JECAM
Joint Experiment for Crop Assessment and Monitoring

JECAM: India-Bargarh- Status

S.K. Dubey[1], K. K. Choudhary[2], Neetu[1], Anima Biswal[2], P. Sriknath[2], Mamta Kumari[2], Neha Sharma[1], Prabha Kanti[1] and S. S. Ray[1]

[1]Mahalanobis National Crop Forecast Centre, DAC&FW, New Delhi, India

[2]National Remote sensing Centre, ISRO, Hyderabad, India

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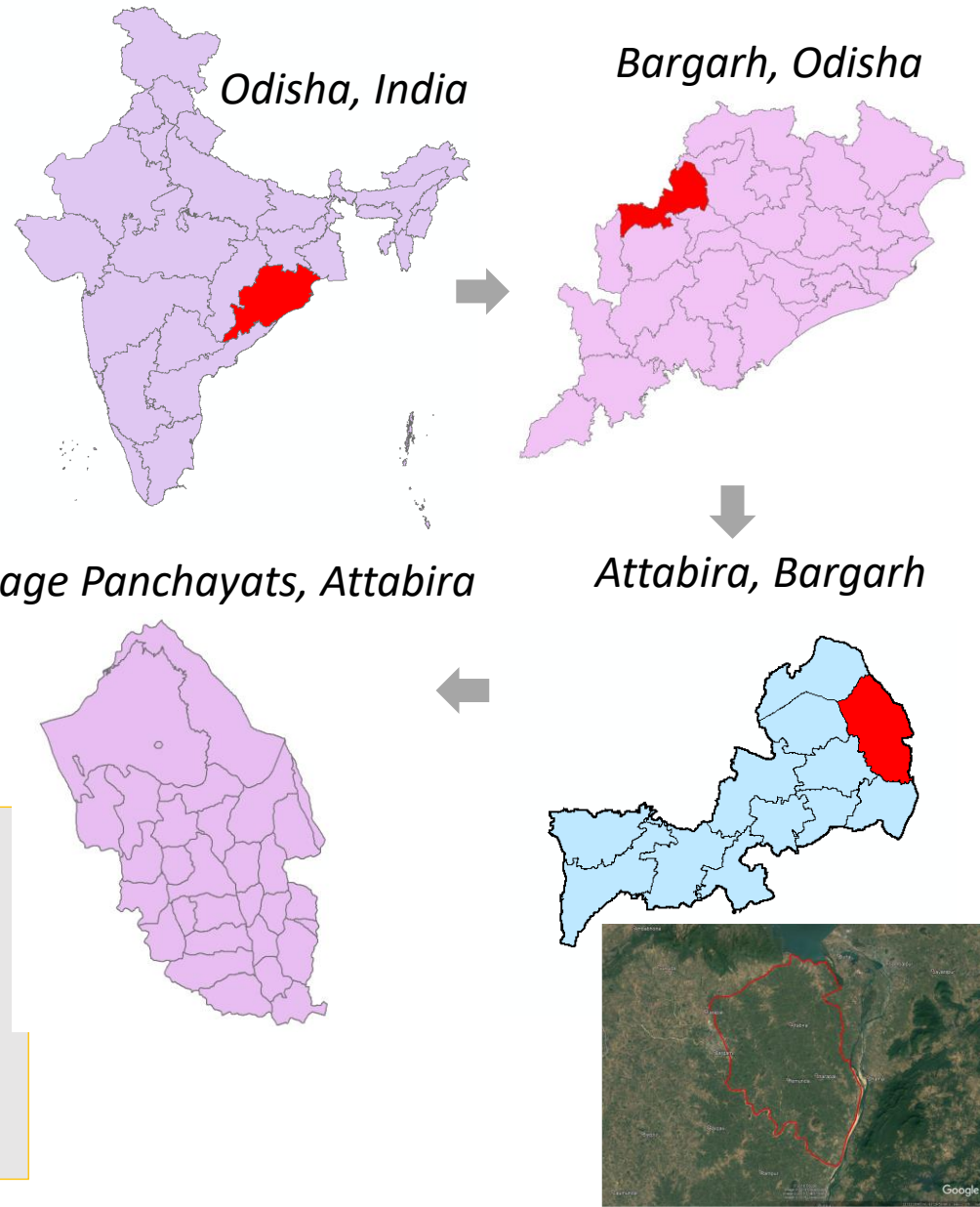
Site Description

Site Description	
Area of Site	791 sq. km
Location	Attabira, Part of Bargarh District (Odisha), India
Landscape Topography	Mostly flatlands surrounded by eastern ghats.
Climatic And Weather	Climate is classified as tropical. Major rainfall during southwest monsoon period. 1527 mm of average annual rainfall. Average temperature 27.2°C
Major Crops And Calendars	*Kharif* (Rainy): Paddy *Rabi* (Winter): Paddy
Soil Type & Texture	Major soil is Lateritic soil with patches of mixed red and yellow soils.
Irrigation Infrastructure	Approx. 76% area is irrigated
Average Field Size	1 ha



- Rice accounts > 40% of total grain production of India.
- It is cultivated and consumed across the country.
- Odisha is a major Rice growing state, where paddy crop is grown, in both the seasons (Kharif & Rabi).
- The site was selected for Yield estimation study.
- Bargarh site was selected because it is major Rice growing site and also irrigated.
- This site can also be used for AsiaRiCE programme.

Project Objectives

- To evaluate the various approaches and data for crop area, condition monitoring and yield estimation, with the aim of establishing ‘best practices’ for Rice-Rice agricultural systems.
- Development of advance protocol for yield estimation, loss assessment and smart sampling, at lower administrative unit, for crop insurance.

In-Situ Obsevations

1. **Ground Truth:** 30 GTs collected covering the study area with multiple crops.

2. **AWS based weather information:** Past 5 years weather data from AWS installed at Bheeden, Padampur and Paikmal. Gridded 0.25° daily weather data collected from IMD.

3. **Crop parameters:** Various crop parameters like Sowing time, Variety, Crop health status, etc. collected.

4. **Crop Cutting Experiments:** Around 50 Crop Cutting Experiments (CCEs) conducted through Smart sampling (remote sensing based CCE planning). Crop information such as Crop yield, Crop Biomass, Harvesting time etc. were collected during CCE.

Satellite Data Used

Data /Product	Satellite	Sensor	Resolution (m)	Source
Daily integrated Insolation	INSAT 3D	Imager	1000	MOSDAC
8-days composite FAPAR	Terra	MODIS	500	NASA-RIVERB
	Resourcesat 2	AWiFS	56	NRSC-NDC
8-days composite surface reflectance	Terra	MODIS	500	NASA-RIVERB
	Resourcesat 2	AWiFS	56	NRSC-NDC
NDVI & LSWSI during Maximum Vegetative Stage	Resourcesat 2	LISS III	23.5	NRSC-NDC
	Sentinel 2	MSI	10	ESA
	Landsat 8	OLI	30	NASA
Crop (Rice) mask	Sentinel 1	SAR	20	FASAL Project
Crop Sowing Period	Sentinel 1	SAR	20	FASAL Project

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Paddy Ground truth in Attabira Block

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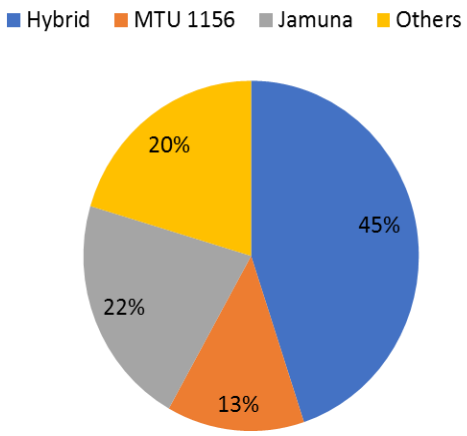
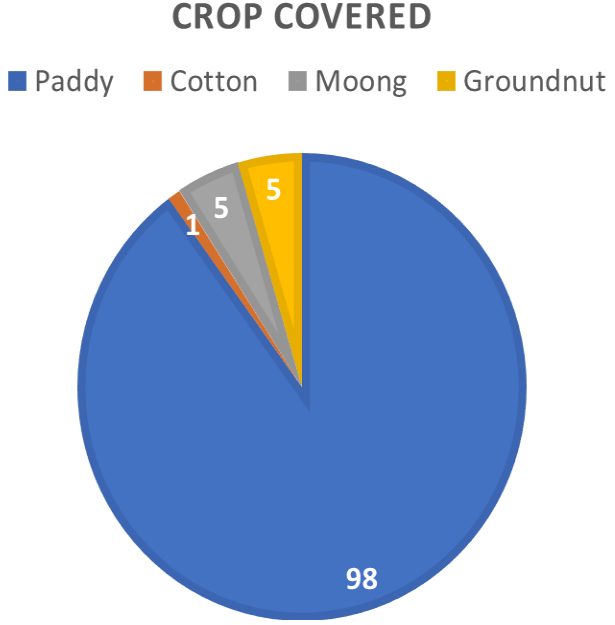
Information collected during Ground truth

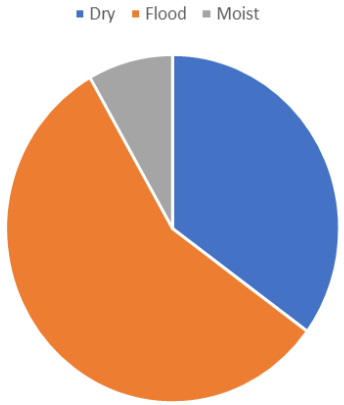
Variety



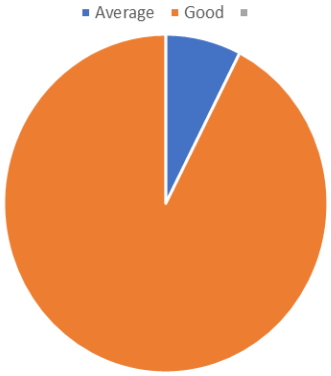
CROP COVERED



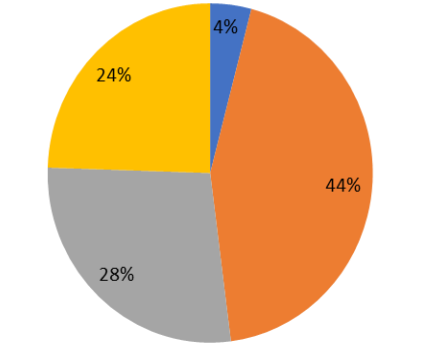
Field condition



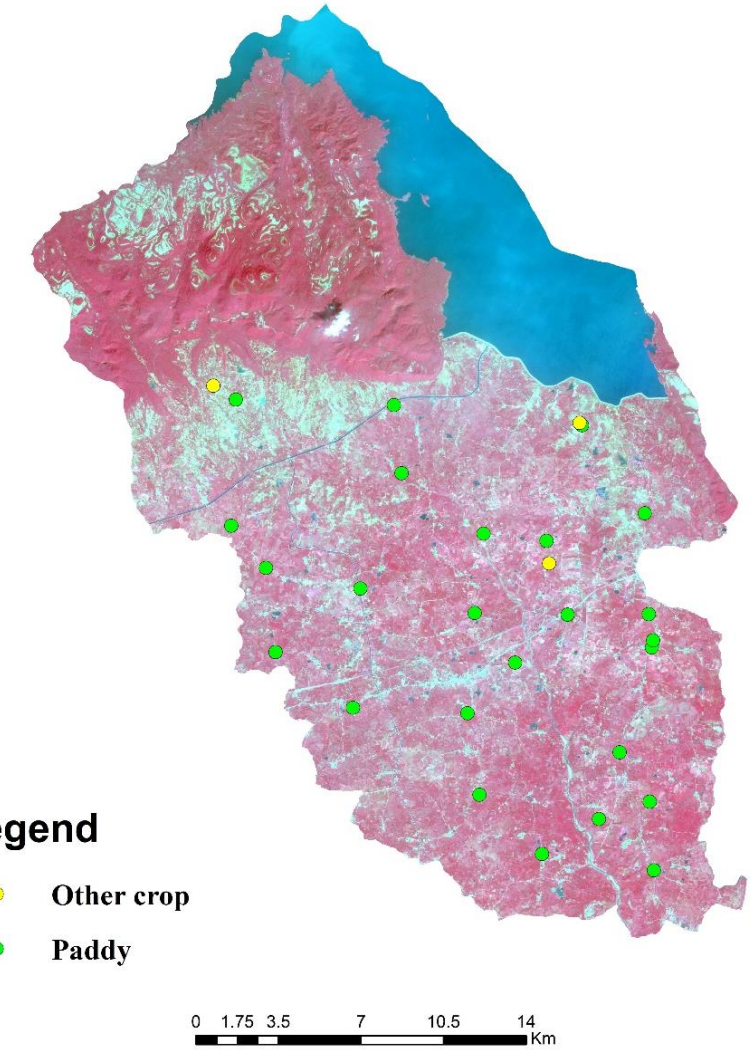
Crop condition



Sowing time



Ground truth points over Attabira Block of Odisha
Satellite data- Sentinel-2 MSI (27 Oct 2020)



UAV Imaging

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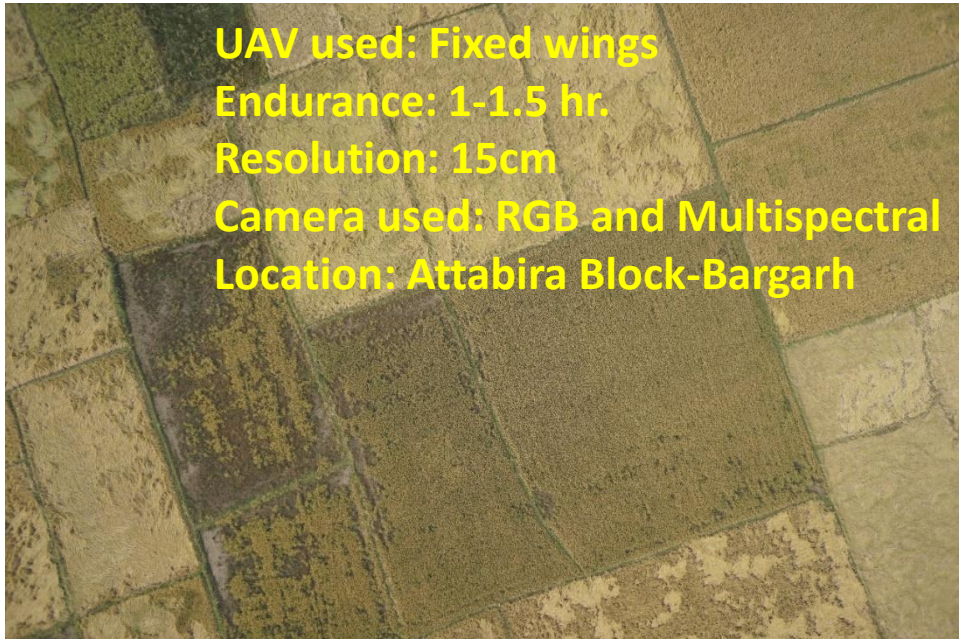

Temporal Sentinel-1 Images Backscatter (VH)

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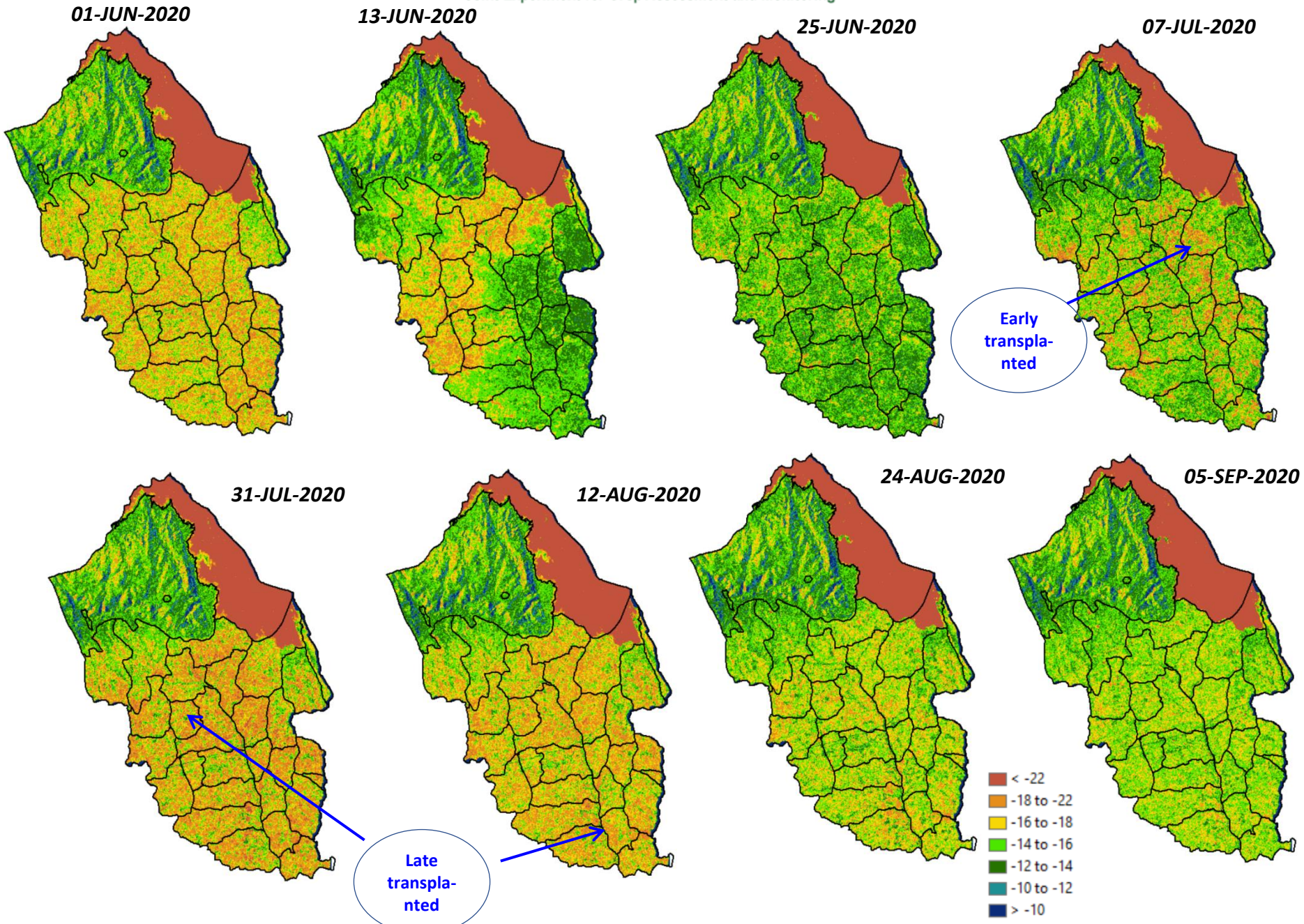

Temporal Sentinel-1 Images Backscatter (VH)

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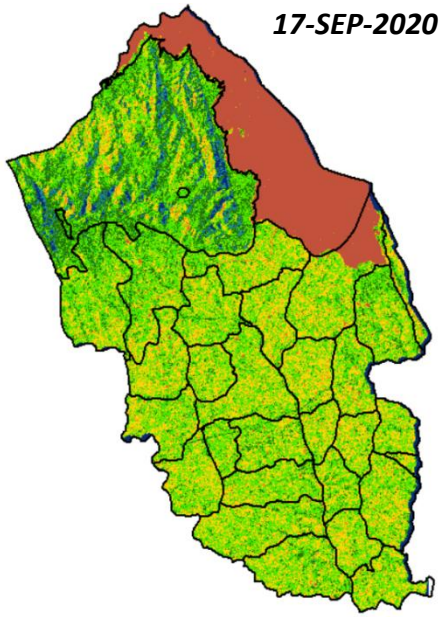
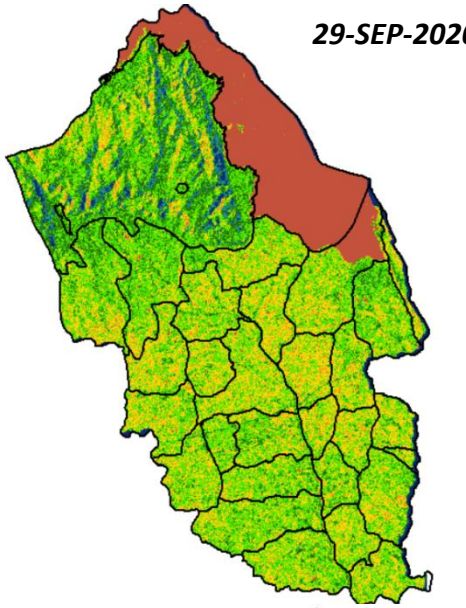
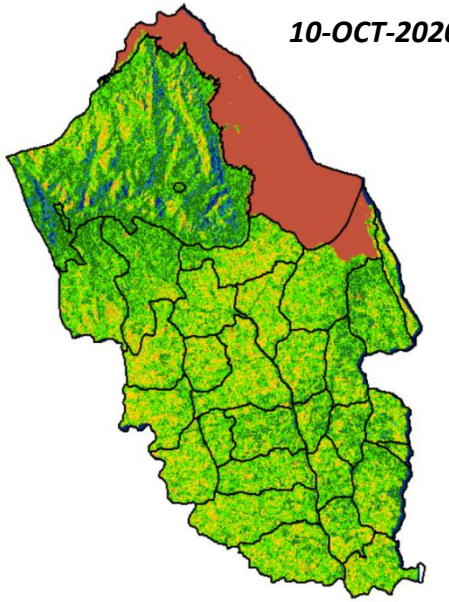
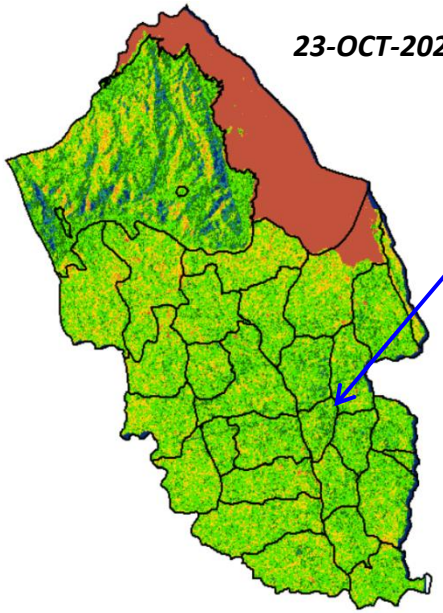
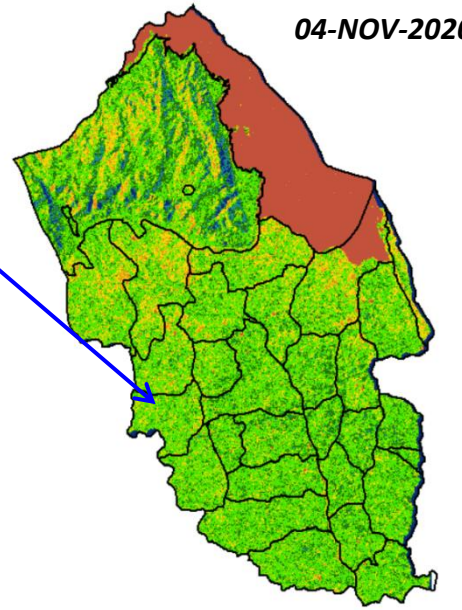


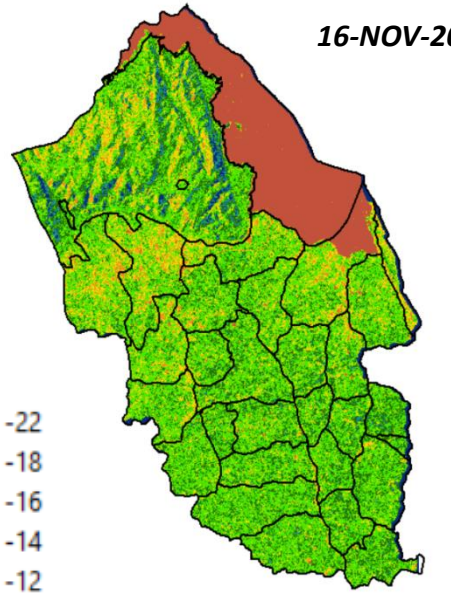






Peak vegetative growth

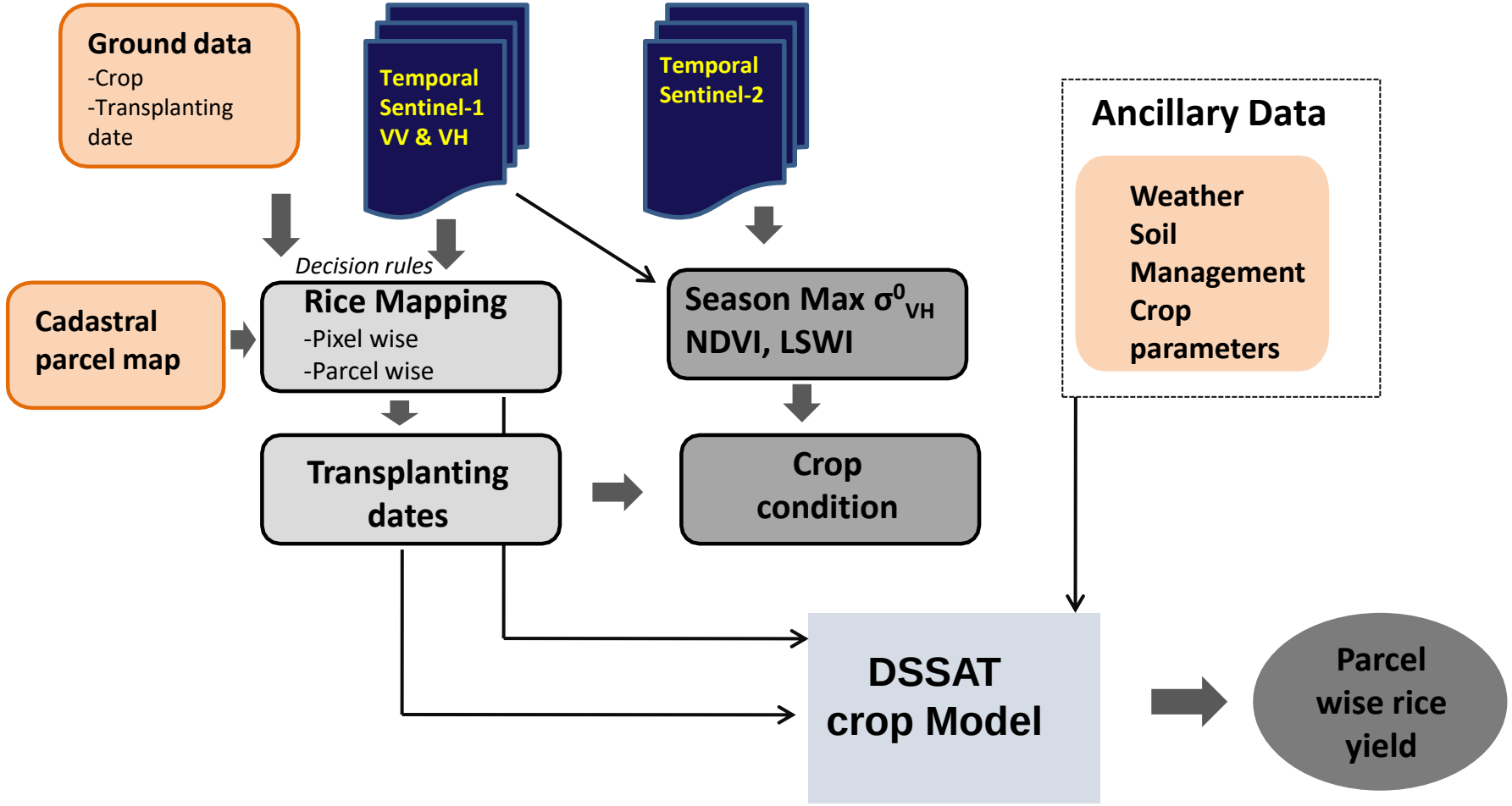




< -22
-18 to -22
-16 to -18
-14 to -16
-12 to -14
-10 to -12
> -10

Rice mapping and Yield estimation

(Schema of work)



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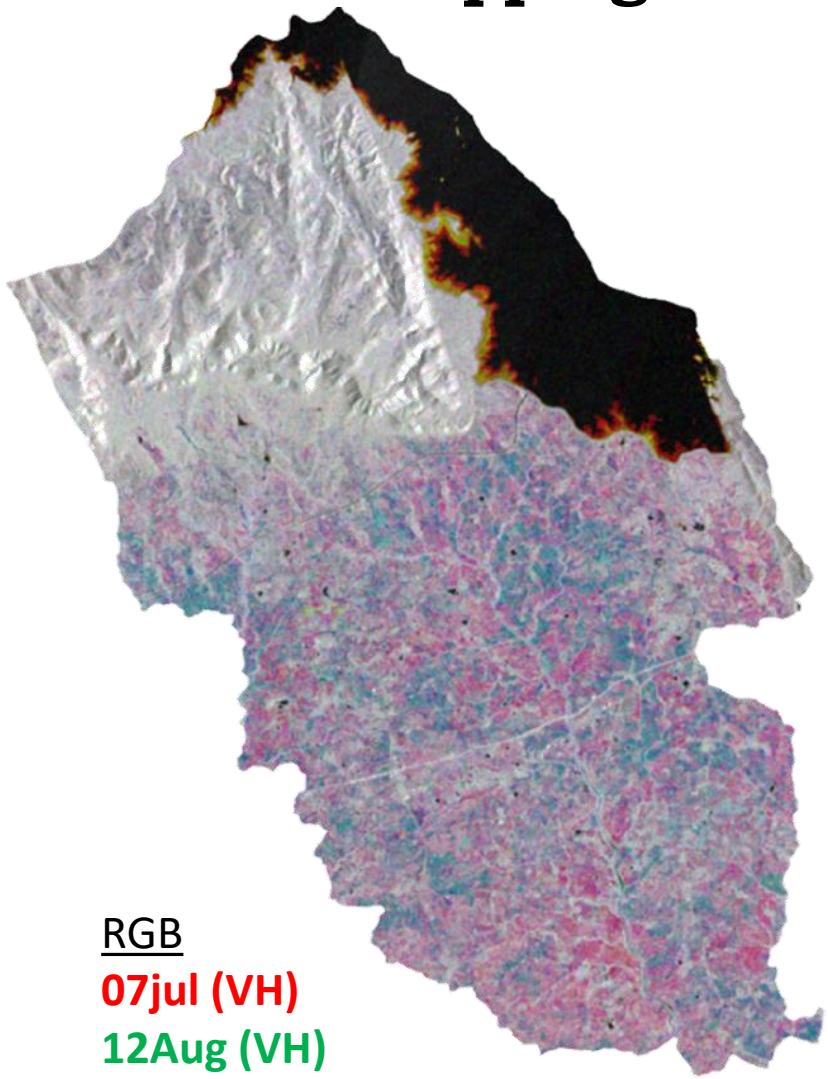
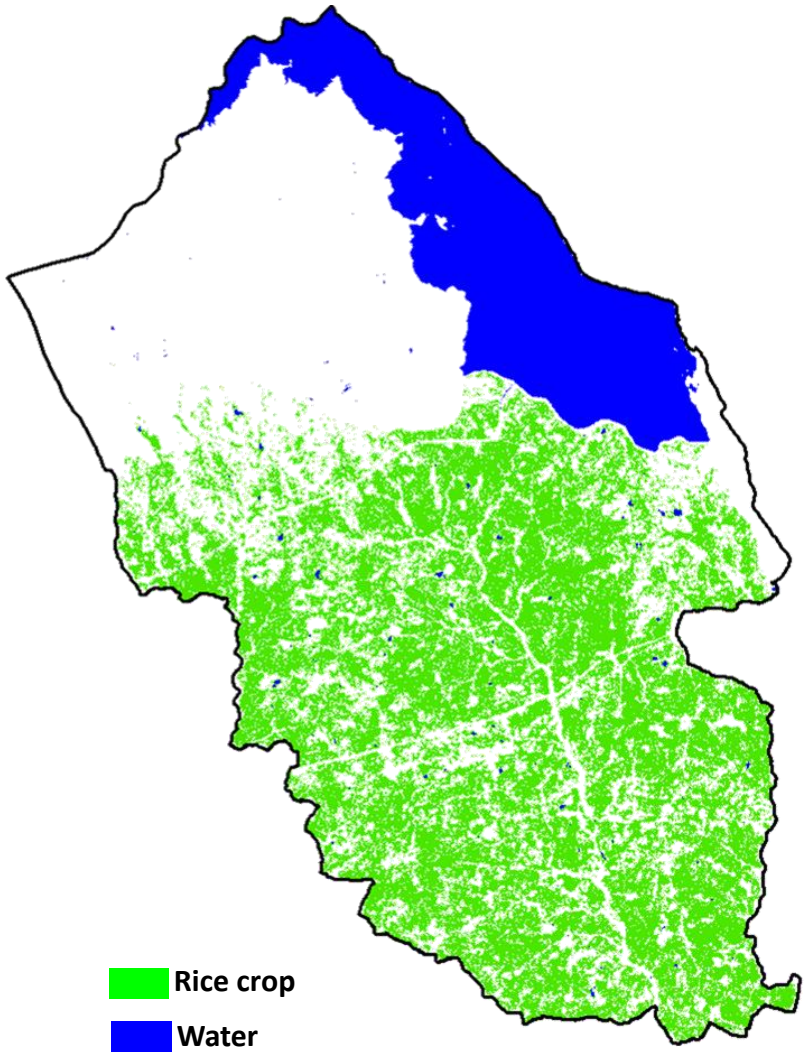
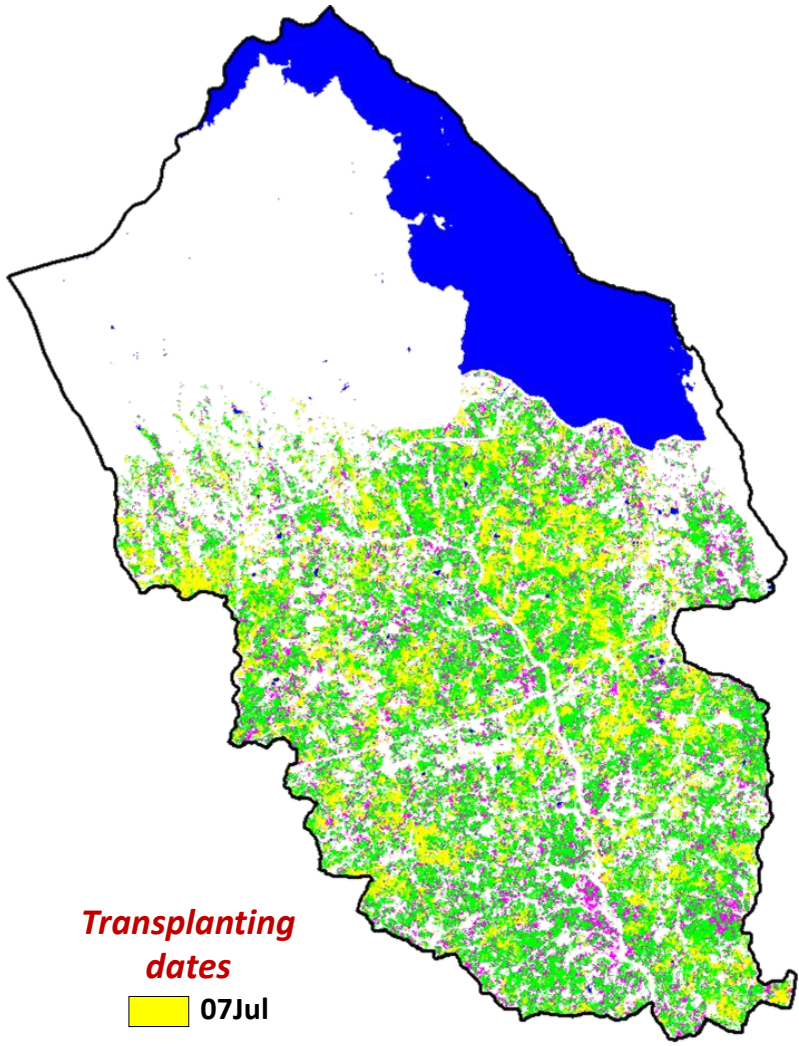
Rice Mapping & Transplanting Dates



RGB
07jul (VH)
12Aug (VH)
05Sep (VH)



Rice crop
Water



Transplanting dates
07Jul
31Jul
12Aug
Water

Area Statistics

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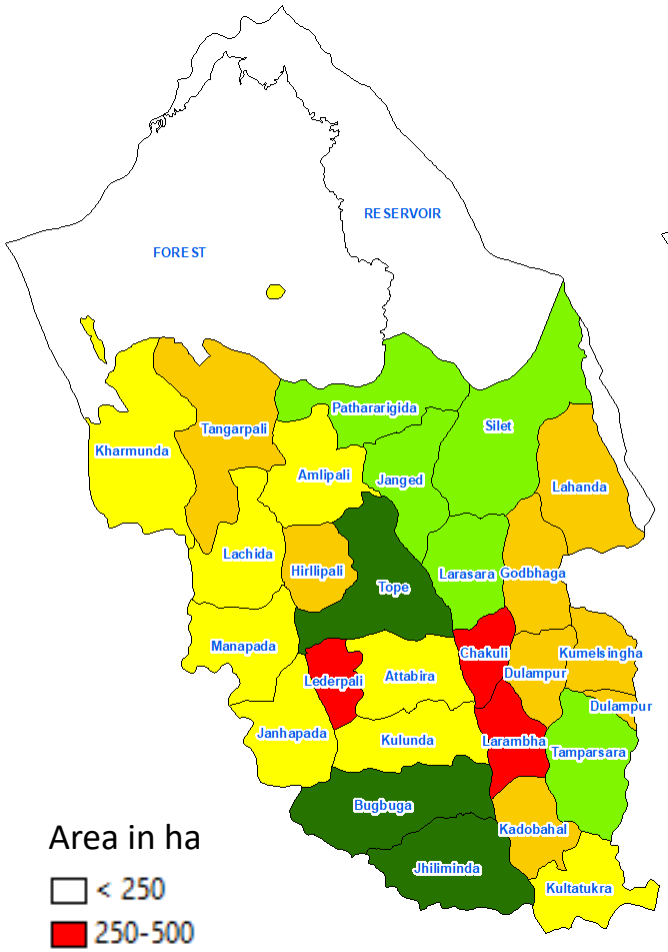
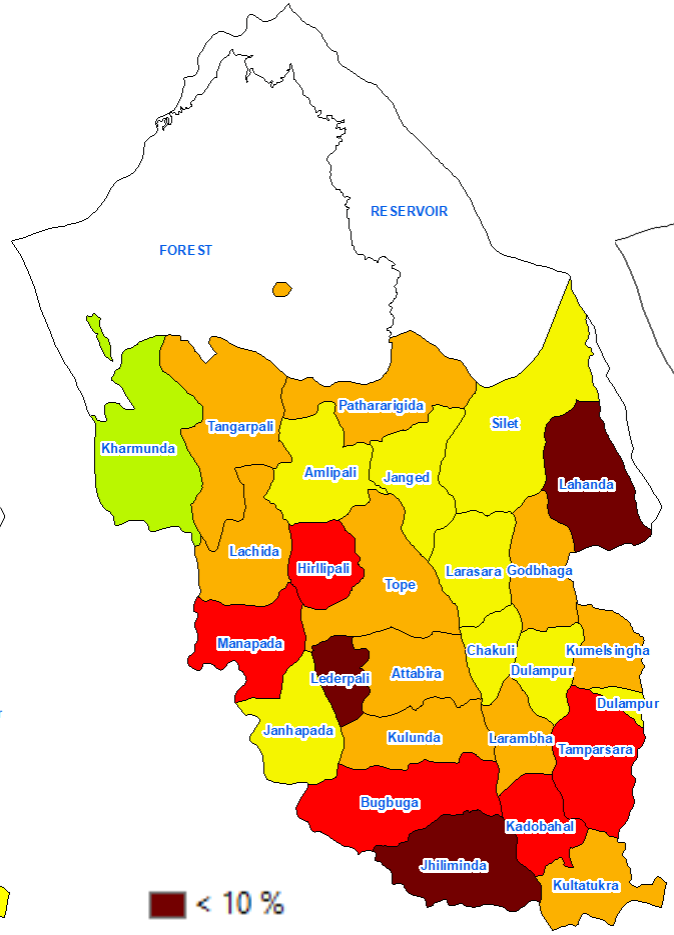
Total Rice area



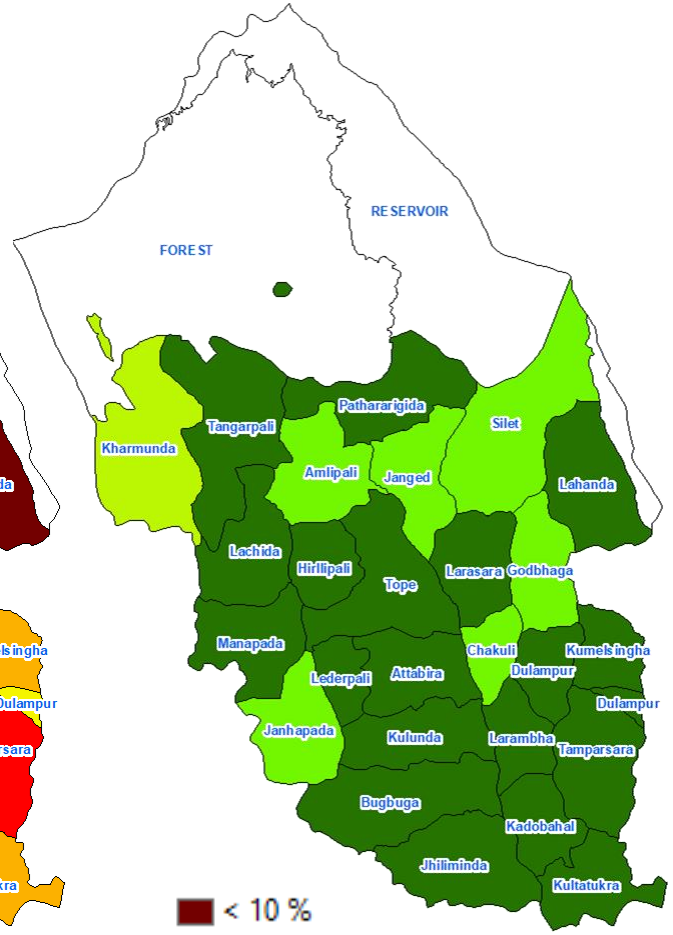
Area in ha
- < 250
- 250-500
- 500-750
- 750-1000
- 1000-1250
- > 1250

Early transplanted



- < 10 %
- 10 - 20 %
- 20 - 30 %
- 30 - 40 %
- 40 - 50 %
- 50 - 60 %
- > 60 %

Late transplanted

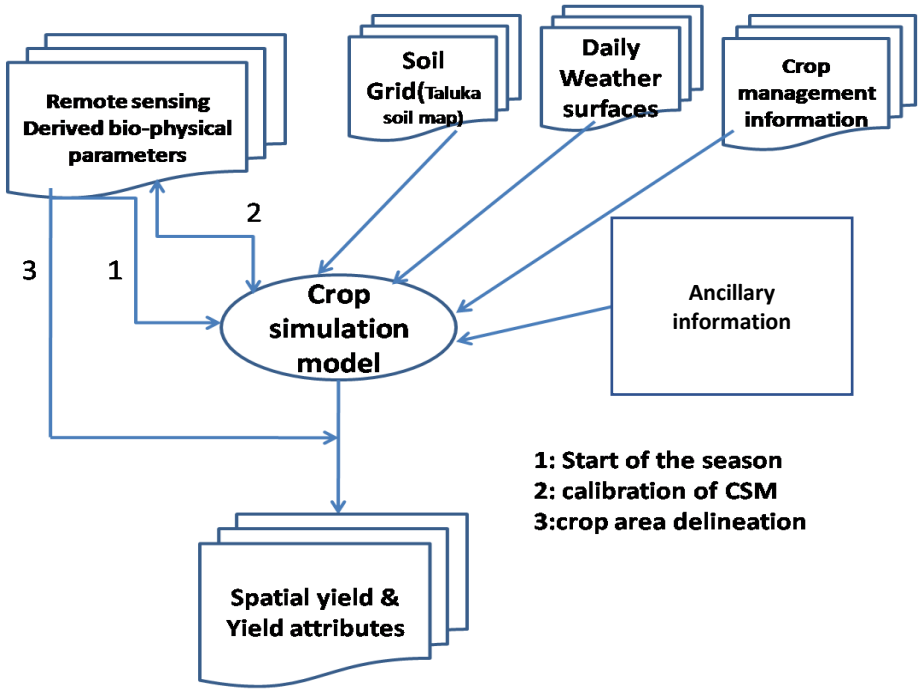


- < 10 %
- 10 - 20 %
- 20 - 30 %
- 30 - 40 %
- 40 - 50 %
- 50 - 60 %
- > 60 %

Rice Yield Simulation

Kharif rice crop growth and yield simulated using crop growth simulation model (DSSAT) with following inputs:

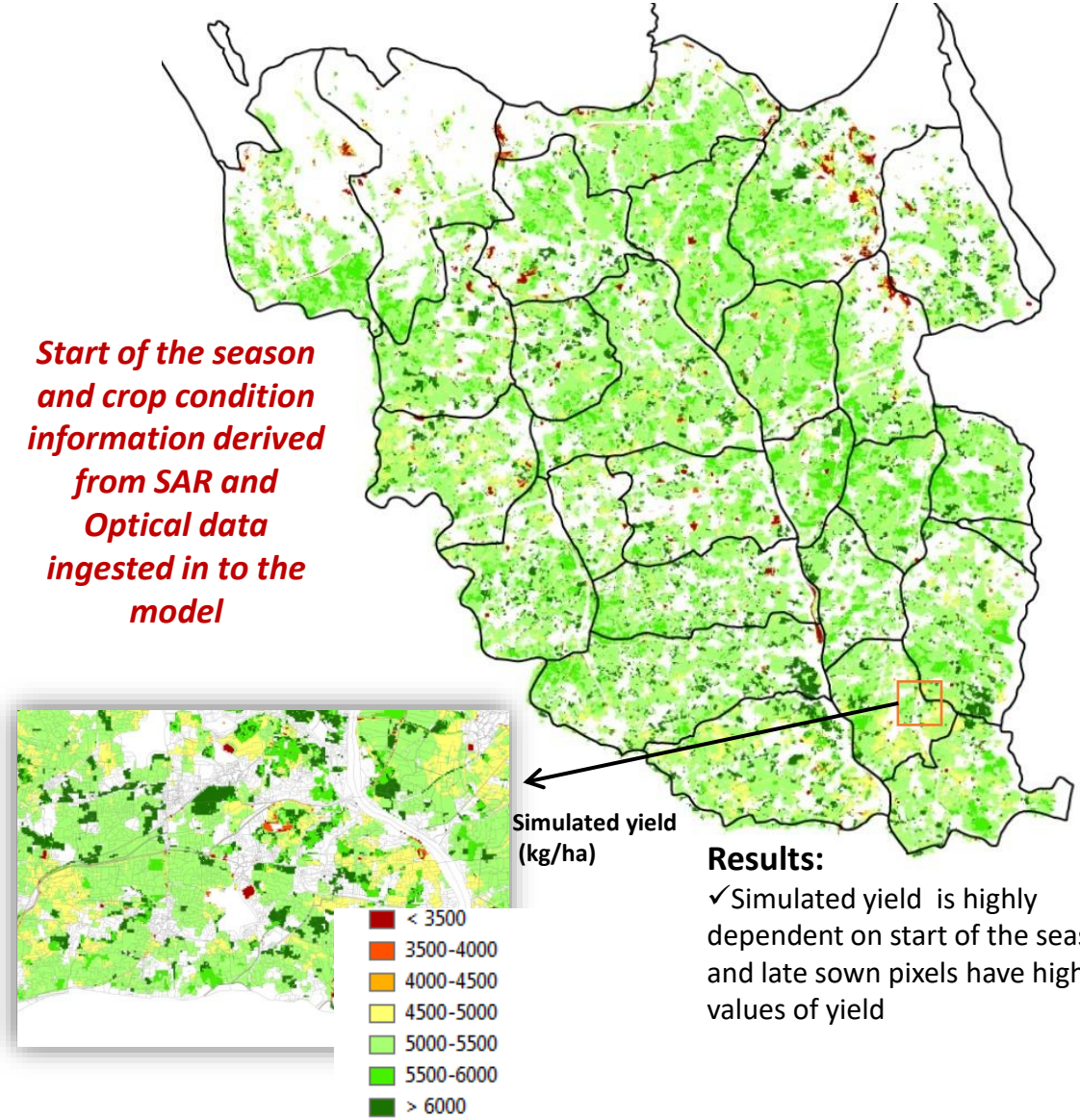
- ✓ Soil map (NBSSLUP)
- ✓ Daily weather data like maximum, minimum temperature, rainfall and solar radiation
- ✓ Rice map (NRSC)
- ✓ Sowing map/start of the season (NRSC)
- ✓ Temporal NDVI &LSWI (Sentinel 2A)



1: Start of the season
2: calibration of CSM
3:crop area delineation

Parcel level Rice Yield Map

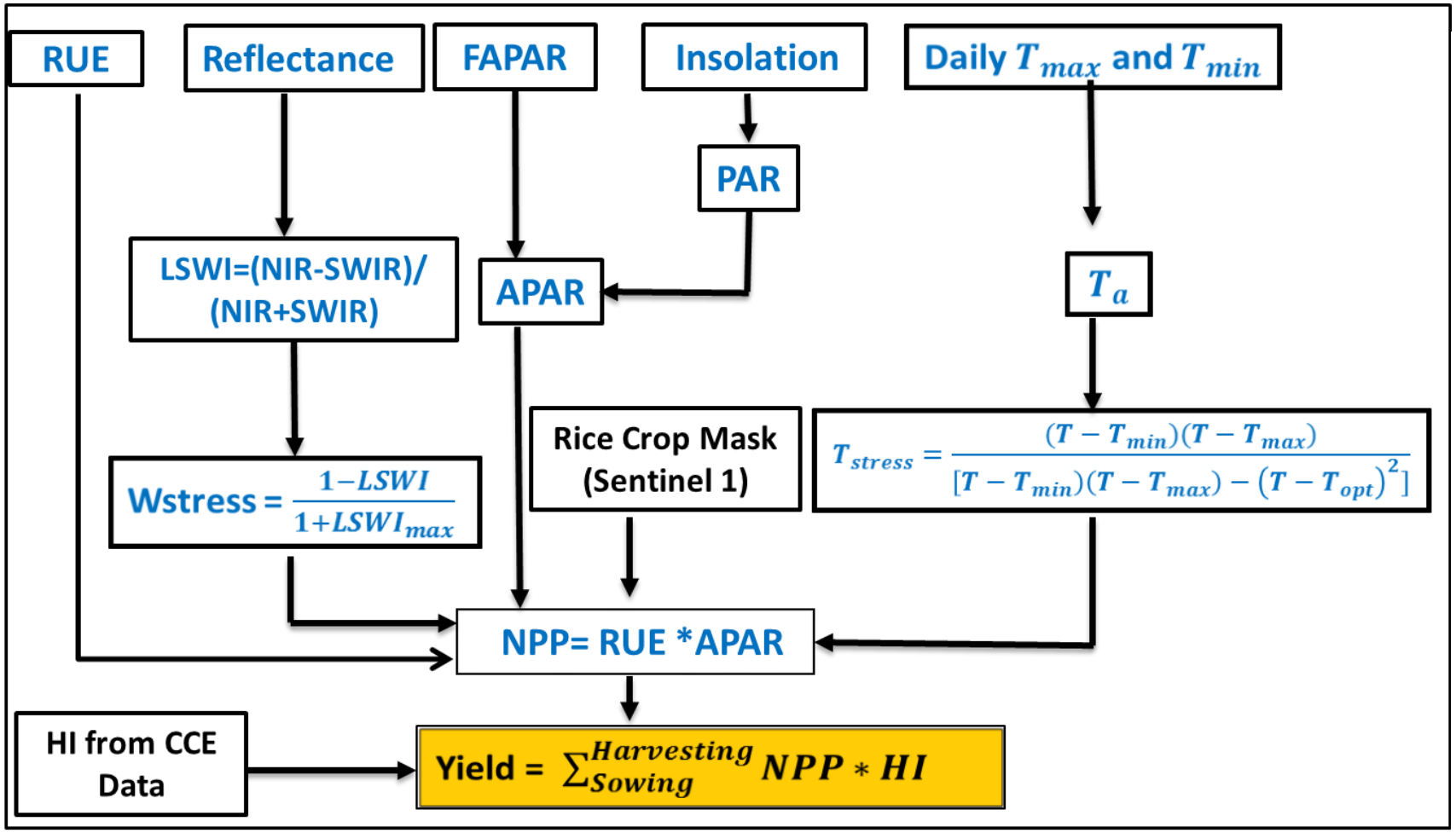
Start of the season and crop condition information derived from SAR and Optical data ingested in to the model

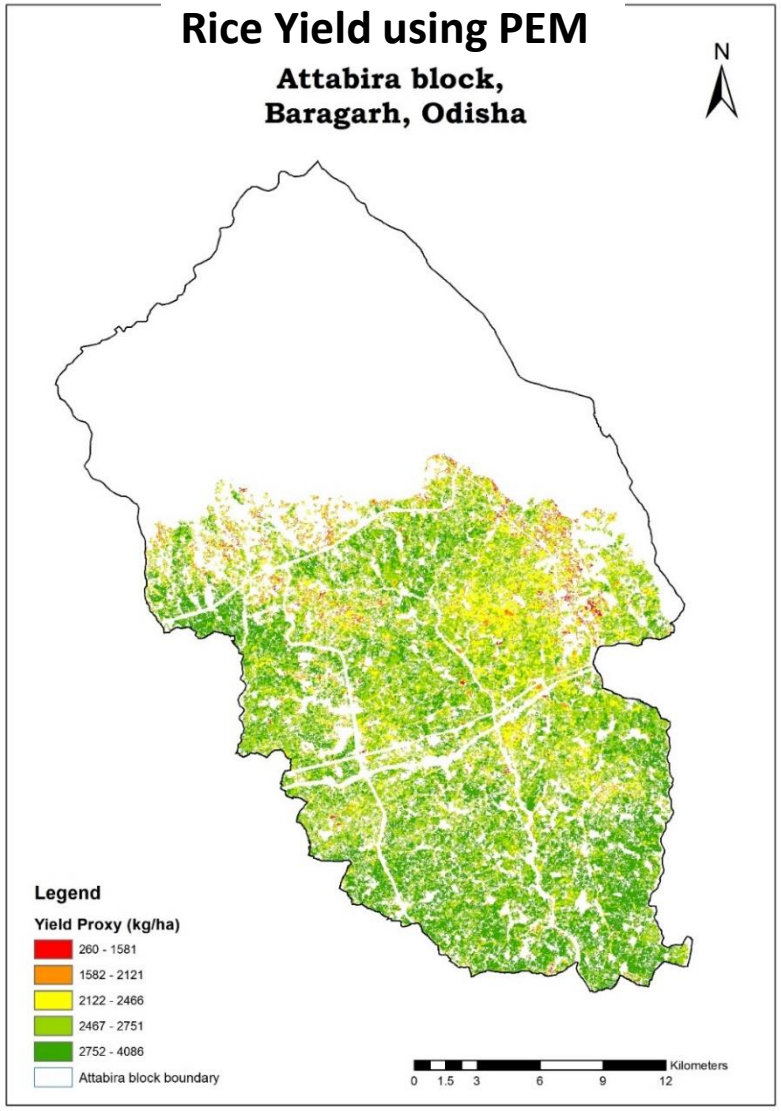


Results:

✓Simulated yield is highly dependent on start of the season and late sown pixels have higher values of yield

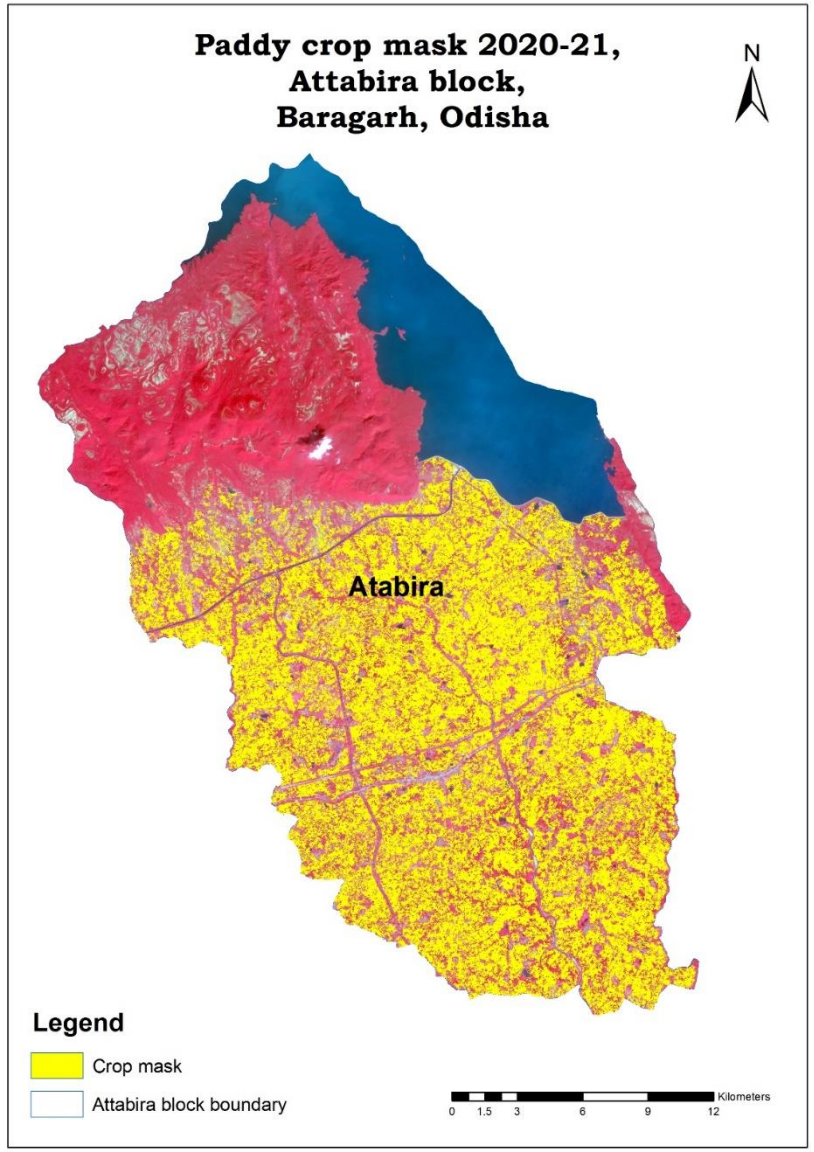
Crop Yield Estimation using Production Efficiency Model (PEM)



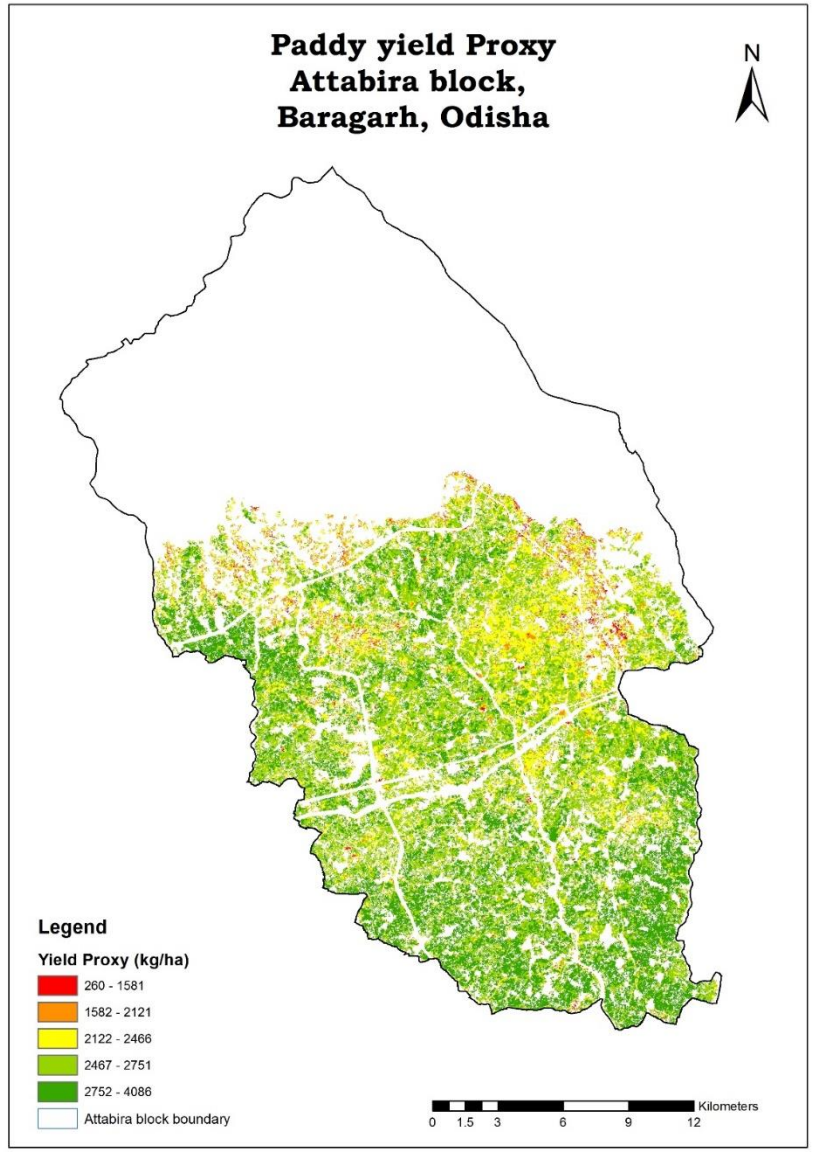


RUE: Maximum radiation use efficiency (g/MJ/day); HI: harvest Index (economic yield/Total dry matter); NPP: Net Primary Product; LSWI: Land Surface Water Index; PAR: Photosynthetically Active Radiation (0.4-0.7µm); fAPAR: Fraction of PAR absorbed by the plant; T: Daily average temperature; Tmax: higher thresh hold for crop growth ; Tmin: Lower thresh hold for crop growth and Topt: Optimum temp. for crop growth

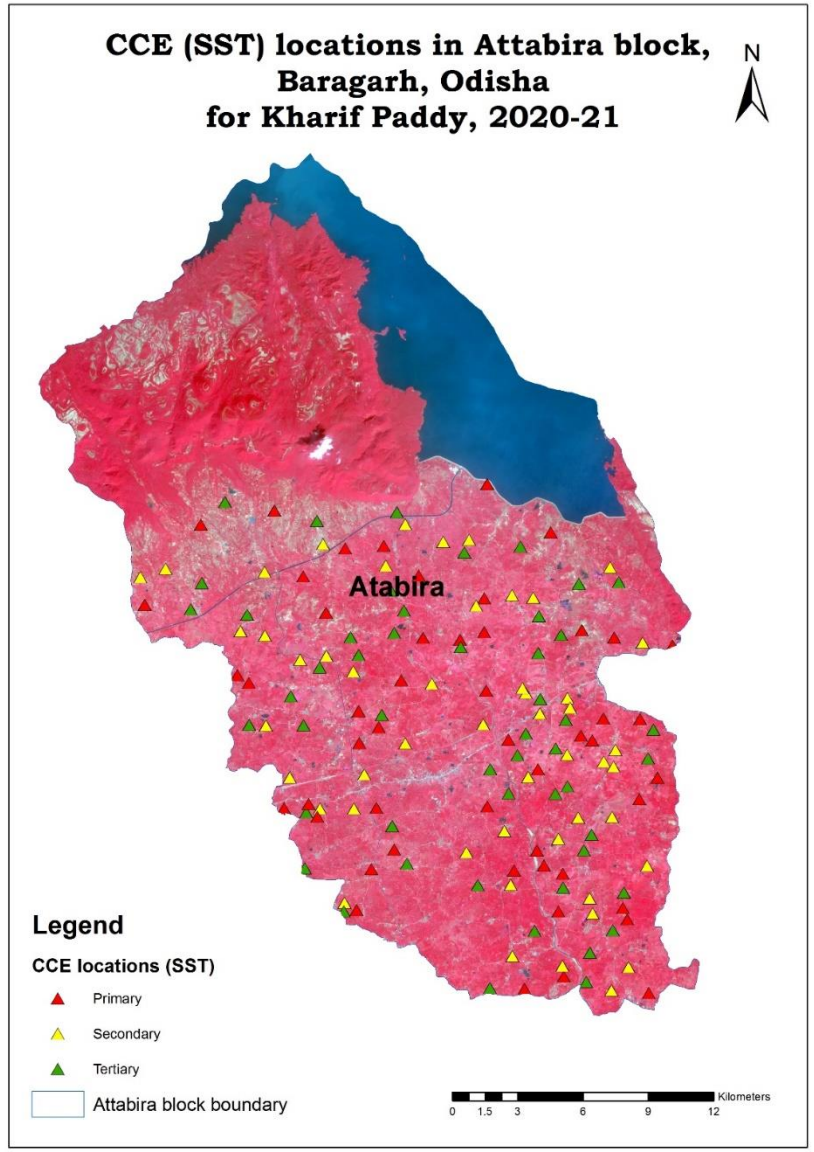
Remote Sensing based Plans for Crop Cutting Experiments (CCE)



Paddy Crop Map

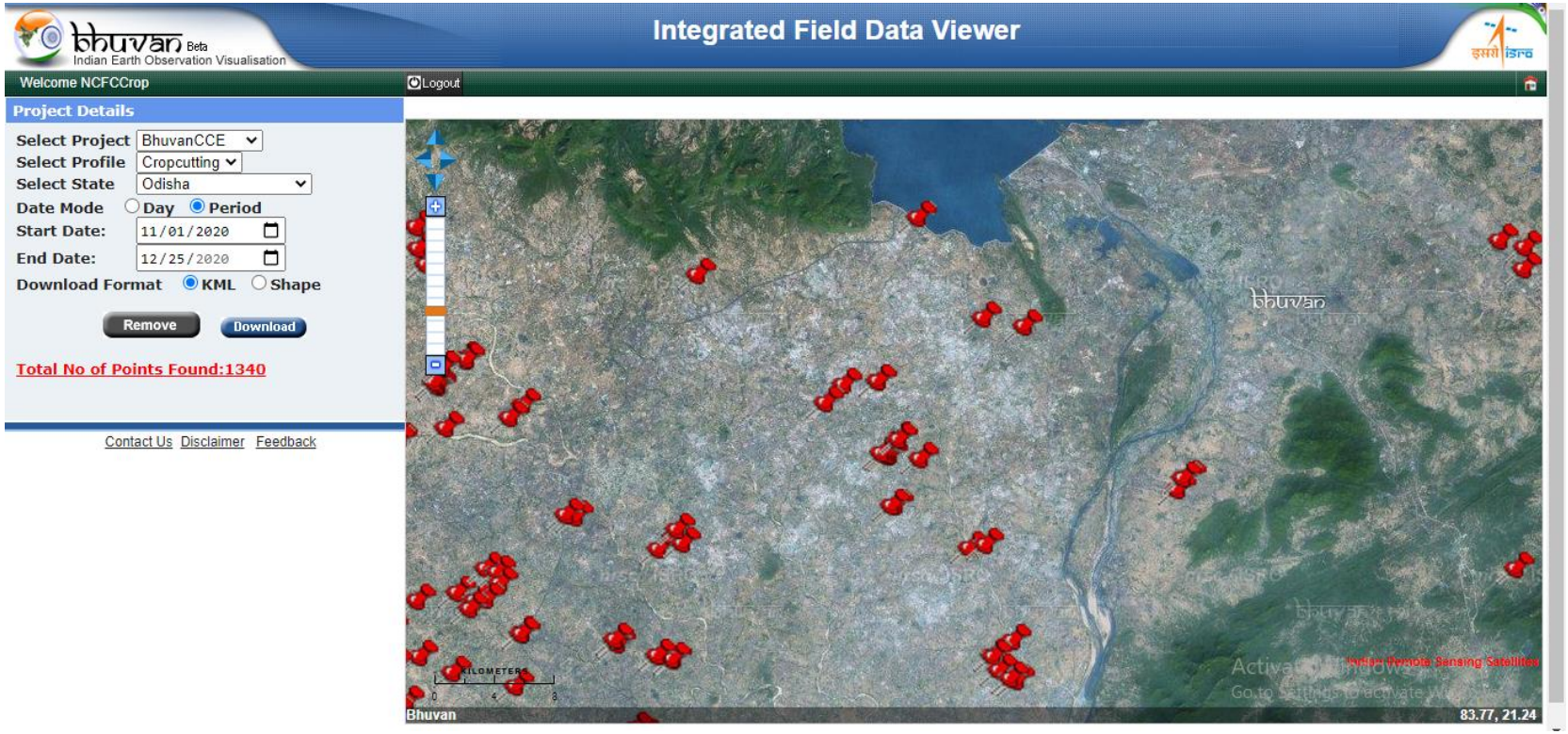


Paddy Yield map using PEM



Proposed CCE location

Crop Cuts conducted in selected sites



Proposed analysis

- Derivation of crop phenological matrices.
- Integration of optical and SAR data for better mapping and monitoring of rice crop.
- Evaluation of advanced classifiers for rice crop classifications.
- Validation of estimated crop yield using CCE data.
- Exploring other methods (AI/ML) for crop yield estimation.

Thank you.