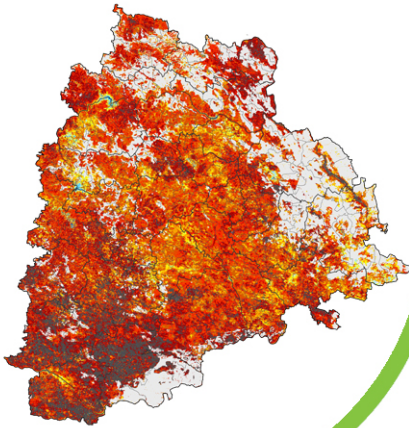
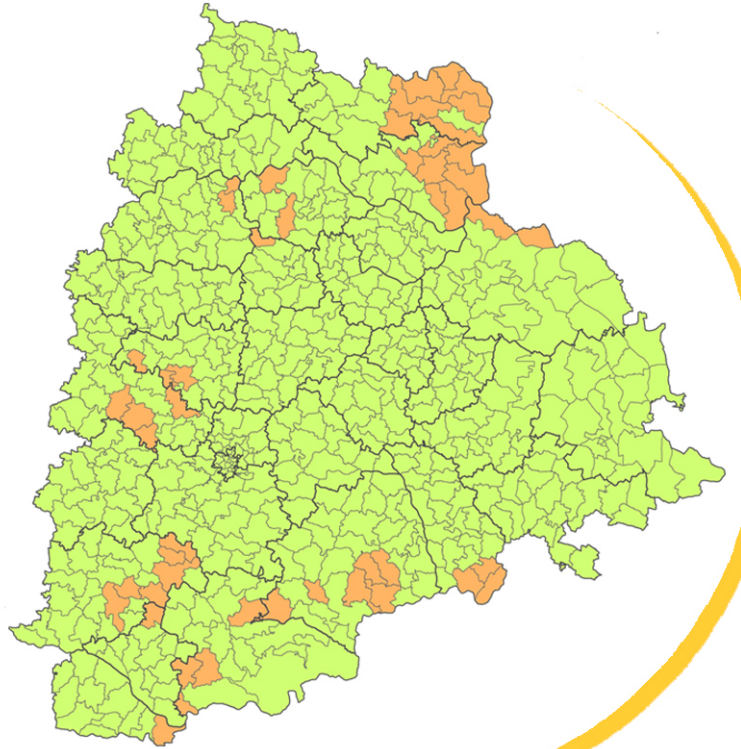
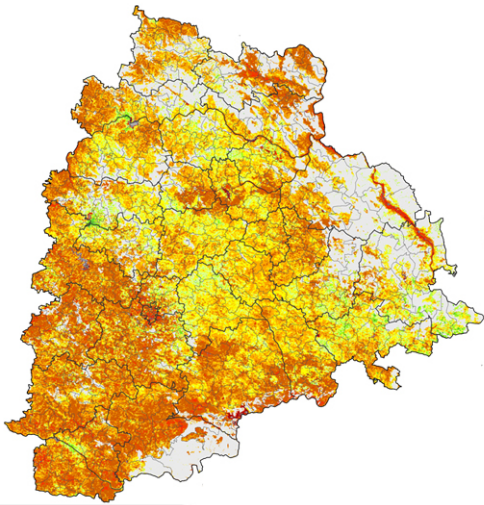


# FORTNIGHTLY REPORT OF SEASONAL CONDITION

Integrated Seasonal Condition Monitoring System



Month of June 2017



TELANGANA STATE REMOTE SENSING APPLICATIONS CENTRE

Planning Department, Government of Telangana



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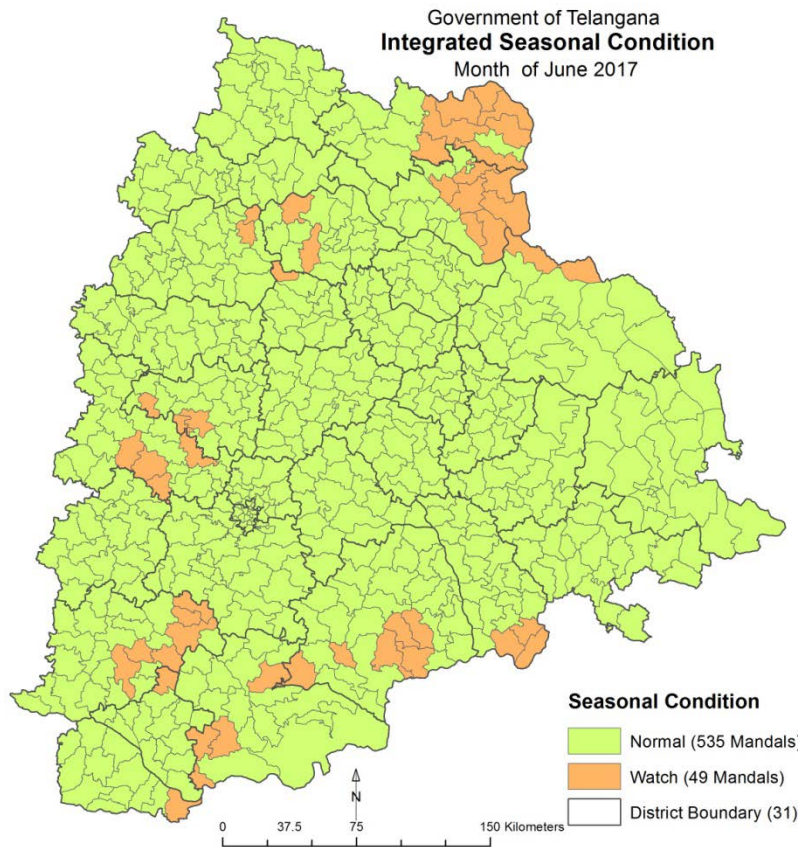
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## HIGHLIGHTS

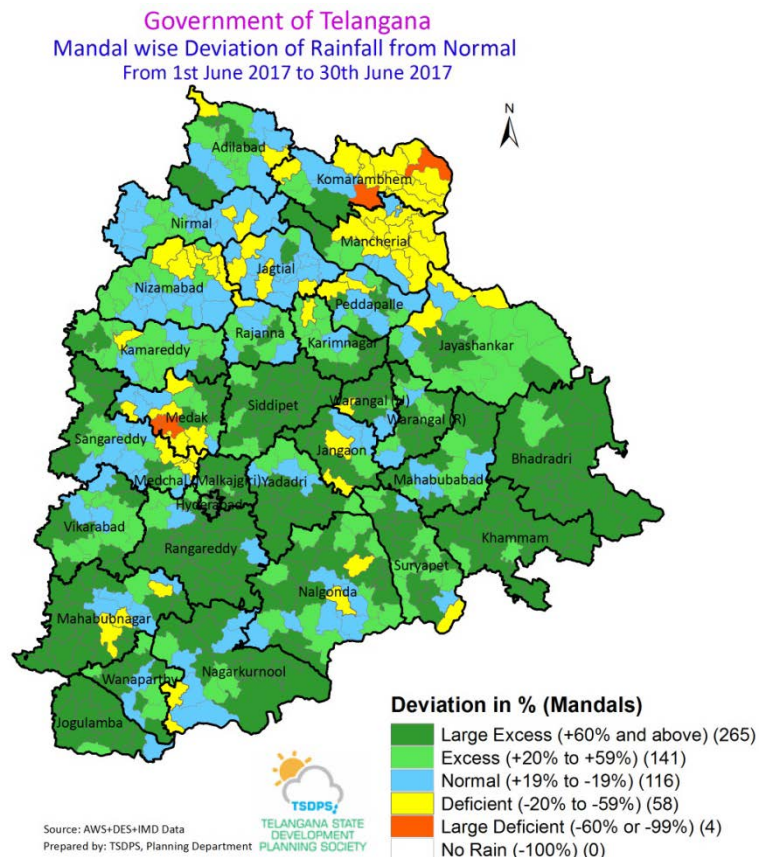
### INTEGRATED SEASONAL CONDITION MONITORING SYSTEM (ISMS) - TELANGANA

#### Cumulative Report up to 30<sup>th</sup> June, 2017

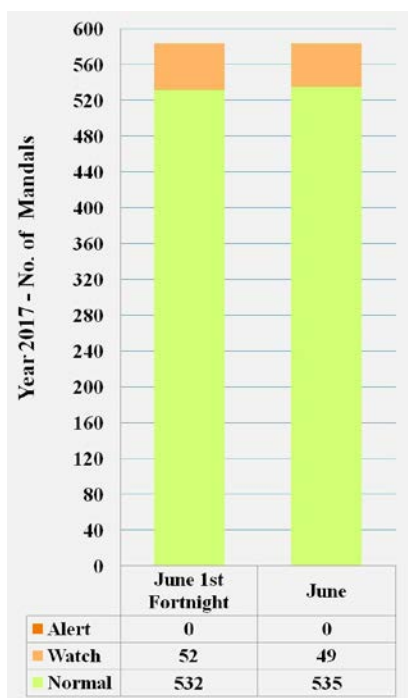
- Seasonal condition is categorised as “Normal” in 535 Mandals as on date 30<sup>th</sup> June 2017
- Seasonal condition is categorised as “Watch” in 49 Mandals as on date 30<sup>th</sup> June 2017



Seasonal Condition upto Month of June, 2017



Rainfall from 1<sup>st</sup> June to 30<sup>th</sup> June, 2017



Seasonal condition of Telangana upto Month of June 2017

#### Rainfall 01<sup>st</sup> June to 30<sup>th</sup> June, 2017

- 58 Mandals out of 584 (10%) of state received Deficient rainfall. 141 Mandals (24%) of the state received Excess rainfall. 4 Mandals (1%) of the state received Large Deficient rainfall. 265 Mandals (45%) of the state received Large Excess rainfall.
- 116 Mandals (20%) have received Normal rainfall respectively.

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## 1. Background and Rationale

Drought is a complex natural hazard. It is defined as any deficiency of water to satisfy the normal need to agriculture, livestock, industry, or human population. Drought assessment and monitoring is essential for the agricultural sector to take appropriate mitigation measures. Drought indices derived from satellite data play a major role in assessing the health and condition of the crops/vegetation.

National Agricultural Drought Assessment and Monitoring System (NADAMS) project of National Remote Sensing Centre (NRSC), Indian Space Research Organization (ISRO) established a remote sensing based drought assessment protocol utilizing the Normalized Difference Vegetation Index (NDVI) and Normalized Difference Water Index (NDWI). The Government of India has established Mahalanobis National Crop Forecast Centre (MNCFC) under Department of Agriculture and Cooperation, New Delhi for carrying out drought assessment at national level.

The Department of Agriculture and Cooperation, Government of India published a drought manual in 2009 which suggested parameters like rainfall deficiency, area under sowing, NDVI, Moisture Adequacy Index (MAI) and some other indicators to declare drought. The Government of Telangana (GoTS) uses the following criterion for declaration of drought.

1. Mandatory Condition - Rainfall deficiency of 25% (>1000 mm rainfall) and 20% (999 to 750 mm rainfall) and 15% (<750 mm rainfall)
2. Minimum of two condition to be fulfilled out of following three
  - a) Reduction in cropped area of 50% and above under all principal crops.
  - b) Reduction in yield (50% and above), in case of high input oriented crops viz., ground nut, bengal gram, hybrid sunflower, 40% reduction of yield or above.
  - c) Dry spells and its impact on crop damages.

An extensive weather observation network of 855 Automatic Weather Stations (AWS), is established in Telangana. Telangana State Development Planning Society (TSDPS) monitor the data and maintains the networks. Figure 1 showing the location of AWS stations in Telangana.

Government of Telangana  
Automatic Weather Stations (AWS)

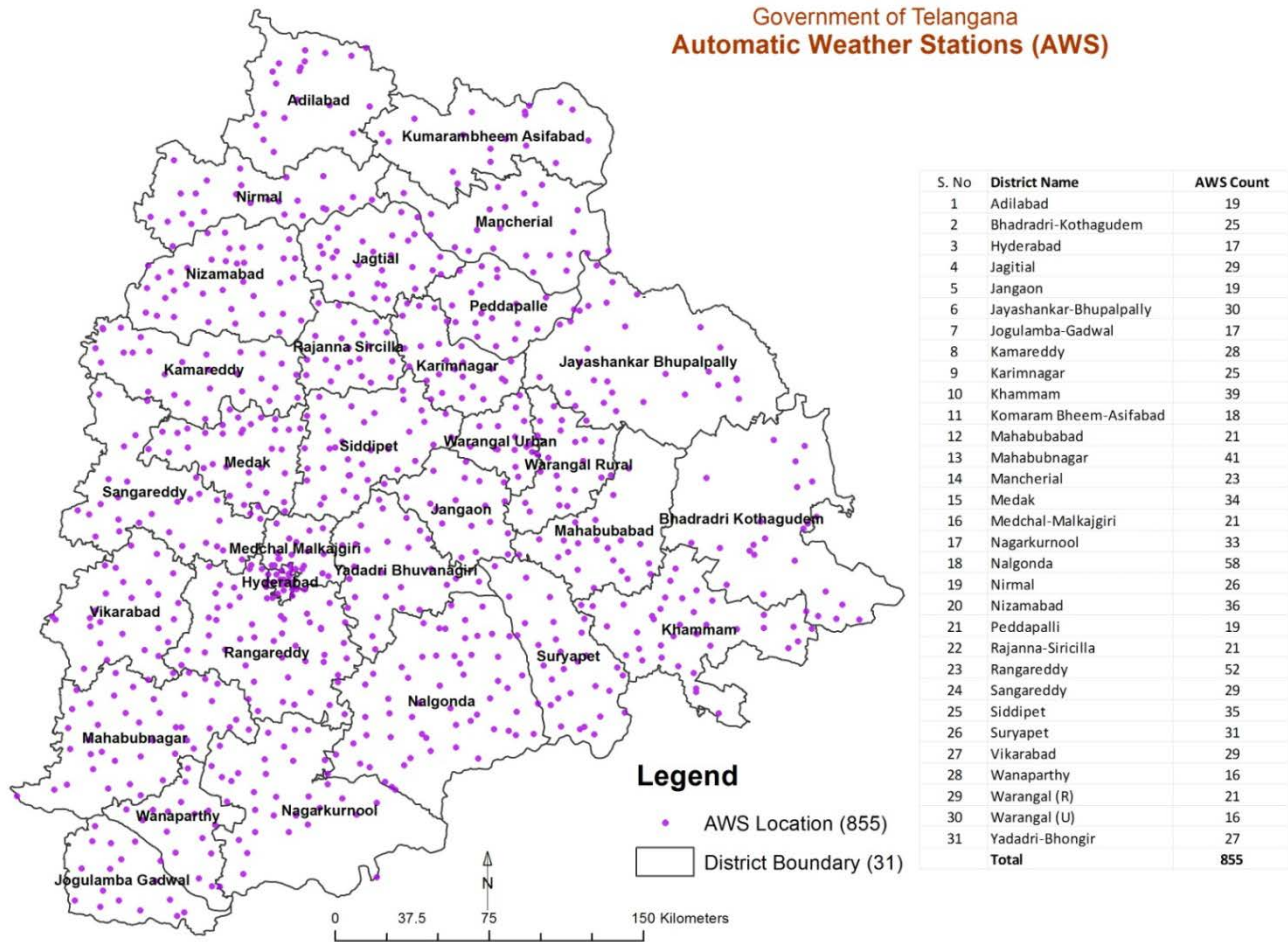


Figure 1: Location of automatic weather stations

Telangana State Remote Sensing Applications Centre (TRAC) has established a protocol *Integrated Seasonal Condition Monitoring System (ISMS)*. The objectives of the ISMS are

- Concurrent monitoring of seasonal conditions using remote sensing, extensive weather network data and continuous ground truth.
- Develop an early warning (monitoring and forecasting) of drought using suite of indicators, which will help to increase drought preparedness, and identify and implement appropriate Disaster Risk Reduction (DRR) measures.
- Early warning to the Districts/Mandals.

ISMS uses the rainfall data provided by Directorate of Economics & Statistics (DE&S), weekly progress of crop area sowings, groundwater level and its fluctuation, command and non-command area, water releases data, reservoir levels in addition to the Normalized Difference Vegetation Index (NDVI) and Normalized Difference Water Index (NDWI) based methodology of MNCFC. This output is verified through ground truth, additionally in context of the state specific drought declaration criteria. The agricultural situation is classified in three to four categories as per the NRSC i.e. Normal, Watch, Alert for June to August and Normal, Mild, Moderate and Severe for September to October. The details of the classification of agricultural situation are given in Table 1.

**Table. 1. Classification of agricultural situation**

Duration	Condition	Description
June - August	Normal	<ul style="list-style-type: none"> <li>• Agricultural situation is normal</li> </ul>
	Watch	<ul style="list-style-type: none"> <li>• Progress of agricultural situation is slow</li> <li>• Ample scope for recovery</li> <li>• No external intervention needed</li> </ul>
	Alert	<ul style="list-style-type: none"> <li>• Very slow progress of agricultural situation</li> <li>• Need for intervention.</li> <li>• Develop and implement contingency plans to minimise loss</li> </ul>
September - October	Mild drought	<ul style="list-style-type: none"> <li>• Crops have suffered stress slightly</li> </ul>
	Moderate drought	<ul style="list-style-type: none"> <li>• Considerable loss in production.</li> <li>• Take measures to alleviate suffering</li> </ul>
	Severe	<ul style="list-style-type: none"> <li>• High risk significant reduction in crop yield</li> <li>• Management measures to provide relief</li> </ul>

## 2. Data used, Indicators and Methodology

### 2.1. Data used

Details of data used under project are discussed in Table 2.

**Table. 2. Data source and indicators**

Data source	Product	Indicators
MODIS (250/500m)	Surface reflectance	NDVI & NDWI
AWiFS	Surface reflectance	NDVI & NDWI
AWS/ DES	<ul style="list-style-type: none"> <li>• Daily rainfall &amp; soil moisture</li> <li>• Crop sown area</li> <li>• Crop cutting experiments</li> </ul>	<ul style="list-style-type: none"> <li>• Rainfall deviation</li> <li>• Dry spells</li> <li>• Soil moisture status</li> <li>• % deviation of crop sown area</li> <li>• Crop yield</li> </ul>
Agriculture Department, GoTS	Weekly sowing progress	District wise sown areas deviation from normal
Irrigation Department, GoTS	Reservoir levels/ Water release data	Command area Mandals under canal irrigation



## 2.2. Indicators and Index

### 2.2.1. Rainfall data

In Telangana, South-West Monsoon is crucial for agriculture sector. ISMS uses integrated (AWS+DES+IMD) mandal wise rainfall data provided by Directorate of Economics & Statistics (DES). This data is used for computation of meteorological drought situation and to derive the mandal wise spatial distribution of rainfall in the state.

### 2.2.2. Reservoir water levels and water release - major and medium project

A scheme having Culturable Command Area (CCA) up to 2,000 hectares individually is classified as minor irrigation scheme. A scheme having CCA more than 2,000 hectares and up to 10,000 hectares individually is a medium irrigation scheme. A scheme having CCA more than 10,000 hectares is major irrigation scheme. In Telangana, water is released during Kharif season to major and medium command areas.

### 2.2.3. Crop sowing progress

Weekly crop sowing progress reports are taken from 'Season and Crop Coverage Report-Kharif 2017' of Commissionerate of Agriculture, Telangana. The report includes current status of Weather condition, Water level, Crop sowing and Agricultural Operations.

### 2.2.4. Vegetation index

The crop/vegetation reflects high energy in the near infrared band due its canopy geometry and health of the standing crops/vegetation and absorbs high in the red band due to its biomass and photosynthesis. Uses of these contrast characteristics of vegetation in near infrared and red bands indicate both the health and condition of the crops/vegetation. Normalised Difference Vegetation Index (NDVI) is widely used for operational drought assessment because of its simplicity in calculation, easy to interpret and its ability to partially compensate for the effects of atmosphere, illumination geometry etc., (Malingreau 1986, Tucker and Chowdhary 1987, Kogan 1995). NDVI is derived by the difference of these measurements and divided by their sum.

$$NDVI = \frac{(NIR - Red)}{(NIR + Red)}$$

The vegetation index is generated from each of the available satellite data irrespective of the cloud cover present. To minimize the cloud, monthly time composite vegetation index is generated.

### 2.2.5. Surface wetness indicator

Shortwave Infrared (SWIR) band is sensitive to moisture available in soil as well as in crop canopy. In the beginning of the cropping season, soil background is dominant hence SWIR is sensitive to soil moisture in the top 1-2 cm. As the crop progresses, SWIR becomes sensitive to leaf moisture content. SWIR band provides only surface wetness information. When the crop is grown-up, SWIR response is only from canopy and not from the underlying soil. NDWI using SWIR can complement NDVI for drought assessment particularly in the beginning of the cropping season. NDWI is derived as under;

$$NDWI = \frac{(NIR - SWIR)}{(NIR + SWIR)}$$

Higher values of NDWI signify more surface wetness. The wetness index is generated from each of the available satellite data irrespective of the cloud cover present. To minimize the cloud, monthly time composite wetness index is generated.

#### **2.2.6. Vegetation condition index**

Kogan (1995) developed Vegetation Condition Index (VCI) using the range of NDVI as under,

$$VCI = \frac{(NDVI - NDVI \min)}{(NDVI \max - NDVI \min)} * 100$$

The current drought assessment expressed as percentage of deviation of NDVI and NDWI based on 10 year NDVI and NDWI index values. The minimum and maximum value of NDVI and NDWI, the VCI discriminated between the weather components.

### 2.3 Methodology

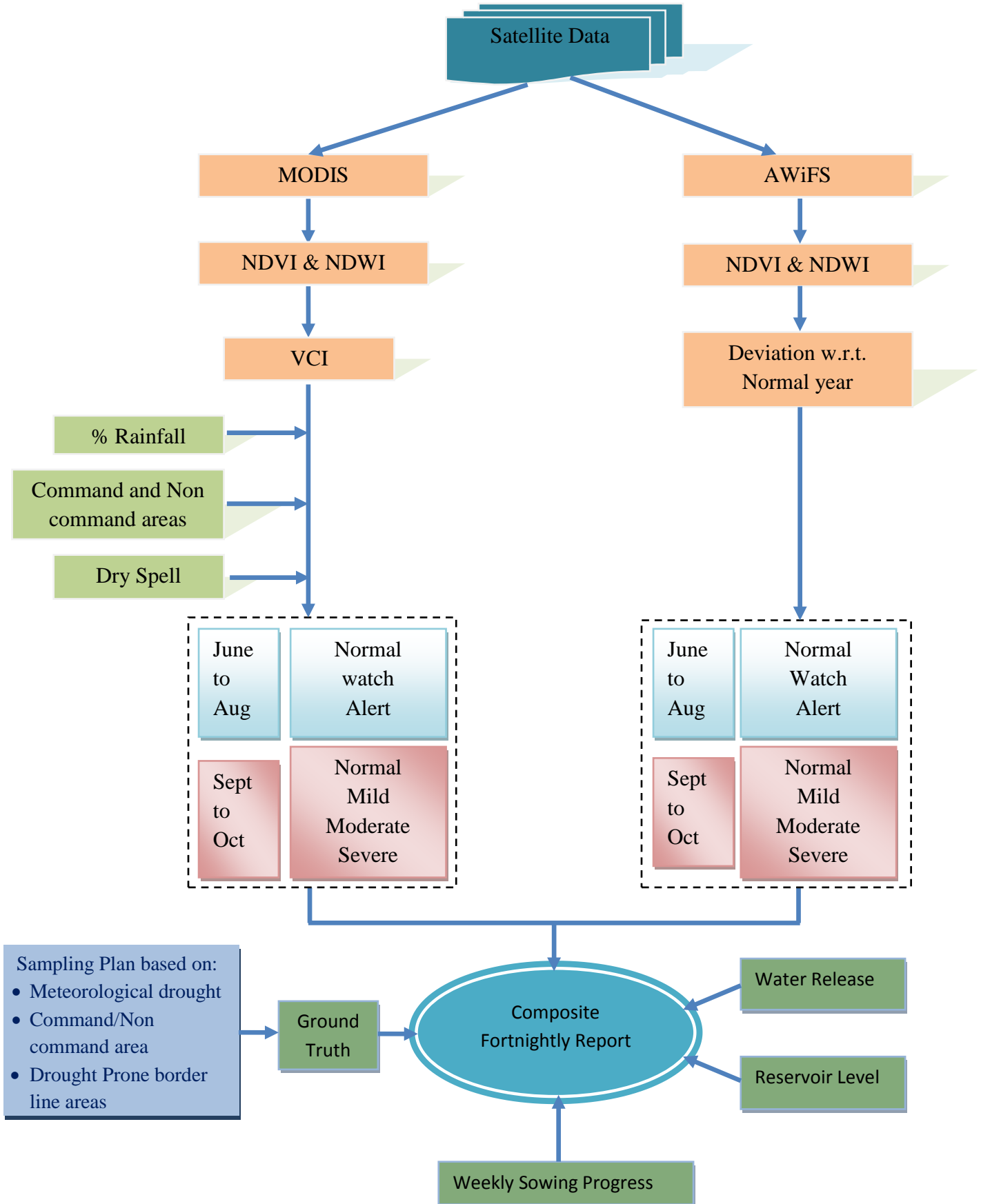


Figure 2: Flow chart of drought assessment methodology

The methodology to assess and monitor the agricultural conditions and situation in the state at district and Mandal level uses IRS Resourcesat-2 AWiFS data. Indian Remote Sensing satellite (IRS) Resourcesat-2 having Advanced Wide Imaging Field Sensor (AWiFS) payload collects data in two spectral bands 0.62-0.68  $\mu\text{m}$  (red) and 0.77-0.86  $\mu\text{m}$  (near infrared) with spatial resolution of 56 m and ground swath of 740 km with a revisit period of 5 days. Along with this MODIS 250/500 m satellite data provide spectra, radiometric and spatial resolutions products for better monitoring of the agriculture. The combination of AWiFS and MODIS is useful to increase the frequency of images.

The different activities carried out through ISMS commence with acquisition of MODIS (250 m) and AWiFS (56 m) satellite data. The satellite data being processed and NDVI and NDWI indices are developed. Based on these indices deviation with respect to normal year (2013) is calculated and Mandal wise statistics are derived. The agricultural situation is assessed incorporating rainfall deviation, command and non command areas, dry spell, drought prone border line areas, crop sown area progress and ground truth along with satellite derived indices. The flow chart of methodology is shown in Figure 2.

### 3. Present status up to Month of June 2017

#### 3.1. Rainfall data

The status of rainfall as on 30<sup>th</sup> June 2017 is shown in Table.3.

- **58** Mandals out of 584 (**10%**) of state received **Deficient** (-20% to -59%) rainfall.
- **141** Mandals (**24%**) of the state received **Excess** (+20% to +59%) rainfall.
- **4** Mandals (**1%**) of the state received **Large Deficient** (-60% to -99%) rainfall.
- **265** Mandals (**45%**) of the state received **Large Excess** (+60% and above) rainfall.
- **116** Mandals (**20%**) have received **Normal** (+19% to -19%) rainfall.

**Table. 3. Rainfall status as on 30<sup>th</sup> June 2017**

Sl. No.	District Name	No. of Mandals	Deficient	Excess	Low Deficient	Large Excess	Normal
1	Adilabad	18	02	07	--	04	05
2	Bhadradi-Kothagudem	23	--	02	--	21	--
3	Hyderabad	16	--	01	--	15	--
4	Jagtial	18	03	01	--	01	13
5	Jangaon	13	02	01	--	07	03
6	Jayashankar-Bhupalpally	20	03	10	--	05	02
7	Jogulamba-Gadwal	12	--	01	--	10	01
8	Kamareddy	22	01	13	--	05	03
9	Karimnagar	16	01	08	--	06	01
10	Khammam	21	--	02	--	19	--
11	Komaram Bheem-Asifabad	15	08	02	02	01	02
12	Mahabubabad	16	--	05	--	07	04
13	Mahabubnagar	26	03	01	--	17	05
14	Mancherial	18	10	02		02	04
15	Medak	20	05	03	02	06	04
16	Medchal-Malkajgiri	14	--	03	--	10	01
17	Nagarkurnool	20	02	03	--	10	05
18	Nalgonda	31	02	10	--	13	06
19	Nirmal	19	01	05	--	--	13
20	Nizamabad	27	07	09	--	--	11
21	Peddapalli	14	02	03	--	04	05
22	Rajanna-Siricilla	13	01	05	--	03	04
23	Rangareddy	27	--	03	--	22	02
24	Sangareddy	26	03	05	--	10	08
25	Siddipet	22	--	04	--	18	--
26	Suryapet	23	01	09	--	11	02
27	Vikarabad	18	-	07	--	08	03
28	Wanaparthy	14	--	05	--	07	02
29	Warangal Rural	15	--	05	--	08	02
30	Warangal Urban	11	01	02	--	06	02
31	Yadadri-Bhongir	16	--	04	--	09	03
	<b>Total</b>	<b>584</b>	<b>58</b>	<b>141</b>	<b>04</b>	<b>265</b>	<b>116</b>

SOURCE: AWS, DE&S and IMD, HYDERABAD

The % deviation of Actual & Normal rainfall received up to 30<sup>th</sup> June 2017 is shown in Fig. 3,4, 5,6 & 7 respectively.

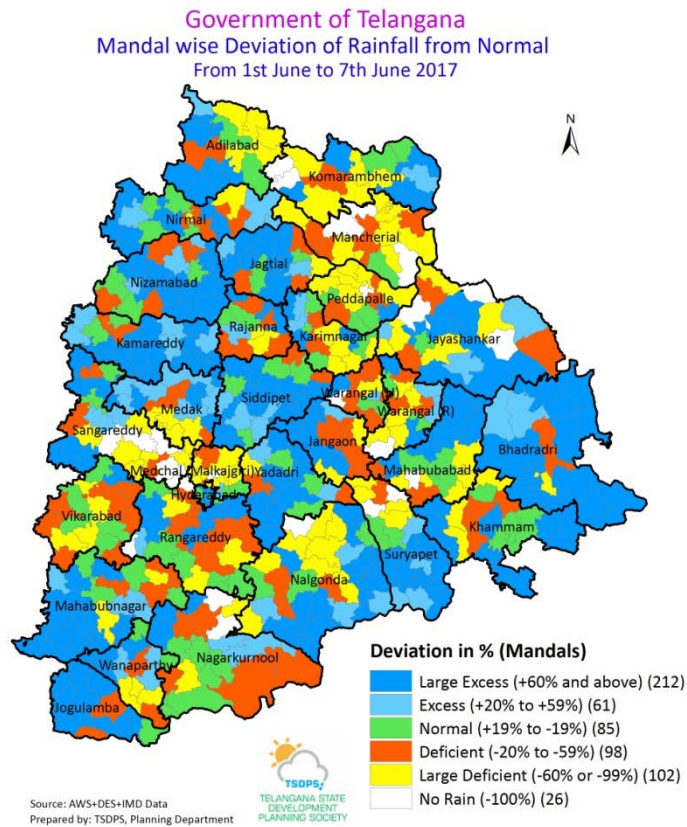


Figure 3: Deviation of Rainfall in percent w.r.t. Normal from June 01<sup>st</sup> to June 07<sup>th</sup>, 2017

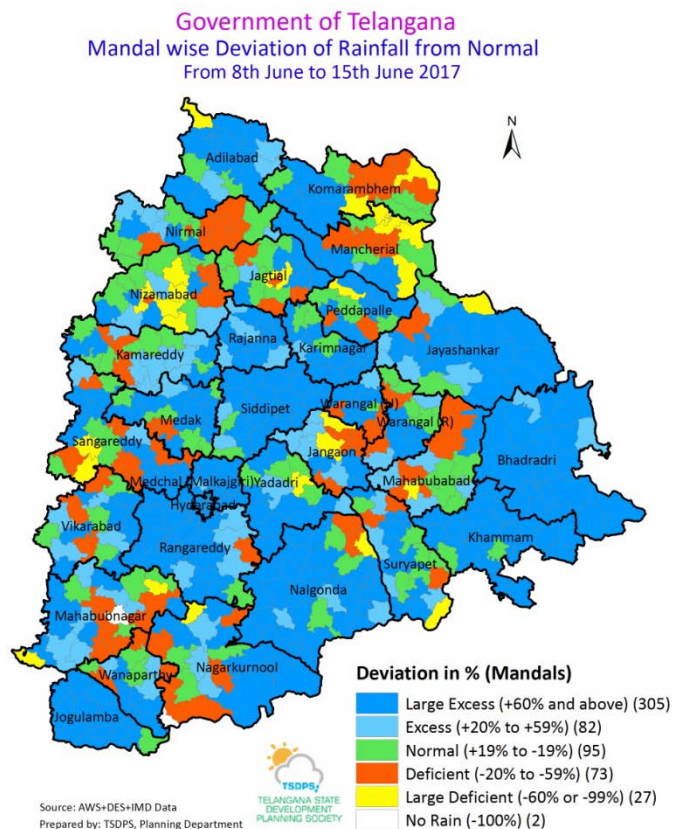


Figure 4: Deviation of Rainfall in percent w.r.t. Normal from June 08<sup>th</sup> to June 15<sup>th</sup>, 2017

**Government of Telangana**  
Mandal wise Deviation of Rainfall from Normal  
From 16th June to 22nd June 2017

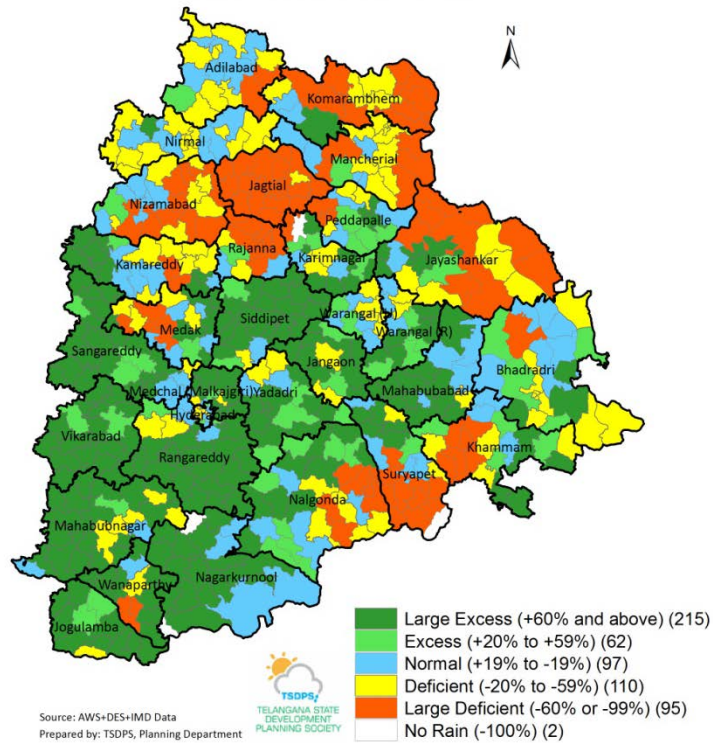


Figure 5: Deviation of rainfall in percent w.r.t. normal from June 16<sup>th</sup> to June 22<sup>nd</sup>, 2017

**Government of Telangana**  
Mandal wise Deviation of Rainfall from Normal  
From 23rd June to 30th June 2017

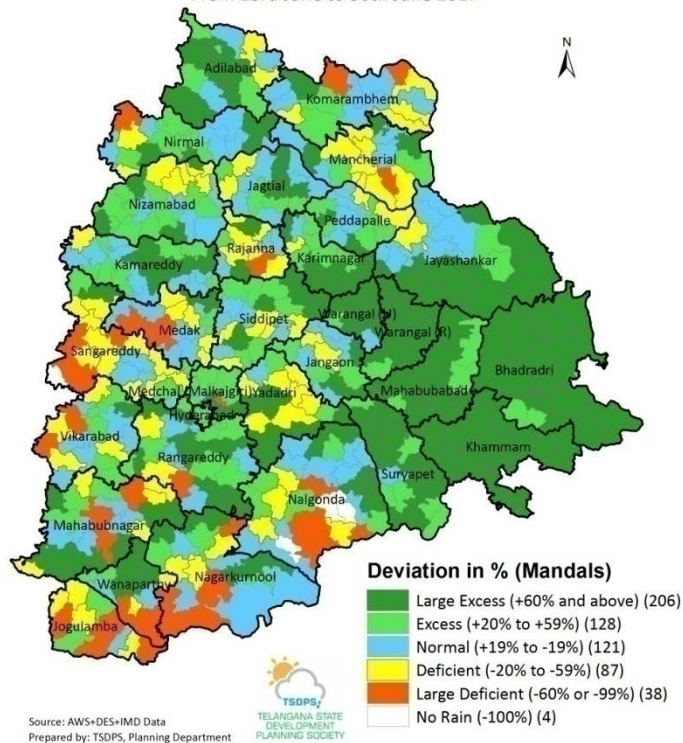


Figure 6: Deviation of rainfall in percent w.r.t. normal from June 23<sup>rd</sup> to June 30<sup>th</sup>, 2017

**Government of Telangana**  
**Mandal wise Deviation of Rainfall from Normal**  
**From 1st June 2017 to 30th June 2017**

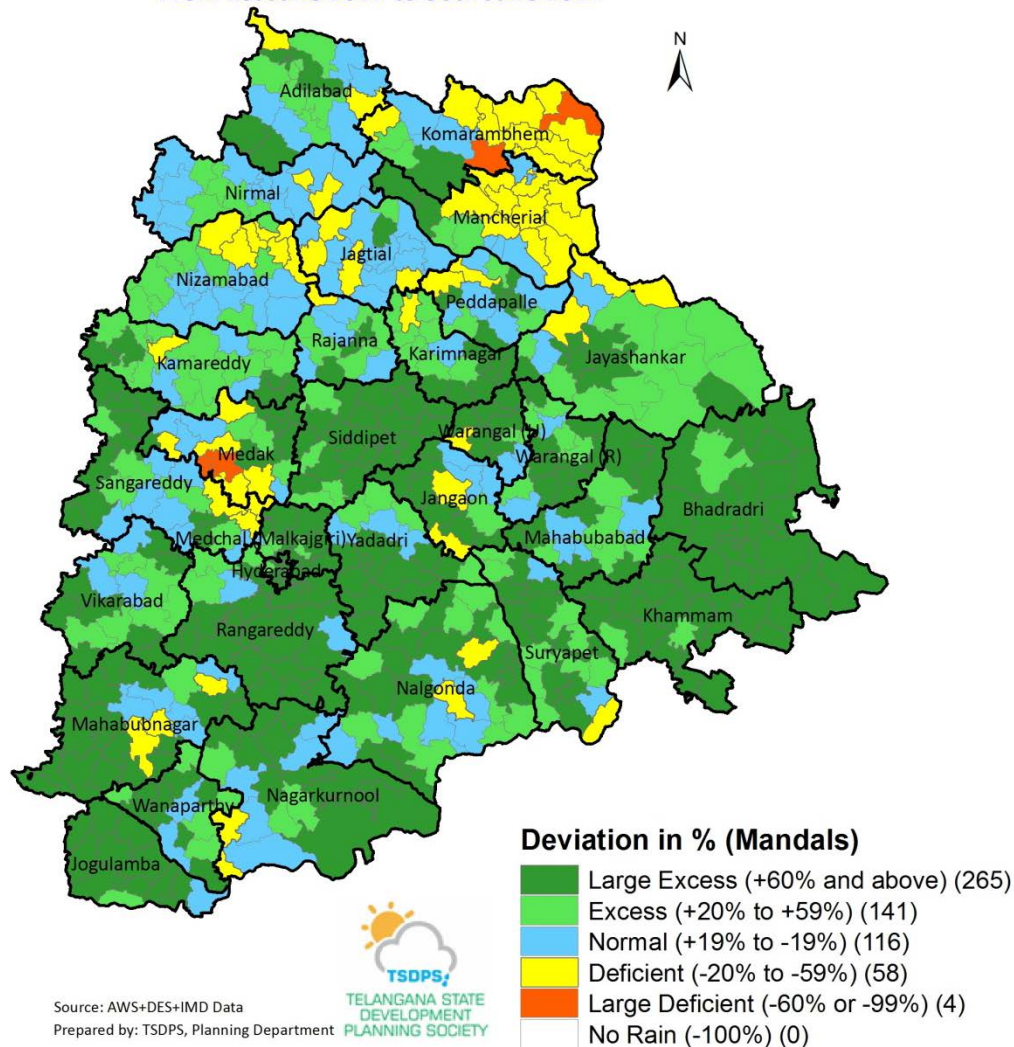


Figure 7: Deviation of rainfall in percent w.r.t. normal from June 01<sup>st</sup> to June 30<sup>th</sup>, 2017



### 3.2. Reservoir water levels

All the major reservoirs are holding 309.11. TMC as on 30-06-2017, and as on date last year the level had stood at 241.96 TMC. The details of water levels of all major reservoirs as on 30-06-2017 are furnished hereunder in Table.4.

**Table.4. Reservoir Water Levels**

PARTICULARS OF MAJOR RESERVOIRS AS ON 30/June/2017										
SI No	Reservoir Name	Time	FRL (feet)	Gross Capacity (TMC)	THIS YEAR As on 30/June/2017				LAST YEAR As on 30/June/2016	
					Level (in feet)	Gross Storage (TMC)	Inflow (Cusecs)	Outflow (Cusecs)	Level (in feet)	Gross Storage (TMC)
					<b>Krishna Basin</b>					
1	Almatti	09:25	1705	129.72	1658.43	14.19	19503	0	1658.63	14.34
2	Jurala	09:27	1045	9.657	1041.67	7.65	1588	523	1031.43	3.23
3	Nagarjunasagar	09:28	590	312.04	501.5	117.69	338	338	504.5	122.52
4	Narayanapur	09:25	1615	37.646	1594.16	15.02	0	0	1594.98	15.62
5	Srisailam	09:27	885	215.80	779	20.02	1093	42	780.5	20.56
6	Tungabhadra	09:26	1633	100.86	1576.39	2.8	14275	34	1579.15	3.81
7	Ujjaini	09:26	1630	117.24	1603.51	49.36	0	221	1594.04	35.23
<b>Godavari Basin</b>										
8	Jaikwad	09:29	1522	102.73	1502.04	40.15	0	754	1487.56	16.72
9	Kaddam	09:32	700	7.6	688.98	5.06	590	73	673.7	2.62
10	Lower Manair Dam	09:32	920	24.074	893.75	7.44	0	151	876.6	2.38
11	Nizam sagar	09:30	1405	17.803	1380.16	1.32	0	48	1364	0
12	Singur	09:30	1718	29.91	1710.24	19.19	0	285	1666.81	0.29
13	Sri Ram Sagar	09:31	1091	90.313	1054.9	9.224	0	211	1046.6	4.64

Source: Irrigation Department, Hyderabad

### 3.3. Vegetation index

The Normalized Difference of Vegetation Index (NDVI) for month of June 2017 is shown in the figures and also compared with 2015 and 2014. The year 2013 is treated as a normal year. Mandal wise NDVI, monthly agricultural situation for the year 2017, 2015 and 2014, deviation of NDVI w.r.t. 2013 are shown in the Figures 8, 9, 10, 11 and 12 respectively. The NDVI deviation with respect to the month of June 2013 indicate that parts of Mahabubnagar, Nalgonda, Nagarkurnool, Rangareddy, Sangareddy, Suryapet, and Vikarabad, districts are under stress condition. As per rainfall distribution the progress of agricultural situation is normal and the vegetation condition in the state is likely to improve in coming fortnight.

Government of Telangana  
**Normalized Difference Vegetation Index**  
**MODIS (250m) Mandal Wise**  
 Month of June 2017

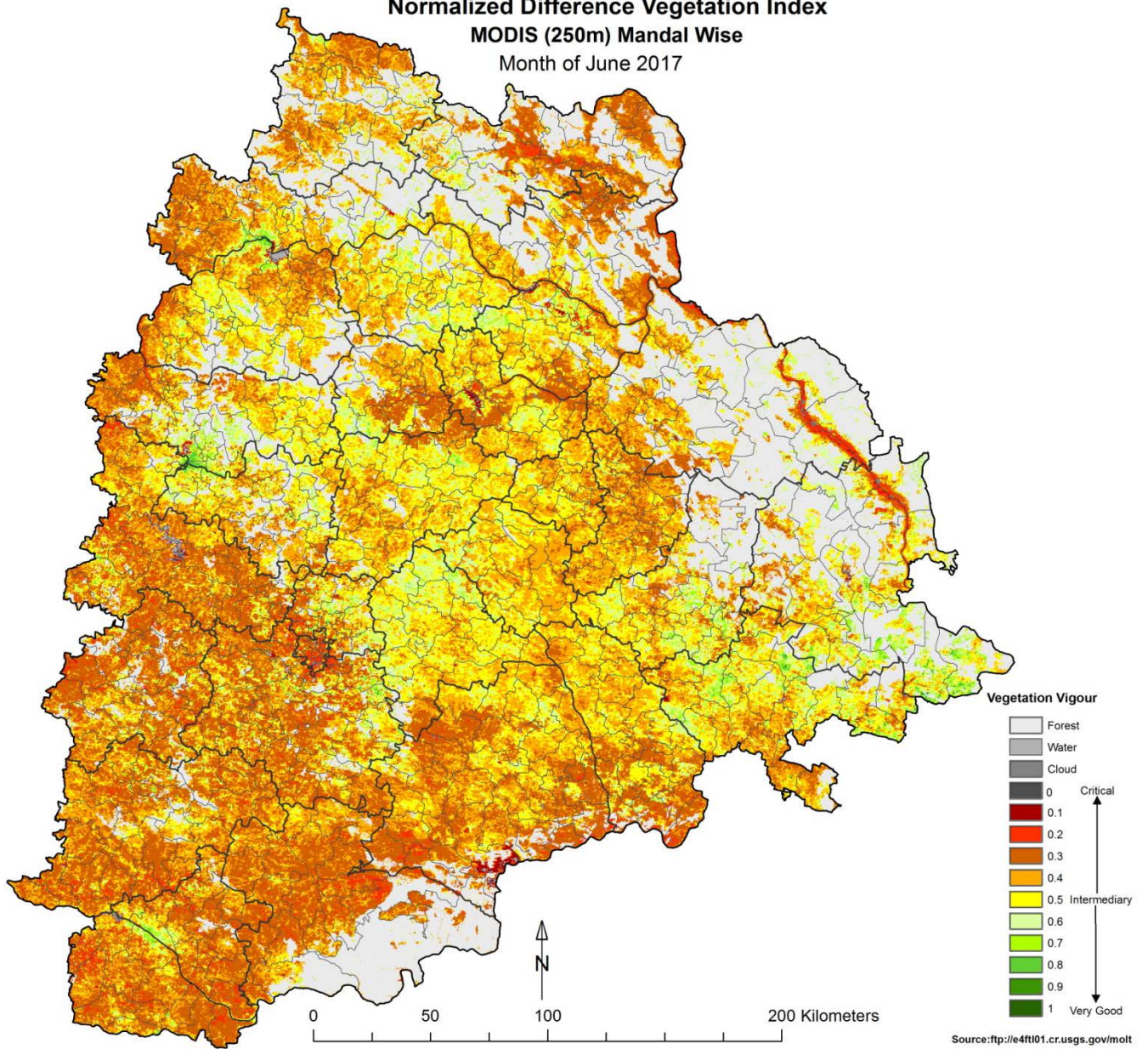


Figure 8: NDVI - MODIS: Month of June 2017

Government of Telangana  
**Normalized Difference Vegetation Index**  
**MODIS (250m) Mandal Wise**

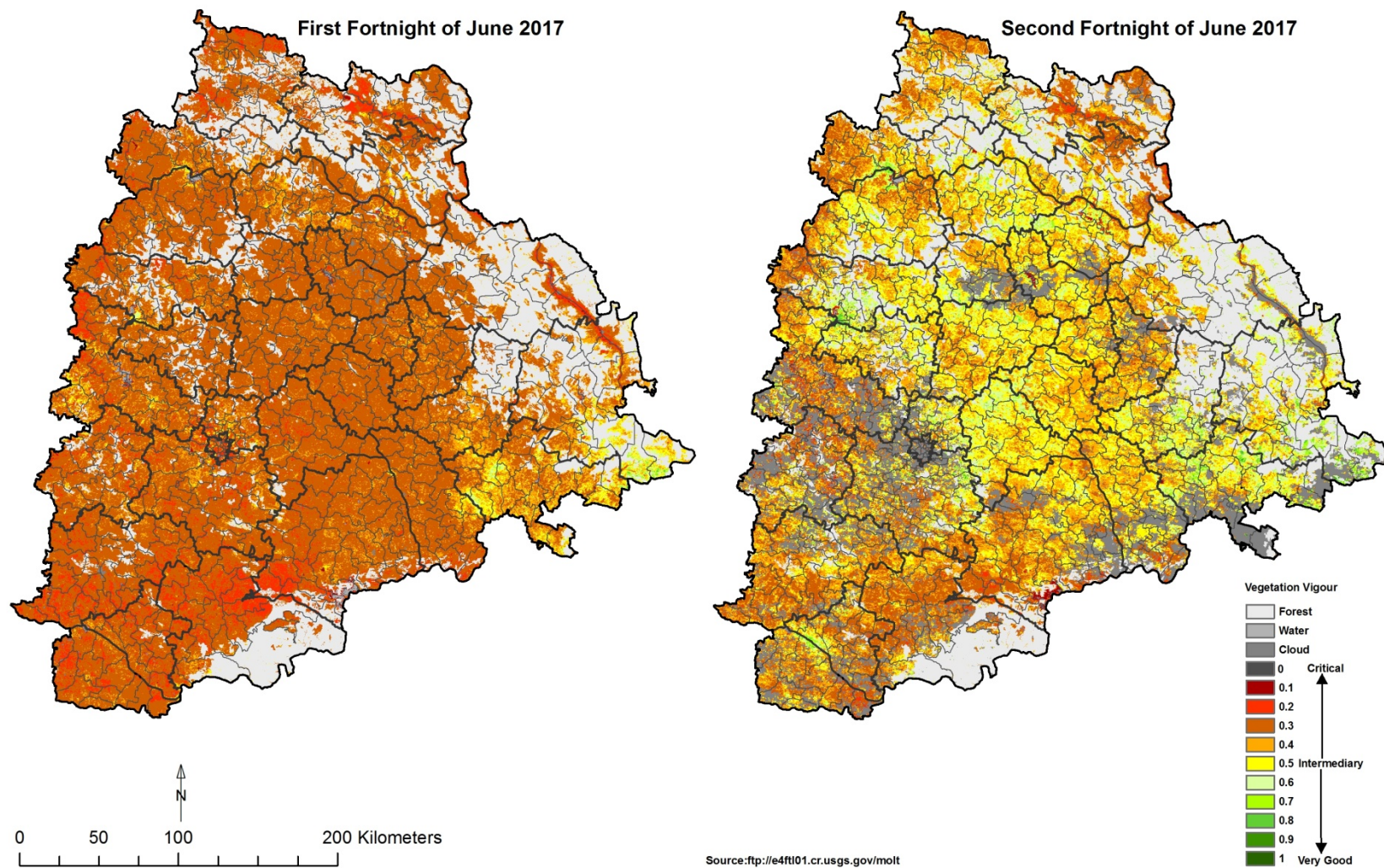


Figure 9: NDVI - MODIS, Fortnightly agricultural situation from June 2017

Government of Telangana  
**MODIS (250m) Mandal Wise NDVI**  
 Agricultural Situation for the Year 2017 & 2013

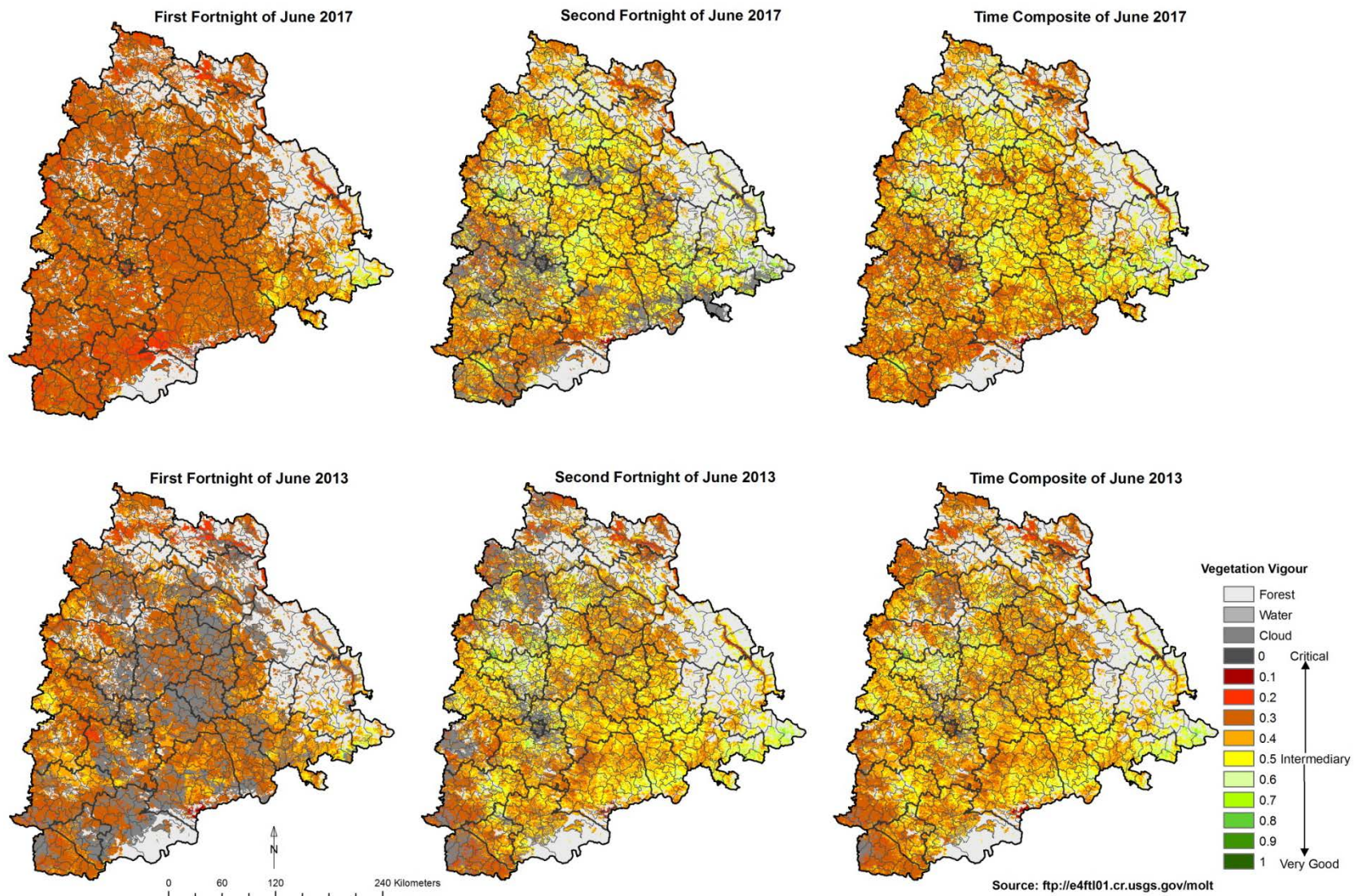


Figure 10: NDVI - MODIS, Time composite of agricultural situation from June 2017 and 2013

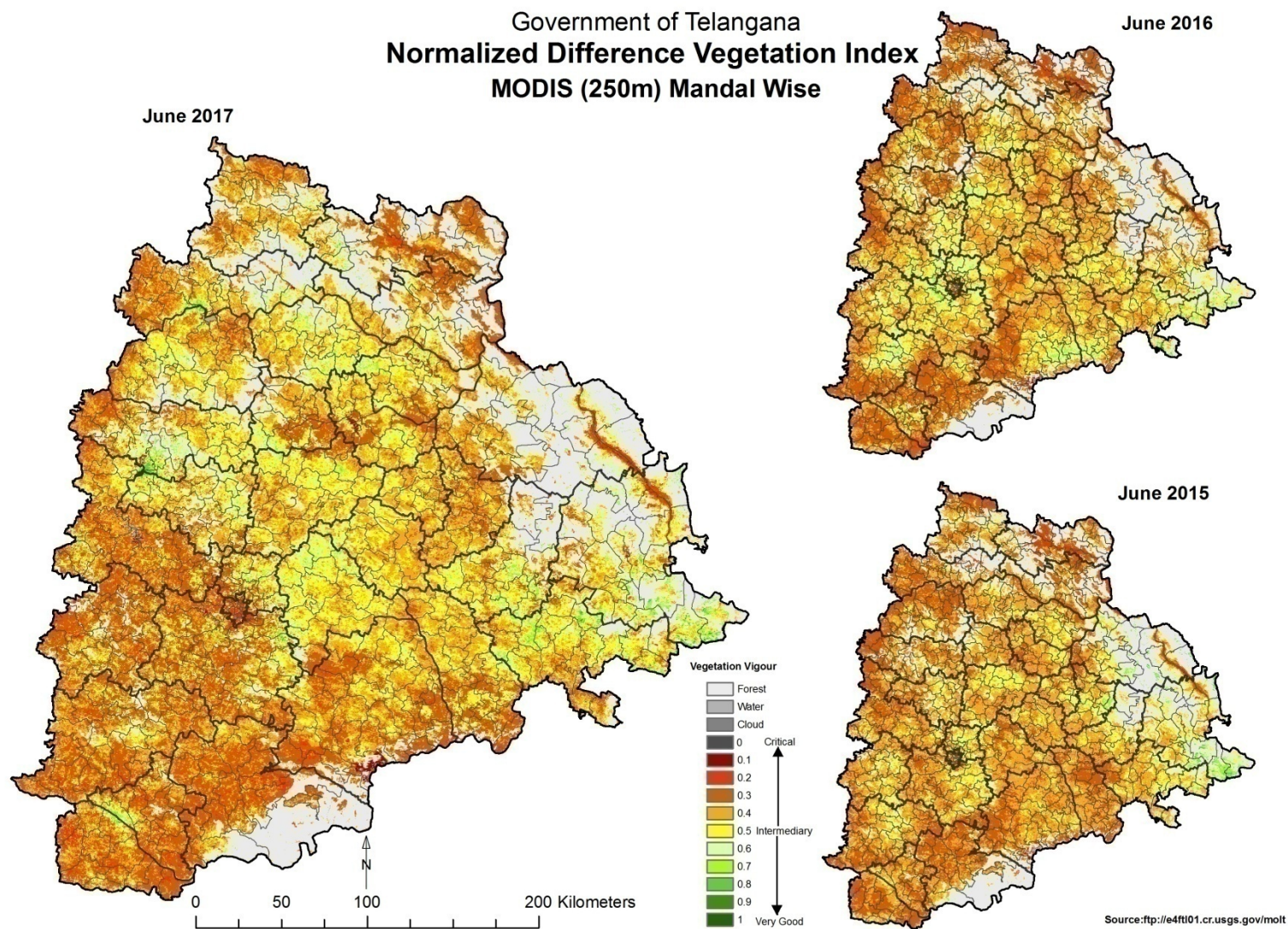


Figure 11: NDVI - MODIS, Monthly agricultural situation from June 2017, 2016 and 2015

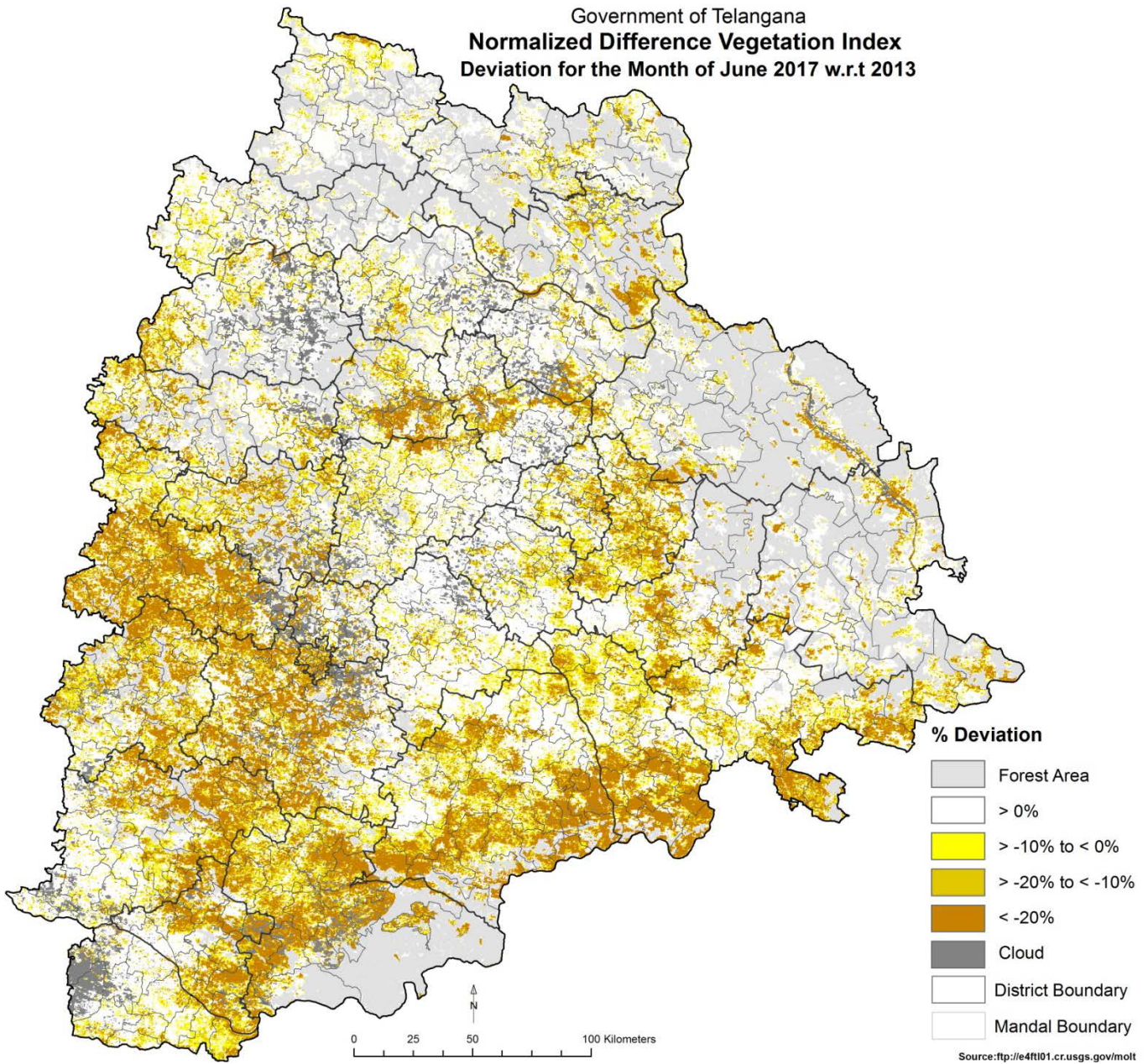


Figure 12: NDVI deviation (MODIS - 250m), Month of June 2017 w.r.t. 2013

### 3.4. Surface wetness indicator

The map indicates status of moisture availability in soil as well as in crop canopy for month of June 2017. The year 2013 is treated as a normal year. Mandal wise Normalized Difference Water Index (NDWI) situation from the year 2017, 2015 & 2014, monthly agricultural situation deviation of NDWI w.r.t. 2013 are shown in the Figures 13, 14, 15, 16 and 17 respectively. NDWI deviations with respect to month of June 2013 indicate that parts of Mahabubnagar, Nalgonda, Nagarkurnool, Nirmal, SangaReddy, and Vikarabad districts are under mild stress condition. As per rainfall distribution the progress of agricultural situation is normal and the soil moisture condition in the state is likely to improve in next fortnight.

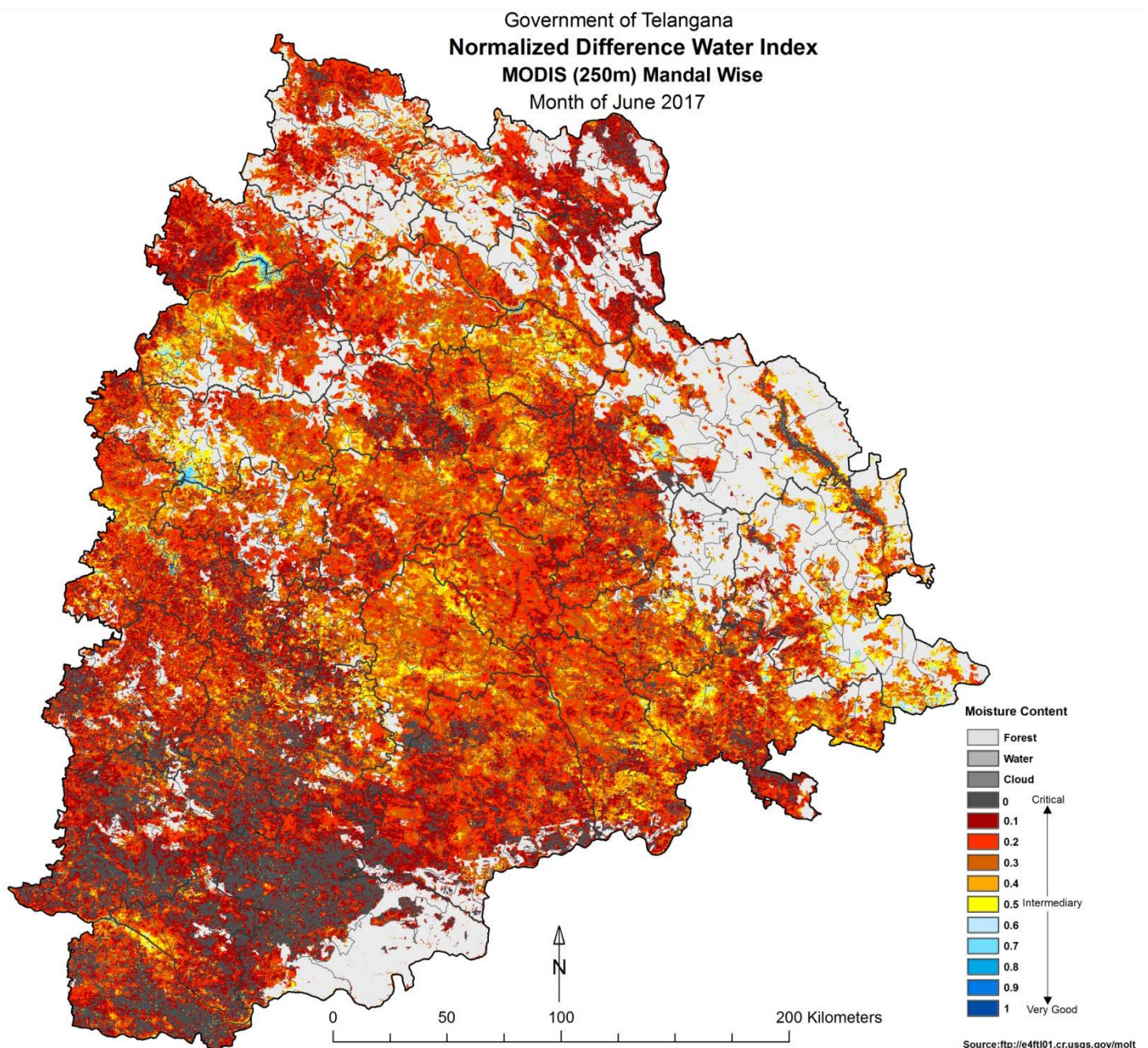


Figure 13: NDWI - MODIS: Month of June 2017

Government of Telangana  
**Normalized Difference Water Index**  
**MODIS (250m) Mandal Wise**

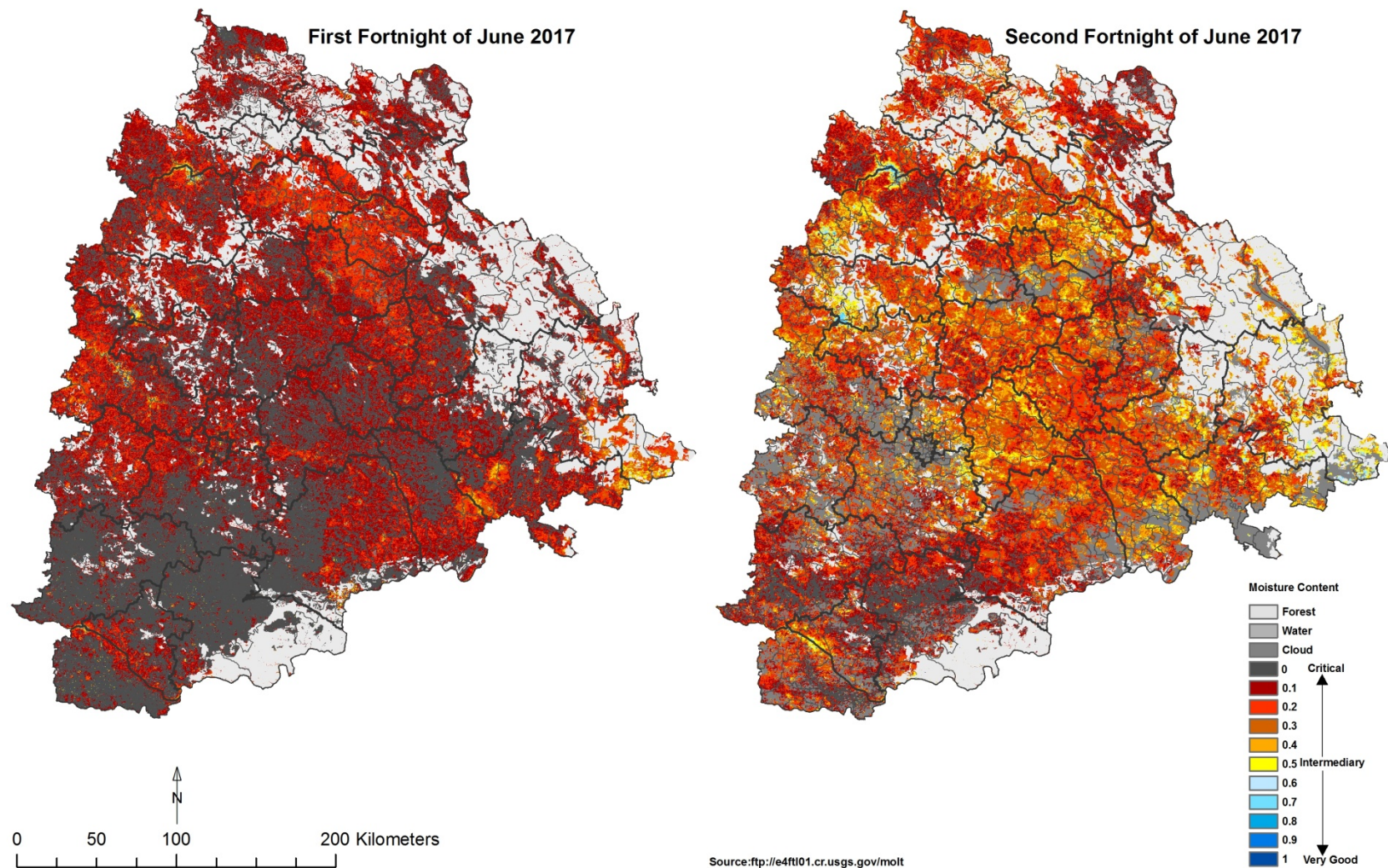


Figure 14: NDWI - MODIS, Fortnightly agricultural situation from June 2017



Government of Telangana  
**MODIS (250m) Mandal Wise NDWI**  
 Agricultural Situation for the Year 2017 & 2013

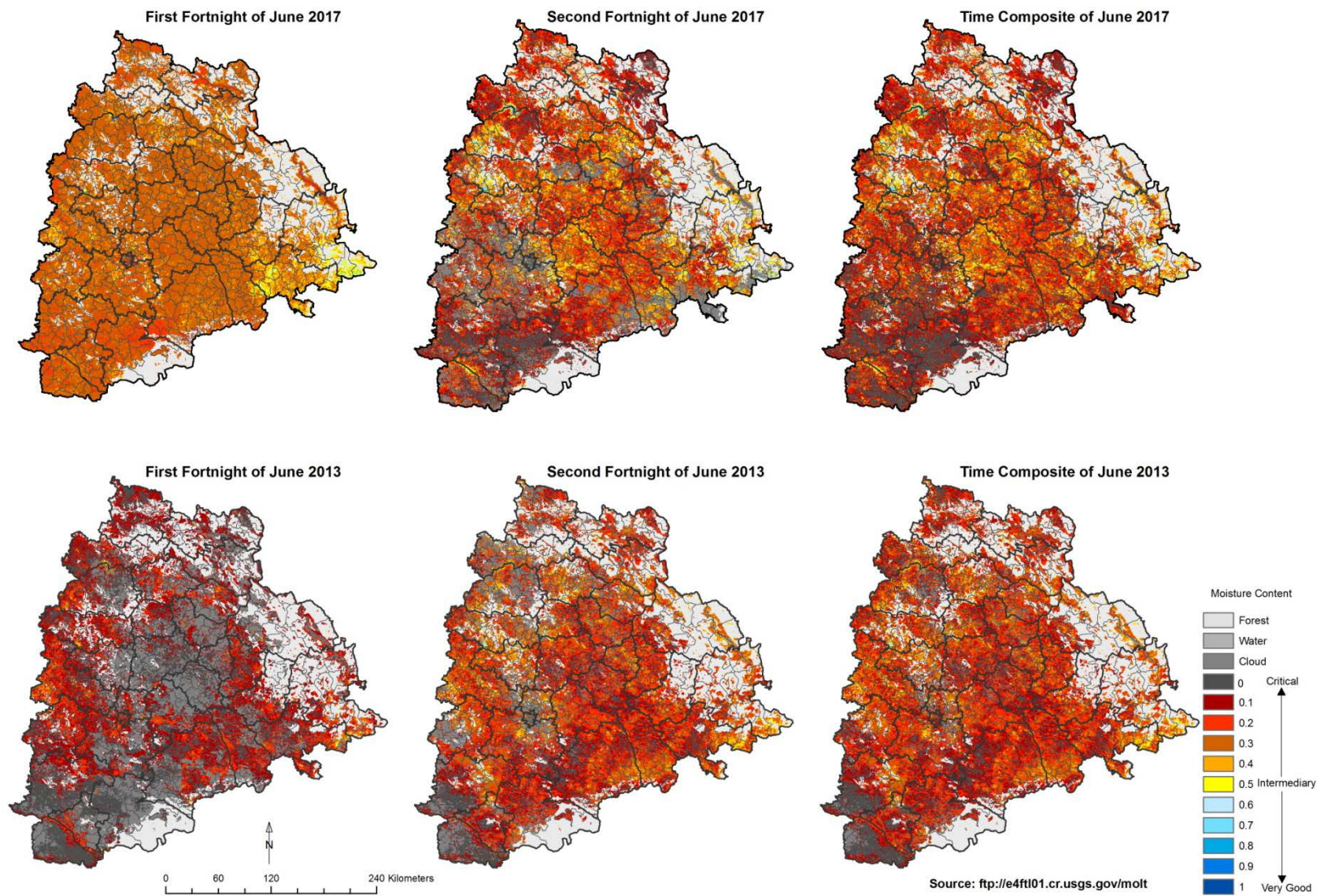


Figure 15: NDWI - MODIS, Time composite of agricultural situation from June 2017 and 2013

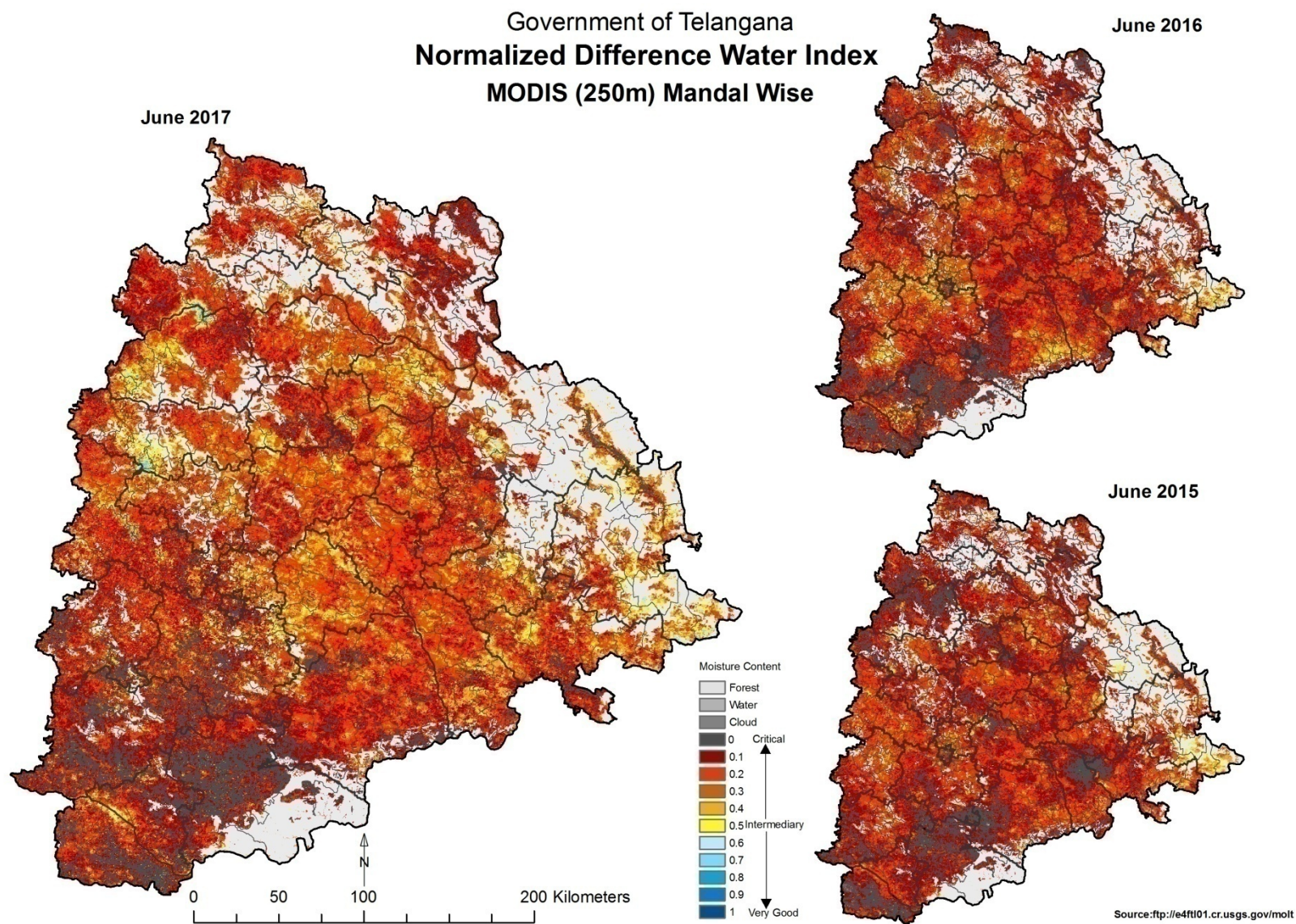


Figure 16: NDWI - MODIS, Monthly agricultural situation from June 2017, 2016 and 2015

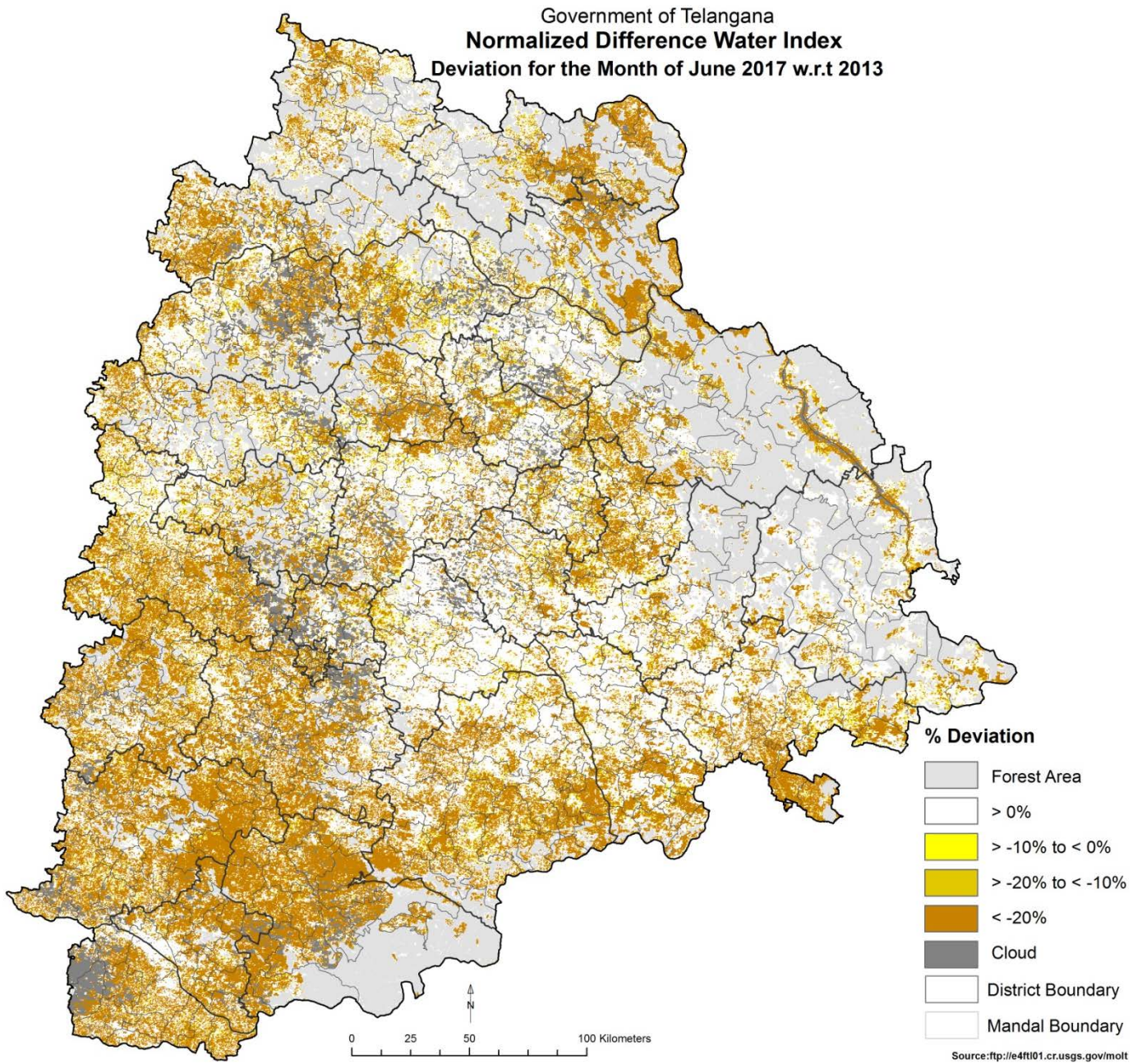


Figure 17: NDWI deviation (MODIS - 250m), Month of June 2017 w.r.t. 2013

### 3.5. Drought situation of Mandals

#### 3.5.1. Composite criteria

The drought situation in the state is assessed using different indicators viz., NDVI, NDWI and rainfall deviation of mandals. Compositing all indicators, mandals were categorised into Normal, and Watch. Mandal-wise analysis for the Month of June 2017 indicated “Normal” agricultural situation in 535 Mandals. The agricultural situation is categorized as “Watch” in 49 Mandals. The Mandals under Normal and Watch categories are given in the Table.5. and their spatial distribution is shown in Figure 18.

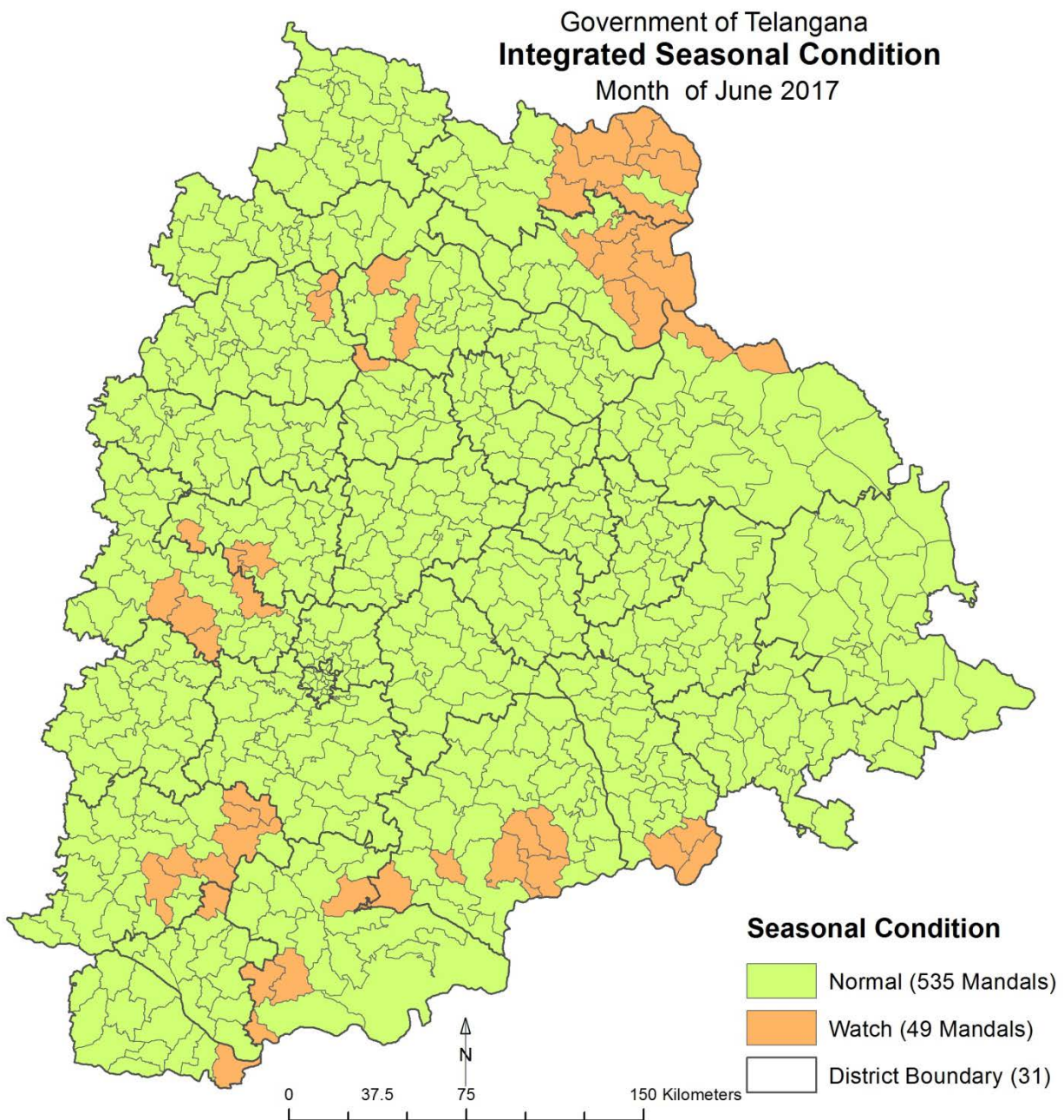


Figure 18: Mandal wise drought assessment based on ISMS criterion

**Table 5: Mandals under watch category based on ISMS criteria**

<b>District</b>	<b>Mandal</b>	<b>Total</b>
<b>Jagtial</b>	Mallapur and Medipalle	02
<b>Jayashankar Bhupalpally</b>	Mahadevpur and Palmela	02
<b>Jogulamba Gadwal</b>	Alampur	01
<b>Kumarambheem Asifabad</b>	Bejjur, Chintalamanepally, Dahegaon, Kagaznagar, Kouthala, Rebbana and Sirpur (T)	07
<b>Mahabubnagar</b>	Balanagar, Bhoothpur, Devarkadara, Jadcherla, Mahabubnagar rural and Rajapur	06
<b>Mancherial</b>	Bellampalle, Bhimaram, Chennur, Kannepalli, Kotapalle, Nennal and Vemanpalle	07
<b>Medak</b>	Alladurg, chilipched and Kowdipalle	03
<b>Nagarkurnool</b>	Kodair, Peddakothapalle, Pentlavelli and Vangoor	04
<b>Nalgonda</b>	AnumulaHaliya, Gundlapalle, Kondamallapally, Nidamanur, Peddavura and Tirumalagiri Saga	06
<b>Nizamabad</b>	Mortad and Yergatla	02
<b>Rajanna Sircilla</b>	Rudrangi	01
<b>Sangareddy</b>	Hathanoora, Kondapur, Munipalli and Sadasivpet	04
<b>Suryapet</b>	Chinthalapalem, Mattampalle and Mellachervu	03
<b>Wanaparthy</b>	Ghanpur	01

#### 4. Conclusions

Highlights of seasonal conditions at the end of the month, June 2017 are as follows.

- **58 Mandals** of state received **Deficient** rainfall. Deficient rainfall was recorded north eastern parts of Komaram Bheem- Asifabad, Mancherial, Nizamabad, Sangareddy districts. South western part of Medak and parts of Jagitial, Mahabunagar district also received deficient rainfall.
- **116 Mandals** received **Normal** rainfall in State. Normal rainfall was recorded mostly in parts of Adilabad, Jagitial, Mahabubnagar, Nagarkurnool, Nalgonda, Nirmal, Nizamabad, Peddapalli and Sangareddy districts.
- **141 and 265 Mandals** of state received **Excess and Large Excess** rainfall in State respectively. All most all parts of Bhadradi kothagudem, Jangaon, Jayashankar-Bhupalpally, Jogulamba Gadwal, Kamareddy, Karimnagar, Khammam, Mahabubabad, Mahabubnagar, Medchal-Malkajiri, Nagarkurnool, Nalgonda, Rangareddy, Sangareddy, Siddipet, Suryapet, Vikarabad, Wanaparthi, Warangal Rural, Warangal Urban and Yadadri Districts received excess to large excess rainfall.
- Mandal wise analysis by the end of June, 2017 indicated “Normal” agricultural situation in **535** Mandals and in **49** Mandals are in "Watch" category.

## References

Department of Agriculture and Cooperation, 2009, Manual for Drought Management, Ministry of Agriculture, Govt. of India, New Delhi.

<http://drought.unl.edu/portals/0/docs/international/GovtIndiaDroughtManual.pdf>

Department of Agriculture, 2017, Season and Crop Coverage Report, Kharif - 2017, Govt. of Telangana

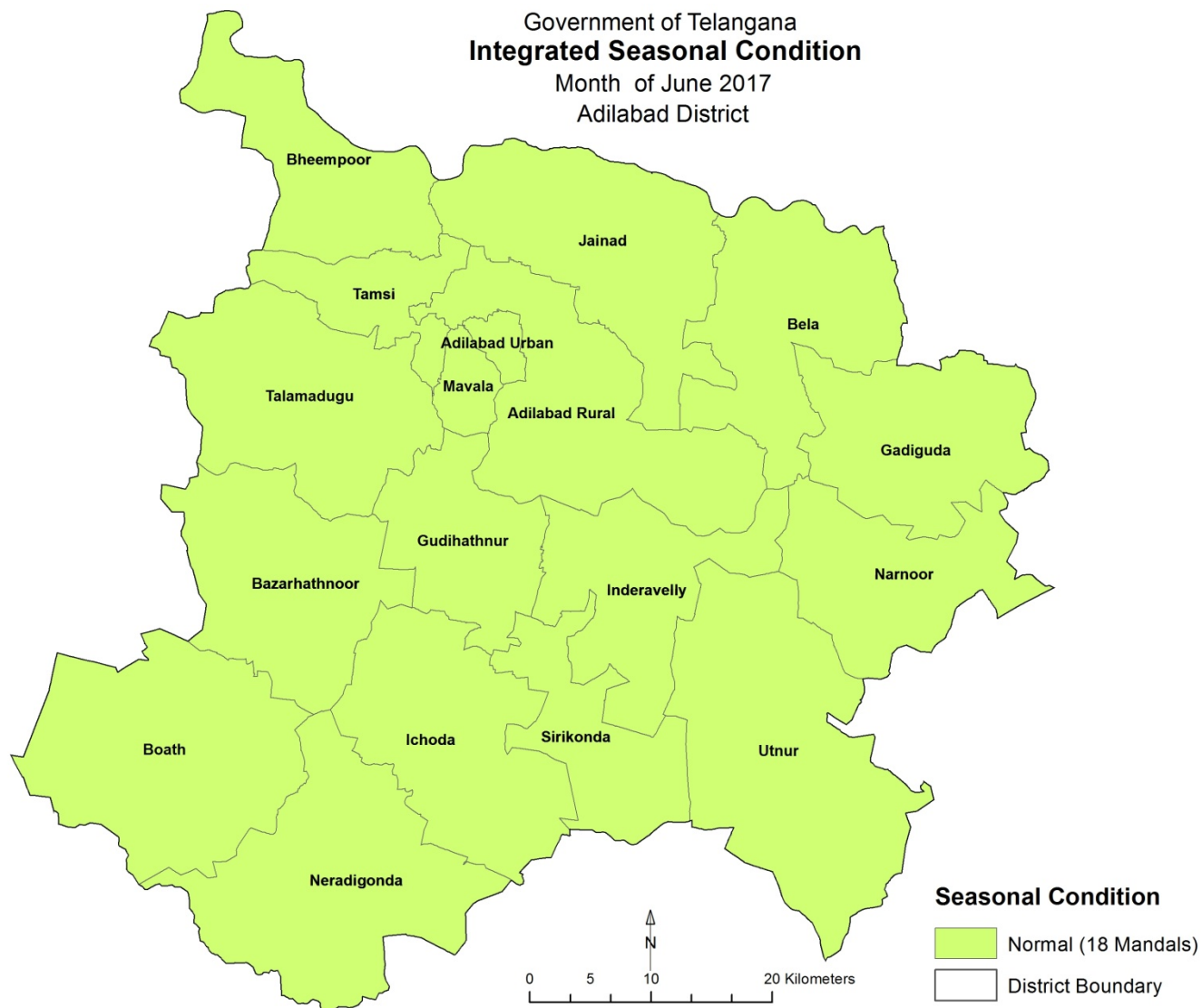
Kogan FN, 1995, Droughts of late 1980s in the USA as derived from NOAA polar orbiting satellite data, *Bulletin of American Meteorological Society*, 76: 655-668

Malingreau JP, 1986, Global vegetation dynamics: Satellite observations over Asia, *International Journal of Remote Sensing*, 7: 1121-1146.

Tucker CJ and Chowdhary BJ, 1987, Satellite remote sensing of drought conditions, *Remote Sensing of Environment*, 23: 243-251

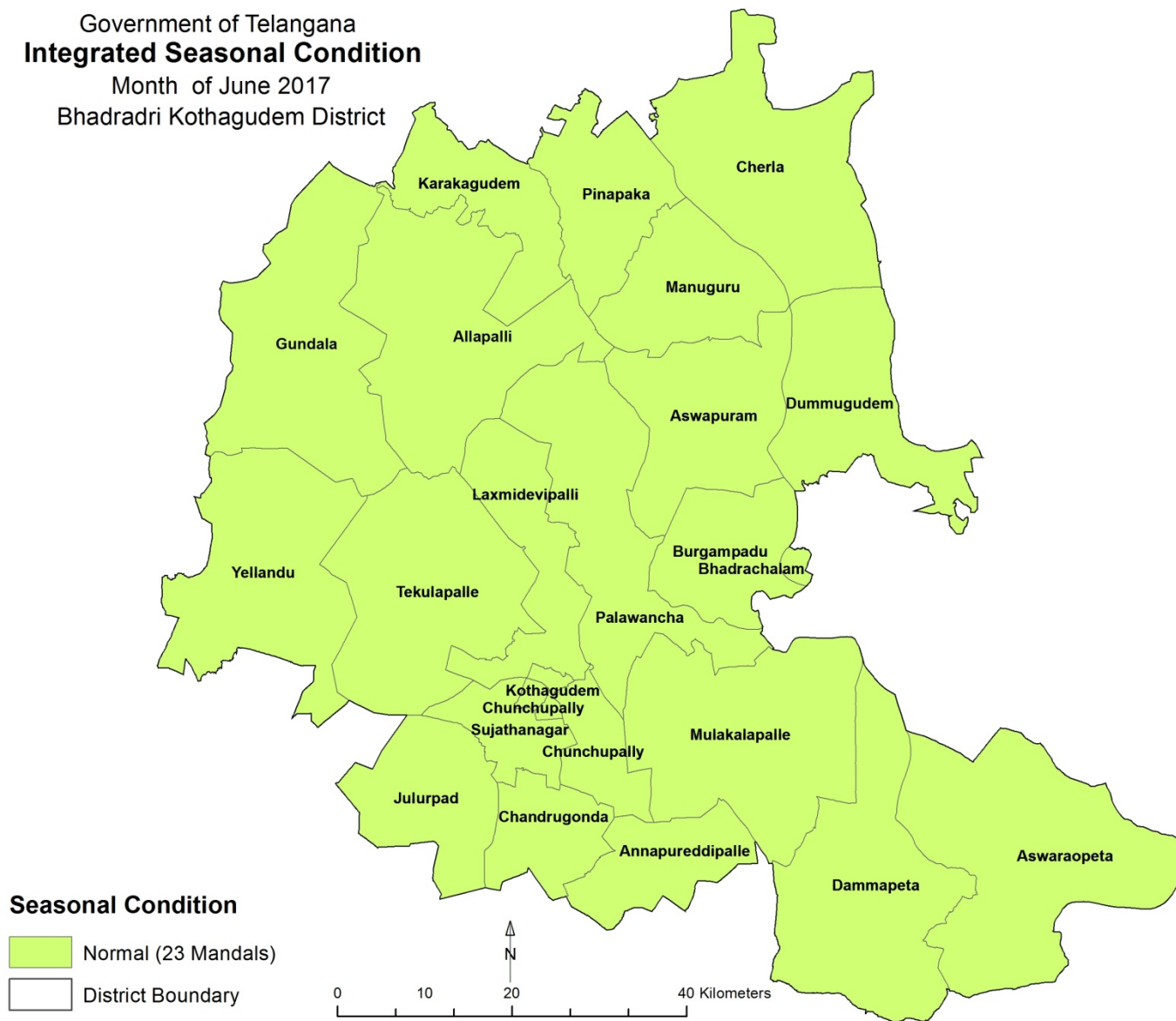
**ANNEXURE I**  
**District Wise Maps Showing Normal, Watch Mandals**

Government of Telangana  
**Integrated Seasonal Condition**  
 Month of June 2017  
 Adilabad District

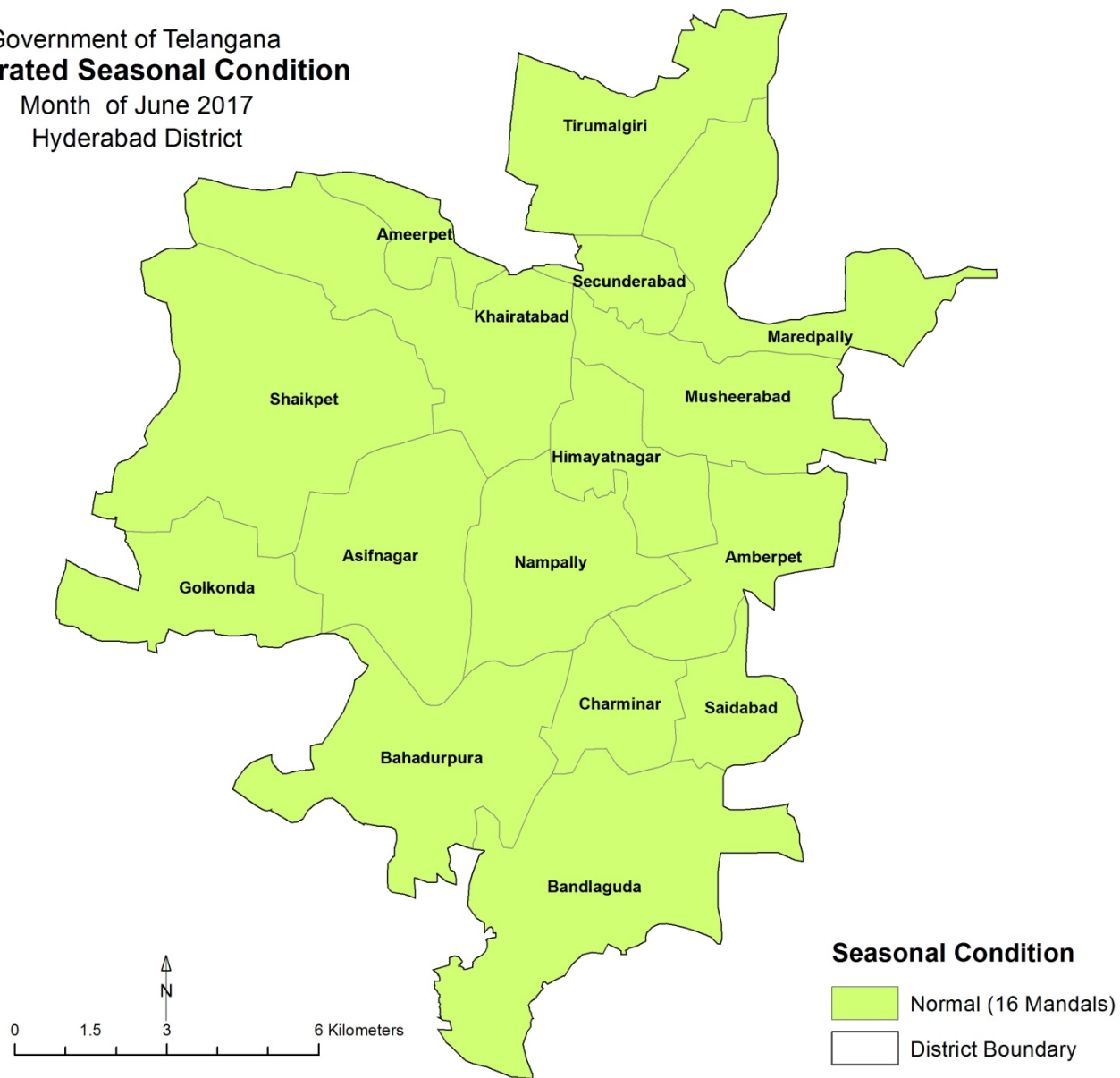




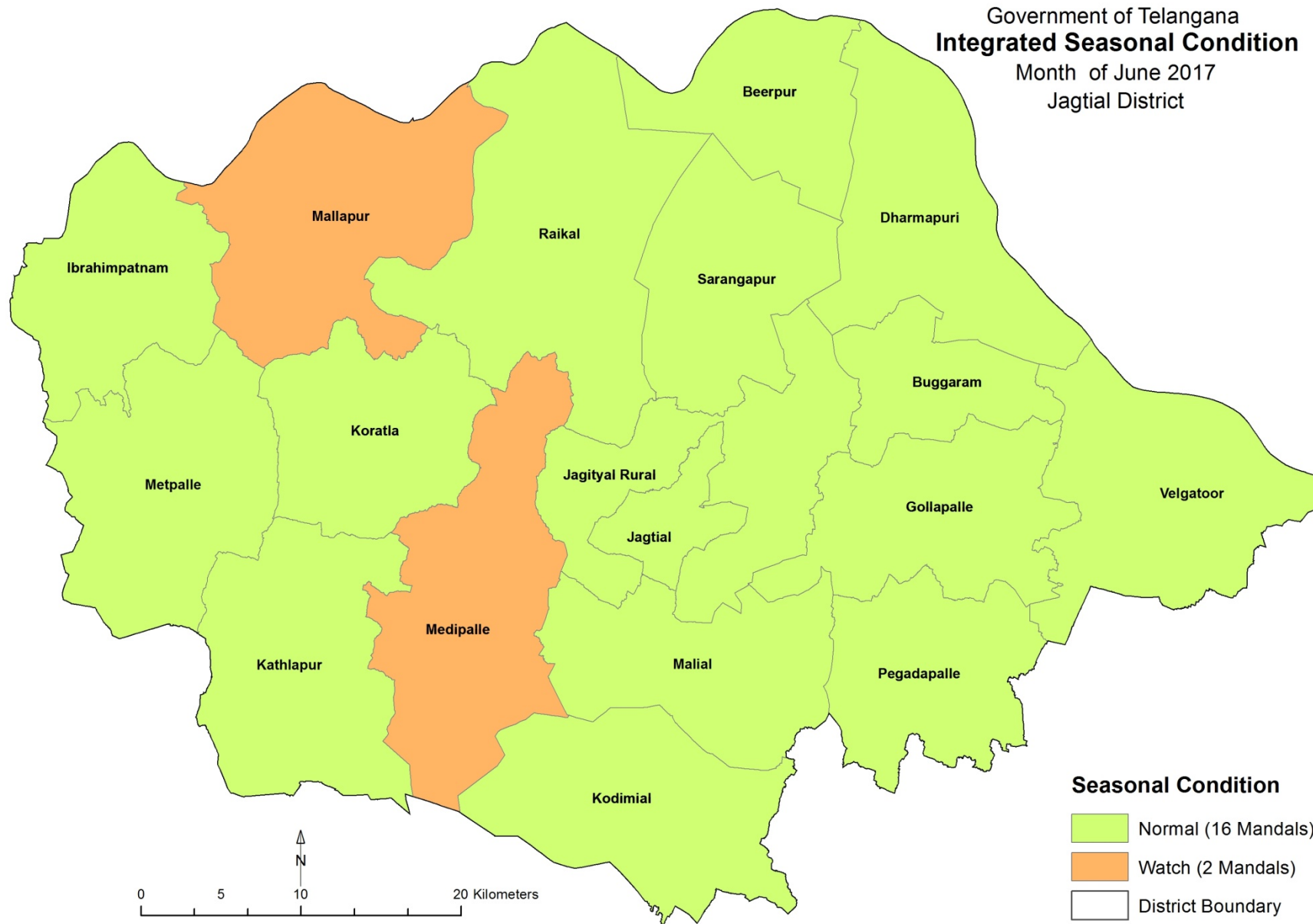
Government of Telangana  
**Integrated Seasonal Condition**  
 Month of June 2017  
 Bhadradri Kothagudem District



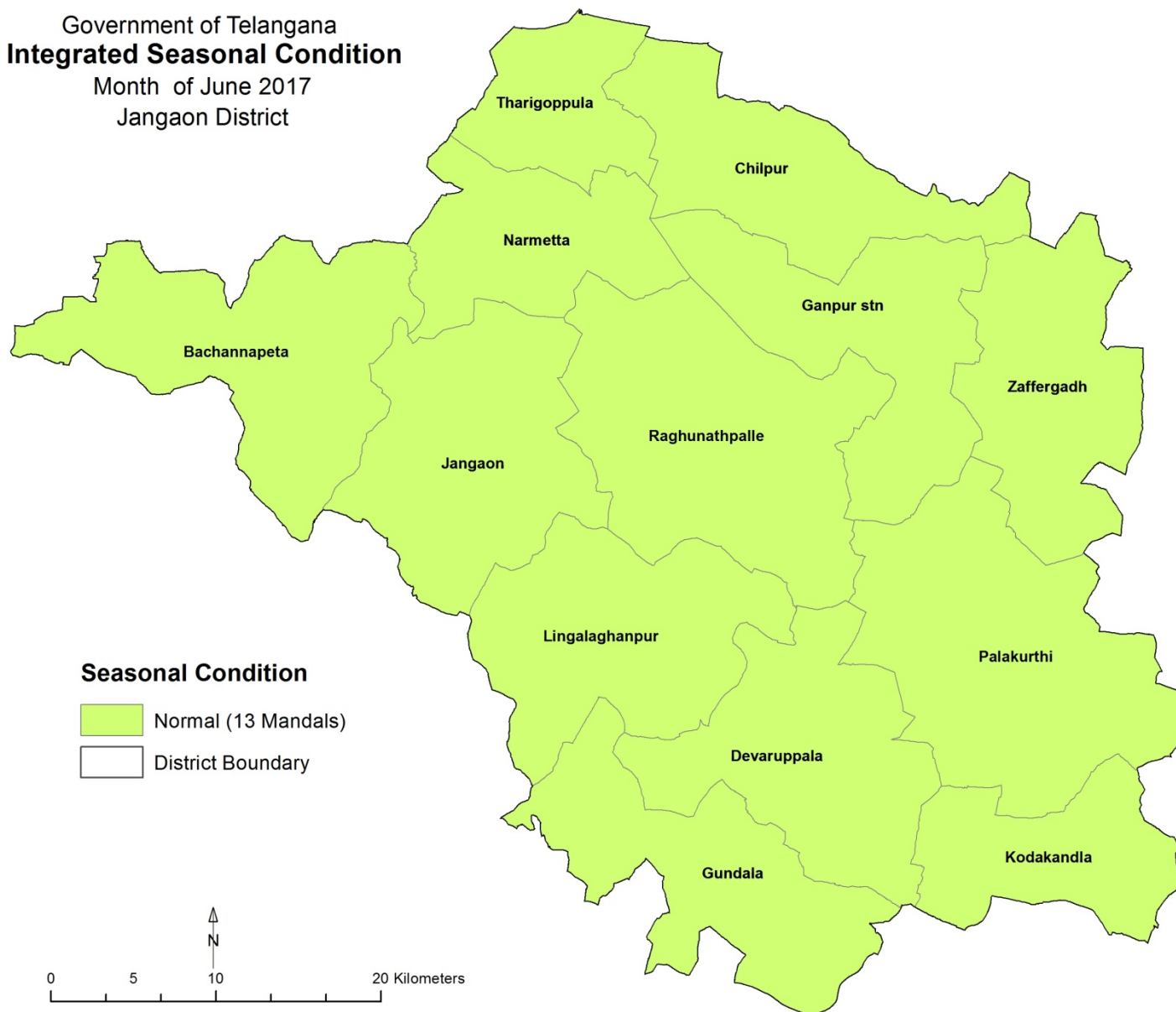
Government of Telangana  
**Integrated Seasonal Condition**  
 Month of June 2017  
 Hyderabad District



Government of Telangana  
**Integrated Seasonal Condition**  
 Month of June 2017  
 Jagtial District



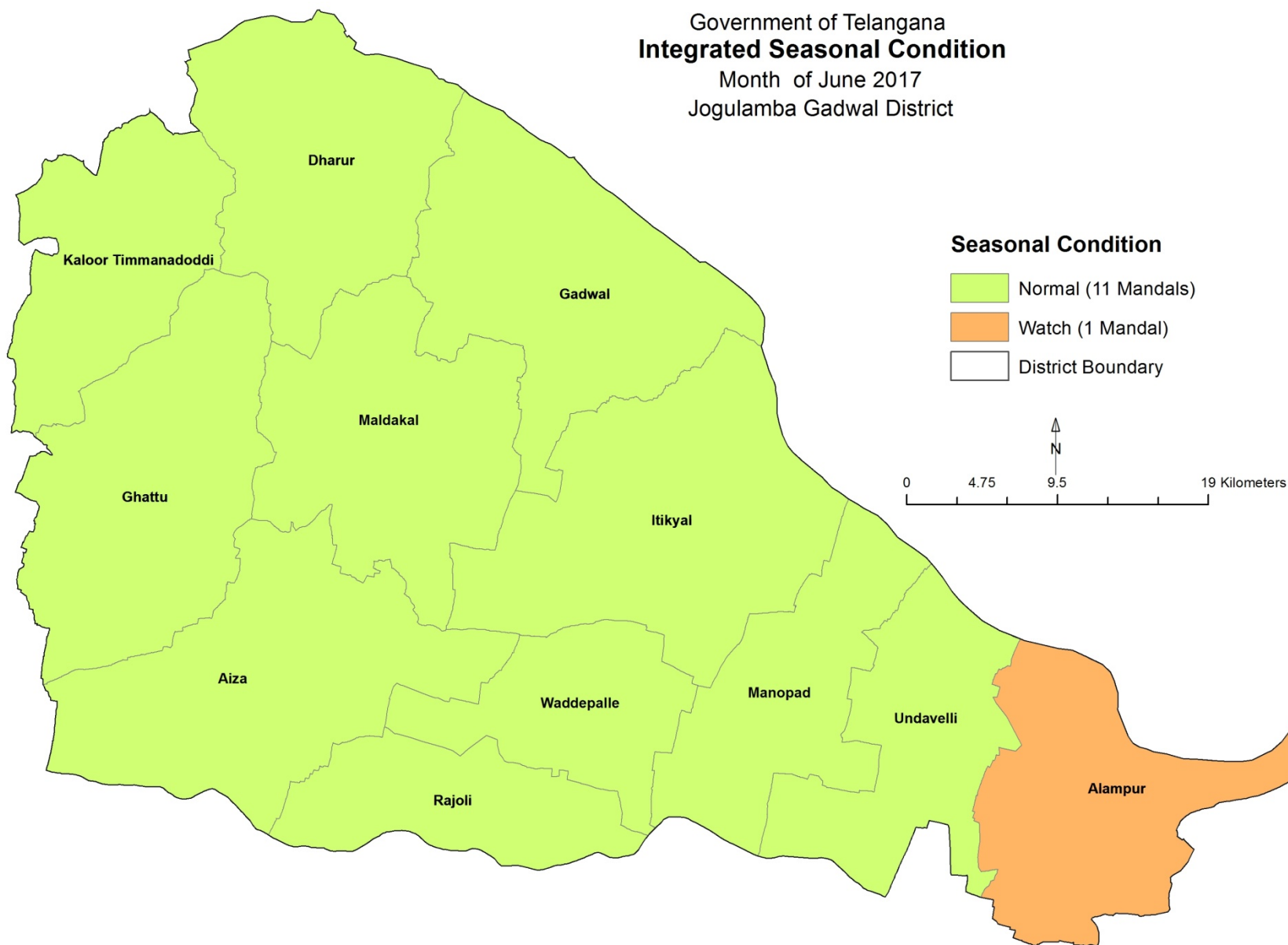
Government of Telangana  
**Integrated Seasonal Condition**  
Month of June 2017  
Jangaon District



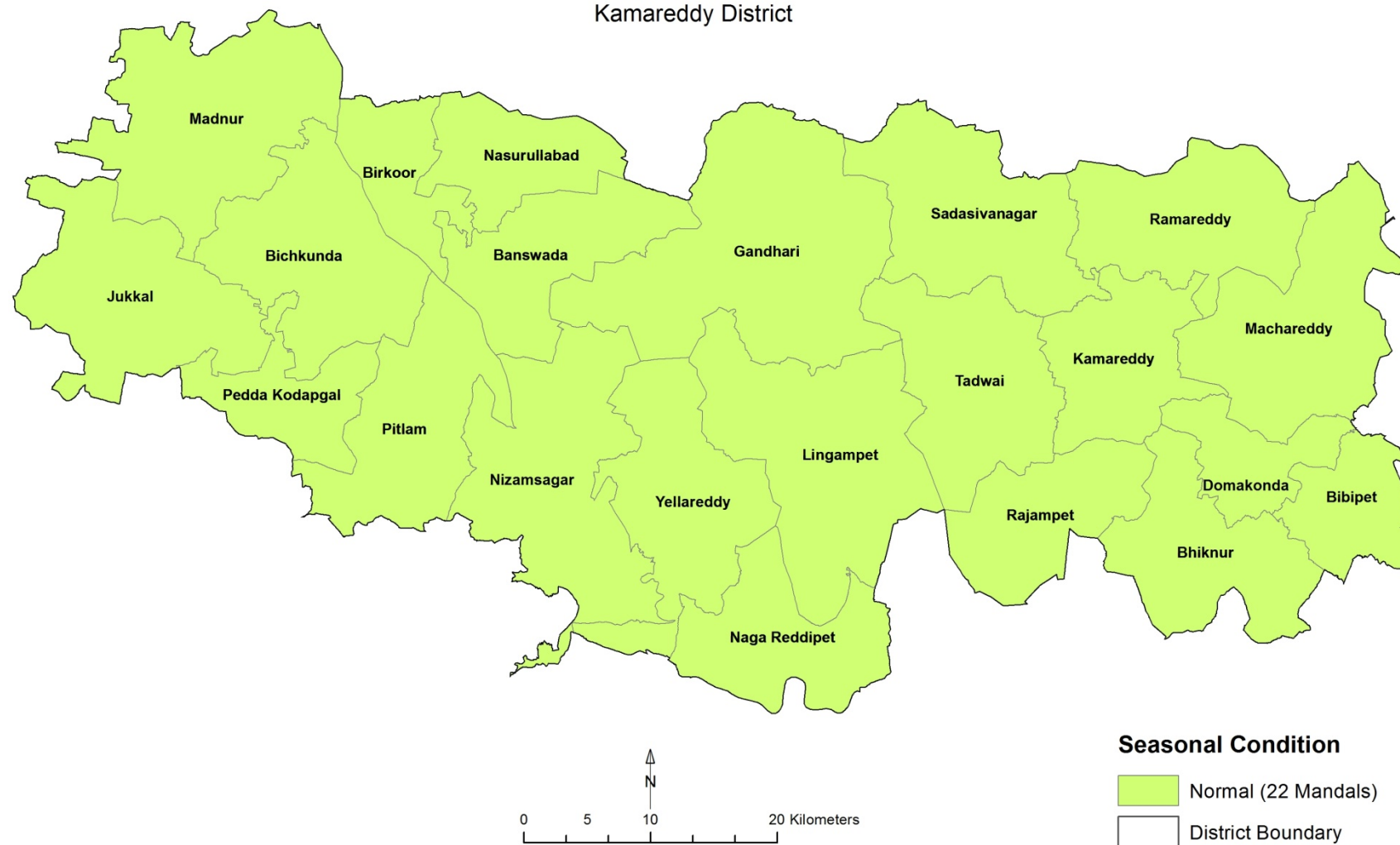
Government of Telangana  
**Integrated Seasonal Condition**  
 Month of June 2017  
 Jayashankar Bhupalpally District



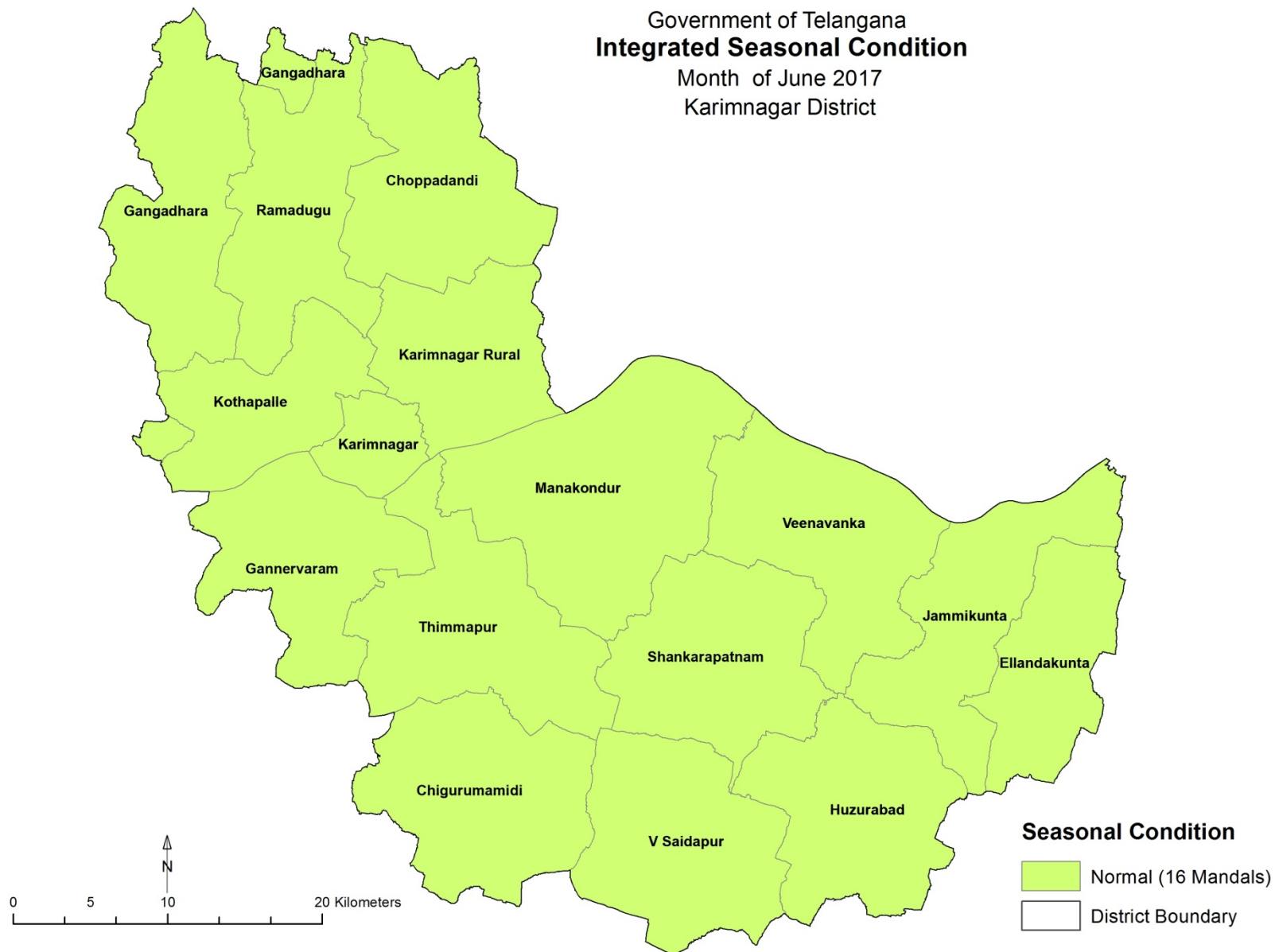
Government of Telangana  
**Integrated Seasonal Condition**  
 Month of June 2017  
 Jogulamba Gadwal District



Government of Telangana  
**Integrated Seasonal Condition**  
 Month of June 2017  
 Kamareddy District

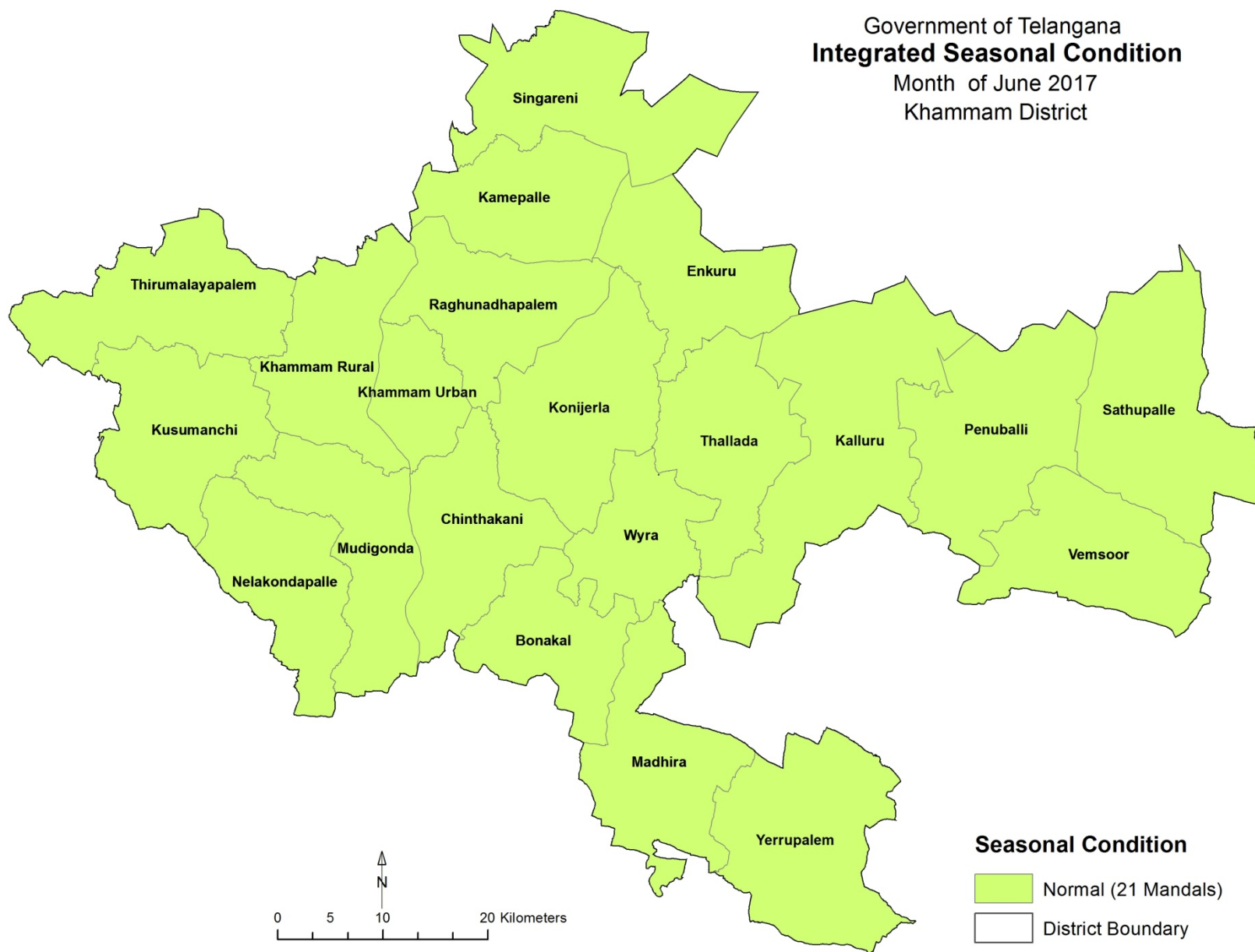


Government of Telangana  
**Integrated Seasonal Condition**  
 Month of June 2017  
 Karimnagar District

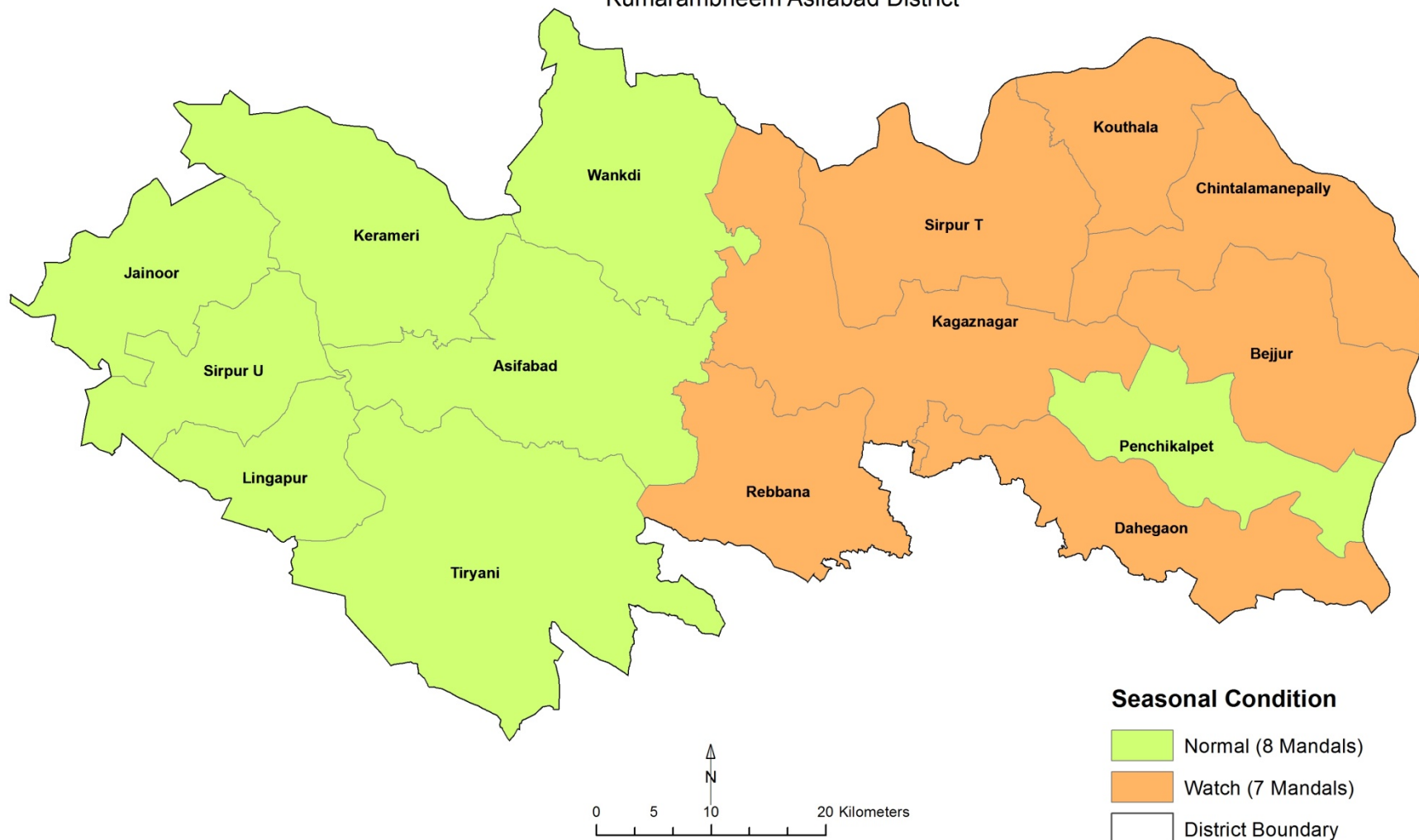




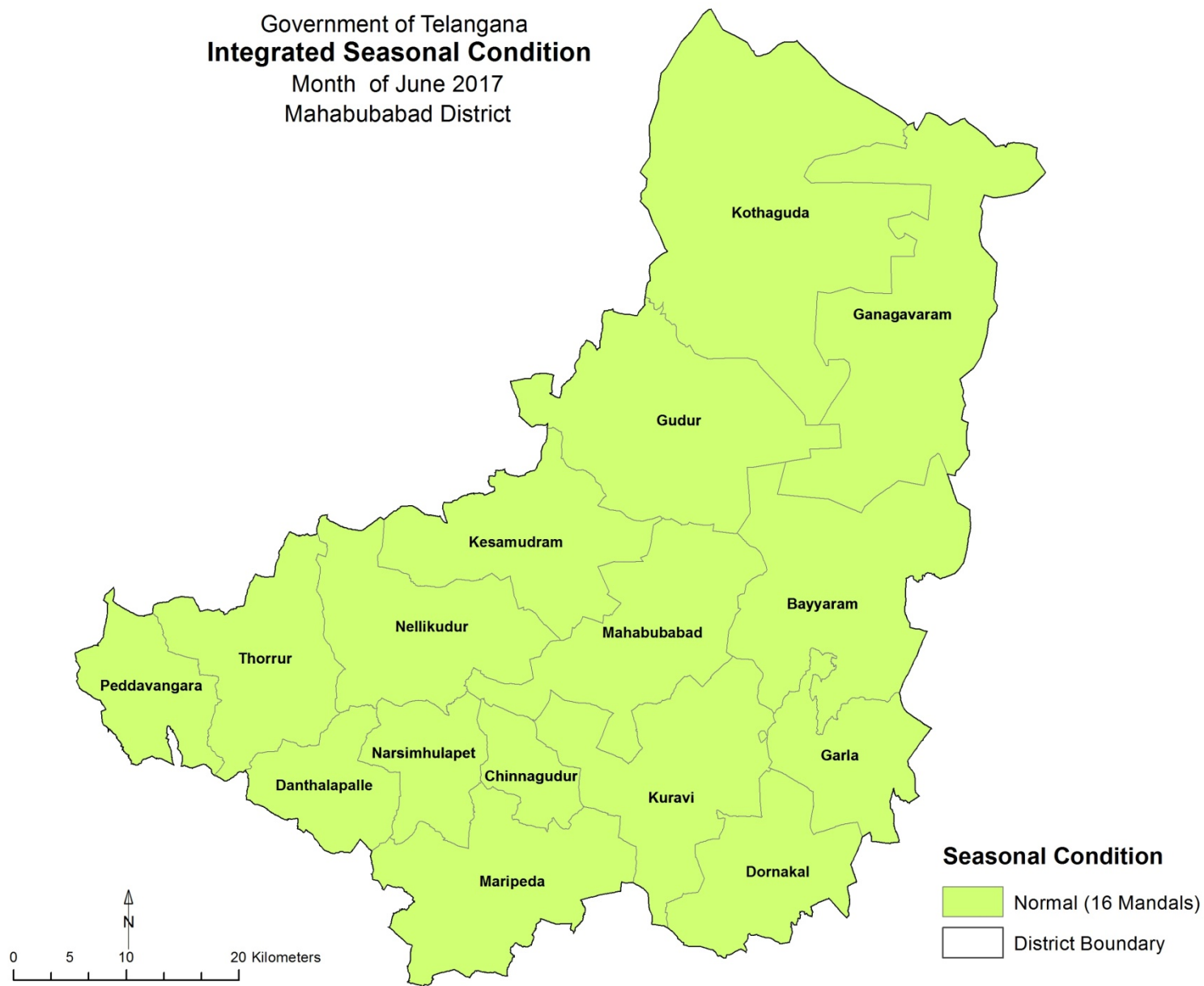
Government of Telangana  
**Integrated Seasonal Condition**  
 Month of June 2017  
 Khammam District



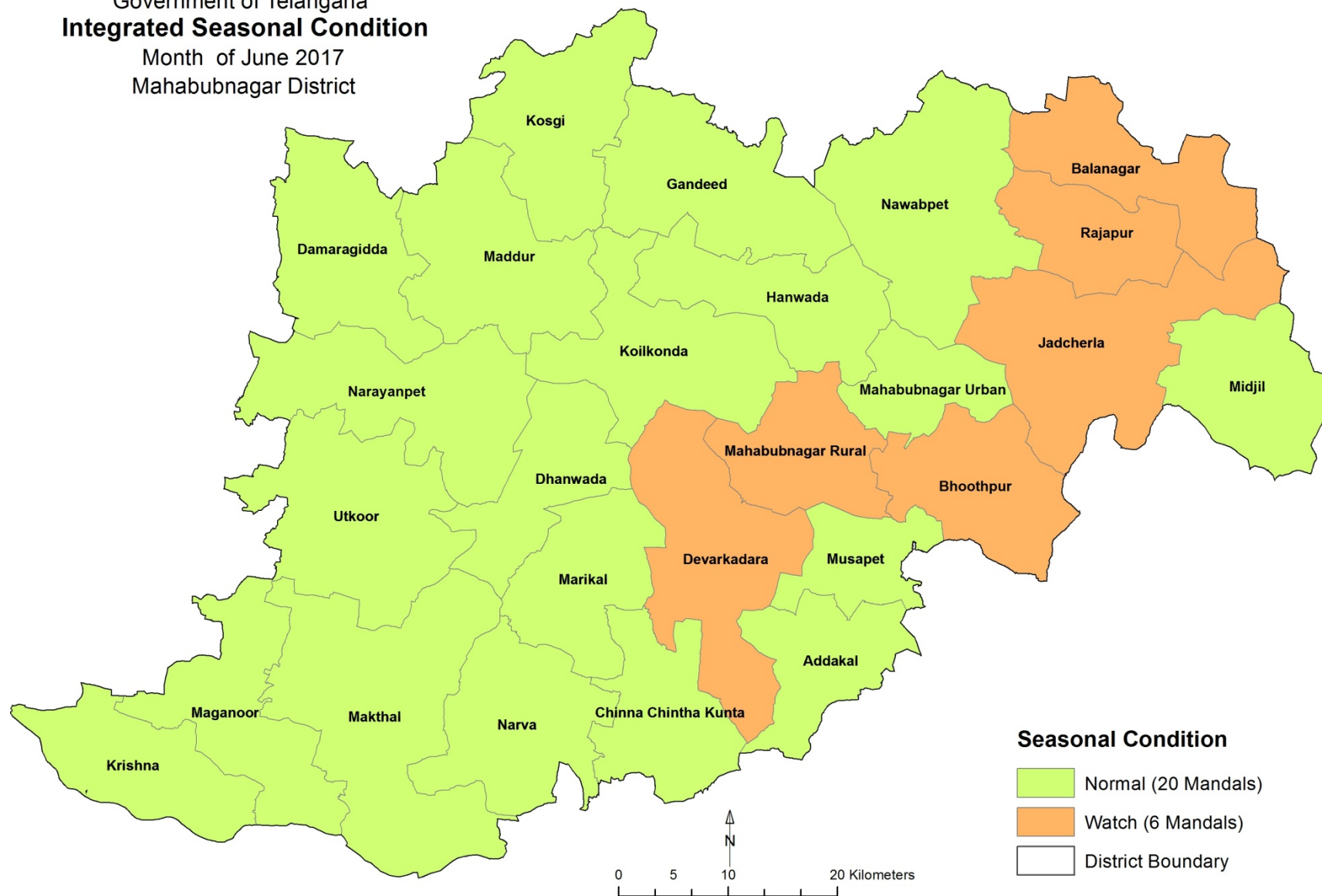
Government of Telangana  
**Integrated Seasonal Condition**  
 Month of June 2017  
 Kumarambheem Asifabad District



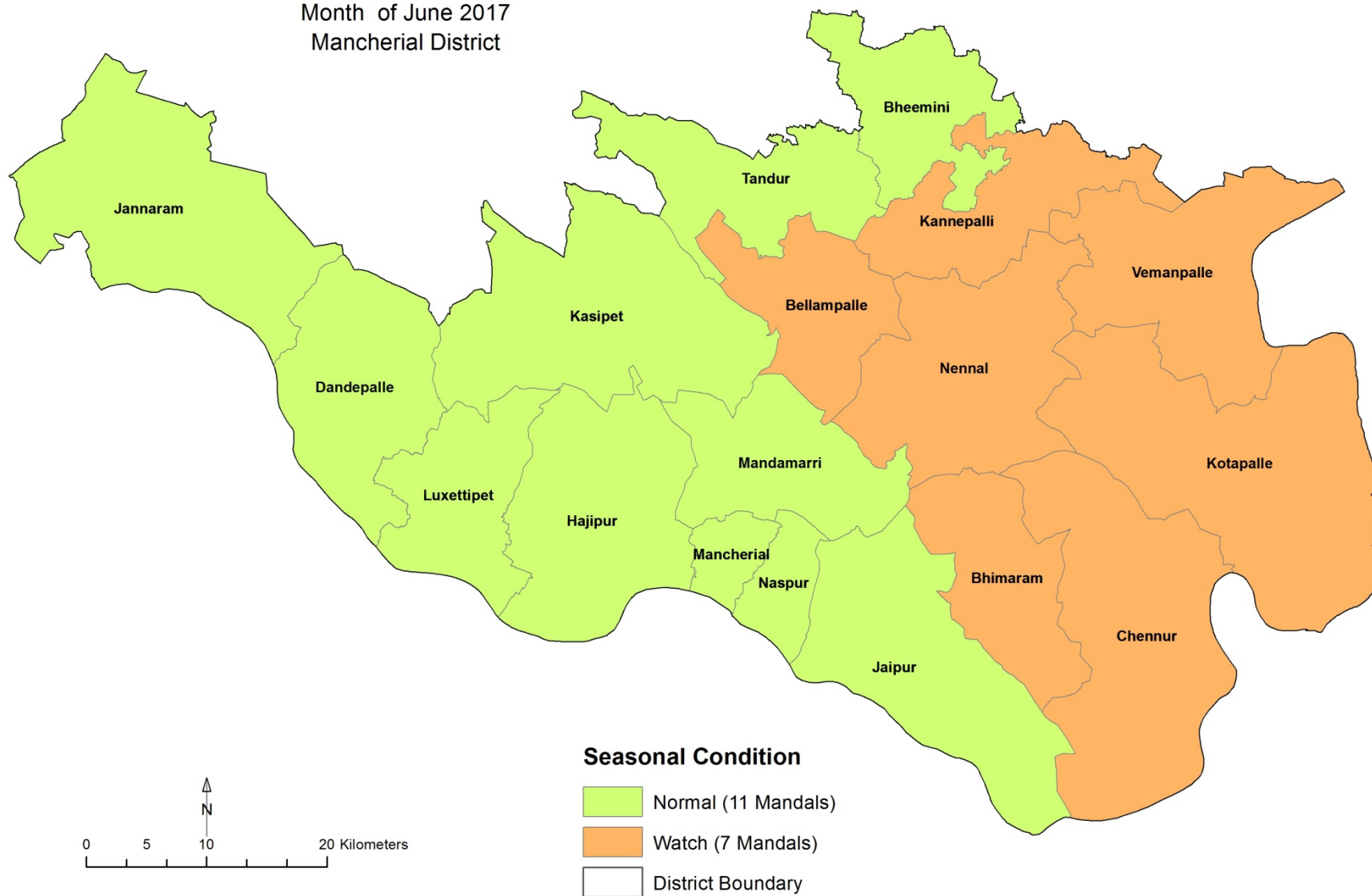
Government of Telangana  
**Integrated Seasonal Condition**  
Month of June 2017  
Mahabubabad District



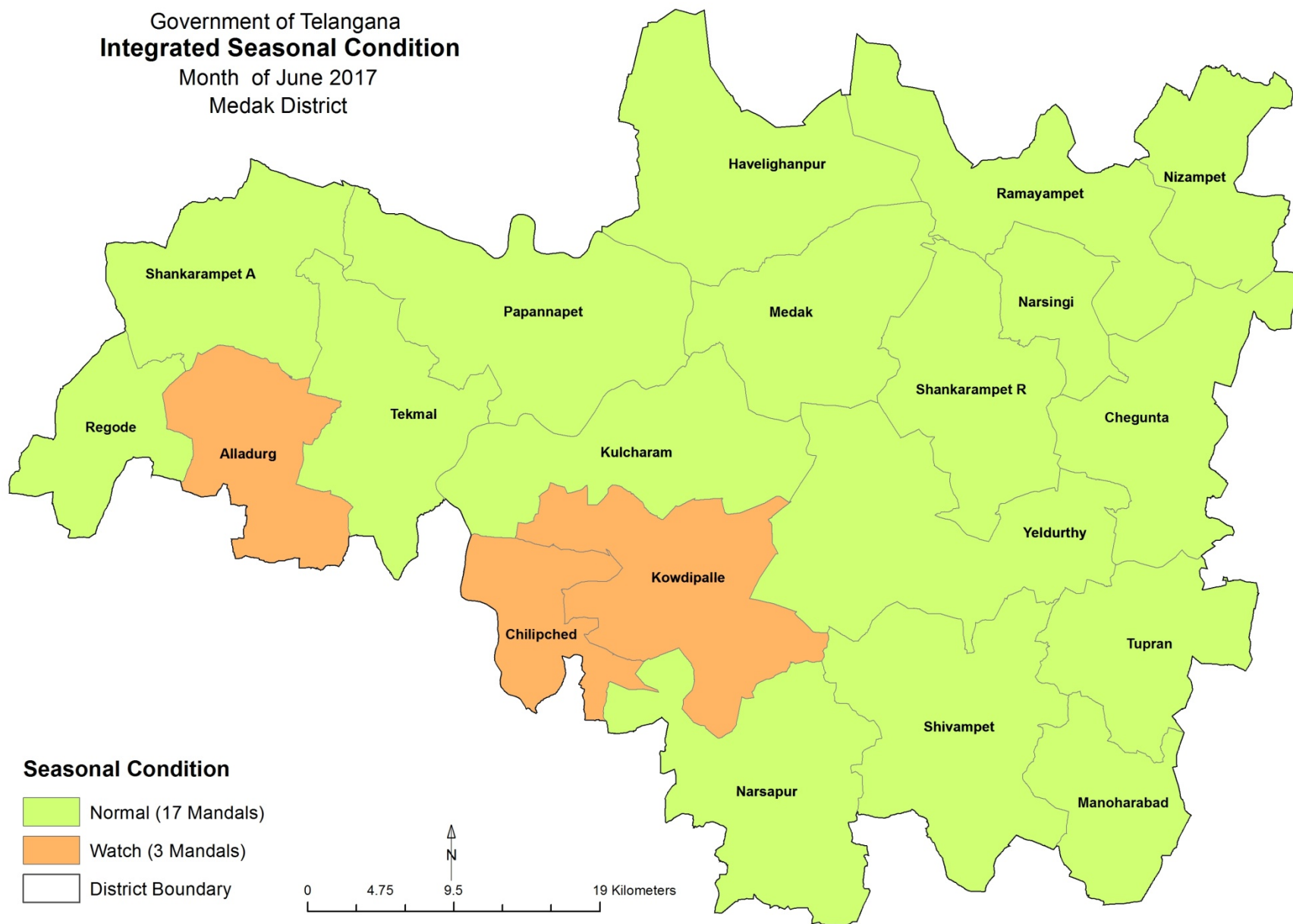
Government of Telangana  
**Integrated Seasonal Condition**  
 Month of June 2017  
 Mahabubnagar District



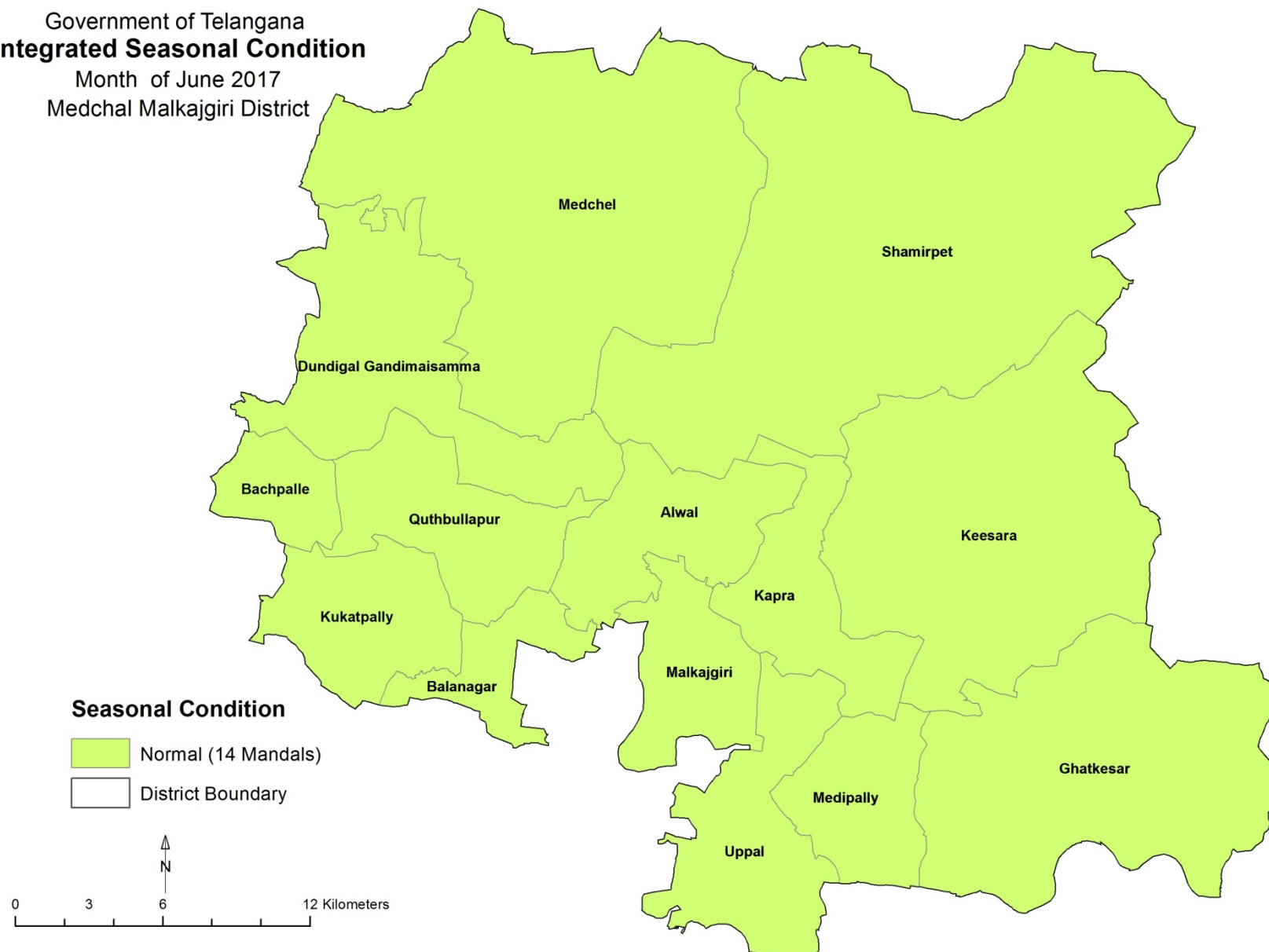
Government of Telangana  
**Integrated Seasonal Condition**  
 Month of June 2017  
 Mancherial District



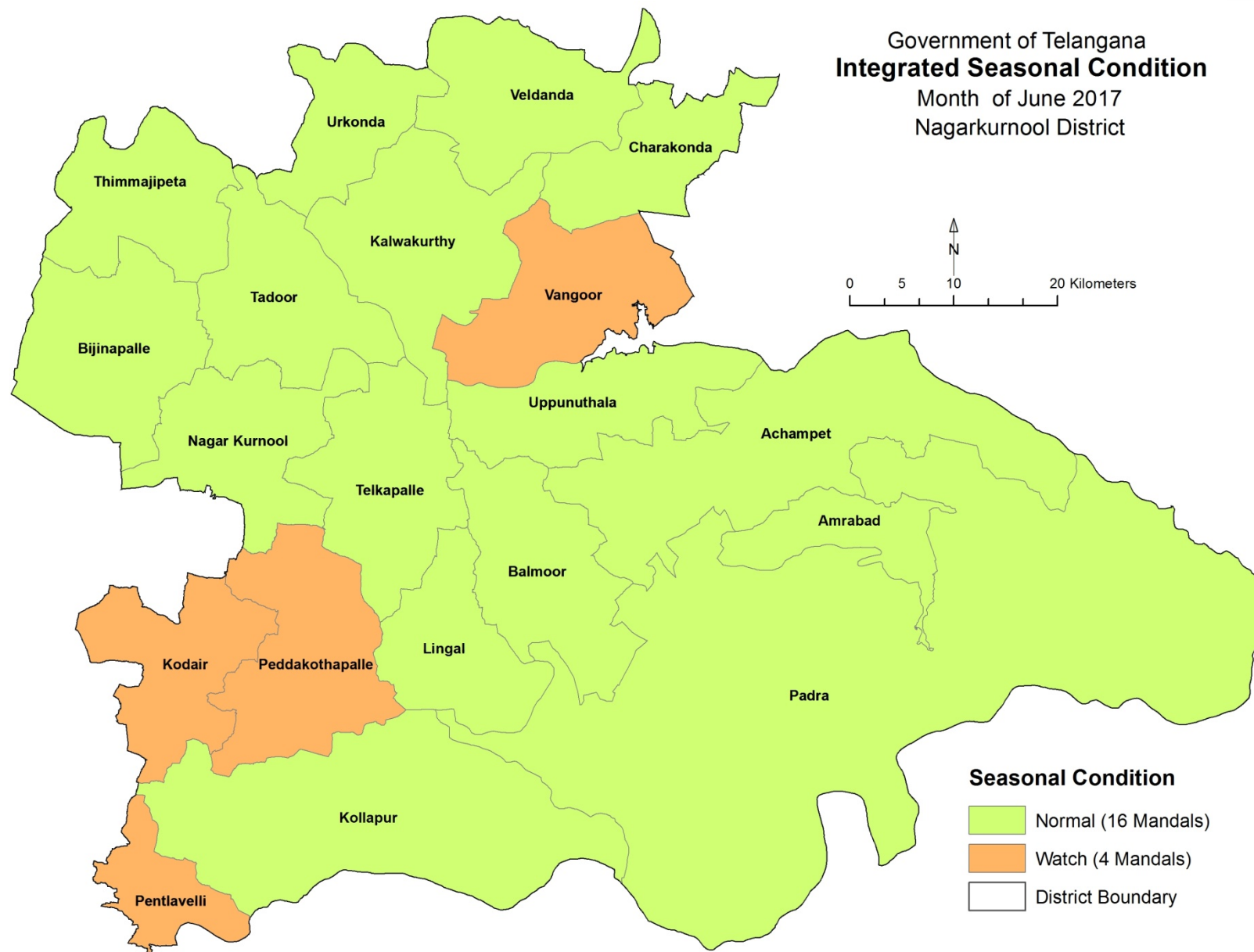
Government of Telangana  
**Integrated Seasonal Condition**  
 Month of June 2017  
 Medak District



Government of Telangana  
**Integrated Seasonal Condition**  
Month of June 2017  
Medchal Malkajiri District

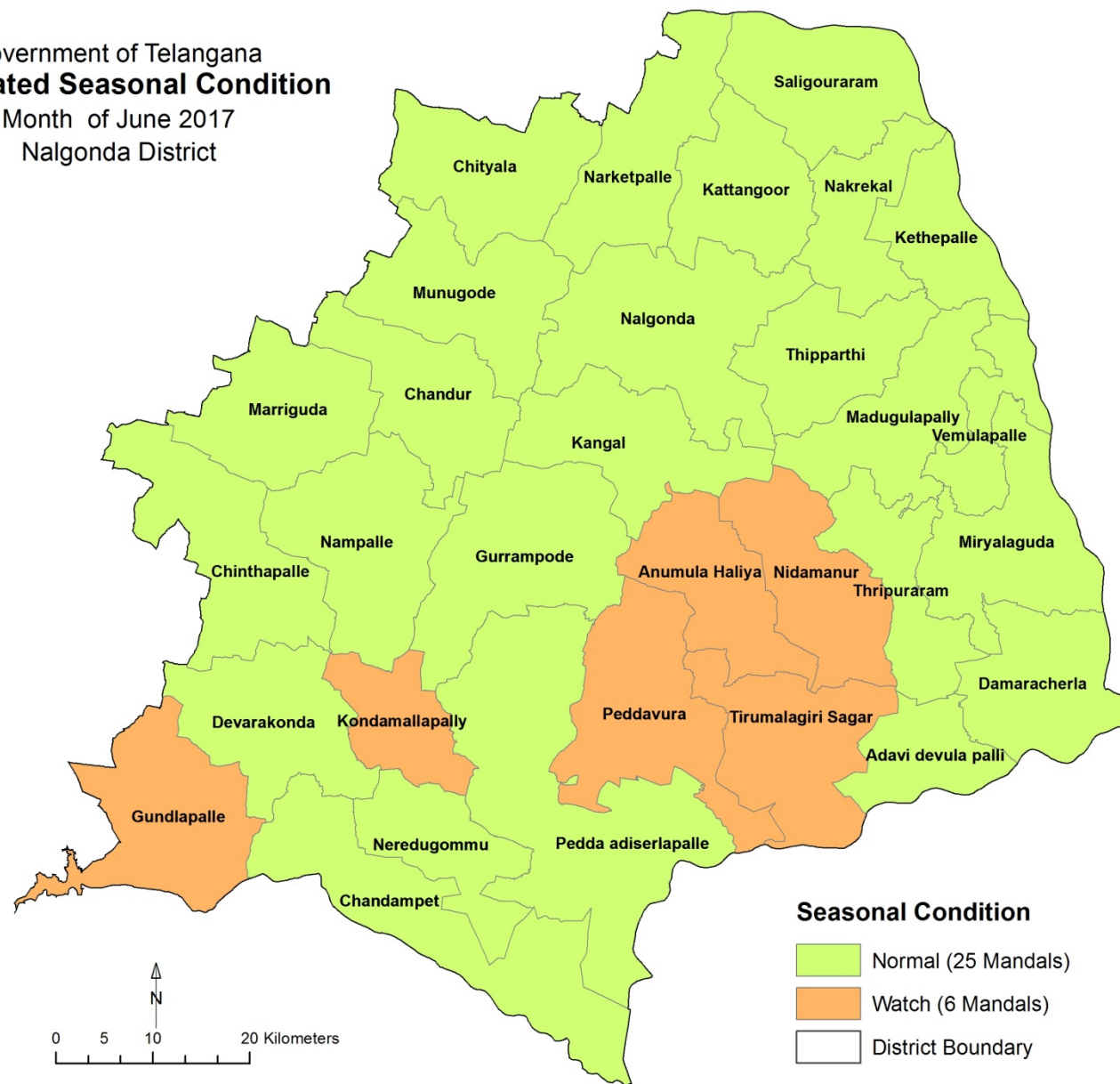


Government of Telangana  
**Integrated Seasonal Condition**  
 Month of June 2017  
 Nagarkurnool District

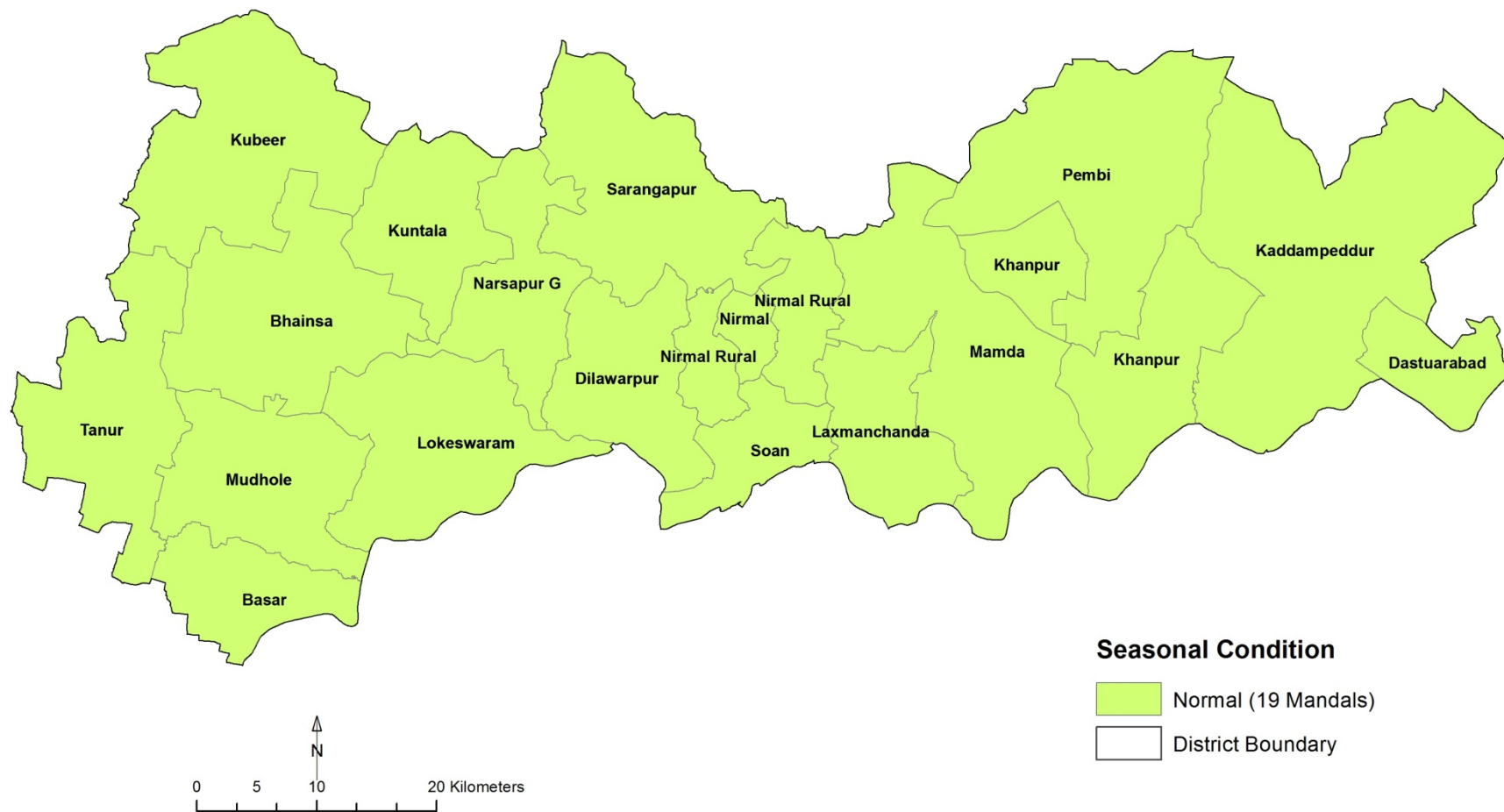




Government of Telangana  
**Integrated Seasonal Condition**  
 Month of June 2017  
 Nalgonda District



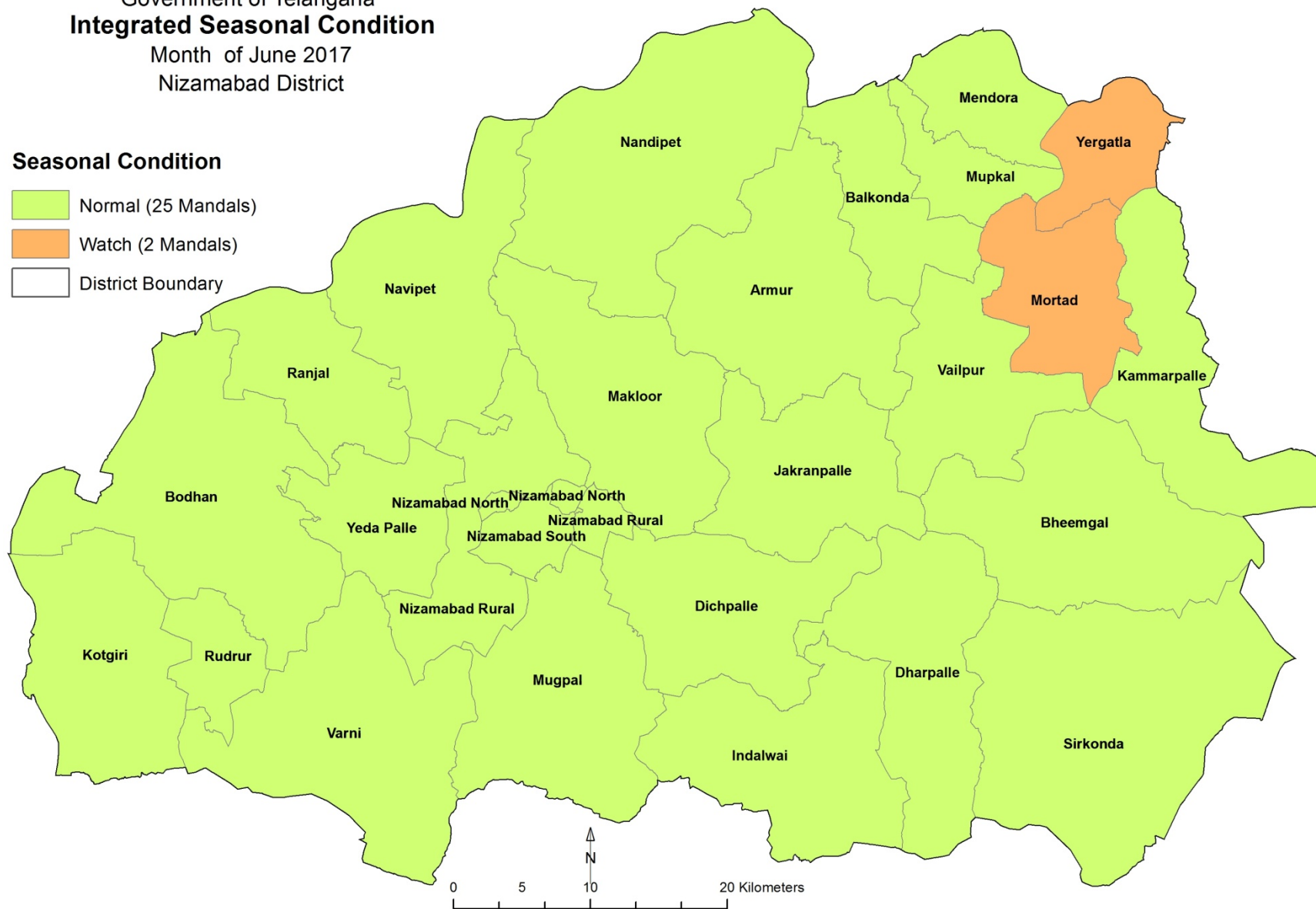
Government of Telangana  
**Integrated Seasonal Condition**  
 Month of June 2017  
 Nirmal District



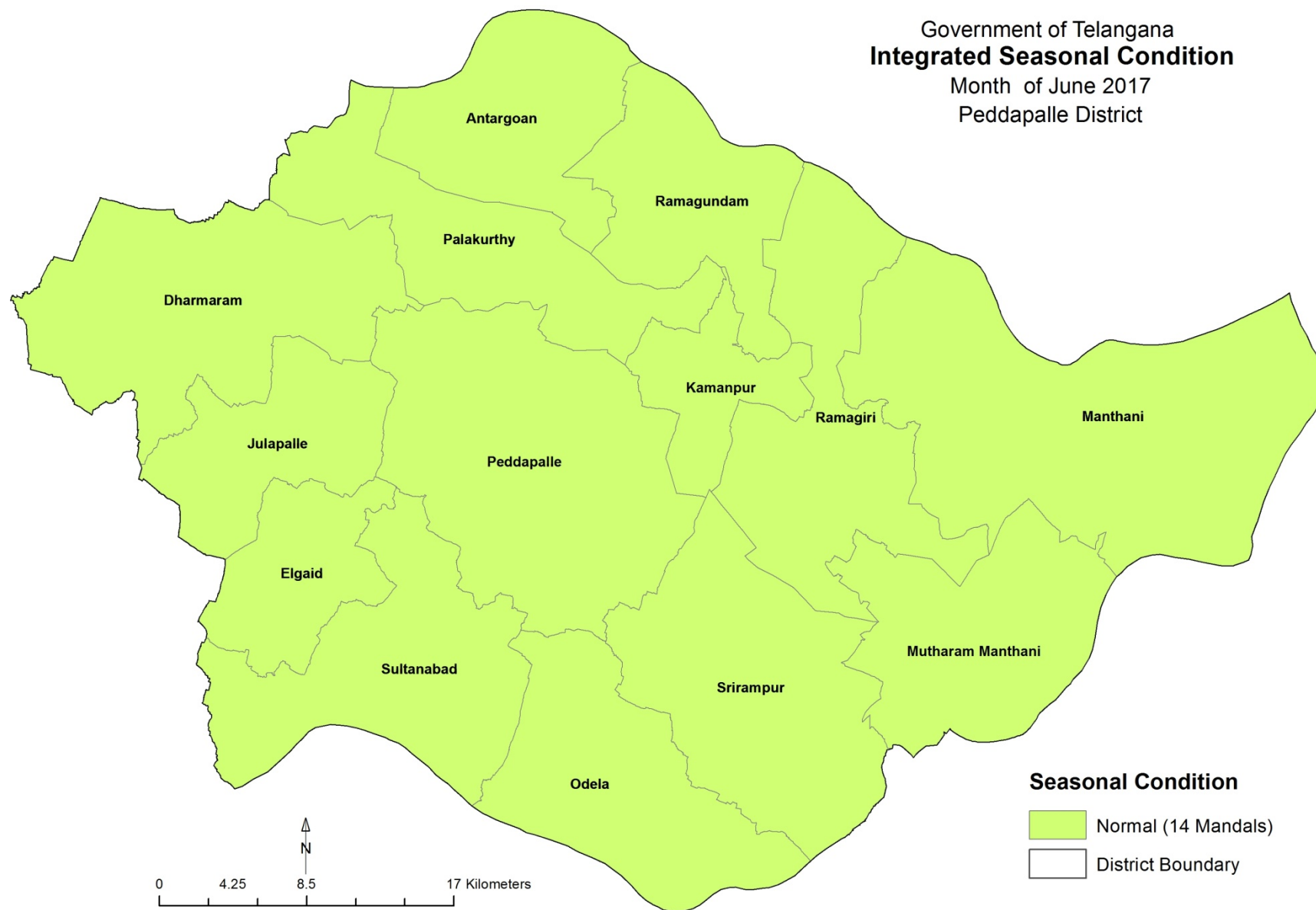
Government of Telangana  
**Integrated Seasonal Condition**  
 Month of June 2017  
 Nizamabad District

**Seasonal Condition**

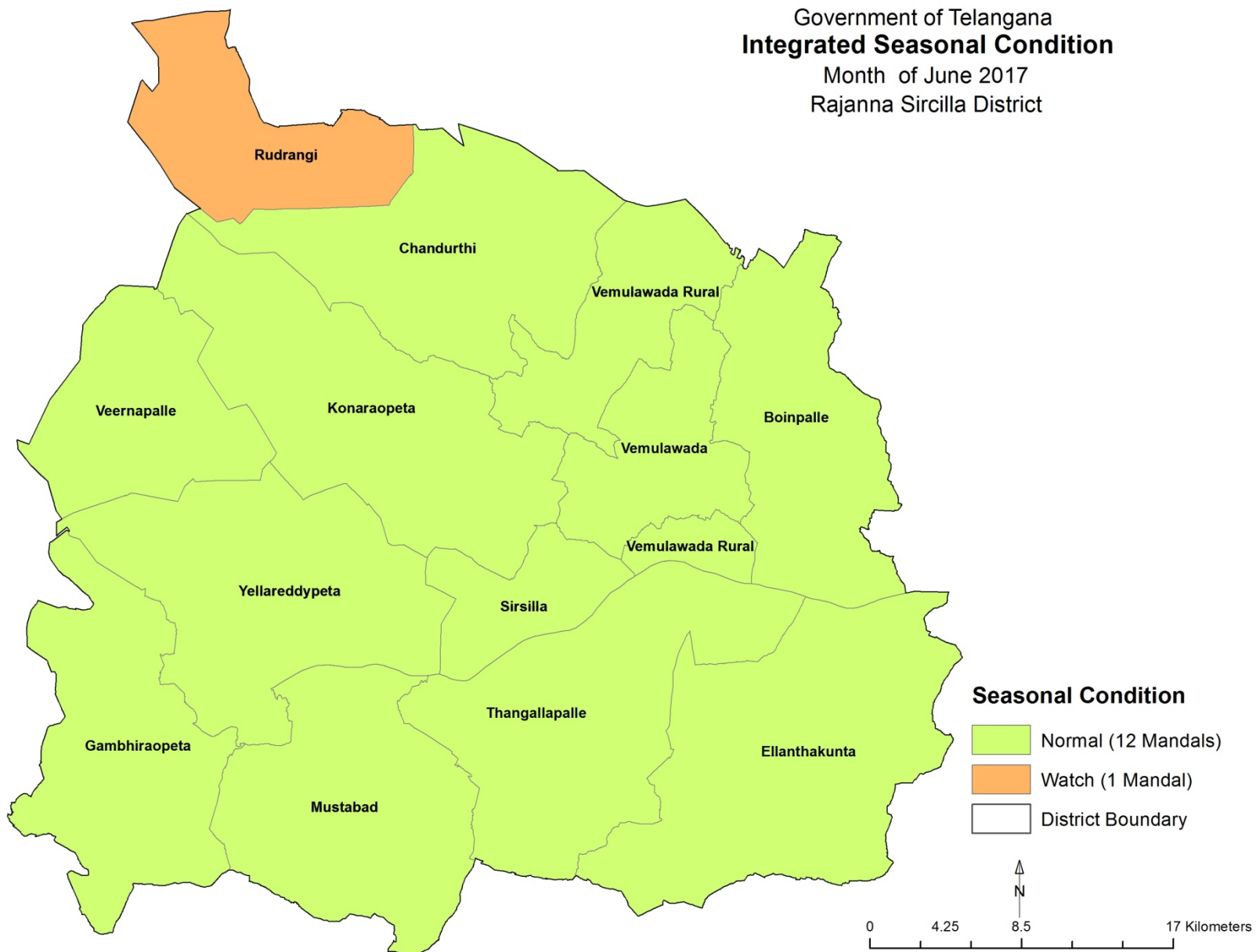
- Normal (25 Mandals)
- Watch (2 Mandals)
- District Boundary



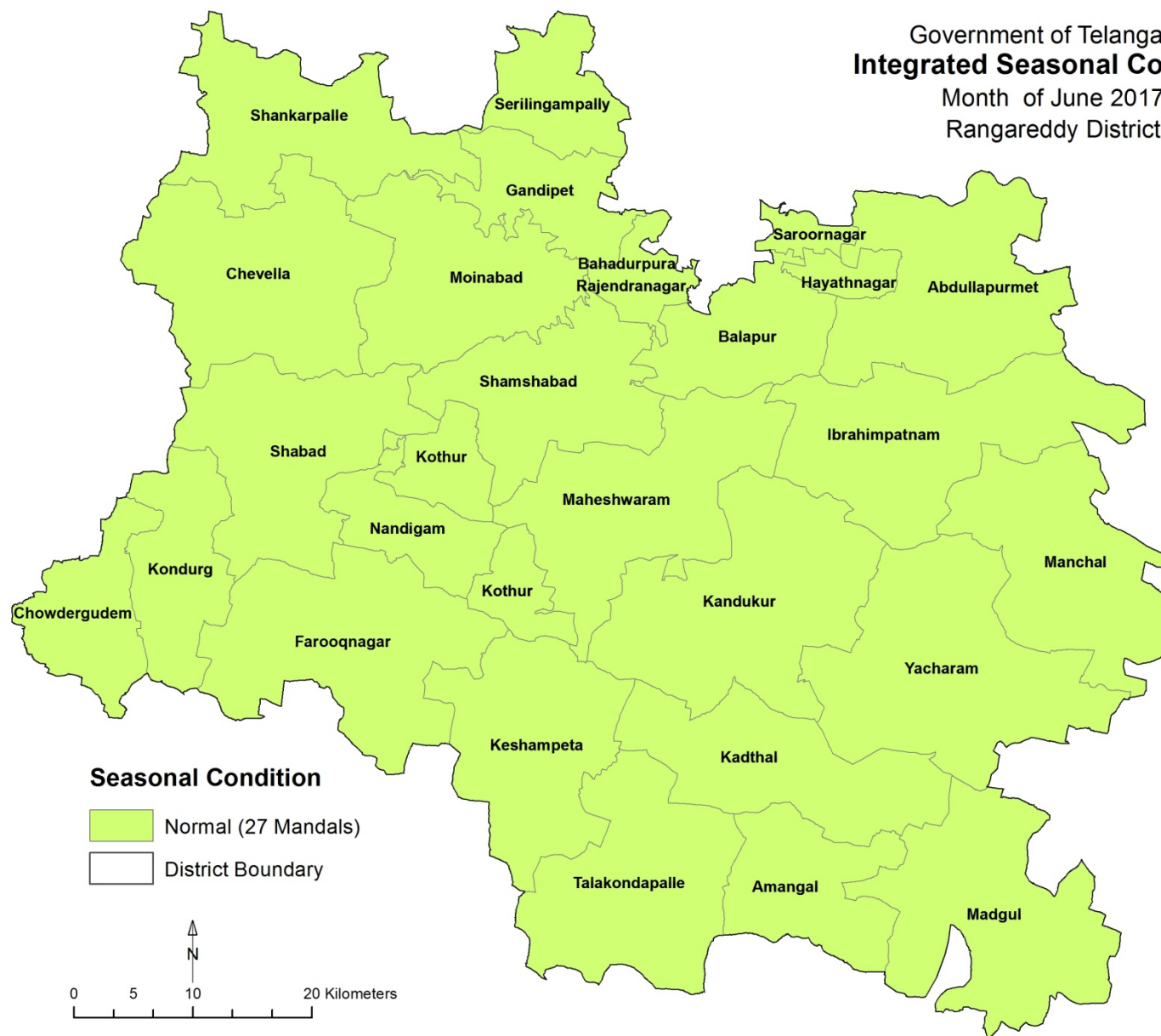
Government of Telangana  
**Integrated Seasonal Condition**  
Month of June 2017  
Peddapalle District



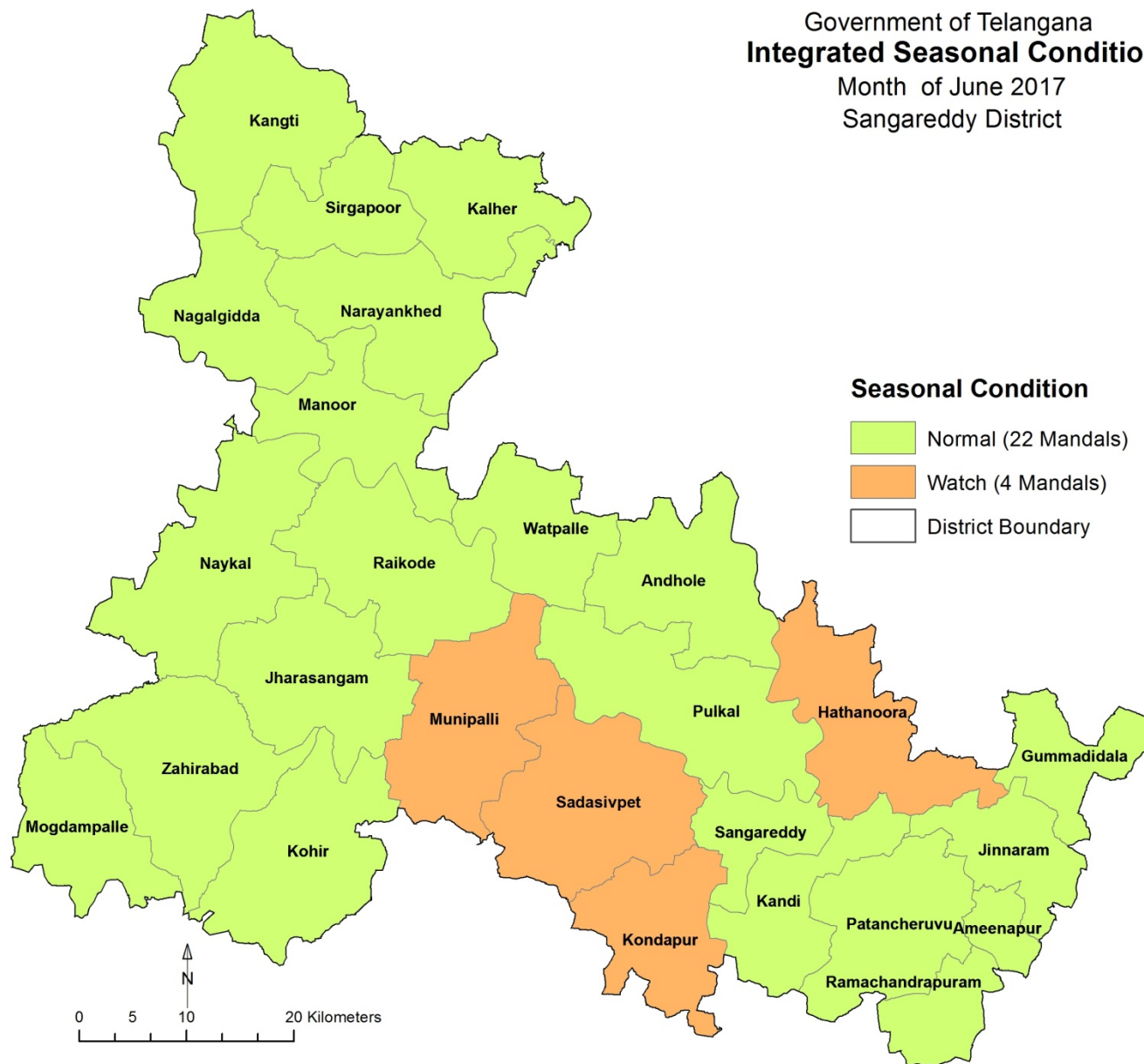
Government of Telangana  
**Integrated Seasonal Condition**  
Month of June 2017  
Rajanna Sircilla District



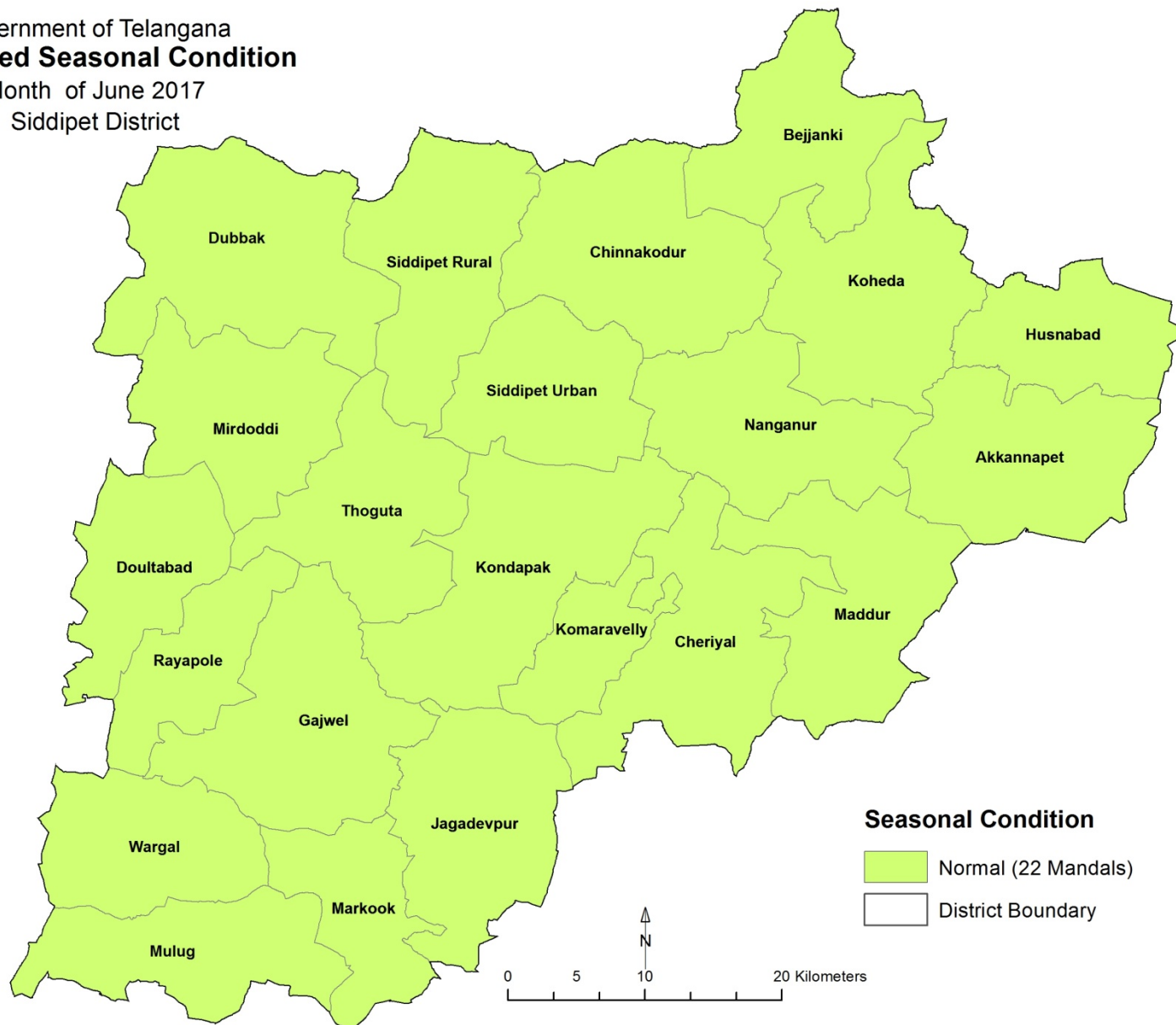
Government of Telangana  
**Integrated Seasonal Condition**  
 Month of June 2017  
 Rangareddy District



Government of Telangana  
**Integrated Seasonal Condition**  
 Month of June 2017  
 Sangareddy District

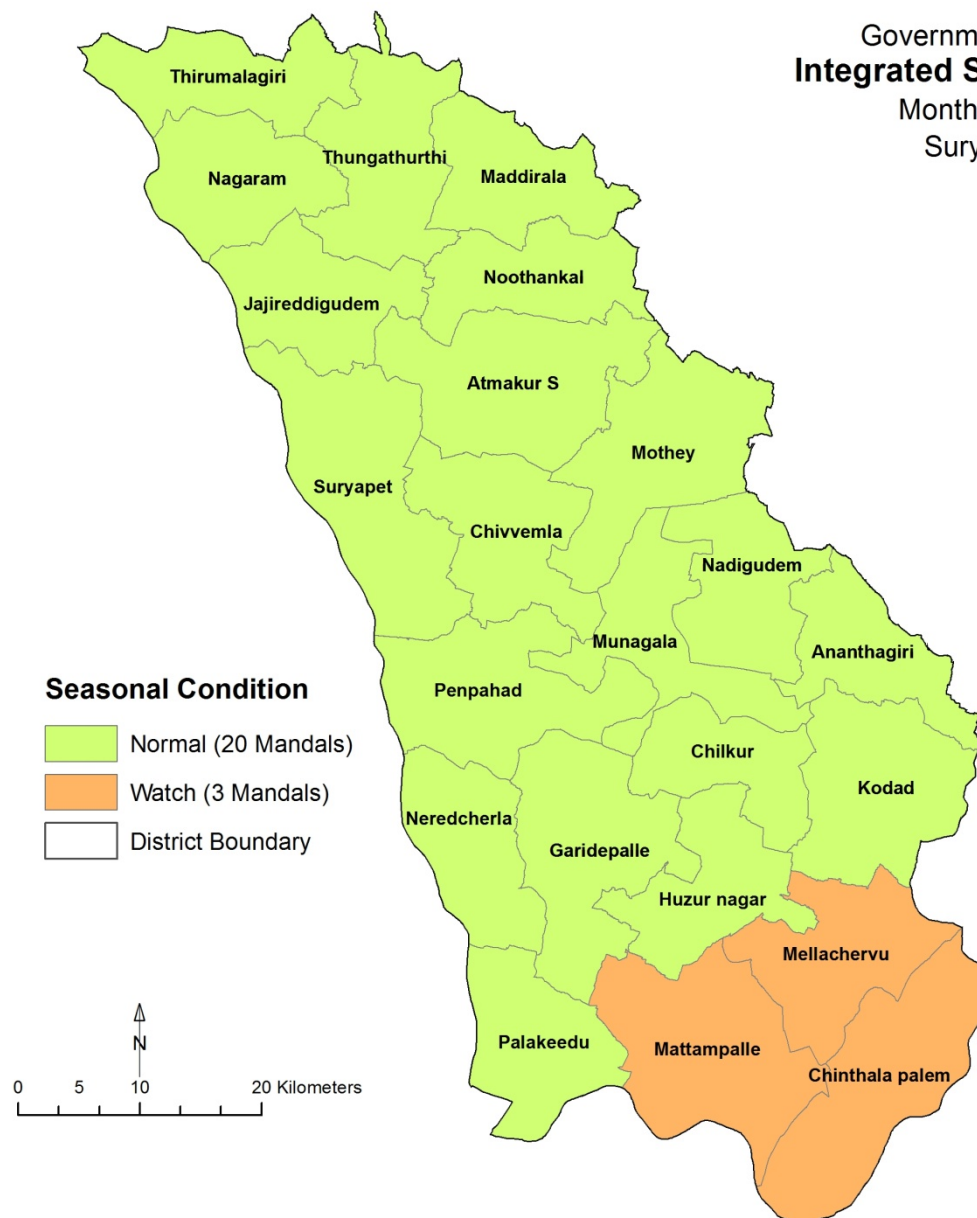


Government of Telangana  
**Integrated Seasonal Condition**  
 Month of June 2017  
 Siddipet District

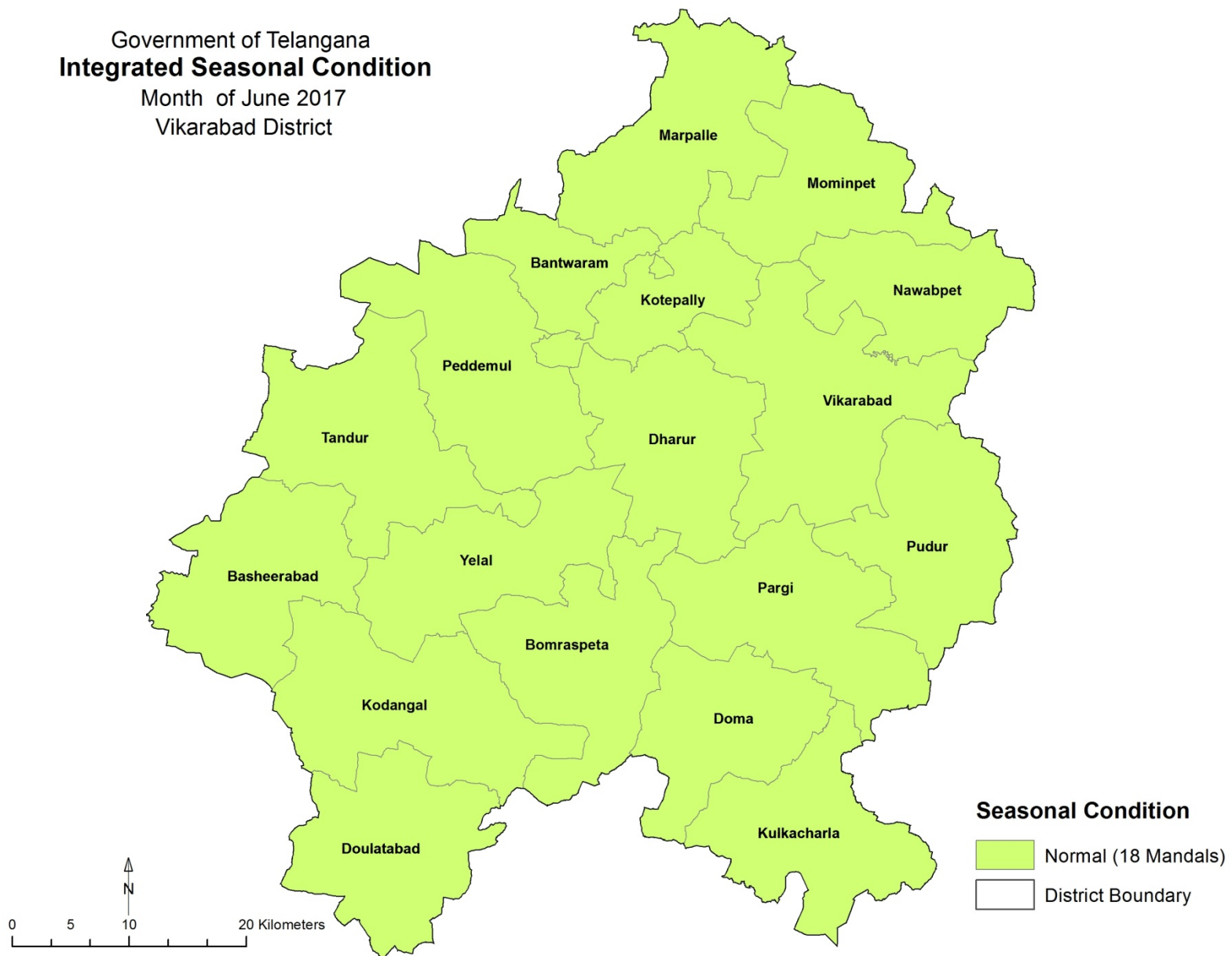




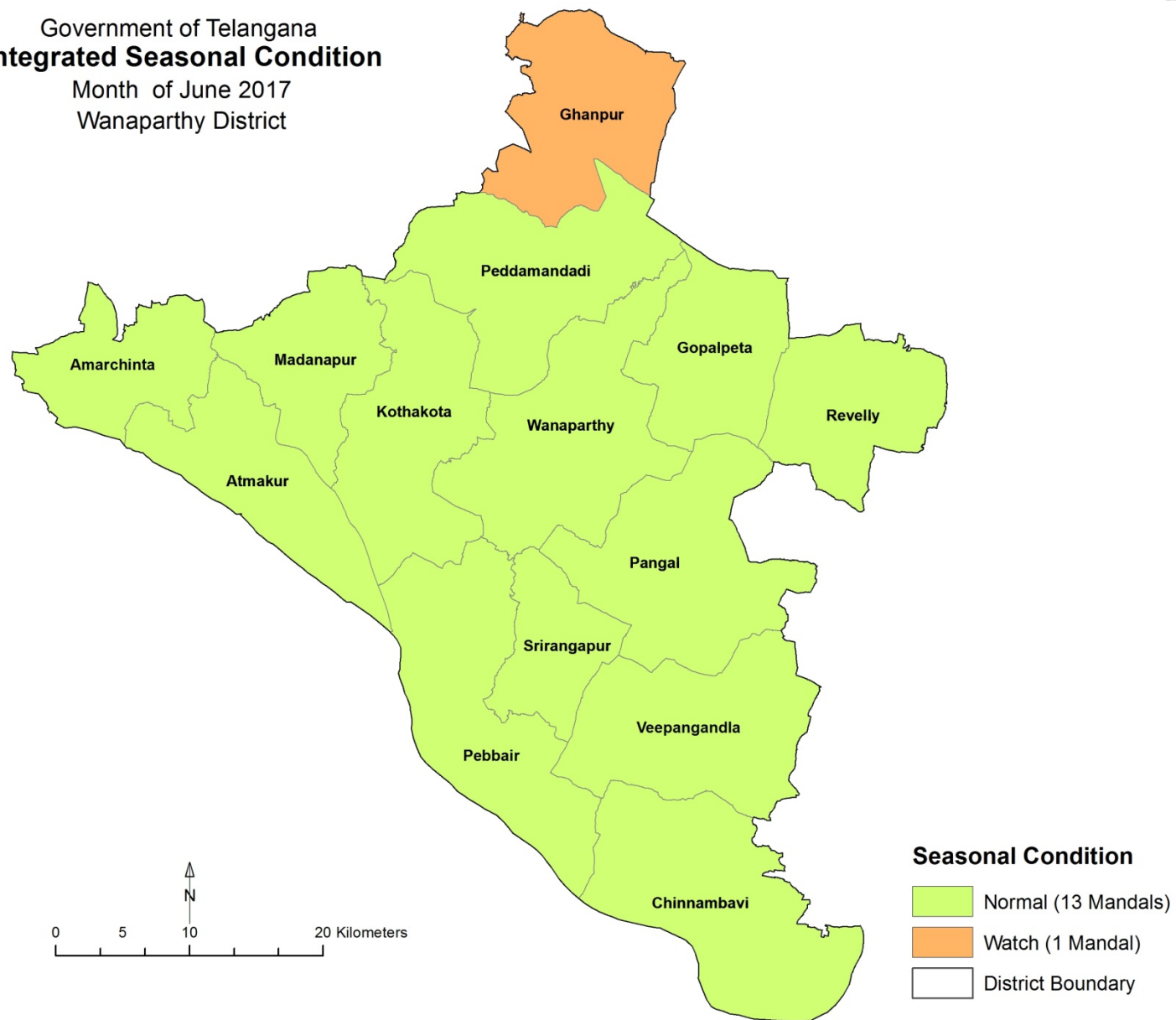
Government of Telangana  
**Integrated Seasonal Condition**  
 Month of June 2017  
 Suryapet District



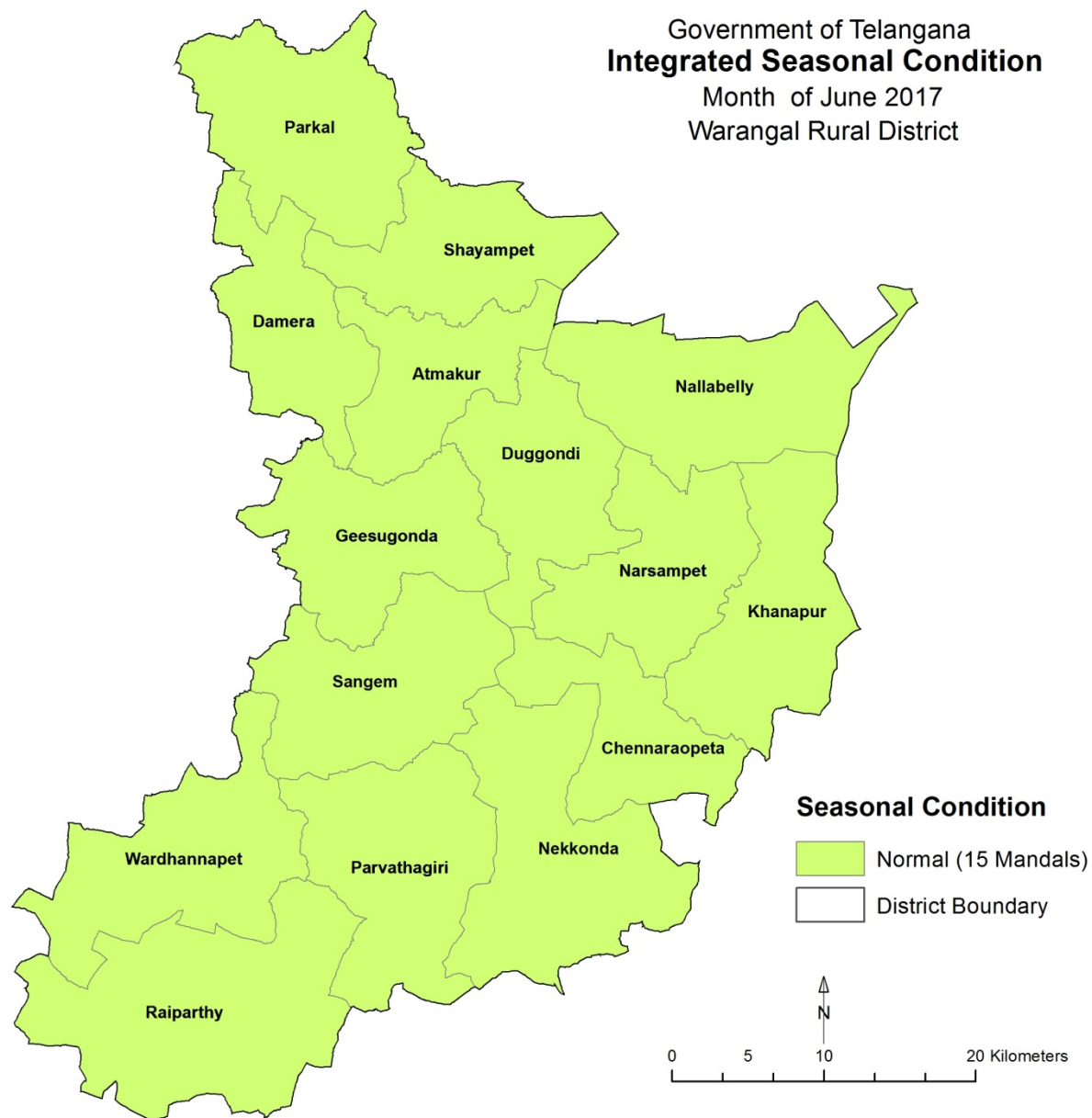
Government of Telangana  
**Integrated Seasonal Condition**  
 Month of June 2017  
 Vikarabad District



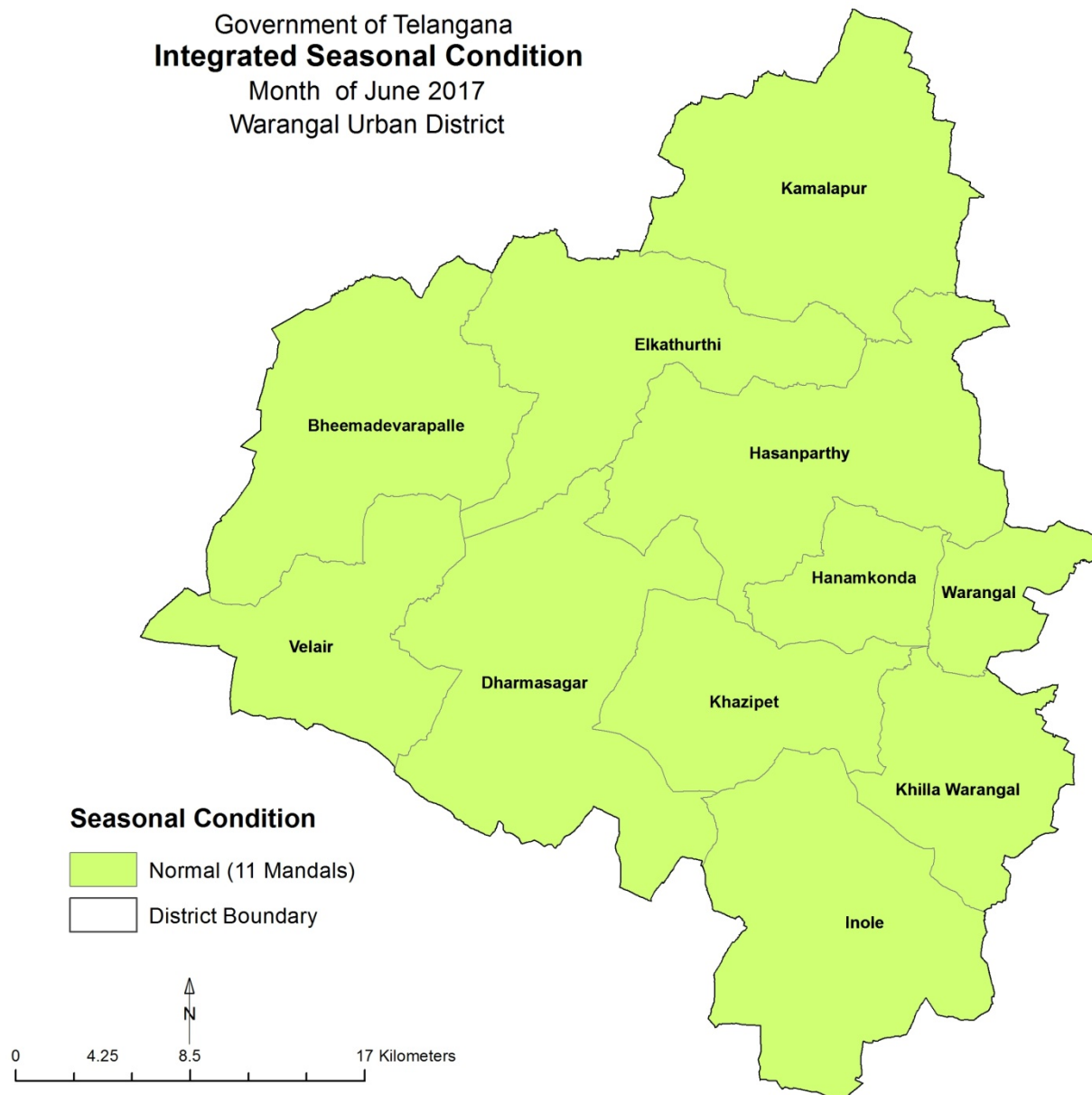
Government of Telangana  
**Integrated Seasonal Condition**  
Month of June 2017  
Wanaparthy District



Government of Telangana  
**Integrated Seasonal Condition**  
Month of June 2017  
Warangal Rural District



Government of Telangana  
**Integrated Seasonal Condition**  
Month of June 2017  
Warangal Urban District



Government of Telangana  
**Integrated Seasonal Condition**  
Month of June 2017  
Yadadri Bhuvanagiri District

