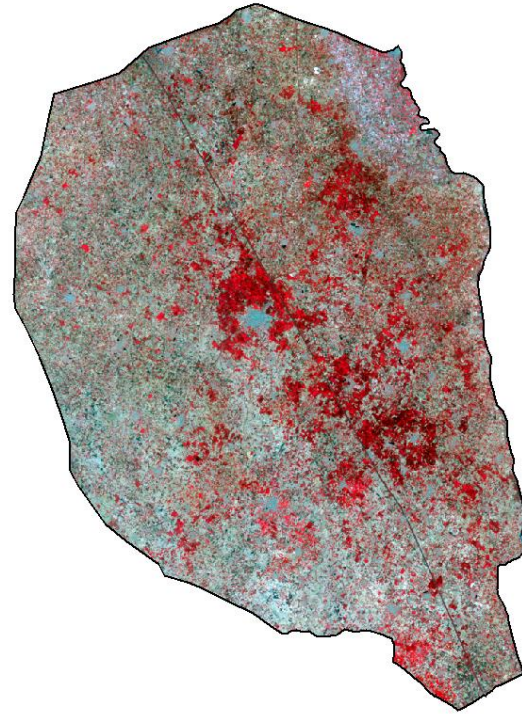# JECAM: India-Bulandsahar_Hapur: Status

Pradeep Kumar[1], N. R. Patel[2], Preeti Tahlani[1], Dipanwita Haldar[2], J. George[2], A. Dandodia[2], B. Debnath[1], Niti Singh[1] and S. S. Ray[1]
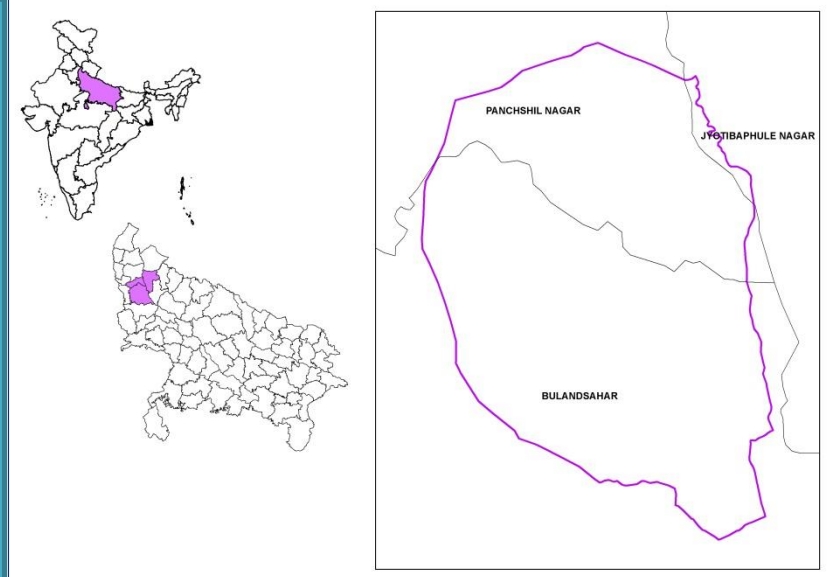
[1]*Mahalanobis National Crop Forecast Centre, DAC&FW, New Delhi, India*

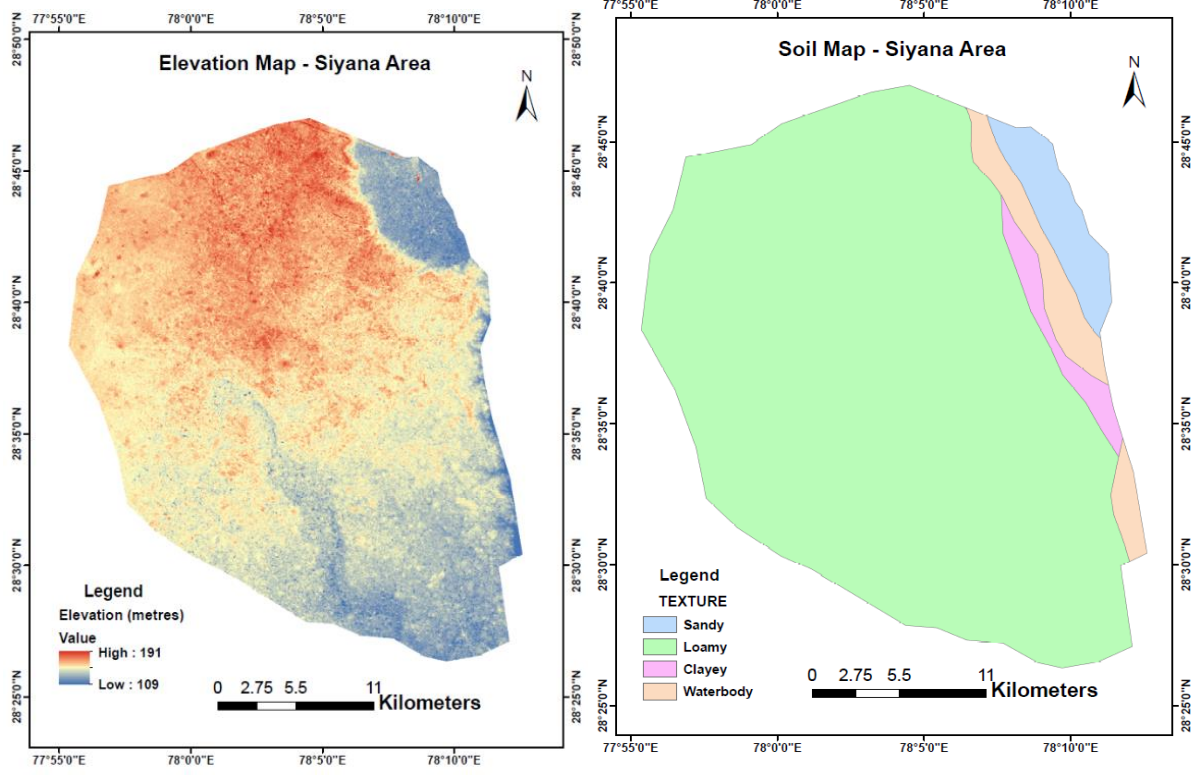[2]*Indian Institute of Remote Sensing, ISRO, Dehradun, India*

December, 2020

Site Description

- **Location**- Siyana Tehsil, Part of Bulandsahar and Hapur District (Uttar Pradesh), India

- **Central Lon/Lat of Site** - 78.072 E, 28.615 N

- **Topography**- Slight undulating. Elevation in the study area varies between 109 to 191 m, with elevation gradients running in both North-South and East-West direction

- **Soils**- Young alluvial soils (entisols) with mild textural variations. Nearly 85% of the area has loamy texture

- **Drainage class/irrigation-** Well irrigated (Canals, tanks and bore-wells)

- **Crop calendar-** Kharif: Paddy, sugarcane, maize; Rabi: Wheat, vegetables, sugarcane

- **Field size**:1-10 Ha.

- **Climate and weather**:Tropics, Hot Sub-humid, Annual precipitation (720 mm approx.)

Site Description

Elevation Map - Siyana Area

Legend
Elevation (metres)
Value
High : 191
Low : 109

0 2.75 5.5 11 Kilometers

Soil Map - Siyana Area

Legend
TEXTURE
Sandy
Loamy
Clayey
Waterbody

0 2.75 5.5 11 Kilometers

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Average high °C (°F)	17 (63)	20 (68)	25 (77)	32 (90)	31 (88)	31 (88)	29 (84)	29 (84)	29 (84)	27 (81)	24 (75)	20 (68)	26 (79)
Average low °C (°F)	07 (45)	09 (48)	11 (52)	15 (59)	17 (63)	17 (63)	19 (66)	21 (70)	19 (66)	13 (55)	12 (54)	08 (46)	14 (57)
Average precipitation mm (inches)	18 (0.7)	24 (0.9)	12 (0.5)	12 (0.5)	21 (0.8)	99 (3.9)	168 (6.6)	207 (8.1)	99 (3.9)	27 (1.1)	6 (0.2)	9 (0.4)	702 (27.6)

Project Objectives

Estimating Crop Area

- Complete mapping of the site (Covering all orchards and vegetable crops)
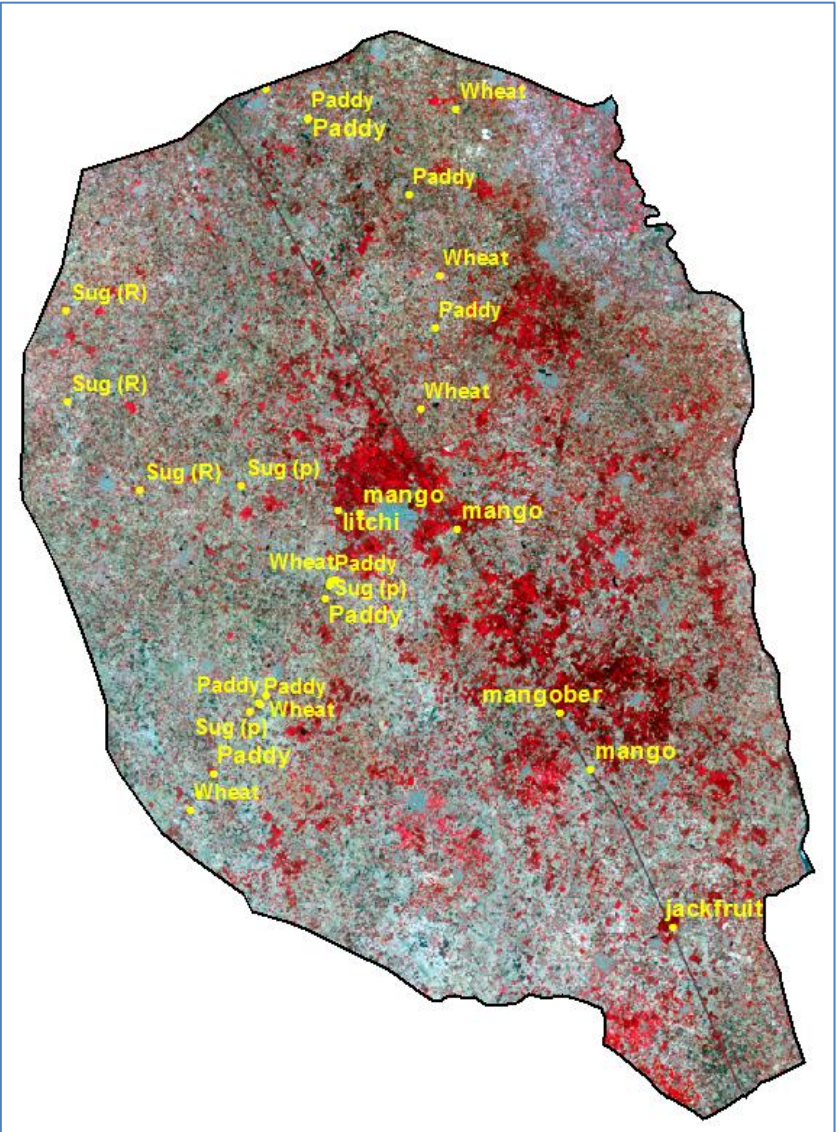- Technique development for Area assessment and production forecasting of the various horticulture crops

Monitoring Phenological Events

- Vegetative Growth
- Flowering
- Fruit Development
- Maturity
- Phenology of Fruit Orchards
- Age of Orchard

Assessment of Biophysical Variables

- Vegetation Indices (NDVI, EVI, SAVI, etc.)
- LAI (Leaf Area Index)
- Plant height
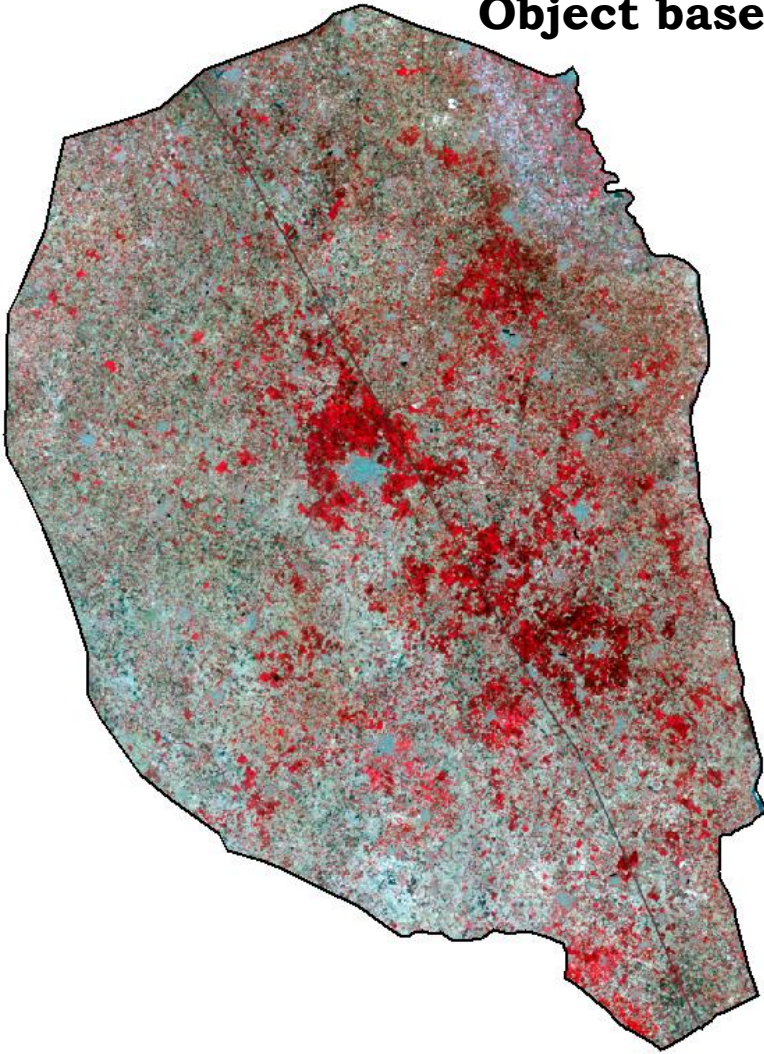- Spectral Signature
- UAV based signature
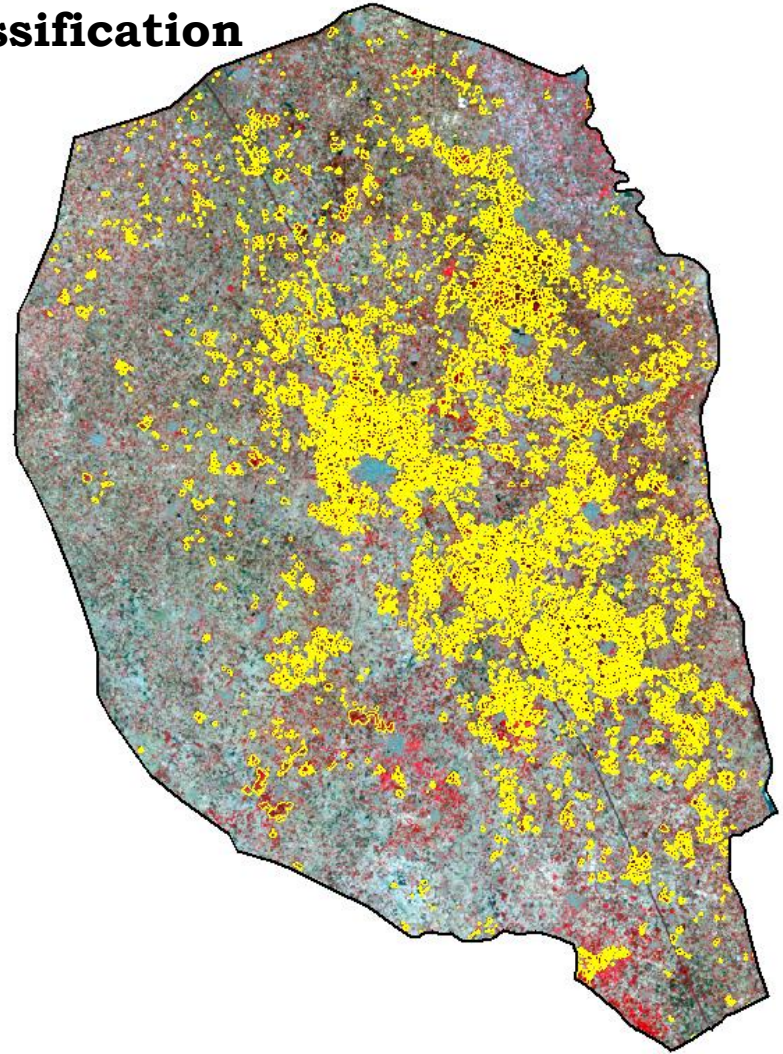
Ground Truth (GT)

The study site have wide variety of cropping pattern. The major horticulture crop in the site is mango. About 15% of the total geographical area of the site has been covered by mango orchards.

Mustard

Wheat

GT overview on LISS-IV image

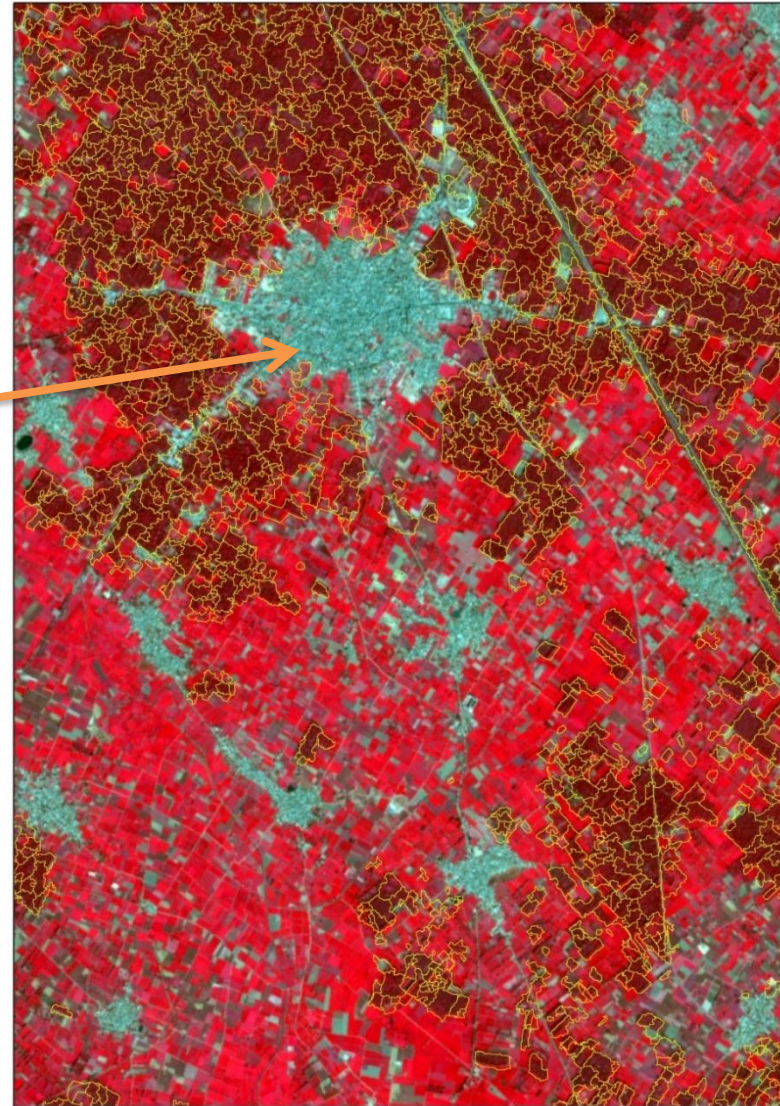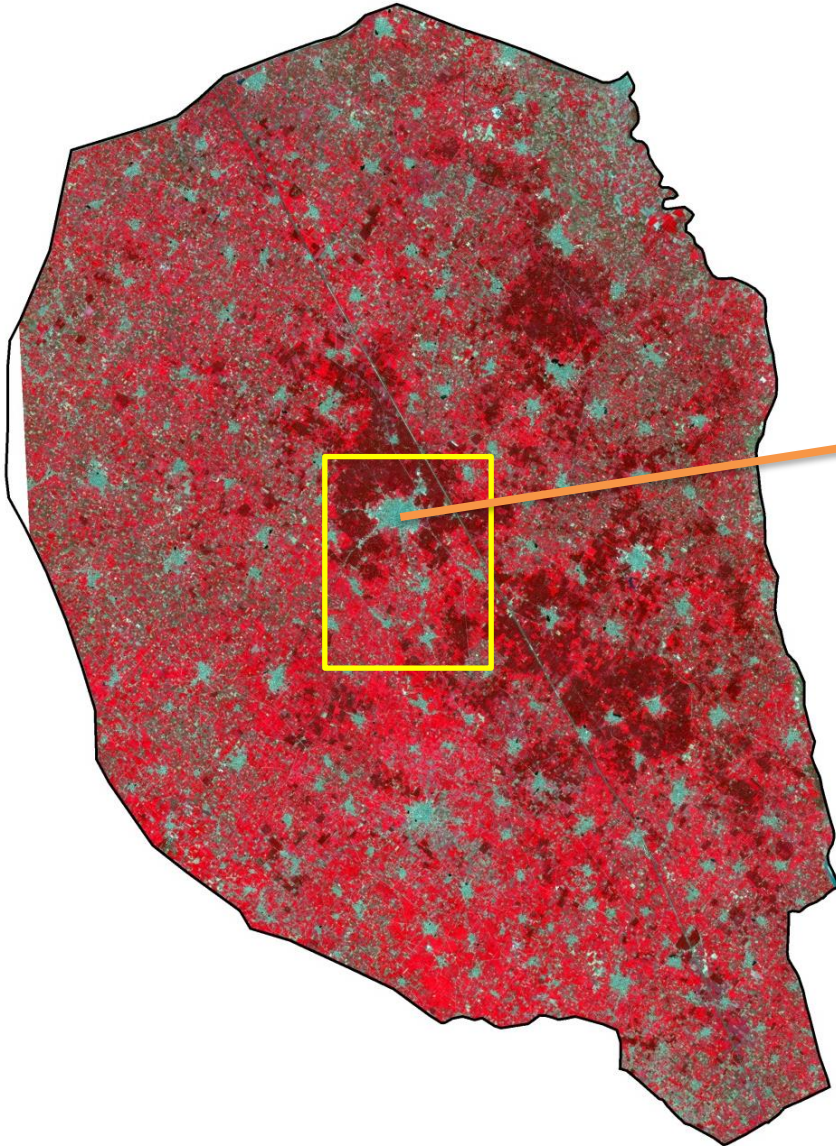# Mango Orchard Mapping LISS IV (5.8m) data and Object based Classification
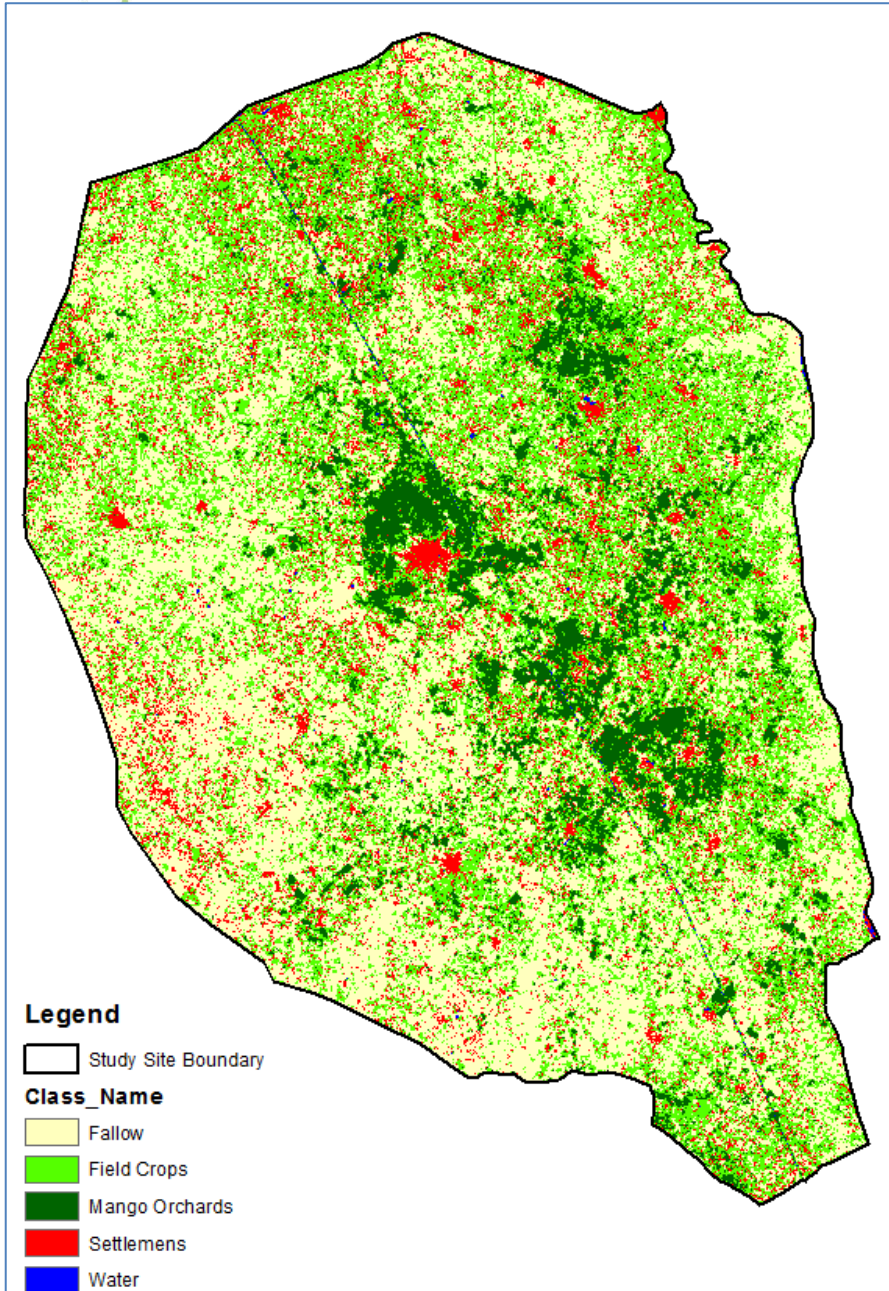

LISS-IV data (04-May)

Mango orchard mapped

Mango orchards around Siyana town

Mango orchards overlaid on Sentinel-2 image of 14-Feb-2020

Random Forest Classification for Mango Orchard using GEE

Class	Area (000 ha)
Mango Orchards	9.0
Fallow	38.3
Settlements	9.5
Water	0.2
Field Crops	29.5
Total area	86.4

Legend

☐ Study Site Boundary

Class_Name

☐ Fallow
☐ Field Crops
☐ Mango Orchards
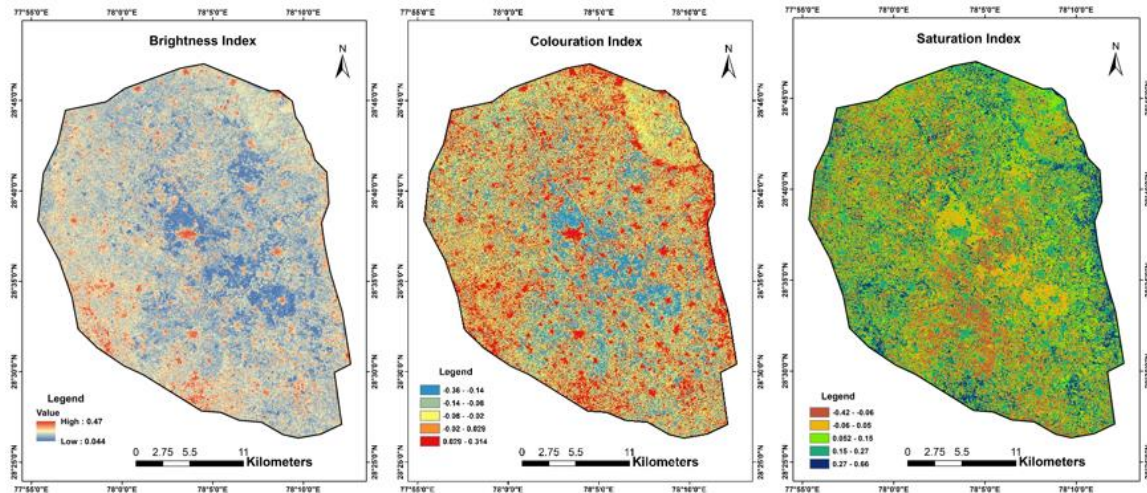☐ Settlemens
☐ Water

Soil Indices

Sentinel 2 MSI based soil indices

- Generated using composite bands of June month

- Bare soil pixels could be identified in FCC as well as with high values of indices

  Brightness index = sqrt[(B^2 + G^2 + R^2)/3]
 Colouration Index = (R-G)/(R+G)
  Saturation Index = (R-B)/(R+B)

✓ These indices have been identified to show good correlation with SOC content of exposed soil   Zhuo et al., 2008

✓ Also aids in studying the measure the thermal alteration of organic matter content of bare soil as well as help to identify the variability in soil-colouring constituents   Lagacherie et al. 2007

An attempt for spatial mapping of soil quality or properties may be undertaken depending on the availability of ground collected soil samples during fallow period and associated RS data.
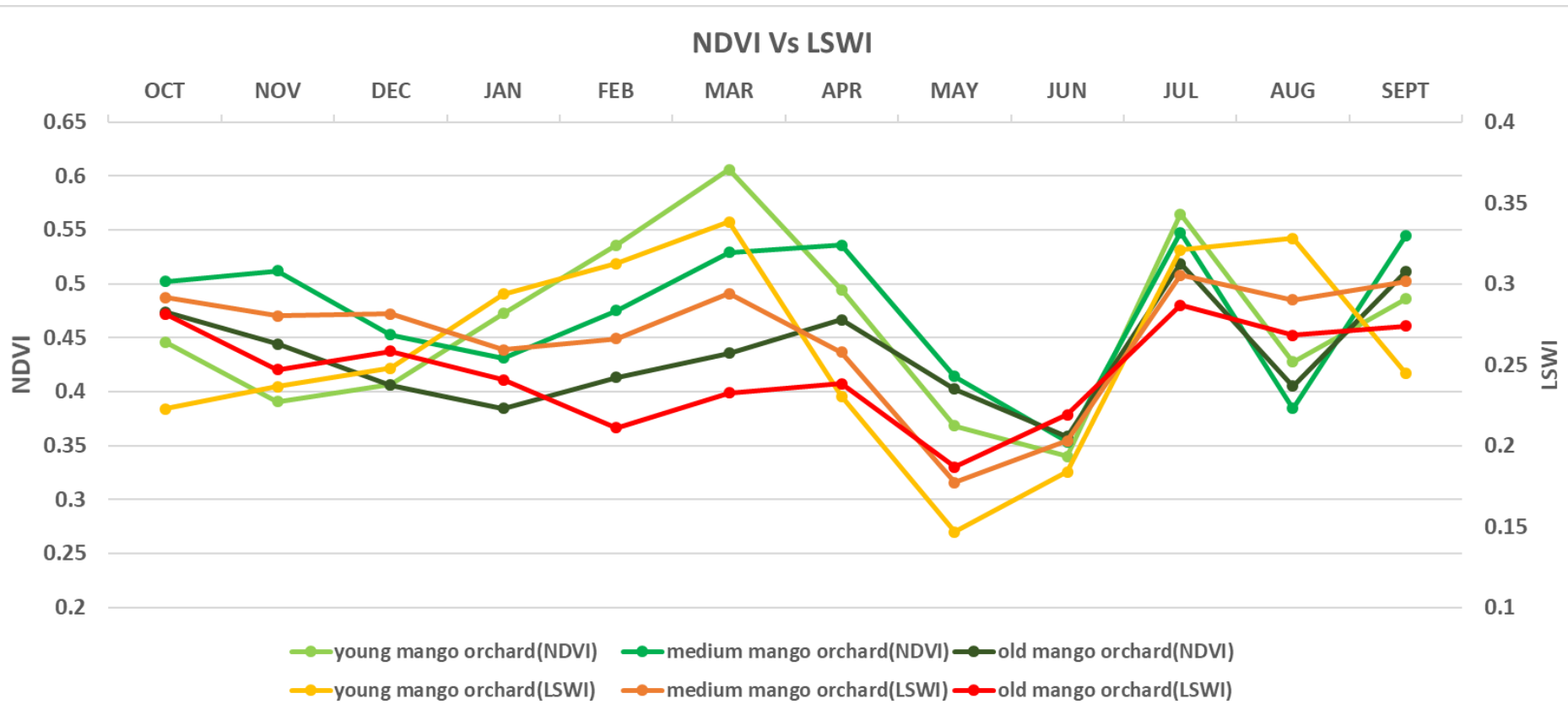
Crop and orchard monitoring using RS based indices
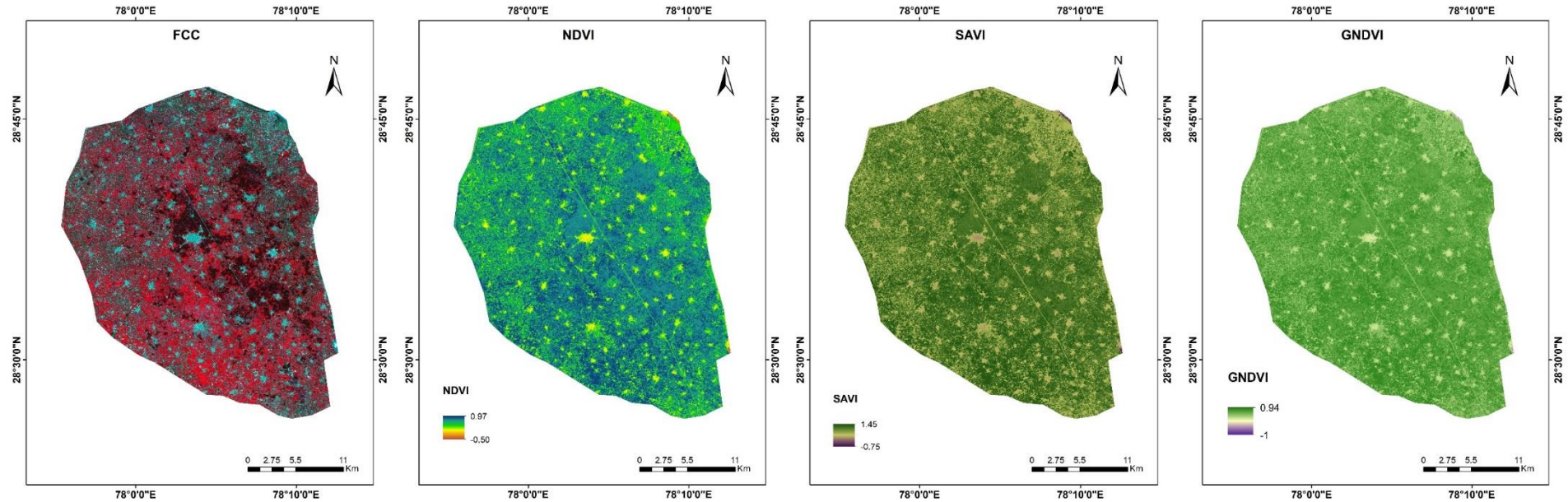
Sentinel-2 MS
Date of Acquisition: 14 Feb 2020

Temporal profile of NDVI and LSWI from Oct, 2019 to Sep, 2020 for Young and Old Orchards

NDVI multi-year profiles of old and young Mango orchards

CLASS	NDVI2016	NDVI2017	NDVI2018	NDVI2019	NDVI2020
OLD1	0.54	0.39	0.43	0.49	0.54
OLD2	0.53	0.40	0.44	0.48	0.55
OLD3	0.55	0.40	0.46	0.48	0.55
OLD4	0.51	0.39	0.43	0.49	0.56
OLD5	0.49	0.43	0.42	0.48	0.54

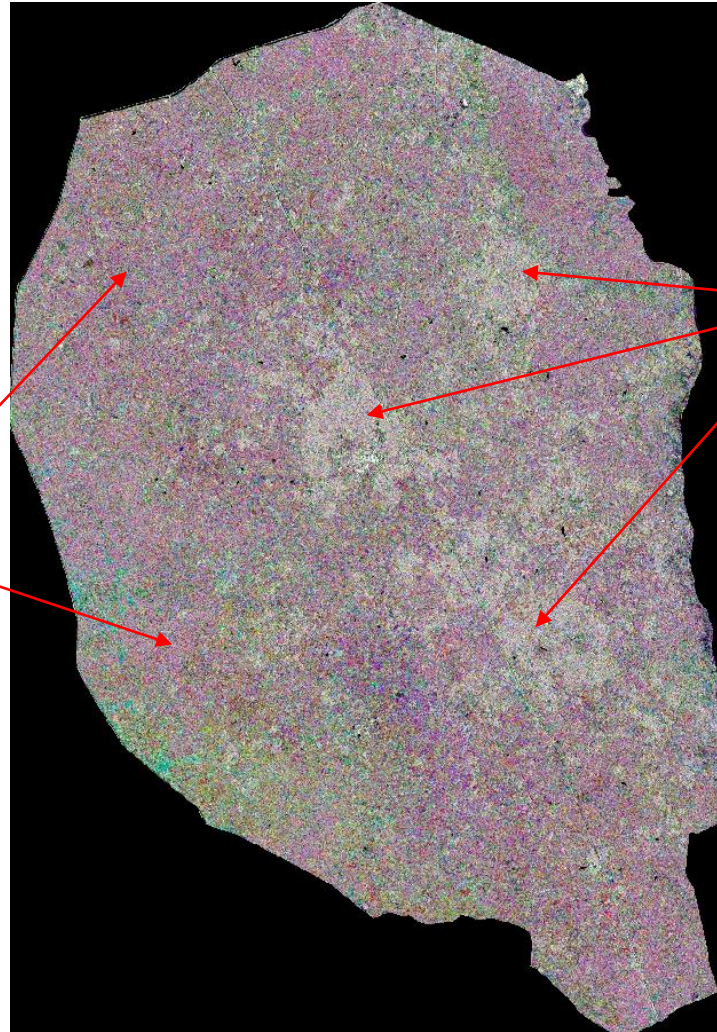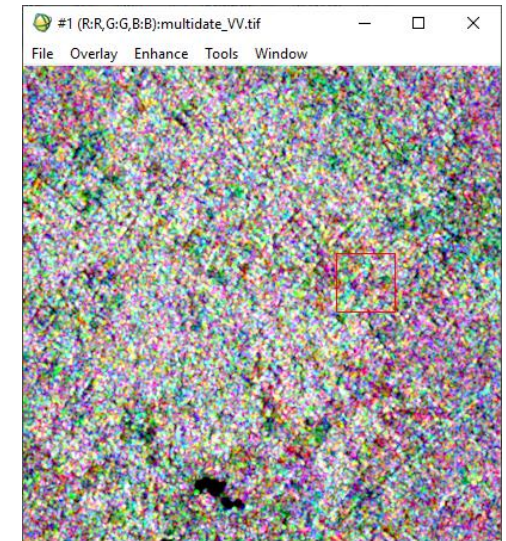| CLASS	NDVI2016	NDVI2017	NDVI2018	NDVI2019	NDVI2020
YOUNG1	0.32	0.33	0.40	0.49	0.55
YOUNG2	0.50	0.56	0.63	0.66	0.65
YOUNG3	0.53	0.41	0.44	0.49	0.56
YOUNG4	0.43	0.38	0.36	0.45	0.55
YOUNG5	0.48	0.37	0.44	0.51	0.56

Old Age Mango
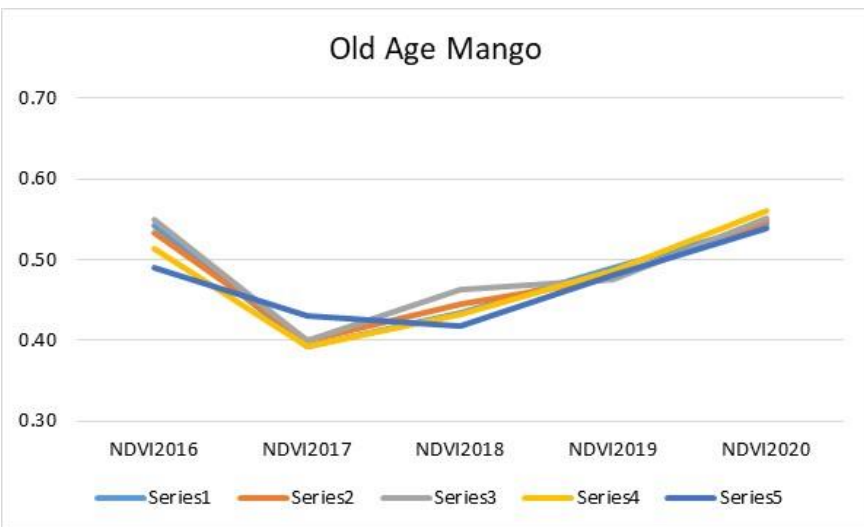
Young Age Mango
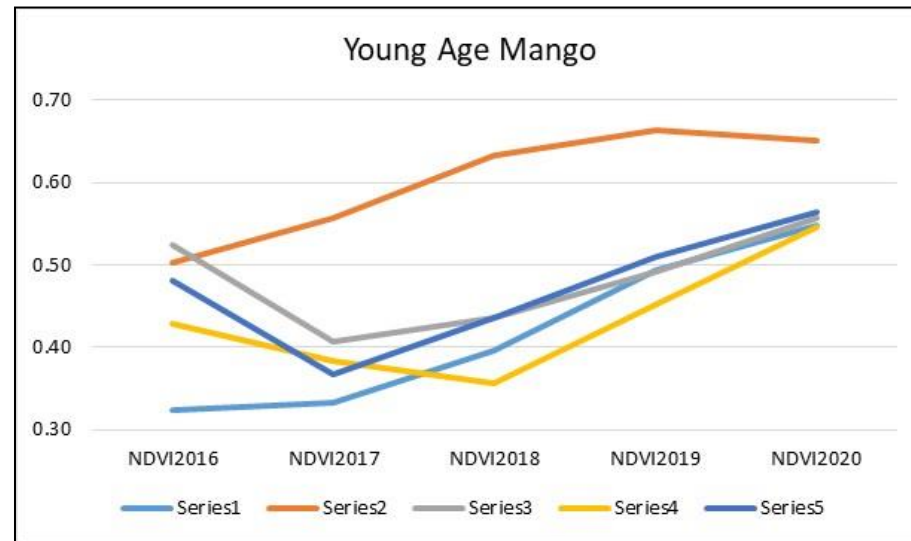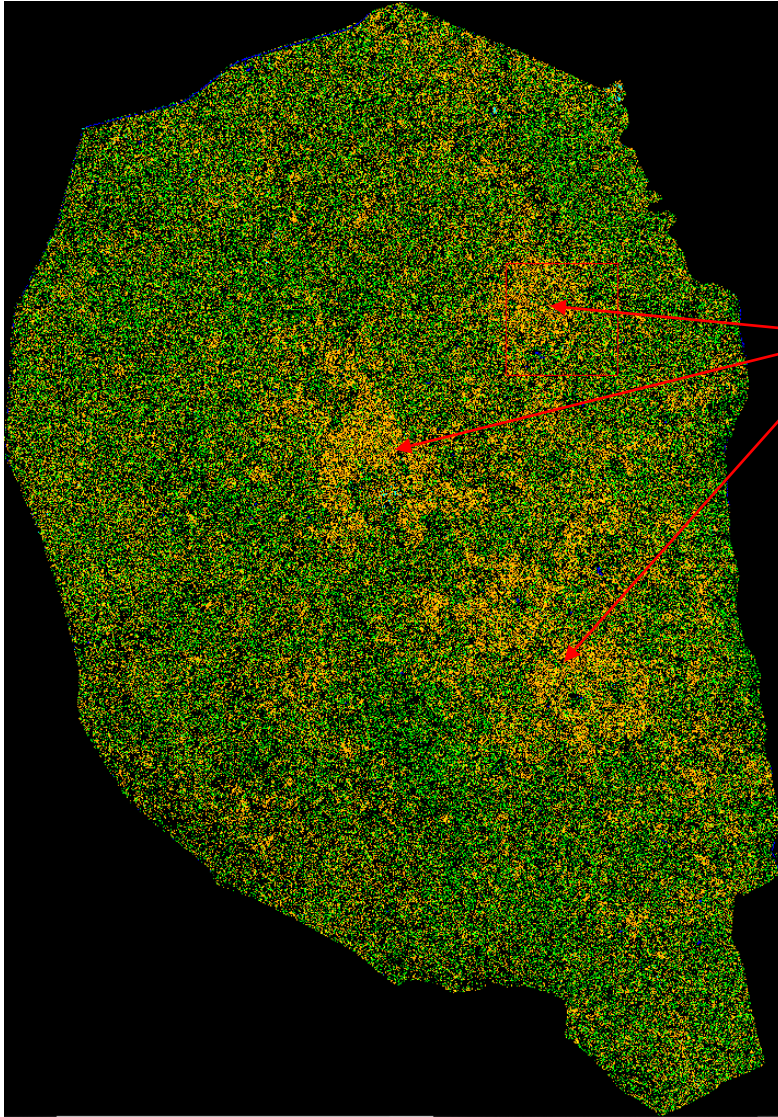
Multi-date SAR VV backscatter

15th July , 2020
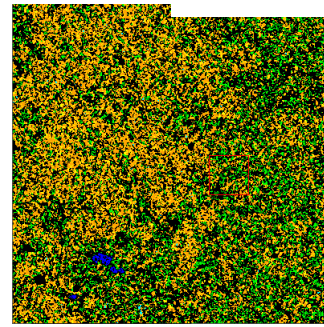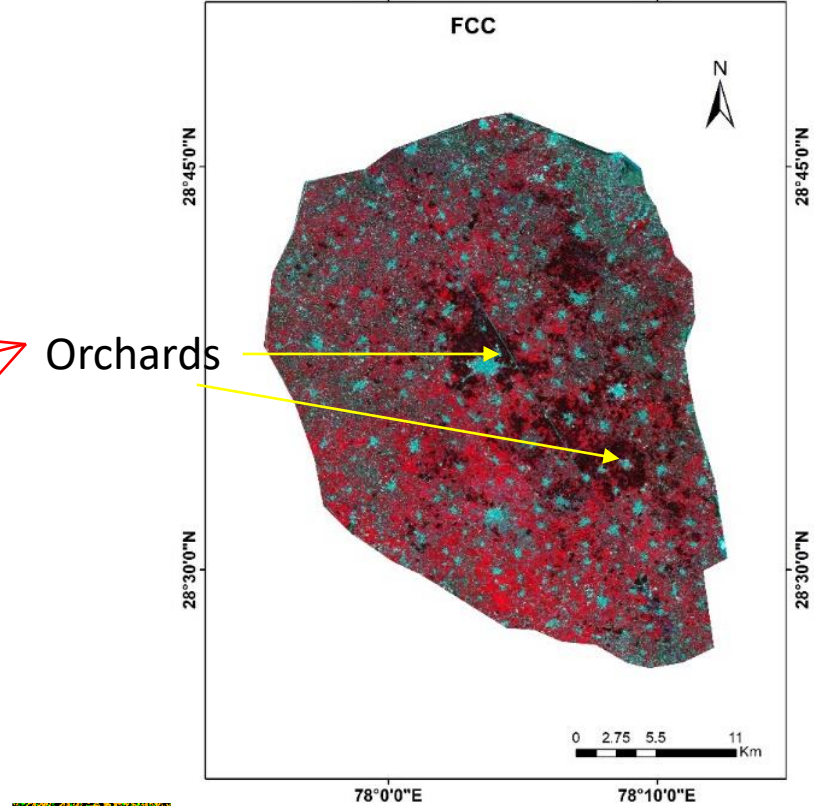12th August,2020
12th September,2020

Orchards

Rice

Orchards

Classified output based on SAR temporal datasets

Hierarchical decision tree based classification – Orchard clusters(orange), paddy- green
About 17% is classified as orchard

Summary of Results

- Orchard mapping using Object based classification and Random Forest on Google Earth Engine
- Soil indices evaluated
- Temporal signatures of Old and Young Orchards studied.
- Preliminary orchard mapping attempted using temporal SAR dataset

Way forward

1) Correlation of Hyperspectral signatures of crops with satellite data and Crop signature library for the horticultural crops grown in the study area.

2) UAV based signature study for the horticultural crops.

3) Horticultural Crop Phenology monitoring.

4) Crop Biophysical parameter retrieval.

5) Technique development for horticulture crop yield assessment.

6) Exploring various types of SAR data for horticultural crop assessment.

Thank You.