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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.

Contents

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

Contents iii

Abbreviations x

Bulletin overview and reporting period xi

Executive summary 12

Chapter 1. Global agroclimatic patterns 15

1.1 Overview 15

1.2 Rainfall 17

1.3 Temperature 18

1.4 Solar Radiation 19

1.5 Biomass production potential BIOMSS and combinations of anomalies 20

Chapter 2. Crop and environmental conditions in major production zones 22

2.1 Overview 22

2.2 West Africa 23

2.3 North America 25

2.4 South America 27

2.5 South and Southeast Asia 30

2.6 Western Europe 33

2.7 Central Europe to Western Russia 36

Chapter 3. Main producing and exporting countries 38

3.1 Overview 38

3.2 Country analysis 43

Chapter 4. China 157

4.1 Overview 157

4.2 China crop production 160

4.3 Regional analysis 163

4.4 Pest and diseases monitoring 172

4.5 Major crops trade prospects 176

Chapter 5. Focus and perspectives 178

5.1 CropWatch food production estimates 178

5.2 Disaster events 182

5.3 Focus: Rangeland management and issues in Africa 188

5.4 Update on El Niño 196

Annex A. Agroclimatic indicators and BIOMSS 198

Annex B. 2017 production estimates 207

Annex C. Quick reference to CropWatch indicators, spatial units and methodologies 209

Data notes and bibliography 218

Acknowledgments 221

Online resources 222

LIST OF TABLES

Table 2.1. July-October 2017 agroclimatic indicators by Major Production Zone, current value and departure from 15YA 22
Table 2.2. July-October 2017 agronomic indicators by Major Production Zone, current season values and departure from 5YA 22
Table 3.1. CropWatch agroclimatic and agronomic indicators for April-July 2017, departure from 5YA and 15YA . 42
Table 3.2. Argentina agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, July-October 2017 47
Table 3.3. Argentina agronomic indicators by sub-national regions, current season's values and departure from 5YA, July-October 2017 47
Table 3.4. CropWatch-estimated maize, rice, wheat, and soybean production for Argentina in 2017 (thousand tons) 47
Table 3.5. Australia agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, July-October 2017 51
Table 3.6. Australia agronomic indicators by sub-national regions, current season's values and departure from 5YA, July-October 2017 51
Table 3.7. CropWatch-estimated wheat production for Australia in 2017 (thousand tons) 51
Table 3.8. Bangladesh agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, July-October 2017 55
Table 3.9. Bangladesh agronomic indicators by sub-national regions, current season's values and departure from 5YA, July-October 2017 55
Table 3.10. CropWatch-estimated maize, rice and wheat production for Bangladesh in 2017 (thousand tons) 55
Table 3.11. Brazil agro-climatic indicators by sub-national regions, current season's values and departure from 15YA, July-October 2017 60
Table 3.12. Brazil agronomic indicators by sub-national regions, current season's values and departure from 5YA, July-October 2017 60
Table 3.13. CropWatch-estimated maize, rice, wheat, and soybean production for Brazil in 2017 (thousand tons) 60
Table 3.14. Canada agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, July-October 2017 63
Table 3.15. Canada agronomic indicators by sub-national regions, current season's values and departure from 5YA, July-October 2017 63
Table 3.16. CropWatch-estimated maize, rice, wheat, and soybean production in Canada for 2017 (thousand tons) 64
Table 3.17. Germany agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, July-October 2017 68
Table 3.18. Germany agronomic indicators by sub-national regions, current season's value and departure from 5YA, July-October 2017 68
Table 3.19. CropWatch-estimated maize and wheat production for Germany in 2017 (thousands tons) 68
Table 3.20. Egypt agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, July-October 2017 71
Table 3.21. Egypt agronomic indicators by sub-national regions, current season's values and departure from 5YA, July-October 2017 71
Table 3.22. CropWatch-estimated maize, rice, and wheat production for Egypt in 2017 (thousand tons) 71
Table 3.22. Ethiopia agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, July-October 2017 74
Table 3.23. Ethiopia, agronomic indicators by sub-national regions, current season's values and departure from 5YA, July-October 2017 74
Table 3.24. CropWatch-estimated maize and wheat production in Ethiopia for 2017 (thousand tons) 74
Table 3.26. France agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, July-October 2017 78
Table 3.27. France agronomic indicators by sub-national regions, current season's value and departure from 5YA, July-October 2017 79
Table 3.28. CropWatch-estimated maize and rice production for France in 2017 (thousand tons) 79

Table 3.29. United Kingdom agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, July-October 2017 82
Table 3.30. United Kingdom, agronomic indicators by sub-national regions, current season's values and departure from 5YA, July-October 2017 82
Table 3.31. CropWatch-estimated wheat production for United Kingdom in 2017 (thousand tons) 82
Table 3.32. Indonesia agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, July-October 2017 85
Table 3.33. Indonesia agronomic indicators by sub-national regions, current season's value and departure from 5YA, July-October 2017 85
Table 3.34. CropWatch-estimated maize and rice production for Indonesia in 2017 (thousands tons) 85
Table 3.35. India agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, July-October 2017 90
Table 3.36. India agronomic indicators by sub-national regions, current season's values and departure from 5YA, July-October 2017 90
Table 3.37. CropWatch-estimated maize, rice, wheat, and soybean production for India in 2017 (thousand tons) 90
Table 3.38. Iran agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, July-October 2017 93
Table 3.39. Iran agronomic indicators by sub-national regions, current season's value and departure from 5YA, July-October 2017 93
Table 3.40. CropWatch-estimated rice and wheat production for Iran in 2017 (thousands tons) 93
Table 3.41. Kazakhstan agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, July-October 2017 96
Table 3.42. Kazakhstan, agronomic indicators by sub-national regions, current season's values and departure from 5YA, July-October 2017 96
Table 3.43. CropWatch-estimated wheat production for Kazakhstan in 2017 (thousand tons) 96
Table 3.44. Cambodia agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, July-October 2017 99
Table 3.45. Cambodia, agronomic indicators by sub-national regions, current season's values and departure from 5YA, July-October 2017 99
Table 3.46. CropWatch-estimated maize and wheat production for Cambodia in 2017 (thousand tons) 99
Table 3.47. Mexico agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, July-October 2017 103
Table 3.48. Mexico agronomic indicators by sub-national regions, current season's values and departure from 5YA, July-October 2017 103
Table 3.49. CropWatch-estimated maize, wheat and soybean production for Mexico in 2017 (thousands tons) . 103
Table 3.50. Myanmar agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, July-October 2017 107
Table 3.51. Myanmar agronomic indicators by sub-national regions, current season's values and departure from 5YA, July-October 2017 107
Table 3.52. CropWatch-estimated maize and rice production for Myanmar in 2017 (thousand tons) 107
Table 3.53. Nigeria agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, July-October 2017 111
Table 3.54. Nigeria, agronomic indicators by sub-national regions, current season's values and departure from 5YA, July-October 2017 111
Table 3.55. CropWatch-estimated maize and rice production for Nigeria in 2017 (thousand tons) 111
Table 3.56. Pakistan agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, July-October 2017 114
Table 3.57. Pakistan, agronomic indicators by sub-national regions, current season's values and departure from 5YA, July-October 2017 114
Table 3.58. CropWatch-estimated maize, rice, and wheat production for Pakistan in 2017 (thousand tons) 114
Table 3.59. Philippines agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, July-October 2017 118
Table 3.60. Philippines agronomic indicators by sub-national regions, current season's values and departure from 5YA, July-October 2017 118
Table 3.61. CropWatch-estimated maize and rice production for Philippines in 2017 (thousand tons) 118

Table 3.62. Poland agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, July-October 2017 122
Table 3.63. Poland agronomic indicators by sub-national regions, current season's values and departure from 5YA, July-October 2017 122
Table 3.64. CropWatch-estimated wheat production for Poland in 2017 (thousand tons) 122
Table 3.65. Romania agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, July-October 2017 125
Table 3.66. Romania agronomic indicators by sub-national regions, current season's values and departure from 5YA, July-October 2017 125
Table 3.67. CropWatch-estimated maize and wheat production for Romania in 2017 (thousand tons) 125
Table 3.68. Russia agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, July-October 2017 129
Table 3.69. Russia agronomic indicators by sub-national regions, current season's values and departure from 5YA, July-October 2017 129
Table 3.70. CropWatch-estimated maize, rice, wheat and soybean production for Russia in 2017 (thousand tons) 129
Table 3.71. July-October 2017 agroclimatic indicators by sub-national regions, current season values and departure from15YA 133
Table 3.72. July-October 2017 agronomic indicators by sub-national regions, current season values and departure from 5YA 133
Table 3.73. CropWatch estimated maize and rice production for 2017 (thousands tons) 133
Table 3.74.Turkey agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, July-October 2017 137
Table 3.75. Turkey agronomic indicators by sub-national regions, current season's values and departure from 5YA, July-October 2017 137
Table 3.76. CropWatch-estimated maize and wheat production for Turkey in 2017 (thousand tons) 137
Table 3.77. Ukraine agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, July-October 2017 141
Table 3.78. Ukraine agronomic indicators by sub-national regions, current season's values and departure from 5YA, July-October 2017 141
Table 3.79. CropWatch-estimated maize, wheat and soybean production for Ukraine in 2017 (thousand tons) 141
Table 3.80. United States agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, July-October 2017 146
Table 3.81. United States agronomic indicators by sub-national regions, current season's values and departure from 5YA, July-October 2017 146
Table 3.82. CropWatch-estimated maize, wheat, rice and soybean production for the United States in 2017 (thousand tons) 146
Table 3.83. Uzbekistan agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, July-October 2017 149
Table 3.84. Uzbekistan agronomic indicators by sub-national regions, current season's values and departure from 5YA, July-October 2017 149
Table 3.85. CropWatch-estimated wheat production for Uzbekistan in 2017 (thousand tons) 149
Table 3.86 Vietnam agroclimatic indicators by sub-national regions, current season values and departure from 15YA, July-October 2017 153
Table 3.87 Vietnam agronomic indicators by sub-national regions, current season values and departure from 5YA, July-October 2017 153
Table 3.88 CropWatch-estimated rice production for Vietnam in 2017 (thousands tons) 153
Table 3.89. South Africa agroclimatic indicators by sub-national regions, current season values and departure from 15YA, July-October 2017 156
Table 3.90. South Africa agronomic indicators by sub-national regions, current season values and departure from 5YA, July-October 2017 156
Table 3.91. CropWatch estimated maize and wheat production for South Africa in 2017 (thousands tons) 156
Table 4.1. CropWatch agroclimatic and agronomic indicators for China, July-October 2017, departure from 5YA and 15YA 158

Table 4.2. China 2017 production of maize, rice, wheat, and soybean, and percentage change from 2016, by province 161
Table 4.3. China 2017 early rice, single rice, and ate rice production and percentage difference from 2016, by province 162
Table 4.4. Aggregated crop production per the harvest season for major agricultural provinces, China 2017 163
Table 4.5. Occurrence ratio of rice planthopper in China, mid to late September 2017 172
Table 4.6. Statistics of rice leaf roller in China, mid to late September 2017 173
Table 4.7. Statistics of rice sheath blight in China, mid to late September 2017 174
Table 4.8. Statistics of maize armyworm in China, late August 2017 175
Table 4.9. Statistics of maize sheath blight in China, August 2017 176
Table 5.1. Summary of 2017 estimates of cereal and soybean output of major producers and variation (%), compared with 2016 179
Table 5.2. 2017 production (million tons) and difference from 2016 of major importing and exporting countries 181
Table 5.3. Main characteristics of major cyclonic events occurring in July-October 2017 183
Table 5.4. Select statistics about rangelands and cattle in Africa 193
Table A.1. July-October 2017 agroclimatic indicators and biomass by global Monitoring and Reporting Unit 198
Table A.2. July-October 2017 agroclimatic indicators and biomass by country 200
Table A.3. Argentina, July-October 2017 agroclimatic indicators and biomass (by province) 201
Table A.4. Australia, July-October 2017 agroclimatic indicators and biomass (by state) 201
Table A.5. Brazil, July-October 2017 agroclimatic indicators and biomass (by state) 201
Table A.6. Canada, July-October 2017 agroclimatic indicators and biomass (by province) 202
Table A.7. India, July-October 2017 agroclimatic indicators and biomass (by state) 202
Table A.8. Kazakhstan, July-October 2017 agroclimatic indicators and biomass (by oblast) 203
Table A.9. Russia, July-October 2017 agroclimatic indicators and biomass (by oblast, kray and republic) 203
Table A.10. United States, July-October 2017 agroclimatic indicators and biomass (by state) 205
Table A.11. China, July-October 2017agroclimatic indicators and biomass (by province) 205
Table C.1. Criteria for wheat yellow rust occurrence level 216
Table C.2. Criteria for wheat sheath blight occurrence level 217
Table C.3. Criteria for wheat aphid occurrence level 217

LIST OF FIGURES

Figure 2.1 West Africa MPZ: Agroclimatic and agronomic indicators, July-October 2017 23
Figure 3.1. Global map of July-October 2017 rainfall (RAIN) by country and sub-national areas, departure from 15YA (percentage) 38
Figure 3.2. Global map of July-October 2017 temperature (TEMP) by country and sub-national areas, departure from 15YA (degrees) 39
Figure 3.3. Global map of July-October 2017 PAR (RADPAR) by country and sub-national areas, departure from 15YA (percentage) 39
Figure 3.4. Global map of July-October 2017 biomass (BIOMSS) by country and sub-national areas, departure from 5YA (percentage) 39
Figure 3.5. Argentina crop condition, July-October 2017 45
Figure 3.6. Australia crop condition, July-October 2017 49
Figure 3.7. Bangladesh crop condition, July - October 2017 53
Figure 3.8. Brazil crop condition, July-October 2017 57
Figure 3.9. Canada crop condition, July - October 2017 62
Figure 3.10. Germany crop condition, July-October 2017 66
Figure 3.11. Egypt crop condition, July-October 2017 69
Figure 3.12. Ethiopia crop condition, July-October 2017 73
Figure 3.13. France crop condition, July-October 2017 76
Figure 3.14. United Kingdom crop condition, July-October 2017 80
Figure 3.15. Indonesia crop condition, July-October 2017 84
Figure 3.17. Iran crop condition, July-October 2017 91
Figure 3.18. Kazakhstan crop condition, July-October 2017 95
Figure 3.19. Cambodia crop condition, July-October 2017 97
Figure 3.20. Mexico crop condition, July-October 2017 101
Figure 3.21. Myanmar crop condition, July-October 2017 105
Figure 3.22. Nigeria crop condition, July-October 2017 109
Figure 3.23. Pakistan crop condition, July-October 2017 113
Figure 3.24. Philippines crop condition, July-October 2017 116
Figure 3.25. Poland crop condition, July-October 2017 120
Figure 3.26. Romania crop condition, July-October 2017 123
Figure 3.27. Russia crop condition, July-October 2017 126
Figure 3.28. Thailand crop condition, July-October 2017 131
Figure 3.29. Turkey crop condition, July-October 2017 135
Figure 3.30. Ukraine crop condition, July-October 2017 139
Figure 3.31. United States crop condition, July-October 2017 143
Figure 3.32. Uzbekistan crop condition, July-October 2017 147
Figure 3.33. Vietnam crop condition, July-October 2017 150
Figure 3.34. South Africa crop condition, July-October 2017 155
Figure 4.6. Crop condition China Northeast region, July-October 2017 164
Figure 4.7. Crop condition China Inner Mongolia, July-October 2017 165
Figure 4.8. Crop condition China Huanghuaihai, July-October 2017 166
Figure 4.9. Crop condition China Loess region, July-October 2017 167
Figure 4.10. Crop condition Lower Yangtze region, July-October 2017 168
Figure 4.11. Crop condition Southwest China region, July-October 2017 169
Figure 4.12. Crop condition Southern China region, July-October 2017 170
Figure 4.13. Distribution of rice planthopper in China, mid to late September 2017 172
Figure 4.14. Distribution of rice leaf roller in China, mid to late September 2017 173
Figure 4.15. Distribution of rice sheath blight in China, mid to late July 2017 174
Figure 4.16. Distribution of maize armyworm in China, late August 2017 175
Figure 4.17. Distribution of maize sheath blight in China, late July 2017 175
Figure 4.18. Rate of change of imports and exports for rice, wheat, maize, and soybean in China in 2017 compared to those for 2016 (%) 177
Figure 5.1. Tracks of the 2017 season tropical cyclones in the Atlantic (a) and Pacific (b) basins 183

Figure 5.2. Trees downed by Hurricane Maria in Dominica 184
Figure 5.3. A man cleans his house in Freetown after the mudslides 185
Figure 5.4. Flooded areas in India, Nepal, and Bangladesh as of 29 August 2017 186
Figure 5.5. Major semi-arid precipitation zones in Africa 189
Figure 5.6. Standard deviation (in days) of the length of the growing season over the reference period 1961-1990 190
Figure 5.7. Migration of gnus (wildebeest) in East Africa 191
Figure 5.8. Average position of the ITCZ during July (red) and January (blue) 191
Figure 5.9. Position of the Inter-tropical front (red) during the third dekad of October 2017 192
Figure 5.10. Monthly SOI-BOM time series for October 2016 to October 2017 197
Figure 5.11. Sea surface temperature anomalies, October, 2017 197

Abbreviations

5YA	Five-year average, the average for the four-month period for July-October from 2012 to 2016; one of the standard reference periods.
15YA	Fifteen-year average, the average for the four-month period from July-October from 2002 to 2016; 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
OISST	Optimum Interpolation Sea Surface Temperature
PAR	Photosynthetically active radiation
PET	Potential Evapotranspiration
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 July and October 2017, a period referred to in this bulletin as the JASO (July, August, September and October) period or just the "reporting period." The bulletin is the 107th such publication issued by the CropWatch group at the Institute of Remote Sensing and Digital Earth (RADI) at the Chinese Academy of Sciences, Beijing.

CropWatch analyses and indicators

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 for 30 major agricultural countries and 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. Importantly, 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 each reporting period, the bulletin reports on the *departures* for all seven indicators, which (with the exception of TEMP) are expressed in relative terms as a percentage change compared to the average value for that indicator for the last five or fifteen years (depending on the indicator). 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) and sub-national regions	As above plus NDVI and GVG survey
Chapter 4	China	As above plus high resolution images; information on pests and diseases; and food import/export outlook
Chapter 5	Production outlook, Rangeland management and issues in Africa, and updates on disaster events and El Niño.	

Regular updates and online resources

The bulletin is released quarterly in both English and Chinese. E-mail cropwatch@radi.ac.cn to sign up for the mailing list or visit CropWatch online at www.cropwatch.com.cn.

Executive summary

The current CropWatch bulletin is prepared jointly by several institutes of the Chinese Academy of Sciences (CAS) under the overall coordination of the Digital Agriculture Division of the Institute of Remote Sensing and Digital Earth (RADI).

Crop condition and production assessments are based mainly on actual and reference data on weather and crops from ground and satellite observations. Reference data include recent historical information and agricultural statistics. Data were turned into agronomically meaningful indicators, such as sunshine, cultivated areas, and crop yields, using biophysical and crop models. The scope of the analyses is global, but CropWatch pays special attention to thirty major agricultural countries and China (the “30+1” countries). Together, they make up at least 80% of the global production and exports of maize, rice, wheat, and soybean. The bulletin also includes specific sections on global production, as well as pests and diseases, trade, and prices in China.

The bulletin is issued at a time when virtually all 2017 crops have been harvested in the temperate northern hemisphere, while in many tropical areas in both hemispheres rice crops are growing (to be harvested in early 2018) or are close to harvest. In the southern hemisphere the summer season/monsoon season is ongoing.

Global agroclimatic patterns

Disasters took a heavy toll on all continents during the period from July to October 2017. The period was characterized by several key events, including (1) the continuation of the complex emergency situation with a drought component in the Horn of Africa, (2) heat waves around the Mediterranean and in north America, (3) more than ten tropical storms and cyclones, essentially in Asia and the Caribbean, and (4) exceptional floods in southern Asia. Weather conditions were also abnormal in a less spectacular way: below average sunshine has affected close to 70% of the CropWatch monitoring units. The departure is sometimes in excess of -15%, which is considerable for a variable that normally undergoes little spatial variability. Especially in rice growing areas, sunshine – rather than rainfall – is often the factor that limits plant growth.

Above-average rainfall

Although “above-average” rainfall over the reporting period has damaged crops, it was often beneficial for grazing lands in semi-arid areas such as in much of the West African Sahel (Mauritania, with a CropWatch RAIN indicator measurement 33% above average) and Central Asia, where the highest departures were recorded in Southern Mongolia (RAIN +144%) and Gansu-Xinjiang (+97%). Excesses close to 30% occurred in China (Loess Region, Qinghai-Tibet, and Huanghuaihai). Large areas in Southern Asia suffered from flooding: up to one third of Bangladesh has been under water. Other areas to be mentioned include parts of southern Africa, central North America (Corn Belt and Northern Plains), and northern-central Europe (+55% in Poland), an area that also recorded abnormally cool weather and a drop in sunshine.

Rainfall deficits

The largest spatially continuous precipitation deficit area covers the whole Mediterranean basin as well the adjacent areas in the east, from the Caucasus and beyond. It includes twenty-five countries as far as northern India. The timing corresponds to the last stages of winter crops as well as the biomass peak for summer crops, which have suffered in non-irrigated areas. Drought at the end of the period is likely to have delayed planting and germination of winter crops. Iran is one of the countries where the agricultural impact was most severe.

Other precipitation deficit areas to be mentioned include the eastern Africa region, where drought has been lasting for two years now; equatorial eastern Brazil and the west and south of the South American continent; parts of Oceania (New Zealand, -46%); and East Asia, especially the Korean peninsula because of the length of the ongoing drought. Several large areas in East Asia suffered from poor sunshine, including important production areas in China (Huanghuaihai, the Loess region, and Southwest China) as well as maritime Southeast Asia.

Production

Global

CropWatch puts the total output of the crops produced during 2017 at 2,509 million tons of major grains and 326 million tons of soybeans. The major grains are made up almost exactly by 41% maize (1,027,897 thousand tons, 2.5% over last year's output), 30% rice (as paddy, 745,448 thousand tons, up 1.0%), and 29% wheat (735,587 thousand tons, down 0.5%). The 2016 shares were 40% for maize and 30% for wheat; the differences are small but show the continuing global trend of maize expanding at the expense of rice and wheat.

Among the three major cereal producers, the output of China reached 519,584 thousand tons (down -1.9% compared with 2016); 435,918 thousand tons in the United States (+0.1%); and a significantly lower amount of 275,676 thousand tons for India (+5.4%). Although India remains a relatively minor producer of maize (19,034 thousand tons) it still out-produces the 4th and 5th cereal producers in terms of total cereal output (Brazil, 103,483 thousand tons, +16.2%; Indonesia, 86,202 thousand tons, -1.6%).

The two South American “giants” (Argentina and Brazil) significantly increased their maize output compared with the previous season (+16.5% and +19.3%, respectively). Rice producers did well in southern Asia (Pakistan +8.3%, recovering from last year’s dip; India +4.1%, in spite of widespread floods) and Vietnam (+6.7%). In general, East and Southeast Asia under-performed due to adverse weather conditions, especially the major producer China (no change in production) and Bangladesh, Thailand, Indonesia, and Myanmar where production fell 5.1%, 2.9%, 1.3%, and 0.5%, respectively.

Regarding wheat, Australia suffered a major drop (-22.1%), while the largest wheat production increases occurred in Brazil (+5.4%) and India (+8.6%).

The major producer of soybean, the United States, suffered a slight decrease in the crop's production (-0.3%), equivalent to 375 thousand tons, which is more than compensated by the production increase in Brazil (+5.4%) equivalent to 4.9 million tons. For the third year in a row, China has increased its soybean production as a result of the new agricultural policy; production numbers are reported below.

China

The current bulletin includes the latest and final revision of the CropWatch 2017 production estimates for maize, single rice, late rice, and soybean.

Overall, CropWatch puts the total 2017 output of summer crops (including maize, single rice, late rice, spring wheat, soybean, minor cereals, and tubers) at 403.0 million tons, a significant decrease (-3%) from 2016. The total annual crop production (including cereals, tubers, and legumes) is 562.3 million tons, a 1.0%

drop or 8.0 million tons less compared with 2016. Increases in total annual crop production in excess of 4% nevertheless occurred in Jiangxi, Shandong and Zhejiang provinces.

The combined production of winter and spring wheat in China increased 0.3%, while the production of maize is down to 1,889 million tons, representing a 5.2% drop compared to last year. This drop results mainly from a 3.7% decrease in planted area for maize in response to the low producer prices that have now been lasting five years. Gansu and Jiangsu are the only two provinces where maize output increased, with +4% and +1%, respectively. Responding to reduced planted areas, production drops in the range of 2% to 3% occurred in Heilongjiang, Henan, Inner Mongolia, Jilin, Liaoning, Shanxi, and Sichuan provinces. The largest drop (-5.3%) of maize area was observed in Henan province where many maize fields were converted to groundnuts.

The rice output for China did not change from 2016, although the production of late rice decreased by 1%. Production decreases linked with management and environmental conditions occurred in Fujian and Sichuan (-3% each) and Ningxia (-5%). In contrast, production increases were brought about by increased hectarage and yield in Hubei, Jiangsu, Jiangxi, and Zhejiang. Production of late rice in Hubei, Jiangxi, and Zhejiang also increased by more than 4%.

At 13,745 thousand tons, the soybean production is up 3.4% over last year. This is the second consecutive year China increases soybean production: a 1.3% yield drop was largely offset by cultivated area expansions that occurred mostly in Inner Mongolia and Heilongjiang, the country's top soybean region. Soybean production decreased in the Henan, Shanxi, Anhui, Liaoning, and Jilin resulting from unfavorable agro-climatic conditions.

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.**

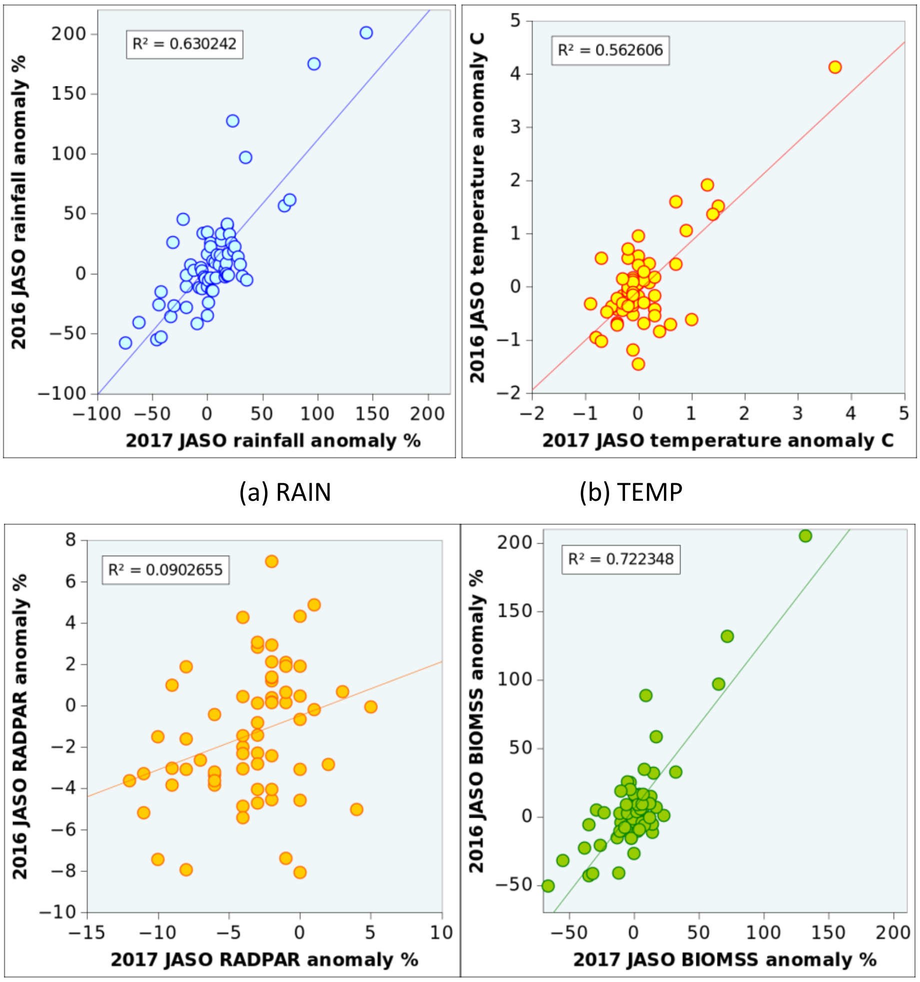
1.1 Overview

Chapter 1 in each CropWatch bulletin aims to identify the features that synthesize recent global agroclimatic patterns. Given the bewildering number of different situations, the purpose is to highlight a limited number of characteristics that are relevant for agriculture, have spatial coherence, and have some persistence over time (as the reference period covers four months) while also being easy to recognize in the maps that illustrate this chapter.

This reporting period, one of those persistent and large-scale features is a continent-wide patch of above average rainfall that affects the semi-arid and arid areas stretching from Senegal in West Africa (Sahel MRU-08) to Southern Mongolia (MRU-47) and beyond. It crosses the Arabian peninsula (MRU-64, Sahara to Afghan desert) and semi-arid Central Asia (western Asia MRU-31). The patch was noted more than one year ago and has apparently become relatively persistent. It is stressed that this patch exists within the context of the CropWatch Agroclimatic Indices (CWAIs), which includes a built-in bias to increase the weight of agricultural areas. It is also important to remember that CWAIs are compared against the average of the previous 15 years, as opposed to the standard 30-year period adopted by climatology. This is because the response time of farming to environmental changes is much faster than 30 years, which represents approximately one generation. The time of 15 years is considered an acceptable compromise between the needs for statistical representation and addressing agricultural adaptations.

As an additional confirmation of the stability of the large area of above-average rainfall, marked correlations were found between the departures from the reference period for several agroclimatic indicators in 2017 and 2016 (Figure 1).

Figure 1.1. Comparison of departures from the recent fifteen-year July-October average of CWAI between 2017 and 2016



(a) RAIN (b) TEMP

(c) RADPAR (d) BIOMSS

Note: Each graph has 65 points corresponding to the 65 MRUs.

It is remarkable that the patterns are so similar for rainfall (R=0.794; significance level well below 0.0005 corresponding to R=0.410) and, to a slightly lesser degree, for temperature (R=0.750). The highest correlations are those for biomass (R=0.85). This results partially from the definition of the BIOMSS index, which is a function of both RAIN and TEMP, but nevertheless shows that impacts are more persistent over time than the factors causing them. As to RADPAR, the positive correlation between the two years is so weak that it is best ignored.

The introduction to the section on disasters, which were particularly severe during the current reporting period, pays attention to the fact that it is becoming more likely that the patterns of droughts, floods, and cyclones may well be a harbinger of the often announced increase of disasters under climate change conditions (see Chapter 5). The current observations are also compatible with climate change. In their methodological description of the CropWatch indicators, Gommes and Wu and their colleagues (2016) quote evidence of the fact that high temperature brought about by global warming tends to be associated with higher rainfall in currently semi-arid areas (Spaulding 1991, Guo et al. 2000, and Petit-Maire and Bouysse 2000) at geological time scales. At shorter time periods, the issue is well addressed in a paper by De Paola and Giugnia (2013), which shows that in the United States long-term (secular) temperature increases have been associated with increased rainfall; the study showed that for an overall increment of the mean of annual average temperatures of +4°C the global increase of precipitation will be about 38 percent, while for an increment of +2°C the increase will be about 22 percent.

The section on African rangeland in Chapter 5 lists the work of Sachs and Myhrvold (2011), who posit that climate change may imply a shift to the north of the Inter-tropical Convergence Zone in Africa. This could account for the improved rainfall in MRU-08 (Sahel) across the Arabian peninsula (MRU-64, Sahara to Afghan desert), and the intensification of the South Asian monsoon, which has resulted in frequent floods recently. Obviously for semi-arid inner Asia (for example, MRU-47, southern Mongolia), where the dominant climates belong to the Bsk and Bwk Köppen categories, other mechanisms must be invoked.

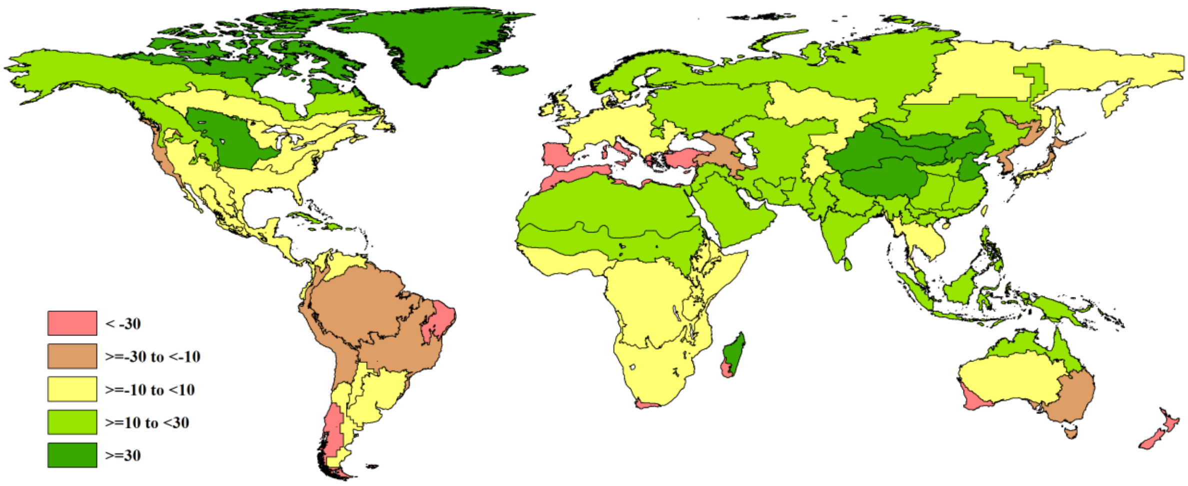
It remains that, in terms of food security, two consecutive years with rainfall deficits (and thus little soil water storage) create situations where even a slight additional shortage can potentially lead to widespread crop failures.

1.2 Rainfall

Globally, precipitation was about 6 percent above average over the July-October (JASO) reporting period, with extreme departures ranging from -75 to +144 percent. Relative departures tend to be larger in high precipitation areas (R=0.303; in 2016, the correlation was weaker with R=0.159, indicating near independence between magnitude of the departure from average and rainfall amounts).

Most of Eurasia and Africa, North and Central America recorded average or above-average precipitation (Figure 2).

Figure 1.2. Global map of July-October 2017 rainfall anomaly (as indicated by the RAIN indicator) by MRU, departure from 15YA (percentage)



Highest departures were recorded in MRU-47 (Southern Mongolia, 477 mm and RAIN, +144 percent), MRU-32 (Gansu-Xinjiang, 300 mm or +97 percent) and MRU-35 (Inner Mongolia, 487 mm or +70 percent). Excesses close to 30 percent occurred in China in areas where average rainfall amounts to at least 400 mm, so that the increases are indeed significant: in the Loess Region (MRU-36, +28 percent), Qinghai-Tibet (MRU-39, +30 percent), and Huanhuaihai (MRU-34, +36 percent). Large positive departures must also be mentioned for much of the island of Madagascar (MRU-05, +32 percent with 159 mm) and the northern Great Plains (MRU-12), which recorded 409 mm, up +35 percent over the average of the recent 15 years.

Large and spatially coherent rainfall deficits are reported for five areas, with the largest in South America. The first two areas had the most serious rainfall deficits, including those in (1) Africa's MRU-10 (Western Cape with 38 mm, a shortfall of 74 percent) and MRU-06, semi-arid Southwest Madagascar (22 mm, -62 percent); and in (2) Oceania, MRU-56 (New Zealand, 152 mm or -46 percent) and MRU-55 (Nullarbor to

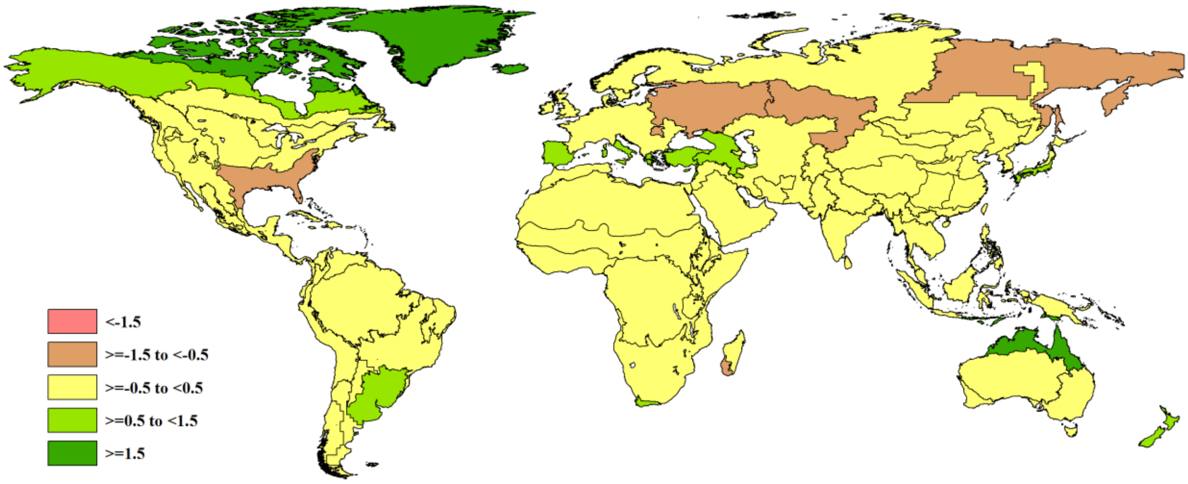
Darling, 115 mm, equivalent to -42 percent). In Europe (3) the overall impact was probably limited on maturing summer crops, but dry conditions have delayed the planting of winter crops. The areas most affected include the whole Mediterranean basin (MRU-59, Mediterranean Europe and Turkey, 91 mm or -44 percent; and MRU-07, Mediterranean North Africa with 58 mm, -42 percent), as well as the adjacent area to the east, the Caucasus (MRU-29) with 117 mm (-30 percent). (4) Although the deficit is less severe than in some of the just listed regions, East Asia (MRU-43, including the Korean peninsula) is mentioned because of the length of the ongoing drought (486 mm, -19 percent). Finally, in South America (5), while the Pampas (MRU-26), the major agricultural area, underwent globally average precipitation (+3 percent), the following areas were stressed by water deficits of decreasing intensity: MRU-27, Western Patagonia (245 mm or -33 percent), the Brazilian Nordeste (MRU-22, 40 mm or -31 percent), MRU-23 (Central eastern Brazil, 166 mm or -19 percent), and MRU-21, the Central-northern Andes (280 mm, -19 percent).

The North American West Coast (MRU-16) recorded a rainfall deficit of 22 percent, which resulted in widespread fires (see also the section in Chapter 5 that reports on disaster events over the reporting period.)

1.3 Temperature

Globally, temperature was close to average. The correlation between TEMP and its departure from average is negative but non-significant, nevertheless indicating that departures tend to concentrate in non-tropical areas, as shown in Figure 3.

Figure 1.3. Global map of July-October 2017 temperature anomaly (as indicated by the TEMP indicator) by MRU, departure from 15YA (degrees Celsius)



Relatively low temperature (departure in excess of -0.5°C) was recorded in eastern Europe and western Russia (MRU-58, Ukraine to Ural mountains, TEMP -0.6°C) and the neighboring MRU-62, Urals to Altai mountains (MRU-62, -0.9°C), which covers parts of Russia and Kazakhstan. Eastern Siberia (MRU-51, -0.7°C) is part of the same general area but can be ignored as it is not relevant for agriculture. Southwest Madagascar (MRU-06, -0,8°C) was already mentioned because the area was unusually dry.

The last "cool" area to mention is the North American Cotton Belt and Mexican Nordeste (MRU-14) with a temperature 0.7°C below average. In adjacent areas temperature deficits were less marked, for instance in MRU-17 (Sierra Madre), MRU-18 (Southwest United States and North Mexican highlands), and MRU-12 (northern Great Plains).

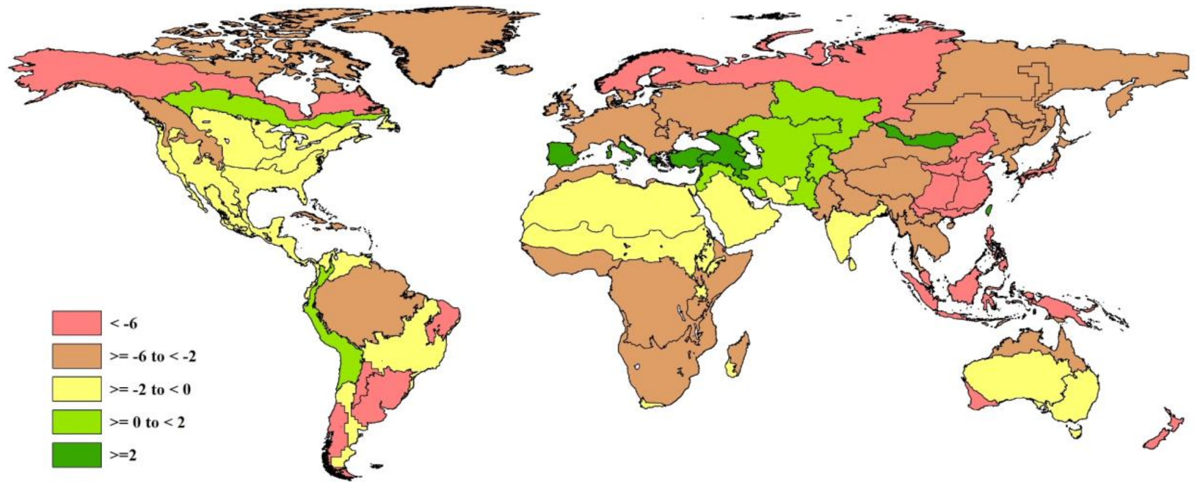
Above average, but not excessively so, TEMP was recorded in part of eastern Asia, culminating in MRU-46 (Southern Japan and the southern fringe of the Korea peninsula, +1.3°C). More significant warm weather is to be mentioned for northern Australia (MRU-53, +1.5°C), New Zealand (MRU-56, +0.7°C), Mediterranean South Africa (MRU-10, Western Cape, +0.9°C), the Pampas in South America (MRU-26, +1°C), the northern Mediterranean and Turkey in Europe (MRU-59, +1.4°C), and the adjacent area to the east, the Caucasus (MRU-29, +0.6°C). Several of the listed areas also experienced below average RAIN (New Zealand, the Caucasus, the western Cape province in South Africa, and the Mediterranean countries in Europe).

1.4 Solar Radiation

As mentioned, global radiation patterns show little resemblance to other 2017 CropWatch indicators, and this year's spatial variability is rather different from the one observed in 2016. In addition, the average departure from normal reached -3.4 percent in 2017 (compared to -1.4 percent in 2016), which is significant considering that sunshine tends to be much less variable spatially compared to for example RAIN and TEMP. In 2017, the extreme departures were -12 percent and +5 percent (against -8 percent and +7 percent last year).

In 2017, as also shown by Figure 4, the majority of MRUs recorded below average solar radiation at ground level, with only few areas recording close to average values: MRU-64 (Sahara to the Afghan desert) to MRU-62 (Ural to Altai mountains) across MRU-30 (the Pamir Area) and MRU-31 (Western Asia). The East African Highlands (MRU-02) can be added to the area. Above-average sunshine occurred in three disjointed areas, most noticeably in (1) MRU-59 (Mediterranean Europe and Turkey, RADPAR, +3 percent) and MRU-29 (Caucasus, +5 percent), two areas that also had record temperature; (2) MRU-42 (Taiwan, +4 percent) and (3) MRU-47 (Southern Mongolia, +2 percent).

Figure 1.4. Global map of July-October 2017 PAR anomaly (as indicated by the RADPAR indicator) by MRU, departure from 15YA (percentage)



The majority of the largest deficits occur in Asia, more specifically in China: Huanghuaihai (MRU-34, RADPAR -12 percent), the Loess region (MRU-36, -11 percent), Southwest China (MRU-41, -10 percent), Lower Yangtze (MRU-37, -8 percent), Southern China (MRU-40, -7 percent), Gansu-Xinjiang (MRU-32, -6 percent), and Inner Mongolia (MRU-35, -6 percent). The remaining Asian areas include southern Japan and the southern fringe of the Korea peninsula (MRU-46, -8 percent), the Southern Himalayas (MRU-44, -6 percent), and Maritime Southeast Asia (MRU-49, -9 percent).

Remaining low sunshine areas include MRU-56 (New Zealand, RADPAR -10 percent) and MRU-55 (Nullarbor to Darling, -6 percent) in Oceania as well as, in central and southern America, MRU-25 (central-north

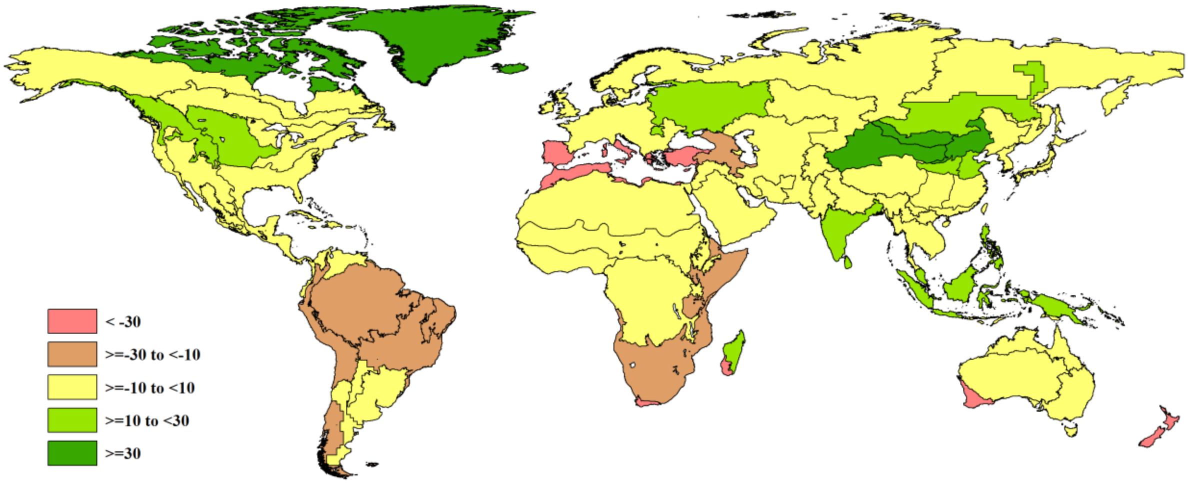
Argentina, -9 percent), MRU-22 (Brazilian Nordeste with -8 percent), MRU-27 (Western Patagonia, -8 percent), and MRU-26 (the Pampas, with a RADPAR of -6 percent).

1.5 Biomass production potential BIOMSS and combinations of anomalies

The section leaves out high latitude areas that are of limited agricultural significance. Due to the large sunshine anomalies, it is unlikely that the positive effect of rainfall has been realized in areas with abundant precipitation.

For this reporting period, the areas that are characterized by the most unfavorable combination of high rainfall, usually low temperature, and low RADPAR, are almost all located in China. They include Gansu-Xinjiang (MRU-32, RAIN +97 percent; TEMP -0.4°C compared with normal; and RADPAR -6 percent), Huanghuaihai (MRU-34, +36 percent; +0.1°C; -12 percent respectively), Loess region (MRU-36, +28 percent; +0°C; -11 percent), Southern China (MRU-40, +17 percent; -0.2°C; -7 percent), and Inner Mongolia (MRU-35, +70 percent; -0.1°C; -6 percent), followed by three more regions, namely Southwest China (MRU-41), Northeast China (MRU-38), and the Lower Yangtze region (MRU-37) where rainfall exceeded average by 10 to 20 percent, while temperature was slightly below average and RADPAR varied between anomalies between -3 percent and -10 percent.

Figure 1.5. Global map of July-October 2017 biomass accumulation (BIOMSS) by MRU, departure from 5YA (percentage)



Four more MRUs in Asia deserve mentioning for similar conditions of excess precipitation (RAIN, +20 to +25 percent), TEMP slightly below average (up to -0.5°C), and markedly poor sunshine (RADPAR between -3 to -9 percent)). These are MRU-52, Eastern Central Asia; MRU-48, Punjab to Gujarat; MRU-44, Southern Himalayas; and MRU-49, Maritime South-east Asia.

Elsewhere, similar conditions prevailed essentially in MRU-58, Ukraine to Ural mountains.

Dry and warm areas occurred essentially in four general regions, including:

- *The Mediterranean and the Caucasus.* This includes Mediterranean Europe and Turkey (MRU-59, with RAIN, -44 percent; TEMP, +1.4°C); North Africa-Mediterranean (MRU-07, with RAIN -42 percent but average TEMP); and the Caucasus (MRU-29, RAIN, -30 percent and TEMP, +0.6°C).
- *Parts of Oceania.* Including Queensland to Victoria (MRU-54, RAIN, -15 percent; TEMP, +0.3°C), Nullarbor to Darling (MRU-55, RAIN, -42 percent, with average temperature), and New Zealand (MRU-56, RAIN, -46 percent and TEMP, +0.7°C).

- *Parts of the American continent.* The United States and Canadian West Coast (MRU-16, RAIN, -22 percent and TEMP, +0.3°C) and the Central-northern Andes (MRU-21, with RAIN -19 percent and TEMP, +0.2°C).
- *Southern Africa.* Western Cape (MRU-10), with RAIN -74 percent and TEMP +0.9°C.

Chapter 2. Crop and environmental conditions in major production zones

Chapter 2 presents the same indicators—RAIN, TEMP, RADPAR, and BIOMSS— as those used in Chapter 1, and combines them with the agronomic indicators—cropped arable land fraction (CALF), maximum vegetation condition index (VCIx), minimum vegetation health index (VHIn), and cropping intensity index (CI)— 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

Tables 2.1 and 2.2 present an overview of the agroclimatic (table 2.1) and agronomic (table 2.2) indicators for each of the six MPZs, comparing the indicators to their fifteen and five-year averages, respectively.

Table 2.1. July-October 2017 agroclimatic indicators by Major Production Zone, current value and departure from 15YA

	RAIN		TEMP		RADPAR	
	Current (mm)	Departure (%)	Current (°C)	Departure (°C)	Current (MJ/m^2)	Departure (%)
West Africa	890	5	26.2	-0.4	974	-3
South America	336	-5	20.3	0.5	962	-4
North America	416	11	20.1	-0.4	1076	-2
South and SE Asia	1211	16	27.4	-0.1	903	-4
Western Europe	263	-3	16.3	0	866	-5
C. Europe and W. Russia	259	11	15.4	-0.3	836	-1

*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 (July-October) for 2002-2016.*

Table 2.2. July-October 2017 agronomic indicators by Major Production Zone, current season values and departure from 5YA

	BIOMSS (gDM/m^2)		CALF (Cropped arable land fraction)		Maximum VCI Intensity	Cropping Intensity	
	Current	Departure (%)	Current	Departure (% points)	Current	Current	Departure (%)
West Africa	1928	-2	96	0	0.91	103	1
South America	859	-13	91	2	0.71	117	-6
North America	1244	8	92	0	0.88	126	-1
South and SE Asia	1987	7	96	1	0.95	128	3
Western Europe	1036	-1	89	-2	0.8	158	-3
C Europe and W Russia	1033	9	97	2	0.93	166	-1

Note: See note for table 2.1, with reference value R defined as the five-year average (5YA) for July-October 2012-2016..

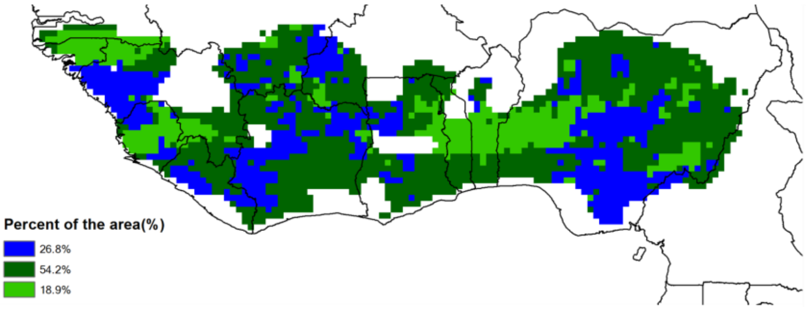
2.2 West Africa

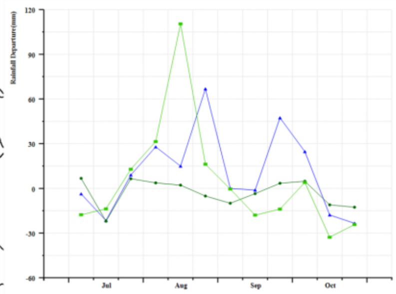
In the north, the reporting period marks the end of the main rainy season and the harvest of main rainfed cereals (maize, sorghum, millet, and rice) and yam, as well as the sowing of irrigated rice. In the south of the MPZ (covering southern Côte d'Ivoire to Nigeria) which receives bi-modal rainfall, harvesting of yams is underway and cassava is still growing; the second maize crop was planted and is growing, as reflected in the CALF map. In the west (Guinea to Liberia), the harvest of rice extends into December and sometimes even January.

Based on CropWatch observations, average rainfall was 890 mm over croplands of the MPZ, corresponding to an increase of +5% compared to average. National values varied from 850 mm (+2% in Nigeria) and 1558 mm (+16% in Guinea Bissau. The MPZ had close to average temperature (26.2°C, -0.4°C) and sunshine (RADPAR -3%) which gave a slight decrease of the biomass production potential (BIOMSS -2%). The MPZ as a whole had a cropped arable land fraction (CALF) reaching 100% as it was the main growing season in this region. Currently precipitation has subsided, and plant growth can only be supported through irrigation. According to the VCIx map the average value was above 0.91.

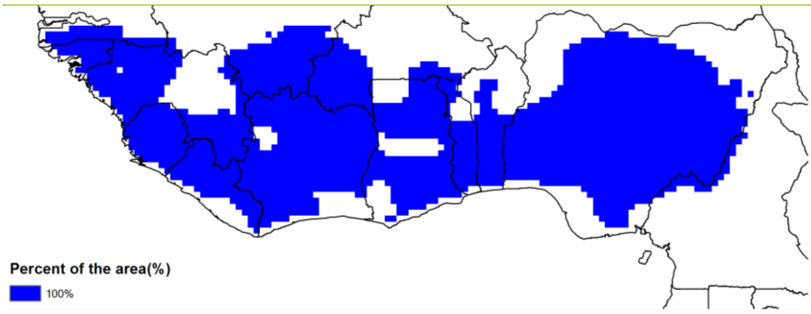
Generally, the climatic conditions were conducive for plant growth with precipitation well distributed in time throughout the region. The temperature fluctuated around average within a +/-0.4°C margin during the main rainy season. The stable and coherent climatic conditions depicted by the CropWatch indicators should lead to a good harvest for 2017.

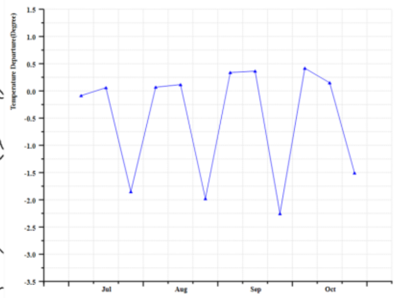
Figure 2.1 West Africa MPZ: Agroclimatic and agronomic indicators, July-October 2017



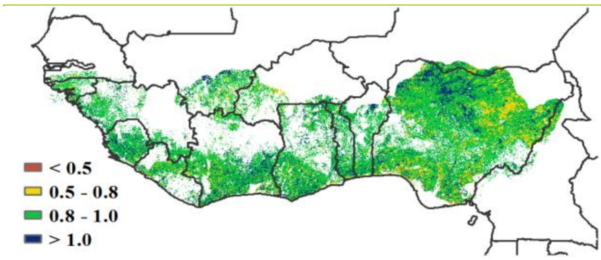


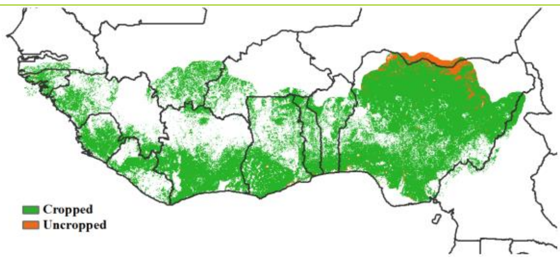
a. Spatial distribution of rainfall profiles b. Profiles of rainfall departure from average (mm)



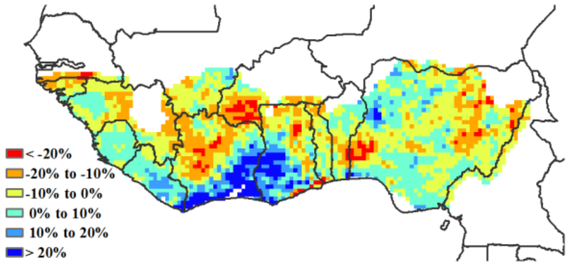


c. Spatial distribution of temperature profiles d. Profiles of temperature departure from average (mm)

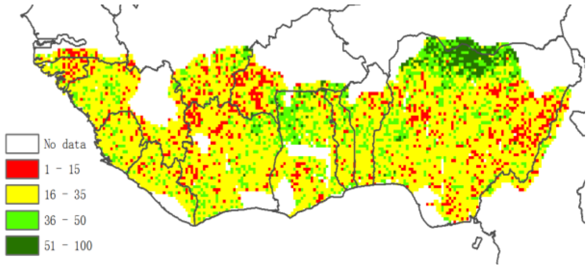




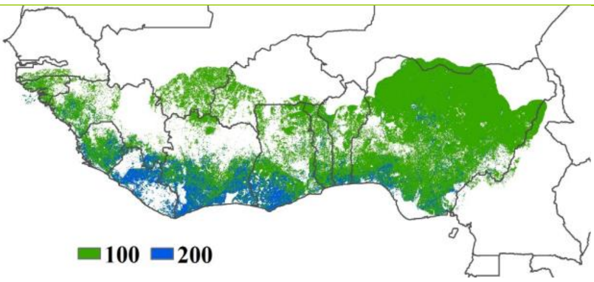
e. Maximum VCI f. Cropped arable land



g. Biomass accumulation potential departure



h. VHI minimum



i. Cropping intensity

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

2.3 North America

The reporting period (July to October, 2017) is the harvesting season of summer crops (maize, soybean, spring wheat, and rice) and the sowing season of 2017/18 winter crops. In general, poor crop condition was recorded in the south of the Canadian Prairies and some regions of the U.S. Northern Plains, while average or above average crop condition occurred in other regions.

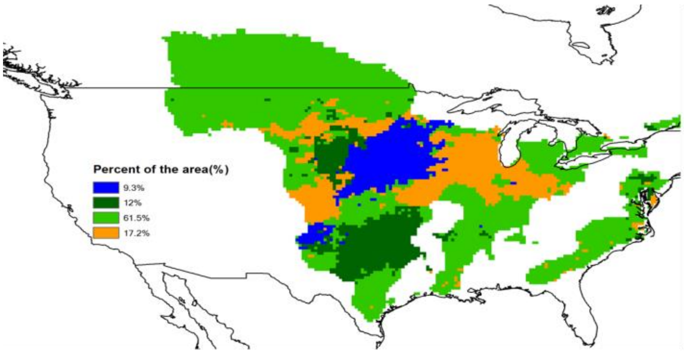
For the region as a whole, moist weather occurred in North America, where rainfall (RAIN) was 11% above average, while temperature was slightly below by 0.4°C and RADPAR by 2%, which is more significant for this indicator. Drought was confined to Manitoba (RAIN, -20%) and Saskatchewan (RAIN, -23%) where the temperature was 2°C to 3°C above average at the beginning of July and in late August, resulting in -17% and -19% decreases in the indicator for the biomass accumulation potential (BIOMSS), respectively.

Drought conditions ended in the Northern Great Plains because abundant rainfall (RAIN, +35%) occurred in mid-July and in August and October. The U.S. Corn Belt, the major maize and soybean producing area in the world, recorded average rainfall and temperature. Normal rainfall was also reported from the Cotton Belt to the Mexican Nordeste region. It is worth noting that abnormally low temperature occurred in the eastern part of North America in late August and early September.

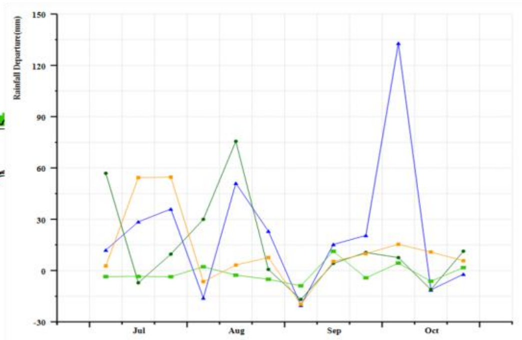
Poor crop condition in the southern Canadian Prairies and some regions of the U.S. Northern Plains is confirmed by maximum VCI (VCIx) and the BIOMSS departure map. In the south of Manitoba, Saskatchewan, and in the north of North Dakota and Montana, VCIx was even below 0.5, which indicates rather poor crops. Drought and warm weather are confirmed by the VHIn and resulted in a decrease of at least 20% for BIOMSS. Other agronomic indicators are average, in particular the Cropped Arable Land Fraction (CALF).

Altogether, CropWatch identified some poor crop condition in parts of Canada and the U.S. Northern Plains, while average and above average conditions prevail elsewhere.

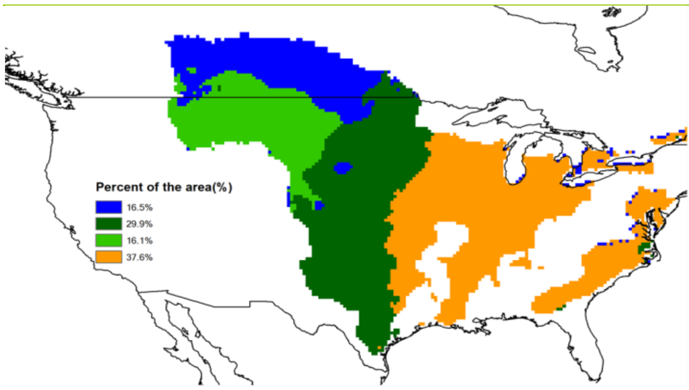
Figure 2.2 North America MPZ: **Agroclimatic and agronomic indicators, July-October 2017**



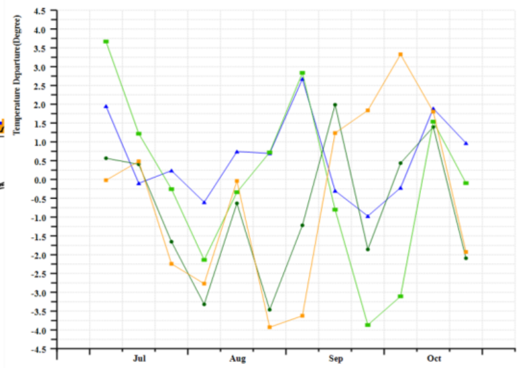
a. Spatial distribution of rainfall profiles



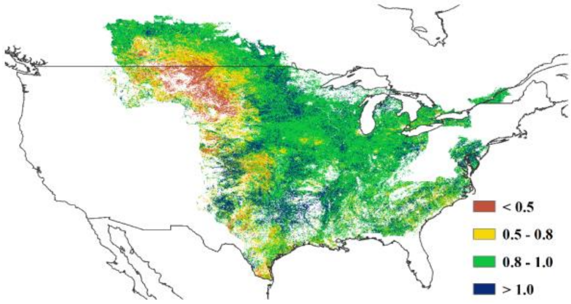
b. Profiles of rainfall departure from average (mm)



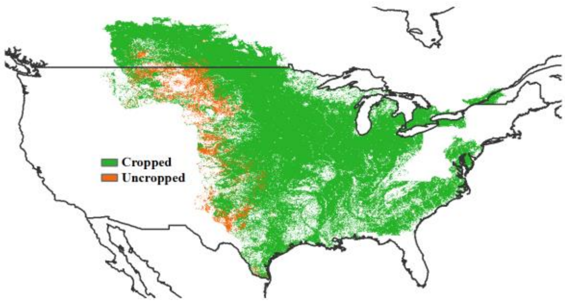
c. Spatial distribution of temperature profiles



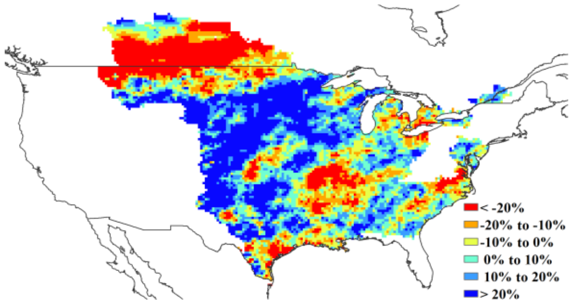
d. Profiles of temperature departure from average (mm)



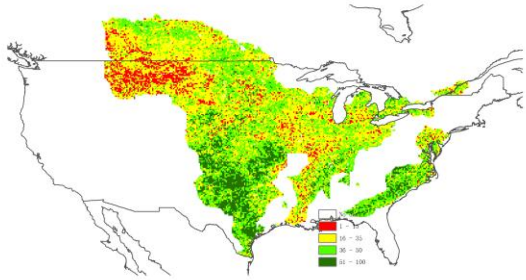
e. Maximum VCI



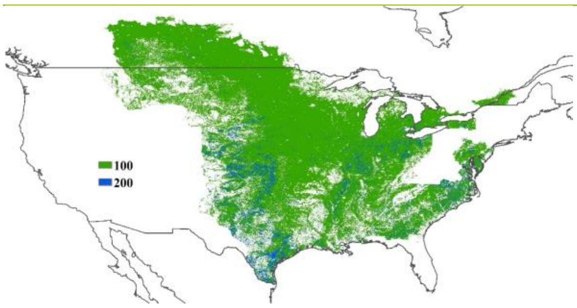
f. Cropped arable land



g. Biomass accumulation potential departure



h. VHI minimum



i. Cropping intensity

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

2.4 South America

Overall crop condition in this MPZ was average over the monitoring period during which wheat was approaching its maturity stage, while main summer crops were just being planted or in early vegetative stages, such as in the case of maize. Figure 2.3 summarizes the CropWatch agroclimatic and agronomic indicators for the area.

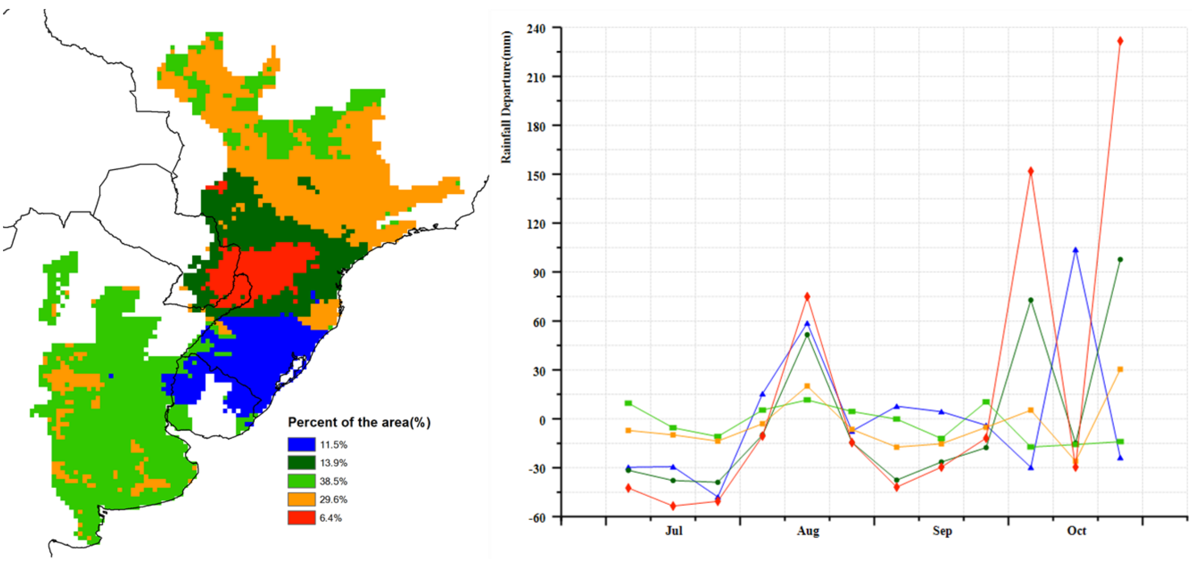
Across the MPZ, slightly below average rainfall (RAIN, -5%), warm temperatures (20.3°C, TEMP +0.5°C above average), and low radiation (RADPAR, -4%) were experienced, altogether resulting in 13% below average BIOMSS. According to the temporal and spatial patterns of rainfall departure, rainfall was slightly below average in the Pampas during July-October, while the Brazilian states of Rio Grande do Sul and Parana experienced above average rainfall in August and October and below average rainfall in July and September. The temperature generally changed from above average in July-August to well below average (-2.5°C) by the end of October. Spatially, agroclimatic conditions were generally unfavorable as indicated by well below average BIOMSS in the accumulated potential biomass departure map, with the exception of Entre Rios in Argentina, Uruguay, and southwestern Rio Grande do Sul in Brazil.

As most summer crops for the region are out of their growing season, croplands in northwestern Buenos Aires and large parts of Cordoba, as well as the northernmost part of the MPZ remained uncropped during the monitoring period; overall CALF was 91%, which was 2% above the five-year average. Accordingly, the VCIx map also presents lower values in those fallow areas. High VCIx mostly concentrates in Santa Fe. On average, VCIx for the entire MPZ is 0.71. Cropping intensity is 166%, slightly below the five-year average (-1%). Fields with a double cropping system are mainly located in Rio Grande do Sul and Parana where wheat-maize double cropping is common according to local interviews with farmers and researchers.

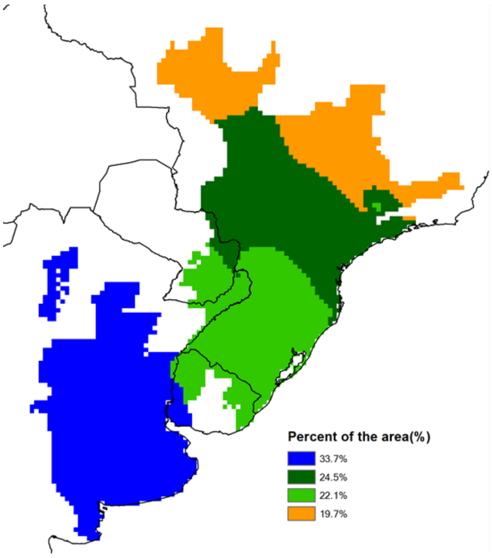
The VHI map presents large differences between Argentina and Brazil. High values in Argentina indicate low water stress situations, while in Brazil the states of Sao Paulo and part of Mato Grosso are suffering water stress, as indicated by VHImin values below 35. This further confirms that low VCIx in Argentina results from non-vegetation rather than unfavorable conditions.

All in all, winter wheat condition in the MPZ is average in spite of lower RAIN. The low rainfall, however, could potentially hamper the sowing and early development of summer crops in the season ahead.

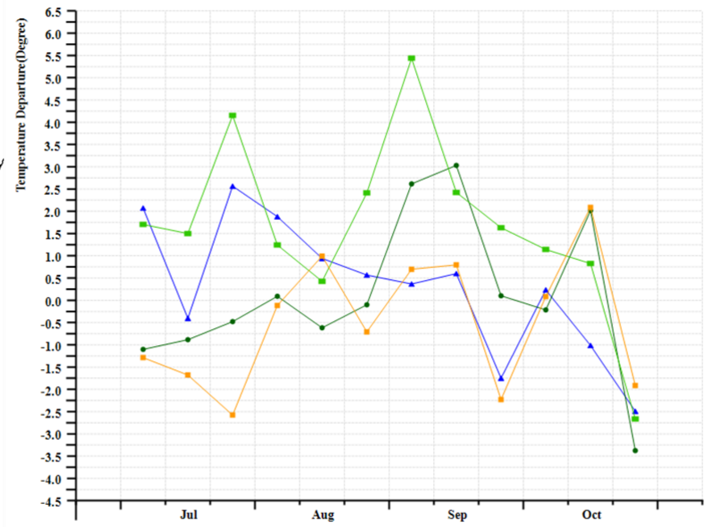
Figure 2.3: South America MPZ: : Agroclimatic and agronomic indicators, July-October 2017



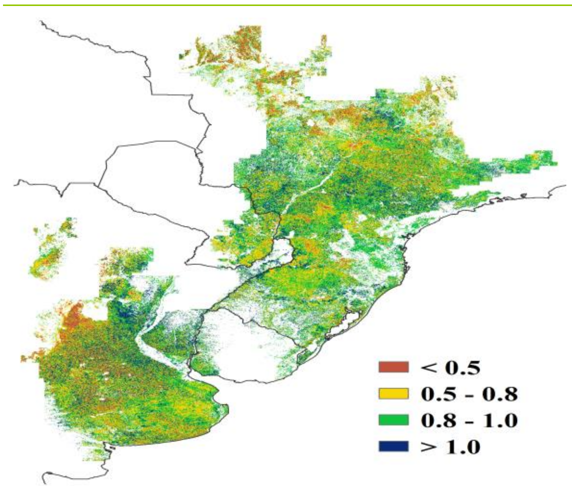
a. Spatial distribution of rainfall profiles　　b. Profiles of rainfall departure from average (mm)



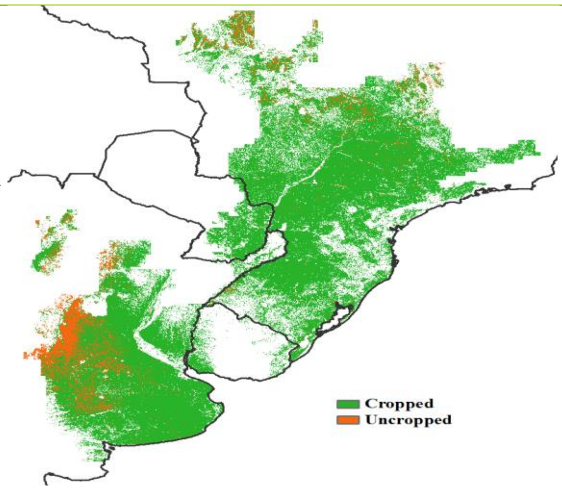
c. Spatial distribution of temperature profiles



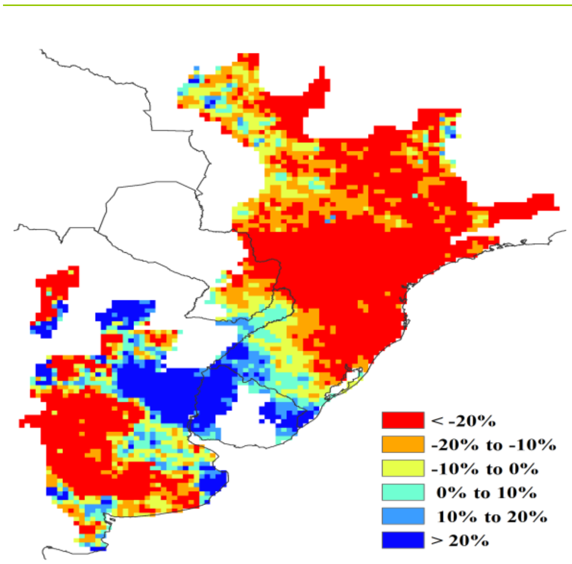
d. Profiles of temperature departure from average (mm)



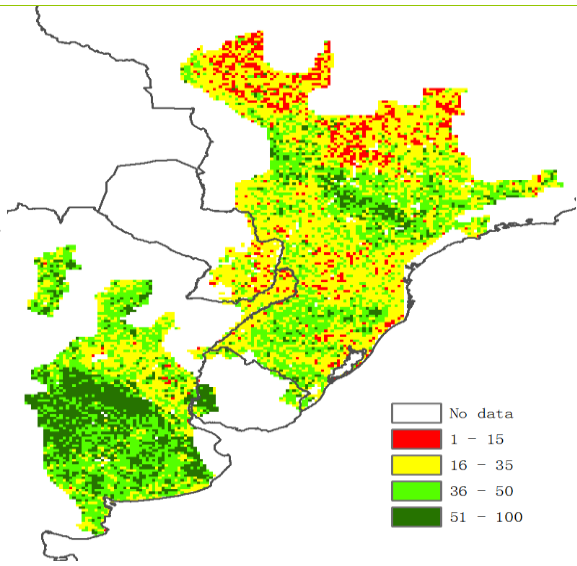
e. Maximum VCI



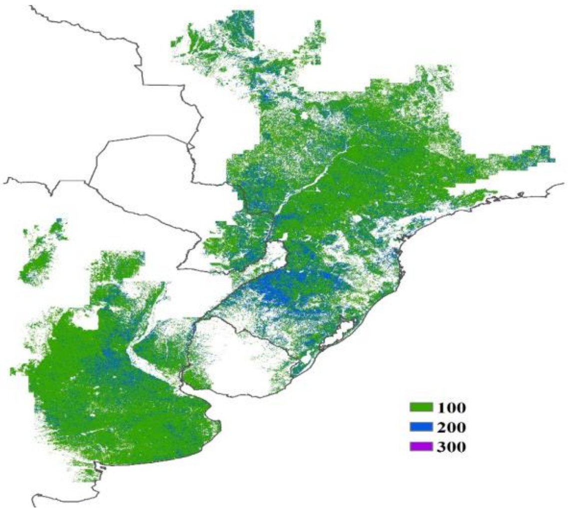
f. Cropped arable land



g. Biomass accumulation potential departure



h. VHI minimum



i. Cropping intensity

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

2.5 South and Southeast Asia

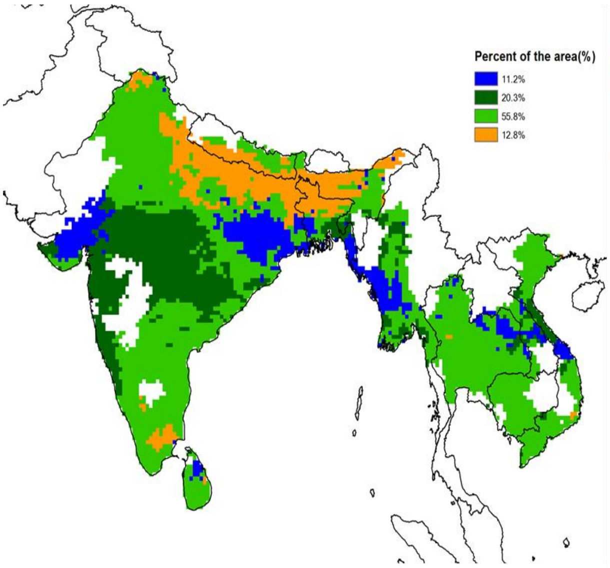
Over the recent reporting period, crops in this MPZ were at varying phenological stages. In Bangladesh for example, the period corresponds with the planting and growing stages of Aman rice and the harvesting of the Aus rice crop. In Cambodia, it was the time for planting of main wet season rice and the growing or harvesting of the maize crop. In India, the period covered Kharif season crops and in particular the planting, growth, and harvest of rice, maize, and soybean; the period also corresponded with the planting of wheat in the country. In Myanmar, it was planting time for maize and wheat, as well as the time to grow and harvest the main rice crop. Meanwhile in Thailand, the period covered the planting, growing, and harvesting of the main rice crop, as well as the harvesting of maize. It was also the major rice season for all rice types in Vietnam except spring and winter rice.

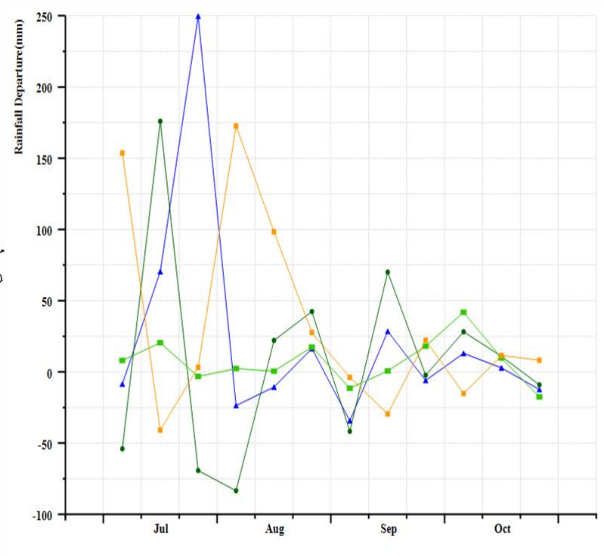
Across the MPZ, the region received 16% above average rainfall (RAIN), marginally lower than average temperatures (TEMP, -0.1°C), and a more significant shortage of sunshine as measured by RADPAR (-4%), providing mostly fair growing conditions for crops. All countries in the MPZ received higher than average precipitation, except for Cambodia where RAIN was -2%. Rainfall (RAIN) in other countries was as follows, as compared to the average for the same period of the year: Bangladesh +49%, India +16%, Lao People's Democratic Republic +9%, Myanmar 9%, Nepal +10%, Thailand +12%, and Vietnam +17%. Similarly, most of the countries had marginally lower than average temperature. RADPAR levels were rather poor in Bangladesh (-12%) and Vietnam (-8%), but closer to average in Cambodia (RADPAR, -3%), India (-3%), Lao PDR (-5%), Myanmar (-4%), Nepal (-4%), and Thailand (-3%). Higher than average BIOMSS is expected almost everywhere (with the exception of Nepal where BIOMSS is -2%) as a direct consequence of high rainfall; BIOMSS values by country are: Bangladesh +16%, Cambodia +1%, India +6%, Lao PDR 6%, Myanmar +3%, Thailand +8%, and Vietnam +9%.

Agronomic indicators for the MPZ show mostly healthy crops when assessed with the VCIx and CALF indicators. Most of the countries had VCIx values of 0.8 or above, except for a few patches in India and the scattered occurrence of low VCIx in Thailand and Vietnam. Similarly, the CALF indicator shows that most of the agricultural land in the MPZ has been cropped during the season, except for some patches in India, one patch in Myanmar, and some scattered places in Myanmar and Thailand. The spatial distribution of BIOMSS indicates favorable conditions in Bangladesh, Lao PDR, and Thailand. Lower than average BIOMSS values are restricted to small areas in Myanmar and Vietnam, while some larger areas are affected in Cambodia and Nepal. In India, positive and negative BIOMSS values coexist, with values favorable in the south and east and unfavorable in the north and northwest. Scattered low VHI values occur throughout the MPZ. For an overview of flood impacts in the region, see the section on disasters in Chapter 5.

Overall, the MPZ presented good cropped area (0.8 and above was cultivated), favorable VCIx, and good--though sometimes excessive--rainfall, average temperature, and locally poor sunshine. Production is expected to be fair to good.

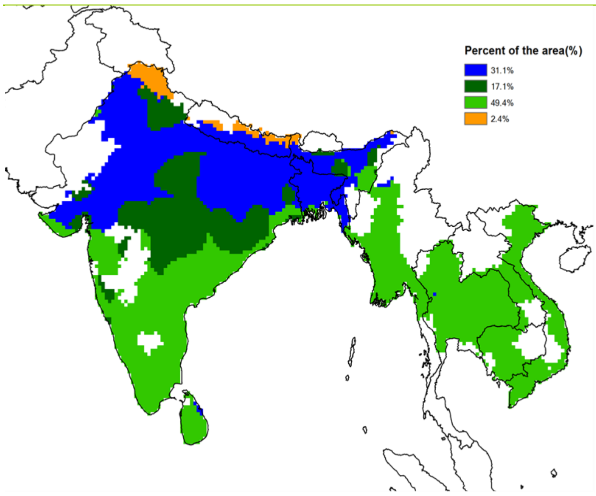
Figure 2.4 South and Southeast Asia MPZ: Agroclimatic and agronomic indicators, July-October 2017

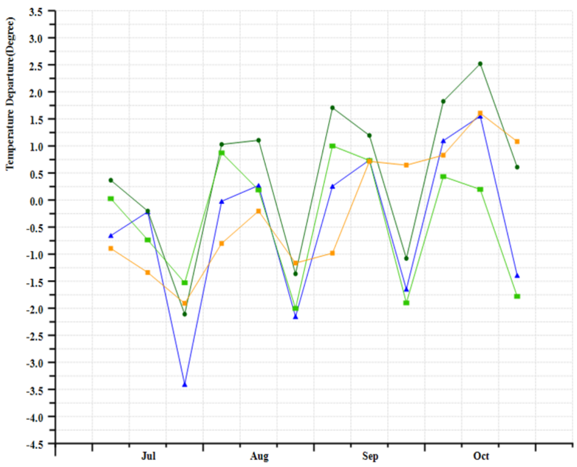




a. Spatial distribution of rainfall profiles

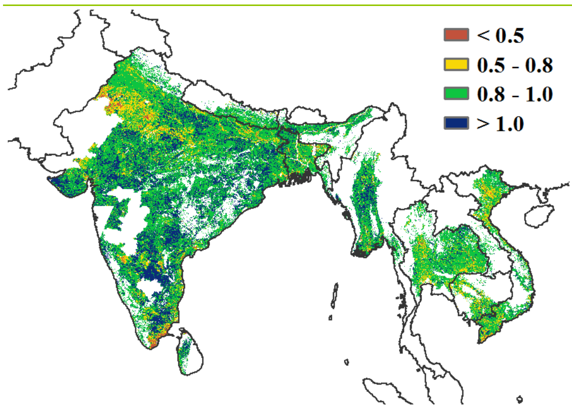
b. Profiles of rainfall departure from average (mm)

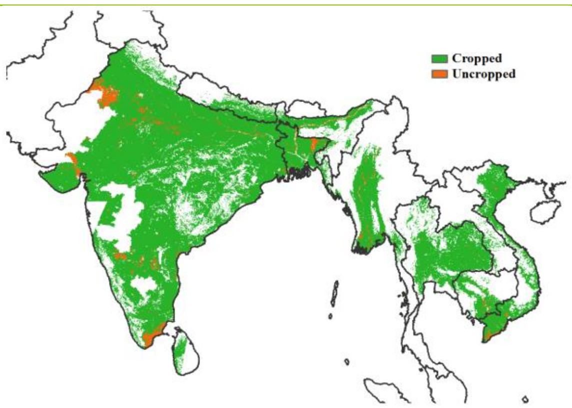




c. Spatial distribution of temperature profiles

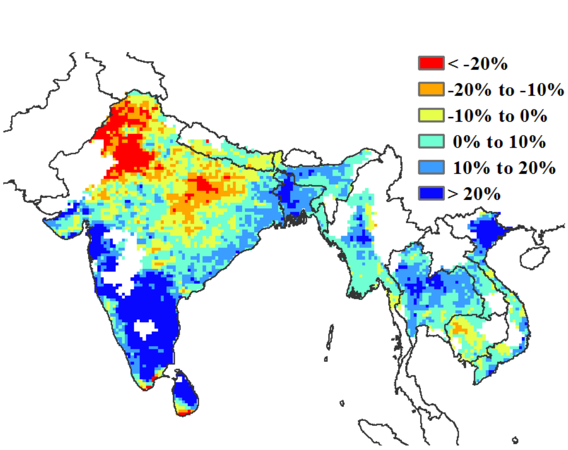
d. Profiles of temperature departure from average (mm)



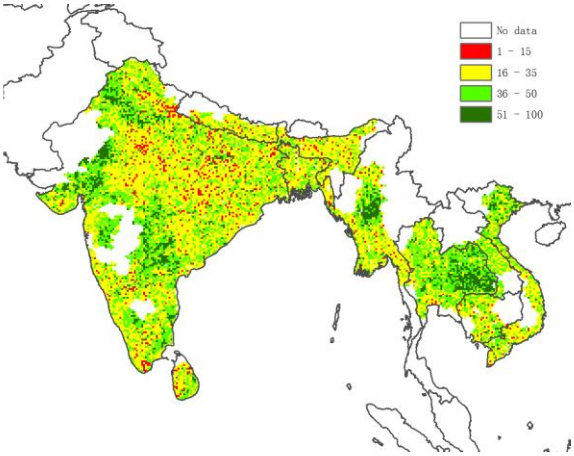


e. Maximum VCI

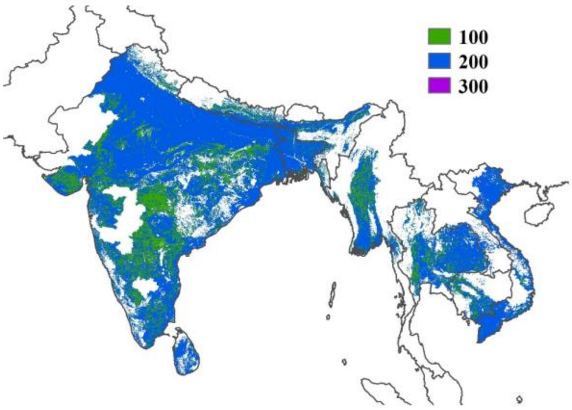
f. Cropped arable land



g. Biomass accumulation potential departure



h. VHI minimum



i. Cropping intensity

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

2.6 Western Europe

At the scale of the MPZ, crop condition was average in the Western European MPZ during this reporting period, with these average conditions resulting from a combination of negative and positive extremes. The figures present an overview of CropWatch agroclimatic and agronomic indicators for this MPZ.

The agroclimatic indicators show that total rainfall across the MPZ (as measured with the RAIN indicator) was 3% below average, resulting from marked negative departures in large parts of the Mediterranean region throughout the monitoring period and also including most of the United Kingdom, Germany, Denmark, the Czech Republic, Slovakia, Austria, and Hungary in late August and mid-October. The most severely affected three countries were Spain (RAIN, -53%), France (-42%), and Italy (-25%). All countries will need more rain in the coming weeks to raise soil moisture levels, allow seedbed preparation, and create favorable conditions for the germination and emergence of newly sown crops. The rainfall deficit was most severe in southern France and western Italy, where sowing activities usually start in November.

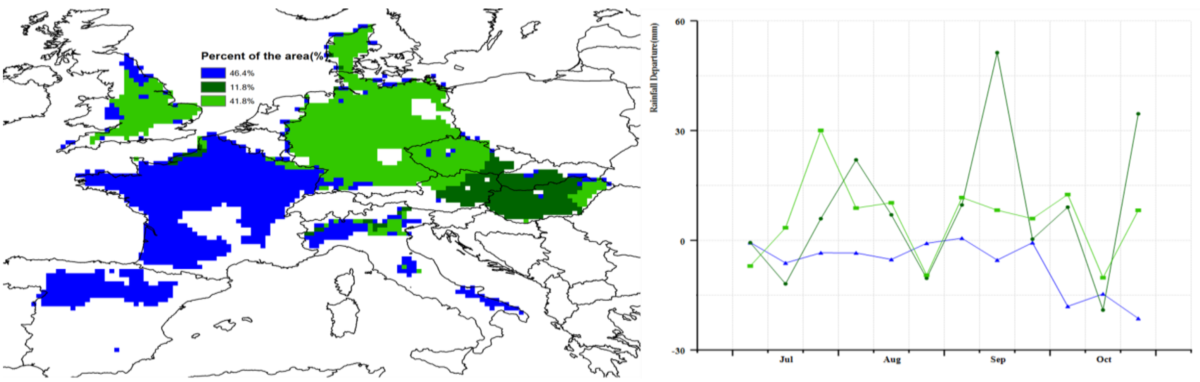
Exceptional positive RAIN departures were recorded (1) over most of the United Kingdom, Germany, Denmark, the center and west of the Czech Republic, western Austria, and eastern Hungary from mid-July to mid-August, early September to early October, and late October, and also (2) east of the Czech Republic, center and east of Austria, southwest Slovakia, and most of Hungary from late July to mid-August, early September to early October, and late October. In large parts of the northern region of this MPZ, the sowing of winter crops, already delayed by the late harvesting, was further hampered by excessively wet conditions.

Temperature (TEMP) was average for the MPZ as a whole, but radiation was below average with RADPAR at -5%. Below average temperatures were observed in most parts of the MPZ from late July to early October, with the exception of Spain. However, heatwaves in Mediterranean regions and eastern parts of the MPZ continued until the end of August.

Due to the rainfall deficit and heatwaves, the biomass accumulation potential BIOMSS was 1% below the recent five-year average.The lowest BIOMSS values (-20% and less) occurred in most of France, Spain, and Italy. In contrast, BIOMSS was above average (sometimes exceeding a 10% departure) over most of the United Kingdom, Germany, the Czech Republic, south Slovakia, northeast Austria, and most of Hungary. The average maximum VCI for the MPZ reached a value of 0.80 during this reporting period, indicating favorable crop condition. More than 89% of arable lands were cropped, which is 2% below the recent five-year average. Most uncropped arable land is concentrated in Spain and southeast Italy. Cropping intensity (117%) was down 6% compared with the five-year-average across the MPZ.

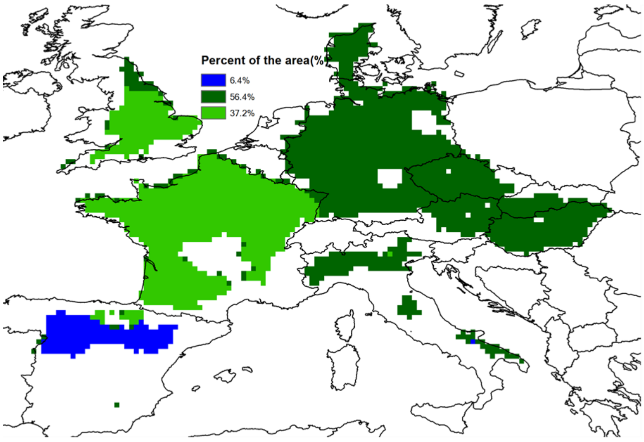
Generally, the condition of summer crops in the MPZ was below average, and more rain will be needed to ensure an adequate soil moisture supply for the ongoing winter crop season.

Figure 2.5 Western Europe MPZ: Agroclimatic and agronomic indicators July-October 2017

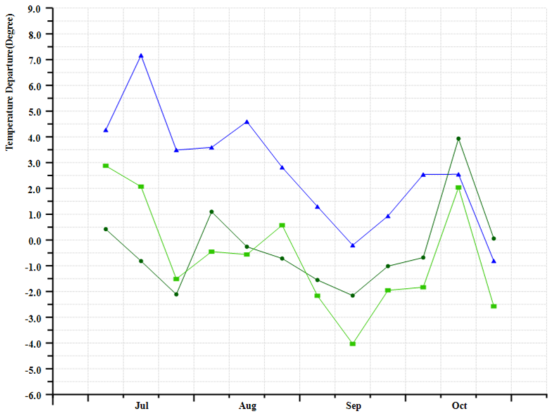


a. Spatial distribution of rainfall profiles

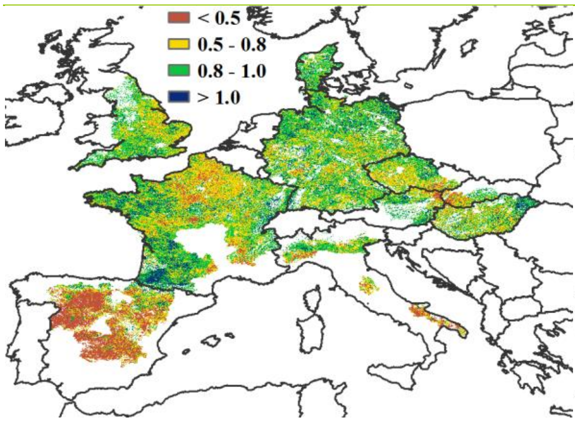
b. Profiles of rainfall departure from average (mm)



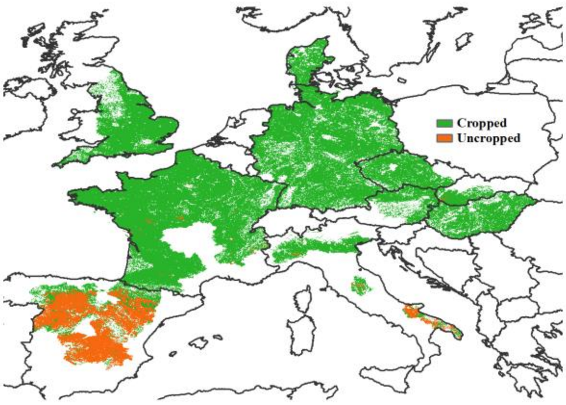
c. Spatial distribution of temperature profiles



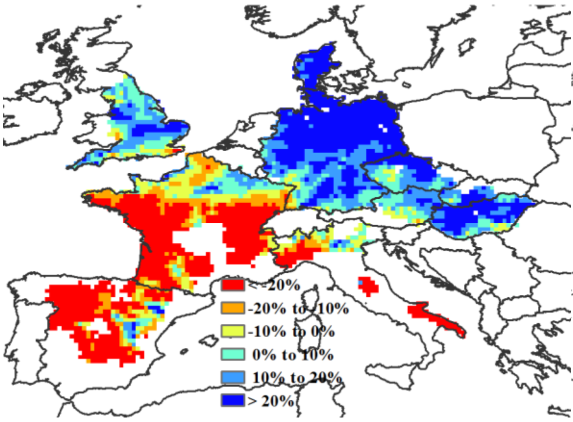
d. Profiles of temperature departure from average (mm)



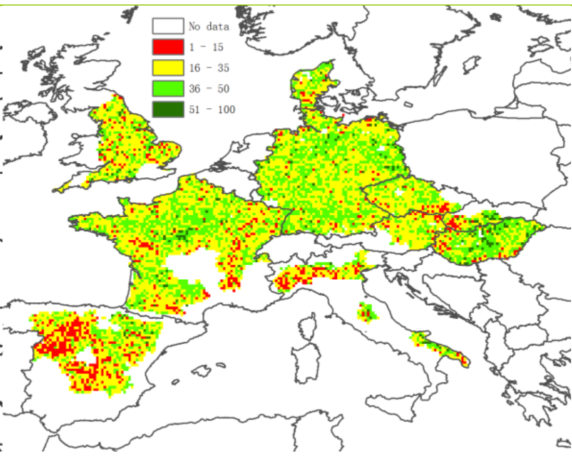
e. Maximum VCI



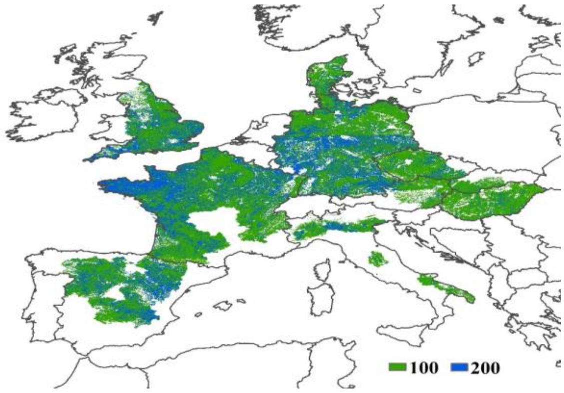
f. Cropped arable land



g. Biomass accumulation potential departure



h. VHI minimum



i. Cropping intensity

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

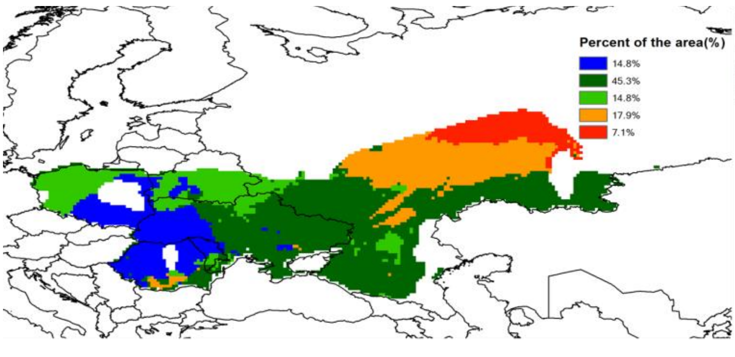
2.7 Central Europe to Western Russia

During the current monitoring period, crop condition showed significant regional disparities over the Central Europe to Western Russia MPZ. Sowing of winter crops was completed under somewhat colder (TEMP, 0.3°C below average) and less sunny (RADPAR, -1%) than average weather, while the abundant rainfall (+11%) improved the condition of soil moisture for the growing of winter crops.

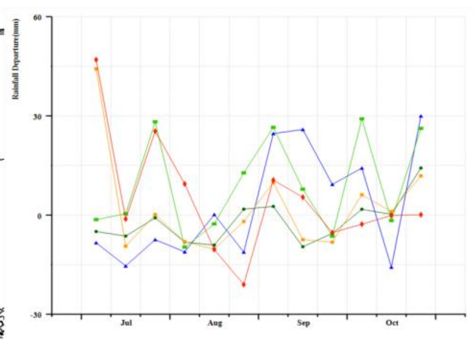
As indicated by the rainfall profiles, the southern part of the MPZ (including Romania, Ukraine, eastern Poland, and southern Russia) shows a rainfall deficit in July and August. In the following two months, rainfall in most regions increased to above average, especially in western Poland and Belarus with three peaks with almost 30% above average rainfall occurring in early September, early October, and late October. Temperature profiles show correlated variations across the whole MPZ, though with the exception of the eastern part (in Russia). The highest temperature (5.5°C above average in mid-September) was recorded for Luhans'ka and Donets'ka of Ukraine and the Oblasts of Rostovskaya and Volgogradskaya as well as the Krasnodarskiy and Stavropolskiy Krays.

The sufficient rainfall led to a significant increase in potential biomass for the whole MPZ (BIOMSS, +9% compared to the five-year average). The distribution map of the potential biomass, however, showed regional differences, including a large positive biomass departure (BIOMSS more than +20%) in Poland, Belarus, western Ukraine, northern Romania, and most parts in southwestern Russia. In contrast, the eastern Ukraine, as well as the Krasnodarskiy Kray and the Oblast of Saratovskaya showed significant drops in potential biomass. The pattern is consistent with the distribution of VHIn and VCIx. Almost 97% of the arable land was actually cropped during the reporting period (with a CALF of 1% above average). Uncropped land concentrated in Crimea, Khersons'ka, and southwestern Russia, leading to low maximum VCI values (less than 0.5) in these areas. The cropping intensity increased by 2% compared to the recent five-year average. The double cropping area is mainly distributed in southern Poland and southwestern Russia. Generally, with most parts indicating above average crop conditions, prospects for crop production are promising in the Central Europe to Western Russia MPZ.

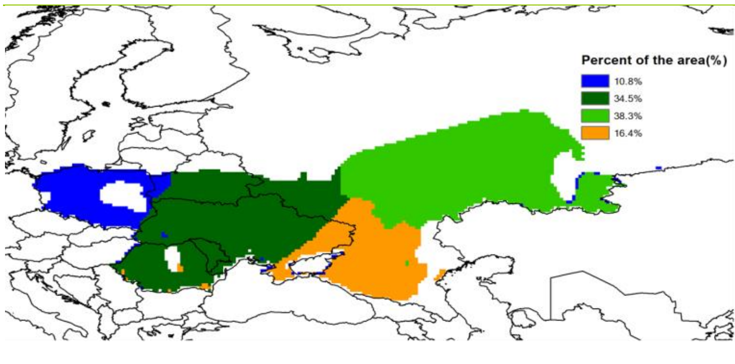
Figure 2.6 Central Europe-Western Russia MPZ: Agroclimatic and agronomic indicators, July-October 2017



a. Spatial distribution of rainfall profiles

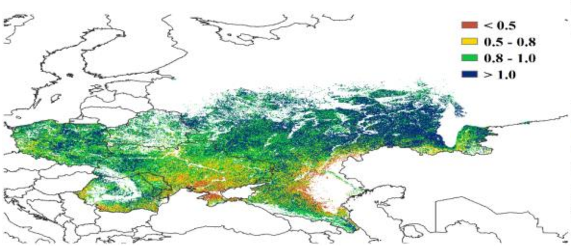


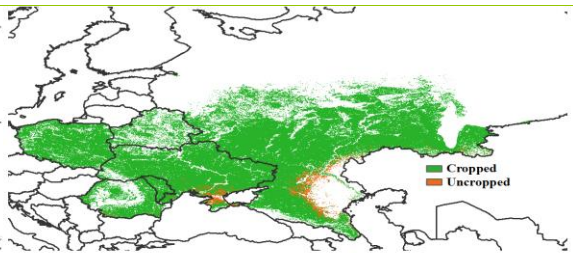
b. Profiles of rainfall departure from average (mm)



c. Spatial distribution of temperature profiles

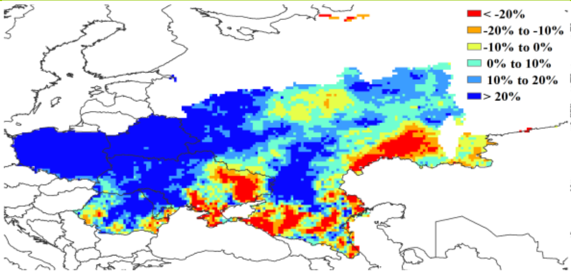
d. Profiles of temperature departure from average (mm)

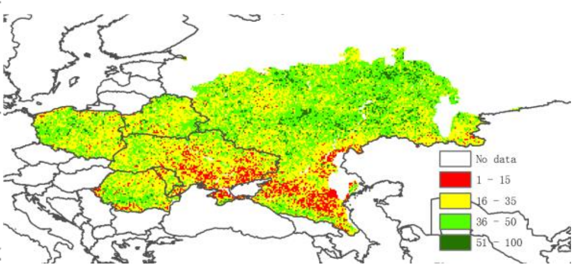




e. Maximum VCI

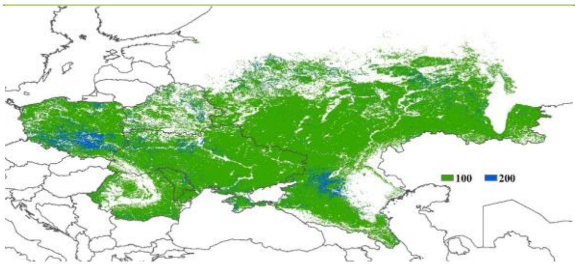
f. Cropped arable land





g. Biomass accumulation potential departure

h. VHI minimum



i. Cropping intensity

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

Chapter 3. Main producing and exporting countries

Chapter 1 has focused on large climate anomalies that sometimes reach the size of continents and beyond. The present section offers a closer look at individual 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, particularly when they logically fit into larger patterns

3.1 Overview

The global agroclimatic patterns that emerge at the level of the Measuring and Reporting Units (MRU) described in Chapter 1 are reflected with greater spatial detail at the national and sub-national administrative levels, which is the focus of this chapter (see figures 3.1-3.4). The 30 major producing and exporting countries are all the object of a specific and detailed narrative in the later sections of this chapter, while China is covered in Chapter 4. Sub-national units and national agro-ecological zones receive due attention in this chapter.

In many cases, the situations listed in this overview are also mentioned in the section on disasters in Chapter 5. Disaster situations, however, tend to be limited spatially, so that the statistical abnormality is not necessarily reflected in the climate statistics that include larger areas. Examples include Hurricane Harvey in Texas, Cyclone Ophelia in Ireland, or floods in Peru that occurred while the whole country experienced a precipitation deficit. In contrast, when extreme conditions affect a large area, they are bound to have been even more extreme in some locations.

Figure 3.1. Global map of July-October 2017 rainfall (RAIN) by country and sub-national areas, departure from 15YA (percentage)

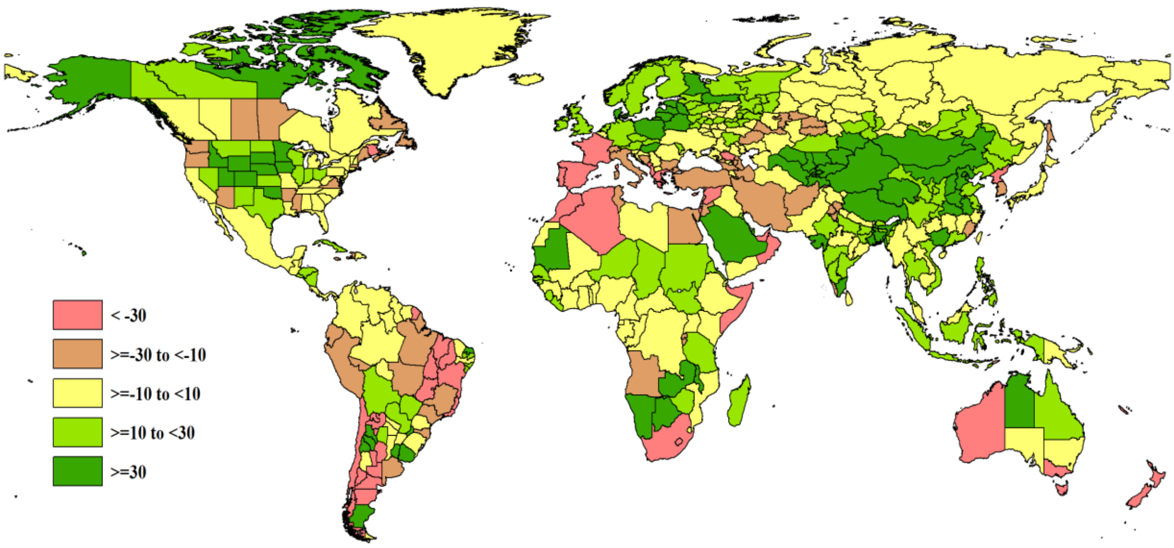


Figure 3.2. Global map of July-October 2017 temperature (TEMP) by country and sub-national areas, departure from 15YA (degrees)

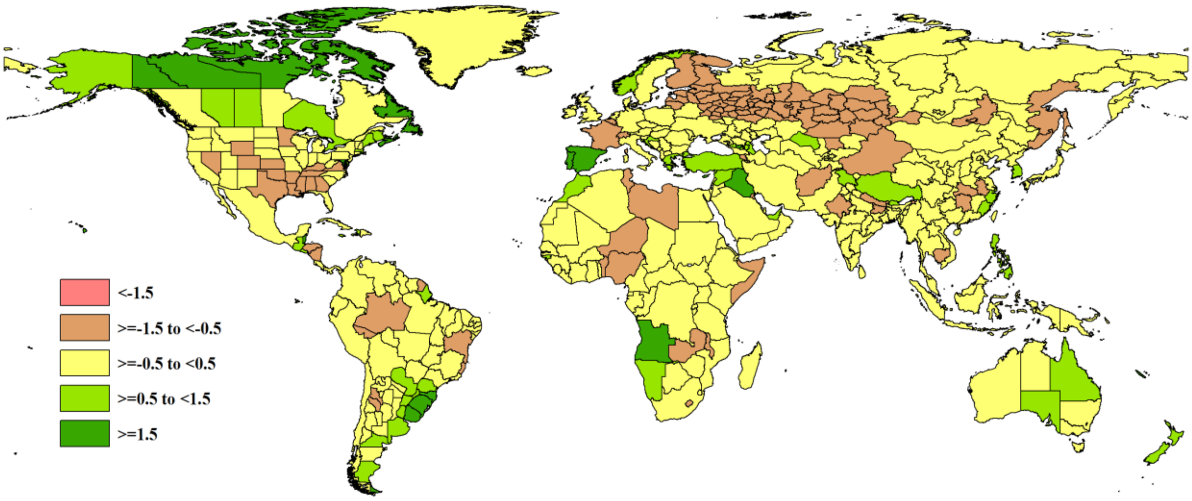


Figure 3.3. Global map of July-October 2017 PAR (RADPAR) by country and sub-national areas, departure from 15YA (percentage)

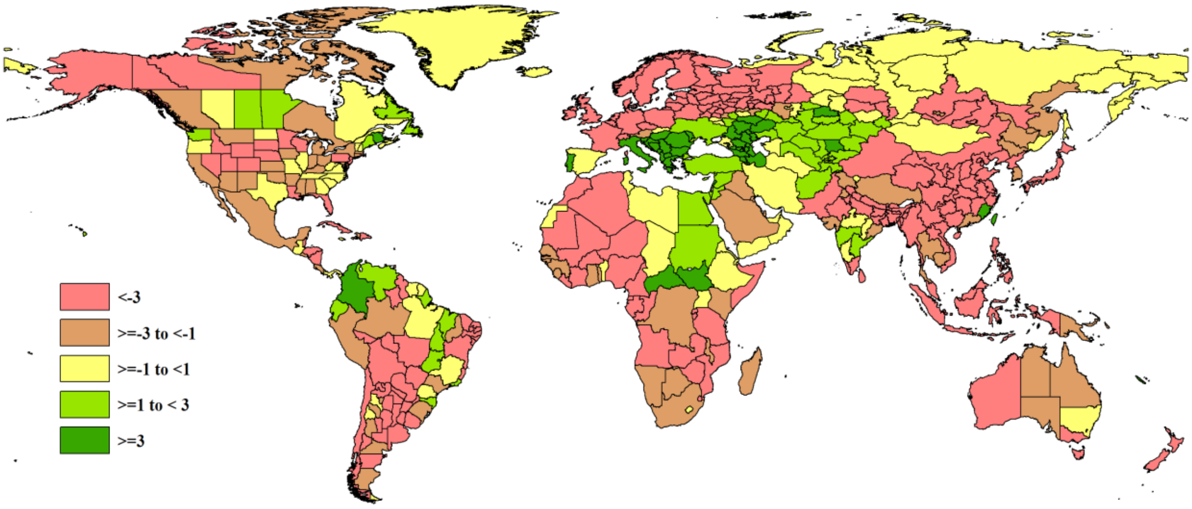
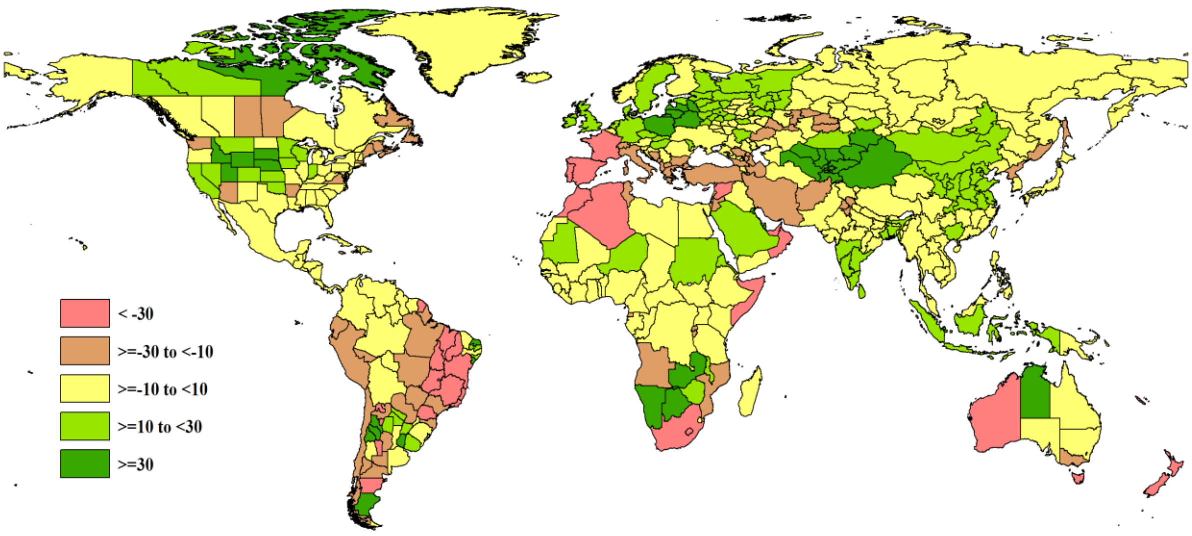


Figure 3.4. Global map of July-October 2017 biomass (BIOMSS) by country and sub-national areas, departure from 5YA (percentage)



Countries with excess precipitation

Excess precipitation in a location can be meaningful depending on the timing of the reporting period relative to the agricultural season, which for both rangeland and cropland centers on the peak of biomass production and directly relates to average precipitation, at least in areas where rainfall tends to be limiting. For example, among the countries with more than 50% excess precipitation is Namibia. Over the reporting period, however, Namibia was in its dry season, which is characterized by an average rainfall of just 17 mm over four months. The recorded RAIN departure for Namibia of 51% (corresponding to an amount of 26 mm) thus is not so spectacular as it may seem, while no doubt benefiting rangelands and cattle during the winter dry season. It is, for instance, far less significant than a 55% increase in Mongolia (346 mm instead of the average of 223) at a time when temperature is high (summer) and livestock needs the biomass. A situation similar to that of Mongolia occurred in other central Asian countries such as Tajikistan (RAIN +51%), Kyrgyzstan (+71%), and Uzbekistan (+92%). In the south of Africa, high positive rainfall departures also occurred in Zambia (+64%), which is less arid than Namibia, and especially Malawi (+68%). Both countries are now entering their main agricultural season (October-March) and the early rain will have been beneficial for the future maize crop by replenishing soil moisture, still low from the recent El Niño drought period.

The mentioned groups of countries are part of two of a total of five excess precipitation areas, with these first two areas encompassing (1) a stretch of land in central and southern Asia from Uzbekistan to the Chitinsky Oblast and Heilongjiang region in China, covering most of southeast and southern Asia and bordered in the west by Gujarat and Rajasthan; and (2) a region in southern Africa from Tanzania (+15%) to Namibia (+51%). A third area with excess precipitation includes (3) a region covering much of the Sahel from Senegal, Sierra Leone, and Liberia (all in the range from 12-15% increased rain) to the Sudan (+25%) and South Sudan (+14%), where rainfall was particularly favorable in Mauritania (601 mm, equivalent to +33%). For the countries in this third region the reporting period covers the peak to the end of the rainy and main cropping season.

The last two excess precipitation areas are in Europe and North America. In Europe, a stark contrast exists between the dry Mediterranean south and the high precipitation area. This fourth area (4) includes middle and northern Europe (Ireland +25% to Hungary +32% to the Komi Republic in Russia), with at its heart Poland (+55%) and the Baltic states. Most of the countries in this group had slightly below average temperature in the range of -0.5°C and well-below average sunshine (-9% and more in most of central-western Europe) along a south-north gradient (RADPAR -17% in Finland). Finally, in the fifth and last high precipitation area in (5) central North America, affected regions include mostly the Corn Belt (+29%) and the Northern Plains (+59%) where other weather variables were average.

Deficit precipitation and heatwave areas

Five areas can be identified for their large and general deficits in precipitation; the areas are described below and listed as (1)-(5). Many of those areas were affected by large-scale fires, often accompanied by above-average temperature, and many of them are listed again in the section on disasters in Chapter 5. When temperature was particularly high, it is mentioned after the rainfall departure from normal.

The largest precipitation deficit area (1), both in terms of extent and severity, includes at least twenty-five countries located around the Mediterranean in Europe and Africa and extends east as far as northern India. The timing of the drought here corresponds to the very last stages of winter crops as well the maximum of the vegetation period for summer crops, which have suffered in non-irrigated areas. Drought at the end of the period is likely to have delayed planting and germination of winter crops. The severest precipitation deficits in this area occurred in Portugal (RAIN -84%, equivalent to 27 mm when 169 were expected; +1.5°C), Cyprus (-59%; +1.8°C), and Morocco, Spain (both +2.6°C) and Syria (+1.5°C), all three in the -50 to -60% precipitation deficit range, and also France, Albania, Algeria, Montenegro, and Greece in the -35% to -42% rainfall range, with close to average temperature. Deficits tend to be in the -25% to -30% range in the central-Mediterranean areas (Italy, Bosnia-Herzegovina, Tunisia) and the east (Israel, Iran, Turkey, Egypt, Afghanistan, Georgia, Lebanon, Azerbaijan, Afghanistan, and part of India (Himachal Pradesh, Punjab, and Haryana)). With few exceptions (Tunisia -1.2°C) countries in this area had, again, close to average thermal conditions.

The second region covers (2) parts of the eastern Africa region, where drought has been lasting for two years now. The main deficits are those of Somalia (79mm or -43%) and the two highland countries of Rwanda (150 mm or -27% and Burundi (120mm or -22%). The whole region, including the countries just mentioned, are in a very difficult humanitarian situation (see also Chapter 5) due to large-scale refugee movements. Both Rwanda and Burundi had well below average radiation (RADPAR -7% and -6%, respectively).

A third area (3), the Korean peninsula is also mentioned in Chapter 5's section on disasters due to long-lasting deficits that reached, for the current reporting period, -34% in the Democratic People's Republic of Korea and -21% in the Republic of Korea. Both countries had a weak sunshine deficit (-3% and -2%, respectively), but about average temperature.

Finally, two areas need to be mentioned in America. The fourth precipitation deficit area covers (4) the equatorial east of Brazil, while the fifth includes (5) the west and south of the South American continent. The equatorial east of Brazil area includes some Caribbean Islands (Jamaica -30%, Dominica -28%), but mostly French Guiana (-42%) and, in Brazil, the major agricultural states of Goias (-40%) and Minas Gerais (-40%), followed by several others with deficits slightly larger than 20% (Mato Grosso, Santa Catarina, and São Paulo). In Belize, which belongs approximately to the same area, the temperature was 2.2°C and sunshine was low (-5%). In the other deficit area (the west and south of the South American continent), the drought gradient increases from coastal areas in the north (Ecuador, -22%; Peru -15%) and expands to several of the winter crop and pastoral areas in the Southern Cone to include Chile (-33%) and, in Argentina, the provinces of Cordoba (-37%) and Buenos Aires (-25%). It is stressed that the situation is spatially complex with other areas doing well, such as Entre Rios (RAIN +31%) and Santiago del Estero (+30%). In all the countries listed under (4) and (5), other indicators were roughly average.

The national rainfall deficit record occurred in Oceania in New Caledonia (-84%, 21 mm instead of 131), which also recorded a huge positive temperature departure of 6.7°C. Somewhat similar, but generally less severe, weather prevailed in New Zealand (RAIN -46% and RADPAR -10%, which is very atypical) and in parts of Australia.

Other areas of concern

The CropWatch BIOMSS indicator is based on rainfall and temperature. For the current reporting period, the relative share of the impact of RAIN and TEMP is 9-1, which is to say that BIOMSS anomalies closely follow rainfall anomalies (+/– 10%), unless temperature departures are significant and rainfall is not limiting. This happens mostly in warm climates, as for instance in Nicaragua (RAIN +17%, TEMP -0.8°C, leading to a BIOMSS +4%), Bangladesh (+49%, -0.4°C, BIOMSS +16%), Trinidad and Tobago (+23%, -0.4°C, BIOMSS +7%), and Malawi (+68%, -0,6°C, BIOMSS +18%). The main purpose of this section, however, is to stress again the observation from Chapter 1 according to which sunshine was unusually low in a large number of areas. This is illustrated as well in the RADPAR figure. When considering all the countries, 110 out of 165 experienced a sunshine deficit (67%). When considering the agro-ecological zones of the 30 major agricultural countries that are described later in this section, this percentage turns out to be 68%. For temperate countries and irrigated crops in the tropics, sunshine is usually the main limiting factor.

In conclusion, where yield is the major determinant of production, such as in summer crop areas where hectarage did not change significantly, overall weather conditions, including rainfall, temperature, and sunshine were not conducive to crop production.

Table 3.1. CropWatch agroclimatic and agronomic indicators for April-July 2017, departure from 5YA and 15YA

Country	Agroclimatic Indicators				Agronomic Indicators		
	Departure from 15YA (2002-2016)				Departure from 5YA (2012-2016)		Current
	RAIN (%)	TEMP (°C)	RADPAR (%)	BIOMSS	CALF (%)	Cropping Intensity (%)	Maximum VCI
Argentina	-5	0.4	-9	0	7	-7	0.71
Australia	-15	0.3	-2	-14	-9	-8	0.56
Bangladesh	49	-0.4	-12	16	0	1	0.91
Brazil	-16	0	-3	-21	-1	3	0.6
Cambodia	-2	-0.5	-3	1	-1	-2	0.89
Canada	-8	0.7	0	-3	-1	0	0.88
China	20	-0.1	-8	12	0	-1	0.78
Egypt	-26	-0.4	1	-2	1	2	0.73
Ethiopia	2	-0.1	0	-1	0	-5	0.93
France	-42	-0.5	-7	-30	-1	-3	0.79
Germany	27	-0.3	-9	22	0	-9	0.89
India	16	0	-3	6	2	-1	0.95
Indonesia	27	0	-10	16	0	1	0.93
Iran	-28	0	1	-28	-7	-1	0.61
Kazakhstan	18	-0.6	3	12	6	-2	0.84
Mexico	5	-0.4	-2	-1	3	5	0.92
Myanmar	9	-0.1	-4	3	0	9	0.96
Nigeria	2	-0.8	-4	-1	0	1	0.89
Pakistan	4	-0.3	-3	-6	5	-5	0.72
Philippines	12	0.7	-3	7	0	-1	0.96
Poland	56	-0.5	-8	40	0	-6	0.96
Romania	-8	0	6	-3	0	2	0.86
Russia	8	-0.7	-2	5	2	-3	0.96
S. Africa	-40	0.1	-2	-35	-9	11	0.68
Thailand	12	-0.3	-3	8	0	2	0.93
Turkey	-28	0.8	3	-29	11	2	0.82
Ukraine	-6	0.2	2	-1	-1	17	0.82
United Kingdom	27	0	-9	12	0	-17	0.88
United States	11	-0.3	-2	10	1	3	0.89
Uzbekistan	92	-0.3	1	88	12	-4	0.88
Vietnam	17	0	-8	9	0	5	0.94

Note: No sign means a positive (+) departure.

3.2 Country analysis

This section presents CropWatch analyses for each of thirty key countries (China is addressed in Chapter 4). The maps refer to crop growing areas only and include: (a) Graph for the phenology of major crops; (b) Crop condition development graph based on NDVI average over crop areas at national scale, comparing the July-October 2017 period to the previous season and the five-year average (5YA) and maximum; (c) Maximum VCI (over arable land mask) for July-October 2017 by pixel; (d) Spatial NDVI patterns up to October 2017 according to local cropping patterns and compared to the 5YA; and (e) NDVI profiles associated with the spatial pattern under (d). Next, separate graphs (labeled as figures (f), (g), and subsequent letters) are included to illustrate crop condition development graphs based on NDVI average over crop areas for major agro-ecological regions within the country, again comparing the July-October 2017 period to the previous season and the five-year average (5YA) and maximum.

In addition, please see also Annexes A and B for additional information about indicator values and production estimates by country. Country agricultural profiles are posted on **www.cropwatch.com.cn.**

[ARG] Argentina

The monitoring period covers the sowing and growing of winter wheat in Argentina. The sowing of maize and rice also started in the end of October, and wheat is approaching its maturity stage. For soybean the reporting period was outside the growing season.

Overall conditions are favorable for the country as a whole. RAIN was slightly below average (-5%), while radiation (RADPAR) was 9% below, which is significant. With the slightly above average temperature (TEMP, +0.4°C), the potential biomass (BIOMSS) was at an average level compared with its five-year average. Conditions for each province can be categorized into three group: (1) water deficit in Buenos Aires (RAIN, -25%), Cordoba (-37%), La Pampa (-32%), San Luis (-47%), Tucuman (-54%), and Salta (-36%); (2) average RAIN in Chaco, Corrientes, and Santa Fe; and (3) excess precipitation in Entre Rios (31% above average), Misiones (+41%), and Santiago Del Estero (+30%). High temperature was observed in Buenos Aires, Entre Rios, and Misiones. Meanwhile, all provinces suffered from radiation shortage, ranging from RADPAR -3% in Tucuman to -14% in Santiago Del Estero. Altogether, climatic conditions resulted in significantly above average BIOMSS in Entre Rios and Santiago Del Estero, and well below average BIOMSS in Cordoba, La Pampa, Salta, and Tucuman. Due to the drought impact, winter wheat yield and production in Buenos Aires and Cordoba was below that of the previous year. Refer to Table B.1 in Annex B for detailed production numbers by province.

The NDVI based crop condition development graph for the country was above the previous five-year average during the monitoring period, indicating a promising outlook for winter wheat yield nationally. According to the NDVI departure clustering analysis, crops were generally above the five-year average in the areas along the Parana River and central Buenos Aires. Below average NDVI mostly occurred in the northern part of Cordoba and central Salta due to the shortage of rainfall. Low VCIx values were also observed in those areas. High VCIx values concentrated in the Santa Fe, Entre Rios, and Corrientes provinces. The Cropped Arable Land Fraction (CALF) from July to October was 7% above average, but the wheat planted area was still below that of the previous year. Cropping intensity during the past 12 months was also 7% below average, indicating a decrease in total planted area.

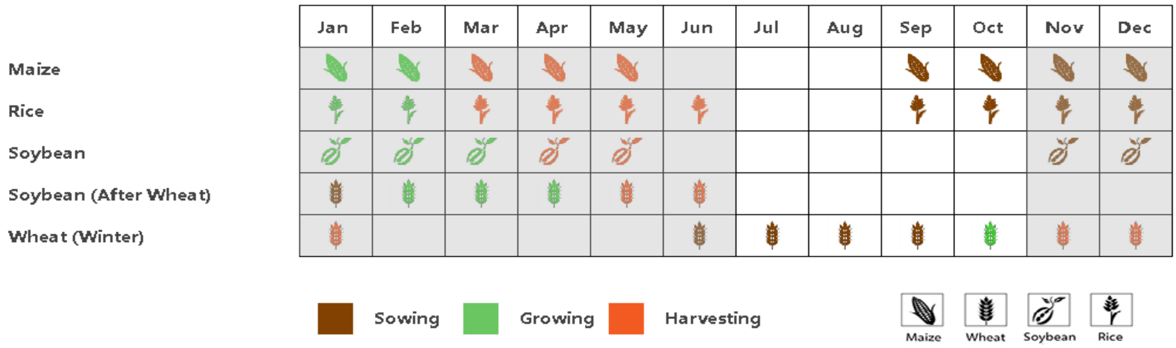
In summary, despite low rainfall hampering the development of winter wheat, the major wheat province--Buenos Aires--still produces a slightly above average wheat output. CropWatch puts wheat production at 11,740 ktons, 1% above the previous years, mostly as a result of increased yield. The unevenly distributed rainfall during the reporting period, however, could still affect planting and development of summer crops.

Regional analysis

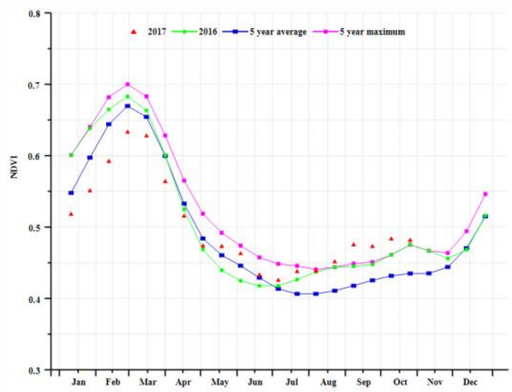
Based on cropping systems, climatic zones, and topographic conditions, eight agro-ecological regions can be distinguished for Argentina, among which five are relevant for crops cultivation. These five regions are the Chaco zone (6), Pampas (7), Mesopotamia (8), Pampas mountains zone (9), and Tropical highland zone (10). They are identified by these numbers in the VCIx map.

All regions received below average RADPAR (-6% to -12%). Below average RAIN in the **Pampas**, **Pampas mountains**, and **Tropical Highland zone** hampered the development of crops as confirmed by the relatively low VCIx compared with the other two zones (**Chaco zone** and **Mesopotamia**) where RAIN was 7% and 17% above average, respectively. Mesopotamia presents the highest VCIx (0.91) among the zones. The conditions in **Pampas**, **Pampas Mountains zone**, and **Tropical Highland zone** are generally unfavorable as indicated by significantly below average BIOMSS. CALF in all regions was above its five-year average, with a large positive departure observed in the **Chaco** and **Tropical Highland zones**. According to the NDVI profiles by zone, crop condition in Chaco, Mesopotamia, and Pampas was generally above average during the wheat growing period, while NDVI was below average for the other two regions.

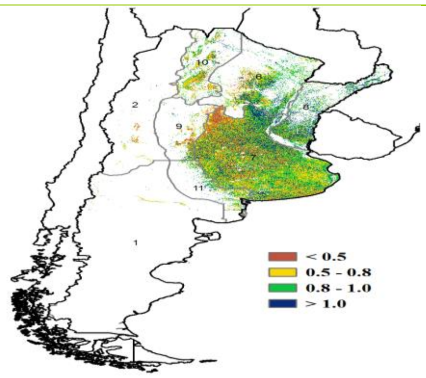
Figure 3.5. Argentina crop condition, July-October 2017



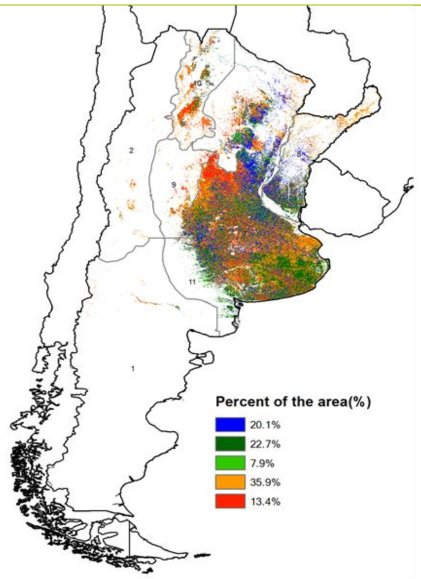
(a). Phenology of major crops



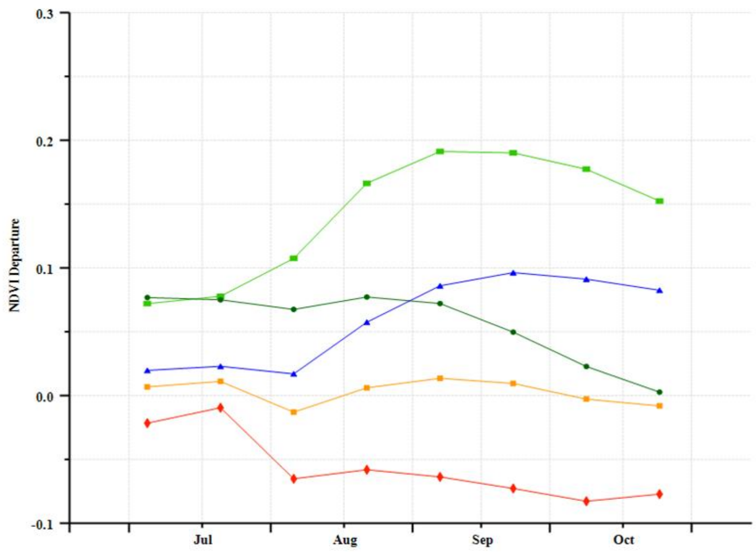
(b) Crop condition development graph based on NDVI



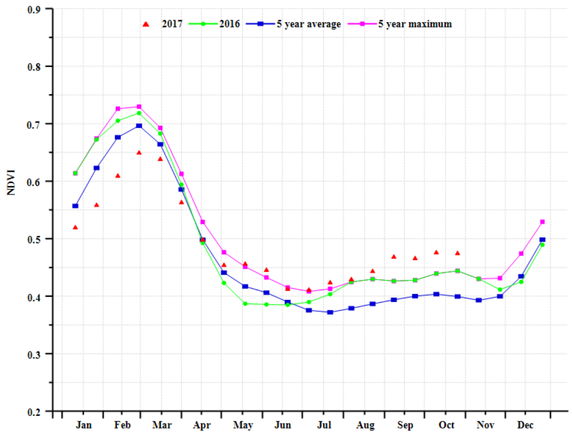
(c) Maximum VCI

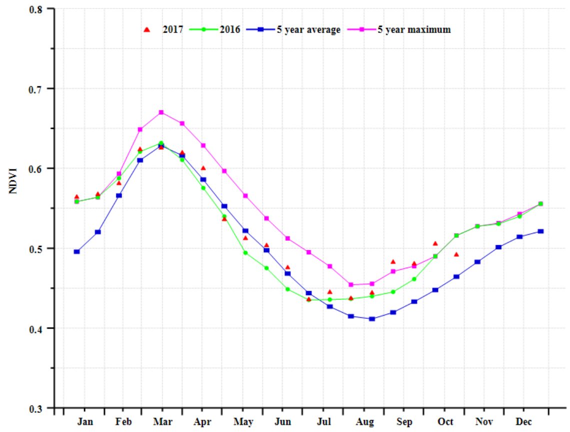


(d) Spatial NDVI patterns compared to 5YA

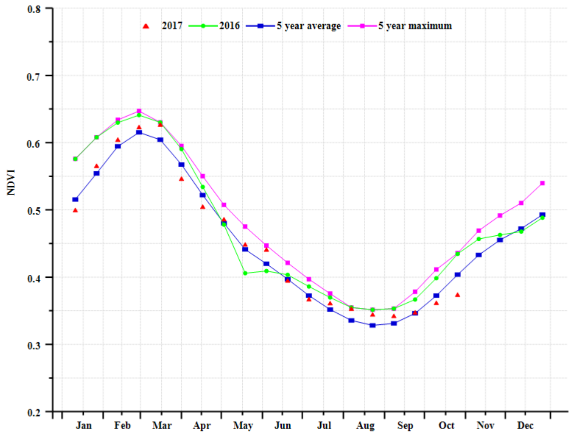


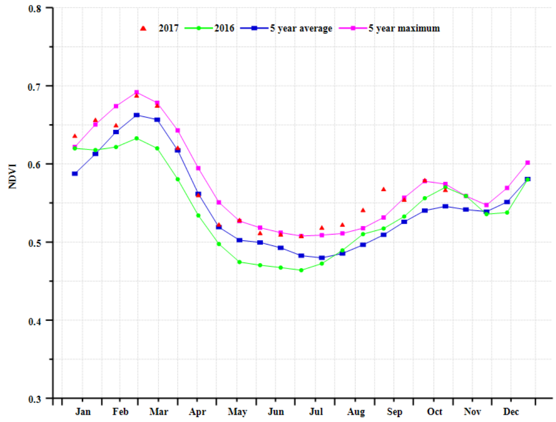
(e) NDVI profiles



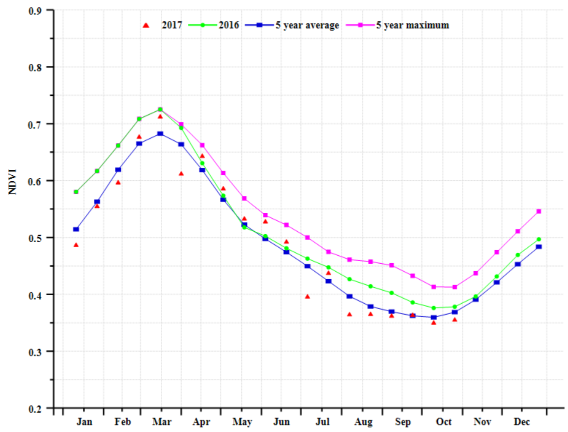


(f) Crop condition development graph based on NDVI (Pampas region (left) (left) and Chaco region (right))





(g) Crop condition development graph based on NDVI (Pampas mountain region (left) and Mesopotamia region (right))



(h) Crop condition development graph based on NDVI Tropical highland region

Table 3.2. Argentina agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, July-October 2017

Region	RAIN		TEMP		RADPAR	
	Current(mm)	Departure from 15YA (%)	Current(°C)	Departure from 15YA (°C)	Current(MJ/m2)	Departure from 15YA (%)
Chaco zone (Argentina)	198	7	19.5	0.3	841	-12
Pampas (Argentina)	174	-26	13.6	0.4	819	-8
Mesopotamia zone (Argentina)	504	18	18	0.9	830	-9
Pampas mountains zone (Argentina)	62	-35	13.4	-0.4	925	-6
Tropical highland zone (Argentina)	42	-21	18.5	-0.2	940	-8

Table 3.3. Argentina agronomic indicators by sub-national regions, current season's values and departure from 5YA, July-October 2017

Region	BIOMSS		Cropped arable land fraction		Maximum VCI
	Current (gDM/m2)	Departure from 5YA (%)	Current (%)	Departure from 5YA (%)	Current
Chaco zone (Argentina)	695	11	89	10	0.85
Pampas (Argentina)	696	-12	82	6	0.78
Mesopotamia zone (Argentina)	1413	21	99	2	0.91
Pampas mountains zone (Argentina)	271	-29	38	2	0.47
Tropical highland zone (Argentina)	184	-12	74	11	0.75

Table 3.4. CropWatch-estimated maize, rice, wheat, and soybean production for Argentina in 2017 (thousand tons)

Crops	Production 2016	Yield variation (%)	Area variation (%)	Production 2017	Production variation (%)
Maize	25710	-3	20	29946	16
Rice	1695	4	1	1789	6
Wheat	11630	4	-3	11740	1
Soybean	51080	-1	1	51116	0

[AUS] Australia

Wheat and barley, the main crops of Australia, are planted mainly from the end of April to July and harvested from October to January. The monitored period thus covers the beginning of their harvesting season. The national NDVI profile shows somewhat below average conditions, mainly in June and July. NDVI, however, was above average in October, compared to the five-year average.

Overall over the reporting period, Australia was short in rainfall with a 15% drop in RAIN, while the country experienced average temperatures and 2% below average radiation. The VCIx was only 0.56 during the reporting period, indicating poor crop condition, especially in the northern part of Western Australia, southeastern parts of New South Wales, and South Australia. This is also reflected by the spatial NDVI profiles at the regional level. CALF decreased by 9% below the recent five-year average.

Regional analysis

This analysis adopts five agro-ecological regions for Australia, namely the Southeastern wheat zone, Southwestern wheat zone, Arid and semi-arid zone, Wet temperate and subtropical zone, and Subhumid subtropical zone.

Crop condition in the **Southeastern wheat zone** showed basically a below average situation in July and August during the main growing season, although condition returned to average in September and October during the maturation and early harvesting stages. The region experienced an 11% rainfall deficit with average temperature and RADPAR, resulting in a low VCIx of 0.64. CALF decreased by 5%.

The **Southwestern wheat zone** also shows below average condition according to the regional NDVI profile. The region received 42% below average rainfall and low radiation (RADPAR -6%) with stable temperature. The weather-based potential biomass was 35% lower than its average of the last five years. The CALF decreased by 14%. The situation here is also reflected by the NDVI cluster maps in the Western Australia region, with a similarly low VCIx of 0.66. Crop condition is below average mostly due to low sunshine.

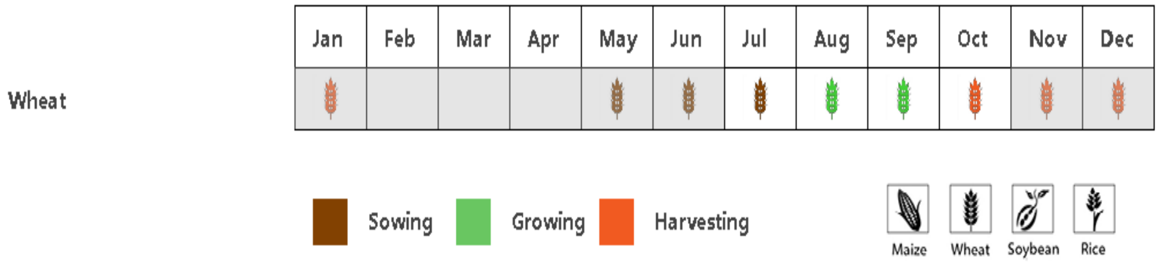
Crop condition based on NDVI profiles was below average in the **Arid and Semi-arid zone**. The region recorded sufficient rainfall, but temperature exceeded average by about 1.3°C and RADPAR was average. The weather based potential biomass (BIOMSS) was about 23% above average. However, the CALF of 0.51 indicates a rather low cropped area.

Next, crop condition in the **Wet Temperate and Subtropical Zone** was above average according to the regional NDVI profile. The region was 9% deficient in rainfall and with a slight positive temperature departure (+0.5°C) and average radiation. BIOMSS was 20% below its five-year average. CALF reached almost 1 (0.99), while VCIx was low (0.39), indicating a high cropped area but very poor crop condition.

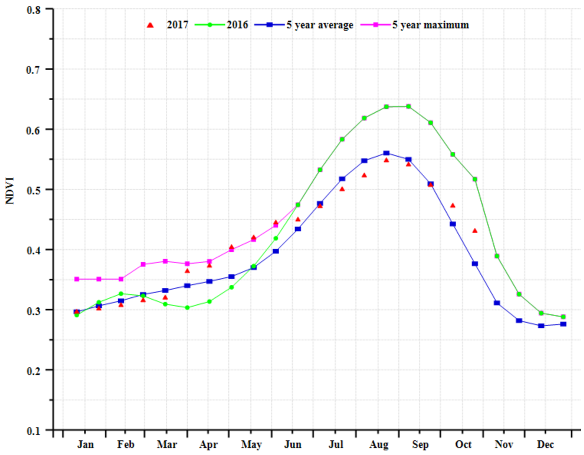
The **Subhumid subtropical zone** showed below average condition during the monitored period based on NDVI. The region was 12% deficient in rainfall, 0.5°C warmer than average, and with average RADPAR. The weather based potential biomass displays a 9% decrease. Just like the arid and semi-arid zone, the area had low CALF (0.48) and presumably a below average cropped area.

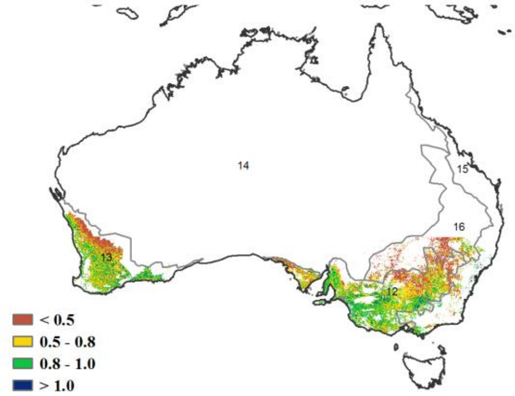
On the whole, CropWatch estimates the production of Australia will decrease by 22.1% in 2017, with a decrease in yield by 16.1% and an area decrease by 7.2%, compared with 2016.

Figure 3.6. Australia crop condition, July-October 2017



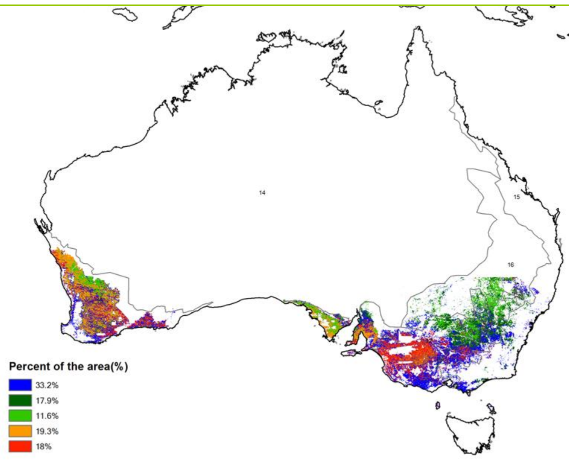
(a). Phenology of major crops

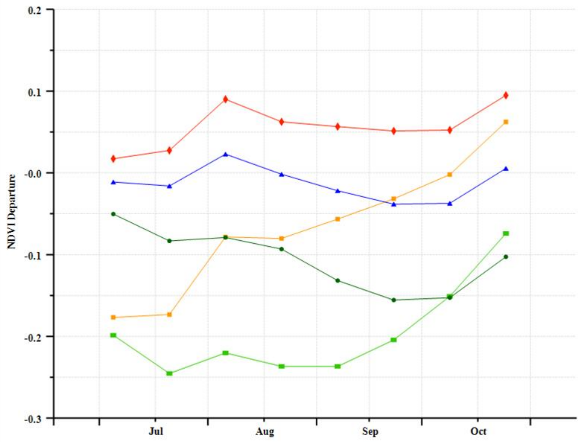




(b) Crop condition development graph based on NDVI

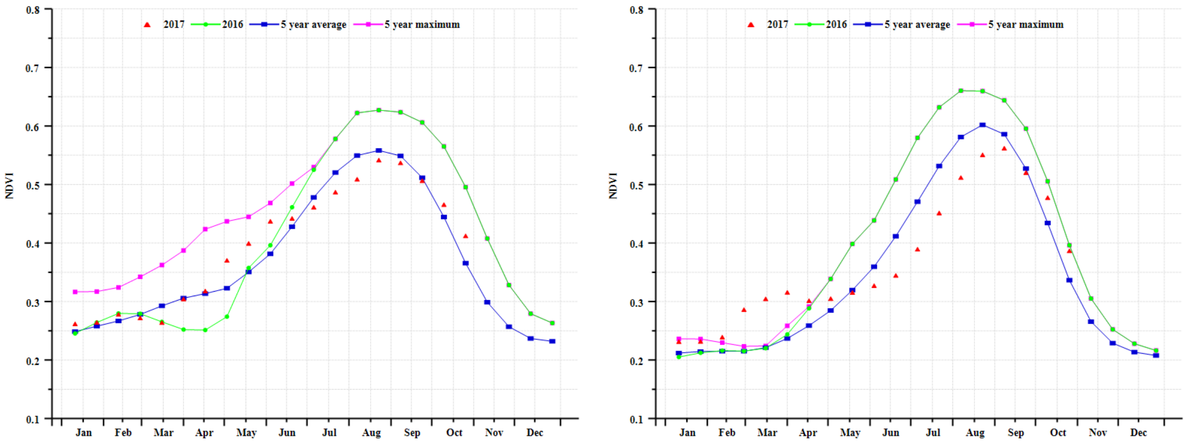
(c) Maximum VCI



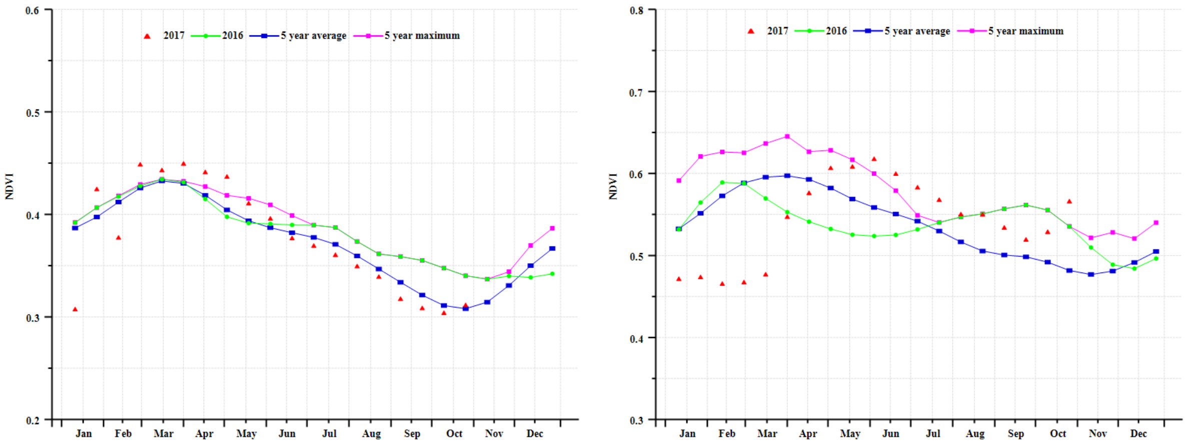


(d) Spatial NDVI patterns compared to 5YA

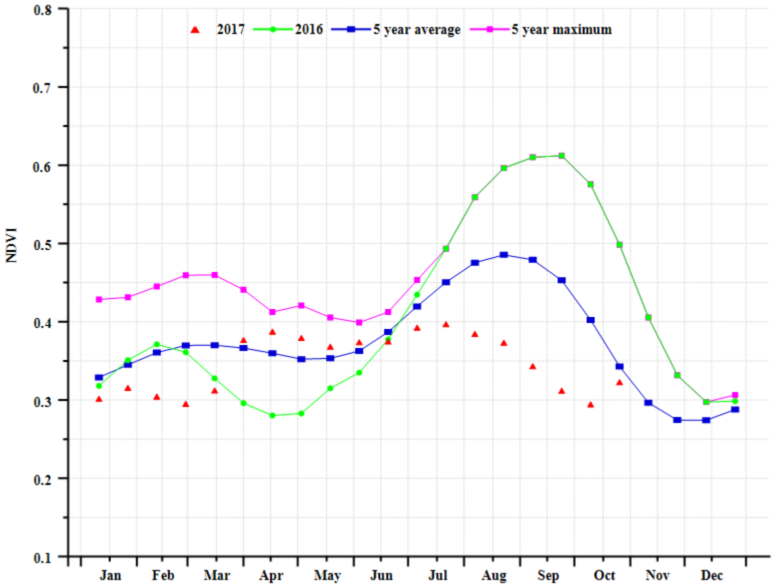
(e) NDVI profiles



(f) Crop condition development graph based on NDVI (Southeastern wheat zone (left) and Southwestern wheat zone (right))



(g) Crop condition development graph based on NDVI (Arid and semi-arid zone (left) and Wet temperate and subtropical zone (right))



(h) Crop condition development graph based on NDVI (Subhumid subtropical zone)

Table 3.5. Australia agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, July-October 2017

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m2)	Departure from 15YA (%)
Southeastern wheat zone	142	-11	11.8	0.1	864	-2
Southwestern wheat zone	115	-42	12.7	0	858	-6
Arid and semiarid zone	90	65	24.7	1.3	1245	-1
Wet temperate and subtropical zone	164	-9	14.2	0.5	950	-1
Subhumid subtropical zone	109	-12	15.8	0.5	1070	0

Table 3.6. Australia agronomic indicators by sub-national regions, current season's values and departure from 5YA, July-October 2017

Region	BIOMSS		CALF		Maximum VCI
	Current (gDM/m2)	Departure from 5YA (%)	Current	Departure from 5YA (%)	Current
Southeastern wheat zone	621	-3	90	-5	0.64
Southwestern wheat zone	458	-35	78	-14	0.66
Arid and semiarid zone	311	23	51	-8	0.27
Wet temperate and subtropical zone	550	-20	99	4	0.39
Subhumid subtropical zone	459	-9	48	-28	0.17

Table 3.7. CropWatch-estimated wheat production for Australia in 2017 (thousand tons)

Crops	Production 2016	Yield variation (%)	Area variation (%)	Production 2017	Production variation (%)
Wheat	31600	-16.10%	-7.20%	24606	-22.10%

[BGD] Bangladesh

The current reporting period covers the planting and growth of Aman rice and the harvesting of Aus rice. The country received heavy rains (2211 mm) exceeding the average by 49%, which did did cause very severe flooding (see also Chapter 5, section on disaster events). Temperature (28.5°C) was just average, while sunshine, measured by RADPAR, was 12% below average, representing a very significant drop for a country where this variable is the main limiting factor for agriculture. The BIOMSS indicator for Bangladesh is up 16% over average. High rainfall, low sunshine, and floods have negatively affected crops. NDVI was very low until August, which corresponded with the maturity of Aus rice; NDVI then picked up to arrive at a level near the five-year average in October, indicating satisfactory conditions for Aman rice. While CALF was only comparable with the five-year average, the VCIx at 0.9 was good. The overall situation during the reporting period was dominated by heavy rains causing floods and so adversely affecting the crop prospects, especially for Aus rice.

Regional analysis

For Bangladesh, four agro-ecological regions are applied, including the Coastal region, the Gangetic Plains, the Hill region, and the Sylhet basin.

The **Coastal region** received 2094 mm rainfall (+43% compared with average). Temperature was average at 28.5°C (a -0.4°C departure), while RADPAR was much below average (-12%). The region's high BIOMSS value (+16% above the five-year average) is contradicted by lower than average NDVI throughout the period. Meanwhile CALF, at 90%, was just average. The VCIx value of 0.92 indicates a good crop condition for the crops grown during the season. Lower than average production, however, is likely due to excess water and low radiation.

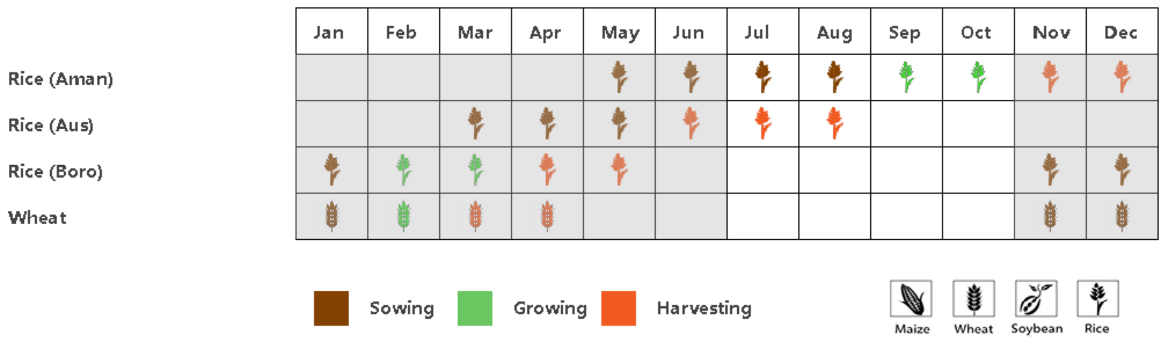
The monsoon rains in the **Gangetic Plains** (2088 mm) exceeded average by 58%. Similar to the Coastal region, temperature was average and RADPAR was well below (-12%). BIOMSS was expected to be 58% of the five-year average. As reflected in the NDVI graphs, heavy rains have damaged the Aus rice (in particular drying the grain was difficult) and delayed the planting of Aman rice. The rains may have also damaged the planted Aman rice, as as seen in low NDVI for the region until August. The later increase in NDVI to near average indicates that Aman rice could reach average condition. Finally, with a CALF at 95% and a VCIx of 0.96, indicators show that most of the cropland was planted and that the Aman crops attained good condition. Overall, crop prospects are poor for Aus but good for Aman rice.

The **Hill region** region received 2335 mm of rains, which is +31% above average. Temperature (at 27.1°C) was slightly below average (-0.8°C), while RADPAR underwent a significant drop, being 9% below average. The biomass production prospect of 2612 gDM/m2 was +5% above its five-year average. The NDVI profile for the region also shows low values throughout the crop growing period, indicating that crop condition remained below average. Still, a CALF of 98% and VCIx of 0.95 together indicate that the Hills region may be one of the least affected regions by the generally poor conditions.

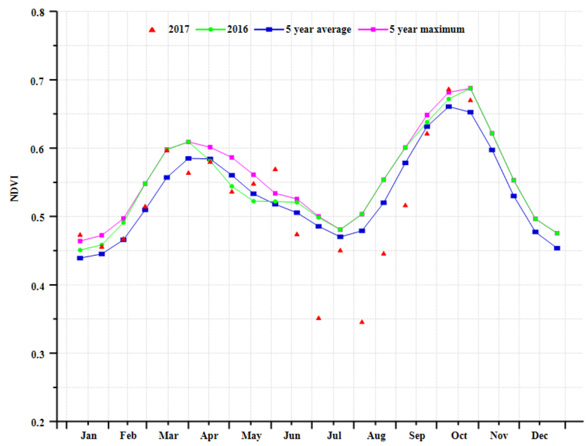
The **Sylhet basin** followed the same pattern as other areas with high rainfall of 2402 mm (52% higher than average). Temperature (28.4°C) was just below average (-0.4°C), while radiation (RADPAR at 743MJ/m2) was the lowest of all for agro-ecological regions down 14% compared with average. The BIOMSS of 2659gDM/m2 for the region represented an increase of 15% over the five-year average. This is, however, contradicted by the low CALF of 86%, confirming that less area could be planted due to floods. Similarly, a VCIx of just 0.84 indicates mixed crop condition. Crop condition development remained poor until mid September, after which it improved, eventually even exceeding the five-year maximum in a case of late recovery. These findings suggest that crop condition for the Aus rice crop was not good, but that the Aman rice crop yield could be better than average, provided agroclimatic indicators remained favorable in November.

Altogether, conditions were poor during July to September due to excessive rainfall, floods, and very low sunshine, although NDVI improved later in the season and particularly in October. Prospects of the already harvested Aus crop are poor. According to the indicators, the condition of the ongoing Aman rice remains fair to good, subject to favorable agroclimatic condition.

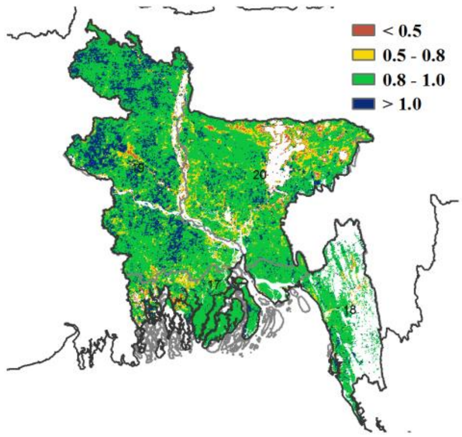
Figure 3.7. Bangladesh crop condition, July - October 2017



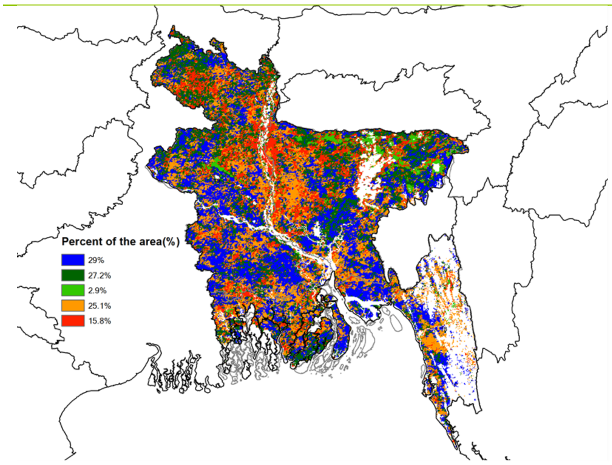
(a). Phenology of major crops



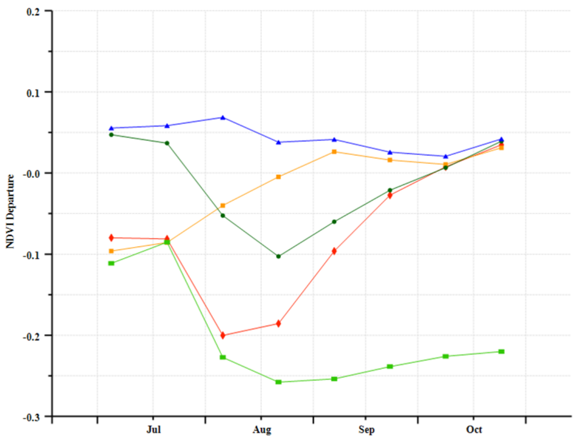
(b) Crop condition development graph based on NDVI



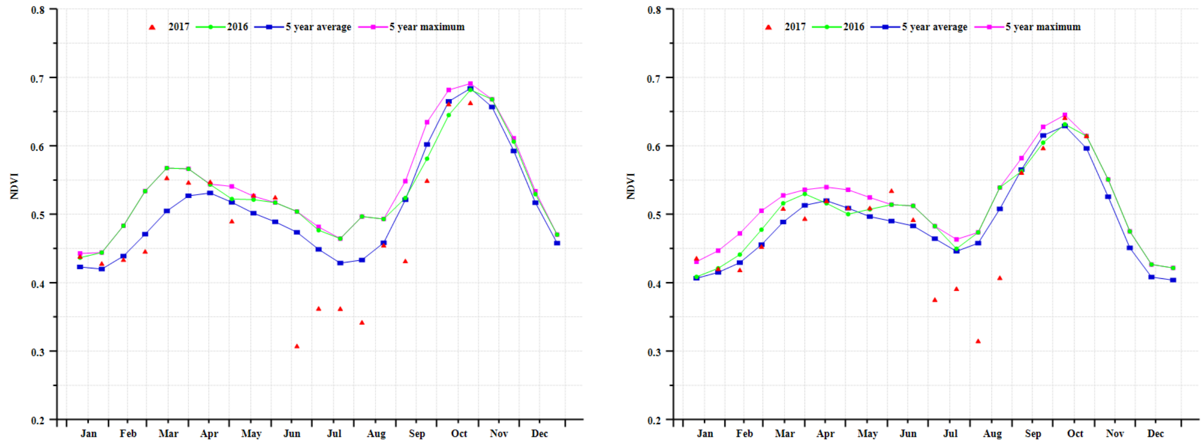
(c) Maximum VCI



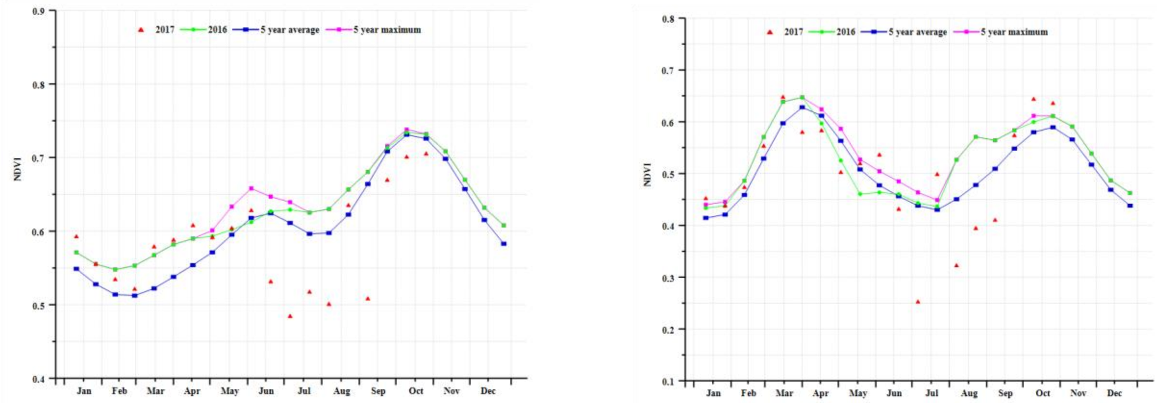
(d) Spatial NDVI patterns compared to 5YA



(e) NDVI profiles



(f) Crop condition development graph based on NDVI (Coastal Region (left) and Gangetic Region (right))



(g) Crop condition development graph based on NDVI (Hill Region (left) and Sylhet Basin (right))

Table 3.8. Bangladesh agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, July-October 2017

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m2)	Departure from 15YA (%)
Coastal region (Bangladesh)	2094	43	28.7	1	805	-11
Hill region (Bangladesh)	2335	31	27.1	-0.8	795	-9
Gangatic plain (Bangladesh)	2088	58	29	-0.4	789	-12
Sylhet basin (Bangladesh)	2402	52	28.4	-0.5	743	-14

Table 3.9. Bangladesh agronomic indicators by sub-national regions, current season's values and departure from 5YA, July-October 2017

Region	BIOMSS		CALF		Maximum VCI
	Current (gDM/m2)	Departure from 5YA (%)	Current (%)	Departure from 5YA (%)	Current
Coastal region (Bangladesh)	2613	15	90	0	0.92
Hill region (Bangladesh)	2612	5	98	0	0.95
Gangatic plain (Bangladesh)	2602	22	95	0	0.96
Sylhet basin (Bangladesh)	2659	15	86	-1	0.84

Table 3.10. CropWatch-estimated maize, rice and wheat production for Bangladesh in 2017 (thousand tons)

Crops	Production 2016	Yield variation (%)	Area variation (%)	Production 2017	Production variation (%)
Maize	2375	-5.50%	0.00%	2245	-10.00%
Rice	47722	-4.50%	-0.70%	45274	-10.00%

[BRA] Brazil

The reporting period covers the growing stage of maize in northern Brazil and that of wheat in southern Brazil. The harvest of rice (in the north) and second maize concluded in early September, while the planting of the main maize crop started in October. Generally, crop condition in Brazil was below average during the monitoring period.

Low rainfall (measured with the CropWatch RAIN indicator) dominated conditions across the country, with 16% below average rainfall. Temperature (TEMP) and radiation (RADPAR) at the national level are close to average. The below average rainfall resulted in a 21% negative departure of potential biomass compared with the five-year average. Among the nine major agricultural states, only Ceará, Mato Grosso do Sul, and Paraná received above average rainfall with +5%, 11%, and 9% positive departures, respectively. All other 6 states suffered from water shortages, with rainfall deficits ranging from -7% in Rio Grande do Sul to -40% in Goias. Well-above average temperature was observed in Paraná, Rio Grande do Sul, and Santa Catarina. Ceará, Mato Grosso do Sul, and Mato Grosso received 7%, 5%, and 7% less radiation than average. Altogether, the nine major agricultural states all yield below average BIOMSS, ranging from 7% negative departure in Rio Grande do Sul to a departure of -33% in the state of Goias.

The national NDVI development profile for Brazil presents below average values throughout the reporting period. As the major summer crops had already been harvested before the reporting period, the unfavorable conditions did not impact the final outputs of soybean and maize. The water deficit, however, could potentially hamper the sowing progress of summers crop for the following growing season. According to the NDVI departure clustering maps and profiles, eastern Rio Grande do Sul and the most eastern part of the Nordeste zone are the only regions where the condition of the crops is above the five-year average, a situation mainly due to excessive local rainfall. NDVI in all other regions was below the five-year average. The unfavorable conditions are confirmed by the low VCIx (0.6) nationally over cropland areas. VCIx for most croplands in central Brazil is lower than 0.5. CALF during the monitoring period is 1% below average, while annual cropping intensity is 3% above its five-year average.

Wheat production is concentrated in Paraná and Rio Grande do Sul. With conditions generally favorable for Paraná and average for Rio Grande do Sul, CropWatch puts wheat production for Brazil at 8,337 ktons, 8% above the previous year.

Regional analysis

Based on cropping systems, climatic zones, and topographic conditions, eight agro-ecological regions are identified for Brazil. These include the central savanna, the east coast, Parana river, Amazon zone, Mato Grosso zone, subtropical rangeland zone, mixed forest and farmland, and the Nordeste. Over the recent reporting period, all zones received well below average rainfall, with the exception of the subtropical rangeland zone where rainfall was just 1% below average. Considering the crops calendar, this bulletin will focus on east coast Brazil, the Parana river zone, the subtropical rangeland zone, and the Nordeste.

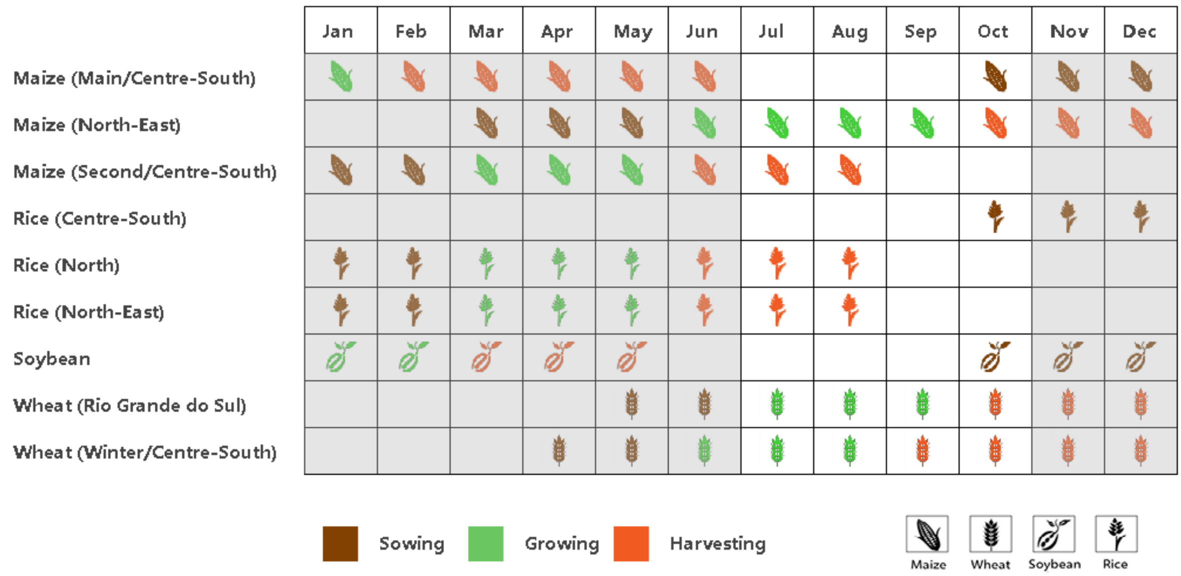
Rice is a major crop in the **East Coast Brazil zone** during the monitoring period, and the overall crop condition for rice was unfavorable. RAIN was 31% below average, while temperature was 1.0°C below average, and RADPAR -5%. Unfavorable conditions resulted in poor crop conditions as indicated by NDVI below its five-year average in the NDVI based profiles.

The **Paraná River zone** is the major wheat producing area of the country. Agroclimatic conditions were generally below average, with rainfall at -10%. CALF, however, is 98% for this zone, indicating that most croplands are cultivated; VCIx is 0.8. Overall the crop condition in this zone s at an average level, which can be explained by good management of the fields.

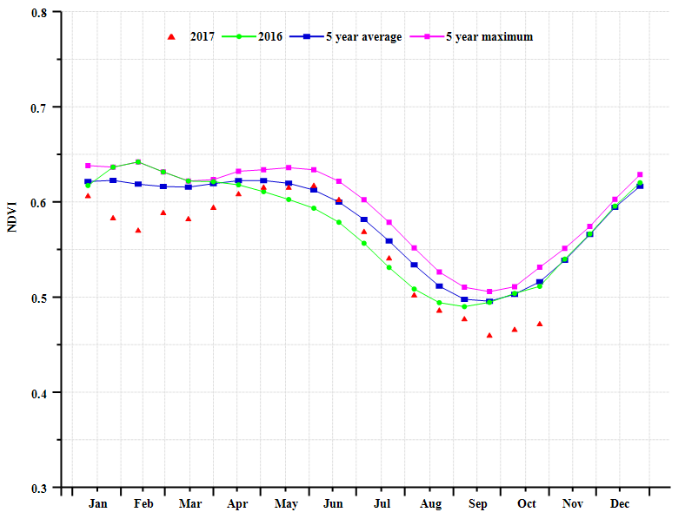
Conditions were generally average in the **subtropical rangeland zone** during the monitoring period, with 1% above average RAIN, 1.7°C above average temperature, and average RADPAR, altogether resulting in 1% above average BIOMSS and CALF at 1% above its five-year average. According to the NDVI profiles, crops in this zone are at their five-year average condition and above that of the previous year.

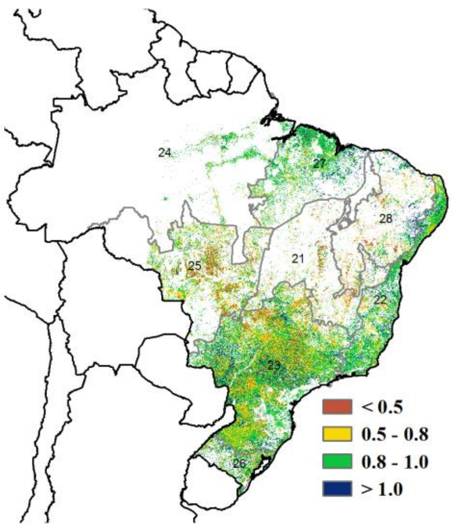
Finally, adverse weather conditions in the **Nordeste zone** have resulted in unfavorable crop condition. The region only received 26 mm of rainfall, down 48% compared to normal for the period. RADPAR was nevertheless 8% below average. Altogether, BIOMSS was 44% below the five-year average according to the model simulation. However, since most of the crops had already been harvested by the end of August, the low rainfall did not impact the final output in the zone.

Figure 3.8. Brazil crop condition, July-October 2017



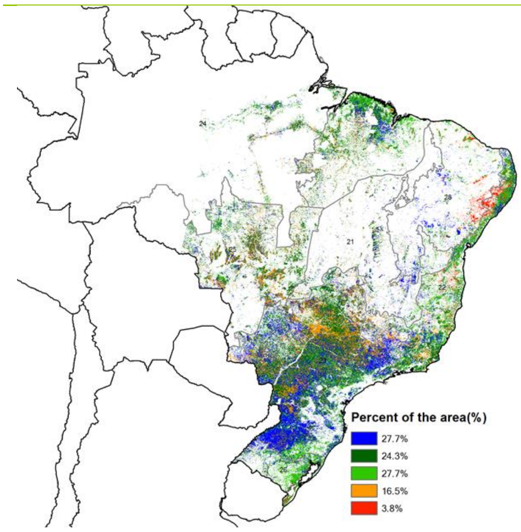
(a). Phenology of major crops

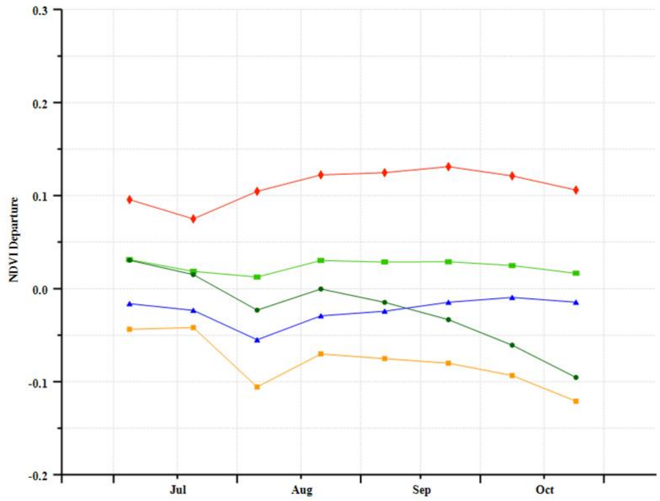




(b) Crop condition development graph based on NDVI

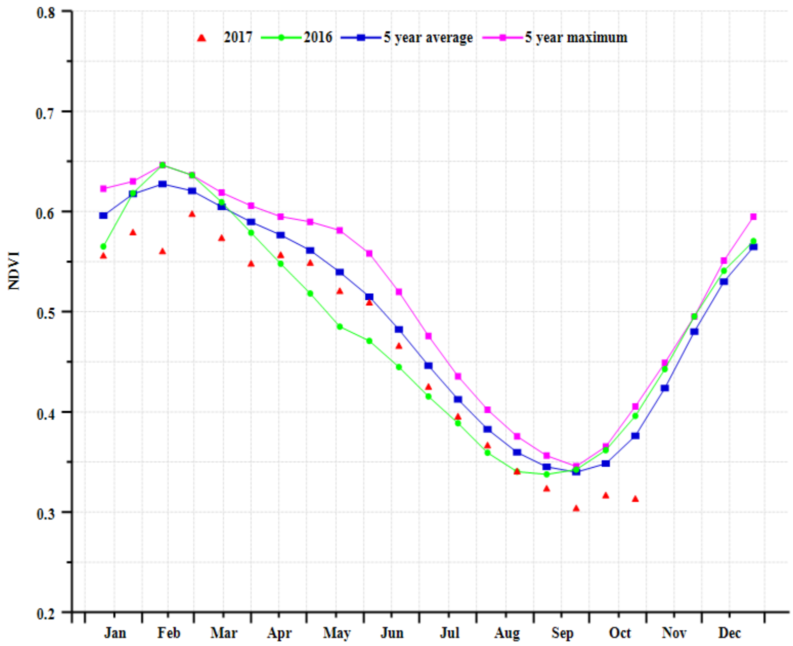
(c) Maximum VCI



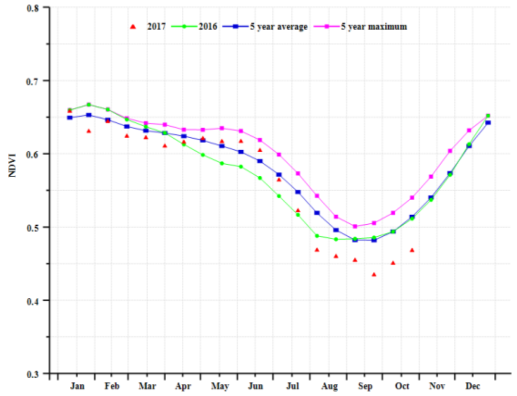


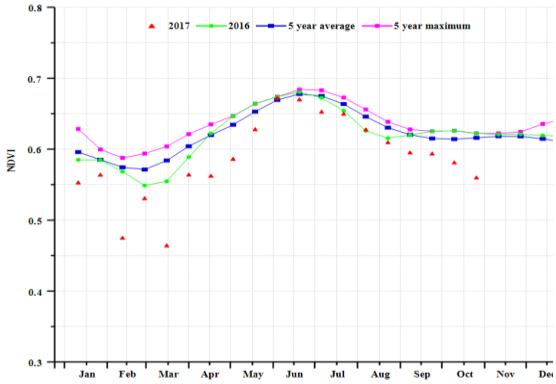
(d) Spatial NDVI patterns compared to 5YA

(e) NDVI profiles

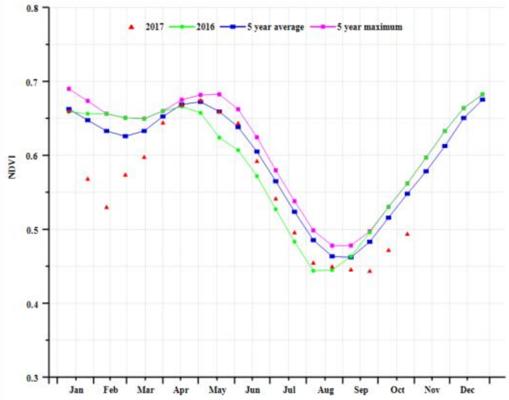


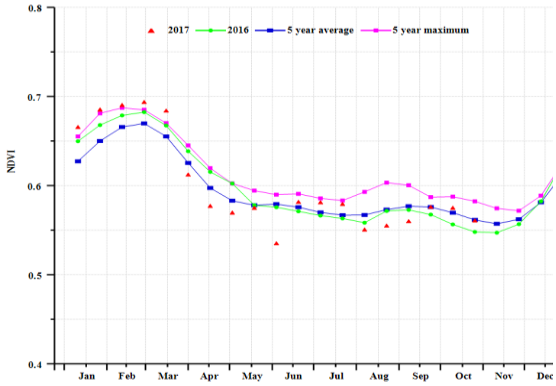
(f) Crop condition development graph based on NDVI (Central Savanna)



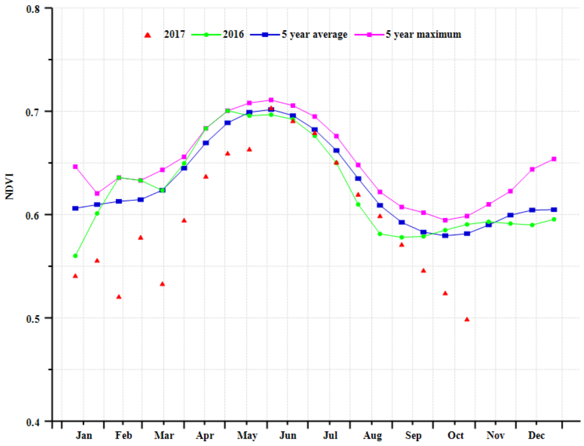


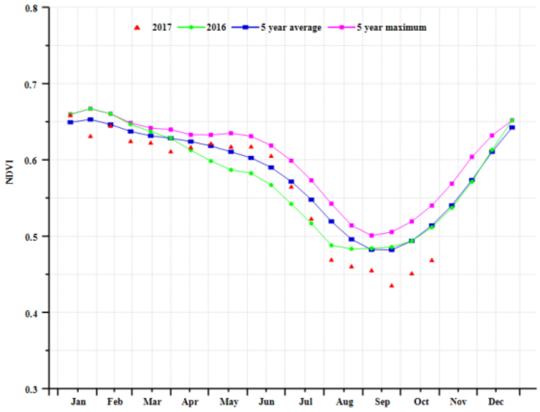
(g) Crop condition development graph based on NDVI (Parana River (left) and Amazon (right))



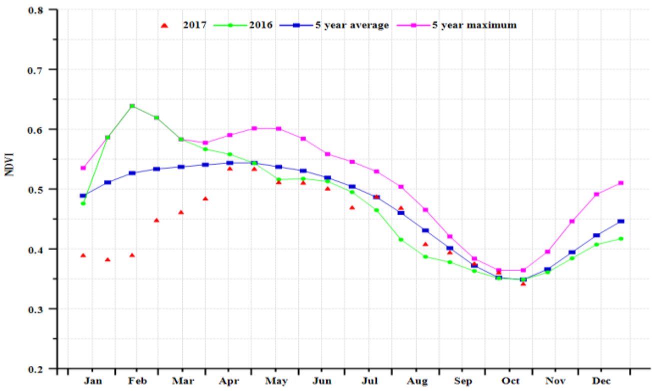


(h) Crop condition development graph based on NDVI (Mato Grosso region (left) and Subtropical rangeland (right))





(i) Crop condition development graph based on NDVI （Mixed forest and farmland （left） and East coast zone （right））



(j) Crop condition development graph based on NDVI for Brazil Nordeste

Table 3.11. Brazil agro-climatic indicators by sub-national regions, current season's values and departure from 15YA, July-October 2017

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m2)	Departure from 15YA (%)
Central Savanna (Brazil)	60	-51	26	-0.5	1232	2
East coast (Brazil)	96	-31	22.4	-1	955	-5
Parana River (Brazil)	343	-10	22.3	0.4	1048	0
Amazon (Brazil)	293	-15	28.7	0.1	1128	-1
Mato Grosso region (Brazil)	208	-15	28.1	-0.1	1073	-7
Subtropical rangeland (Brazil)	607	-1	18.6	1.7	815	-4
Mixed forest and farmland (Brazil)	132	-28	29.3	0	1212	0
Nordeste (Brazil)	26	-48	26.7	-0.1	1159	-8

Table 3.12. Brazil agronomic indicators by sub-national regions, current season's values and departure from 5YA, July-October 2017

Region	BIOMSS		Cropped arable land fraction		Maximum VCI
	Current (gDM/m2)	Departure from 5YA (%)	Current (%)	Departure from 5YA (%)	Current
Central Savanna (Brazil)	224	-46	55	-10	0.68
East coast (Brazil)	363	-24	98	1	0.91
Parana River (Brazil)	810	-24	97	0	0.8
Amazon (Brazil)	974	-13	100	0	0.9
Mato Grosso region (Brazil)	716	-13	89	-4	0.72
Subtropical rangeland (Brazil)	1571	1	97	1	0.89
Mixed forest and farmland (Brazil)	454	-27	99	0	0.9
Nordeste (Brazil)	105	-44	59	1	0.73

Table 3.13. CropWatch-estimated maize, rice, wheat, and soybean production for Brazil in 2017 (thousand tons)

Crops	Production 2016	Yield variation (%)	Area variation (%)	Production 2017	Production variation (%)
Maize	25710	19	0	84019	19
Rice	1695	1	1	11344	3
Wheat	11630	7	1	8120	8
Soybean	51080	3	3	96726	5

[CAN] Canada

The current reporting period covers the development and early harvest of summer crops, and the harvest and sowing of winter wheat in Canada. Overall rainfall for Canada's agricultural areas was below average (-8%), which brought a slight drought to the crops. Temperature was slightly above (+0.7°C), while radiation and cropping index were average. The VCIx was 0.88, and the potential biomass was slightly below the recent five-year average (BIOMSS, -3%). A possibly (and only slightly) poor crop condition could be indicated.

Meanwhile, based on the national NDVI profiles and clusters, crop condition was below that of last year for the same period, a situation similar to the previous reporting period. The VCIx values in the central-south of the Canadian Prairies were mostly below 0.5 due to the aforementioned drought, providing a confirmation of the poor crop condition. In Manitoba (RAIN, -20%) and Saskatchewan (RAIN, -23%), two of the three main production provinces, the continuing drop in rainfall over two reporting periods resulted in a decrease in the biomass production potential (BIOMSS, -17% and -19%), respectively.

Overall, the condition of crops in Canada was poor, even if indicators show a normal situation in the east. Generally, CropWatch assesses crop growth condition in Canada as below that of 2016.

Regional analysis

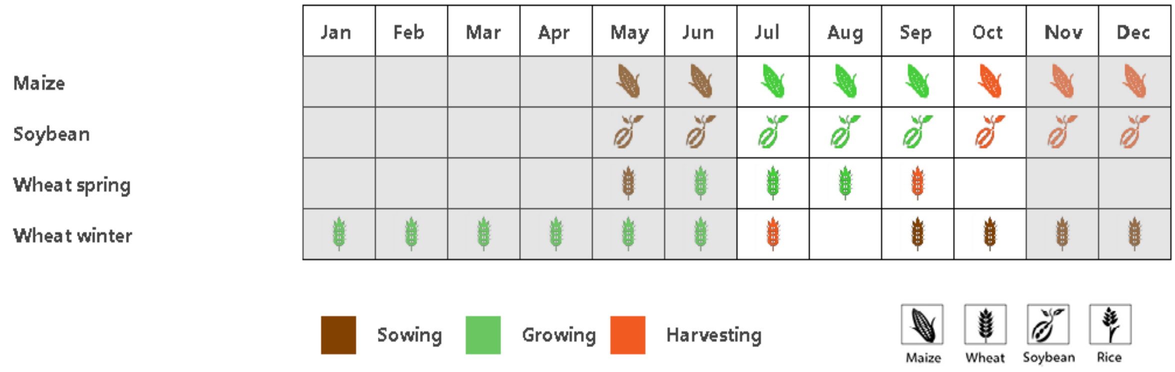
For Canada, five agro-ecological regions are adopted by CropWatch to provide additional spatial detail. They include the Prairies (32) and the Atlantic Ocean area (34, Ontario and Quebec), which both are major food production regions for the country. The numbers identify the regions in the VCIx and other maps.

The **Prairies region** is the largest food production area in Canada. During the reporting period, rainfall was below average (RAIN, -13%). Although the weather was slightly warmer than expected (TEMP, +0.5°C), radiation was almost average (RADPAR, +1%), and the potential biomass dropped below the five-year average (BIOMSS, -12%). The Cropped Arable Land Fraction (CALF) was stable, while VCIx was fair at 0.86. Taking into account the NDVI profiles, the difference between the current period and the five-year average ranged from 0.05 to 0.1, which provides supplementary evidence for the poor growth conditions. CropWatch predicts crop production will be below that of last year.

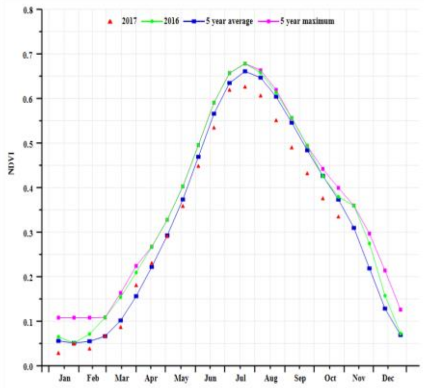
In the **Atlantic Ocean region**, rainfall was below the average (RAIN -9%), the temperature was above (TEMP, +1.1°C), and both radiation and CALF were unchanged (PAR, 0%; CALF, 0%). The potential biomass was slightly below the five-year average (BIOMSS, -3%) as a direct consequence of the drop in rainfall. VCIx was 0.94. According to the NDVI profiles, crop growth conditions were mostly fair, but decreased below the reference in October. Crop production will be slightly lower than the previous year's.

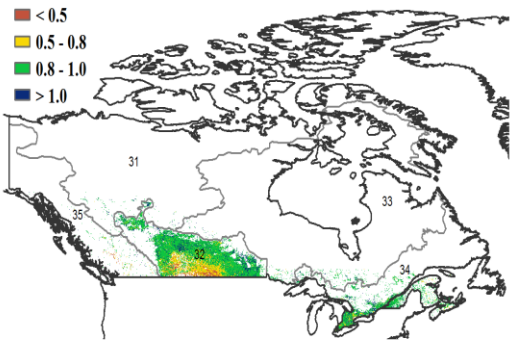
Overall, wheat production of Canada could undergo a drop due to the mild drought conditions, which affected mostly the development stages of winter wheat and spring wheat. Maize and soybean are mostly unaffected. As a result, CropWatch predicts a drop in wheat production (30,679 ktons, -7.8% below 2016), but slight increases for maize (11,881 ktons, +1.5%) and soybean (5,471 ktons, +1.6%).

Figure 3.9. Canada crop condition, July - October 2017



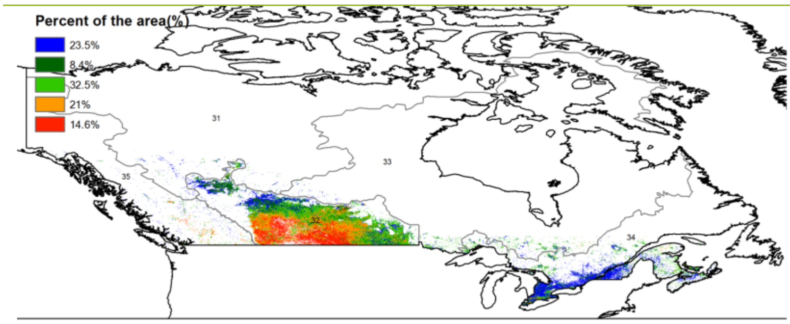
(a). Phenology of major crops

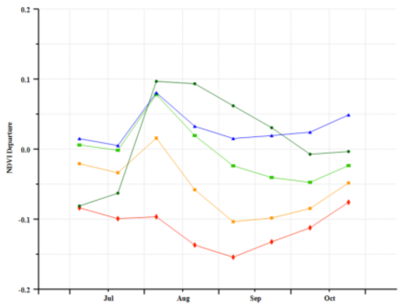




(b) Crop condition development graph based on NDVI

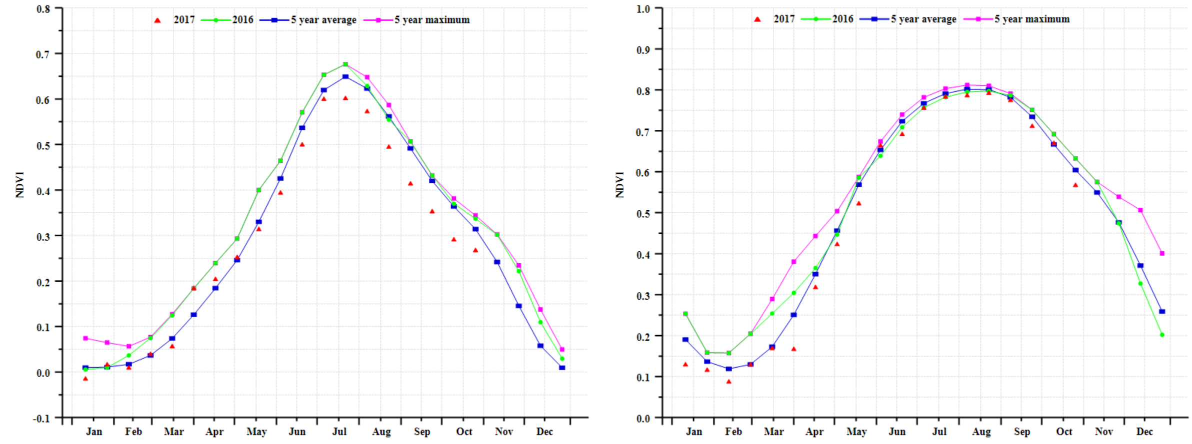
(c) Maximum VCI





(d) Spatial NDVI patterns compared to 5YA

(e) NDVI profiles



(f) Crop condition development graph based on NDVI (Canadian Prairies region (left) and Atlantic Ocean (right))

Table 3.14. Canada agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, July-October 2017

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m2)	Departure from 15YA (%)
National	Rain	Departure	TEMP	Temp departure	PAR	PAR departure
Arctic Ocean (Canada)	232	0	7.3	0.1	1066	-3
Canadian Prairies (Canada)	237	-14	12.1	0.5	1249	0
Hudson Bay (Canada)	322	-4	10.2	-0.6	1108	-4
Altantic Ocean (Canada)	329	-5	11.4	-0.2	1083	-7
Pacific Ocean (Canada)	256	-11	8.7	0	1253	0

Table 3.15. Canada agronomic indicators by sub-national regions, current season's values and departure from 5YA, July-October 2017

Region	BIOMSS		CALF		Maximum VCI
	Current (gDM/m2)	Departure from 5YA (%)	Current (%)	Departure from 5YA (%)	Current
Arctic Ocean (Canada)	936	29	87	0	0.93
Canadian Prairies (Canada)	807	-12	97	-2	0.86
Hudson Bay (Canada)	1347	0	97	0	0.97
Altantic Ocean (Canada)	1325	-3	100	0	0.94
Pacific Ocean (Canada)	865	-10	97	0	0.85

Table 3.16. CropWatch-estimated maize, rice, wheat, and soybean production in Canada for 2017 (thousand tons)

Crops	Production 2016	Yield variation (%)	Area variation (%)	Production 2017	Production variation (%)
Maize	11701	1.4	0.1	11881	1.5
Wheat	33290	-6.8	-1.1	30679	-7.8
Soybean	5386	1.4	0.2	5471	1.6

[DEU] Germany

Generally, the crops in Germany showed above average condition during the reporting period from July to October. Currently, summer crops have been harvested, and winter crops are at the planting stage. The CropWatch agroclimatic indicators show that for the country as a whole, total precipitation (as measured by the RAIN indicator) was 27% above average, temperature was slightly below average (TEMP, -0.3°C), and radiation significantly below average (RADPAR, -9%) over the period of analysis. Above average rainfall occurred throughout the country from mid-July to mid-August, early September to early October, and in late October, with negative departures occurring only in late August and mid-October. With favorable moisture and temperature, biomass (BIOMSS) is expected to increase by 22% nationwide compared to the five-year average, even if below average sunshine may reduce expectations.

During the period from early July to late July and in early October, the crop condition development graph showed national NDVI values that were above average and even close to the five-year maximum values. These observations are confirmed by the NDVI profiles. Crops had generally favorable or even very favorable condition, as shown by the high VCIx areas, a pattern confirmed by the NDVI clusters. Summer crops also are about average in most of the country according to the NDVI profiles, a spatial pattern again reflected by VCIx in the different areas, with a VCIx of 0.89 for Germany overall.

Generally, the values of agronomic indicators show favorable condition for most summer crops and the sowing of winter crops in Germany. CALF during the reporting period was 100%, the same as the recent five-year average. Cropping intensity was down 9% compared with the five-year-average. Due to favorable condition, the production of wheat and maize is estimated at respectively 0.1% and 3.3% above 2016 values.

Regional analysis

Based on cropping systems, climatic zones, and topographic conditions, six sub-national agro-ecological regions are adopted for Germany. They include, listed with their identification numbers: (58) Northern wheat zone including Mecklenburg-Vorpommern and Schleswig-Holstein, (59) Northwest mixed wheat and sugarbeets zone covering Niedersachsen (Lower Saxony) and Nordrhein-Westfalen, (60) Central wheat zone with Sachsen-Anhalt and Thüringen, (61) Eastern sparse crop areas with Bandenburg and Saxony, (62) western sparse crop areas (Hessen and Rheinland-Pfalz), and (63) Southern highland including Baden-Würtenberg and Bavaria. The numbers identify the areas on the maps.

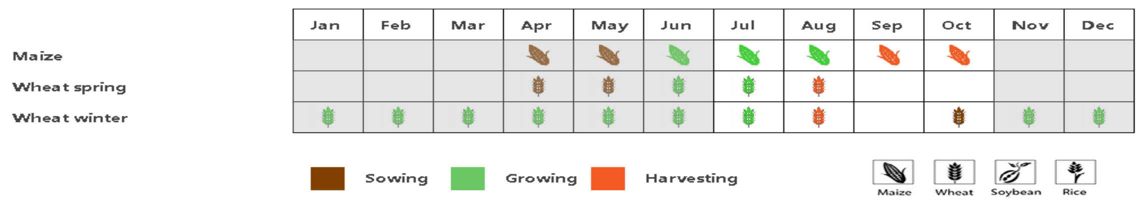
In the **Northern wheat zone,** the CropWatch agroclimatic indicator RAIN was well above average (+57%) with warm weather (TEMP, +0.9°C) but radiation significantly below average (RADPAR, -11%). With favorable moisture and temperature, biomass (BIOMSS) in this zone is expected to increase by 40% compared to the five-year average. Above average crop condition is indicated by the region's NDVI development profiles. The area has a high CALF (100%) as well as a favorable VCIx (0.89), indicating high cropped area and favorable crop prospects.

The CropWatch agroclimatic indicators show that abundant RAIN (41% above average) in the **Northwest mixed wheat and sugarbeets zone** resulted in favorable crop condition for both crops. As shown by the crop condition development graph, NDVI values were below both normal and last year’s values in early July, then again above average from early August to early October, and finally below average after early October. Overall crop condition for the region is good according to the high VCIx (0.90).

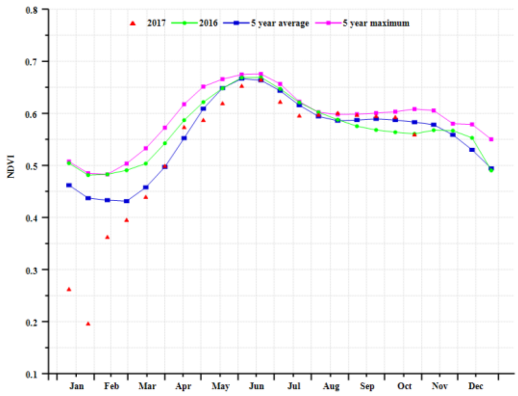
The **Central wheat zone** received about 37% above average rainfall and experienced slightly cool temperatures (TEMP, -0.5°C). At the same time, the biomass potential (BIOMSS indicator) increase of 25% is also optimistic with favorable moisture. Late crop emergence is evident from the NDVI profile, confirmed also by a CALF of 100%. The VCIx of 0.85 for this region also shows favorable crop prospects.

The **Eastern and western sparse crop areas** experienced very wet weather conditions, with RAIN above average (+36% and +25%, respectively), slightly below average temperatures (TEMP, -0.3°C and -0.5°C), and very poor radiation (RADPAR, -9% and -6%). Compared to the average of the last five years, BIOMSS was up by 26% and 17% respectively with favorable moisture and temperature, while CALF was at 100% for both. Favorable crop condition was recorded with high VCIx values of 0.90 for the eastern and 0.89 for the western areas, respectively.

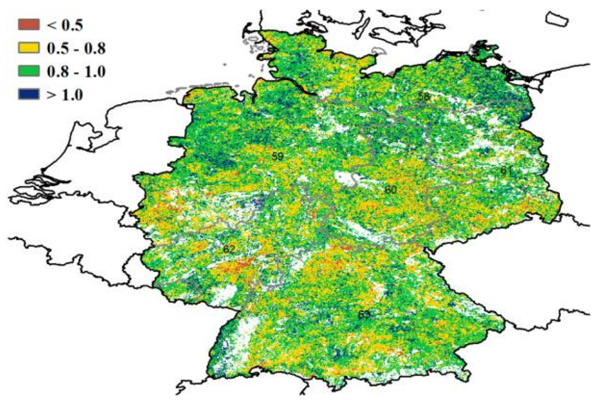
Figure 3.10. Germany crop condition, July-October 2017



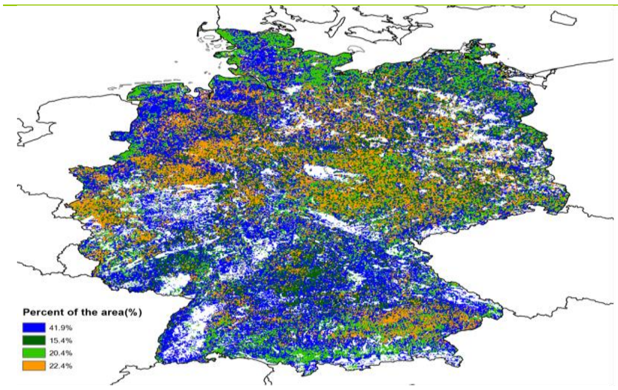
(a). Phenology of major crops



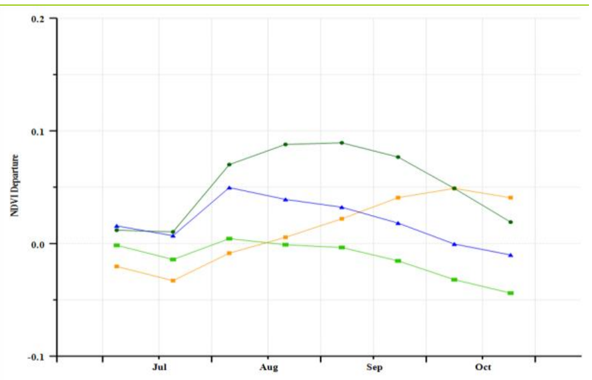
(b) Crop condition development graph based on NDVI



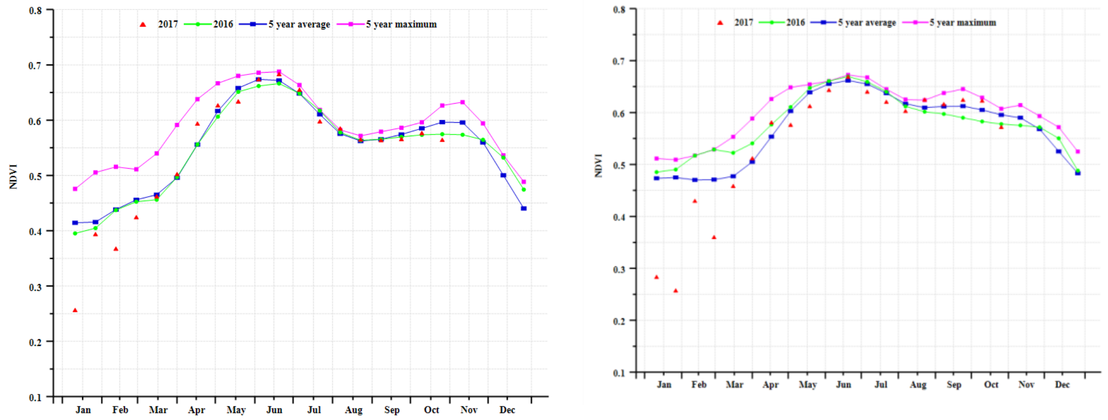
(c) Maximum VCI



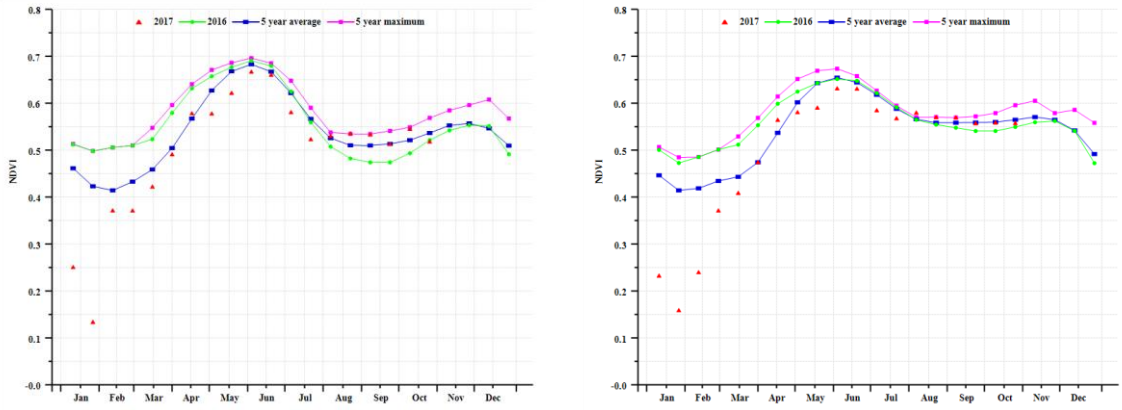
(d) Spatial NDVI patterns compared to 5YA



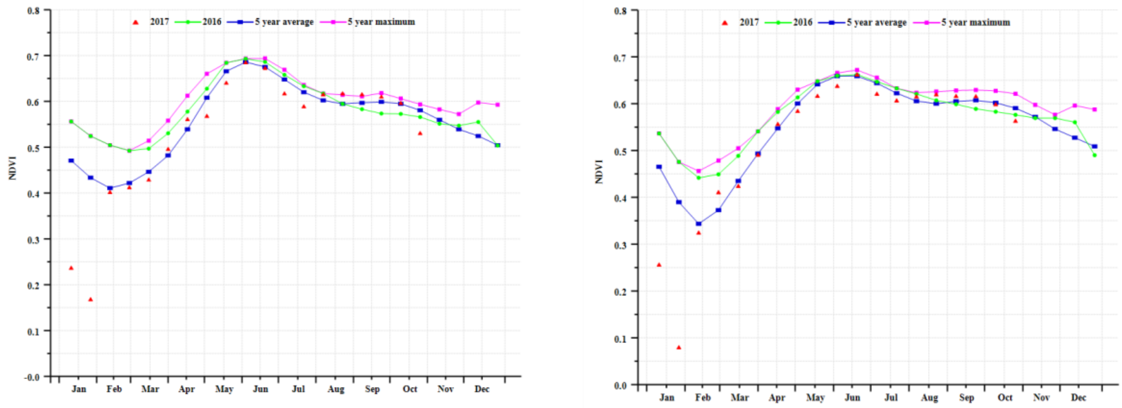
(e) NDVI profiles



(f) Crop condition development graph based on NDVI (Northern wheat zone (left) and Northwest mixed wheat and sugarbeets zone (right))



(g) Crop condition development graph based on NDVI (Central wheat zone (left) and Eastern sparse crop area (right))



(h) Crop condition development graph based on NDVI (Western sparse crop area (left) and Southern highland (right))

Table 3.17. Germany agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, July-October 2017

Region	RAIN Current (mm)	RAIN Departure from 15YA (%)	TEMP Current (°C)	TEMP Departure from 15YA (°C)	RADPAR Current (MJ/m2)	RADPAR Departure from 15YA (%)
Northern wheat zone	417	57	15.4	0.9	690	-11
Northwest mixed wheat and sugarbeets zone	392	41	15.3	-0.5	690	-12
Central wheat zone	345	37	15.7	-0.5	730	-10
Eastern sparse crop area	336	36	15.8	-0.3	733	-9
Western sparse crop area	329	25	15.2	-0.5	752	-9
Southern highland	367	6	14.9	-0.4	812	-6

Table 3.18. Germany agronomic indicators by sub-national regions, current season's value and departure from 5YA, July-October 2017

Region	BIOMSS Current (gDM/m2)	BIOMSS Departure from 5YA (%)	Cropped arable land fraction Current (%)	Cropped arable land fraction Departure from 5YA (%)	Maximum VCI Current
Northern wheat zone	1544	40	100	0	0.89
Northwest mixed wheat and sugarbeets zone	1515	32	100	0	0.9
Central wheat zone	1335	26	100	0	0.85
Eastern sparse crop area	1308	26	100	0	0.9
Western sparse crop area	1310	17	100	0	0.89
Southern highland	1391	8	100	0	0.9

Table 3.19. CropWatch-estimated maize and wheat production for Germany in 2017 (thousands tons)

Crops	Production 2016	Yield variation	Area variation	Production 2017	Production variation
Maize	4602	3.30%	0.00%	4755	3.30%
Wheat	28106	0.10%	0.00%	28130	0.10%

[EGY] Egypt

Over this reporting period, the mean temperature in Egypt was 26.3°C, a slight decrease (about 0.4°C) compared to the average. RADPAR was also about average (+1%), and so was RAIN (with virtually no rainfall expected during the summer in Egypt). All crops are irrigated: the CropWatch projected increases in the production of wheat, maize, and rice (with projected increases of respectively +7.4%, 3.8%, and 4% over 2016) result from an increase in both areas and yield. The latter has probably benefited from the mentioned increase in sunshine as well.

Nationwide, NDVI showed a decrease compared with both 2016 and the five-year average values for NDVI, while VCIx values varied between 0.8 and 1. The spatial distribution of NDVI profiles, however, shows that the condition of 12.6% of agricultural areas was below the five-year average. Condition for about half of the agricultural areas (45.2%) was comparable to the last five-years, while for about 16.3% condition was mostly above that same average.

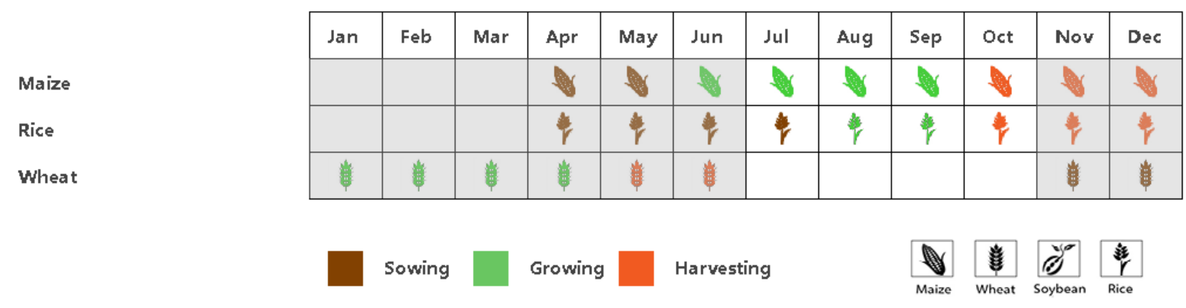
Regional analysis

According to the agro-climatic conditions, Egypt can be divided into three main agro-ecological regions: the Nile delta with the Mediterranean coastal strip; the Nile valley, where most crops are located; and desert. This analysis will focus on the two main regions.

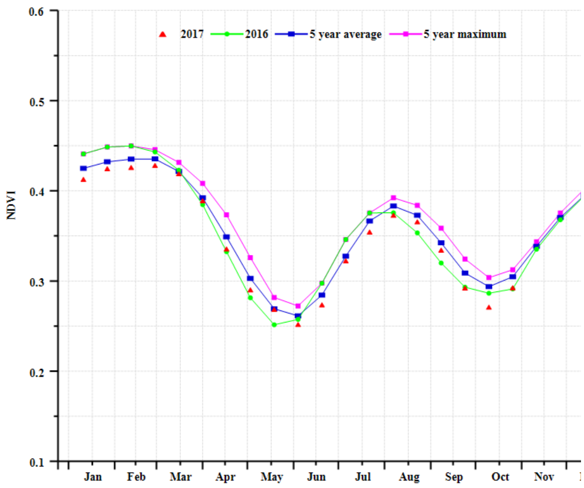
In the **Nile delta,** which includes about 40% of the agricultural lands, all indicators were close to their averages. NDVI over the observed period showed a decrease in comparison with the five-year average values. Meanwhile, the map of the spatial distribution of NDVI profiles shows that the areas classified as "below average condition" are mostly located in the western part of the delta.

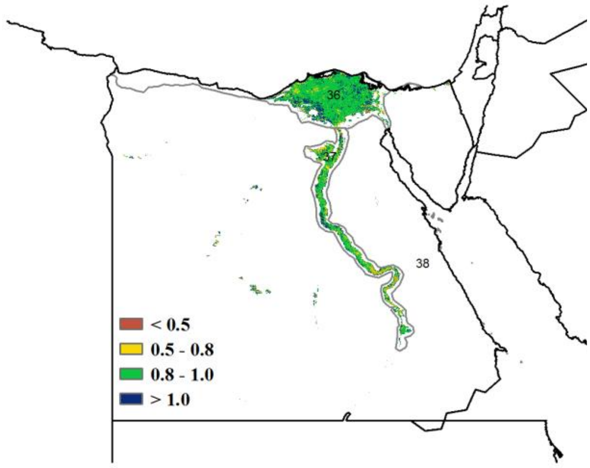
Conditions in the **Nile valley** were very similar to those that prevailed in the delta**.** The spatial NDVI patterns describing the condition of agricultural lands show that most of the the valley did not depart noticeably from the average of the recent five years.

Figure 3.11. Egypt crop condition, July-October 2017

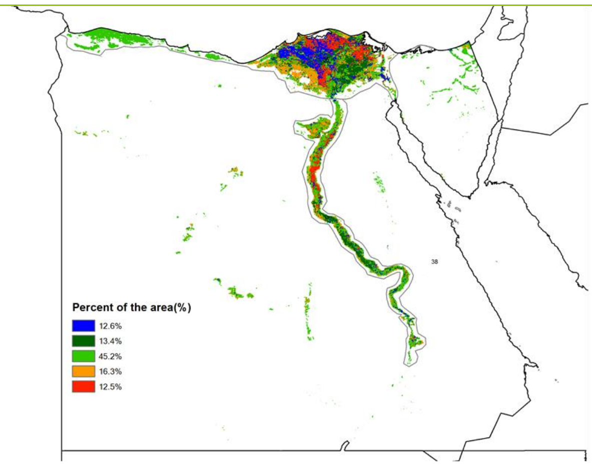


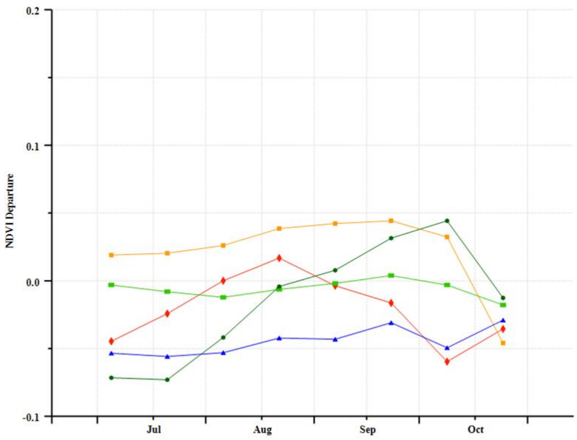
(a). Phenology of major crops



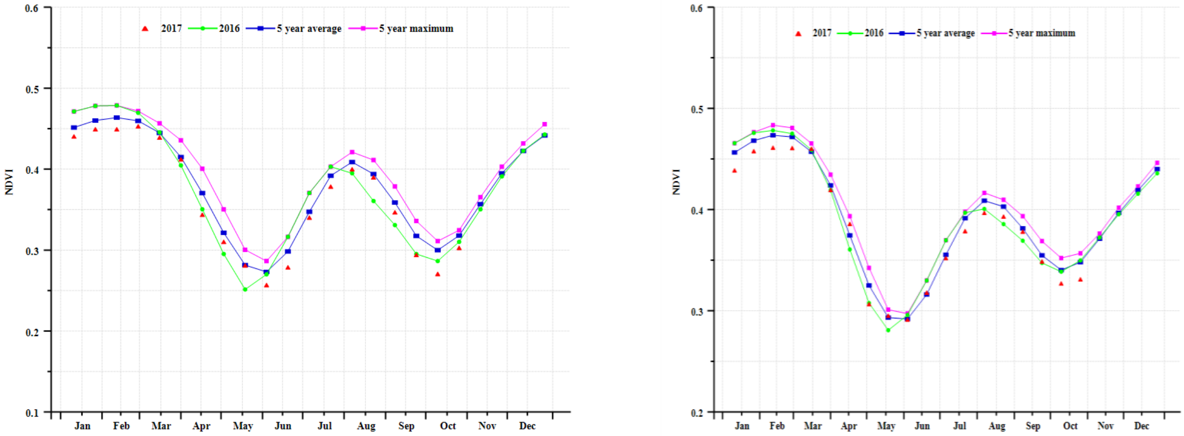


(b) Crop condition development graph based on NDVI (c) Maximum VCI





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



(f) Crop condition development graph based on NDVI (Nile Delta (left) and Nile Valley (right))

Table 3.20. Egypt agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, July-October 2017

	RAIN		TEMP		RADPAR	
Region	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m2)	Departure from 15YA (%)
Nile Delta	1	-85	26.4	-0.2	1375	1
Nile Valley	3	-18	27.8	-0.5	1442	1
Desert	9	94	26	-0.3	1409	2

Table 3.21. Egypt agronomic indicators by sub-national regions, current season's values and departure from 5YA, July-October 2017

	BIOMSS		CALF		Maximum VCI
Region	Current (gDM/m2)	Departure from 5YA (%)	Current (%)	Departure from 5YA (%)	Current
Nile Delta	7	-69	62	1	1
Nile Valley	8	-39	67	0	1
Desert	34	147	0	39	0

Table 3.22. CropWatch-estimated maize, rice, and wheat production for Egypt in 2017 (thousand tons)

	Production 2016	Yield variation	Area variation	Production 2017	Production variation
Maize	5701	2.00%	1.80%	5918	3.80%
Rice	6293	1.80%	2.20%	6545	4.00%
Wheat	10207	5.00%	2.30%	10963	7.40%

[ETH] Ethiopia

The monitoring period covers part of the main rainy season of Ethiopia, with heavy Kremt rains falling in July and August when most cereal was in full growth. On a local level, however, events were characterized by re-occurring droughts that have continued to ravage most of Eastern Africa since last year. The first season in bimodal rainfall areas (the Belg season) is typically harvested before August, and this season was generally unfavorable. Based on the VCIx values and spatial NDVI profiles, however, the main Meher cropping season (harvest from August to the end of the year) has so far been promising. There was a slight increase in rainfall (669 mm, +2%), while both temperature (TEMP) and sunshine (RADPAR) were average, resulting in a biomass production potential that was average as well. However, North Oromia and Amhara recorded favorably high VCIx, between 0.8 and 1.0. While most regions suffered droughts, parts of the central-northern maize-teff region enjoyed some fairly good rains (RAIN +5%), which were, however, insufficient to significantly improve BIOMSS. Meanwhile, the cropped area remained unchanged for most parts of producing areas.

The disruptions in the Kremt rains during the growing period affected maize and teff in the central and western parts of the country, where below average conditions do occur. Food insecurity may continue to prevail in the eastern part.

Regional analysis

Most of the growing regions experienced increased spatial and temporal variability in rainfall as observed in the semi-arid pastoral zone, southeastern mixed-maize zone, western-mixed maize regions, and central-northern maize-teff highlands, which are the major cereal and grain-producing areas of Ethiopia.

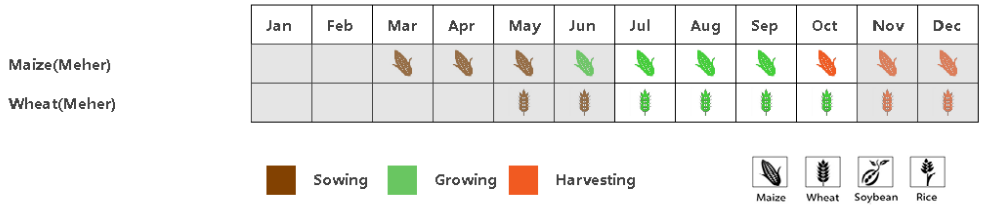
Severe rainfall deficit was experienced in the **southeastern mixed-maize zone** of Oromia and Dire Dawa, Harari and near the Somali Highlands (a major maize and teff producing area), which suffered a 24% rainfall shortage, resulting in unfavorable conditions. A significant biomass production potential reduction (BIOMSS, -11%) was observed too.

The **semi-arid pastoral region**, which is a major livestock producer, recorded biomass and rainfall reduction (BIOMSS, -5%) and (RAIN -11%), leading to increased food insecurity risk and vulnerability in the region.

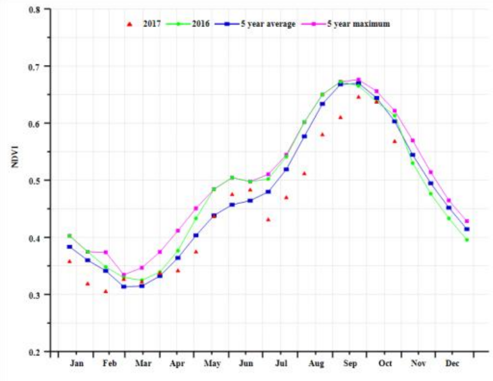
In contrast, the **western mixed maize region** experienced better conditions (RAIN +5%; RADPAR +3%), with a BIOMSS increment (+5%) compared to average. Similarly, conditions in the **central-northern maize highlands** remained quite promising (VCIx 0.93), differing only marginally from the average.

Overall, the grazing land conditions deteriorated due to insufficient rainfall, while wheat production is estimated by CropWatch to be 28% below last year's level.

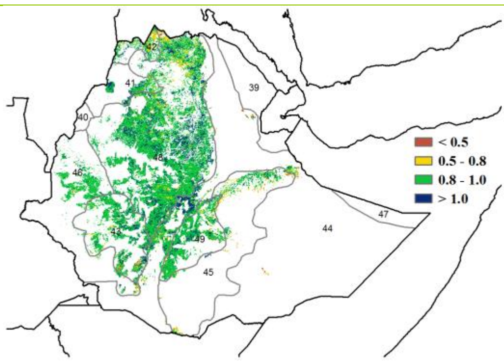
Figure 3.12. Ethiopia crop condition, July-October 2017



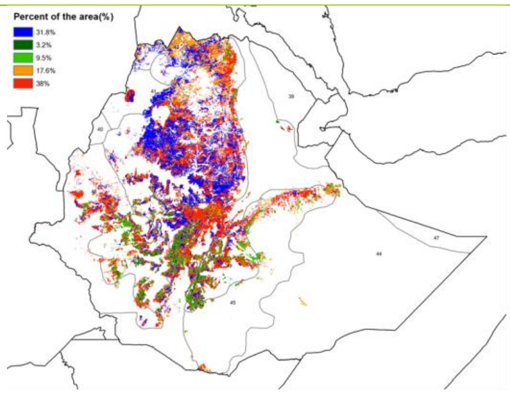
(a). Phenology of major crops



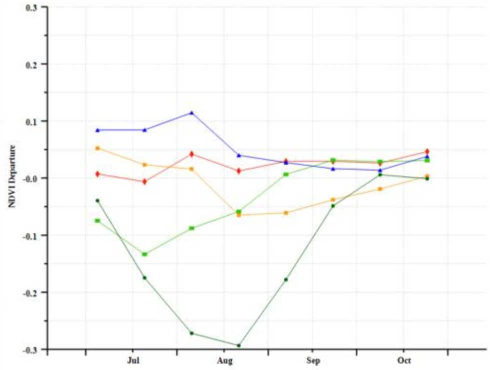
(b) Crop condition development graph based on NDVI



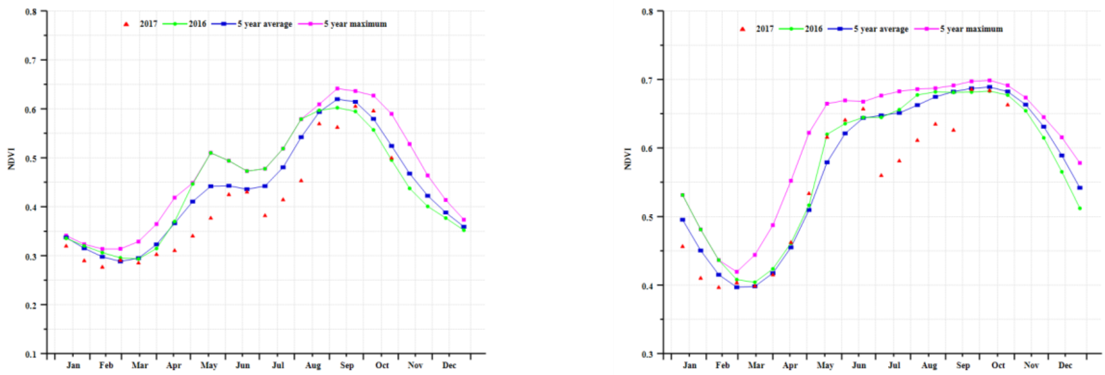
(c) Maximum VCI



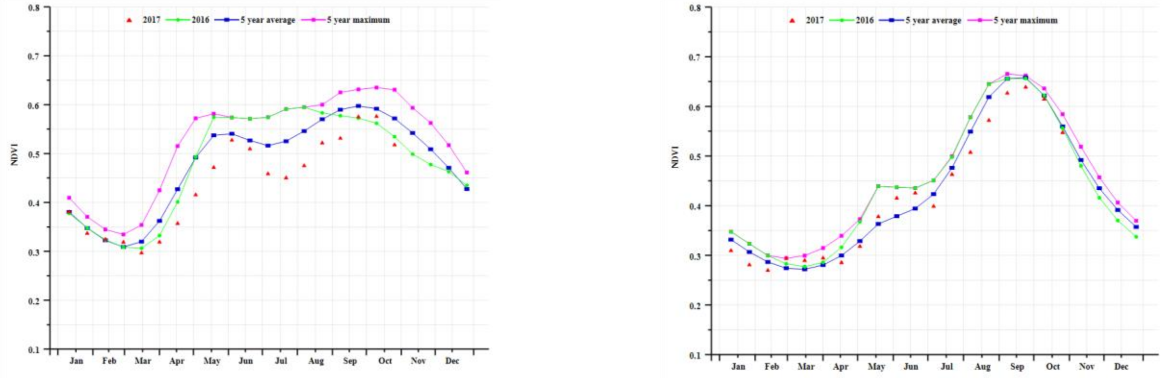
(d) Spatial NDVI patterns compared to 5YA



(e) NDVI profiles



(f) Crop condition development graph based on NDVI (Semi-arid pastoral region (left) and central northern maize highlands region (right))



(g) Crop condition development graph based on NDVI (South-east mixed-maize region (left) and Western mixed-maize region (right))

Table 3.22. Ethiopia agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, July-October 2017

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m2)	Departure from 15YA (%)
Semi-arid pastoral	396	-11	22.4	-0.3	1208	3
South-eastern mixed maize zone	352	-24	22.5	-0.2	1166	2
Western mixed maize zone	906	17	23.1	-0.1	1099	3
Central-northern maize-teff highlands	767	5	19.4	0	1130	-2

Table 3.23. Ethiopia, agronomic indicators by sub-national regions, current season's values and departure from 5YA, July-October 2017

Region	BIOMSS		CALF		Maximum VCI
	Current (gDM/m2)	Departure from 5YA (%)	Current (%)	Departure from 5YA (%)	Current
Semi-arid pastoral	1321	-5	92	0	0.91
South-eastern mixed maize zone	1262	-11	92	-3	0.83
Western mixed maize zone	2106	5	100	0	0.95
Central-northern maize-teff highlands	1728	-1	98	0	0.93

Table 3.24. CropWatch-estimated maize and wheat production in Ethiopia for 2017 (thousand tons)

	Production 2016	Yield variation (%)	Area variation (%)	Production 2017	Production variation (%)
Maize	7157	0	9	7154	0
Wheat	4743	2	10	72	-28

[FRA] France

Over the monitoring period, the harvest of spring wheat was completed by September, while the harvest of maize lasted into October. Winter wheat was also harvested, and the planting of the 2017-18 crop started in September and October.

Compared to average, CropWatch agroclimatic indicators show that the conditions were unfavorable. This includes the following: a 42% drop in RAIN, about average temperature, and a marked drop (7%) in RADPAR at the national level. Also at the national level, crop condition was below average, which is confirmed by a significant decrease for the BIOMSS indicator (-30%).

As shown by the crop condition development graph, national NDVI values were mostly above those for 2016, but close to the five-year average from July to October. The national NDVI values began to drop rapidly below average in September, which is consistent with the lack of rainfall during this period. The spatial NDVI patterns compared to the five-year average and corresponding NDVI departure cluster profiles further indicate that NDVI is above average in 69.1% of arable land, with below average NDVI in the other regions. This spatial pattern is reflected by the maximum VCI (VCIx) in the different areas, with a VCIx of 0.79 and a CALF of -3% for France overall, respectively. Generally, due to the rainfall deficit, the agronomic indicators mentioned above show unfavorable condition for some crop areas of France. In the next few months, more rain is needed for the winter wheat areas.

Regional analysis

Considering the cropping system, climatic zones, and topographic conditions, additional sub-national detail is provided for eight agro-ecological zones. They are identified in the maps by the following numbers: (50) Northern barley region, covering the regions of Île-de-France, Picardie, and Nord-Pas-de-Calais; (51) Western mixed maize, barley, and rapeseed area (Centre, Pays-de-Loire, and Poitou-Charentes); (52) North-western mixed maize and barley region (Basse Normandie, Bretagne, and Haute Normandie), (53) Rapeseed region (Alsace, Bourgogne, Champagne-Ardenne, Franche-Comté, and Lorraine); (54) Central dry zone (Auvergne, Limousin, and NW Rhone-Alpes); (55) South-western maize region (Aquitaine and Midi-Pyrenées); (56) Eastern highland region coinciding with the Rhône-Alpes region, and (57), the Mediterranean climate region (Languedoc-Roussillon and Provence-Alpes-Côte-d'Azur).

In the **Northern barley region**, RAIN is 13% and TEMP is 0.5°C below average respectively, while RADPAR is 7% below. As a result of the shortage of rain, the BIOMSS indicator is 7% below the five-year average. High VCIx values, however, are observed, reflecting overall favorable crop condition.

Mostly unfavorable climatic conditions dominated the **Western mixed maize, barley, and rapeseed region** over the reporting period. Rainfall was 47% below average (123 mm over four months). Temperature was normal, but radiation (RADPAR) was well below (-9%). The dry conditions have hampered crop growth, indicated also by a BIOMSS indicator 37% below average for the period.

The **Northwest mixed maize and barley region** also had below average rainfall (RAIN, -30%). Temperature was average, but sunshine was very low (RADPAR, -11%). According to the NDVI profile map and VCIx map, crop condition was good in the region. Overall, the situation is considered to be close to average.

Generally, crop condition for the **Rapeseed region** is slightly above average, in spite of climate conditions being poor (RAIN -32%, TEMP -1.0°C, and RADPAR, -8%). Almost all arable land in this region was cropped during the monitoring period, and the average VCIx is 0.81. The NDVI profile confirms the favorable conditions with above average NDVI since September.

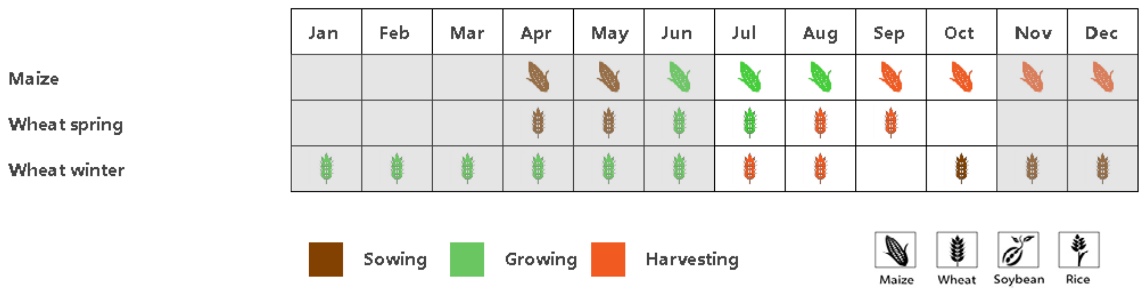
The **Central dry region** recorded 157 mm of rainfall over four months (RAIN -51%). Temperature was average (TEMP -0.3°C) but RADPAR was 7% below. The drop in BIOMSS was 39% compared to the five-year average. The region produces mostly livestock and forest products.

The **Southwest maize region** is one of the major irrigated maize regions in France. Rainfall decreased 46% below average, temperature was average, but radiation was well below expectations (RADPAR -8%). Crop condition was below average according to the NDVI development graph, an observation confirmed by the decrease of BIOMSS by 34% compared to average. The VCIx map, however, shows that the crop condition was favorable, with a high VCIx value recorded for the region as a whole (0.89), resulting from irrigation.

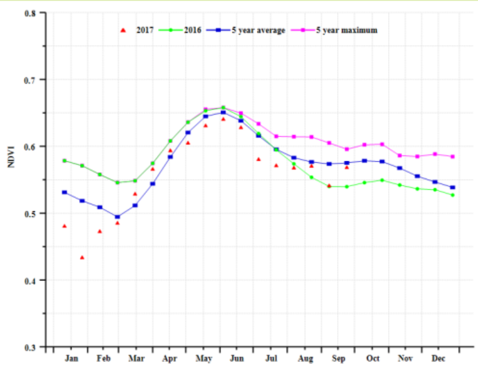
With the Mediterranean area, the **Eastern highland region** was one of the driest in France (RAIN -50%), representing however average values for both RADPAR and TEMP. BIOMSS for the region is 35% below the five-year average, and a low VCIx value reflects the generally unfavorable crop condition. That overall crop condition is unfavorable compared with the previous five years is further confirmed by the crop condition development graph.

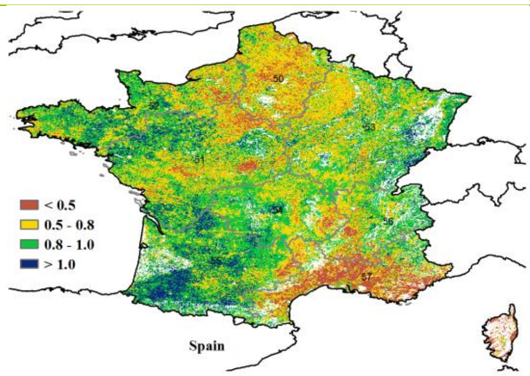
Finally, the most severe adverse weather conditions were observed in the **Mediterranean climate region** (RAIN -65%) even if other indicators remain close to average. According to the NDVI profiles, crop condition has been continuously deteriorating since June. BIOMSS is 52% below its five-year average, and the VCIx value of 0.6 for the region is the lowest in the country.

Figure 3.13. France crop condition, July-October 2017

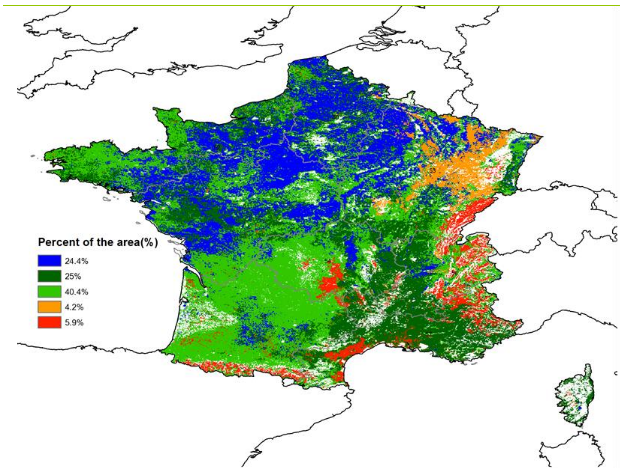


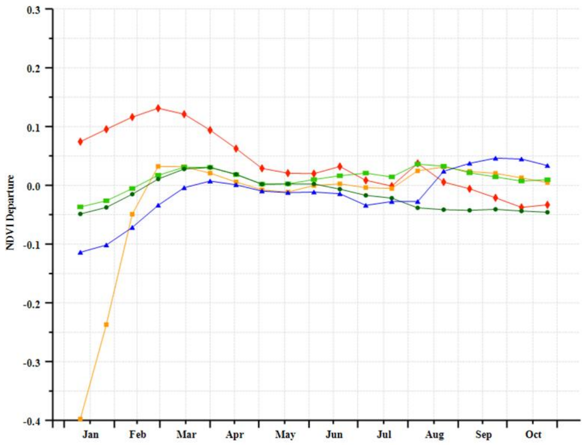
(a). Phenology of major crops





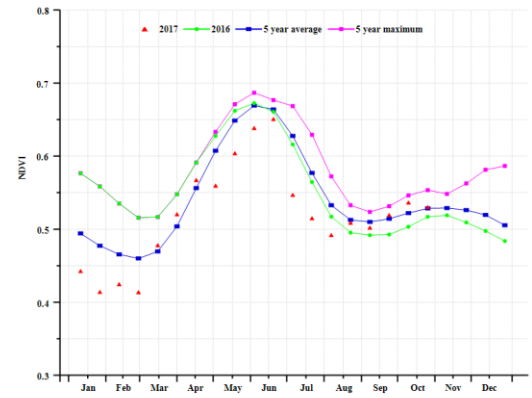
(b) Crop condition development graph based on NDVI (c) Maximum VCI

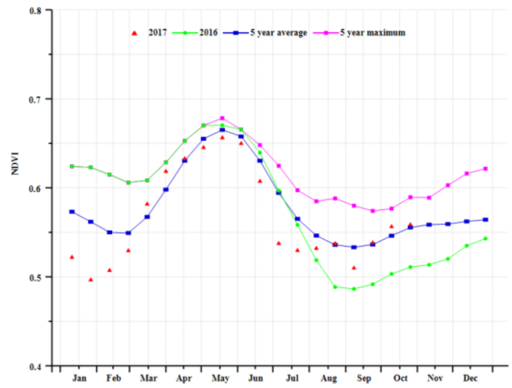




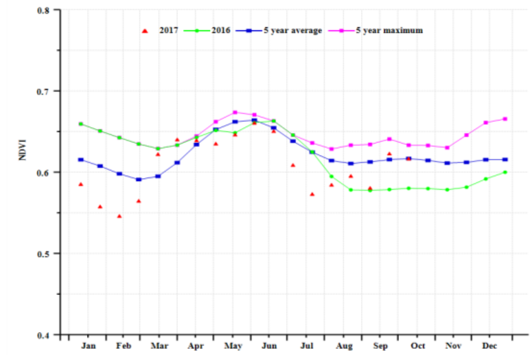
(d) Spatial NDVI patterns compared to 5YA

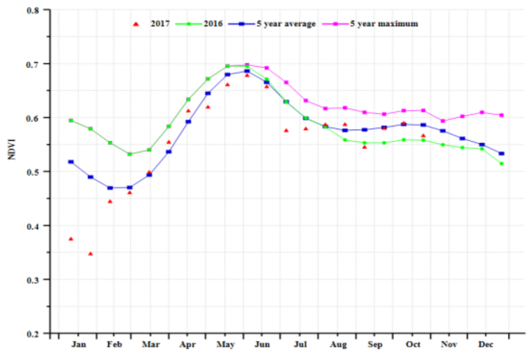
(e) NDVI profiles



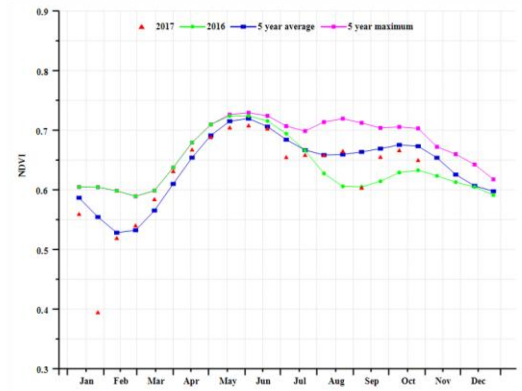


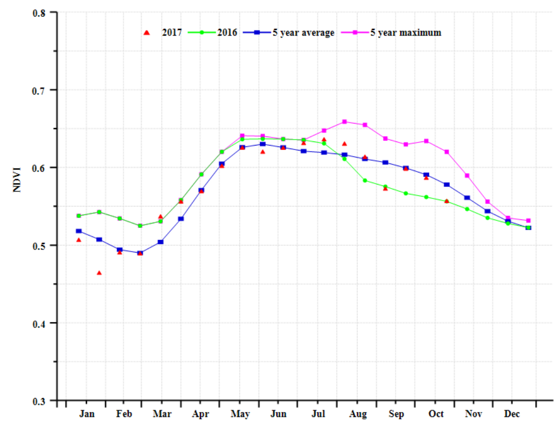
(f) Crop condition development graph based on NDVI (Northern barley region (left) and Western mixed maize, Barley and Rapeseed zone (right))



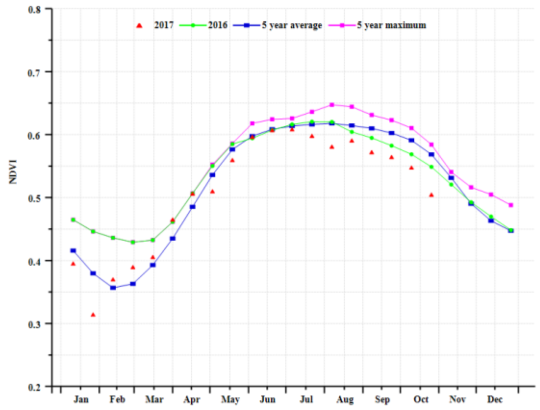


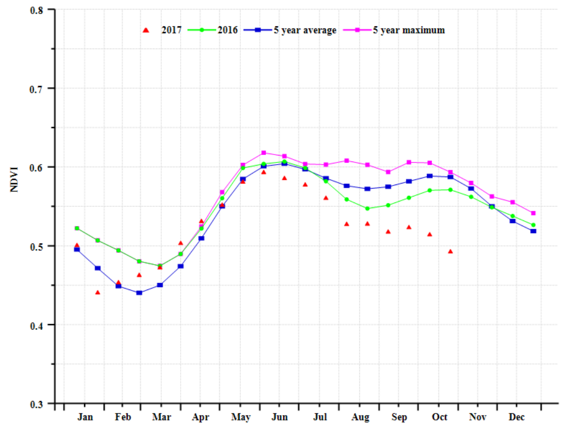
(g) Crop condition development graph based on NDVI (Northwest mixed maize, Barley and rapeseed zone (left) and Rapeseed zone (right))





(h) Crop condition development graph based on NDVI (Central dry zone (left) and Southwest maize zone (right))





(i) Crop condition development graph based on NDVI (Eastern highland (left) and Mediterranean climate zone (right))

Table 3.26. France agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, July-October 2017

Region	RAIN Current (mm)	RAIN Departure from 15YA (%)	TEMP Current (°C)	TEMP Departure from 15YA (°C)	RADPAR Current (MJ/m2)	RADPAR Departure from 15YA (%)
Northern barley zone (France)	206	-13	16	-0.6	769	-10
Western mixed maize, barley, and rapeseed zone (France)	123	-47	17	-0.5	852	-9
Northwest mixed maize and barley zone (France)	161	-29	16	-0.6	783	-11
Rapeseed zone (France)	210	-32	16	-1	822	-8
Central dry zone (France)	157	-51	16	-0.3	907	-7
Southwest maize zone (France)	139	-46	18	-0.5	938	-8
Eastern highland (France)	196	-50	15	-0.5	1004	-2
Mediterranean climate zone (France)	94	-65	17	-0.4	1120	1

Table 3.27. France agronomic indicators by sub-national regions, current season's value and departure from 5YA, July-October 2017

Region	BIOMSS		Cropped arable land fraction		Maximum VCI
	Current (gDM/m2)	Departure from 5YA (%)	Current (%)	Departure from 5YA (%)	Current
Northern Barley zone (France)	952	-7	100	0	0.67
Western mixed maize, barley, and rapeseed zone (France)	584	-37	99	-1	0.78
Northwest mixed maize and barley zone (France)	766	-19	100	0	0.87
Rapeseed zone (France)	943	-21	100	0	0.81
Central dry zone (France)	729	-39	100	0	0.83
Southwest maize zone (France)	663	-34	100	0	0.89
Eastern highland (France)	803	-35	97	0	0.78
Mediterranean climate zone (France)	456	-52	87	-7	0.6

Table 3.28. CropWatch-estimated maize and rice production for France in 2017 (thousand tons)

Crops	Production 2016	Yield variation (%)	Area variation (%)	Production 2017	Production variation (%)
Maize	14703	-0.2	0	14577	-0.9
Wheat	37984	0	0.1	38051	0.2

[GBR] United Kingdom

Crops in the United Kingdom showed favorable conditions during this reporting period. Summer crops have been harvested, and winter crops (wheat and barley) are at the sowing stage. The national NDVI values were below to average from August to October according to the crop condition graph. The NDVI departure cluster profiles indicate above average NDVI values in 88% of arable land (including East Midlands, East Anglia, and South East and West Midlands) while only 11.2% of arable land had below average condition, concerning especially west midland, southwest and northwest England (Cornwall, Devon, Caernarfonshire, Marioneth, east Radnorshire, and northeast Brecknockshire).

The agroclimatic indicators show that rainfall for the country was above average (RAIN +27%), with well below average radiation (RADPAR, -9%) and temperature close to average. However, with below average radiation, BIOMSS on the national scale increased only 11.6% compared to the five-year average.

The national VCIx (0.88) was satisfactory, and the cropped arable land fraction is unchanged compared to its five-year average.

Regional analysis

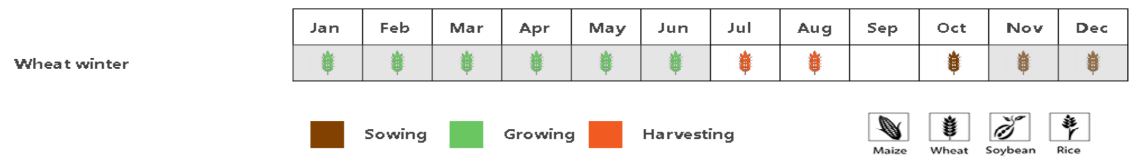
CropWatch has adopted three agro-ecological zones to provide a more detailed spatial analysis for the country; they include the central sparse crop region (covering northern England, Wales, and northern Ireland), the northern barley region (Scotland and northern England), and the southern mixed wheat and barley region (southern England). All three regions are characterized by unchanged fractions of arable land (CALF) compared to average.

The **central sparse crop region** is one of the country's major agricultural regions in terms of crop production. NDVI values were below the five-year maximum according to the region's crop condition development graph in August to October. Agroclimatic conditions include 34% above average RAIN, average TEMP, and RADPAR significantly below average at -10%. The VCIx (0.94) was well above average.

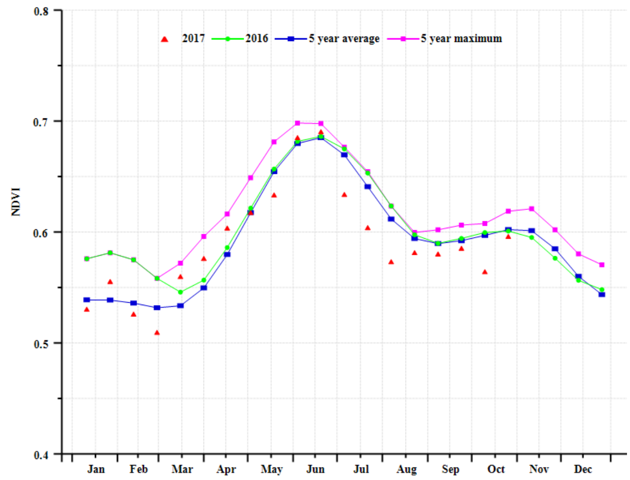
The **northern barley region** is one of the main barley regions in the United Kingdom. NDVI here was below average according to the crop condition graphs. Agroclimatic conditions were: RAIN +34%, slightly below average TEMP (-0.5°C), and rather poor sunshine (RADPAR -11%). The regional VCIx (0.90) was well above average.

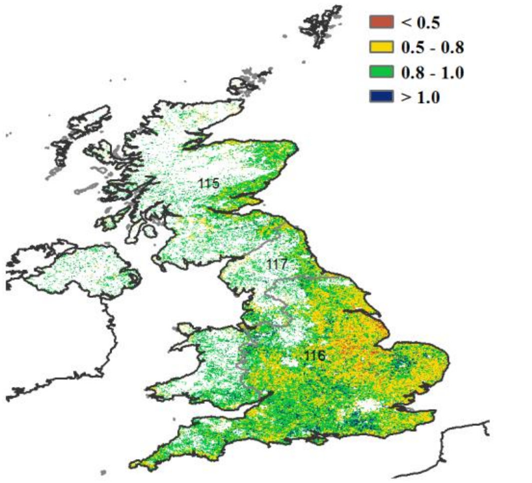
Finally, wheat and barley are the major crops in the **southern mixed wheat and barley region**. The NDVI was above average from August to late September and below average until late October according to the crop condition graph for the zone. Rainfall (RAIN +12%) and sunshine (RADPAR -8%) were less abnormal than in the two other regions, and temperature was average. The region had above average VCIx (0.86), although less so than the other regions.

Figure 3.14. United Kingdom crop condition, July-October 2017

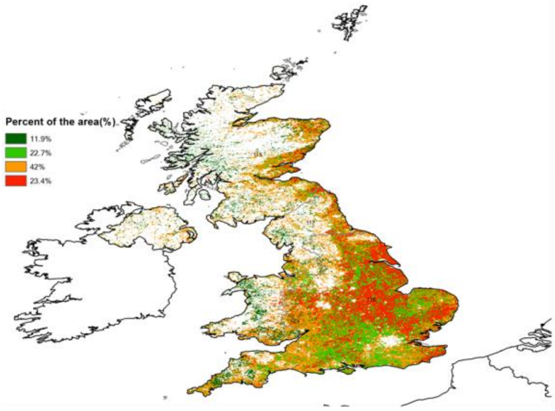


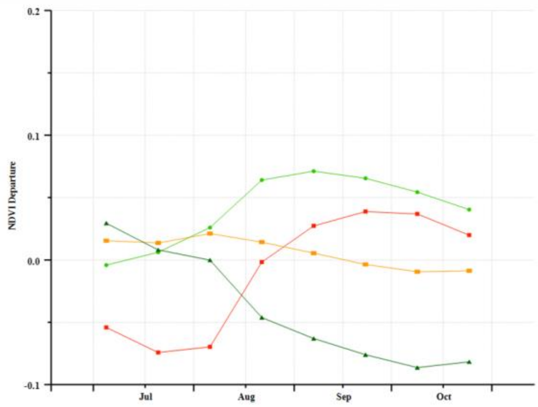
(a). Phenology of major crops



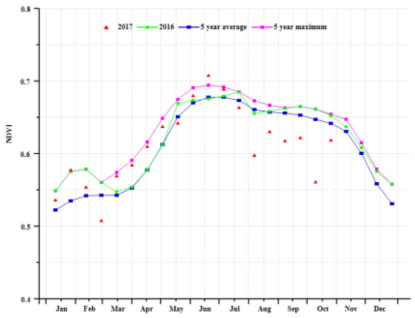


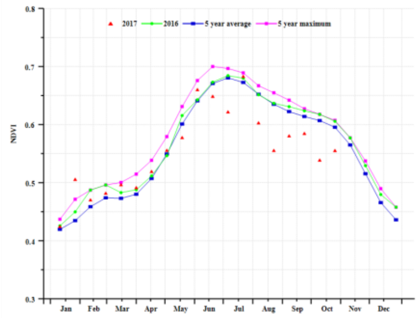
(b) Crop condition development graph based on NDVI (c) Maximum VCI



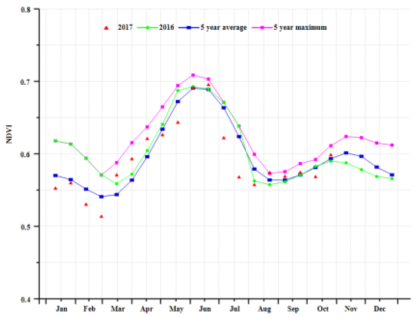


(d) Spatial NDVI patterns compared to 5YA (e) NDVI profiles





(f) Crop condition development graph based on NDVI (Central sparse crop region (left) and Northern Barley region (right))



(g) Crop condition development graph based on NDVI (Southern mixed wheat and Barley region)

Table 3.29. United Kingdom agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, July-October 2017

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m2)	Departure from 15YA (%)
Northern barley area (UK)	546	34	11.5	0.5	581	-11
Southern mixed wheat and barley zone (UK)	290	12	14.6	-0.1	706	-8
Central sparse crop area (UK)	466	34	13	-0.2	654	-10

Table 3.30. United Kingdom, agronomic indicators by sub-national regions, current season's values and departure from 5YA, July-October 2017

Region	BIOMSS		CALF		Maximum VCI
	Current (gDM/m2)	Departure from 5YA (%)	Current (%)	Departure from 5YA (%)	Current
Northern barley area (UK)	1496	6	100	0	0.9
Southern mixed wheat and barley zone (UK)	1198	13	100	0	0.86
Central sparse crop area (UK)	1541	16	99	0	0.94

Table 3.31. CropWatch-estimated wheat production for United Kingdom in 2017 (thousand tons)

Crops	Production 2016	Yield variation (%)	Area variation (%)	Production 2017	Production variation (%)
Wheat	14337	1.3	0.0	14521	1.3

[IDN] Indonesia

Crops in Indonesia generally showed good condition from August to October, with the maximum VCI (VCIx) value on the national level reaching 0.93. During the monitoring period, the irrigated dry season maize and rice entered the generative or early ripening stage. Compared with the recent average, temperature was normal, while precipitation was significantly above average (+27%) and radiation underwent a significant decrease of 10% compared to average. Influenced by the high precipitation, biomass accumulation (measured by the CropWatch BIOMSS indicator) increased significantly by 16% compared with the recent five-year average. Due to persistent cloudiness and very wet weather, however, the NDVI values of most pixels are invalid. This lead to unrealistically low values in the national NDVI profiles compared to the recent five-year average and last year's level before mid-October, after which the values improved to reach the five-year maximum level in late-October. The cropped arable land fraction (CALF) remained stable compared with previous years, and the cropping intensity increased by 1% over average.

Regional analysis

For more spatial detail, CropWatch also prepares regional analysis for three agro-ecological zones within the country, covering the main islands groups: Sumatra; Java (the main agricultural region in the country); and Kalimantan and Sulawesi.

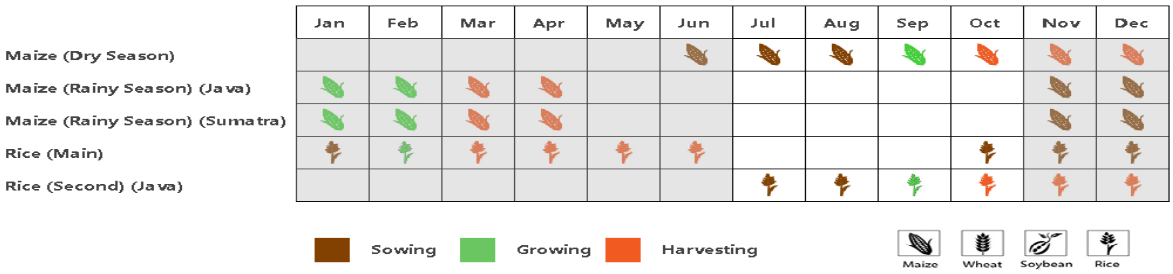
Crop condition was mostly average in **Sumatra**. The island experienced wet conditions, with a 9% increase of rainfall over average, average temperature, and a significant drop in sunshine (RADPAR, -7%); the biomass production potential increased by 8% compared to the recent five-year average. According to the NDVI clusters, crop condition was slightly above average in Bengkulu, Sumatera Selatan, and Lampung over the entire monitoring period, while the NDVI profile was below average in mid-August in Riau and Jambi, rising above average in October.

The case of **Java** is special compared to other regions in the country. Rainfall here was below average by as much as 24%, temperature was high (+1.1°C), and radiation was 5% below average. Due to the deficit in rainfall and sunshine, the biomass production potential indicator was 8% below its five-year average. The NDVI profile of Java for July-October is nearly the same as its five-year average. The VCIx for Java is 0.88, lower than other sub-regions in Indonesia.

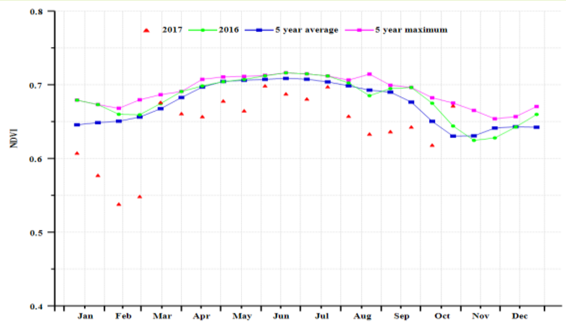
Kalimantan and Sulawesi experienced very wet weather conditions, with rainfall 32% above average. As radiation decreased by 12%, the listed biomass production potential increase of 25% is considered too optimistic. According to the NDVI clusters, the crop condition in Kalimantan Tengah dropped below average in August and early-September, then improved to above average in October. The VCIx map shows the value of some pixels in Kalimantan Timur exceeding 1, indicating very favorable crop condition in those places.

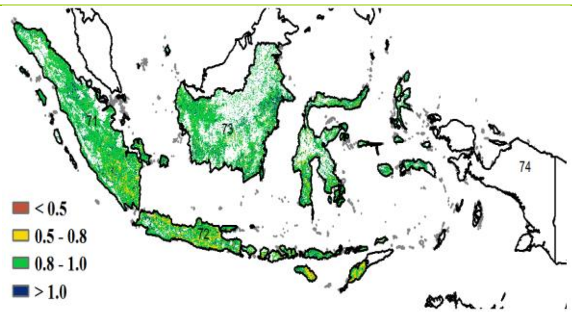
Overall, the abundant rainfall during the reporting period provided a favorable soil moisture condition for crops. However, the significant drop in sunshine is likely to have affected yields negatively, and the BIOMSS value is too optimistic. CropWatch assesses that the yield of maize and rice in Indonesia in 2017 will decrease by 2.9% and 1.3%, respectively.

Figure 3.15. Indonesia crop condition, July-October 2017

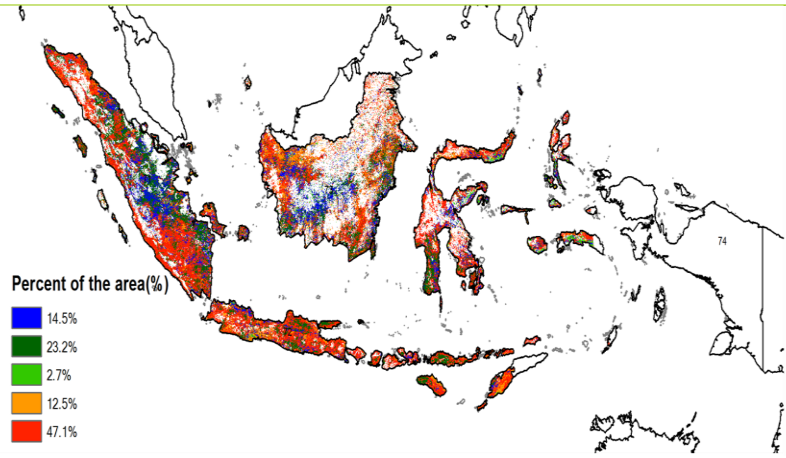


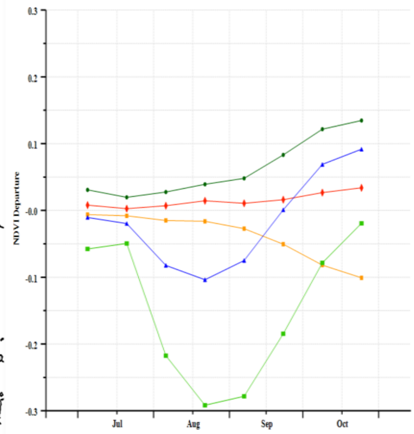
(a). Phenology of major crops



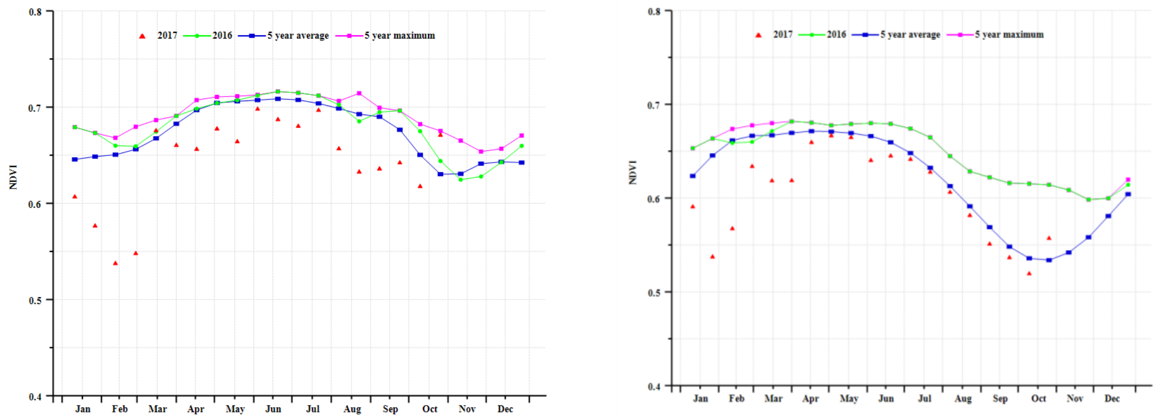


(b) Crop condition development graph based on NDVI (c) Maximum VCI

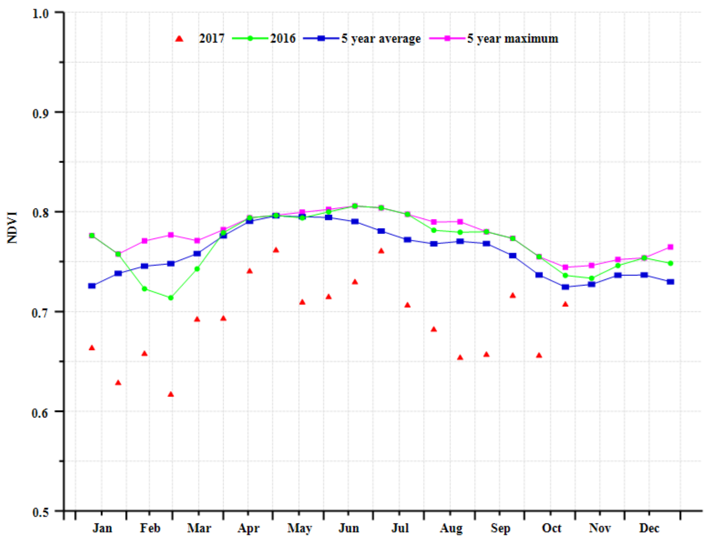




(d) Spatial NDVI patterns compared to 5YA (e) NDVI profiles



(f) Crop condition development graph based on NDVI (Sumatra (left) and Java (right))



(g) Crop condition development graph based on NDVI (Kalimantan and Sulawesi)

Table 3.32. Indonesia agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, July-October 2017

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure (%)	Current (°C)	Departure (%)	Current (MJ/m2)	Departure (%)
Sumatra	849	9	25.6	-0.3	982	-6.8
Java	194	-23.7	25.8	1.1	1159	-5.4
Kalimantan Sulawesi	941	31.8	25.9	0.2	931	-12.3
Irian Jaya	1454	43.1	24.6	0.1	832	-10.2

Table 3.33. Indonesia agronomic indicators by sub-national regions, current season's value and departure from 5YA, July-October 2017

Region	BIOMSS		Cropped arable land fraction		Maximum VCI
	Current (gDM/m2)	Departure (%)	Current (%)	Departure (%)	Current
Sumatra	2012	8	100	0	0.94
Java	605	-8	98	0.1	0.88
Kalimantan and Sulawesi	2116	25	100	0	0.94
Irian Jaya	2193	15	100	-0.2	0.93

Table 3.34. CropWatch-estimated maize and rice production for Indonesia in 2017 (thousands tons)

Crops	Production 2016	Yield variation	Area variation	Production 2017	Production variation
Maize	18316	-2.70%	-0.20%	17791	-2.90%
Rice	69304	-1.20%	0.00%	68411	-1.30%

[IND] India

The reporting period corresponds to the planting and growing of maize, as well as the planting, growing, and harvesting of Kharif rice and soybean. As the period included the most active part of the southwest monsoon, rainfall was 1089 mm rainfall on the national level, or 16% above average. Meanwhile, temperature (at 27.4°C) was just normal, while radiation at 918 MJ/m2 was 3% below average.

Considering rainfall by state, results show that 17 states had positive rainfall departures in excess of 11% over average, ranging from 11 to 100%. This includes Puducherry +106%, Tripura +63%, Assam +45%, Tamilnadu +39%, West Bengal +34%, Gujarat +33%, Nagaland +26%, Jharkhand and Meghalaya +25%, Bihar and Manipur 23%, Andhra Pradesh and Mizoram +22%, Karnataka +17%, Rajasthan +13%, and Maharashtra and Uttar Pradesh +11%. Other states, namely Chhattisgarh, Madhya Pradesh, Daman and Diu, Odisha, and Uttarakhand, recorded +1%, +2%, + 3%, +5%, and +6% RAIN over the fifteen-year average, respectively. The states that recorded lower than average rainfall include Sikkim -6%, Kerala -11%, Himachal Pradesh -15%, Punjab -26%, Haryana -28%, Goa -34%, and Delhi -38%.

Temperature for all states with the exception of Puducherry remained within 0.5°C of average. RADPAR departure was also within 5% of average for most of the states, with the exception of the following states: Sikkim -15%; Meghalaya and Tripura -12%; West Bengal -10%; Assam -8%; Bihar -7%; Kerala, Jharkhand, and Uttar Pradesh -6%; and Manipur, Nagaland, Mizoram, and Rajasthan -5%.

BIOMSS patterns mostly follow the average rainfall pattern. Increases over average BIOMSS by 10% or more were observed for the states of Andhra Pradesh, Assam, Karnataka, Maharashtra, Puducherry, Tamil Nadu, Tripura, and West Bengal. On the other end of the spectrum, drops in BIOMSS of 10% occurred in Delhi, Haryana, Himachal Pradesh, and Punjab. Other states are expected to produce near average BIOMSS and include Bihar, Chhatisgarh, Daman and Diu, Gujarat, Jharkhand, Manipur, Meghalaya, Mizoram, and Nagaland. It is stressed that, due to low RADPAR, large BIOMSS increases are unlikely. The NDVI profile for the country, which was initially low, picked up in the middle of the season, then increased above average and even reached higher than five-year maximum values in September. These indicators, coupled with VCIx values above 0.8 and higher than 95% CALF indicate the condition for average crop production.

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Regional analysis

Based on geography and agroclimatic conditions, India can be divided into seven agro-ecological regions, used by CropWatch to provide more detailed spatial analysis. The seven regions are central India, the eastern coastal region, Gangetic plains, the northeastern region, western coastal region, western dry region, and the western Himalaya. Crop prospects for six out of seven regions are described below.

In **central India,** average rainfall (999 mm, +1%) was recorded, while temperature was 0.2°C over the period's average and radiation 1% above. Accordingly, the agronomic indicators also show that the biomass production potential was 1846 gDM/m2, up +3% above the five-year average, while the cropped area was 99% of agricultural area. VCIx reached a rather high value of 0.96, indicating that there was no major crop stress. Crop condition development as observed through NDVI indicated that after an initial delay, crop growth picked up and by the end of August NDVI even exceeded the five-year maximum. Few pixels show VCIx values below 0.8. Thus, the region is due for near-average crop production.

The **eastern coastal region** received 1019 mm of rainfall, representing an amount 22% over average for the period of the year. Both temperature and RADPAR were average and provided favorable conditions for crop planting as well as growth. BIOMSS was estimated to be +19% compared with the five-year average . The cropped arable land fraction, however, was only 94%. Crop development and growth were initially low, but increased significantly in early September and remained even higher than the five-year maximum. Most of the region had VCIx above 0.8 with some large patches even above 1, indicating an average to good prospect for Kharif crops.

Next, 1145 mm of rainfall fell over the **Gangetic plains**, which was 22% above average. Temperature was average but radiation was poor (RADPAR -7%). Accordingly, the biomass production potential for the region was +2%. In response to favorable agroclimatic conditions, 98% of the agricultural area was brought under crops. Judging by the NDVI values, crop growing was delayed in August but then raised above the five-year maximum by October. In agreement with this finding, most of the region had VCIx values of 0.8 and at places higher than 1. Nearly average crop production is expected.

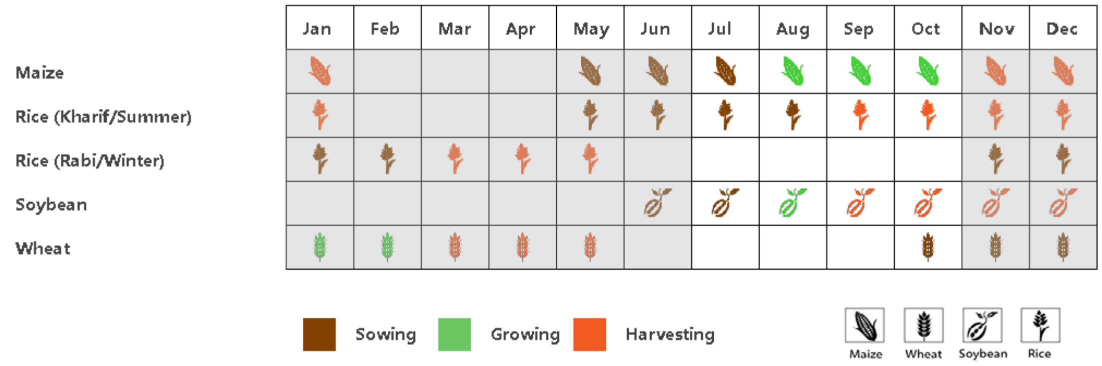
The **northeastern region** experienced the largest precipitation excess nationally (2060 mm or 36% above average. Temperature remained near average, but radiation was well below (-8%). The high BIOMSS measure of +10% brought about by high rainfall is unlikely to be achieved due to floods and poor sunshine. The region nevertheless achieved a cropped arable land fraction (CALF) of 95%. Crop condition as observed through NDVI was initially low but returned to average by the end of September, indicating delayed growth. VCIx was above 0.8 in most of the region. Crop output is deemed to be below or close to average due to low sunshine and water logging.

With the **western coastal region** enjoying better than average rainfall (1106 mm, +10%) and near normal temperature and radiation, the BIOMSS index for the region was 18% above average. The region achieved very good CALF at 97% and a VCIx of 0.97. The NDVI development paralleled the situation in the previously described regions. Among all the regions, the western coast is the one with the most favorable indicators, which points to crop production being at least average.

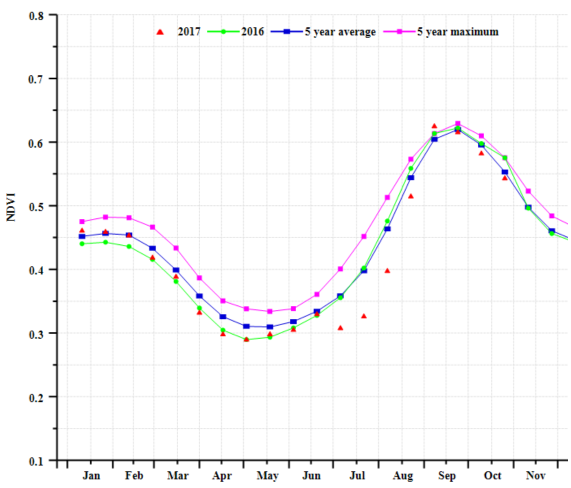
The **western dry region**, as suggested by its name, usually records low rainfall. For the current reporting period, 732 mm of rainfall represented a 22% increase over average. With a temperature of 29.1°C, the TEMP indicator was average, while radiation at 982MJ/m2 was 4% below. As a result, biomass production is expected to be average as well. CALF, however, was only 80%, just 2% above the five-year average. The crop growth condition as observed through the NDVI profile indicates a late start for the crops, with growth picking up in August but falling below average in September. VCIx shows patches of pixels below 0.8 in many places and even some values below 0.5. All these would result in lower than average crop production in the region.

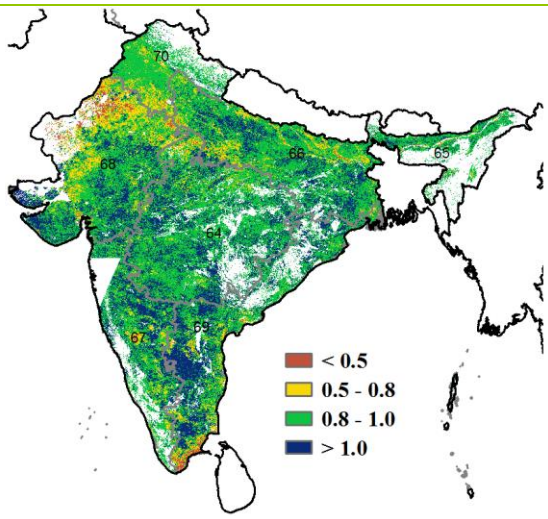
In summary, India experienced a mix of favorable and unfavorable conditions, with conditions depending on the region. Altogether, the 2017 Kharif production in the country is estimated to have been average or just below.

Figure 3.16. India crop condition, July-October 2017

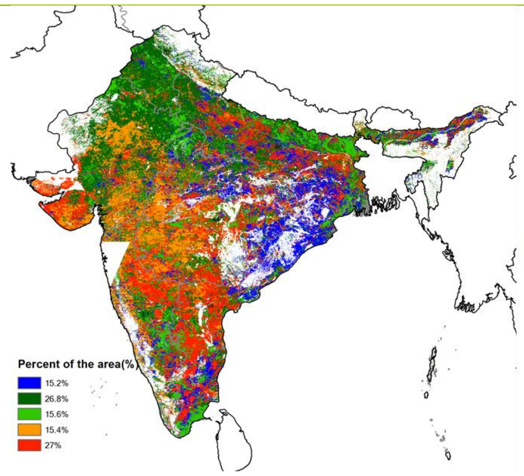


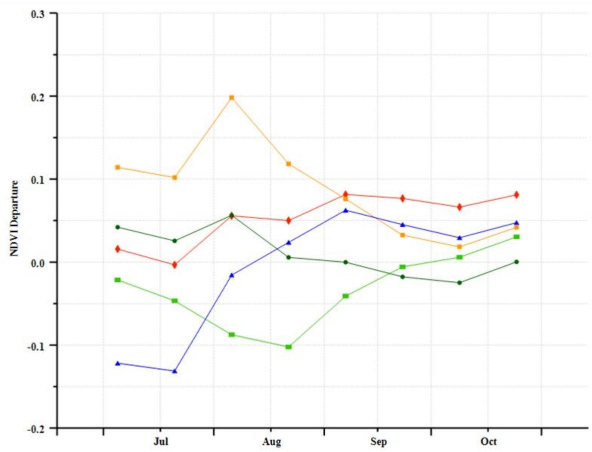
(a). Phenology of major crops



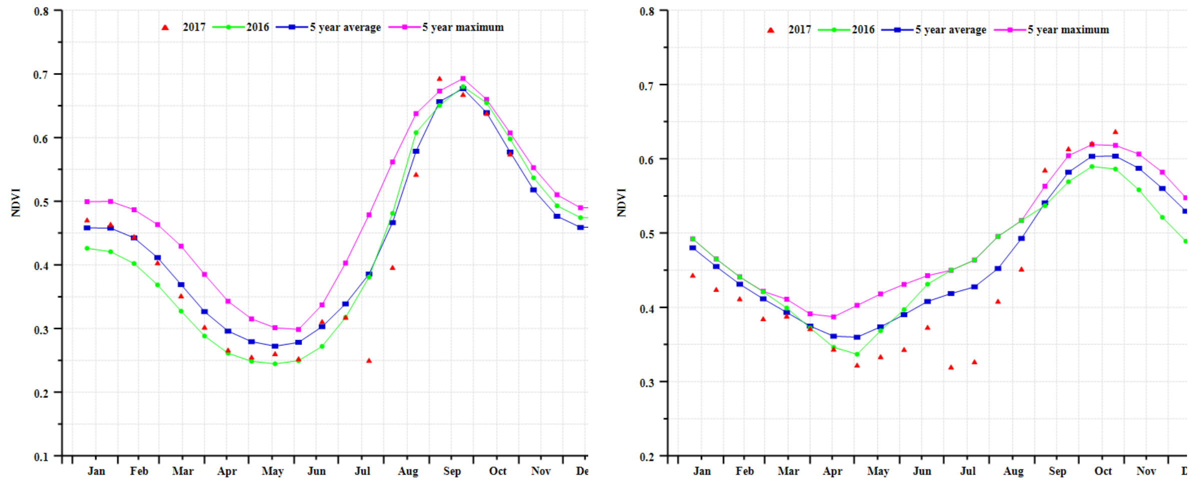


(b) Crop condition development graph based on NDVI (c) Maximum VCI

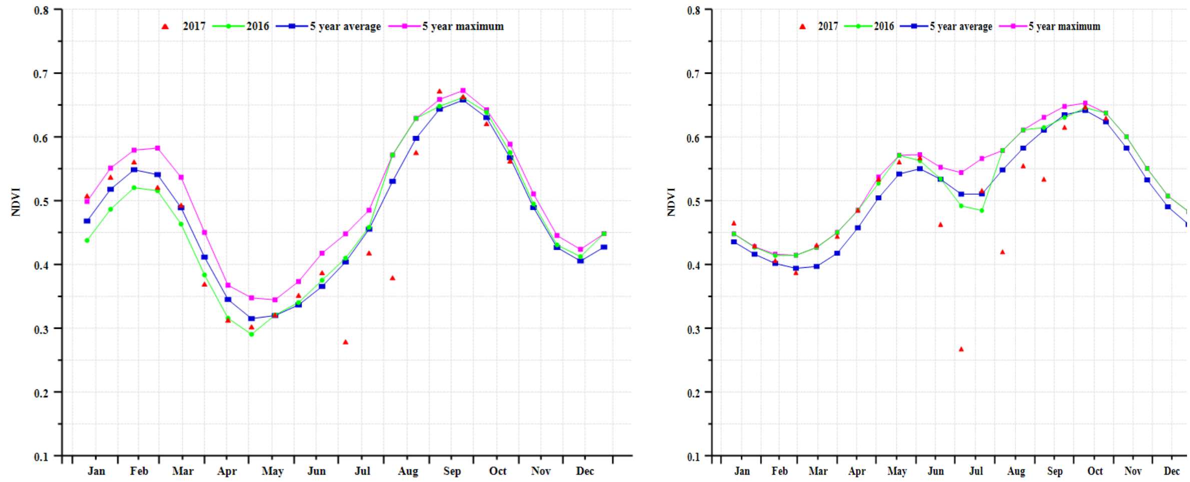




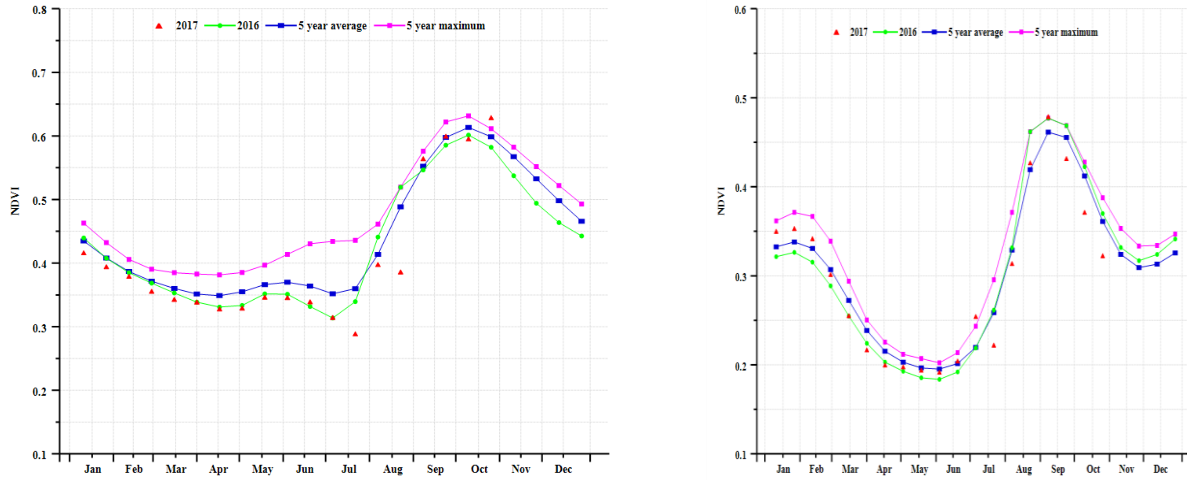
(d) Spatial NDVI patterns compared to 5YA (e) NDVI profiles



(f) Crop condition development graph based on NDVI (Central India (left) and Eastern Coastal Region (right))



(g) Crop condition development graph based on NDVI (Gangatic Plains (left) and North Eastern Region (right))



(h) Crop condition development graph based on NDVI (Western Coastal Region (left) and Western Dry Region (right))

Table 3.35. India agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, July-October 2017

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m2)	Departure from 15YA (%)
Central India	999	1	27.7	0.2	926	1
Northeastern region (India)	2060	36	26.4	-0.2	786	-8
Gangatic plain (India)	1145	22	29.1	-0.3	894	-7
Western coastal region (India)	1106	10	25.3	-0.1	883	0
Western dry region (India)	732	22	29.1	-0.3	982	-4
Eastern coastal region (India)	1019	22	28.2	0.3	948	-1
Western Himalayan region (India)	633	-8	21.2	0	1051	-3

Table 3.36. India agronomic indicators by sub-national regions, current season's values and departure from 5YA, July-October 2017

Region	BIOMSS		CALF		Maximum VCI
	Current (gDM/m2)	Departure from 5YA (%)	Current (%)	Departure from 5YA (%)	Current
Central India	1846	3	99	0	0.96
North eastern region (India)	2495	10	95	0	0.95
Gangatic plain (India)	1854	2	98	0	0.96
Western coastal region (India)	1986	18	97	6	0.97
Western dry region (India)	1125	-1	80	2	0.88
Eastern coastal region (India)	2108	19	94	5	0.99
Western Himalayan region (India)	1137	-13	98	0	0.91

Table 3.37. CropWatch-estimated maize, rice, wheat, and soybean production for India in 2017 (thousand tons)

Crops	Production 2016	Yield variation (%)	Area variation (%)	Production 2017	Production variation (%)
Maize	18649	40.00%	1.60%	19034	0.00%
Rice	156783	130.00%	2.70%	163146	0.00%
Wheat	86099	310.00%	5.30%	93496	10.00%
Soybean	12176	-40.00%	0.30%	12159	0.00%

[IRN] Iran

Crop condition was generally below average from July to October 2017 in Iran. The summer crops (potatoes and rice) were harvested in August, while winter wheat and barley started to be sown in September. Accumulated rainfall (RAIN, -28%) was below average over the last four months, while temperature and radiation (RADPAR, +0.9%) were close to average. The unfavorable agroclimatic conditions resulted in a significant decrease in the BIOMSS index by 28% compared to the five-year average. The national maximum VCI index for this monitoring period was rather low at 0.61, while the cropped arable land fraction (CALF) decreased by 7%. The cropping intensity (1.4% below the five-year average) indicated lower crop land utilization in 2017.

According to the national crop condition development graphs, crop condition over the monitoring period was below average in most of Iran's crop areas accounting for 68.5% of its total arable land. Only 12.8% of croplands experienced favorable crop condition, mainly in Khuzestan, some regions of Mazandaran, and in Golestan and Razavi Khorasan provinces.

Overall, the unfavorable weather and crop condition prevailed during the monitoring period. The decrease of both rice area (-11.8%) and yield (-6.8%) resulted in a rice production at a level 17.8% below last year's harvest. The persistent rainfall deficit since the last season will affect the sowing of the winter crops.

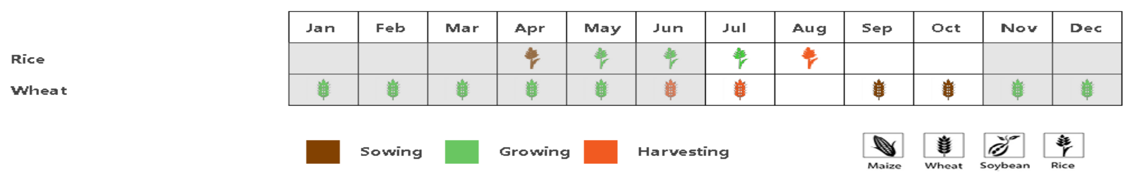
Regional analysis

Based on cropping systems, climatic zones, and topographic conditions, four sub-national agro-ecological regions can be distinguished for Iran, among which two are relevant for crop cultivation.The two regions are referred to as the west and north region and south coast.

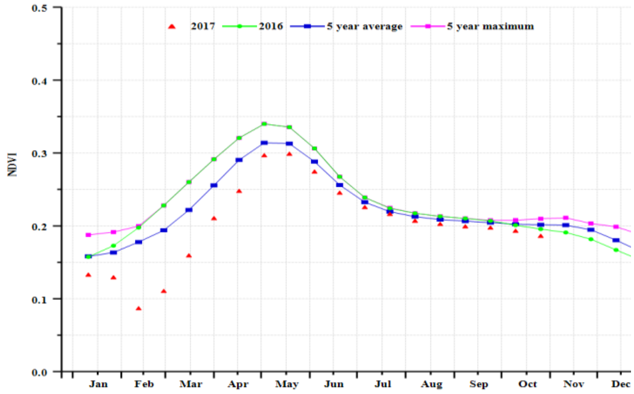
In the **west and north region,** the accumulated rainfall (RAIN) was only 39 mm, representing a RAIN value 26% below average. Radiation and temperature were close to average. The water shortage due to low rainfall resulted in a decrease of BIOMSS by 26% compared to the recent five years average. A 10% drop in CALF and unfavorable crop condition, as shown by the NDVI profiles, both lead to the outcome of the summer crops season in this region to be assessed as poor.

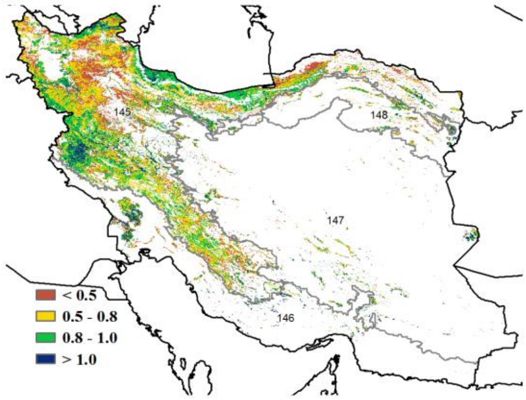
Compared to average, the **south coast region** received only 7 mm rainfall, 53% below average. The continued rainfall deficit since last season was the main factor behind the low CALF (6%) and poor VCIx (0.42). According to the NDVI profiles, however, crop condition for the region was close to the five-year average. Therefore, the outcome for summer crops of this semi-arid-region is nevertheless expected to be normal.

Figure 3.17. Iran crop condition, July-October 2017



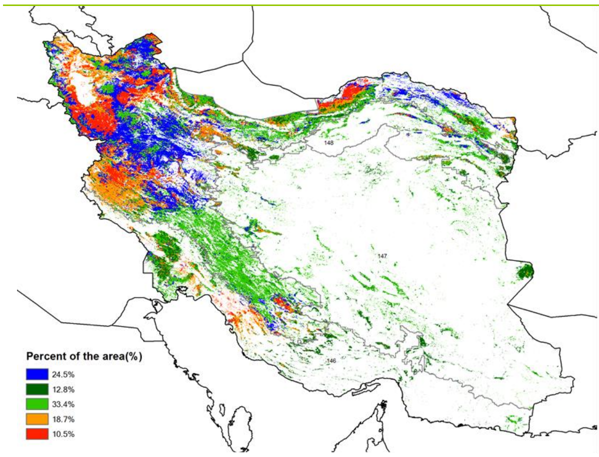
(a) Phenology of major crops

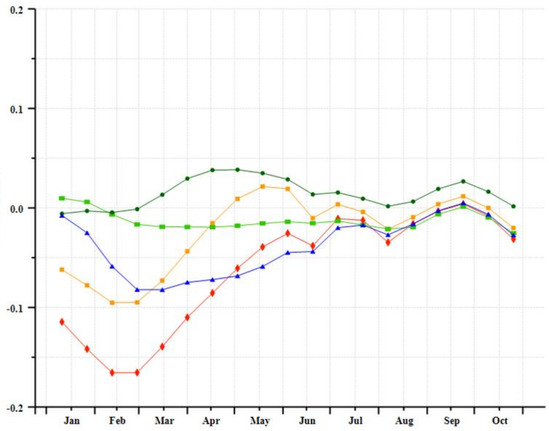




(b) Crop condition development graph based on NDVI

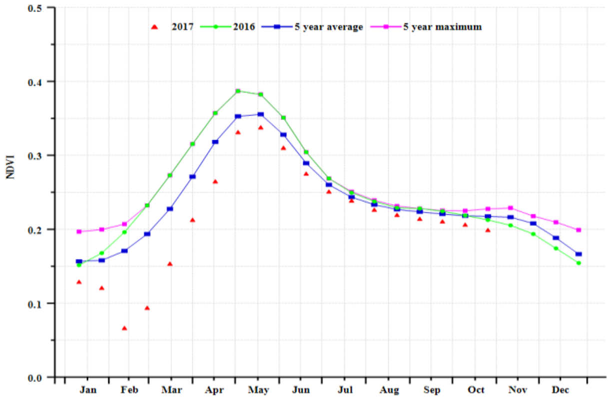
(c) Maximum VCI

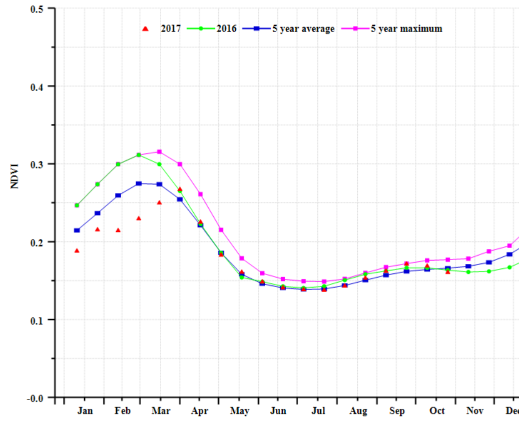




(d) Spatial NDVI patterns compared to 5YA

(e) NDVI profiles





(f) Crop condition development graph based on NDVI (West and north region (left) and South coast region (right))

Table 3.38. Iran agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, July-October 2017

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m2)	Departure from 15YA (%)
West and north region	39	-26	21.6	0.2	1274	1
South coast region	7	-53	31.5	0.3	1366	0

Table 3.39. Iran agronomic indicators by sub-national regions, current season's value and departure from 5YA, July-October 2017

Region	BIOMSS		Cropped arable land fraction		Maximum VCI
	Current (gDM/m2)	Departure from 5YA (%)	Current (%)	Departure from 5YA (%)	Current
West and north region	149	-26	10	-10	0.67
South coast region	36	-40	6	34	0.42

Table 3.40. CropWatch-estimated rice and wheat production for Iran in 2017 (thousands tons)

Crops	Production 2016	Yield change(%)	Area change (%)	Production 2017	Production change (%)
Rice	2763	-6.8	-11.8	2272	-17.8
Wheat	16073	-10	-12	12735	-20.8

[KAZ] Kazakhstan

The monitoring period covers the growing and harvesting stages of spring wheat, barley, and other cereals in Kazakhstan. The crop condition in the country was generally normal. The national average VCIx was 0.84, and the cropped arable land fraction (CALF) increased by 6% compared to the five-year average. Among the CropWatch agroclimatic indicators, RAIN and RADPAR were above average (+18% and +3%, respectively), while TEMP was slightly below average (-0.6°C). BIOMSS is expected to increase by +12% compared to the five-year average at the national scale.

As shown by the NDVI development graph, crop condition was below average from late July to October in most parts of the country. The spatial NDVI patterns and profiles show that the crop condition was above average only from July to the beginning of August in 84% of the cropped areas. However, NDVI was 86.8% below average from late August to October compared with the five-year average in most parts of Akmola, the eastern and southern parts of north Kazakhstan, and the northern part of Pavlodar region. Currently CropWatch wheat production estimates are 8.8% below last year's output, due to a combination of decreased yield and reduced area.

Regional analysis

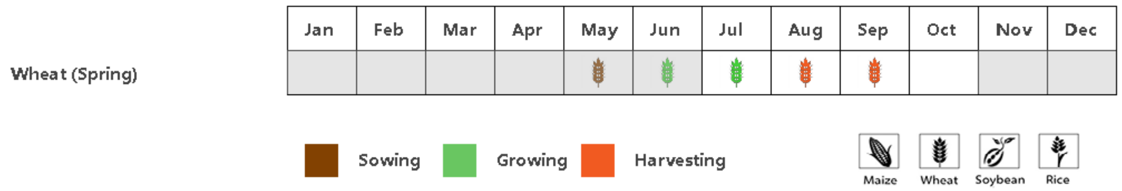
The following paragraphs provide additional detail for the major agro-ecological zones of Kazakhstan, referred to as the northern zone, the southeast zone, and the southwest zone.

In the **northern zone**, crop condition was below the five-year average from late July to late October. RAIN and RADPAR were above average (by 8% and 3%, respectively) and TEMP was slightly below average (-0.6°C), resulting in a minor increase of the BIOMSS index (6%). CALF significantly increased by 5% compared to the recent five-year average. The NDVI profiles for the region were consistently below average. Overall, the outcome for the spring crops in the region is assessed as normal.

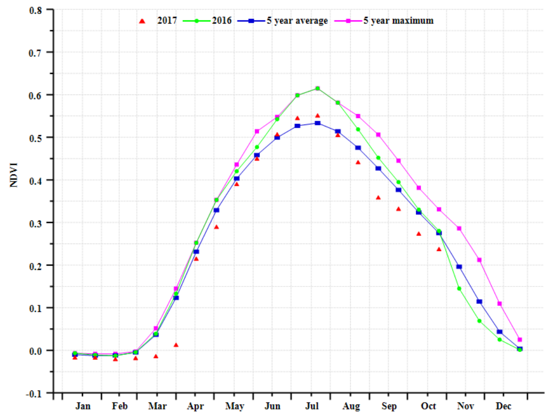
The **southeast zone** displays NDVI above the five-year average from July to late August, but values worsened from September to late October. RAIN was 67% above average, but TEMP and RADPAR were normal (-0.3°C and +2%, respectively). The agroclimatic indicators also resulted in an increase of the BIOMSS index by 41%. The cropped area increased by 16% compared to the five-year average. Overall crop prospects are favorable.

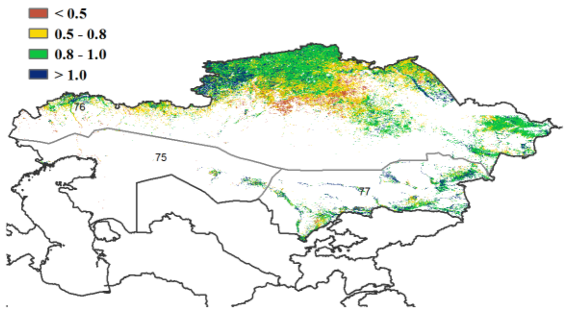
In the **southwest zone**, NDVI was generally above the five-year average from July to late September. RAIN was well above average (+82%), while TEMP and RADPAR were slightly above (0.7°C and 2%). The agroclimatic conditions resulted in a BIOMSS increase of 72%. CALF also significantly increased by 11% compared to the five-year average. Overall, the outcome for the crops is considered favorable in this region.

Figure 3.18. Kazakhstan crop condition, July-October 2017



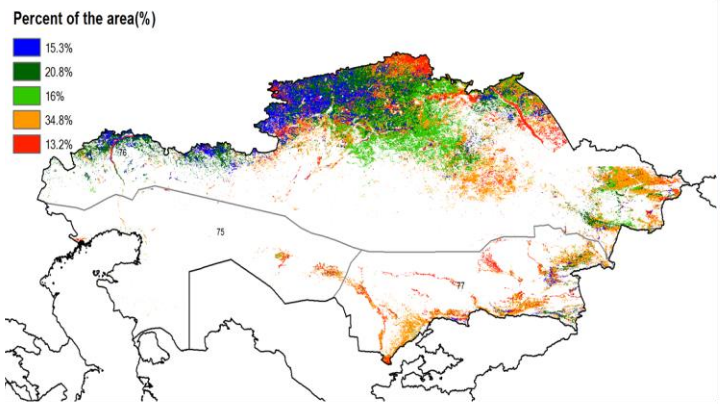
(a). Phenology of major crops

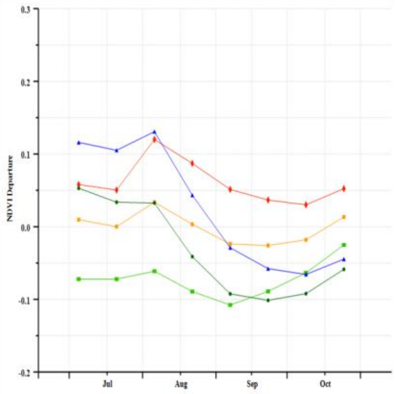




(b) Crop condition development graph based on NDVI

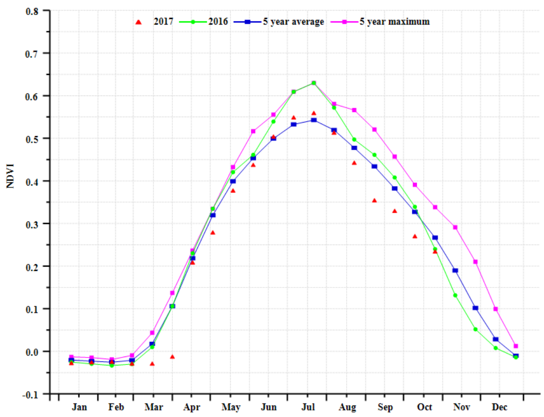
(c) Maximum VCI

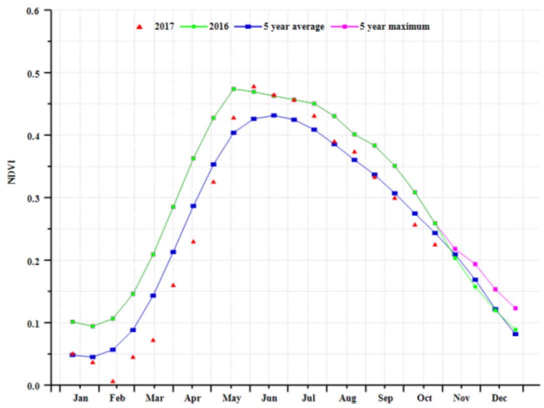




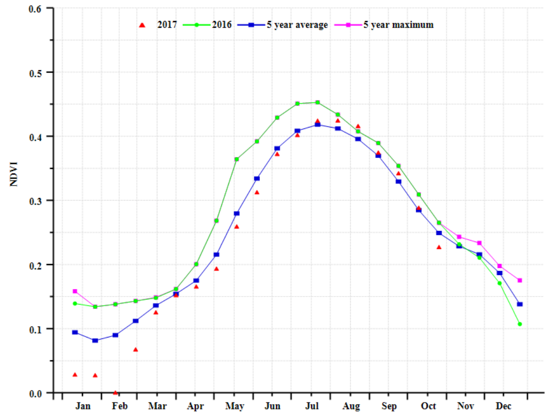
(d) Spatial NDVI patterns compared to 5YA

(e) NDVI profiles





(f) Crop condition development graph based on NDVI (Northern region (left) and Southeast region (right))



(g) Crop condition development graph based on NDVI (Southwest region)

Table 3.41. Kazakhstan agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, July-October 2017

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m2)	Departure from 15YA (%)
Northern region	168	8	13.8	-0.7	918	3
Southeast region	217	67	18.1	-0.3	1158	2
Southwest	90	82	21	0.7	1107	2

Table 3.42. Kazakhstan, agronomic indicators by sub-national regions, current season's values and departure from 5YA, July-October 2017

Region	BIOMSS		CALF		Maximum VCI
	Current (gDM/m2)	Departure from 5YA (%)	Current (%)	Departure from 5YA (%)	Current
Northern region	715	6	83	5	0.83
Southeast region	735	41	70	16	0.95
Southwest	383	72	55	11	0.82

Table 3.43. CropWatch-estimated wheat production for Kazakhstan in 2017 (thousand tons)

Crops	Production 2016	Yield variation (%)	Area variation (%)	Production 2017	Production variation (%)
Wheat	18.2	-7.7	-1.2	16.6	-8.8

[KHM] Cambodia

The reporting period covers the sowing of the main wet season rice in Cambodia, which started from late June (depending on the area), as well as the growing and harvesting period of maize. No dry season rice was cultivated in this monitoring season. Nationwide, crop condition before November was close to the average of the recent five years, with some fluctuation in October but recovering before November.

With 1152 mm of precipitation, rainfall (RAIN) in the country was only 2% down compared to average, following a 7% increase of rainfall during the previous monitoring period. Near average rainfall was accompanied by average temperature (TEMP, -0.5°C) and radiation (RADPAR, -3%). All the climate indicators combined resulted in an average biomass production potential (BIOMSS, +0.7%), which points at an average crop condition. The cropped arable land fraction decreased 1% on the national level. According to the VCIx distribution map, fair crop condition (VCIx>0.5) occurs over most of the country, except some sparse areas around Tonle Sap representing less than 5% percent of croplands. Over 50% percent of the crop area showed good crop health condition nationwide (VCIx>0.8), which means the absence of any agricultural disasters this season. NDVI clusters confirm the VCIx map: Of the total cropping area, 38.1% shows a slight increase in NDVI compared with average, while about 50% shows fluctuations while remaining close to average. Only 1.2% percent of croplands near the northeast shore of Tonle Sap show a marked decrease. It cannot be excluded that the decrease results from cloud contamination of the NDVI image.

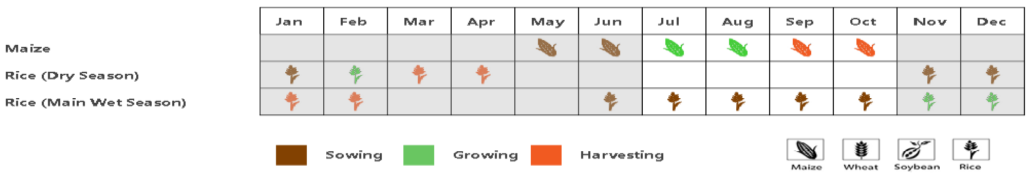
Overall, CropWatch puts the rice production estimate for the country 2.4% above that of last year. For maize, the increase is even higher, at +4.1%.

Regional analysis

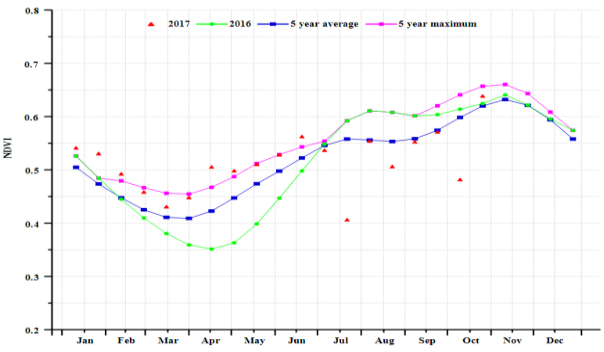
Based mostly on climate differences, two agro-ecological regions can be distinguished in Cambodia. Weather in the **Tonle Sap lake area** (especially rainfall and temperature) is mainly influenced by the lake itself. In the second area, named the **main crop area** and covering the border areas with Thailand and Laos in the north and Vietnam in the east, climate conditions are based on the monsoon.

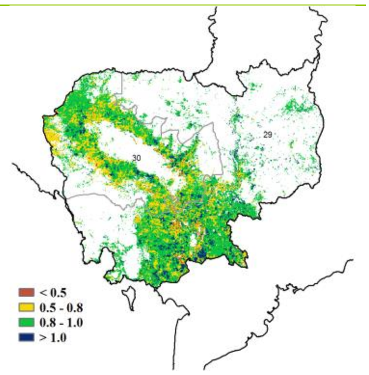
Both regions display similar NDVI profiles in this monitoring period. The profile in the **Tonle Sap lake area**, however, is slightly lower than the five-year average because of an obvious decrease in rainfall near Tongle Sap (987 mm; a 10% decrease). Similar to the NDVI profile of the whole country, the NDVI for the region recovered to the five-year average after fluctuations in October. The two sub-regions also display similar radiation (RADPAR about +3%) and temperature (TEMP about -0.5°C) departures. Water deficit led to a 2% decrease in BIOMSS in the lake area.

Figure 3.19. Cambodia crop condition, July-October 2017



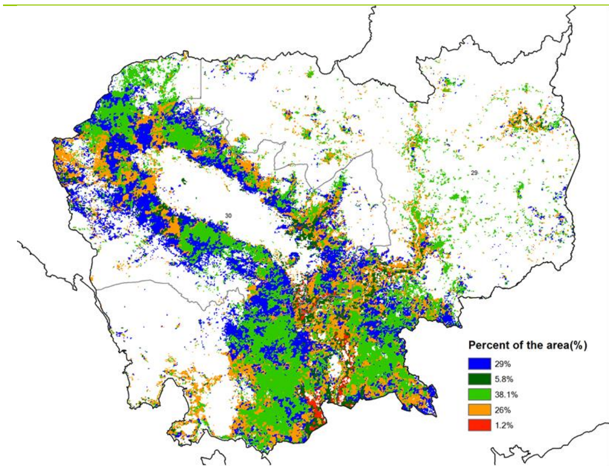
(a). Phenology of major crops

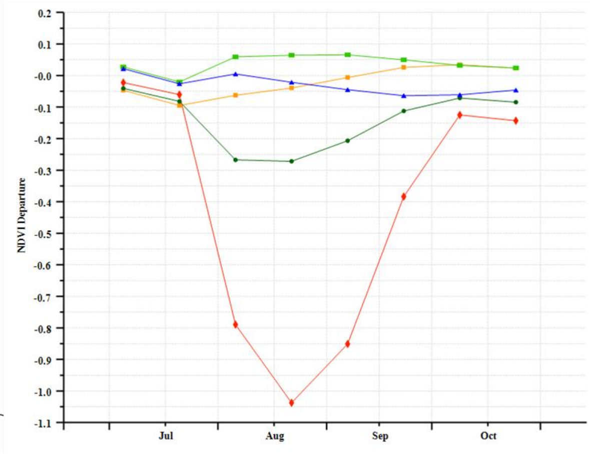




(b) Crop condition development graph based on NDVI

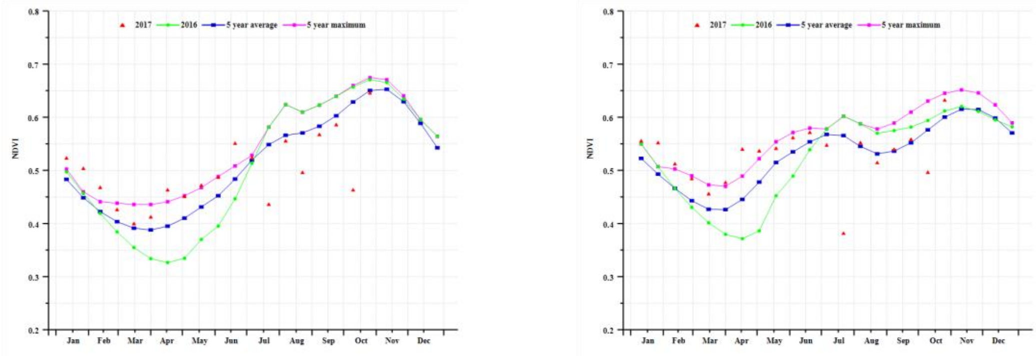
(c) Maximum VCI





(d) Spatial NDVI patterns compared to 5YA

(e) NDVI profiles



(f) Crop condition development graph based on NDVI (Lake area of Tongle Sap (left) and Main cropping area (right))

Table 3.44. Cambodia agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, July-October 2017

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m2)	Departure from 15YA (%)
Main cropping area (Cambodia)	1268	3	27.9	-0.5	956	-3
Lake plains (Cambodia)	987	-10	28.1	-0.6	982	-2

Table 3.45. Cambodia, agronomic indicators by sub-national regions, current season's values and departure from 5YA, July-October 2017

Region	BIOMSS		CALF		Maximum VCI
	Current (gDM/m2)	Departure from 5YA (%)	Current	Departure from 5YA (%)	Current
Main cropping area (Cambodia)	2470	3	0.9	-1	0.9
Lake plains (Cambodia)	2258	-2	1	-1	0.9

Table 3.46. CropWatch-estimated maize and wheat production for Cambodia in 2017 (thousand tons)

Crops	Production 2016	Yield variation (%)	Area variation (%)	Production 2017	Production variation (%)
Maize	779	0.10%	0.10%	780	4.10%
Rice	8588	3.40%	1.30%	8792	2.40%

[MEX] Mexico

During the monitoring period, maize was being sown in the northwestern part of Mexico, while in other areas it was being harvested. Rice also was being sown during this time, while winter wheat was being harvested. Nationwide, crop condition was average or slightly below average, as shown by the crop condition development graph based on NDVI.

The CropWatch agroclimatic indicators showed that, compared with average, rainfall increased by 5%, while temperature and radiation respectively dropped by 0.4°C and 2%. Consequently, BIOMSS was slightly below average (-1%) as well, while the VCIx on the national level was 0.92. As indicated by the spatial NDVI patterns and corresponding profiles, about 62.4% of crops were continuously above average or with average condition over the whole reporting period, especially in southeastern and northern Mexico. In contrast, 8.8% of planted areas presented persistently unfavorable condition, mainly in the central part of the country. Considering CALF and cropping intensity increased respectively by 3% and 5%, crop production in the current season is estimated to be average or slightly above average.

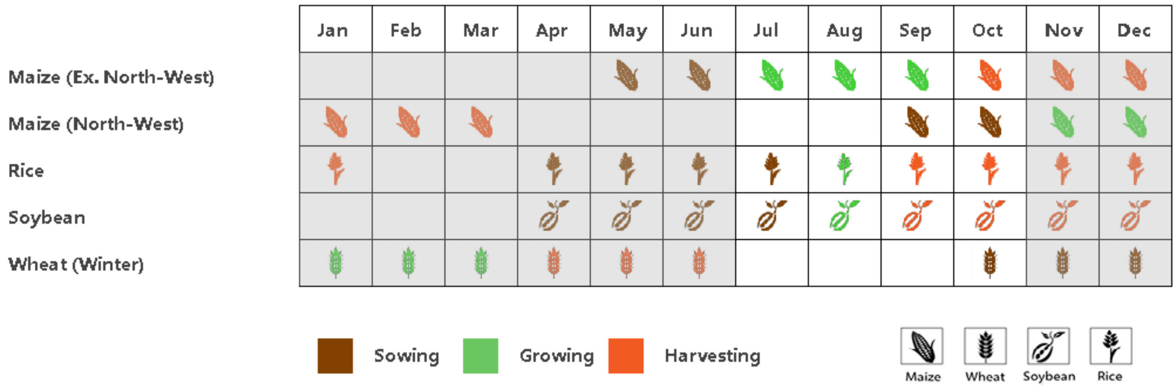
Regional analysis

According to cropping systems, climatic zones, and topographic conditions, Mexico is divided into five agro-ecological regions, including the northwestern mixed wheat and maize area, a southern maize zone, a central temperate zone, a northern mixed cotton and wheat area, and a northeastern mixed sorghum and maize area.

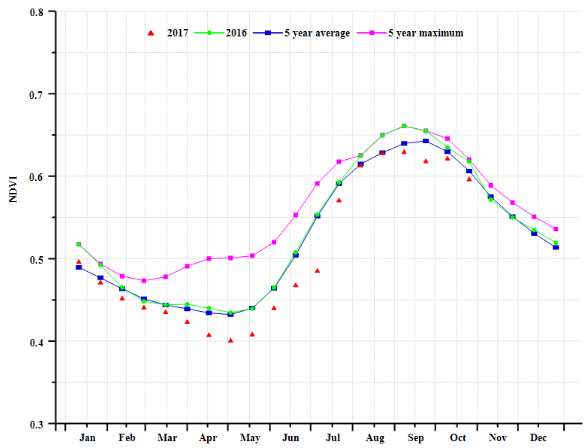
As shown by the crop condition development graph based on NDVI, crops condition was generally below average in the **northwestern mixed wheat and maize area**, while continuously average or above average conditions prevailed in the **southern maize zone**, the **central temperate zone**, and the **northern mixed cotton and wheat area** during July through October. In the **northeastern mixed sorghum and maize area,** crop condition was below average from July to early September, but improved to above average from late September.

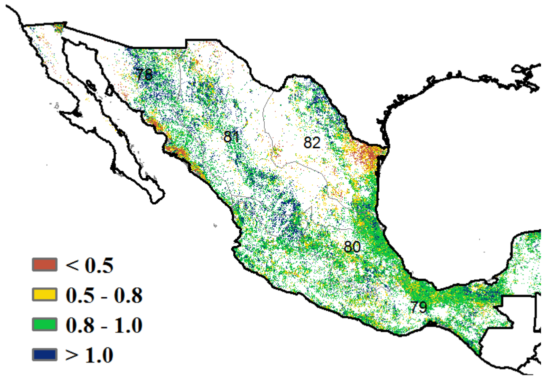
The CropWatch agroclimatic and agronomic indicators showed different departures from average for the different regions. Rainfall was below average in the **central temperate zone** (RAIN -5%) and **northeastern mixed sorghum and maize area** (-12%), but above average in the **northwestern mixed wheat and maize area** (+6%) and the **southern maize zone** (+10%). In the **northern mixed cotton and wheat area**, rainfall was average. Temperature and radiation were generally below average in the **southern maize zone**, the **central temperate zone**, the **northern mixed cotton and wheat area**, and the **northeastern mixed sorghum and maize area**, but average in the **northwestern mixed wheat and maize area**. BIOMSS was above average in the **southern maize zone** (+4%) but generally below average in the other four regions. Compared to the recent five-year average, CALF increased in almost all the regions with the exception of the **southern maize zone**, where the indicator was average. The maximum VCI was between 0.83 and 0.94 in these sub-national regions.

Figure 3.20. Mexico crop condition, July-October 2017



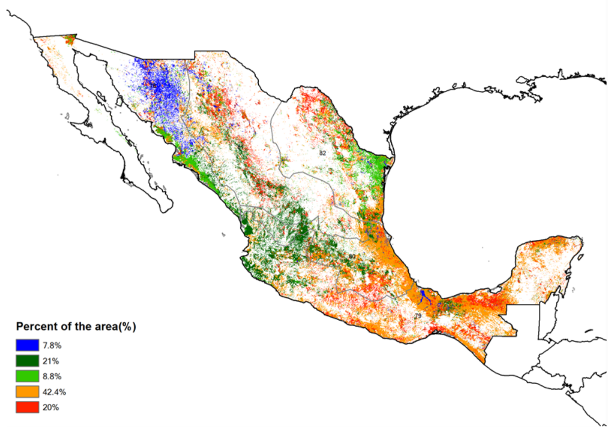
(a). Phenology of major crops

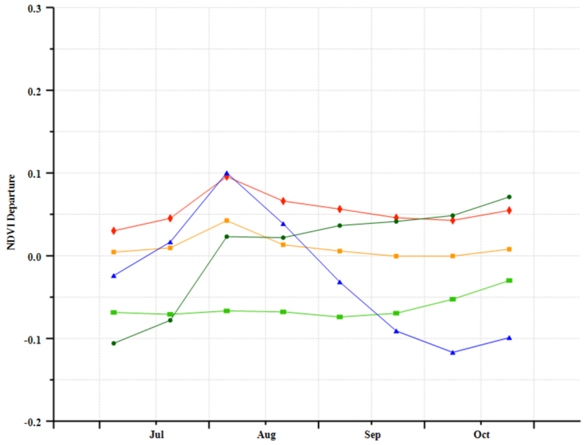




(b) Crop condition development graph based on NDVI

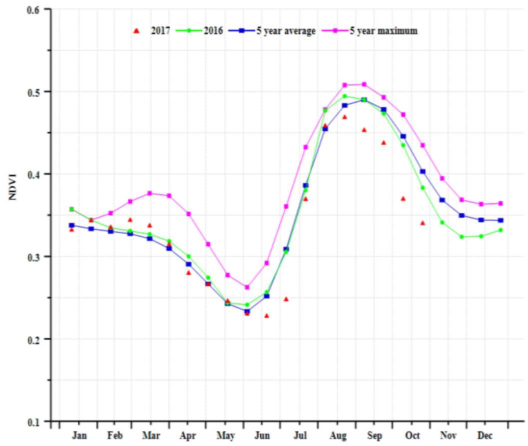
(c) Maximum VCI

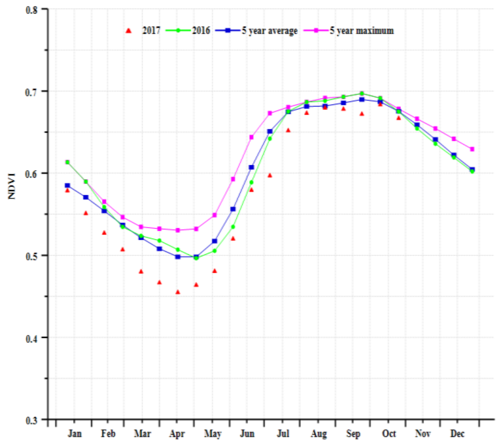




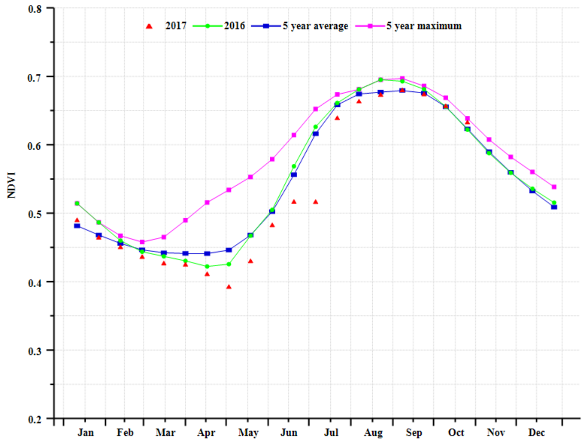
(d) Spatial NDVI patterns compared to 5YA

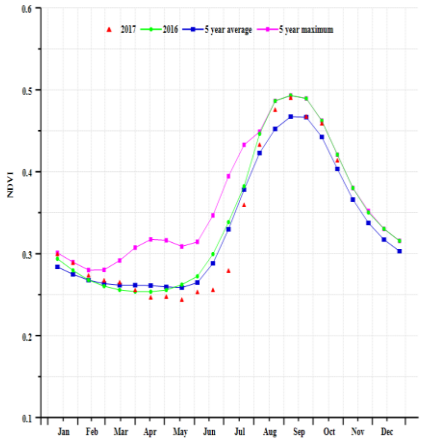
(e) NDVI profiles



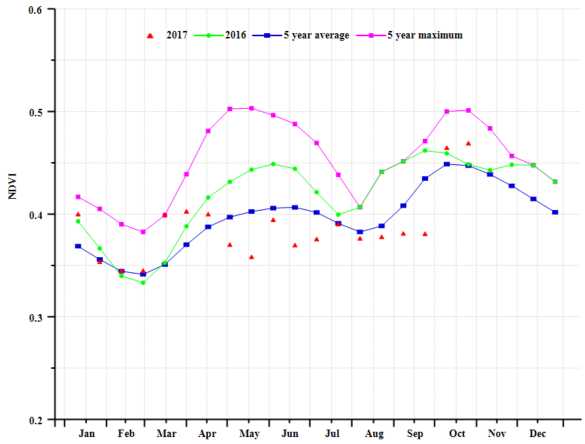


(f) Crop condition development graph based on NDVI (Northwestern mixed wheat and maize area (left) and Southern maize zone (right))





(g) Crop condition development graph based on NDVI (Centre temperate zone (left) and Northern mixed cotton and wheat area (right))



(h) Crop condition development graph based on NDVI (Northeastern mixed sorghum and maize area)

Table 3.47. Mexico agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, July-October 2017

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m2)	Departure from 15YA (%)
Northwestern mixed wheat and maize area	512	6	26.9	0.0	1236	1
Southern maize zone	1055	10	24.6	-0.4	1106	-3
Central temperate zone	642	-5	21.0	-0.4	1153	-3
Northern mixed cotton and wheat area	436	0	20.7	-0.6	1231	-2
Northeastern mixed sorghum and maize area	339	-12	26.6	-1.0	1233	-1

Table 3.48. Mexico agronomic indicators by sub-national regions, current season's values and departure from 5YA, July-October 2017

Region	BIOMSS		Cropped arable land fraction		Maximum VCI
	Current (gDM/m2)	Departure from 5YA (%)	Current (%)	Departure from 5YA (%)	Current
Northwestern mixed wheat and maize area	1072	-4	77	1	0.89
Southern maize zone	2134	4	100	0	0.94
Central temperate zone	1595	-4	99	1	0.93
Northern mixed cotton and wheat area	1277	-1	90	9	0.94
Northeastern mixed sorghum and maize area	965	-11	79	9	0.83

Table 3.49. CropWatch-estimated maize, wheat and soybean production for Mexico in 2017 (thousands tons)

Crops	Production 2016	Yield variation	Area variation	Production 2017	Production variation
Maize	23780	-0.20%	0.50%	23858	0.30%
Wheat	3550	-0.70%	-6.90%	3283	-7.50%

[MMR] Myanmar

Myanmar is a major agricultural country that cultivates several main crops every year. Maize is distributed mainly in the Hills region, while wheat and rice are planted across the country. The reporting period covers the entire growing season and early harvesting season of main rice, while also the early sowing of wheat and maize (starting in September) are included. CropWatch assesses crop condition throughout the country as generally below the average of the previous five years during July and early September, but average in August and October.

As shown by the CropWatch agroclimatic indices, compared to average, rainfall increased by 9%; temperature remained average, and radiation showed a marked decrease (RADPAR, -4%). The fraction of cropped arable land (CALF) showed no change, but cropping intensity increased by 9% compared to its five-year average. Sufficient precipitation and improved cropping intensity led to an increase in BIOMSS (+3%). The crop condition development graph based on NDVI does not show a favorable situation. Crop condition, which had been unsatisfactory already in June, remained so in July, recovered to average in August before declining again in early September. Similar fluctuations of crop condition can also be seen for the agro-ecological regions described in the regional analysis below.

In terms of spatial distributions, cropland across the country displayed bad conditions to different extents. The central areas of Mandalay and Magwe showed above average condition throughout the reporting period, while other parts of the two provinces and the north of Bago were below average during July. Moreover, Ayeyarwady and south of Sagaing suffered from poor crop condition during late August, recovering slowly in September. The maximum VCI (VCIx) map displays the same patterns of spatial distribution with high values in the central part of the central plain and low values in the coastal region.

Regional analysis

For Myanmar, again based on the cropping system, climatic zones, and topographic conditions, three sub-national, agro-ecological regions can be distinguished. They are the hill region, the central plain, and the coastal region.

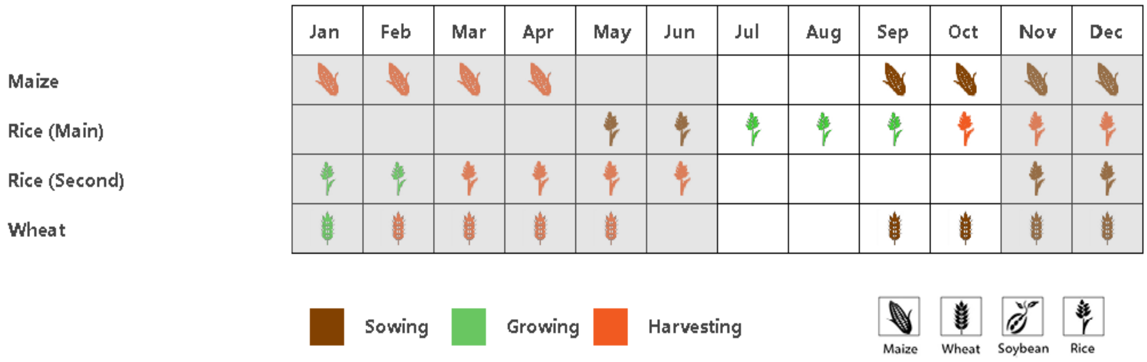
Maize, the major crop in the **hill region**, was harvested during the monitoring period. Agroclimatic indicators were close to the national values. According to the NDVI development graphs, crop condition was largely below average in early September, after which it recovered slowly though still remaining slightly below the average; this probably affected maize and eventually impacted its production.

The **central plain** is the main crop region of the country, and the area shows the most favorable values among the three sub-national regions discussed here. More precipitation compared with average and close to average temperature provided good condition for the crops.

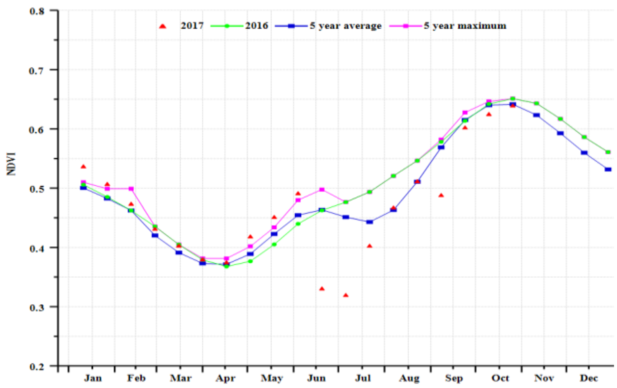
The **coastal region** shows the least favorable agroclimatic and crop conditions for the country, especially in Ayeyarwady. The unfavorable crop condition in July and August substantially impacted the growing of main rice. Rainfall was somewhat below average (RAIN -2%) and radiation was poor (RADPAR -6%).

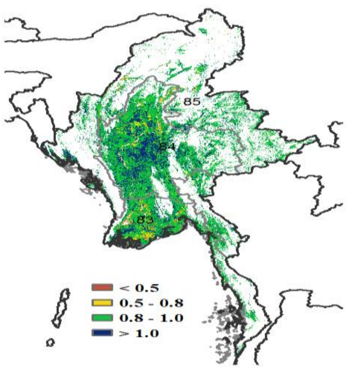
On the whole, crop condition for Myanmar for the reporting period was generally below average due to the adverse conditions the country suffered since June during the growing season of main rice and the harvest of maize. With a stable cropped arable land fraction (CALF), the poor condition of crops may lead to a reduction in production. CropWatch puts the productions of maize and rice during 2017 slightly below those of 2016.

Figure 3.21. Myanmar crop condition, July-October 2017



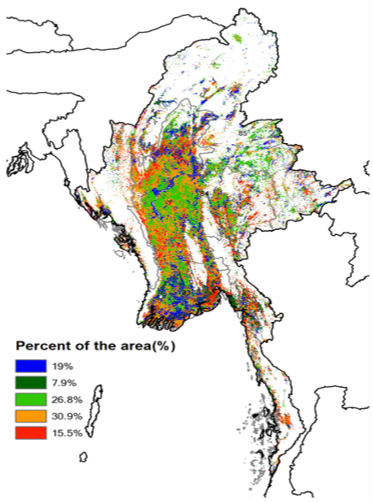
(a). Phenology of major crops

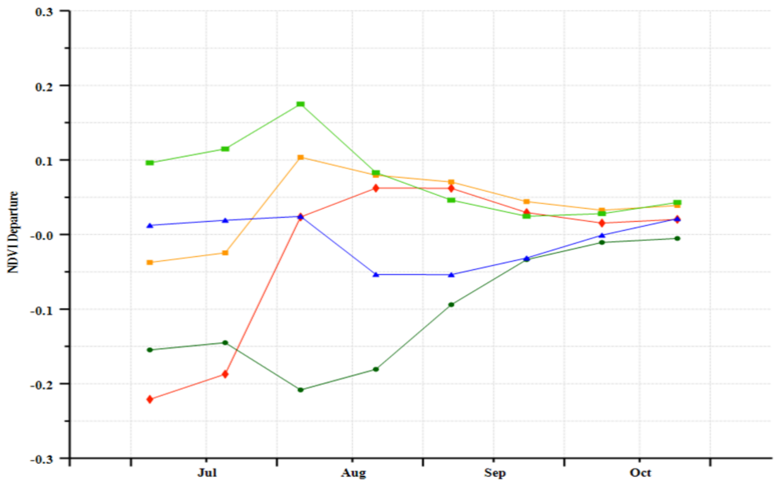




(b) Crop condition development graph based on NDVI

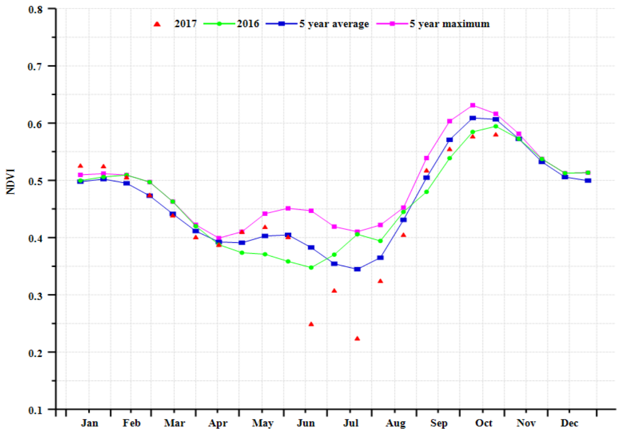
(c) Maximum VCI

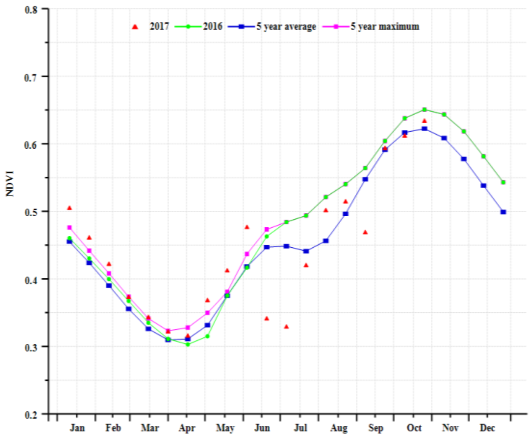




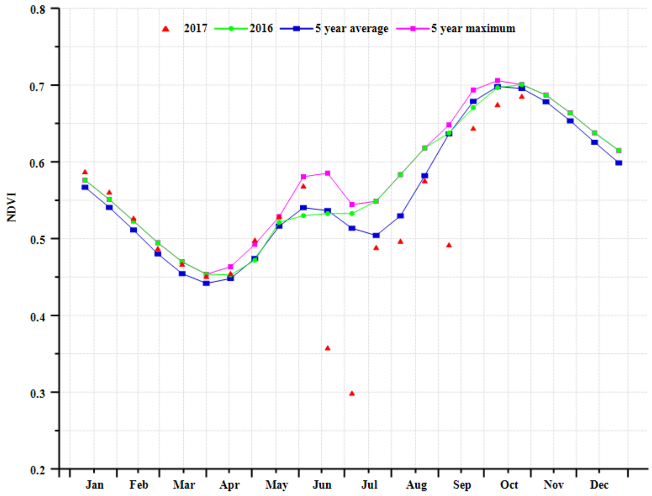
(d) Spatial NDVI patterns compared to 5YA

(e) NDVI profiles





(f) Crop condition development graph based on NDVI (Coastal region (left) and Central plain (right))



(g) Crop condition development graph based on NDVI (Hill region)

Table 3.50. Myanmar agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, July-October 2017

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m2)	Departure from 15YA (%)
Coastal region	1733	-2	27.4	0.6	772	-6
Central plain	1097	15	26.9	-0.3	857	-2
Hill region	1390	10	24.8	0	782	-5

Table 3.51. Myanmar agronomic indicators by sub-national regions, current season's values and departure from 5YA, July-October 2017

Region	BIOMSS		CALF		Maximum VCI
	Current (gDM/m2)	Departure from 5YA (%)	Current (%)	Departure from 5YA (%)	Current
Coastal region	2538	1	93	-1	0.91
Central plain	2224	4	97	1	0.98
Hill region	2320	2	98	0	0.97

Table 3.52. CropWatch-estimated maize and rice production for Myanmar in 2017 (thousand tons)

Crops	Production 2016	Yield variation (%)	Area variation (%)	Production 2017	Production variation (%)
Maize	1746	-250.00%	0	1702	-2.5
Rice	25541	210.00%	-2.6	25407	-0.5

[NGA] Nigeria

From early July to September, harvesting of the main maize crop took place in the south (July/August) and the north (August/September) of the country. Rainfed rice was also harvested, while in October harvesting of irrigated rice began. A second maize crop started to be planted in August.

At the national level, the CropWatch agroclimatic indicators were close to average. A slight increase was registered for RAIN (+2%), while minor decreases were noted for TEMP, RADPAR, and BIOMSS (-0.8ºC, -4% and -1%, respectively). Meanwhile, the fraction of cropped arable land (CALF) was stable, and VCIx was 0.89.

According to the national NDVI development profile, crop condition from July to October remained below that of the same period last year and also the five-year average. As shown in the NDVI departure clustering maps and profiles, 7.6% of the cropped area had better than average conditions (with a clear peak in August and September). For 7.1% of the cropped area, crop conditions were below the average during the entire monitoring period. Both mentioned areas occur in the south. For about 77.1% of the total cropped area, mostly situated in the northern half of the country, conditions were close to the average.

Regional analysis

Based again on cropping systems, climatic zones, and topographic conditions, Nigeria is divided into four agro-ecological regions. They are referred to (from north to south) as the Sudano-sahelian, derived savana, the humid forest zone, and the Guinean savanna.

In the **Sudano-sahelian** zone**,** crop condition development was above the five-year average from early July to late August, and then below from late August up to October. The agroclimatic indicators for this region show an increase in rainfall (RAIN +5%) and decreases in temperature (TEMP -0.7ºC) and radiation (RADPAR -5%). The agronomic indicators show a CALF value of 84%, a reduction of 1% below the five-year average for this indicator, and VCIx of 0.88.

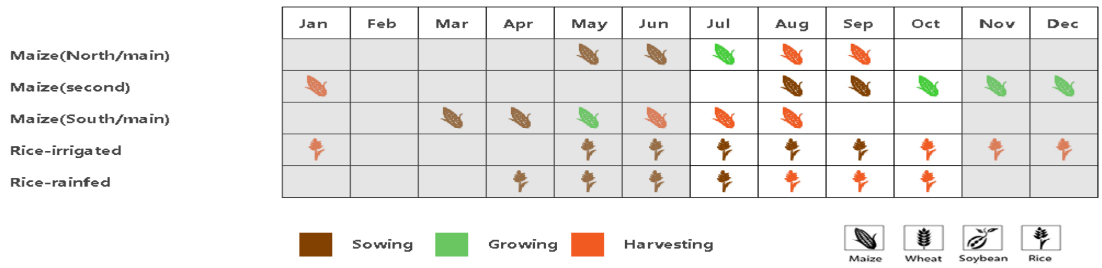
Similar to the Sudano-sahelian zone, the **derived savana** region shows a decrease in temperature and radiation (TEMP -0.8ºC and RADPAR -1.6%), although rain was unchanged and the drop in sunshine less significant. Generally, crop condition development for this zone was below the five-year average for the entire monitoring period. The agronomic indicators show that while CALF registered a slight increase of 1%, the biomass production potential did not vary.

In the **humid forest zone**, NDVI was below the five-year average in July; it improved in August and turned about average, but then dropped again until October. The agroclimatic conditions for this area show that while rainfall increased by 3%, temperature was about average and radiation decreased markedly to a value 8% below average. The agronomic indicators show a marginal increase in all variables (BIOMSS +1%, CALF +1%), while the VCIx was 0.85.

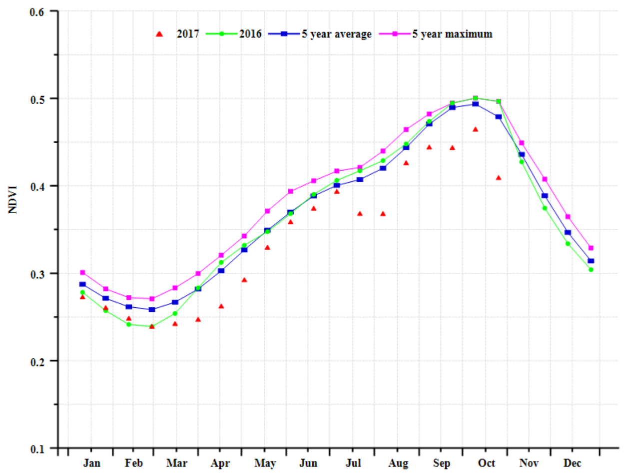
As already mentioned for the national NDVI clusters, rather poor conditions prevailed in parts (7.1%) of the south, and essentially in the area with bi-modal rainfall in the **Guinean savanna** zone. The crop condition development based on NDVI for this region was consistently below the average of the past five years and below the average of the same monitoring period in 2016. BIOMSS and CALF indicators decreased by 3% and 0.1% respectively, while VCIx was 0.91. The agroclimatic indicators show a decrease in temperature (TEMP -0.9ºC) and radiation (RADPAR -3.%), while rainfall increased by 2%.

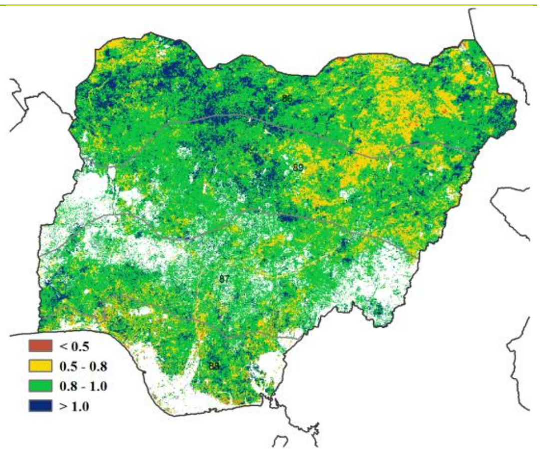
Conditions were generally favorable in the northern half of the country, but less so in the south. Altogether, CropWatch projects both rice and maize production to increase compared to last year's output.

Figure 3.22. Nigeria crop condition, July-October 2017



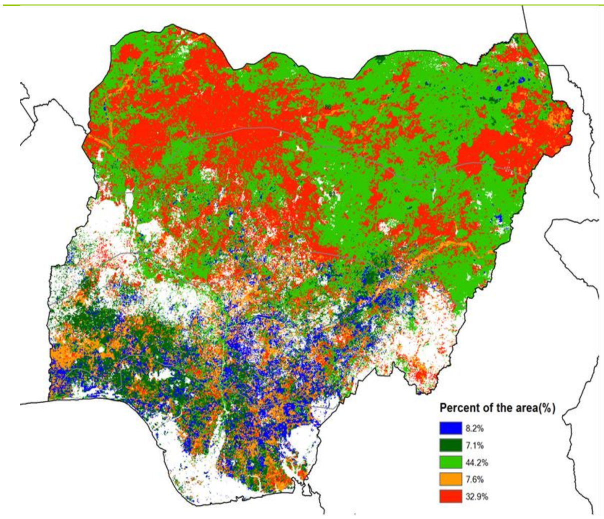
(a) Phenology of major crops

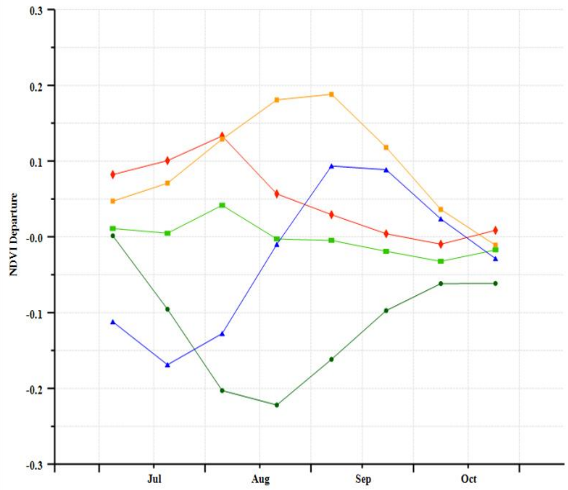




(b) Crop condition development graph based on NDVI

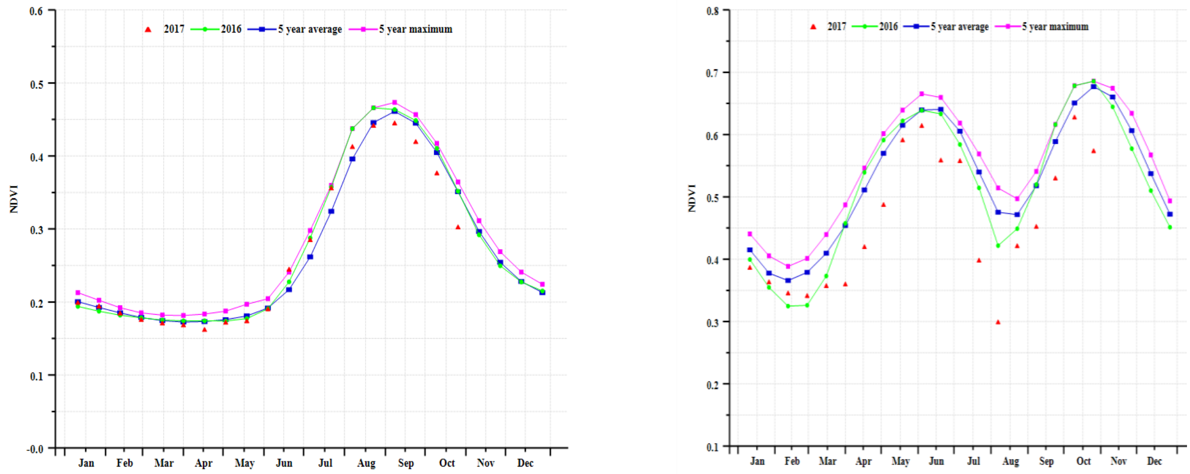
(c) Maximum VCI



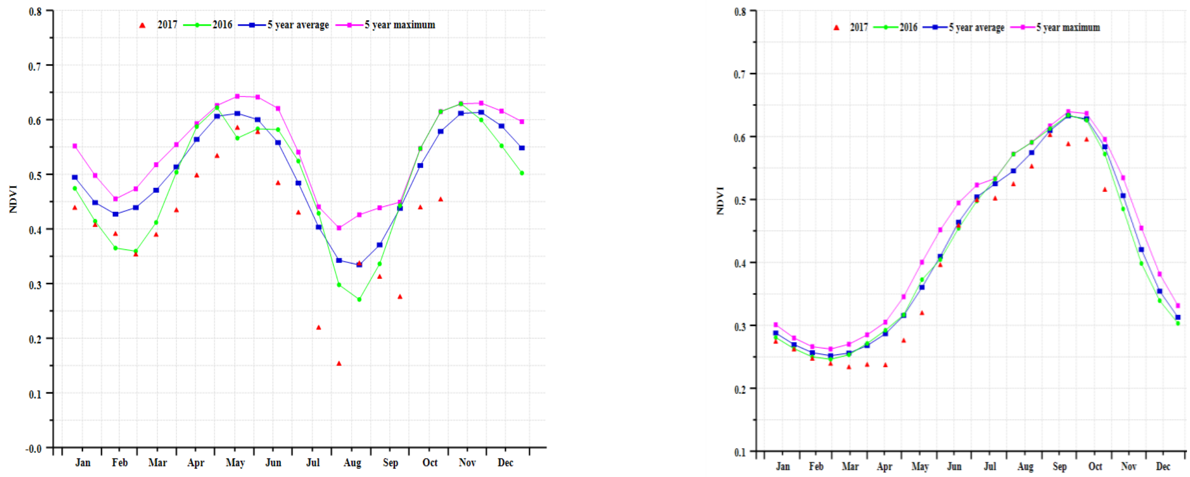


(d) Spatial NDVI patterns compared to 5YA

(e) NDVI profiles



(f) Crop condition development graph based on NDVI (Soudano-sahelian region (left) and Derived savanna zone region (right))



(g) Crop condition development graph based on NDVI (Humid forest zone region (left) and Guinean savanna region (right))

Table 3.53. Nigeria agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, July-October 2017

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m2)	Departure from 15YA (%)
Sudano Sahelian	606	5	28.2	-0.7	1211	-5
Derived savana	880	0	25.8	-0.8	938	-2
Humid forest Zone	1216	3	25.9	-0.5	786	-8
Guinean savanna	769	2	26	-0.9	1077	-3

Table 3.54. Nigeria, agronomic indicators by sub-national regions, current season's values and departure from 5YA, July-October 2017

Region	BIOMASS		Cropped arable land fraction		Maximum VCI
	Current (gDM/m2)	Departure from 5YA (%)	Current	Departure from 5YA (%)	Current
Sudano Sahelian	1572	0	84	-1	0.88
Derived savana	2079	-1	99	0	0.91
Humid forest zone	2382	1	97	1	0.85
Guinean savanna	1900	-3	99	0	0.91

Table 3.55. CropWatch-estimated maize and rice production for Nigeria in 2017 (thousand tons)

Crops	Production 2016	Yield variation (%)	Area variation	Production 2017	Production variation (%)
Maize	10770	380.00%	-10.00%	11165	370.00%
Rice	4588	190.00%	20.00%	4904	210.00%

[PAK]Pakistan

The reporting period for this bulletin corresponds to Pakistan's maize and rice crop planting, growth, and harvesting. From July to October, the country received 293 mm rainfall, which was 4% above the fifteen-year average. Temperature, at 27.0°C, was 0.3°C below average, while radiation, at 1159 MJ/m2, dropped by 3%. As a result, the biomass production potential is estimated to be 616 gDM/m2, a drop of 6% compared to average. Similarly, the NDVI profile on the national level mostly followed the average line, occasionally dropping below it. For the country as a whole, CALF was 5.4% above average, but VCIx was still poor at 0.7 indicating just average crop condition in the country.

Regional analysis

For a more detailed spatial analysis, CropWatch subdivides Pakistan into three agro-ecological regions based essentially on geography and agroclimatic conditions: the Lower Indus basin, the northern highlands, and the northern Punjab region.

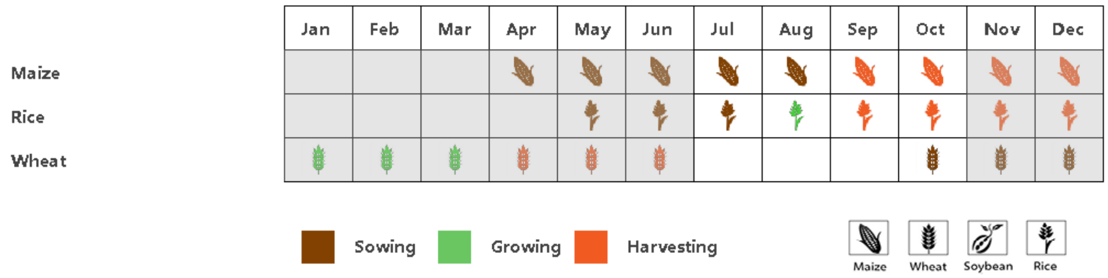
The rainfall recorded in the **Lower Indus basin** reached 296 mm, which was 38% above average. Temperature here was average, but radiation was significantly below average (-5%) to the extent that the estimated BIOMSS departure of -1% compared to the five-year average is probably optimistic, even considering that the vast majority of crops is irrigated. Crop condition development as seen from NDVI was nearly average during the period. The CALF of 61% and a VCIx of 0.87 also indicate average crop condition. Overall, the situation for the region is assessed as marginally below average.

With a recorded amount of 333 mm, rainfall in the **northern highland region** was 11% below average. Radiation was low compared to average (RADPAR -4%) but temperature was close to average (-0.2°C). Accordingly, the biomass accumulation potential dropped 13% below average. The region also achieved a low CALF of 54%, representing a slight increase (+2%) over 2016. Crop condition development, which was initially close to average, declined from the middle of September. Large parts in the region show VCIx values below 0.8, indicating mixed crop prospects. Overall, the situation for the region is assessed as marginally below average.

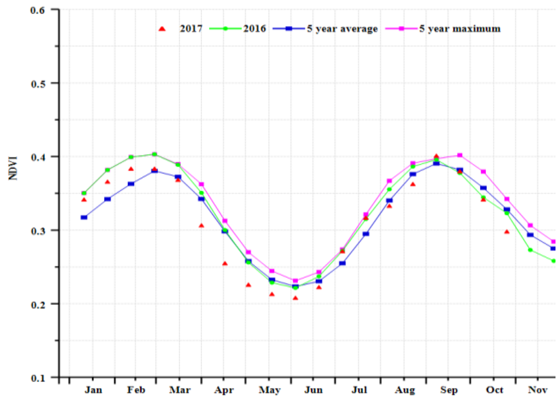
Northern Punjab, the main agricultural region in Pakistan, received 445 mm of rainfall over the reporting period, which is 4% above the average. At 29.4°C, temperature was slightly below average, while the radiation departure was -3%. The resulting BIOMSS therefore fell 4% below the recent five-year average. The area had a good CALF of 81% (up 4% over 2016) and a VCIx of 0.88. Crop condition assessed through NDVI mostly followed the average profile. Overall, the crop production potential for the region is deemed to be just average.

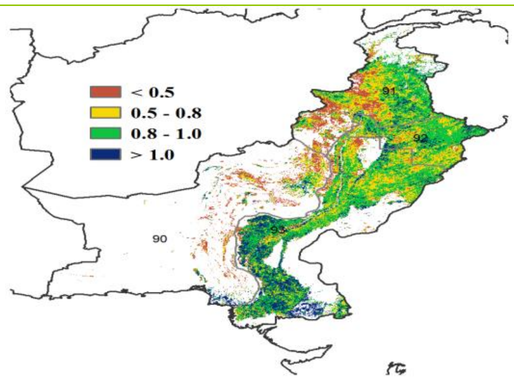
In summary, CropWatch assesses the production of the major cereals in Pakistan as just average or slightly below average, and at the same level as during 2016.

Figure 3.23. Pakistan crop condition, July-October 2017

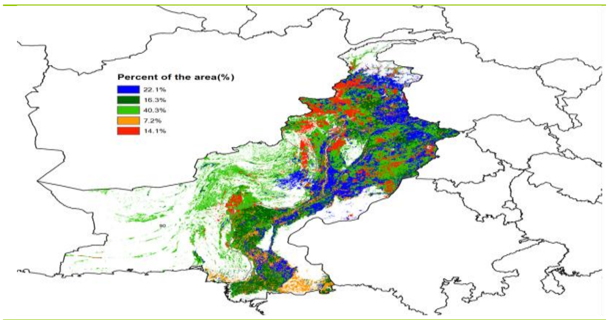


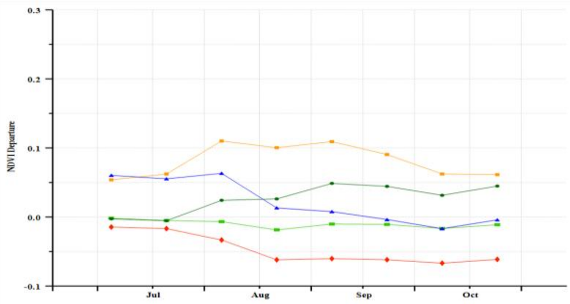
(a). Phenology of major crops



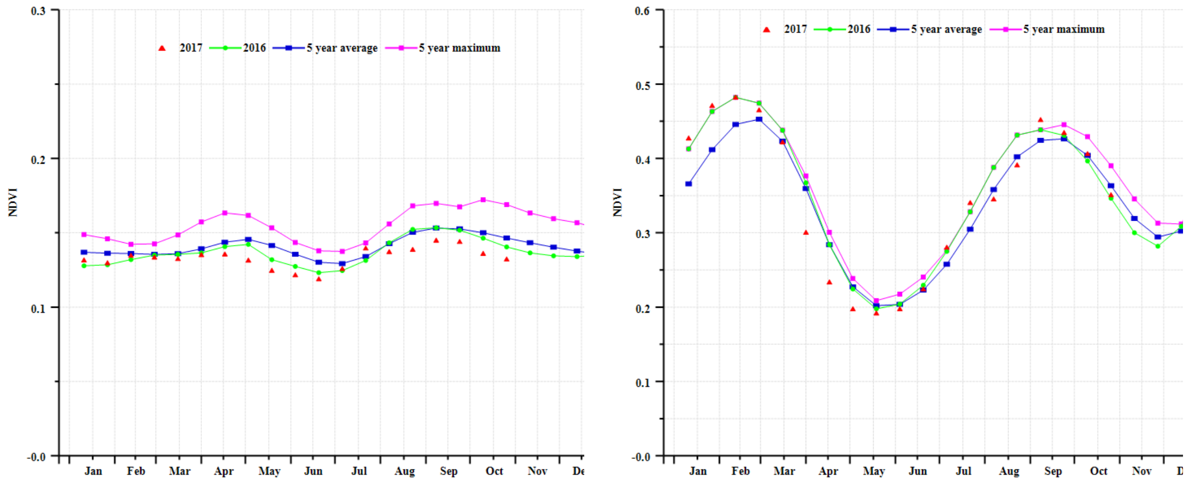


(b) Crop condition development graph based on NDVI (c) Maximum VCI

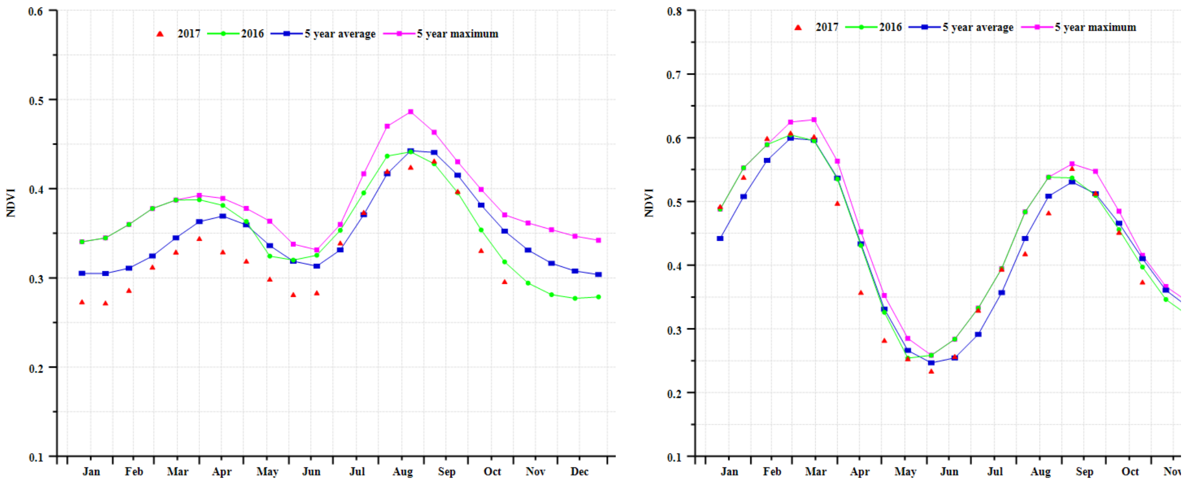




(d) Spatial NDVI patterns compared to 5YA (e) NDVI profiles



(f) Crop condition development graph based on NDVI (Balochistan Non-agricultural Region (left) and Lower Indus River Basin (right))



(g) Crop condition development graph based on NDVI (Northern Highland (left) and Northern Punjab (right))

Table 3.56. Pakistan agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, July-October 2017

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m2)	Departure from 15YA (%)
Northern highland (Pakistan)	333	-11	23.3	-0.2	1113	-4
Northern Punjab (Pakistan)	445	4	29.4	-0.6	1071	-3
Lower Indus river basin (Pakistan)	296	38	31.2	-0.5	1130	-5

Table 3.57. Pakistan, agronomic indicators by sub-national regions, current season's values and departure from 5YA, July-October 2017

Region	BIOMSS		CALF		Maximum VCI
	Current (gDM/m2)	Departure from 5YA (%)	Current (%)	Departure from 5YA (%)	Current
Northern highland (Pakistan)	947	-13	54	2	0.71
Northern Punjab (Pakistan)	1103	-4	81	4	0.88
Lower Indus river basin (Pakistan)	572	-1	61	8	0.87

Table 3.58. CropWatch-estimated maize, rice, and wheat production for Pakistan in 2017 (thousand tons)

Crops	Production 2016	Yield variation (%)	Area variation (%)	Production 2017	Production variation (%)
Maize	4528	0.10%	8.20%	4904	0.1
Rice	9142	3.60%	4.50%	9904	0.1
Wheat	24638	0.50%	-1.90%	24283	0

[PHL] The Philippines

In the Philippines, harvesting of the main season is currently underway. According to the NDVI profiles for the country, crops generally showed unfavorable condition during the current monitoring period. Rainfall was above average (RAIN +12%), accompanied by a slight increase in temperature over average (TEMP +0.7ºC) and somewhat low radiation (RADPAR -3%). The increase in rainfall resulted in BIOMSS being 7% above average.

Based on the VCIx values, favorable crop conditions prevailed as the value mostly exceeded 0.90. VCIx levels by region were 0.95 in the forest region, 0.94 in the hilly agriculture region, and 0.96 in the lowland agriculture region. The cropped arable land fraction (CALF) nation-wide was almost 100%. Considering the spatial patterns of NDVI profiles, 97.7% of the cropped area experienced above average conditions for the entire period, from July to October. Conditions in July, however, suddenly dropped below average, but it cannot be excluded, however, that this drop stems from an unknown artifact or perhaps a typhoon. The Philippines in fact experienced several typhoons, starting with Nesat (also known as Gorio) at the end of July, Hato (Isang) in late August, Doksuri (Marig) in mid-September, and Khanum (Odette) in mid-October (see also Chapter 5, section on disasters). Altogether, the outputs for maize and rice in the country are expected to be about average.

Regional analysis

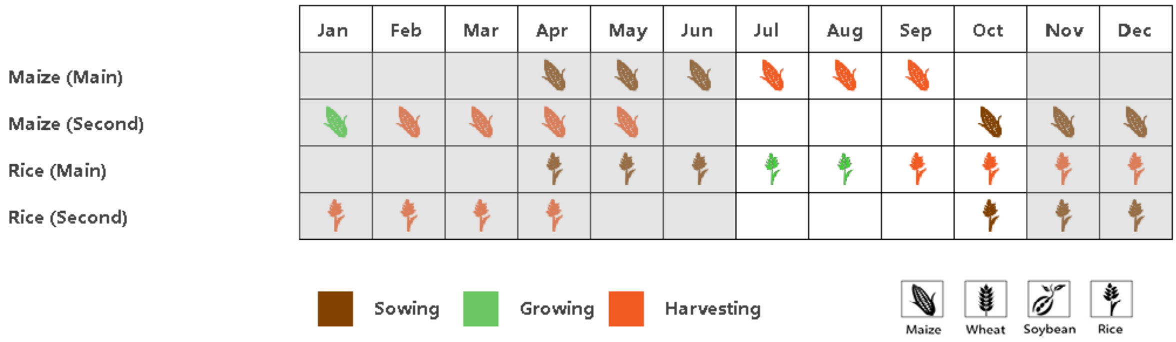
Based on cropping systems, climatic zones, and topographic conditions, three main agro-ecological regions can be distinguished for the Philippines. They are the lowlands agriculture region, the hilly agriculture region, and the forest region.

The **lowlands agriculture region** experienced normal rainfall (RAIN +3%) and somewhat weak radiation (RADPAR 2%) and temperature (TEMP -0.6°C). The biomass production potential was +4% compared to the average for the period and region. Regional CALF is 100%, and the VCIx was good at 0.96. Altogether, the outputs for maize and rice are expected to be at least average.

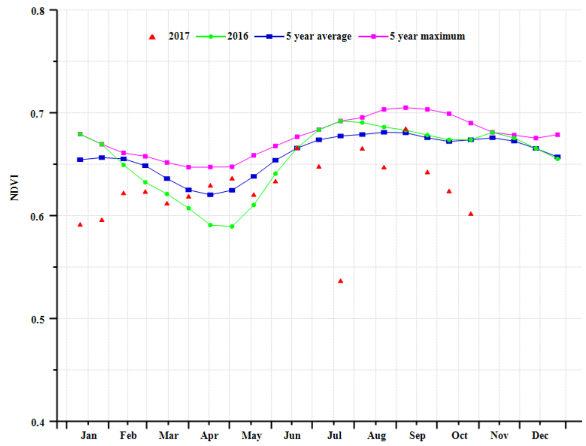
The **hilly agriculture region** recorded above average rainfall (RAIN, +10%), low radiation (RADPAR -4%), and high temperature (TEMP +1.8°C), leading to an expected biomass production potential (BIOMSS) of about 7% above average. With a CALF of 99% and good VCIx (0.94), the outputs of the maize and rice seasons are expected to be average or slightly below due to the combination of poor sunshine and high temperature.

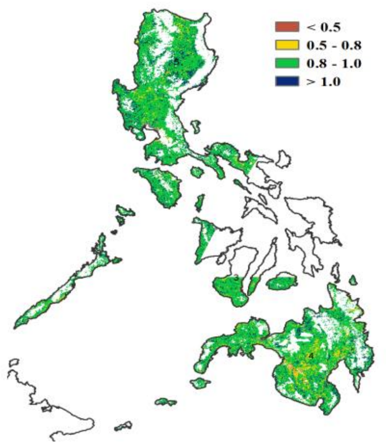
The highest rainfall departure was recorded for the **forest region** (RAIN, +28%). Temperature here was normal, as was radiation. BIOMSS is 11% above the five-year average. A high CALF (100%) and good VCIx (0.95) should result in above average maize and main rice seasons.

Figure 3.24. Philippines crop condition, July-October 2017



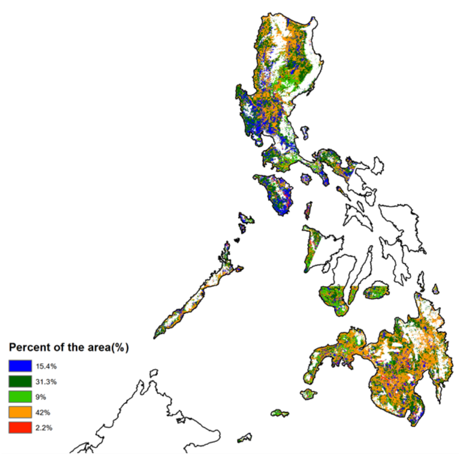
(a). Phenology of major crops

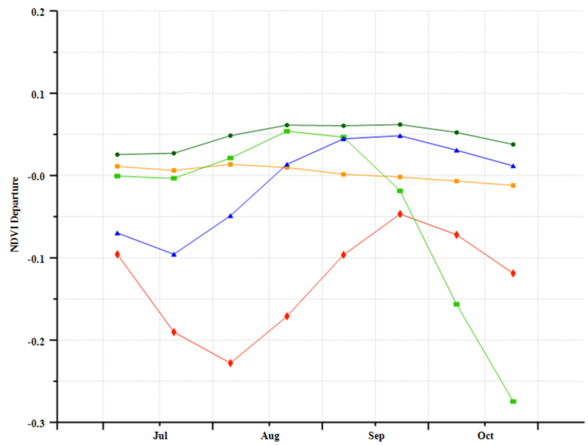




(b) Crop condition development graph based on NDVI

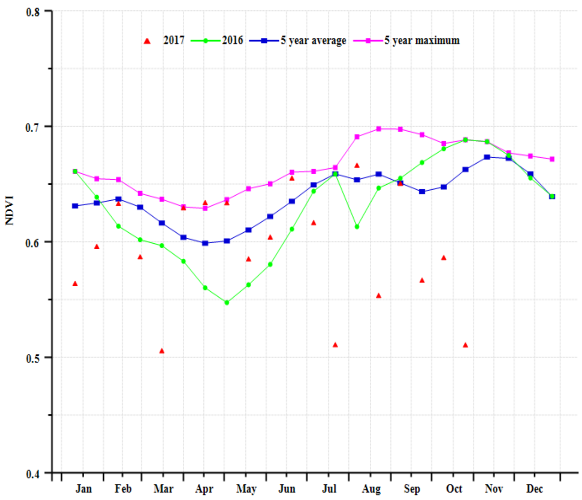
(c) Maximum VCI

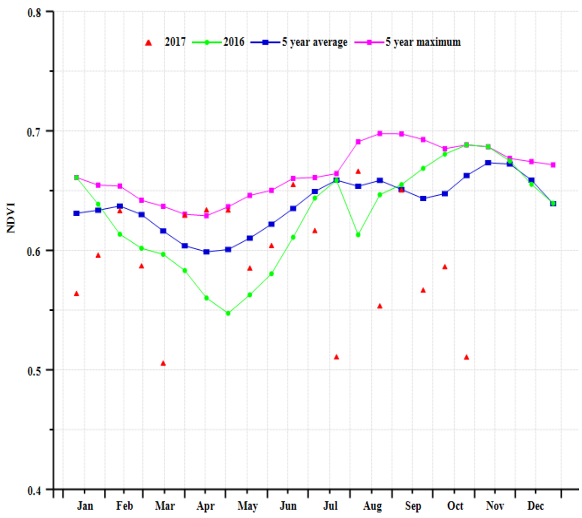




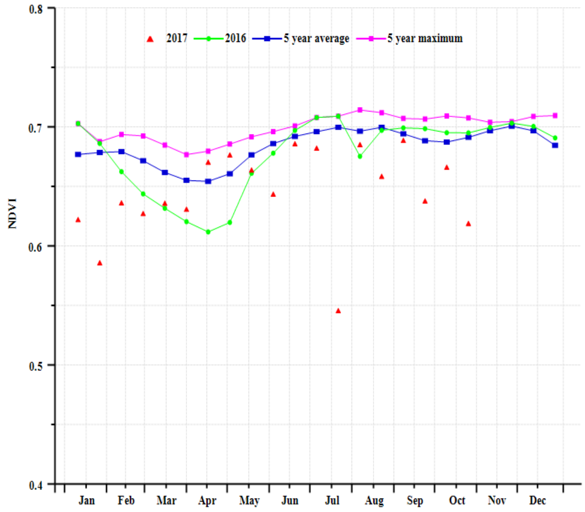
(d) Spatial NDVI patterns compared to 5YA

(e) NDVI profiles





(f) Crop condition development graph based on NDVI (Lowland agriculture region (left) and Hilly agriculture region (right))



(f) Crop condition development graph based on NDVI (Forest region (right))

Table 3.59. Philippines agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, July-October 2017

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m2)	Departure from 15YA (%)
Lowland agriculture region	1465	3	26.1	0.6	987	-2
Hilly agriculture region	1179	10	26.7	1.8	992	-4
Forest fegion	1167	28	26.1	0.6	1006	-5

Table 3.60. Philippines agronomic indicators by sub-national regions, current season's values and departure from 5YA, July-October 2017

Region	BIOMSS		Cropped arable land fraction		Maximum VCI
	Current (gDM/m2)	Departure from 5YA (%)	Current	Departure from 5YA (%)	Current
Lowland agriculture region	2416	4	1	0	0.96
Hilly agriculture region	2471	7	0.99	0	0.94
Forest region	2376	11	1	0	0.95

Table 3.61. CropWatch-estimated maize and rice production for Philippines in 2017 (thousand tons)

Crops	Production 2016	Yield variation	Area variation	Production 2017	Production variation
Maize	7565	0.90%	0.00%	7626	0.80%
Rice	20106	0.50%	-0.10%	20188	0.40%

[POL] Poland

Maize in Poland is grown between June and September. July also is the harvest of winter wheat, while in August spring wheat is harvested. Finally, from August to October, winter wheat is being planted.

Over the reporting period, the cropped arable land fraction (CALF) in the country was nearly 100%, remaining the same as the average of the last five years. Both temperature and radiation were below average (TEMP, -0.5°C and RADPAR a significant -8%), while rainfall (RAIN) was up 56% compared to average. The potential biomass production estimate (BIOMSS) increased 40%, mainly in response to rainfall, while the low sunshine may have limited it. As shown in the NDVI crop condition development graphs, the NDVI in Poland was below average when compared to the previous season, especially from July to September. By October, NDVI was close to average. Compared to last five years, NDVI was above average during the reporting period. The VCIx is 0.96 for the whole country.

Overall, the crop condition in Poland is assessed by CropWatch to be average or above.

Regional analysis

Based on the Global Agro-Ecological Zones (GAEZ) map, Poland can be divided into three cropping regions, namely a cold and mesic forest zone, which occupies the northeast of the country; a cool temperate and dry zone (the largest zone); and a cool temperate and moist zone, located in the south and southwest of the country. As shown in the tables, the departure of biomass is consistent with the departure of rainfall in the three zones.

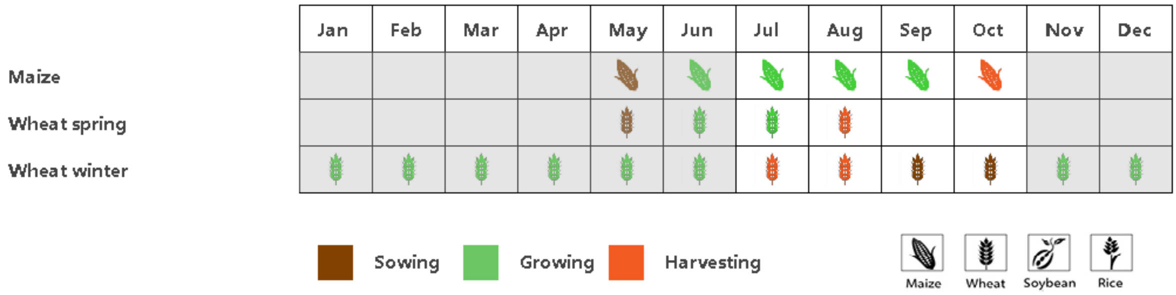
The **cold and mesic forest zone** experienced above rainfall (RAIN +47%), weak radiation (RADPAR, -11%) and temperature (TEMP, -0.5°C), while the biomass production potential is above (BIOMSS, +38%). CALF in this zone was close to 100%. and the VCIx was good at 0.98.

In the **cool temperate and dry zone**, agroclimatic indicators show an increase of rainfall over average (RAIN, +59%) and a marked decline of radiation (RADPAR, -8%). Temperature was below average (TEMP, -0.5°C), while the biomass production potential is above (BIOMSS, +42%). CALF in this zone was close to 100%.

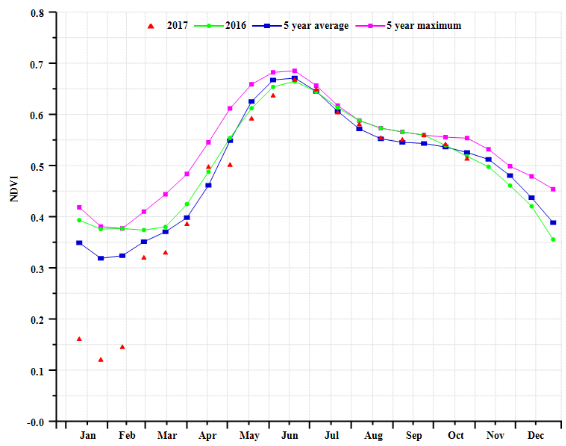
Cool temperate and moist zone was the lowest zone with above rainfall (RAIN +37%), weak radiation (RADPAR, -4%) and temperature (TEMP, -0.3°C). The biomass production potential was +26% compared to the average. Regional CALF is 100%, and the VCIx was good at 0.91.

Overall, both crop condition and BIOMSS were above average across the three zones due to sufficient rainfall in the monitoring period, pointing to an estimated yield and production in 2017 that both increase over 2016.

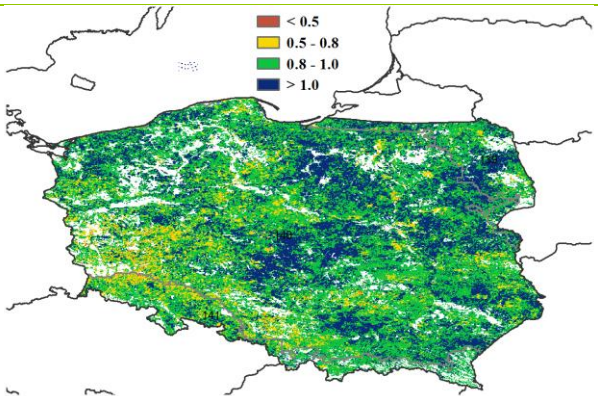
Figure 3.25. Poland crop condition, July-October 2017



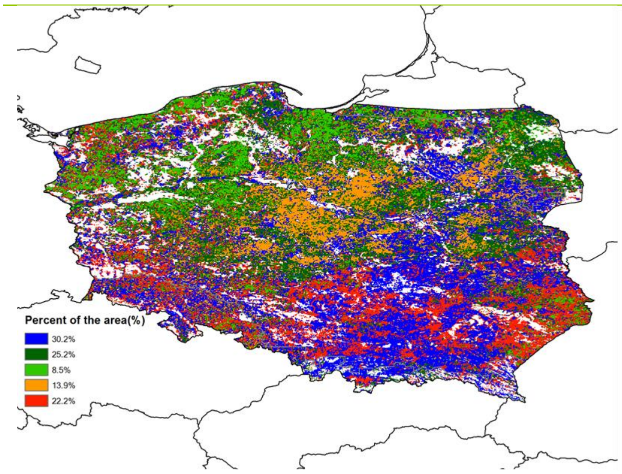
(a). Phenology of major crops



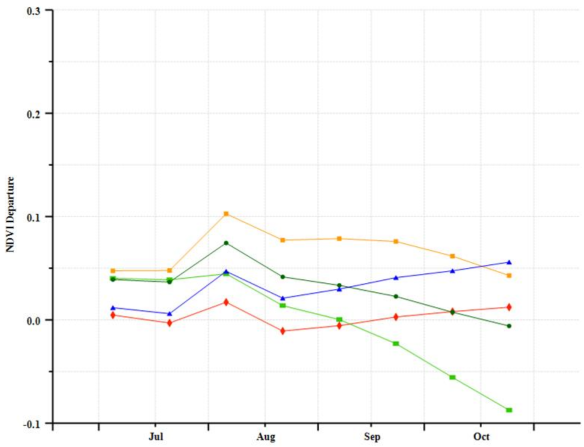
(b) Crop condition development graph based on NDVI



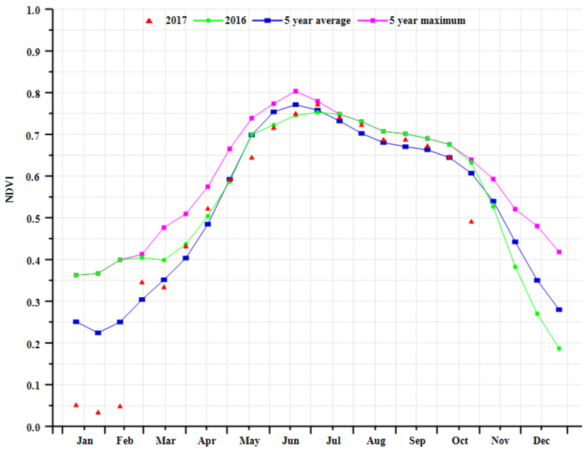
(c) Maximum VCI

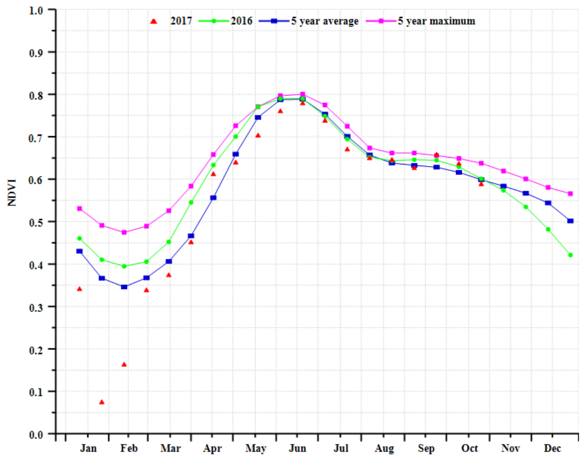


(d) Spatial NDVI patterns compared to 5YA

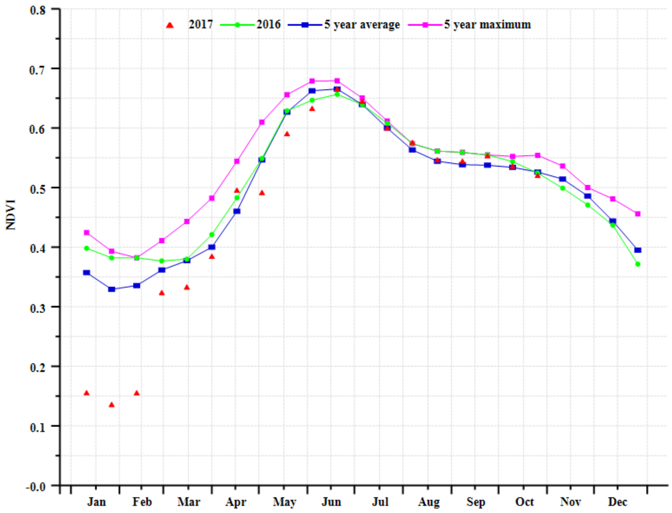


(e) NDVI profiles





(f) Crop condition development graph based on NDVI (Cold and mesic forest zone (left) and Cool temperate and moist zone (right))



(g) Crop condition development graph based on NDVI (Cool temperate and dry zone)

Table 3.62. Poland agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, July-October 2017

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m2)	Departure from 15YA (%)
Cold and mesic forest zone	381	47	14.2	-0.5	696	-11
Cool temperate and dry zone	386	59	15.1	-0.5	738	-8
Cool temperate and moist zone	398	37	14.7	-0.3	785	-4

Table 3.63. Poland agronomic indicators by sub-national regions, current season's values and departure from 5YA, July-October 2017

Region	BIOMSS		Cropped arable land fraction		Maximum VCI
	Current (gDM/m2)	Departure from 5YA (%)	Current	Departure from 5YA (%)	Current
Cold and mesic forest zone	1456	38	100	0	0.98
Cool temperate and dry zone	1438	42	100	0	0.96
Cool temperate and moist zone	1467	26	100	0	0.91

Table 3.64. CropWatch-estimated wheat production for Poland in 2017 (thousand tons)

Crops	Production 2016	Yield variation	Area variation	Production 2017	Production variation
Wheat	10704	2.10%	0.00%	10931	2.10%

[ROU] Romania

During the reporting period, maize and spring wheat in Romania were harvested from September, while winter wheat sowing started around the same time. Overall crop condition in the country was fair (VCIx = 0.86). Rainfall was somewhat below average (RAIN -8%) with abundant sunshine (RADPAR 7%) and average temperature. Compared with 2016, maize yield is expected to increase by 3.6%, while wheat yield shows a small decrease (-0.1%). The expected change in area for the maize, compared to last year, is 0.7%, while the wheat area is expected to remain the same (0.0%). Production of maize is also projected to increase, while wheat remains unchanged.

Regional analysis

aMore spatial detail is provided for three main agro-ecological zones in the country; they are the **west region**, the **middle region**, and a **south and east plain region**.

Crop condition was below average in all three regions, and especially so in the south and east plain region where, according to the NDVI development profile, values dropped markedly after July, possibly resulting from the drop in rainfall. In other regions, such as the west region and the northern part of the country, NDVI remained stable through the monitoring period. According to CALF values in the three regions, nearly all fields were cultivated (CALF close to 100%).

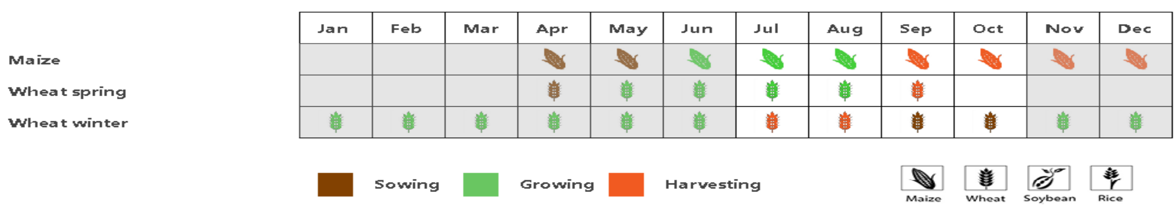
All three regions suffered from a mild rainfall (RAIN) deficit compared with average: west region -5%, middle region -7%, and the south and east plain region -10%. Winter wheat, the main crop sowed in September, may require additional precipitation.

Temperature was average in the three regions, but sunshine increased markedly: RADPAR +5% in the west region and +6% in the other two. These changes may to some extent compound the shortage of rain by increasing crop water consumption. BIOMSS changes for the regions vary between -1% and -4%. More significant impacts are also likely as a result of the increased sunshine, both for the summer crops (maize and spring wheat, harvested since September) and the forthcoming winter crops.

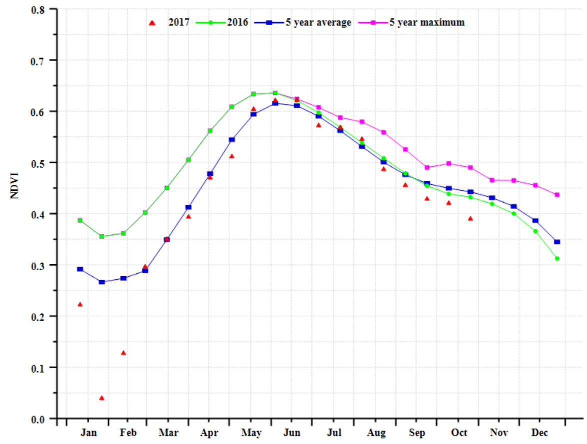
All three regions of Romania enjoyed high VCIx values in excess of 0.85. For the west region, crop condition was not so good near the western border (VCIx near 0.5), while in the agriculturally less important middle region, indicators were rather satisfactory. For the south and east plain, crop condition was not favorable (VCIx close to or below 0.5).

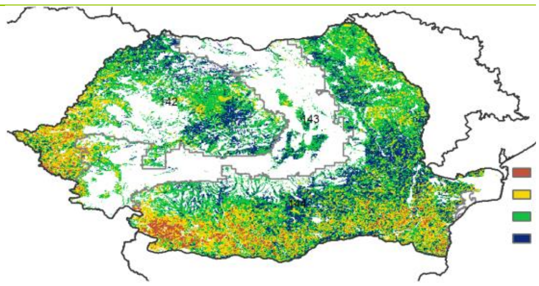
Overall, crop prospects for Romania remain fair. As for the prospects for winter wheat, they much depend on future rain.

Figure 3.26. Romania crop condition, July-October 2017



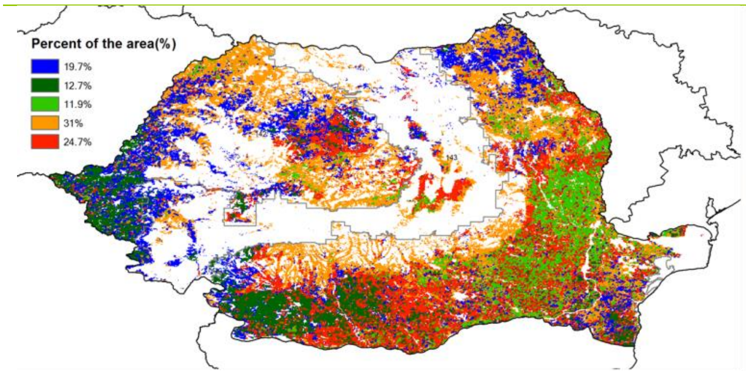
(a). Phenology of major crops

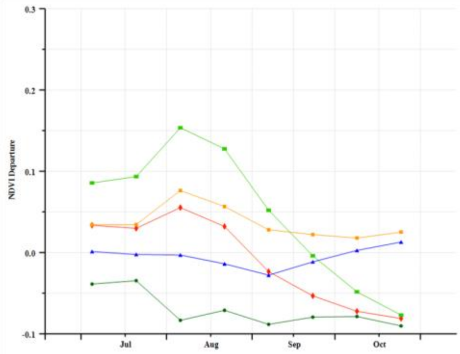




(b) Crop condition development graph based on NDVI

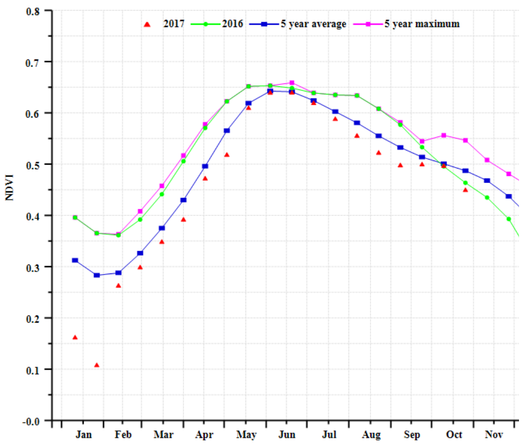
(c) Maximum VCI

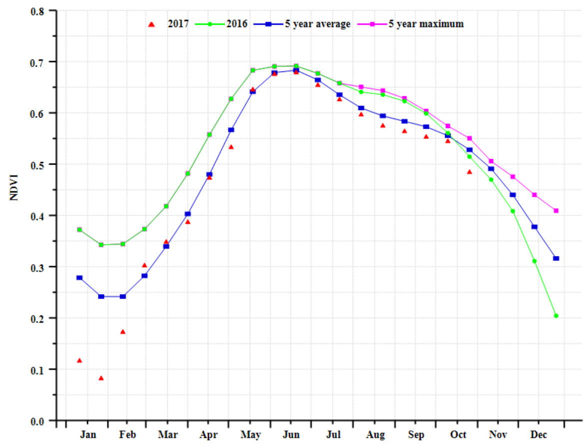




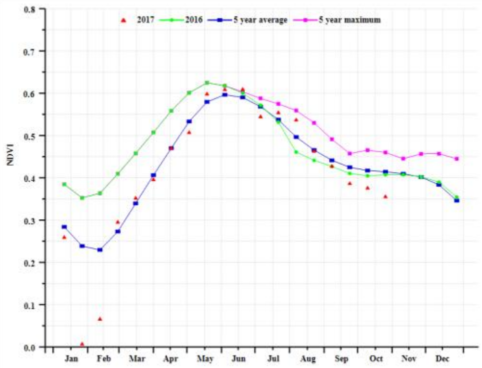
(d) Spatial NDVI patterns compared to 5YA

(e) NDVI profiles





(f) Crop condition development graph based on NDVI (West Region (left) and Middle Region (right))



(f) Crop condition development graph based on NDVI (South&East Plain (right))

Table 3.65. Romania agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, July-October 2017

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m2)	Departure from 15YA (%)
West region	281	-4.92	17	0.06	1006	6.08
Middle region	298	-6.87	14	-0.1	987	5.15
South and east plain	229	-9.77	19	-0.09	1032	6.19

Table 3.66. Romania agronomic indicators by sub-national regions, current season's values and departure from 5YA, July-October 2017

Region	BIOMSS		Cropped arable land fraction		Maximum VCI
	Current (gDM/m2)	Departure from 5YA (%)	Current	Departure from 5YA (%)	Current
West region	1080	-2	1	0	0.88
Middle region	1138	-1.34	1	0	0.9
South and east plain	915	-3.64	1	1	0.85

Table 3.67. CropWatch-estimated maize and wheat production for Romania in 2017 (thousand tons)

Crops	Production 2016	Yield variation	Area variation	Production 2017	Production variation
Maize	11491	3.60%	0.70%	11986	4.30%
Wheat	7675	-0.10%	0.00%	7670	-0.10%

[RUS] Russia

Russia experienced favorable climate conditions (VCIx=0.96) during the current reporting period. During the reporting period, the winter wheat harvest began in July, while the harvest of maize started in August. Also in August, spring wheat started to be sowed. The cropped arable land fraction for Russia was 2% above its five-year average for the period. In general, the country experienced cool and wet conditions over the recent four months. Compared with average, precipitation had a small increase (RAIN +8%) while temperature and radiation were somewhat lower (-0.7°C and -2%, respectively). Mainly due to weather condition, the BIOMSS indicator increased by 5% nationwide compared to the five-year average.

As shown in the NDVI crop condition development graph for the country, the values exceed the recent five-year average in July, the time of the biomass peak when maize and wheat are close to maturity. Crop condition was generally favorable in most parts of Russia’s croplands. Compared with the previous season, maize and wheat production are expected to increase (+3.9% and +2.4%, respectively).

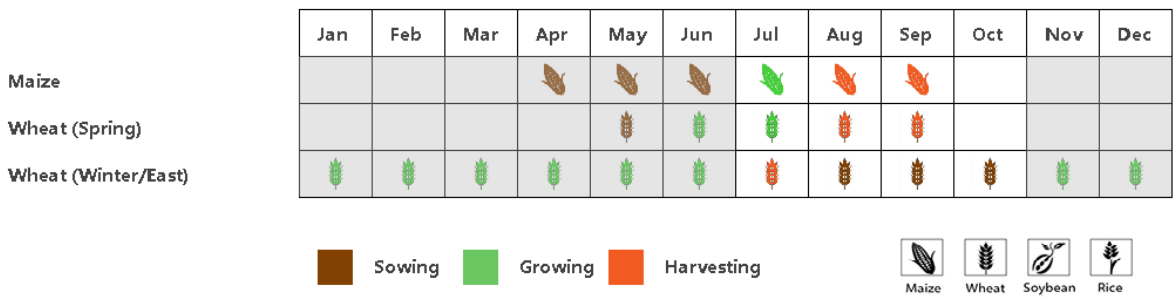
Regional analysis

A more detailed analysis is provided for seven agro-ecological zones, namely the Kalingrad region (94), Caucasus (95), Volga region (97), central region (100), southern Urals (99), south Siberia (98), and the northwest region (101). The numbers correspond to the labels on the VCIx map.

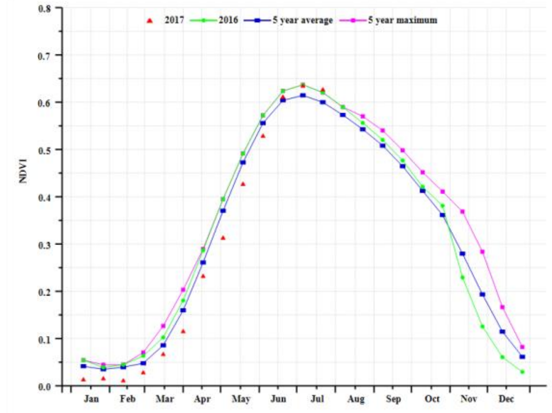
In **Kalingrad, Volga, southern Siberia, central**, and **northwest** regions, patterns are close to the national one, that is: weather conditions were favorable for crops. Rainfall is abundant and varied from + 6% to +76%. The NDVI values in those areas (see the map of spatial NDVI patterns) are higher than usual in June and July. In **Kalingrad** and the **northwest region,** the excess of rainfall was significant (between +41% and +76%) and accompanied by cool temperature and very low sunshine (up to -13% RADPAR). The NDVI values in those areas are lower than last year due to complicated climate conditions.

Unlike most of Russia, the **Caucasus** and **southern Urals** regions experienced a shortage of rainfall (RAIN -16% and -13% respectively, compared with the average), with BIOMSS decreasing accordingly (-10% and -8%). NDVI also decreased in about 13.2% of Russia's arable land.

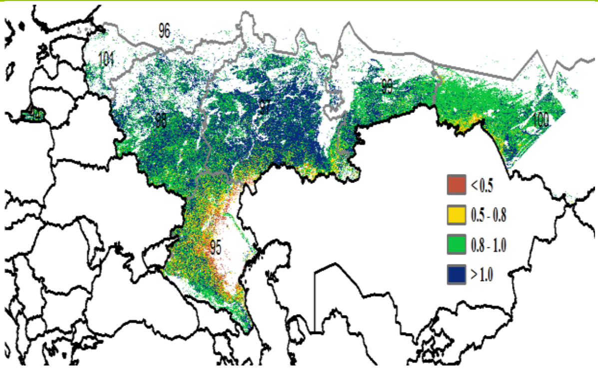
Figure 3.27. Russia crop condition, July-October 2017



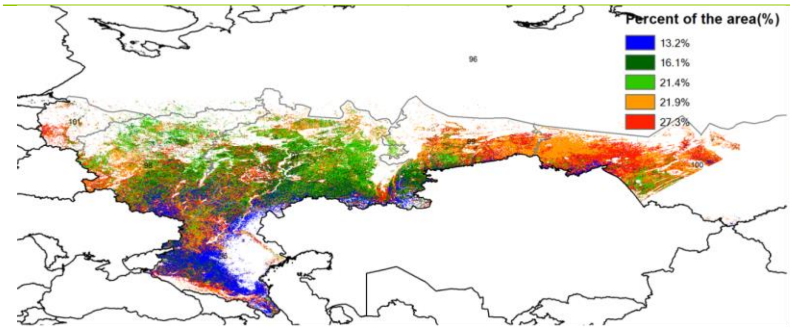
(a). Phenology of major crops



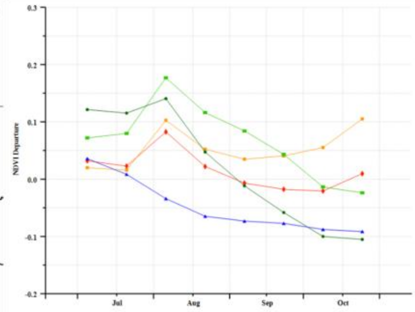
(b) Crop condition development graph based on NDVI



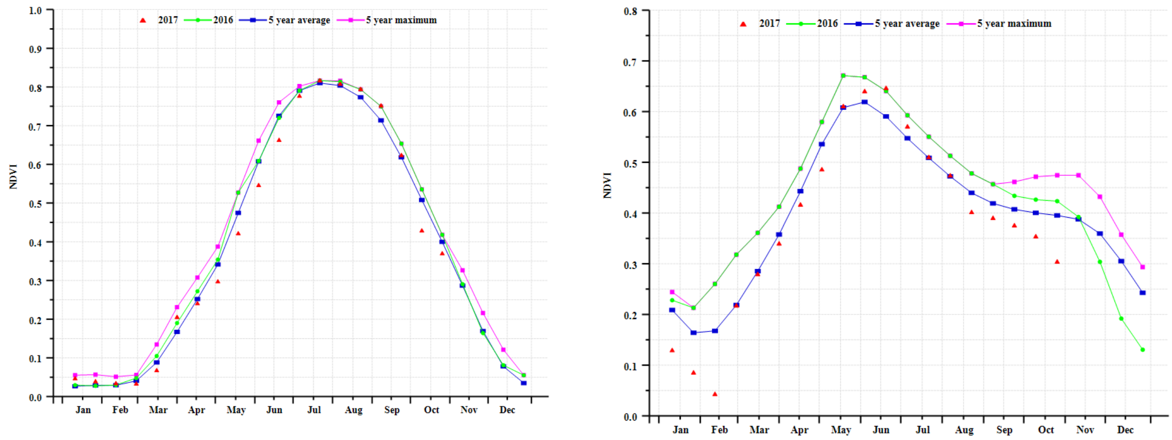
(c) Maximum VCI



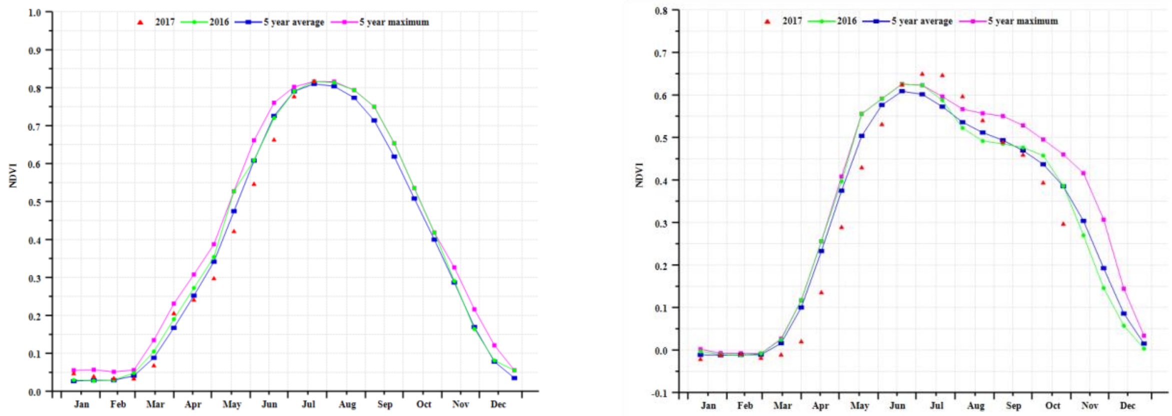
(d) Spatial NDVI patterns compared to 5YA



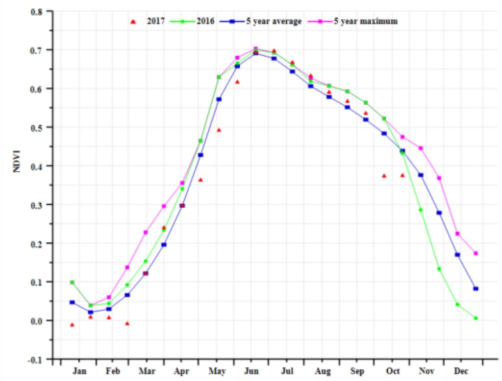
(e) NDVI profiles

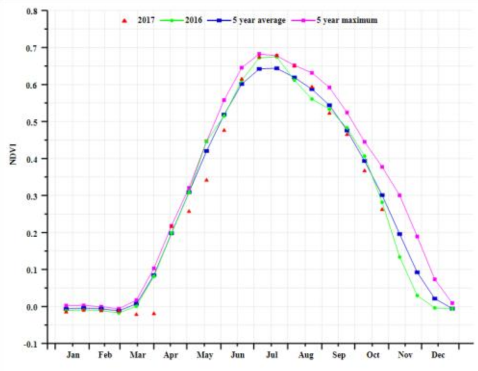


(f) Crop condition development graph based on NDVI (Kalingrad (left) and Caucasian (right))

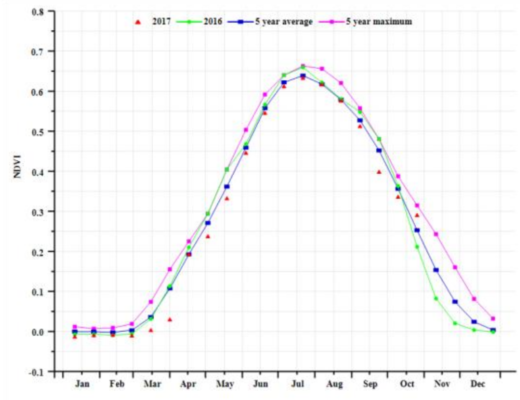


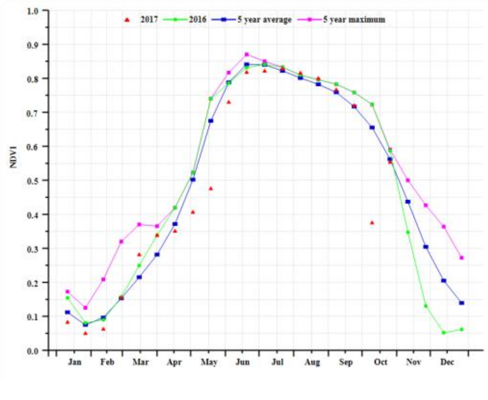
(g) Crop condition development graph based on NDVI (North Subarctic area (left) and Volga (right))





(h) Crop condition development graph based on NDVI (Central area (left) and South Urals area (right))





(i) Crop condition development graph based on NDVI (South Siberian area (left) and Northwest area (right))

Table 3.68. Russia agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, July-October 2017

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m2)	Departure from 15YA (%)
Kalingrad (Russia)	506	76	14.4	-0.4	704	-9
Caucasus (Russia)	169	-16	19.5	0.3	1024	6
Volga (Russia)	239	10	13.6	-0.8	786	-2
Central area (Russia)	278	11	13.7	-0.7	742	-5
Southern Urals area (Russia)	197	-13	11.8	-1.1	759	0
South Siberian area (Russia)	274	13	10.3	-0.9	807	-3
Northwest area (Russia)	396	41	12.3	-1.2	619	-13

Table 3.69. Russia agronomic indicators by sub-national regions, current season's values and departure from 5YA, July-October 2017

Region	BIOMSS		Cropped arable land fraction		Maximum VCI
	Current (gDM/m2)	Departure from 5YA (%)	Current	Departure from 5YA (%)	Current
Kalingrad (Russia)	1686	45	100%	0	0.94
Caucasus (Russia)	715	-10	86%	7	0.83
Volga (Russia)	976	5	99%	4	1.02
Central area (Russia)	1158	10	100%	0	0.99
Southern Urals area (Russia)	891	-8	100%	1	0.98
South Siberian area (Russia)	1086	8	98%	1	0.93
Northwest area (Russia)	1497	29	1	0	1

Table 3.70. CropWatch-estimated maize, rice, wheat and soybean production for Russia in 2017 (thousand tons)

Crops	Production 2016	Yield variation	Area variation	Production 2017	Production variation
Maize	12337	3.90%	0.00%	12817	3.90%
Wheat	57506	2.70%	-0.20%	58912	2.40%

[THA] Thailand

The monitoring period covers the end of the southeast Asian monsoon season in Thailand. The maize harvest was completed in September, while the main rice crop was sown in July and harvested in October.

At the national level, agroclimatic indices show that radiation (RADPAR -3%) and temperature (TEMP -0.26°C) were below average, while accumulated rainfall (RAIN +12%) was above. Although the production potential (BIOMSS) increased 8%, crop condition is not favorable according to the NDVI development graph for the national level. According to the NDVI profiles, crop condition was below average at he beginning of the monitoring period in 65.6% of cropped areas. It then improved after mid-August in parts of the **single-cropped rice** and **horticulture** areas, representing 37.2% of croplands. Other parts of the **horticulture** area as well as the **double and triple-cropped rice** area were slightly below average in terms of crop condition throughout the monitoring period, together representing 26.9% of cropped areas. Persistently poor conditions, worsening even after July, are confined to 1.5% of croplands in the **single-cropped rice** area and the **double and triple-cropped rice** area.

Regional analysis

The regional analysis below focuses on some of the already mentioned agro-ecological zones of Thailand, of which some are defined by the rice cultivation typology in the area. Agro-ecological zones include the **double and triple-cropped rice** area (109) in the center of the country, the **mountain** area (108) in the west, south, and north of the country, the **horticulture** area (107) in the east, and the **single-cropped rice** area (106) in the northeast. The numbers correspond to the labels in the VCIx and NDVI profile maps.

Indicators for the **double and triple-cropped rice** area follow the same patterns as those for the country as a whole: temperature was average, radiation slightly below (RADPAR -2%), and accumulated rainfall was in excess (RAIN +26%), resulting in the largest biomass production potential increase in Thailand (BIOMSS +14%). The NDVI development graph, however, shows that crop condition was unfavorable in this region due to excess precipitation and reduced sunshine. This is confirmed by the VCIx map and applies particularly to Phitsanulok, Phichit, Samut Sakhon, and Samut Songkhram. Overall, the situation was below but close to average.

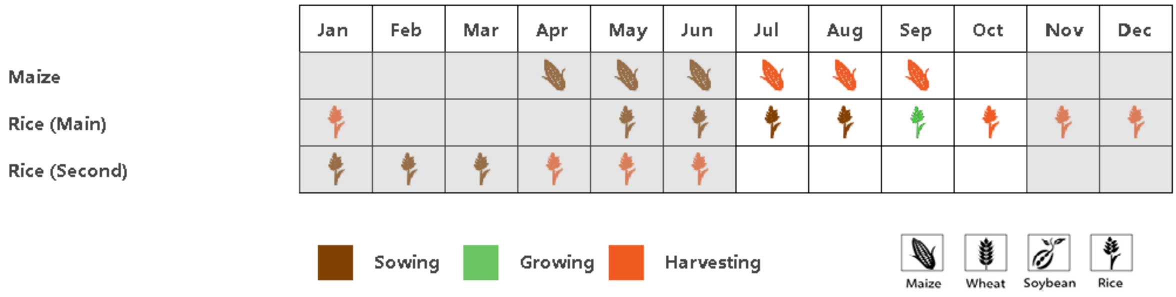
Conditions were very close to average in the **mountain region**: RAIN +1%, TEMP + 0.2°C, RADPAR -2%, and BIOMSS +3% when compared to the five-year average. According to the NDVI development graph, crop condition was below average, while the NDVI profiles show that most of this region was slightly above average. Overall, the situation was slightly above but close to average.

The **horticulture** area was the only agro-ecological region in Thailand that recorded a slight negative anomaly for all indicators: RAIN -8%, TEMP -0.3°C, and RADPAR -1%. The VCIx map, NDVI development graph, and BIOMSS indicators (-1%) all lead to the conclusion that crop condition was close to average.

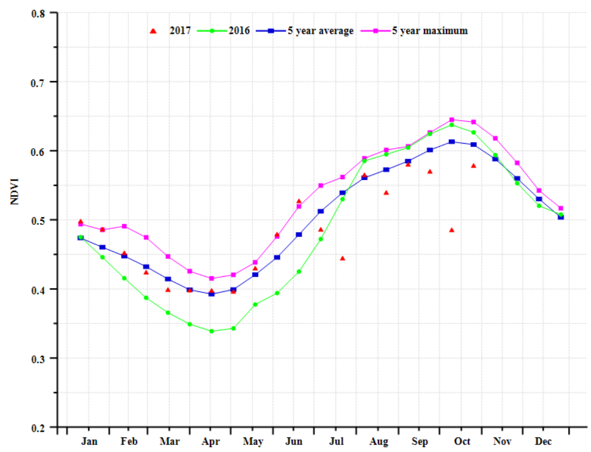
Finally, the situation in the **single-cropped rice** area was comparable to that of the country as a whole: rainfall was above average (RAIN +22%) with lower temperature (TEMP -0.6°C) and radiation (RADPAR -4%). BIOMSS (+11%) shows above average values. The NDVI development graph shows that crop condition was below average, probably due to excess water and low sunshine. According to the NDVI profiles, crop condition in most of this region was close to average.

At the national level, most arable land was cropped during the season and had favorable VCIx values around 0.9. CropWatch projections are that the production of maize and rice will slightly decrease compared to last year's output.

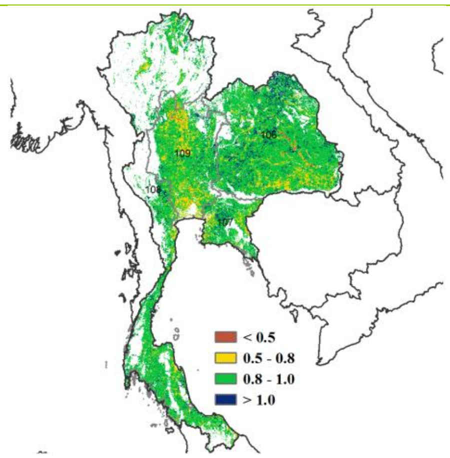
Figure 3.28. Thailand crop condition, July-October 2017



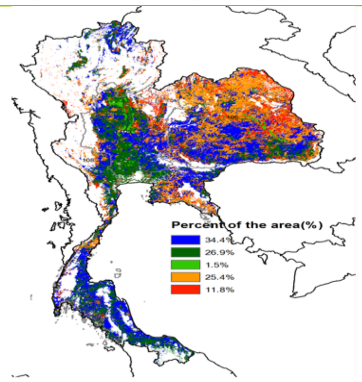
(a). Phenology of major crops



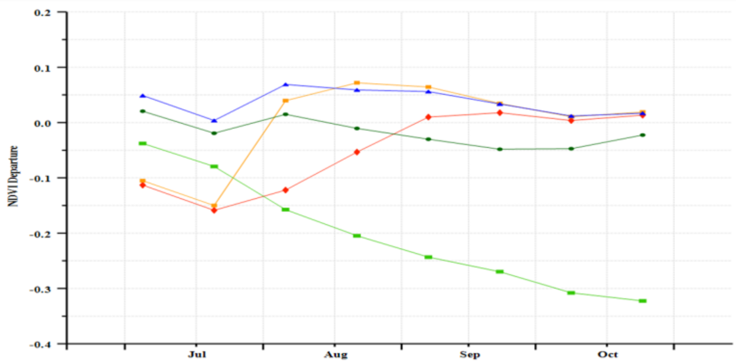
(b) Crop condition development graph based on NDVI



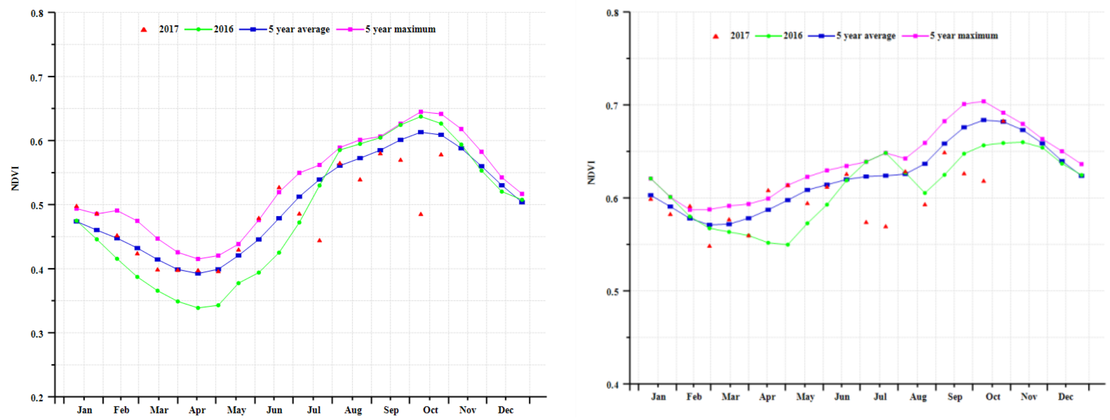
(c) Maximum VCI



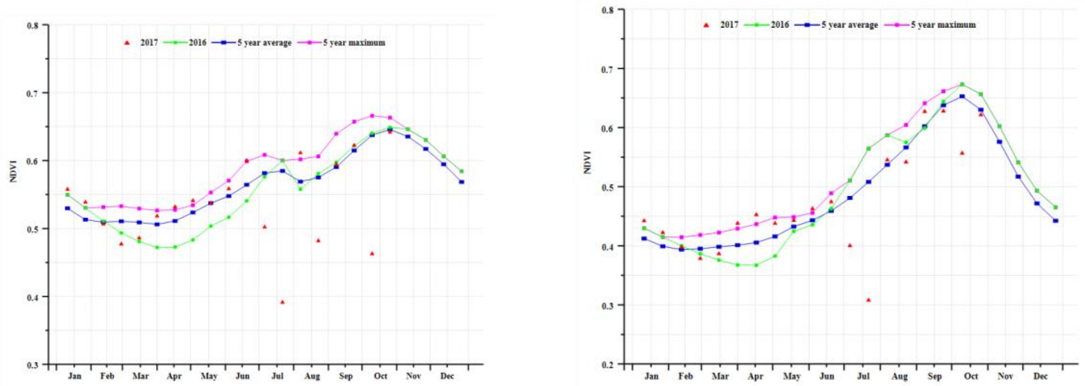
(d) Spatial NDVI patterns compared to 5YA



(e) NDVI profiles



(f) Crop condition development graph based on NDVI (Double_triple-cropped rice area (left) and Mountains area (right))



(g) Crop condition development graph based on NDVI (Horticulture area (left) and Single-cropped rice area (right))

Table 3.71. July-October 2017 agroclimatic indicators by sub-national regions, current season values and departure from15YA

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m2)	Departure from 15YA (%)
Single-cropped rice area (Thailand)	1251	22	27.5	-0.6	959	-4
Horticulture area (Thailand)	1011	-8	27.3	-0.3	957	-1
Mountains area (Thailand)	961	1	26.4	0.2	925	-2
Double and triple-cropped rice area (Thailand)	1072	26	27.5	-0.5	940	-2

Table 3.72. July-October 2017 agronomic indicators by sub-national regions, current season values and departure from 5YA

Region	BIOMSS		Cropped arable land fraction		Maximum VCI
	Current (gDM/m2)	Departure from 5YA (%)	Current	Departure from 5YA (%)	Current
Single-cropped rice area (Thailand)	2343	11	99	0	0.94
Horticulture area (Thailand)	2378	3	99	0	0.94
Mountains area (Thailand)	2227	3	100	0	0.95
Double and triple-cropped rice area (Thailand)	2371	14	99	0	0.91

Table 3.73. CropWatch estimated maize and rice production for 2017 (thousands tons)

Crops	Production 2016	Yield variation (%)	Area variation (%)	Production 2017	Production variation (%)
Maize	5080	-1.40%	-0.20%	4999	-1.60%
Rice	39661	-2.90%	0.00%	38495	-2.90%

[TUR] Turkey

In Turkey, most of the maize and rice was harvested during the reporting period, while the planting of winter wheat in the country started in September.

For the country as a whole, rainfall was below average (RAIN -28%), with temperature (TEMP) and radiation (RADPAR) above average by +0.8°C and +3%, respectively. The biomass production potential was below average (BIOMSS -29%) due to unfavorable weather conditions. The maximum VCI (VCIx) for the country was 0.82. Compared with the recent five-year average, the cropped arable land fraction (CALF) and the cropping intensity were above average for Turkey as a whole (CALF +11% and CI +2%).

As shown by the crop condition development graph, national NDVI closely followed the average of the previous five years from July to August, but remained below that average from September to October. The spatial NDVI patterns and NDVI profiles indicate that NDVI values were below average in more than half of croplands over the entire reporting period. Above average values from July to October occur in parts of the Black Sea region and the Marmara-Aegean-Mediterranean region. NDVI values were above average until August, but below average from September to October in some areas of the central Anatolia region. The VCIx map shows that crop condition was not very good in most of the Eastern Anatolia region.

For Turkey, the main crops for the recent reporting period are maize and wheat. For maize, CropWatch puts the production 6.3% above that of the previous season due to an increase in both yield and cropped area (+2.9% and +3.3%, respectively). The smaller increase (+1%) proposed for wheat production results from slightly higher yield (+1.2%) and a small drop in cultivated area (-0.2%).

Regional analysis

The five agro-ecological areas examined more closely for CropWatch include the Black Sea region, the northeast region, the southeast region, central Anatolia, and the Marmara-Aegean-Mediterranean region.

In the **Black Sea region**, the crop condition was below but close to the recent five-year average. Rainfall was well below average (RAIN -48%), which accounts for the decrease of biomass (BIOMSS -40%). The temperature was closed to average (TEMP +0.5°C). CALF was 96% and the VCIx was 0.90.

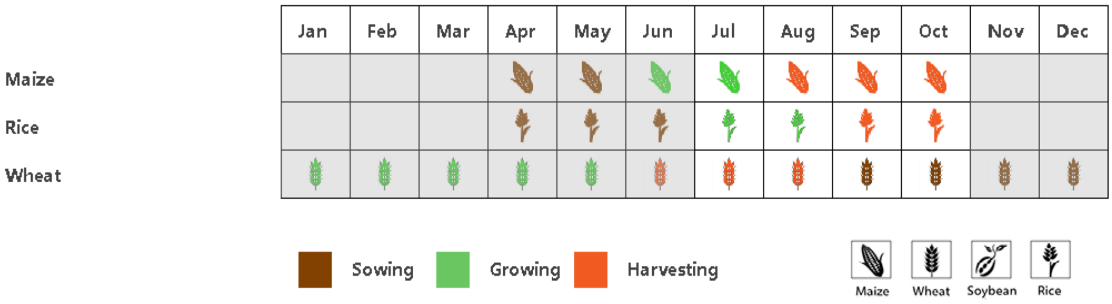
Compared with the average, TEMP and RADPAR in the **northeast region** increased by 1.6°C and 6% respectively, while RAIN decreased 30% compared to average. The region's CALF (+1%) was close to the five-year average. The biomass production potential was below average (BIOMSS, -30%), in direct response to the shortage of rainfall. Consistent with the spatial NDVI patterns, CropWatch estimates bad crop condition for this region.

The **southeast region** experienced a large deficit in RAIN (-47%) with warm weather (TEMP +1.5°C) and average sunshine. The CALF was low with 24%, while the VCIx was 0.7. The NDVI trend graph showed the crop condition was below average from September to October, and crops in the region are considered to be generally in poor condition.

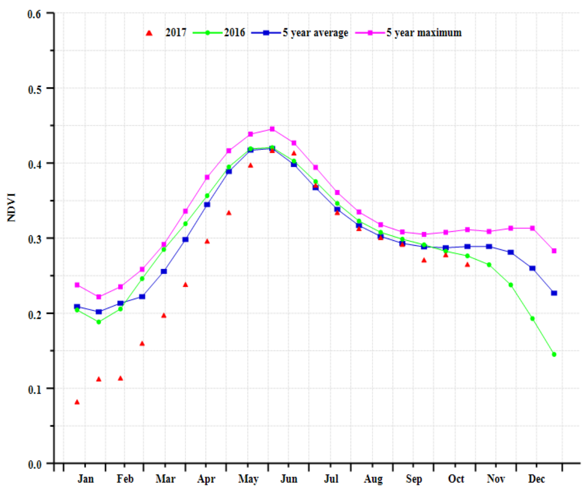
The **central Anatolia region** experienced a deficit of RAIN of 24%. Both TEMP and RADPAR, however, were above but close to average. CALF in the region increased by 31%, and the VCIx was 0.88. The NDVI trend line indicated that crop condition was above the five-year average from July to August. Crop production prospects are fair for this region.

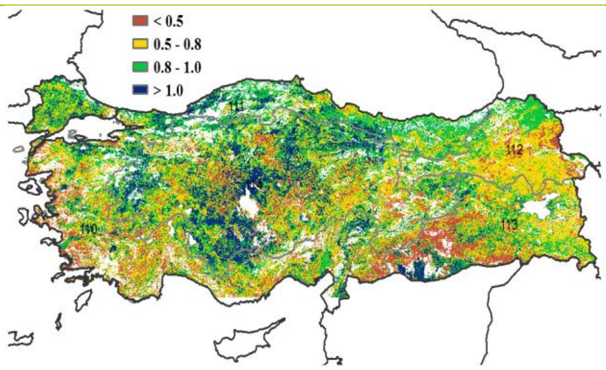
The **Marmara-Aegean-Mediterranean region** had the smallest rainfall deficit in the country (-14%), but temperature and radiation were average. CALF was above average (+6%), and the VCIx was 0.78. In the NDVI trend graph, the crop condition was above the recent five-year average from July to August and close to that average from September to October.

Figure 3.29. Turkey crop condition, July-October 2017

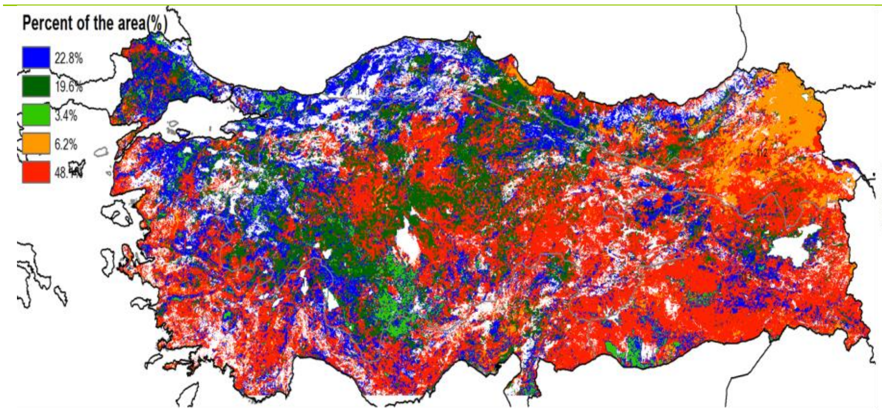


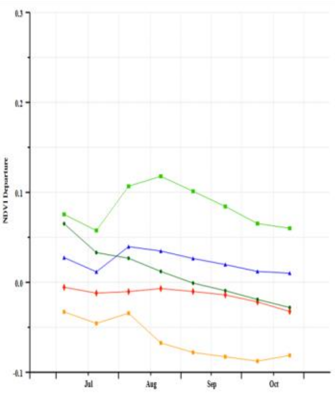
(a). Phenology of major crops



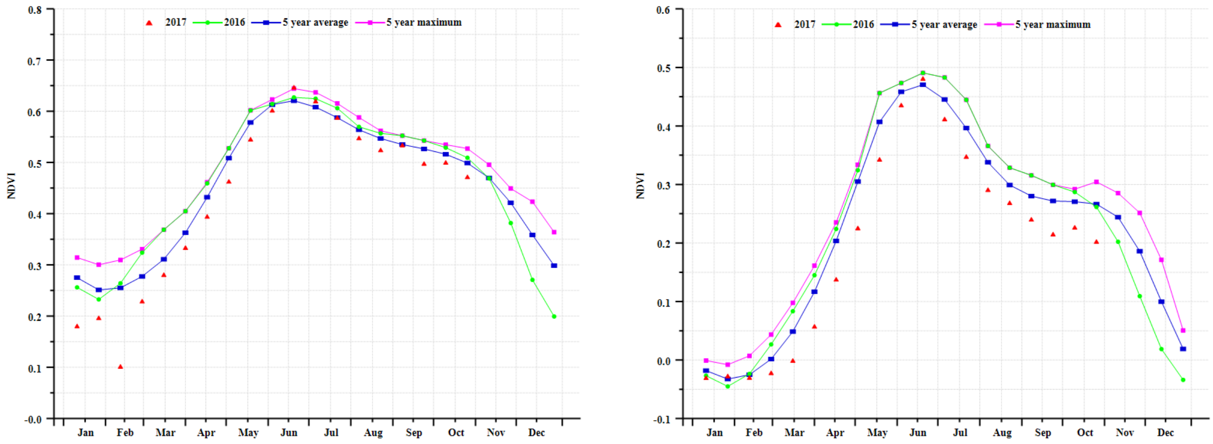


(b) Crop condition development graph based on NDVI (c) Maximum VCI

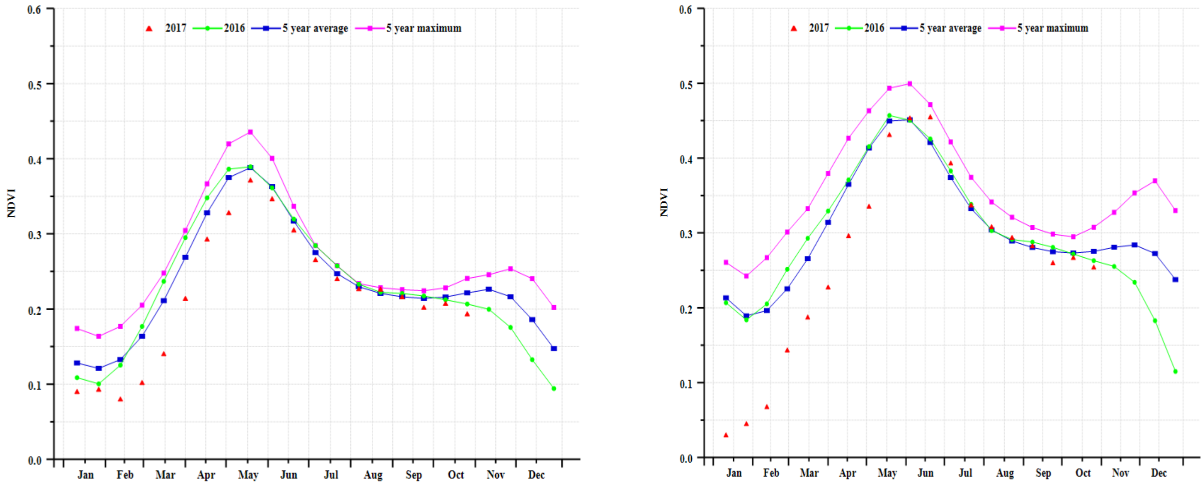




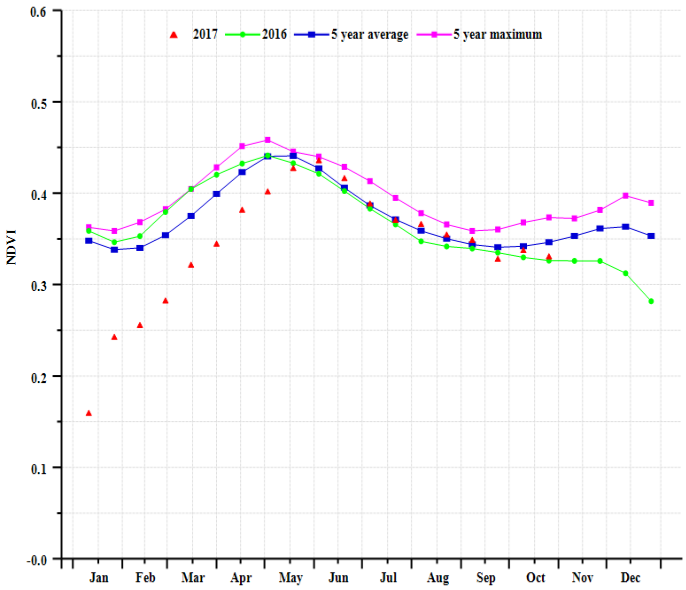
(d) Spatial NDVI patterns compared to 5YA (e) NDVI profiles



(f) Crop condition development graph based on NDVI (Black Sea region (left) and North East region (right))



(g) Crop condition development graph based on NDVI (South East region (left) and Central Anatolia region (right))



(h) Crop condition development graph based on NDVI (Marmara_Agean_Mediterranean region (right))

Table 3.74.Turkey agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, July-October 2017

Region	Rain		TEMP		RADPAR	
	Rain Current (mm)	Rain 15 YA Departure (%)	TEMP Current (°C)	Temp 15YA Departure (°C)	RADPAR Current (MJ/m^2)	RADPAR 15YA departure (%)
Black Sea region	108	-48	18.6	0.5	1061	3
Northeast region	131	-30	16	1.6	1223	6
Southeast region	43	-47	23.7	1.5	1329	2
Central Anatolia region	80	-24	19.5	0.6	1264	3
Marmara-Agean-Mediterranean region	112	-14	21.8	0.4	1257	2

Table 3.75. Turkey agronomic indicators by sub-national regions, current season's values and departure from 5YA, July-October 2017

Region	BIOMSS		CALF		Maximum VCI
	BIOMSS Current (gDM/m^2)	BIOMSS 5 YA Departure (%)	CALF(%)	Departure from 5YA (%)	VCI Current
Black Sea region	462	-40	96	3	0.9
Northeast region	520	-30	68	1	0.73
Southeast region	202	-42	24	2	0.74
Central Anatolia region	320	-28	39	31	0.88
Marmara-Agean-Mediterranean region	391	-20	59	6	0.78

Table 3.76. CropWatch-estimated maize and wheat production for Turkey in 2017 (thousand tons)

Crops	Production 2016	Yield variation (%)	Area variation (%)	Production 2017	Production variation (%)
Maize	5920	2.9	3.3	6294	6.3
Wheat	18981	1.2	-0.2	19174	1

[UKR] Ukraine

In the Ukraine, maize harvest started in September, while winter wheat was sown after the harvest of the previous season's crop in July. On the national level, temperature and radiation were close to their average values (TEMP +0.2°C, RADPAR +2%), while rainfall was in slight deficit (RAIN -6%). At the national level, and compared against the recent five-year average, both cropping intensity and the fraction of cropped arable land were low (CI -17%; CALF -1%); NDVI was generally low as well, which all resulted in a slight decrease of the biomass production potential (BIOMSS -1%). At 0.82, the national maximum vegetation condition index (VCIx) was fair, but it varied from region to region. According to the VCIx and NDVI cluster maps, the least favorable crop condition occurred in the southern wheat and maize areas.

Overall, CropWatch puts the maize production for Ukraine at 2.0% above last year's output, while wheat production is projected to drop 5.8%.

Regional analysis

To provide additional spatial detail, CropWatch analysis is also provided for the following four major agro-ecological zones: the central wheat area, the northern wheat area, the mountain region, and the southern wheat and maize area.

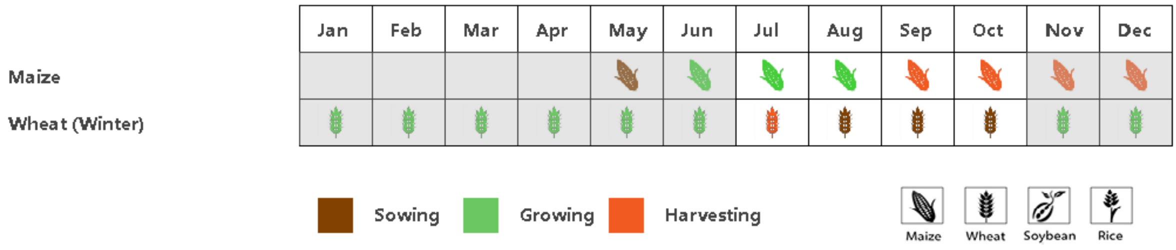
As indicated mainly by the regional NDVI development profile, below average crop condition prevailed over the **central wheat area**. Although temperature and radiation were close to average (TEMP +0.3°C; RADPAR +1%), cropped arable land fraction was also stable (CALF 100%), while rainfall deficiency (RAIN -12%) lead to a 6% reduction in potential biomass (BIOMSS) compared to its five-year average for the region.

In the **northern wheat area**, favorable agroclimatic conditions benefited crop growth, with sufficient rainfall (RAIN +8%) and average temperature and radiation (TEMP -0.1°C; RADPAR -1%). BIOMSS was 8% above average, VCIx was good (0.96), and all cropland was in use (CALF is 100%), which should result in above average production.

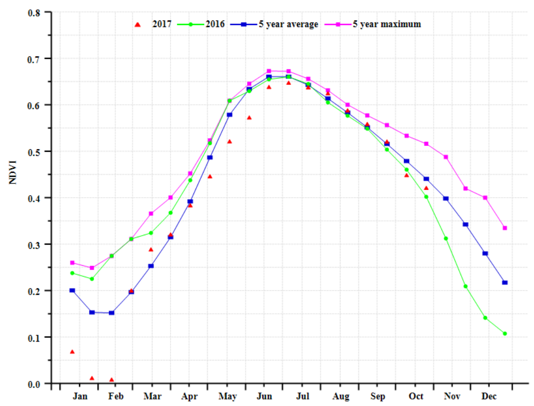
Next, the **mountains region** of Ukraine received slightly less precipitation than normal (RAIN -5%), with normal temperature (TEMP -0.1°C) and higher than average radiation (RADPAR +4%), resulting in a BIOMSS increase of 5% above the five-year average. The agronomic indicators for the region all show favorable conditions (CALF 100%, VCIx 0.96, and a near average NDVI development profile), which is expected to result in a good crop.

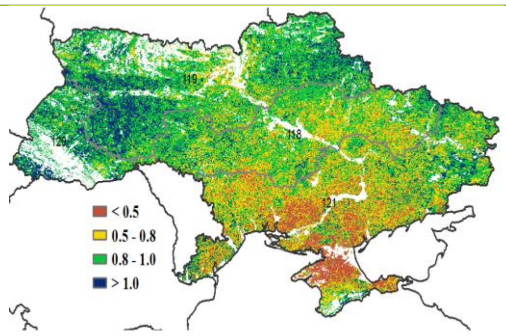
Conditions were less favorable, as already mentioned, in the **southern wheat and maize area,** which featured a deficit in rainfall (RAIN -20%) accompanied by slightly higher temperature and radiation (TEMP +0.5°C, RADPAR +4%). As a result, biomass is projected to be 15% below the five-year average. Significantly below average crop condition is also suggested by the regional NDVI development profile, a decrease in the cropped arable land fraction (CALF -2%), and low VCIx (0.71). Altogether, crop production is expected to decrease in this area.

Figure 3.30. Ukraine crop condition, July-October 2017

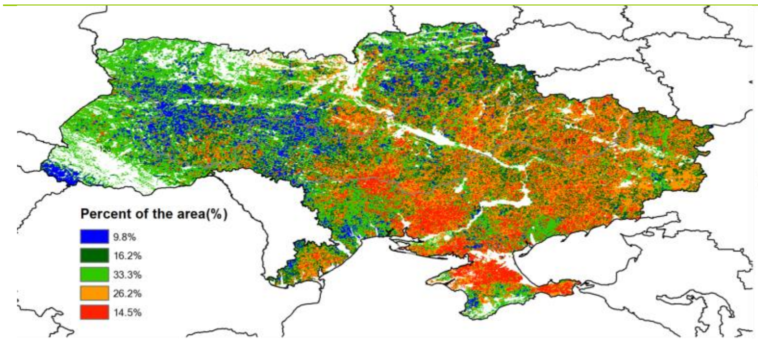


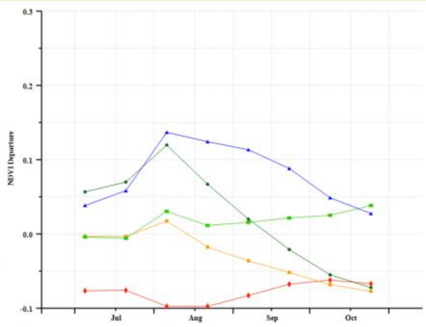
(a). Phenology of major crops



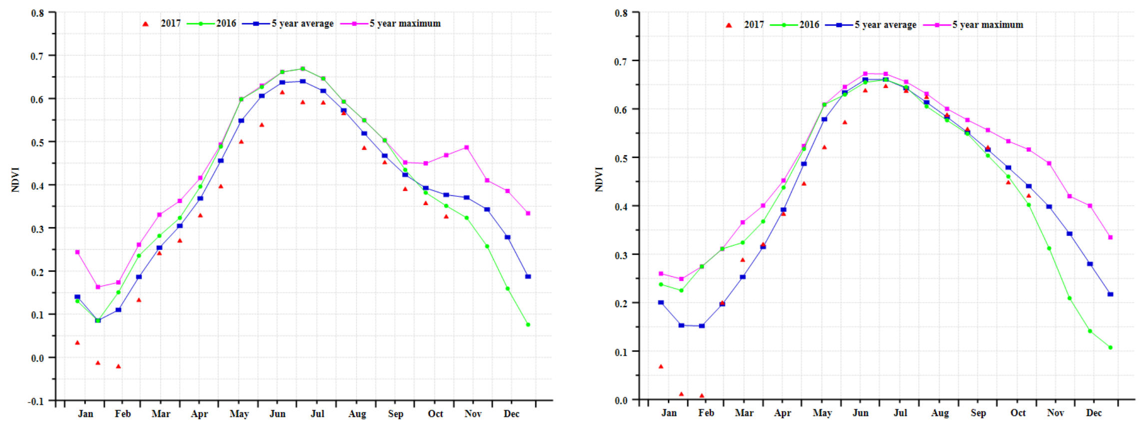


(b) Crop condition development graph based on NDVI (c) Maximum VCI

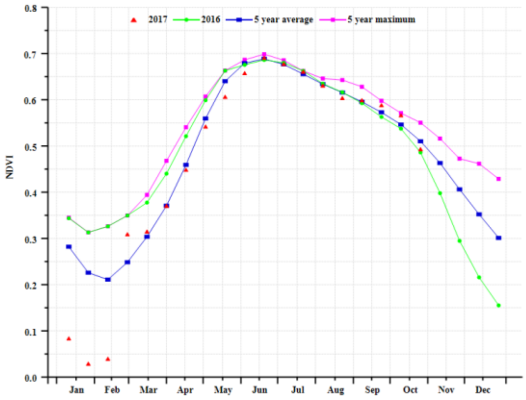


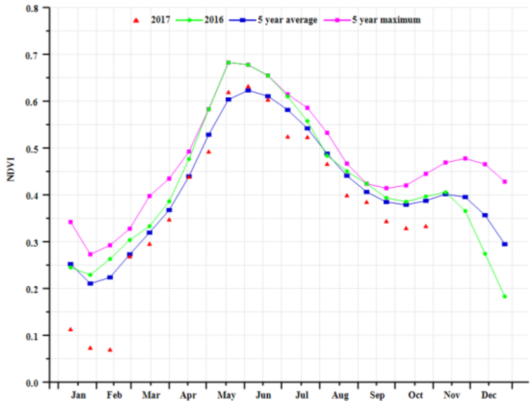


(d) Spatial NDVI patterns compared to 5YA (e) NDVI profiles



(f) Crop condition development graph based on NDVI (Cebntral wheat area (left) and Northern wheat area (right))





(f) Crop condition development graph based on NDVI (Mountains regions (left) and Southern wheat and maize area (right))

Table 3.77. Ukraine agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, July-October 2017

	RAIN		TEMP		RADPAR	
Region	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m2)	Departure from 15YA (%)
Central wheat area (Ukraine)	176	-12	17.3	0.3	908	1
Northern wheat area (Ukraine)	249	8	15.9	-0.1	840	-1
Mountains regions (Ukraine)	311	-5	15.2	-0.1	889	4
Southern wheat and maize area (Ukraine)	143	-20	19	0.5	995	4

Table 3.78. Ukraine agronomic indicators by sub-national regions, current season's values and departure from 5YA, July-October 2017

	BIOMSS		CALF		Maximum VCI
Region	Current (gDM/m2)	Departure from 5YA (%)	Current (%)	Departure from 5YA (%)	Current
Central wheat area (Ukraine)	802	-6	100	0	0.82
Northern wheat area (Ukraine)	1084	13	100	0	0.92
Mountains regions (Ukraine)	1257	2	100	0	0.96
Southern wheat and maize area (Ukraine)	632	-15	89	-2	0.71

Table 3.79. CropWatch-estimated maize, wheat and soybean production for Ukraine in 2017 (thousand tons)

Crop	Production 2016	Yield variation	Area variation	Production 2017	Production variation
Maize	30774	-0.7	1.9	31398	2
Wheat	24059	-5.7	-0.1	22662	-5.8
Soybean	3799			3799	

[USA] United States

The reporting period covers the harvesting season of maize, rice, soybean, and spring wheat in the United States, as well as the sowing of winter wheat. In general, crop condition was close to average at the time of harvest.

Slightly humid weather was recorded over the United States as a whole, with 11% above average precipitation (RAIN) accompanied by a 2% drop in sunshine (RADPAR). Temperature was about average (TEMP -0.3°C). After serious rainfall shortage, abundant rainfall was recorded over the **Northern Plains**, including South Dakota (+80%), Nebraska (+91%) and North Dakota (+13%), which provided sufficient soil moisture for spring wheat and maize growing in this region, with some places suffering from excess precipitation. Wet weather conditions and average temperature prevailed in the **Corn Belt**, covering Illinois (RAIN +13%), Iowa (+44%), Wisconsin (+16%), Indiana (+24%), and Ohio (+14%), providing ample soil moisture for maize and soybean growth. Arkansas, one of the main rice growing states that had experienced excess precipitation during the previous reporting period (+47% from April to July, 2017) now suffered a shortage (-23%) in this monitoring period. Dry weather was also recorded in the **Northwest** including Washington (RAIN -29%), and Oregon (-20%).

In the main spring wheat zone, NDVI recovered from the very bad conditions at the end of June--thanks to abundant precipitation--in North Dakota, South Dakota, and Nebraska. The peak values in August indicate the good crop performance in this region. In the region from the **Corn Belt** to the **Northeast**, positive NDVI departure was recorded from early July to the end of October, also indicating above average crop condition. In the **Southern** and **Southeast** regions, above average NDVI departures were maintained from May to October, indicating favorable crop condition. In spite of the shortage of rainfall in Arkansas, the NDVI departure was above the average, most likely because of abundant rainfall in the upstream reaches of the Mississippi basin. The **Northwest** (and especially in Washington and Oregon) was the only region where NDVI was below average due to a long term water shortage that started during the previous reporting period.

The cropped arable land fraction (CALF) in the United States was 1% over the five-year average and the cropping intensity was 3% above the average.

CropWatch estimates that maize and rice production outperformed the 2017 crop (estimated increases of +0.2% and +3.0%, respectively), while soybean production is projected to decreased -0.3%.

Regional analysis

For the purpose of providing additional spatial detail, CropWatch adopts 12 agro-ecological zones for the United States. Four are listed below: Northern Plains, Corn Belt, Southeast, and Lower Mississippi.

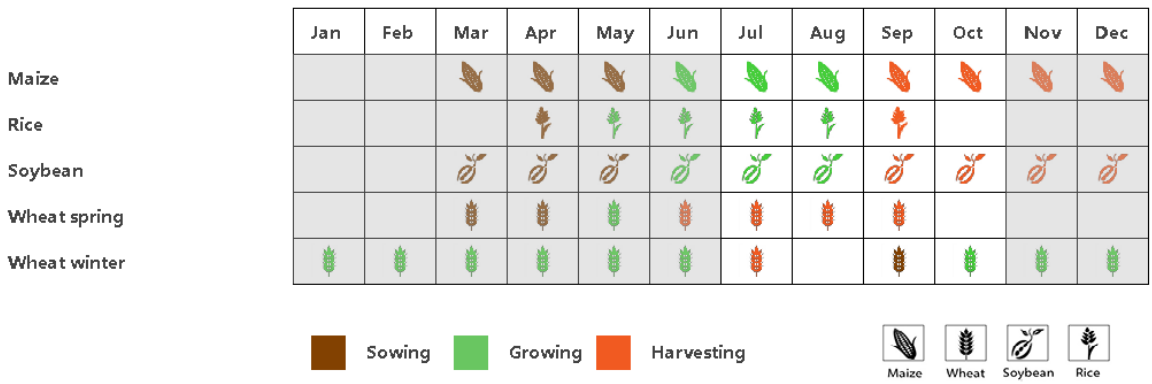
The **Northern Plains** (North Dakota, South Dakota, Montana, and parts of Nebraska) is the main spring wheat production zone of the United States. The NDVI development profile for this region recovered from being far below last year's profile and the five-year average at the beginning of July; it then stayed slightly below that average. Moist weather was recorded, with RAIN 53% above average, while both TEMP and RADPAR were slightly below average (-0.3°C and -3%, respectively). Montana and North Dakota recovered from drought and recorded excess rainfall (+22% and +13%, respectively). The estimated biomass production potential (BIOMSS) for the region is +33%, while the cropped arable land fraction is far below average (CALF -16%). Considering the large drop of CALF in this monitoring period, below average output is projected in spite of the late recovery.

The **Corn Belt** (Iowa, Illinois, Indiana, Ohio, Michigan, Minnesota, and Wisconsin) is the main maize and soybean producing area of the United States. Average crop condition is indicated by the region's NDVI development profile, even though levels are below last year's. Due to the rainy weather (RAIN +29%), with average temperature (TEMP -0.3°C) and radiation (RADPAR -2%), BIOMSS increased by 17% above the five-year average. CALF was stable (0%). Favorable crop condition prevailed in Wisconsin, Michigan, and Illinois, while the crop condition in Ohio should be watched.

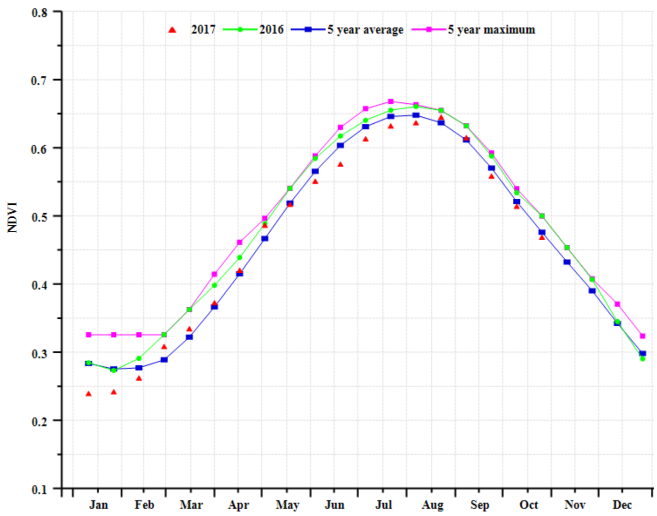
The **Southeastern states** of Alabama, Georgia, and Florida form the major cotton production zone of the United States. Slightly below average crop condition is indicated by this region's NDVI development profile. Average weather was recorded during this reporting period: RAIN -2%; TEMP -0.5°C; and RADPAR -2%. With BIOMSS 1% above the five-year average, a CALF similar to its 2016 value, and VCIx at 0.90, expectations are for average crops.

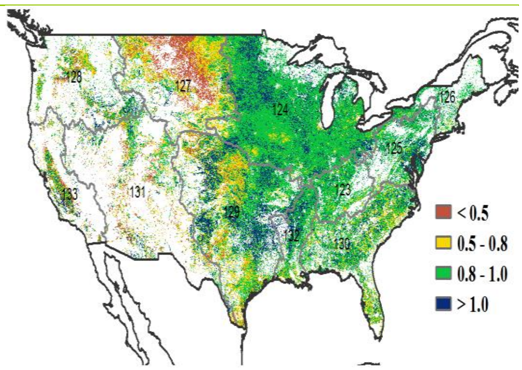
In the **Lower Mississippi**, the major rice production zone, the NDVI development profile was almost identical to its 2016 behavior and above the five-year average. Low rainfall (RAIN -21%) was accompanied by low sunshine (RADPAR -3%). The dry weather condition resulted in a BIOMSS decrease of 12%, while crop performance did not suffer due to abundant rainfall in the upstream reaches of the Mississippi basin.

Figure 3.31. United States crop condition, July-October 2017



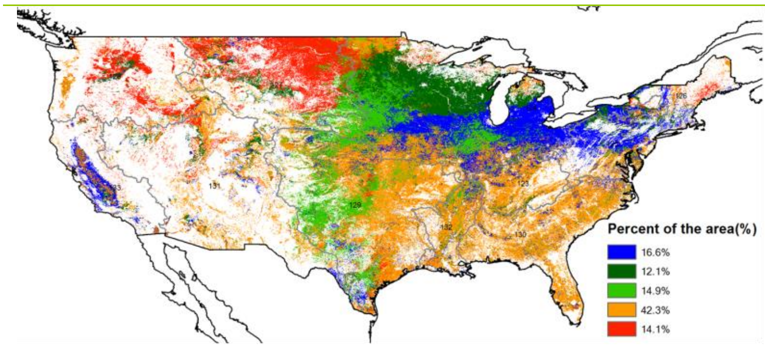
(a). Phenology of major crops

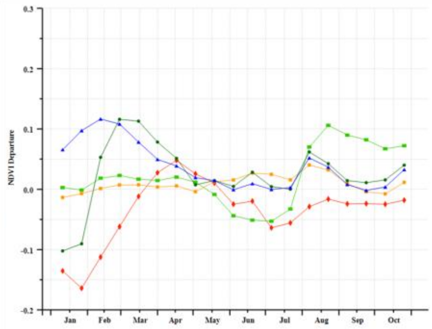




(b) Crop condition development graph based on NDVI

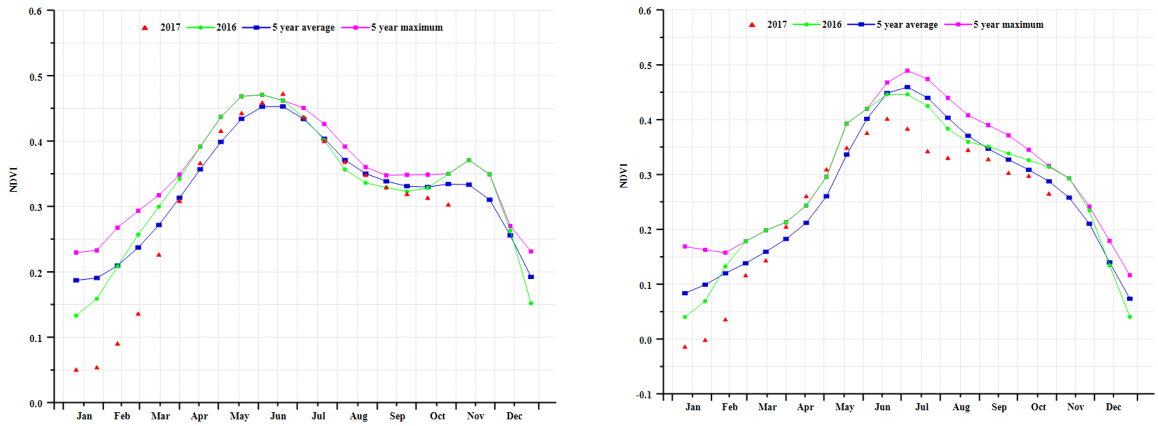
(c) Maximum VCI



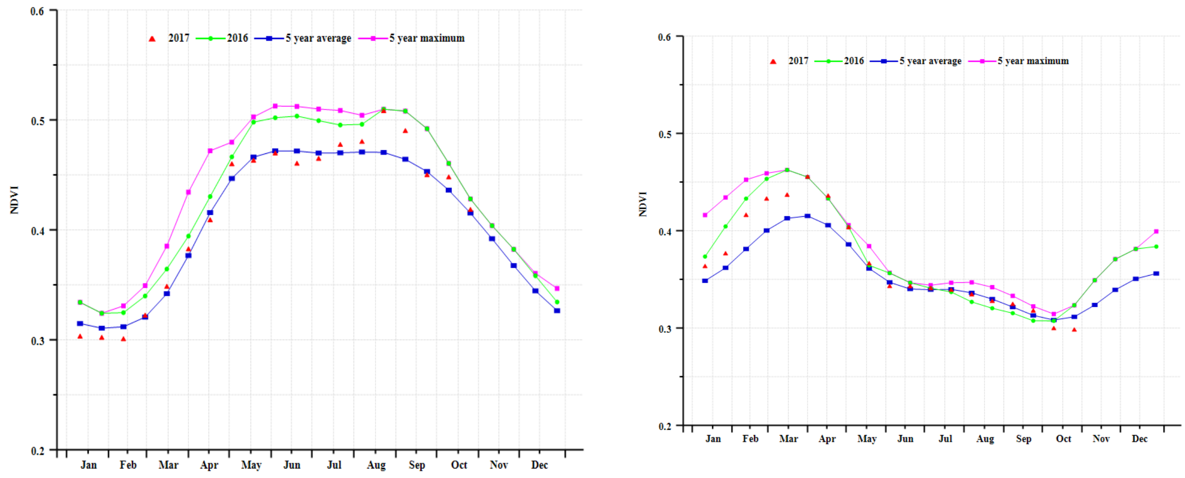


(d) Spatial NDVI patterns compared to 5YA

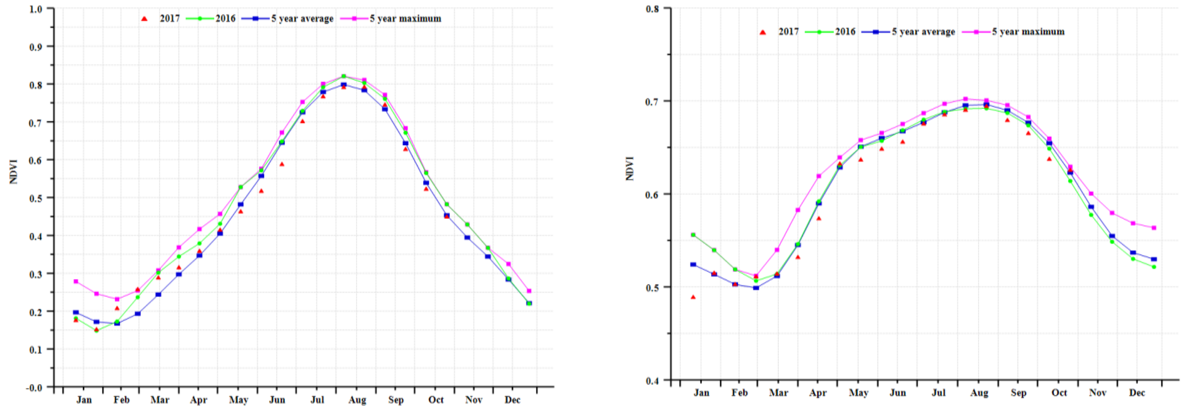
(e) NDVI profiles



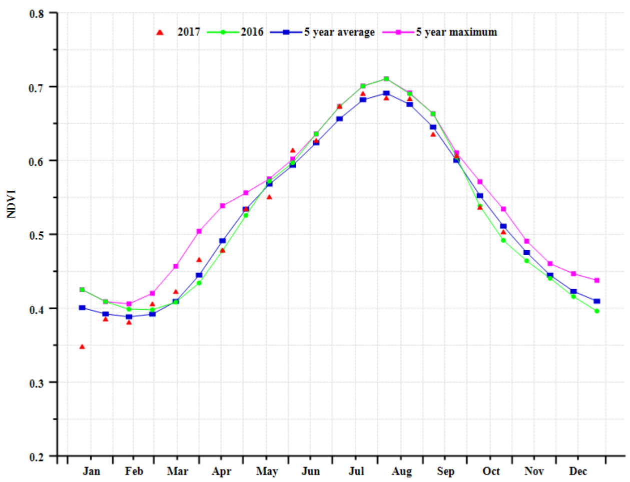
(f) Crop condition development graph based on NDVI (northwest region (left) and North plains (right))



(g) Crop condition development graph based on NDVI (South plains (left) and California (right))



(h) Crop condition development graph based on NDVI (Corn Belt (left) and Southeast (right))



(i) Crop condition development graph based on NDVI (Lower Mississippi)

Table 3.80. United States agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, July-October 2017

Region	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m2)	Departure from 15YA (%)
Blue Grass	442	0	20.6	-0.9	1059	-1
Corn Belt	505	29	18.3	-0.3	1037	-2
Middle Atlantic	403	-10	19.2	0.1	996	-2
Northeast	401	-9	17.1	0.5	964	0
Northern Plains	292	53	16.1	-0.3	1104	-3
Northwest	114	-4	14.8	-0.2	1175	-1
Southern Plains	425	19	23	-0.9	1166	-2
Southeast	511	-2	23.9	-0.5	1069	-2
Southwest	185	12	18.7	-0.2	1260	-3
Lower Mississippi	369	-21	23.9	-0.9	1097	-3
California	55	5	18.7	0.4	1346	-2

Table 3.81. United States agronomic indicators by sub-national regions, current season's values and departure from 5YA, July-October 2017

	BIOMASS		CALF		Maximum VCI
Region	Current (gDM/m2)	Departure from 5YA (%)	Current (%)	Departure from 5YA (%)	Current
Blue Grass	1468.71	3.6	99.98	0.02	0.93
Corn Belt	1486.22	16.79	99.88	0.16	0.95
Middle Atlantic	1374.29	-6.1	99.94	0.01	0.97
Northeast	1312.16	-9.5	99.97	0.01	0.95
Northern Plains	1043.99	32.52	63.86	-16.13	0.68
Northwest	521.08	8.95	69.06	8.09	0.87
Southern Plains	1232.95	12.82	88.06	9.83	0.9
Southeast	1557.23	1.14	99.86	-0.01	0.9
Southwest	723.77	8.01	39.63	7.63	0.81
Lower Mississippi	1218.25	-12.01	99.86	0.02	0.94
California	239.51	20.51	40.54	3.94	0.84

Table 3.82. CropWatch-estimated maize, wheat, rice and soybean production for the United States in 2017 (thousand tons)

	Production 2016	Yield variation	Area variation	Production 2017	Production variation
Maize	367862	0.20%	0%	370173	0.60%
Rice	10528	3.00%	0.80%	10933	3.80%
Wheat	56877	-1.90%	-1.70%	54812	-3.60%
Soybean	110024	-0.30%	0.00%	109649	-0.30%

[UZB] Uzbekistan

The monitoring period covers the harvesting and sowing stages of winter wheat in Uzbekistan, as well as the growing and harvesting stages of maize. Crop condition was generally favorable. The national average VCIx was 0.87, and the cropped arable land fraction was 12% above the five-year average.

Among the CropWatch agroclimatic indicators, RAIN and RADPAR were above average; RAIN was 73 mm instead of 38 mm, which represents a 92% increase, while RADPAR increased by 1%. The CropWatch temperature indicator, TEMP, was slightly below average (-0.2°C). The combination of factors resulted in high BIOMSS (+88%) compared to average. As shown by the NDVI development graph, crop condition was above average from August to late September and below in October. NDVI cluster graphs and profiles show that 52.9% of the agriculture areas had above average condition from August to late September (covering mainly parts of Qunghirot, Chimbay, Altynkul, and Takhtakupyr provinces, as well as the three eastern provinces (Namangan, Andijon, and Farghona) where most wheat is produced; Quqon and Guliston provinces; and part of Samarqand, Qarshi, Urganch Khiva, and Denau provinces). NDVI was below average in part of Termez, Bukhoro, Nawoiy, Guzar Kitab, and Munok provinces. Crop condition was normal or above in other regions. Overall, CropWatch expects an increase of 0.8% in wheat production compared with last year, with summer crops also expected to be favorable.

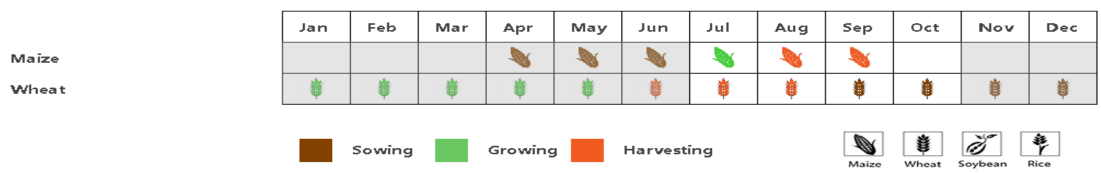
Regional analysis

For the regional analysis, additional details is provided for two agro-ecological zones in the country: the maize and cereals zone, and the cotton zone.

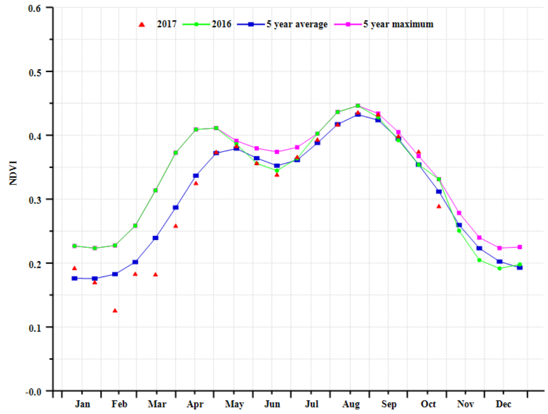
In the **maize and cereals zone**, NDVI was generally above the five-year average from July to late September, indicating good crop condition. NDVI then decreased from October but crop condition was generally favorable. RAIN was 54% above average, but TEMP and RADPAR were normal (-0.3°C and +1%, respectively). The agroclimatic indicators also include an increase of the BIOMSS index by 43%. The maximum VCI index was 0.87, while the cropped area increased by 11% compared to the five-year average. Overall crop prospects are favorable.

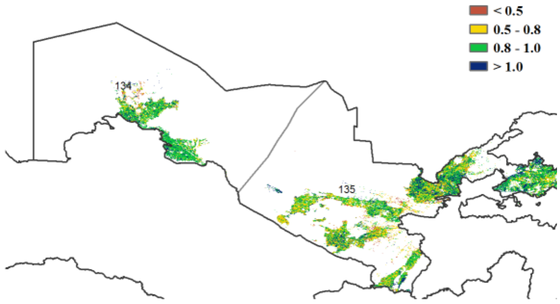
The western and northern areas of the country constitute the **cotton zone**. Crop condition was above the five-year average from August to late September. Accumulated rainfall was about five times the average during the monitoring period (RAIN +362%), radiation was above average (RADPAR 1%), while temperature (TEMP -0.2°C) was just below average. The agroclimatic indices for the current season indicate very favorable weather conditions for crop growth, which is confirmed by the significant increase of the BIOMSS index by 225% compared to its five-year average. The regional average of the VCIx was 0.90. Overall crop prospects for the country are favorable.

Figure 3.32. Uzbekistan crop condition, July-October 2017



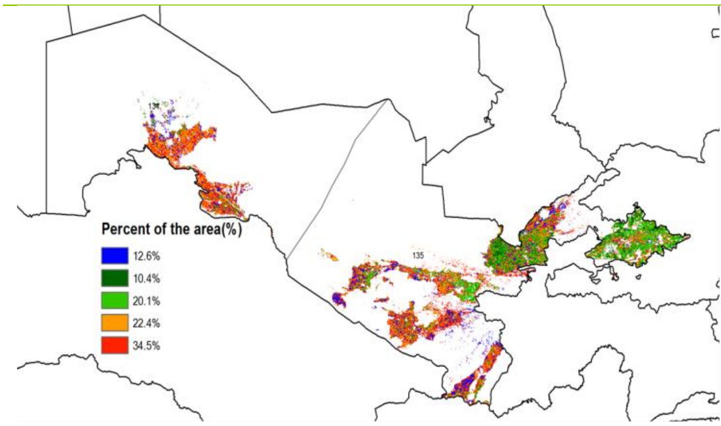
(a). Phenology of major crops

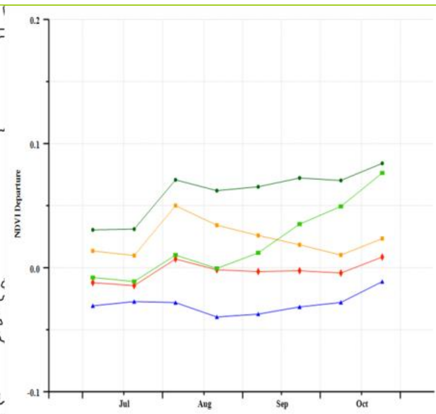




(b) Crop condition development graph based on NDVI

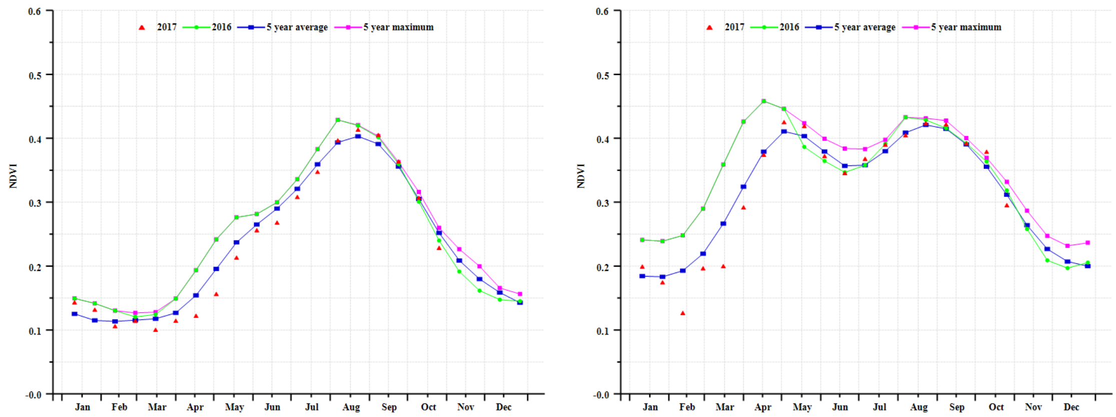
(c) Maximum VCI





(d) Spatial NDVI patterns compared to 5YA

(e) NDVI profiles



(f) Crop condition development graph based on NDVI (Cotton region (left) and Maize and Cereals region (right))

Table 3.83. Uzbekistan agroclimatic indicators by sub-national regions, current season's values and departure from 15YA, July-October 2017

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m2)	Departure from 15YA (%)
Cotton zone	206	362	22	-0.2	1191	1
Maize and cereals zone	57	54	21.2	-0.3	1263	1

Table 3.84. Uzbekistan agronomic indicators by sub-national regions, current season's values and departure from 5YA, July-October 2017

Region	BIOMSS		CALF		Max. VCI
	Current (gDM/m2)	Departure from 5YA (%)	Current (%)	Departure from 5YA (%)	Current
Cotton zone	612	225	73	14	0.9
Maize and cereals zone	215	43	56	11	0.87

Table 3.85. CropWatch-estimated wheat production for Uzbekistan in 2017 (thousand tons)

Type	Production 2016	Yield variation (%)	Area variation (%)	Production 2017	Production variation (%)
Wheat	6391	0.1	0.7	6442	0.8

[VNM] Vietnam

Summer and autumn rice harvesting in Vietnam has been completed during the reporting period, while late rice is still growing.

Generally, compared with the recent five-year average and the same period last year, crop condition in Vietnam was significantly lower than normal, except during August. Initial NDVI values for the reporting period were unstable, but the fluctuation gradually became smaller after August. For about 35.4% of croplands (mainly in the southeast and center of the country), the crop condition is above the reference five-year average, with a VCIx of almost 0.93 confirming the favorable situation. Unfavorable crops occur in about 18.7% of the arable land, mainly in the southwest and in a limited area in the north. In the north, covering about 27.7% of Vietnam's arable land area, NDVI increased above average after August. The national NDVI condition development graph indicates mostly below average crop condition. CropWatch agroclimatic indicators show that precipitation (RAIN), biomass production (BIOMSS), cropped arable land fraction (CALF), cropping intensity (CI), and the maximum vegetation condition index (VCIx) were slightly above their averages for the region and period, while temperature (TEMP) and radiation (RADPAR) were slightly below. RAIN in fact was 17% above average. Overall crop condition in the country is considered satisfactory.

Regional analysis

Based on cropping systems, climatic zones, and topographic conditions, three sub-national agro-ecological regions are distinguished for Vietnam. They include northern Vietnam, middle Vietnam, and southern Vietnam.

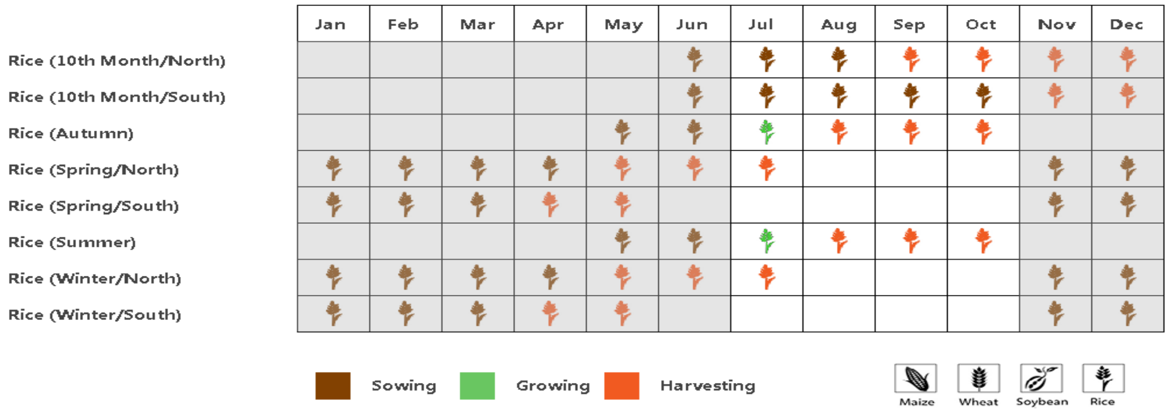
In **northern Vietnam**, abundant precipitation (RAIN +47%), well below average radiation (RADPAR -15°C), and close to average temperature (TEMP -0.4°C) were recorded. The CALF for the region was unchanged compared to its five-year average, while BIOMSS was up 20% and VCIx was high (0.94). NDVI was especially poor in July and September, although findings are inconclusive because of the above mentioned erratic behavior of the NDVI values in the crop condition development graph. Based on the agroclimatic indicators, about average output is expected.

In southern Vietnam and **middle Vietnam,** agroclimatic and agronomic conditions and their assessed impact on crops are very similar, with indicator values for middle Vietnam as follows: RAIN +4%, TEMP 0.1°C, RADPAR -4%, BIOMSS +5%, VCIx 0.94, and CALF +0%. The crop condition development graph of NDVI for Middle Vietnam reached the maximum of the last five years in August and September. According to the agroclimatic indicators, above average output is expected.

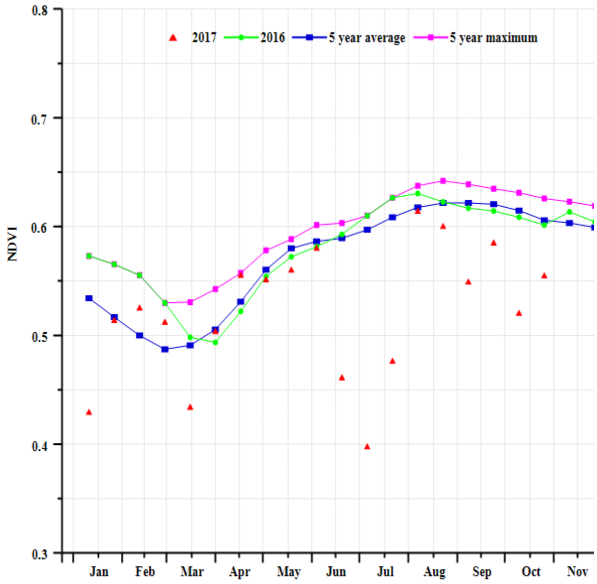
Southern Vietnam was characterized by low radiation (RADPAR -4%) and average RAIN (+2%), TEMP (+0.2°C) and BIOMSS (+3%). VCIx was high (0.93) with CALF up 1% over 2016. However, the crop condition development graph of NDVI indicates mostly below average crop condition, especially in July. CropWatch expects average production.

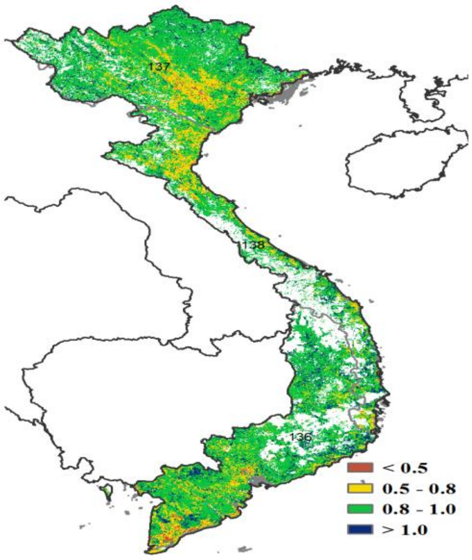
With the mentioned caveats, crop prospects are generally similar to the average. Rice production for 2017 is also expected to be average.

Figure 3.33. Vietnam crop condition, July-October 2017



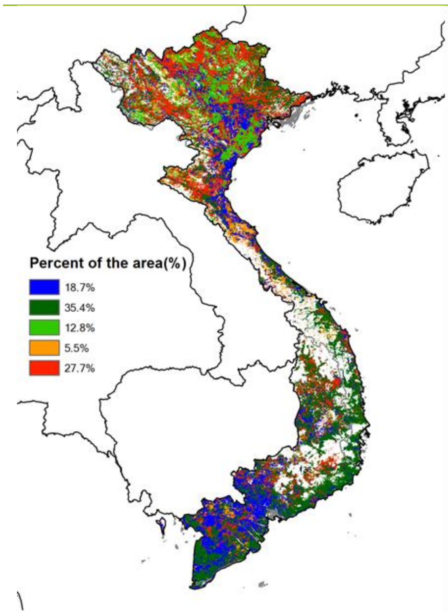
(a). Phenology of major crops

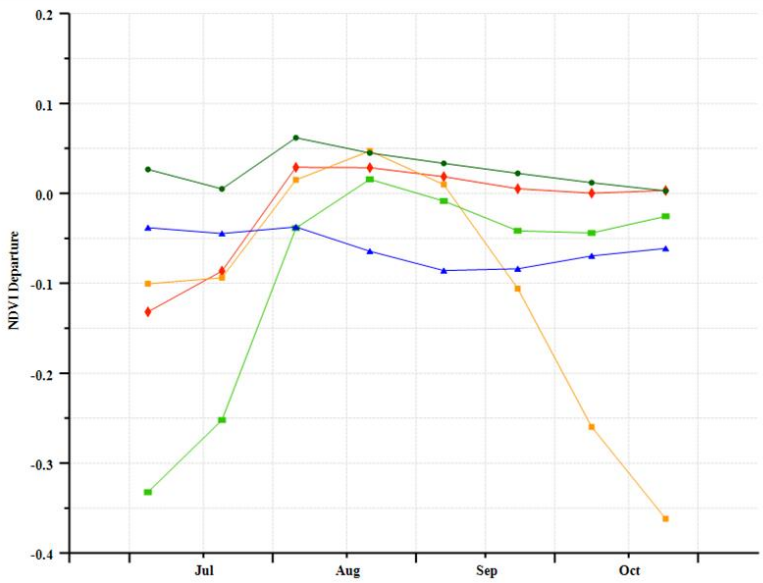




(b) Crop condition development graph based on NDVI

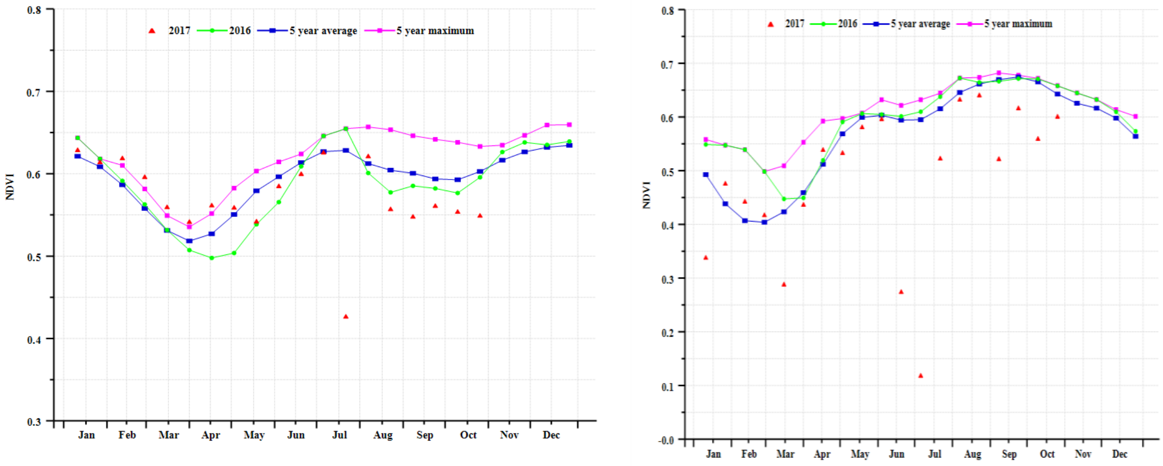
(c) Maximum VCI



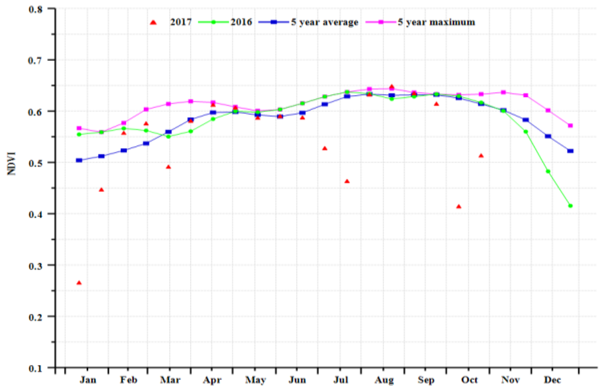


(d) Spatial NDVI patterns compared to 5YA

(e) NDVI profiles



(f) Crop condition development graph based on NDVI (Southern Vietnam (left) and Northern Vietnam (right))



(g) Crop condition development graph based on NDVI (Middle Vietnam)

Table 3.86 Vietnam agroclimatic indicators by sub-national regions, current season values and departure from 15YA, July-October 2017

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m2)	Departure from 15YA (%)
Southern Vietnam	1205	2	26.2	0.2	945	-4
Northern Vietnam	1424	47	25.2	-0.4	824	-15
Middle Vietnam	1309	4	27.7	0.1	967	-4

Table 3.87 Vietnam agronomic indicators by sub-national regions, current season values and departure from 5YA, July-October 2017

Region	BIOMSS		Cropped arable land fraction		Maximum VCI
	Current (gDM/m2)	Departure from 5YA (%)	Current	Departure from 5YA (%)	Current
Southern Vietnam	2398	3	94	1	0.93
Northern Vietnam	2363	20	99	0	0.94
Middle Vietnam	2171	5	97	0	0.94

Table 3.88 CropWatch-estimated rice production for Vietnam in 2017 (thousands tons)

Crops	Production 2016	Yield variation (%)	Area variation (%)	Production 2017	Production variation (%)
Rice	42550	2.0	2.7	45422	6.7

[ZAF] South Africa

During the reporting period, winter wheat harvesting in South Africa started in early October. Eastern parts of the country are currently sowing a new maize crop, whose establishment so far is promising as observed from the spatial NDVI profiles. In the wake of the previous seasons' El-Niño conditions, rainfall was 40% below average (70 mm against an average of 120 mm). Temperature, however, was almost exactly average. With radiation and biomass production potential reduced by 2% and 35%, respectively, the country is currently experiencing moderate growing conditions. The maximum VCIx is reportedly good (>0.8) in most parts of Western Cape, the northwest, Gauteng, northern Mpumalanga, and eastern Kwa-Zulu Natal and Eastern Cape.

A notable reduction in the cropped arable land fraction (CALF) was observed ranging from 4% in the humid subtropical region to about 27% in the arid desert region. In the Mediterranean region of the Western Cape, the reduction in cropped area (CALF -10%) could partly explain the corresponding poor vegetation condition (VCIx 0.32).

Following this notable reduction in CALF, wheat production in South Africa is likely to be less than the previous year’s in some areas. Last season's droughts, which depleted irrigation reserves, could have influenced farmers' decisions to reduce cropped area. Currently, CropWatch estimates a wheat production reduction of 8%, while a high estimated increase for maize production (about +57%) is attributed mainly to very favorable rainfall intensity and distribution during the growing season.

Regional analysis

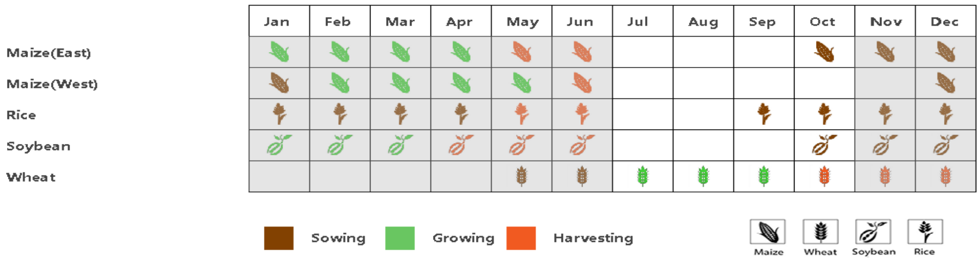
South Africa's four main agro-ecological growing regions are considered in this analysis; they are the humid subtropical region, the Mediterranean region, the arid desert region, and the semi-arid steppe. Generally, fluctuations in vegetation conditions have continued to prevail in these regions with a remarkable rainfall reduction in some areas.

Most of wheat in South Africa is grown in the **Mediterranean** Western Cape, and this crop is currently being harvested till around December. A 70% reduction in BIOMSS compared to the average for this region reveals the large differences in crop conditions currently on the ground. Rainfall, estimated at 29 mm, indicates a severe reduction (RAIN - 79%) compared to the average. Temperature and radiation were average over the period. Spatial NDVI profiles and crop development graphs show that throughout the growing season, the crop condition was much below average (VCIx was 0.32), with a reduced cropped area (CALF -14%), which resulted in the mentioned remarkable reduction in BIOMSS, as well as prospects for wheat production.

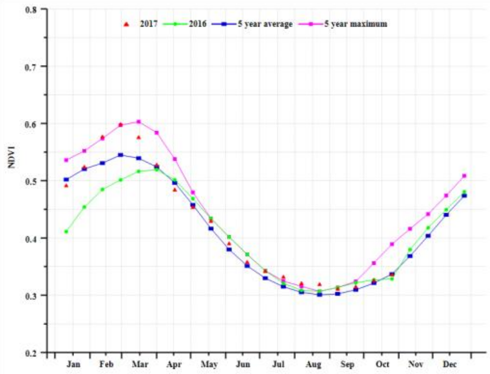
In the **humid subtropical region**, vegetation conditions are currently slightly below average, though not so different from the average as seen from the NDVI profiles. At the same time, irrigated maize is growing in parts of the region and showing generally good conditions. According to the NDVI profiles, there is a slight improvement in vegetation condition compared to the average, despite the 45% reduction in rainfall reported for the region. Radiation (RADPAR) was down 4%, while the BIOMSS reduction was about 36%.

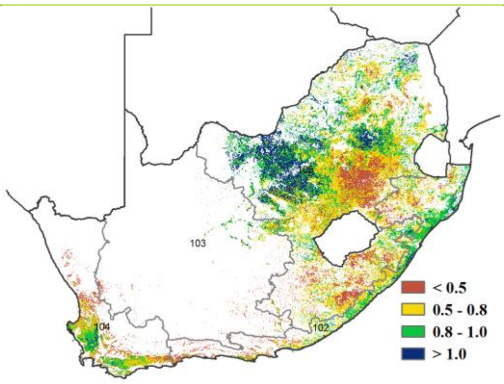
Next, with a rainfall reduction of 40% and a resultant BIOMSS reduction of 38%, indicators demonstrate continued dry conditions over the rangelands in the **arid desert region**. NDVI profiles revealed that this trend has prevailed for over a decade now, showing little or no improvement. Similar conditions were observed in the **semi-arid steppe region**. In this region, however, based on spatial NDVI profiles and the VCIx (0.74), better conditions apply.

Figure 3.34. South Africa crop condition, July-October 2017



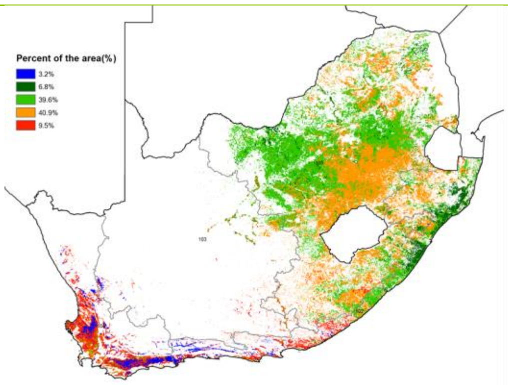
(a). Phenology of major crops

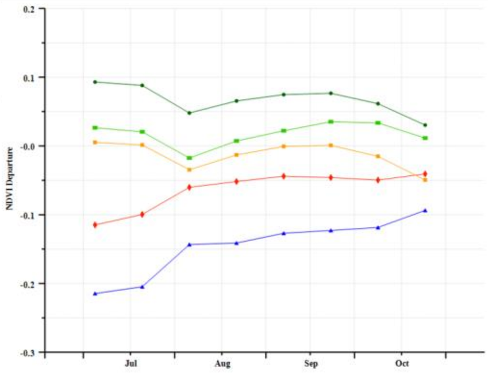




(b) Crop condition development graph based on NDVI

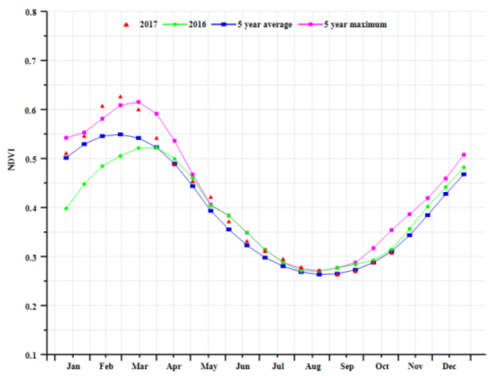
(c) Maximum VCI

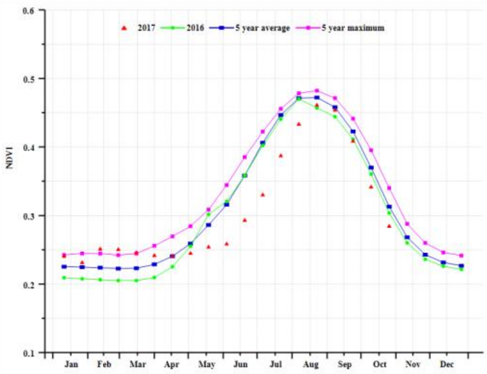




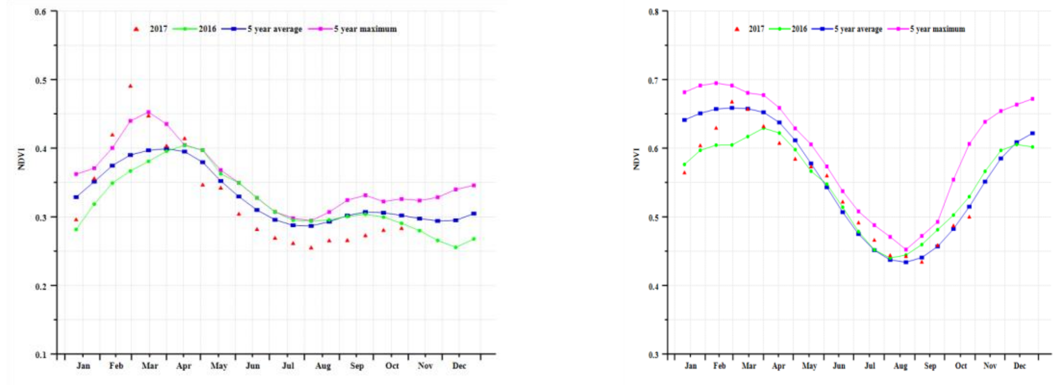
(d) Spatial NDVI patterns compared to 5YA

(e) NDVI profiles





(f) Crop condition development graph based on NDVI (Semi-arid steppe region (left) and Mediterranean region (right))



(g) Crop condition development graph based on NDVI (Arid_desert region (left) and Humid sub-Tropical region (right))

Table 3.89. South Africa agroclimatic indicators by sub-national regions, current season values and departure from 15YA, July-October 2017

Region	RAIN		TEMP		RADPAR	
	Current (mm)	Departure from 15YA (%)	Current (°C)	Departure from 15YA (°C)	Current (MJ/m2)	Departure from 15YA (%)
Humid subtropical	97	-45	16.5	1.1	906	-4
Arid desert	49	-40	13.9	-0.1	1089	-1
Mediterranean	29	-79	12.4	0.1	967	0
Semi-arid steppe	68	-33	15.5	-0.1	1098	-2

Table 3.90. South Africa agronomic indicators by sub-national regions, current season values and departure from 5YA, July-October 2017

Region	BIOMSS		CALF		Maximum VCI
	Current (gDM/m2)	Departure from 5YA (%)	Current	Departure from 5YA (%)	Current
Humid subtropical	393	-36	73	-4	0.59
Arid desert	196	-38	16	-27	0.61
Mediterranean	142	-70	72	-14	0.32
Semi-arid steppe	272	-30	11	-10	0.74

Table 3.91. CropWatch estimated maize and wheat production for South Africa in 2017 (thousands tons)

	Production 2016	Yield variation %	Area variation %	Production 2017	Production variation %
Maize	9018	35	16	14161	57
Wheat	1704	4	-11	1576	-8

Chapter 4. China

After a brief overview of the agroclimatic and agronomic conditions in China over the reporting period (section 4.1), Chapter 4 presents an updated estimate of national winter crop production (4.2) and describes the situation by region, focusing on the seven most productive agro-ecological regions of the east and south: Northeast China, Inner Mongolia, Huanghuaihai, Loess region, Lower Yangtze, Southwest China, and Southern China (4.3). Section 4.4 presents the results of ongoing pests and diseases monitoring, while sections 4.5 and 4.6 describe trade prospects (import/export) of major crops (4.5) and an updated outlook for domestic prices of maize, rice, wheat and soybean (4.6). Additional information on the agroclimatic indicators for agriculturally important Chinese provinces are listed in table A.11 in Annex A.

4.1 Overview

During the monitoring period, rainfall in China increased by 20% over average, while temperature decreased by 0.1°C and RADPAR by 8%, which is considerable. Consequently, the biomass production potential indicator (BIOMSS) was above average (+12%). At the sub-national scale, above-average rainfall occurred in all regions, with departures from +13% to +70%. Temperature was average or close to average, with departures ranging between -0.3°C and +0.1°C. The spatial distribution of rainfall profiles showed that this climatic variable fluctuated largely between July and mid-August (figure 4.1), but was relatively stable and close to average since late August for all the regions. Northeast and Southwest China (accounting for 23.9% of planted areas) and the Lower Yangtze region (22.2% of planted areas) respectively experienced excess rainfall (more than 75 mm compared to average) in early and mid-August, indicating that these areas may have suffered from flood damage. During the reporting period, temperature continuously fluctuated in various regions.

As shown in figure 4.3, high cropping intensity values mainly occurred in southern, southeast, southwest, and central China, with the values between 200% and 300%. On the contrary, low values (100%) are located in the northern part of China, including northeast China, Inner Mongolia, and Xinjiang. These indicate that double and triple cropping practices are distributed in the southern parts of China while single cropping is practiced in the north. The current period covers the growing and harvesting time for summer crops in China. Hence, most cropland in China was cropped, except for some regions of central Inner Mongolia, Ningxia, and Gansu. The VCIx map shows that higher values (greater than 0.8) of this indicator mainly occurred in Northeast China. In contrast, lower values (0.5-0.8) were primarily located in central Inner Mongolia, some parts of Ningxia and Gansu, western Henan, the Yangtze river delta and the Pearl river delta. CALF was average or near average for all regions, with the anomalies between -2% and 2%, as displayed in Table 4.1. The map for VHIn showed that low values (16-35) were mainly located in Sichuan Basin, southern Hebei and northwestern Henan (figure 4.6), except for Northeast China. This pattern was consistent with that of VCIx.

Table 4.1. CropWatch agroclimatic and agronomic indicators for China, July-October 2017, departure from 5YA and 15YA

Region	Agroclimatic indicators			Agronomic indicators			
	Departure from 15YA (2002-2016)			Departure from 5YA (2012-2016)			Current
	RAIN (%)	TEMP (°C)	RADPAR (%)	BIOMSS (%)	CALF (%)	Cropping Intensity (%)	Maximum VCI
Huanghuaihai	36	0.1	-12	23	0	-1	0.87
Inner Mongolia	70	-0.1	-6	32	2	0	0.77
Loess region	28	0	-11	17	-2	0	0.73
Lower Yangtze	13	-0.1	-8	4	0	1	0.74
Northeast China	19	-0.3	-3	4	0	-2	0.87
Southern China	17	-0.2	-7	7	-1	-2	0.69
Soutwest China	16	-0.1	-10	6	0	-6	0.77

Figure 4.1. China spatial distribution of rainfall profiles, July-October 2017

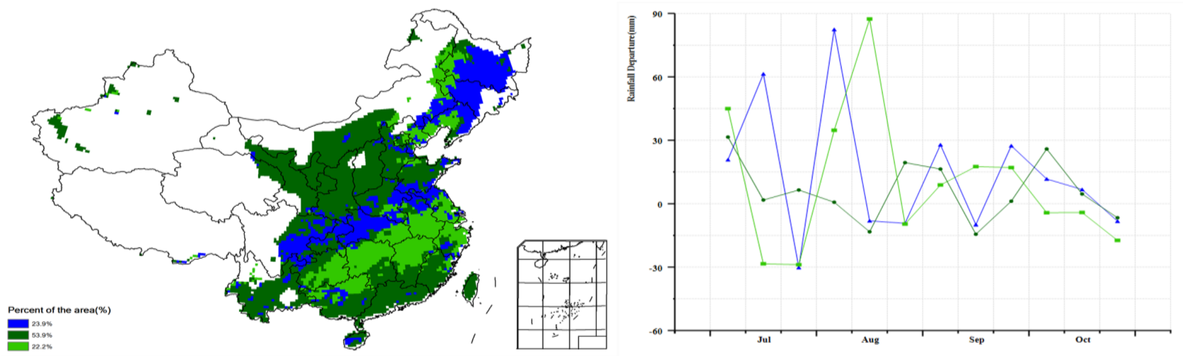


Figure 4.2. China spatial distribution of temperature profiles, July-October 2017

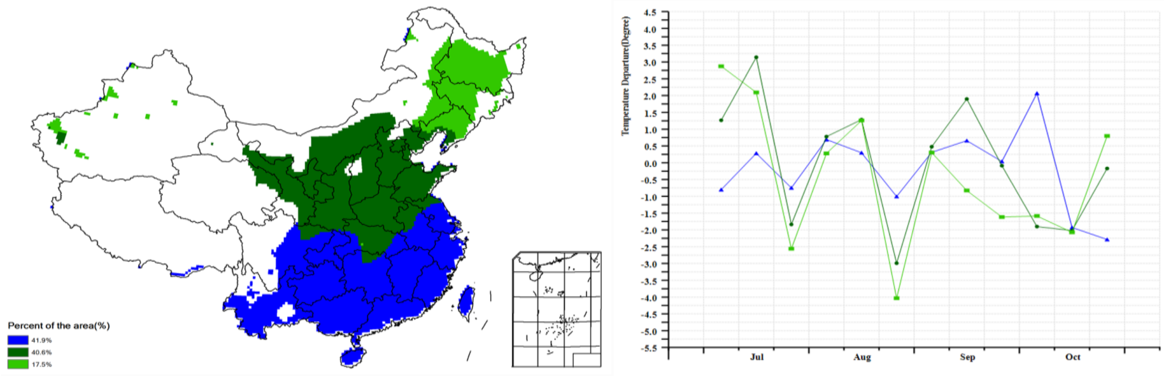


Figure 4.3. China cropping intensity, by pixel, July-October 2017

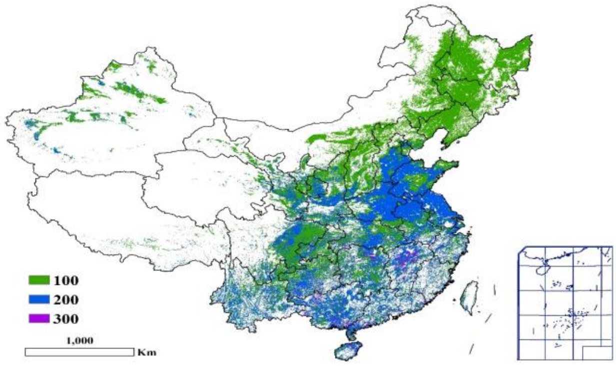


Figure 4.4. China cropped and uncropped arable land, by pixel, July-October 2017

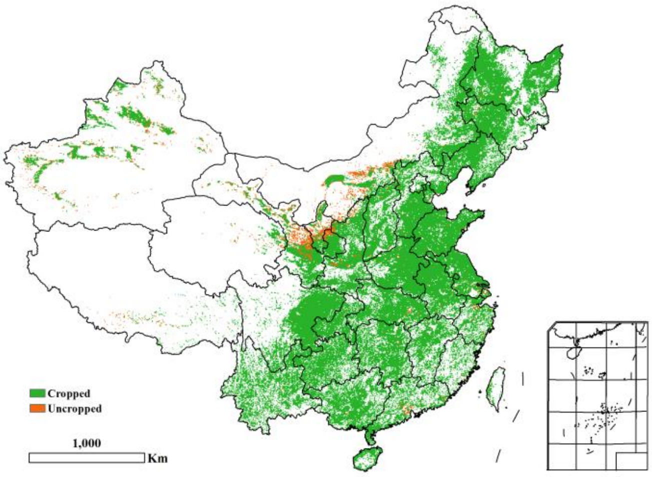


Figure 4.5. China maximum Vegetation Condition Index (VCIx), by pixel, July-October 2017

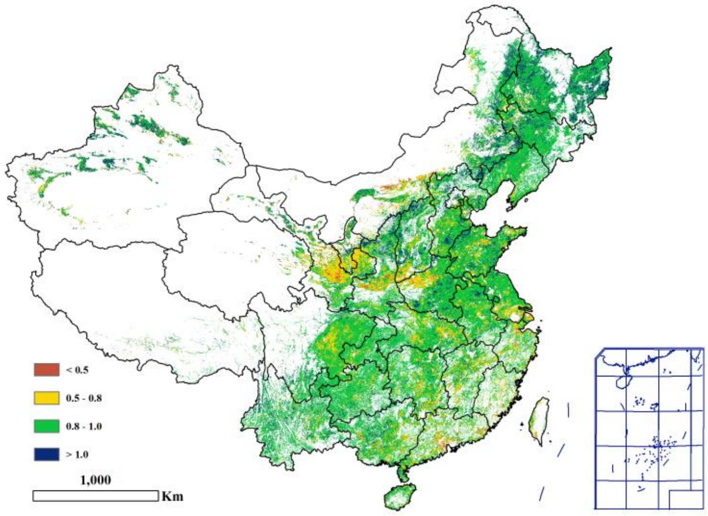
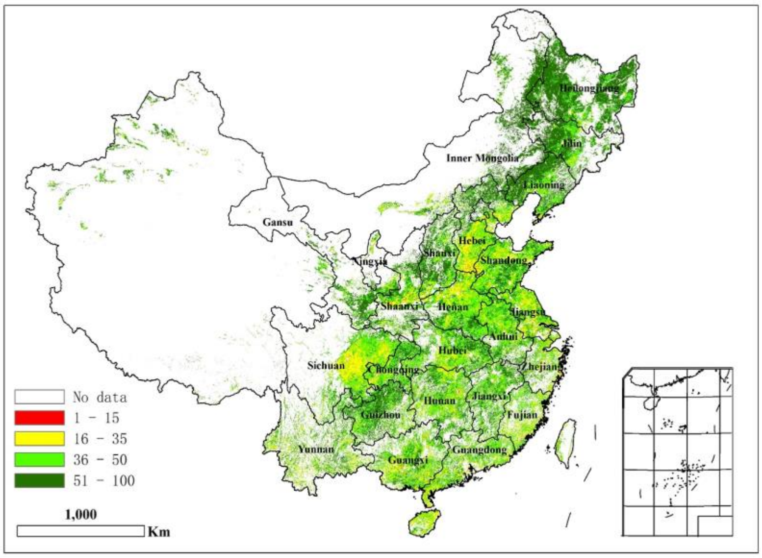


Figure 4.6. China minimum Vegetation Health Index (VHIn), by pixel, July-October 2017



4.2 China crop production

Most crops in China have already been harvested by the end of the reporting period, with the exception of late rice, for which harvesting just started in late October. Taking advantage of the full coverage of remote sensing data and agro-climatic indicators throughout the growing season, CropWatch gives a final revision of the 2017 yield and production estimates for maize, rice, wheat and soybean (table 4.2). Table 4.3 presents additional estimates for different types of rice for various growing seasons.

Maize

As illustrated in the tables, the production of maize is down to 1889.9 million tons, a 5% drop compared to 2016 due mainly to a decrease in planted area. Since late 2016, the maize price has been well below that of the previous five years, and farmers decided to plant less maize in order to have more profit from the fields. In addition, since 2016, China has been implementing a new agricultural policy that encourages farmers to shift from maize to other, more suitable crops in regions where maize cultivation is less than optimal due to soil or climate constraints. As a result, the planted area of maize decreased by 3.7% from 2016. Among the major maize producing provinces, Gansu and Jiangsu are the only two provinces that output more maize (+4% and +1%, respectively) than last year thanks to the favorable conditions. Heilongjiang, Henan, Inner Mongolia, Jilin, Liaoning, Shanxi, and Sichuan experienced significant production drops (more than 3%). Maize planted area in Heilongjiang, Henan, and Inner Mongolia decreased by more than 3%, while average yield in Shanxi and Sichuan decreased 2% or more. The largest drop (-5.3%) in maize area was observed in Henan province where many maize fields were converted to groundnuts cultivation.

Rice

The aggregated rice and single rice production in 2017 remains at 200.6 million tons, the same level as 2016, while production of late rice decreased by 1%. At the provincial scale, the total rice production in Fujian, Ningxia, and Sichuan decreased by 3%, 5%, and 3%, respectively. Both early rice and late rice production dropped in Fujian because of the shifts from double cropping rice to single rice. Adverse weather conditions hampered yield accumulation for rice in Ningxia and Sichuan. Large increases in rice production occurred in Hubei, Jiangsu, Jiangxi, and Zhejiang because of increasing planted area and average yield. Production of late rice in Hubei, Jiangxi, and Zhejiang also increased by more than 3%.

Wheat

The harvest of both winter wheat and spring wheat had been concluded by August and production of wheat remained the same as the previous estimates listed in this year's August CropWatch Bulletin.

Soybean

CropWatch revised its estimates for soybean production to 13,745 ktons, up 3% from last year's increased production. This is the second year of the increased production mainly due to increased planted area, even if the national average yield is down by 1.3%. The most significant increase in soybean production occurred in Inner Mongolia (a 6% increase). Heilongjiang, the top soybean region in China, produced 2% more than in 2016 thanks to increased area. Soybean production decreased in the Henan, Shanxi, Anhui, Liaoning, and Jilin resulting from unfavorable agro-climatic conditions and resulting lower yield.

Table 4.2. China 2017 production of maize, rice, wheat, and soybean, and percentage change from 2016, by province

	Maize		Rice		Wheat		Soybean	
	2017	Change (%)	2017	Change (%)	2017	Change (%)	2017	Change (%)
Anhui	3520	-2	17069	2	10233	-10	1062	-3
Chongqing	2090	-1	4745	0	1089	-2		
Fujian			2797	-3				
Gansu	4965	4			2559	0		
Guangdong			11062	1				
Guangxi			11179	-1				
Guizhou	4997	-2	5430	0				
Hebei	17999	0			10626	-2	188	1
Heilongjiang	26148	-4	20938	0	473	5	4709	2
Henan	15503	-8	3889	1	25619	2	753	-4
Hubei			15905	3	4281	-1		
Hunan			24638	0				
Inner Mongolia	15169	-6			2118	3	1078	6
Jiangsu	2210	1	17122	3	9540	-2	779	0
Jiangxi			17456	4				
Jilin	23572	-3	5682	0			694	-2
Liaoning	15274	-3	4376	-1			411	-2
Ningxia	1695	-1	523	-5	782	-1		
Shaanxi	3439	0	1020	0	3841	-4		
Shandong	19302	0			22293	2	699	0
Shanxi	8420	-3			2254	6	159	-4
Sichuan	7005	-3	14551	-3	4677	1		
Xinjiang	6713	0						
Yunnan	6139	0	5612	-1				
Zhejiang			6498	4				
Sub total	186706	-3	190492	1	100384	-1	10531	**1**
Other provinces*	3198	-63	10131	-14	18518	6	3215	13
China*	189904	-5	200623	0	118902	0	13745	**3**

* Production for Taiwan province is not included.
Note: Wheat data include both winter wheat and spring wheat.

Table 4.3. China 2017 early rice, single rice, and ate rice production and percentage difference from 2016, by province

	Early rice		Single rice		Late rice	
	2016	Change (%)	2016	Change (%)	2016	Change (%)
Anhui	1822	2	13496	2	1751	2
Chongqing			4745	0		
Fujian	1667	-3			1130	-3
Guangdong	5254	1			5808	1
Guangxi	5366	-1			5813	-1
Guizhou			5430	0		
Heilongjiang			20938	0		
Henan			3889	1		
Hubei	2339	3	10728	2	2837	5
Hunan	8220	0	8144	-1	8275	0
Jiangsu			17122	3		
Jiangxi	7591	4	2817	4	7048	4
Jilin			5682	0		
Liaoning			4376	-1		
Ningxia			523	-5		
Shaanxi			1020	0		
Sichuan			14551	-3		
Yunnan			5612	-1		
Zhejiang	823	4	4806	4	869	4
Sub total	33083	1	123788	1	33530	1
China	34469	1	131563	0	34592	-1

* Production for Taiwan province is not included

Overall, CropWatch puts the total 2017 output of summer crops (including maize, single rice, late rice, spring wheat, soybean, minor cereals, and tubers) at 403.0 million tons, a significant decrease (-3%) from 2016. The total annual crop production (including cereals, tubers, and legumes) is 562.3 million tons, a 1.0% drop or 8.0 million tons less compared with 2016. Detailed information of seasonal aggregated production by province is listed in Table 4.4. Inner Mongolia experienced the largest drop with 6% lower annual production than 2016, while Jiangxi, Shandong, and Zhejiang showed a significant increase in annual production of 4%, 5%, and 4%, respectively, compared to 2016.

Table 4.4. Aggregated crop production per the harvest season for major agricultural provinces, China 2017

	Winter crops		Early rice		Summer cops		Total	
	2017	Change (%)	2017	Change (%)	2017	Change (%)	2017	Change (%)
Anhui	11101	-8	1822	2	20480	1	33402	-2
Chongqing	2289	-1			8178	0	10467	0
Fujian			1667	-3	4123	-3	5790	-3
Gansu	2999	0			6139	4	9137	2
Guangdong			5254	1	7574	1	12828	1
Guangxi			5366	-1	10332	-1	15698	-1
Guizhou					12250	-1	12250	-1
Hebei	11391	-2			18186	0	29577	2
Heilongjiang					52855	-2	52855	-2
Henan	26293	4			24522	-6	50815	-1
Hubei	5756	-2	2339	3	18729	3	26824	2
Hunan			8220	0	19054	0	27274	0
Inner Mongolia					20207	-6	20207	-6
Jiangsu	9585	-4			21585	3	31170	1
Jiangxi			7591	4	10100	4	17691	4
Jilin					29949	-2	29949	-2
Liaoning					20061	-2	20061	-2
Ningxia					3020	-2	3020	-2
Shaanxi	3889	-5			6239	0	10128	-2
Shandong	24540	2			21319	0	45859	5
Shanxi	2251	1			8884	-3	11135	-2
Sichuan	5513	-1			26051	-3	31564	-2
Yunnan					14351	0	14351	0
Zhejiang			823	4	6614	4	7436	4
Sub total	105606	0	33083	1	390801	-1	529490	0
Other provinces*	19207	3	1386	2	12234	-37	32828	-17
China*	124814	0	34469	1	403035	-3	562318	-1

* Production for Taiwan province is not included.

4.3 Regional analysis

Figures 4.6 through 4.12 present crop condition information for each of China's seven agricultural regions. The provided information is as follows: (a) Phenology of major crops; (b) Crop condition development graph based on NDVI, comparing the current season up to July 2017 to the previous season, to the five-year average (5YA), and to the five-year maximum; (c) Spatial NDVI patterns for July to October 2017 (compared to the (5YA)); (d) NDVI profiles associated with the spatial patterns under (c); (e) maximum VCI (over arable land mask); and (f) biomass for July-October 2017. Additional information about agroclimatic indicators and BIOMSS for China is provided in Annex A.

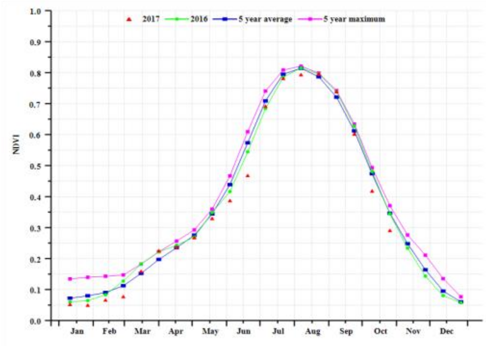
Northeast region

For the Northeast region, the current monitoring period mostly covers the harvest of spring crops, which was concluded in October in most areas. “Single crops” (including maize, rice, and soybean) reached the grain-filling to maturity stages in August to late September. The overall condition of crops was below the five-year average before August, but it recovered when NDVI reached its peak.

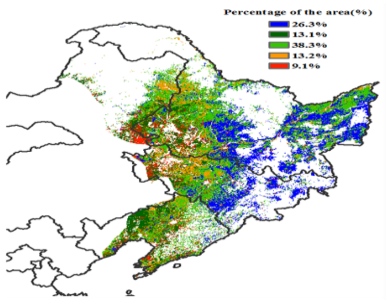
According to the CropWatch agroclimatic and agronomic indicators, rainfall increased +19% across the Northeast region. The increase in rainfall in Heilongjiang and Jilin provinces was over 25%, while in Liaoning it was 10%. Rainy and cloudy weather (TEMP -0.3°C and RADPAR -3%) combined with abundant water supply led to a 4% increase in the biomass production potential, which indicates fair crop condition. Among the three provinces, Heilongjiang enjoyed a near 6% BIOMSS increase, with relatively ample rainfall.

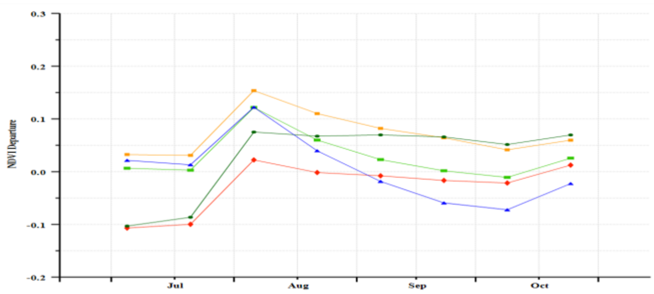
The NDVI profiles for the region stayed below the five-year average before August, but then recovered to average before harvesting. According to the VCIx distribution map, almost all of this area enjoyed a suitable VCIx (over 0.8), which points to a generally good condition without impact of agricultural disaster events. The region also experienced a slight drought over the reporting period, which mainly affected the west of Liaoning and Jilin. As a result of heavy rain at the start of August, crop condition recovered. This is also confirmed by the NDVI cluster map, showing crops in west Liaoning and Jilin recovering and slightly surpassing average condition before August.

Figure 4.6. Crop condition China Northeast region, July-October 2017



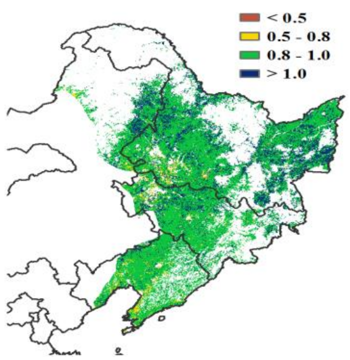
(a) Crop condition development graph based on NDVI

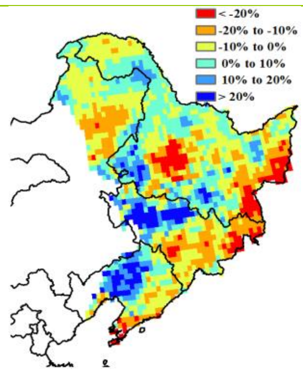




(b) Spatial NDVI patterns compared to 5YA

(c) NDVI profiles





(d) Maximum VCI

(e) Biomass

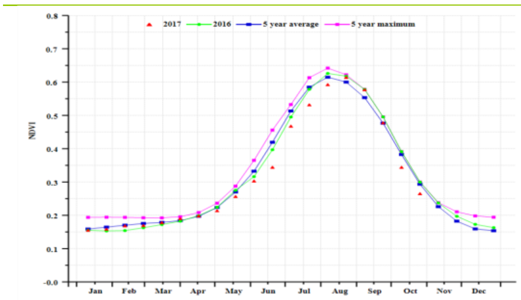
Inner Mongolia

During July to October 2017, the condition of maize and soybean was generally unfavorable in Inner Mongolia. Rainfall was well above average (RAIN +70%), but its temporal and spatial distribution was not homogeneous; both the west and the northeast of the region suffered dry weather from May. Temperature was close to average (TEMP -0.1°C) and radiation was below average (RADPAR -6%). Altogether, the region experienced a large potential biomass (BIOMSS) increase of 32% compared to the recent five-year average.

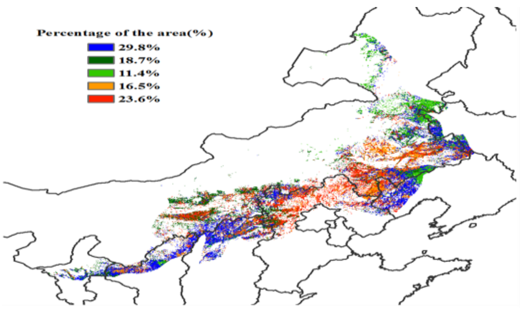
The crop development graph also indicates poor crop condition from May. Coming to July, central Ningxia, north Shaanxi and Shanxi, as well as the east and northeast of Inner Mongolia suffered from drought, which affected crop growth; below average conditions can be found in July in about 60% of the region. The maximum VCI is low (in some areas less than 0.5), and the potential biomass was poor as well in the area mentioned above. Until mid-August, decreased rainfall affecting crop growth is clearly shown by below-average NDVI, which is confirmed by the spatial NDVI patterns and profiles in about 19% of the region. Hereafter, crop condition improved and reached and exceeded the average of the last five years from late August to late September. This relief, however, came late, and the drought at crucial growing periods may eventually influence the crops' outcome. From late September, below average condition had little effect as the crops had reached maturity and were ready for harvest.

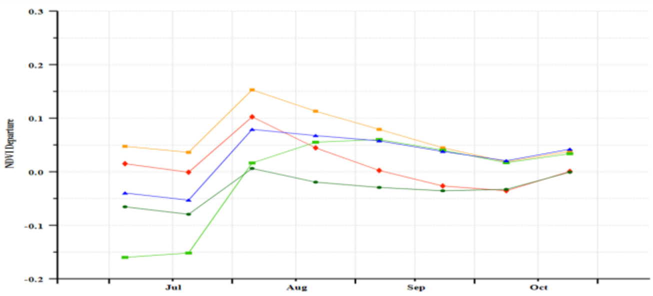
On the basis of the CropWatch monitoring results, maize production is estimated to decrease in Inner Mongolia and Shanxi compared with the last year (-6.4% and -2.8% respectively).

Figure 4.7. Crop condition China Inner Mongolia, July-October 2017



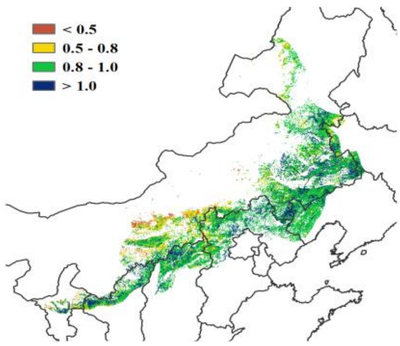
(a) Crop condition development graph based on NDVI

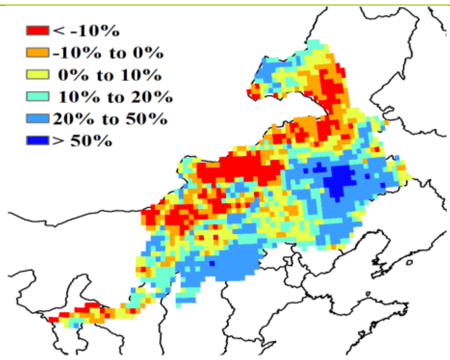




(b) Spatial NDVI patterns compared to 5YA

(c) NDVI profiles





(d) Maximum VCI

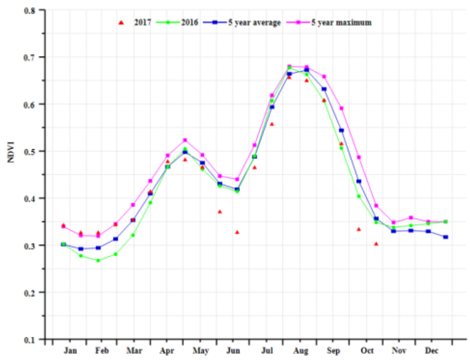
(e) Biomass

Huanghuaihai

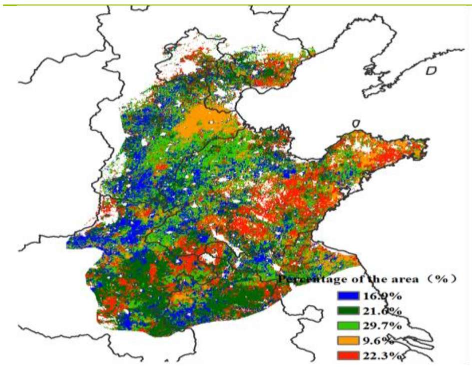
Crop condition in Huanghuaihai was generally below the recent five-year average. The main crop during the monitoring period is summer maize, which was planted in mid-June after the harvesting of winter wheat and completes its cycle by September. According to the crop condition development graph based on NDVI, crop condition was slightly below the five-year average during the entire period and declined sharply in October. Unfavorable condition may be related to the frequent precipitation and the continuous cloud over the region. According to the CropWatch agroclimatic indicators, temperature (TEMP) was average but precipitation (RAIN) was 36% above and radiation (RADPAR) 12% below. Excess precipitation and low sunshine may influence the growing of summer maize and possibly depress its yield. Precipitation can also provide favorable soil moisture condition for the sowing of winter wheat in October.

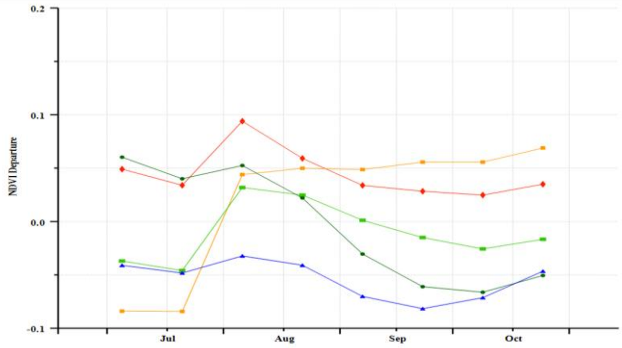
Regarding spatial distribution, many scattered areas over the region display below average condition. Southern Hebei, Northern Anhui, and eastern Shandong were below average throughout the period. Southern and central Huanghuaihai also experienced poor conditions throughout the period except for late July and August. The situation is confirmed by the VCIx and biomass departure maps.

Figure 4.8. Crop condition China Huanghuaihai, July-October 2017



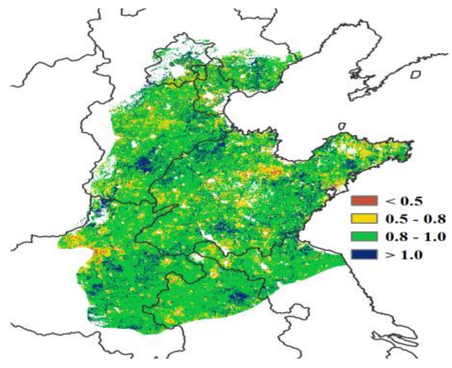
(a) Crop condition development graph based on NDVI

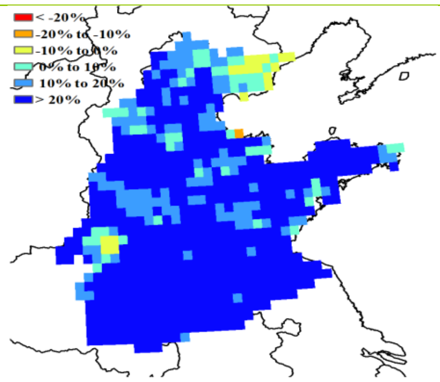




(b) Spatial NDVI patterns compared to 5YA

(c) NDVI profiles





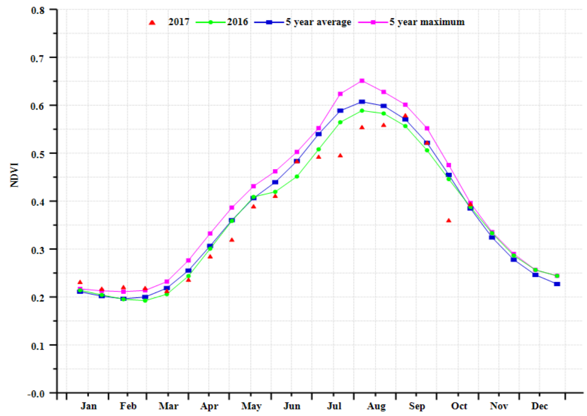
(d) Maximum VCI

(e) Biomass

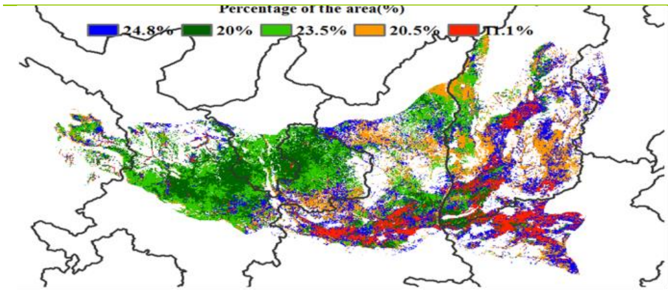
Loess region

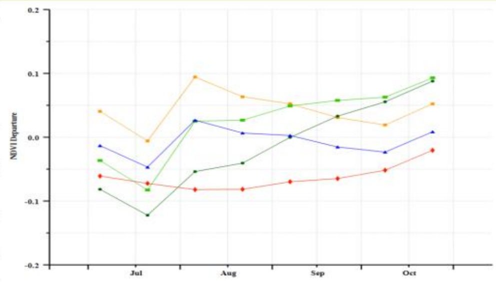
Maize was harvested in late September and early October, and winter wheat in the Loess region has been planted at the end of the monitoring period. According to the crop condition development graph based on NDVI, crops were gradually ripening from August to early September, after which they were harvested from mid-September to the end of the monitoring period. The temperature (TEMP) was close to average while radiation was well below (RADPAR -11%). Abundant precipitation (RAIN +28%) resulted in a potential biomass production potential (BIOMSS) to be above average (+17%). In most of the area, the analyses based on spatial NDVI clusters and profiles are consistent with VCIx. The most favorable conditions occurred mainly in the north-central part of Shaanxi and the west and south central part of Shanxi from July to October, due to the abundant rainfall and suitable sunlight. On the contrary—and mostly because of drought during the monitoring period (as confirmed by the maps of potential biomass)—crops were in unfavorable condition (compared to the five-year average) in most parts of Gansu and Ningxia, especially in central Gansu. Moreover, the cropped arable land fraction (CALF) decreased by 2% compared with recent years, resulting in a relatively pessimistic crop production outlook for the region, which was also confirmed by figure 4.3.

Figure 4.9. Crop condition China Loess region, July-October 2017



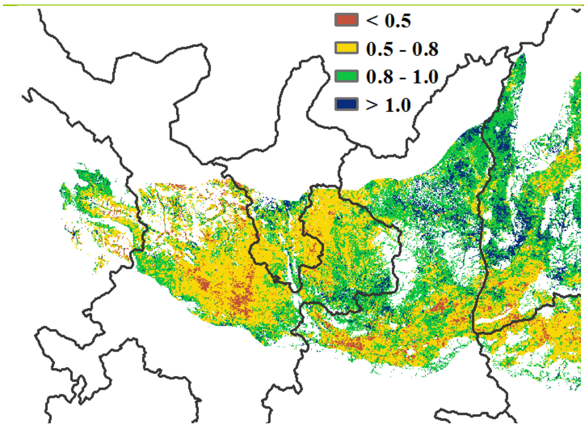
(a) Crop condition development graph based on NDVI

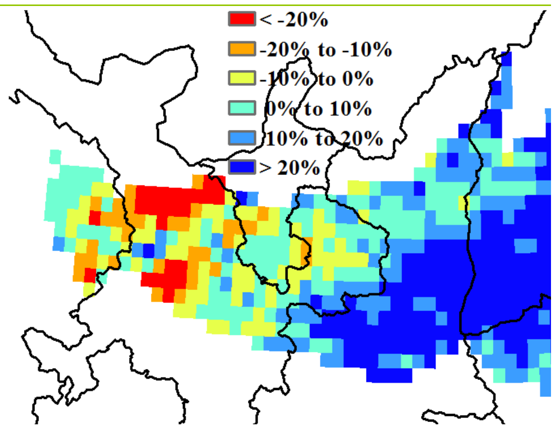




(b) Spatial NDVI patterns compared to 5YA

(c) NDVI profiles





(d) Maximum VCI

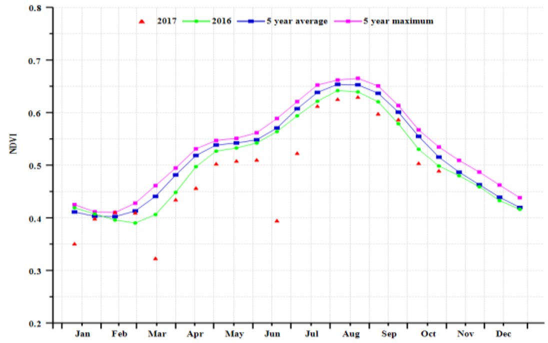
(e) Biomass

Lower Yangtze region

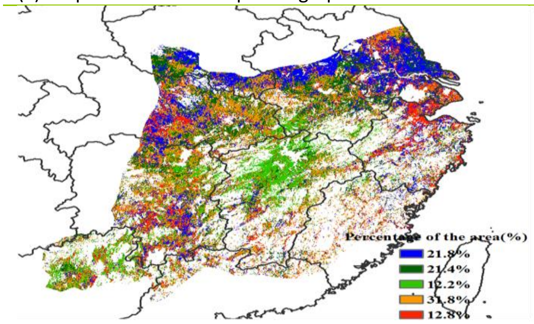
During this monitoring period, late rice matured in the center of the region including in Fujian, Jiangxi, Hunan, and Hubei provinces, while semi-late rice and maize have been harvested in the north of the Lower Yangtze region. Crop condition was slightly below last year's and the recent five-year average according to the crop condition development graph. CropWatch agroclimatic and agronomic indicators show that temperature (TEMP) was slightly below average (-0.1°C), while radiation (RADPAR -8%) decreased significantly compared to its fifteen-year average. Meanwhile, rainfall (RAIN) was significantly above average (13%), which brought about a slight increase of production potential (BIOMSS, 4%). According to the BIOMSS map, the biomass production potential was below average in the central and south of this region, especially in the center of Zhejiang, Hunan and Jiangxi province, which is mostly contradicted by fair VCIx values in the range from 0.5 to 0.8. NDVI profiles show that crop condition was slightly above but close to average in 65.4% of cropped areas after mid-July. Across the country, 21.8% of cropped areas located in the south of Jiangsu, Henan, and middle of Anhui provinces displayed above average condition before mid-July, after which NDVI levels dropped to below average. In another 12.8% of the region's total cropped area including central Hubei and northern Zhejiang province, crop condition was slightly below average.

The production of crops in the Lower Yangtze region is expected to be above but close to average.

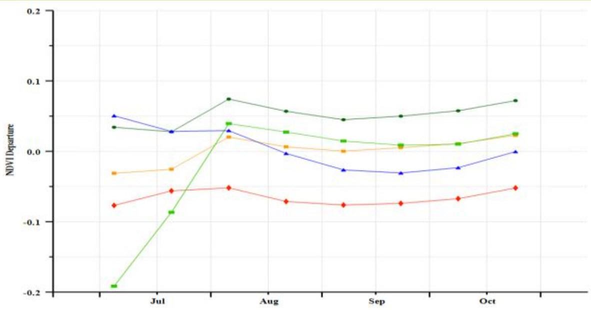
Figure 4.10. Crop condition Lower Yangtze region, July-October 2017



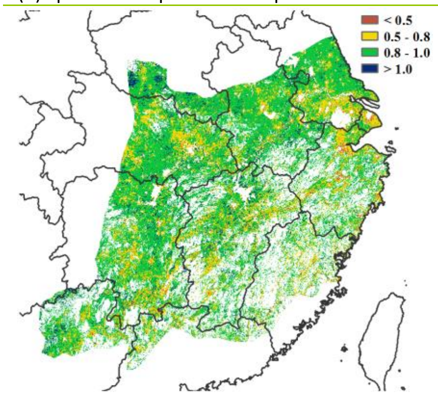
(a) Crop condition development graph based on NDVI



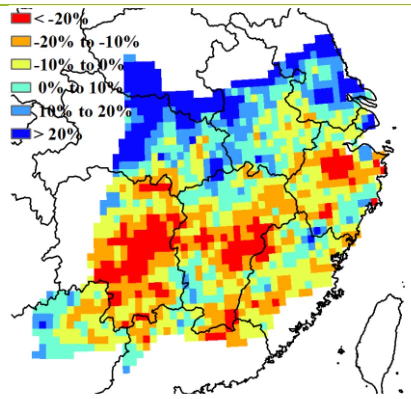
(b) Spatial NDVI patterns compared to 5YA



(c) NDVI profiles



(d) Maximum VCI

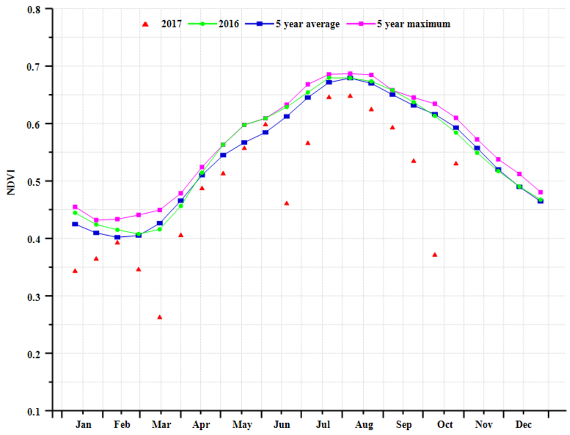


(e) Biomass

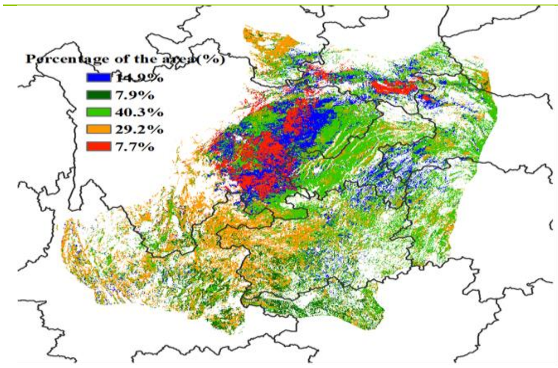
Southwest China

The reporting period coincides with the harvest of maize and single cropped rice, as well as the planting of winter wheat. Based on NDVI profiles for the region, crop condition in Southwest China was below average. This is possibly due to the excess of precipitation (RAIN +16%) and insufficient radiation (RADPAR -10%), compared with average. The NDVI in eastern Sichuan and part of southern Shaanxi was significantly below the five-year average level from August to October, with the VCIx in the range of 0.5-0.8. CropWatch found above average precipitation in Sichuan (RAIN +14%) and Shaanxi (+25%), and below average RADPAR in Sichuan (-7%) and Shaanxi (-12%), which has had a negative impact on crop condition. Although the fraction of cropped arable land (CALF) remained stable during the monitoring period, the cropping intensity in Southwestern China decreased by 6%, which is expected to negatively influence production.

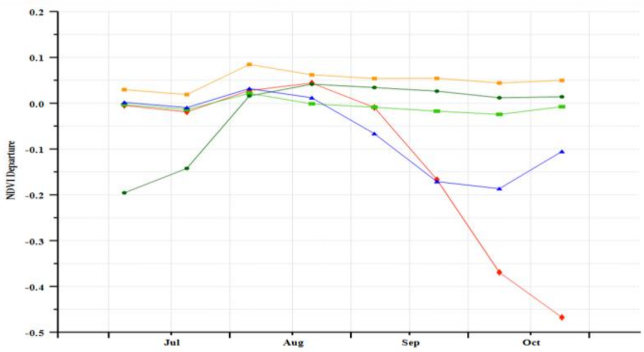
Figure 4.11. Crop condition Southwest China region, July-October 2017



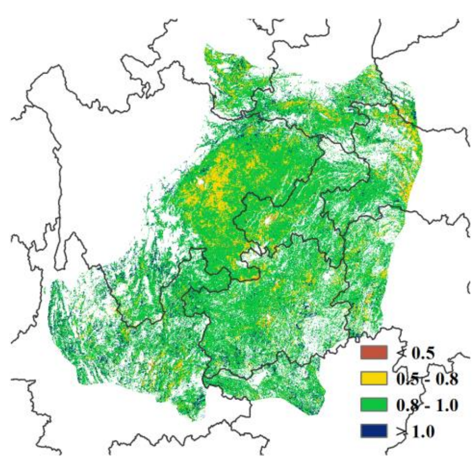
(a) Crop condition development graph based on NDVI



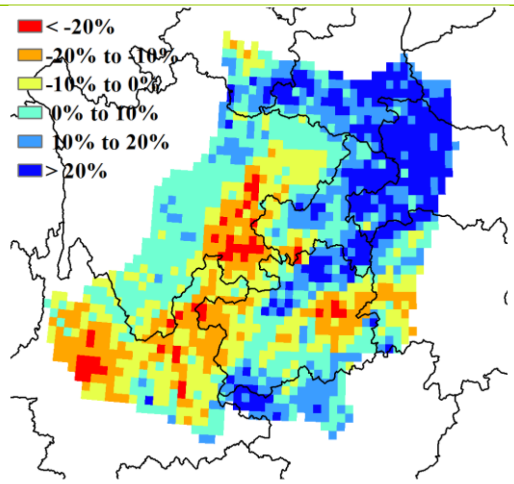
(b) Spatial NDVI patterns compared to 5YA



(c) NDVI profiles



(d) Maximum VCI



(e) Biomass

Southern China

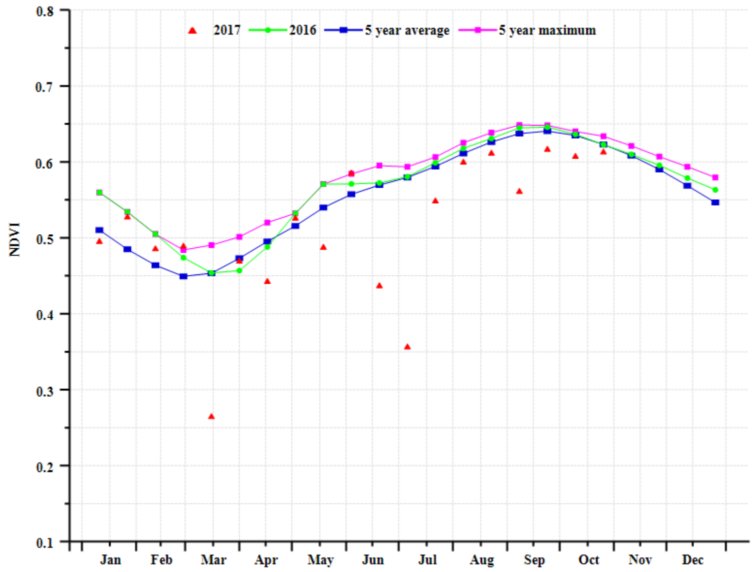
For Southern China, including some areas of the provinces of Yunnan, Guangxi, Guangdong, and Fujian, the NDVI development graph shows that crop condition was below the average of the recent five years.

According to the agroclimatic indicators, rainfall was above average (RAIN +17%), which accounts for the increase of biomass (BIOMSS +7%). Temperature was slightly below average (TEMP -0.2℃), while radiation was well below (RADPAR -7%). Compared to average, the cropped arable land fraction (CALF) decreased by 1%. The maximum VCI (VCIx) was 0.69.

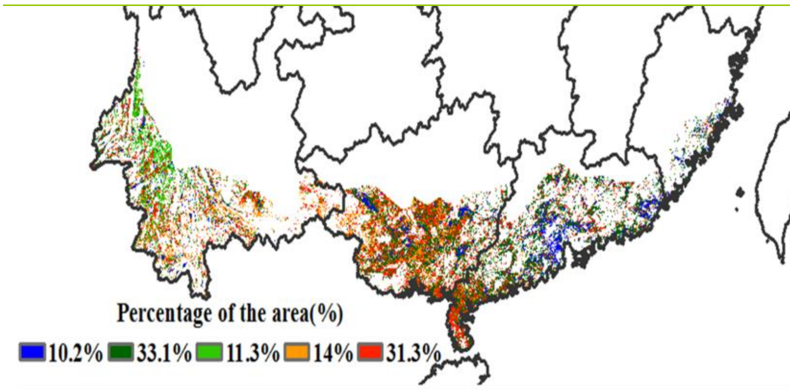
As shown in spatial NDVI patterns graph and NDVI departure profiles graph, 10.2% of the region's crop area has lower NDVI than average during the monitoring period, affecting small areas of the four provinces. A total of 11.3% of crop area has higher NDVI than average, mainly in western parts of Yunnan province. As a result of the abundant rainfall in Guangdong and Guangxi (RAIN +16% and +39%, respectively), the biomass production potential (BIOMSS) was also above average (beyond 20%) in southern parts of these two provinces, as displayed by the biomass map. Below average rainfall in Fujian province (RAIN -13%) led to lower biomass in most areas of the province. In most areas of Yunnan, the VCIx value was greater than 0.8 because of the moderate increase of RAIN (+5%) .

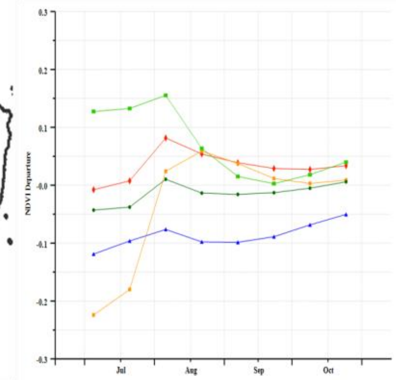
Overall, the biomass graph indicates crop conditions were just fair in parts of southwest Yunnan, eastern Guangdong, and most of Fujian. Unfavorable agroclimatic and agronomic conditions will have a negative effect on production for these areas, and CropWatch will continue to closely monitor these areas.

Figure 4.12. Crop condition Southern China region, July-October 2017



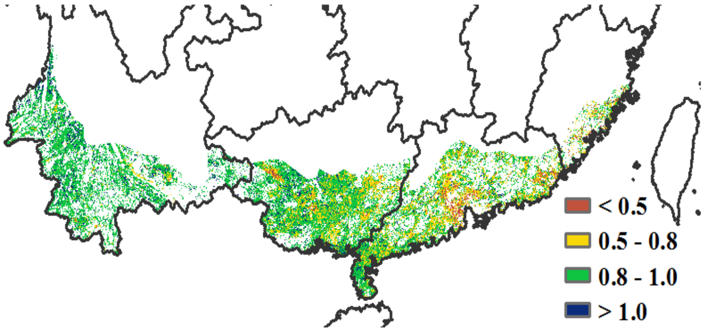
(a) Crop condition development graph based on NDVI



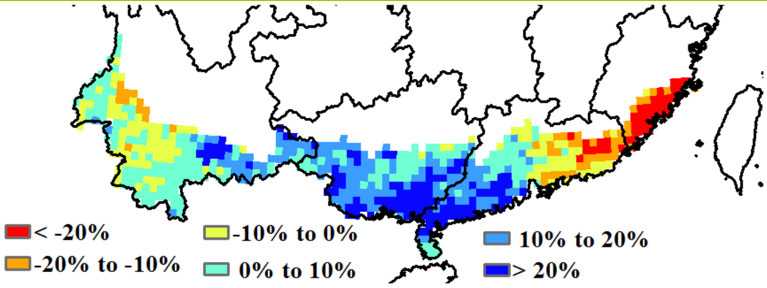


(b) Spatial NDVI patterns compared to 5YA

(c) NDVI profiles



(d) Maximum VCI



(e) Biomass

4.4 Pest and diseases monitoring

The impact of pests and diseases was relatively moderate during mid to late September 2017 in the main rice regions of China. Rainfall in the southern China and southern Yangtze River regions created habitat conditions conducive to rice planthopper and leaf roller migration, as well as dispersal of sheath blight.

Rice pests and diseases

The distribution of rice planthopper during mid to late September 2017 is shown in figure 4.7 and table 4.5. The total area affected reached 5.9 million hectares, with severe impact in central Anhui, central Guizhou, most of Jiangsu, and most of Guangxi, but only moderate impact in western Guangdong, central Hunan, central Jiangxi, and eastern Yunnan.

Rice planthopper

The distribution of rice planthopper during mid to late July 2017 is shown in figure 4.13 and table 4.5. The total area affected by the planthopper reached 6.1 million hectares, with severe impact in central Guizhou, northern Guangxi, and most of Guangdong; the pest only moderately affected rice crops in northern Yunnan and northern Hunan.

Figure 4.13. Distribution of rice planthopper in China, mid to late September 2017

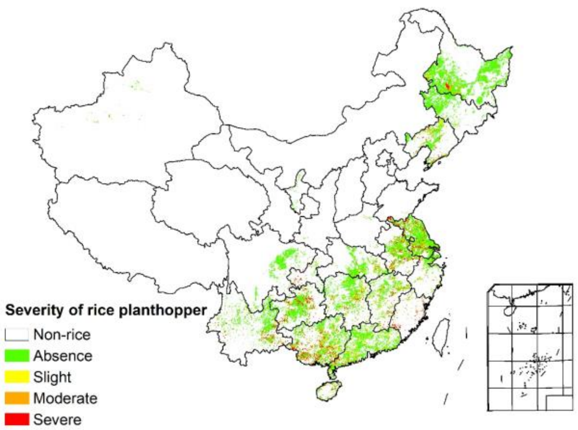


Table 4.5. Occurrence ratio of rice planthopper in China, mid to late September 2017

Region	Occurrence ratio (%)			
	Absence	Slight	Moderate	Severe
Huanghuaihai	63	17	14	6
Inner Mongolia	88	5	6	1
Loess region	89	7	4	0
Lower Yangtze	67	15	13	5
Northeast China	84	6	8	2
Southern China	70	13	12	5
Southwest China	82	7	7	4

Rice leaf roller

Rice leaf roller (figure 4.8 and table 4.6) damaged around 4.9 million hectares, severely so in most of Jiangsu, most of Guangxi, and central Guizhou. The impact was moderate in eastern Yunnan, central Anhui, and central Hunan.

Figure 4.14. Distribution of rice leaf roller in China, mid to late September 2017

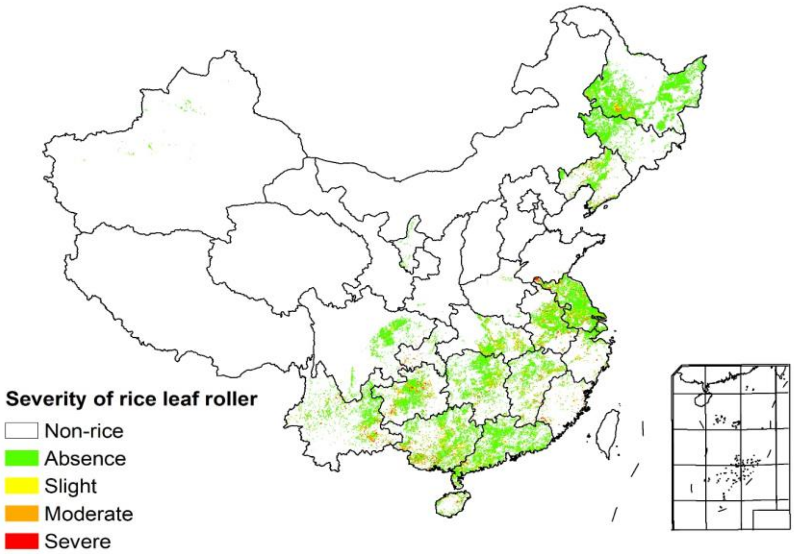


Table 4.6. Statistics of rice leaf roller in China, mid to late September 2017

Region	Occurrence ratio (%)			
	Absence	Slight	Moderate	Severe
Huanghuaihai	71	16	9	4
Inner Mongolia	92	3	4	1
Loess region	90	7	3	0
Lower Yangtze	75	13	9	3
Northeast China	89	5	5	1
Southern China	77	11	9	3
Southwest China	75	11	11	3

Rice sheath blight

Rice sheath blight (figure 4.9 and table 4.7) touched around 7.1 million hectares, severely affecting central Anhui, central Guangdong, and most of Jiangsu. The impact was moderate in eastern Guangxi, central Hunan, and central Jiangxi.

Figure 4.15. Distribution of rice sheath blight in China, mid to late July 2017

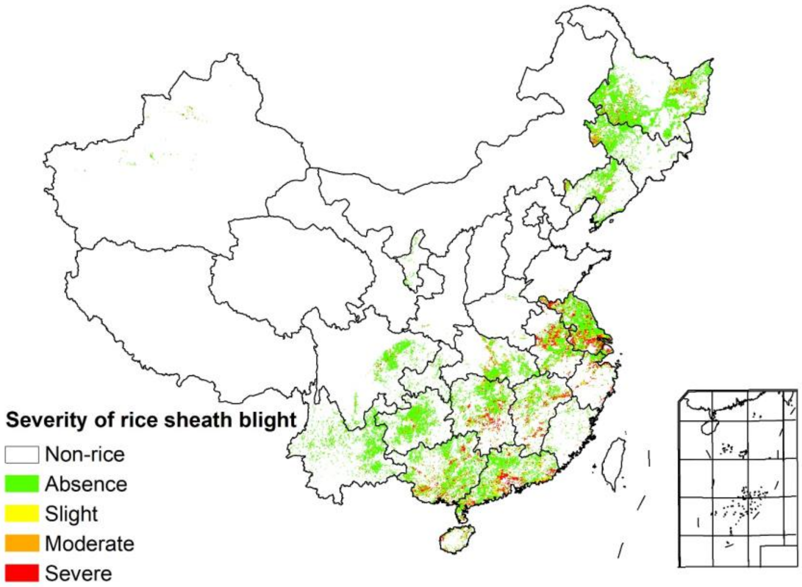


Table 4.7. Statistics of rice sheath blight in China, mid to late September 2017

Region	Occurrence ratio (%)			
	Absence	Slight	Moderate	Severe
Huanghuaihai	52	18	8	22
Inner Mongolia	80	6	10	4
Loess region	80	4	8	8
Lower Yangtze	58	14	9	19
Northeast China	81	6	8	5
Southern China	67	12	8	13
Southwest China	87	4	7	2

Maize pests and diseases

Maize suffered moderately from pest and disease attacks during late August in the main production areas. Abundant precipitation, some of it due to typhoons, created conditions conducive to the reproduction of armyworms and the dispersal of leaf blight.

Armyworm

The distribution of maize army worm in late August 2017 is shown in figure 4.10 and table 4.8. The total area affected reached 4.2 million hectares, part of it severely (central Shannxi, central Hebei, northern Shandong, and southwest Heilongjiang). The impact was moderate in central Jiangsu, northern Anhui, and southern Hebei.

Figure 4.16. Distribution of maize armyworm in China, late August 2017

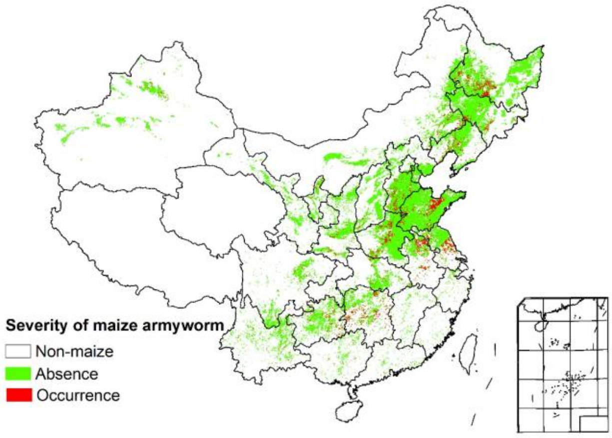


Table 4.8. Statistics of maize armyworm in China, late August 2017

Region	Occurrence ratio (%)	
	Absence	Occurrence
Huanghuaihai	86	14
Inner Mongolia	93	7
Loess region	95	5
Lower Yangtze	92	8
Northeast China	87	13
Southern China	97	3
Southwest China	92	8

Leaf blight

Maize leaf blight damaged around 2.0 million hectares, mostly in northwest Jilin, central Shannxi, central Gansu, and most of Ningxia (severe impact), and in southwest Heilongjiang and central Inner Mongolia (moderate impact). Figure 4.11 and table 4.9 present an overview.

Figure 4.17. Distribution of maize sheath blight in China, late July 2017

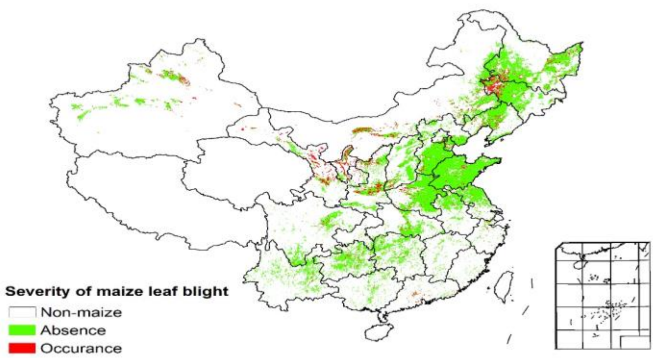


Table 4.9. Statistics of maize sheath blight in China, August 2017

Region	Occurrence ratio (%)	
	Absence	Occurrence
Huanghuaihai	95	5
Inner Mongolia	90	10
Loess region	91	9
Lower Yangtze	97	3
Northeast China	91	9
Southern China	99	1
Southwest China	97	3

4.5 Major crops trade prospects

Grain import and export in China in the first half of 2017

Rice

In the first three quarters of 2017, the total import of rice in China was 2.9818 million tons, an increase of 16.3% compared to the previous year. The imported rice mainly stems from Vietnam, Thailand, and Pakistan, respectively accounting for 57.9%, 30.1%, and 5.3% of imports. The expenditure for rice import was US$1358 million. Total rice exports over the period were 887,600 tons, mainly exported to the Côte d'Ivoire, Republic of Korea, and Turkey (29.6%, 14.9%, and 7.4%, respectively). The value of the export was US$420 million.

Wheat

During the first three quarters of 2017, Chinese wheat imports reached 3.6265million tons, an increase of 25.6% over 2016. The main sources include Australia (46.7%), the United States (37.7%), and Canada (7.6%). Imports amounted to US$847 million. Wheat exports were 98,300 tons. Hong Kong (58.9%), Korea (32.7%) were the main destinations of Chinese wheat exports. The value of the export was US$48 million.

Maize

In the first three quarters of 2017, maize imports totaled 2275,900 tons, down by 23.6% year-on-year. The main importing countries were Ukraine and the United States, accounting for 65.3% and 30.9% of imports respectively. The value of the import was US$472 million. Total maize exports were 75,200 tons, mainly exported to Japan (26.4%) and North Korea (66.6%). The value of the export was US$17.125 million.

Soybean

The total import of soybean was up by 16.8% to 71,451,700 tons in China during the first three quarters of 2017. Brazil, Argentina and the United States respectively contributed 60.0%, 6.3% and 28.9%, for a total value of US$2968,100 million. Soybean exports were 60,400 tons, down 13.1%.

Import prospects for major grains in China for 2017

Based on the latest monitoring results, China grain imports are projected to increase. The projections are based on remote sensing data and the Major Agricultural Shocks and Policy Simulation Model, which derived from the standard GTAP (Global Trade Analysis Project).

Rice

According to the model forecast, rice imports and exports increased by 14.6% and 18.3% respectively in 2017. As the international rice prices continued to fall, domestic and international price differences still existed. The import of rice in our country will increase. It is estimated that the import of rice in 2017 will maintain its growth momentum within the quota range.

Wheat

China’s wheat imports will increase by 19.5 percent, but exports are projected to drop 13.1% compared with those of 2016. At present, the global supply and demand of wheat is still in a relaxed pattern. The persistence of high quality wheat price difference at home and abroad still exists. Wheat imports will grow steadily throughout the entire year.

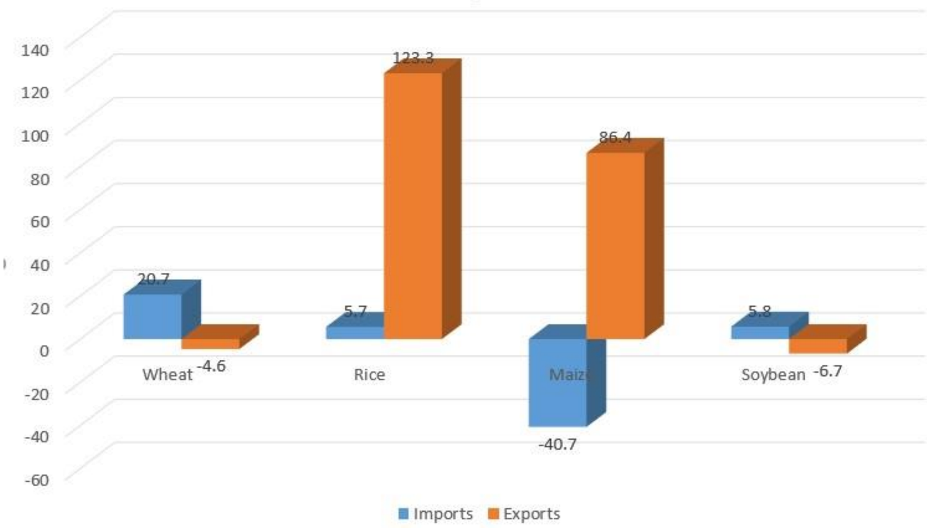
Maize

According to the model forecast results, maize imports decreased by 25.4% in China in 2017, but exports increased by 17.9%. Due to the slackening global supply and demand of maize, prices at home and abroad both dropped. Maize imports are expected to decline sharply throughout the year in China.

Soybean

Soybean imports will increase by 5.8% while exports will be reduced by 7.2% in 2017. With abundant soybean supply in the world, China's soybean imports will remain at a high level. Under the impetus of the structural adjustment policies for planting, the domestic soybean production will increase and the space for the growth of imported soybean will narrow. It is estimated that the increase of soybean imports in 2017 will not be large.

Figure 4.18. Rate of change of imports and exports for rice, wheat, maize, and soybean in China in 2017 compared to those for 2016 (%)



Chapter 5. Focus and perspectives

Building on the CropWatch analyses presented in chapters 1 through 4, this chapter presents revised CropWatch food production estimates for 2017 (section 5.1), as well as sections on recent disaster events (5.2), the rangeland management in Africa (5.3), and an update on El Niño (5.4)..

5.1 CropWatch food production estimates

Methodological introduction

Table 5.1 presents global 2017 production estimates for maize, rice, wheat, and soybean. Earlier estimates, published in recent bulletins, were prepared by the CropWatch team in May and August. The current version is the last revision for 2017 production. It is based on a combination of remote-sensing models (for major commodities at the national level) and statistical trend-based projections for minor producers with a national output approximately between 100 thousand and one million tons. The table includes China and the 30 countries ("30+1 countries") which, together, make up at least 80% of production and exports of the main cereals and soybean.

For the current reporting period, virtually all 2017 crops have been harvested in the temperate northern hemisphere, while in many tropical areas in both hemispheres rice crops are growing (to be harvested in early 2018) or are close to harvest. In the southern hemisphere the summer season/monsoon season is ongoing.

CropWatch estimates differ from global production data published by some other national and international institutions in two important ways: (1) they are modeled based on actual and direct geophysical observations of climate and crops, including up-to-date crop by crop distribution maps. For each crop, both yield variation and cultivated area variation are taken into account; (2) most of them (those shown in red in Table 5.1) are independent of FAOSTAT [1], being based on sub-national country statistics.

The numbers in red in Table 5.1 represent 22% (for soybean) to 89% (wheat) of the countries; when production amounts are considered, the modeled percentages vary from 96% (soybean) to 100% (wheat). This corresponds to 85% (wheat) to 89% (soybean and rice) of the worldwide production when trend-based production estimates for minor producers [2] are included. Numbers in black were derived based on trends computed from FAOSTAT data and previous CropWatch estimates [3]. They include minor crops for the major producers (such as rice in France or wheat in Myanmar), the sum of all minor producers at the global scale (including the 151 countries from Afghanistan and Angola to Zambia and Zimbabwe, which are shown as "Others" in Table 5.1), as well as the total production, which logically combines all data.

Production estimates by country

CropWatch put the total output of the crops produced during 2017 at 2,509 million tons of major grains and 326 million tons of soybeans. The major grains are made up almost exactly by 41% maize (1,027,897 thousand ton, +2.5% over last year's output), 30% rice (as paddy, 745,448 thousand tons, +1.0% from the previous year), and 29% wheat (735,587 thousand tons, down -0.5% from 2016). The 2016 shares were 40% for maize and 30% for wheat; The differences are small but show the continuing global trend of the growth of maize at the expense of rice and wheat.

As often happens, the bulk of minor producers ("Others" in Table 5.1), where food is grown more for local consumption by people and animals than for industrial uses and export, generally perform better than the major producers, among others because most of them have not reached the environmental and economic constraints that prevent the expansion of land and the increase of yields. For instance, maize production by the minor producers is up 5.9%, rice increases 1.0%, wheat 4.1%, and soybeans 13.1%, illustrating the appeal for maize and the efforts in many countries to satisfy the ever growing demand for soybean at the national and international levels.

Among the three major cereal producers, the output of China reached 519,584 thousand tons (down 1.9% from 2016), while 435,918 thousand tons were produced in the United States (+0.1%) and a significantly lower amount of 275,676 thousand tons in India (+5,4%). Although India remains a relatively minor producer of maize (19,034 thousand tonnes), it still out-produces the 4th and 5th cereal producers in terms of total cereal output (Brazil with 103,483 thousand tonnes, +16.2%; Indonesia with 86,202 thousand tonnes, -1.6%).

Most eastern and southeastern Asian countries suffered unfavorable weather conditions (mostly excess precipitation), which directly impacted their cereal productions. In addition to the already mentioned drop in China, other countries with reduced rainfall include Bangladesh (RAIN -4.8%), Thailand (-2,8%), Indonesia (-1.6%), and Myanmar (-0.6%). Notable exceptions are the Philippines (RAIN +0.5%) and especially Vietnam (+5.8%). Some of the listed countries suffered severely from El Niño induced drought in 2016.

Table 5.1. Summary of 2017 estimates of cereal and soybean output of major producers and variation (%), compared with 2016

Region	Maize		Rice		Wheat		Soybean	
	Production	Δ%	Production	Δ%	Production	Δ%	Production	Δ%
Argentina	29,946	16.5	1,789	5.6	11,740	0.9	51,116	0.1
Australia	491	−1.7	1,335	4.7	24,606	−22.1	117	−0.9
Bangladesh	2,245	−5.5	45,274	−5.1	1,344	11.7	129	15.1
Brazil	84,019	19.3	11,344	2.6	8,120	7.6	96,726	5.4
Cambodia	512	−21.0	8,792	2.4			192	6.3
Canada	11,881	1.5			30,679	−7.8	5,471	1.6
China	189,904	−5.2	200,623	0	118,901	0.3	13,745	3.4
Egypt	5,918	3.8	6,545	4	10,963	7.4	42	8.3
Ethiopia	7,154	0	147	4.1	4,180	−11.9	109	8.3
France	14,577	−0.9	1,632	21.3	38,051	0.2	271	18.6
Germany	4,755	3.3			28,130	0.1	30	22.7
India	19,034	2.1	163,146	4.1	93,496	8.6	12,159	−0.1
Indonesia	17,791	−2.9	68,411	−1.3			940	3.5
Iran	2,535	−5.8	2,272	−17.8	12,735	−20.8	213	3.7
Kazakhstan	812	8.1	378	1.7	16,595	−8.8	305	8.9
Mexico	23,858	0.3	245	6.3	3,283	−7.5	509	13.6
Myanmar	1,702	−2.5	25,407	−0.5	193	0.6	76	−13.4
Nigeria	11,165	3.7	4,684	2.1	6	−66.1	809	5
Pakistan	4,904	8.3	9,904	8.3	24,283	−1.4		

Philippines	7,626	0.8	20,188	0.4				
Poland	4,703	27.8			10,931	2.1	1	0
Romania	11,986	4.3	39	−17.8	7,670	−0.1	245	15.9
Russia	12,817	3.9	996	−2.0	58,912	2.4	2,190	−3.5
South Africa	14,161	57	3	0.5	1,576	−7.5	1,198	12.1
Thailand	4,999	−1.6	38,495	−2.9	2	7.7	144	−37.8
Turkey	6,294	6.3	817	−1.7	19,174	1	227	8.7
Ukraine	31,398	2	98	−8.0	22,662	−5.8	3,799	−16.2
United Kingdom					14,521	1.3		
United States	370,173	0.6	10,933	3.8	54,812	−3.6	109,649	−0.3
Uzbekistan	550	8.2	524	3.6	6,442	0.8		
Vietnam	5,113	−2.3	45,422	6.7			47	−29.0
Sub-total CW	903,020	2.1	669,443	1	624,006	−1.2	300,459	1.6
Others	124,877	5.9	76,005	1	111,581	4.1	25,117	13.1
Total	1,027,897	2.5	745,448	1	735,587	−0.5	325,577	2.4

*Notes: Numbers in red are model-based estimates by CropWatch calibrated against national data up to 2016; numbers in black are (or include: last line) statistical projections based on FAOSTAT data up to 2014 and earlier CropWatch estimates for 2015 and 2016. "Others" is based on the sum of individual projections for 151 countries; there are several reasons why this is preferable to the projection of the sum of productions.*Maize

Maize

Countries that have to be singled out for their good performance in terms of maize production include the two South American "giants" Argentina and Brazil, where maize production grew 16.5% and +19.3%, respectively. These increases come after the first country's production stagnated in 2016 and the second country's production actually decreased by more than 10% in the last season. Both are now back to "normal" production levels. Poland (+27.8%) and South Africa (+57%) deserve mentioning as well, with South Africa now actually recovering from the serious El Niño drought that led to a 32% production shortfall in 2016. Both Pakistan and Turkey did well (+8.3% and +6.3%) after a poor season in 2016 (-7% and 0%, respectively).

Poor conditions were already mentioned for cereals in general in Southeast and Eastern Asia, which also includes maize in Bangladesh (-5.5%, after years of steady growth), China (-5.2%, although the drop must be considered in a broader policy context that aims, among others, at relaunching soybean), Indonesia (-2.9%), and an important exporter in the region, Thailand (-1.6%).

Rice

As far as rice is concerned, southern Asia did well, starting with Pakistan (+8.3% in rice production, following a 3.0% dip the previous season) and India (+4.1%, in spite of widespread floods). Vietnam, with a production increase of +6.7%, did well also, as did Cambodia (+2.4). China, the major rice producer, stagnated, while Bangladesh, Thailand, Indonesia, and Myanmar underwent rice production decreases estimated to be -5.1%, -2.9%, -1.3%, and -0.5%, respectively. Rice did very poorly as well in Iran (-17.8% production) which, together with an even larger drop in wheat production (-20.8%) highlights Iran as the country where the largest drop in cereal production occurred. Wheat

Wheat

Australia suffered a drop in wheat production (-22.1%) that exceeds the combined loss of wheat and rice in Iran. Australia is followed by a long list of countries where wheat production declined, in the range from -4% to -8%. They include Ethiopia (-11.9%), Kazakhstan (-8.8%), Mexico (-7.8%), South Africa (-7.5%), Ukraine (-5.8%), and the United States (-3.6%). The largest increases occurred in already mentioned Brazil (+5.4%) and in India (+8.6%). We also mention Egypt (+7.4%), where the good wheat performance was accompanied by good maize (+3.8%) and rice (+4.0%) crops.

Soybean

The Indian soybean production of 12,159 thousand tons is marginally less (-0.1%) than the 2016 output. The major producer, the United States, suffered a slight decrease as well (-0.3%), equivalent to 375 thousand tons, which is largely compensated by the production increase in Brazil (+5.4%) equivalent to 4.9 million tons. For the last ten years, soybean production in the United States has on average exceeded Brazilian production by between 15 and 16 million tons annually, and it has not happened so far that Brazil has outperformed the United States. For the second year in a row, China has increased its soybean production, indicating that the new agricultural policy was apparently successful in halting the decade long period of decline in national production.

Production by importers and exporters

The variation in the global demand for maize, rice, wheat, and soybean can be roughly assessed through variations in the domestic production of major importers [4] (Table 5.2). The 10 major importers, which account for about 22% of global maize production, have suffered a decrease of their domestic output of the commodity (-4.1% for the top 10 importers). The top 5 rice importers lost 1% of their domestic production compared with 2016. This indicates that international demand will be sustained for maize and rice. In contrast, importers increased their output by just under 4%.

Table 5.2. 2017 production (million tons) and difference from 2016 of major importing and exporting countries

		Maize		Rice		Wheat		Soybean	
		Share%	Δ%	Share%	Δ%	Share%	Δ%	Share%	Δ%
Importers	Top 5	21	−4.4	4	−1.0	4	3.2	4	3.8
	Top 10	22	−4.1	40	−0.3	5	3.8	5	4.1
Exporters	Top 5	52	4	36	3.6	28	−4.7	85	2.5
	Top 10	57	5	41	3.1	40	−4.3	93	2.4

Notes: Share % is the fraction of global production that is contributed by the top 5 and the top 10 countries. The identification of major exporters and importers was obtained from the following sources. Wheat, maize and rice export data source (2015 data): ***http://www.worldstopexports.com/wheat-exports-country/****; Soybean exports combine meal and seeds:* ***http://legroupindustries.com/top-10-exporters-of-soybeans-and-soybean-meals-by-country/*** *(2013 data); maize imports (2016 estimates)* ***http://www.indexmundi.com/agriculture/?commodity=corn&graph=imports****; rice importer (2015)****http://www.worldatlas.com/articles/the-largest-rice-importers-in-the-world.html****; wheat imports* ***http://www.indexmundi.com/agriculture/?commodity=wheat&graph=imports****; soybean imports (2011)* ***www.earth-policy.org/datacenter/xls/book_fpep_ch9_3.xlsx****.*

Very similar situations prevail for wheat and soybean. The major importers account for about 5% of world production, and their domestic production increased by close to 4% (3.8% for wheat and 4.1 for soybean).

Considering that the volume of traded commodities is approximately equivalent for the top 10 importers and the top 10 exporters, the production deficit among importers is compensated by the increased production by exporters. For wheat, the opposite situation arises with increased production of importers reducing their import needs at a time when exporters globally reduced their production by 4.3%. As to soybean, the production increase among importers (especially China) will only marginally affect the markets of a commodity for which there is, at present, no apparent limit to demand.

[1] **http://www.fao.org/faostat/en/#data/QC**

[2] Their number varies from 65 for soybean to 136 for maize, which is the most widely cultivated crop in addition to being the first in terms of production.

[3] The FAOSTAT database includes national production data up to 2014. For 2015 and 2016, CropWatch estimates were used.

[4] This discussion does not include countries where the 2016 production was estimated based on trend, such as is the case for the "minor producers."

5.2 Disaster events

Disasters took a heavy toll on all continents during the period from July to October 2017. The period was characterized by the continuation of the complex emergency with a drought component in the Horn of Africa, heat waves and drought in Europa and North America, numerous tropical storms and cyclones essentially in Asia and especially the Caribbean, and exceptional floods in southern Asia.

Cyclones

Numerous tropical cyclones and storms occurred over the reporting period in the Pacific and Atlantic basins. Their tracks are illustrated in figure 5.1, and some of their features have been assembled in table 5.3. For now, only little quantitative information is available for some of them.

One of the earliest storms in the period (Talas) made landfall in the provinces of Nghe An and Ha Tinh in central Vietnam. Overall, about 100,000 hectares of crops were damaged as the event also affected South China (Hainan), Laos, Thailand, and Myanmar.

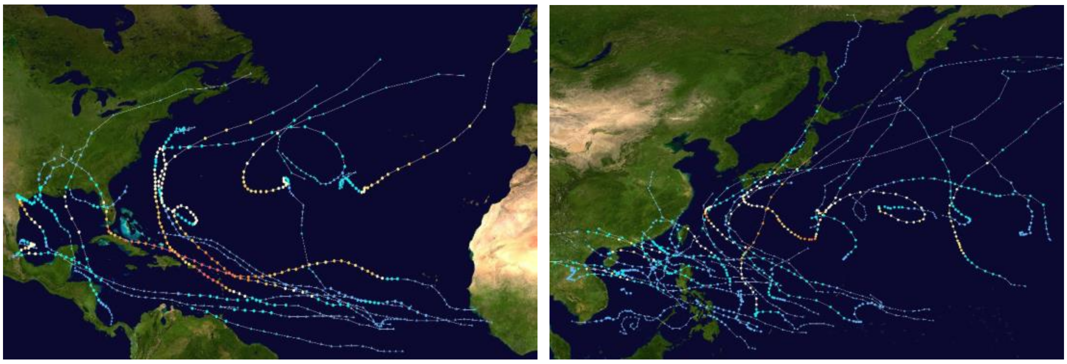
Other relatively minor events include Noru, Franklin, Hato, Doksuri, Khanum, Ophelia, and Odette. Each created havoc, sometimes severely affecting local economies, and most stood out for some specific feature. For instance, Noru, which affected essentially Japan, subsisted for an exceptionally long duration of more than three weeks. Hato (late August) formed near the Philippines and made landfall in China on 23 August. According to Xinhua News Agency, Hato was the strongest typhoon of the year, having destroyed 50,000 hectares of farmland and creating damage amounting US$1.87 billion. In spite of floods in Guangdong, Guangxi, Yunnan, Fujian, and Guizhou, as well as in Lào Cai in Vietnam, agricultural damage was contained. Doksuri (mid-September) affected the same countries as Hato, but also created damage in Laos and Thailand and, to a limited extent, in the Philippines. Khanum and Ophelia both occurred in October. The first was responsible for deadly floods and landslides in Vietnam. Ophelia is much of a curiosity as it moved eastward from the Caribbean, made landfall in Ireland on October 16 and eventually died at a unusually high latitude in Russia. This most easternmost hurricane on record created US$1.2 billion in damages in Ireland.

Table 5.3. Main characteristics of major cyclonic events occurring in July-October 2017

Name		Date		Wind speed	Countries affected	Fatalities	Damage	
International	Other	Start	End				Total	Agriculture
Talas		42930	42933	95 (10)	VNM, CHN (Hainan), LAO, THA, MMR	14	73 M (VNM)	100 kHa
Noru		42935	9 Aug.	175 (10)	JPN	2	55 M	?
Nesat	Gorio	42941	42946	150 (10)	PHL, CHN	2	118 M	6 M
Franklin		7 Aug.	10 Aug.	140 (1)	BLZ, CYM, MEX, USA	0	?	
Harvey		17 Aug.	3 Sep.	215 (1)	SUR, GUY, NIC, HND, BLZ, CYM, MEX, USA	63	200 G	150 M (USA)
Hato	Isang	19 Aug.	25 Aug.	185 (10)	PHL, CHN, VMM	26	5 G	0.2 kHa
Irma		30 Aug.	6 Sep.	295 (1)	CPV, CUB, USA	134	> 63 G	
Doksuri	Maring	10 Sep.	16 Sep.	150 (10)	PHL, CHN, VNM, LAO, THA, MMR, BGD, MYS	28	741 M	30 kHa (VNM)
Maria		16 Sep.	3 Oct.	280 (1)	DMA, DOM, HTI, KNA, USA	66	55 G	> 1 G
Nate		4 Oct.	11 Oct.	150 (1)	CRI, CYM, SLV, HND, GTM, NIC, PAN, CUB, USA	45	> 685 M	
Khanum	Odette	11 Oct.	16 Oct.	175 (10)	PHL, CHN	1	200 M	
Ophelia		9 Oct.	20 Oct.	185 (1)	PRT, ESP, FRA, IRL, GBR, NOR, SWE, RUS	3	> 1.2 G	

Notes: Wind speed is the "sustained" highest wind speed in km/hour, referring to a 10 or 1 minute period. Countries affected are identified by their 3-letter ISO 3166 codes, https://en.wikipedia.org/wiki/ISO_3166-1_alpha-3. Total damage is given in million (M) or billion (G) U.S. dollars. Agricultural damage is given as the total damage (M or G) or in thousands of hectares (kHa). Most impact estimates are very rough underestimates. They stem from several sources and mostly from Wikipedia. Unless otherwise indicated, the damage refers to the whole life cycle of the event.

Figure 5.1. Tracks of the 2017 season tropical cyclones in the Atlantic (a) and Pacific (b) basins



(a) (b)

Note: Colors identify the category on the Saffir-Simpson scale (SS) with blue then green for tropical storms and pale yellow to red for tropical cyclones proper. The SS scale is based on wind speeds. Source of images: Wikipedia.

Hurricanes Irma, Maria, and Nate followed roughly parallel northwest tracks and all eventually made landfall in the United States. The track of Irma remained north of the large Caribbean islands, but nevertheless affected the Dominican Republic, Haiti, Cuba, and eventually Florida in the United States, where the damage to agriculture (essentially citrus) was put at US$2.5 billion. Minor impact is reported from Puerto Rico and Georgia. Mid-September, Hurricane Maria literally destroyed agriculture in the Dominican Republic where all "trees" (bananas and palms) in the country were reported to have been "flattened" for a loss amounting to billions of U.S. dollars. Some sources even asserted that in some areas the destruction was beyond "agriculture" and affected the "ecosystem," meaning the roots of the local livelihoods system, for instance in Dominica. In relative terms, the island was the most severely affected in the whole Caribbean. In Puerto Rico, losses are estimated at US$50 billion. About 80 percent of agriculture was destroyed, amounting to a loss of US$780 million. Bananas were heavily affected throughout the region (such as with a 100 percent loss in Guadeloupe). At the beginning of October, Hurricane Nate followed a somewhat more southern track than Irma and Maria, hitting several central American countries. It was labelled “one of the main disasters in Costa Rica” by national sources. Rainfall locally exceeded 400 mm per day along the southern border, and 76 out of 85 cantons were declared in emergency. Among the hardest hit crops were 120,000 hectares of sugar cane, vegetables, grains, melons and papayas, and rice.

Figure 5.2. Trees downed by Hurricane Maria in Dominica

Source: ***http://wp.caribbeannewsnow.com/2017/09/28/agriculture-sector-dominica-destroyed-hurricane-maria/***

The three hurricanes affected countries where tourism contributes a fair share to the national income, but where nonetheless at least 25 percent of the population lives off the land. Based on the recent experience with Hurricane Matthew in Haiti and Enawo in Madagascar, rebuilding the agricultural sector is likely to take long, resulting in deteriorated food security for many months to come.

Drought and fires

In Asia, drought is reported mainly from the Democratic People’s Republic of Korea (Korea DPR) and Mongolia. At the end of July, FAO and Reliefweb reported that the shortage of rainfall in some key crop producing areas in the country was such that rice (the main staple), maize, potatoes, and soybean could drop by as much as 30 percent in the provinces of South and North Pyongyang, South and North Hwanghae, and Nampo City. The Mongolian drought follows a long spell of above average rainfall and occurred from mid-August.

A heat wave (dry weather and high temperature) that affected much of western Europe started in June and affected England, France, Belgium, the Netherlands, Switzerland, and the Mediterranean. Fires were widespread especially around the Mediterranean (Greece, France, and especially Corsica, Spain, Portugal, Italy, Albania, and Tunisia). Winds that accompanied hurricane Ophelia made the situation worse in Spain and Portugal. More than 60 people died and hundreds of thousands of forest hectares were lost.

In North America, wildfires became widespread in the western United States and Canada, mostly in California, south-central Oregon, Nevada, and British Columbia. The fires have destroyed at least 5,700 homes and businesses, making them the deadliest and most destructive group of wildfires in the history of California. At least 32 people were killed and at mid-October hundreds remained unaccounted for. Also in mid-October, the total burned area in the United States and Canada combined was estimated at 6.4 million hectares, with about equal areas in each country.

Floods and landslides

Floods are reported from all continents, but mostly from Asia where they were associated with the listed tropical cyclones or a particularly active monsoon in southern Asia.

Figure 5.3. A man cleans his house in Freetown after the mudslides

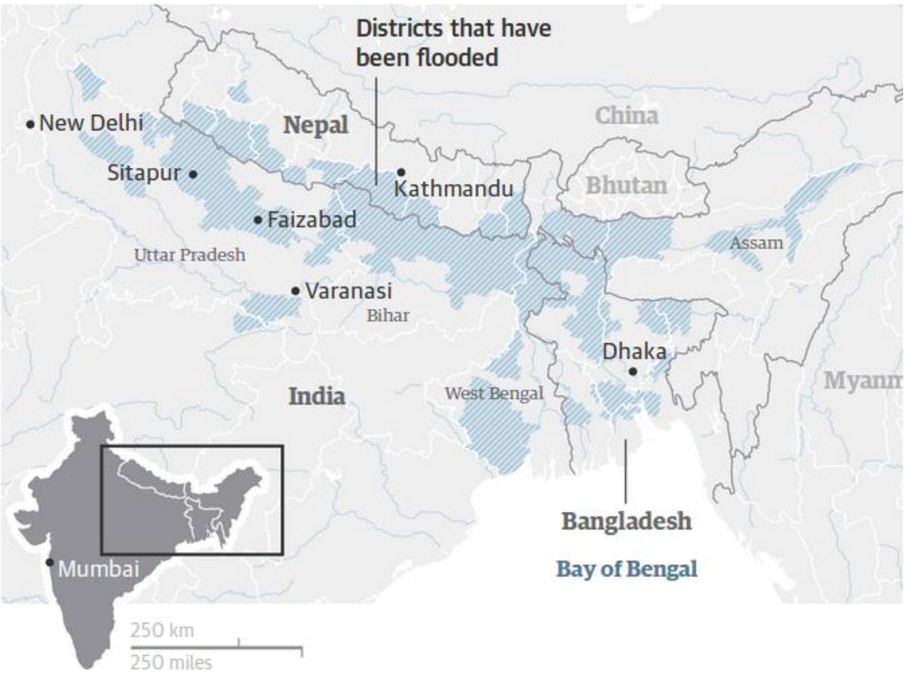
Source:OliviaAcland,UNDP2017, ***https://reliefweb.int/sites/reliefweb.int/files/resources/Sierra%20Leone%20Sit%20Update%20no%208.pdf****.*

In Africa in July, Ghana experienced major floods in several regions, including Greater Accra, Central Region, Western Region, and Eastern Region, which were all declared flood emergency areas. In Freetown, the capital of Sierra Leone, devastating mudslides and floods claimed over 500 lives in mid-August; many are still missing and presumed dead. At the end of August, floods were also reported from Nigeria and Ethiopia.

In South America, August and mid-September witnessed excess precipitation and resulting floods over most of the national territory in Guatemala, with the exceptions of Santa Rosa and Chimaltenango Departments. Alta Verapaz, Petén, and Suchitepéquez were particularly wet. In Peru, floods occurred at the end of July and early August, including some areas already affected by the Putumayo floods that were reported on in the previous CropWatch bulletins.

Floods of exceptional extent occurred at the end of July and during August in parts of southern and southeast Asia, including the Philippines, Vietnam (with landslides and flash floods especially in the north), and Nepal (Koshi, and neighboring Bihar in India) where about 50 percent of the districts have been affected by landslides and flooding in late August. Floods also occurred in Thailand and Myanmar (140,000 people affected), and especially in several Indian states (11 million affected) including Manipur, Arunachal Pradesh, Gujarat, Bihar, Uttarkand, Orissa, and Uttar Pradesh where about 104 people have died, more than 3000 villages were submerged, and almost 3 million villagers have been affected by flooding, according to local officials. In Assam alone, heavy rain created havoc for close to 1,100,000 people in over 3300 villages in 21 out of 32 districts. Flooding worsened on 22 July, when new areas were submerged by the rising waters of the Brahmaputra River and its tributaries.

Figure 5.4. Flooded areas in India, Nepal, and Bangladesh as of 29 August 2017



Source: ***https://www.theguardian.com/world/2017/aug/30/mumbai-paralysed-by-floods-as-india-and-region-hit-by-worst-monsoon-rains-in-years***.

In the same region, neighboring Bangladesh is said to be the victim of "unprecedented conditions," perhaps the worst floods in 100 years, accompanied by numerous landslides in the hilly areas of Chittagong. In total, 4.8 million people in 26 districts were affected by the floods, especially after rivers broke embankments in low-lying areas such as Sylhet, Moulvibazar, and eight more districts. At the maximum extension of floods, one third of the country was estimated to be under water. Xinhua reported on 19 August that, according to the International Federation of Red Cross and the Red Crescent Societies, a major humanitarian crisis was unfolding across large areas in South Asia, with more than 16 million people affected by monsoon floods.

In India, Nepal, and Bangladesh, the three countries where the worst floods occurred, 40 million people had their lives disrupted, a million houses were lost, and at least 1200 persons died. In Bihar alone over 700,000 hectares have been destroyed. In Nepal food crops have been wiped out by the floods in the major farming lands in the southern lowlands. As most farmers in the region practice subsistence agriculture and food production, the resulting nutritional state of the population is bound to suffer.

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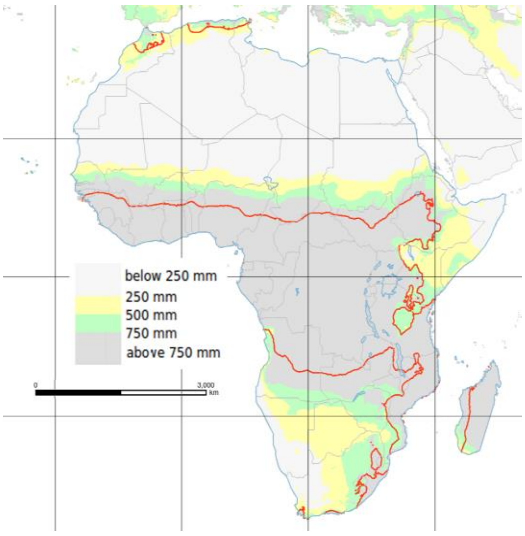
5.3 Focus: Rangeland management and issues in Africa

Agroclimatic environment of rangelands

Rangelands are a land-use category in which pastoralists and their livestock play a significant, and often predominant, part in the agricultural economy. Rangelands typically occur in the dry-lands bordering the general areas of the Sahara and the Kalahari deserts, with rainfall amounts between virtually nil to 750 mm (figure 5.5).

Figure 5.5. Major semi-arid precipitation zones in Africa



Note: The red line indicates the limit of the 180-day growing season. It is based on the 1961-90 reference values from GAEZ (GAEZ, 2012); the precipitation grid is from the WORDCLIM database (Hijmans, 2005).

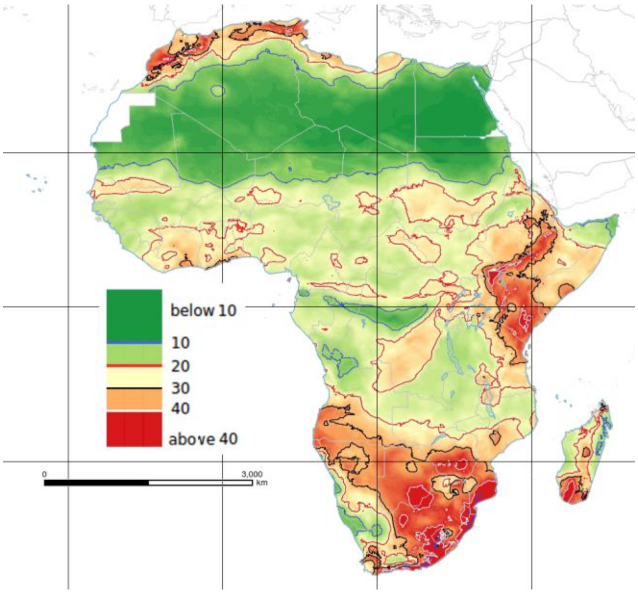
According to the authors of the African Union sponsored report on the rational use of rangelands and fodder crop development in Africa (Inter-African Bureau for Animal Resources, AU-IBAR 2012; an important source for several sections of this note), "dry-lands" are better defined by the length of the rainless period than by rainfall amounts. This is because of seasonality (two or more rainy and rainless periods); the relations between evapotranspiration, temperature, and elevation; and rainfall distribution patterns over the year. The common definition of dry-lands puts the length of the rainless period at 180 days, which often allows for some combination of crop agriculture and livestock husbandry. When, however, rainfall drops below 200 or 250 mm, most crop farming without irrigation becomes mostly impossible or, at least, extremely risky.

It is stressed that, contrary to the arid Sahara, most of the Kalahari "desert" is, in fact, semi-arid: precipitation is generally between 250 and 500 mm (Figure 5.5, centered around Botswana). In many ways, the region is comparable to the Sahelian zone in West Africa, and it is frequently covered by sparse "forest." The Namib desert, which includes the border area between South Africa and Namibia, from the coast to southwest Botswana, is the driest area of he Kalahari; it is mostly sand desert akin to much of the Sahara.

Dry-lands (delimited by the 180-day season line in figure 5.5) make up 43 percent of Africa's inhabited surface and are home to 40 percent of the continent's population. Dry-lands include areas that are climatically sub-humid, semi-arid, and arid in the BS, BW, and CW classes in the Köppen Climate Classification System. In parallel with the decreasing gradient of rainfall, the economy changes from agro-pastoralism to pure pastoralism. As stressed above about the Kalahari "desert," the vegetation of African rangelands reflects amounts of precipitation and may include mixed woodland/grassland "forest" (miombo), shrub-lands, and grasslands. AU-IBAR (2012) stresses that in African dry-lands, dwarf shrubs account for a larger share of cattle nutrition than perennial grasses.

Another defining feature of African dry-lands is the variability of rainfall, which affects all facets of precipitation distribution: spatial, intra-seasonal, and inter-seasonal. Rainfall variability is the main source of risk in all African cropping and livestock production. As illustrated in figure 5.6, both the driest (arid) and wettest (equatorial) areas enjoy low variability. The largest inter-annual variability occurs in the driest areas in east Africa (especially the Horn of Africa), southern Africa, and southern Madagascar. In comparison, the Sahel enjoys relatively low variability.

Figure 5.6. Standard deviation (in days) of the length of the growing season over the reference period 1961-1990



Source: Based on gridded data in GAEZ (2012).

Varying degrees of nomadism

In the driest areas, rangeland management becomes an exercise in optimizing the use of scarce and dispersed biomass resources using the mobility of livestock. Livestock harvests an irregularly distributed resource, provided sufficient biomass and watering points are available to maintain the livestock healthy. It has been argued that pastoralism outperforms ranching in terms of returns (in cash) per hectare, meat production, and energy generation as firewood and cow-dung (de Jode 2010).

Somehow, at least in the driest areas, livestock production and rangeland management systems never reach equilibrium. The whole society and social arrangement, including land ownership and the nomadic live-style, are aimed at optimizing survival in the face of the extreme variability of resources.

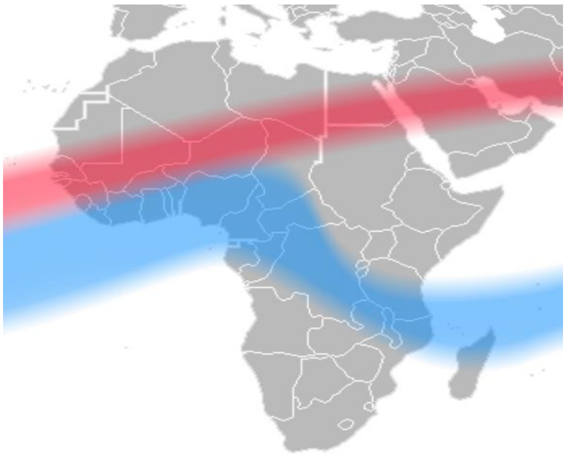
Nomadism essentially occurs at two spatial scales. At the largest scale, herders and their cattle follow the movements of rainfall-generating weather systems. These are the same systems that also condition the timing and number of rainy seasons in tropical areas, essentially the Inter-tropical Convergence zone (ITCZ); the same systems also trigger the spectacular migration of large wild ruminants in eastern Africa (figure 5.7).

Figure 5.7. Migration of gnus (wildebeest) in East Africa

Source: **https://commons.wikimedia.org/wiki/File:Wildebeest_Migration_in_Serengeti_National_Park,_Tanzania.jpg**.

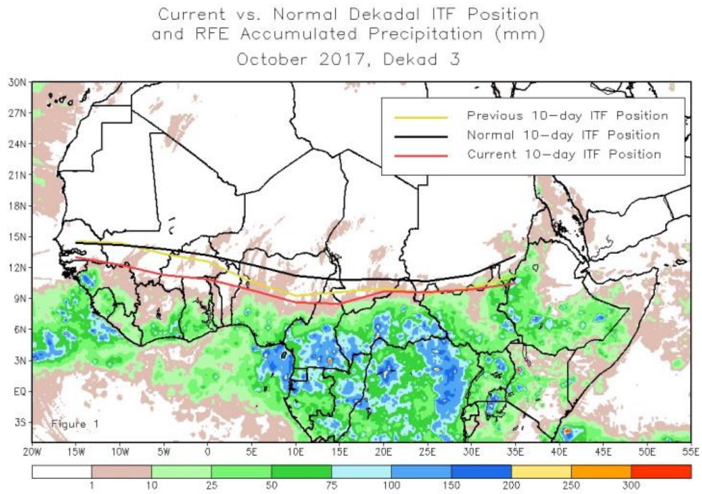
The ITCZ corresponds approximately to the "thermal equator," which is the latitudinally variable band area where highest temperatures are recorded [footnote 1]. Trade winds (blowing from the east) converge at the ITCZ and rise, thereby cooling and generating clouds and rainfall. Precipitation does not occur exactly at the position of the ITCZ, but usually 200 or 300 km closer to the geographic equator than the thermal equator. Throughout the year, the position of the ITCZ changes, with the zone being in the southern hemisphere in the months around January and in the northern hemisphere in the months around July (figure 5.8). The intensity of the color in the figure indicates the frequency of the presence of the ITCZ, highlighting the considerable uncertainty (inter-annual variability) that exists for the position of the ITCZ, which is a fundamental variable for rangeland and cattle monitoring, management, and information systems (figure 5.9). According to Sachs and Myhrvold (2011), current data indicate that climate change could entail a shift of the average position of the ITCZ by up to 5 latitudinal degrees, which would completely modify current cropping and rangeland patterns in Africa. It can be assumed that this would "re-green" the Sahara but turn the Kalahari into a true BW desert in the Köppen Climate Classification System.

Figure 5.8. Average position of the ITCZ during July (red) and January (blue)



Source: ***https://upload.wikimedia.org/wikipedia/commons/d/d7/ITCZ_january-july.png***.

Figure 5.9. Position of the Inter-tropical front (red) during the third dekad of October 2017



Source: ITCZ monitoring by NOAA, ***http://www.cpc.ncep.noaa.gov/products/international/itf/itcz.shtml****.*

The large-scale nomadism that is associated with the large movements of the ITCZ is usually referred to as transhumance. In addition to transhumance, there is also micro-nomadism, with cattle movements occurring within a limited region, especially during the rainy season in areas where this season lasts more than a couple of months. Many potential conflicts derive from the interaction during at least part of the year between crops and cattle, farmers and herders. Unless they are given feeds, animals need to move in search of biomass and water.

Characterization of livestock and rangelands in African economies

Grazing lands (rangelands combined with permanent meadows) occupy between 21 percent (in the middle of Africa) and 57 percent (in the south of the continent) of the total land area of African countries [footnote 2]. When considering agricultural land only, the percentages increase to 30 percent in the middle area to as much as 91 percent in southern Africa and around 70 percent in remaining areas (table 5.4). As shown in the table, these percentages have been decreasing over the last 15 or so years, especially in the east, while they have remained stable in the south. This finding is consistent with Nkonya et al. (2013), which stresses the increase of croplands at the expense of other land uses, including wetlands and "forest."

Table 5.4. Select statistics about rangelands and cattle in Africa

	Grazing land (rangeland and permanent meadows) as part of total and agricultural land areas and change over time			Animal numbers		Herd composition				LSU	Exports		Imports	
	Total	Agricultural		million	% Change	Sheep	Goat	Beef			M$	%	M$	%
	%		Δ%	[1]	[2]	%	%	%	Δ[3]	[4]		[5]		[5]
North	24	77	−0.2	212	1	51	25	21	−3	0.14	276	172	418	301
West	30	64	−1.3	319	35	31	43	20	0	0.11	189	28	304	23
East	41	77	−2.7	375	54	21	33	39	−3	0.22	432	329	87	575
Middle	21	30	−1.6	67	23	14	40	35	−3	0.07	62	−3	42	132
South	57	91	0.5	61	−3	47	18	33	1	0.08	86	37	106	33

Notes: Imports and exports refer to live animals. Prepared with data extracted from FAOSTAT. For a list of countries in each region (North-South), see footnote 2.
[1] Beef cattle, camels, pigs, goats, and sheep, in millions, average 2010-14 numbers; [2] Change from 2001-5 to 2010-14 in percentage; [3] percentage point change from 2001-5 to 2010-14; [4] Livestock Unit (LSU) density in the agricultural area in LSU/hectare; [5] Percentage change between 2001-5 and 2009-13.

Livestock numbers are very similar to those of the human population throughout most of the continent, with the exception of central and eastern Africa where animals outnumber people by a factor of two to three. With the exception of the north and south, numbers have increased markedly over the last decade, up to 54 percent in east Africa, which includes some of the areas with large potential of conflicts because of human concentrations and large environmental variability (Figure 5.6).

Goats and sheep numbers generally exceed beef populations by a factor of two to three. This is explained by various factors that include the robustness of small animals and the preference for small amounts of meat when animals are slaughtered, as large volumes cannot be easily stored and need to be consumed immediately. In general the share of beef has been decreasing over the last decade. Other animals are also kept in Africa but nowhere reach the importance of the listed ruminants. They include water buffaloes (mostly in Egypt, FAO 2017a), camels, and pigs. Camels reach 3 percent in north and east Africa and--with the exception of north Africa where they are absent--pigs make up about 3 percent too, except in middle Africa where they reach 10 percent.

Table 1 also lists the density of livestock units (LSU) because the variable is a good measure of the pressure put on rangelands by the animals. An LSU [footnote 3] is, somehow, a measure of the “grazing power” of animals. A “modern dairy cow” is assigned a LSU value of 1, while FAO assigns tropical cattle a lower value of about 0.7. The small ruminants count as approximately 0.1, while camels reach or exceed 1.0. The LSU density, therefore, is a direct measure of the grazing pressure on agricultural land. Values are highest in east Africa (0.22 LSU/hectare) and lowest in the middle and south of the continent with values below 0.1 LSU/hectare). Much literature of the 1990s (for example, World Bank 1995) focused on the concept of Carrying Capacity (CC) of rangelands, which is the number of LSU a given area can sustain. It appears that the carrying capacity is difficult to handle when both livestock and biomass vary considerably over time due to the inherent variability of arid-lands, and equilibrium is never reached.

Most countries in Africa have a trade deficit in terms of live animals and meat products, with the exception of countries in the middle of Africa and, especially, east Africa. The latter region exports cattle mostly to the neighboring Arabian peninsula.

Problems and issues related to rangeland management in Africa

The sections above have stressed that livestock and the exploitation of rangelands are important sectors of the economy in most African regions. Many problems do, however, arise because of the risks connected with the exploitation of a spatially and temporally variable resource using mostly traditional techniques that compete with other sectors. Several good syntheses of the issues facing livestock and rangelands in Africa have been developed by the African Union (the already mentioned AU-IBAR of 2012), FAO and the CGIAR centers, especially ILRI (International Livestock Research Institute, Nairobi), and the World Agroforestry Centre (a brand name used by the International Centre for Research in Agroforestry, ICRAF, also based in Nairobi).

Restrictions to the short-range movements of cattle

Land, including grazing lands, is often collectively owned in Africa. Where this is the case, the lands are managed by traditional authorities who may assign parts to other uses, such as crop agriculture. The land use changes are driven by population and "development," such as construction, establishment of ranches, and large scale agriculture. This has frequently led to land fragmentation, a decrease of land available to herders, and impediments to free cattle movements. This, in turn, has entailed the degradation of rangelands and the over-exploitation of water resources. Conflicts frequently erupt in rangelands due to a variety of factors, including cattle rustling (stealing) and the weakening of traditional authorities, which generally results in ambiguous rights. Fencing of rangelands or croplands is now common, and farming tends to substitute other land uses including wetlands, which are essential for cattle survival during the dry season.

As mentioned above, woody biomass is a source of food for cattle that is as important as herbaceous vegetation, and fuel-wood collection by villagers (which has been increasing) directly competes with cattle. This is often compounded by refugee fluxes who also need fuel-wood and bring some cattle with them. Finally, livestock competes with wildlife for rangelands outside of protected areas, while livestock is not permitted into parks, many of which actually constitute the traditional herding areas or nomads in the low rainfall areas.

Limits to long-range (transhumance) movements

Most African countries are gradually introducing border controls in areas where transhumance had traditionally taken herders and their livestock across those border areas well before their establishment. Fortunately, recognition of the ecological and economic efficiency of pastoral land management is growing. Most regional associations (such as ECOWAS, EAC, and COMESA) have provided or work at developing a framework to enable trans-boundary movements of cattle in the form of International Transhumance certificates, which provide for the registration of the movements of herders and the identification of their cattle (ECOWAS 2017).

Land degradation and desertification

Overgrazing and the gradual decrease of the capacity of plant biomass (natural vegetation) to regenerate is one of the facets of land degradation. Many dry-lands, however, suffer from various types of degradation, including soil erosion, loss of biodiversity, salinization, and unsustainable use of water. According to some estimates, about three quarters of African rangelands are somehow degraded. Desertification is defined as land degradation in semi-arid areas. Its causes include the direct actions of humans in the area, but also, and to a growing extent, the effects of climate change.

Solutions?

Innovative systems have to be designed to tap the biomass of rangelands in a sustainable way, to ensure the preservation of traditional pastoralist knowledge, and to optimize the interaction between crop agriculture and herding. The whole community must be involved to ensure collective ownership of solutions. It is also essential to halt the impoverishment of nomads due to the loss of their traditional live-styles. This includes schooling systems suitable for nomadic children, as well as payment for environmental services, such as ecotourism, watershed management, water harvesting, and the sustainable management of the interface between wild animals and livestock.

There has been an increase in integrated crop-livestock systems, for instance when livestock can graze on crop residues, with the fields benefiting from cow dung as fertilizer. While clearly mobility must be regulated and coordinated with crop farmers and among pastoralist groups, additional solutions may come from multilateral environmental agreements such as the Convention to Combat Desertification (UNCDD), the Convention on Biodiversity (UNCBD), and especially the Framework Convention on Climate change (UNFCCC), using the mechanisms of carbon sequestration. Techniques suitable to store carbon in soil in rangelands would be of huge relevance considering the size of rangelands and the benefits associated with increased carbon, including improved soil fertility and better soil moisture storage capacity. According to Milne et al. (2016), relatively simple management techniques can contribute to improve soil carbon in sub-Saharan grazing lands. The international agreements are of direct relevance to dry-lands and the associated livelihood systems.

New communications and observation technology can play an essential part in surveillance of rainfall and biomass, and the optimized management of rangelands and cattle. This could result in the rehabilitation of and improved conservation of rangelands, as well as the maintenance of biodiversity through controlled grazing, fire-control, rotations, and reseeding when required. Eventually it will also be necessary to adopt modern management techniques for rangelands and cattle, including animal health and breeds, as well as improved fodder production (which may involve trees and shrubs, Opuntia, and grasses). Improvements are also needed for the marketing of rangeland products (such as meat, milk, skins, wool, medicinal herbs, and other plants such as frankincense and gum Arabic, honey, and minerals).

According to FAO (2017b), per capita milk consumption decreased in sub-Saharan Africa over the two last decades. Compared with other regions of the world, milk consumption is medium (30 to 150 kg per capita per year) in northern and southern Africa and Kenya, and low (below 30 kg per capita per year) in most of central Africa. Milk provides 3 percent of the dietary energy supply in Africa, compared with 8 to 9 percent in Europe and Oceania, and 6 to 7 percent of dietary protein supply in Africa, compared with 19 percent in Europe. Milk is just one of several livestock products that has a good potential for development in Africa.

Conclusions

African rangelands are a huge resource at the continental scale. Because they occupy mostly dry-lands with low vegetation density, the use of small ruminants and beef cattle constitutes a well-tested and efficient form of biomass harvesting, as demonstrated by the importance of livestock in the economies of most African regions. Unfortunately, the harvesting of sparse biomass implies the mobility of cattle and their herders, at scales varying from local to international in the traditional transhumance movements by which cattle follow the rain. With economic development, the increase of crop agriculture and other land uses, cattle movements are more and more restricted, creating or fueling conflicts. This is compounded by climate change and--partially human-made--land degradation. The pastoralists' way of life has apparently become less sustainable, while their populations became impoverished. Yet, solutions and opportunities do exist. They imply technical improvements to the husbandry of livestock and rangelands, agreed and mutually beneficial arrangements between farmers and herders, improved ease of movement across borders, and the optimization of grazing through modern communication and observation techniques.

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Footnotes

[1] This latitude corresponds approximately to the declination of the sun.

[2] The groups of countries categorized under North, West, East, Middle and South Africa are those adopted by FAOSTAT, as follows: "Middle: approximately corresponds to central equatorial Africa, but East Africa extends south as far as Zambia, Zimbabwe and Malawi, which leaves only five countries in the South. West includes the Sahel and the Gulf of Guinea countries and corresponds approximately to ECOWAS. Using the three-letter ISO-3166 code for countries (https://en.wikipedia.org/wiki/ISO_3166-1_alpha-3), the exact grouping is as follows: North Africa: DZA, EGY, LBY, MAR, TUN; West Africa: BEN, BFA, CPV, CIV, GMB, GHA, GIN, GNB, LBR, MLI, MRT, NER, NGA, SHN, SEN, SLE, TGO; East Africa: BDI, COM, DJI, ERI, ETH, KEN, MWI, MOZ, RWA, SOM, SSD, UGA, TZA, ZMB, ZWE as well as the large (MDG) and small Indian Ocean islands (MUS, MYT, REU, SYC); Middle Africa: AGO, CMR, CAF, TCD, COG, COD, GNQ, GAB, STP; and South Africa: BWA, LSO, NAM, ZAF, SWZ.

[3] https://en.wikipedia.org/wiki/Livestock_grazing_comparison.

5.4 Update on El Niño

El Niño conditions have been neutral across the Pacific Ocean during the third quarter of 2017, but a La Niña event is likely to occur in late 2017. Figure 5.10 illustrates the behavior of the standard Southern Oscillation Index (SOI) of the Australian Bureau of Meteorology (BOM) from October 2016 to October 2017.

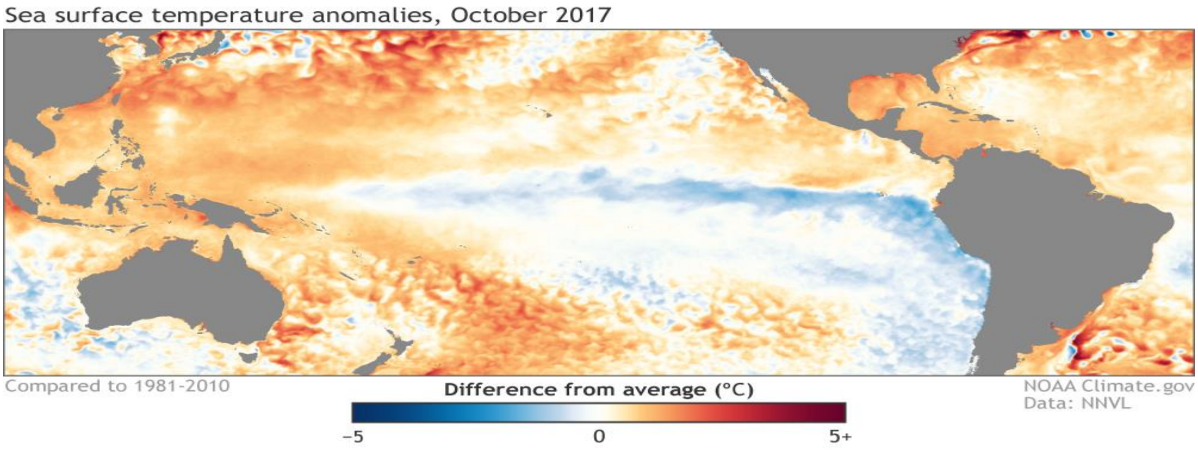
Sustained positive values of the SOI above +7 typically indicate La Niña while sustained negative values below −7 typically indicate El Niño. Values between about +7 and −7 generally indicate neutral conditions. During the current season, SOI increased from -10.4 in June directly to +8.1 in July, then decreased to 3.3 in August; however, it increased again to +6.9 in September and to +9.1 in October. The sustained large positive value indicates a La Niña might be coming. In the coming months, CropWatch will continue to monitor the condition of La Niña.

Figure 5.10. Monthly SOI-BOM time series for October 2016 to October 2017

Source: **http://www.bom.gov.au/climate/current/soi2.shtml**

As shown in figure 5.11, the sea surface temperature in the so called "Niño 3.4 region" in the central tropical Pacific Ocean, which is sensitive to El Niño events, is 0.5°C cooler than its 1981-2010 average, according to NOAA monitoring. BOM and NOAA agree that this overall cooler condition indicates that a La Niña event might occur in late 2017, but that it might not be so strong.

Figure 5.11. Sea surface temperature anomalies, October, 2017



Source: **https://www.climate.gov/sites/default/files/ENSO-NovEDD-Fig2_SSTA_map_large.jpg**

Annex A. Agroclimatic indicators and BIOMSS

Table A.1. July-October 2017 agroclimatic indicators and biomass by global Monitoring and Reporting Unit

65 Global MRUs	RAIN Current (mm)	RAIN 15YA dep. (%)	TEMP Current (°C)	TEMP 15YA dep. (°C)	RADPAR Current(MJ/m2)	RADPAR 15YA dep. (%)	BIOMSS Current (gDM/m2)	BIOMSS 5YA dep. (%)
Equatorial central Africa	443	-3	24.7	0.0	1080	-2	1226	0
East African highlands	584	1	19.6	-0.2	1122	-1	1496	-2
Gulf of Guinea	913	5	26.1	-0.4	950	-2	1971	-1
Horn of Africa	101	-9	23.7	-0.4	1201	-4	336	-12
Madagascar (main)	159	32	21.7	0.1	1087	-2	474	14
Southwest Madagascar	22	-62	21.1	-0.8	1184	-1	101	-55
North Africa-Mediterranean	58	-42	24.2	0.0	1267	-2	252	-35
Sahel	624	12	28.8	-0.4	1212	-2	1590	5
Southern Africa	58	-7	21.4	-0.1	1140	-3	210	-13
Western Cape (South Africa)	38	-74	12.6	0.9	942	0	181	-66
British Columbia to Colorado	231	18	11.9	-0.1	1100	-3	852	15
Northern Great Plains	409	35	17.9	-0.2	1080	-2	1166	17
Corn Belt	416	0	17.8	0.0	990	-2	1378	1
Cotton Belt to Mexican Nordeste	442	0	23.7	-0.7	1109	-2	1313	1
Sub-boreal America	269	-4	12.3	0.3	858	0	1086	-3
West Coast (North America)	74	-22	17.5	0.3	1267	0	291	-5
Sierra Madre	632	1	20.0	-0.5	1184	-2	1591	-1
SW U.S. and N. Mexican highlands	183	-2	21.3	-0.3	1266	-2	675	0
Northern South and Central America	1004	8	26.8	-0.3	1053	0	2121	3
Caribbean	869	11	27.1	0.2	1181	-3	1960	-1
Central-northern Andes	280	-19	15.5	0.2	1110	1	718	-10
Nordeste (Brazil)	40	-31	26.4	-0.2	1132	-8	145	-29
Central eastern Brazil	166	-19	25.1	-0.2	1101	-2	525	-23
Amazon	336	-12	28.4	-0.1	1096	-3	1026	-11
Central-north Argentina	85	-6	19.3	-0.1	890	-9	328	-5
Pampas	454	3	17.4	1.0	849	-6	1077	-5
Western Patagonia	245	-33	6.6	-0.2	678	-8	751	-11
Semi-arid Southern Cone	62	0	10.7	-0.1	949	-1	264	0
Caucasus	117	-30	19.8	0.6	1183	5	457	-26
Pamir area	167	0	17.8	-0.2	1242	0	557	8
Western Asia	67	13	23.7	-0.1	1251	1	235	2

Gansu-Xinjiang (China)	300	97	16.7	-0.4	1064	-6	912	72
Hainan (China)	1163	3	27.1	0.0	1006	-4	2067	3
Huanghuaihai (China)	635	36	23.0	0.1	883	-12	1581	23
Inner Mongolia (China)	487	70	15.9	-0.1	988	-6	1375	32
Loess region (China)	479	28	17.9	0.0	905	-11	1458	17
Lower Yangtze (China)	590	13	24.9	-0.1	949	-8	1471	4
Northeast China	448	19	16.0	-0.3	918	-3	1272	4
Qinghai-Tibet (China)	913	30	12.5	0.3	980	-3	1338	6
Southern China	864	17	24.5	-0.2	931	-7	1865	7
Southwest China	641	16	21.1	-0.1	819	-10	1666	6
Taiwan (China)	1016	3	25.7	0.3	1106	4	1693	0
East Asia	486	-19	17.2	-0.1	868	-4	1374	-7
Southern Himalayas	1234	19	25.5	-0.2	877	-6	1882	2
Southern Asia	1131	17	27.4	0.1	911	-2	2026	14
Southern Japan and the southern fringe of the Korea peninsula	819	5	22.4	1.3	874	-8	1819	3
Southern Mongolia	477	144	15.0	-0.3	1146	2	1084	65
Punjab to Gujarat	648	20	29.4	-0.4	1010	-4	1017	-3
Maritime Southeast Asia	1015	22	25.6	0.1	949	-9	2093	13
Mainland Southeast Asia	1283	7	27.1	-0.1	909	-3	2355	5
Eastern Siberia	279	-5	10.6	-0.7	773	-4	1134	-2
Eastern Central Asia	302	24	9.7	-0.4	888	-3	1101	12
Northern Australia	127	23	24.8	1.5	1153	-4	392	9
Queensland to Victoria	138	-15	13.1	0.3	938	-1	565	-10
Nullarbor to Darling	115	-42	12.7	0.0	856	-6	460	-35
New Zealand	152	-46	9.1	0.7	660	-10	590	-32
Boreal Eurasia	389	18	9.9	-0.3	622	-11	1258	8
Ukraine to Ural mountains	275	16	14.5	-0.6	785	-3	1100	12
Mediterranean Europe and Turkey	91	-44	20.5	1.4	1217	3	364	-38
W. Europe (non Mediterranean)	304	4	16.0	-0.1	858	-4	1136	4
Boreal America	483	25	8.0	0.7	573	-9	1165	3
Ural to Altai mountains	221	9	12.5	-0.9	855	0	903	6
Australian desert	84	-5	14.2	0.4	989	0	372	-6
Sahara to Afghan deserts	37	18	30.0	-0.2	1368	-1	144	7
Sub-arctic America	210	75	-0.4	3.7	288	-4	754	132

Table A.2. July-October 2017 agroclimatic indicators and biomass by country

31 Countries	31 Countries	RAIN Current (mm)	RAIN 15YA Departure (%)	TEMP Current (°C)	TEMP 15YA Departure (°C)	RADPAR Current (MJ/m2)	RADPAR 15YA Departure (%)	BIOMSS Current (gDM/m2)	BIOMSS 5YA Departure (%)
ARG	Argentina	215	-5	15.7	0.4	841	-9	687	0
AUS	Australia	135	-15	14.1	0.3	951	-2	530	-14
BGD	Bangladesh	2211	49	28.5	-0.4	777	-12	2623	16
BRA	Brazil	224	-16	25.6	0.0	1094	-3	613	-21
KHM	Cambodia	1152	-2	28.0	-0.5	967	-3	2386	1
CAN	Canada	273	-8	12.9	0.7	905	0	1022	-3
CHN	China	623	20	21.2	-0.1	913	-8	1452	12
EGY	Egypt	3	-26	26.3	-0.4	1387	1	16	-2
ETH	Ethiopia	689	2	20.4	-0.1	1117	0	1696	-1
FRA	France	160	-42	16.4	-0.5	889	-7	736	-30
DEU	Germany	367	27	15.3	-0.3	744	-9	1410	22
IND	India	1089	16	27.4	0.0	918	-3	1762	6
IDN	Indonesia	963	27	25.5	0.0	943	-10	1948	16
IRN	Iran	28	-28	23.5	0.0	1309	1	94	-28
KAZ	Kazakhstan	176	18	14.7	-0.6	968	3	711	12
MEX	Mexico	740	5	23.9	-0.4	1165	-2	1516	-1
MMR	Burma	1351	9	26.0	-0.1	806	-4	2318	3
NGA	Nigeria	850	2	26.4	-0.8	1008	-4	1906	-1
PAK	Pakistan	293	4	27.0	-0.3	1159	-3	616	-6
PHL	Philippines	1312	12	26.1	0.7	996	-3	2401	7
POL	Poland	387	56	15.0	-0.5	740	-8	1442	40
ROU	Romania	258	-8	17.1	0.0	1015	6	1003	-3
RUS	Russia	261	8	13.3	-0.7	801	-2	1051	5
ZAF	South Africa	70	-40	15.4	0.1	1053	-2	274	-35
THA	Thailand	1082	12	27.0	-0.3	942	-3	2304	8
TUR	Turkey	93	-28	20.4	0.8	1243	3	357	-29
GBR	United Kingdom	412	27	13.3	0.0	654	-9	1373	12
UKR	Ukraine	205	-6	17.1	0.2	910	2	874	-1
USA	United States	402	11	19.8	-0.3	1088	-2	1158	10
UZB	Uzbekistan	73	92	21.3	-0.3	1256	1	298	88
VNM	Vietnam	1313	17	26.2	0.0	906	-8	2331	9

Table A.3. Argentina, July-October 2017 agroclimatic indicators and biomass (by province)

Region	RAIN Current (mm)	RAIN 15YA Departure (%)	TEMP Current (°C)	TEMP 15YA Departure (°C)	RADPAR Current (MJ/m2)	RADPAR 15YA Departure (%)	BIOMSS Current (gDM/m2)	BIOMSS 5YA Departure (%)
Buenos Aires	205	-25	12.6	0.7	801	-6	822	-7
Chaco	199	-2	19.9	0.4	838	-12	760	13
Cordoba	87	-37	14.4	-0.2	869	-10	357	-30
Corrientes	428	-1	19.0	0.8	840	-8	1363	14
Entre Rios	425	31	16.1	0.7	799	-11	1389	39
La Pampa	131	-32	12.5	0.2	838	-6	596	-14
Misiones	965	41	20.3	1.5	882	-4	1666	-1
Santiago Del Estero	127	30	18.6	0.1	844	-14	452	21
San Luis	67	-47	12.9	-0.3	905	-6	311	-36
Salta	35	-36	18.9	-0.2	952	-8	156	-28
Santa Fe	217	-2	16.7	0.4	830	-11	788	6
Tucuman	22	-54	16.8	-0.3	979	-3	107	-45

Table A.4. Australia, July-October 2017 agroclimatic indicators and biomass (by state)

Region	RAIN Current (mm)	RAIN 15YA Departure (%)	TEMP Current (°C)	TEMP 15YA Departure (°C)	RADPAR Current (MJ/m2)	RADPAR 15YA Departure (%)	BIOMSS Current (gDM/m2)	BIOMSS 5YA Departure (%)
New South Wales	146	-3	12.8	0.2	982	1	593	1
South Australia	146	-9	12.6	0.5	848	-2	617	-4
Victoria	121	-42	10.3	0.0	770	-4	563	-27
W. Australia	110	-42	13.7	0.3	890	-5	445	-34

Table A.5. Brazil, July-October 2017 agroclimatic indicators and biomass (by state)

Region	RAIN Current (mm)	RAIN 15YA Departure (%)	TEMP Current (°C)	TEMP 15YA Departure (°C)	RADPAR Current (MJ/m2)	RADPAR 15YA Departure (%)	BIOMSS Current (gDM/m2)	BIOMSS 5YA Departure (%)
Ceara	34	5	28.2	0.3	1261	-7	125	-9
Goias	101	-40	25.5	-0.4	1213	3	401	-33
Mato Grosso Do Sul	327	11	25.1	-0.2	1033	-5	863	-11
Mato Grosso	189	-21	28.2	-0.1	1087	-7	652	-18
Minas Gerais	106	-30	22.6	-0.5	1125	0	348	-34
Parana	645	9	20.9	1.0	974	0	1031	-31
Rio Grande Do Sul	636	-7	18.6	1.9	844	-3	1525	-7
Santa Catarina	533	-23	18.0	1.9	882	2	1162	-28
Sao Paulo	234	-22	22.3	0.0	1051	-1	697	-27

Table A.6. Canada, July-October 2017 agroclimatic indicators and biomass (by province)

Region	RAIN Current (mm)	RAIN 15YA Departure (%)	TEMP Current (°C)	TEMP 15YA Departure (°C)	RADPAR Current (MJ/m2)	RADPAR 15YA Departure (%)	BIOMSS Current (gDM/m2)	BIOMSS 5YA Departure (%)
Alberta	205	-1	12.1	0.6	921	0	877	-1
Manitoba	211	-20	14.1	0.1	934	1	916	-17
Saskatchewan	165	-23	13.3	0.6	947	1	741	-19

Table A.7. India, July-October 2017 agroclimatic indicators and biomass (by state)

Region	RAIN Current (mm)	RAIN 15YA Departure (%)	TEMP Current (°C)	TEMP 15YA Departure (°C)	RADPAR Current (MJ/m2)	RADPAR 15YA Departure (%)	BIOMSS Current (gDM/m2)	BIOMSS 5YA Departure (%)
Andhra Pradesh	916	22	28.2	-0.1	973	2	2043	20
Assam	2076	45	29.2	0.0	786	-8	2655	15
Bihar	1210	23	29.4	-0.8	874	-7	1885	1
Chhattisgarh	1147	1	27.1	0.2	899	1	2136	4
Daman and Diu	1053	3	28.2	-0.4	954	1	1471	7
Delhi	324	-37	29.9	-0.3	1022	-4	1119	-15
Gujarat	1034	33	29.0	0.0	940	-3	1275	3
Goa	1043	-34	25.3	0.2	813	0	2074	-2
Himachal Pradesh	710	-15	15.2	-0.3	1055	-3	1237	-13
Haryana	352	-28	29.1	-0.4	1039	-4	964	-21
Jharkhand	1264	25	27.7	-0.2	877	-6	2172	7
Kerala	1077	-11	25.2	-0.2	823	-6	2180	3
Karnataka	960	17	24.9	-0.2	910	-1	1958	23
Meghalaya	2632	25	25.4	0.2	740	-12	2517	7
Maharashtra	1126	11	26.7	0.1	908	3	1878	10
Manipur	1259	23	23.0	0.0	795	-5	2357	8
Madhya Pradesh	942	2	27.7	0.2	923	0	1661	-1
Mizoram	1720	22	23.6	-0.5	836	-5	2422	2
Nagaland	1624	26	23.1	0.4	821	-5	2384	6
Orissa	1212	5	27.9	0.4	868	-1	2325	9
Puducherry	660	103	29.7	87.8	1068	-3	1566	44
Punjab	367	-26	28.7	-0.3	1063	-3	930	-23
Rajasthan	540	13	29.4	-0.5	1017	-5	1007	-4
Sikkim	1210	-6	13.5	-1.1	877	-15	1383	-3
Tamil Nadu	811	39	28.4	0.3	1033	-4	1892	24
Tripura	2531	63	27.7	-0.4	778	-12	2634	10
Uttarakhand	1125	6	19.2	0.4	965	-4	1547	-3
Uttar Pradesh	900	11	29.5	-0.1	933	-6	1591	-4
West Bengal	1756	34	29.3	0.2	810	-10	2441	14

Table A.8. Kazakhstan, July-October 2017 agroclimatic indicators and biomass (by oblast)

Region	RAIN Current (mm)	RAIN 15YA Departure (%)	TEMP Current (°C)	TEMP 15YA Departure (°C)	RADPAR Current (MJ/m2)	RADPAR 15YA Departure (%)	BIOMSS Current (gDM/m2)	BIOMSS 5YA Departure (%)
Akmolinskaya	123	-16	13.4	-0.7	890	2	588	-11
Karagandinskaya	157	10	13.1	-0.7	943	3	735	14
Kustanayskaya	129	-9	14.2	-1.0	891	3	629	-1
Pavlodarskaya	151	-8	13.5	-0.9	866	2	717	-2
Severo kazachstanskaya	162	-15	12.8	-0.9	835	4	741	-11
Vostochno kazachstanskaya	312	61	12.3	-0.7	1007	2	1080	39
Zapadno kazachstanskaya	81	-18	18.0	0.0	967	3	398	-14

Table A.9. Russia, July-October 2017 agroclimatic indicators and biomass (by oblast, kray and republic)

Region	RAIN Current (mm)	RAIN 15YA Departure (%)	TEMP Current (°C)	TEMP 15YA Departure (°C)	RADPAR Current (MJ/m2)	RADPAR 15YA Departure (%)	BIOMSS Current (gDM/m2)	BIOMSS 5YA Departure (%)
Bashkortostan Rep.	215	-1	12.8	-0.9	802	-1	949	1
Chelyabinskaya Oblast	164	-22	12.4	-1.0	799	0	782	-14
Gorodovikovsk	256	8	21.0	0.3	1050	7	932	-5
Krasnodarskiy Kray	254	-2	15.0	-0.3	890	0	1096	1
Kurganskaya Oblast	171	-19	12.1	-1.3	790	2	807	-13
Kirovskaya Oblast	348	25	11.9	-0.9	660	-9	1337	15
Kurskaya Oblast	200	-7	15.1	-0.6	828	-1	913	0
Lipetskaya Oblast	202	-4	14.6	-0.9	806	-2	928	1
Mordoviya Rep.	279	16	13.5	-1.1	771	-3	1119	8
Novosibirskaya Oblast	223	-2	10.9	-1.2	753	-4	984	1
Nizhegorodskaya O.	269	3	13.1	-0.9	711	-6	1101	0
Orenburgskaya Oblast	112	-21	15.0	-0.5	903	2	542	-15
Omskaya Oblast	226	4	11.4	-0.9	756	0	971	3
Permskaya Oblast	333	19	11.5	-0.7	677	-7	1296	11
Penzenskaya Oblast	256	20	14.0	-1.0	824	0	1075	15
Rostovskaya Oblast	167	0	19.4	0.3	1007	5	729	-1
Ryazanskaya Oblast	272	12	13.9	-0.8	753	-4	1131	10
Stavropolskiy Kray	128	-37	21.0	0.5	1053	8	595	-30
Sverdlovskaya Oblast	245	-3	11.3	-0.8	698	-4	1047	-2

Samarskaya Oblast	168	-7	14.7	-0.5	866	2	733	-7
Saratovskaya Oblast	152	1	16.3	-0.6	910	4	688	2
Tambovskaya Oblast	212	5	14.6	-0.8	837	1	949	7
Tyumenskaya Oblast	209	-8	11.3	-1.1	751	1	940	-4
Tatarstan Rep.	279	24	13.5	-1.0	765	-4	1096	12
Ulyanovskaya Oblast	237	11	14.3	-0.7	812	-1	984	6
Udmurtiya Rep.	309	18	12.0	-1.0	698	-6	1238	11
Volgogradskaya O.	172	28	18.1	-0.4	954	4	736	18
Voronezhskaya Oblast	171	2	16.1	-0.2	888	2	789	3

Table A.10. United States, July-October 2017 agroclimatic indicators and biomass (by state)

Region	RAIN Current (mm)	RAIN 15YA Departure (%)	TEMP Current (°C)	TEMP 15YA Departure (°C)	RADPAR Current (MJ/m2)	RADPAR 15YA Departure (%)	BIOMSS Current (gDM/m2)	BIOMSS 5YA Departure (%)
Arkansas	330	-23	23.1	-0.9	1106	-3	1162	-12
California	50	0	18.9	0.4	1349	-2	228	19
Idaho	150	33	13.8	-0.5	1188	-4	688	37
Indiana	504	24	19.8	-0.4	1041	-3	1509	12
Illinois	454	13	20.2	-0.3	1083	-1	1407	8
Iowa	636	44	18.8	-0.2	1069	-1	1706	26
Kansas	475	23	21.4	-0.7	1150	-2	1381	14
Michigan	333	-2	16.9	0.3	995	-1	1236	3
Minnesota	564	49	15.9	-0.6	957	-6	1607	27
Missouri	448	-3	21.3	-0.4	1126	0	1382	1
Montana	186	22	15.1	0.0	1106	-3	803	16
Nebraska	612	91	18.9	-0.4	1117	-3	1596	43
North Dakota	273	13	15.8	-0.1	1029	-1	1044	9
Ohio	447	14	19.1	-0.4	1008	-3	1413	4
Oklahoma	589	54	23.1	-1.3	1173	-1	1538	28
Oregon	88	-20	15.9	0.1	1198	0	401	-4
South Dakota	502	80	17.9	-0.4	1078	-3	1498	45
Texas	370	12	25.0	-0.9	1192	-1	1063	5
Washington	95	-29	15.7	-0.1	1145	2	367	-21
Wisconsin	479	16	16.5	-0.2	969	-4	1475	11

Table A.11. China, July-October 2017agroclimatic indicators and biomass (by province)

Region	RAIN Current (mm)	RAIN 15YA Departure (%)	TEMP Current (°C)	TEMP 15YA Departure (°C)	RADPAR Current (MJ/m2)	RADPAR 15YA Departure (%)	BIOMSS Current (gDM/m2)	BIOMSS 5YA Departure (%)
Anhui	748	31	24.2	-0.6	852	-14	1717	15
Chongqing	697	25	22.0	-0.3	805	-12	1792	14
Fujian	479	-13	25.1	0.9	1108	6	1384	-6
Gansu	362	12	15.7	0.1	899	-10	1192	14
Guangdong	795	16	26.4	-0.2	1029	-3	1687	5
Guangxi	901	39	25.6	-0.4	917	-11	1899	20
Guizhou	524	9	21.9	0.2	845	-9	1472	3
Hebei	529	46	19.6	-0.1	928	-11	1456	22
Heilongjiang	434	24	15.1	-0.5	908	-2	1279	6
Henan	687	42	22.9	-0.2	844	-15	1702	22
Hubei	692	33	22.8	-0.7	819	-16	1722	17
Hunan	514	8	24.2	-0.5	894	-11	1304	-2
Jiangsu	713	27	24.5	0.1	857	-12	1750	20
Jiangxi	523	9	25.8	-0.2	1011	-4	1308	-4
Jilin	502	30	16.6	-0.3	953	-2	1262	3
Liaoning	480	10	18.9	0.0	933	-7	1323	4
Inner Mongolia	418	54	15.1	-0.2	974	-5	1272	28
Ningxia	270	20	16.9	0.1	967	-12	962	14

Shaanxi	581	25	19.1	0.0	855	-12	1667	18
Shandong	589	25	23.0	0.5	895	-11	1504	19
Shanxi	578	57	17.4	0.2	936	-10	1614	30
Sichuan	694	14	19.9	0.2	812	-7	1641	4
Yunnan	696	5	19.4	-0.1	850	-8	1708	-2
Zhejiang	573	-1	25.2	0.7	971	-4	1460	-5

Annex B. 2017 production estimates

Tables B.1-B.5 present 2017 CropWatch production estimates for Argentina, Brazil, Canada, Australia, and the United States.

Table B.1. Argentina, 2017 maize and soybean production, by province (thousand tons)

Region	Maize		Wheat		Soybean	
	2017	Δ%	2017	Δ%	2017	Δ%
Buenos Aires	7651	7.7	7073	-3	13660	-2.9
Córdoba	7387	4.9	730	-5	11911	-1.6
Entre Rios	1269	11.0	1237	12	3806	5.8
San Luis	1085	-2.8				
Santa Fe	4264	-0.8	1404	11	10218	-3.1
Santiago Del Estero	1210	-0.4				
Sub total	22866	4.3	10444	0	39595	-1.8
Others	7080	86.8	1296	6	11521	7.0
Argentina	29946	16.5	11740	1	51116	0.1

Δ% indicates percentage difference with 2016.

Table B.2 Brazil, 2017 maize, rice, and soybean production, by state (thousand tons)

Region	Maize		Rice		Wheat		Soybean	
	2017	Δ%	2017	Δ%	2017	Δ%	2017	Δ%
Goias	8717	37					10327	5
Mato Grosso	20121	12					28146	5
Mato Grosso Do Sul	7735	17					6816	7
Minas Gerais	6351	5					3422	-3
Parana	16250	12			2762	8	18327	6
Rio Grande Do Sul	4812	4	8663	2	4834	7	13684	1
Santa Catarina	2957	5	1163	14	364	2	1790	5
Sao Paulo	3946	10					2195	1
Sub total	70888	14	9826	3	7960	7	84708	4
Others	13131	64	1517	-2	377	20	12018	13
Brazil	84019	19	11344	3	8337	8	96726	5

Δ% indicates percentage difference with 2016.

Table B.3. Canada, 2017 wheat production, by province (thousand tons)

Region	Wheat	
	2017	Δ%
Alberta	8819	-6.0
Manitoba	3713	-1.7
Ontario	1862	8.0
Saskatchewan	12631	-11.9
Sub total	27024	-7.5
others	3655	-10.4
Canada	30679	-7.8

Δ% indicates percentage difference with 2016.

Table B.4. Australia, 2017 wheat production, by province (thousand tons)

Region	Wheat	
	2017	Δ%
New South Wales	5974	-34
South Australia	4063	-19
Victoria	3844	-10
Western Australia	10427	-17
Sub total	24308	-22
others	298	-52
Australia	24606	-22

Δ% indicates percentage difference with 2016.

Table B.5. United States, 2017 maize, rice, wheat, and soybean production, by state (thousand tons)

States	Maize		Rice		Wheat		Soybean	
	2017	Δ%	2017	Δ%	2017	Δ%	2017	Δ%
Alabama	1208	3					521	3
Arkansas	2723	6	5586	5	654	2	4741	4
California			1668	-5	728	10		
Colorado	3762	13			1853	-24		
Georgia	1438	1			320	3		
Idaho					2879	7		
Illinois	60637	-2			1210	-1	15275	-2
Indiana	26904	-1			753	1	8542	-1
Iowa	58715	-3					13602	-3
Kansas	15829	7			7799	-8	3939	-3
Kentucky	5811	-2			1007	1	2210	-2
Louisiana	1776	3	1538	1			2258	1
Maryland					495	4	642	4
Michigan	9833	-1			1072	2	2473	-1
Minnesota	28995	1			1771	0	8421	0
Mississippi	2340	-1	750	13	362	5	3272	3
Missouri	16235	-2	685	1	1191	0	6943	-1
Montana					4626	-15		
Nebraska	41889	-2			1964	-7	7828	0
New York	2632	3			176	8		
North Carolina	2744	2			1203	-1	1959	2
North Dakota	7778	-2			7836	-18	5348	-3
Ohio	14299	1			1237	3	7120	0
Oklahoma	1316	19			1350	-2		
Oregon					1170	19		
Pennsylvania	3977	3			270	2	784	3
South Carolina					281	0		
South Dakota	18924	5			3766	1	6403	6
Tennessee	3808	0			757	-1	2061	0
Texas	6321	-3	491	-3	1995	-7		
Virginia	1446	2			501	2	708	2
Washington					3347	15		
Wisconsin	12962	-1			361	-20	2236	-1
Sub total	354302	0	10718	3	52934	-5	107285	0
United States	370173	1	10933	4	54812	-4	109649	0

Δ% indicates percentage difference with 2016.

Annex C. Quick reference to CropWatch indicators, spatial units and methodologies

The following sections give a brief overviewof CropWatch indicators and spatial units, along with a description of theCropWatch production estimation methodology. For more information about CropWatchmethodologies, visit CropWatch online at **www.cropwatch.com.cn.**

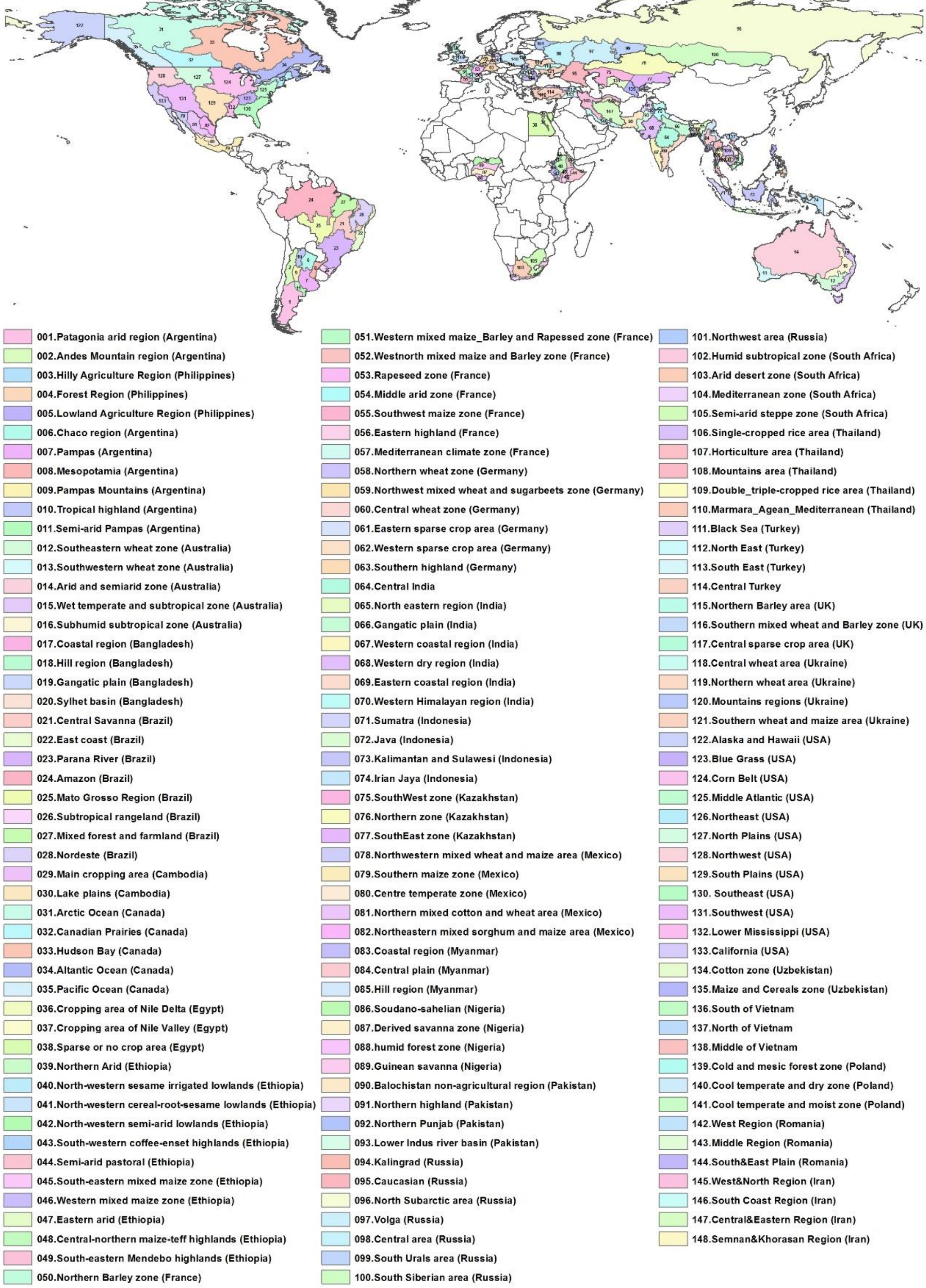
Sub-national regions for 31 key countries

Overview

148 sub-national regions for the 31 key countries across the globe

Description

31 key agricultural countries are dividedinto 148 sub-national regions based on cropping systems, climatic zones, andtopographic conditions. Each country is considered separately. A limited numberof regions (e.g., region 001, region 031, and region 122) are not relevant forthe crops currently monitored by CropWatch but are included to allow for morecomplete coverage of the 31 key countries. Some regions are more relevant forrangeland and livestock monitoring, which is also essential for food security.


001.Patagonia arid region (Argentina)
002.Andes Mountain region (Argentina)
003.Hilly Agriculture Region (Philippines)
004.Forest Region (Philippines)
005.Lowland Agriculture Region (Philippines)
006.Chaco region (Argentina)
007.Pampas (Argentina)
008.Mesopotamia (Argentina)
009.Pampas Mountains (Argentina)
010.Tropical highland (Argentina)
011.Semi-arid Pampas (Argentina)
012.Southeastern wheat zone (Australia)
013.Southwestern wheat zone (Australia)
014.Arid and semiarid zone (Australia)
015.Wet temperate and subtropical zone (Australia)
016.Subhumid subtropical zone (Australia)
017.Coastal region (Bangladesh)
018.Hill region (Bangladesh)
019.Gangatic plain (Bangladesh)
020.Sylhet basin (Bangladesh)
021.Central Savanna (Brazil)
022.East coast (Brazil)
023.Parana River (Brazil)
024.Amazon (Brazil)
025.Mato Grosso Region (Brazil)
026.Subtropical rangeland (Brazil)
027.Mixed forest and farmland (Brazil)
028.Nordeste (Brazil)
029.Main cropping area (Cambodia)
030.Lake plains (Cambodia)
031.Arctic Ocean (Canada)
032.Canadian Prairies (Canada)
033.Hudson Bay (Canada)
034.Altantic Ocean (Canada)
035.Pacific Ocean (Canada)
036.Cropping area of Nile Delta (Egypt)
037.Cropping area of Nile Valley (Egypt)
038.Sparse or no crop area (Egypt)
039.Northern Arid (Ethiopia)
040.North-western sesame irrigated lowlands (Ethiopia)
041.North-western cereal-root-sesame lowlands (Ethiopia)
042.North-western semi-arid lowlands (Ethiopia)
043.South-western coffee-enset highlands (Ethiopia)
044.Semi-arid pastoral (Ethiopia)
045.South-eastern mixed maize zone (Ethiopia)
046.Western mixed maize zone (Ethiopia)
047.Eastern arid (Ethiopia)
048.Central-northern maize-teff highlands (Ethiopia)
049.South-eastern Mendebo highlands (Ethiopia)
050.Northern Barley zone (France)
051.Western mixed maize_Barley and Rapessed zone (France)
052.Westnorth mixed maize and Barley zone (France)
053.Rapeseed zone (France)
054.Middle arid zone (France)
055.Southwest maize zone (France)
056.Eastern highland (France)
057.Mediterranean climate zone (France)
058.Northern wheat zone (Germany)
059.Northwest mixed wheat and sugarbeets zone (Germany)
060.Central wheat zone (Germany)
061.Eastern sparse crop area (Germany)
062.Western sparse crop area (Germany)
063.Southern highland (Germany)
064.Central India
065.North eastern region (India)
066.Gangatic plain (India)
067.Western coastal region (India)
068.Western dry region (India)
069.Eastern coastal region (India)
070.Western Himalayan region (India)
071.Sumatra (Indonesia)
072.Java (Indonesia)
073.Kalimantan and Sulawesi (Indonesia)
074.Irian Jaya (Indonesia)
075.SouthWest zone (Kazakhstan)
076.Northern zone (Kazakhstan)
077.SouthEast zone (Kazakhstan)
078.Northwestern mixed wheat and maize area (Mexico)
079.Southern maize zone (Mexico)
080.Centre temperate zone (Mexico)
081.Northern mixed cotton and wheat area (Mexico)
082.Northeastern mixed sorghum and maize area (Mexico)
083.Coastal region (Myanmar)
084.Central plain (Myanmar)
085.Hill region (Myanmar)
086.Soudano-sahelian (Nigeria)
087.Derived savanna zone (Nigeria)
088.humid forest zone (Nigeria)
089.Guinean savanna (Nigeria)
090.Balochistan non-agricultural region (Pakistan)
091.Northern highland (Pakistan)
092.Northern Punjab (Pakistan)
093.Lower Indus river basin (Pakistan)
094.Kalingrad (Russia)
095.Caucasian (Russia)
096.North Subarctic area (Russia)
097.Volga (Russia)
098.Central area (Russia)
099.South Urals area (Russia)
100.South Siberian area (Russia)
101.Northwest area (Russia)
102.Humid subtropical zone (South Africa)
103.Arid desert zone (South Africa)
104.Mediterranean zone (South Africa)
105.Semi-arid steppe zone (South Africa)
106.Single-cropped rice area (Thailand)
107.Horticulture area (Thailand)
108.Mountains area (Thailand)
109.Double_triple-cropped rice area (Thailand)
110.Marmara_Agean_Mediterranean (Thailand)
111.Black Sea (Turkey)
112.North East (Turkey)
113.South East (Turkey)
114.Central Turkey
115.Northern Barley area (UK)
116.Southern mixed wheat and Barley zone (UK)
117.Central sparse crop area (UK)
118.Central wheat area (Ukraine)
119.Northern wheat area (Ukraine)
120.Mountains regions (Ukraine)
121.Southern wheat and maize area (Ukraine)
122.Alaska and Hawaii (USA)
123.Blue Grass (USA)
124.Corn Belt (USA)
125.Middle Atlantic (USA)
126.Northeast (USA)
127.North Plains (USA)
128.Northwest (USA)
129.South Plains (USA)
130. Southeast (USA)
131.Southwest (USA)
132.Lower Mississippi (USA)
133.California (USA)
134.Cotton zone (Uzbekistan)
135.Maize and Cereals zone (Uzbekistan)
136.South of Vietnam
137.North of Vietnam
138.Middle of Vietnam
139.Cold and mesic forest zone (Poland)
140.Cool temperate and dry zone (Poland)
141.Cool temperate and moist zone (Poland)
142.West Region (Romania)
143.Middle Region (Romania)
144.South&East Plain (Romania)
145.West&North Region (Iran)
146.South Coast Region (Iran)
147.Central&Eastern Region (Iran)
148.Semnan&Khorasan Region (Iran)

CropWatch indicators

The CropWatch indicators are designed toassess the condition of crops and the environment in which they grow anddevelop; the indicators—RAIN (for rainfall), TEMP (temperature), and RADPAR(photosynthetically active radiation, PAR)—are not identical to the weathervariables, but instead are value-added indicators computed only over cropgrowing areas (thus for example excluding deserts and rangelands) and spatiallyweighted according to the agricultural production potential, with marginalareas receiving less weight than productive ones. The indicators are expressedusing the usual physical units (e.g., mm for rainfall) and were thoroughlytested for their coherence over space and time. CWSU are the CropWatch SpatialUnits, including MRUs, MPZ, and countries (including first-level administrativedistricts 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 (2012-2016), 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 (2012-2016), 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.
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 (2012-2016), 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/m^2, CWSU	The spatial average (for a CWSU) of PAR accumulation over agricultural	RADPAR is shown as the percent departure of the RADPAR value for the reporting period compared to the recent fifteen-year average (2002-2016),

INDICATOR			
		pixels, weighted by the production potential.	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/m^2, 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 (2002-16), 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 (2002-16), 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 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).	Low VHI values indicate unusually poor crop condition, but high values, when due to low temperature, may be difficult to interpret. VHI is 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.

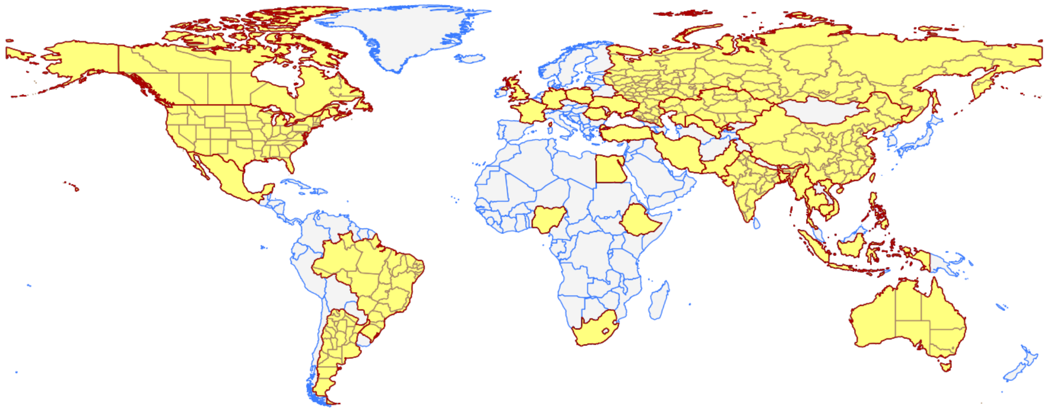
Note: Type is either "Weather" or "Crop"; source specifies if the indicator is obtained from ground data, satellite readings, or a combination; units: in the case of ratios, no unit is used; scale is either pixels or large scale CropWatch spatial units (CWSU). Many indicators are computed for pixels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

CropWatch spatial units (CWSU)

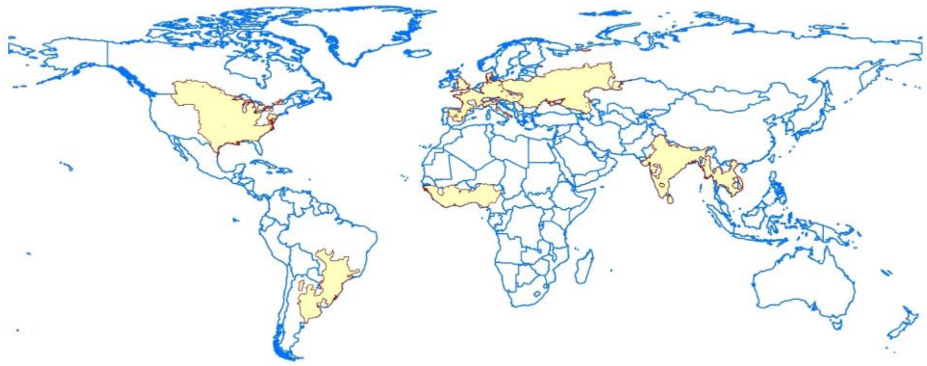
CropWatch analyses are applied to four kinds of CropWatch spatial units (CWSU): Countries, China, Major Production Zones (MPZ), and global crop Monitoring and Reporting Units (MRU). The tables below summarize the key aspects of each spatial unit and show their relation to each other. For more details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

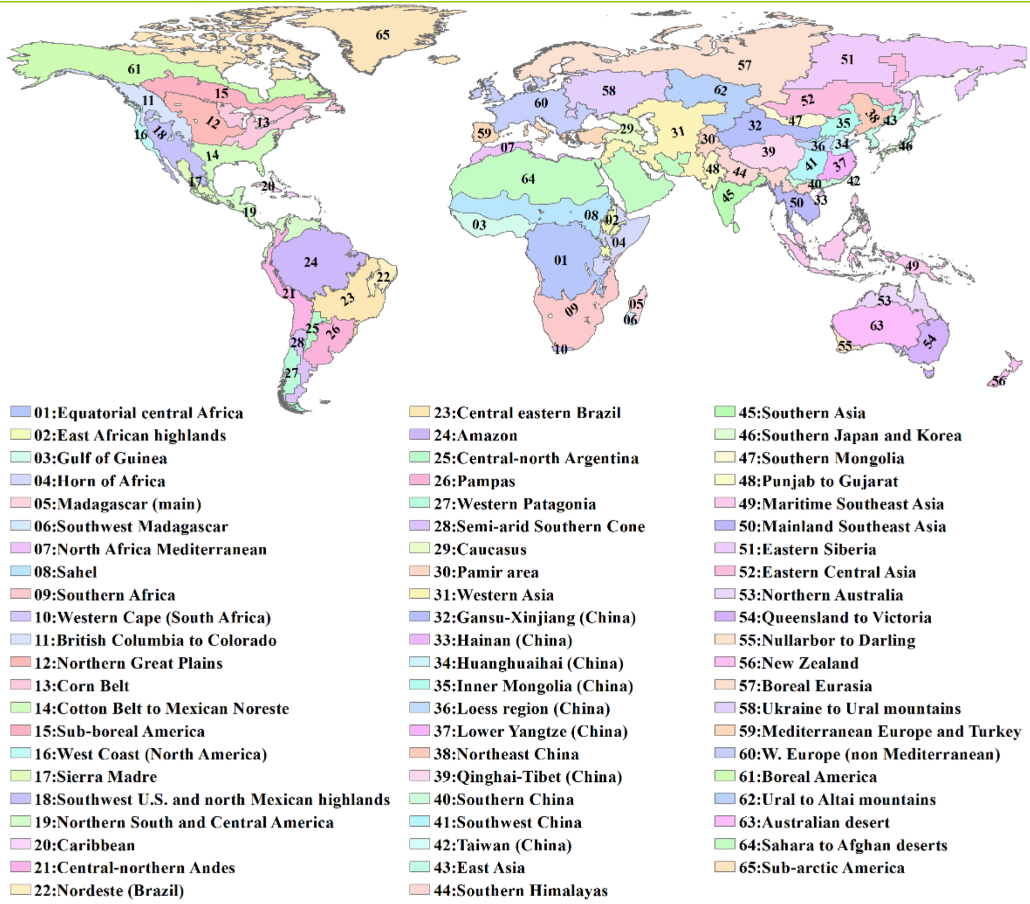
Countries (and first-level administrative districts, e.g., states and provinces)	
Overview	*Description*
"Thirty plus one" countries to represent main producers/exporters and other key countries.	CropWatch monitored countries together represent more than 80% of the production of maize, rice, wheat and soybean, as well as 80% 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 linear trend projection for 2014 of aggregated FAOSTAT data (using aggregated world production minus the sum of production by the 31 CropWatch monitored countries).

Classification of pests and diseases

The criteria for the classification of pests and diseases in this report are based on industry standards and plant protection survey and evaluation specifications issued by the Chinese Ministry of Agriculture, combined with crop growth information and conditions obtained through remote sensing.

Table C.1 presents the criteria for determining the level of wheat yellow rust occurrence, which is based on the “Rules for the investigation and forecast of wheat yellow rust” (GB/T15795-2011). Based on this standard, a disease index model was established, integrating the remote sensing disease data and in-field survey disease data. The term “mildly severe” used in this report to describe the occurrence of wheat yellow rust corresponds with levels 1 and 2, while “moderately severe” refers to level 3, and “severe” comprises levels 4 and 5.

Table C.1. Criteria for wheat yellow rust occurrence level

Index	Level				
	1	2	3	4	5
Disease index	0.001<Y≤5	5＜Y≤ 10	10＜Y≤20	20＜Y≤30	Y＞30
Disease field rate/%	1<R≤5	5＜R≤10	10＜R≤20	20＜R≤30	R＞30

Note: In the table, Y is the disease index; it shows the impact of the disease and is defined as: Y=F*D*100, in which F is the rate of disease leaves and D is the average of the severity level of disease leaves. R is the disease field rate, which means the rate of disease field in the whole region.
Source: Standardization Administration of China, Rules for the investigation and forecast of wheat yellow rust (GB/T 15795-2011), 2011. http://doc.mbalib.com/view/2e0ae53c7f397af70deb37edb07c5a12.html

Tables C.2 and C.3 respectively list the criteria for wheat sheath blight (table C.2 and based on the “Rules for the investigation and forecast of wheat sheath blight” (NY/T614-2002)) and wheat aphid (table C.3, following “Rules for the investigation and forecast of wheat aphid” (NY/T612-2002)). The terms mildly severe, moderately severe, and severe—as used in this report—again refer to levels 1-2, 3, and 4-5 in the table.

Table C.2. Criteria for wheat sheath blight occurrence level

Index	Level				
	1	2	3	4	5
Disease index	Y≤5	5＜Y≤15	15＜Y≤25	25＜Y≤35	Y＞35

Source: Standardization Administration of China, Rules for the investigation and forecast of wheat sheath blight (NY/T614-2002), 2002. http://doc.mbalib.com/view/4c9d23d380f36d038af855fcdf089f93.html

Table C.3. Criteria for wheat aphid occurrence level

Index	Level				
	1	2	3	4	5
Aphid (heads/ hundred plants, Y)	Y≤500	500＜Y≤1500	1500＜Y≤2500	2500＜Y≤3500	Y＞3500

Source: Standardization Administration of China, Rules for the investigation and forecast of wheat aphid (NY/T612-2002), 2002. http://www.doc88.com/p-7708315673411.html

Data notes and bibliography

Notes

[1] Although Yemen is not part of the Horn of Africa (HoA), it is geographically close and maintains close links to the region. The countries of the HoA are grouped in the regional development association IGAD (Inter-governmental Authority on Development, with headquarters in Djibouti). IGAD has recently established the IGAD Drought Disaster Resilience and Sustainability Initiative (IDDRSI, 2016).

[2] Under-investment in agriculture was one of the main drivers of the 2008 crisis of high food prices (Mittal 2009, ATV 2010), even if several other local and global triggering factors can be identified (Evans 2008).

[3] Previous large humanitarian crises were those of the West African Sahel (from the early sixties to the mid eighties), the Ethiopian droughts of the mid-eighties, the Indian Ocean tsunami of 2004, several large earthquakes (for example, Haiti, 2010), and floods and medical emergencies (such as the West African Ebola outbreak, 2013-16).

[4] http://www.agrhymet.ne/eng/index.html

[5] http://www.icpac.net/

[6] Belg is harvested before or during July.

[7] "Purely man-made disasters" is, however, a concept that deserves a closer look, as many wars and insurgencies are partially triggered by shortages of natural resources, including land. As such, most “man-made disasters” do have an environmental component.

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Online resources

Online Resources posted on www.cropwatch.com.cn

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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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