CCAFS AGRICULTURE MONITOR

A report on weather deviations and crop loss assessment for insurance

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ACKNOWLEDGEMENT:

This work was implemented as part of the CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS), which is carried out with support from CGIAR Fund Donors and through bilateral funding agreements. For details please visit https://ccafs.cgiar.org/donors. The views expressed in this document cannot be taken to reflect the official opinions of these organizations. We acknowledge the use of data derived from MODIS satellite and NOAA-CPC.

Correct citation

Aggarwal, P.K., Shirsath, P.B., Arumugam, P., and S. Goroshi. 2017. CCAFS Agriculture Monitor: A Report on Weather Deviations and Crop Loss Assessment for Insurance. CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS) of South Asia, New Delhi, India.

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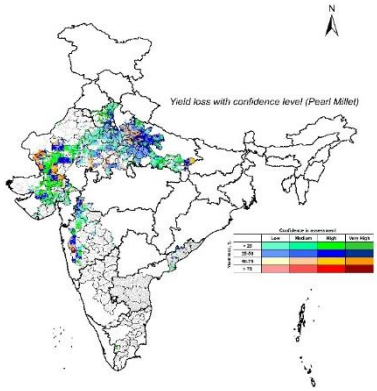
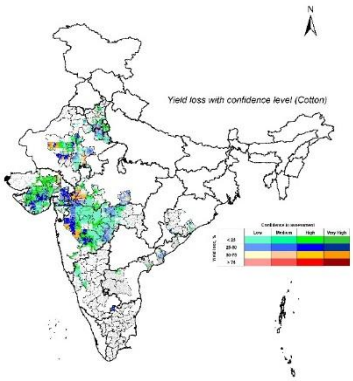
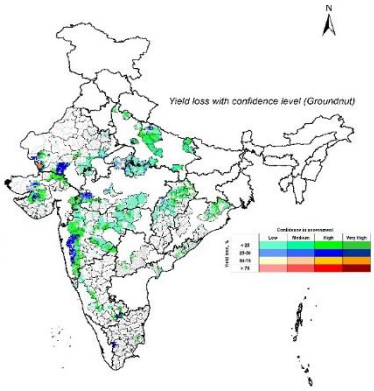
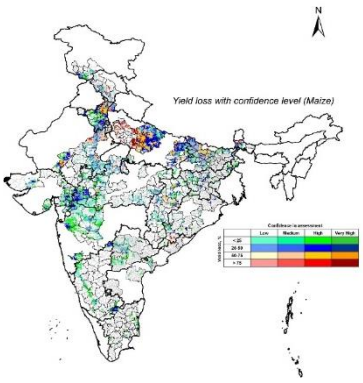
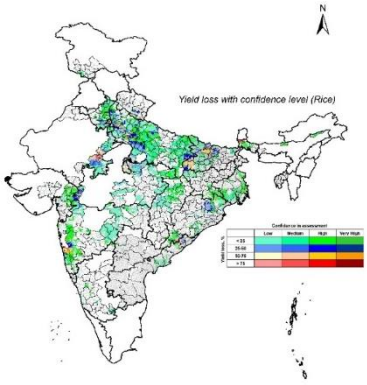
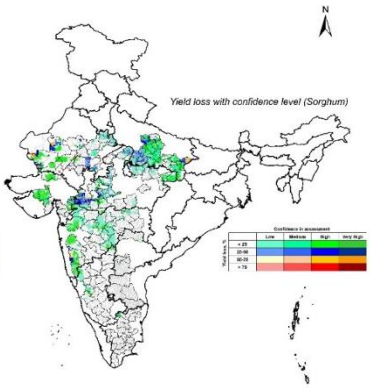


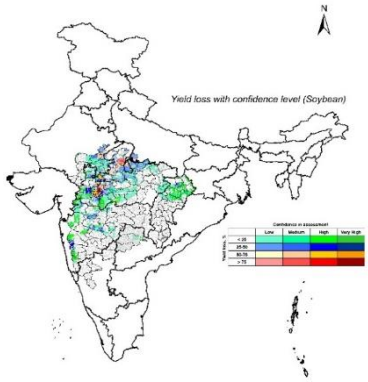












INTRODUCTION

Agriculture is intricately linked with location-specific meteorological conditions. Prevalent weather and extreme events thus shape the agricultural output of the season, along with management and farm-specific characteristics. Monitoring such events becomes a fruitful pursuit for agencies and individuals involved in agricultural and allied sectors. This report presents district-level analysis of agriculture-specific indicators prevalent over India. High resolution gridded data is used to estimate near-real time crop condition and weather parameters. With temporal dimension of two weeks and district level analysis, this report can ensure consistent and extensive monitoring. It aims to build a common platform where location specific, high quality data is available with minimal time lag, to monitor weather conditions and track the progress of agriculture in the country. Seasonal data is also accompanied with summaries from start of Kharif period for overall seasonal analysis. Deviations from long term averages is presented to gauge overall climatic trends.

The report is structured in three sections. First section presents weather parameters, second section describes the crop condition and crop specific conditions of prevented sowing, sowing failure and final yield estimates are described thereafter.

Weather comprises of rainfall and temperature analysis. Rainfall is analyzed comprehensively by focusing on volume, distribution, extremes. Additional section of drought is also included, which presents derived parameter of Standardized Precipitation Index (SPI) from the rainfall data. Crop condition is described by Normalized Difference Vegetation Index (NDVI). MODIS derived NDVI values are used to define Vegetation Growth Index. Comparison from previous year and long-term averages enables identification of overall trends in vegetation cover.

Next section on crop condition presents areas with likely chances of prevented sowing and crop failure, and finally yield loss assessment under different confidence level using multi-criteria assessment. Prevented sowing indicates areas where there are likely chances that sowing could not take place due to inadequate conditions. Similarly, sowing failure indicates areas where there are likely chances that crops could not survive due to unfavorable conditions. Mid-season adversity is also included. The indicators are derived through multi-criteria assessment using weather derivatives, remotely sensed vegetation indices and crop growth modelling. The results are relevant only for rainfed regions; and flood losses are not considered. Minimal validation and ground-truthing should be done before further use.

This periodic reports can be used for further research and will aid agencies and/or individuals involved in agriculture sector. The analysis will soon be automated into a web-based portal where all the indicators and district wise data can be accessed.

1. Weather

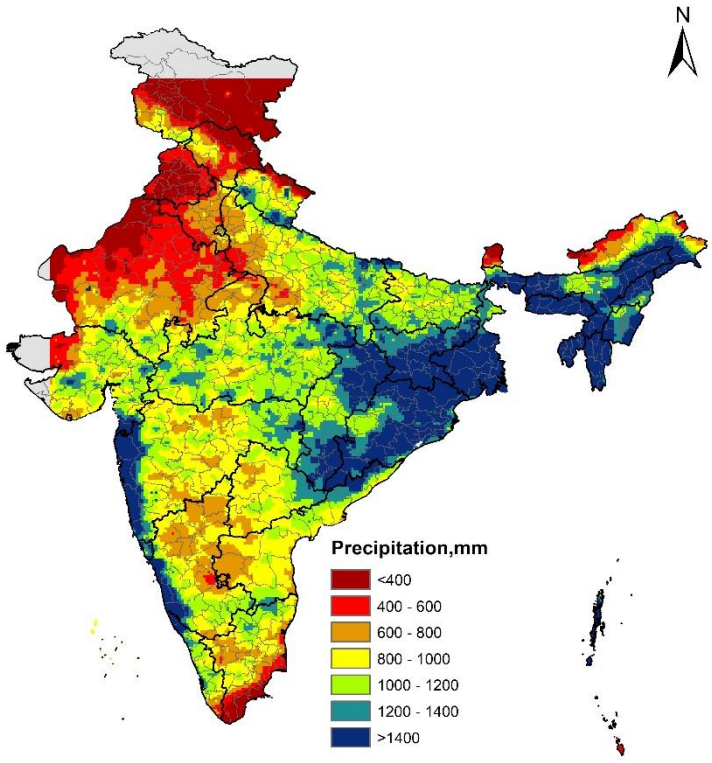
This section presents district level analysis of near-real time weather parameters and their deviations from historical trends. Rainfall is presented first followed by temperature. Rainfall analysis is further divided into sub-sections of Rainfall Volume, Rainfall Distribution, Rainfall Extremes and derived parameters for Drought.

1.1 Rainfall

Rainfall Volume

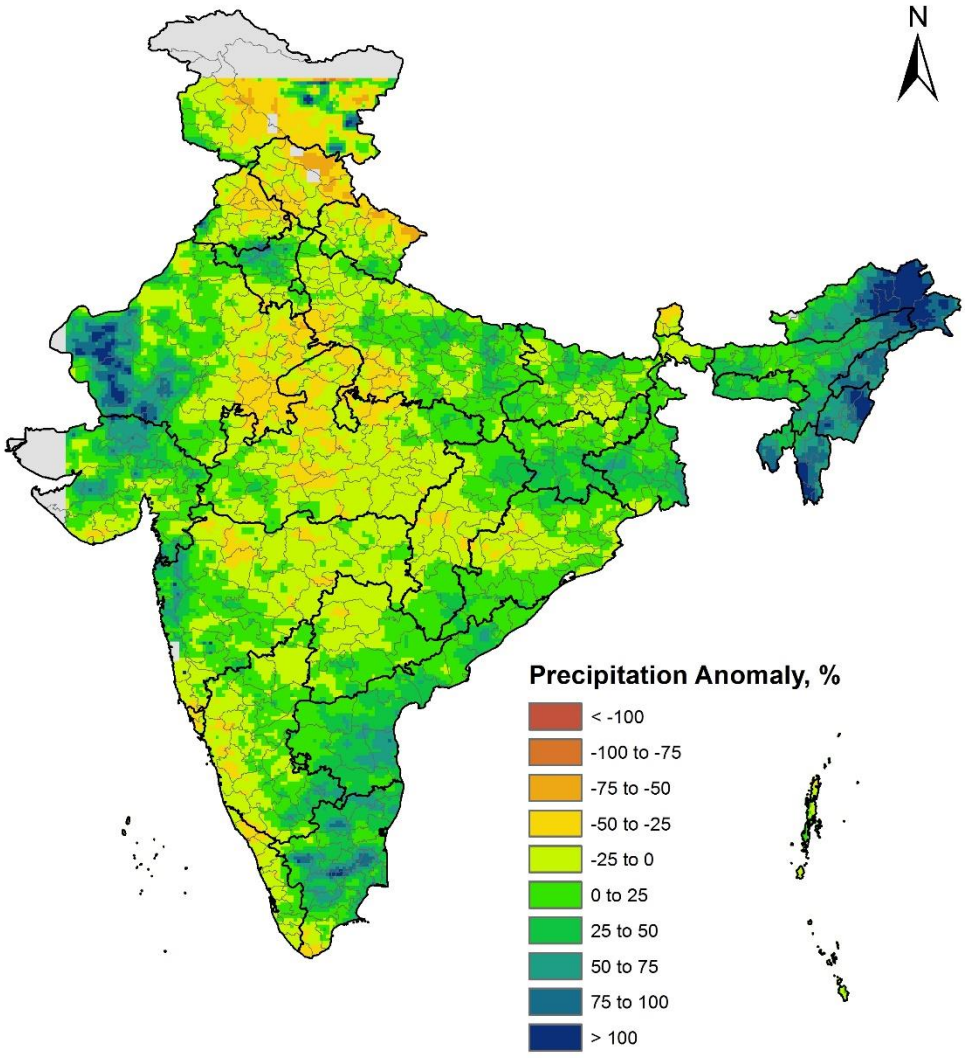
SEASONAL RAINFALL (JUNE 1- SEPTEMBER 30, 2017)

The following map presents seasonal cumulative rainfall volume (in mm) over the country from start of June, 2017. Data is derived from Climate Prediction Centre of National Oceanic and Atmospheric Administration. Most of eastern and North-eastern India and parts of Western India received high rainfall greater than 1400 mm during current Kharif season. Northern India including Jammu and Kashmir and Himachal Pradesh received low seasonal rainfall of less than 400 mm. Grey areas show regions with no-data.



SEASONAL RAINFALL DEVIATION FROM LONG TERM AVERAGE (JUNE 1- SEPTEMBER 30, 2000-2017)

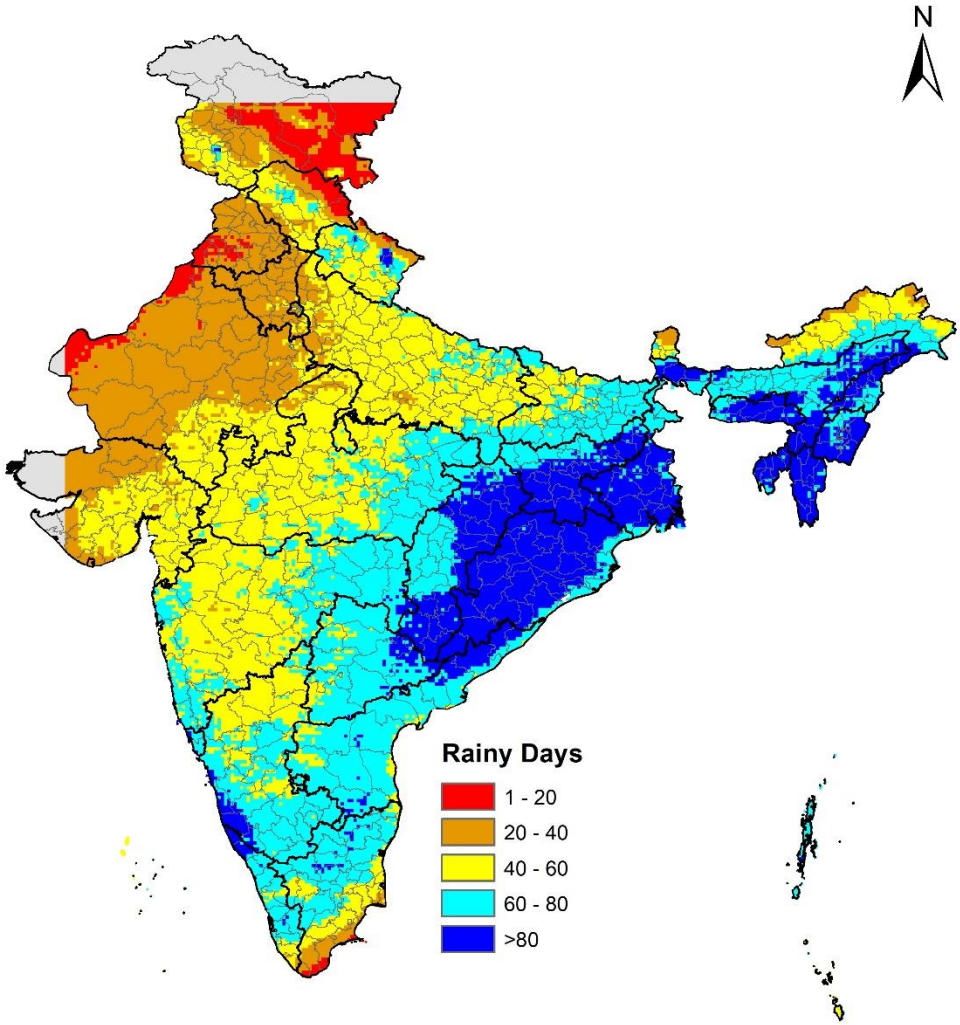
The following map presents deviation of seasonal cumulative Kharif rainfall (%) from long-term average, over the country. Data is derived from Climate Prediction Centre of National Oceanic and Atmospheric Administration. Highest negative anomaly was observed for parts of central and western India and coastal parts of Karnataka and Kerala where rainfall anomaly was more than >-50%. Parts of North-East India, Rajasthan and Gujarat witnessed positive anomaly where Kharif rainfall anomaly was >50%. Grey areas show regions with no-data.



Rainfall Distribution

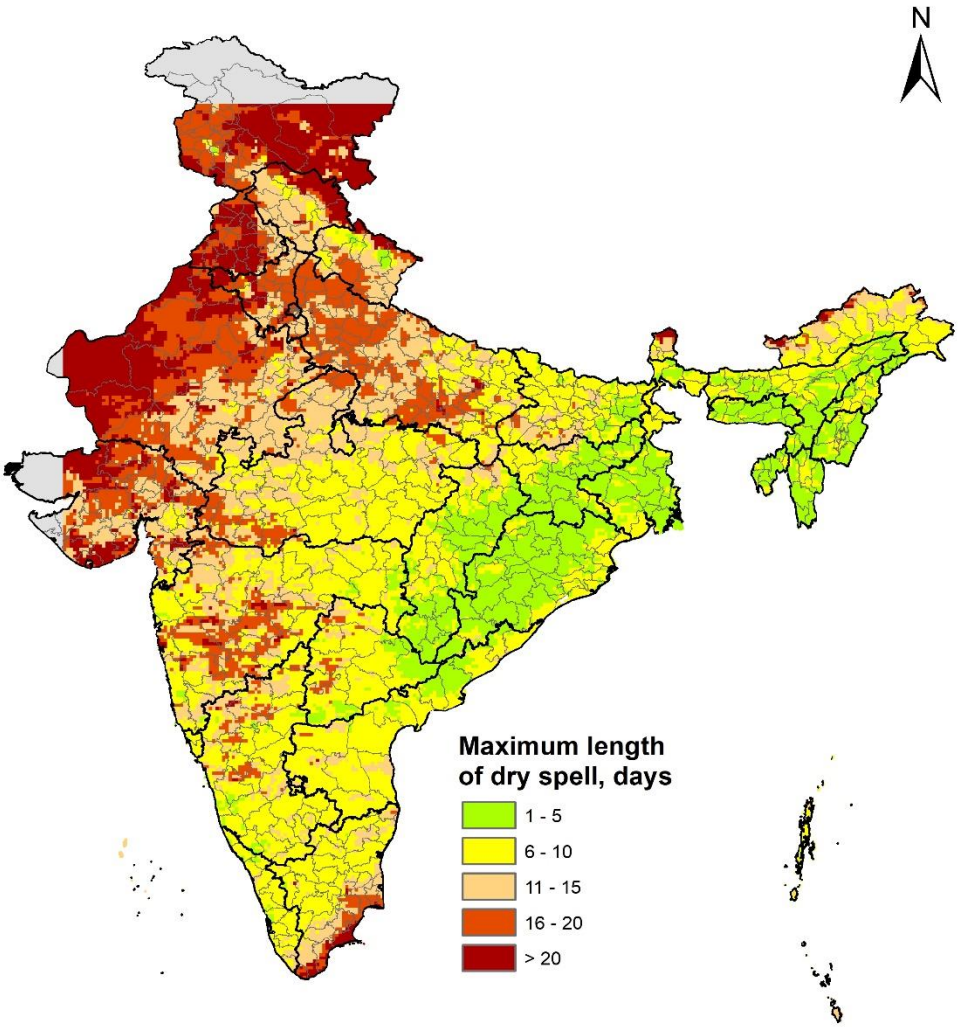
NUMBER OF RAINY DAYS (JUNE 1- SEPTEMBER 30, 2017)

The following map presents number of rainy days over the country. Data is derived from Climate Prediction Centre of National Oceanic and Atmospheric Administration. Lowest number of rainy days occurred in western India, and highest number of rainy days occurred in Eastern and North-Eastern India with rainy days of more than 80. Grey areas show regions with no-data.



MAXIMUM LENGTH OF DRY SPELLS (JUNE 1- SEPTEMBER 30, 2017)

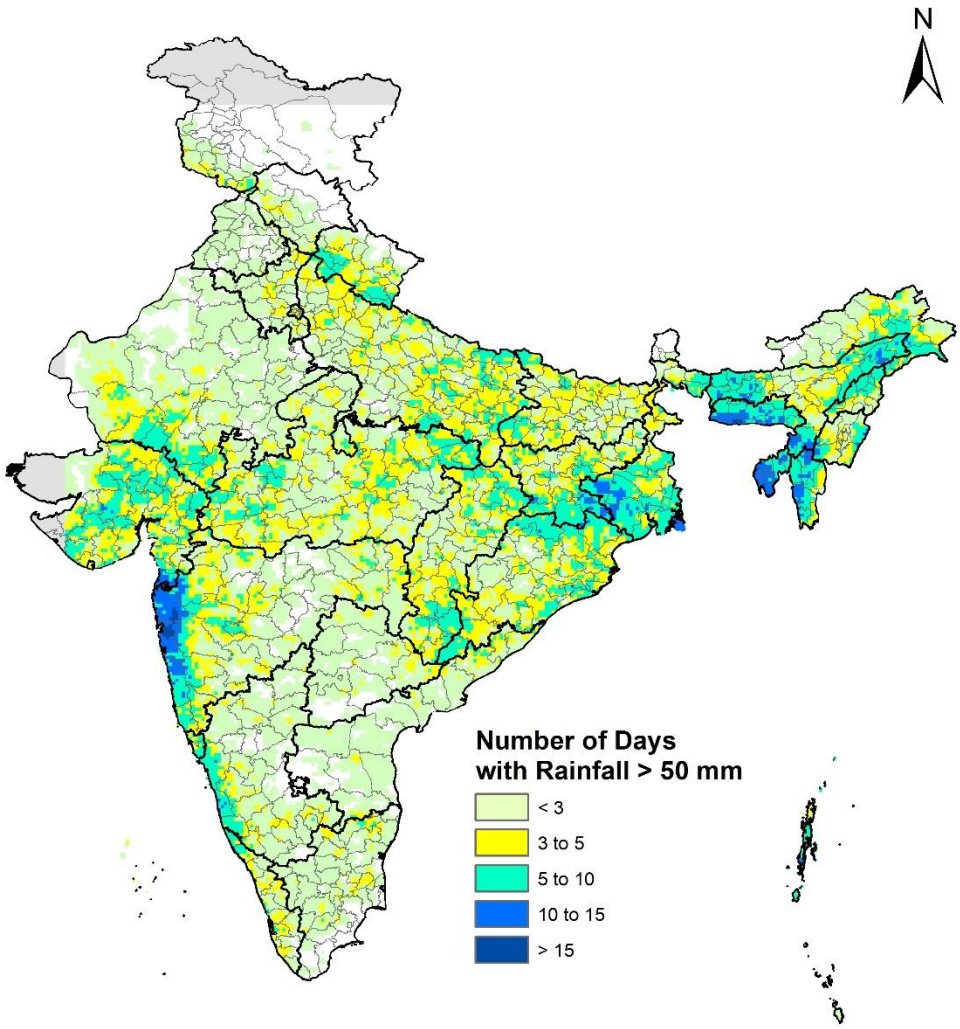
The following map presents seasonal maximum length of dry spells (in days) over the country. Data is derived from Climate Prediction Centre of National Oceanic and Atmospheric Administration. Parts of Rajasthan, Gujarat, Jammu and Kashmir, Maharashtra, Punjab and Tamil Nadu witnessed maximum dry spells with more than 20 days having dry spells. Most of eastern, and North-Eastern India had very few dry spell days. Grey areas show regions with no-data.



Rainfall Extremes

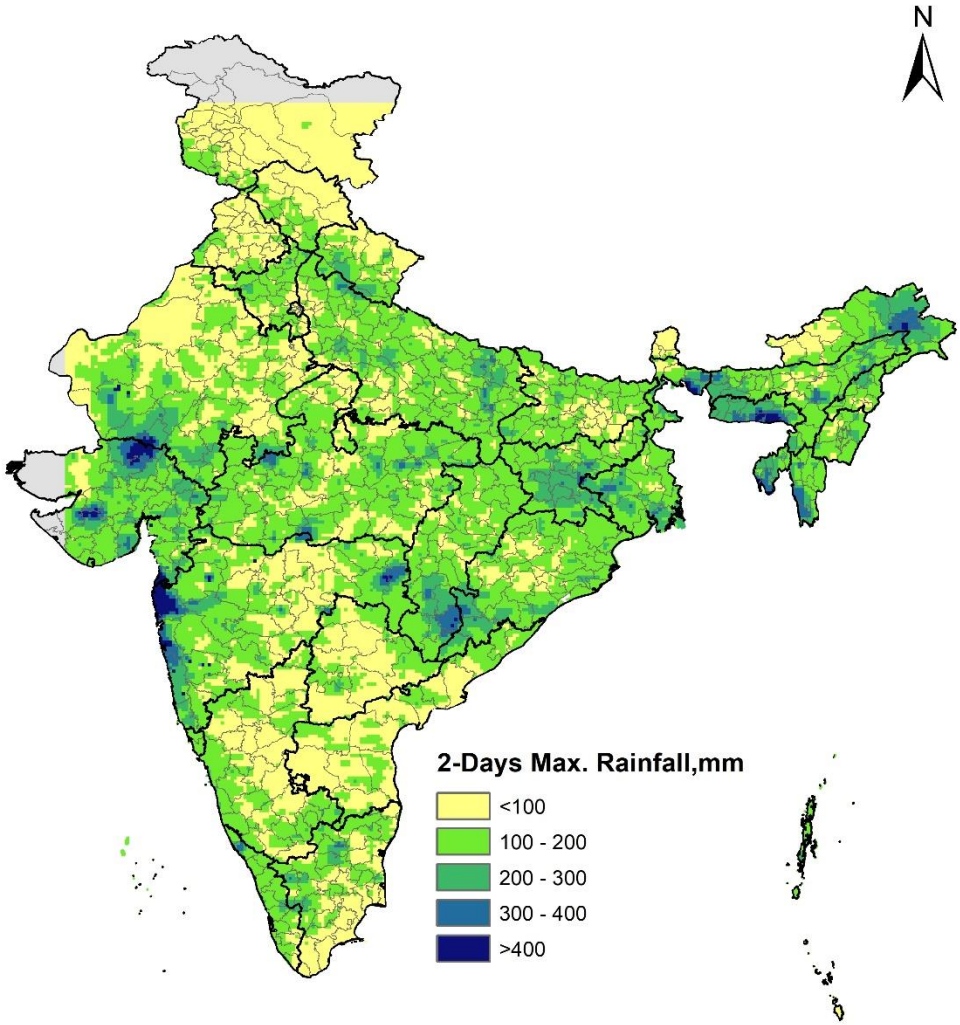
RAINFALL GREATER THAN 50 MM (JUNE 1- SEPTEMBER 30, 2017)

The following map presents seasonal rainfall extremes as number of days when rainfall exceeded 50 mm over the country. Maximum rainy days were observed in Maharashtra and some regions of eastern India. Data is derived from Climate Prediction Centre of National Oceanic and Atmospheric Administration. Grey areas show regions with no-data.



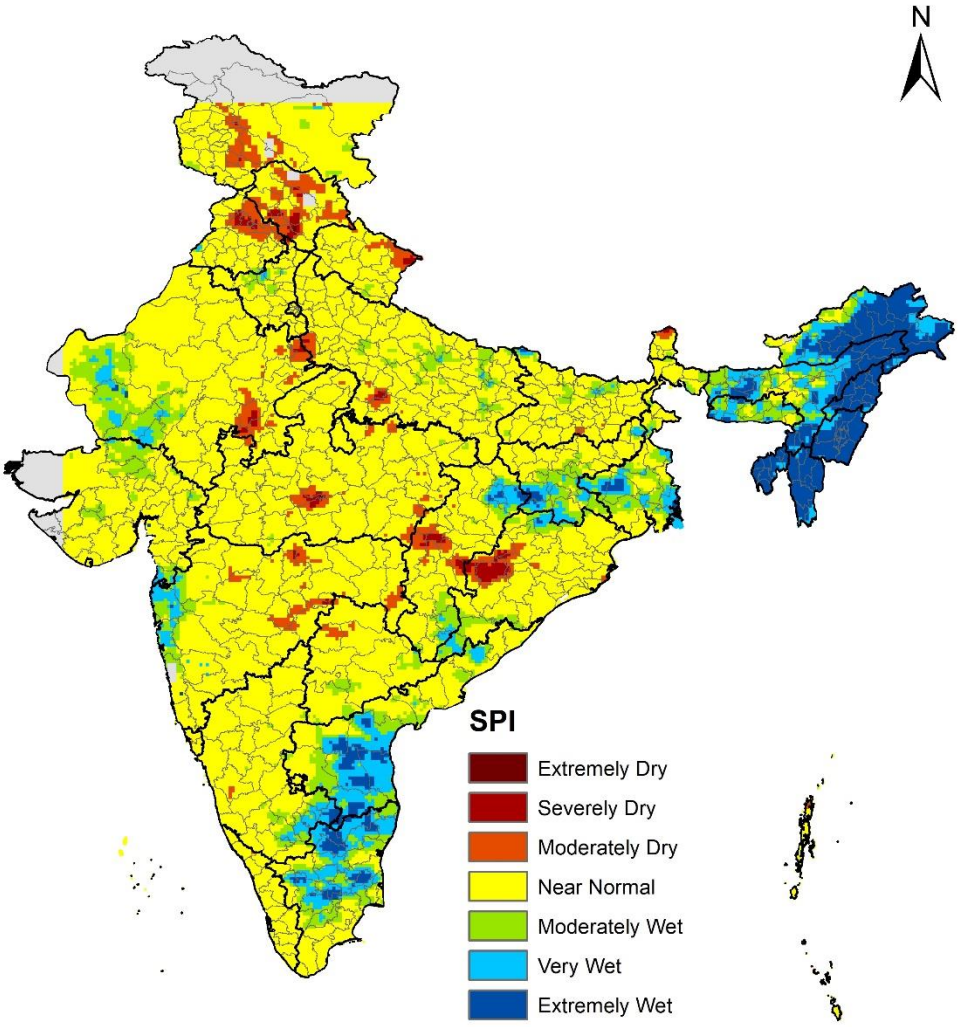
TWO DAY MAXIMUM RAINFALL (JUNE 1- SEPTEMBER 30, 2017)

The following map presents seasonal two-day maximum rainfall (in mm) over the country. Data is derived from Climate Prediction Centre of National Oceanic and Atmospheric Administration. Parts of Rajasthan, Gujarat, Maharashtra received two-day maximum rainfall of more than 300 mm. Grey areas show regions with no-data.



SEASONAL STANDARDIZED PRECIPITATION INDEX (JUNE 1- SEPTEMBER 30, 2017)

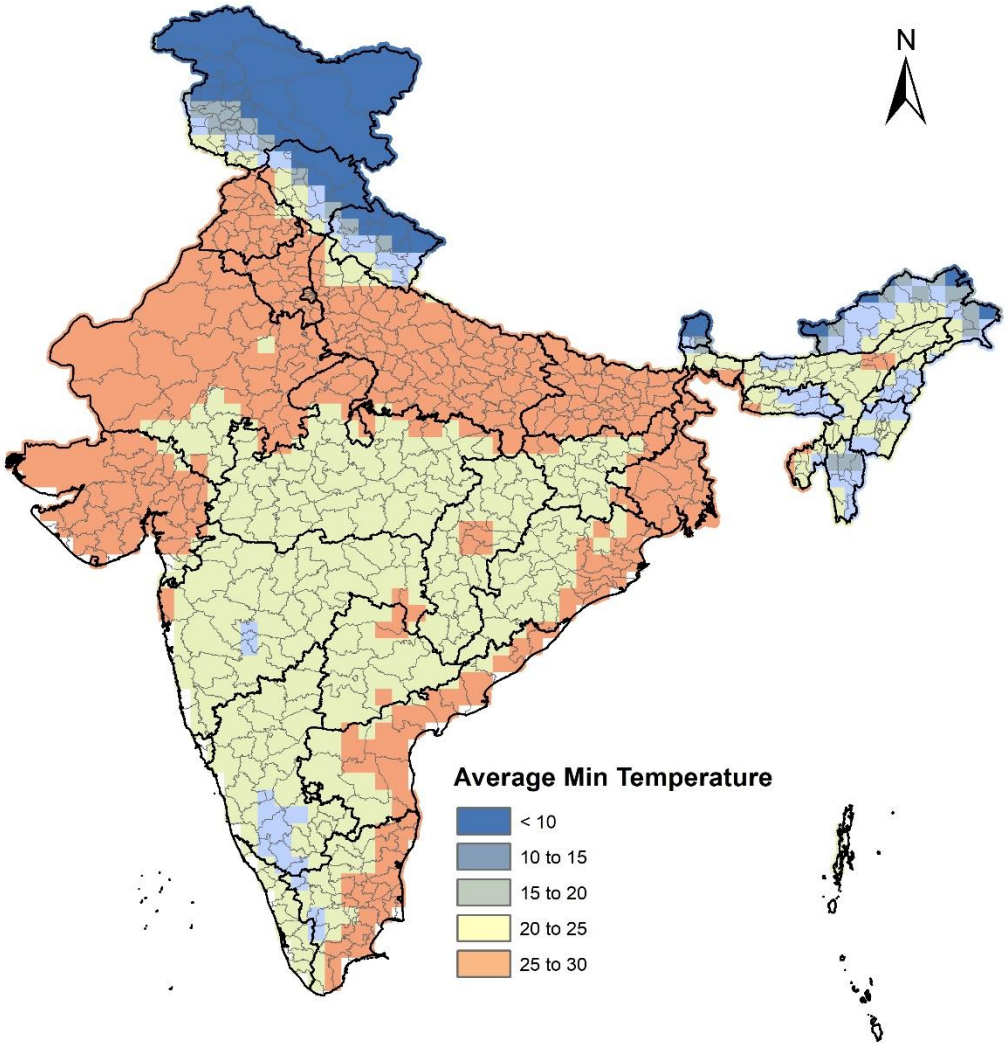
The following map presents seasonal Standardized Precipitation Index, as a proxy indicator of drought over the country. Data is derived from Climate Prediction Centre of National Oceanic and Atmospheric Administration. Parts of western (Rajasthan), eastern and almost most of North-eastern Region witnessed very wet conditions throughout the Kharif season. Dry conditions were scattered all over the country, with parts of central and peninsular India (Punjab, Haryana, Rajasthan, Chhattisgarh, Orissa, Madhya Pradesh and Maharashtra) witnessing severe to extreme dry conditions. Grey areas show regions with no-data. The classification of the index is the same as used by World Meteorological Organization (http://www.wamis.org/agm/pubs/SPI/WMO_1090_EN.pdf).



1.2 Temperature

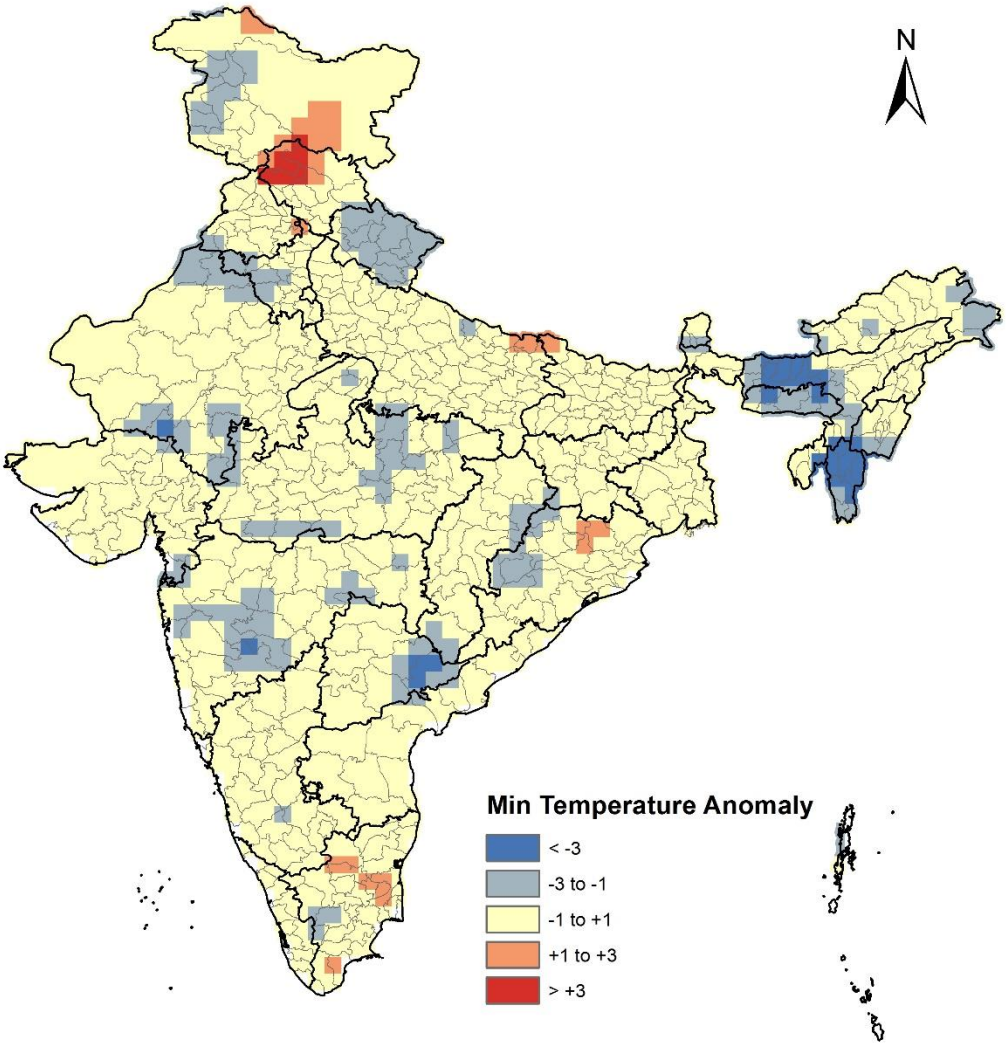
Seasonal Average Minimum Temperature (June 1-September 30, 2017)

The following map presents seasonal average minimum temperature (in degree Celsius) over the country. Data is derived from Climate Prediction Centre of National Oceanic and Atmospheric Administration. Most of western and Indo-Gangetic Plains had average minimum temperature greater than 25 degrees Celsius. Northern Himalayan states of Jammu and Kashmir, Himachal Pradesh, Uttaranchal and parts of north-east; had minimum temperature less than 10 degrees.



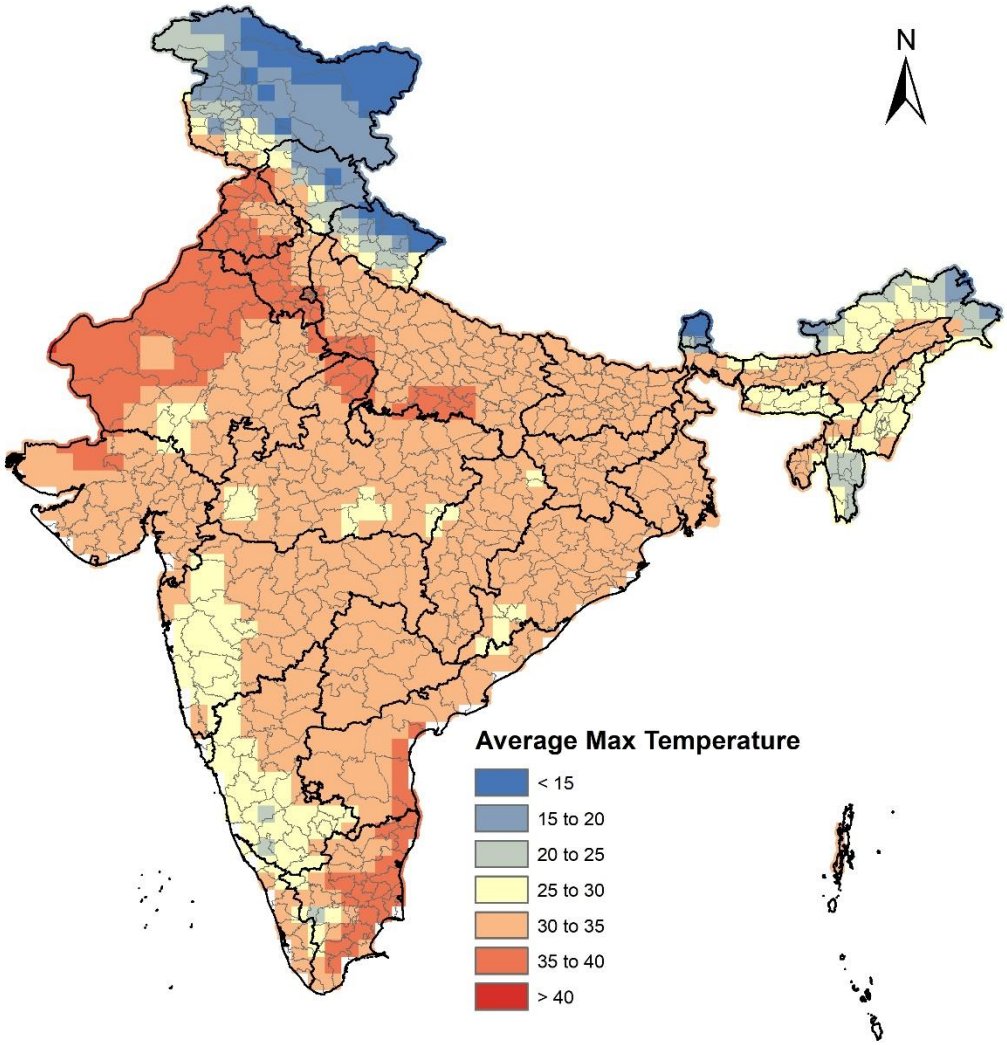
Minimum temperature deviation from long term average (June 1-September 30, 1990-2017)

The following map presents seasonal Minimum temperature deviation from long term average (in degree Celsius) over the country. Maximum deviation was observed in Himachal Pradesh and negative deviation was observed in Eastern India. Data is derived from Climate Prediction Centre of National Oceanic and Atmospheric Administration. Grey areas are outside satellite coverage.



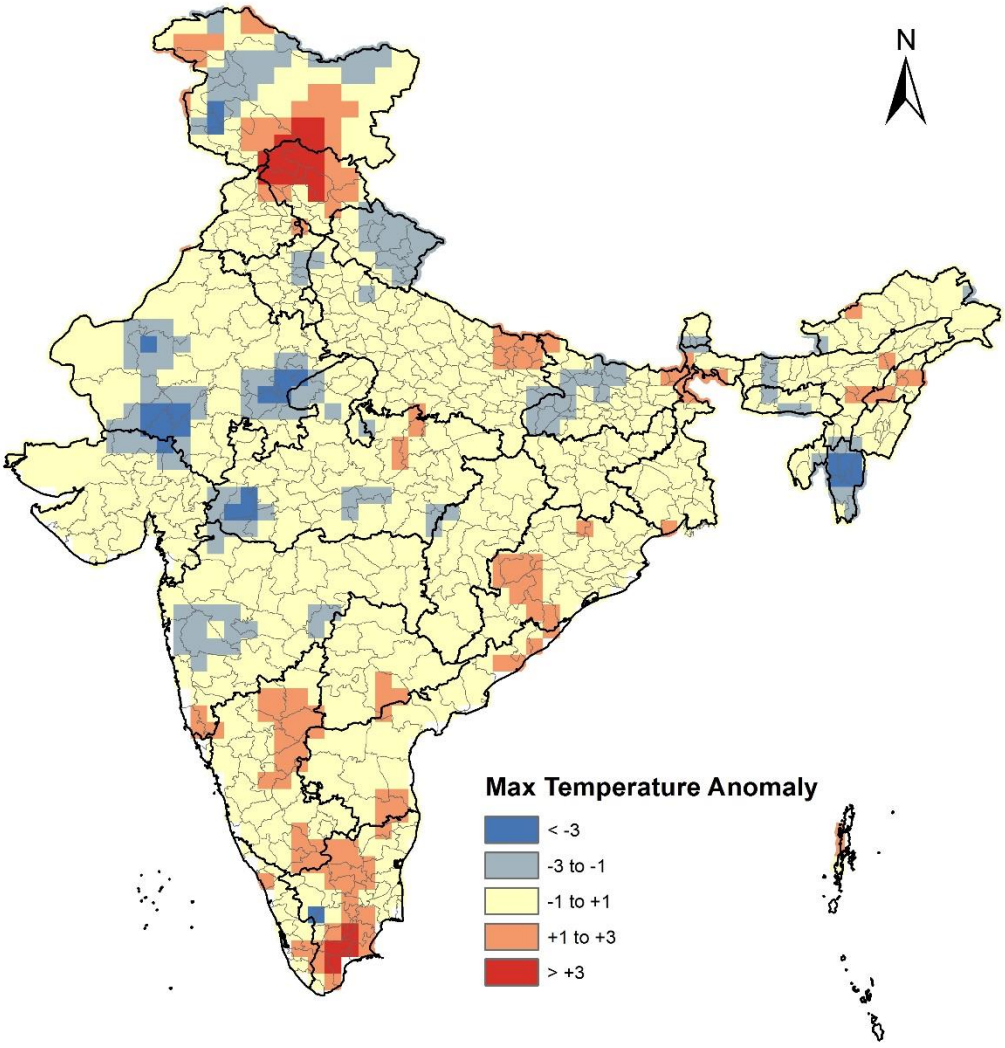
Average Maximum Temperature (June 1-September 30, 2017)

The following map presents seasonal average maximum temperature (in degree Celsius) over the country. Data is derived from Climate Prediction Centre of National Oceanic and Atmospheric Administration. Parts of Punjab, Rajasthan, Uttar Pradesh and Haryana witnessed average maximum temperature of more than 35 degrees Celsius. On the other hand, Jammu and Kashmir, Himachal Pradesh, Uttaranchal and Sikkim had average maximum temperature less than 15 degrees.



Maximum temperature deviation from long term average (June 1-September 30, 1990-2017)

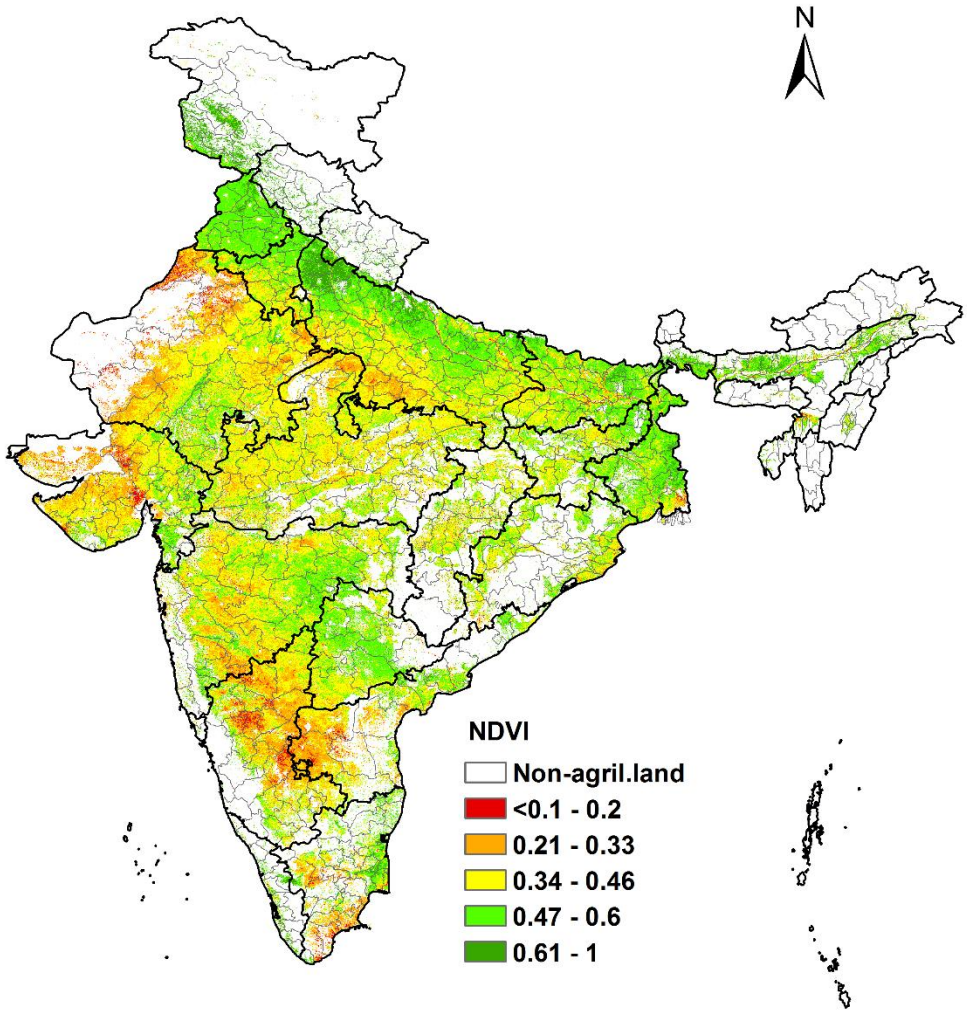
The following map presents seasonal Maximum temperature deviation from long term average (in degree Celsius) over the country. Highest deviation was seen in Himachal Pradesh and negative deviation was observed in multiple parts of the county. Data is derived from Climate Prediction Centre of National Oceanic and Atmospheric Administration. Grey areas are outside satellite coverage.



2 Vegetation Condition

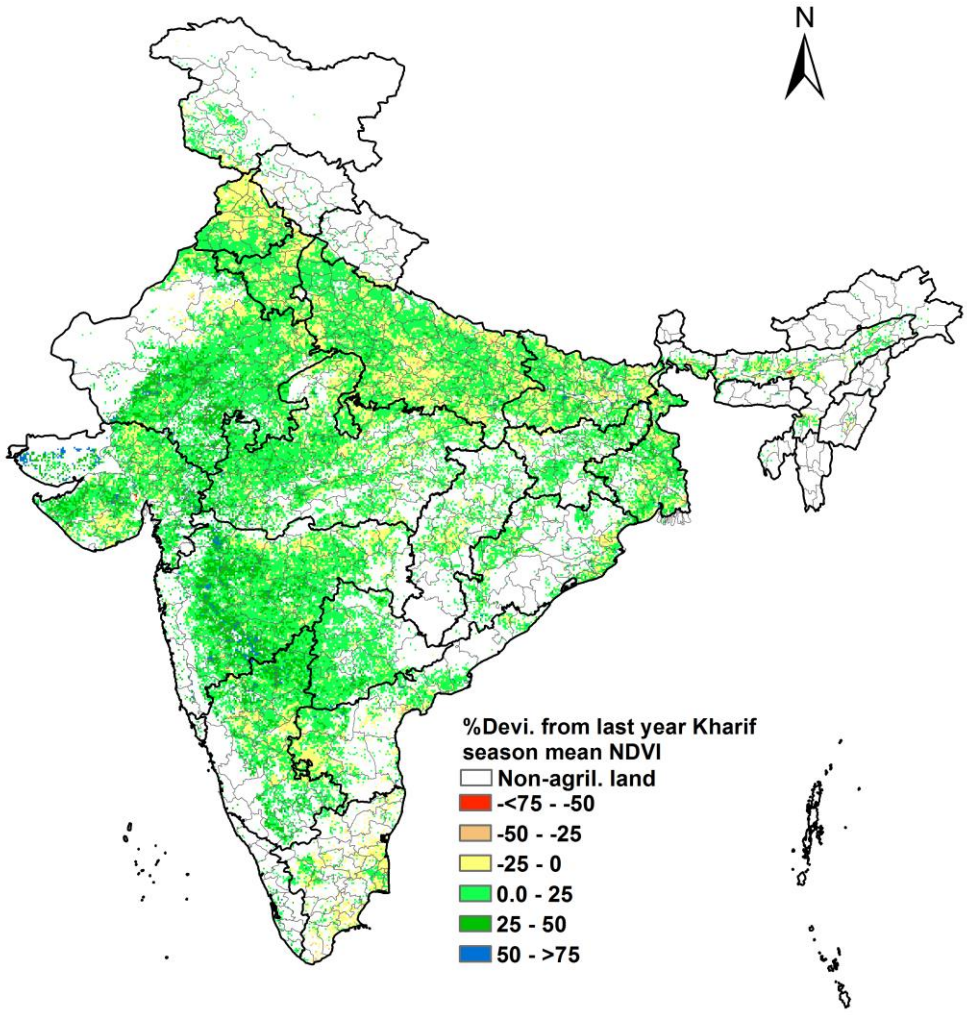
Current Vegetation Growth Index (June 1- September 30, 2017)

The following map presents seasonal Vegetation Growth Index over the country. Data is derived from MODIS (Moderate Resolution Imaging Spectro-radiometer) satellite data with 250-meter resolution. Good vegetation condition was observed over Indo-Gangetic plains (Punjab, Haryana, Uttar Pradesh). Parts of Rajasthan, Gujarat, Maharashtra, Karnataka and Andhra Pradesh showed poor vegetation conditions.



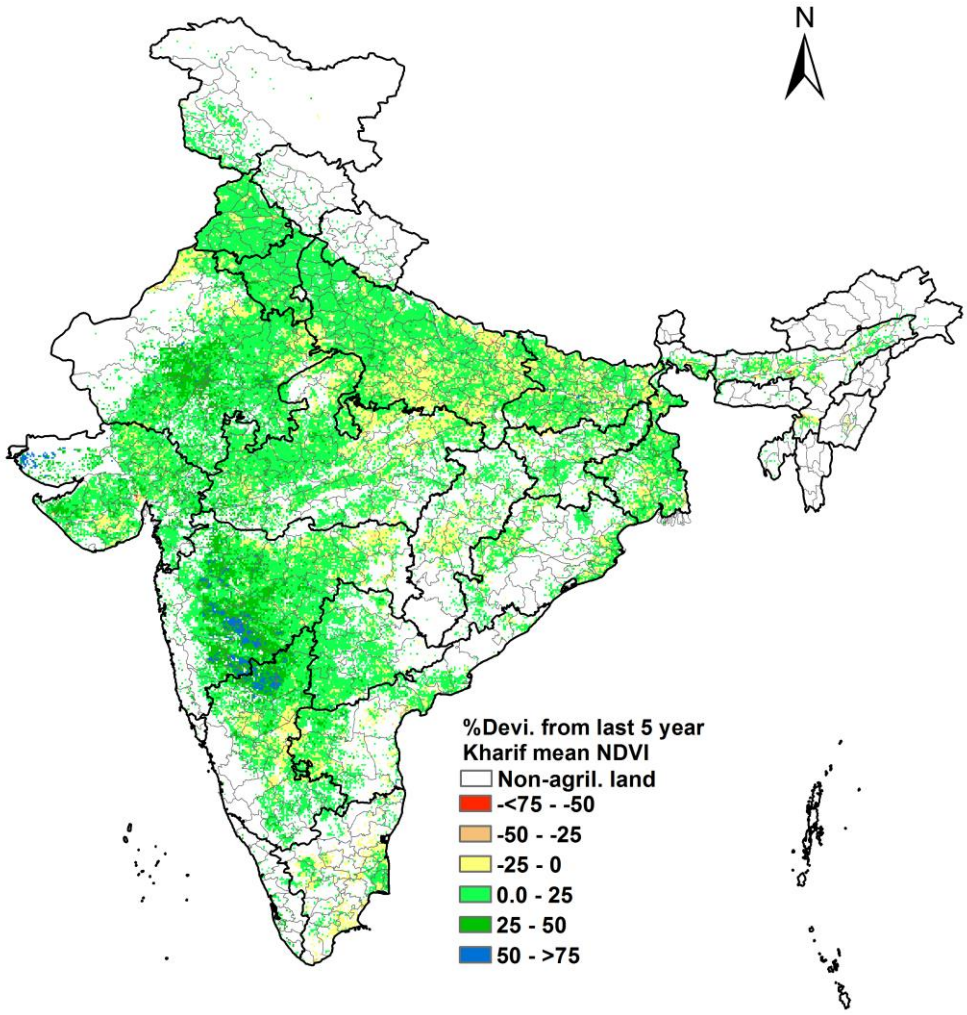
Deviation of current Vegetation Growth Index (June 1- September 30, 2017) from previous year

The following map presents deviation of seasonal Vegetation Growth Index from previous year, over the country. Data is derived from MODIS (Moderate Resolution Imaging Spectro-radiometer) satellite data with 250-meter resolution. Highest negative deviation of vegetation conditions from previous year was scattered all over the country, but was mostly observed in parts of Punjab, Uttar Pradesh and Bihar.



Deviation of current Vegetation Growth Index (June 1- September 30, 2017) from previous 5-year average

The following map presents deviation of seasonal Vegetation Growth Index from previous five years, over the country. Data is derived from MODIS (Moderate Resolution Imaging Spectro-radiometer) satellite data with 250-meter resolution.

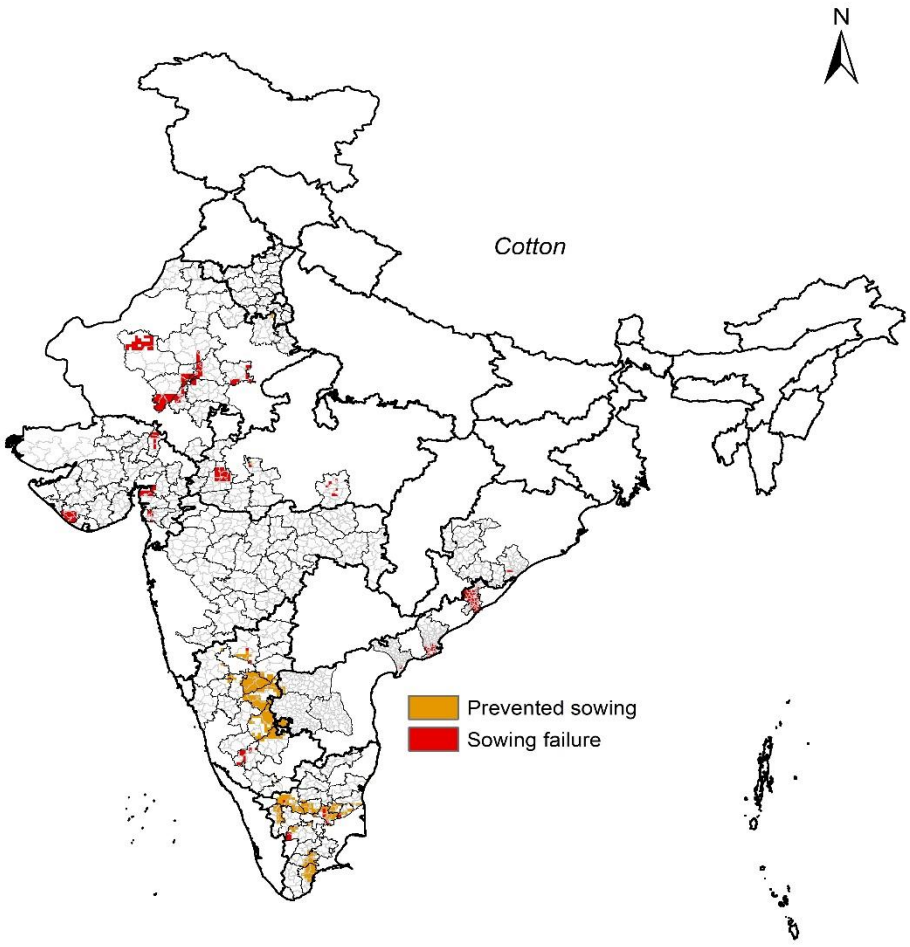


3 Crop Condition

3.1 Cotton

PREVENTED SOWING AND SOWING FAILURE

The following map presents regions where there are likely chances that sowing couldn't take place due to inadequate moisture conditions, however the crops may have failed later on in the season in other regions. It also presents regions where there are likely chances that crop growth was poor or they couldn't survive in this season due to inadequate/excess moisture conditions.

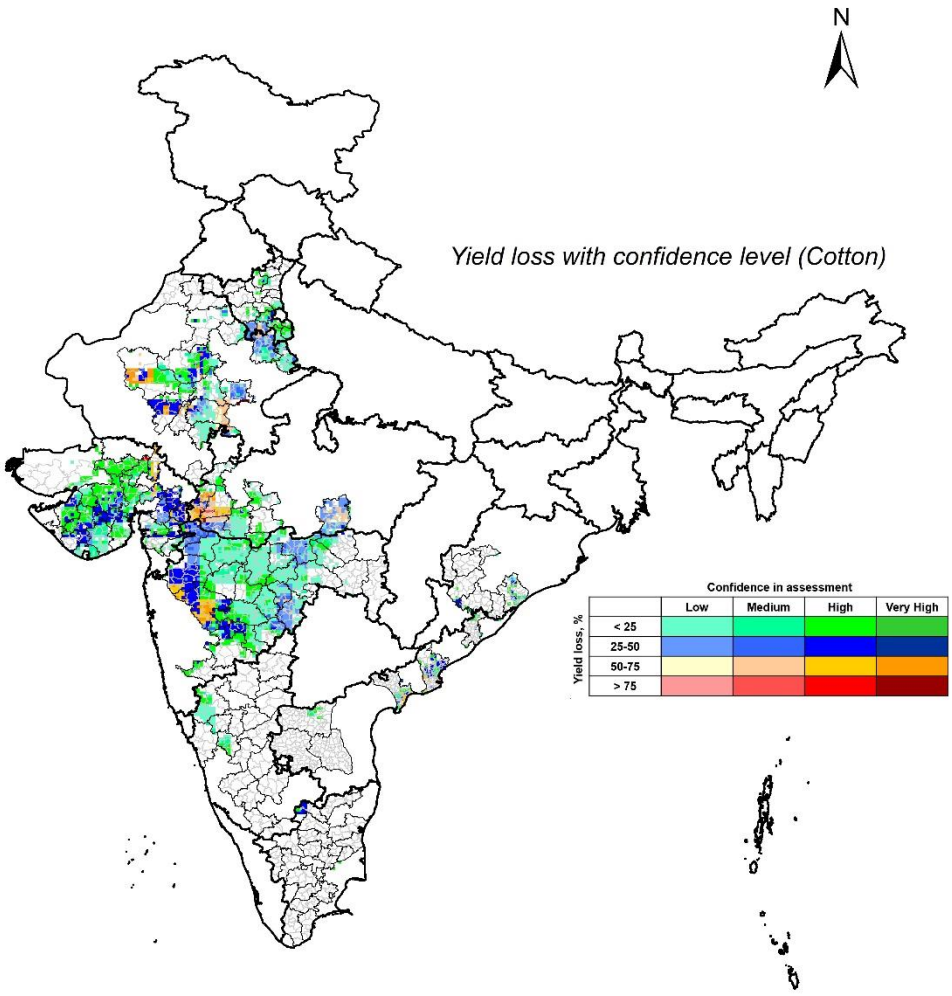


Note: These maps are based on our assessments depending on multiple criteria of weather, satellite remote sensing and crop simulation model. Results are shown for only those districts which are insured as rainfed crop or irrigation condition unspecified in PMFBY Kharif-2017.Please note, these results are relevant only for rainfed areas and flood losses are also not considered.

We recommend minimal validation and ground-truthing before further use.

COTTON: YIELD LOSS ASSESSMENT

The following map presents regions where there are likely chances that there was crop loss in this season due to inadequate/excess moisture conditions. Areas showing maximum crop losses were observed in Rajasthan and Peninsular India.



Note: These maps are based on our assessments depending on multiple criteria of weather, satellite remote sensing and crop simulation model. Results are shown for only those districts which are insured as rainfed crop or irrigation condition unspecified in PMFBY Kharif-2017.Please note, these results are relevant only for rainfed areas and flood losses are also not considered.

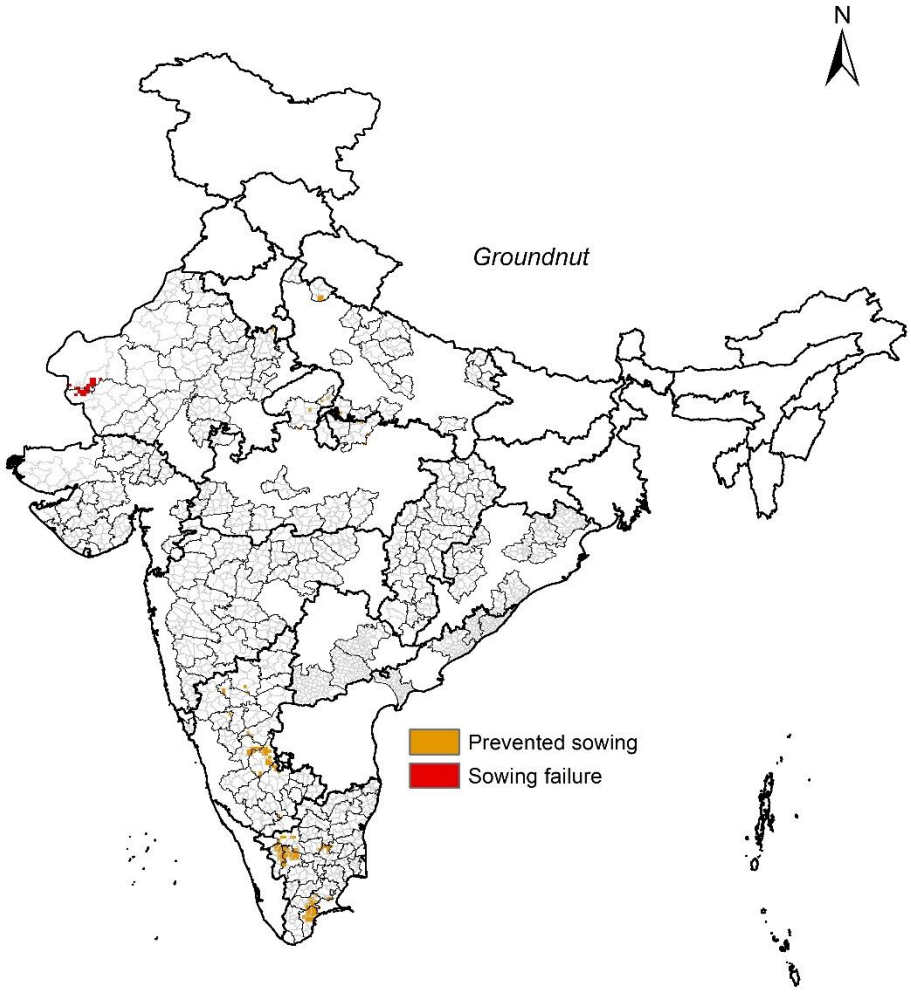
We recommend minimal validation and ground-truthing before further use.

Please note that these are provisional estimates, considers average yield until end of season (Oct-22, 2017); incase pickings are still continued then revised estimate is required.

3.2 Groundnut

PREVENTED SOWING AND SOWING FAILURE

The following map presents regions where there are likely chances that sowing couldn't take place due to inadequate moisture conditions, however the crops may have failed later on in the season in other regions. It also presents regions where there are likely chances that crop growth was poor or they couldn't survive in this season due to inadequate/excess moisture conditions. Most regions are observed in southern and western India.

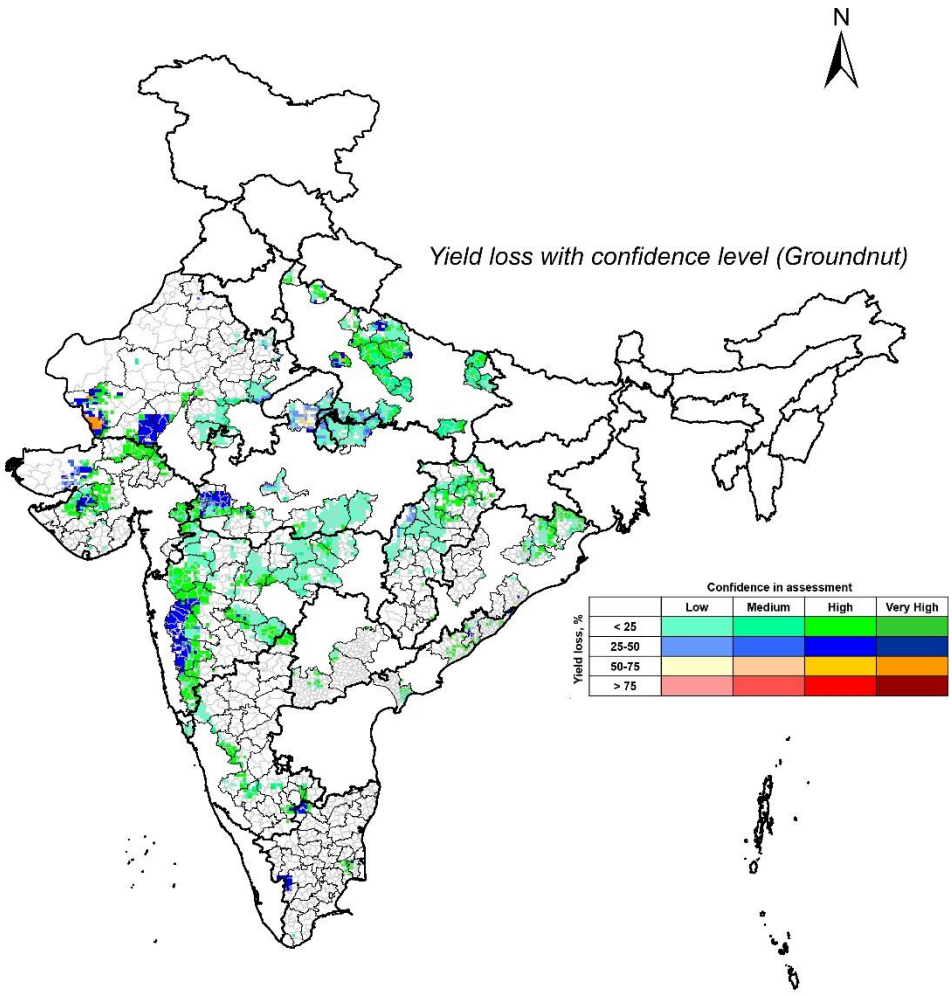


Note: These maps are based on our assessments depending on multiple criteria of weather, remotely sensed vegetation indices and crop simulation model. Results are shown for only those districts which are insured as rainfed crop or irrigation condition unspecified in PMFBY Kharif-2017.Please note, these results are relevant only for rainfed areas and flood losses are also not considered. Grey area indicates no losses.

We recommend minimal validation and ground-truthing before further use.

GROUNDNUT: YIELD LOSS ASSESSMENT

The following map presents regions where there are likely chances that there was crop loss in this season due to inadequate/excess moisture conditions. Most of the crop loss areas were observed in Western and peninsular India.



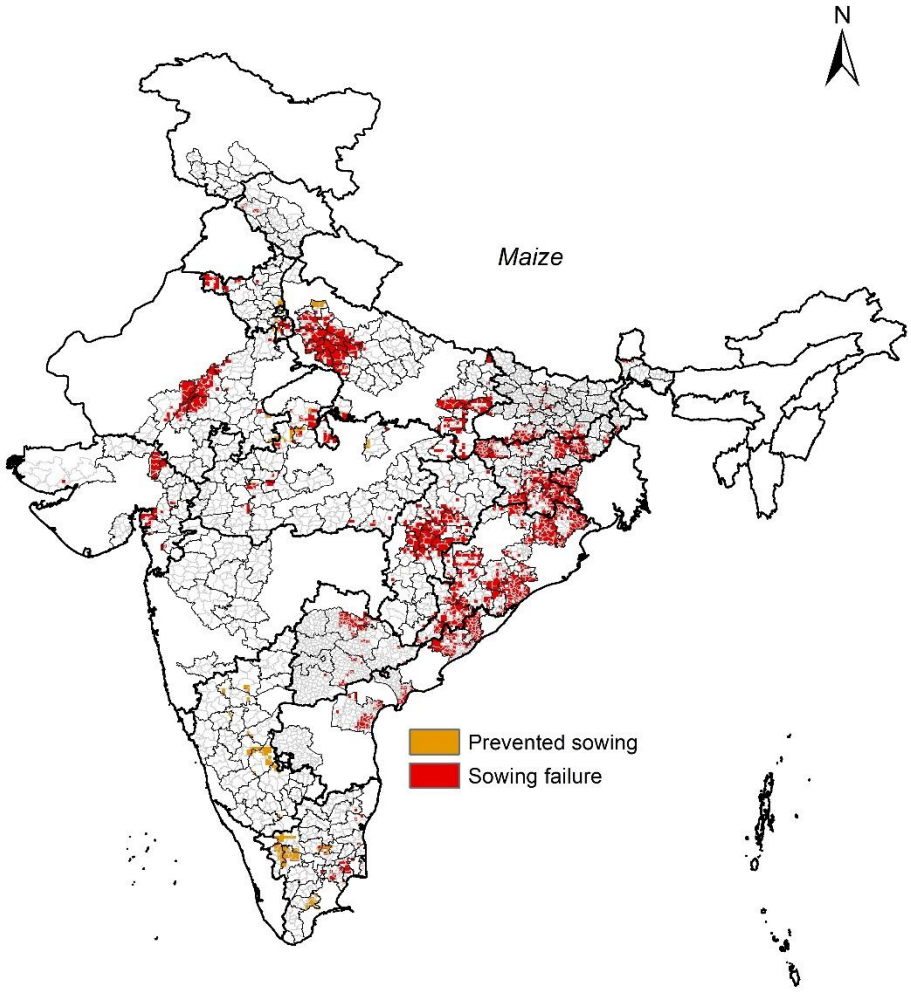
Note: These maps are based on our assessments depending on multiple criteria of weather, remotely sensed vegetation indices and crop simulation model. Results are shown for only those districts which are insured as rainfed crop or irrigation condition unspecified in PMFBY Kharif-2017.Please note, these results are relevant only for rainfed areas and flood losses are also not considered. Grey area indicates no losses.

We recommend minimal validation and ground-truthing before further use.

3.3 Maize

PREVENTED SOWING AND SOWING FAILURE

The following map presents regions where there are likely chances that sowing couldn't take place due to inadequate moisture conditions, however the crops may have failed later on in the season in other regions. It also presents regions where there are likely chances that crop growth was poor or they couldn't survive in this season due to inadequate/excess moisture conditions. Most regions are observed in eastern and central India.

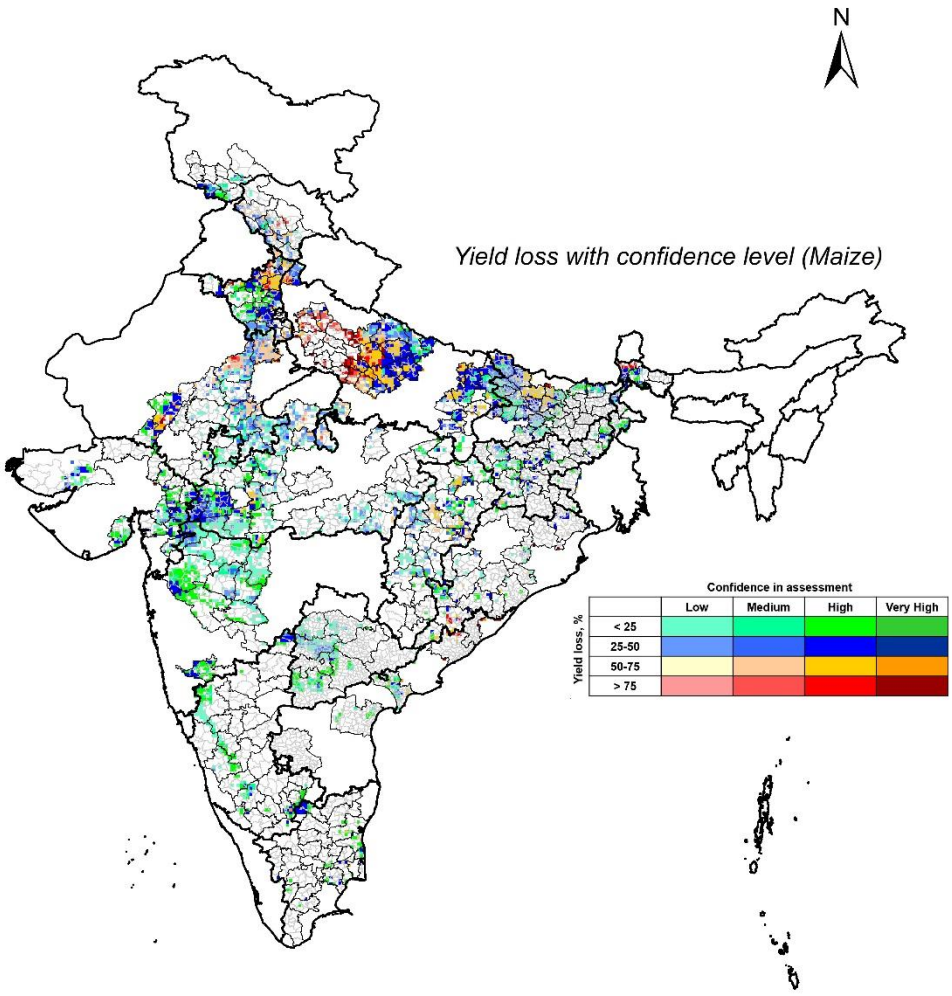


Note: These maps are based on our assessments depending on multiple criteria of weather, remotely sensed vegetation indices and crop simulation model. Results are shown for only those districts which are insured as rainfed crop or irrigation condition unspecified in PMFBY Kharif-2017.Please note, these results are relevant only for rainfed areas and flood losses are also not considered. Grey area indicates no losses.

We recommend minimal validation and ground-truthing before further use.

MAIZE: YIELD LOSS ASSESSMENT

The following map presents regions where there are likely chances that there was crop loss in this season due to inadequate/excess moisture conditions. Most of the maximum crop loss areas were observed in eastern and peninsular India.



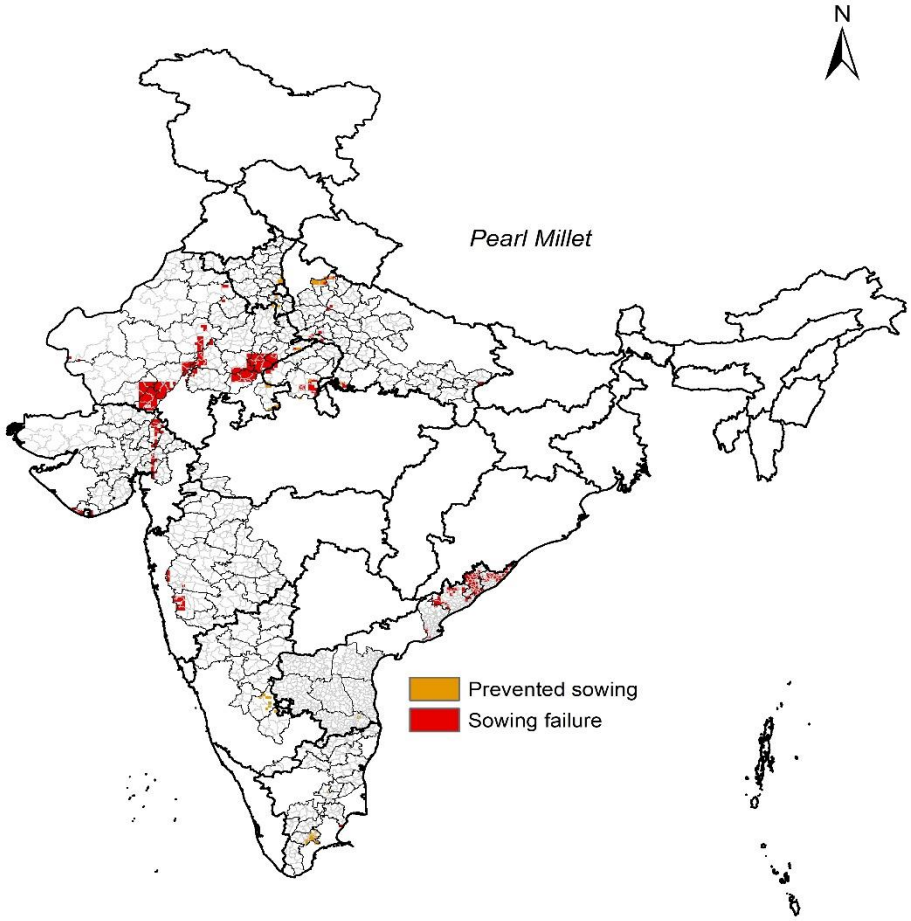
Note: These maps are based on our assessments depending on multiple criteria of weather, remotely sensed vegetation indices and crop simulation model. Results are shown for only those districts which are insured as rainfed crop or irrigation condition unspecified in PMFBY Kharif-2017.Please note, these results are relevant only for rainfed areas and flood losses are also not considered. Grey area indicates no losses.

We recommend minimal validation and ground-truthing before further use.

3.4 Pearl Millet (Bajra)

PREVENTED SOWING AND SOWING FAILURE

The following map presents regions where there are likely chances that sowing couldn't take place due to inadequate moisture conditions, however the crops may have failed later on in the season in other regions. It also presents regions where there are likely chances that crop growth was poor or they couldn't survive in this season due to inadequate/excess moisture conditions. Such areas were observed scattered sporadically throughout the country but mainly observed in western India.

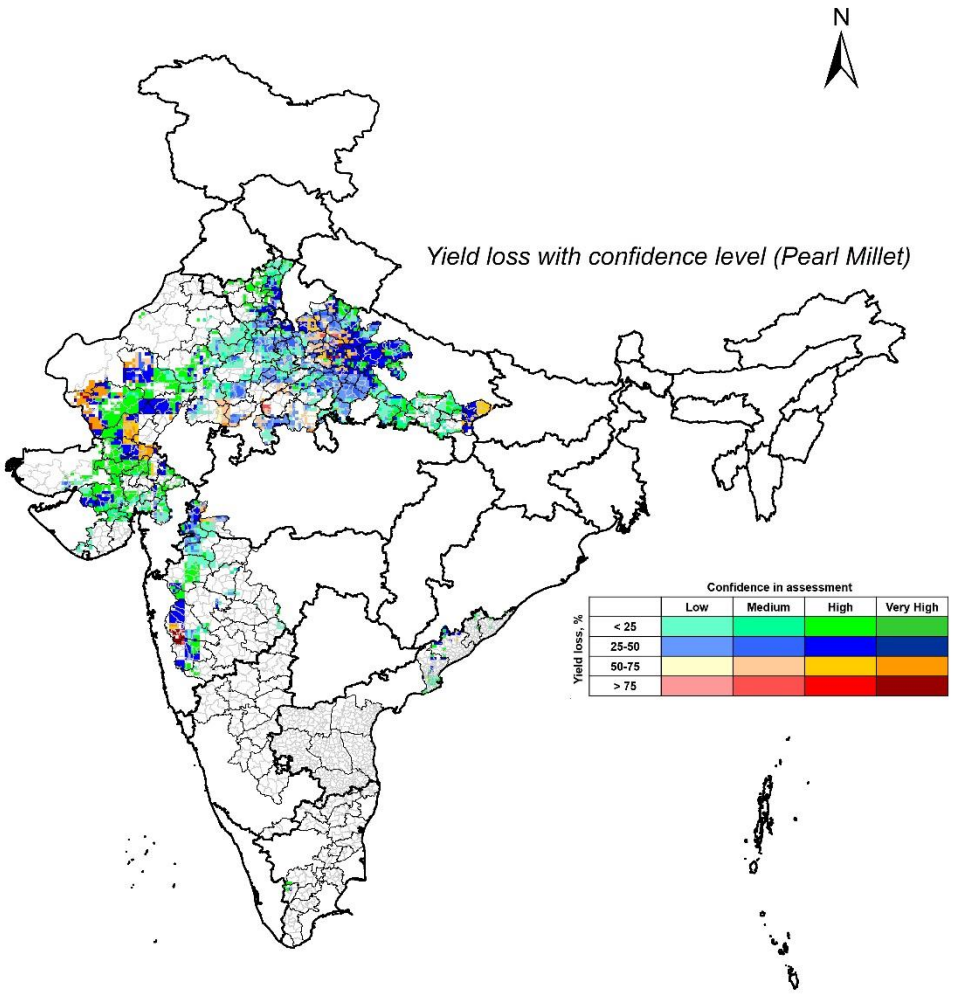


Note: These maps are based on our assessments depending on multiple criteria of weather, remotely sensed vegetation indices and crop simulation model. Results are shown for only those districts which are insured as rainfed crop or irrigation condition unspecified in PMFBY Kharif-2017.Please note, these results are relevant only for rainfed areas and flood losses are also not considered. Grey area indicates no losses.

We recommend minimal validation and ground-truthing before further use.

PEARL MILLET (BAJRA): YIELD LOSS ASSESSMENT

The following map presents regions where there are likely chances that there was crop loss in this season due to inadequate/excess moisture conditions. Areas with crop losses were mainly observed in western parts of the country.



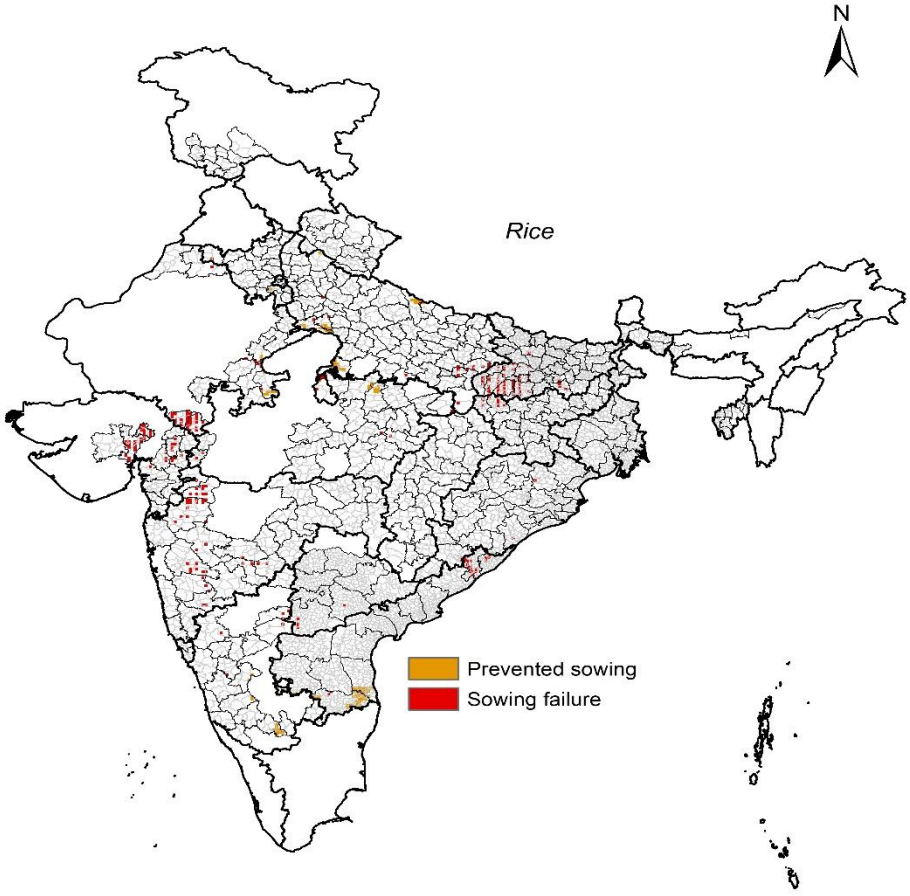
Note: These maps are based on our assessments depending on multiple criteria of weather, remotely sensed vegetation indices and crop simulation model. Results are shown for only those districts which are insured as rainfed crop or irrigation condition unspecified in PMFBY Kharif-2017.Please note, these results are relevant only for rainfed areas and flood losses are also not considered. Grey area indicates no losses.

We recommend minimal validation and ground-truthing before further use.

3.5 Rice

PREVENTED SOWING AND SOWING FAILURE

The following map presents regions where there are likely chances that sowing couldn't take place due to inadequate moisture conditions, however the crops may have failed later on in the season in other regions. It also presents regions where there are likely chances that crop growth was poor or they couldn't survive in this season due to inadequate/excess moisture conditions. Such areas were observed scattered sporadically throughout the country but mainly observed in western and eastern India.

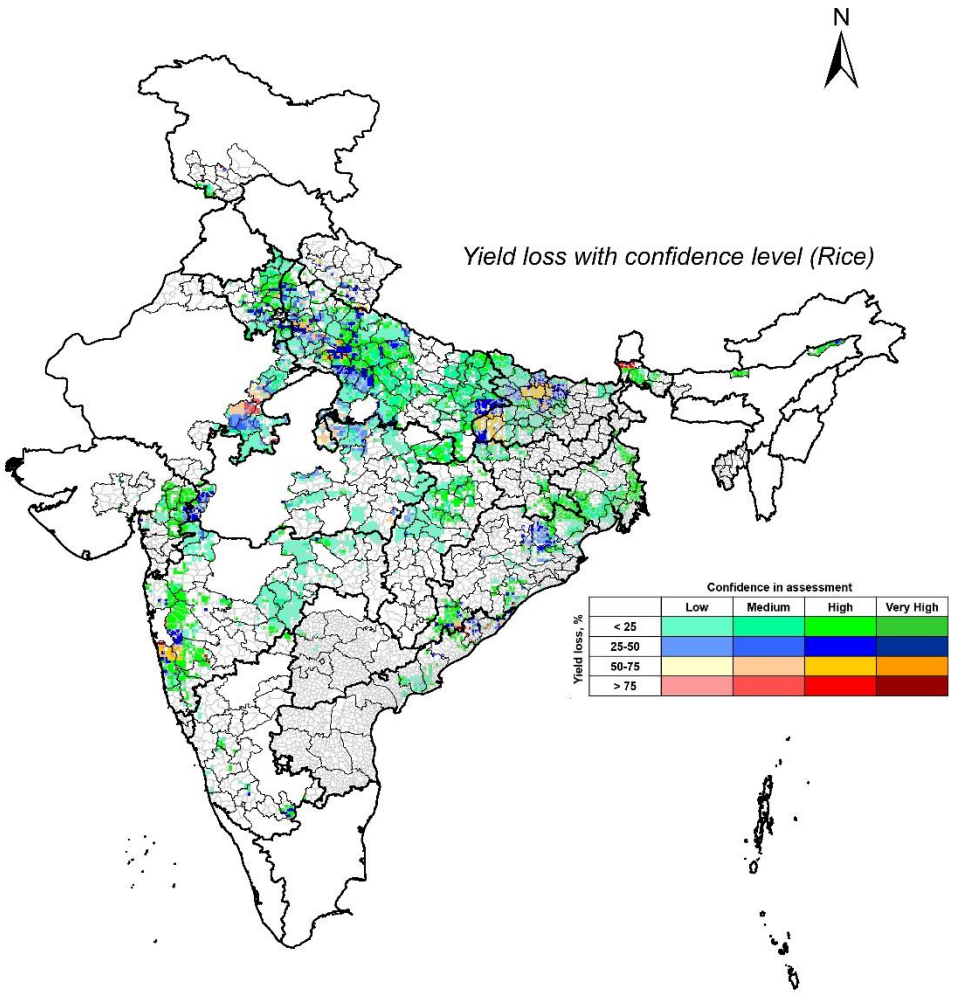


Note: These maps are based on our assessments depending on multiple criteria of weather, remotely sensed vegetation indices and crop simulation model. Results are shown for only those districts which are insured as rainfed crop or irrigation condition unspecified in PMFBY Kharif-2017.Please note, these results are relevant only for rainfed areas and flood losses are also not considered. Grey area indicates no losses.

We recommend minimal validation and ground-truthing before further use.

RICE: YIELD LOSS ASSESSMENT

The following map presents regions where there are likely chances that there was crop loss in this season due to inadequate/excess moisture conditions. Most of the yield loss regions were observed in central, peninsular and eastern parts of the country.



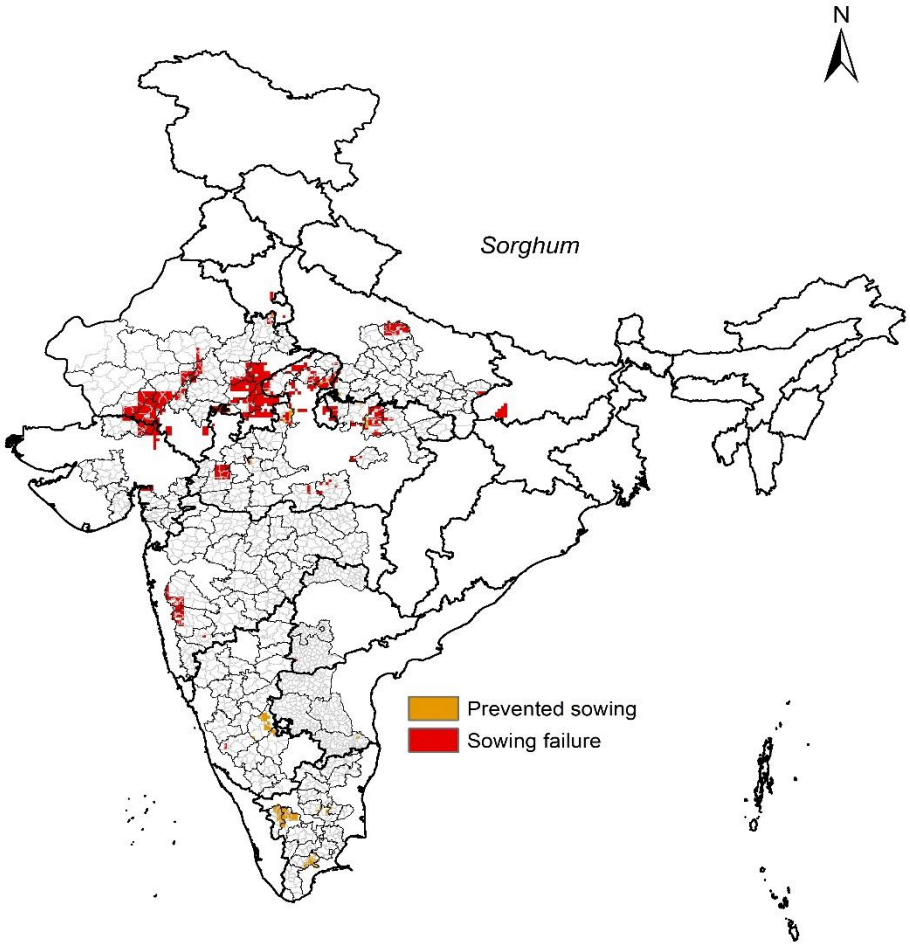
Note: These maps are based on our assessments depending on multiple criteria of weather, remotely sensed vegetation indices and crop simulation model. Results are shown for only those districts which are insured as rainfed crop or irrigation condition unspecified in PMFBY Kharif-2017.Please note, these results are relevant only for rainfed areas and flood losses are also not considered. Grey area indicates no losses.

We recommend minimal validation and ground-truthing before further use.

3.6 Sorghum

PREVENTED SOWING AND SOWING FAILURE

The following map presents regions where there are likely chances that sowing couldn't take place due to inadequate moisture conditions, however the crops may have failed later on in the season in other regions. It also presents regions where there are likely chances that crop growth was poor or they couldn't survive in this season due to inadequate/excess moisture conditions. Such areas were observed scattered sporadically throughout the country but mainly observed in central and southern India.

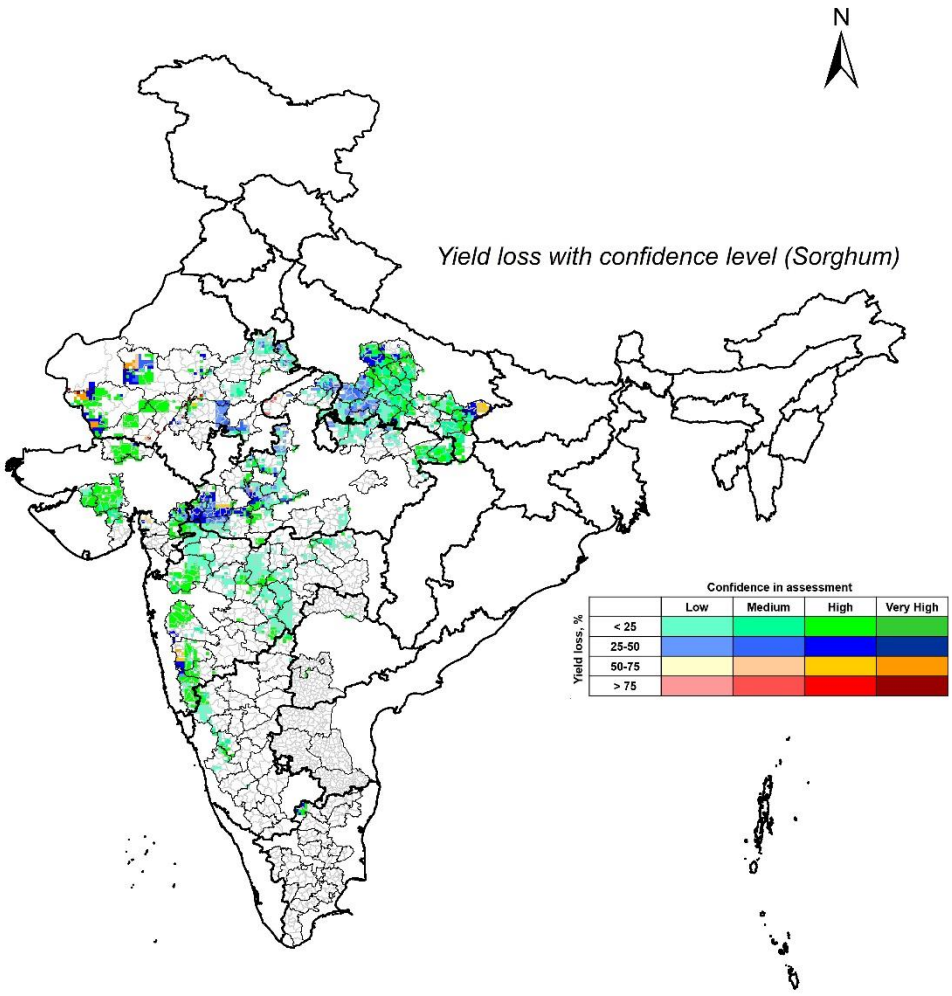


Note: These maps are based on our assessments depending on multiple criteria of weather, remotely sensed vegetation indices and crop simulation model. Results are shown for only those districts which are insured as rainfed crop or irrigation condition unspecified in PMFBY Kharif-2017.Please note, these results are relevant only for rainfed areas and flood losses are also not considered. Grey area indicates no losses.

We recommend minimal validation and ground-truthing before further use.

SORGHUM: YIELD LOSS ASSESSMENT

The following map presents regions where there are likely chances that there was crop loss in this season due to inadequate/excess moisture conditions. Such areas were mainly observed in central and western parts of the country.



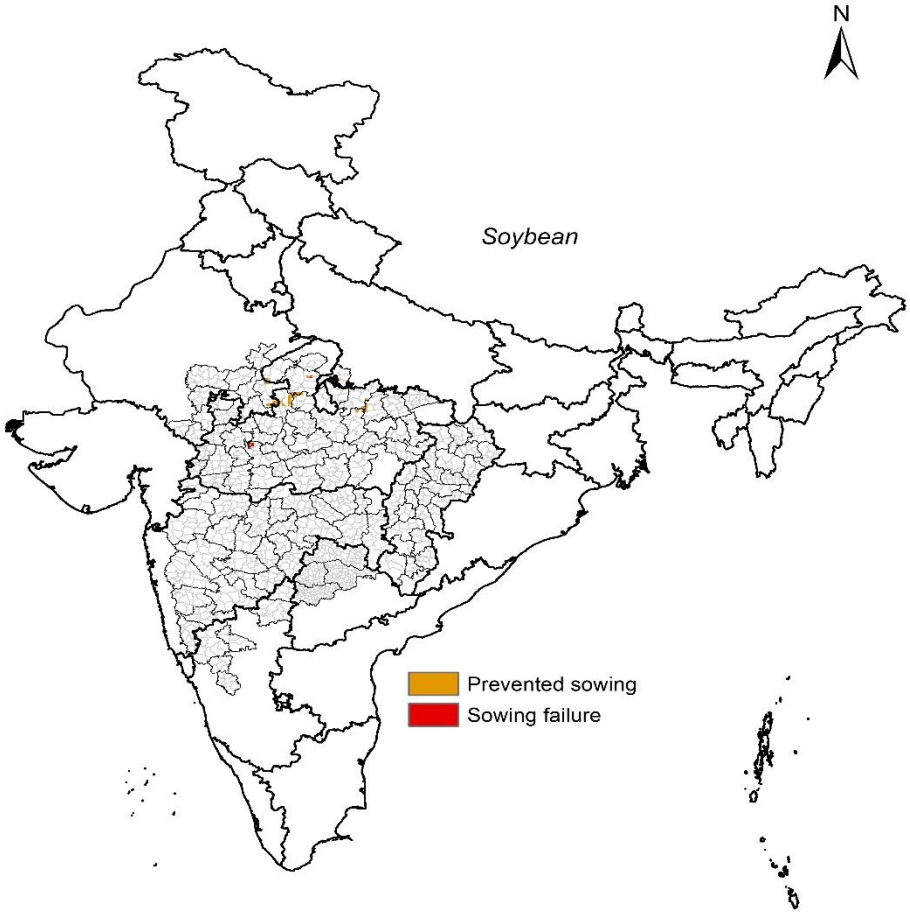
Note: These maps are based on our assessments depending on multiple criteria of weather, remotely sensed vegetation indices and crop simulation model. Results are shown for only those districts which are insured as rainfed crop or irrigation condition unspecified in PMFBY Kharif-2017.Please note, these results are relevant only for rainfed areas and flood losses are also not considered. Grey area indicates no losses.

We recommend minimal validation and ground-truthing before further use.

3.7 Soybean

PREVENTED SOWING AND SOWING FAILURE

The following map presents regions where there are likely chances that sowing couldn't take place due to inadequate moisture conditions, however the crops may have failed later on in the season in other regions. It also presents regions where there are likely chances that crop growth was poor or they couldn't survive in this season due to inadequate/excess moisture conditions. Such areas were found mainly in central India.

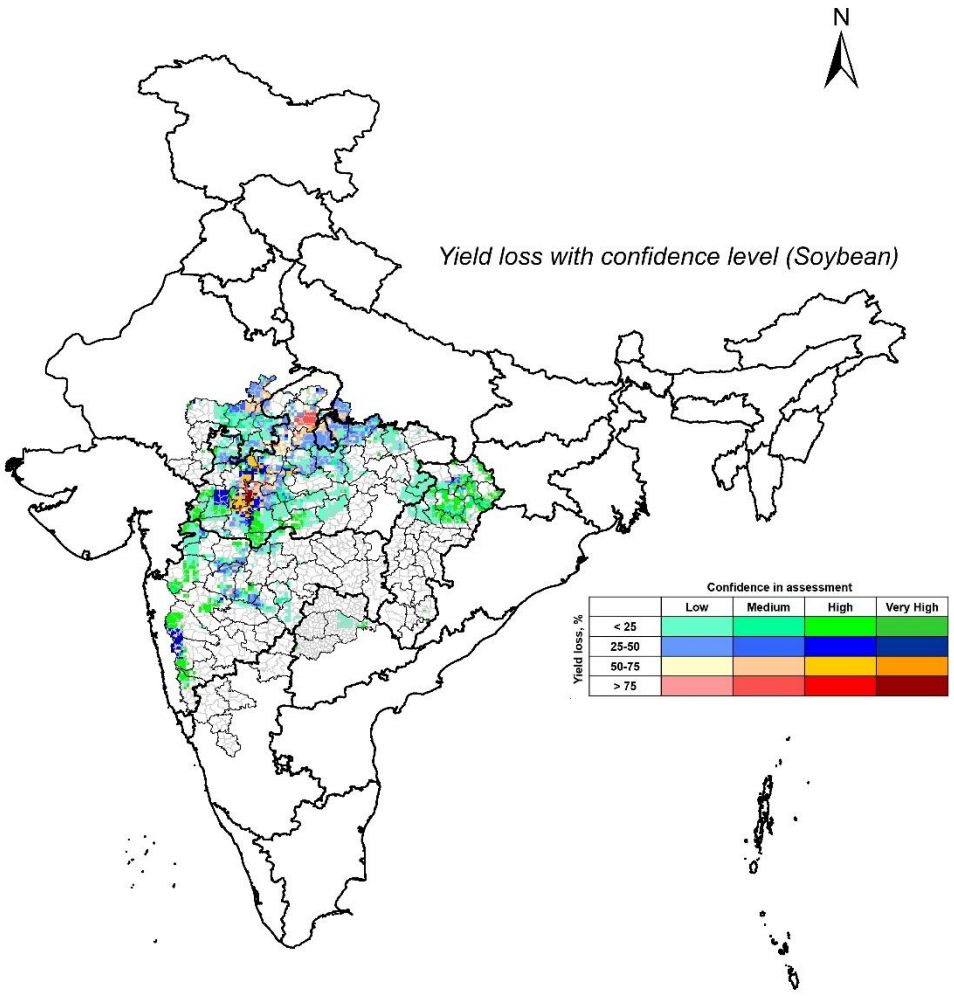


Note: These maps are based on our assessments depending on multiple criteria of weather, remotely sensed vegetation indices and crop simulation model. Results are shown for only those districts which are insured as rainfed crop or irrigation condition unspecified in PMFBY Kharif-2017.Please note, these results are relevant only for rainfed areas and flood losses are also not considered. Grey area indicates no losses.

We recommend minimal validation and ground-truthing before further use.

SOYBEAN: YIELD LOSS ASSESSMENT

The following map presents regions where there are likely chances that there was crop loss in this season due to inadequate/excess moisture conditions. Such areas were found mainly in central and peninsular India.



Note: These maps are based on our assessments depending on multiple criteria of weather, remotely sensed vegetation indices and crop simulation model. Results are shown for only those districts which are insured as rainfed crop or irrigation condition unspecified in PMFBY Kharif-2017.Please note, these results are relevant only for rainfed areas and flood losses are also not considered. Grey area indicates no losses.

We recommend minimal validation and ground-truthing before further use.

Data sources and definitions

DEFINITIONS

Rainy Day- When rainfall exceeds 2.5 mm or more in twenty-four hours, the day is declared as a rainy day. *Source- Indian Meteorological Department*

Maximum Length of Dry Spell- Number of consecutive days with rainfall less than 2.5 mm per day.

Standardized Precipitation Index- Mathematically, Standardized Precipitation Index signifies cumulative probability of a rainfall event, occurring at a particular station and time. It is a standardized tool developed to define and monitor drought across spatial-temporal dimensions. *Source- World Meteorological Organization*

Vegetation Growth Index- Vegetation Growth Index signifies vegetation condition at a given time, based on satellite measurement of peak Normalized Difference Vegetation Index. *Source- National Oceanic and Atmospheric Administration*

Normalized Difference Vegetation Index- Normalized Difference Vegetation Index is an index for measuring greenness of the earth's surface. The surface reflectance properties in the red and near infrared spectral bands are used to compute the index. *Source- National Oceanic and Atmospheric Administration.*

DATA SOURCES

WEATHER DATA

Rainfall and Temperature data is derived from Climate Prediction Centre of National Oceanic and Atmospheric Administration (NOAA-CPC). Source (http://www.cpc.ncep.noaa.gov/). Particulars of the dataset are:

1. Rainfall- NOAA-CPC-RFE V2.0 (0.1 degree)
2. Temperature- NOAA-CPC (0.5 degree)

VEGETATION INDEX

Vegetation Growth Index was derived from MODIS (Moderate Resolution Imaging Spectroradiometer) satellite data. Source (https://earthdata.nasa.gov/).

Data set- NDVI (Normalized Difference Vegetation Index)

Spatial Resolution: 250 x250 meters

Crop Model: InfoCrop V2.0

About CCAFS

The CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS) is a research initiative seeking to overcome the threats to agriculture and food security in a changing climate. CCAFS invests in research to address the crucial tradeoffs between climate change, agriculture, and food security and works to promote more adaptable and resilient agriculture and food systems in five focus regions: South Asia,Southeast Asia, West Africa, East Africa and Latin America. CCAFS work is carried out with support from CGIAR Fund Donors and through bilateral funding agreements. For details please visit https://ccafs.cgiar.org/donors. The views expressed in this document cannot be taken to reflect the official opinions of these organizations.

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