# Seasonal Condition (Agricultural Drought) Monitoring Telangana State





TELANGANA STATE REMOTE SENSING APPLICATIONS CENTRE Planning Department, Government of Telangana



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#### HIGHLIGHTS

# INTEGRATED SEASONAL CONDITION MONITORING SYSTEM (ISMS) - TELANGANA

# Cumulative Report June 01<sup>st</sup> to 15<sup>th</sup> September, 2019

- Seasonal condition is categorised as "Normal" in 320 Mandals as on date 15<sup>th</sup> September 2019
- Seasonal condition is categorised as "Mild" in 195 Mandals as on date 15<sup>th</sup> September 2019
- Seasonal condition is categorised as "Moderate" in 46 Mandals as on date 15<sup>th</sup> September 2019
- Seasonal condition is categorised as "Severe" in 28 Mandals as on date 15<sup>th</sup> September 2019



Seasonal Condition First Fortnight of September 2019

Rainfall from 1<sup>st</sup> June to 15<sup>th</sup> September 2019



Seasonal condition of Telangana First Fortnight of September 2019

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#### **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 2016 which suggested parameters like rainfall deficiency, area under sowing, NDVI, NDWI, Moisture Adequacy Index (MAI) and other indictors to declare drought. State Government monitor drought by obtaining information from various sources on key variables of drought which include rainfall, reservoir / lake water levels, surface water / groundwater, soil moisture and sowing / crop conditions etc. The key variables for monitoring drought in Telangana are:

- Meteorological Data Rainfall and other parameters like Temperature, Wind speed and Relative Humidity (AWS data)
- Weather forecast Short, medium, extended range
- Soil Moisture (Moisture Adequate Index)
- Sown Area / Crop Health / Stress
- Satellite based Vegetation Index (NDVI/NDWI)
- Stream Flow Discharge
- Groundwater Levels
- Reservoir and Lake Storage / Level
- Impacts distress sale and migration of cattle, human migration, fodder availability, drinking water, animal health, employment opportunities in agriculture sector

An extensive weather observation network of 1044 Automatic Weather Stations (AWS) is established in Telangana. Telangana State Development Planning Society (TSDPS) monitors the data and maintains the networks. Figure 1 showing the location of AWS stations in Telangana.



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 noncommand 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.

Duration	Condition	Description		
	Normal	Agricultural situation is normal		
		• Progress of agricultural situation is slow		
	Watch	• Ample scope for recovery		
July - August		• No external intervention needed		
		• Very slow progress of agricultural situation		
	Alart	• Need for intervention.		
	Alert	• Develop and implement contingency plans to		
		minimise loss		
	Mild	• Crops have suffered stress slightly		
	drought	• Crops have suffered stress slightly		
September -	Moderate	• Considerable loss in production.		
October drought		Take measures to alleviate suffering		
	Severe	• High risk significant reduction in crop yield		
		• Management measures to provide relief		

Table. 1. Classification of agricultural situation

### 1. 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
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Data source	Product	Indicators
MODIS (250/500m)	Surface reflectance	NDVI & NDWI
AWiFS	Surface reflectance	NDVI & NDWI
	Daily rainfall	Rainfall deviation
AWS/ DES	• Crop sown area	• Dry spells
	• Crop cutting experiments	Crop yield
Agriculture	Weekly sowing progress	District wise sown areas
Department, GoTS	weekly sowing progress	deviation from normal
Irrigation	Reservoir levels/ Water Command area Mandals	
Department, GoTS	release data	under canal irrigation

#### 2.2. Indicators and Index

#### 2.2.1. Rainfall data

In Telangana, South-West Monsoon is crucial for agriculture sector. ISMS use 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 2019' of Commissioner 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.

## 1.3 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  $\mu$ m (red) and 0.77-0.86  $\mu$ 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 First Fortnight of September 2019

#### 3.1. Vegetation index

The Normalized Difference of Vegetation Index (NDVI) for the First Fortnight of September 2019 is shown in the figures and also compared with 2018 and 2017. The year 2013 is treated as a normal year. Mandal wise NDVI, monthly agricultural situation for the year 2019, 2018 and 2017, deviation of NDVI w.r.t. 2013 are shown in the Figures 3, 4 and 5 respectively. As per NDVI deviation w.r.t normal moderate stress is observed in Jogulamba Gadwal, Nalgonda, Narayanpet, Suryapet, and Yadadri Bhongiri Districts.



Figure 3: NDVI - MODIS: First Fortnight of September 2019



Figure 4: NDVI - MODIS, Fortnightly agricultural situation from September 2019, 2018 and 2017



Figure 5: NDVI deviation (MODIS - 250m), First Fortnight of September 2019 w.r.t. 2013

#### 3.2. Surface wetness indicator

The map indicates status of moisture availability in soil as well as in crop canopy for the Month of August 2019. The year 2013 is treated as a normal year. Mandal wise Normalized Difference Water Index (NDWI) situation the year 2019, 2018 & 2017, Monthly agricultural situation deviation of NDWI w.r.t. 2013 are shown in the Figures 6, 7 and 8 respectively. As per NDWI deviation w.r.t normal, moderate stress is observed in few parts of Jogulamba Gadwal, Khammam, Mahabubnagar, Medak, Nagarkurnool, Nalgonda, Narayanpet, Rangareddy, Siddipet, Suryapet, and Wanaparthy Districts.



Figure 6: NDWI - MODIS: First Fortnight of September 2019



Figure 7: NDWI - MODIS, Fortnightly agricultural situation from September 2019, 2018 and 2017



Figure 8: NDWI deviation (MODIS - 250m), First Fortnight of September 2019 w.r.t. 2013



# 3.3. District Wise NDVI / NDWI / VCI Status

	NDVI/NDWI/VCI status as on 15/09/2019, Telangana							
S. No	District	NDVI Value	Average NDVI	NDWI Value	Average NDWI	VCI (NDVI)	VCI (NDWI)	VCI Condition
1	Adilabad	0.67	0.66	0.52	0.52	68.20	61.24	Normal
2	Bhadradri-							
	Kothagudem	0.53	0.54	0.45	0.44	60.84	64.95	Normal
3	Hyderabad	0.14	0.27	0.11	0.16	15.41	23.72	Moderate
4	Jagtial	0.64	0.64	0.56	0.51	71.86	91.24	Normal
5	Jangaon	0.69	0.61	0.53	0.44	98.21	92.82	Normal
6	Jayashankar- Bhupalpally	0.51	0.50	0.46	0.40	55.13	73.66	Normal
7	Jogulamba-Gadwal	0.39	0.38	0.23	0.21	60.22	52.34	Normal
8	Kamareddy	0.68	0.64	0.57	0.51	76.37	83.80	Normal
9	Karimnagar	0.70	0.61	0.57	0.48	98.83	97.24	Normal
10	Khammam	0.59	0.59	0.45	0.46	57.48	52.53	Mild
11	Komaram Bheem- Asifabad	0.45	0.55	0.41	0.45	37.54	47.46	Mild
12	Mahabubabad	0.63	0.62	0.49	0.47	61.53	57.44	Normal
13	Mahabubnagar	0.50	0.50	0.37	0.35	69.20	64.97	Normal
14	Mancherial	0.53	0.50	0.49	0.40	67.91	88.39	Normal
15	Medak	0.62	0.64	0.50	0.50	52.05	54.15	Mild
16	Medchal-Malkajgiri	0.43	0.50	0.29	0.34	39.10	30.91	Moderate
17	Mulugu	0.43	0.48	0.44	0.42	50.34	69.73	Normal
18	Nagarkurnool	0.48	0.46	0.33	0.29	65.49	63.62	Normal
19	Nalgonda	0.52	0.54	0.36	0.37	44.99	48.44	Mild
20	Narayanpet	0.50	0.42	0.34	0.27	82.99	76.10	Normal
21	Nirmal	0.62	0.57	0.51	0.46	82.20	79.74	Normal
22	Nizamabad	0.70	0.62	0.58	0.50	90.84	95.15	Normal
23	Peddapalli	0.62	0.56	0.54	0.45	78.47	97.73	Normal
24	Rajanna-Siricilla	0.68	0.61	0.56	0.47	83.85	96.68	Normal
25	Rangareddy	0.50	0.51	0.35	0.36	65.66	57.70	Normal
26	Sangareddy	0.58	0.57	0.47	0.44	71.14	73.41	Normal
27	Siddipet	0.67	0.63	0.49	0.47	75.29	64.59	Normal
28	Suryapet	0.53	0.58	0.45	0.45	33.26	60.39	Mild
29	Vikarabad	0.49	0.52	0.39	0.40	63.76	66.51	Normal
30	Wanaparthy	0.44	0.47	0.35	0.33	48.91	53.09	Mild
31	Warangal Rural	0.68	0.63	0.57	0.50	77.09	79.00	Normal
32	Warangal Urban	0.68	0.61	0.54	0.46	97.86	92.49	Normal
33	Yadadri-Bhongir	0.63	0.59	0.46	0.41	73.19	71.75	Normal

Table. 3 District wise NDVI / NDWI / VCI Status

\*Normalized Difference Vegetative Index (NDVI) Value - Current year NDVI
\*Normalized Difference Wetness Index (NDWI) Value - Current year NDWI
\*Average NDVI - Average of previous 16 years NDVI
\*Average NDVI - Average of previous 16 years NDWI
\*VCI (NDVI) - Vegetation Condition Index based on NDVI
\*VCI (NDWI) - Vegetation Condition Index based on NDWI
\*NDVI/NDWI Condition - VCI>=60 (Normal), VCI>=40 (Mild), VCI>=20 (Moderate), VCI



### 3.4. Rainfall data

The status of rainfall as on 15<sup>th</sup> September 2019 is shown in Table.4.

- 4 Mandals (1%) of the state received Large Excess (+60% and above) rainfall.
- 60 Mandals (10%) of the state received Excess (+20% to +59%) rainfall.
- **363** Mandals (**62%**) have received **Normal** (+19% to -19%) rainfall.
- 158 Mandals out of 589 (27%) of state received Deficient (-20% to -59%) rainfall.
- 4 Mandals (1%) of the state received Large Deficient (-60% to -99%) rainfall.

S. No	District Name	Large Excess	Excess	No Rain	Normal	Deficient	Large Deficient	Total
1	Adilabad				11	7		18
2	Bhadradri Kothagudem		5		14	4		23
3	Hyderabad				6	10		16
4	Jagtial		1		15	2		18
5	Jangoan	1			7	3	1	12
6	Jayashankar Bhupalpally		3		8			11
7	Jogulamba Gadwal				8	4		12
8	Kamareddy		3		17	2		22
9	Karimnagar	1	2		12	1		16
10	Khammam		1		6	14		21
11	Kumurambheem Asifabad	1	4		10			15
12	Mahabubabad		1		11	4		16
13	Mahabubnagar		3		10	2		15
14	Mancherial				13	5		18
15	Medak		4		12	4		20
16	Medchal Malkajgiri				9	6		15
17	Mulugu		5		4			9
18	Nagarkurnool	1	1		13	5		20
19	Nalgonda				13	16	2	31
20	Narayanpet		2		9			11
21	Nirmal				11	8		19
22	Nizamabad		8		20	1		29
23	Peddapalli		2		8	4		14
24	Rajanna Sircilla		2		11			13
25	Rangareddy				18	9		27
26	Sangareddy				17	9		26
27	Siddipet		3		18	2		23
28	Suryapet				6	17		23
29	Vikarabad		1		11	6		18
30	Wanaparthy		4		9	1		14
31	Warangal Rural				14	2		16
32	Warangal Urban		5		6			11
33	Yadadri Bhongir				6	10	1	17
	Total	4	60		363	158	4	589

# Table. 4. Rainfall status as on 15<sup>th</sup> September 2019

SOURCE: DE&S





Figure 9: Deviation of rainfall in percent w.r.t. normal from September 01<sup>st</sup> to September 07<sup>th</sup>, 2019

Integrated Seasonal Condition Monitoring System (Month of August, 2019)





Figure 10: Deviation of rainfall in percent w.r.t. normal from September 08<sup>th</sup> to September 15<sup>th</sup>, 2019

Integrated Seasonal Condition Monitoring System (Month of August, 2019)



Figure 11: Deviation of rainfall in percent w.r.t. normal from June 01<sup>st</sup> to September 15<sup>th</sup>, 2019

Integrated Seasonal Condition Monitoring System (Month of August, 2019)

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#### 3.5. Dry Spell

A dry spell is a short period, usually 4 weeks (up to 3 weeks in case of light soils), of low rainfall or no rainfall. Thus, consecutive 3-4 weeks after the due date for the onset of monsoon with rainfall less than 50% of the normal in each of the weeks is defined as a Dry spell. In State **175** Mandals experienced **one dry spell, 40** Mandals experienced **two dry spell** up to Month of August, 2019. The distribution of the Mandals under dry spell category is shown in Figure: 12 and Table 5.

15 Mandals in the state have recorded one dry spell with excess rainfall, 92 Mandals in the state have recorded one dry spell with Normal rainfall, 2 Mandals have recorded one dry spell with large deficient rainfall, 65 Mandals have recorded one dry spell with deficient rainfall.

*9* Mandals have recorded two dry spell with normal rainfall, *1* Mandal have recorded two dry spell with large deficient rainfall, *29* Mandals have recorded two dry spell with deficient rainfall. (Figure: 13).



Figure 12: Dry spells from June 01st to September 15th, 2019





Figure 13: Dry spells With Rainfall Status from June 01st to September 15th, 2019



# Table 5. Mandal wise Dry Spells

District Name	One Dry Spell (175)	Two Dry Spell (40)
Adilabad	<b>Total: 08</b> Adilabad Rural, Bazarhathnoor, Bela, Bheempoor, Boath, Gudihathnur, Talamadugu, Tamsi.	Total: 07 Adilabad Urban, Ichoda, Inderavelly, Mavala, Neradigonda, Sirikonda, Utnur.
Bhadradri Kothagudem	<b>Total: 06</b> Annapureddipalle, Aswapuram, Dummugudem, Karakagudem, Manuguru, Mulakalapalle.	<b>Total: 04</b> Chandrugonda, Gundala, Julurpad, Sujathanagar.
Hyderabad	<b>Total: 02</b> Bahadurpura, Bandlaguda.	
Jagtial	<b>Total: 02</b> Buggaram, Gollapalle.	
Jangaon	<b>Total: 02</b> Kodakandla, Lingalaghanpur.	<b>Total: 02</b> Chilpur, Tharigoppula.
Jogulamba	<b>Total: 04</b> Dharur, Gadwal, Kaloor Timmanadoddi, Maldakal.	
Jayashankar Bhupalpally	<b>Total: 04</b> Kataram, Mahadevpur, Mutharam Mahadevpur, Palmela.	
Kamareddy	<b>Total:06</b> Banswada, Domakonda, Jukkal, Machareddy, Madnur, Nasurullabad.	<b>Total: 01</b> Pedda Kodapgal.
Karimnagar	<b>Total: 02</b> Gangadhara, Ramadugu.	
Khammam	<b>Total: 12</b> Enkuru, Kamepalle, Khammam Urban, Kusumanchi, Mudigonda, Nelakondapalle, Raghunadhapalem, Sathupalle, Singareni, Thirumalayapalem, Vemsoor, Yerrupalem.	<b>Total: 03</b> Bonakal, Madhira, Penuballi.
Komaram Bheem	<b>Total: 07</b> Bejjur, Dahegaon, Jainoor, Lingapur, Penchikalpet, Sirpur T, Sirpur U.	
Mahabubabad	<b>Total: 05</b> Danthalapalle, Garla, Gudur, Narsimhulapet, Peddavangara.	<b>Total: 01</b> Nellikudur.
Mahabubnagar	<b>Total: 03</b> Balanagar, Koilkonda, Musapet.	
Mancherial	<b>Total: 15</b> Bellampalle, Bheemini, Bhimaram, Chennur, Hajipur, Jaipur, Kannepalli, Kasipet, Kotapalle, Mandamarri, Naspur, Nennal, Tandur, Vemanpalle.	
Medak	<b>Total: 03</b> Kowdipalle, Narsingi, Tekmal.	Total: 01 Narsapur.
Medchal Malkajgiri	Total: 01 Medchel.	
Mulugu	<b>Total: 04</b> Eturunagaram, Kannaigudem, Tadvai, Wazeed.	



Nagarkurnool	Total: 02	
_	Urkonda, Vangoor.	
<b>X</b> Y <b>X</b>		
Nalgonda		Total: 05
	Adavi devula palli, Gurrampode, Kattangoor, Kondamallapally,	Anumula Haliya,
	Marriguda, Nakrekal, Nidamanur, Saligouraram, Thipparthi,	Chityala,
	l irumalagiri Sagar.	Neredugommu,
		Vemulanelle
Niume al	Tatal 07	Vennulapane.
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	Kotairi Makloor Mugnal Munkal Nizamahad North	Mizailiauau Kurai.
	Nizamabad South Rudrur, Sirkonda Vailnur Varni	
Peddanalli	Total: 02	
reduapam	Antargoan Manthani	
Rajanna Sircilla	Total: 03	
	Boinpalle, Mustabad, Vemulawada.	
Rangareddy	Total: 07	Total: 01
Itangui cuuj	Faroognagar, Gandipet, Kandukur, Madgul, Raiendranagar.	Shankarpalle.
	Shamshabad, Talakondapalle.	
Sangareddy	Total: 06	Total: 01
,	Jinnaram, Manoor, Nagalgidda, Naykal, Patancheruvu,	Zahirabad.
	Sirgapoor.	
Siddipet	Total: 04	
	Bejjanki, Jagadevpur, Komaravelly, Maddur.	
Survapet	Total: 13	Total: 04
v I	Atmakur S, Chilkur, Chinthala palem, Jajireddigudem,	Ananthagiri, Huzur
	Maddirala, Mellachervu, Munagala, Nadigudem, Nagaram,	nagar, Kodad,
	Neredcherla, Noothankal, Suryapet, Thirumalagiri.	Penpahad.
Vikarabad	Total: 05	Total: 01
	Kulkacharla, Mominpet, Nawabpet, Pargi, Pudur.	Marpalle.
Wanaparthy	Total: 02	
	Amarchinta, Atmakur.	
Warangal Rural	Total: 04	
	Duggondi, Geesugonda, Nekkonda, Sangem.	
Yadadri Bhongir	Total: 08	Total: 04
	Addagudur, Bhongiri, Gundala, Mootakondur, Mothkur,	Atmakur M,
	Narayanapur, Rajapet, Yadagirigutta.	Bibinagar,
		Bommalaramaram,
		Choutuppal.



#### 3.6. Drought situation of Mandals

#### 3.6.1 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, Mild, Moderate and Severe. Mandal wise analysis for the First Fortnight of September 2019 indicated Normal agricultural situation in **320** Mandals. The agricultural situation is categorized as Mild in **195**, Moderate in **46** and Severe in **28** Mandals. The Mandals under Mild, Moderate and Severe categories are given in the Table.6 and their spatial distribution is shown in Figure 14.



Figure 14: Mandal wise drought assessment based on ISMS criterion



<b>District Name</b>	Mild(195)	Moderate(46)	Severe(28)
Adilabad	Total: 13	Total: 04	Total: 01
	Bela, Bheempoor, Boath, Mavala, Sirikonda,	Bazarhathnoor, Ichoda,	Utnur.
Bhadradri	Total: 08	Total: 04	Total: 03
Kothagudem	Bhadrachalam, Burgampadu, Chunchupally,	Annapureddipalle,	Chandrugonda,
8	Kothagudem, Laxmidevipally, Manuguru,	Aswapuram,	Julurupad,
	Mulakalapally, Palvancha.	Dummugudem, Gundala.	Sujathanagar.
Jagtial	Total: 05		
	Saranganur		
Jangaon	Total: 01	Total: 01	Total: 01
g	Kodakandla.	Tharigoppula.	Chilpur.
Jayashankar	Total: 02	Total: 01	
Bhupalpally	Mahadevpur, Mutharam Mahadevpur.	Palmela.	
Jogulamba	Total: 10		Total: 01
Gadwal	Kaloor Thimmandoddi Maldakal Manonad		Gauwai.
	Rajoli, Undavelly.		
Kamareddy	Total: 03		Total: 01
	Nasurullabad, Pedda Kodapgal, Yellareddy.		Banswada.
Karimnagar	Total: 01		
Vhammam	Ramadugu.	Total. 07	Total: 02
Кпаннаш	Kalluru, Kamepally, Kusumanchi, Mudigonda,	Enkoor, Thallada.	Bonakal, Madhira.
	Nelakondapally, Raghunadhapalem, Sathupally,		Penuballi.
	Singareni, Tirumalayapalem, Vemsoor, Wyra,		
17	Yerrupalem.		
Komaram Bheem	Iotal: 08 Beijur, Chintalamanenally, Dahegaon		
Directii	Kouthala, Lingapur, Penchikalpet, Sirpur T,		
	Sirpur U.		
Mahabubabad	Total: 04	Total: 01	
	Bayyaram, Dornakal, Garla, Kesamudram,	Garla.	
	Nellikudur		
Mahabubnagar	Total: 13	Total:01	
	Addakal, Balanagar, Bhoothpur, Chinna , hinta	Koilkonda.	
	Kunta, Gandeed, Hanwada, Jadcherla,		
	Manabubhagar Kural, Manabubhagar Urban, Midiil Moosapet Nawahpet Rajapur		
Mancherial	Total: 10		
	Bheemaram, Bheemini, Chennur, Hajipur,		
	Jaipur, Jannaram, Kannepalli, Kasipet,		
Mall	Kotapalle, Vemanpalle.		
Wiedak	10tal: 0/ Chilinched Kowdinally Kulcharam Narsanur		
	Narsingi, Papannapet, Tekmal.		
Medchal	Total: 05	Total:01	
Malkajg	Alwal, Ghatkesar, Kapra, Kukatpally,	Malkajgiri.	
	Quthbullapur.		

# Table.6. Mandals under Mild, Moderate and Severe category based on ISMS criteria



Mulugu	<b>Total: 04</b> Eturnagaram, Kannaigudem, Tadvai, Sammakka Sarakka) Wazeed			
Nagarkurnool	<b>Total: 12</b> Bijinapalle, Charakonda, Kalwakurthy, Kodair, Kollapur, Padara, Peddakothapalle, Pentlavelli, Telkapalle, Thimmajipeta, Uppunuthala, Veldanda.	<b>Total: 05</b> Amrabad, Balmoor, Lingal, Urkonda, Vangoor.		
Nalgonda	<b>Total:15</b> Chandur, Chinthapally, Devarakonda, Gundlapally, Kanagal, Kattangur, Kethepally, Madugulapally, Munugode, Nakrekal, Nalgonda, Nidamanoor, Peda , disharla Palli, Tipparthy, Tirumalagiri Sagar.	Total: 07 Chityal, Damaracherla, Gurrampode, Kondamallapally, Marriguda, Shaligouraram, Vemulapally.	Total: 06 Adavidevulapally, Anumula Haliya, Nampally, Neredugommu, Peddavoora, Tripuraram.	
Narayanpet	<b>Total:06</b> Dhanwada, Kosgi, Maddur, Makthal, Marikal, Narva.			
Nirmal	<b>Total:07</b> Dilawarpur, Khanapur, Kuntala, Laxmanchanda, Nirmal Rural, Pembi, Sarangapur.	<b>Total: 02</b> Kaddampeddur, Narsapur G.	Total: 01 Kubeer.	
Peddapalli	<b>Total: 03</b> Anthergaon, Manthani, Mutharam Manthani.			
Rangareddy	<b>Total: 11</b> Abdullapurmet, Chevella, Chowdergudem, Keshampeta, Kondurg, Kothur, Manchal, Moinabad, Shabad, Shamshabad, Talakondapally.	<b>Total: 03</b> Farooqnagar, Gandipet, Madgul.	<b>Total: 01</b> Shankarpalle.	
Sangareddy	<b>Total: 08</b> Ameenpur, Hathnoora, Jinnaram, Nyalkal, Patancheruvu, Ramachandrapuram, Sadasivpet, Sirgapoor.		<b>Total: 01</b> Zahirabad.	
Siddipet	<b>Total: 01</b> Jagdevpur.			
Suryapet	<b>Total: 08</b> Chilkur, Garidepalli, Maddirala, Mellachervu, Nadigudem, Nagaram, Noothankal, Thungathurthy.	<b>Total: 07</b> Ananthagiri, Huzur nagar, Mattampalli, Munagala, Nereducherla, Palakeedu, Suryapet.	<b>Total: 03</b> Chinthala palem, Kodad, Penpahad	
Vikarabad	<b>Total: 08</b> Bommaraspeta, Dharoor, Doma, Kotepally, Mominpet, Peddemul, Tandur, Yelal.	Total: 01 Vikarabad.	<b>Total: 05</b> Kulkacharla, Marpalle, Nawabpet, Pargi, Pudur.	
Wanaparthy	<b>Total: 11</b> Ghanpur, Gopalpet, Kothakota, Madanapur, Pangal, Pebbair, Peddamandaddi, Revally, Srirangapur, Wanaparthy, Weepangandla.	<b>Total: 02</b> Amarchintha, Atmakur.		
Yadadri- Bhongir	<b>Total: 06</b> Bibinagar, Bommalaramaram, Gundala, Narayanapoor, Ramannapet, Yadagirigutta.	<b>Total: 04</b> Addagudur, Athmakur (M), Motakondur, Mothkur.	Total: 01 Choutuppal.	



#### 3.7. Reservoir water levels

All the major reservoirs are holding 1074TMC as on 15-09-2019 and as on date last year the level had stood at 1012 TMC. The details of water levels of all major reservoirs as on 15-09-2019 are furnished hereunder in Table.7.

PARTICULARS OF MAJOR RESERVOIRS AS ON 15/ September /2019										
SI No	Reservoir Name	Time	FRL	Gross Capacity	THIS YEAR			LAST YEAR		
								As on		
					As on 15 / September / 2019			15 / September /		
								2018		
			(feet) (TMC)		Level	Gross	Inflow	Outflow	Loval	Gross
				Storage	IIIIOw	Outilow	Level	Storage		
					(in feet)	(TMC)	(Cusecs)	(Cusecs)	(in feet)	(TMC)
Krishna Basin										
1	Almatti	09:30	1705	129.721	1704.69	128.01	113122	30657	1704.66	127.83
2	Jurala	09:32	1045	9.657	1044.62	9.42	199337	194140	1044.88	9.583
3	Nagarjunasagar	09:33	590	312.045	589.5	310.551	217262	199970	586.1	300.84
4	Narayanapur	09:31	1615	37.646	1614.14	36.96	45971	30651	1612.43	34.12
5	Srisailam	09:33	885	215.807	884.8	214.36	304033	298462	877.3	174.7
6	Tungabhadra	09:32	1633	100.86	1633	100.86	28892	28892	1631.52	95.24
7	Ujjaini	09:31	1630	117.24	1630	117.24	53241	53580	1630	117.24
Godavari Basin										
8	Jaikwad	09:35	1522	102.732	1521.84	102.05	15753	3060	1510.48	61.34
9	Kaddam	09:37	700	7.6	697.55	6.98	873	873	697.93	7.07
10	Lower Manair Dam	09:37	920	24.074	905.2	13.164	3784	275	892.05	6.76
11	Nizam sagar	09:36	1405	17.803	1381.9	1.69	213	37	1383.84	2.14
12	Singur	09:35	1717.93	29.91	1670.23	0.42	0	30	1696.34	7.24
13	Sri Ram Sagar	09:36	1091	90.313	1073.2	32.68	10401	554	1085.4	68.113

Source: Irrigation Department, Hyderabad



#### **3.8. Crop Sowing Progress**

For the end of 11<sup>th</sup> September 2019, the total area sown in the state is **4234097** ha as against the normal sown area of **4334487** hectare as on date. The details are shown in Figure 15 and the deviation graph is shown in Figure 16.



Figure 15: District wise deviation from normal crop sown area as on date 11-09-2019

S. No	District Name	Normal (ha)	Actual (ha)	Deviation %
1	Medchal Malkajgiri	7183	5935	-17.37
2	Jangaon	107473	89097	-17.10
3	Mahabubabad	120876	100284	-17.04
4	Nagarkurnool	216703	179915	-16.98
5	Khammam	230498	197729	-14.22
6	Medak	83373	71797	-13.88
7	Rangareddy	167894	145196	-13.52
8	Siddipet	195839	173388	-11.46
9	Warangal Rural	138259	123671	-10.55
10	Mulugu	54281	48656	-10.36
11	Sangareddy	224132	203401	-9.25
12	Vikarabad	172153	156553	-9.06
13	Jogulamba Gadwal	133468	122629	-8.12
14	Yadadri Bhuvanagiri	123426	113874	-7.74
15	Mahabubnagar	117368	108920	-7.20
16	Jayashankar Bhupalpally	85228	79155	-7.13
17	Bhadradri Kothagudem	124651	119494	-4.14
18	Suryapet	157521	152137	-3.42
19	Warangal Urban	55790	54135	-2.97
20	Nalgonda	335088	330144	-1.48
21	Jagtial	119149	123194	3.39
22	Hyderabad	0	0	0.00
23	Adilabad	193072	194308	0.64
24	Wanaparthy	80405	84158	4.67
25	Nizamabad	169540	178310	5.17
26	Peddapalle	85953	90672	5.49
27	Kumarambheem Asifabad	124465	137857	10.76
28	Karimnagar	111169	124833	12.29
29	Rajanna Sircilla	76626	88166	15.06
30	Nirmal	145982	169658	16.22
31	Mancherial	94260	114723	21.71
32	Narayanpet	137387	168028	22.30
	Total	4334487	4234097	

Table 8: District Wise Crop Sowing Area - Up to the week ending 11-09-2019



Figure 16: District wise deviation (graph) from normal crop sown area as on date 11-09-2019



### 4. References

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