Indian Agricultural Research Institute

Drought Monitoring – State of the Art & Way Forward

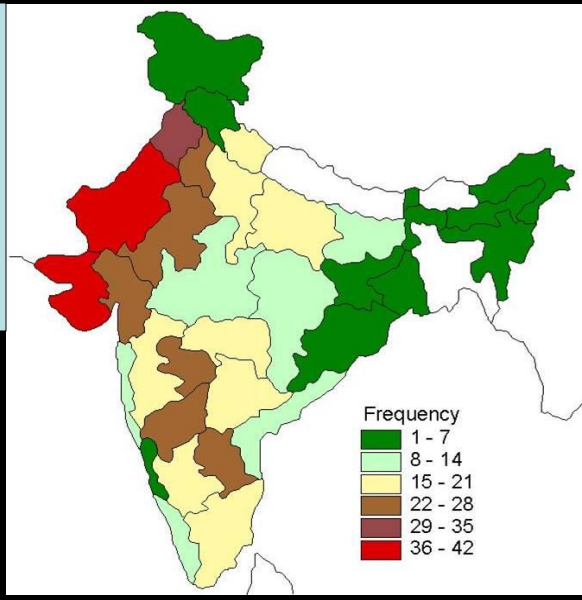



Ravinder Kaur
Project Director
Water Technology Center &
Director (Actg.)
Indian Agricultural Research Institute, New Delhi
Email: pd_wtc@iari.res.in ; director@iari.res.in ; rk132.iari@gmail.com

Drought : A Silent Threat to Indian Rural Economy

- 70% population (900 million) depend on agril.
- 68% net sown area (97 M ha) drought prone
- 50% of drought prone area severe in nature
- 1871-2012: 22 major droughts with 5 severe

Geographical Area
328.7 M ha
Net Sown Area
142.2 M ha
Net Irrigated Area
55.10 Mha



Frequency of droughts in India- 1871-1999

Crop Failure

Unemployment

Cattle - starvation

Fodder shortage

Drinking water shortage

Indian Agricultural Research Institute

Drought Monitoring by Indian Meteorological Department

IMD carrying out meteorological drought monitoring since 1875 based on meteorological indices:

1. **Percent deviation of Rainfall from Normal**
2. **Aridity Anomaly Index (AAI)**

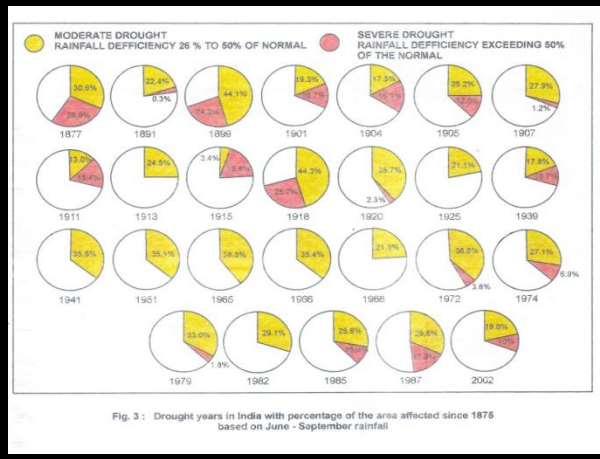
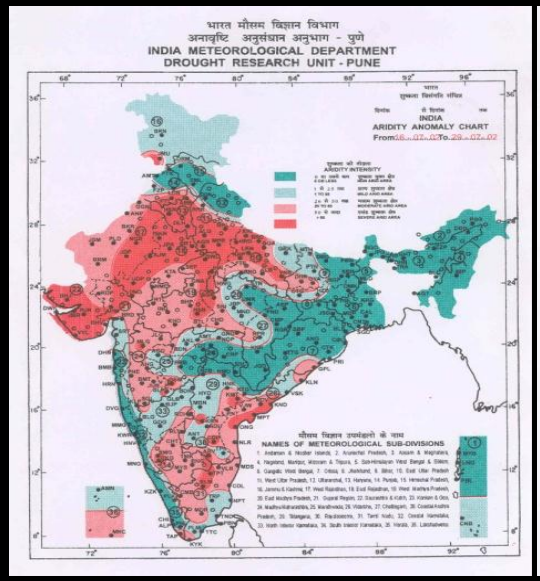
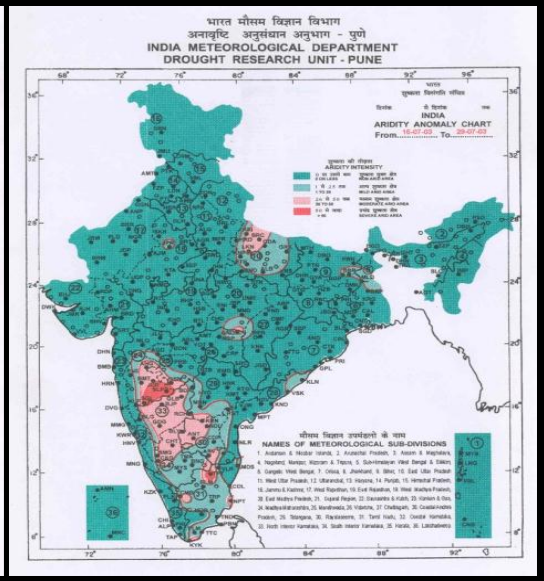


Fig. 3 : Drought years in India with percentage of the area affected since 1875 based on June - September rainfall

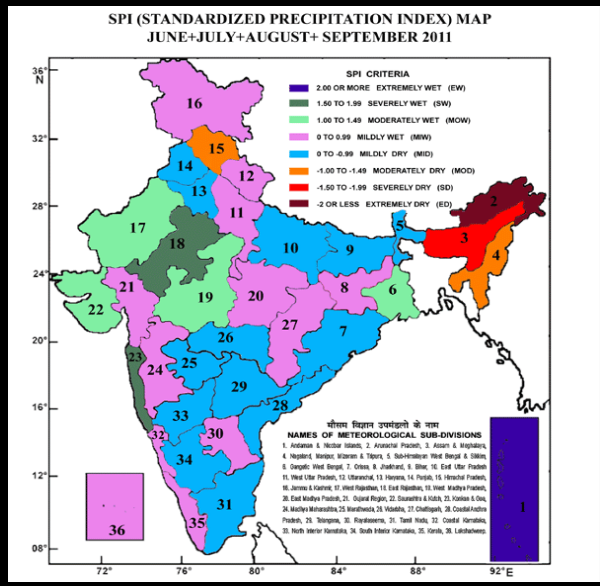


July 2002

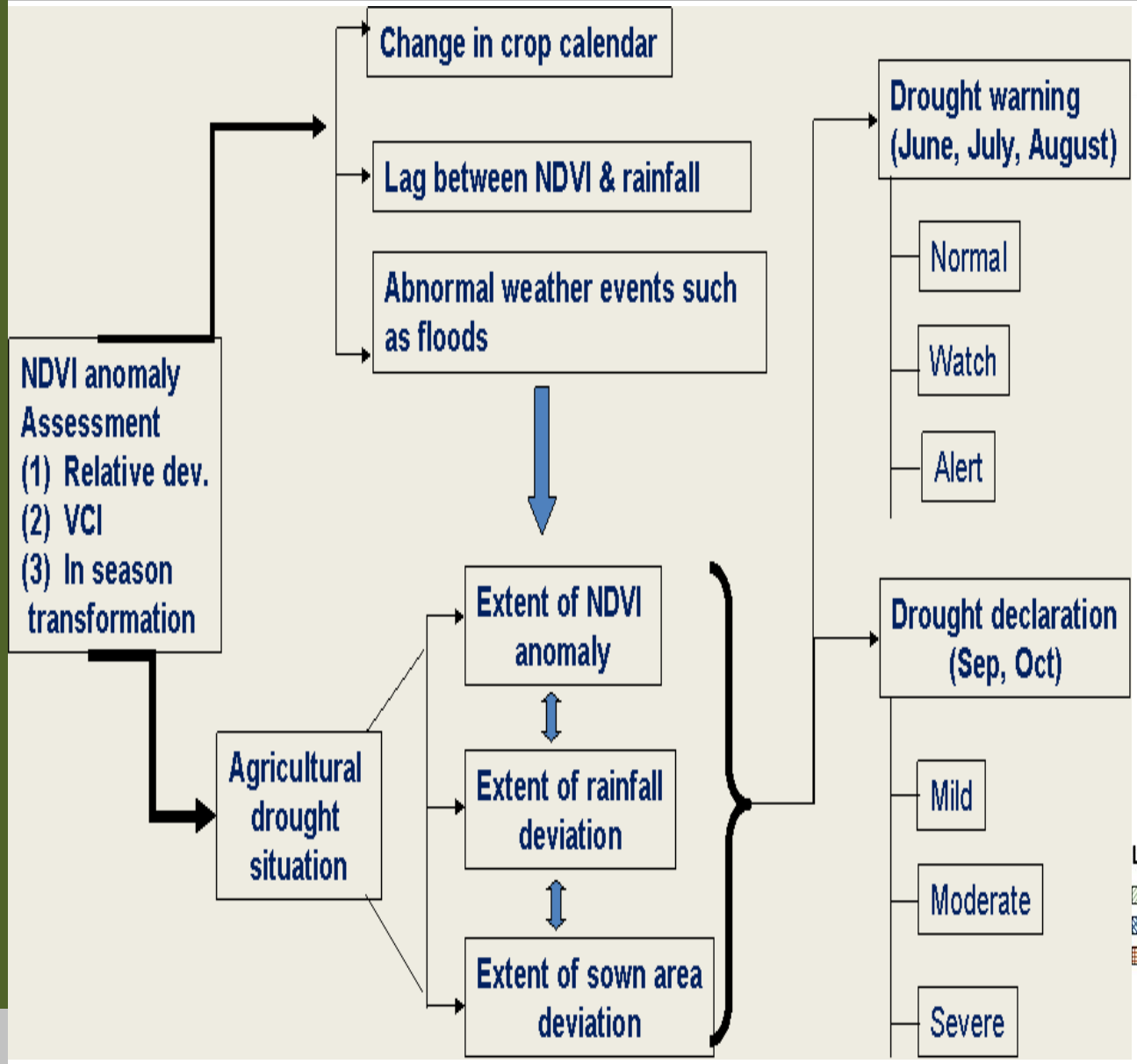


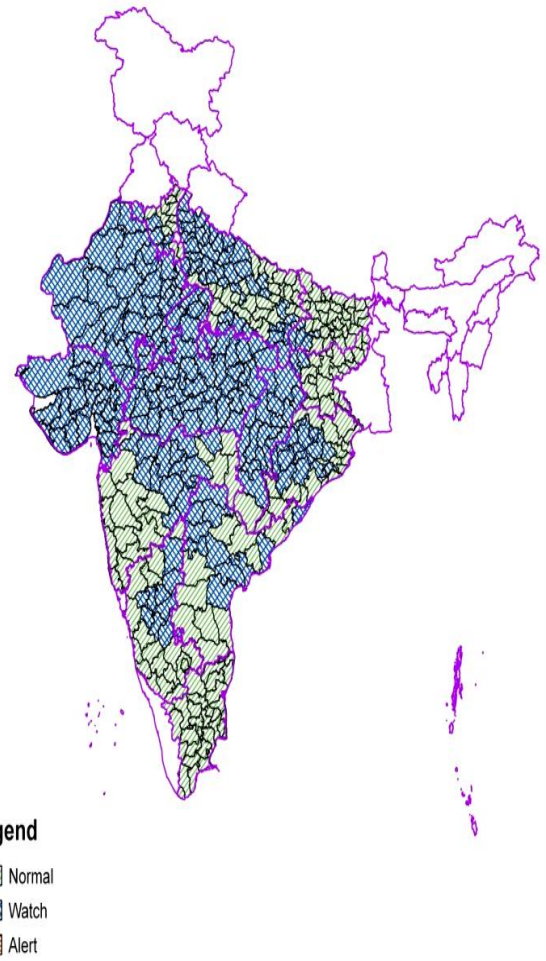
July 2003

3. **Standardized Precipitation Index (SPI)**

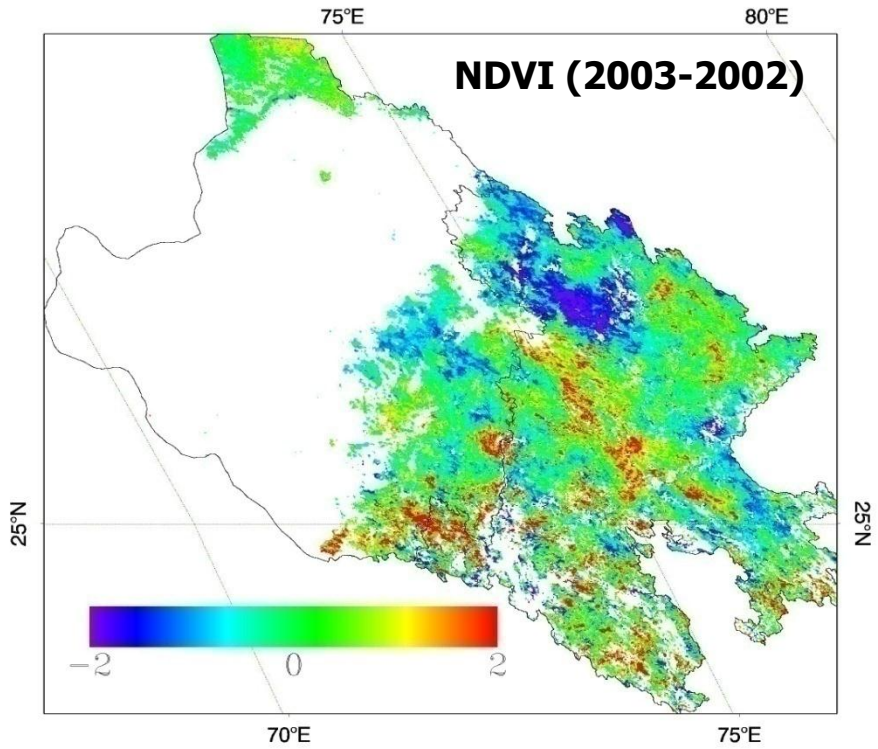


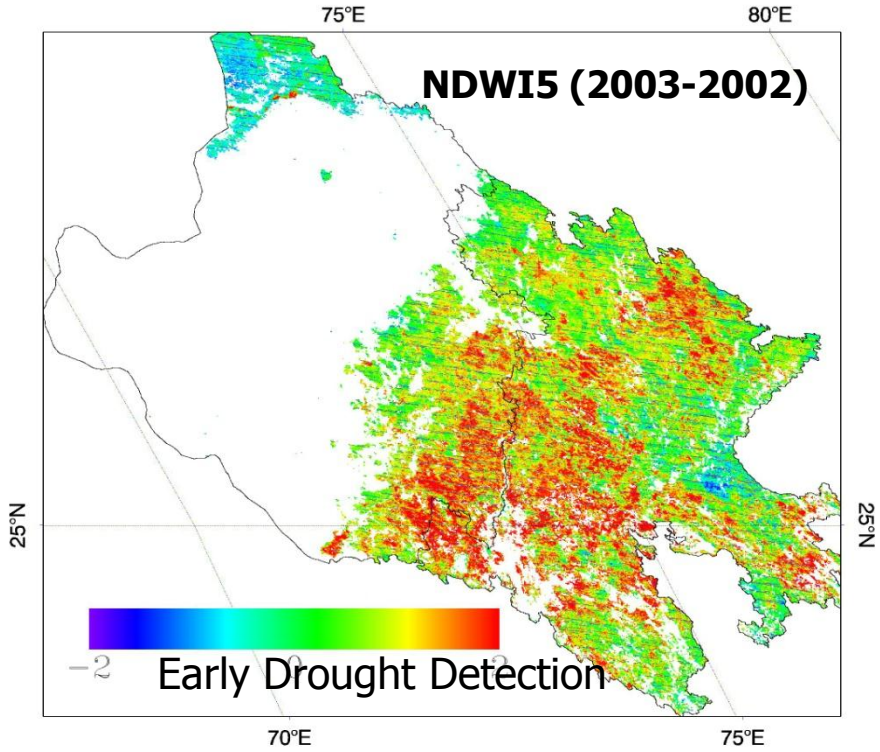
Drought Assessment from Space : National Agricultural Drought Assessment and Monitoring System (NADAMS, NRSC, India)

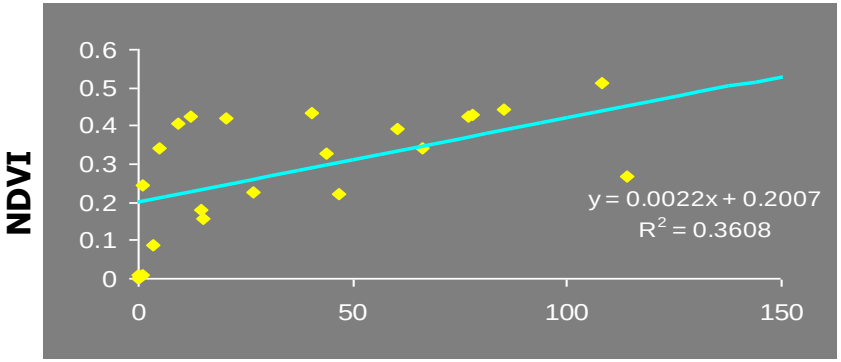


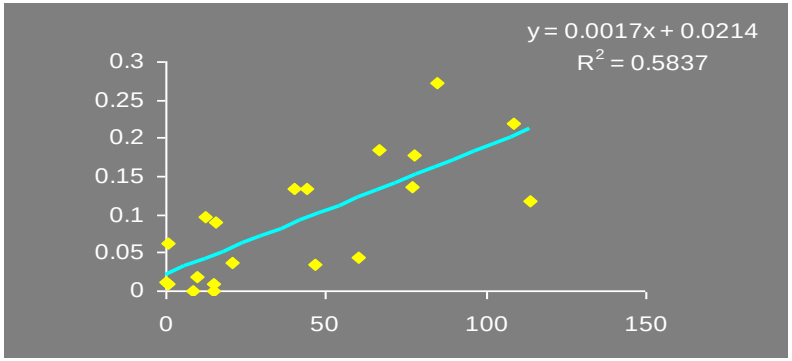


Agricultural Drought Monitoring Using NDVI and NDWI

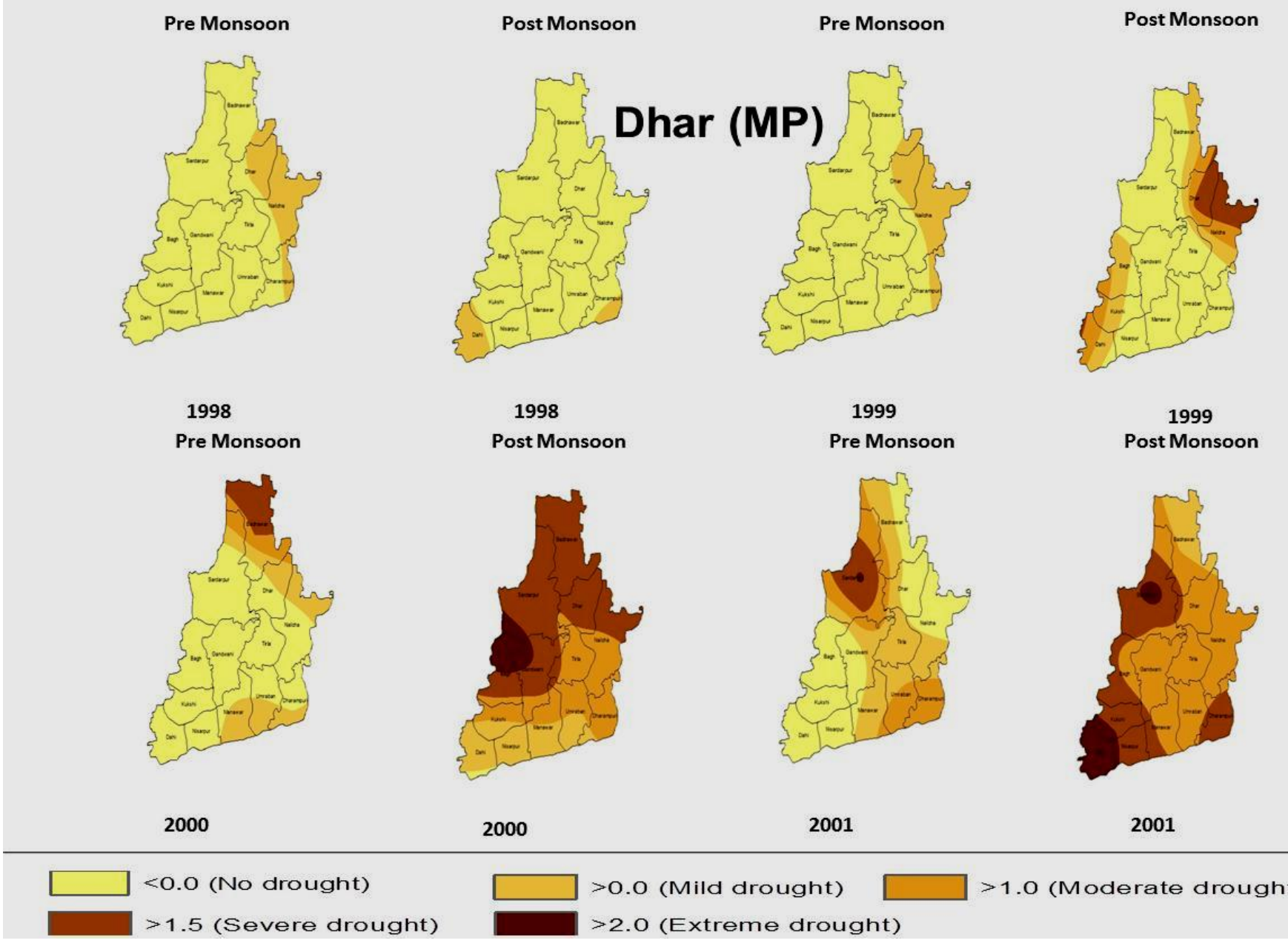




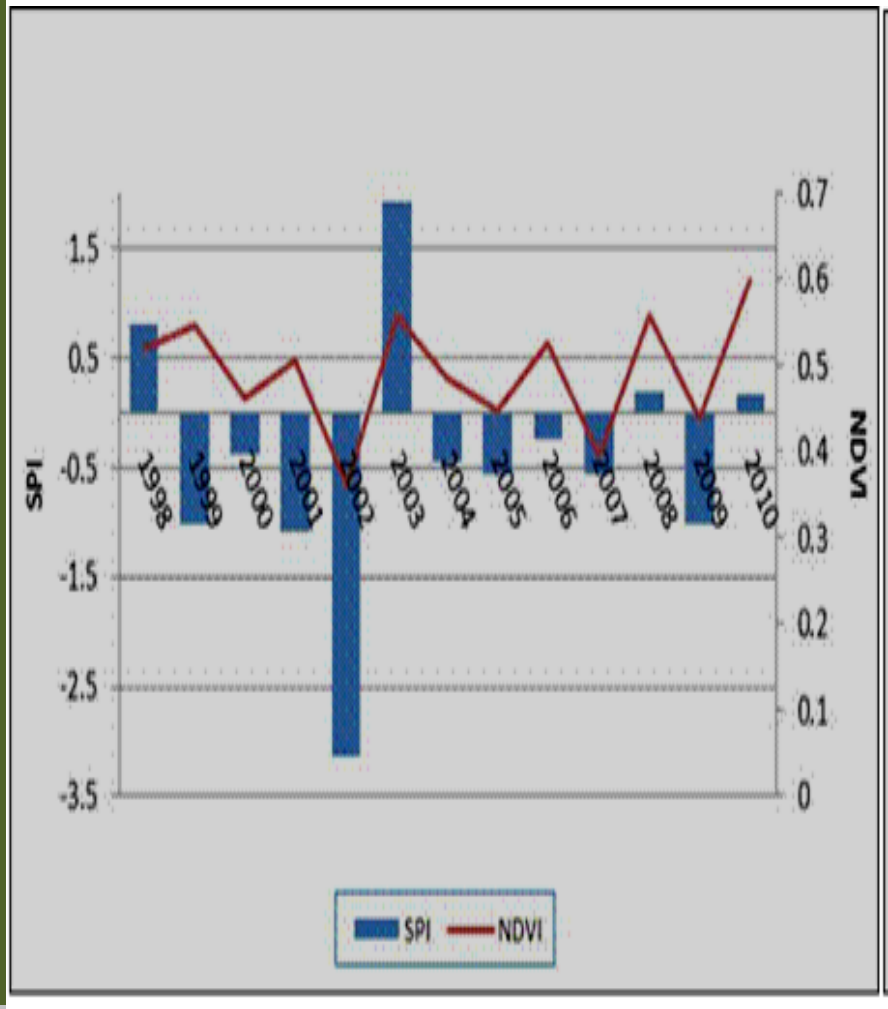


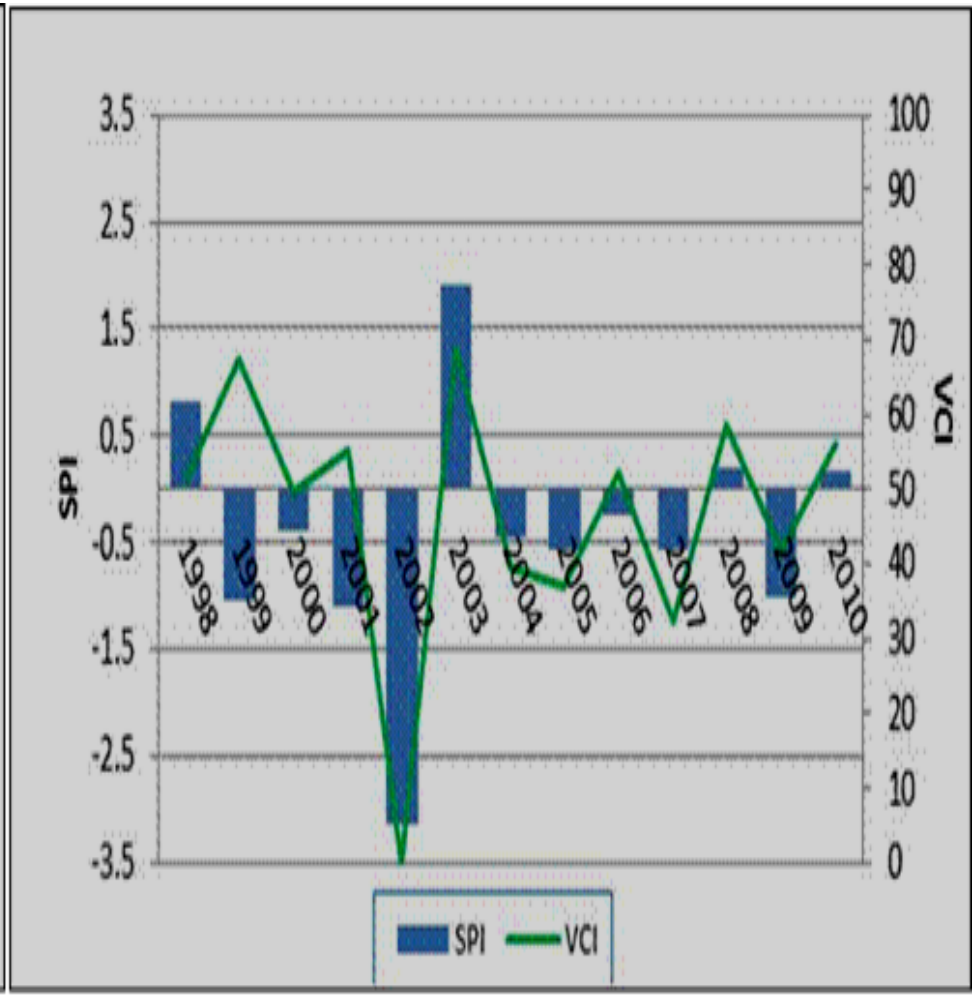


Hydrologic Drought Monitoring through Standardized Water Level Index

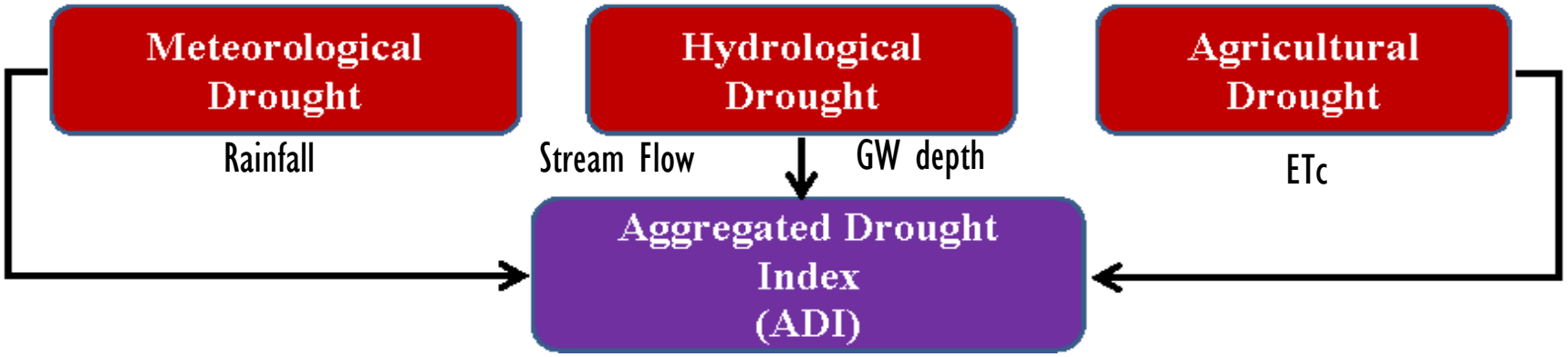


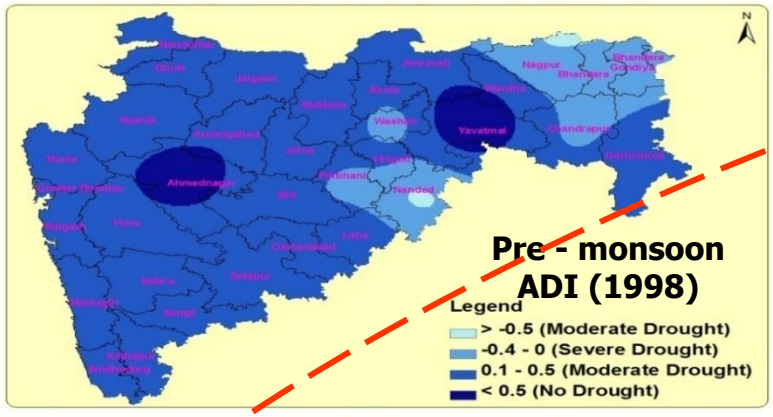
Meteorological and Biophysical Drought Indices

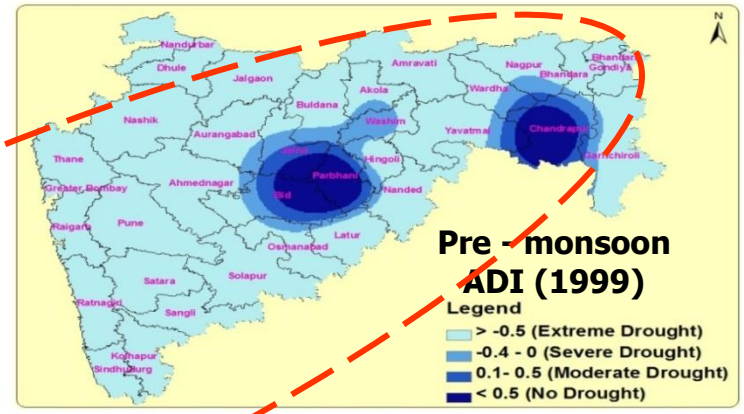


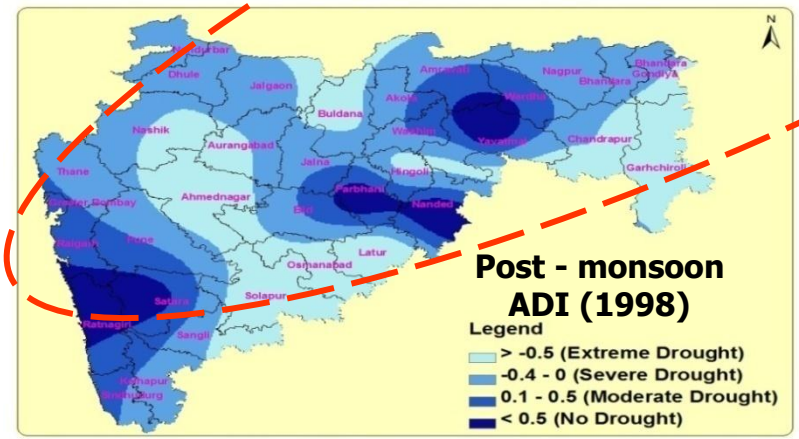


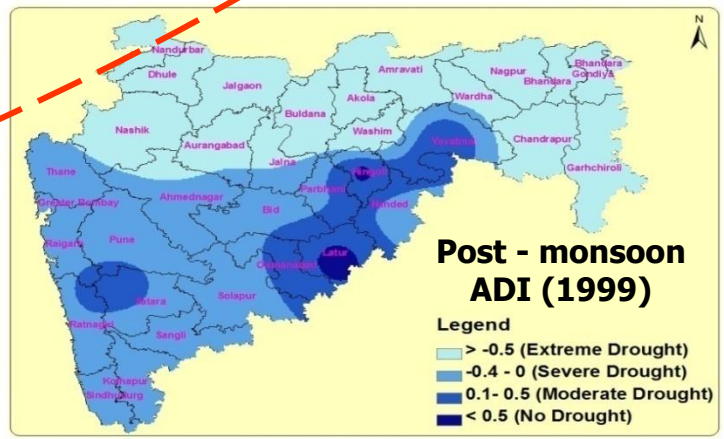
Drought Monitoring using Composite Indices











Could satisfactorily mimic both the onset and establishment of drought conditions following 1998-monsoon failure & re-establishment of normal conds. post good 1999 monsoon

Agricultural Risk Management through Near Real Time Crop Condition Monitoring

❖Specification

-Covered 564 districts of India

-Database: 2000-2014

-Update: week / Fortnight

-Automatized workflow

-Database: MySQL

-Web programming: PhP

-Web server: Apache tomcat

- Website: http://creams.iari.res.in

❖Satellite derived parameters

-NDVI -> Crop Condition Index (CCI)

-LST (Day) -> Temperature Condition Index (TCI_D)

-LST (Night) -> Temperature Condition Index (TCI_N)

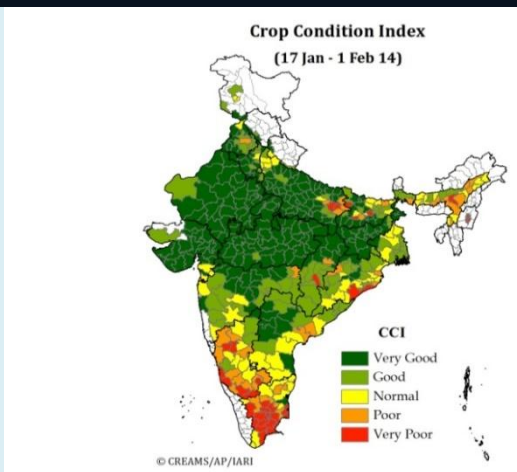
-Rainfall -> Standardized Precipitation Index (SPI)

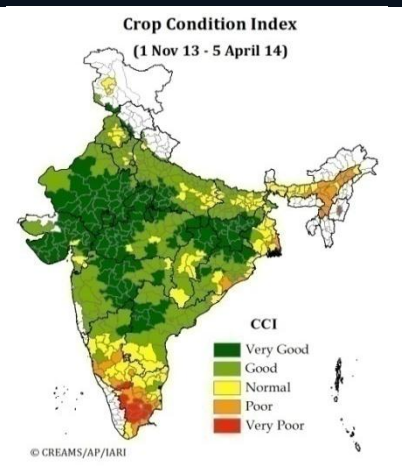
-Soil Moisture (still under development)

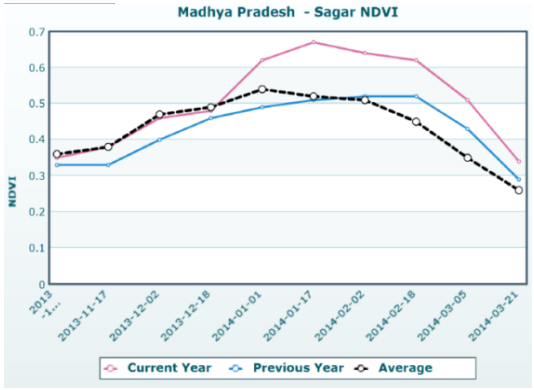
❖Visualization

-Country Level: as periodic & seasonal maps

-District level: Temporal profile of parameters in current season as compared to previous year and average

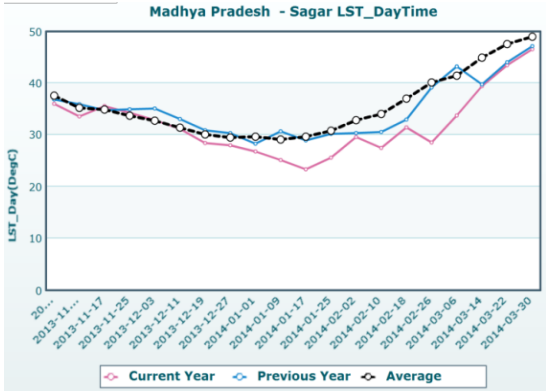






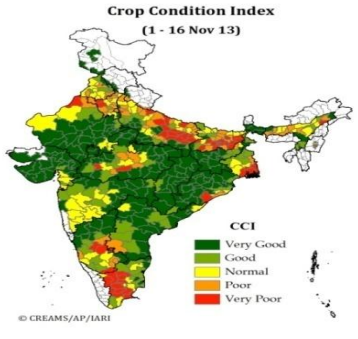
Updates crop conditions at every weekly and fortnightly interval

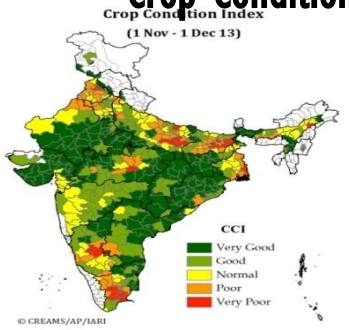
Allows temporal comparison of each parameter in current season Vs. that in last year and over long term average

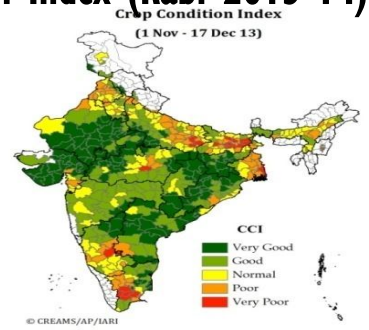


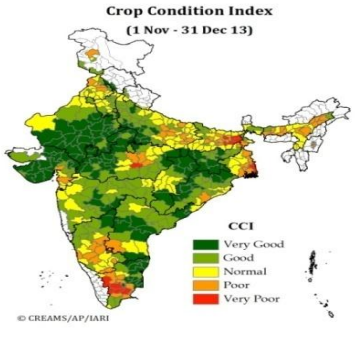
Near Real Time Crop Condition Monitoring

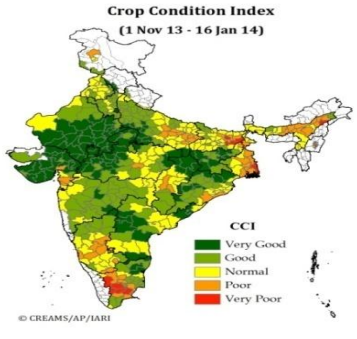
Crop Condition Index (Rabi 2013-14)

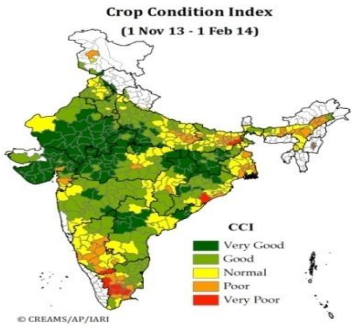


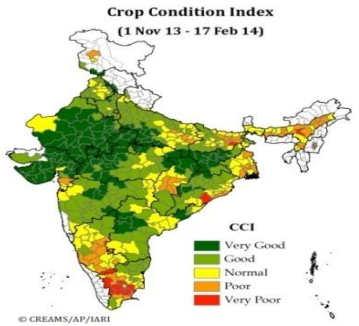


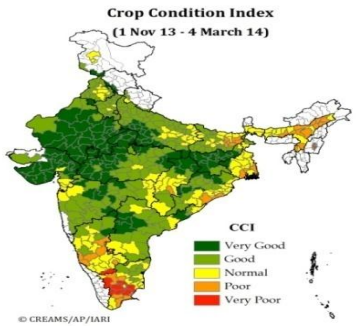


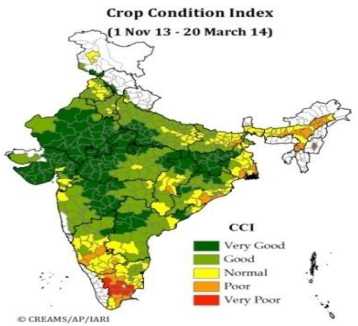


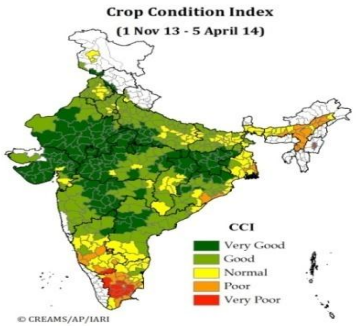


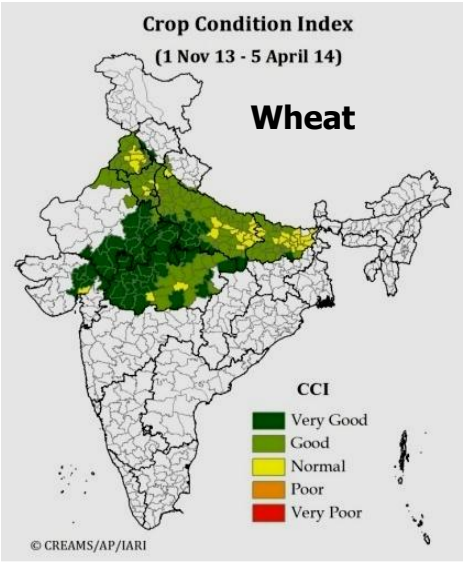


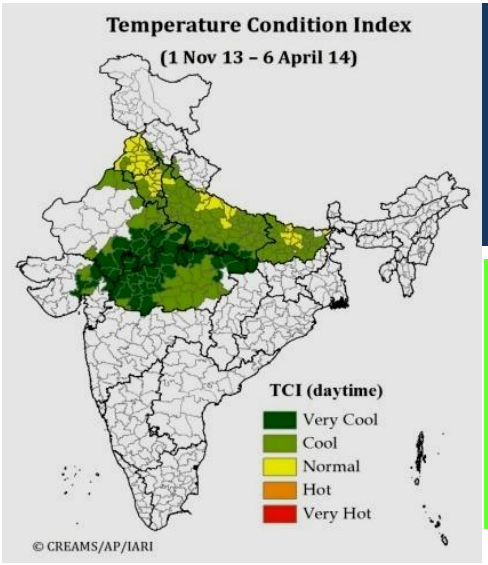






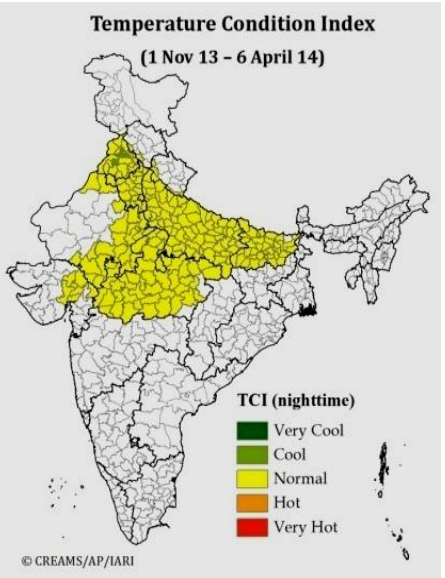






During Rabi 2013-14, the Temperature regime **during day** was **cool** while it was **normal during night**.

On account of favorable temperature regime during day and higher rainfall in the season, Wheat CCI very good until April 14.



Satellite Based Pre-Harvest Wheat Yield Forecasting for Punjab and Haryana

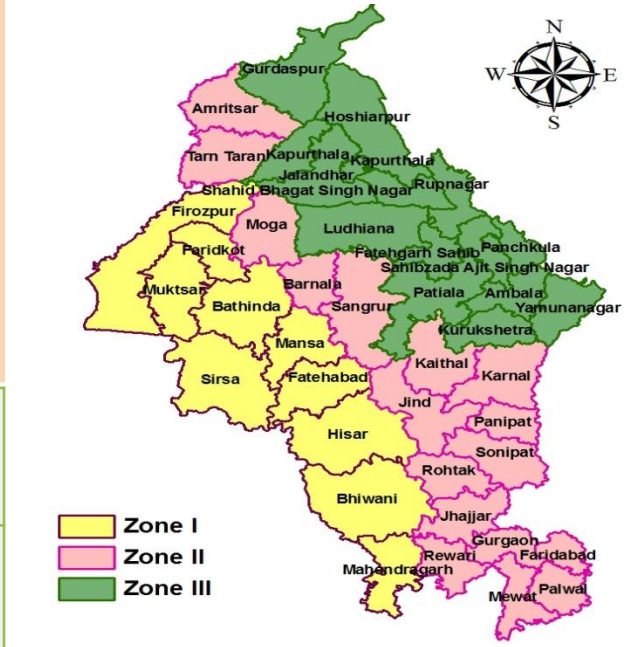
Satellite Sensor: MODIS

Data products: Spatio-temporal EVI, Fortnightly,

Noise Filteration, Crop Phenology Derivatives, EVI Amplitude Aggregation & Regression

Data Period: 2000-2014 (14 years)

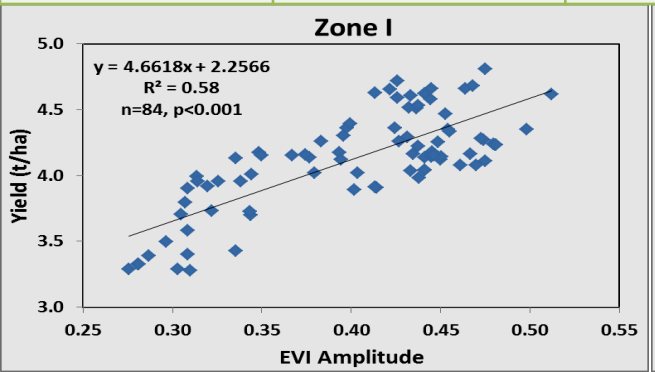
For Forecast: Data used up to 20-March-2014

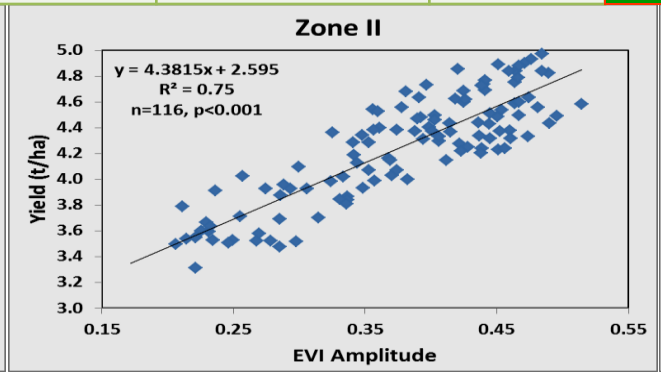


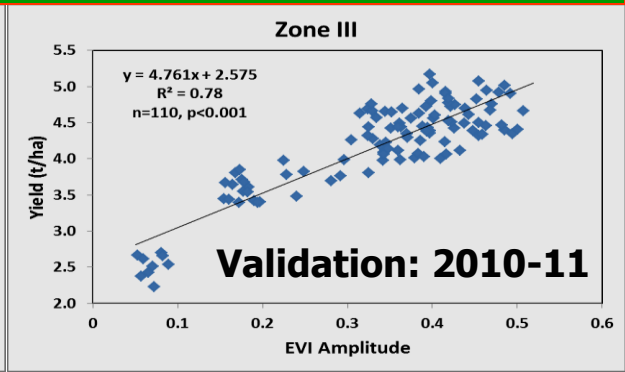
Target Area	Forecast for 2013-2014 (at 10% prediction error)		Change Over Previous Year	
	Production (M t)	Yield (t/ha)	Production (%)	Yield (%)
Punjab	**16.97**	**4.84**	**+ 2.2**	**+ 2.3**
Haryana	**11.48**	**4.59**	**+ 3.0**	**+ 2.9**

Expected Wheat yields: 3% more over last year

Proposed forecast in close conformity with GAIN - forecasts







Indian Drought Monitoring & Declaration Process

Criteria For Drought Declaration By Different States

- Drought is a state subject
- Declaration of drought at state level

i. Based on Large area unsown

or

ii. Wait till end of season (Oct/Nov) to realize the yield

- Memorandum of scarcity
- Verification by Central Govt.

State	Criteria for drought declaration
Andhra Pradesh	1. Block level rainfall 2. Block level crop sown area 3. Yield reduction 4. Dry spells
Karnataka	Rainfall Dry weeks
Maharashtra	Yield loss
Odisha	Block level rainfall, Crop assessment
Rajasthan, UP and J & K	Yield loss criteria

No unified and standard criterion for drought declaration

Drought Declaration Process

Rainfall Deficiency / Yield loss/ Red. cropped area at Block and District level

↓

Crop Weather Watch Group

A nodal Inter-ministerial Group within the MOA responsible for all matters of drought;With experts from climate, water, crop, input supply, extension, power & R&D agencies.

↓

District Collector monitors his district

↓

State level drought is watched by State Relief Commissioner

↓

Estimation of losses

↓

Declaration

↓

Verification by Federal Teams

↓

Relief Quantum is decided

Collaborations/Partnerships

MOU between IARI and University of Nebraska/Daugherty Water for Food Institute

Water for Food
ROBERT B. DAUGHERTY INSTITUTE
University of Nebraska

Development of a prototype toolbox for :

Near real time drought monitoring and early warning based on composite indices.

Quantitative Estimation of Drought Impacts on Agriculture


THANK YOU