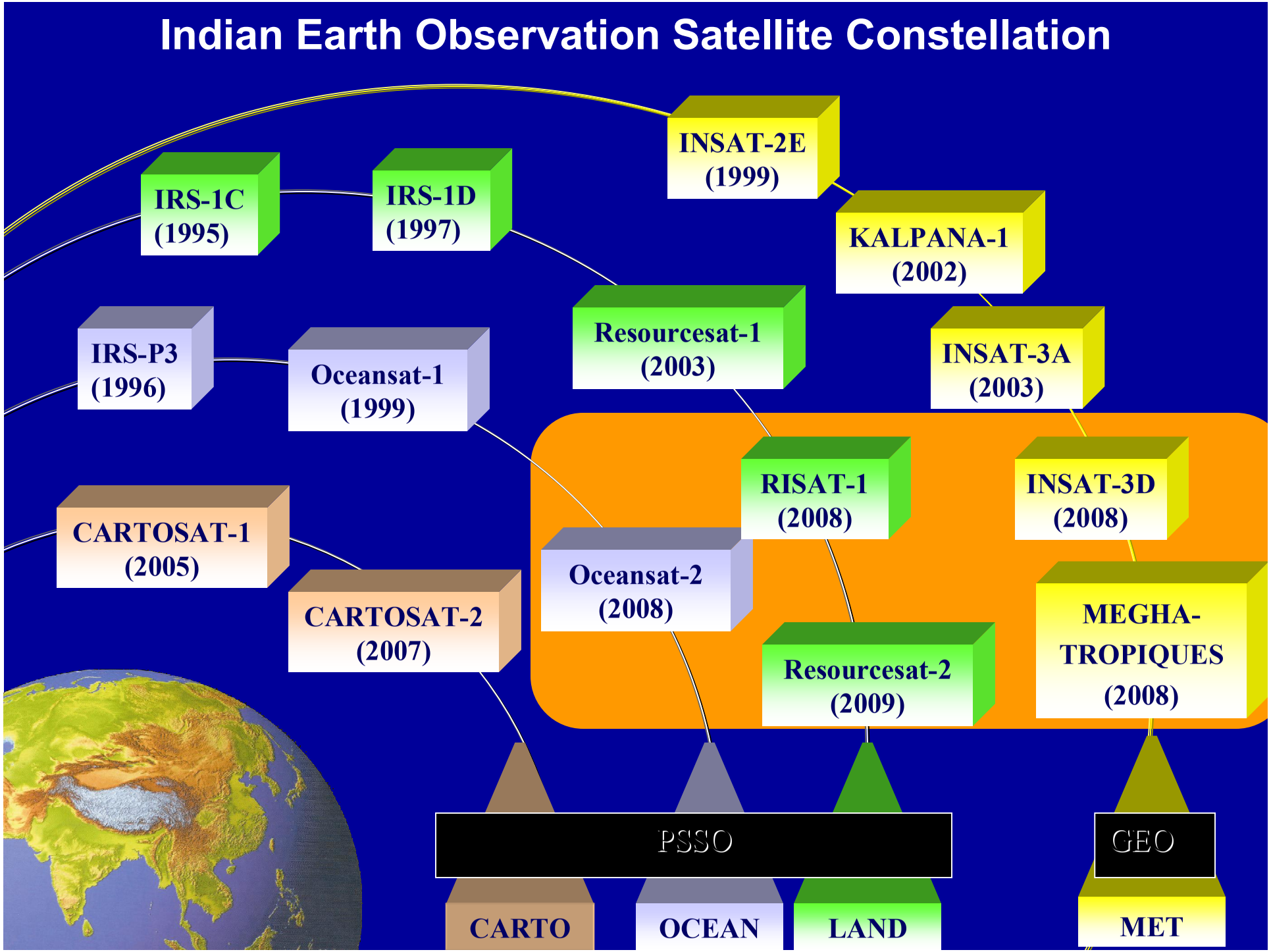
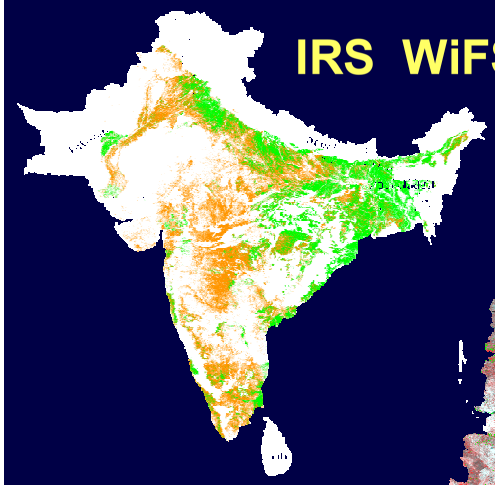
Crop Monitoring for Planning
A Geospatial Perspective

MVR Sesha Sai
Head, Agriculture Division (LRG)
National Remote Sensing Agency
HYDERABAD – 500037, India
E-mail: seshasai_mvr@nrsa.gov.in

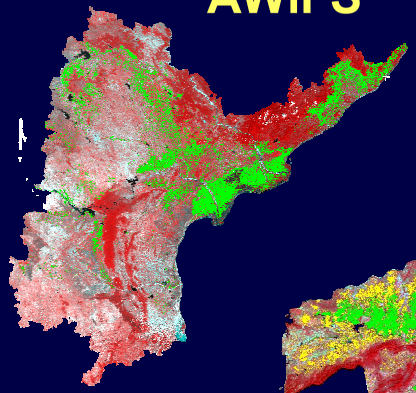
Indian Earth Observation Satellite Constellation



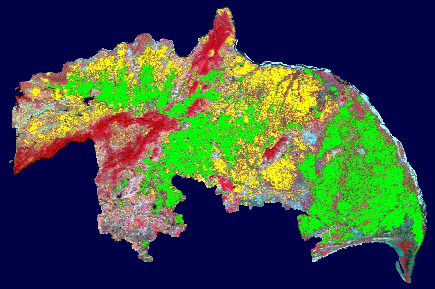
Crop Inventory at National to Farm level



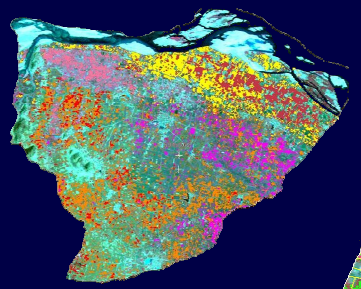
IRS WiFS



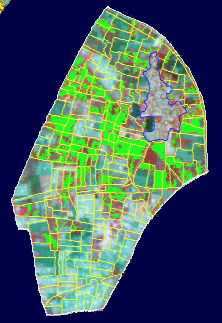
AWiFS



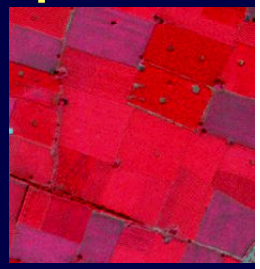
IRS LISS-III



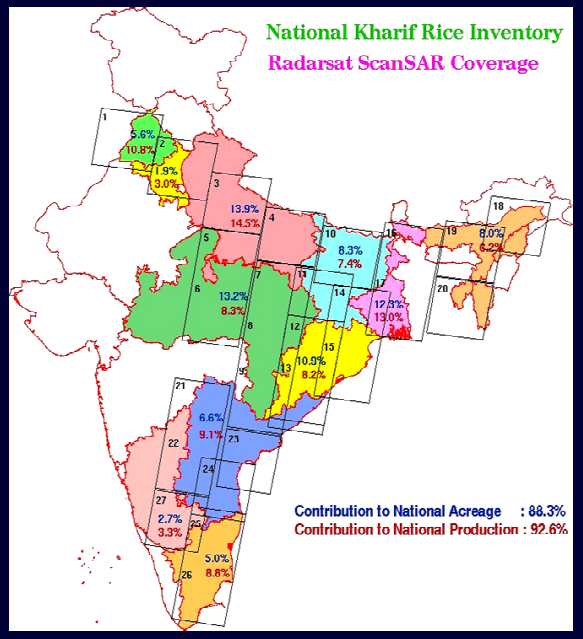
LISS-IV data

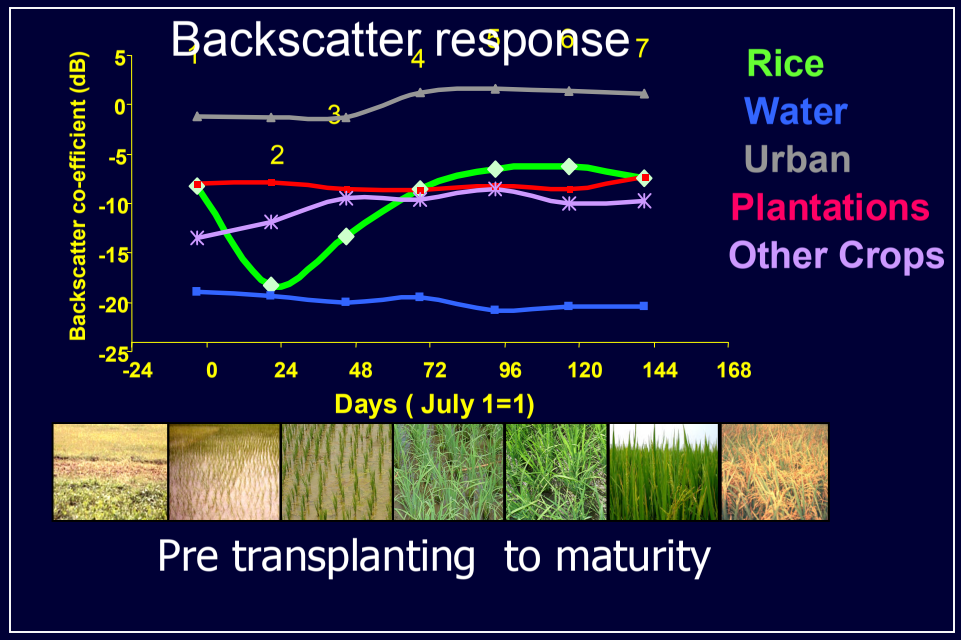


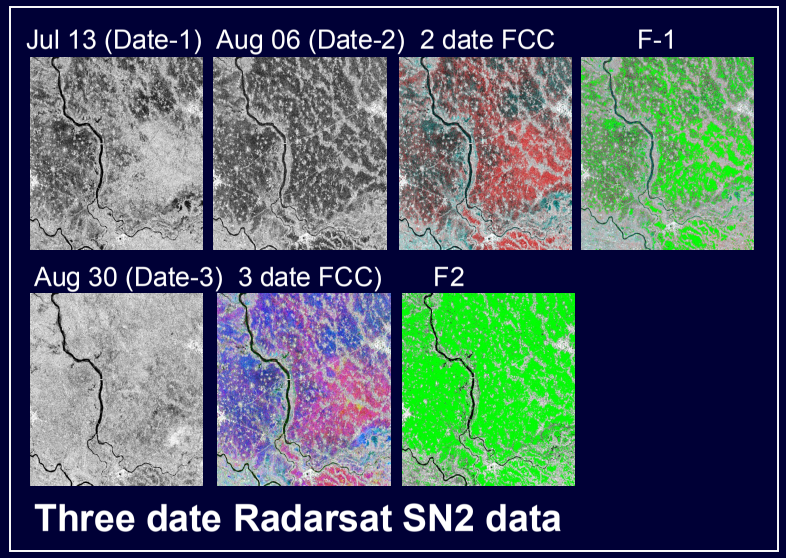
HR Multi-spectral



NATIONAL RICE INVENTORY – MULTI-DATE SAR DATA

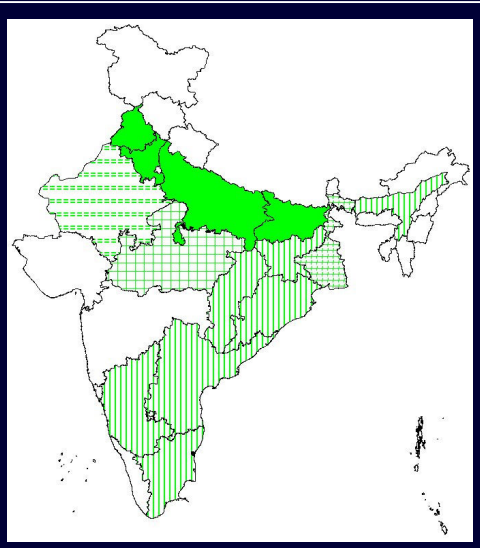




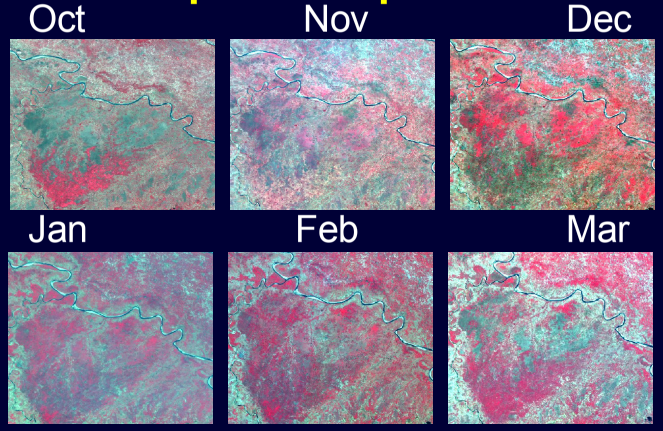


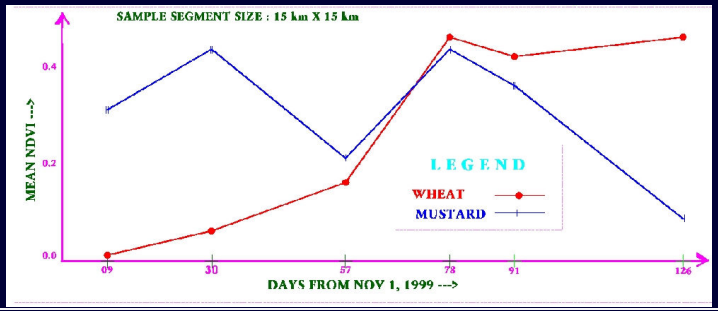
Deliverables	Area (Mha)	Date of Release
I Estimate	33.7	15-09-2007
II Estimate	35.8	15-10-2007
Final Estimate	35.6	16-01-2008

National Wheat : Multi-date AWIFS Data

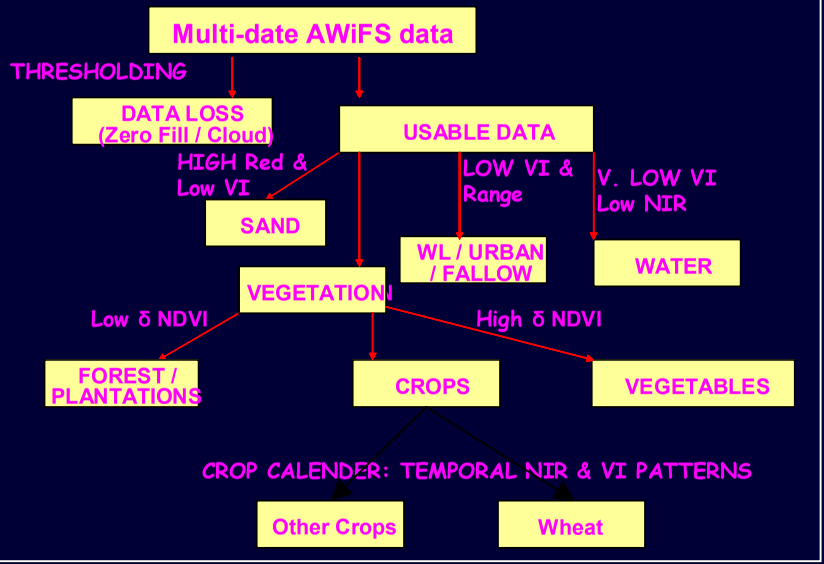


Multi-temporal Crop Discrimination





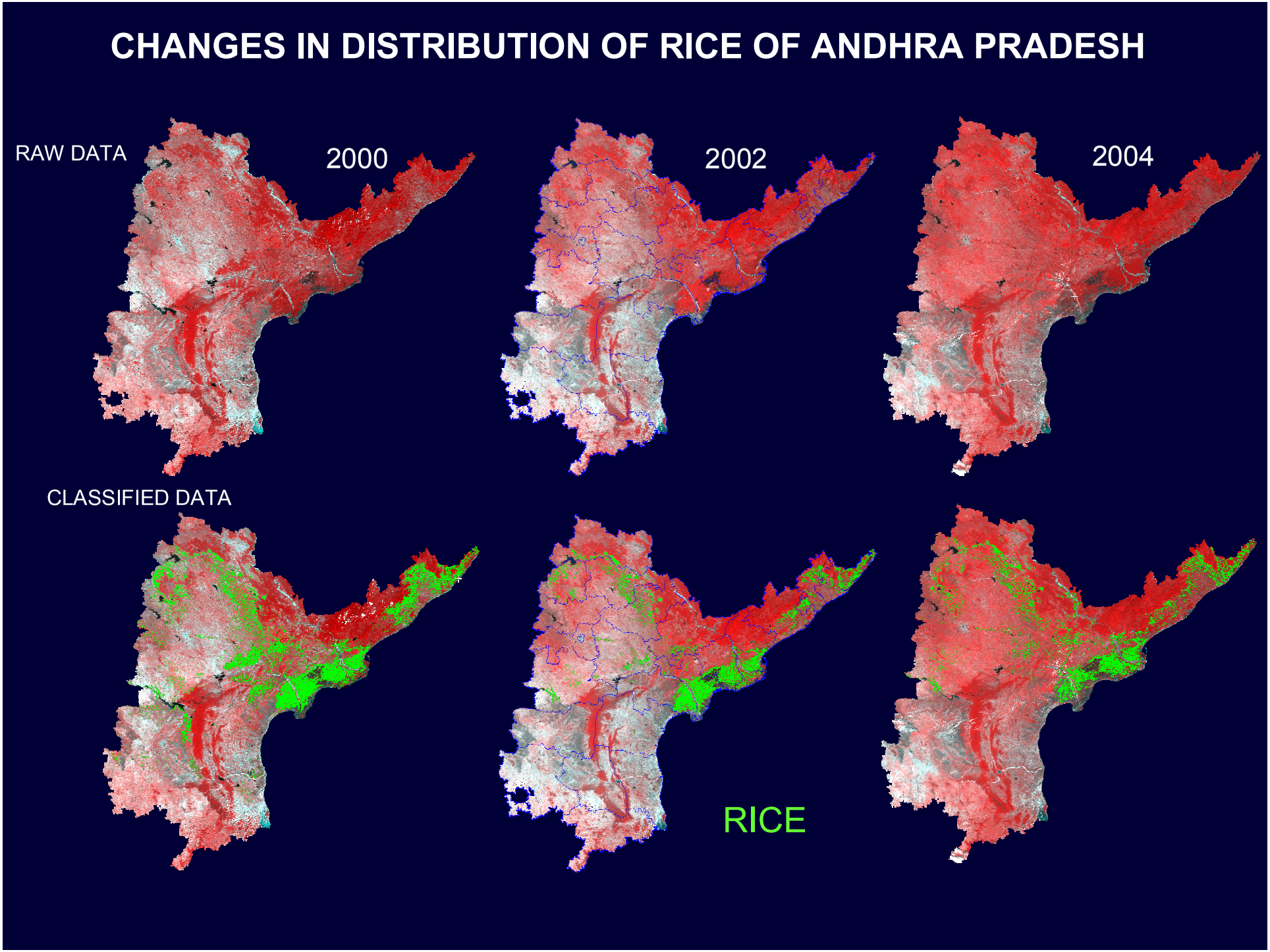
Decision Tree Classifier: Schematic Diagram



NATIONAL WHEAT 2006-07

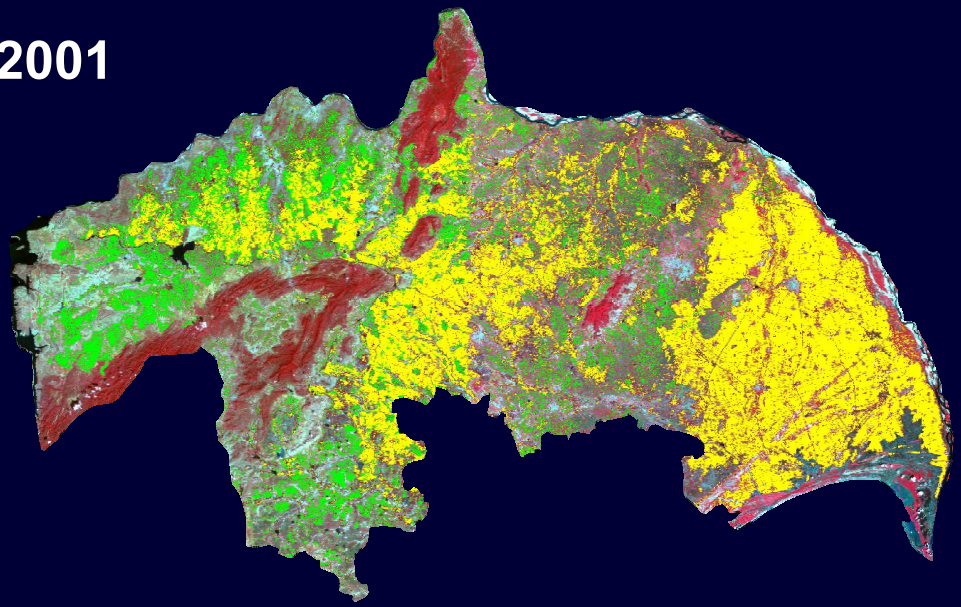
Deliverables	Area Mha)	Date of Release
Rabi Cropped Area	34.81	28-01-07
First Estimate	27.17	23-02-07
Final Estimate	27.30	23-03-07

CHANGES IN DISTRIBUTION OF RICE OF ANDHRA PRADESH

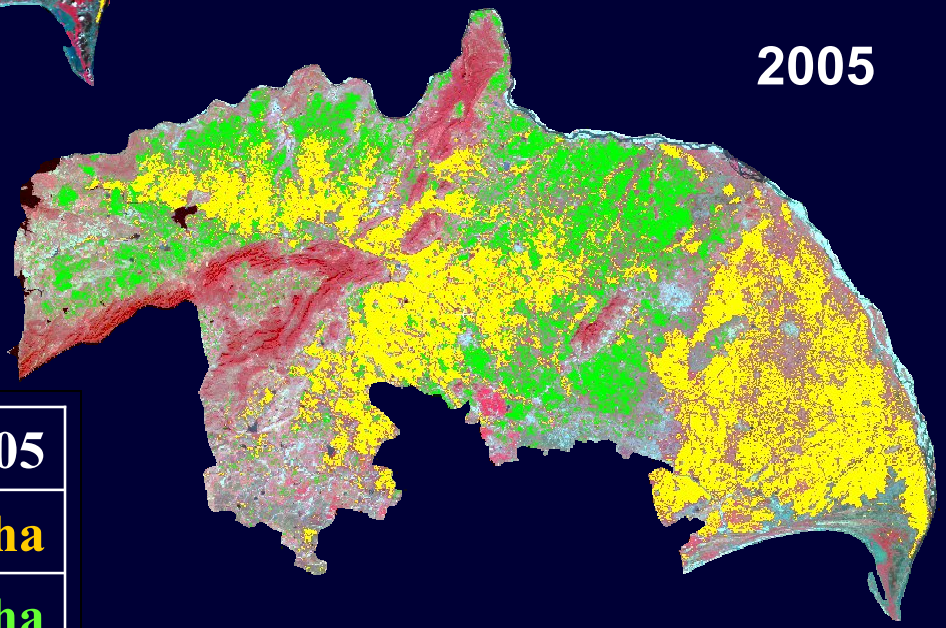


CHANGES CROPPING PATTERN OF GUNTUR DISTRICT OF A. P

2001



2005



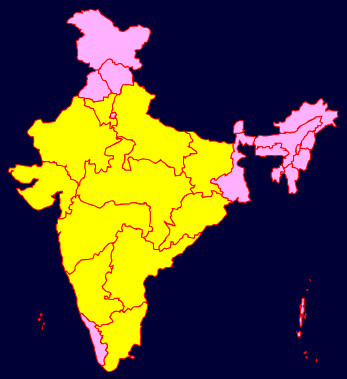
Cotton Rice

CROP	Area-2001	Area-2005
RICE	274208 ha	289873 ha
COTTON	142428 ha	136538 ha

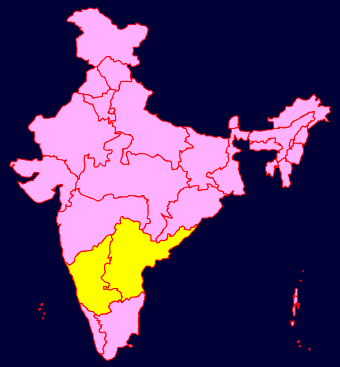
NATIONAL AGRICULTURAL DROUGHT ASSESSMENT & MONITORING

The agricultural condition is monitored at National / state level using coarse resolution (1.1 km) NOAA AVHRR data for entire country and at state / district level for Andhra Pradesh and Karnataka States using IRS WiFS data (188 m)

Nationwide Monitoring



Regional Monitoring



NOAA (1km) satellite Time composite data

State wise reports at district level for fourteen states (Andhra Pradesh, Bihar, Chattisgarh, Gujarat, Haryana, Jharkhand, Karnataka, Maharashtra, Madhya Pradesh, Orissa, Rajasthan, Tamil Nadu, Uttaranchal and Uttar Pradesh)

Summary reports at State level for Entire Country

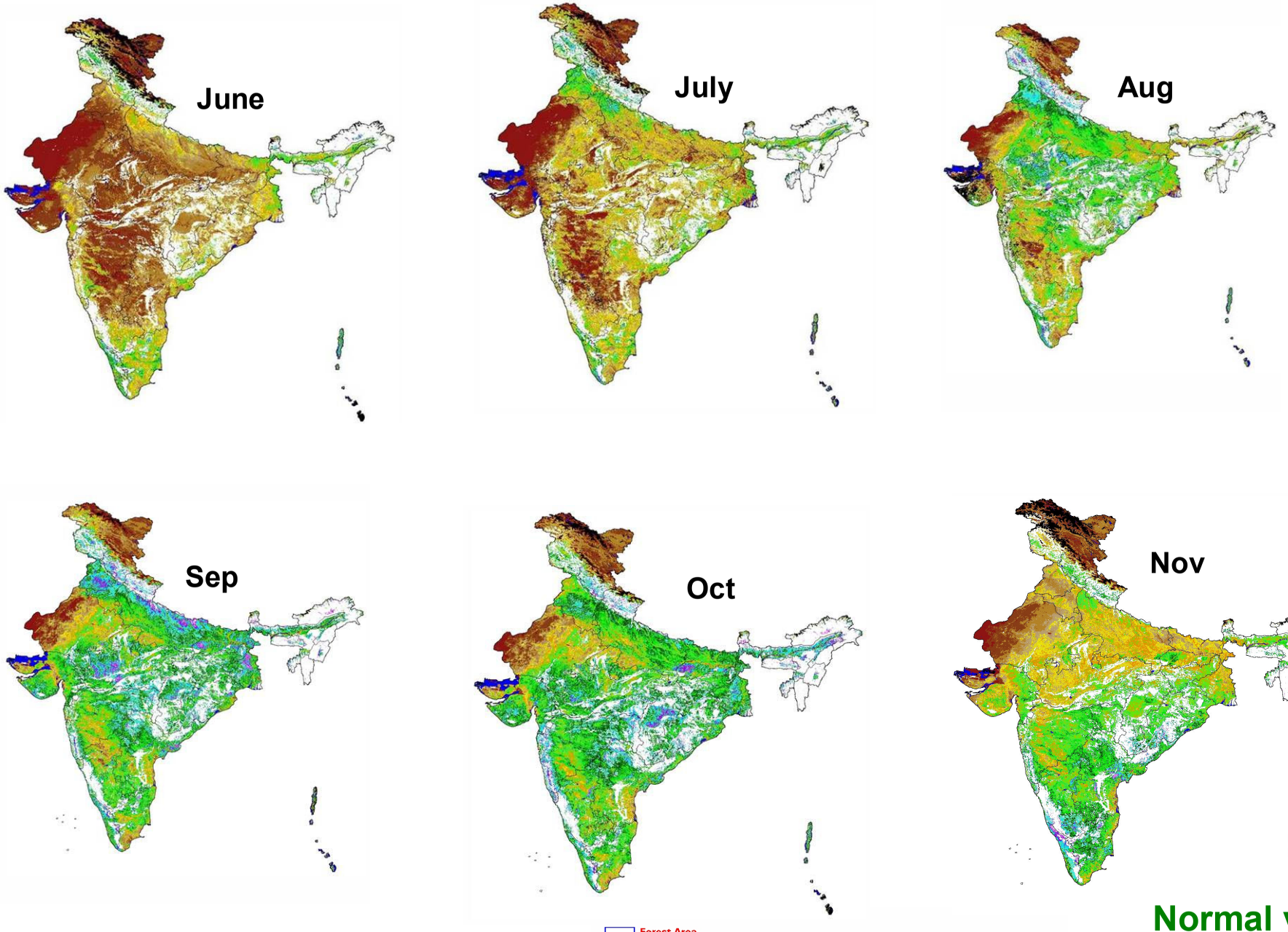
Central Agencies - Dept. of Agrl and Cooperation,
State Agencies - State Relief, State Agril Depts.

IRS-WiFS Time composite data

State wise reports at district and sub-district level for
Andhra Pradesh
Karnataka
Maharasthra

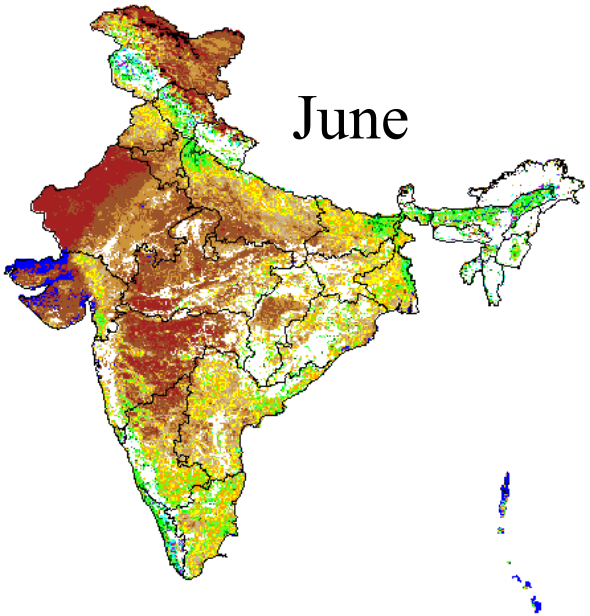
Central Agencies - Dept. of Agril and Cooperation
State Agencies - State Relief , State Agril. Depts.

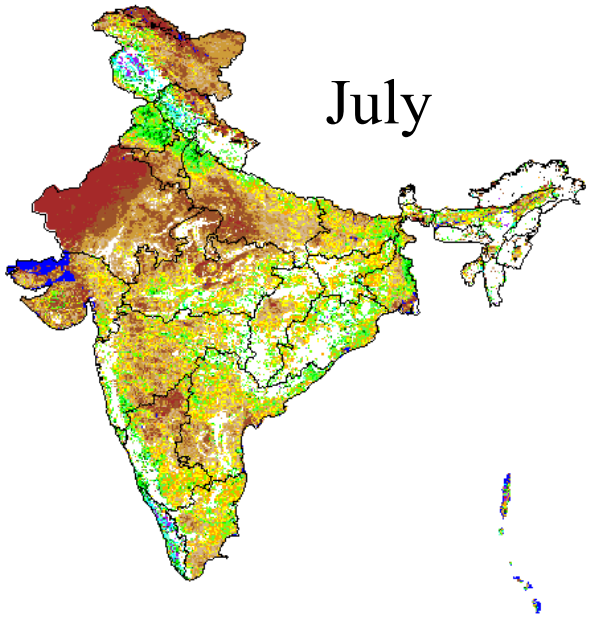
Seasonal NDVI (AVHRR) of Kharif 2005

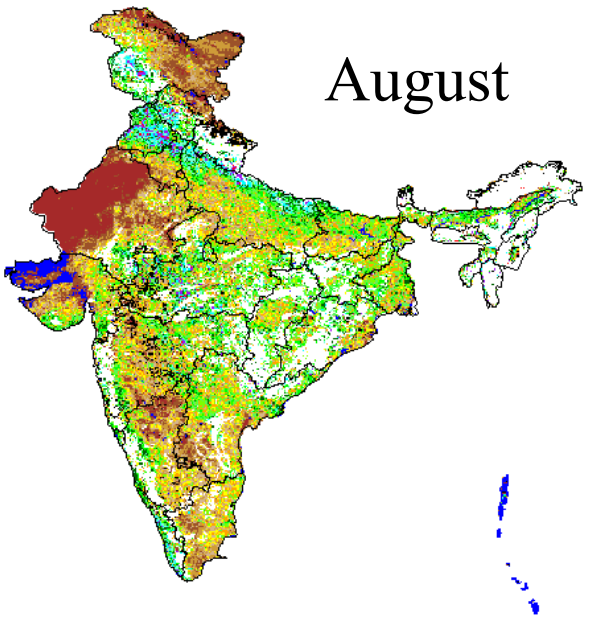


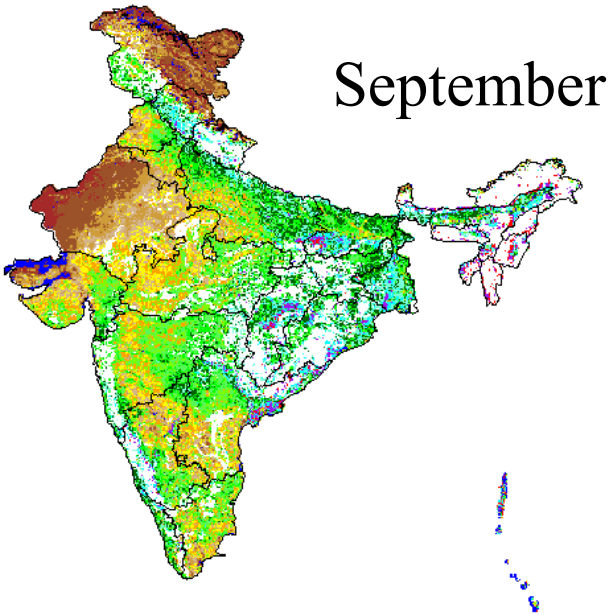
Normal year

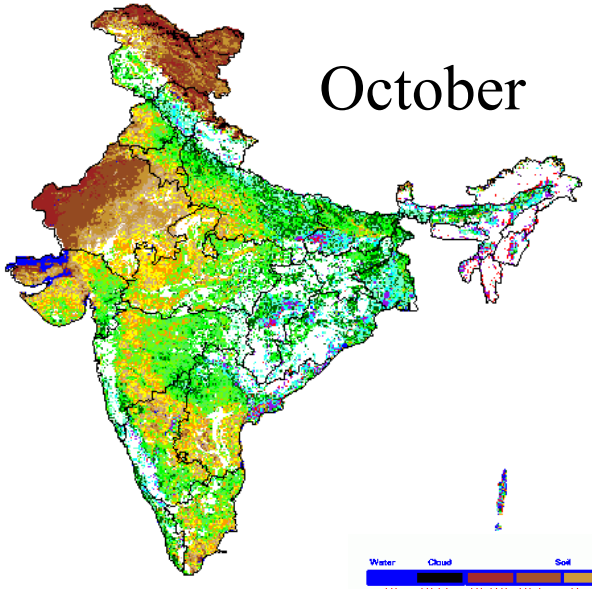
Agricultural situation in Kharif 2002 - AVHRR NDVI



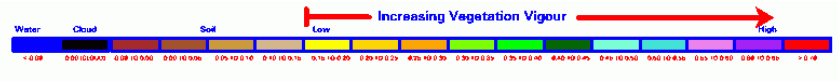




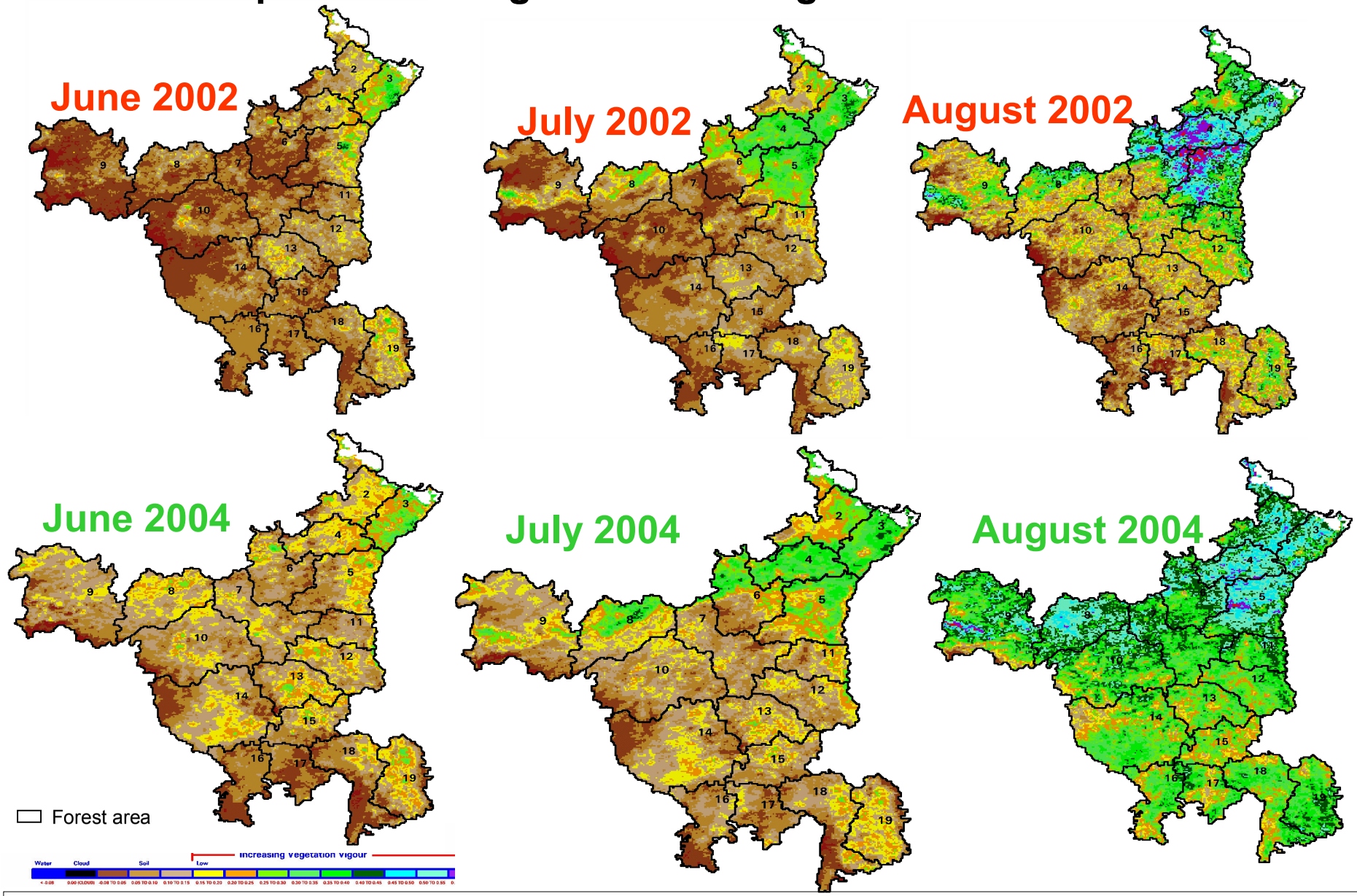




Drought year

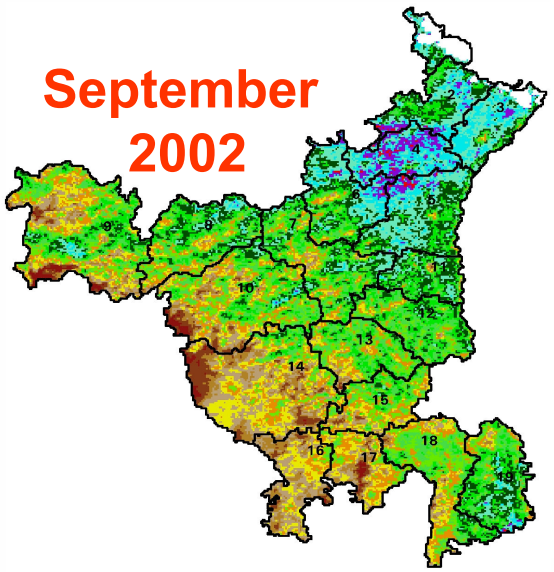


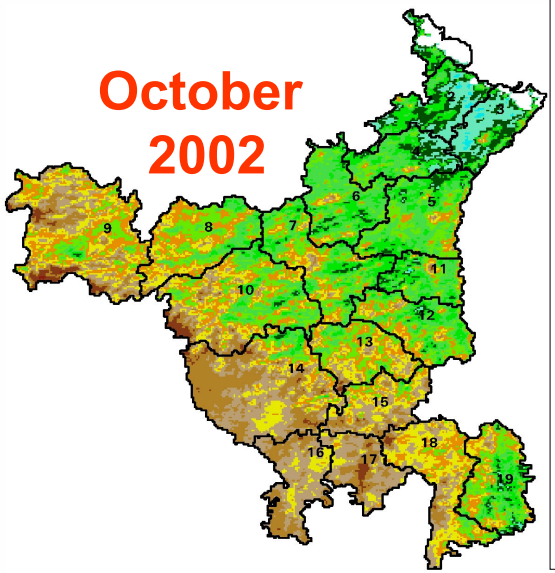
NDVI comparison and agricultural drought assessment 2002 Vs. 2004



Low NDVI and its progression at a very slow rate till August in the year 2002 indicate prevalence of severe drought situation in many parts of the state. Slow progression of NDVI in 2002 compared to 2004 is due to reduced/delayed sowings, poor germination and stunted growth caused by drought situation resulted from deficit/scanty rainfall. However in northern districts with high NDVI drought impact is not observed due to high irrigation support.

NDVI comparison and agricultural drought assessment 2002 Vs. 2004



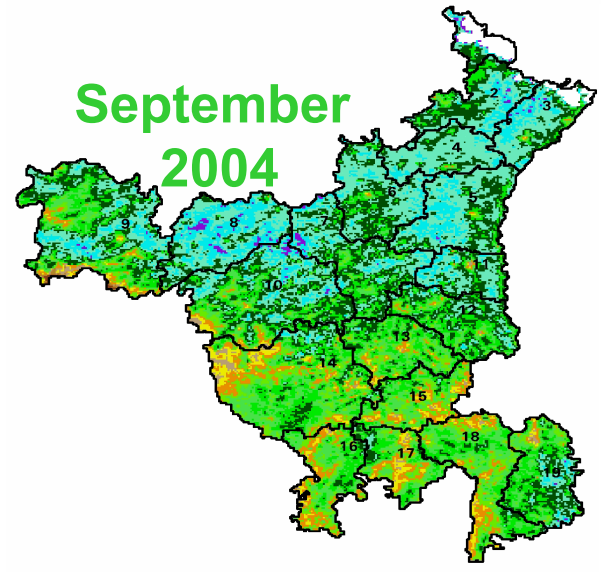


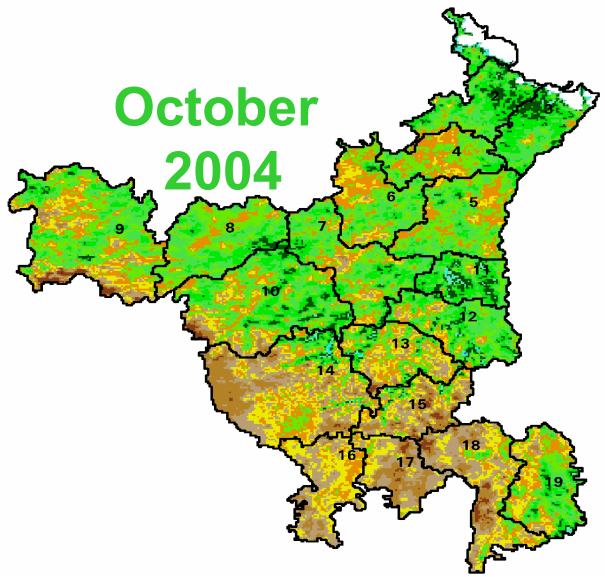
During September kharif crops are in their peak greenness stage under normal conditions. Natural senescence of agricultural crops results in the reduction of NDVI in October.

Low NDVI in many districts during 2002 and its significant deviation from the maximum achieved in a normal year like 2004, are due to the cumulative effect of drought situation in the districts with less irrigation support.

Districts with high irrigation support maintained high NDVI on par with normal year, unaffected by meteorological drought of 2002.

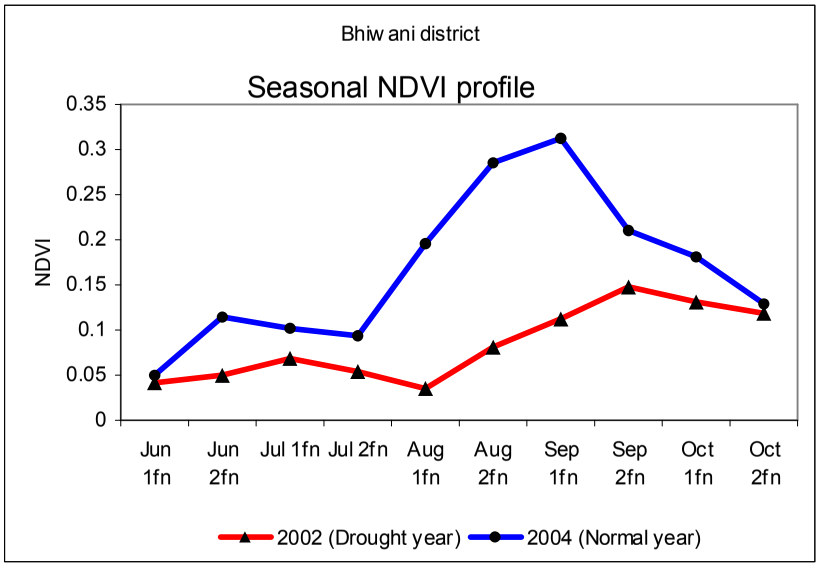


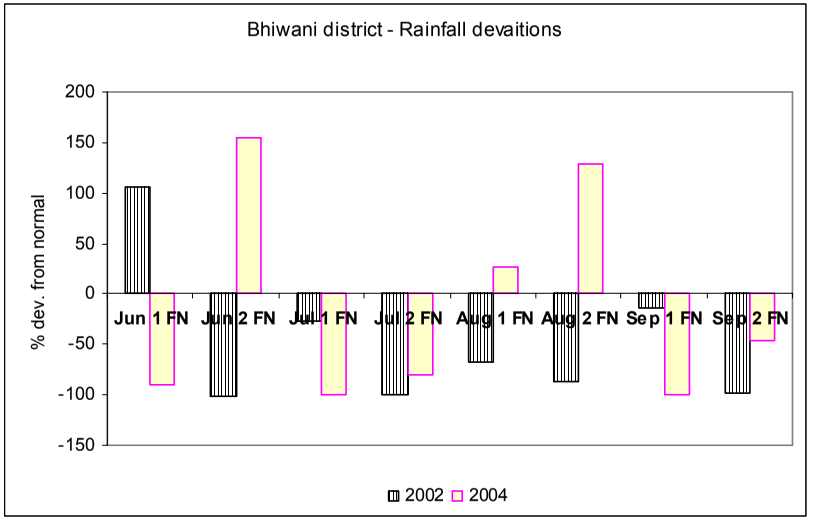


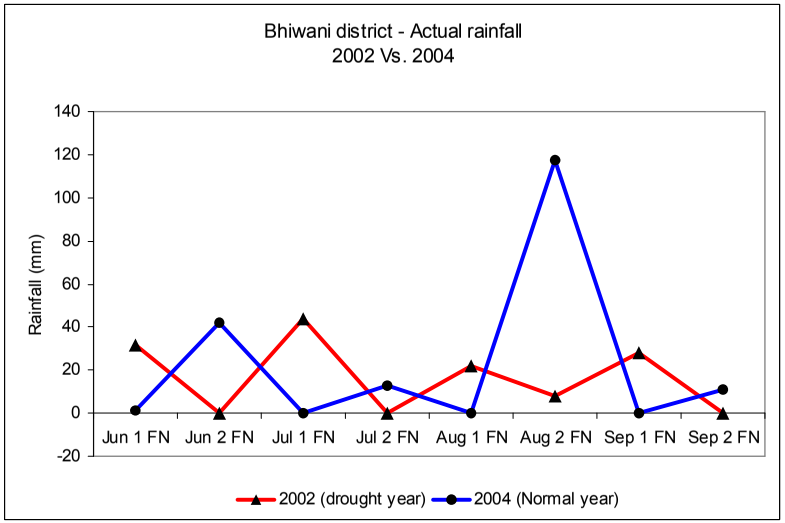


1. Panchkula
2. Ambala
3. Yamunanagar
4. Kurukshetra
5. Karnal
6. Kaithal
7. Jind
8. Fatehbad
9. Sirsa
10. Hisar
11. Panipat
12. Sonipat
13. Rhotak
14. Bhiwani
15. Jhajjar
16. Mahendragarh
17. Rewari
18. Gurgaon
19. Faridabad

Seasonal NDVI and rainfall profiles in the district with less irrigation support







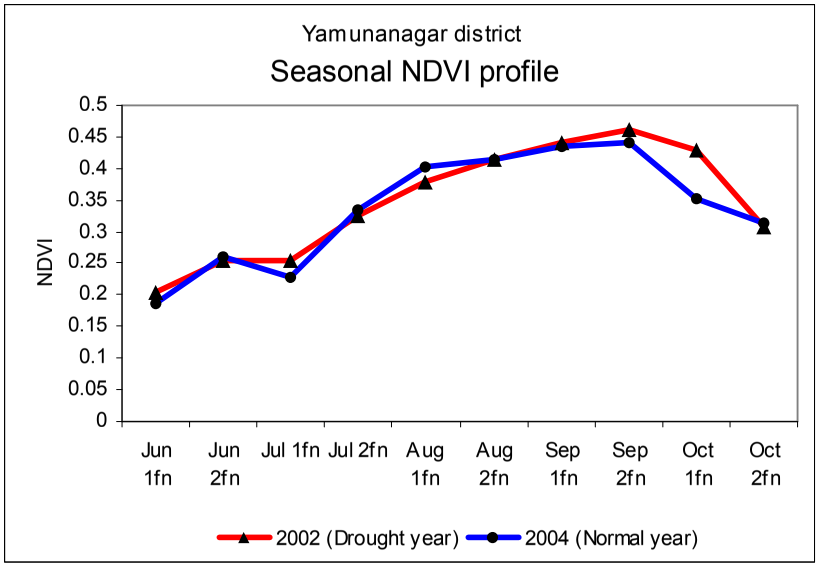
Rainfall pattern

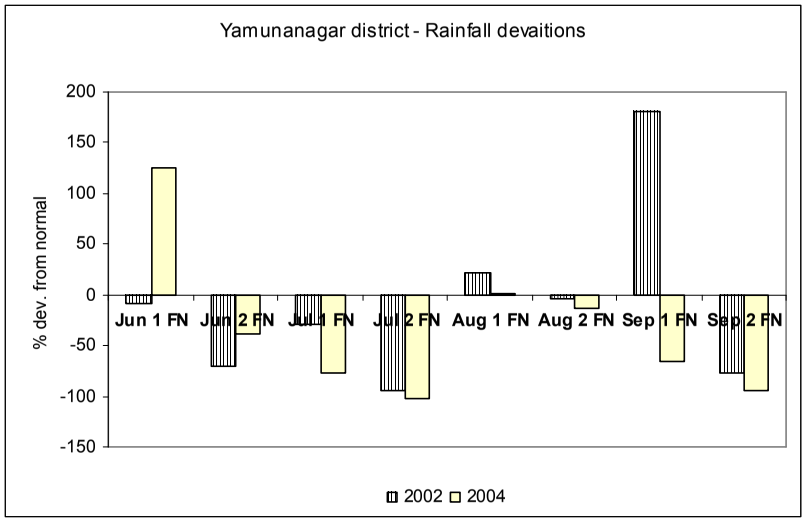
	2002	2004
Jun 1 FN	Excess	Scanty
Jun 2 FN	Scanty	Excess
Jul 1 FN	Deficit	Scanty
Jul 2 FN	Scanty	Scanty
Aug 1 FN	Scanty	Excess
Aug 2 FN	Scanty	Excess
Sep 1 FN	Normal	Scanty
Sep 2 FN	Scanty	Scanty

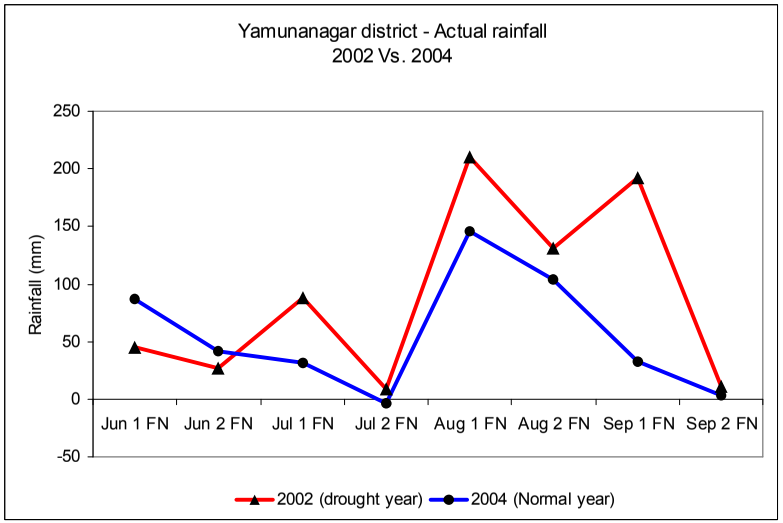
Bhiwani district

Seasonal NDVI profiles differing significantly from each other and being influenced by rainfall pattern. Due to deficit/scanty rainfall the NDVI profile of 2002 with slow progression maintains very low NDVI compared to 2004 signifying the prevalence of severe drought situation.

Seasonal NDVI and rainfall profiles in the district with high irrigation support







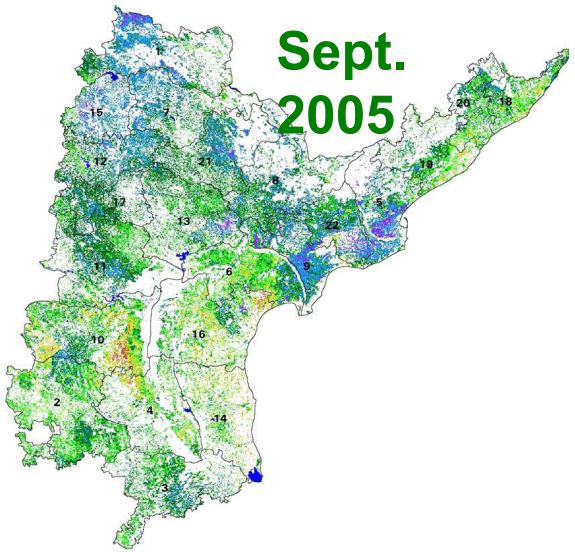
Rainfall pattern

	2002	2004
Jun 1 FN	Normal	Scanty
Jun 2 FN	Scanty	Deficit
Jul 1 FN	Deficit	Scanty
Jul 2 FN	Scanty	Scanty
Aug 1 FN	Excess	Normal
Aug 2 FN	Normal	Normal
Sep 1 FN	Excess	Scanty
Sep 2 FN	Scanty	Scanty

Yamunanagar

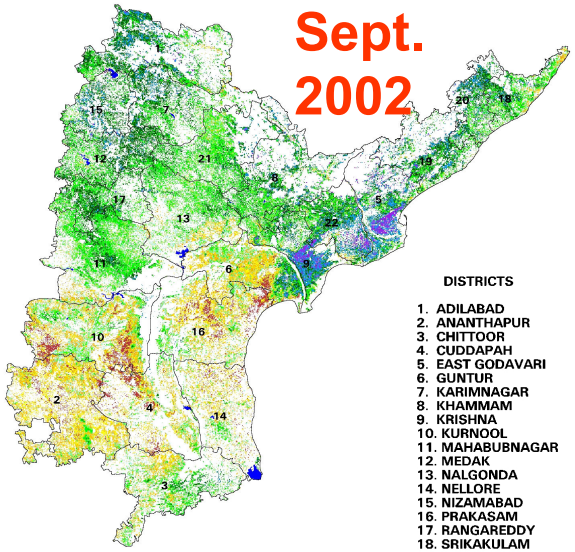
Seasonal NDVI profiles of the two years do not deviate significantly from each other and are not being influenced by rainfall pattern due to irrigation support.

Response of NDVI during peak vegetative phase of crops



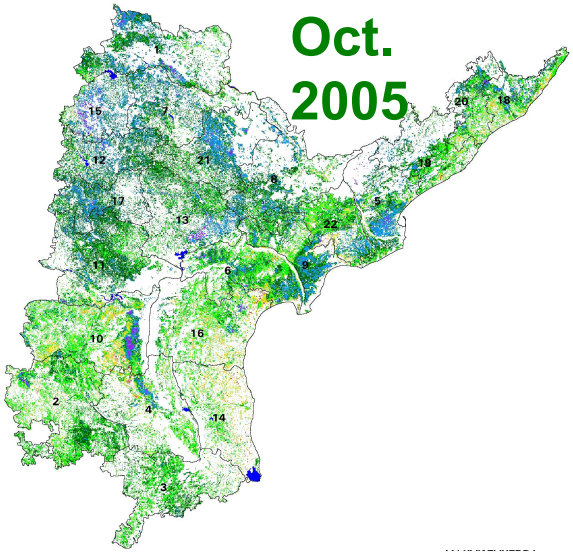
Drought year 2002

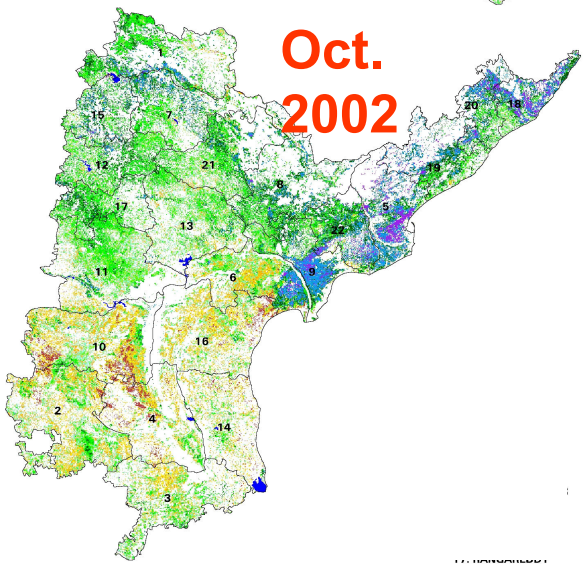
Normal year 2005

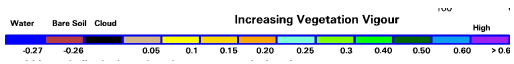


DISTRICTS

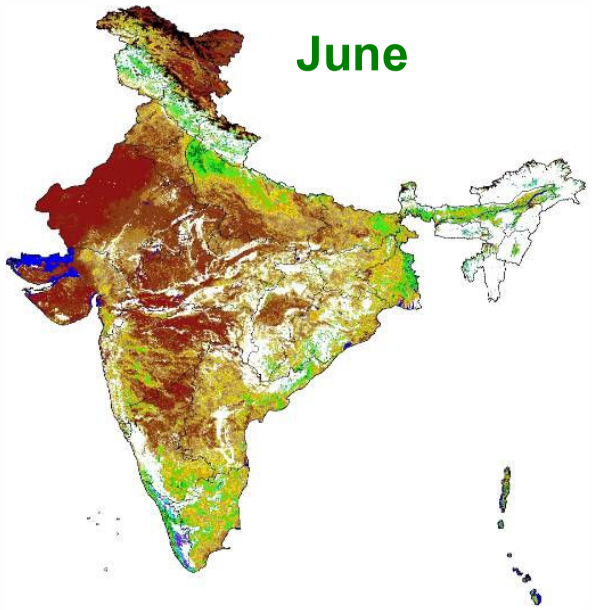
1. ADILABAD
2. ANANTHAPUR
3. CHITTOOR
4. CUDDAPAH
5. EAST GODAVARI
6. GUNTUR
7. KARIMNAGAR
8. KHAMMAM
9. KRISHNA
10. KURNOOL
11. MAHABUBNAGAR
12. MEDAK
13. NALGONDA
14. NELLORE
15. NIZAMABAD
16. PRAKASAM
17. RANGAREDDY
18. SRIKAKULAM
19. VISAKHAPATNAM
20. VIZIANAGARAM
21. WARANGAL
22. WEST GODAVARI

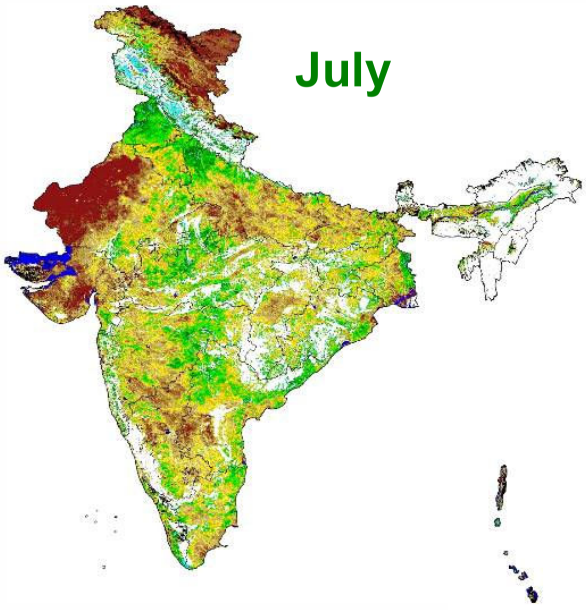


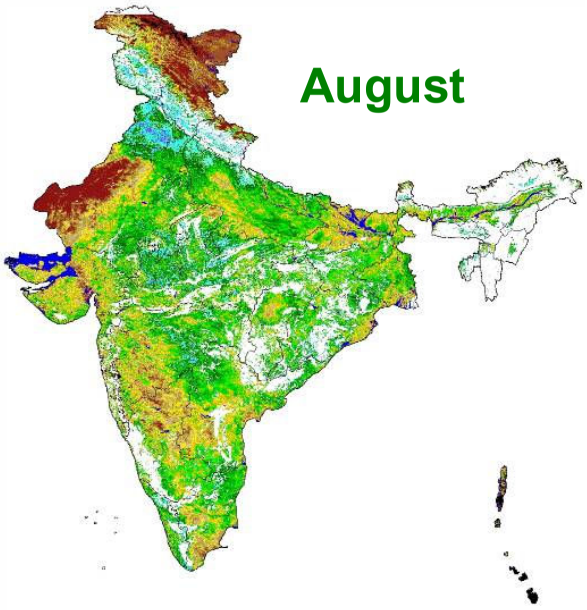


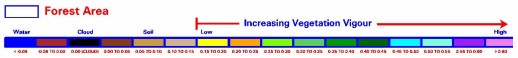


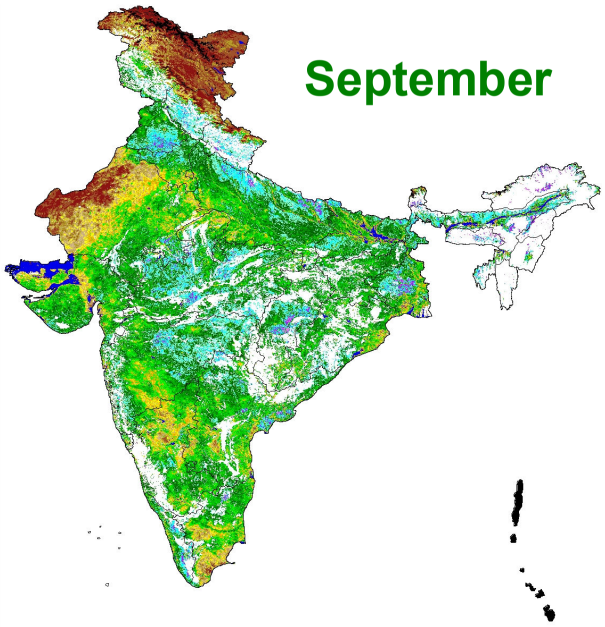
NOAA AVHRR NDVI – kharif 2007

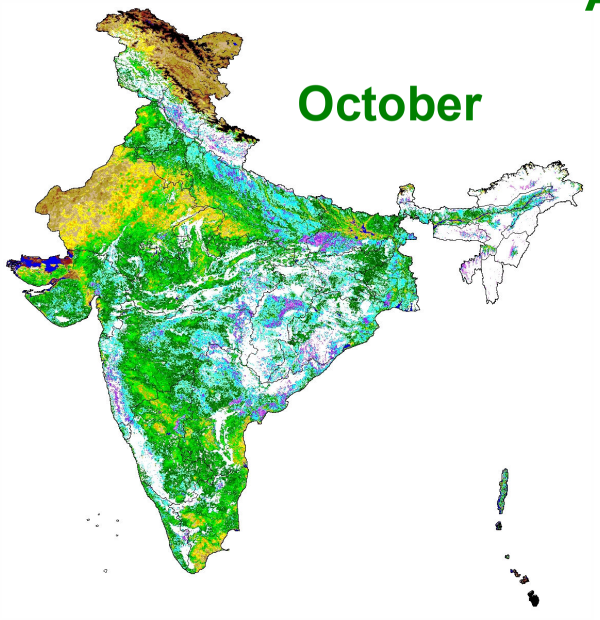




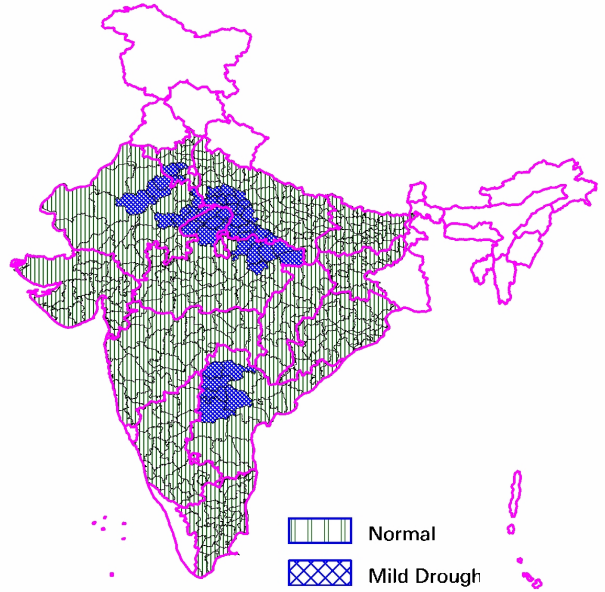




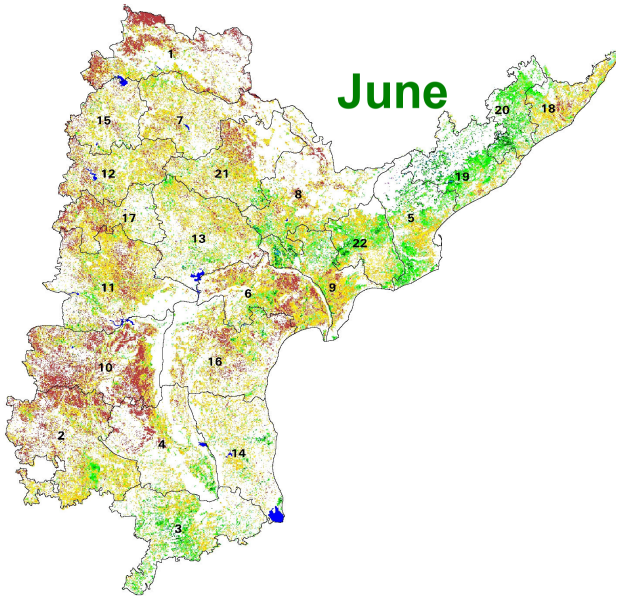


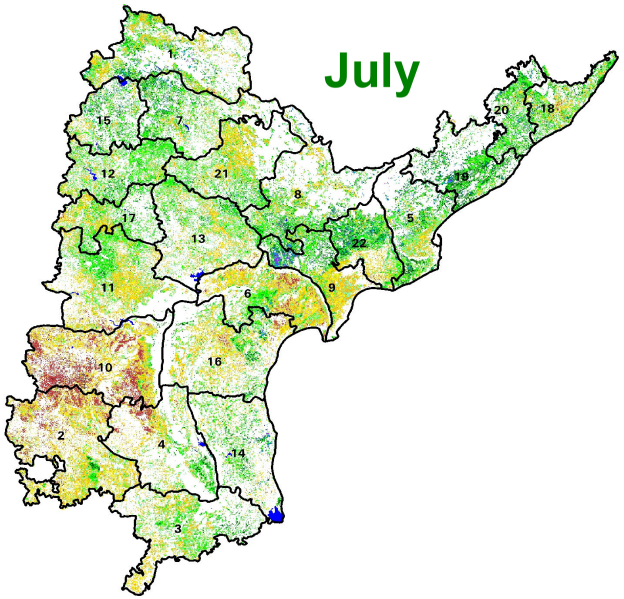


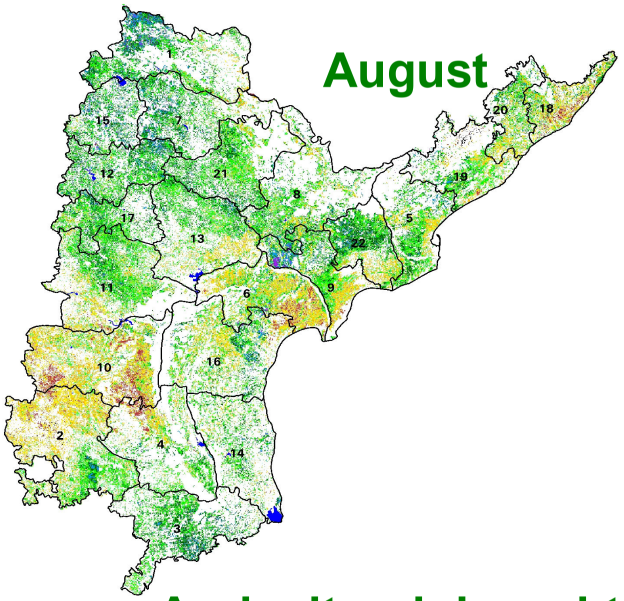
Agril. drought assessment

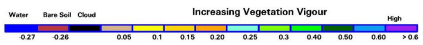


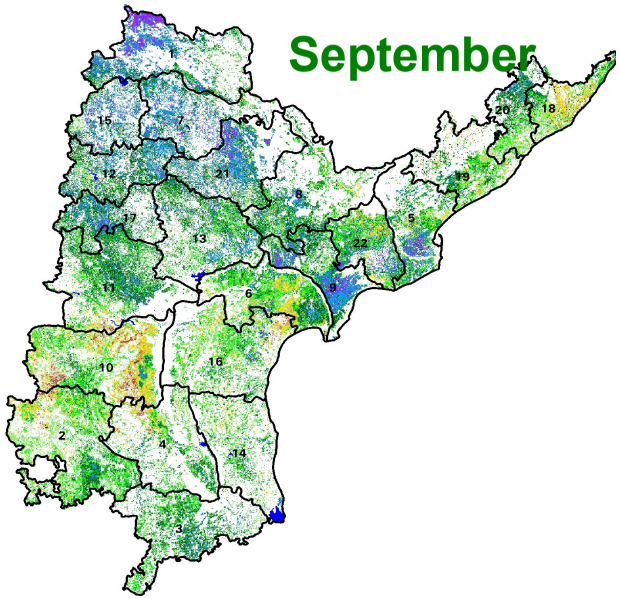
AWiFS NDVI over Andhra Pradesh – Kharif 2007

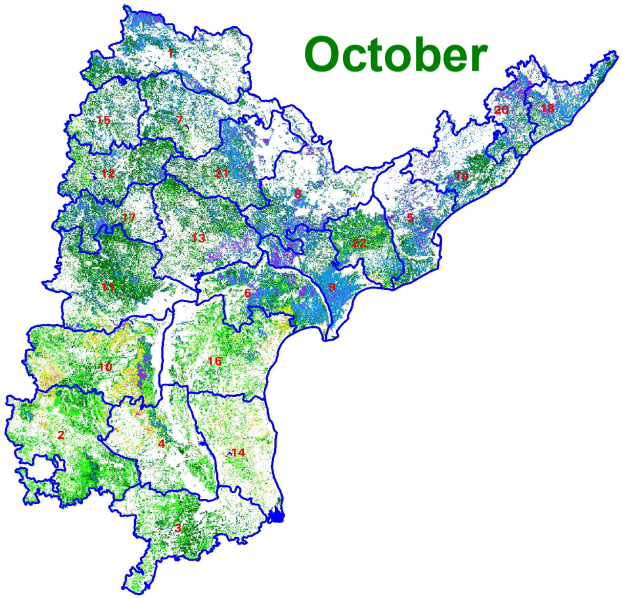




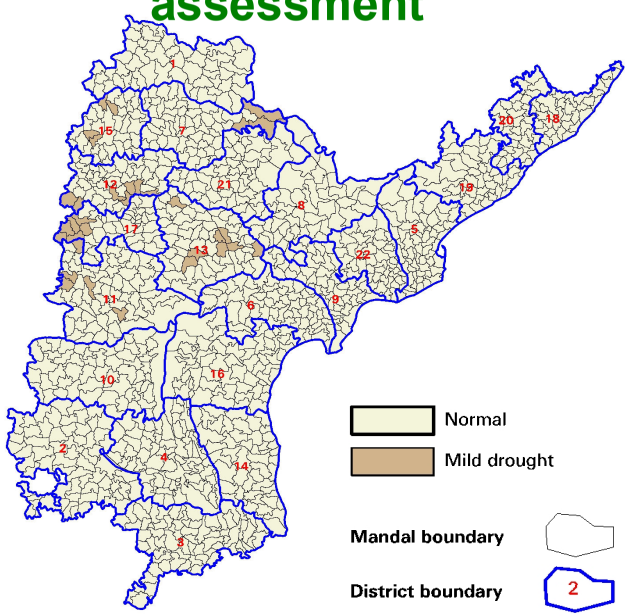




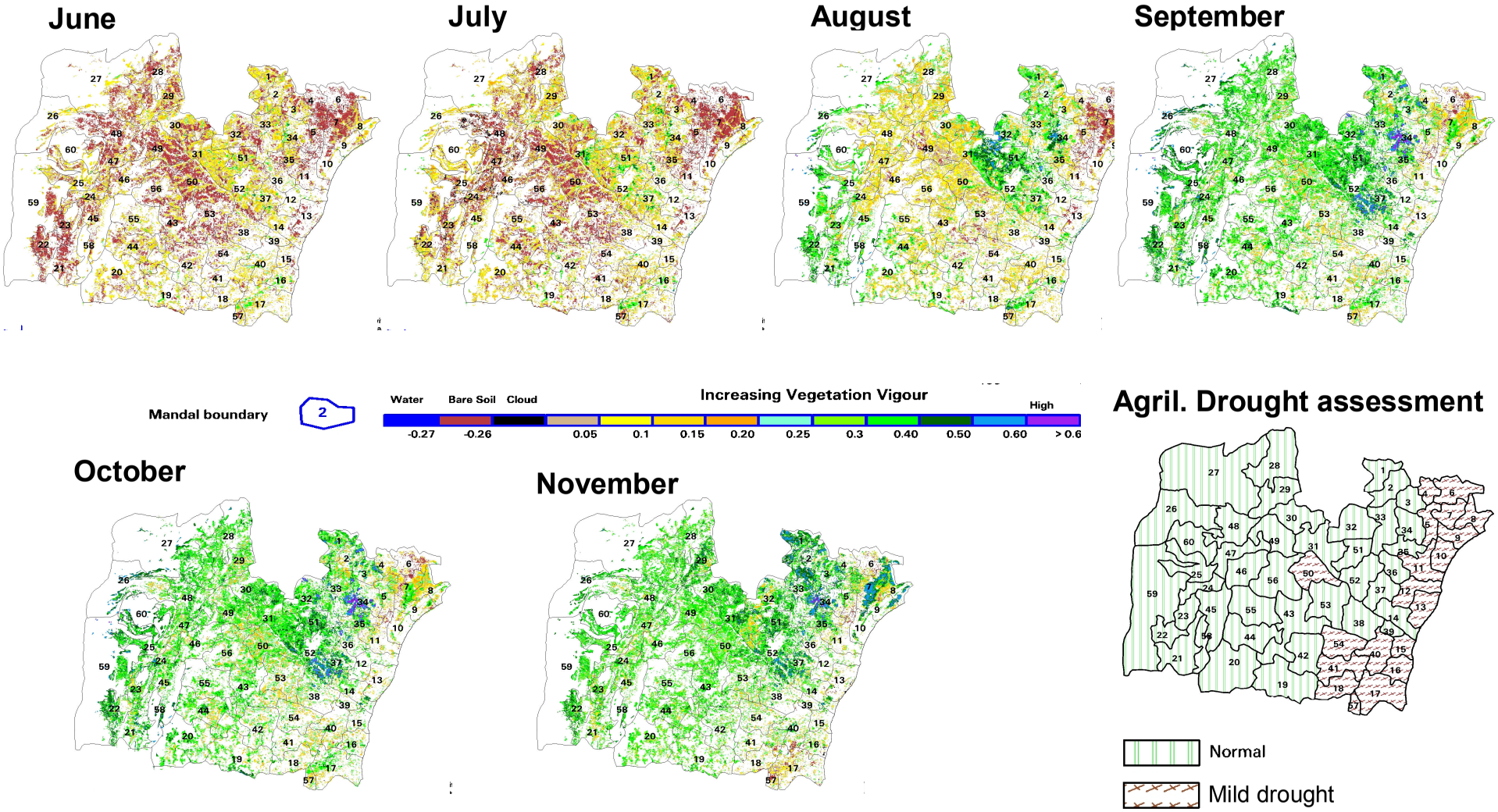




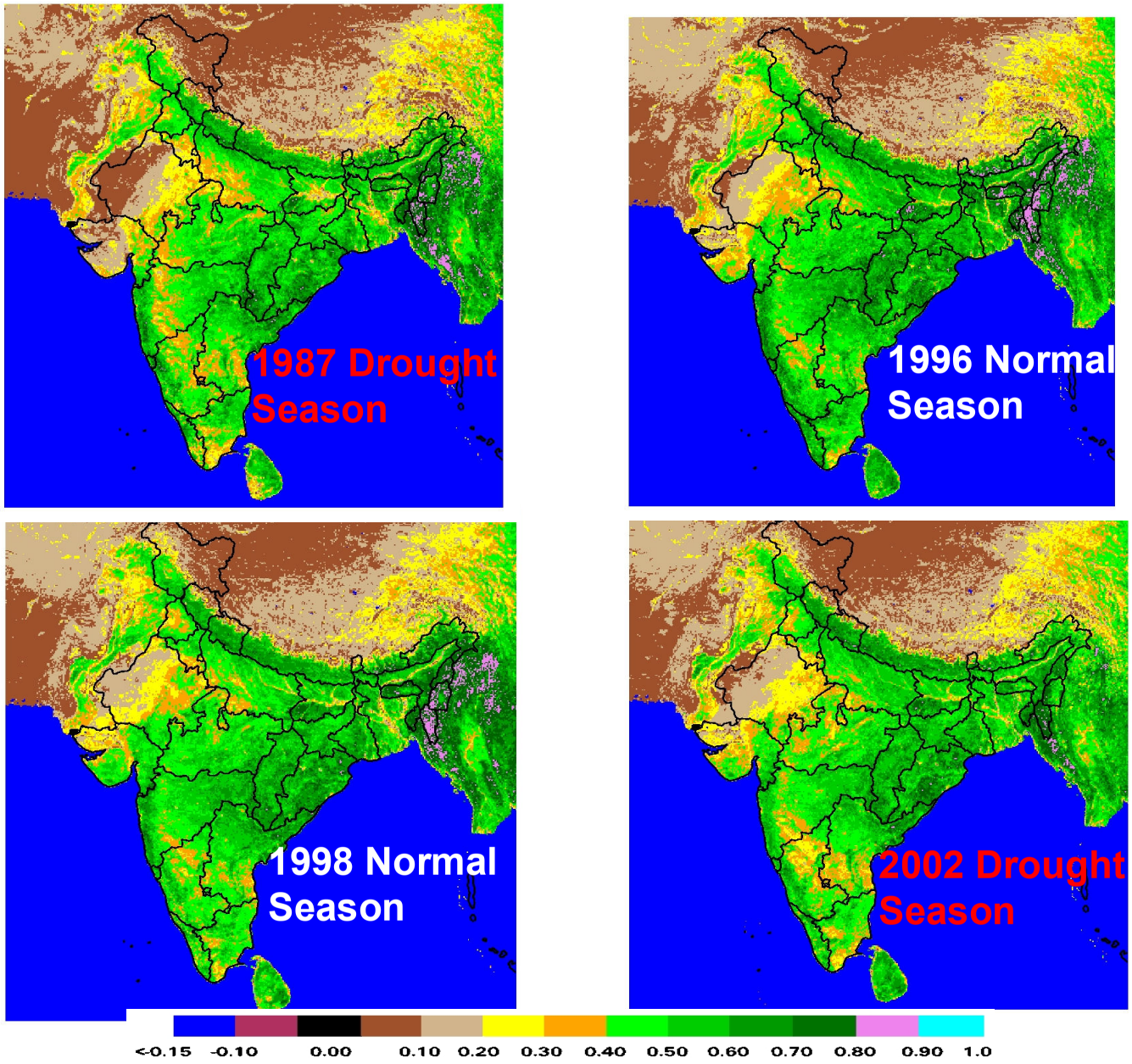
Agricultural drought assessment



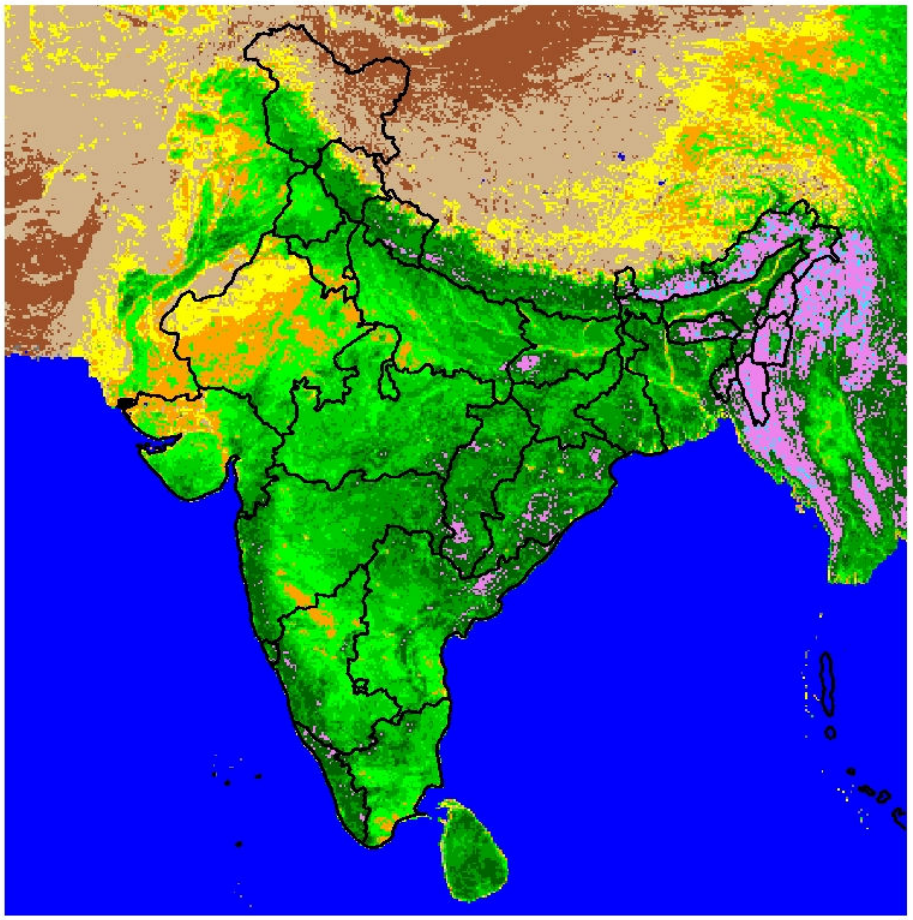
Sub-district level agricultural drought assessment using AWiFS/WiFS Agricultural area NDVI during kharif 2005 – Prakasam district, Andhra Pradesh



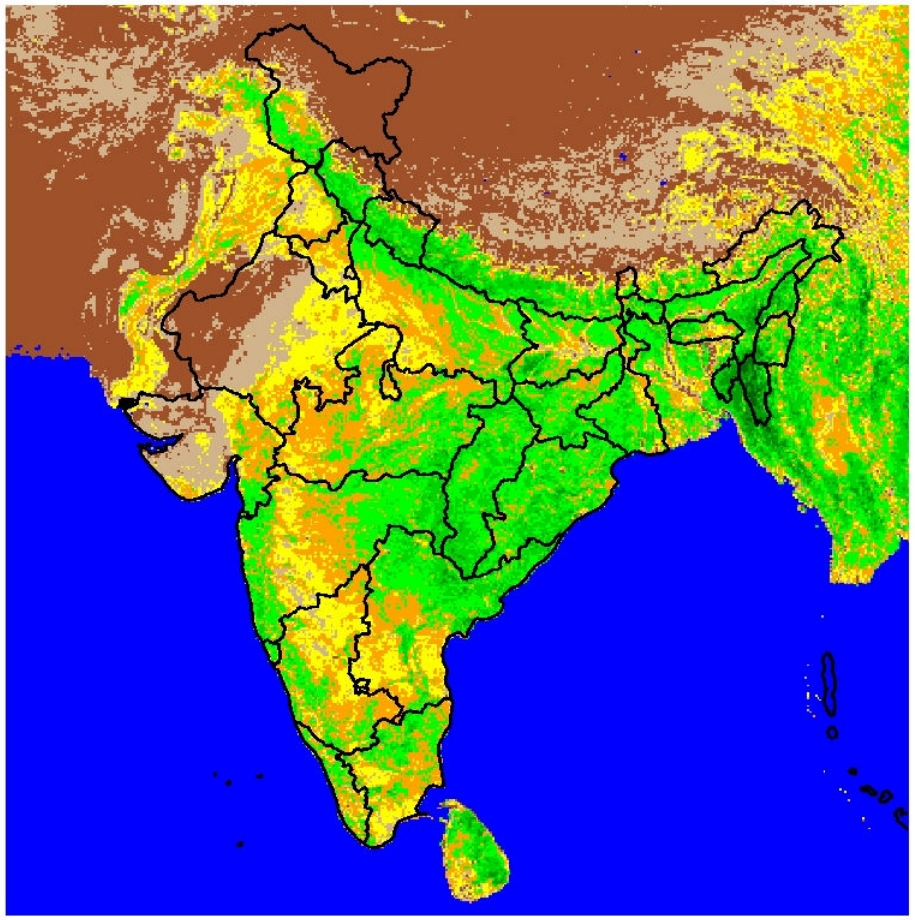
RESPONSE OF THE ECOSYSTEM Using GVI- INDIA



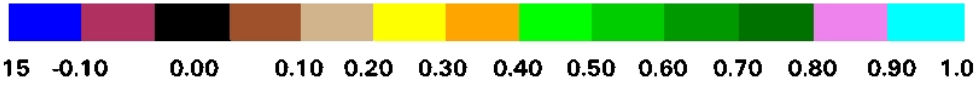
RESILIENCE OF THE ECOSYSTEM - INDIA



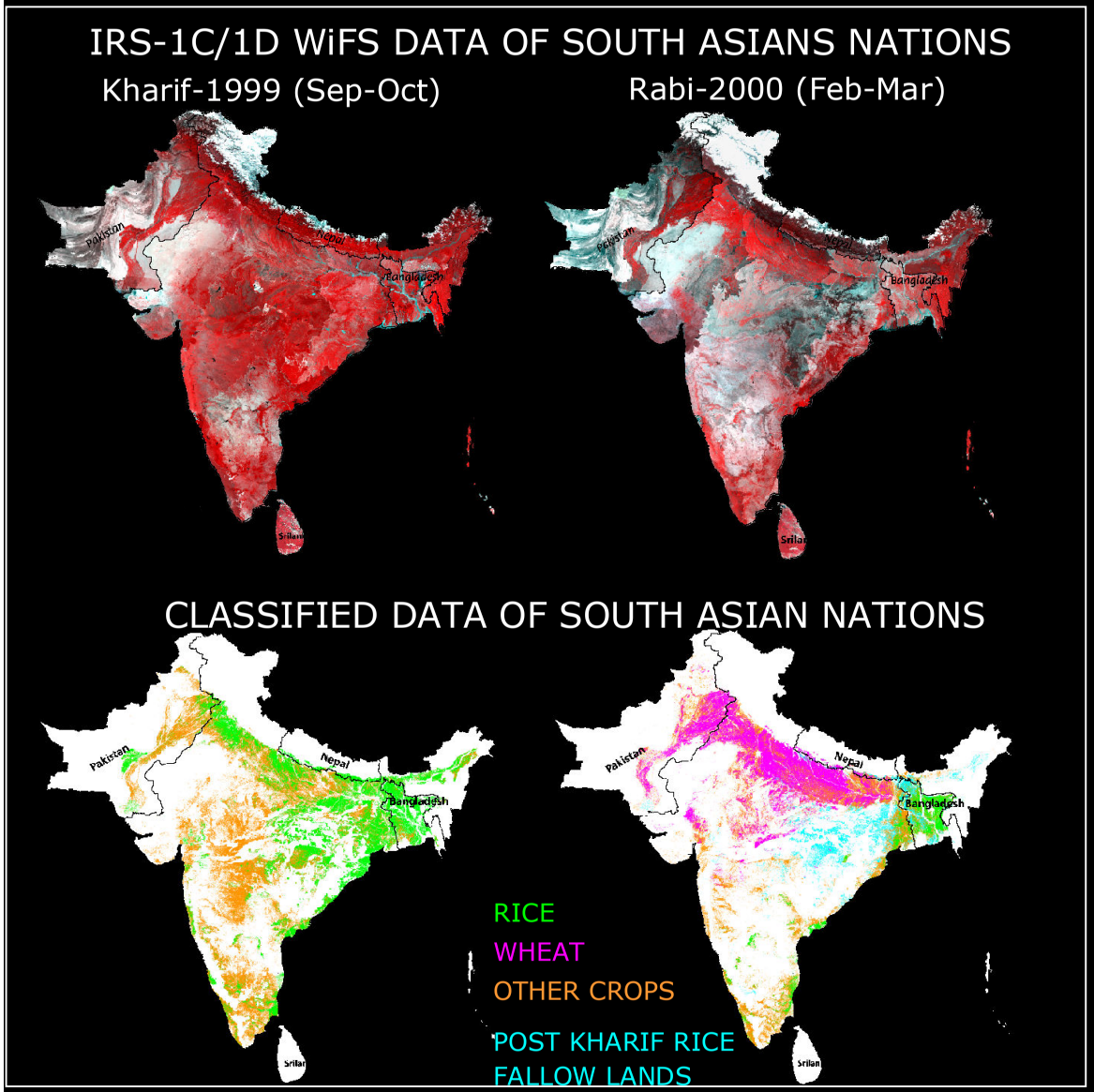
Max GVI Image of October 1st Fortnight



Min GVI Image of October 1st Fortnight



INVENTORY OF POST KHARIF RICE FALLOW LANDS USING REMOTE SENSING DATA



Acreages of Kharif Rice (1999) And Rice Fallows (2000)

Country	Rice acreage (Mha)	Rice fallows (Mha)
India	40.18	11.65
Bangladesh	6.36	2.11
Nepal	1.45	0.39
Pakistan	2.45	0.14

ACREAGES OF KHARIF RICE & POST KHARIF RICE FALLOW LANDS OF INDIA

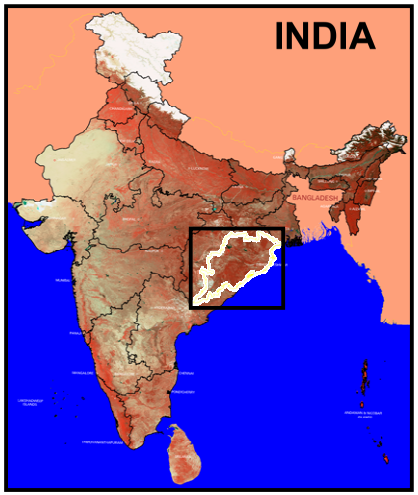
REGION / STATE	KHARIF RICE ACREAGE ('000 ha)	POST KHARIF RICE FALLOW ACREAGE ('000 ha)	PROPORTION OF RICE FALLOWS (%)
WESTERN INDIA			
RAJASTHAN	214	25	15.8
GUJARAT	469	83	
EAST INDIA			
BIHAR	3466	282	**33.9**
JHARKALAND	2508	1914	
ASSAM	2234	539	
WEST BENGAL	4617	1719	
ORISSA	3879	1219	
NORTH INDIA			
PUNJAB	2498	0.0	3.6
HARYANA	1109	0.0	
UTTAR PRADESH	6255	353	
SOUTH INDIA			
ANDHRA PRADESH	2657	305	**9.1**
KARNATAKA	984	182	
TAMIL NADU	1695	20	
KERALA	241	0.0	
CENTRAL INDIA			
MADHYA PRADESH	2242	1506	**68.1**
CHATTISGARH	3356	2876	
MAHARASHTRA	1762	629	

LEGUMES SUITABLE FOR RICE FALLOWS

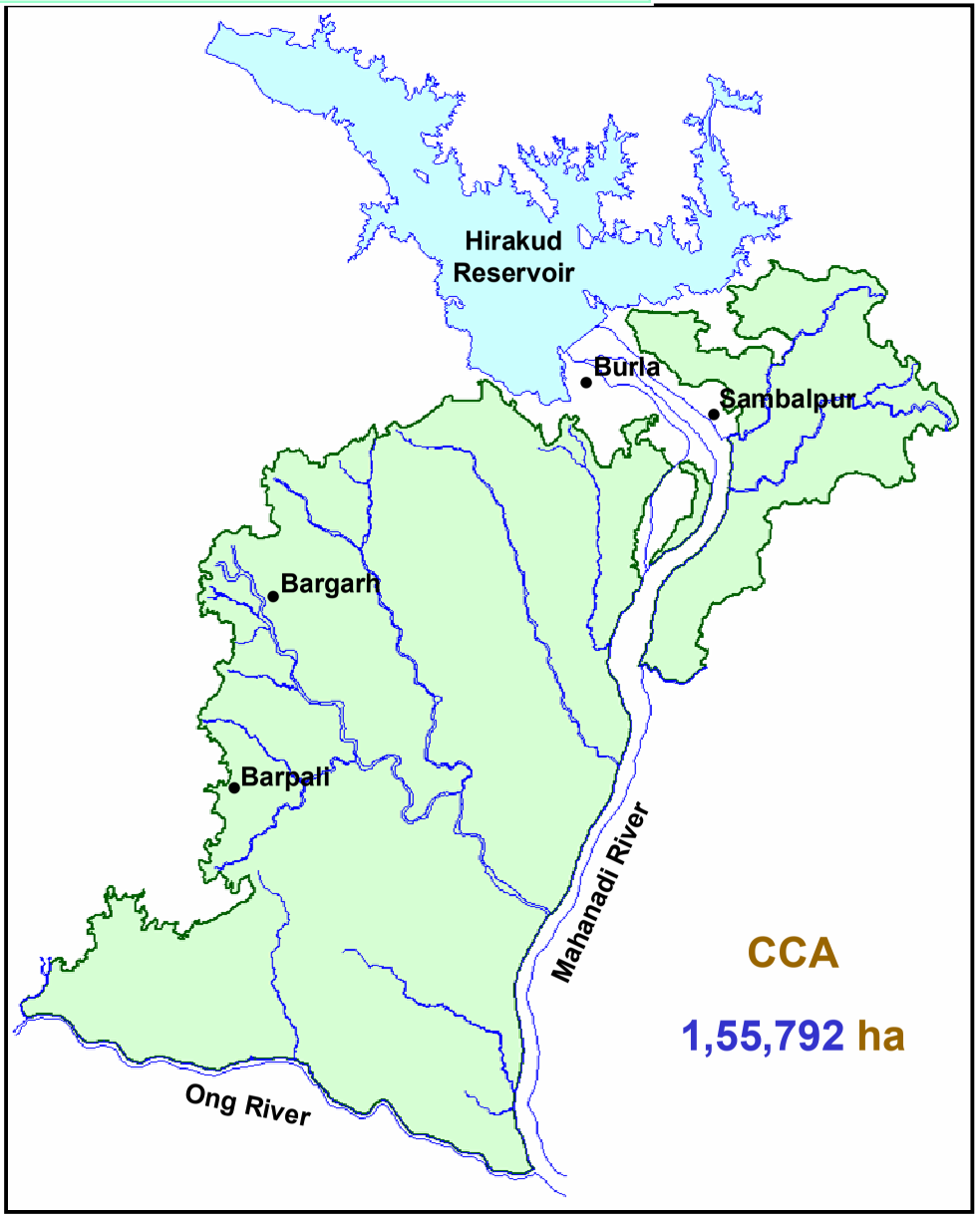
Cool season legumes: Optimum temperature 15-25^{o}C
Chickpea, Lentil, Khesari, Peas

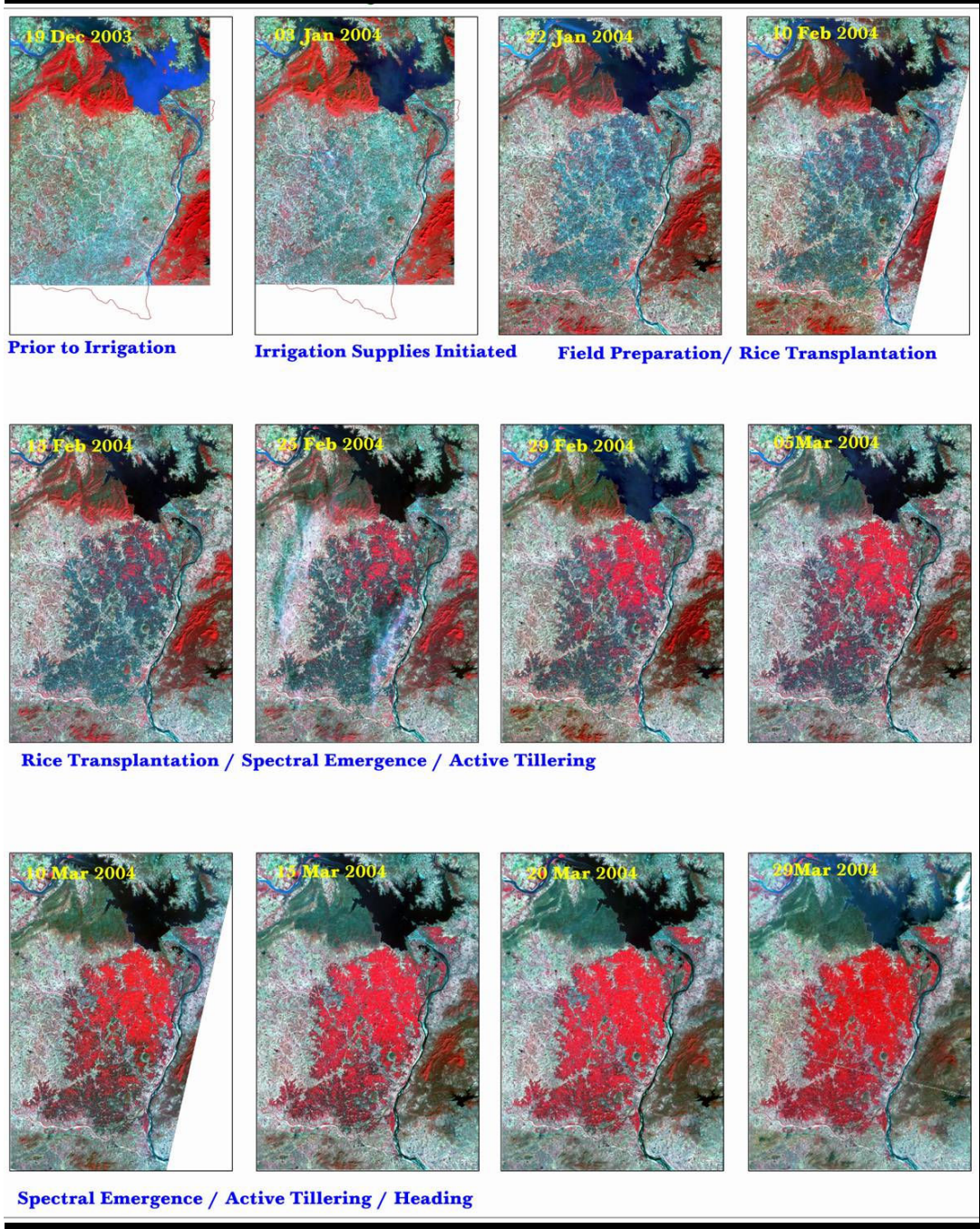
Warm Season Legumes: Optimum Temperature 25-35^{o}C
Pigeonpea, groundnut, Mungbean, blackgram, cowpea, Horsegram

Hirakud Project Command Area



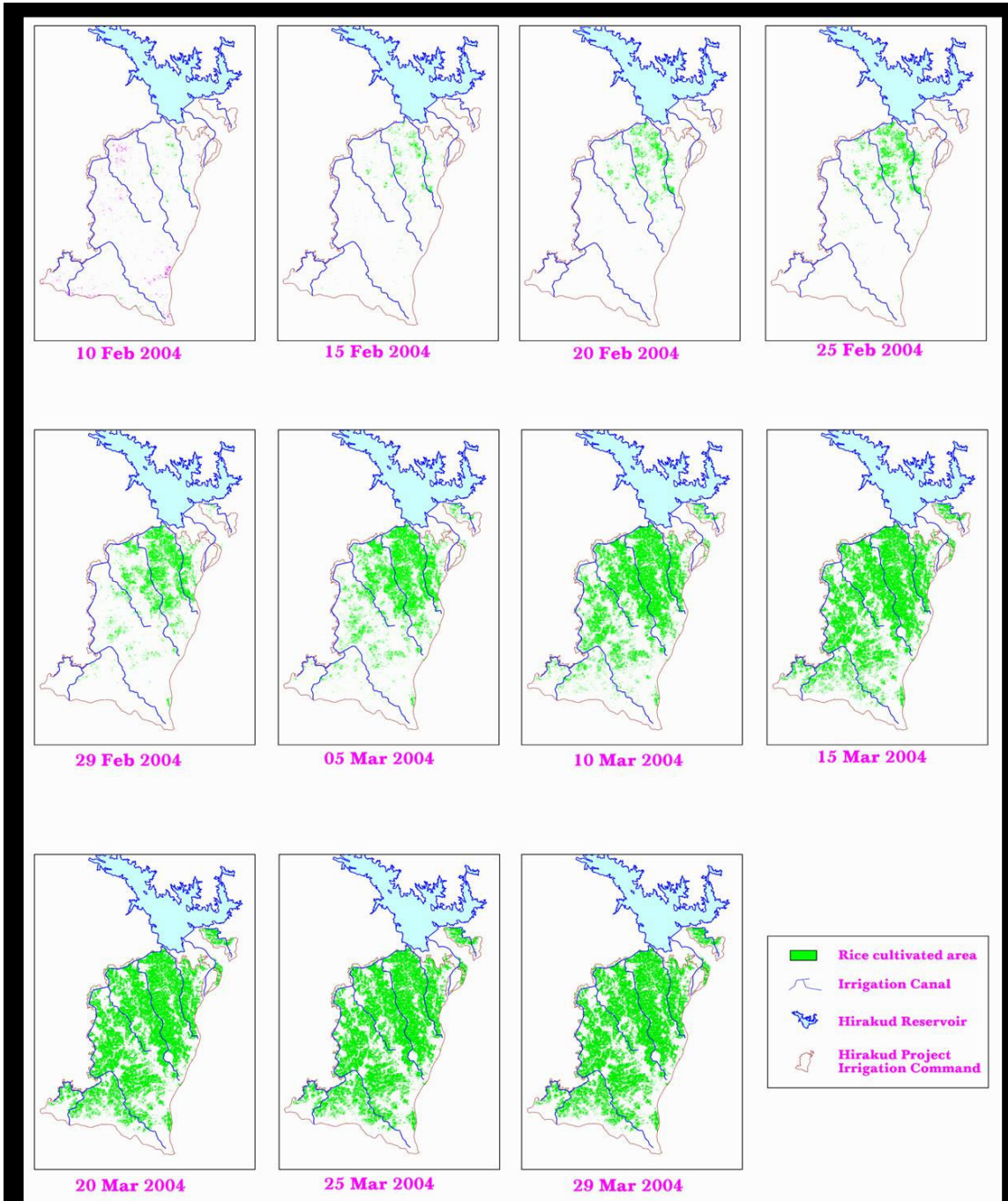






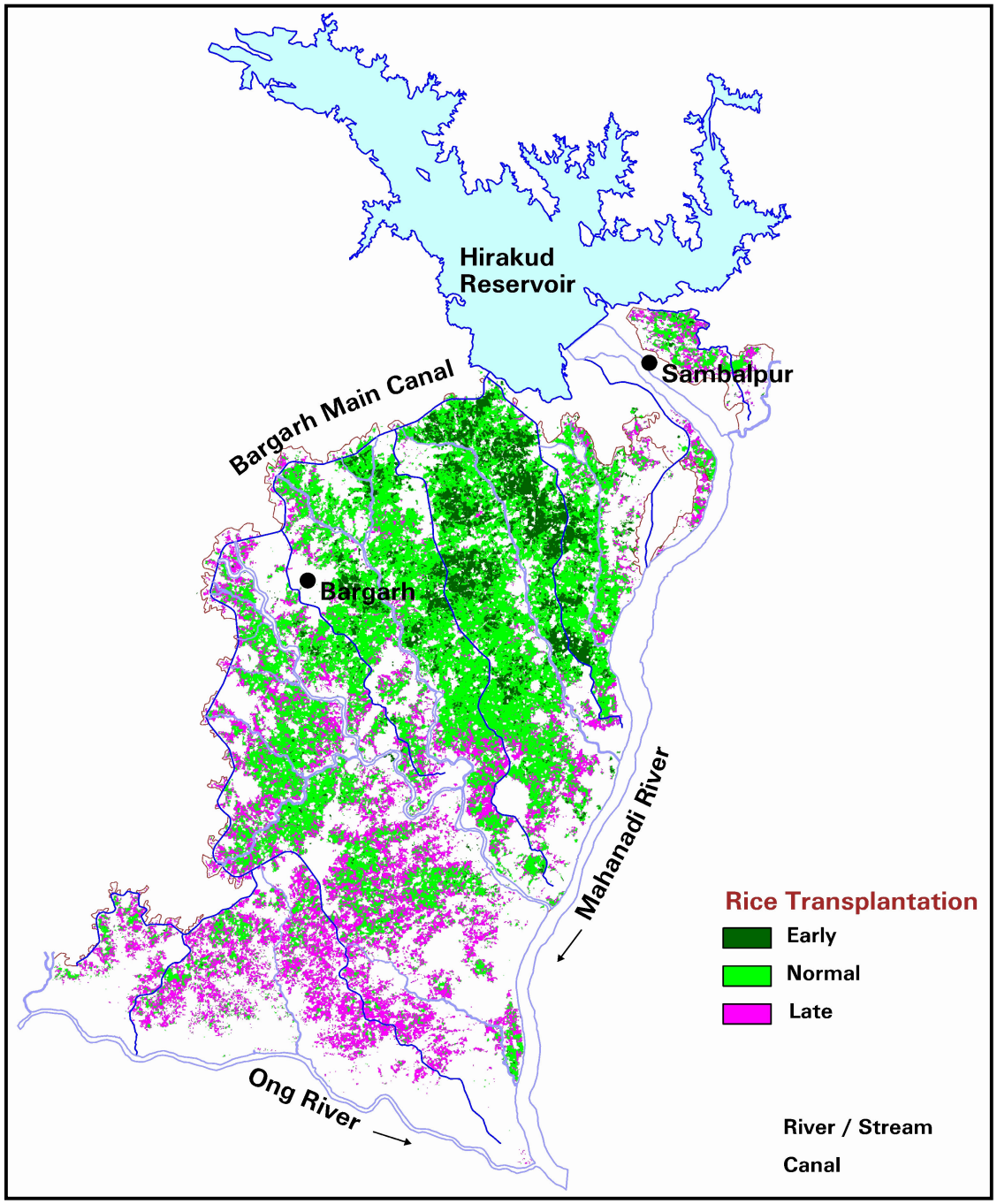
Progression of 2003-04 Rabi Season Crop Area

As captured by multi-date AWiFS data



Progression of Rice Cultivated Area

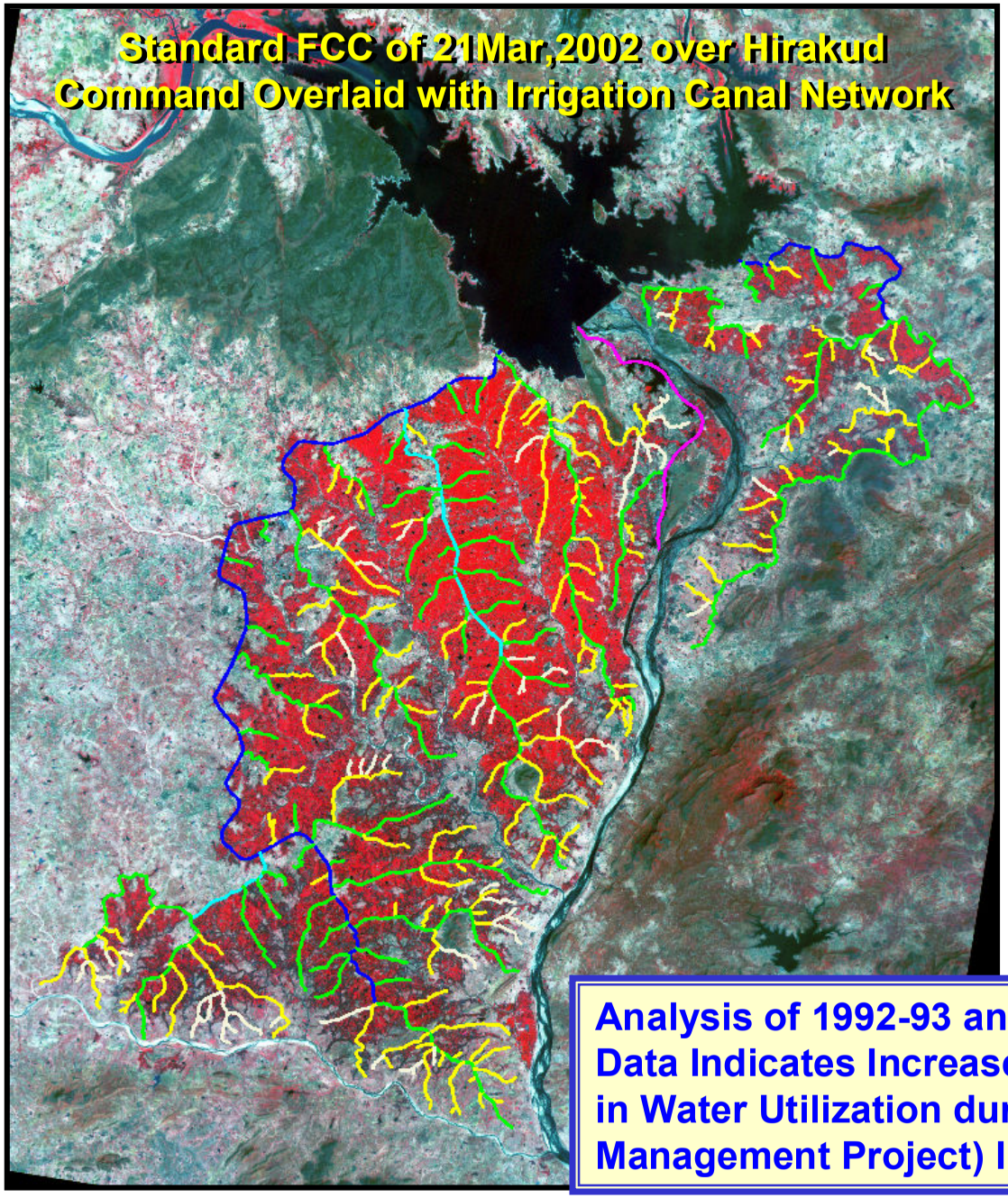
As derived from multi-date AWiFS data

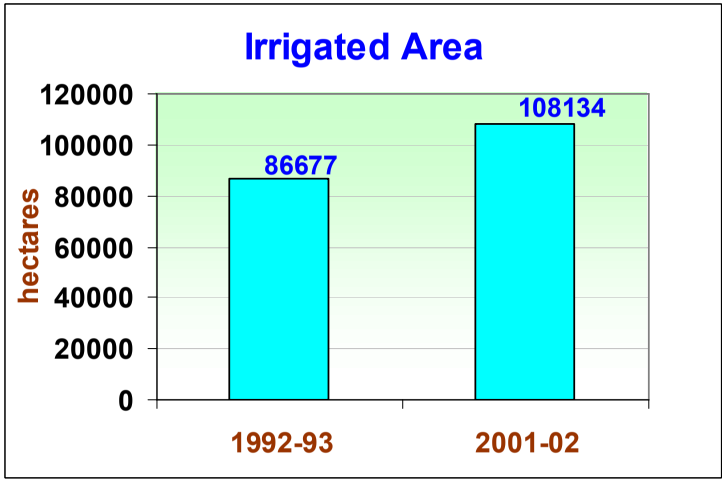


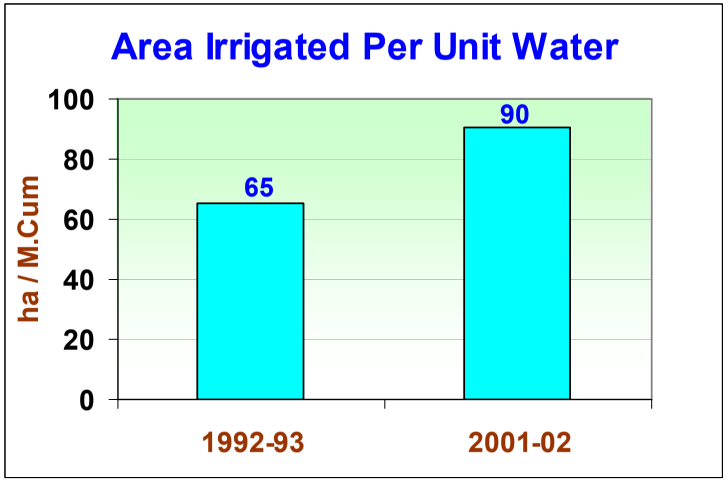
Variability in Rice Transplantation period

Performance Evaluation of Hirakud Command Area, Orissa State

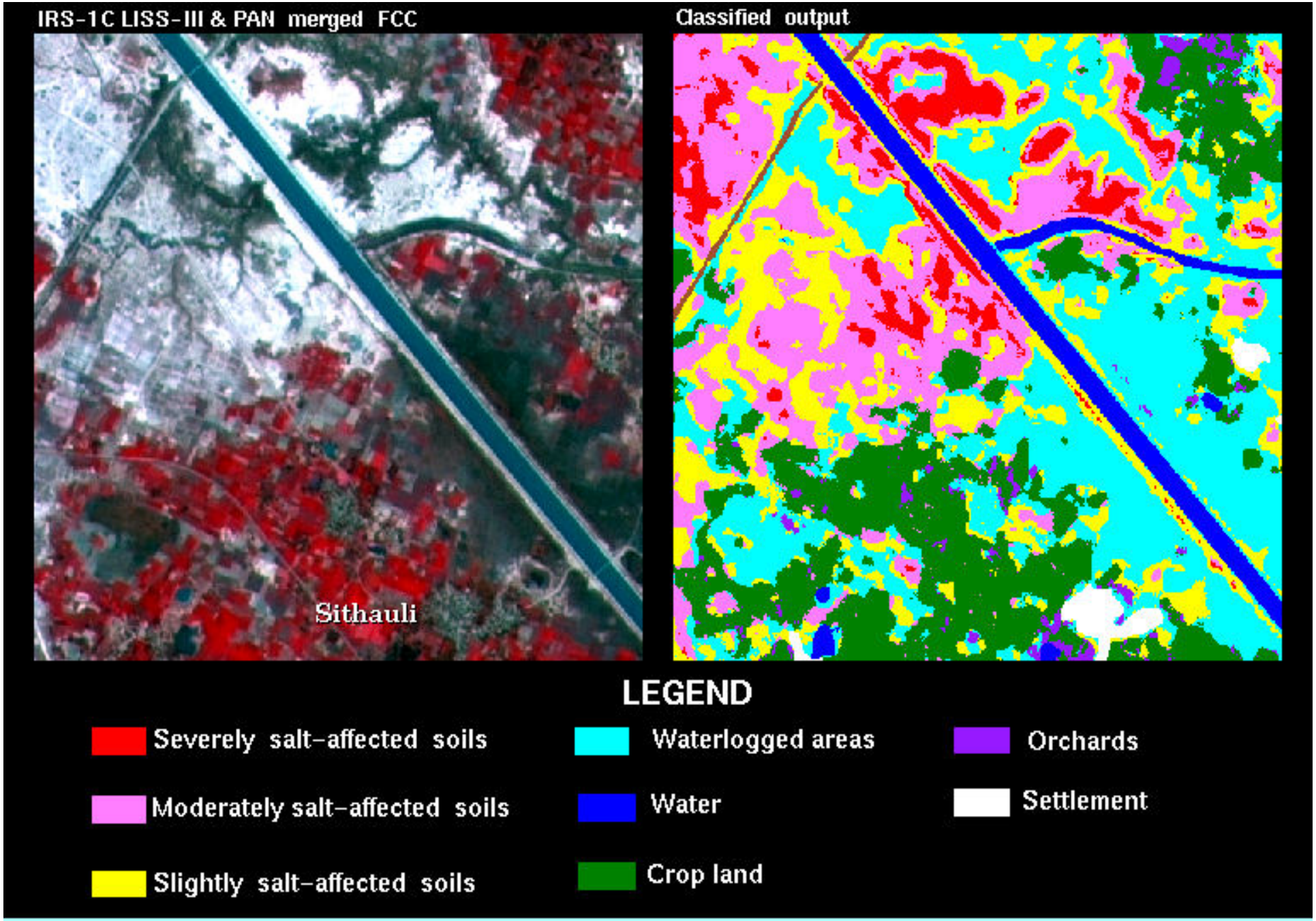
(for the decade 1993 - 2002)







Analysis of 1992-93 and 2001-02 Rabi Season Satellite Data Indicates Increase in Irrigated Area and Improvement in Water Utilization during NWMP (National Water Management Project) Implementation



MAPPING SALT-AFFECTED SOILS AND WATERLOGGED AREAS USING IRS-1C DATA

MONITORING WATER-LOGGING IN PART OF INDIRAGANDHI CANAL COMMAND AREA







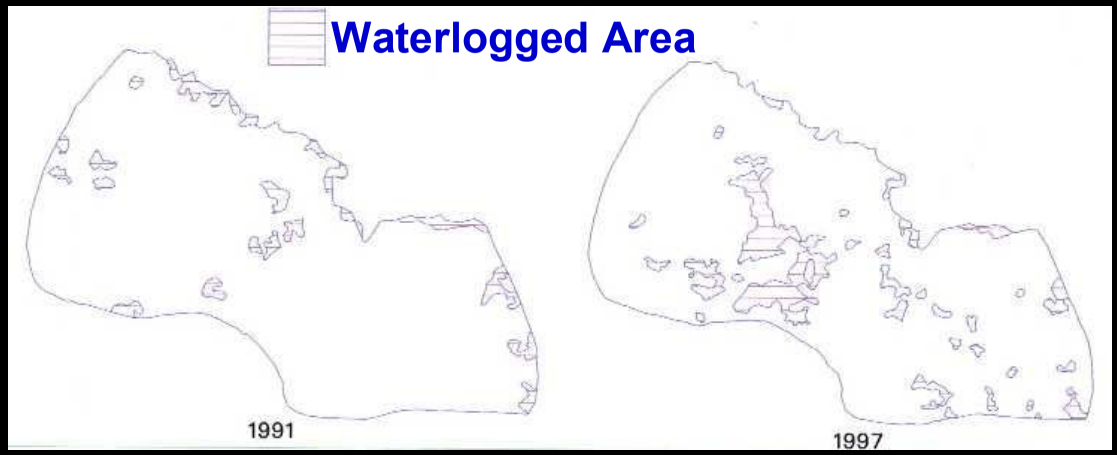




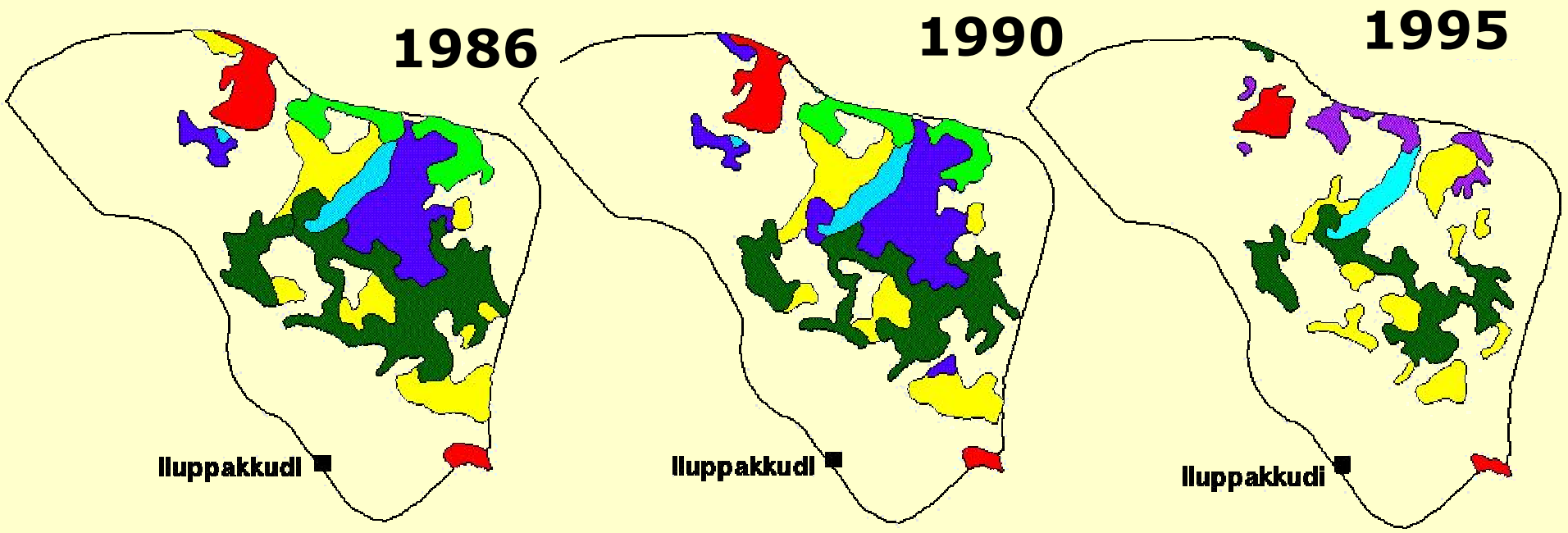


MONITORING WATERLOGGING, PANSORA DISTRIBUTARY,MAHI COMMAND ,GUJARAT





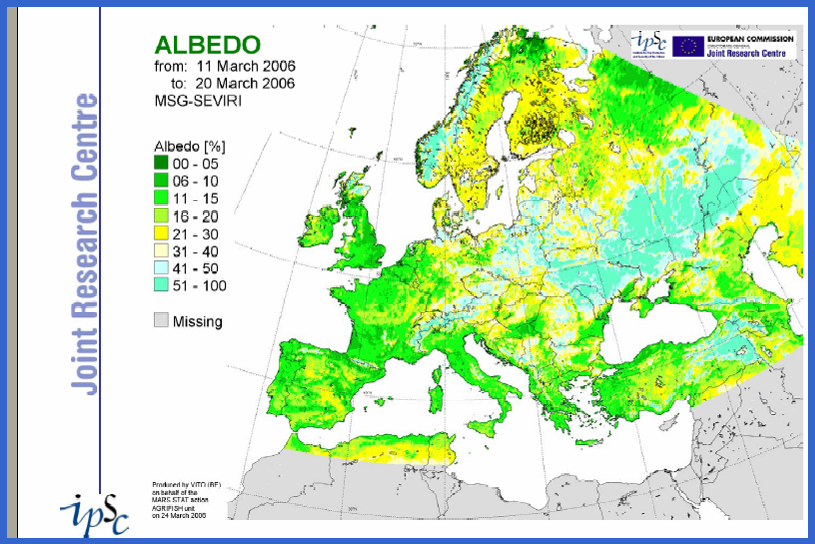
MONITORING WATERLOGGING AND SOIL SALINITY
IN PART OF PERIYAR - VAIGAI COMMAND, TAMILNADU



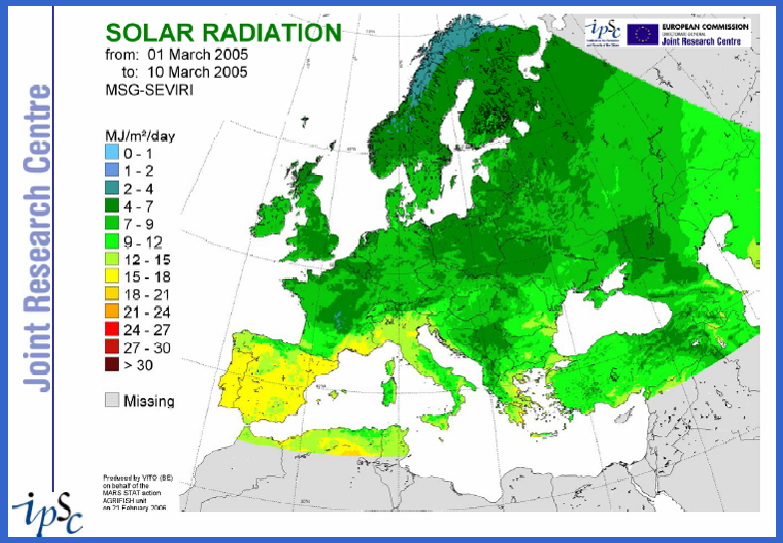
LEGEND

- SLIGHTLY SODIC
- SLIGHTLY SALINE SODIC
- SLIGHTLY SALINE MODERATELY SODIC
- MODERATELY SALINE SLIGHTLY SODIC
- MODERATELY SALINE STRONGLY SODIC
- SLIGHTLY SALINE SODIC WITH WATER LOGGING

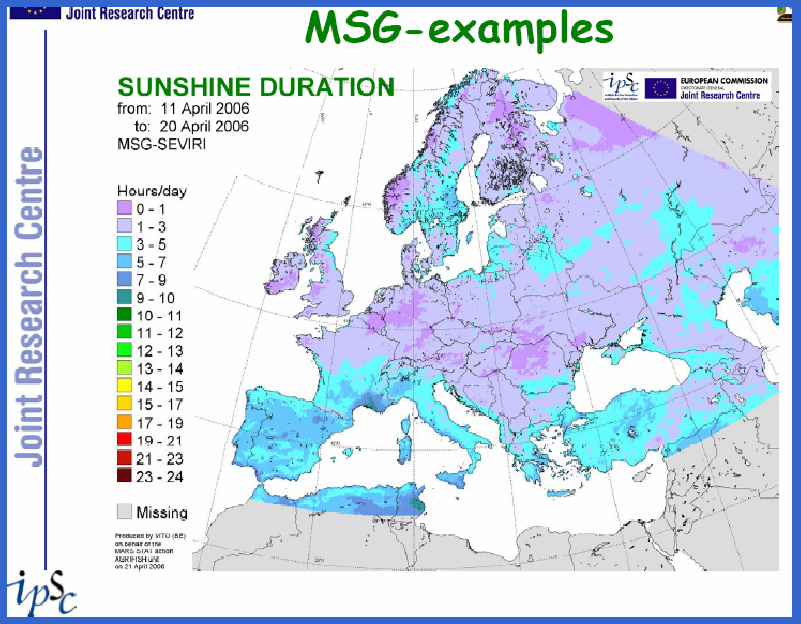
MSG Examples



Albedo



Solar Radiation



Sunshine Duration

Automatic Weather Stations

- Affordable alternatives to get detailed weather information.
- AWS measures – meteorological parameters like rainfall, humidity, temperature



- Special sensors for measuring soil moisture
- Data transmission through communication satellites – Kalpana - 1, INSAT 3A
- consistency in data recording enhanced frequency of coverage
- Coverage of inaccessible areas, all weather and all time operations



Crop Growth Monitoring System

Purpose:	Timely and quantitative yield forecasts at regional & national scales
Monitors crops:	Driven by meteorological conditions Modified by soil characteristics and crop parameters
Characteristics:	Spatialisation component Integrating interpolated meteorological data, soils and crops parameters

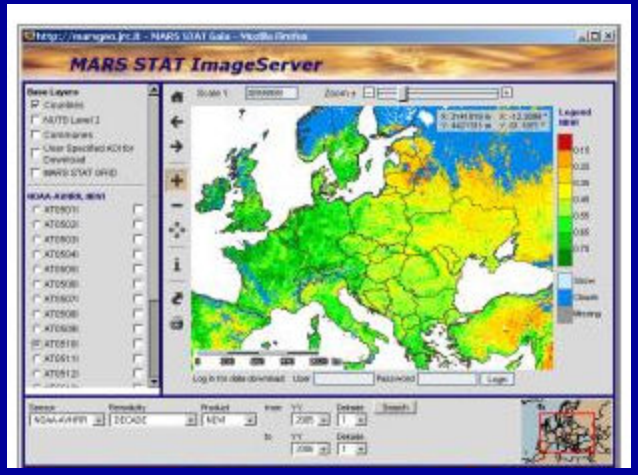
Parameters from EUMETSAT by Land Surface Analysis Satellite Applications Facility

Land Surface Temperature
Downwelling Shortwave Radiant Flux
Downwelling Longwave Radiant Flux
Surface Albedo
Snow Cover

Leaf Area Index
Fractional Vegetal Cover

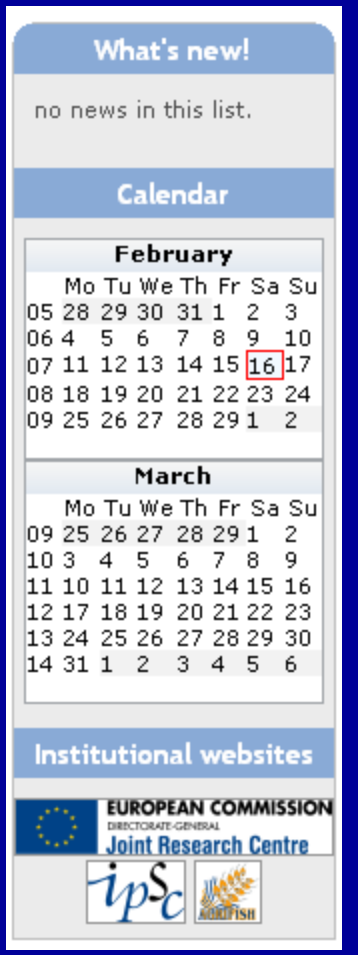
Evapo Transpiration
Fire Radiative power

http://landsaf.meteo.pt



Spot, NOAA, MODIS:
Dekad & Monthly

MSG products:
Daily, Dekad & Monthly



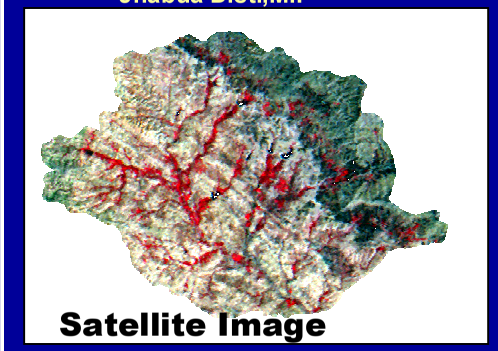
http://cid.jrc.it/idp/thematic-portals/mars-stat-imageserver/



Watershed Management

Upper Hatni Watershed

Jhabua Dist.,M.P



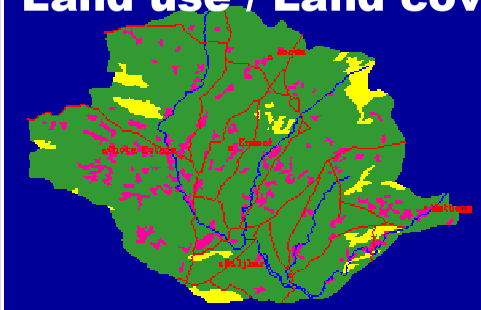
Satellite Image

Soil & Water Conservation
Land Use Planning
Increase Forest Cover
Bio-diversity
Characterization

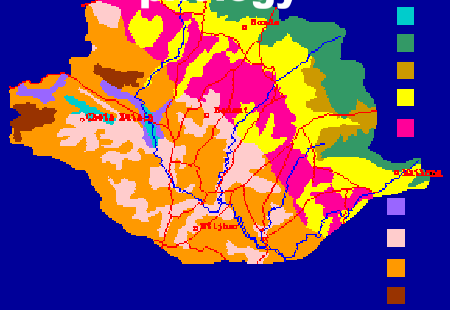
Programs

- IMSD –Integrated Mission for Sustainable Development
- IRIS-DA : Integrated resources System for desertification Areas
- NATP –National Agricultural Technology Project

Land use / Land cover



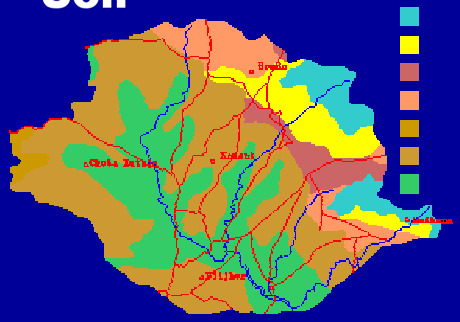
Hydrogeomor-phology



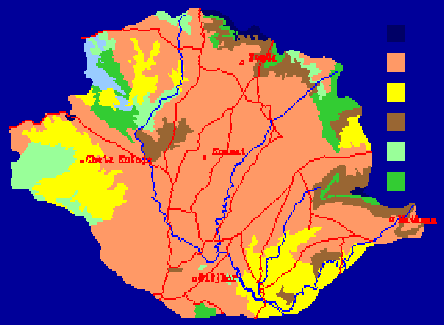




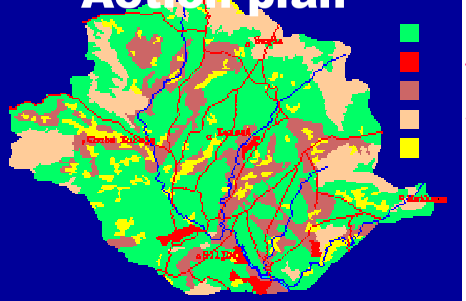
Soil



Slope



Action plan



Agro-forestry
Agro-horticulture
Intensive agriculture
Sivipasture
Existing double crop

Village Resource Centres for Societal Services from Space

- A new Initiative of ISRO to Reach Common man through Space Technology Enabled Societal Services in Association with NGOs / Trusts / Hospitals / Universities / Govt. Depts.



Setup 262 VRCs including 59 Expert Centres & Regional Nodes to Liaison among NGOs, Expert Centres & VRCs Serving about 3000 Villages in 15 States. Additional 117 VRCs are being setup



10 Regional Nodes across the country act as expert centres, coordinate / monitor VRC programs and offer satellite data derived information for optimum management of local natural resources



A single window delivery mechanism for offering tele-education, tele-healthcare and customised services, advisories on agriculture, land and water management, enhanced livelihood opportunities, etc


THANK YOU