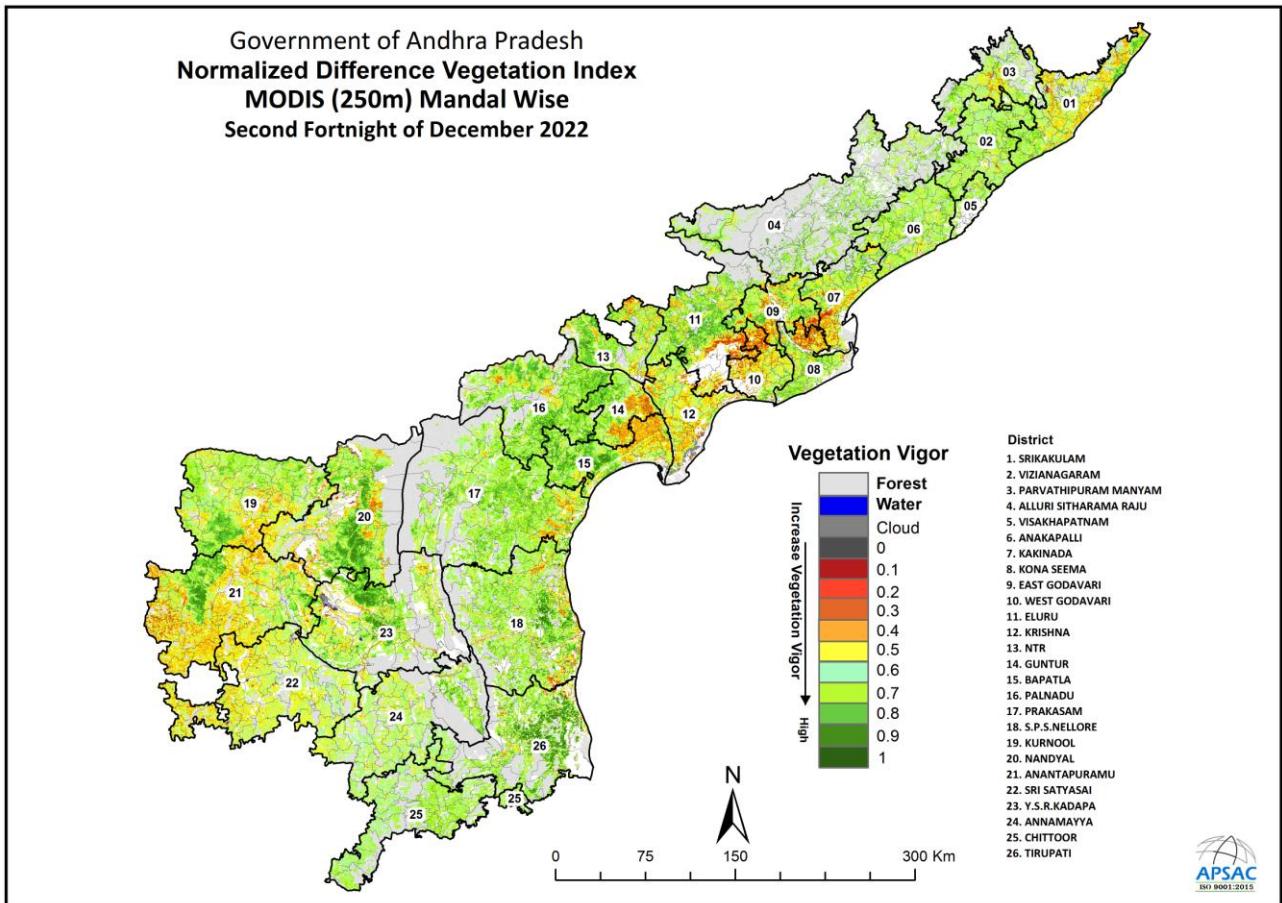




Technical Report: Drought Monitoring

**Remote sensing Indicators (NDVI, NDWI and VCI) for Drought Declaration in Andhra Pradesh State
up to 2nd FN December 2022 (Rabi Season)**



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Background

Advancements in satellite remote sensing technology has enabled regular monitoring of crop conditions/vigour over large regions. Among the various spectral vegetation indices commonly derived from remote sensing data, Normalized Difference Vegetation Index (NDVI) is most widely used for operational assessment of drought owing to the ease in calculation and interpretation and also its ability to partially compensate for the effects of atmosphere, illumination geometry etc. NDVI is derived using the formula $(\text{NIR} - \text{Red}) / (\text{NIR} + \text{Red})$, where NIR and Red are the reflectance in visible and near infrared channels. Water, clouds and snow have higher reflectance in the visible region and consequently NDVI assumes negative values for these features. Bare soil and rocks exhibit similar reflectance in both visible and near IR regions and the index values are near zero. The NDVI values for vegetation generally range from 0.2 to 0.6, the higher index values being associated with greater green leaf area and biomass. 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 12 cm. As the crop growth progresses, SWIR becomes sensitive to leaf moisture content. SWIR band provides only surface wetness information. Normalized Difference Wetness Index (NDWI), computed using SWIR data, can complement NDVI for drought assessment particularly in the beginning of the cropping season. NDWI is derived as follows: $\text{NDWI} = (\text{NIR}-\text{SWIR}) / (\text{NIR}+\text{SWIR})$ where, NIR and SWIR are the reflected radiation in Near Infrared and Shortwave Infrared channels. Higher values of NDWI signify more surface wetness. Satellite based crop condition anomalies which point towards agricultural drought can be generated by computing Vegetation Condition Index (VCI) of NDVI and VCI of NDWI. While combining VCI of NDVI and NDWI, the minimum of two values can be taken, i.e. if at least one is in Severe category, the category will be considered as Severe. If at least one is moderate then category will be taken as moderate (**As per the Drought manual:2016 and amendments**). Fortnightly (FN) NDVI, NDWI and VCI status is being generated and submitted to Andhra Pradesh State Disaster Management Authority and Revenue (DM) department for monitoring and Declaration of drought at mandal level in the state of Andhra Pradesh.

VCI Value (%)	Vegetation Condition	Description
60-100	Normal	Crop condition is Normal
40-60	Moderate	Crop condition is Moderate
0-40	Severe	Crop condition is Severe

The 26 districts of Andhra Pradesh have 679 mandals. It is identified that 396 mandals are in Normal, 96 mandals Moderate, and 175 mandals are in a severe category. The 12 mandals are excluded from the vegetation condition assessment as these mandals under predominantly urban or forest cover. The status of indicators at the district and mandal level are shown in Table 1 and Table 2 respectively.

Table 1: District wise number of Mandals under Normal, Moderate and Severe up to 2nd FN December 2022.

Sno.	District	No. of Mandals	VCI		
			Normal	Moderate	Severe
1	A. Sitharama Raju	22	16	2	4
2	Anakapalli	24	10	10	4
3	Anantapuramu	31	27	2	2
4	Annamayya	30	30	0	0
5	Bapatla	25	8	5	12
6	Chittoor	31	29	0	2
7	East Godavari	19	2	5	12
8	Eluru	28	9	2	17
9	Guntur	18	4	5	8
10	Kakinada	21	1	6	14
11	Kona Seema	22	2	6	14
12	Krishna	25	1	5	19
13	Kurnool	26	21	2	2
14	Manyam	15	3	4	8
15	Nandyal	29	21	4	3
16	NTR	20	5	7	4
17	Palnadu	28	16	6	6
18	Prakasam	38	32	1	5
19	S.P.S.Nellore	38	32	4	1
20	Sri Satyasai	32	32	0	0
21	Srikakulam	30	3	4	23
22	Tirupati	34	33	1	0
23	Visakhapatnam	11	7	0	0
24	Vizianagaram	27	17	10	0
25	West Godavari	19	3	3	13
26	Y.S.R.Kadapa	36	32	2	2
Grand Total		679	396	96	175

***Note:**

- Twelve urban mandals are excluded from the vegetation condition assessment.
- The excluded mandals are as follows: Visakhapatnam (Seethammadhara, Maharanipeta, Gopalapatnam, Mulagada), NTR (Vijayawada North, Vijayawada East, Vijayawada Central, Vijayawada West), Guntur (Guntur urban), Kurnool (Kurnool urban), Nandyal (Srisailam) and S.P.S Nellore (Nellore urban).

dmcode	DISTRICT	MANDAL	NDVI						NDWI						Final Status
			fn2 Dec 22	Avg.	Max	Min	VCI	NDVI Status	fn2 Dec 22	Avg.	Max	Min	VCI	NDWI Status	
2629	Tirupati	Buchinaidu Kandriga	0.69	0.60	0.69	0.48	98.6	Normal	0.48	0.40	0.48	0.22	100.0	Normal	Normal
2630	Tirupati	Varadalahpalem	0.69	0.62	0.70	0.50	93.2	Normal	0.50	0.43	0.51	0.25	95.7	Normal	Normal
2631	Tirupati	Tada	0.61	0.54	0.62	0.41	97.6	Normal	0.51	0.44	0.51	0.27	100.0	Normal	Normal
2632	Tirupati	Satyavedu	0.62	0.58	0.64	0.51	83.8	Normal	0.40	0.35	0.43	0.23	87.9	Normal	Normal
2633	Tirupati	Nagalapuram	0.69	0.64	0.69	0.58	100.0	Normal	0.49	0.42	0.49	0.34	98.6	Normal	Normal
2634	Tirupati	Pichatur	0.64	0.58	0.64	0.53	100.0	Normal	0.42	0.35	0.42	0.26	100.0	Normal	Normal

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