

Status of JECAM Site: India- Dharwad



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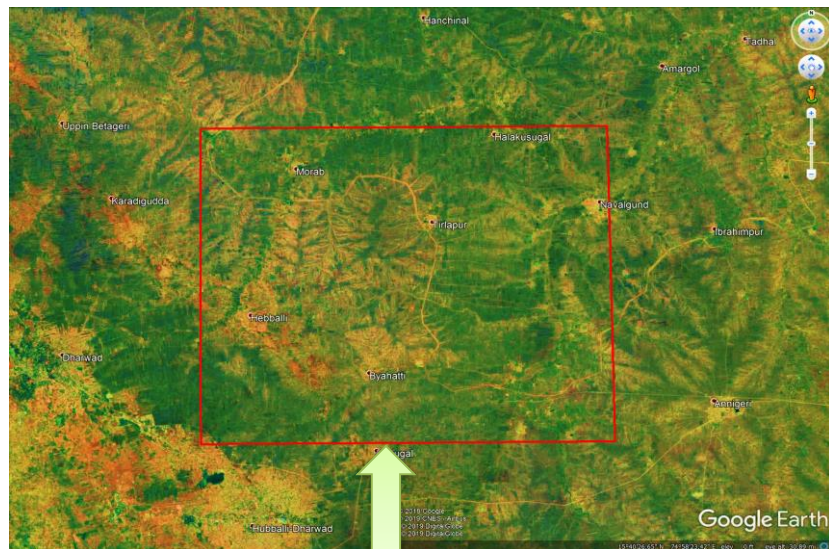
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Site Description



Study site in Tirlapur, Dharwad District of Karnataka State

Area Of Site	Approx. 642 sq. km
Location	Part of Dharwad District (Karnataka) Lon/Lat of Centroid of Site - 75.230, 15.505
Landscape	i. Semi Malnad, Eastern Maidan.
Typical Field Size	1-10 Ha.
Climatic And Weather	Northern Transitional Zone and Dry Zone
Major Crops And Calendars	i. Kharif Rice –June to October ii. Jowar- May/July to September/December iii. Cotton- May/July to December/April iv. Maize-May/August-September/Decemebtr v. Green Gram- May/August-October/December vi. Soybean vii. Rabi Jowar-September/October-January/March viii. Wheat-October/December-January/March
Soil Type & Texture	Black Cotton soil, Loamy & Kankery soil at river banks
Soil Drainage	The district is drained by two major rivers: Malaprabha and Tungabhadra, with the main tributaries such as Bennihalla, Varada and Kumudvati.
Irrigation Infrastructure	Canal, Tanks, Open Wells, Bore wells

Project Objectives

- i. Evaluation of various Drought indicators (meteorological and remote sensing based)
- ii. Development of a composite drought index
- iii. Validation of soil moisture estimations
- iv. Development of protocol for crop loss assessment

Technical work done/to be done

- Month wise report of Drought assessment
- Monthly soil moisture verification
- Inter-comparison of various drought indices
- Composite Drought Indicators
- Protocol for Crop Loss Assessment

Data Used

Agricultural Drought was assessed up to sub-district level. To assess drought , the methodology mentioned in Government of India Drought Manual was followed

**Key Variable, Indicators and source of Data
for drought monitoring**

Sl.No.	Key Variables	Indicators/Index	Source of Data/Product
1.	Rainfall	Rainfall Deviation/Dry Spell	NOAA CPC ((0.1 x 0.1 degree)
2.	Crop Sown Area	Deviation from Normal	Resourcesat-2 AWiFS (56m)/MODIS-Terra (MOD13Q1)
3.	Satellite Based Crop Condition	NDVI, NDWI Deviation from Normal VCI of NDVI/NDWI	Resourcesat-2 AWiFS (56m)/MODIS-Terra (MOD13Q1, 250m)
4.	Soil Moisture	Soil Moisture Index- Percent Available Soil Moisture (PASM)	Water Balance Model (NRSC)- NOAA CPC (0.1 x 0.1 degree)/Global PET (1.0x1.0 degree)/ Theta Probe

Parameters for Drought Declaration

(Drought Manual, 2016)

Levels	Category	Parameters
Trigger 1 (Mandatory Indicator)	Rainfall Based	<ol style="list-style-type: none"> 1. RF Deviation or SPI 2. Dry Spell
Trigger 2 (Impact Indicator) Need to Select 3 out of 4 type of Indicators	<ol style="list-style-type: none"> 1. Remote Sensing 2. Crop Situation 3. Soil Moisture 4. Hydrological 	<ol style="list-style-type: none"> 1. NDVI & NDWI Deviation or VCI 2. Area under sowing 3. PASM or MAI 4. RSI/GWDI/SFDI
Verification	Field Data	GT in 5 sites, each, of 10% of Villages

RF – Rainfall

SPI – Standardized Precipitation Index

NDVI – Normalized Difference Vegetation Index

NDWI – Normalized Difference Wetness Index

PASM – Plant Available Soil Moisture

MAI – Moisture Adequacy Index

RSI – Reservoir Storage Index

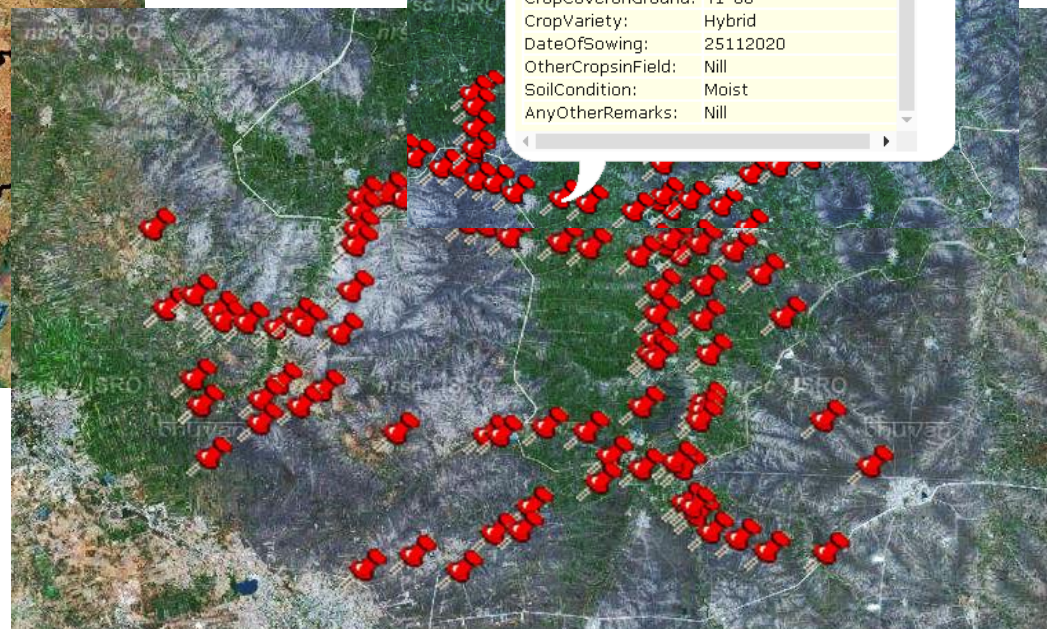
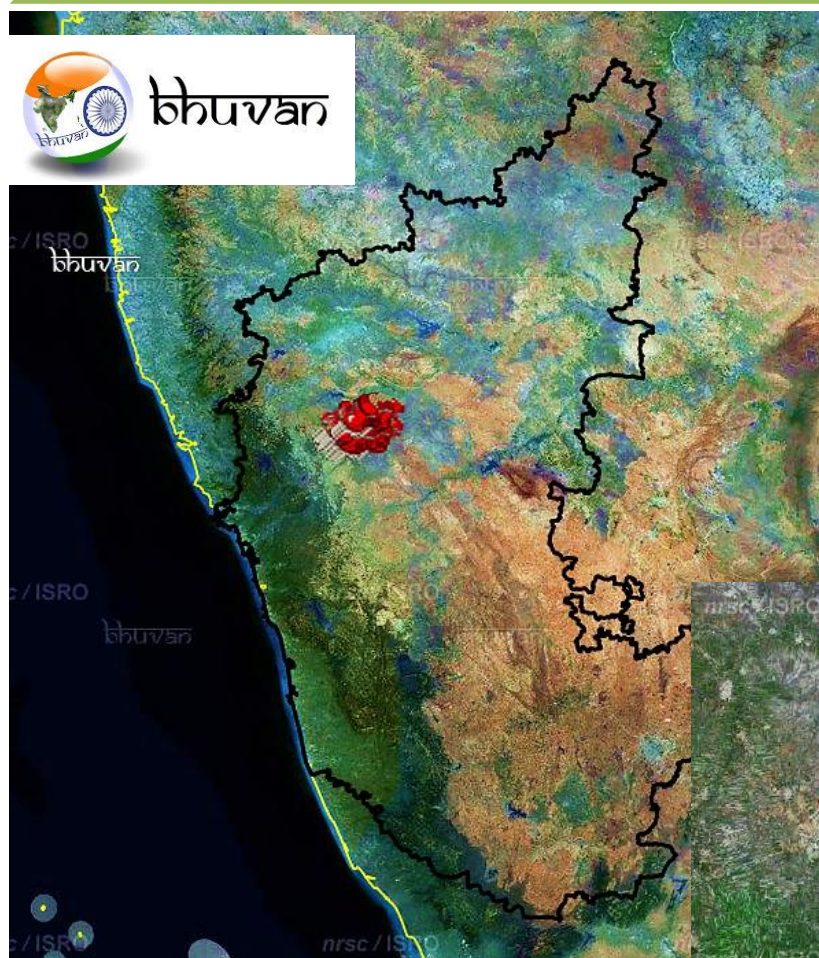
GWDI – Ground Water Drought Index

SFDI – Stream Flow Drought Index

GT – Ground Truth

- ☐ **Severe drought:** if two of the selected 3 impact indicators are in Severe category and 1 is in Moderate category
- ☐ **Moderate drought:** (i) if two of the selected 3 impact indicators are in 'Moderate' class. (ii) if two of the selected 3 impact indicators are in severe and 1 is in Normal category
- ☐ **Normal:** for all other cases.
- ☐ Trigger 2 will be set off in the event of a finding of 'severe' or 'moderate' drought.
- ☐ The State has an option to reduce the drought category by one rank (i.e. Severe to Moderate) if the irrigation percentage of the administrative region (District/Taluk/Block/Mandal), for which drought is being declared is more than 75%.
- ☐ Finally the drought assessed using impact indicators needs to be validated through ground truth.

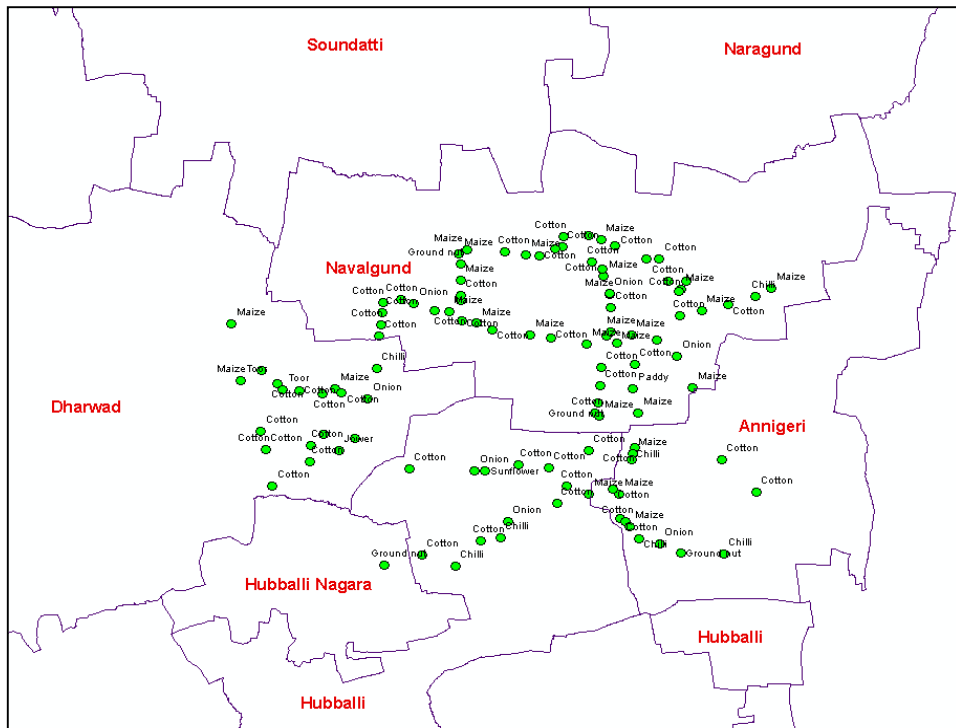
Ground Truth



Sl.No	5182423
apptype:	fdc
appsubtype:	fdc
FDCprojectname:	BhuvanFASAL
themename:	FDCBhuvanFASAL1dot3
profilename:	FASAL
observername:	Narendrababu v
project scientist	
org:	KRSRAC
mobilen:	9845299118
creationtime:	2020-10-14 10:50:14
uuid:	42e0f0f7aa168751
deviceid:	NB
GPS Accuracy	2.1 Meters
StateDistrictVillage:	Karnataka Dharawad Thirlapura
FieldSiteID:	20201012_12
TypeofCrop:	Maize
SizeofCropField:	64000
CropGrowthStage:	Vegetative
CropHealthCondition:	Average
CropCoveronGround:	41-60
CropVariety:	Hybrid
DateOfSowing:	25112020
OtherCropsinField:	Nil
SoilCondition:	Moist
AnyOtherRemarks:	Nil

Total No of GT - 112

Details of GT Collected



S.I. No	Crops	Number of GT	Growth Stage	Soil condition in field
1.	Chilli	07	Vegetative	Moist
2	Cotton	58	Vegetative	Moist
3.	Millet	01	Vegetative	Moist
4	Ground Nut	05	Vegetative	Moist
5.	Jowar	02	Vegetative	Moist
6.	Maize	27	Vegetative /Maturity	Moist
7.	Onion	07	Vegetative	Moist
8.	Paddy	01	Vegetative	Moist
9.	Sugarcane	01	Vegetative	Moist
10.	Sunflower	01	Vegetative	Moist
11.	Toor	02	Vegetative	Moist

Ground truth of crops

Cotton Field



Maize Field



Sunflower Field



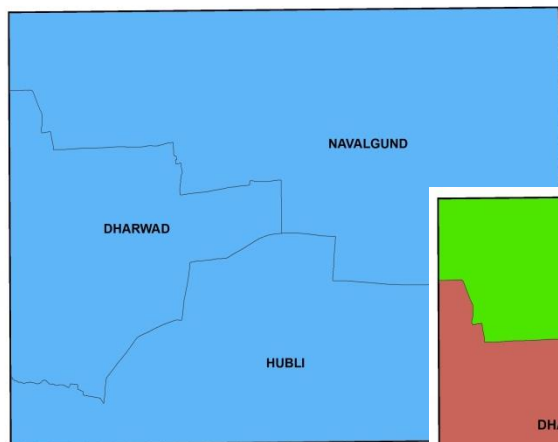
Tur Field



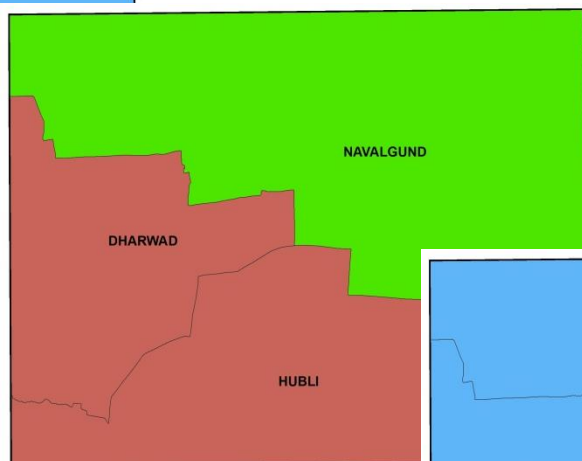
Soil moisture readings using Theta Probe



01st to 7th Sep 2020



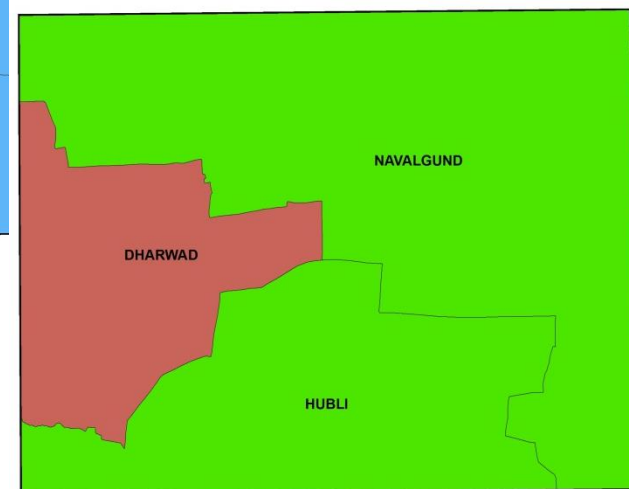
8th to 14th Sep 2020



15th to 21st Sep 2020



22nd to 28th Sep 2020

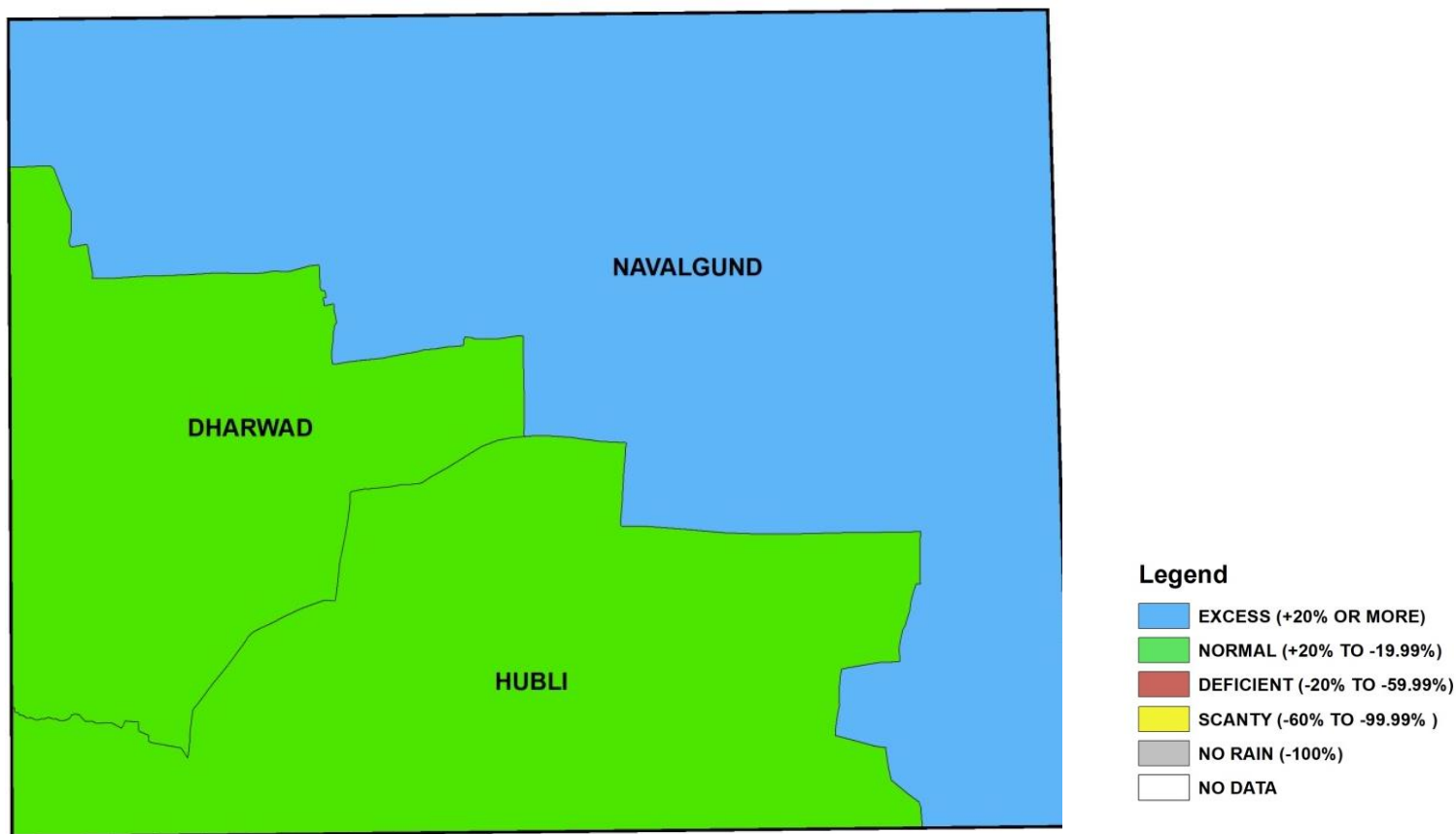


Legend

- EXCESS (+20% OR MORE)
- NORMAL (+20% TO -19.99%)
- DEFICIENT (-20% TO -59.99%)
- SCANTY (-60% TO -99.99%)
- NO RAIN (-100%)
- NO DATA

(Source: NOAA CPC)

Block level Rainfall Deviation (1st June to 28th September 2020)



Excess Rainfall (+20%) in Navalgund and normal rain was observed in Hubli and Dharwad blocks

(Source: NOAA CPC)

Kharif season Drought monitoring up to September 2020

(As per Drought Manual)

Dry Spell up to Sep

NAVALGUND
DHARWAD
HUBLI

- ☐ Trigger 1 was computed based on Rainfall Deviation and Dry Spell.
- ☐ Rainfall is Scanty if the District had more than 60% deficiency in rainfall.
- ☐ Dry spell is considered if at least for 3-4 consecutive weeks (from state wise monsoon normal onset date) rainfall is below 50% of Normal.
- ☐ Trigger 1 is YES, if there is Dry spell and/or Scanty rainfall

Scanty RF up to Sep end

NAVALGUND
DHARWAD
HUBLI

Legend

Yes
No

Trigger-1

NAVALGUND
DHARWAD
HUBLI

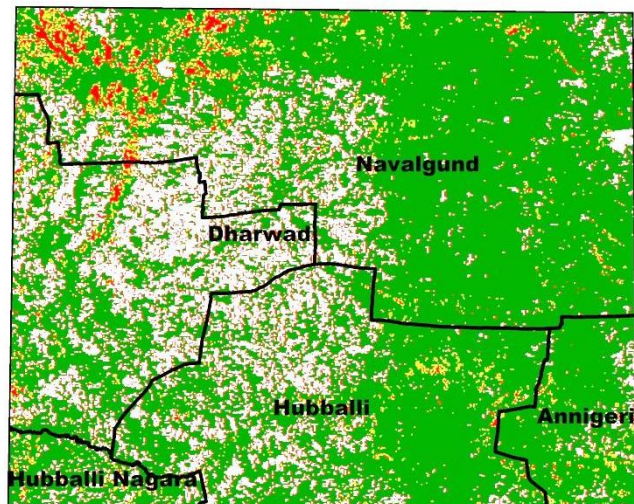
Trigger 1

Yes
No

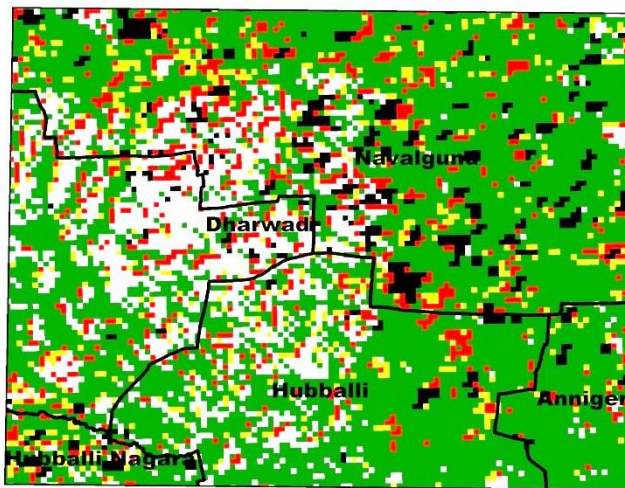
Dharwad and Hubli taluks are under Trigger-1 situation.

Resourcesat 2-AWiFS and MODIS derived NDVI/NDWI Deviation for September 2020 w.r.t. normal

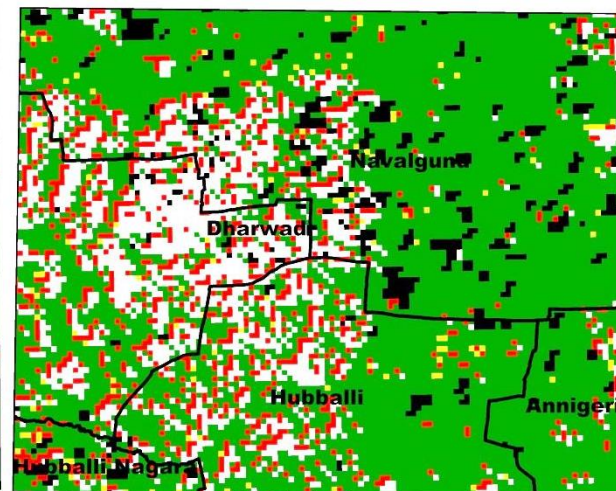
RS-2 AWiFS derived NDVI Deviation



MODIS derived NDVI Deviation



MODIS derived NDWI Deviation



For AWiFS: Normal Year of NDVI is calculated by using NDVI data from 2013 to 2019

For MODIS: Normal Year of NDVI/NDWI is calculated by Averaging data from 2006 to 2019

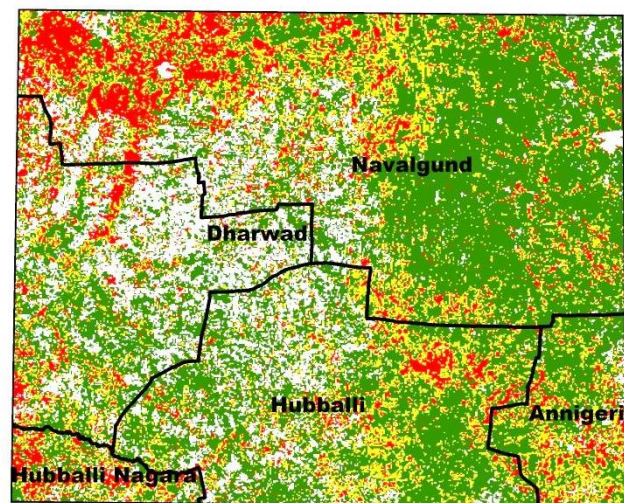
Crop condition and wetness situation was observed to be good

Resourcesat 2-AWiFS VCI (NDVI) and MODIS derived VCI (NDVI/NDWI) for September 2020

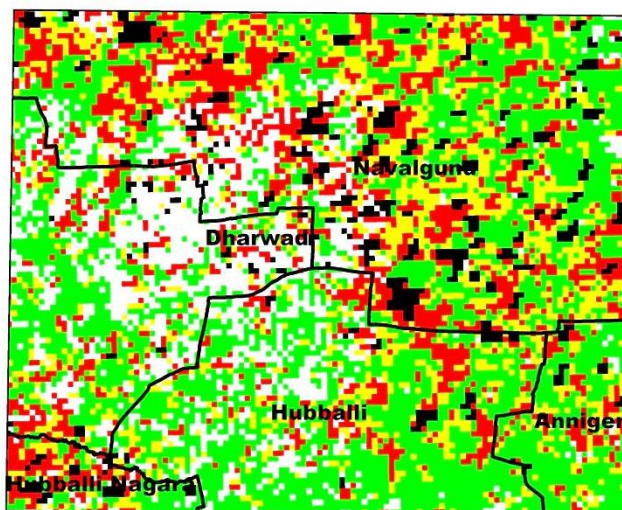
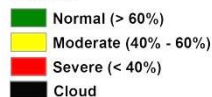
RS2-AWiFS VCI (NDVI)

MODIS derived VCI (NDVI)

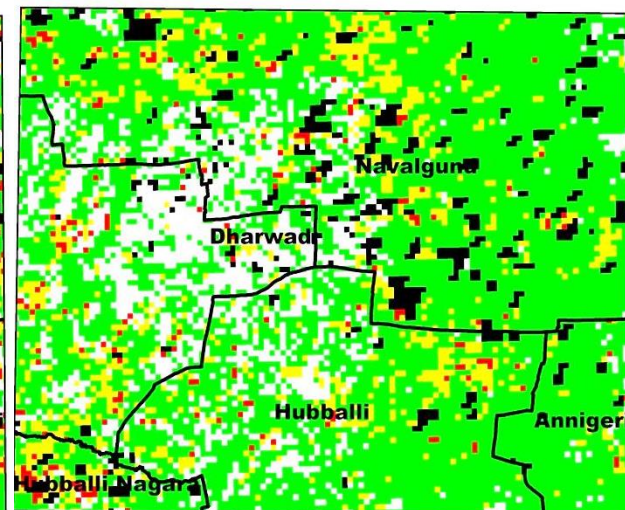
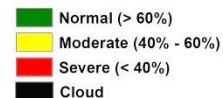
MODIS derived VCI (NDWI)



Legend



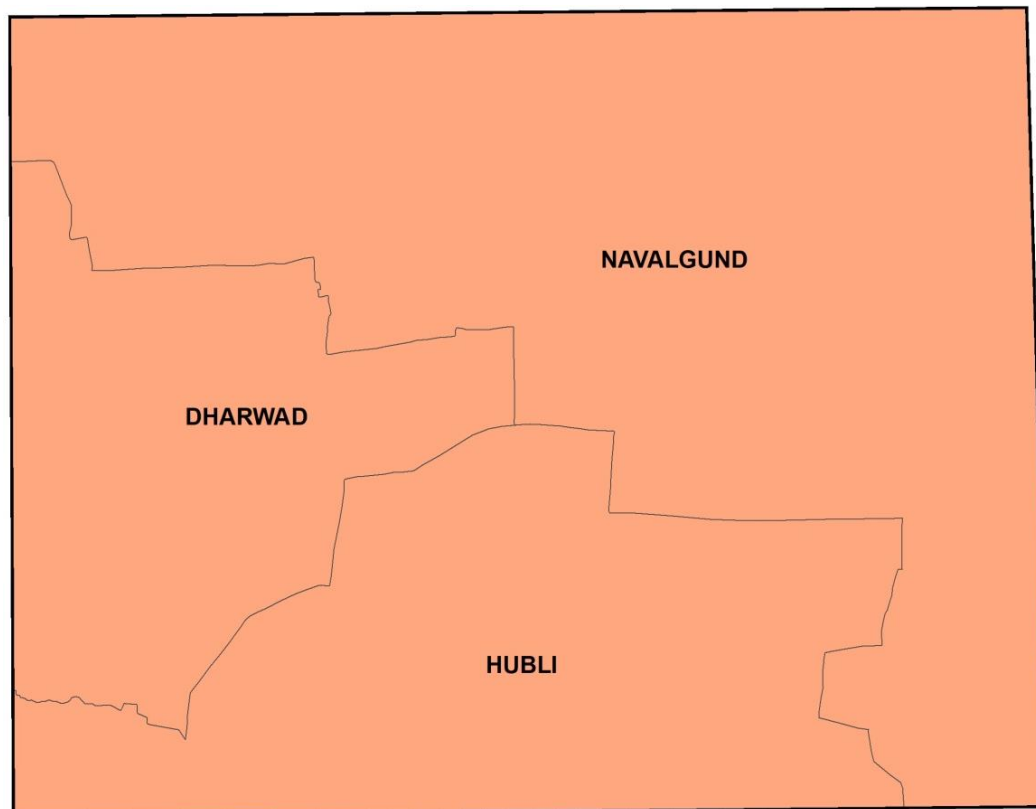
Legend



Legend



Model Derived Percent Available Soil Moisture



The whole region was under severe condition .

Legend

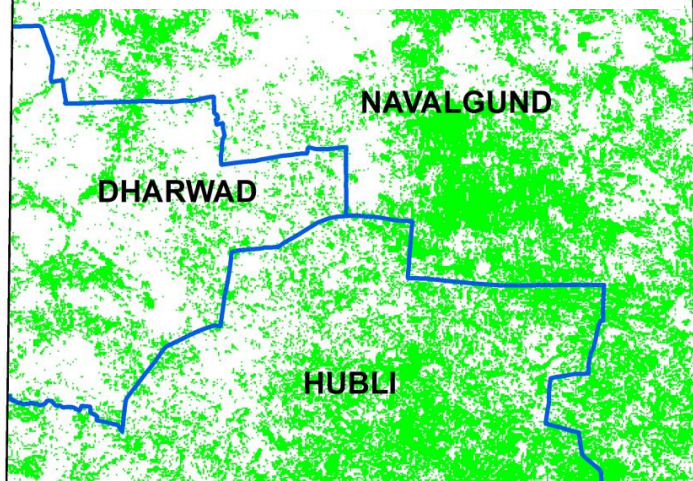
- Normal ($> 75\%$)
- Moderate ($50\% - 75\%$)
- Severe ($< 50\%$)

- *PASM indicator is assessed by averaging consecutive three weeks of lowest moisture (%) from the monsoon onset date.*

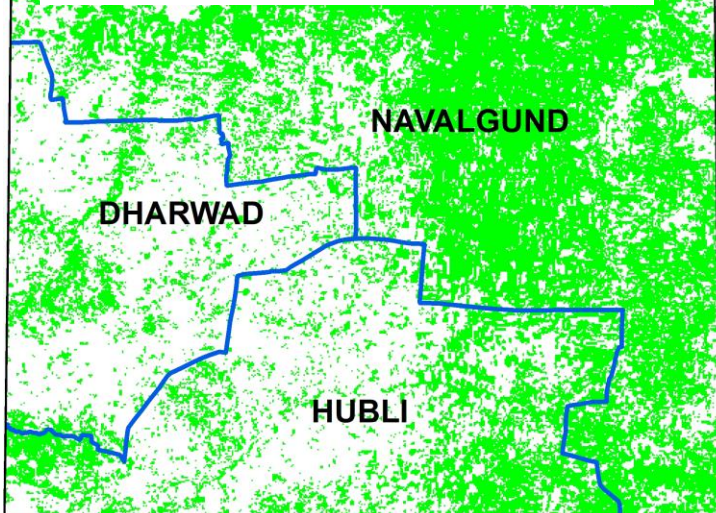
Crop Sown Area Deviation

MODIS derived Crop Sown Area map

Crop Sown Area for Tirupur Location (2016-17)



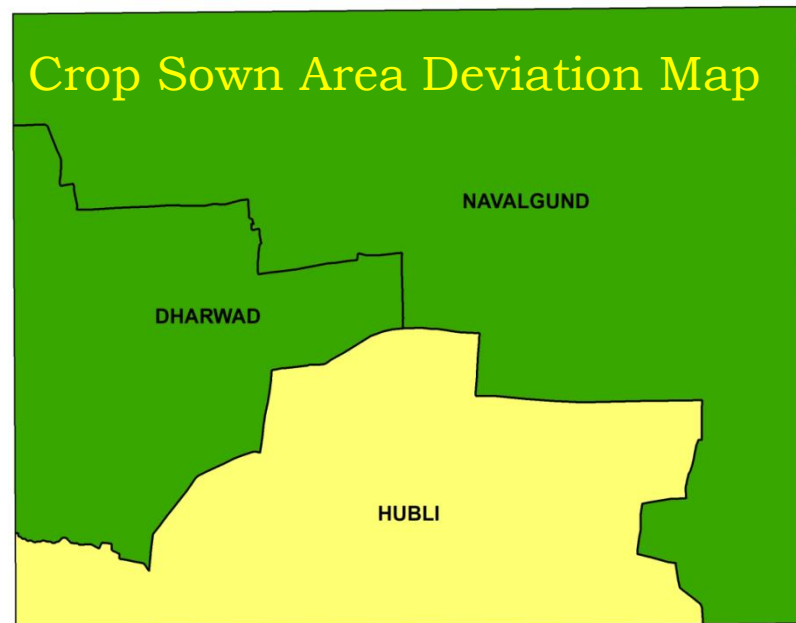
Crop Sown Area for Tirupur Location (2020-21)



Crop sown area was mapped using MODIS multi-date NDVI product, for both 2016 and 2020.

Crop sown area deviation (%) was computed by comparing 2020 values with that of 2016, assuming 2016, a normal year.

Crop Sown Area Deviation Map



Legend

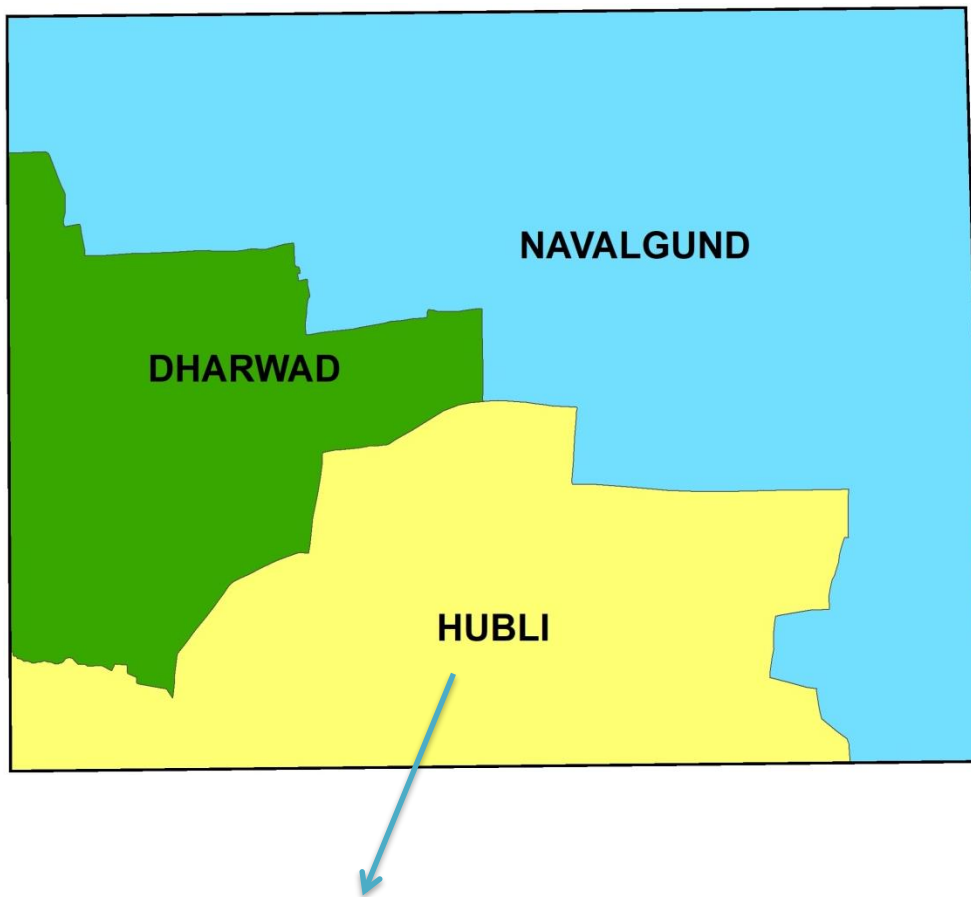
- Normal (> 85%)
- Moderate (75% - 85%)

75 to 85 % of normal sown area was observed in Hubli block which came under moderate category of sown area percentage. Rest of the two blocks had more than 85% area under crops.

Agricultural Drought Assessment

September 2020

(Based on Rainfall, Remote sensing , Soil Moisture and sown area)



Legend

No Trigger

Trigger 1: Yes

Normal

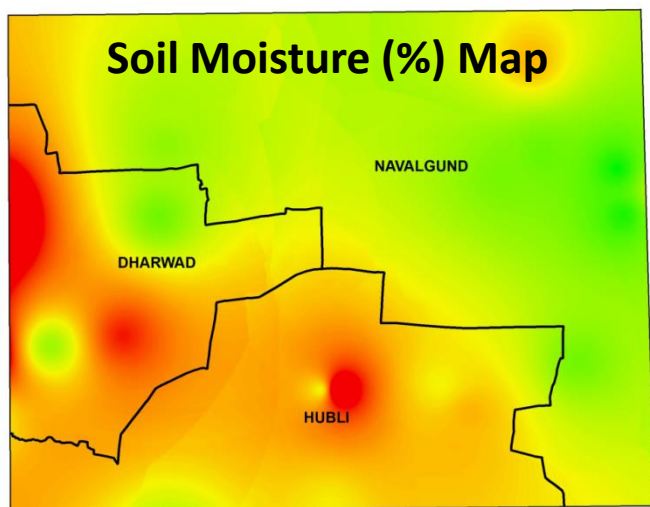
Moderate

Severe

Moderate category of Drought

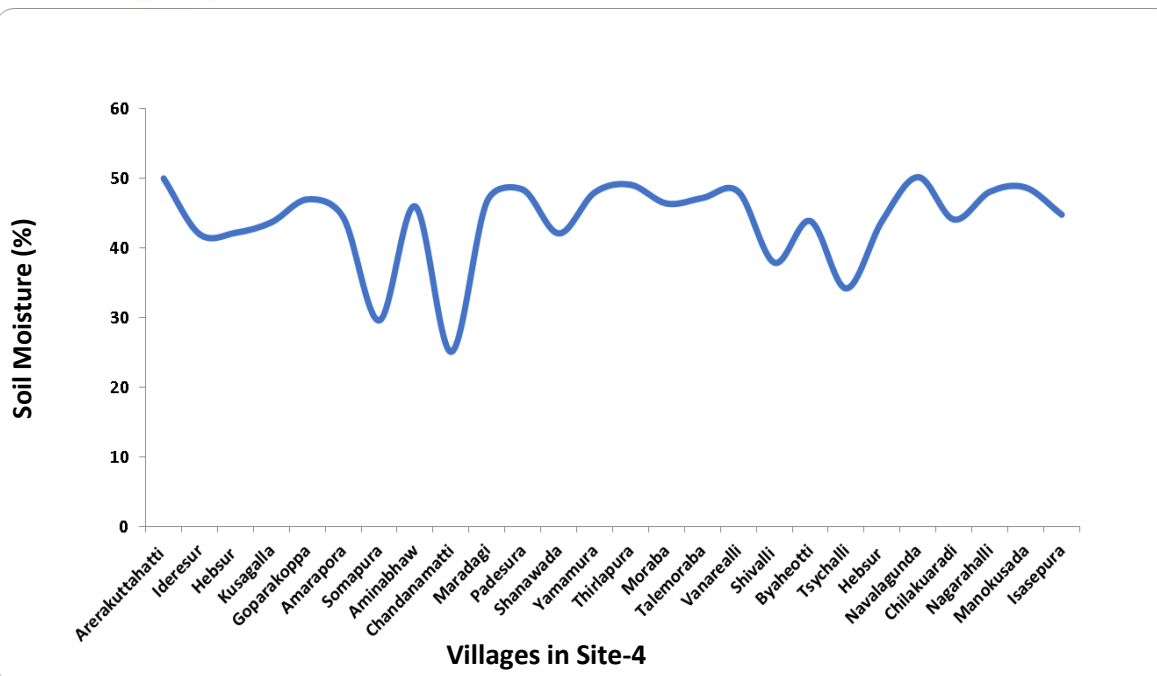
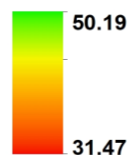
Due to severe soil moisture and moderate sown area percentage

Soil Moisture (%) Map (collected using Theta probe)



Soil moisture data was collected in 26 locations. Map was generated for its representation. As per ground data, Hubli and Dharwad was having low soil moisture whereas better condition was observed in Navalgund taluk.

Soil Moisture (%)



Further work to be done

- *Kharif* (rainy season) drought monitoring completed, need to start *Rabi* (winter season) drought assessment.
- New Drought indices evaluation.
- Soil moisture validation.

Future Tasks

For Soil Moisture validation

- Satellite (SMAP) derived data will be used to monitor Soil Moisture and validation will be carried out using hand held soil moisture meter reading.

Composite Drought Indicator

- To identify various location specific indices or parameters for drought.
- Estimation of their weightage by AHP or PCA methods.
- To develop a CDI or model using remote sensing/weather based indices or ground information.
- Validation will be carried against the drought assessed as per methodology given Drought Manual.

Thank You