condition, January-April 2016



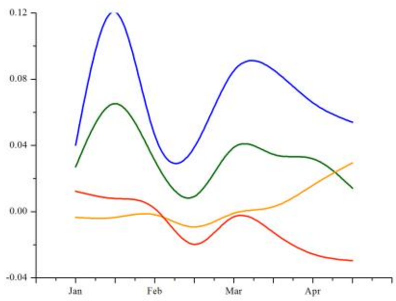
(a) Crop condition development graph based on NDVI



(b) Maximum VCI



(c) Spatial NDVI patterns compared to 5YA



(d) NDVI profiles

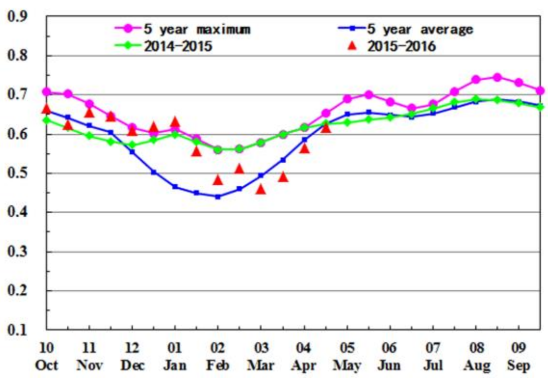
[VNM] Vietnam

The period from January to April covers the growing period of spring rice in Vietnam. Most of the rice cultivation regions are distributed in the northern Red River delta in the Mekong delta in the south. The fraction of cropped arable land (CALF) decreased 1 percentage point compared with the average of the previous five years. Average vegetation condition indices (maximum VCI) were moderate (0.73).

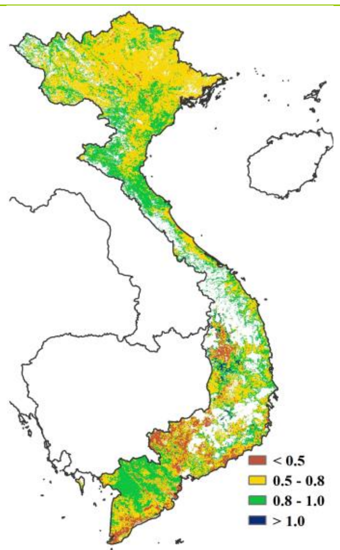
CropWatch agroclimatic indicators show above average rainfall (RAIN, +28 percent), a slight increase in radiation (RADPAR, +4 percent), with average temperature (TEMP, -0.5°C), which lead to a minor increase of biomass (BIOMSS, +2 percent). Rainfall profiles (see section 2.5) show that the positive rainfall anomaly in Vietnam is due to abundant precipitation in the northern part of the country in April; during other periods rainfall was average. The pattern explains the sharp increase of NDVI profiles over northeastern Vietnam at the end of the reporting period.

For 2016, the crop condition development graphs (average annual NDVI) tend to fluctuate around the average of the recent five years, never reaching 2014-15 values or the maximum of the last five years. Considering a drop in CALF and the fact that the Mekong Delta is fed by water supplied by rainfall in distant locations (including Yunnan and El Niño affected southeast Asia), crop condition for the country is assessed as not exceeding average.

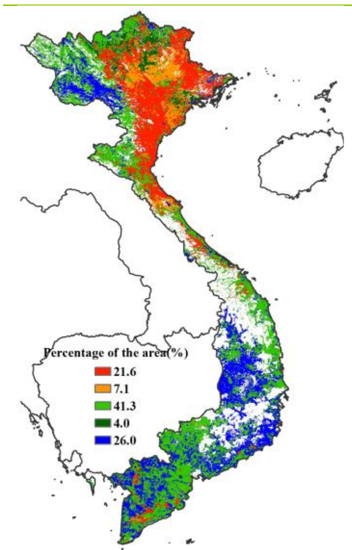
Figure 3.33. Vietnam crop condition, January-April 2016



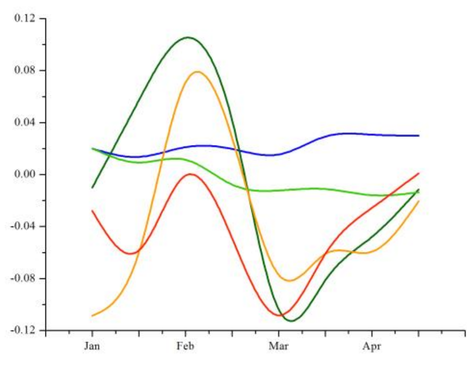
(a) Crop condition development graph based on NDVI



(b) Maximum VCI



(c) Spatial NDVI patterns compared to 5YA



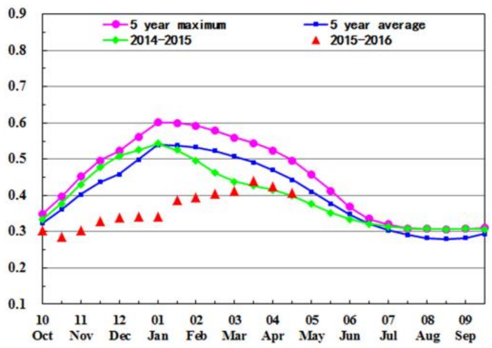
(d) NDVI profiles

ARG AUS BGD BRA CAN DEU EGY ETH FRA GBR IDN IND IRN KAZ KHM MEX MMR NGA PAK PHL POL ROU RUS THA TUR UKR USA UZB VNM **ZAF**

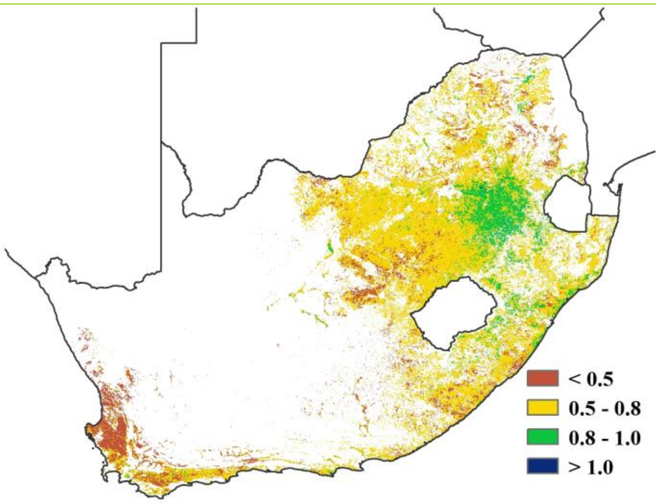
[ZAF] South Africa

The first quarter of the year includes the harvest of summer crops (maize, soybean) in the east (up to June) and somewhat later in the west (June-July). The CropWatch agroclimatic indicators concur to describe the current season as generally very poor. Overall rainfall was 7 percent below average, accompanied by a slightly above average temperature (+0.6°C) and sunshine (RADPAR, +3 percent), all resulting in a biomass production potential deficit of 8 percent. The dry period started in the first half of the growing season during the last quarter of 2015, when the rainfall deficit was 26 percent compared to average. CALF decreased significantly below the average of the last five years (-20 percentage points), while average VCIx is fair at 0.63. The highest VCIx values occur as a homogeneous patch in Mpumalanga province, but this is not confirmed by other indicators. NDVI profiles show that the worst conditions occurred in the Free State province, especially for maize, while the North West province generally did better, also thanks to the later phenology. Only the Mediterranean climate area in western Cape, where the season is about to start, received slightly above average rainfall (+2 percent) accompanied by more significantly below average sunshine (-6 percent). The production outlook in chapter 5.1 puts the maize output for the current season 32 percent below last year's output, which describes a very poor 2016 season.

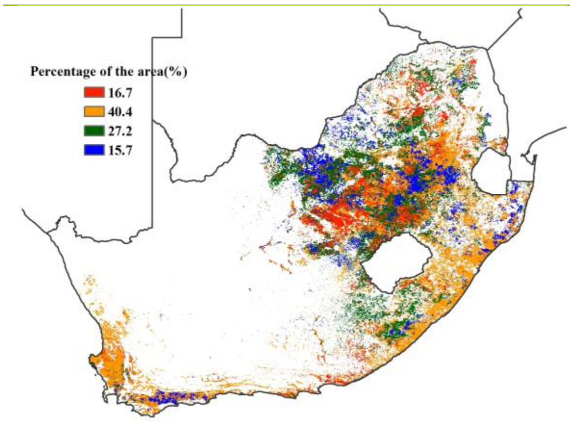
Figure 3.34. South Africa crop condition, January-April 2016



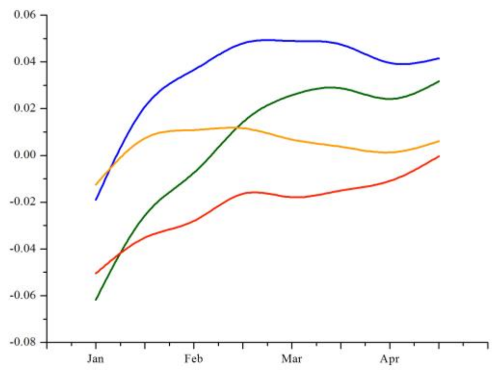
(a) Crop condition development graph based on NDVI



(b) Maximum VCI



(c) Spatial NDVI patterns compared to 5YA



(d) NDVI profiles

Chapter 4.China

Chapter 4 presents a detailed analysis for China, focusing on the seven most productive agro-ecological regions of the east and south. After a brief overview of the agroclimatic and agronomic conditions over the monitoring period (section 4.1), section 4.2 presents CropWatch estimates for 2016 winter crop production in China. Section 4.3 reports on ongoing pest and diseases monitoring. Individual regions are analyzed in section 4.4. Additional information on the agroclimatic indicators for agriculturally important Chinese provinces is listed in table A.11 in Annex A.

4.1 Overview

With the exception of rainfall, the CropWatch agroclimatic indicators for China were generally close to average over the first quarter of 2016. RAIN was 55 percent above average, while RADPAR was 5 percent below, and TEMP was close to the average level. The biomass production potential (BIOMSS) increased by 39 percent mainly resulting from abundant rainfall.

Table 4.1 provides an overview of the agroclimatic and agronomic indicators for selected provinces. Temperature fluctuated widely, but RAIN was consistently above average in all regions and provinces, especially in Inner Mongolia (163 percent), Southern China (99 percent), Northeast China (84 percent), and the Loess region (61 percent). In all provinces except Jiangsu, rainfall was above average, with rainfall more than 80 percent above average in Inner Mongolia, Fujian, Guangdong, Guangxi, Jilin, Liaoning, and Shanxi provinces. TEMP was below average in Southern China (-1.1°C) and Southwest China (-0.3°C), and particularly so in the southern islands of Taiwan (-1.5°C) and Gansu province (-1.2°C). PAR (RADPAR) was below average, except for Inner Mongolia (+1 percent), Huanghuaihai (+1 percent), and Northeast China (0 percent), as well as Guangdong, Gansu, and Guangxi, where the departure exceeded 10 percent. The abundant rainfall resulted in BIOMSS values exceeding the recent five-year average by more than 50 percent in Inner Mongolia and Southern China.

Figures 4.1 to 4.5 illustrate the spatial distribution of rainfall (figure 4.1) and temperature profiles (figure 4.2), the maps of cropped and uncropped arable land (figure 4.3), maximum VCI (figure 4.4), and VHI minimum (figure 4.5). Both high and low maximum VCI values are scattered in almost all provinces, with high values mainly located in Northeast China, Inner Mongolia, and Southwest China, and low values (below 0.5) in the east of Sichuan, Yunnan, and Henan province, indicating unfavorable crop condition in these areas. The clusters and corresponding profiles of rainfall and temperature indicate that the two agroclimatic indicators markedly fluctuated during the monitoring period; temperature was below average across China in mid-February. During the growing season of winter wheat, adequate rainfall in the major production provinces benefited winter crops, but wheat yield is likely to result in a lower yield due to abnormal low temperature than during the previous year. Normal rainfall in the Northeast region resulted in average soil moisture, which is conducive to the sowing and emergence of spring wheat, soybean, and maize.

Overall, the cropped arable land fraction (CALF) was 3 percentage points above the five-year average for China. Because of relatively low temperatures, most of the uncropped land is found in the Northeast and Northwest China regions, as well as in Inner Mongolia. The sowing of spring crops has been underway since late April. The CALF of the Loess region, Southern China, Southwest China, and Huanghuaihai regions was above average (increases of 3, 2,4, and 1percentage points, respectively), while it was below average in the Lower Yangtze region (-5 percentage points), indicating a decrease in the cropped area for this period. Minimum VHI indicates that east of Sichuan, the northwest of Henan, the Southwest of Shandong, and central Jiangsu province all experienced mild water stress, while in other regions water was sufficient for crop growth and planting. However, abundant rainfall also resulted in flooding at local scales in southern China.

Table 4.1. CropWatch agroclimatic and agronomic indicators for China, January-April 2016, departure from 5YA and 15YA

Region	Agroclimatic indicators			Agronomic indicators		
	Departure from 15YA (2001-15)			Departure from 5YA (2011-15)		Current
	RAIN (%)	TEMP (°C)	RADPAR (%)	BIOMSS (%)	CALF (%)	Maximum VCI
Huanghuaihai	23	0.5	1	35	1	0.72
Inner Mongolia	163	0.0	1	99	/	0.88
Loess region	61	0.0	-1	44	3	0.85
Lower Yangtze	47	-0.1	-8	24	-5	0.80
Northeast China	84	0.6	0	72	/	0.67
Southern China	99	-1.1	-8	53	2	0.84
Southwest China	36	-0.3	-8	30	4	0.66

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 fifteen-year average (15YA) for the same period (January-April).

Figure 4.1. China spatial distribution of rainfall profiles, January-April 2016

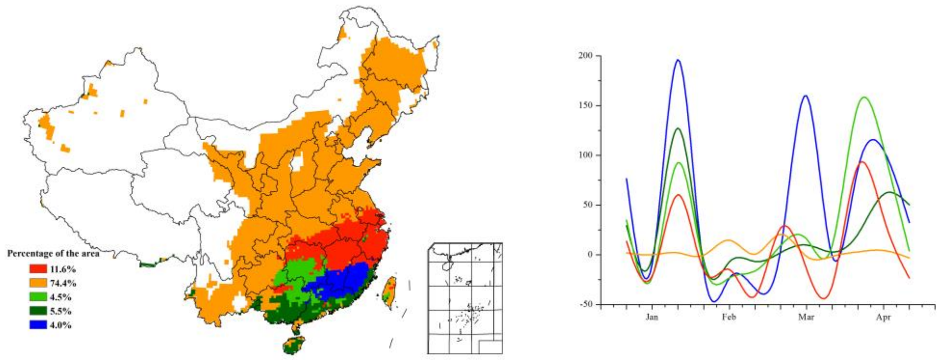


Figure 4.2. China spatial distribution of temperature profiles, January-April 2016

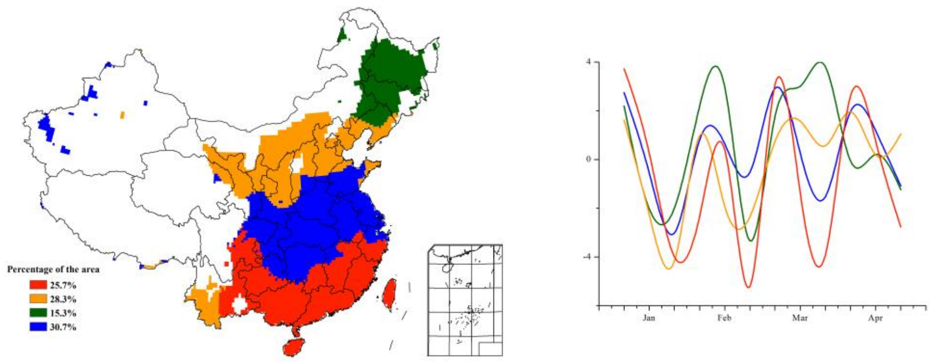


Figure 4.3. China cropped and uncropped arable land, by pixel, January-April2016

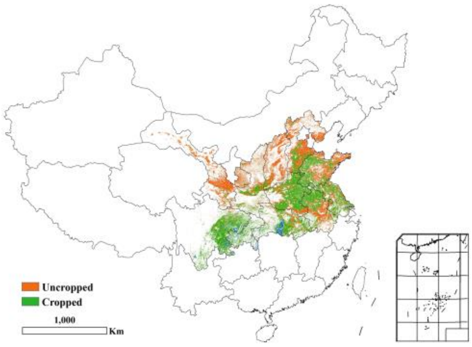


Figure 4.4. China maximum Vegetation Condition Index (VCIx), by pixel, January-April 2016

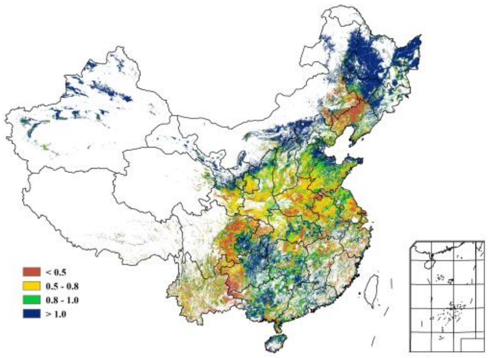
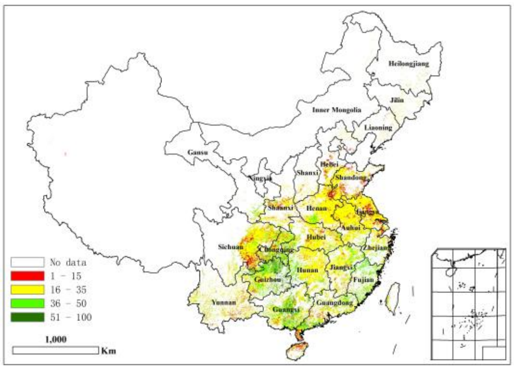


Figure 4.5. China minimum Vegetation Health Index (VHI), by pixel, January-April 2016



4.2 Winter crop production

In China, wheat represents the main output for winter crops; over the past ten years, it has accounted for 91 percent of the output.

This season, unfavorable conditions during the wintering period have exerted a negative influence on the prospects for winter wheat: production is expected to reach 111.2 million tons, a decrease of 2.3 million tons or 2.0 percent compared to 2015's bumper crop (table 4.3). Only three of the eleven major winter wheat producing provinces—Jiangsu, Anhui, and Shaanxi—show increased production compared to the previous year. A combination of increases in both yield and planted area resulted in higher production in Jiangsu and Anhui. The most significant increase in planted area (4.0 percentage points) was observed in Shaanxi, but the gain was reversed by a 2.6 percent decrease in yield. In Shandong and Henan—the top two winter wheat producing provinces—production drops are expected to reach 4.4 percent and 3.2 percent, due to a 3.3 percent decrease in wheat planted area in Shandong and a 3.8 percent decrease in yield in Henan. Decreased production was also observed in Hebei, Shanxi, Jiangsu, Chongqing, Sichuan, and Gansu.

Following in part from the drop in wheat production, for 2016, CropWatch puts the total winter crop production forecasts at 121.8 million tons, 2.9 percent below the previous year's production (table 4.2). Both yield and planted area contributed to the decreased production. The total area under winter crops dropped by 1.8 percent due to a change in the government policy (June 2015) for the minimum rapeseed purchase price[6], leading farmers to switch from rapeseed to winter wheat or even keep the land fallow during winter. The most significant drop of winter crop area occurred in Jiangsu (-8.6 percentage points), where the combined production of all winter crops nevertheless increased in spite of the lower planted area because of the high yield of wheat compared with rapeseed. The planted area of winter crops also decreased more than 2 percent compared to 2015 in Shandong, Chongqing, and Shaanxi. Decreased yield resulted from unfavorable climatic conditions, especially in Central China (see figure 4.4). With the exception of Jiangsu and Anhui (which was also one of two provinces, together with Hubei, where production increased), all other provinces recorded reduced yield due to continuous rainy weather, which interferes with yield formation and ripening.

During early May, most winter wheat was between heading and grain-filling stage. Even if the agroclimatic conditions remain average until harvest, the production of winter crops in China will be below the 2015 record.

Table 4.2. China, 2016 winter crops production (thousand tons) and percentage difference with 2015, by province

	2015 (thousand ton)	2016			
		Area change (%)	Yield change (%)	Production change (%)	Production (thousand ton)
Hebei	10989	-1.2	-1.4	-2.6	10700
Shanxi	2184	2.2	-2.2	0.0	2184
Jiangsu	10050	-8.6	8.5	-0.8	9971
Anhui	11764	0.8	1.6	2.4	12044
Shandong	23062	-3.3	-0.2	-3.5	22252
Henan	26139	0.6	-3.8	-3.2	25305
Hubei	5865	0.6	-0.4	0.2	5875
Chongqing	2323	-2.4	-0.8	-3.2	2249
Sichuan	5626	-1.0	-0.5	-1.5	5541
Shaanxi	4395	-5.4	-1.8	-7.1	4085
Gansu	3067	-1.0	-3.0	-3.9	2947
Sub total	105465	-	-	-2.2	103153
Other provinces	19921	-	-	-6.6	18613
National total*	**125386**	**-1.8**	**-1.1**	**-2.9**	**121766**

Note: * National total production does not include Taiwan province.

Table 4.3. China, 2016 winter wheat area, yield, and production and percentage difference with 2015, by province

	Area (kha)			Yield (kg/ha)			Production (thousand ton)		
	2015	2016	Δ(%)	2015	2016	Δ(%)	2015	2016	Δ(%)
Hebei	2035	2048	0.7	5315	5228	-1.7	10815	10706	-1.0
Shanxi	509	520	2.2	4146	4038	-2.6	2109	2099	-0.5
Jiangsu	2036	2057	1.0	4709	4730	0.5	9586	9729	1.5
Anhui	2605	2624	0.7	4256	4322	1.6	11088	11340	2.3
Shandong	4217	4076	-3.3	5430	5371	-1.1	22898	21893	-4.4
Henan	4961	4991	0.6	5239	5041	-3.8	25992	25160	-3.2
Hubei	1043	1047	0.4	4152	4137	-0.4	4328	4330	0.0
Chongqing	356	357	0.5	3144	3107	-1.2	1118	1110	-0.7
Sichuan	1272	1299	2.1	3673	3577	-2.6	4673	4646	-0.6
Shaanxi	1016	1056	4.0	3901	3798	-2.6	3962	4011	1.2
Gansu	392	387	-1.4	4075	3879	-4.8	1599	1500	-6.2
Sub total	20442	20462	0.1	-	-	-	98170	96525	-1.7

[6] The government has ended the policy that guaranteed farmers a minimum rapeseed purchase price, letting the price be established by the market. In areas where the price dropped below the former minimum purchase price, farmers have decided not to plant rapeseed.

	Area (kha)			Yield (kg/ha)			Production (thousand ton)		
	2015	2016	Δ(%)	2015	2016	Δ(%)	2015	2016	Δ(%)
Other provinces	3253	3210	-2.7	-	-	-	15332	14690	-4.2
National total*	**23694**	**23672**	**-0.1**	**4790**	**4698**	**-1.9**	**113502**	**111214**	**-2.0**

Note: * National total production does not include Taiwan province.

4.3 Pest and diseases monitoring

Winter wheat progressed well during May 2016 in the main production regions of China, especially in Hebei, Shandong, Henan, Anhui, and Jiangsu provinces. In the middle of April and early May, the temperature of the main wheat region was0.5-1°C higher than during past years, especially in the northern Huanghuaihai, southern North China, and most of Southwest China. Favorable temperature and above average rainfall have created conditions conducive to aphid reproduction, powdery mildew development, and sheath blight dispersal in the eastern southwest China, Huanghuaihai, and the middle and lower reaches of the Yangtze River.

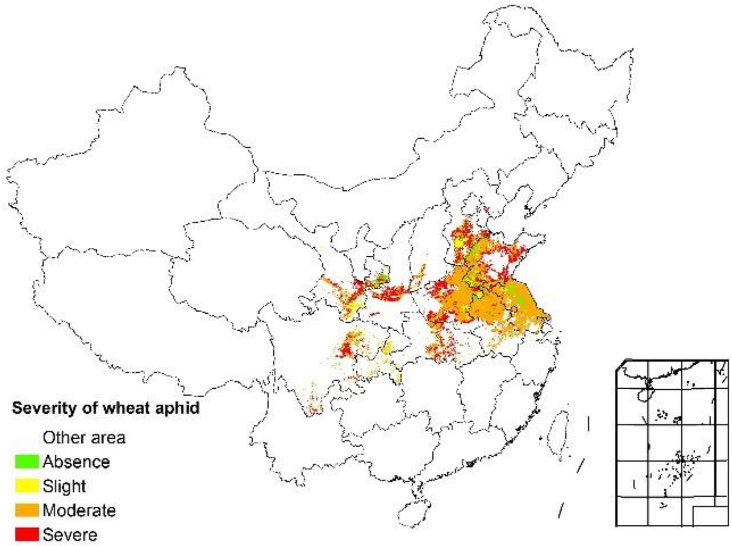
Aphids

The total wheat area affected by aphids has reached 16 million hectares (ha), mostly in Huanghuaihai, the middle and lower reaches of the Yangtze River, and eastern and southern Southwest China (table 4.4. and figure 4.6). Most damage, some of which severe occurred in 14 million ha spread over eastern Sichuan, southern Gansu, central Shaanxi, central Hubei, and most of Henan, Shandong, Anhui and Jiangsu. 16 percent of areas are severely affected, as high as 35 percent in the Loess region.

Table 4.4. Statistics of aphids in China, May 2016

Region	Area (thousand hectares)					
	Absence	Slight	Moderate	Severe	Total	Occurrence ratio %
Huanghuaihai	3964.8	1888.3	6481.7	2138.8	14473.6	72.6
Loess region	1177.2	257.4	326.1	947.4	2708.1	56.5
Lower Yangtze	1288.2	128.9	2989.7	400.1	4806.9	73.2
Southwest China	385.9	208.2	252.1	308.1	1154.3	66.6

Figure 4.6. Distribution of winter wheat aphid in China, May 2016



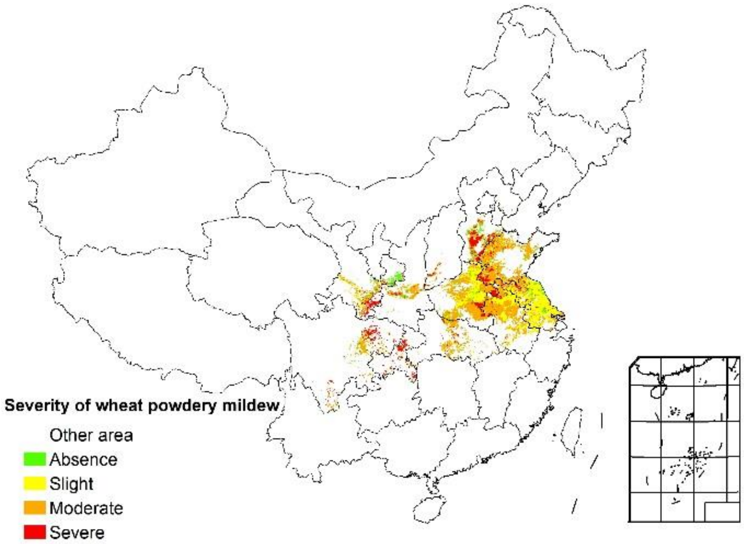
Powdery mildew

Powdery mildew (table 4.5 and figure 4.7) damaged around 8 million ha of wheat across China, with the disease mostly found along the middle and lower reaches of the Yangtze River and most of Huanghuaihai. The most severely affected areas include central Anhui, most of Henan, southern Jiangsu, central Hubei, and southern Gansu. For these provinces, the total damaged area is about 6.7 million ha. In total, 9 percent of cropped areas are severely affected, with little difference between regions.

Table 4.5. Statistics of powdery mildew in China (May 2016)

Region	Area (thousand hectares)					
	Absence	Slight	Moderate	Severe	Total	Occurrence ratio %
Huanghuaihai	8808.4	1772.2	2270.0	1623.0	14473.6	39.1
Loess region	2362.1	117.7	155.8	72.5	2708.1	12.7
Lower Yangtze	3009.7	865.9	669.9	261.4	4806.9	37.4
Southwest China	928.5	104.4	88.0	33.3	1154.3	19.6

Figure 4.7. Distribution of wheat powdery mildew in China, May 2016



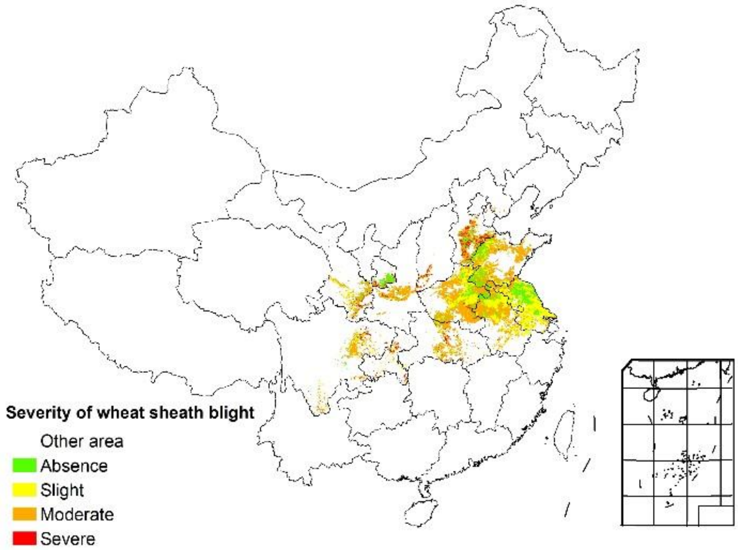
Winter wheat sheath blight

Finally, about 6.1 million ha in China were infected by winter wheat sheath blight (table 4.6 and figure 4.8), with the disease widespread in most regions of Huanghuaihai. The most severe impact was observed in northern Anhui, most of Henan, southern Jiangsu, central Hubei, and southern Shaanxi, where the total damaged area reached 4.8 million ha. Altogether, 3 percent of the areas were severely affected, more so (6 percent) in both the Loess region and in South-west China.

Table 4.6. Statistics of wheat sheath blight in China, May 2016

Region	Area (thousand hectares)					
	Absence	**Slight**	**Moderate**	**Severe**	**Total**	**Occurrence ratio %**
Huanghuaihai	10273.2	1704.8	2063.8	431.8	14473.6	29.0
Loess region	2101.5	112.7	328.6	165.2	2708.1	22.4
Lower Yangtze	3778.2	527.6	422.0	79.1	4806.9	21.4
Southwest China	844.3	63.7	174.9	71.4	1154.3	26.9

Figure 4.8. Distribution of wheat sheath blight in China, May 2016



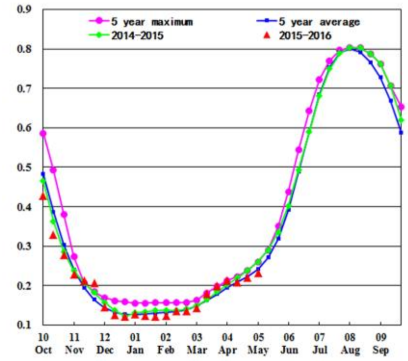
4.4 Regional analysis

Figures 4.9 through 4.16 present crop condition information for each of China's seven agricultural regions. The provided information is as follows: (a) Crop condition development graph based on NDVI, comparing the current season up to April 2016 to the previous season, to the five-year average (5YA), the five-year maximum; (b) Spatial NDVI patterns from January to April 2016 (compared to the (5YA); (c) NDVI profiles associated with the spatial patterns under (b); (d) maximum VCI (over arable land mask); and (e) biomass for January to April 2016. Additional information about agroclimatic indicators and BIOMSS for China is provided in Annex A, table A.11.

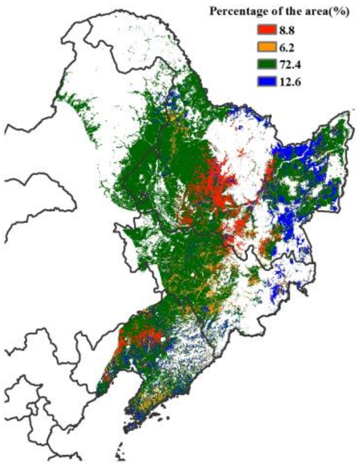
Northeast region

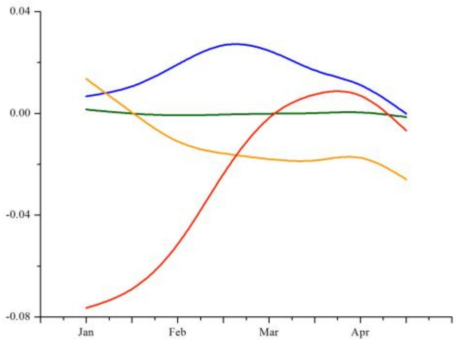
Agro-climatic conditions were favorable during the period from January to April, which covers the sowing period of crops in northeast China. CropWatch agroclimatic indicators show markedly above average rainfall (RAIN is over 70 percent above average in three provinces), average radiation, and generally average temperature. The favorable agro-climatic conditions resulted in 70 percent above average biomass potential in the region. According to a field visit to the plain by CropWatch, the crop has just been sowed. So far, crop condition is favorable.

Figure 4.9. Crop condition China Northeast region, January-April 2016

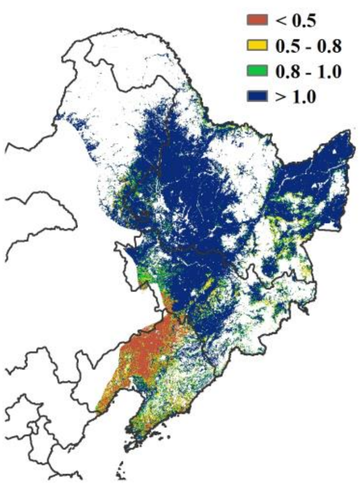


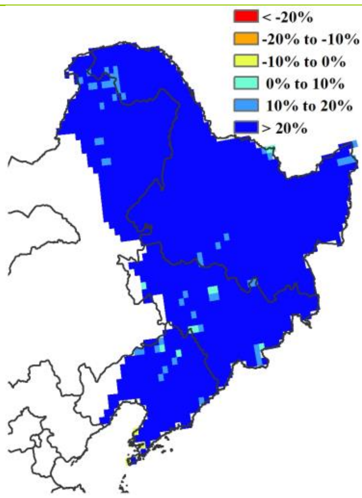
(a) Crop condition development graph based on NDVI





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



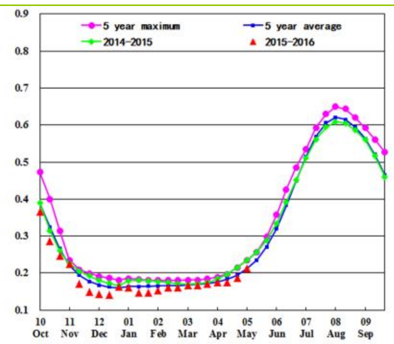


(d) Maximum VCI (e) Biomass

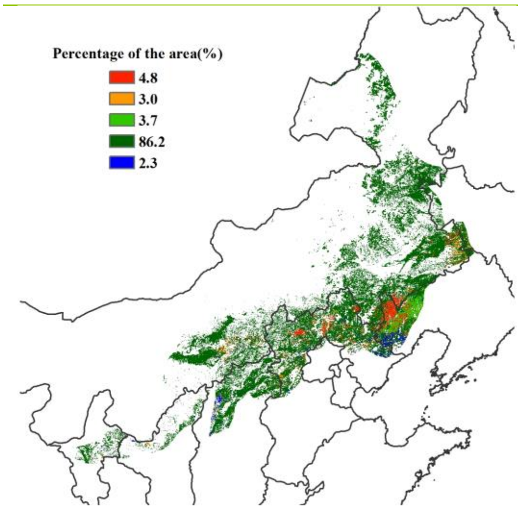
Inner Mongolia

No crops were cultivated in this region over the reporting period due to the seasonally low temperatures. Only from late April, along with gradually increasing temperatures, did crops started to get sowed. Considering the first four months of this year, rainfall indices were well above average (RAIN +163 percent) and PAR accumulation was about average, with both resulting in a large potential biomass increase of 99 percent and record VCIx in most areas. If favorable conditions continue in the future and over the entire crop cycle, the outcome may be an exceptionally good season.

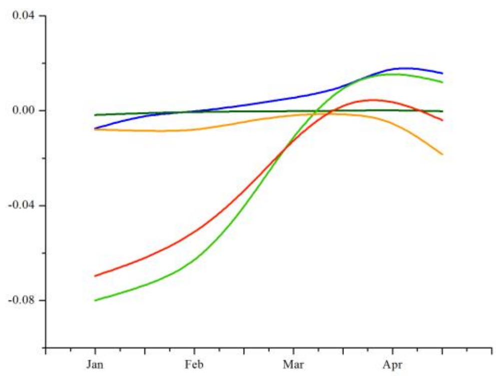
Figure 4.10. Crop condition China Inner Mongolia, January-April 2016



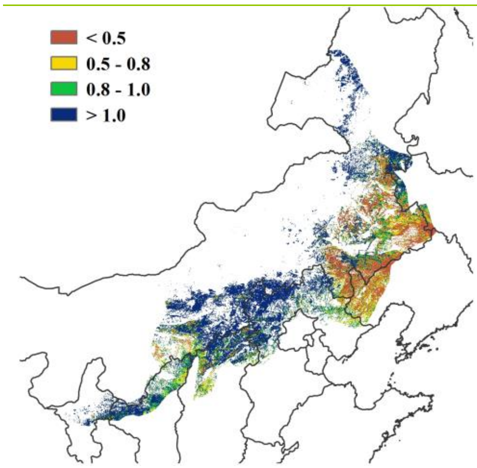
(a) Crop condition development graph based on NDVI



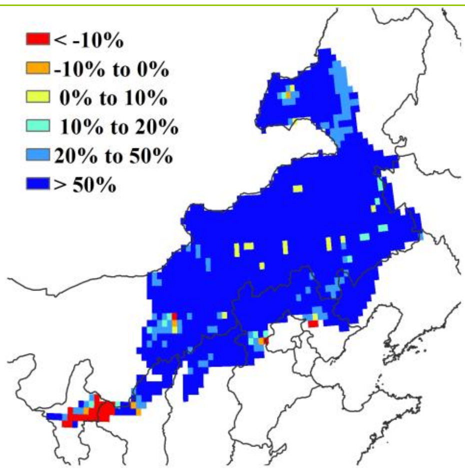
(b) Spatial NDVI patterns compared to 5YA



(c) NDVI profiles



(d) Maximum VCI

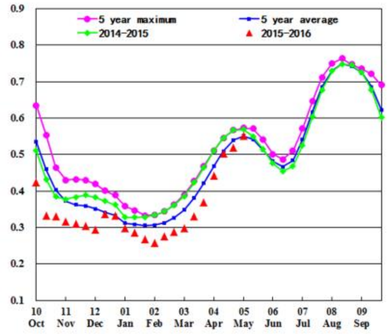


(e) Biomass

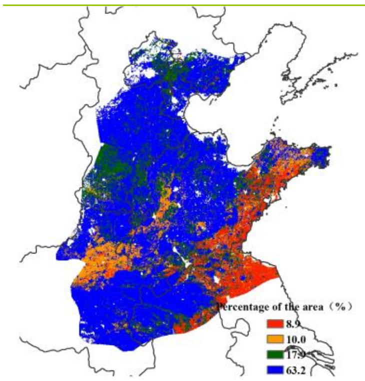
Huanghuaihai

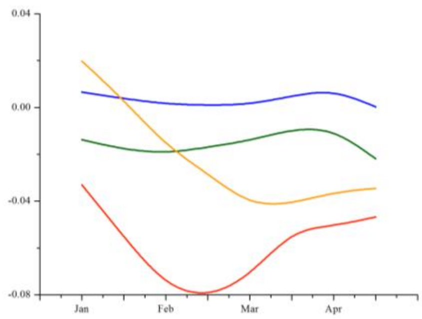
In Huanghuaihai, the main crop—winter wheat—will be harvested in two months. As shown by the NDVI development graph, crop condition was generally below the five-year average during the monitoring period and worse than the previous year. The overall situation, however, appears to be average in most of the region, as shown by the spatial NDVI patterns; crop condition was below average in northern Tianjin, southern Hebei, eastern Shandong, and northern Jiangsu. Besides, parts of Henan and Shandong were above average in January but deteriorated in February. Satisfactory crop condition can be also inferred from the prevailing agroclimatic conditions in Huanghuaihai: 23 percent above average rainfall, 0.5°C above average temperature, and 1 percent above average PAR, resulting in a large improvement in the biomass production potential (35 percent). The maximum VCI presents high values in eastern Hebei and northern Shandong, while low values occur in central and eastern Henan. Overall, favorable climatic conditions will greatly benefit the development of winter wheat and the sowing of the next season crop.

Figure 4.11. Crop condition China Huanghuaihai, January-April 2016



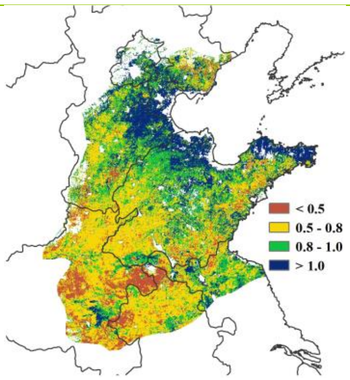
(a) Crop condition development graph based on NDVI

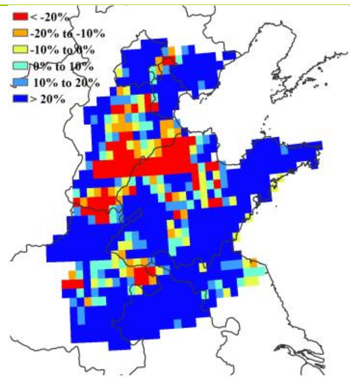




(b) Spatial NDVI patterns compared to 5YA

(c) NDVI profiles





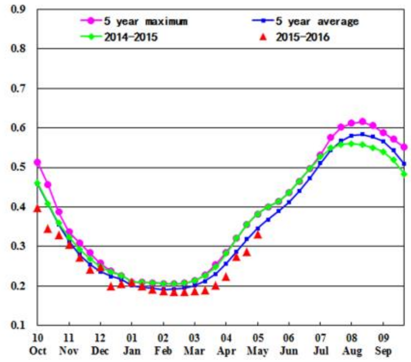
(d) Maximum VCI

(e) Biomass

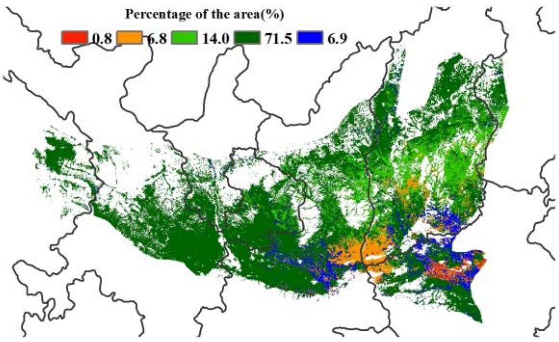
Loess region

The average NDVI profile indicates that crop condition in the Loess region is not as good as last year's and also below the five-year average. The main crops are spring wheat and winter wheat. Winter wheat was sowed in October and will be harvested in early June. During the monitoring period, rainfall exceeded average by 61 percent and temperature was average. Radiation dropped by 1 percent, in line with the excess precipitation. The additional detail provided by the NDVI clusters and profiles shows that crop condition was close to average in most parts of the region until early April. However, at the end of the monitoring period, crop condition was worse than the average, especially in the northwest of Henan province. The fraction of cropped arable land (CALF) increased 3 percentage points when compared with the five-year average, which indicates more land is cropped. The potential biomass indicator was 44 percent above average, especially in the north of Shanxi and central Shaanxi province. Crop condition in the region is generally good, except in the southeast.

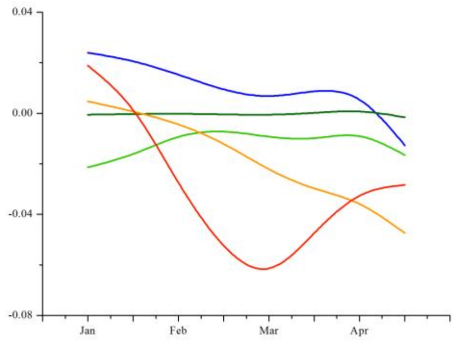
Figure 4.12. Crop condition China Loess region, January-April 2016



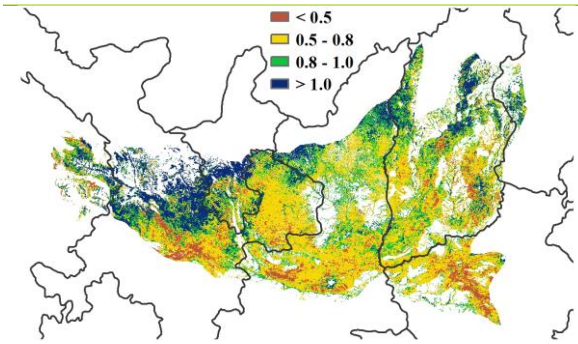
(a) Crop condition development graph based on NDVI



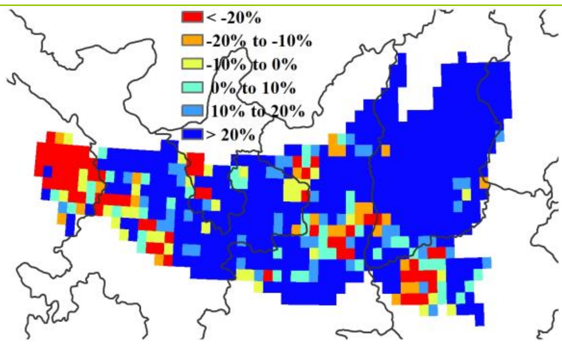
(b) Spatial NDVI patterns compared to 5YA



(c) NDVI profiles



(d) Maximum VCI

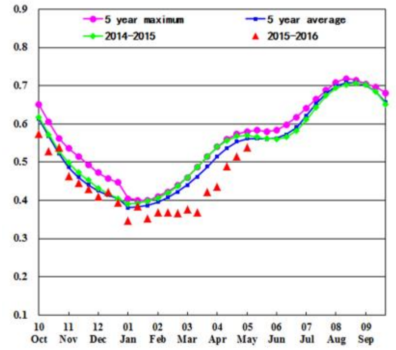


(e) Biomass

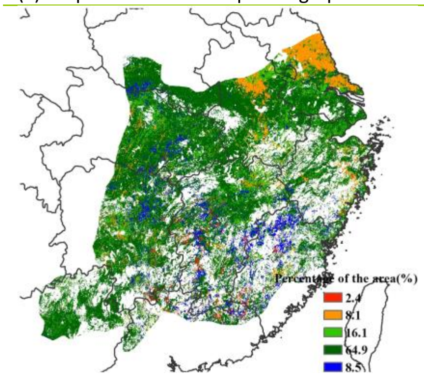
Lower Yangtze region

In the northern part of the region, winter wheat is currently close to its flowering stage, while in the south early rice is at transplanting stage. Rapeseed in the region is being harvested since early April. Overall, crop condition has been significantly below the recent five-year average from January to April, according to the crop condition development graph based on NDVI. Fortunately, the condition improved and is currently closer to average. The CropWatch agroclimatic indicators show that rain exceeded average by 47 percent, whereas temperature was close to average (-0.1°C). Excess rainfall is paralleled by below average radiation (RADPAR, -8 percent). The cropped arable land fraction was below average (-5 percentage points).The average VCIx value for the region is high (0.88), due to values exceeding 1 (which is the best condition ever during at least one dekad) in the west, especially southwest, but many areas in the north and east display low values, which are more significant than high ones. This is only partly corroborated by the other indicators: The spatial patterns and NDVI departure profiles displayed that about 24 percent of crops were continuously below average, although 65 percent of crops were close to or slightly above average. Overall, crop production in the Lower Yangtze region is expected to be average or below average.

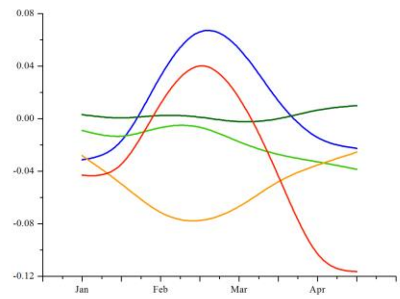
Figure 4.13. Crop condition Lower Yangtze region, January-April 2016



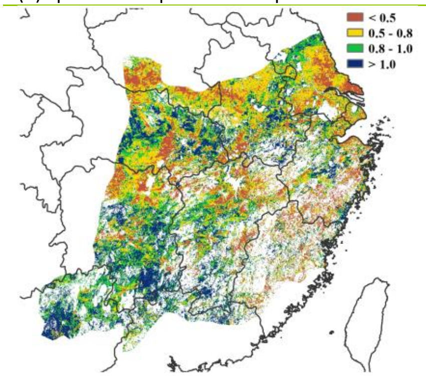
(a) Crop condition development graph based on NDVI



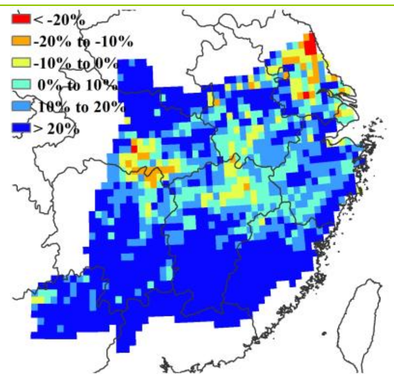
(b) Spatial NDVI patterns compared to 5YA



(c) NDVI profiles



(d) Maximum VCI



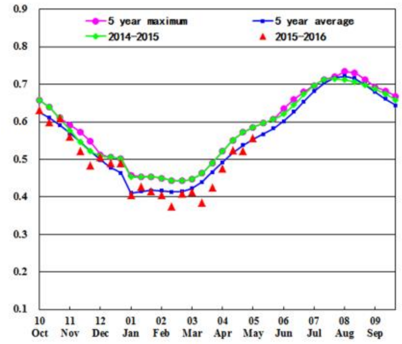
(e) Biomass

Southwest China

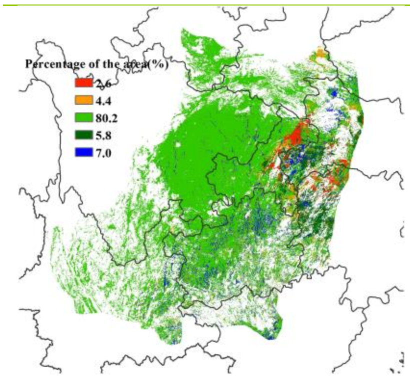
In this region, the first quarter of the year covers planting of maize and early rice, as well as the growing period of winter wheat. The season this year can generally be characterized as somewhat below average. Between January and February, the crop condition was average. From March, it dropped below average, possibly due to the heavy rain during that period, and reverted to average again from April. The maximum VCI of 0.66 further confirms this result, although the CALF kept a stable level (4 percentage points above average), in line with the agroclimatic indicators (RAIN, +36 percent; TEMP, -0.3°C and RADPAR, -8 percent).

Compared to the recent five-year average, parts of northern Chongqing and northwest Hunan both show varying degrees of below average condition in February and March, as illustrated by the spatial NDVI patterns and NDVI profiles. Compared to the recent average, rainfall increases of 47and 53 percent were recorded for Chongqing and Hunan, respectively, which will probably have a negative effect on the local crops.

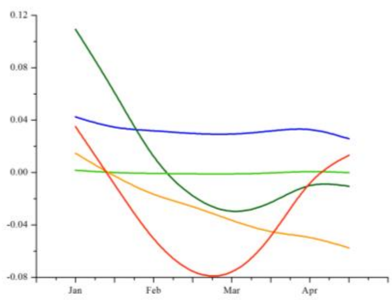
Figure 4.14. Crop condition Southwest China region, January-April 2016



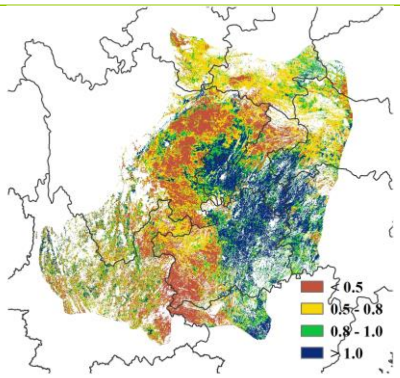
(a) Crop condition development graph based on NDVI



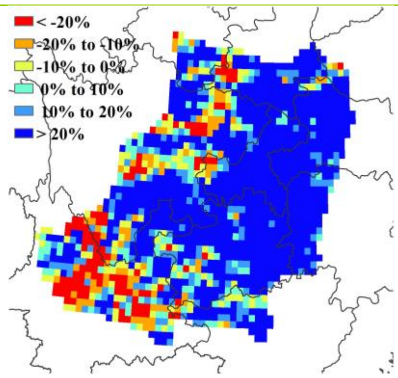
(b) Spatial NDVI patterns compared to 5YA



(c) NDVI profiles



(d) Maximum VCI

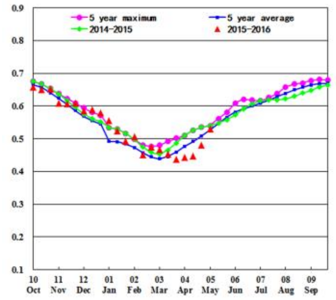


(e) Biomass

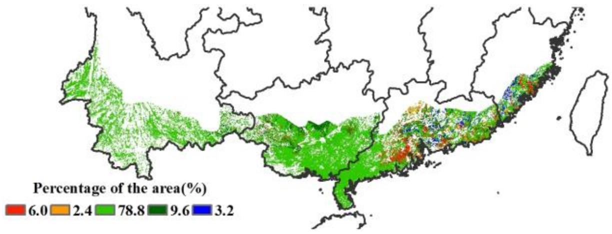
Southern China

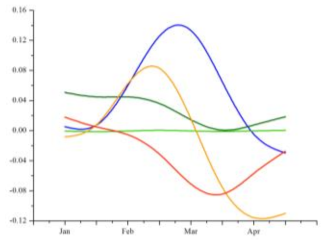
In southern China, the reporting period mainly covers the planting of early rice and the growing season of winter wheat. Crop condition was mixed during the entire period: generally above average between January and February, below average from March to April—possibly due to heavy rain and low temperature—and average again at the end of April. For the period as a whole, rainfall was almost double the average (RAIN, +99 percent), while a negative temperature departure was recorded (-1.1°C). Compared to average, parts of Southern Fujian and Southern Guangxi both show below average crop condition in March and April, according to the spatial NDVI patterns and NDVI profiles. This was brought about by excess rain (+96 percent in Guangxi and +85 percent in Fujian), and the area will need close scrutiny in the subsequent monitoring periods. Southern Yunnan and Southern Guangdong show a mix of average and anomalous climate variables: in Yunnan, rain was average (+1 percent) but TEMP and RADPAR were low (-1.1°C and -6 percent, respectively); in Guangdong rainfall was still significantly above average (+45 percent) but TEMP and RADPAR were average (0.0°C and -2 percent). Southern Yunnan shows a significant biomass production potential drop (-20 percent) and will need close monitoring over the coming months. Even if CALF increased 2 percentage points over average, the excess precipitation is likely to negatively influence the current winter crops. Summer crops are likely to benefit from abundant soil moisture.

Figure 4.15. Crop condition Southern China region, January-April 2016



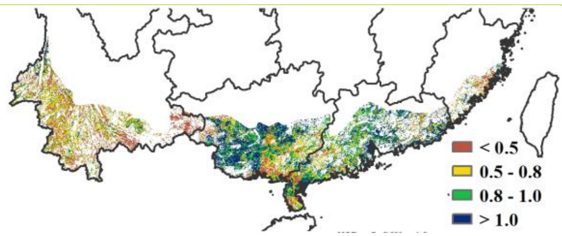
(a) Crop condition development graph based on NDVI



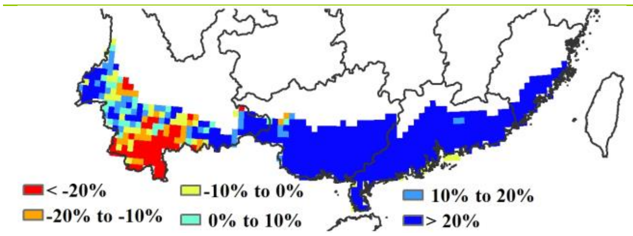


(b) Spatial NDVI patterns compared to 5YA

(c) NDVI profiles



(d) Maximum VCI



(e) Biomass

Chapter 5. Focus and perspectives

This focus section complements CropWatch analyses presented in chapters 1 through 4 by presenting additional information about topics of interest to global agriculture. This issue includes the production outlook for 2016 (5.1), an overview of relevant disaster and extreme weather events (5.2), a focus on agriculture in Central Asian countries (5.3), and an update on El Niño (5.4).

5.1 Production outlook

Overview

Tables 5.1and 5.2 present the current CropWatch estimate of 2016 crop production, based on a combination of remote-sensing and trend-based projections.[7] The information will be updated in the two other quarterly bulletins to be published in 2016, including more actual information each time as it becomes available. Except for wheat, of which the largest share is produced in the northern hemisphere as a winter crop, only about 50 percent of the total 2016 production has been harvested or is currently growing.

Table 5.1. Summary of 2016 production estimates by major aggregates (thousand tons) and variation (%, compared with 2015) of maize, rice, wheat, and soybean

	Maize		Rice		Wheat		Soybean	
	2016	Δ%	2016	Δ%	2016	Δ%	2016	Δ%
Sub-total (CW)	**417743**	**-2**	**439842**	**1**	**608330**	**0**	**142906**	**-3**
Sub-total (trend+CW)	879878	0	682721	1	619781	0	283230	-1
Sub-total (others)	116839	3	74322	2	99412	2	22108	-7
Total	**996717**	**1**	**757043**	**2**	**719193**	**0**	**305338**	**-1**
5 major exporters	508403	2	259603	2	179709	-1	255754*	-2
5 major importers	96929	-1	226579	1	20488	0	13386	-2

Note: Sub-total (CW) and Sub-total (trend + CW) lines include only China and the 30 major producers and exporting countries that are listed in Chapter 3. Sub-total (CW): Sum of productions of crops currently in the field or just harvested, and for which at least some actual remote-sensing information is available. Sub-total (trend+CW): Same data as the previous line, but including trend-based projections for crops still to be planted. Sub-total (others): Refers to 132 minor crop producers, with estimates based on trend-based projections. Total: Sum of Sub-total (trend + CW) and Sub-total (others) lines. 5 major exporters and 5 major importers: the total production of the top 5 exporters and importers in 2013. When the European Union (EU) occurs in the list (e.g., among the wheat exporters or maize importers) crop production estimates for the sum of all EU countries was used, using CropWatch estimates preferably to FAOSTAT-based productions whenever they are available. Δ%=Percentage change compared to 2015 production. *, only three major soybean exporters (Argentina, Brazil and USA) are taking into account.

As illustrated in table 5.1, CropWatch currently estimates the production of 2016 to depart little from the previous year, with a slight 1 percent increase for maize, 2 percent increase for rice, and 1 percent drop for soybeans, while wheat production is estimated to be almost identical to the 2015 output. For major exporters, the output of maize and rice increased 2 percent, while the volume of wheat and soybean are expected to drop 1 percent and 2 percent respectively compared with the previous year. The major importers are expected to increase their rice production while wheat will stagnate. For both maize and soybeans, the expected drop (-1 and -2 percent, respectively) will be easily met by the increased availability of the major maize exporters and 2015 soybean bumper production. It is also noted, as often

[7] The CropWatch estimates are based in part on current information and enjoy a larger degree of confidence than the trend-based projections.

happens, that the minor producers grouped as "others" collectively outperform the major players. Both paddy rice and wheat increase 2 percent, and the production of maize—by now the preferred cereal worldwide—grows 3 percent. However, soybean for “others” deceases by 7 percent. In China, production drops are expected for wheat and maize (2percent)—in the case of wheat the result of environmental factors and policy changes, as well as for soybean (3 percent), continuing its decade-long trend. Rice is expected to increase 1 percent.

Maize and soybean are the crops where the largest disparity of condition appears between countries, while rice and wheat are far less variable. Sometimes also marked differences exist for crop performance within countries. In Egypt and the Philippines, no crop did well, and in both cases shortage of water can be blamed directly. In Egypt, in particular, the poor rainfall in the East African highlands resulted in reduced Nile discharge, in a country where virtually all crops are irrigated. Countries that do well include Australia, in spite of drought conditions, India (even if the country was recently exposed to varying degrees of floods and droughts), eastern Europe to central Asia (Poland, Kazakhstan, and Uzbekistan), mostly due to abundant precipitation and above-average temperature, and Turkey, an island of favorable conditions while the remaining Mediterranean suffered prolonged and sometimes severe drought.

Maize

With the exception of South-Africa (-32 percent drop due to drought; see also sections 3.2 and 5.2), maize variations stay within the -6 percent (Mexico, probably due to drought in the south of the country) and +9 percent (Ukraine) interval. Since the projections are based on 2005-2014 trends, an overestimation is likely in Ukraine. Other large production growths occur mostly in middle-sized tropical countries (Bangladesh, Cambodia, Nigeria, and Ethiopia) where maize has enjoyed very robust growth recently. For Ethiopia (+5 percent) much will depend on the development of the current season and the expected waning of El Niño conditions. Among the major producers, China was already mentioned with -2 percent. CropWatch estimates that Brazil with stay within 1 percent of last years' production, while the United States will increase 2 percent.

Rice

Most major exporters did well, with India and Vietnam recording +2 percent output for the crop and Thailand a 1 percent increase. This is significantly lower than the annual growth rate of rice exports sustained by Thailand (close to 5 percent) and by Vietnam (close to 10 percent), and can be linked to the widespread drought conditions over southern and southeast Asia. The same also applies to Mexico (-9 percent). The production is expected to stagnate in Pakistan and the United States. Large increases are conjectured for Brazil (+12 percent) and Uzbekistan (+6 percent), a central Asian country that is trying, with some success, to diversify out of cotton (see also section 5.3).

Wheat

Low production values for wheat are listed for Iran (-7 percent), Argentina, the United States, and Ukraine (all at -4 percent), and China (-2 percent). A production increase of 4 percent is expected in Brazil, Canada, and Kazakhstan, and an even higher increase (+5 percent) in Nigeria, where irrigated cold season wheat is produced in volumes close to 100,000 tons. India achieved an increase of 6 percent for wheat, but most of the grain is for local consumption. Among the exporters, Canada (+4 percent) and France (+2 percent) compensate the estimated drop of 4 percent in the United States.

Soybeans

For soybeans, two of the major producers and exporters are expected to drop (-5 percent for United States and -1 percent for Argentina compared to last year) while Brazil is doing well (+2 percent compared to last year). China, as mentioned, continues the downward trend (-3 percent).

Table 5.2. 2016 production estimates (thousand tons) and variation (%, compared with 2015) of maize, rice, wheat, and soybean

	Maize		Rice		Wheat		Soybean	
	2016	Δ%	2016	Δ%	2016	Δ%	2016	Δ%
Argentina	**25710**	**1**	**1695**	**0**	**11630**	**-4**	**51080**	**-1**
Australia	444	2	992	7	**25807**	**1**		
Bangladesh	1732	7	**50801**	**0**	1284	4		
Brazil	**79105**	**-1**	**13244**	**12**	**6946**	**4**	**91826**	**2**
Cambodia	1010	6	**9363**	**-2**				
Canada	**11845**	**0**			**31855**	**4**	6284	6
China	**190070**	**-2**	214561	1	**111214**	**-2**	12623	-3
Egypt	**5769**	**-3**	**6222**	**-5**	**9652**	**-3**		
Ethiopia	**6842**	**5**	162	9	4414	5		
France	**14864**	**1**	104	0	**39766**	**2**		
Germany	**4589**	**0**			**27317**	**0**		
India	26316	4	**158608**	**2**	**96448**	**6**	13768	3
Indonesia	**17994**	**0**	**67176**	**-1**				
Iran	2076	0	2319	-1	**12942**	**-7**		
Kazakhstan	637	4	395	3	**16680**	**4**		
Mexico	**22353**	**-6**	144	-9	3680	1		
Myanmar	1868	5	**27574**	**0**	199	2		
Nigeria	**11268**	**8**	6328	5	122	5		
Pakistan	5157	4	5811	-5	**24789**	**0**		
Philippines	**7475**	**-1**	**19264**	**-1**				
Poland	4683	8			**10414**	**0**		
Romania	**10841**	**1**	73	6	**7220**	**1**		
Russia	12227	8	1226	5	**53711**	**-1**	2549	8
South Africa	**9018**	**-32**	3	-2	1751	-1		
Thailand	5343	2	**39912**	**1**	1	3		
Turkey	5903	4	987	3	**23480**	**3**		
Ukraine	34211	9	138	2	**22422**	**-4**	3917	9
United Kingdom					**14914**	**1**		
United States	354513	2	9289	0	**54271**	**-4**	101183	-5
Uzbekistan	402	6	347	6	**6852**	**2**		
Vietnam	5613	3	**45983**	**2**				
Sub-total (CW)	**417743**	**-2**	**439842**	**1**	**616278**	**0**	**142906**	**-3**
Sub-total (trend+CW)	879878	0	682721	1	619781	0	283230	-1
Sub-total of others	116839	3	74322	2	99412	2	22108	-7
Total	996717	1	757043	2	719193	0	305338	-1

Note: Refer to table 5.1 for explanations about the last lines of the table. **Numbers in bold**, including those in the "Sub-total (CW)" line were estimated using remote sensing inputs and country statistics; others are based on the 2005-2014 trend from FAOSTAT.

5.2 Disaster events

Introduction

According to a new international database of disasters assembled by a team based at the Karlsruhe Institute of Technology in Germany, between 1900 and 2015 about 35,000 extreme events have caused the death of 8 million people[8] and economic losses equivalent to US$7,000 billion. Just over 50 percent of losses are associated with water (floods and drought), which is consistent with recent insured losses data regularly reported by the insurance industry. The authors of the study suggest that, in relative terms, the impacts of disasters have decreased over the century, which is no doubt due to improved legislation and better preparedness and warning systems.

The long-term decreasing trend in the impact of individual disasters, however, is reported at a time of increasing numbers of disasters and more intense extreme factors, as illustrated by the recent occurrence of the strongest cyclones on record in different parts of the world. This includes Hurricane Patricia (October 2015, landfall in an area with a low population density in western Mexico), as well as two 2016 cyclones: cyclone Fantala (strongest cyclone in the south-west Indian Ocean, April 2016) and cyclone Winston in the south Pacific Basin (February 2016, see below). By sheer luck, none of them created any dramatic damage. Cyclone Winston was particularly strong because it occurred under El Niño conditions and in combination with a Madden-Julian Oscillation (MJO).[9]

The current El Niño, although atypical in many respects, is also one of the most intense recorded so far. It affected and continues to affect hundreds of millions of people in three continents. According to the United Nations (UN) Office for the Coordination of Humanitarian Affairs (OCHA), "response plans have been completed in 13 countries, requesting some US$3.6 billion to meet critical needs for food and agricultural support, as well as nutrition, health and emergency water and sanitation needs."As some countries still need to submit their response plans, the overall impact estimate is likely to increase.

Earthquakes

CropWatch pays relatively little attention to earthquakes and volcanic eruptions as their agricultural impacts are normally limited, except where they involve the destruction of infrastructure such as roads and irrigation canals. A number of minor earthquakes were recorded during the reporting period, including in Austria, Israel, Russia, Japan, Morocco, Indonesia, Chile, and Turkey, as well as continuing aftershocks in Nepal, one year after the Ghorka earthquake, which was last year's worst earthquake in terms of casualties.

Several recent earthquakes with Richter scale magnitudes (M) above 6 are worth mentioning, especially the 6 February M 6.4 earthquake in Taiwan where about 120 people died. An M 6.7 earthquake rocked Manipur on 8 January, killing 11 and injuring about 200 in India and Bangladesh and creating panic as far as Myanmar and China (Tibet), Bhutan, and eastern Nepal. The most serious earthquake (M 7.8) occurred on 16 April in northern Ecuador. Local sources report just short of 700 deaths, more than fifteen thousand injured people, and more than 200,000 affected through destruction of infrastructure, houses, and schools, especially in Esmeraldas and Manabí provinces. The UN and other humanitarian organizations have issued an international appeal for emergency assistance of US$72.7 million.

[8]The number of casualties is 5 to 10 percent of those due to man-made disasters (e.g., war) over the same period.
[9]Madden-Julian Oscillations (MJOs), first described at the beginning of the 1970s, are large east-moving circulation cells over tropical oceans. They circle the earth and return to their original position over one to two months.

Cold weather

Bad winter conditions have affected eastern Asia and the United States. At the end of January (25 January), 85 people were killed in Kaohsiung, Taiwan, and crops suffered minor damage (US$300,000). On the same day in Japan snow fell as far south as Nagasaki and Kagoshima Prefectures. Al locations (especially Taiwan) normally enjoy a warm temperate climate, and winter conditions are rarely severe. In the United states, winter storms Jonas (24 January) and Juno caused floods and claimed about 20 lives in North Carolina, Arkansas, Kentucky, Tennessee, and Virginia. A state of emergency was declared in Delaware, Georgia,

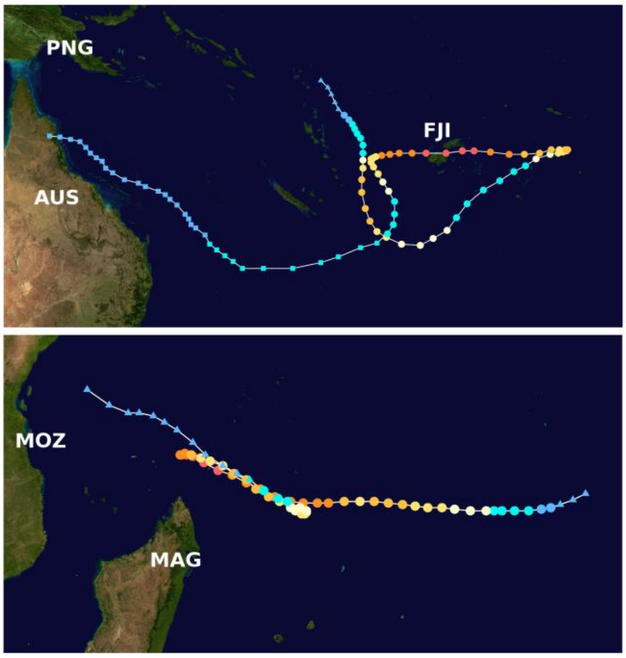
Kentucky, Maryland (which observed a snow record with more than 70 centimeters of precipitation), New Jersey, North Carolina, Virginia, Pennsylvania, Tennessee, and West Virginia, as well as neighboring areas.

Storms and cyclones

As mentioned above, two record cyclones occurred during the reporting period. Considering their strength, they created relatively limited damage due to their trajectories avoiding high vulnerability areas.

Cyclone Winston was active between 7 February and 3 March. It formed east of Vanuatu and was characterized by a complex track that affected Fiji, Vanuatu, Tonga, Niue, and Queensland, killing about 50 people and causing damage for a billion U.S. dollars, the costliest cyclone to date in the South Pacific. In Fiji, the cyclone made landfall with sustained winds reaching just under 300 km/h, killing 20 people and affecting 350,000, of which more than half were in need of shelter; estimated damage reached about US$200 million to crops and livestock, and about 20 million to forestry and fisheries. In Tonga, reports indicate damage to bananas and the vanilla crop, a major foreign exchange earner. It is stressed that the same area also suffered drought, so that Winston compounded the difficulties of the agricultural sector.

Figure 5.1. Tracks of cyclones Winston and Fantala



Note: Cyclone track for Winston (top image) is for February 7 to March 3, 2016, near Australia (AUS), Fiji (FJI), and Papua New-Guinea (PNG); the track for Fantala (bottom image) is for April 11 to 26, 2016, near Mozambique (MOZ) and Madagascar (MAG). Modified from Wikipedia.

Other cyclones included Amos (late April), in the same general area as Winston, Alex (Azores, January), as well as the strongest tropical cyclone of the southwest Indian Ocean in terms of sustained winds, Fantala, which affected mostly the Seychelles and to some extent northern Madagascar between 11 and 26 April. Compared to Winston, the impact of Fantala was very limited.

Floods and landslides

Landslides are reported from all continents, resulting from either heavy or prolonged rainfall, such as for example in the wake of cyclone Amos in Samoa. The most dramatic floods are those that affected

Pakistan and neighboring areas in Iran and Afghanistan in March and April, killing more than 200 people, especially in the North-western Tribal Belt and in Baluchistan, but also affecting Pakistan-administered Kashmir and Punjab. The impact was worst in Khyber Pakhtunkhwa province (Peshawar).

Other Asian floods include those that occurred in North East India (Arunachal Pradesh at the end of April) and mid-March in Bandung District, West Java Province, in Indonesia.

In South America, Brazil suffered from landslides and flooding in São Paulo, among other areas, in mid-March as a result of torrential rainfall, burying people and causing some to drown. In North America, in the state of Texas, floods caused about US$5 billion in damage.

Finally, a severe storm caused havoc in Uganda at the beginning of April, killing thirty and destroying houses in Buliisa District. Excess water in early March hit both north-east Ghana (Yendi) and Angola (Lubango in Huíla province), where flooding of the Capitão river destroyed a bridge.

Figure 5.2. Floods in Pakistan

Note: People try to save their belongings as floods rush through a market area on the outskirts of north-west Pakistan's Peshawar, April 3, 2016. Source: http://en.people.cn/n3/2016/0404/c90000-9039578-3.html.

Drought

Drought was the most serious disaster in terms of agricultural impacts during the reporting period. Initial analyses in previous CropWatch bulletins reported about the South American drought corridor, where the shortage of water supply appeared clearly in the CropWatch RAIN indicators (e.g., figures 1.1 and 3.1 in the November 2015 CropWatch bulletin). Situations of concern are mostly reported from Guatemala and neighboring El Salvador where about 1.5 million people are affected by the drought, which especially harmed maize crops, with about 1 million people needing food assistance. In terms of severity and numbers affected, however the brunt of the impact has now moved to Asia and Africa.

In Asia and the Pacific, for obvious reasons of less diversified crop growing conditions, some small countries are seriously affected, for instance Timor Leste, Fiji and Palau, as well as Papua new Guinea. Some of them (Fiji and Timor) will now enter their dry season, which will worsen water shortages for a large share of the population (about one third) already affected by crop failures. Papua New-Guinea mostly enjoys year-round humid equatorial conditions and diverse conditions brought about by topography, except in the south-west where rainfall will decline from now and where more than one million people are currently impacted by drought.

Among the large and populated countries, drought is mostly reported from Indonesia, the Philippines, Thailand, Vietnam, and India. In Indonesia, where ACAPS ranks the impact as “low,” both planting of the previous and the current crops was delayed, which resulted in about 1 million people requiring food assistance. In the Philippines, about 3.5 million people suffered from a moderate-impact drought that affected almost half of the country, most seriously in south Mindanao. Rice prices in March remained just below last year’s, which is generally attributed to the government’s policy of preventively increasing rice stocks. In Thailand, about one fifth of provinces suffered drought and water use was restricted for domestic and agricultural use. In Vietnam, about a third of the provinces suffered from water shortage, mostly in the southern-central areas, including the Mekong delta, the main rice producing area. Drought and the resulting salt-water intrusion affected the timing and rate of planting in about half a million hectares. Both Vietnam and Thailand are major exporters of rice and other agricultural commodities, and the availability of rice and maize may be affected. In India, national sources inform that nearly a quarter of the population was affected to varying degrees by drought and by heat-waves, some areas for the second year in a row. Water reserves are low.

In Africa, drought affects two areas: the Horn of Africa and the south of the continent. No major alarm is raised about northern Mozambique, Tanzania, and crop-growing areas in Kenya, which lie between the two mentioned disaster areas.

In Ethiopia, more than 10 million people are currently facing or are at risk of being exposed to serious food shortages due to the worst drought in several decades. The resulting loss of more than half of 2015 Meher crops (the main growing season harvested after August, mostly in the center of the country) results in a cost of close to US$1.5 billion, according to the World Food Programme. The emergency is not planned to dissipate before the end of September, particularly in some of the poorest parts of the country where livestock plays a central part in the economy.

Figure 5.3. Hungry cattle in Zimbabwe

Note: In Masvingo province, Zimbabwe, hungry cattle is too weak to stand. January 2016. Source: http://www.timeslive.co.za/sundaytimes, 18 March 2016. Image: Philimon Bulawayo, Reuters.

In southern Africa, importantly, while food shortages are one of the most dramatic impacts of the ongoing drought, the current crisis in southern Africa—probably the worst since the 1981/82 El Niño—has wide-ranging and certainly long-lasting impacts beyond nutrition and agriculture. Food prices have risen and low water levels in dams (notably Kariba on the border between Zimbabwe and Zambia) has led to shortages of electricity, shortage of drinking water, a general slow-down of the economy, and loss of income, including in the mining sector where workers had to be laid-off. In South-Africa, many small farmers are going out of business.

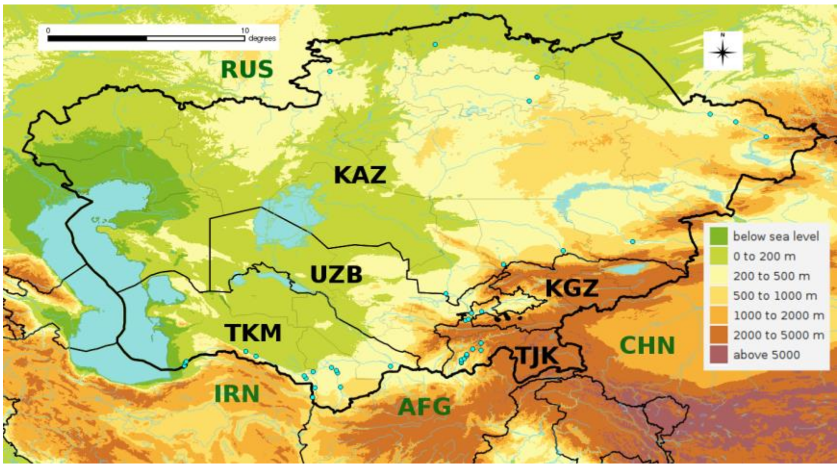
Drought prevails in many areas in the region (more than half the provinces in South-Africa, and 80 percent of the districts in Malawi). In Zimbabwe and Swaziland, every fourth person is directly affected. Severe malnutrition is reported from all countries, including Madagascar.

5.3 Focus: Central Asia

Overview

The countries most commonly grouped as “Central Asia "include Kazakhstan (KAZ), Kyrgyzstan (KGZ), Tajikistan (TJK), Turkmenistan (TKM), and Uzbekistan (UZB). They share many environmental and agricultural features with bordering areas in Afghanistan (AFG), China (CHN), Iran (IRN), and Russia (RUS) (figure 5.4), as well as Mongolia and Pakistan.

Figure 5.4. General setting and topography of Central Asia



Note: AFG: Afghanistan; CHN: China;IRN: Iran; KAZ: Kazakhstan; KGZ: Kyrgyzstan; RUS: Russia;TJK: Tajikistan; TKM: Turkmenistan; and UZB: Uzbekistan. Blue dots indicate major dams.The major water bodies are two lakes: the Caspian Sea (west) and the Aral Sea on the border between Uzbekistan and Kazakhstan, represented by its maximum extent. Based on ETOPO1 data (NOAA, 2016).

The five countries range considerably in size and population, as well as—but less so—in agricultural statistics (see table 5.3). Kazakhstan with 2.7 million km²is the 8th largest country in the world, with an area about 6 times that of Turkmenistan or Uzbekistan and fifteen times the size of Kyrgyzstan (190,000km²) or Tajikistan (143,000km²). The most populated country in the region is Uzbekistan, where the population density of 70 persons/km² is still comparable with Tajikistan (61 persons/km²) but ten times larger than that for Kazakhstan. All five countries are predominantly agricultural with up to 50 percent of employment in that sector, supplying about one fifth of the countries' GDP (less so in Kazakhstan, due to a large energy sector). In the region as a whole, cotton and wheat are the major crops, contributing to the countries' GDP next to mineral resources such as oil and gas (in Kazakhstan, in addition to wheat), gold (in Kyrgyzstan, together with cotton and tobacco), aluminum (Tajikistan, with cotton and wheat), gas (Turkmenistan, with cotton), and again oil and gas for Uzbekistan (together with cotton, for which the country is a leading exporter).

Table 5.3. Basic descriptors of land, population, economy, and agriculture in Central Asia

	KAZ	KGZ	TJK	TKM	UZB	Year
Total population (thousands)	17,625	5,940	8,482	5,373	29,893	2015
Rural population (% of total)	44	62	74	50	63	2015
Agric. employed (% of total)	24	32	55	n.a.	39	1998-2013
Land area (LA, million km²)	2.70	0.19	0.14	0.47	0.42	2013
Arable land (AL) (% of LA)	11	7	6	4	10	2013
Irrigation (% of AL)	7	100	91	95	88	2004-12
Permanent pastures (% of LA)	69	48	28	68	52	2013
Forest (% of LA)	1	3	3	9	8	2013
Pop. density (km^{-2})	7	31	61	11	70	n.a.
Agricultural sector as % of GDP	5	15	21	14	18	2013
Monthly average wage US$	696	425	247	717	521	n.a.

Note: Data from FAOSTAT; AQUASTAT 2016; Bucknall et al. 2003; ICG 2005; and USDA 2010. Monthly average wage from UNECE 2016, except for TKM and UZB for which the value was estimated based on the regression of monthly average wage against IMF 2016 gross domestic product (at purchasing power parity) per capita, i.e., the purchasing power parity (PPP) in other CEI countries.

Agriculture in the region has undergone severe stress due to environmental conditions and the socio-economic changes associated with the split of the Soviet Union, which used to have large-scale collective and state farms coexisting with private household plots. After the early 1990s, a new category of mid-sized peasant farms and "farmers" has developed, leading to rapidly changing demand for agricultural commodities and traditional trade partners in the region and beyond. Most of the countries are currently trying to diversify away from cotton monoculture, a crop associated with a lot of social tensions and environmental problems, including the environmental and public health disaster related to lake called the Aral Sea (IGC, 2005).

Over the last four or five decades, the Aral Sea has lost three quarters of its volume due to the use of water for cotton irrigation. The water supply of the Aral basin depends on rainfall in remote mountain areas through the Syr Darya, which flows from the melting of the Tien Shan glaciers in Kyrgyzstan, and the Amu Darya, which originates in the Pamir mountains of northern Afghanistan and southern Tajikistan (Figure 5.4 and Eric, 2012). Today, the Aral Sea is down to several small lakes, and its shrinking has been referred to as the “most notorious ecological catastrophe of human making” with the area nicknamed the “dustiest place on earth.” The Sea is now also a major source of toxic dust and affects an area that far exceeds its immediate surroundings (Giles 2005; Oceanworld 2016).

Irrigation has not only been a problem for the Aral Sea, but in general irrigation infrastructure in the Central Asia region has been deteriorating rapidly; in Uzbekistan for example, 70 percent of water is lost. Some estimates put the cost of the rehabilitation of the irrigation system at 40 billion US$ for the region. Due to water logging and salinization, at least 10 percent of land has gone out of production over the last decade (ICG 2005).

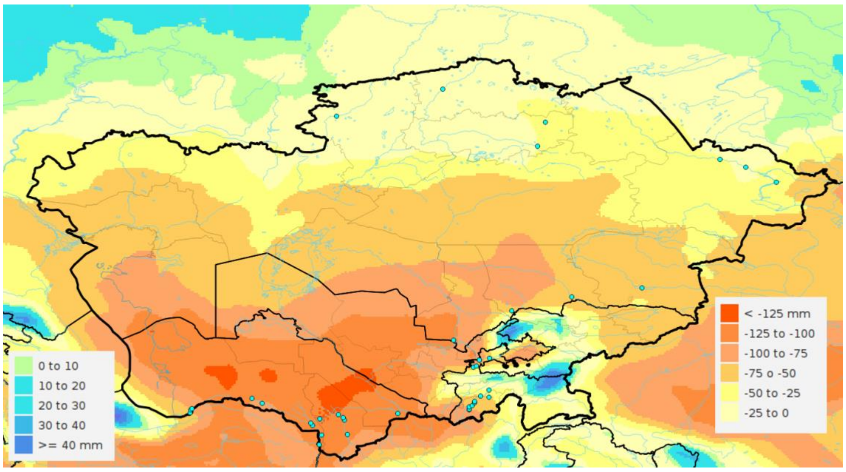
Even with more efficient and sized down irrigation systems, it is unlikely that the Sea will ever regain its past extent, as policies change and hydropower increasingly competes with agriculture for water resources (Dixon 2001, Motamed et al 2013, and LOC 2014). In addition, policies now need to be national policies from the different countries, which is much more difficult to coordinate than when the area was under Soviet rule. This creates additional stress, particularly in the Fergana Valley region, which is split between Kyrgyzstan, Uzbekistan, and Tajikistan. The Valley (5 percent of the area of Central Asian countries) is a major source of food (wheat, cotton, rice, vegetables, and fruit) for the region, but also concentrates 25 percent of population, resulting in the highest population density in the region with more than 600 people/km² (Stratfor, 2013).

The post-Soviet recession in the region is now fading due to economic restructuring and foreign investment, but monthly average wages are still low by international standards (as low as US$247 per month in Tajikistan; table 5.3),even if undernourishment is moderate, with values close to or below 5 percent (FAO, 2012).

Agricultural environment

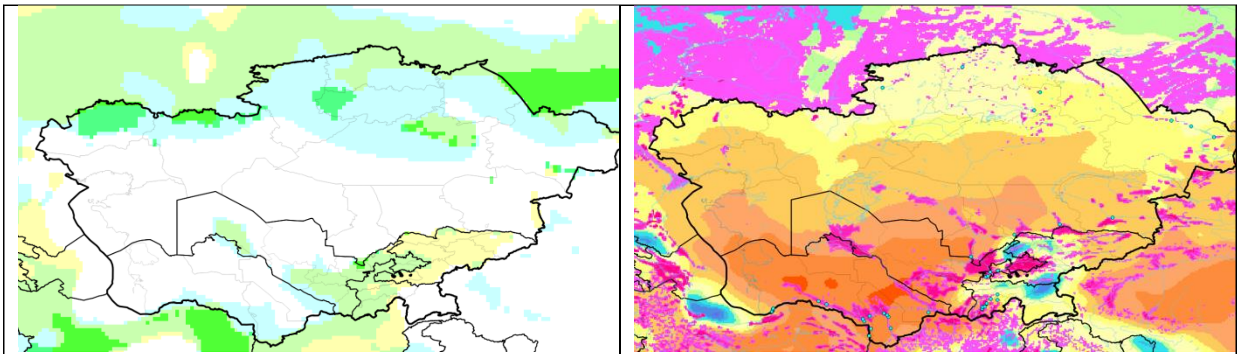
With the exception of a few high mountain ranges, most of the region suffers a deficit of rainfall over potential evapotranspiration (PET) (figure 5.5), with aridity increasing from north to south along with average temperature. Although the region has winter rains, they are most abundant in areas in the north of Kazakhstan that are usually too cold to grow winter crops. As a result of the aridity, most agricultural land in the smaller countries is irrigated, while in Kazakhstan, which produces little cotton but sizeable amounts of exportable wheat, only 7 percent of the agricultural land is under irrigation. In line with mostly semi-arid climatic conditions, livestock plays a major role in all five countries, and agriculture includes typical drought staples such as millet and sorghum. Figures 5.6a and b illustrate the distribution of wheat, barley, and potatoes, as well as irrigated land in the region.

Figure 5.5. Average monthly value of the difference between rainfall and PET, in mm



Note: Based on data in Grieser et al, 2006.

Figure 5.6. Distribution of wheat, barley, and potatoes (a) and irrigated land (b)



(a) (b)

Note: Figure (a) illustrates the distribution of areas growing wheat (blue), barley (yellow), both wheat and barley (light green) and potatoes (bright green), based on JRC crop masks, Vancutsem et al 2013. Figure (b) illustrates the distribution of irrigated land (pink), based on FAO, 2016.

In Kazakhstan, about 75 percent of wheat originates in three north-central Oblasts: Kostanai, Akmola, and North Kazakhstan. About 12 million hectares are cultivated with spring wheat, while only 1 million hectares—mostly confined to southern Kazakhstan—are used for winter wheat (about 5 percent of the output). Spring grain (also including oats and barley, an important crop in the region) is sown under low input conditions in mid-May to early June, to be harvested from late August to October (Abugalieva and Peña 2010, USDA 2010, Wikipedia). In the southern countries, wheat and barley are cultivated as rainfed winter crops (e.g., Khatlon province in south-west Tajikistan). Cotton, tobacco, maize, and rice are grown only as irrigated crops in the southern areas.

As mentioned above, livestock plays a central role in the region's extensive cereal-livestock systems (in semi-arid areas) and pastoral farming systems (in the high elevation areas) (Dixon et al, 2001). As shown in table 5.1, permanent pastureland, whether managed or natural, exceeds arable land by a factor 5 or more. Hay and other fodder crops are actually major crops in the region (also see "feeds" in figure 5.9below). In a report from 2001, observations for the pastoral farming systems are that "Due to excessive animal populations, poor pasture management and overgrazing, deterioration of natural vegetation and soil erosion are important issues. Wool production, which was a major output during the Soviet era, has fallen dramatically since the early 1990s, while meat output has increased as farmers have reverted to the sturdy traditional meat breeds. Poverty is particularly widespread in this (pastoral) system."(Dixon et al, 2001.)

Production and trends

Even though this analysis focuses on crops, in general livestock (mostly cattle and sheep) play the largest role in the agricultural economy of Central Asia. By value, meat and milk exceed the importance of crops in all countries, except in Tajikistan where cotton and potatoes are the leading commodities.

As for crops, according to FAOSTAT data, over the last 25 years since Soviet times, the share of wheat in cereals has increased from 56 to 78 percent for the region, while coarse grains have decreased from 56 to 18 percent. Over the same period, maize grew from just 10 to 33 percent, mostly at the expense of barley (down from 74 to 53 percent). Minor cereals (millet, sorghum, oats, and rye) continue to be widely cultivated, even if their total volume represents less than 300,000 tons and all of those cereals, with the exception of oats, are decreasing. Cultivated area for all crops, which has varied more than yield and production (see also Figure 5.8a), has been recovering since 1999.

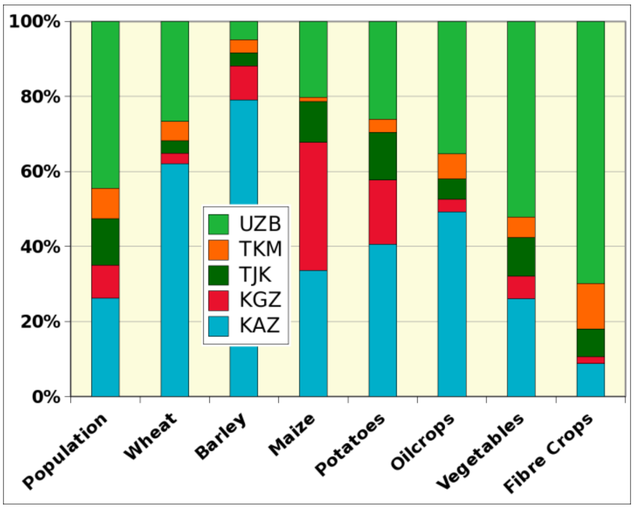
Figure 5.7 illustrates the population distribution and share of production of major commodities by country, while table 5.4 and figure 5.8 show current production volumes and their recent variations. Figure 5.7 confirms Kazakhstan as the agricultural giant of Central Asia: its population makes up 26 percent of the regional total while the country produces 62 percent of the wheat output for the region, as well as 80 percent of the barley, 34 percent of the maize, 41 percent of the potato, and 49 percent of the oil crops output, leading to sizeable exportable surplus. Similar—but less spectacular—specialization can be noted for Kyrgyzstan, with a population that constitutes 9 percent of the region's, producing 17 percent of the potato and 34 percent of the maize output in Central Asia. Actually, Kyrgyzstan is the only central Asian country where both potatoes and coarse grain exceed wheat production. Finally, as already mentioned, Uzbekistan (45 percent of the population) produces slightly more than half the vegetables (52 percent) but as much as 70 percent of the cotton for the region.

Table 5.4. Production of major crops/categories in Central Asia (million tons)

Crop	Production (million tons)	Percentage variation
All cereals	27.91	10
Wheat	21.84	5
Coarse grains	5.13	33
Barley	2.73	15
Maize	1.7	54
Millet	0.04	−16
Sorghum	0.01	−24
Rye	0.04	-40
Oats	0.23	38
Potatoes	8.11	61
Oil crops	0.98	45
Fruits	0.32	134
Vegetables	18.41	118
Fiber crops	1.65	0

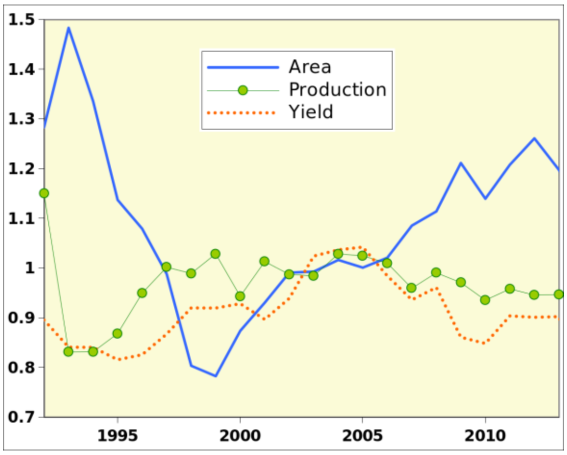
Note: Data is the 2012-2014 average (million tons) and change since 2001-2003. Source: FAOSTAT.

Figure 5.7. Population distribution and share of production of major commodities by country

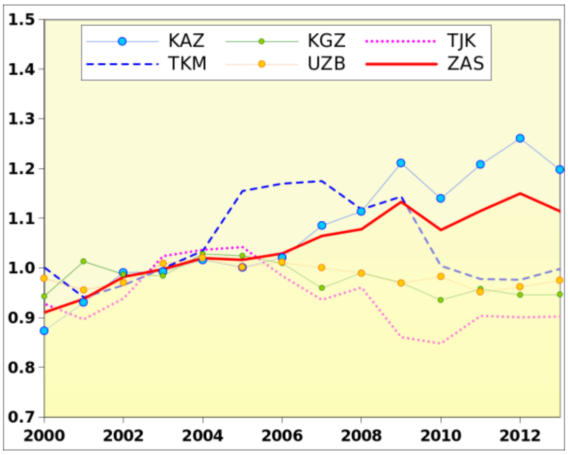


Note: Data is for 2011-13, based on FAOSTAT.

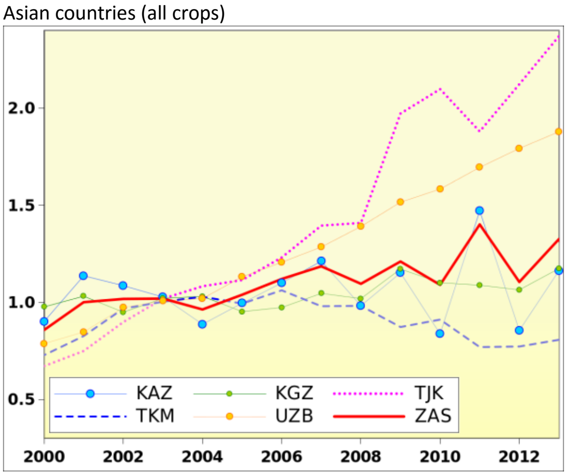
Figure 5.8. Recent variations of yield, area, and production in Central Asia (ZAS)



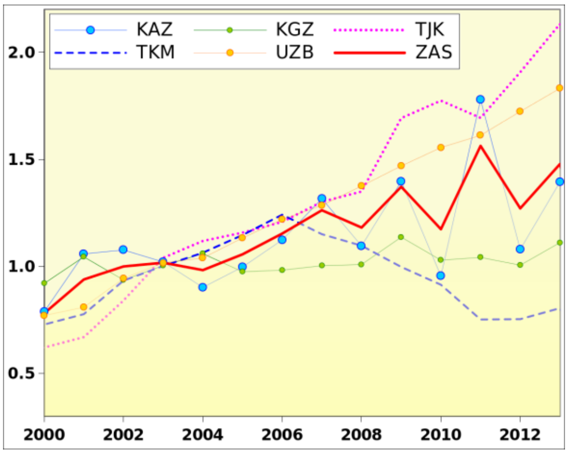
(a) Long-term variation of area, production and yields in central Asian countries (all crops)



(b) Area



(c) Yield



(d) Production

Note: In the figure, 2001-2003 data is taken as 1.

The described agricultural results have been achieved mostly through area increases in Kazakhstan (Figure 5a), while all other countries are undergoing a reduction in cropped agricultural land (Figure 5(b)). This is no doubt related with the inherent risk and yield fluctuations brought about by the semi-arid conditions and limited irrigation in Kazakhstan. While still the largest cotton producer in Central Asia, Uzbekistan has a policy of attaining self-sufficiency in wheat (IGC 2005). Turkmenistan is in a state of general deterioration of crop agriculture with areas, yield, and production decreasing since 2006, and only cotton showing some signs of vitality or, more appropriately, survival.

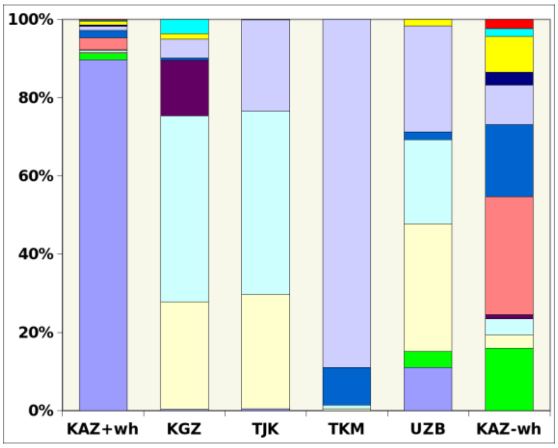
Trade

Close to 90 percent of agricultural exports from the region are made up by Kazakh wheat (Figure 5.9). In 2013, the country exported 6.9 million tons of wheat and wheat products, mostly to neighboring Uzbekistan (1.7 million tons), the Russian Federation (1.1 million tons), Azerbaijan (0.9 million tons), and Tajikistan (0.9 million tons). The next importers of Kazakh wheat include Iran, Kyrgyzstan, and Afghanistan, with 500 to 600 thousand tons, and Turkey, Georgia and China buying between 100 thousand to 200 thousand tons each. Fodder, coarse grains (barley and maize), and oilseed and oil come next among Kazakh exports.

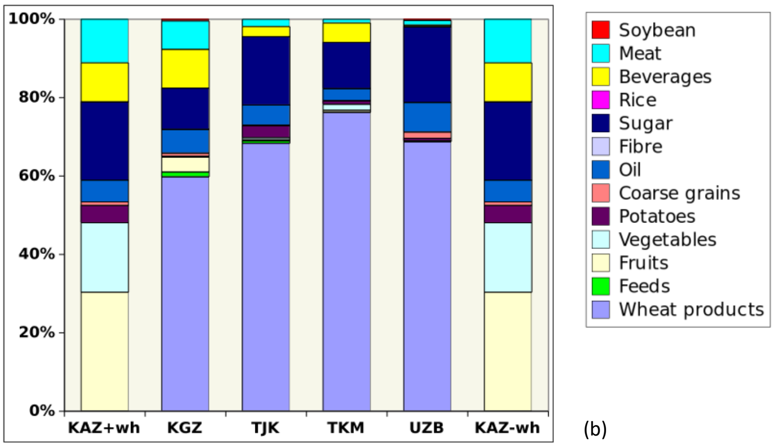
The major exports of Kyrgyzstan, Tajikistan, and Uzbekistan are very similar; they include all types of fruits (fresh, dried, and nuts) and vegetables to Kazakhstan. Kyrgyzstan, in addition, exports about 45 thousand tons of potatoes to Kazakhstan. Turkmenistan again exports mostly oil seeds and cotton.

Kazakhstan imports fruits and vegetables from the three Fergana valley countries (Uzbekistan, Kyrgyzstan, and Tajikistan) and sausages, cigarettes, and beverages (including milk) from Russia. The largest individual import items include 362 thousand tons of sugar from Brazil and 199 thousand tons of chicken meat from the United States. All countries import mainly oil, sugar, and meat and, with the exception of Uzbekistan, beverages from Russia.

Figure 5.9. Exports (a) and imports (b) of Central Asian countries, 2013



(a)



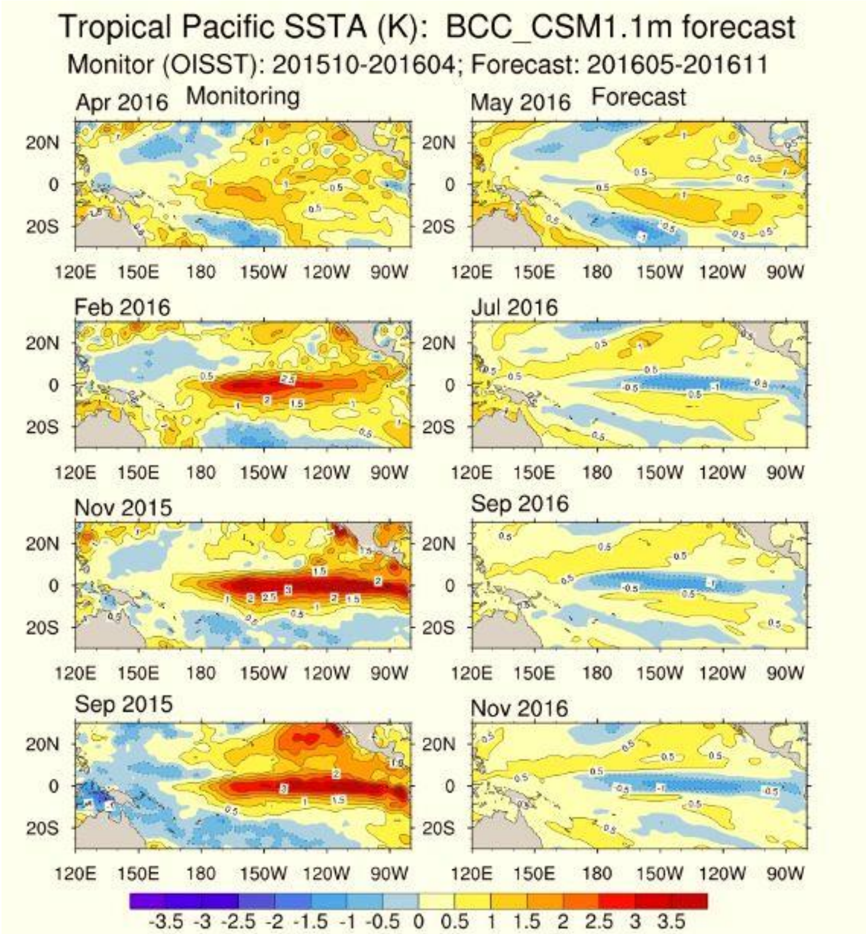
(b)

Note: Meat includes all meat products and eggs; sugar includes sugar as well as sugar beets, with an assumed extraction rate of 20 percent; fiber is mostly cotton and some jute; oil includes fat, butter, cheeses, oil and oil seeds assuming an extraction rate of 40 percent; coarse grains includes maize, barley, oats and other grass cereals as well as buckwheat; vegetables includes vegetables, pulses, mushrooms, peppers, etc.; fruits refers to dry and fresh fruits, nuts and tomatoes; feeds stands for all fodder and feeds including green maize; wheat products include wheat, macaroni, and flour (assumed extraction rate of 80 percent). KAZ+wh and KAZ-wh refer to Kazakhstan data with and without wheat. Computed from FAOSTAT data.

5.4 El Niño

El Niño has continued its decline during the first quarter of 2016. Eastern tropical Pacific sea surface temperatures have cooled gradually from September 2015 to April 2016, according to the Optimum Interpolation Sea Surface Temperature (OISST) and the temperature datasets of the Beijing Climate Center's Climate System Model (BCC_CSM1.1) ensemble (figure 5.10). After May 2016, the middle and eastern Pacific Ocean temperatures return to average conditions according to the China Meteorological Administration (CMA).[10]

Figure 5.10 Tropical Pacific SSTA (forecasted and monitored datasets)

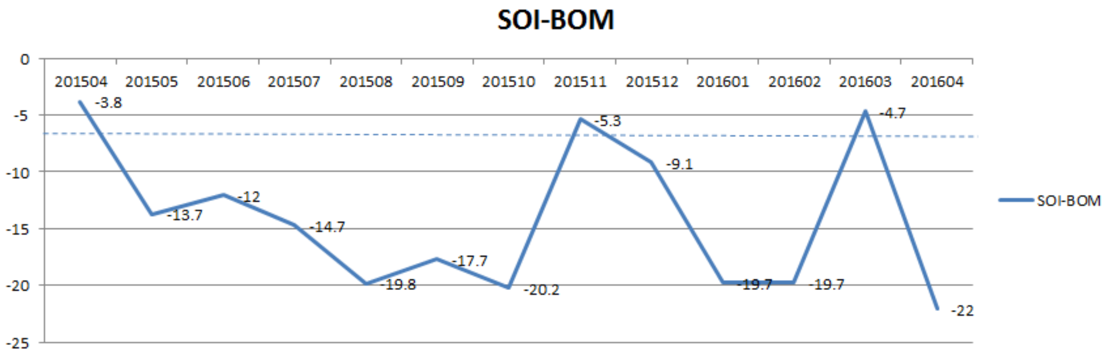


Source: http://cmdp.ncc-cma.net/download/ENSO/Variables_evolution/ENSO_SSTA_Patterns_O7P7_20160501.png

Figure 5.11 illustrates the behavior of the Southern Oscillation Index (SOI) of the Australian Bureau of Meteorology (BOM) from April 2015 to April 2016. During the current season, SOI has kept at a generally low value range: -19.7 in January and February, -22.0 in April, with a peak of -4.7 in March. Eastern tropical Pacific sea surface temperatures have cooled significantly in the past fortnight since April 26, and are now approaching neutral levels, which is also reflected in figure 5.12.

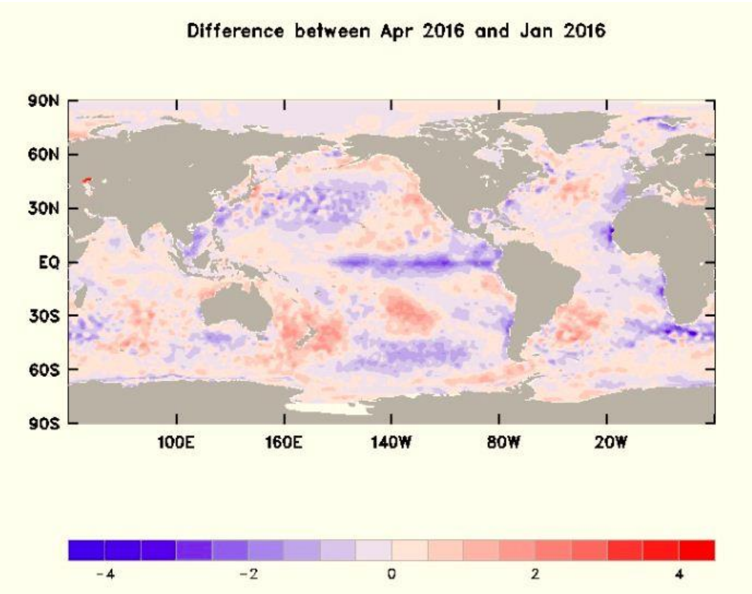
[10]Additional information about OISST and BCC-CSM1.1 ensemble forecast datasets is available from http://cmdp.ncc-cma.net/pred/cn_enso.php?FromYear=2016&FromMonth=5&Elem=SSTA_Patterns&Search=%BF%AA%CA%BC%BC%EC%CB%F7&product=cn_enso_ncc&source_from=

Figure 5.11. Monthly BOM SOI time series from April 2015 to April 2016



Source of **data:** http://www.bom.gov.au/climate/glossary/soi.shtml**.**

Figure 5.12. Sea surface temperature difference between April and January, 2016



Source: http://www.bom.gov.au/productsIDYOC059.shtml

According to NOAA, El Niño is still ongoing and is expected to continue through the northern hemisphere spring or early summer. The heat content in the central Pacific decreased below average in March for the first time in a year.

In the meantime, BOM and NOAA both issued a La Niña warning: conditions are favorable for La Niña to emerge within 6 months. In the next few months, CropWatch will keep a close eye on the development of El Niño, La Niña, and the regions that shown sensitivity to this event.

Annex A. Agroclimatic indicators and BIOMSS

Table A.1. January-April 2016 agroclimatic indicators and biomass by global Monitoring and Reporting Unit

	65 Global MRUs	RAIN		TEMP		RADPAR		BIOMSS	
		Current (mm)	15YA dep. (%)	Current (°C)	15YA dep. (°C)	Current (MJ/m²)	15YA dep. (%)	Current (g DM/m²)	5YA dep. (%)
1	Equatorial central Africa	494	-6	26.3	0.3	1176	4	1492	2
2	East African highlands	181	-20	21.1	0.1	1269	0	657	0
3	Gulf of Guinea	190	0	28.6	-0.5	1242	2	654	3
4	Horn of Africa	350	-3	24.9	-0.3	1263	0	993	3
5	Madagascar (main)	882	-13	24.8	-0.6	1088	1	1813	-7
6	Southwest Madagascar	376	-28	25.1	-1.2	1269	6	1144	-17
7	North Africa-Mediterranean	74	-54	12.7	0.5	983	2	289	-44
8	Sahel	29	21	29.6	-0.5	1364	0	97	26
9	Southern Africa	483	-4	24.9	0.3	1211	3	1283	-2
10	Western Cape (South Africa)	102	-7	19.6	0.0	1292	0	422	7
11	British Columbia to Colorado	275	37	-1.2	2.0	766	-2	583	28
12	Northern Great Plains	207	24	2.2	2.7	750	-6	670	25
13	Corn Belt	329	-4	1.5	1.2	715	-2	741	8
14	Cotton Belt to Mexican Nordeste	440	20	12.5	0.3	903	1	1123	14
15	Sub-boreal America	54	-58	-6.5	2.8	593	-1	387	11
16	West Coast (North America)	294	8	8.6	1.4	789	-3	781	28
17	Sierra Madre	80	14	15.7	-0.3	1268	0	295	13
18	SW U.S. and N. Mexican highlands	107	41	9.7	0.6	1080	1	395	40
19	Northern South and Central America	216	-11	26.6	-0.1	1109	2	589	-15
20	Caribbean	180	-9	24.2	-0.6	1068	-2	578	-6
21	Central-northern Andes	626	-1	18.2	0.9	1081	6	1325	-3
22	Nordeste (Brazil)	437	-5	27.9	0.4	1192	-2	1195	12
23	Central eastern Brazil	710	-7	26.3	-0.2	1126	2	1696	-8
24	Amazon	1021	-6	27.7	0.0	995	4	2090	-7
25	Central-north Argentina	583	25	24.4	-1.0	1042	-4	1492	7
26	Pampas	789	39	23.2	-0.5	1087	-5	1780	14
27	Western Patagonia	102	-28	13.2	-0.9	1156	-1	433	2
28	Semi-arid Southern Cone	218	41	17.8	-1.1	1145	-4	723	36
29	Caucasus	328	22	4.2	1.5	805	0	800	8
30	Pamir area	242	2	4.4	1.2	963	-1	575	-13
31	Western Asia	168	6	8.7	1.5	897	-2	562	1
32	Gansu-Xinjiang (China)	86	83	-1.2	1.0	883	-2	311	53
33	Hainan (China)	205	56	20.6	-1.4	906	-1	655	30
34	Huanghuaihai (China)	110	23	6.9	0.5	912	1	456	35
35	Inner Mongolia (China)	111	163	-4.4	0.0	881	1	424	99
36	Loess region (China)	94	61	3.1	0.0	923	-1	413	44
37	Lower Yangtze (China)	634	47	11.0	-0.1	716	-8	1277	24
38	Northeast China	135	84	-6.3	0.6	785	0	454	72
39	Qinghai-Tibet (China)	213	32	2.0	-0.1	1036	-3	431	8
40	Southern China	460	99	15.2	-1.1	789	-8	1027	53
41	Southwest China	211	36	9.7	-0.3	726	-8	674	30
42	Taiwan (China)	352	77	16.0	-1.5	840	-8	1185	83
43	East Asia	178	0	-1.7	0.6	787	-1	564	29
44	Southern Himalayas	191	16	19.8	0.4	1064	-2	447	-15

	65 Global MRUs	RAIN		TEMP		RADPAR		BIOMSS	
		Current (mm)	15YA dep. (%)	Current (°C)	15YA dep. (°C)	Current (MJ/m²)	15YA dep. (%)	Current (g DM/m²)	5YA dep. (%)
45	Southern Asia	67	-35	27.3	0.8	1247	1	235	-34
46	Southern Japan and Korea	388	0	7.5	0.9	780	-5	1092	10
47	Southern Mongolia	57	133	-8.4	0.0	833	-2	261	109
48	Punjab to Gujarat	41	-24	23.5	0.2	1184	0	178	-31
49	Maritime Southeast Asia	1003	-7	26.2	0.0	1002	0	1885	-12
50	Mainland Southeast Asia	88	-44	26.7	-0.2	1230	6	319	-44
51	Eastern Siberia	107	-16	-11.1	0.1	596	-3	315	1
52	Eastern Central Asia	66	38	-12.7	1.5	683	-2	267	37
53	Northern Australia	685	-17	27.2	0.0	1160	6	1454	-16
54	Queensland to Victoria	172	-23	21.9	0.3	1224	0	638	-25
55	Nullarbor to Darling	208	134	21.0	-0.7	1223	-7	796	99
56	New Zealand	164	-39	15.7	0.7	1000	-3	694	-18
57	Boreal Eurasia	216	16	-5.0	0.1	400	-7	467	3
58	Ukraine to Ural mountains	236	45	-0.1	1.9	449	-11	711	21
59	Mediterranean Europe and Turkey	225	-15	8.7	0.8	776	-3	734	-9
60	W. Europe (non Mediterranean)	270	17	5.1	0.2	544	-6	907	18
61	Boreal America	272	26	-4.2	5.1	441	-8	462	44
62	Ural to Altai mountains	128	16	-5.2	2.8	568	-6	488	24
63	Australian desert	148	52	22.5	-1.0	1283	-3	624	17
64	Sahara to Afghan deserts	97	26	17.8	-0.2	1155	-1	346	24
65	Sub-arctic America	83	171	-18.2	5.9	173	-3	72	186

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-year (5YA) or fifteen-year average (15YA) for the same period between January and April.

Table A.2. January-April 2016 agroclimatic indicators and biomass by country

	31 Countries	RAIN		TEMP		RADPAR		BIOMSS	
		Current (mm)	15YA Dept (%)	Current (°C)	15YA Dept (°C)	Current (MJ/m²)	15YA Dept (%)	Current (g DM/m²)	5YA Departure (%)
[ARG]	Argentina	732	50	22.2	-0.8	1086	-5	1592	16
[AUS]	Australia	226	-13	22.3	0.1	1221	-1	701	-13
[BGD]	Bangladesh	255	23	24.1	0.4	1063	-4	614	3
[BRA]	Brazil	784	-7	26.5	-0.1	1091	1	1772	-5
[CAN]	Canada	173	-9	-4.5	2.7	620	-2	437	14
[CHN]	China	321	55	7.2	-0.1	790	-5	662	39
[DEU]	Germany	265	24	4.3	0.0	481	-7	928	20
[EGY]	Egypt	42	-28	16.8	0.5	1035	-1	202	2
[ETH]	Ethiopia	150	-19	21.9	0.2	1266	0	573	-2
[FRA]	France	252	2	6.4	-1.1	570	-8	940	31
[GBR]	United Kingdom	412	49	5.0	-1.3	450	-3	986	5
[IDN]	Indonesia	1215	3	26.3	0.0	966	-1	2167	-4
[IND]	India	97	-5	24.9	0.8	1197	0	242	-31
[IRN]	Iran	196	-2	8.4	0.9	994	-1	599	-6
[KAZ]	Kazakhstan	143	28	-3.3	3.0	620	-7	527	27
[KHM]	Cambodia	58	-67	29.0	0.0	1267	8	247	-60
[MEX]	Mexico	117	35	19.6	-0.3	1174	-1	376	24
[MMR]	Myanmar	70	-24	23.7	-0.6	1186	0	267	-26
[NGA]	Nigeria	156	12	29.0	-0.4	1293	0	447	11
[PAK]	Pakistan	142	-13	15.4	-0.1	1065	-1	357	-27
[PHL]	Philippines	125	-77	26.0	-0.1	1153	9	497	-62

	31 Countries	RAIN		TEMP		RADPAR		BIOMSS	
		Current (mm)	15YA Dept (%)	Current (°C)	15YA Dept (°C)	Current (MJ/m²)	15YA Dept (%)	Current (g DM/m²)	5YA Departure (%)
[POL]	Poland	216	25	3.1	0.7	451	-10	862	17
[ROU]	Romania	274	38	5.0	1.8	606	-5	951	28
[RUS]	Russia	191	36	-3.7	2.1	505	-8	542	22
[THA]	Thailand	89	-54	27.1	-0.1	1245	8	339	-49
[TUR]	Turkey	338	13	6.1	2.0	854	2	901	6
[UKR]	Ukraine	236	35	3.2	1.8	516	-7	883	29
[USA]	USA	334	14	6.4	1.2	818	-2	811	19
[UZB]	Uzbekistan	199	2	8.4	2.2	800	-2	650	4
[VNM]	Vietnam	214	28	21.9	-0.5	981	4	593	2
[ZAF]	South Africa	299	-7	21.4	0.6	1248	3	948	-8

See note table A.1.

Table A.3. Argentina, January-April 2016 agroclimatic indicators and biomass (by province)

	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	15YA Departure (%)	Current (°C)	15YA Departure (°C)	Current MJ/m²)	15YA Departure (%)	Current (g DM/m²)	5YA Departure (%)
Buenos Aires	616	41	19.7	-1.0	1126	-5	1571	19
Chaco	1009	80	25.5	-0.6	1085	-6	2084	34
Cordoba	617	35	21.4	-0.9	1062	-8	1578	9
Corrientes	1065	71	24.9	-0.7	1078	-7	1923	20
Entre Rios	1039	78	23.0	-0.5	1095	-6	1734	16
La Pampa	615	62	20.1	-1.3	1134	-7	1638	31
Misiones	826	18	24.9	0.0	1079	-4	2035	11
Santiago Del Estero	517	13	24.5	-1.0	1032	-6	1476	7
San Luis	589	49	20.4	-1.4	1091	-7	1523	14
Salta	725	38	23.3	-0.7	1022	0	1577	13
Santa Fe	839	53	23.6	-0.4	1090	-6	1705	10

See note table A.1.

Table A.4. Australia, January-April 2016 agroclimatic indicators and biomass (by state)

	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	15YA Departure (%)	Current (°C)	15YA Departure (°C)	Current (MJ/m²)	15YA Departure (%)	Current (g DM/m²)	5YA Departure (%)
New South Wales	154	-33	22.5	0.4	1250	1	616	-31
South Australia	131	34	19.9	-0.2	1226	-3	580	5
Victoria	119	-32	19.4	0.4	1166	-4	546	-30
W. Australia	215	72	21.6	-0.6	1232	-6	799	78

See note table A.1.

Table A.5. Brazil, January-April 2016 agroclimatic indicators and biomass (by state)

	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	15YA Departure (%)	Current (°C)	15YA Departure (°C)	Current (MJ/m²)	15YA Departure (%)	Current (g DM/m²)	5YA Departure (%)
Ceara	483	-27	27.9	0.1	1114	-3	1542	3
Goias	666	-20	25.7	-0.4	1156	2	1670	-19
Mato Grosso Do Sul	783	14	26.6	-1.1	1131	-1	1928	0

	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	15YA Departure (%)	Current (°C)	15YA Departure (°C)	Current (MJ/m²)	15YA Departure (%)	Current (g DM/m²)	5YA Departure (%)
Mato Grosso	991	-3	27.6	0.2	1093	5	2168	-8
Minas Gerais	534	-16	25.1	0.2	1178	1	1357	-8
Parana	652	-3	24.3	0.0	1097	2	1811	-3
Rio Grande Do Sul	830	35	23.5	-0.3	1066	-5	1975	16
Santa Catarina	703	-2	22.2	0.1	1037	-2	1865	-3
Sao Paulo	689	-8	25.3	0.1	1127	2	1786	-8

See note table A.1.

Table A.6. Canada, January-April 2016 agroclimatic indicators and biomass (by province)

	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	15YA Departure (%)	Current (°C)	15YA Departure (°C)	Current (MJ/m²)	15YA Departure (%)	Current (g DM/m²)	5YA Departure (%)
Alberta	92	-15	-2.3	4.2	591	-4	453	6
Manitoba	89	-12	-6.5	2.9	636	-5	407	18
Saskatchewan	100	4	-4.7	3.9	617	-6	433	18

See note table A.1.

Table A.7. India, January-April 2016 agroclimatic indicators and biomass (by state)

	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	15YA Departure (%)	Current (°C)	15YA Departure (°C)	Current (MJ/m²)	15YA Departure (%)	Current (g DM/m²)	5YA Departure (%)
Arunachal Pradesh	658	29	15.2	-0.3	758	-14	1202	10
Andhra Pradesh	28	-54	29.1	0.8	1279	2	119	-48
Assam	606	68	22.1	0.2	863	-9	1158	32
Bihar	47	-34	24.5	0.4	1163	-1	195	-45
Chandigarh	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Chhattisgarh	72	-7	26.6	0.9	1210	0	340	-12
Daman and Diu	0	-100	26.8	1.5	1308	0	0	-100
Delhi	45	-53	22.2	0.7	1129	0	194	-64
Dadra and Nagar Haveli	5	-5	24.5	-0.9	1306	1	30	-27
Gujarat	12	86	26.7	0.5	1278	0	63	26
Goa	0	-100	26.5	-0.7	1338	1	0	-100
Himachal Pradesh	273	6	5.8	1.4	1065	-3	515	-21
Haryana	59	-46	20.9	0.3	1113	0	249	-54
Jharkhand	45	-43	25.1	1.1	1194	0	222	-41
Kerala	126	-52	28.4	0.7	1280	2	454	-42
Karnataka	20	-76	27.6	0.7	1310	2	97	-67
Meghalaya	652	46	20.2	1.3	974	-7	966	14
Maharashtra	36	-3	27.7	1.1	1289	2	175	-16
Manipur	701	118	18.0	0.5	974	-9	1164	51
Madhya Pradesh	45	-14	25.6	1.0	1229	1	201	-33
Mizoram	387	54	20.4	-0.3	1053	-7	918	39
Nagaland	434	45	17.3	0.1	899	-10	1071	32
Orissa	100	13	26.9	0.9	1198	-1	382	-8
Puducherry	15	-89	28.7	1.2	1286	5	80	-81
Punjab	89	-36	19.4	0.2	1063	0	363	-37
Rajasthan	13	-58	23.9	0.2	1204	0	70	-59
Sikkim	285	40	8.0	1.0	999	-7	604	4
Tamil Nadu	25	-79	28.6	0.3	1320	4	104	-71
Tripura	388	55	23.6	0.5	1028	-5	972	46
Uttarakhand	140	-33	12.5	2.5	1099	-1	380	-45
Uttar Pradesh	42	-51	23.6	0.9	1165	1	189	-61

	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	15YA Departure (%)	Current (°C)	15YA Departure (°C)	Current (MJ/m²)	15YA Departure (%)	Current (g DM/m²)	5YA Departure (%)
West Bengal	87	-29	25.6	1.1	1128	-2	319	-37

See note table A.1.

Table A.8. Kazakhstan, January-April 2016 agroclimatic indicators and biomass (by oblast)

	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	15YA Departure (%)	Current (°C)	15YA Departure (°C)	Current (MJ/m²)	15YA Departure (%)	Current (g DM/m²)	5YA Departure (%)
Akmolinskaya	116	30	-5.1	3.4	580	-7	526	43
Karagandinskaya	118	27	-4.7	3.1	652	-6	530	40
Kustanayskaya	145	44	-4.9	2.7	545	-9	551	38
Pavlodarskaya	60	-17	-5.5	2.8	594	-5	328	-1
Severo	119	25	-5.7	3.0	529	-6	502	30
Vostochno	128	2	-6.8	2.5	692	-5	418	21
Zapadno	197	63	-0.3	3.3	511	-16	727	41

See note table A.1.

Table A.9. Russia, January-April 2016 agroclimatic indicators and biomass (by oblast, kray and republic)

	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	15YA Departure (%)	Current (°C)	15YA Departure (°C)	Current (MJ/m²)	15YA Departure (%)	Current (g DM/m²)	5YA Departure (%)
Bashkortostan	202	33	-3.5	3.3	473	-10	560	32
Chelyabinskaya	135	24	-5.2	2.1	487	-9	514	29
Gorodovikovsk	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Krasnodarskiy	174	-13	-2.1	1.2	572	-2	556	3
Kurganskaya	118	22	-5.5	2.4	477	-11	523	29
Kirovskaya	226	40	-3.6	2.4	401	-7	535	20
Kurskaya	298	83	0.5	1.5	447	-17	753	16
Lipetskaya	318	96	0.0	2.1	424	-21	720	21
Mordoviya	297	94	-1.4	2.5	434	-13	646	24
Novosibirskaya	99	-3	-7.0	3.0	514	-6	456	23
Nizhegorodskaya	276	77	-1.9	2.1	418	-9	619	22
Orenburgskaya	210	48	-2.8	3.2	505	-13	603	32
Omskaya	100	-2	-6.6	3.0	501	-6	478	25
Permskaya	211	35	-4.4	3.1	392	-11	513	24
Penzenskaya	287	84	-1.0	2.9	442	-17	670	27
Rostovskaya	212	1	3.7	2.4	529	-10	841	18
Ryazanskaya	290	78	-0.8	2.2	420	-14	676	21
Stavropolskiy	268	37	5.3	2.1	613	-3	854	18
Sverdlovskaya	142	26	-5.2	2.5	420	-11	505	21
Samarskaya	203	42	-2.0	3.1	479	-12	636	29
Saratovskaya	226	57	-0.3	3.0	480	-18	721	29
Tambovskaya	323	102	0.0	2.9	427	-21	726	25
Tyumenskaya	104	4	-6.0	3.0	476	-7	502	25
Tatarstan	209	46	-2.6	2.8	462	-9	596	27
Ulyanovskaya	205	43	-2.0	2.8	468	-11	627	27
Udmurtiya	225	48	-3.4	3.0	406	-11	546	25
Volgogradskaya	240	54	1.9	2.8	488	-18	838	29
Voronezhskaya	276	73	1.7	3.1	458	-17	826	29

See note table A.1.

Table A.10. United States, January-April 2016 agroclimatic indicators and biomass (by state)

	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	15YA Departure (%)	Current (°C)	15YA Departure (°C)	Current (MJ/m²)	15YA Departure (%)	Current (g DM/m²)	5YA Departure (%)
Arkansas	705	49	10.9	0.8	843	1	1320	3
California	259	16	9.5	1.4	891	-3	683	32
Idaho	311	84	0.2	1.5	794	-1	710	31
Indiana	360	-5	4.8	1.1	751	-3	1009	12
Illinois	272	-21	4.8	1.3	760	-4	953	7
Iowa	267	6	2.2	1.7	734	-8	842	18
Kansas	210	7	7.0	1.7	889	1	627	-1
Michigan	313	7	-0.1	1.3	644	-9	669	12
Minnesota	260	49	-1.9	2.4	658	-10	623	25
Missouri	348	-6	7.2	1.4	805	0	1040	1
Montana	243	116	1.1	3.1	713	-7	747	51
Nebraska	219	37	4.0	2.2	822	-4	805	31
North Dakota	229	113	-1.4	3.7	663	-12	636	47
Ohio	366	5	4.2	1.3	729	-2	971	12
Oklahoma	371	33	10.1	0.9	927	4	860	4
Oregon	335	33	5.3	1.6	698	-3	900	35
South Dakota	257	85	1.9	3.0	730	-9	797	41
Texas	319	42	14.0	0.3	977	3	792	35
Washington	313	24	4.9	1.8	645	0	898	29
Wisconsin	296	13	-0.8	1.5	657	-9	672	16

See note table A.1.

Table A.11. China, January-April 2016 agroclimatic indicators and biomass (by province)

	RAIN		TEMP		RADPAR		BIOMSS	
	Current (mm)	15YA Departure (%)	Current (°C)	15YA Departure (°C)	Current (MJ/m²)	15YA Departure (%)	Current (g DM/m²)	5YA Departure (%)
Anhui	332	5	9.7	0.2	810	-4	1018	22
Chongqing	275	47	9.5	0.0	609	-8	900	50
Fujian	871	85	11.9	-0.7	688	-14	1504	45
Gansu	769	131	15.4	-1.2	682	-13	1513	74
Guangdong	77	45	1.8	0.0	936	-2	306	22
Guangxi	574	96	14.6	-0.7	640	-8	1153	42
Guizhou	298	54	10.2	-0.2	596	-13	868	37
Hebei	75	58	2.3	0.2	928	4	333	47
Henan	138	18	8.4	0.5	879	-1	585	32
Heilongjiang	122	79	-8.1	0.7	755	0	428	74
Hubei	355	26	9.5	0.3	758	-4	998	29
Hunan	634	53	10.9	0.0	649	-8	1340	27
Jilin	145	89	-5.0	0.6	805	-1	502	70
Jiangsu	190	-10	8.6	0.3	849	-2	747	12
Jiangxi	770	39	11.8	-0.1	691	-10	1484	22
Liaoning	153	89	-0.9	0.5	869	2	550	72
Inner Mongolia	115	176	-6.6	0.2	833	0	395	97
Ningxia	44	37	1.2	-0.1	946	-2	207	23
Sichuan	129	22	8.7	-0.4	773	-6	509	22
Shandong	101	31	6.6	0.6	925	2	434	34
Shaanxi	110	40	4.8	0.0	841	-3	469	36
Shanxi	113	110	1.2	0.0	930	1	500	94
Yunnan	118	1	12.4	-1.1	964	-6	458	2
Zhejiang	545	21	10.0	0.0	742	-7	1285	18

See note table A.1.

Annex B. 2016 production estimates

Tables B.1 –B.3 present 2016 CropWatch production estimates for Argentina, Brazil, and the United States.

Table B.1. Argentina, 2016 maize and soybean production, by province (thousand tons)

	Maize		Soybean	
	2016	Δ%	2016	Δ%
Buenos Aires	7104	-1	14067	-1
Córdoba	7044	0	12107	1
Entre Rios	1143	3	3597	6
San Luis	1116	0		
Santa Fe	4299	2	10541	1
Santiago Del Estero	1215	0		
Sub total	**21920**	**0**	**40312**	**1**
Others	3790	9	10769	-8
Argentina	**25710**	**1**	**51080**	**-1**

Δ% indicates percentage difference with 2015.

Table B.2. Brazil, 2016 maize, rice, and soybean production, by state (thousand tons)

	Maize		Rice		Soybean	
	2016	Δ%	2016	Δ%	2016	Δ%
Goias	8505	0			9802	-2
Mato Grosso	20103	2			26810	3
Mato Grosso Do Sul	7954	4			6388	1
Minas Gerais	7220	-2			3512	-3
Parana	15086	0			17227	0
Rio Grande Do Sul	4824	-1	9513	10	13529	-1
Santa Catarina	3050	0	1128	7	1708	0
Sao Paulo	3828	0			2172	0
Sub total	**70570**	**1**	**10641**	**10**	**81148**	**1**
Others	8535	-10	2603	21	10678	12
Brazil	**79105**	**-1**	**13244**	**12**	**91826**	**2**

Δ% indicates percentage difference with 2015.

Table B.3. United States, 2016 wheat production, by state (thousand tons)

	Wheat				
	2016	Δ%		2016	Δ%
Arkansas	649	-5	Nebraska	2093	1
California	631	8	North Carolina	1263	4
Colorado	2415	-2	North Dakota	901	-4
Idaho	2351	-13	Ohio	1197	8
Illinois	1235	0	Oklahoma	1332	-8
Indiana	733	6	Oregon	981	-15
Kansas	7992	3	South Dakota	3041	-6
Kentucky	1010	1	Tennessee	869	0
Michigan	1048	6	Texas	1829	-12
Missouri	1193	1	Washington	2851	-1
Montana	5420	-3			
Sub total	41035	-2			
Other states	13236	-10			
United States	54271	-4			

Δ% indicates percentage difference with 2015.

Annex C. Quick reference to CropWatch indicators, spatial units, and production estimation methodology

The following sections give a brief overview of CropWatch indicators and spatial units, along with a description of the CropWatch production estimation methodology. For more information about CropWatch methodologies, visit CropWatch online atwww.cropwatch.com.cn.

CropWatch indicators

The CropWatch indicators are designed to assess the condition of crops and the environment in which they grow and develop; the indicators—RAIN (for rainfall), TEMP (temperature), and RADPAR (photosynthetically active radiation, PAR)—are not identical to the weather variables, but instead are value-added indicators computed only over crop growing areas (thus for example excluding deserts and rangelands) and spatially weighted according to the agricultural production potential, with marginal areas receiving less weight than productive ones. The indicators are expressed using the usual physical units (e.g., mm for rainfall) and were thoroughly tested for their coherence over space and time. CWSU are the CropWatch Spatial Units, including MRUs, MPZ, and countries (including first-level administrative districts in select large countries). For all indicators, high values indicate "good" or "positive."

INDICATOR			
BIOMSS			
Biomass accumulation potential			
Crop/ Ground and satellite	grams dry matter/m^2, pixel or CWSU	An estimate of biomass that could potentially be accumulated over the reference period given the prevailing rainfall and temperature conditions.	Biomass is presented as maps by pixels, maps showing average pixels values over CropWatch spatial units (CWSU), or tables giving average values for the CWSU. Values are compared to the average value for the last five years (2011-15), with departures expressed in percentage.
CALF			
Cropped arable land and cropped arable land fraction			
Crop/ Satellite	[0,1] number, pixel or CWSU average	The area of cropped arable land as fraction of total (cropped and uncropped) arable land. Whether a pixel is cropped or not is decided based on NDVI twice a month. (For each four-month reporting period, each pixel thus has 8 cropped/ uncropped values).	The value shown in tables is the maximum value of the 8 values available for each pixel; maps show an area as cropped if at least one of the 8 observations is categorized as "cropped." Uncropped means that no crops were detected over the whole reporting period. Values are compared to the average value for the last five years (2011-15), with departures expressed in percentage.
CROPPING INTENSITY			
Cropping intensity Index			
Crop/ Satellite	0, 1, 2, or 3; Number of crops growing over a year for each pixel	Cropping intensity index describes the extent to which arable land is used over a year. It is the ratio of the total crop area of all planting seasons in a year to the total area of arable land.	Cropping intensity is presented as maps by pixels or spatial average pixels values for MPZs, 31 countries, and 7 regions for China. Values are compared to the average of the previous five years, with departures expressed in percentage.

INDICATOR			
NDVI			
Normalized Difference Vegetation Index			
Crop/ Satellite	[0.12-0.90] number, pixel or CWSU average	An estimate of the density of living green biomass.	NDVI is shown as average profiles over time at the national level (cropland only) in crop condition development graphs, compared with previous year and recent five-year average (2011-15), and as spatial patterns compared to the average showing the time profiles, where they occur, and the percentage of pixels concerned by each profile.
RADPAR			
CropWatch indicator for Photosynthetically Active Radiation (PAR), based on pixel based PAR			
Weather/Satellite	W/m², CWSU	The spatial average (for a CWSU) of PAR accumulation over agricultural pixels, weighted by the production potential.	RADPAR is shown as the percent departure of the RADPAR value for the reporting period compared to the recent fifteen-year average (2001-15), per CWSU. For the MPZs, regular PAR is shown as typical time profiles over the spatial unit, with a map showing where the profiles occur and the percentage of pixels concerned by each profile.
RAIN			
CropWatch indicator for rainfall, based on pixel-based rainfall			
Weather/Ground and satellite	Liters/m², CWSU	The spatial average (for a CWSU) of rainfall accumulation over agricultural pixels, weighted by the production potential.	RAIN is shown as the percent departure of the RAIN value for the reporting period, compared to the recent fifteen-year average (2001-15), per CWSU. For the MPZs, regular rainfall is shown as typical time profiles over the spatial unit, with a map showing where the profiles occur and the percentage of pixels concerned by each profile.
TEMP			
CropWatch indicator for air temperature, based on pixel-based temperature			
Weather/Ground	°C, CWSU	The spatial average (for a CWSU) of the temperature time average over agricultural pixels, weighted by the production potential.	TEMP is shown as the departure of the average TEMP value (in degrees Centigrade) over the reporting period compared with the average of the recent fifteen years (2001-15), per CWSU. For the MPZs, regular temperature is illustrated as typical time profiles over the spatial unit, with a map showing where the profiles occur and the percentage of pixels concerned by each profile.
VCIx			
Maximum vegetation condition index			
Crop/ Satellite	Number, pixel to CWSU	Vegetation condition of the current season compared with historical data. Values usually are [0, 1], where 0 is "NDVI as bad as the worst recent year" and 1 is "NDVI as good as the best recent year." Values can exceed the range if the current year is the best or the worst.	VCIx is based on NDVI and two VCI values are computed every month. VCIx is the highest VCI value recorded for every pixel over the reporting period. A low value of VCIx means that no VCI value was high over the reporting period. A high value means that at least one VCI value was high. VCI is shown as pixel-based maps and as average value by CWSU.
VHI			
Vegetation health index			
Crop/ Satellite	Number, pixel to CWSU	The average of VCI and the temperature condition index (TCI), with TCI defined like VCI but for	Low VHI values indicate unusually poor crop condition, but high values, when due to low temperature, may be difficult to interpret. VHI is

INDICATOR			
		temperature. VHI is based on the assumption that "high temperature is bad" (due to moisture stress), but ignores the fact that low temperature may be equally "bad" (crops develop and grow slowly, or even suffer from frost).	shown as typical time profiles over Major Production Zones (MPZ), where they occur, and the percentage of pixels concerned by each profile.
VHIn			
Minimum Vegetation health index			
Crop/ Satellite	Number, pixel to CWSU	VHIn is the lowest VHI value for every pixel over the reporting period. Values usually are [0, 100]. Normally, values lower than 35 indicate poor crop condition.	Low VHIn values indicate the occurrence of water stress in the monitoring period, often combined with lower than average rainfall. The spatial/time resolution of CropWatch VHIn is 16km/week for MPZs and 1km/dekad for China.

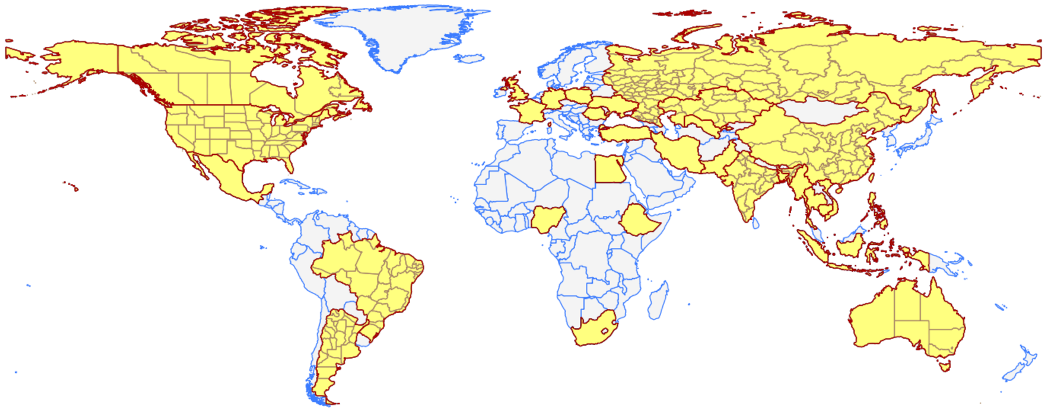
Note: Type is either "Weather" or "Crop"; source specifies if the indicator is obtained from ground data, satellite readings, or a combination; units: in the case of ratios, no unit is used; scale is either pixels or large scale CropWatch spatial units (CWSU). Many indicators are computed for pixels but represented in the CropWatch bulletin at the CWSU scale.

CropWatch spatial units (CWSU)

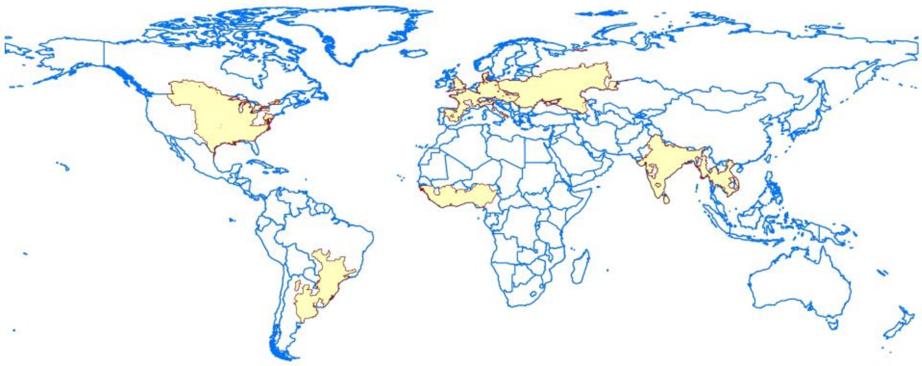
CropWatch analyses are applied to four kinds of CropWatch spatial units (CWSU): Countries, China, Major Production Zones (MPZ), and global crop Monitoring and Reporting Units (MRU). The tables below summarize the key aspects of each spatial unit and show their relation to each other. For more details about these spatial units and their boundaries, see the CropWatch bulletin online resources.

SPATIAL LUNITS	
CHINA	
Overview	*Description*
Seven monitoring regions	The seven regions in China are agro-economic/agro-ecological regions that together cover the bulk of national maize, rice, wheat, and soybean production. Provinces that are entirely or partially included in one of the monitoring regions are indicated in color on the map below.

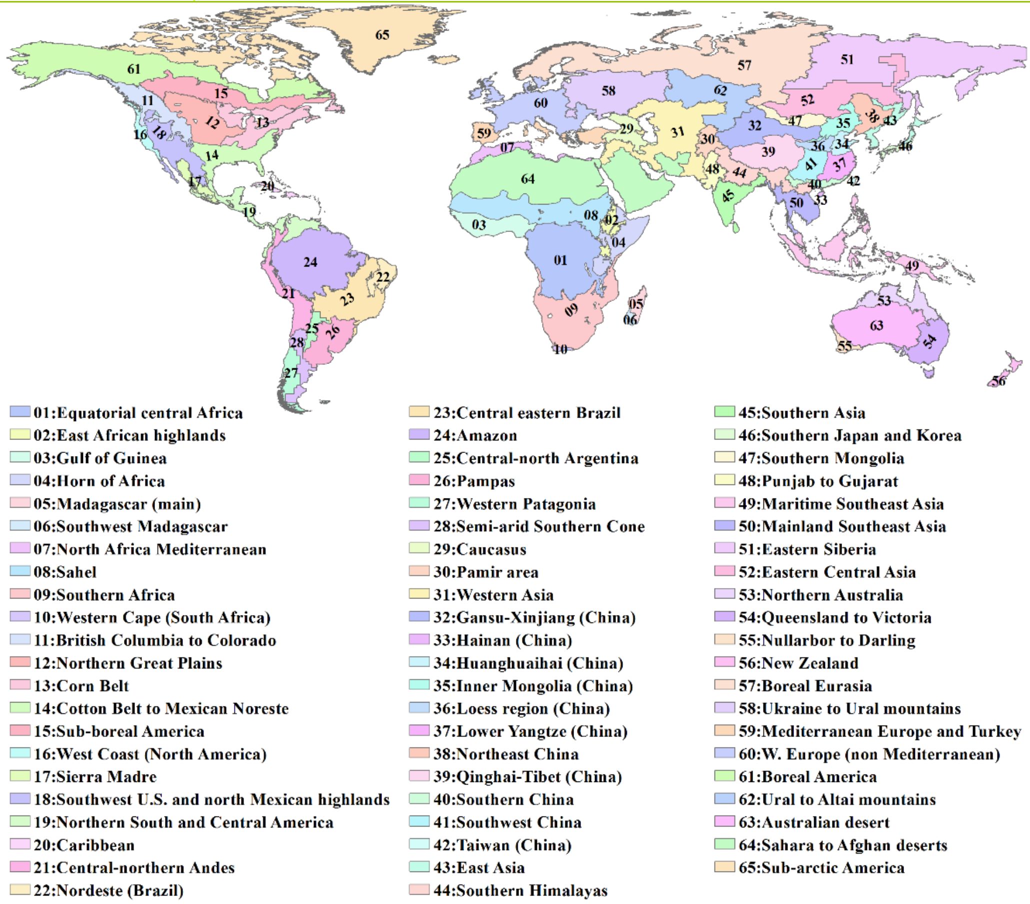
Countries (and first-level administrative districts, e.g., states and provinces)	
Overview	*Description*
"Thirty plus one" countries to represent main producers/exporters and other key countries.	CropWatch monitored countries together represent more than 80 percent of the production of maize, rice, wheat and soybean, as well as 80 percent of exports. Some countries were included in the list based on criteria of proximity to China (Uzbekistan, Cambodia), regional importance, or global geopolitical relevance (e.g., four of five most populous countries in Africa). The total number of countries monitored is "thirty plus one," referring to thirty countries and China itself. For the nine largest countries—, United States, Brazil, Argentina, Russia, Kazakhstan, India, China, and Australia, maps and analyses may also present results for the first-level administrative subdivision. The CropWatch agroclimatic indicators are computed for all countries and included in the analyses when abnormal conditions occur. Background information about the countries' agriculture and trade is available on the CropWatch Website, **www.cropwatch.com.cn**.



Major Production Zones (MPZ)	
Overview	*Description*
Seven globally important areas of agricultural production	The six MPZs include West Africa, South America, North America, South and Southeast Asia, Western Europe and Central Europe to Western Russia. The MPZs are not necessarily the main production zones for the four crops (maize, rice, soybean, wheat) currently monitored by CropWatch, but they are globally or regionally important areas of agricultural production. The seven zones were identified based mainly on production statistics and distribution of the combined cultivation area of maize, rice, wheat and soybean.



Global Monitoring and Reporting Unit (MRU)	
Overview	*Description*
65 agro-ecological/agro-economic units across the world	MRUs are reasonably homogeneous agro-ecological/agro-economic units spanning the globe, selected to capture major variations in worldwide farming and crops patterns while at the same time providing a manageable (limited) number of spatial units to be used as the basis for the analysis of environmental factors affecting crops. Unit numbers and names are shown in the figure below. A limited number of units (e.g., MRU-63 to 65) are not relevant for the crops currently monitored by CropWatch but are included to allow for more complete coverage of global production. Additional information about the MRUs is provided online under **www.cropwatch.com.cn** .



Production estimation methodology

The main concept of the CropWatch methodology for estimating production is the calculation of current year production based on information about last year's production and the variations in crop yield and cultivated area compared with the previous year. The equation for production estimation is as follows:

$$Production_i = Production_{i-1} * (1 + \Delta Yield_i) * (1 + \Delta Area_i)$$

Where i is the current year, $\Delta Yield_i$ and $\Delta Area_i$ are the variations in crop yield and cultivated area compared with the previous year; the values of $\Delta Yield_i$ and $\Delta Area_i$ can be above or below zero.

For the 31 countries monitored by CropWatch, yield variation for each crop is calibrated against NDVI time series, using the following equation:

$$\Delta Yield_i = f(NDVI_i, NDVI_{i-1})$$

Where$NDVI_i$ and $NDVI_{i-1}$ are taken from the time series of the spatial average of NDVI over the crop specific mask for the current year and the previous year. For NDVI values that correspond to periods after the current monitoring period, average NDVI values of the previous five years are used as an average expectation. $\Delta Yield_i$ is calculated by regression against average or peak NDVI (whichever yields the best regression), considering the crop phenology of each crop for each individual country.

A different method is used for areas. For China, CropWatch combines remote-sensing based estimates of the crop planting proportion (cropped area to arable land) with a crop type proportion (specific type area to total cropped area). The planting proportion is estimated based on an unsupervised classification of high resolution satellite images from HJ-1 CCD and GF-1 images. The crop-type proportion for China is obtained by the GVG instrument from field transects. The area of a specific crop is computed by multiplying farmland area, planting proportion, and crop-type proportion of the crop.

To estimate crop area for wheat, soybean, maize, and rice outside China, CropWatch relies on the regression of crop area against cropped arable land fraction of each individual country (paying due attention to phenology):

$$Area_i = a + b * CALF_i$$

where a and b are the coefficients generated by linear regression with area from FAOSTAT or national sources and CALF the Cropped Arable Land Fraction from CropWatch estimates. $\Delta Area_i$ can then be calculated from the area of current and the previous years.

The production for "other countries" (outside the 31 CropWatch monitored countries) was estimated as the 2015 and 2016 extrapolation of the 2005-2014 linear trend of FAOSTAT data.

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Online resources

This bulletin is only part of the CropWatch resources available. Visit www.cropwatch.com.cnfor access to additional resources, including the methods behind CropWatch, country profiles, and other CropWatch publications. For additional information or to access specific data or high-resolution graphs, simplycontact the CropWatch team at cropwatch@radi.ac.cn.

Online Resources posted on www.cropwatch.com.cn:

- ✓ **Definition of spatial units**
  Adescription of the four spatial levels of analysis: Monitoring and Reporting Units (MRU), Major Production Zones (MPZ), selected countries, and the use of sub-national administrative areas.
- ✓ **Methodology**
  Overview of CropWatch data sources and methods.
- ✓ **Time series of indicators**
  Background data on agroclimatic indicators presented in a series of tables.
- ✓ **Country profiles**
  Short profiles for each of the 30 countries and China highlighting key facts of interest to agriculture.
- ✓ **Country long termtrends**
  Quick overview of average crop area, yield, and production values for maize, rice, soybean, and wheat for recent years, along with long-term (2001-12) trends (basedon FAOSTAT data).

CropWatch bulletins introduce the use of several new and experimental indicators. We would be very interested in receiving feedback about their performance in other countries. With feedback on the contents of this report and the applicability of the new indicators to global areas, please contact:

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