Food Security and Satellite Monitoring

Working Group 5: Agriculture and Food Security

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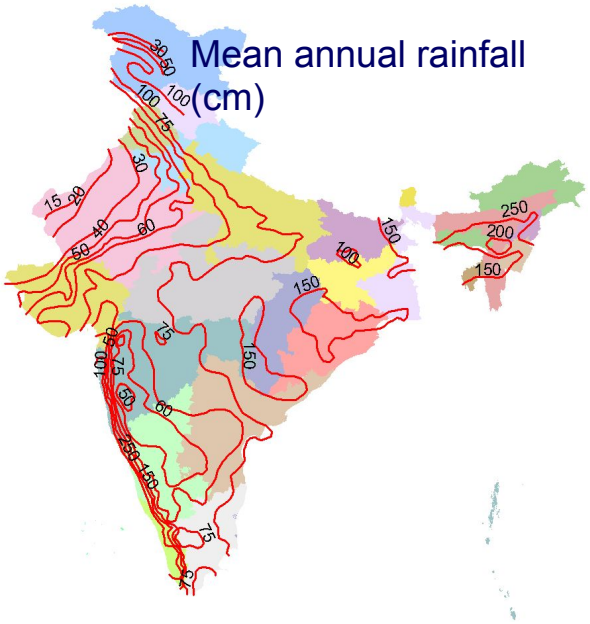
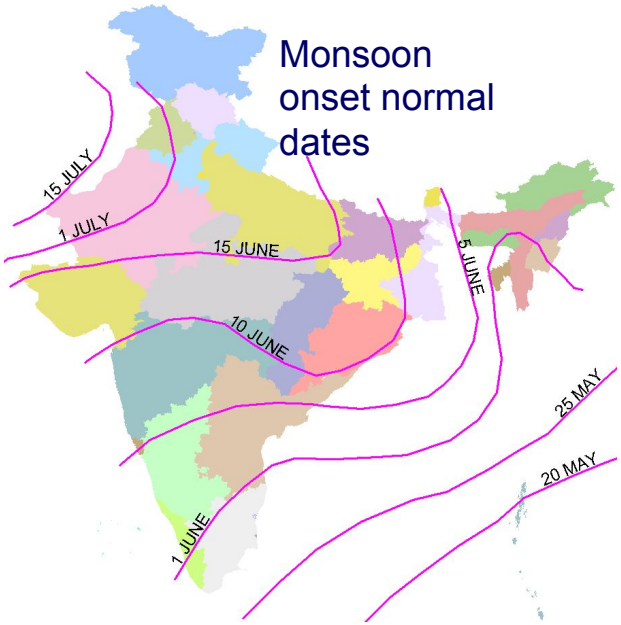
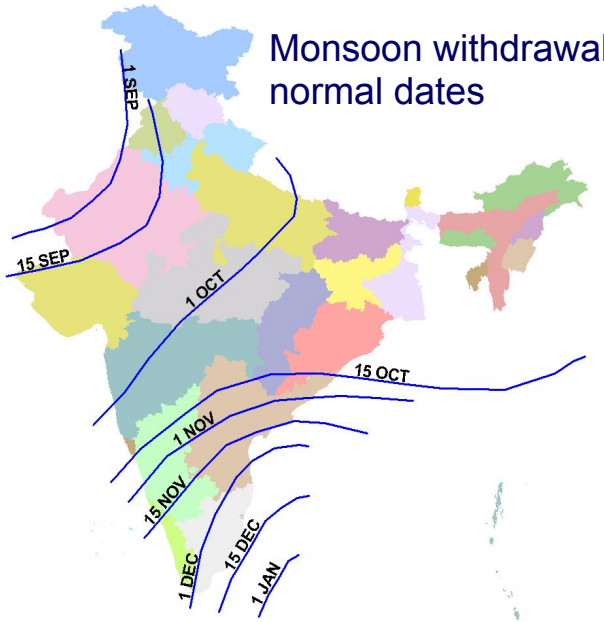
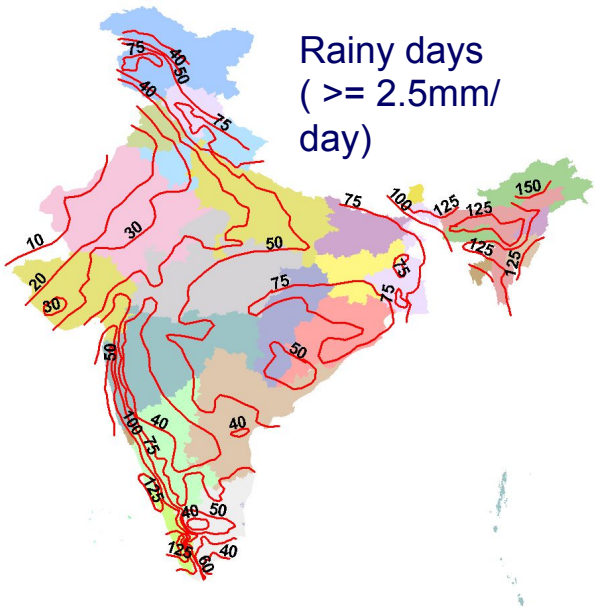
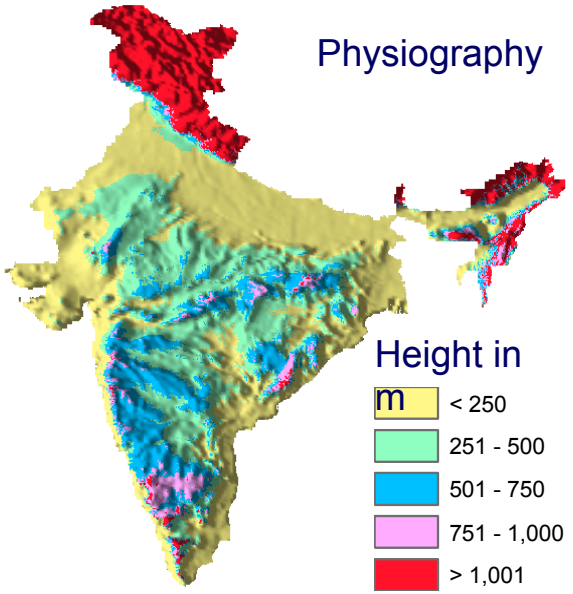
Indian Monsoon, Irrigation and Physiography



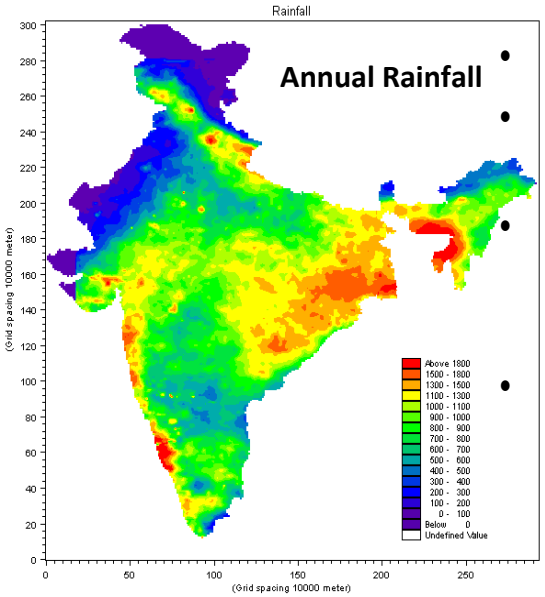




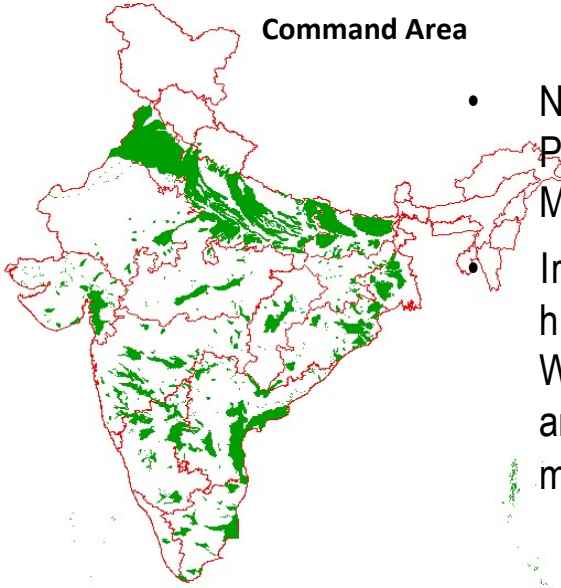




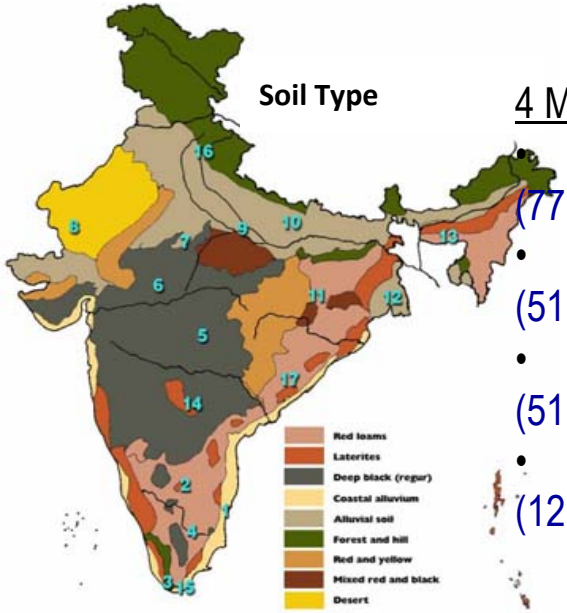
Controlling Factors of Agriculture



- 120 cm rainfall
- 75% during southwest monsoon season
- Western coastal plain and NE region >400cm
- Western Rajasthan, Gujarat, Haryana & Punjab < 60cm

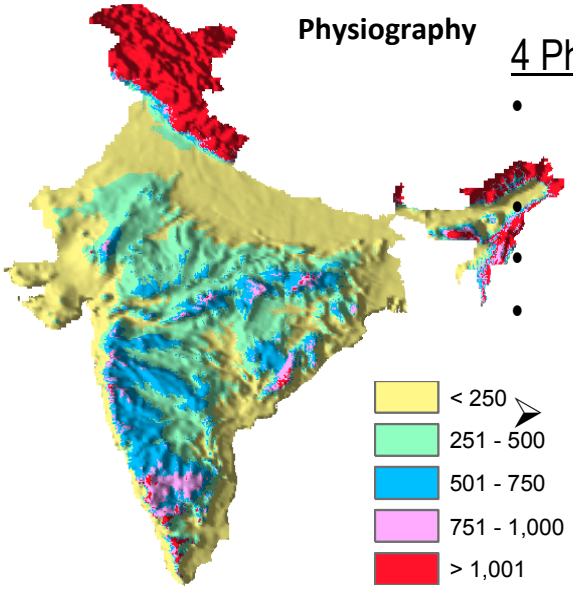


- NAI/NAS is >90% for Punjab and <15% for Maharashtra
- Irrigation coverage high (>80%) for Wheat, sugarcane and low (<15%) for millets, pulses



<u>4 Major Soil types</u>

- Alluvial soils (77.7 Mha, Fertile)
- Black soils (51.8 Mha, Fairly fertile)
- Red soils (51.8 Mha, Differ in fertility)
- Laterite soils (12.7 Mha, Low Fertility)



<u>4 Physiographical divisions</u>

- Northern mountain region
- Great plains of the north
- The Peninsular plateau
- The Coastal plains and Islands

Altitude ranges from > 1000 m to <250 m

Agricultural Assessment: the Evolution

Airborne Data | Experimental Satellites | Operational Satellites | Theme-Specific Satellites | Satellites in New Domain

Parameter Retrieval

Cropping System Analysis

CAPE – I
CAPE II

Taluk & Selected Districts Acreage Estimation

CGMS

EIA, Climate Change

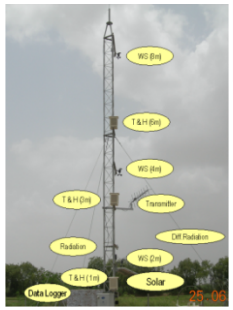
National Level Wheat Acreage

Experimental Studies on Agriculture, CYM

Energy & Mass Exchange

Crop Simulation Model

Crop Discrimination Signature Study



Large Scale Observations

Crop Rotation

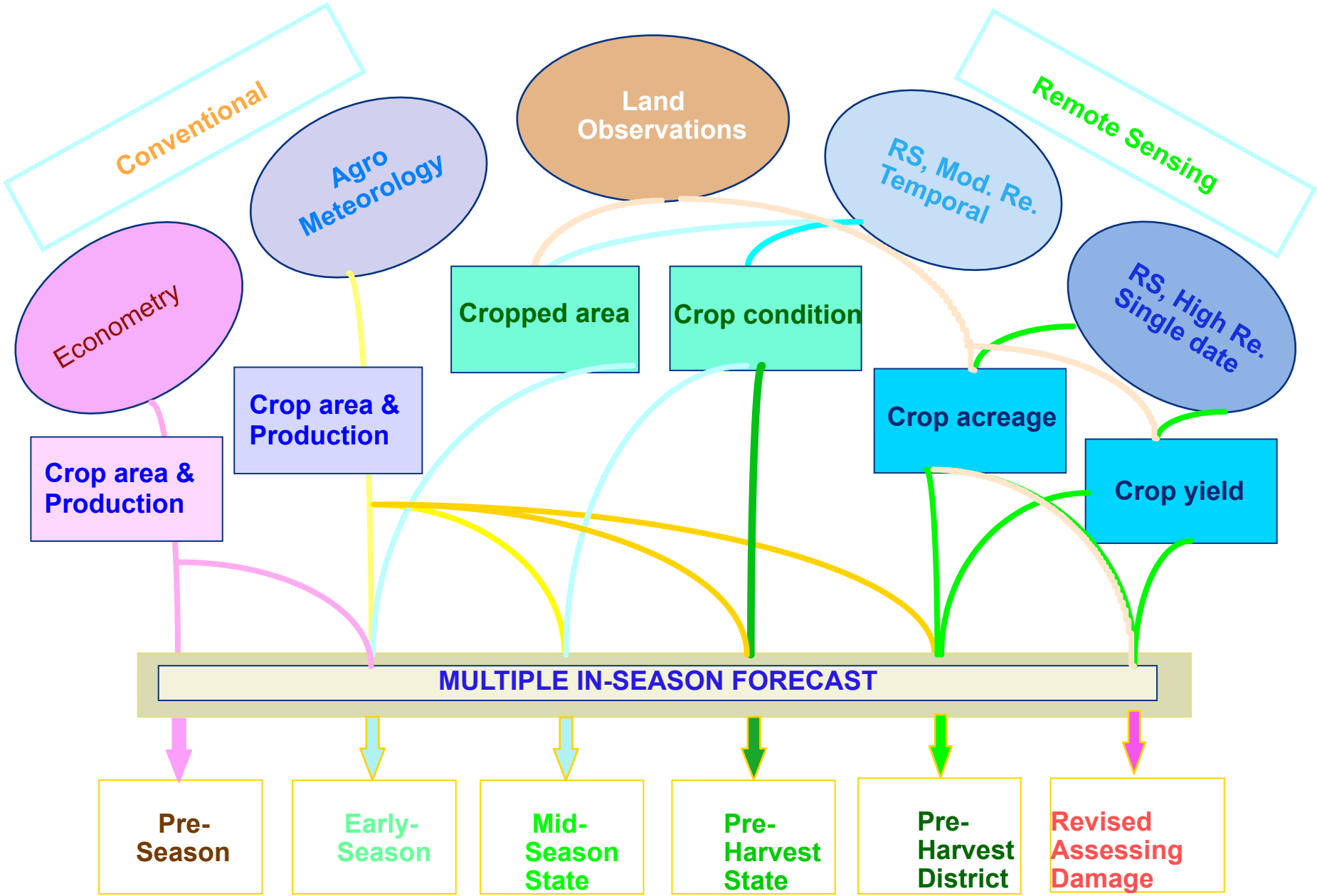
Coconut Wilt Disease Experiment

Sensor System Studies

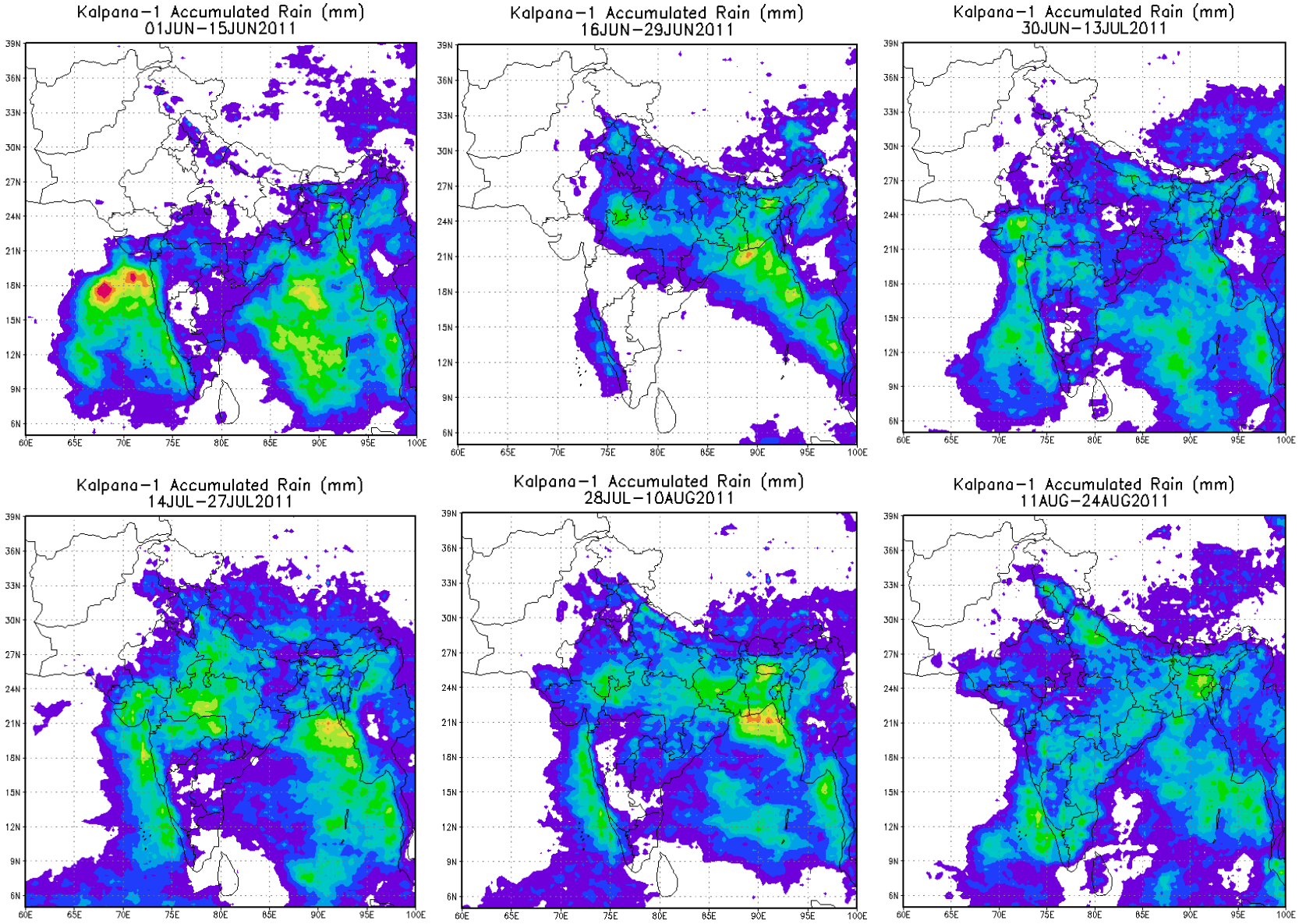
Visual Intrprtn. | DIP | DIP+GIS | Modeling | Gr. Obs. | Inversion

1970's | 1980's | 1990's | 2000's | 2010's

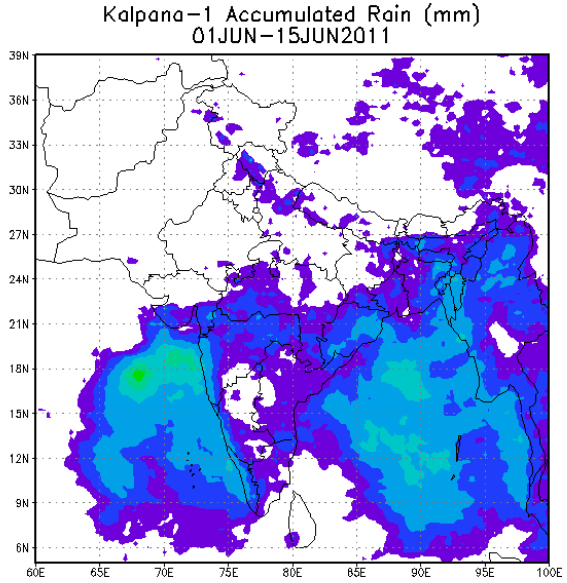
Forecasting Agricultural output using Space, Agrometeorology and Land based observations (FASAL)

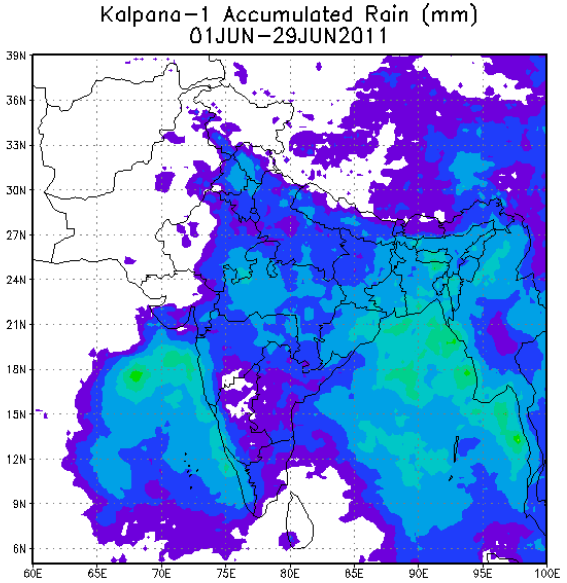


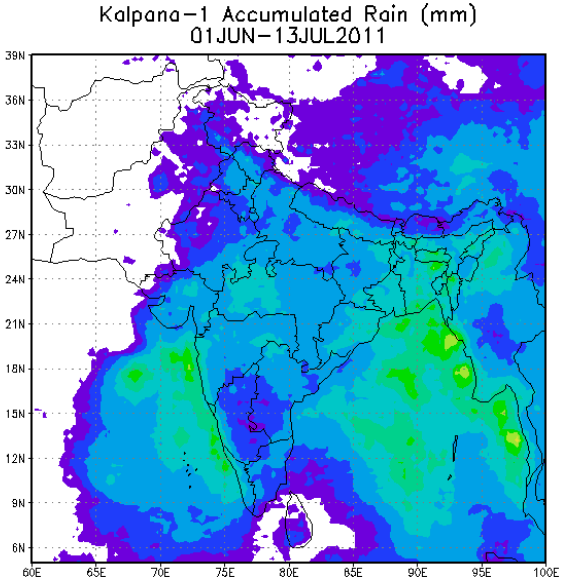
Fortnightly Rainfall, June 1-August 24, 2011

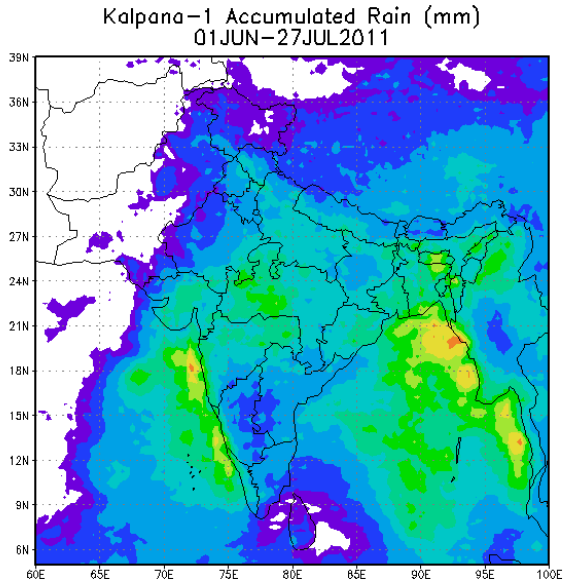


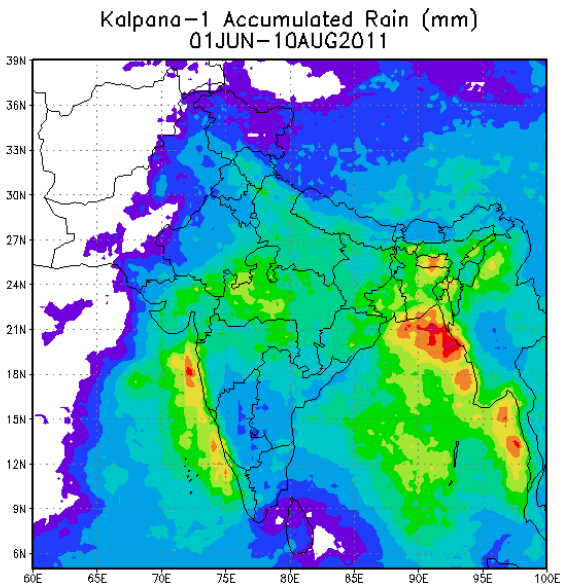
Cumulative Total Rainfall, June 1-August 24, 2011

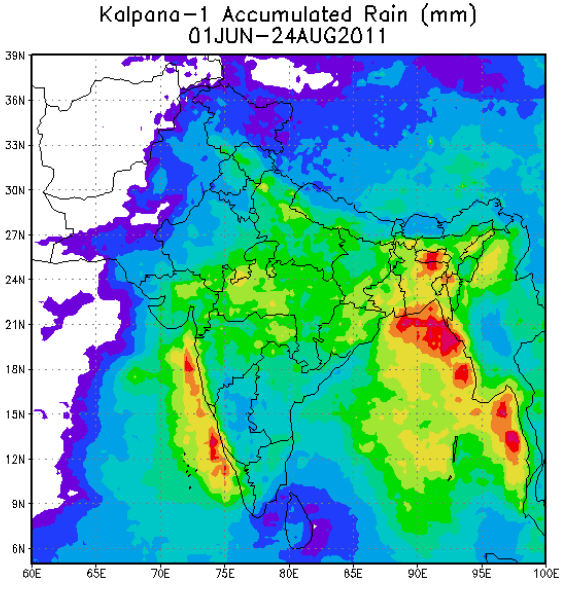


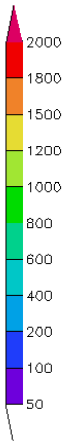


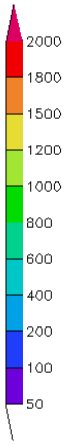




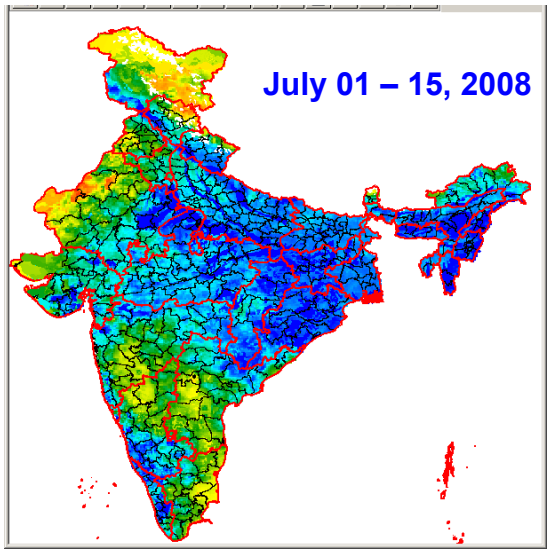


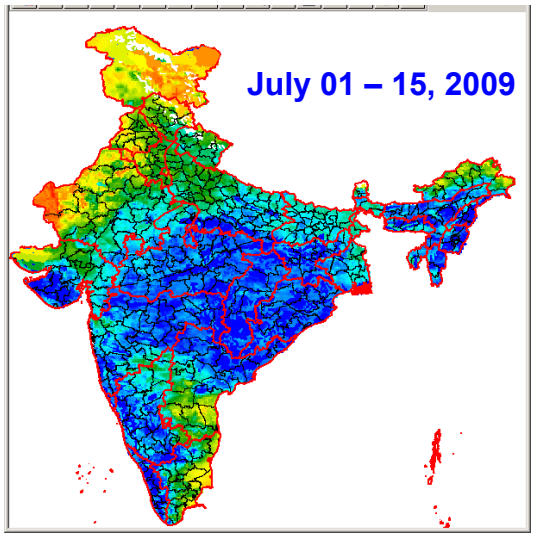


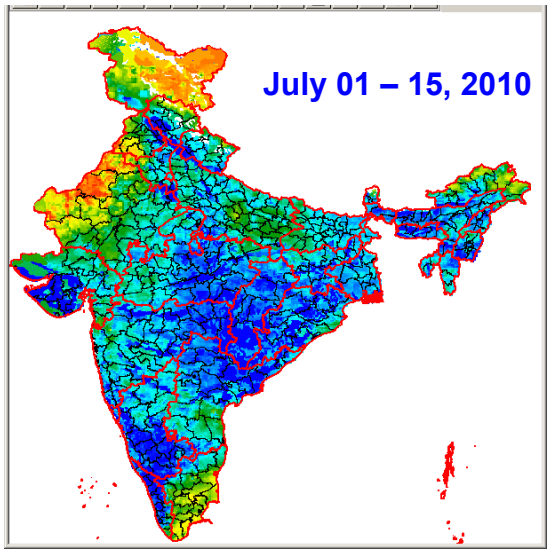


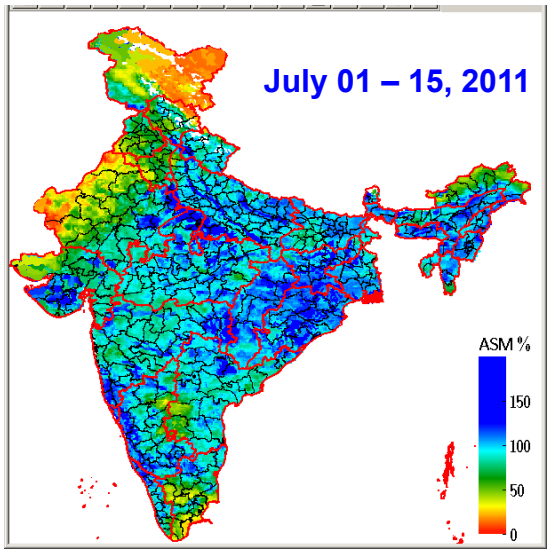


Soil Moisture based Assessment of Crop Situation (SMACS)









Available Soil Moisture (ASM) in %

Colour Codes:

Red to Yellow (ASM < 50): Not suitable for sowing of Crops. Requires irrigation for sowing.

Green to Blue: Suitable for Coarse Cereals.

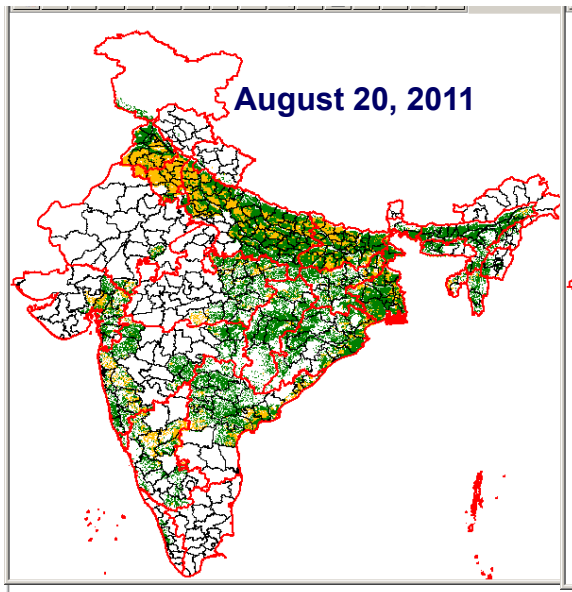
Deep Blue: Suitable for Rice.

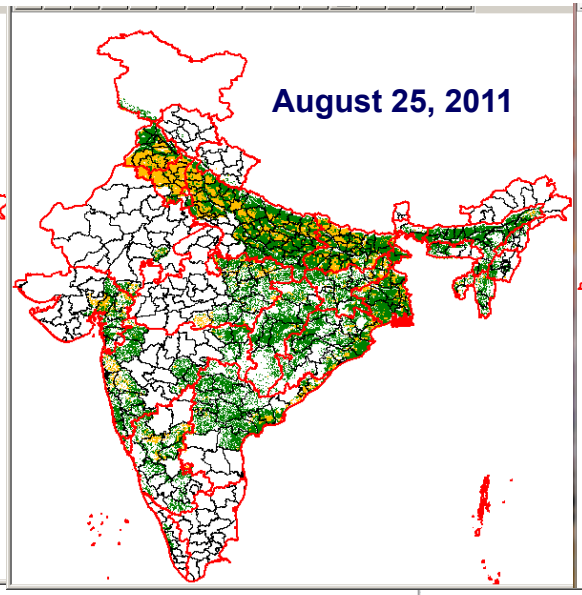
Note:

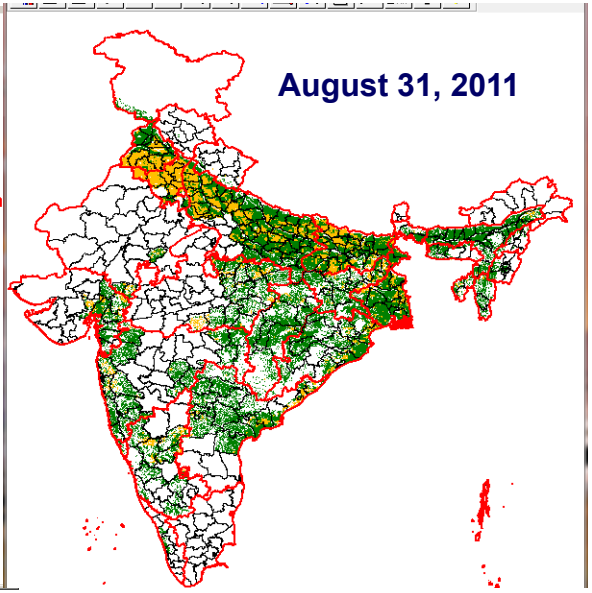
***Suitability does not imply crops have been sown it* depends on various other factors.**

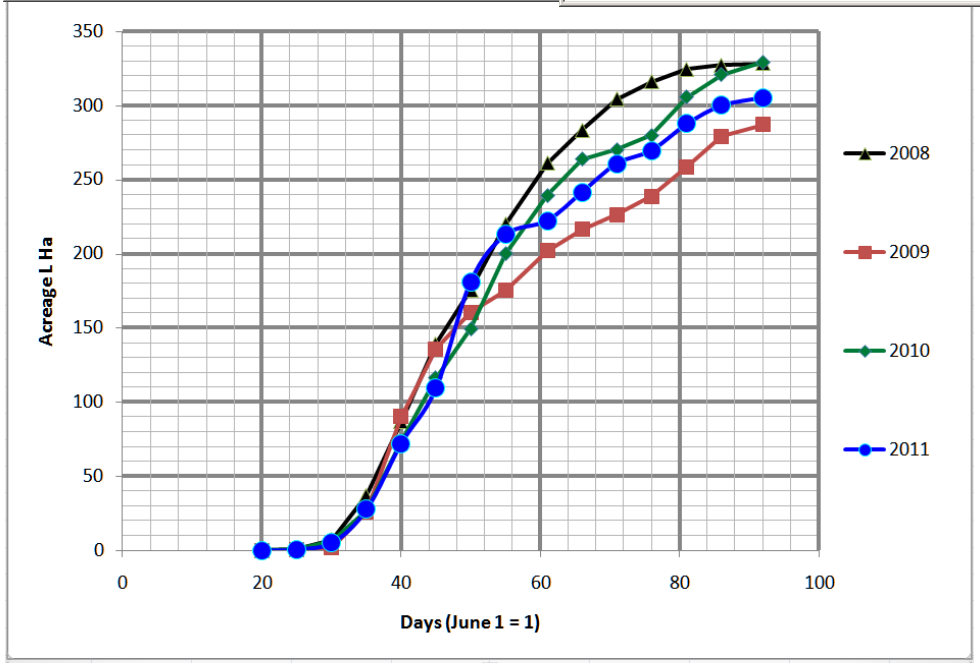
***Not suitable does not imply that no crops are sown* as irrigation of the fields is possible.**

Weekly Assessment of Progress in Kharif Rice Acreage







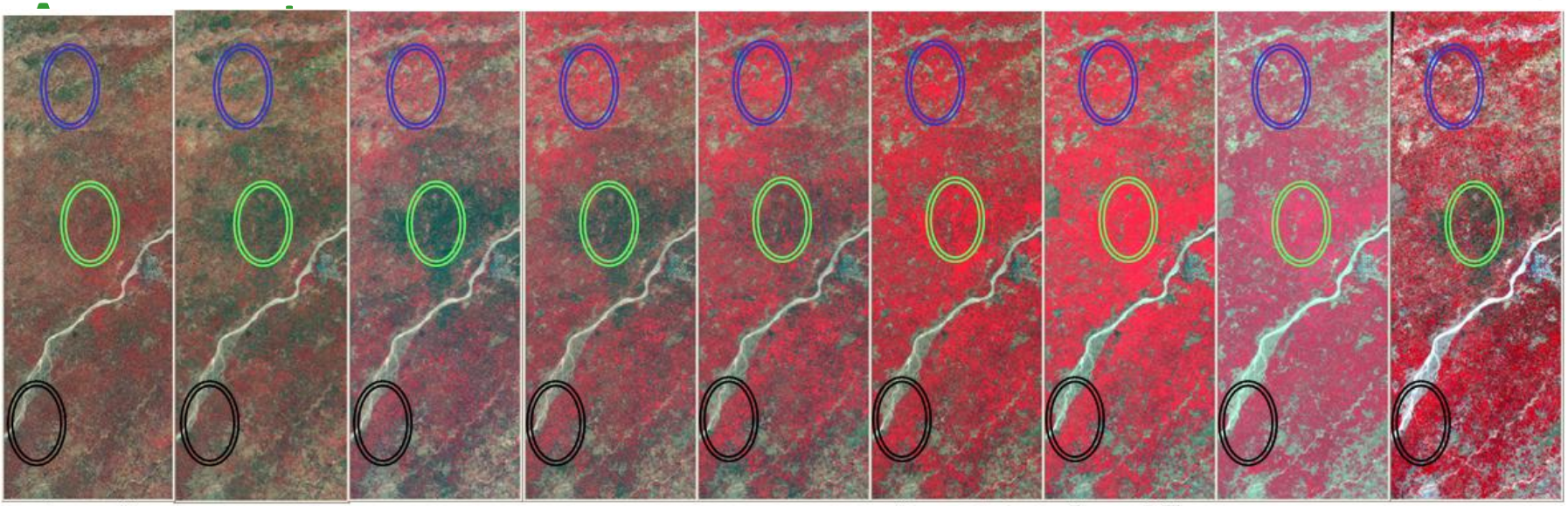


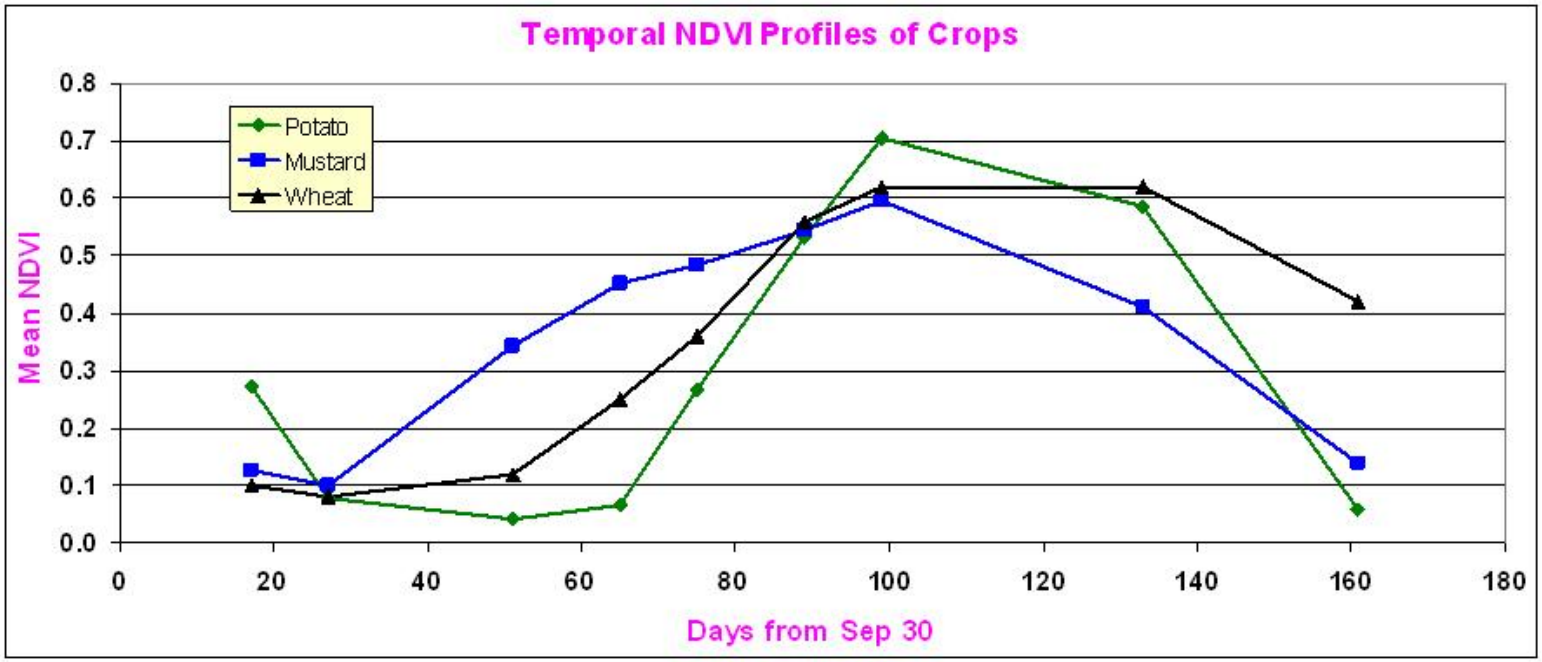
Rainfed rice Area Sown = 30.51 M ha

Relative Deviations -7.3 % (w.r.t. 2010)

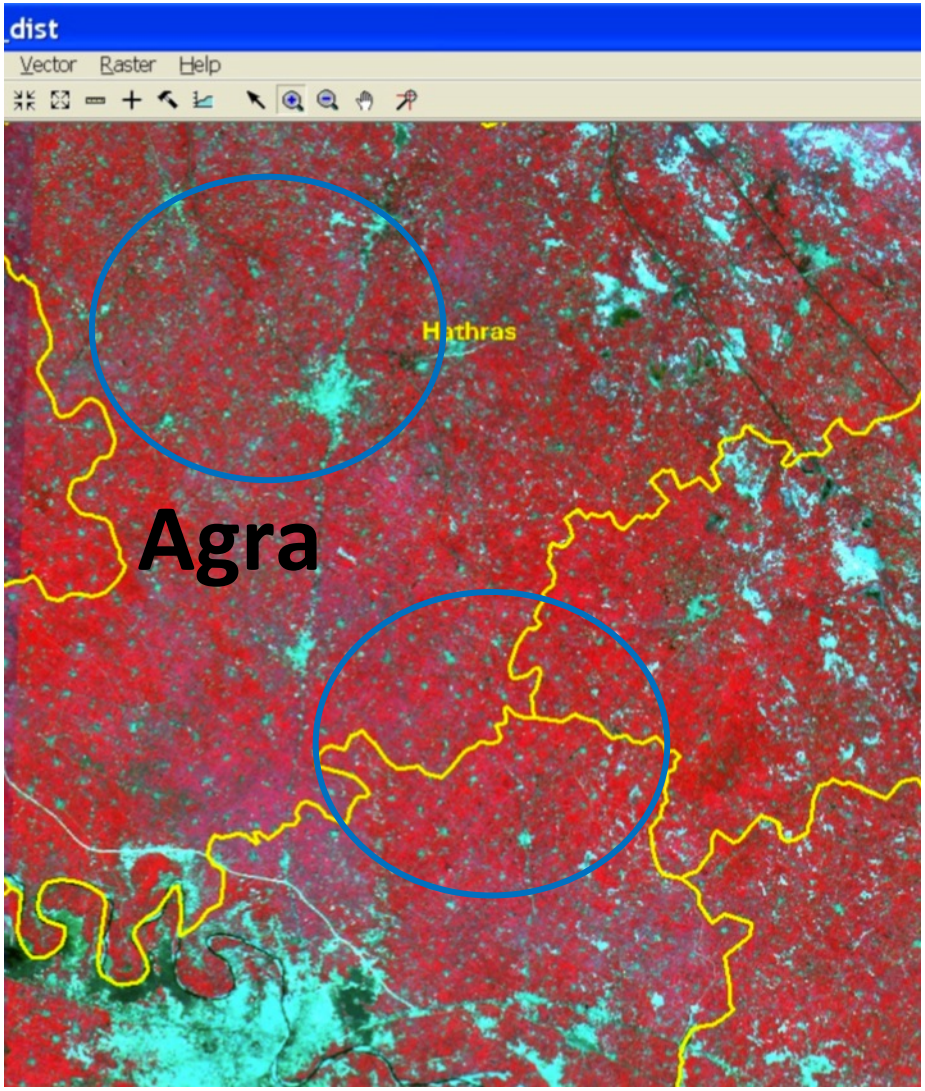
+6.3 % (2009 - poor rainfall year)

Multidate Optical Remote Sensing and its use in Crop

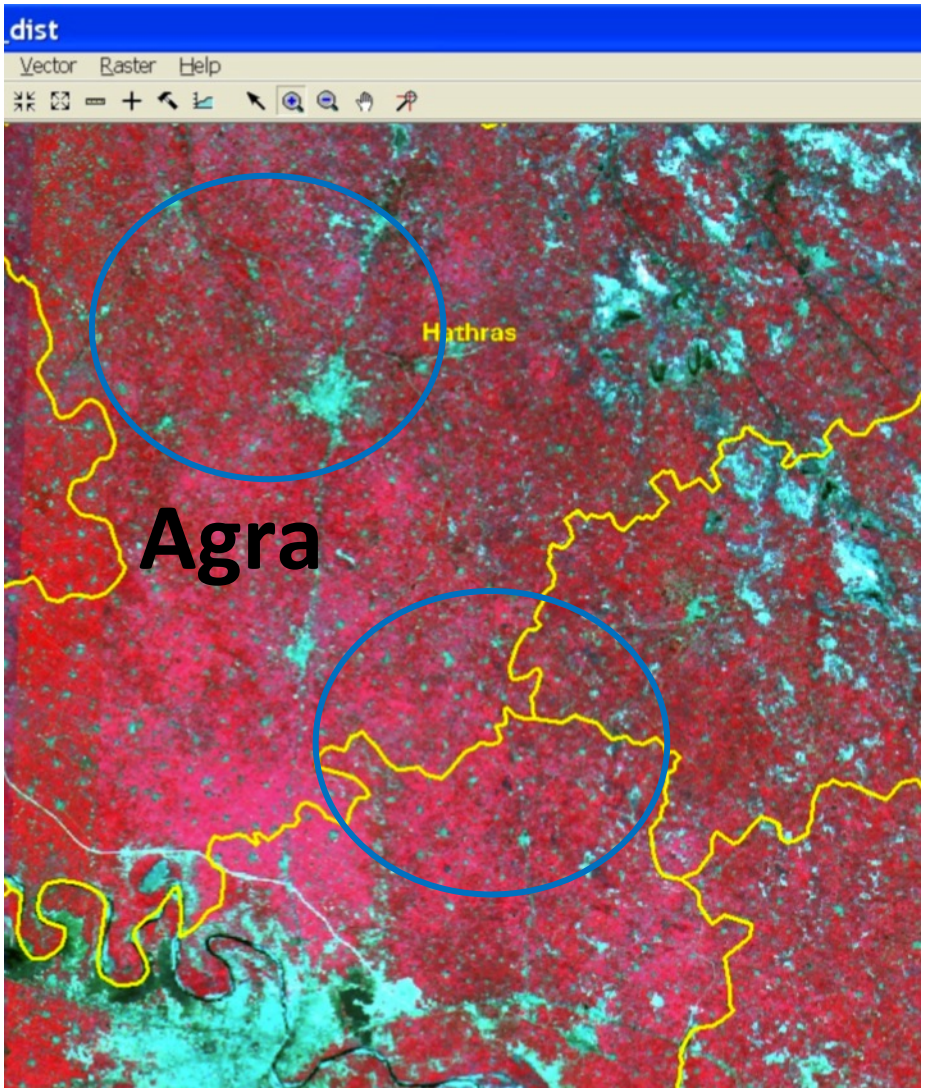




Decrease in Mustard & Increase in Potato Area During 2010-11 w.r.t. 2009-10 (Parts of UP)

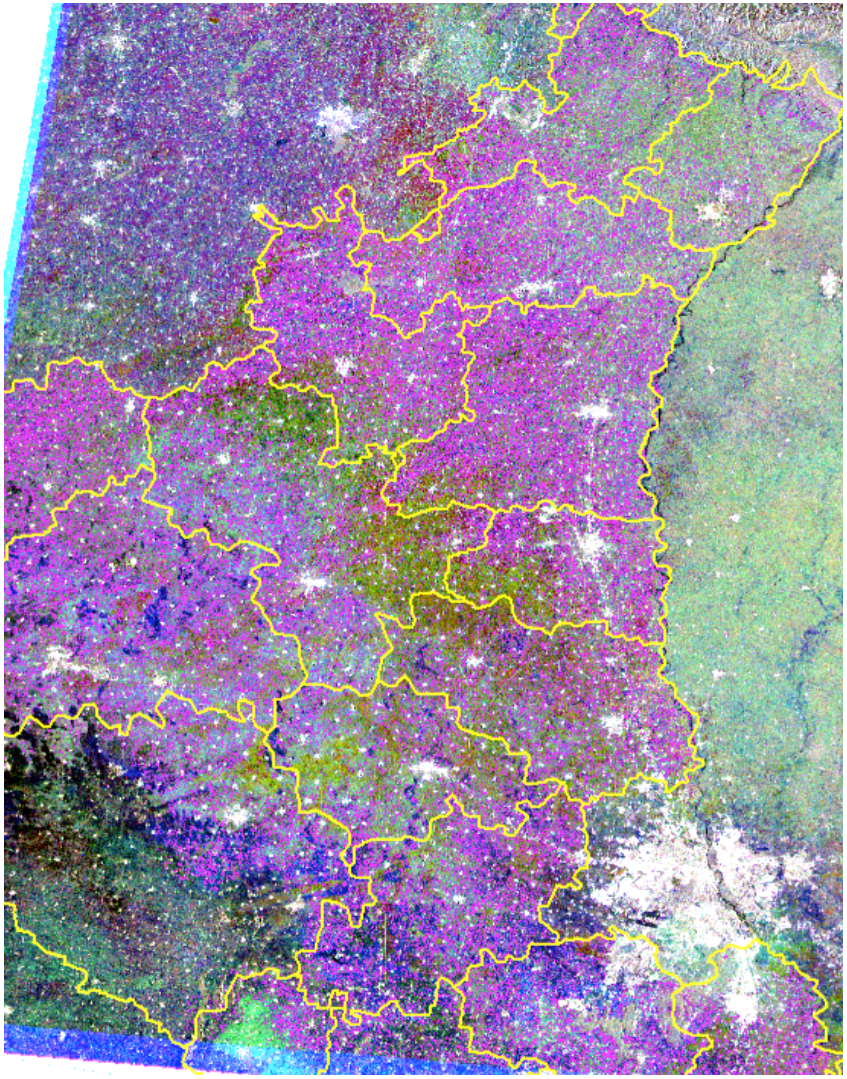


06-Feb-2010

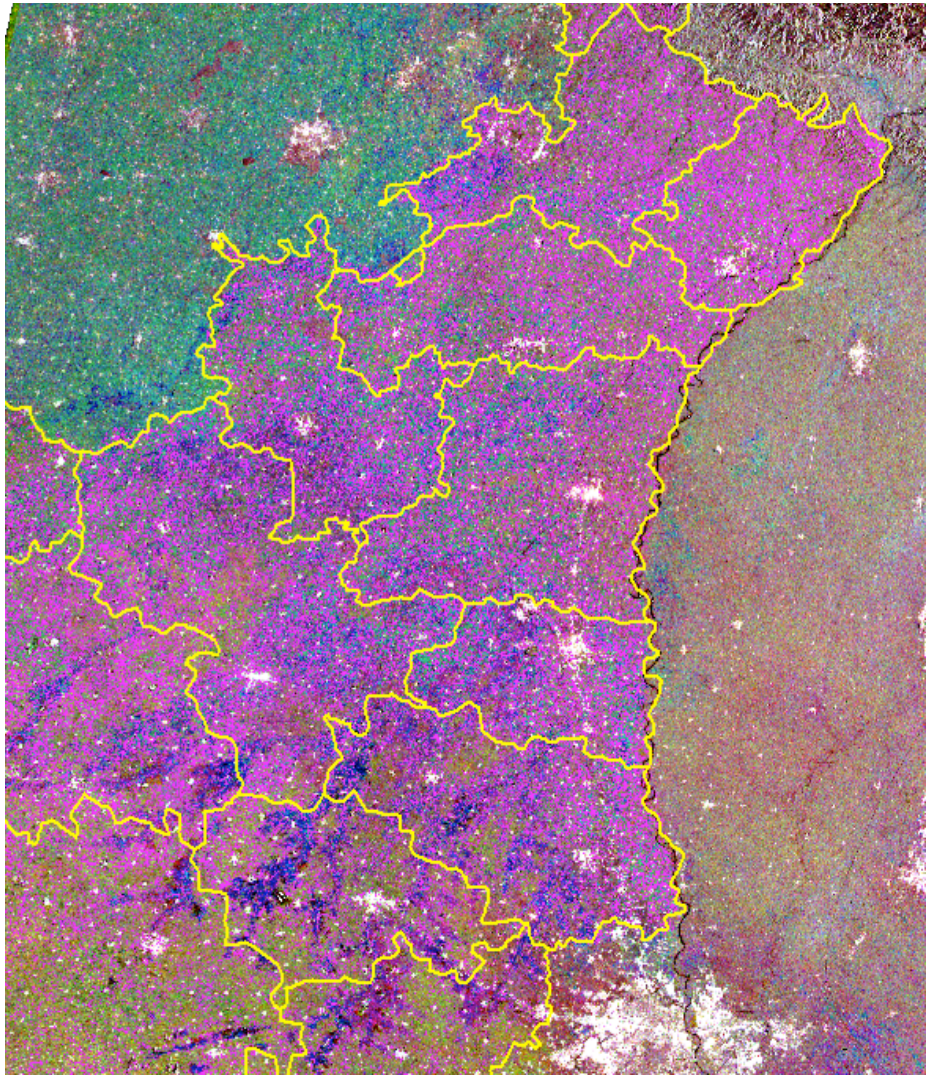


01-Feb-2011

Assessment of Kharif Rice using Multi Date RADAR Data (Decrease in Rice Area in Haryana in 2009 Compared to 2008)



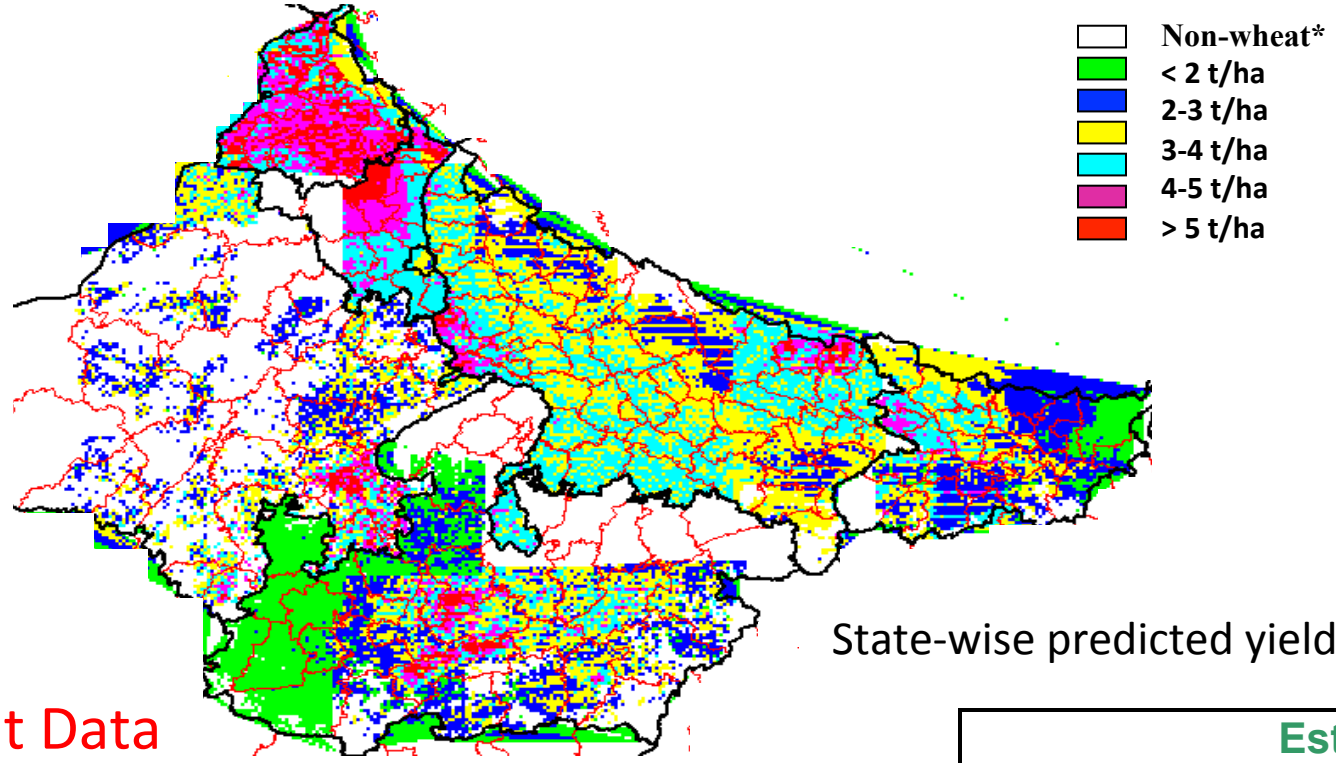
June 10, July 04, July 28, 2009



July 09, Aug 02, Aug 26, 2008

Crop Yield modeling: RS, Agro-met and Simulation Model

Spatial Wheat Yield Map for Major Wheat Growing States (5 Km)



State-wise predicted yield for 2009-10

State	Estimated yield (t/ha)
Bihar	2.127
Haryana	4.065
MP	1.833
Punjab	4.678
Rajasthan	2.507
UP	2.887

Input Data

- Interpolated Weather Data
- Calibrated Crop Coefficient
- Sowing Date from Remote sensing
- LAI from Remote Sensing

*** In Haryana the white colour doesn't represent non-wheat. LAI data was not available for some grids due to fog**

National Agricultural Drought Assessment and Monitoring System (NADAMS)

Satellite data analysis – Resourcesat, Oceansat, NOAA, Terra, Aqua

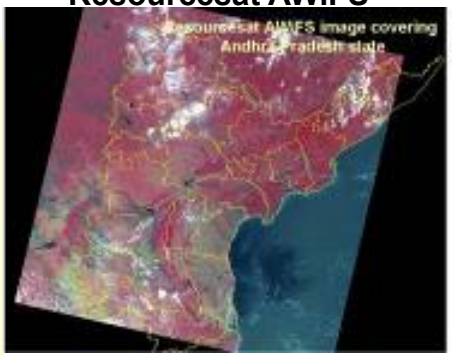
Agricultural drought assessment

Coverage

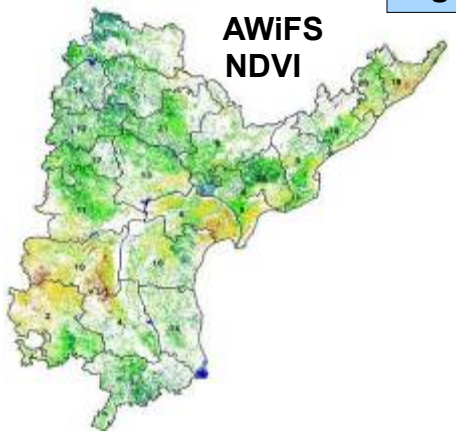
District level – 9 states

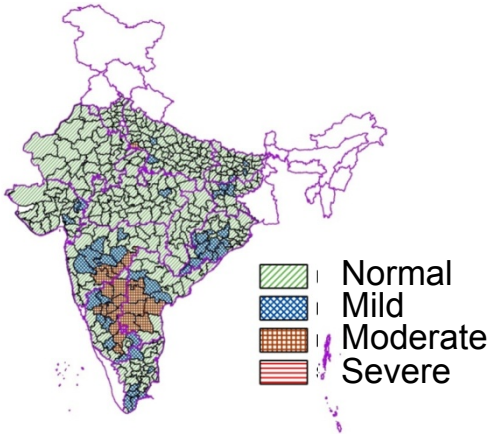
Sub-district level - 4 states

Resourcesat AWiFS

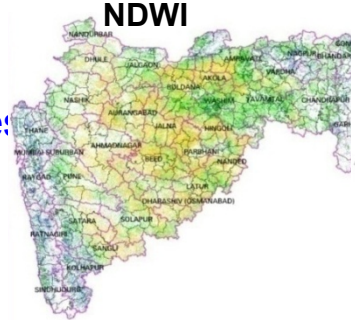


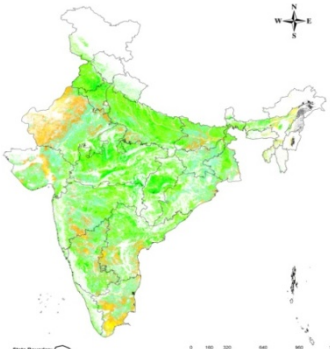
AWiFS NDVI



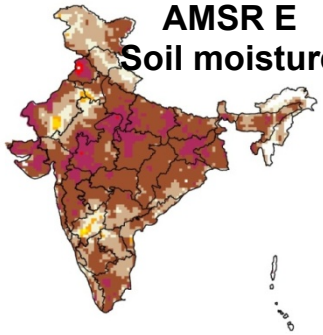


NDWI

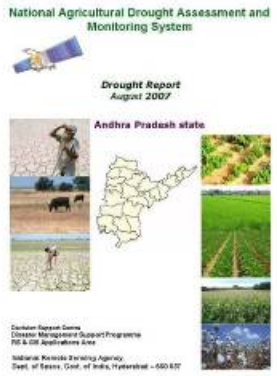




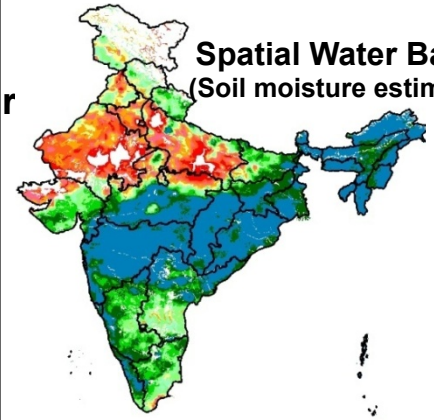
AMSR E Soil moisture



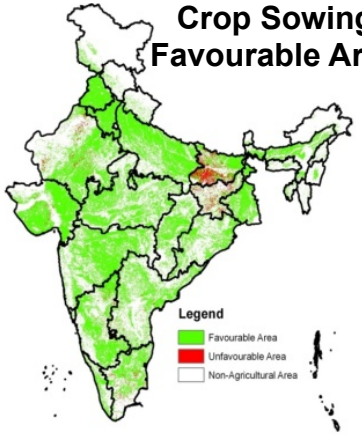
Information reporting



Spatial Water Balance
(Soil moisture estimation)



Crop Sowing Favourable Area



Satellite derived Indicators/information

- **NDVI**
- **NDWI**
- **SASI**
- **AMSR E soil moistur**

Ground data

- **Soil**
- **Rainfall**
- **Sown area**
- **Cropping pattern**
- **Irrigation support**

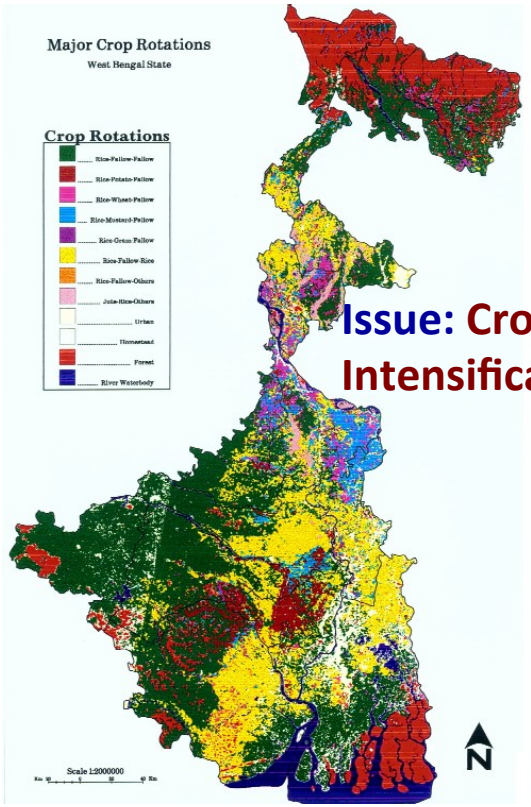
- Ministry of Agriculture
- State Depts. of Agril and Relie
- Scientific Organizations

End use:

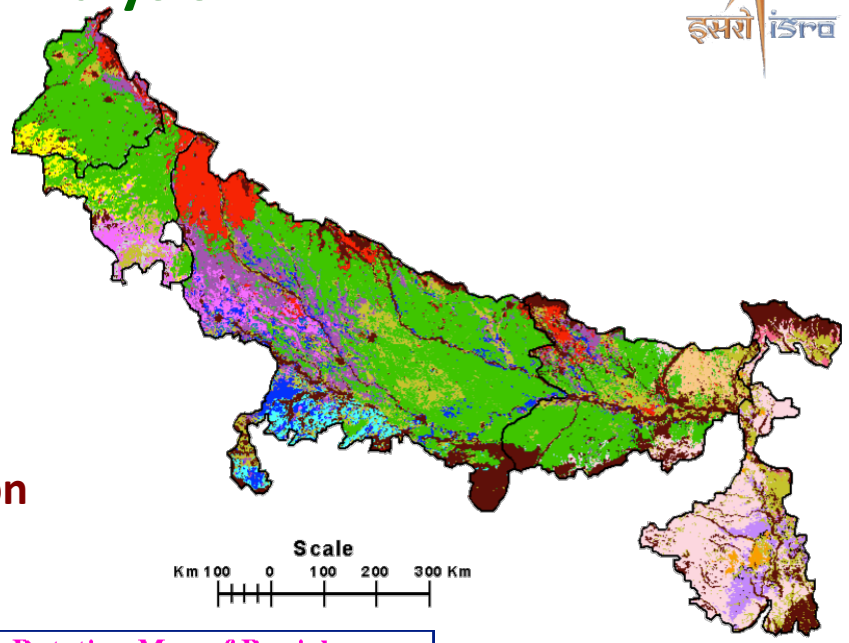
- Crop contingency plans
- Drought declaration

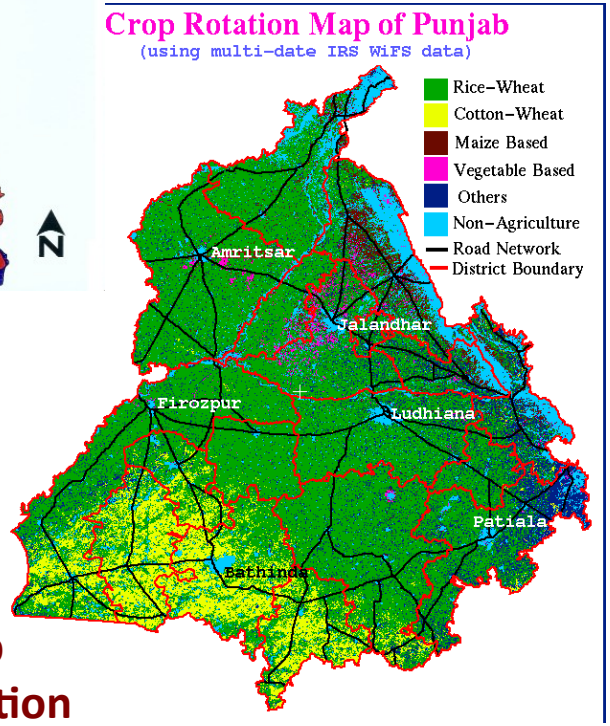
Cropping System Analysis

- Cropping Pattern & Crop Rotation Mapping
- Cropping System Characterization
- Alternate Cropping System
- Long-term Impact Assessment
- Impact of Climate Change on Cropping System



Issue: Crop Intensification



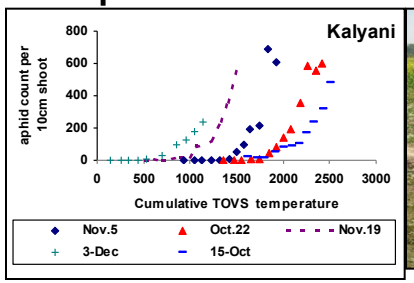


Issue: Crop Diversification

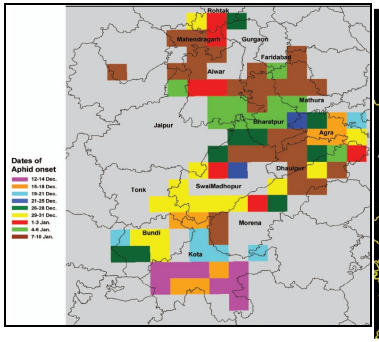
Rice-Wheat
Sugarcane Based
Cotton-Wheat
Rice-Potato
Maize-Wheat
Pearlmillet-Wheat
Rice-Fallow-Rice
Rice-Fallow-Fallow
Rice-Fallow-Jute
Rice-Wheat-Other
Fallow-Pulse
Fallow-Wheat
Minor Crop Rotations
Fallow
Non-Arable

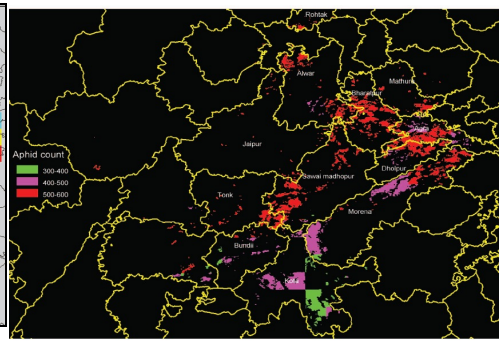
Assessment of Biotic Stress in Crops

Forewarning of aphid pest infestation rate in mustard crop based on different dates of sowing

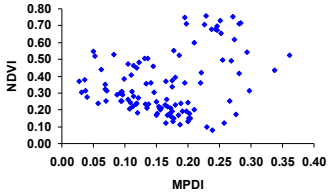


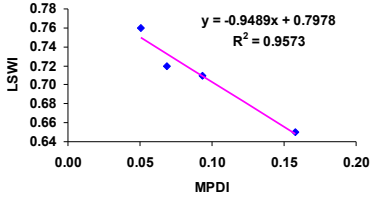
Aphid onset and population growth based on accumulated heat units

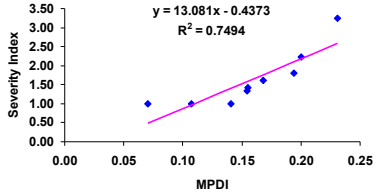




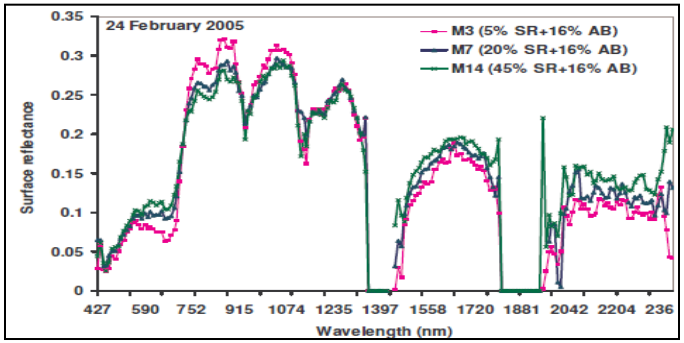
Detection of mealy bug infestation in cotton with MPDI and LSWI

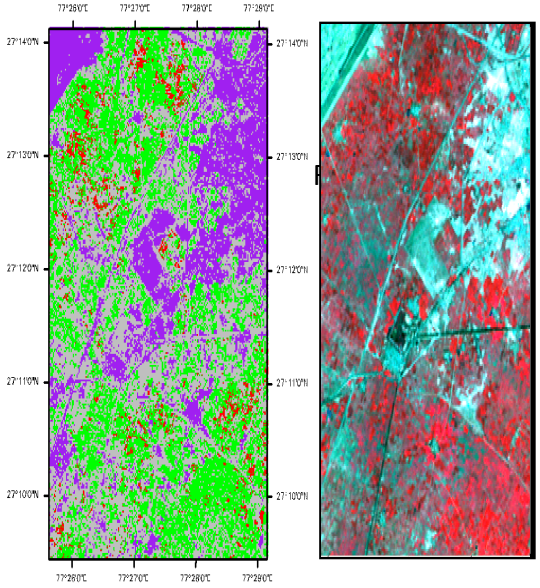






Detection of sclerotinia affected mustard crop using EO-1 Hyperion data





Normal mustard
Non-agriculture
Diseased mustard crop
Non-mustard crop

Understanding the Processes in Agriculture

Energy and Mass Exchange in Vegetative Systems

Goal :

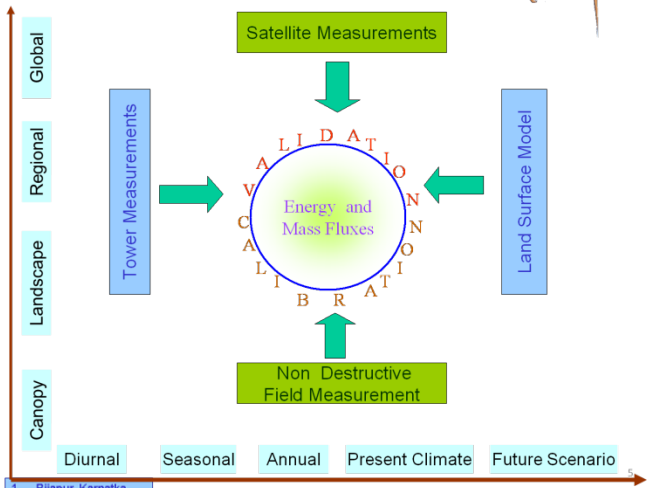
Characterizing Vegetation – Atmosphere 'response - feedback' mechanism from canopy to regional scale

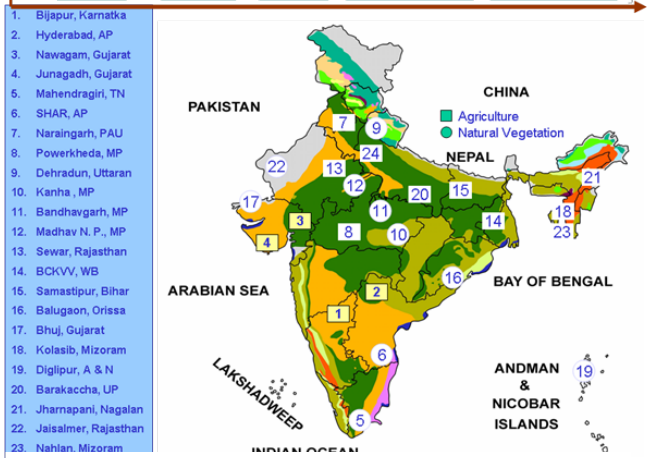
Objectives

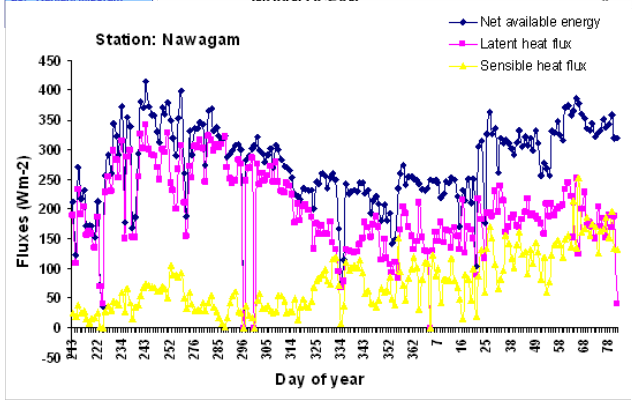
- **Understanding and characterizing vegetation-atmosphere energy (E : radiative, convective) and mass (M : water, net CO2 assimilation) exchange processes at canopy scale using measurements and simulation**

- **Bridging the gap between canopy to regional scale E-M fluxes through modelling with space observations**

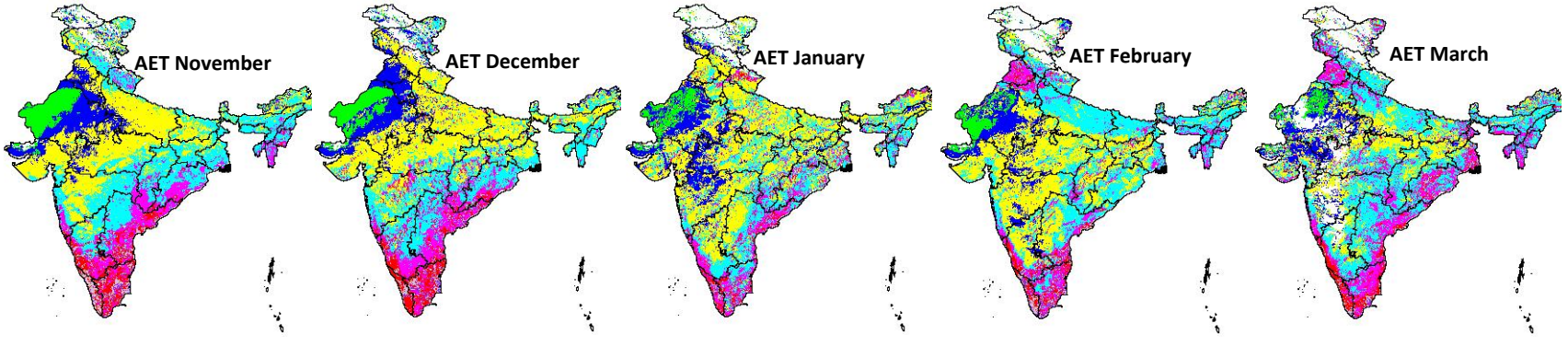
- **Tracking long term trend of regional E-M fluxes to develop understanding of past and present scenarios**

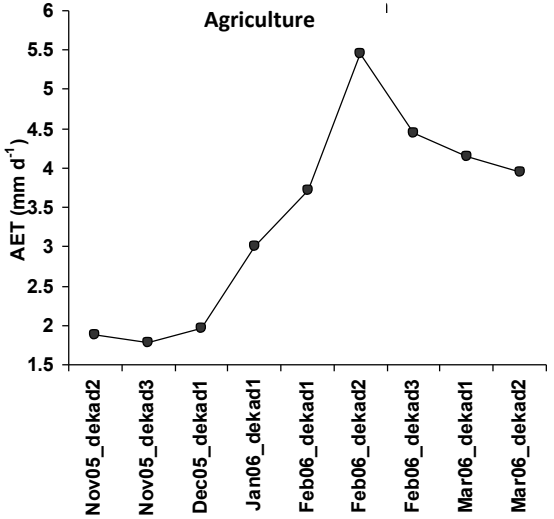


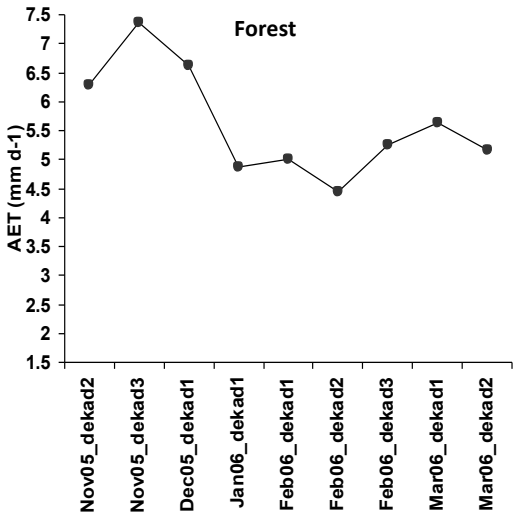


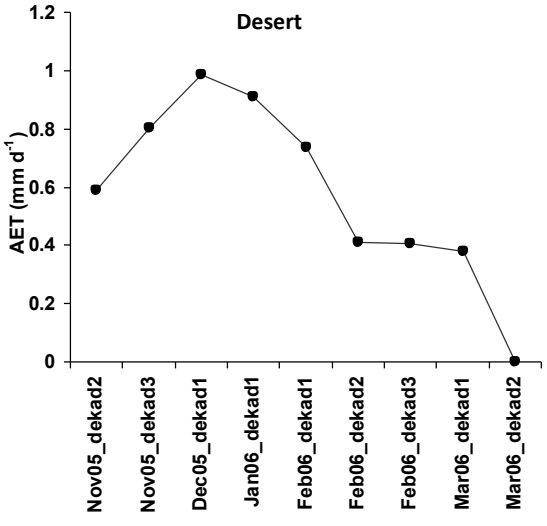


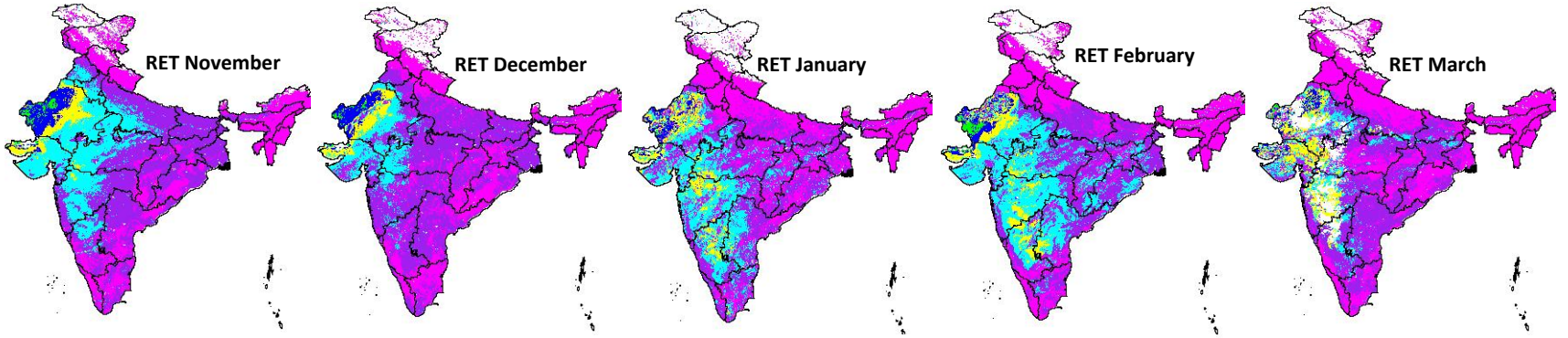
Actual and Relative ET (surface energy balance approach)





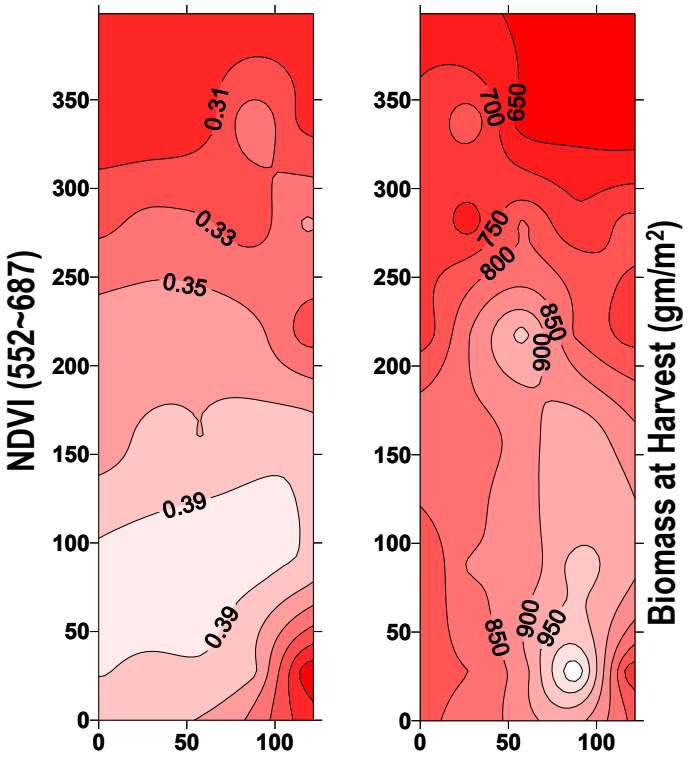


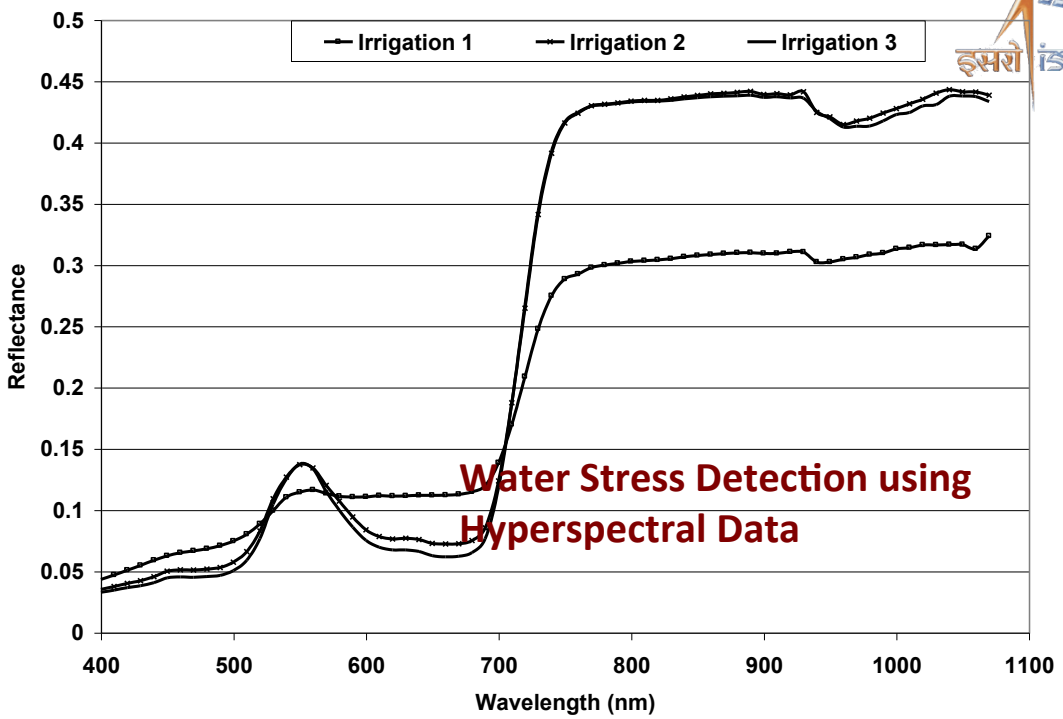




Precision Farming

- Within-field variability Mapping
- Yield Mapping
- Management Zone Creation
- Targeted Soil Sampling
- Crop Stress Detection



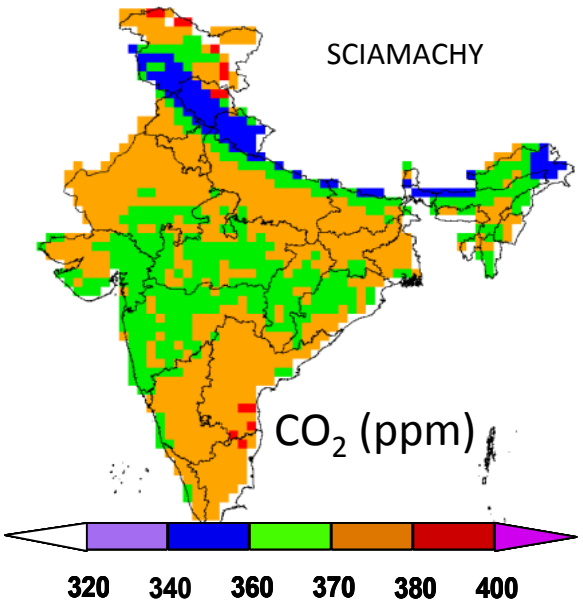


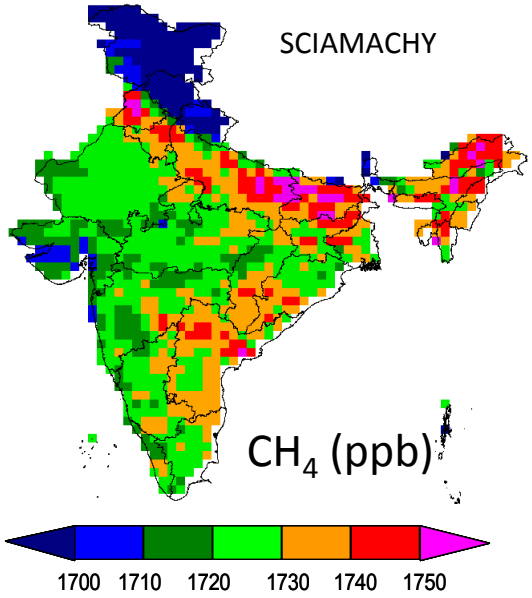
Nutrient Use Efficiency and Economics of Fertilizer Use In Precision Faming(PF) vis-à-vis Recommended Dose

Treatments	Total NPK fertilizer used (kg/ha)	Use Efficiency (kg REY/ kg NPK)	Cost of Cultivation (Rs/ha)	Gross income (Rs/ha)	Benefit: Cost (B:C) Ratio	Net Return (Rs/ha)
CONTROL	0	-	58055	88977	1.53	30992
RF	890	25.7	67335	123619	1.84	56283
PF	452	50.5	62736	123166	1.96	60430

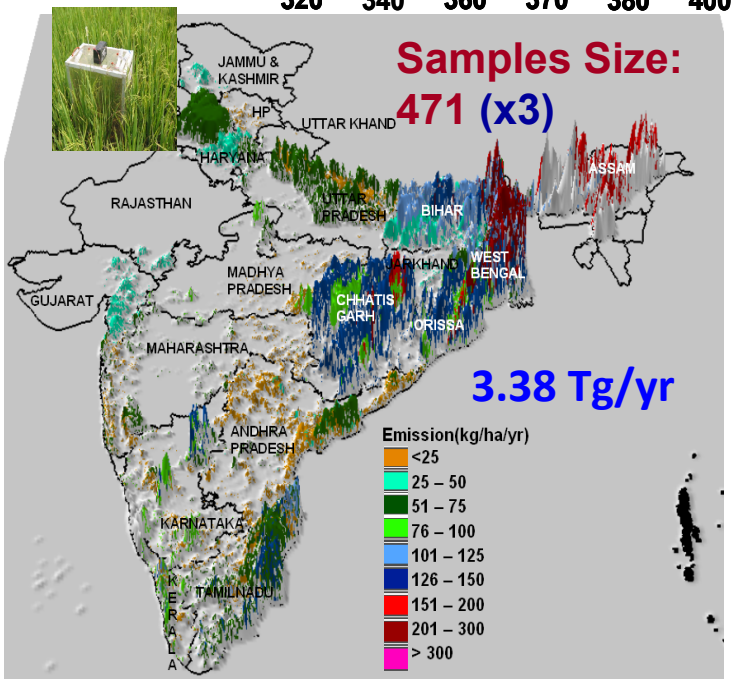
Monitoring Agents of Climate Change

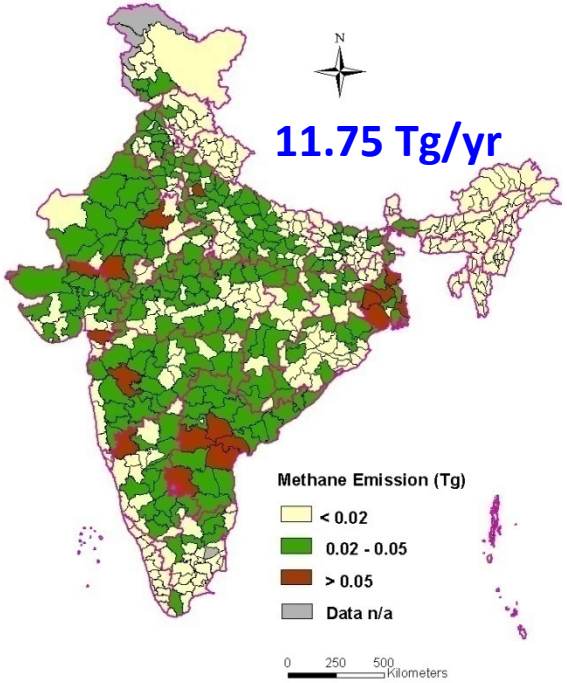
Spatial variability of Trace Gases over India





Methane Emission from Rice Fields





Methane Emission from Indian Live Stock

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THANK YOU FOR ATTENTION