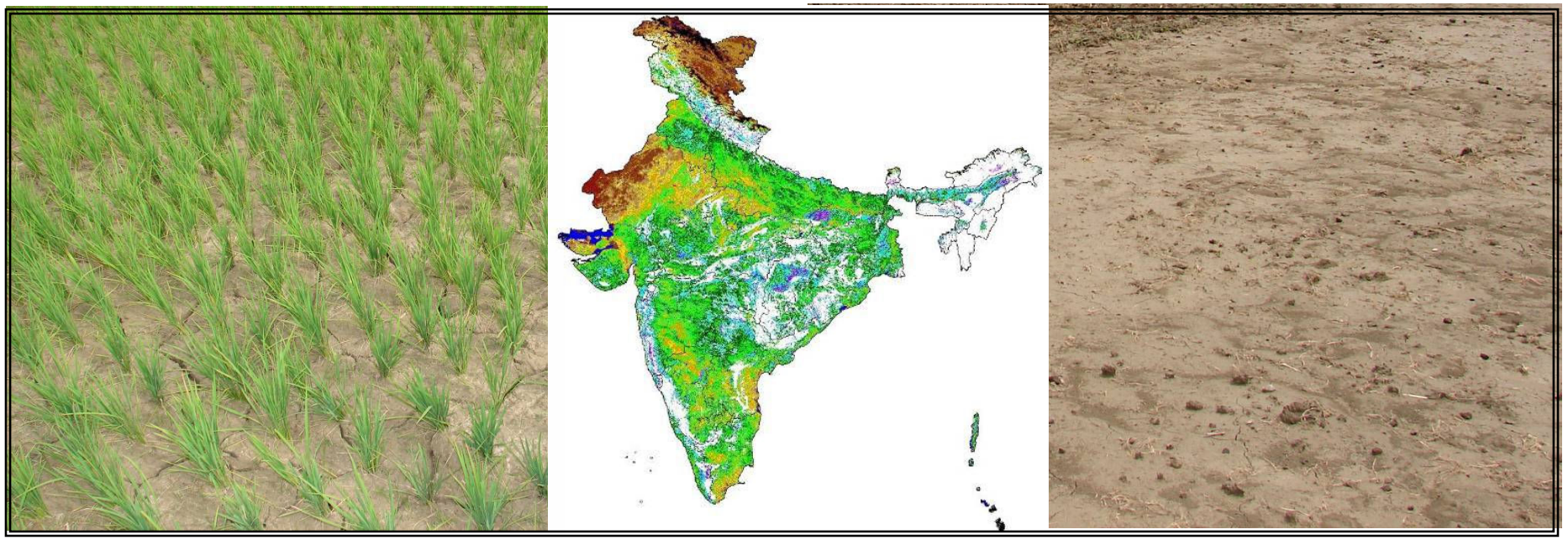


An Integrated Approach for Characterization and Delineation of Drought prone areas

C.S. Murthy, M.V.R. Sesha Sai, R.S. Dwivedi, P.S. Roy, G.G.S.N. Rao and Y.S. Rama Krishna

National Remote Sensing Agency (Dept. of Space, Govt. of India)
Central Research Institute for Dry Land Agriculture (CRIDA), ICAR



International Symposium on Agrometeorology and Food security, 18-21 Feb 2008, Hyderabad, India

Drought prone areas

Efficient disaster management system requires

- **vulnerability mapping**
- **hazard zonation**

Management of drought prone areas

Minimize adverse effects of drought on crop production, live stock production productivity of land, water and human resources

Ultimate goal – drought proofing of vulnerable areas

Identification of drought prone areas in India

Hanumantharao committee 1994

- **% area irrigated at district and block level in different agro climatic zones was the main criteria**

- **1173 blocks in 185 districts of 13 states – 120 M ha as drought prone**

Parthasarathy Committee 2005 – re-look in to criteria for drought proneness

Objectives of the study

Characterization and delineation of drought prone blocks using two approaches and integration of two approaches

Approach 1 – Delineation on the basis of causative factors, non spatial in nature

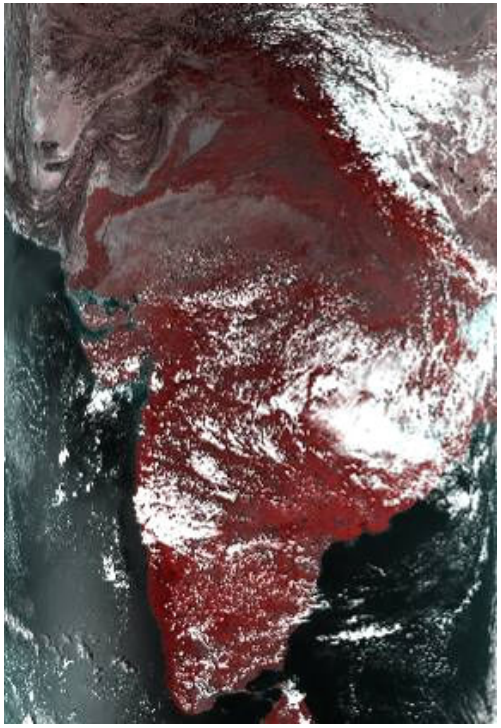
Approach 2 – Geospatial approach, on the basis of impact parameter – geospatial indicators of drought impact on crops.

- Sensitivity of Geospatial indicators to drought situation
- Delineation of drought prone areas on the basis of geospatial indicators
- Delineation of drought prone areas using non spatial data
- Agreement between the two approaches
- Issues for further work

Availability of data from multiple satellites/sensors

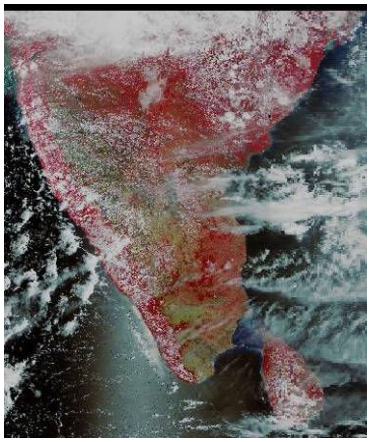
NATIONAL

NOAA AVHRR



Wavelength range (µm)
0.58 – 0.68 (red)
0.725 – 1.1 (NIR)
3.55 – 3.93 (MIR)
10.3 – 11.3 (TIR)
11.5 -12.5 (TIR)
Spatial Resolution
1.1 Km

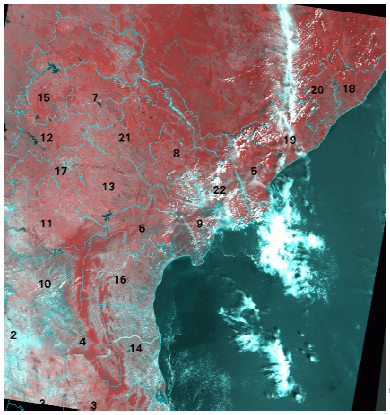
Terra Modis



Wavelength range (µm)
0.62 – 0.67 (red)
0.841 – 0.876 (NIR)
Spatial Resolution
250m
Swath 2330 kms

STATE

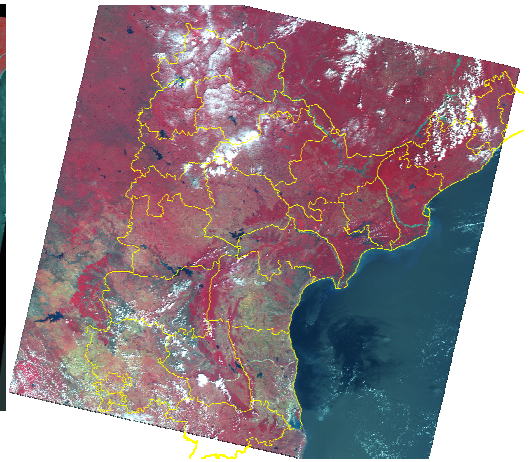
IRS-WiFS



Spatial resolution
188 metres
Wave lengths 3 bands
(green, red and NIR)
Swath : 700 kms.

DISTRICT

IRS P6 AWiFS



Spatial resolution
56 metres
Wave lengths 4 bands
(green, red, NIR and MIR)
Swath : 700 kms.

NDVI and its response to drought situation

Spectral response of vegetation

Red – more absorption due to chlorophyll

Near Infra red – more reflection due to leaf structure

Normalized Difference Vegetation Index (NDVI)

NIR – Red / NIR+Red

Reflected radiation in Near infrared and red bands.

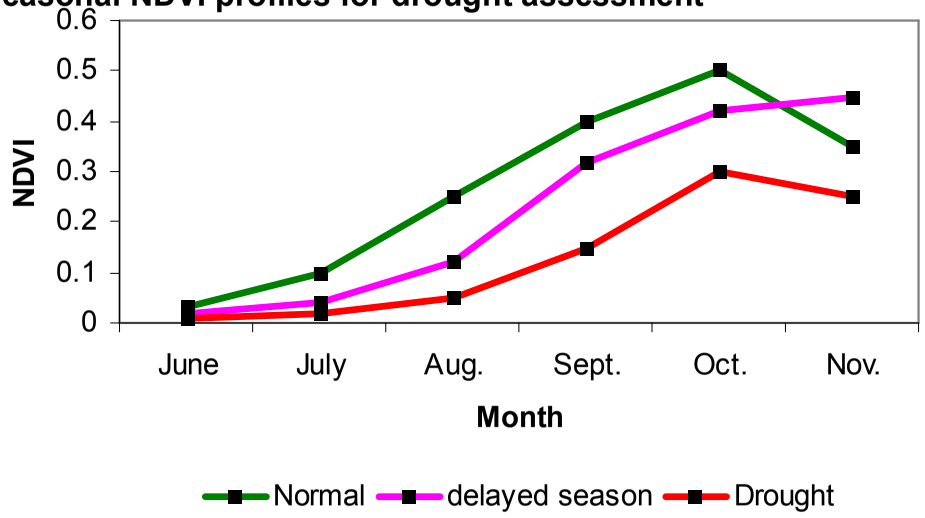
NDVI ranges from -1 to +1

Water – negative NDVI

Clouds – zero NDVI

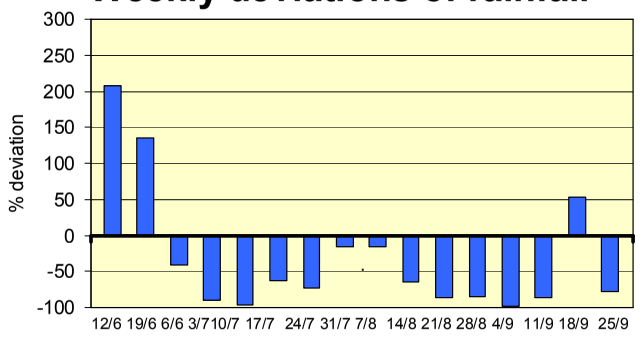
Vegetation – positive NDVI represents density, vigor

Seasonal NDVI profiles for drought assessment

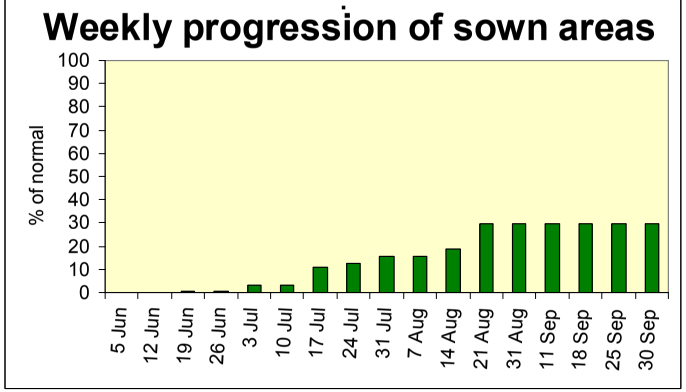


Integration with ground data

Weekly deviations of rainfall



Weekly progression of sown areas

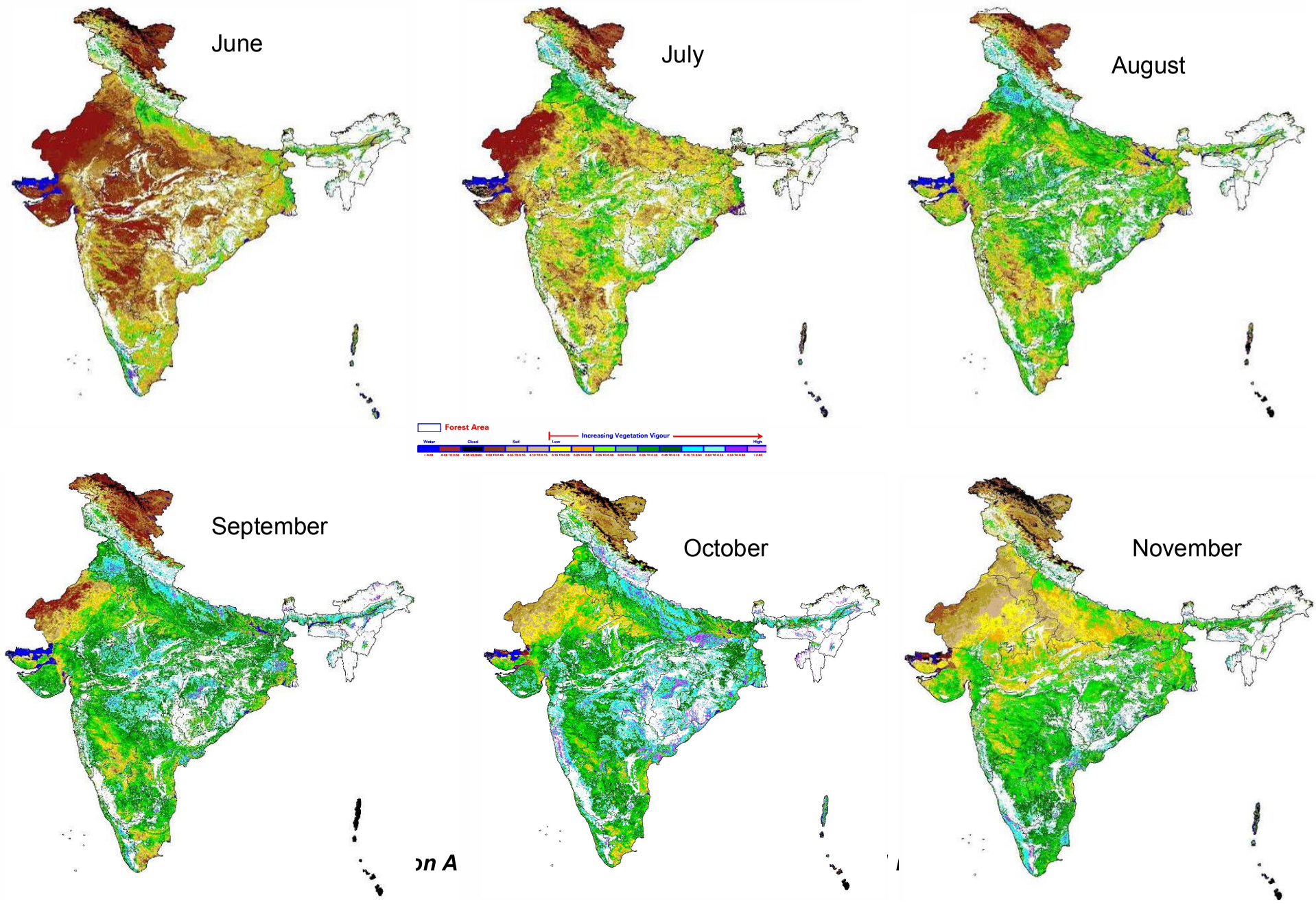


(1) relative deviation from normal,

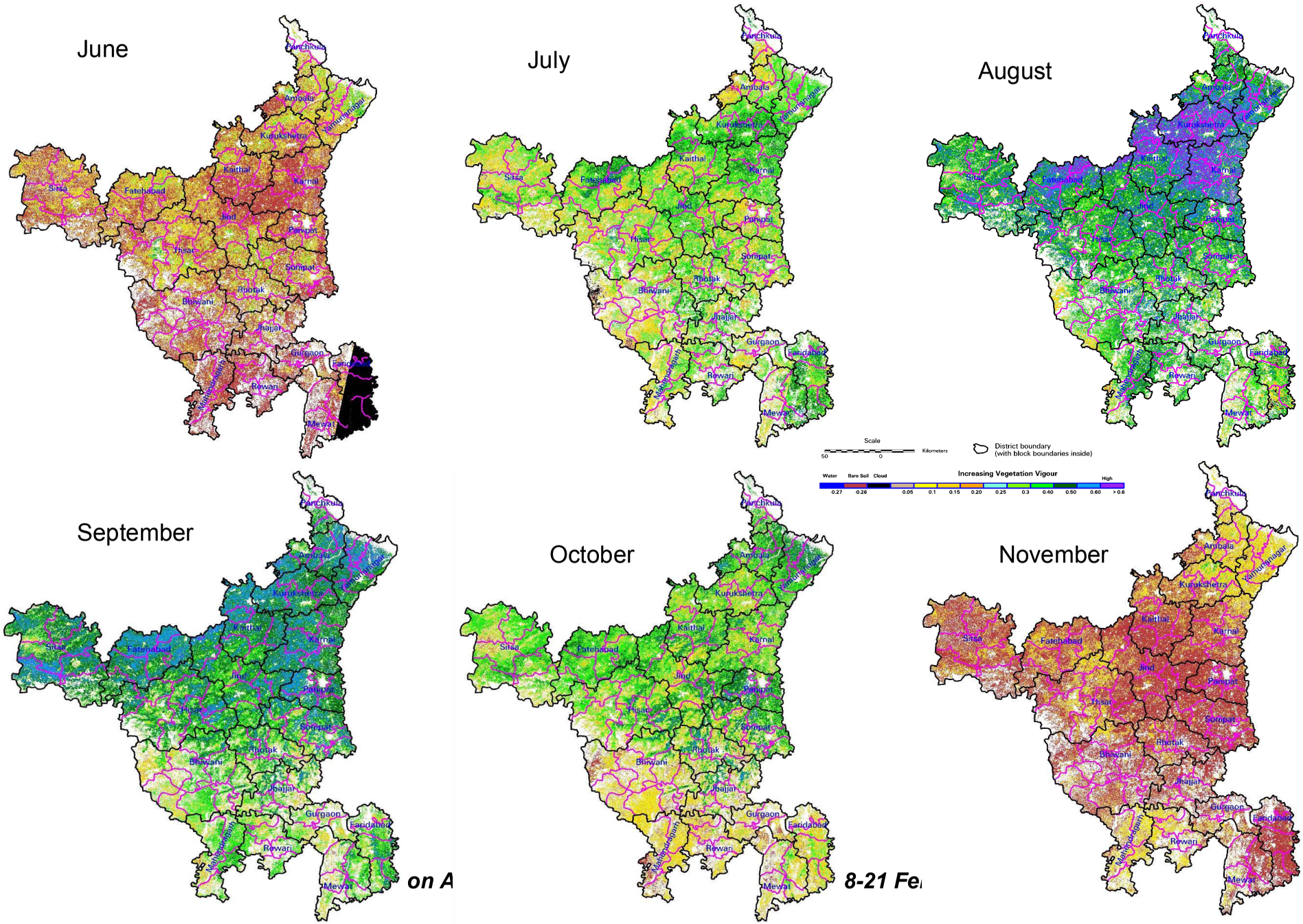
(2) vegetation Condition Index,

(3) in season rate of transformation

NOAA AVHRR NDVI – kharif 2007

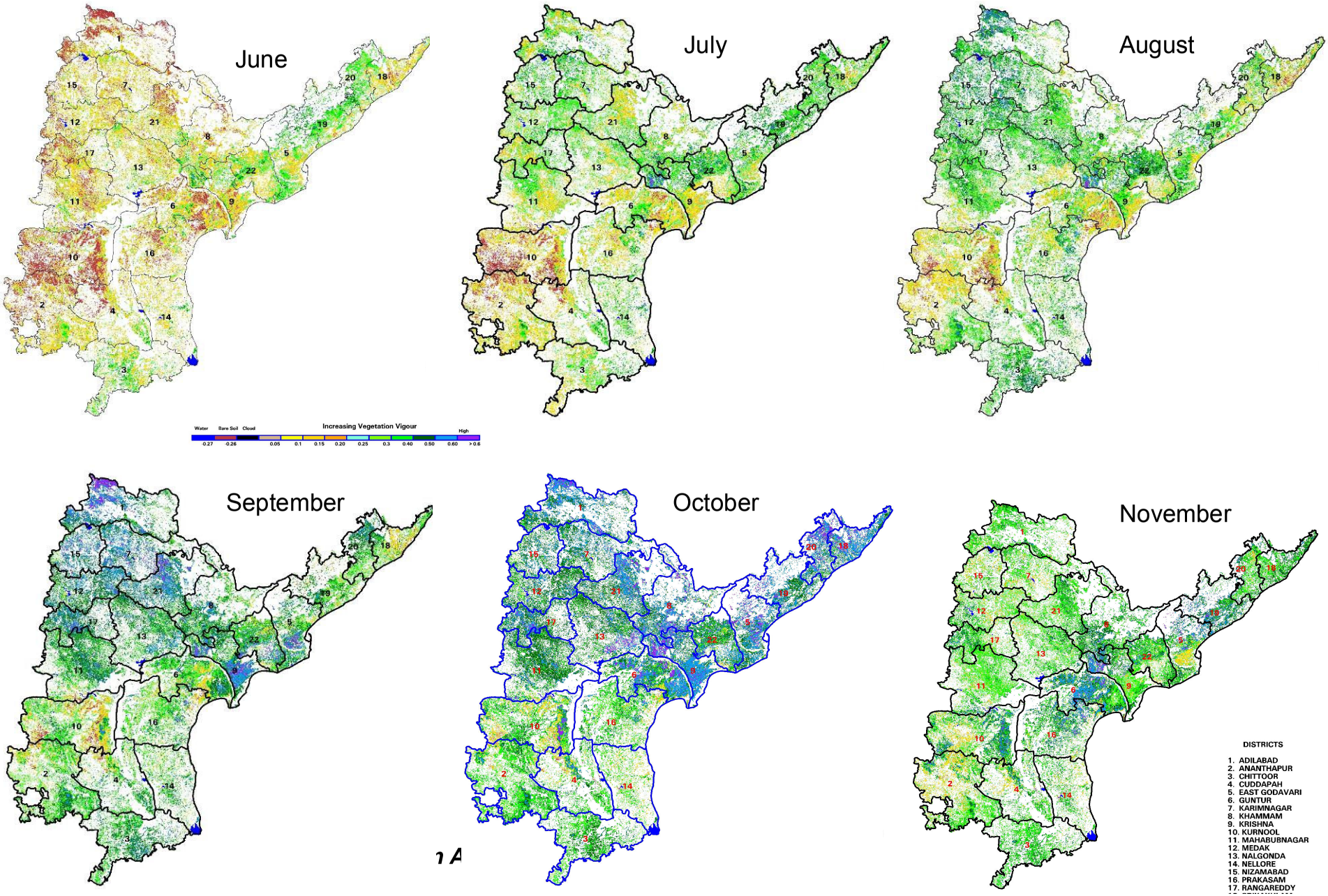


AWiFS agricultural area NDVI over Haryana – Kharif 2007

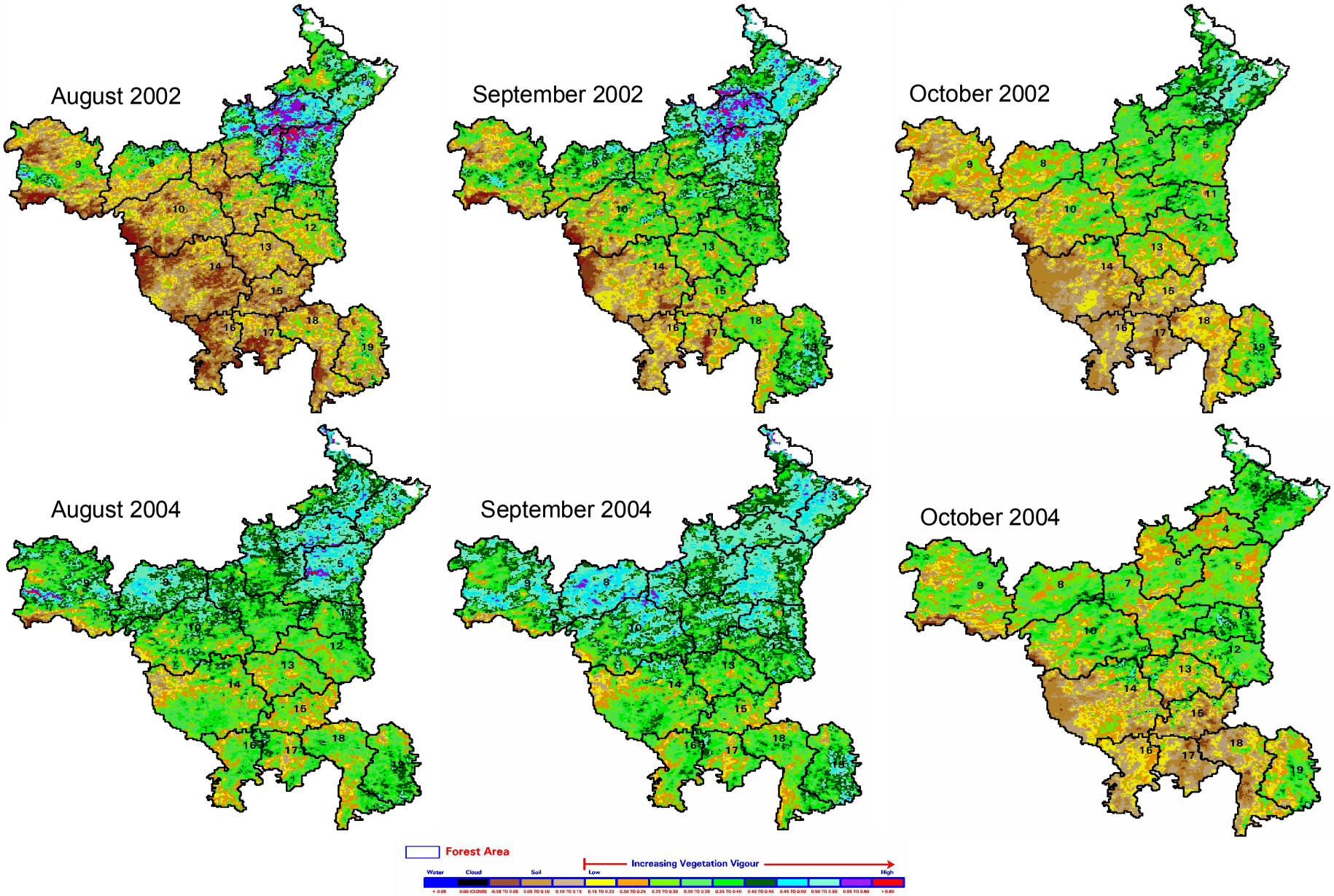


on A *8-21 Fe*

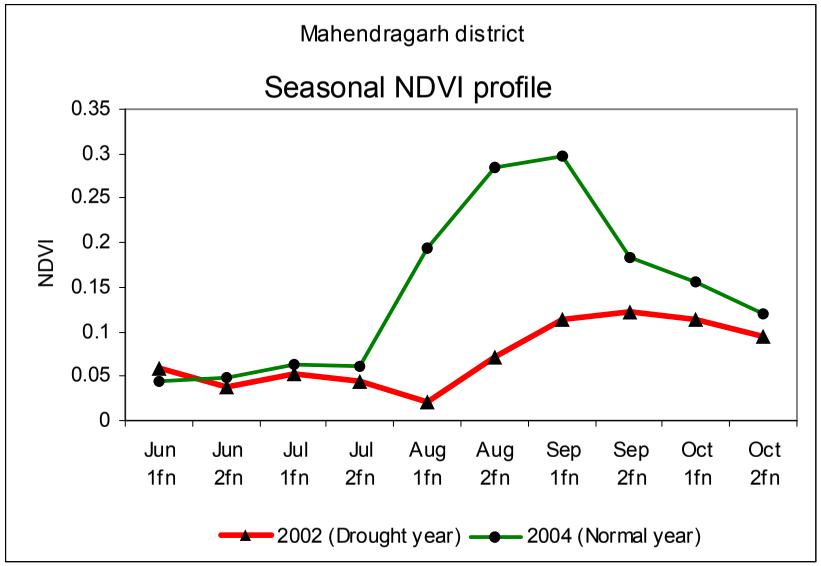
AWiFS agricultural area NDVI over Andhra Pradesh – Kharif 2007

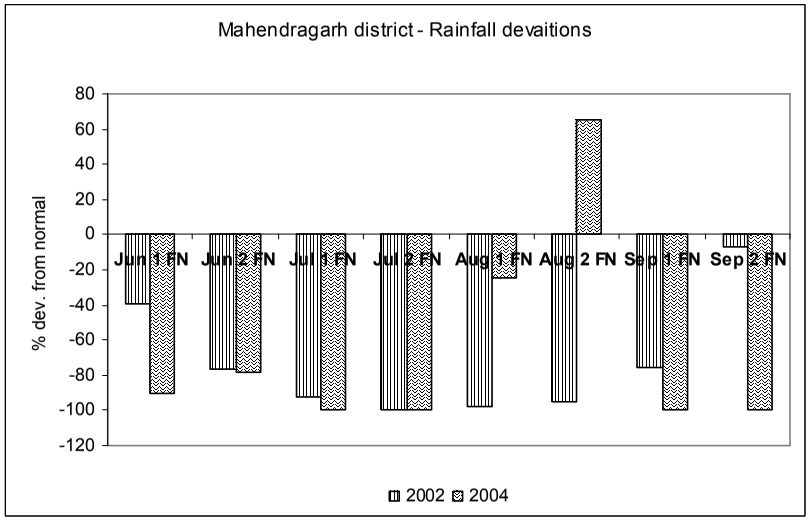


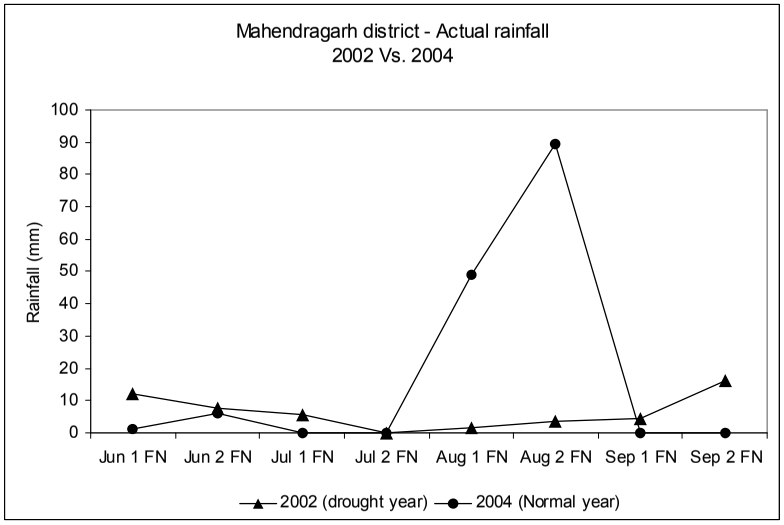
NDVI response in irrigated and unirrigated districts - 2002 (Drought year) Vs. 2004 (Normal year)



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



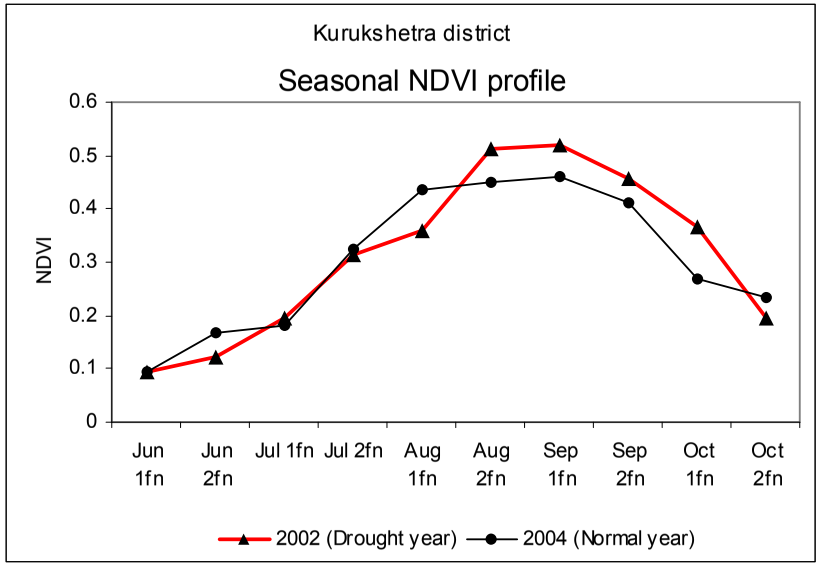


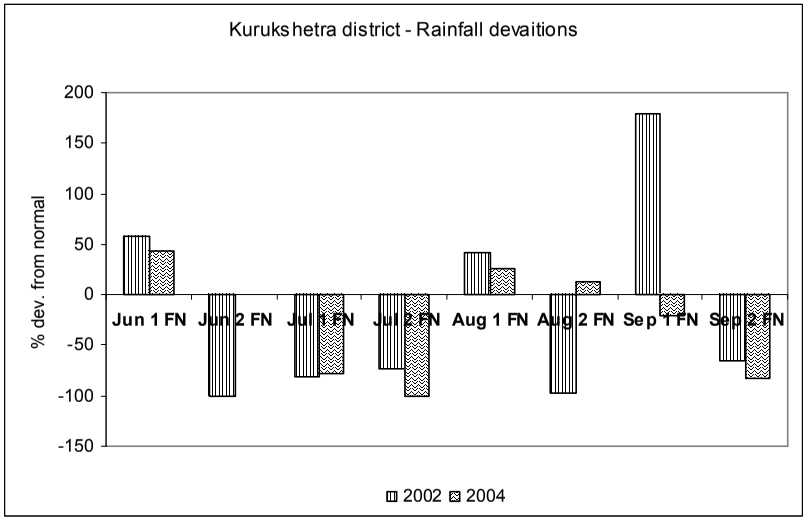


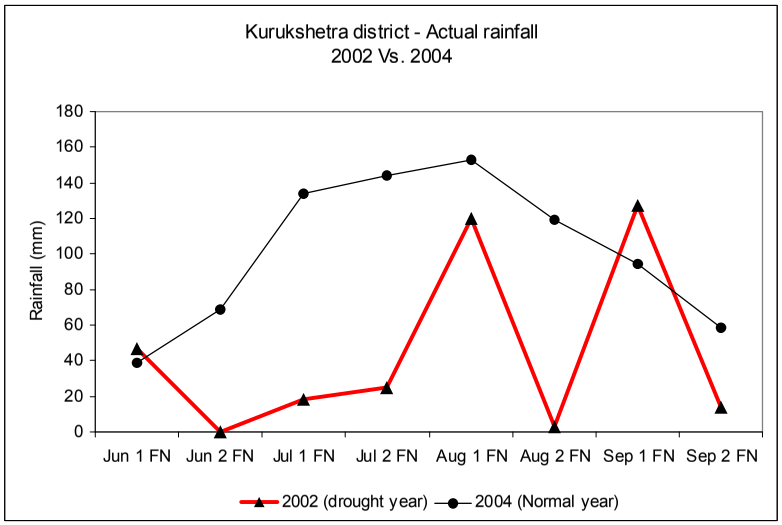
Rainfall pattern

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

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





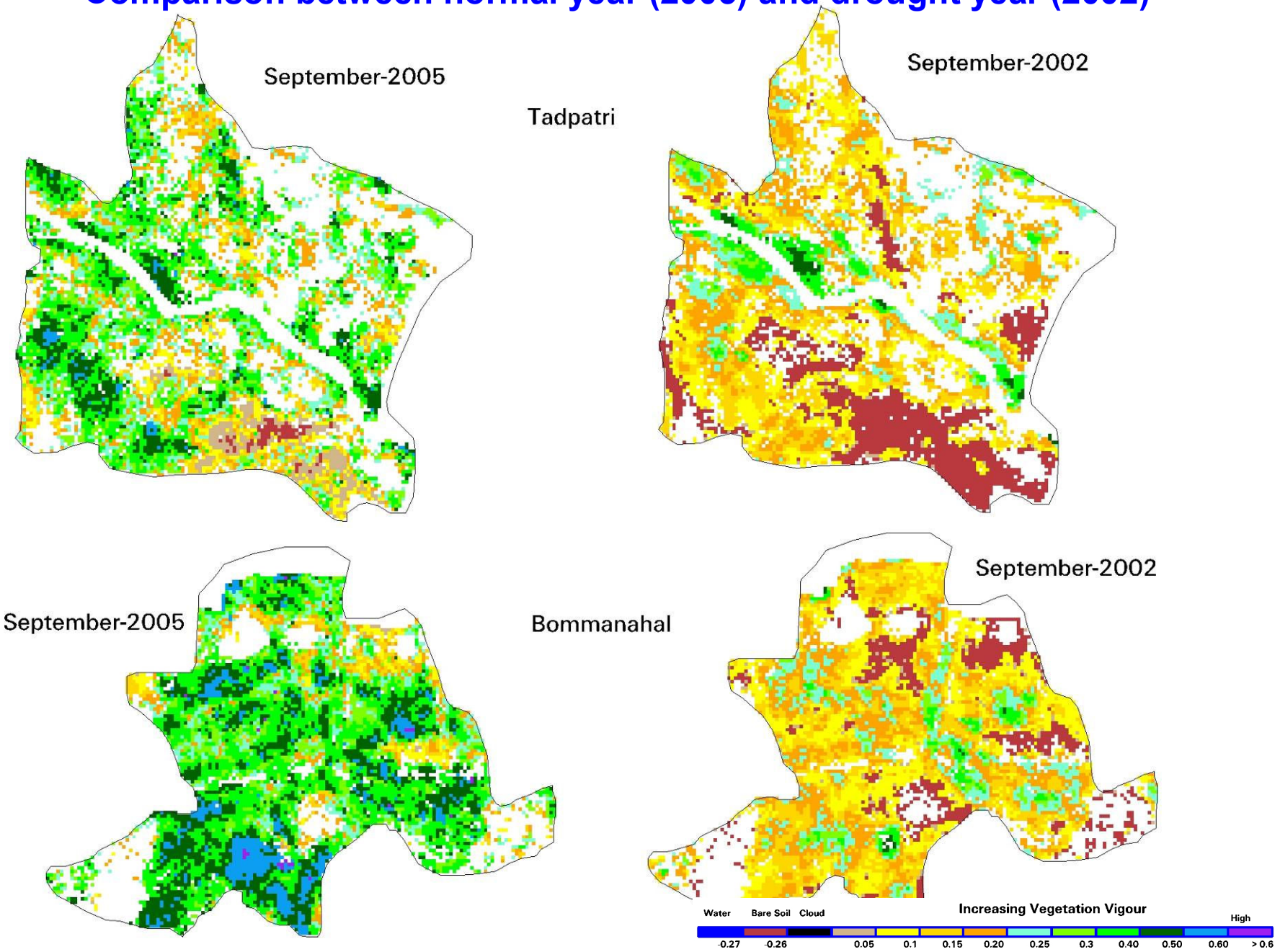


Rainfall pattern

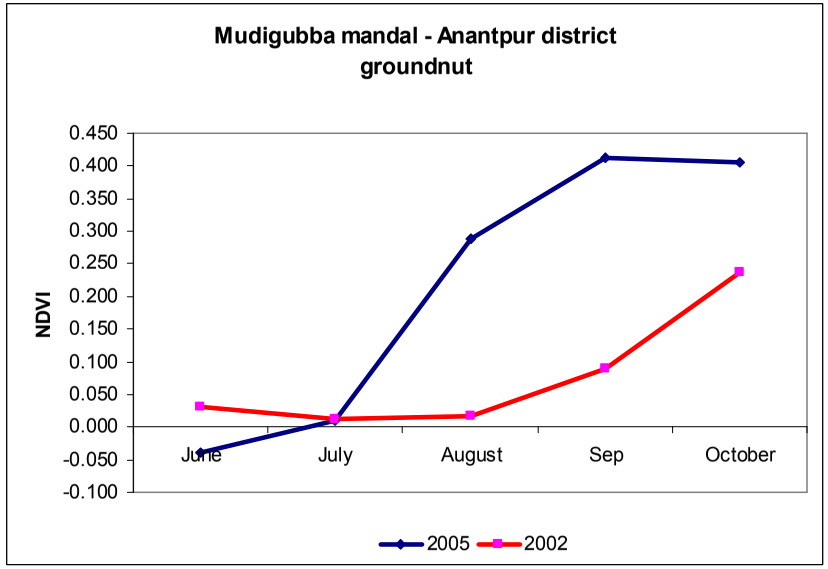
	2002	2004
Jun 1 FN	Excess	Excess
Jun 2 FN	Scanty	Normal
Jul 1 FN	Scanty	Scanty
Jul 2 FN	Scanty	Scanty
Aug 1 FN	Excess	Excess
Aug 2 FN	Scanty	Normal
Sep 1 FN	Excess	Deficit
Sep 2 FN	Scanty	Scanty

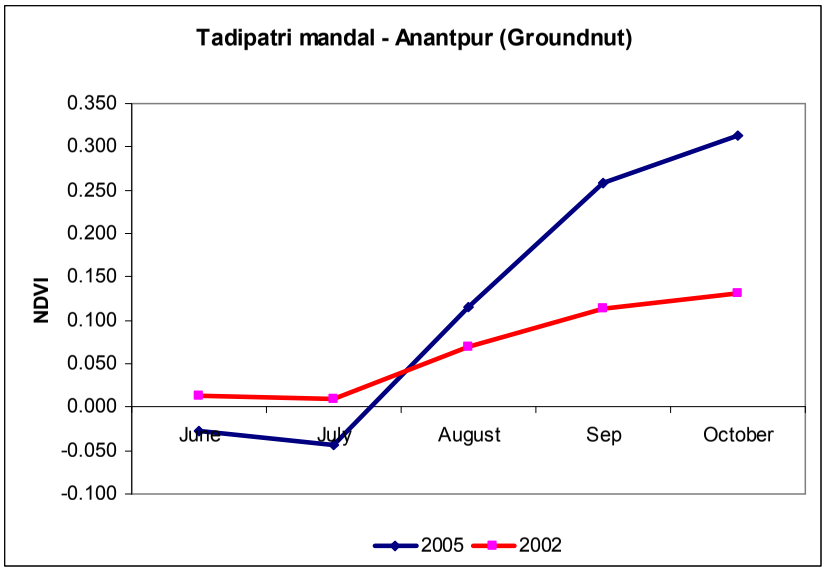
Seasonal NDVI profiles of the two years do not deviate significantly from each other and are not being influenced by rainfall pattern due to irrigation support.

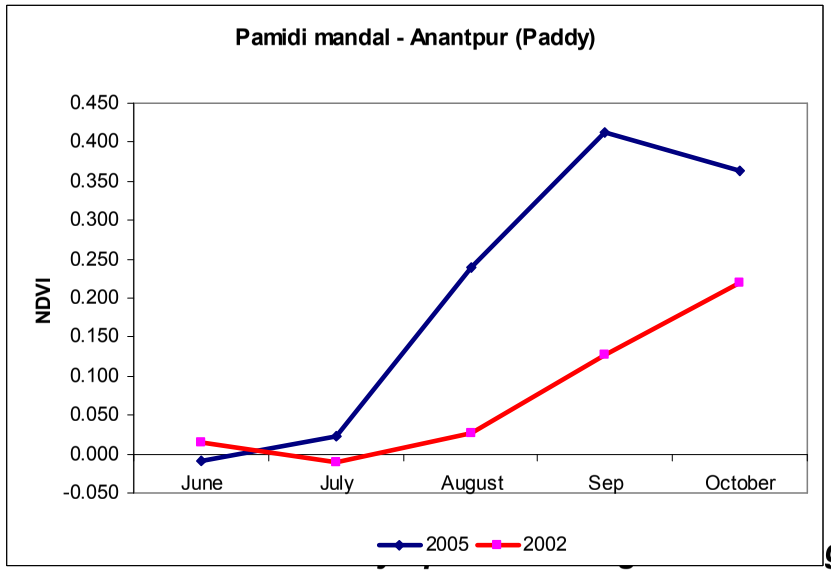
Block level crop condition – Anantpur district
Comparison between normal year (2005) and drought year (2002)

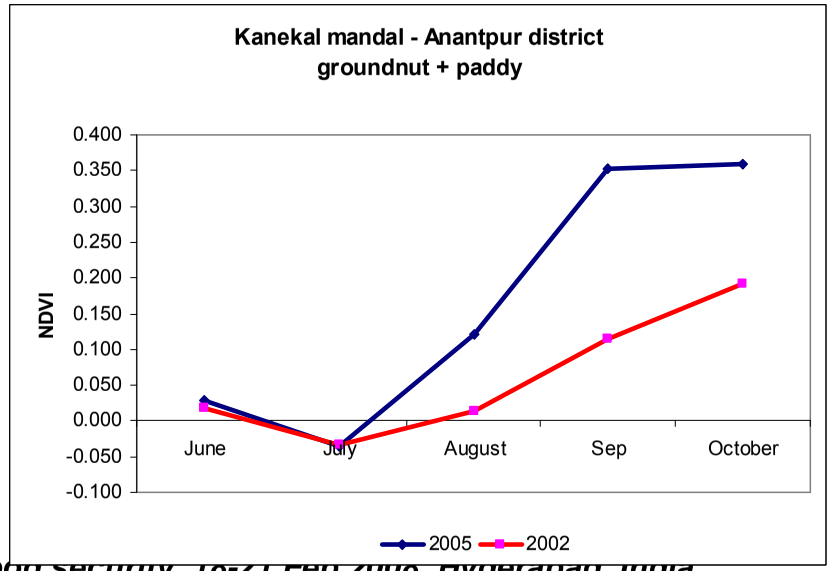


Impact of 2002 drought at mandal level Anantpur district





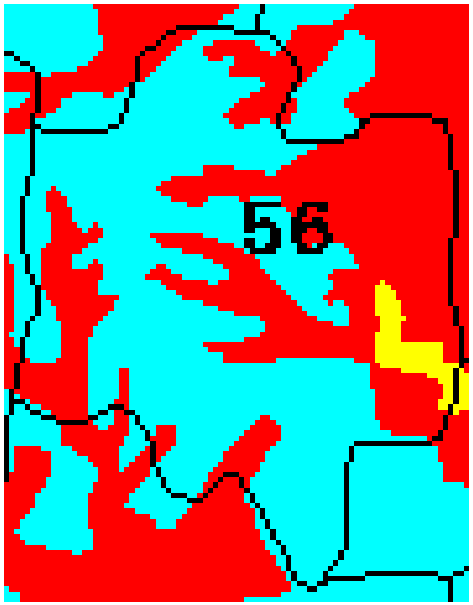




Rainfall – Soil – NDVI interactions at disaggregated level

Mahaboobnagar district – Maldekal mandal

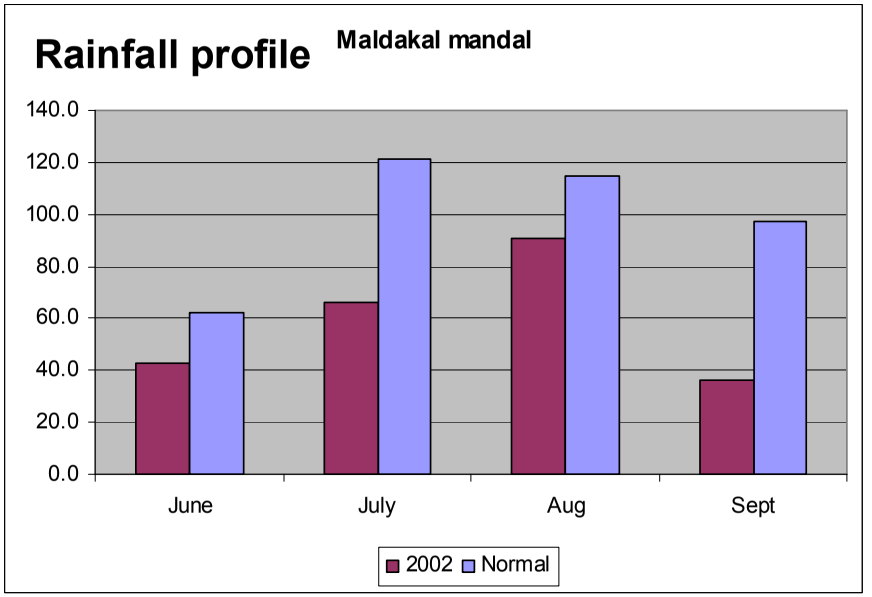
SOIL TYPE

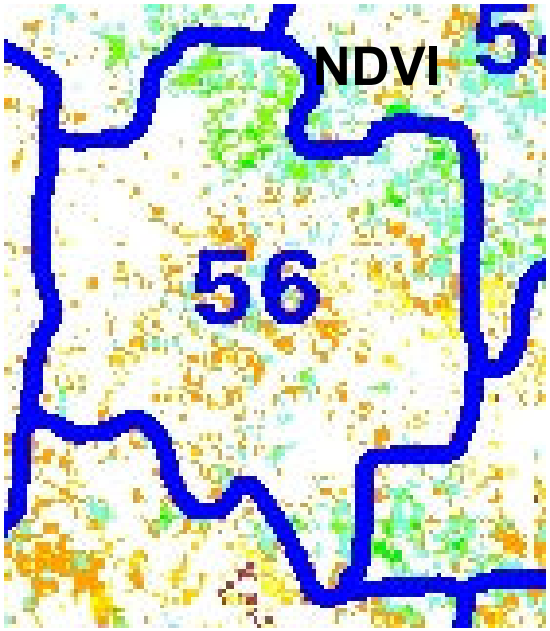


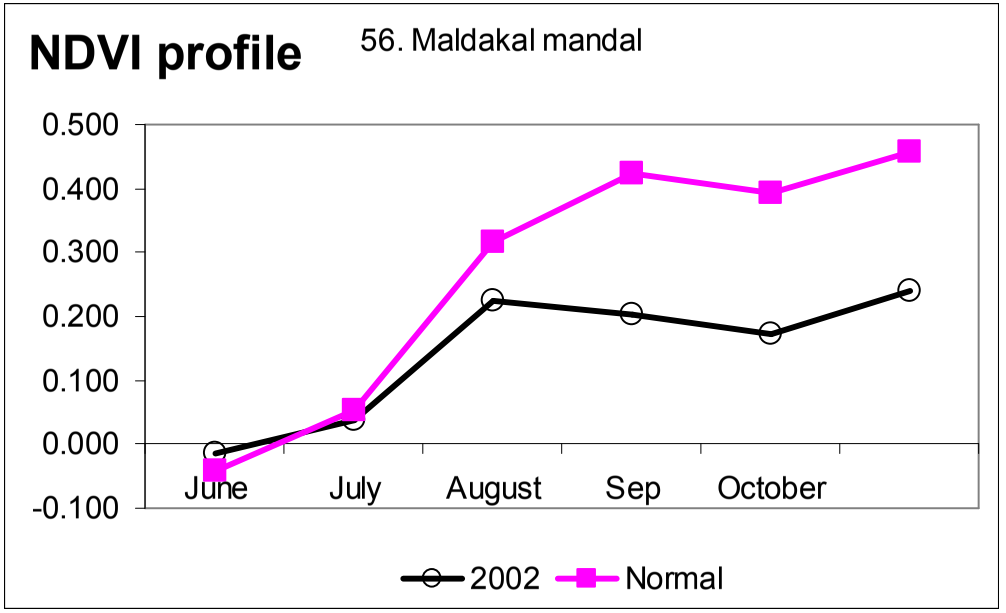
Fine
Loamy skeletal
Fine loamy

Soil type:
Fine 50 %
Loamy 49 %

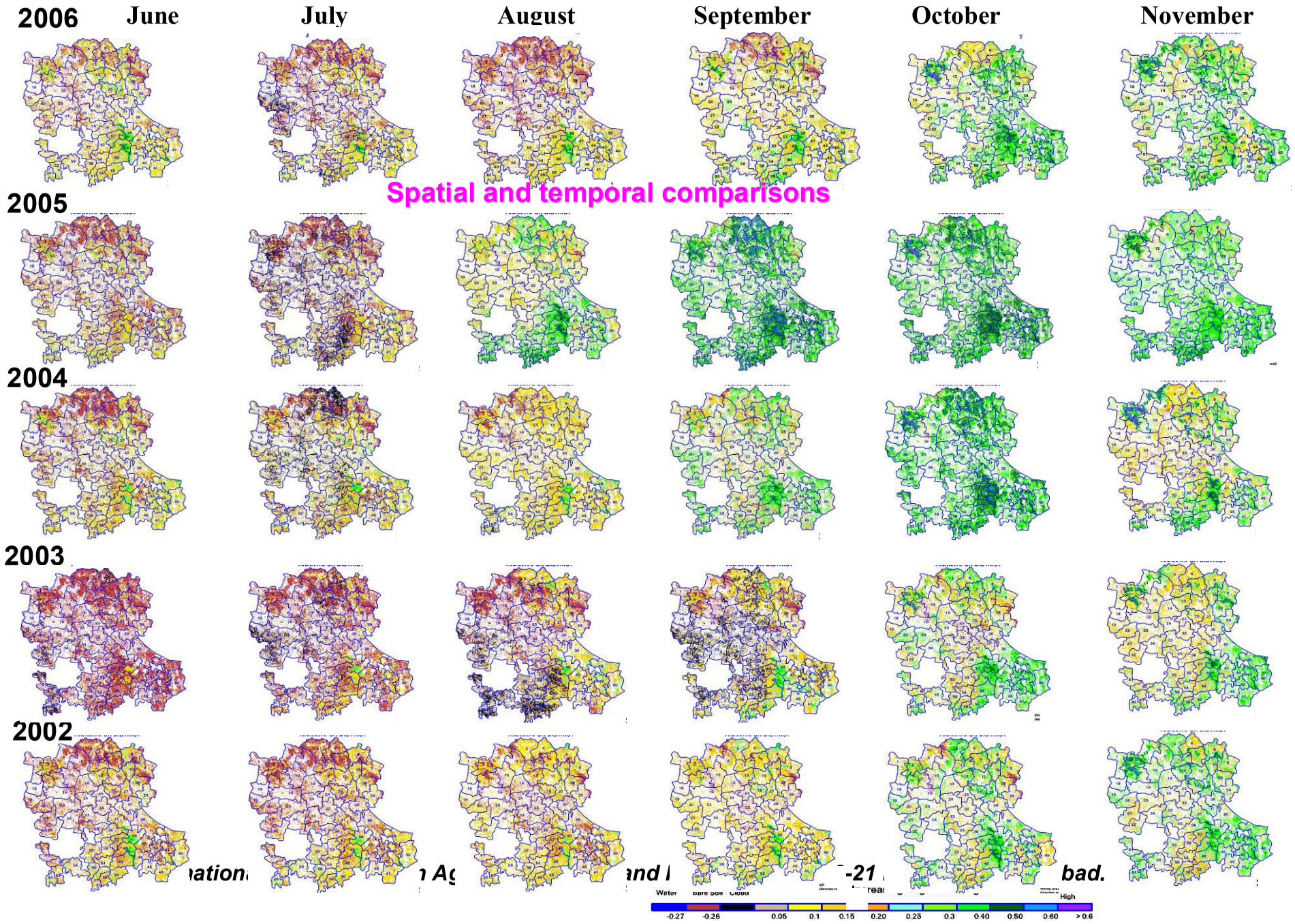
Soil depth
Deep 33 %
Moderately deep 67 %
AWC
High 50 %
Low 49 %



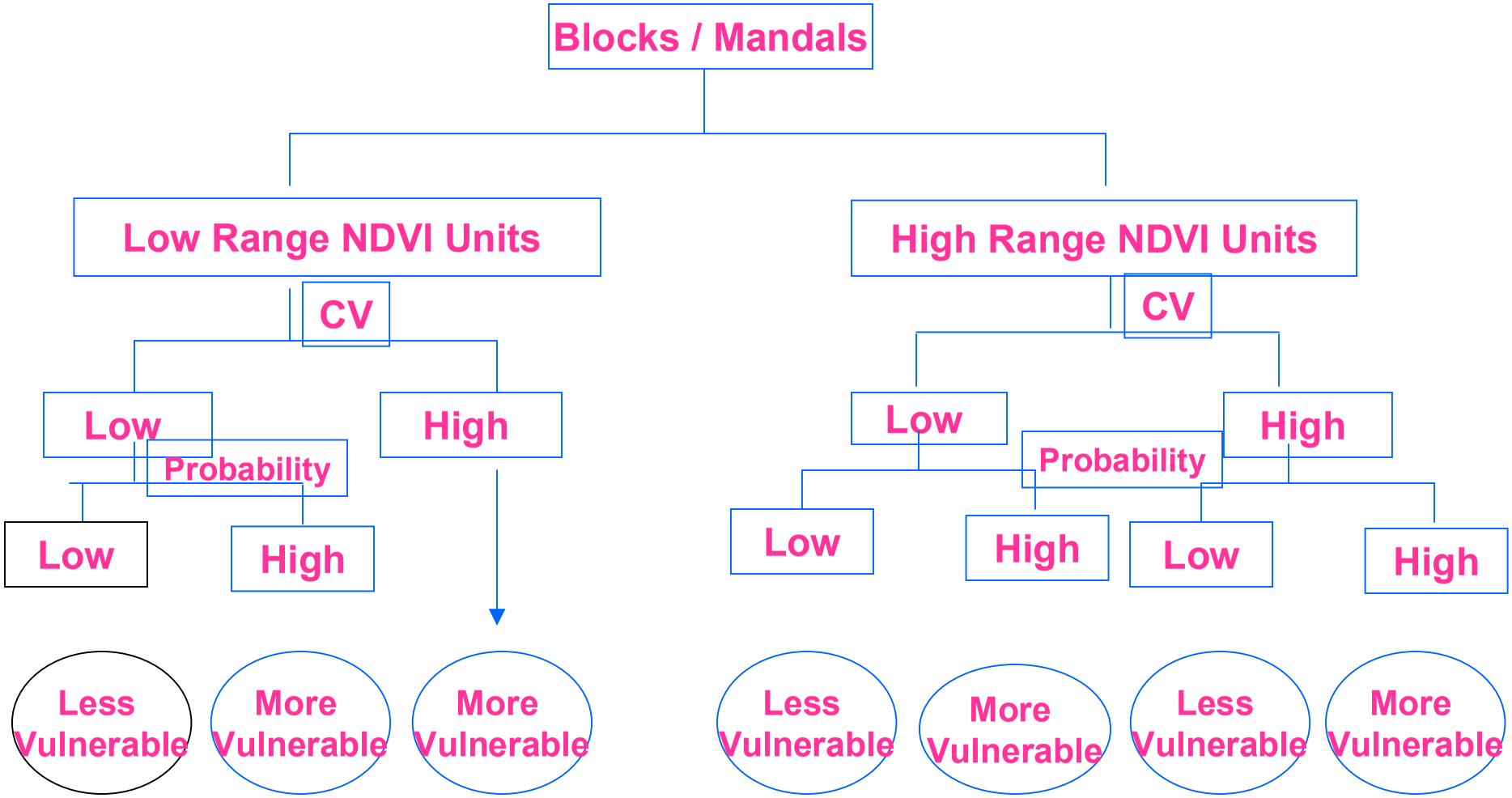




Crop condition (NDVI) – Anantapur District (AP)- Kharif 2002-2006

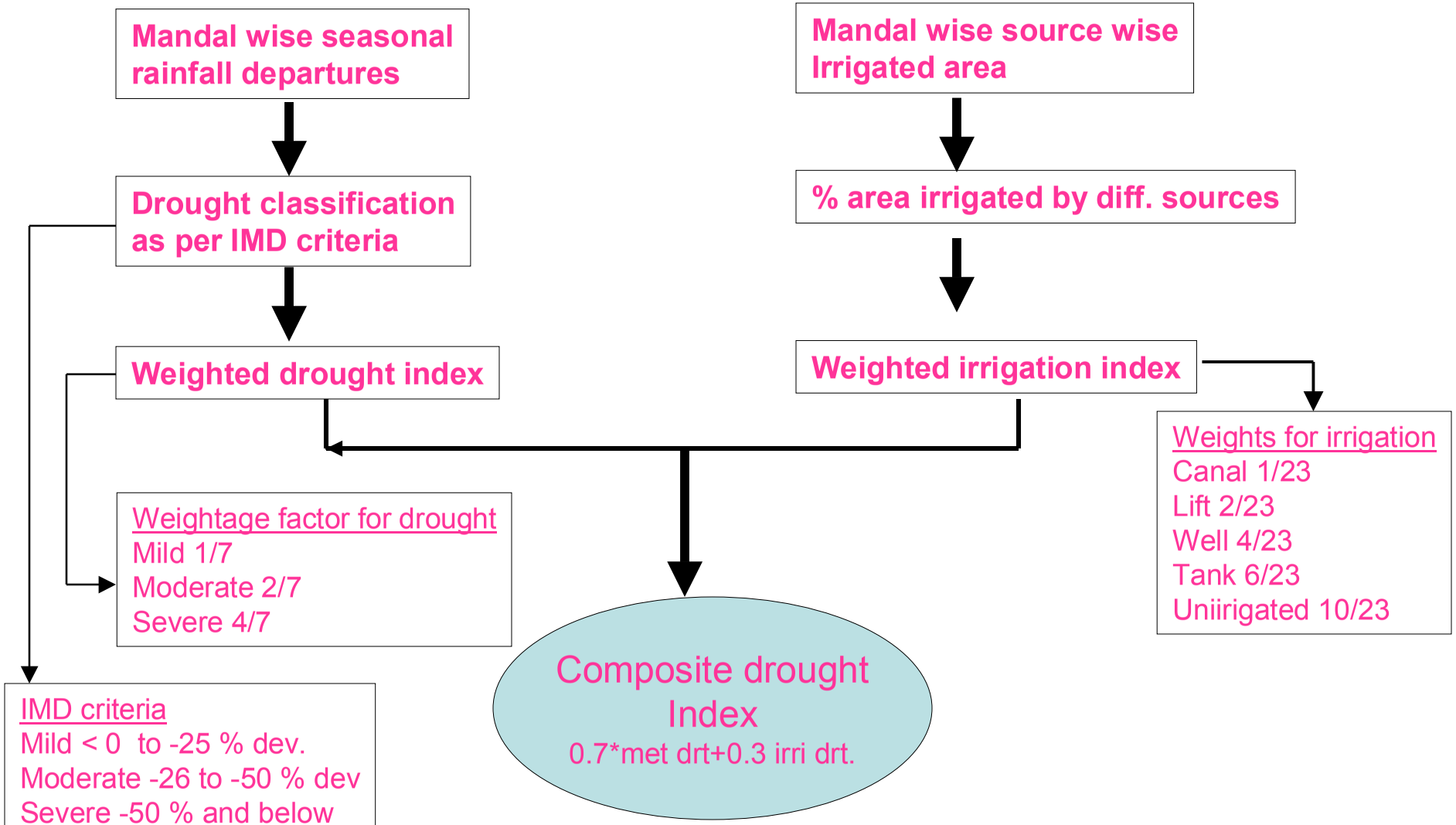


Methodology for NDVI based delineation of drought prone blocks

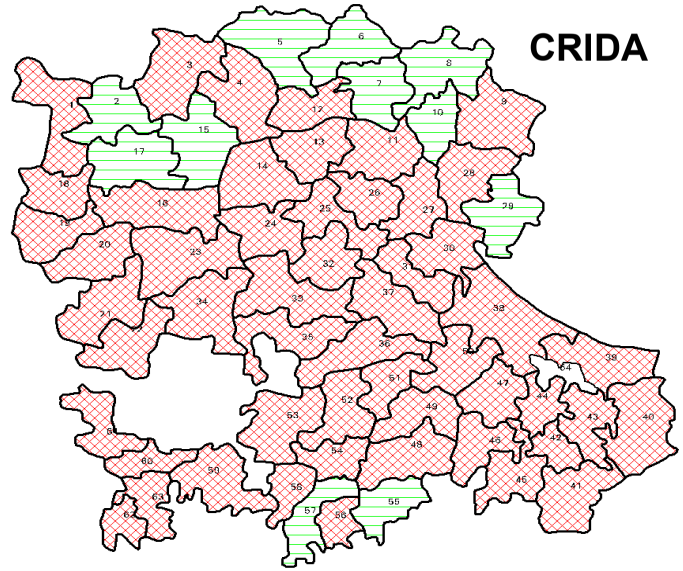


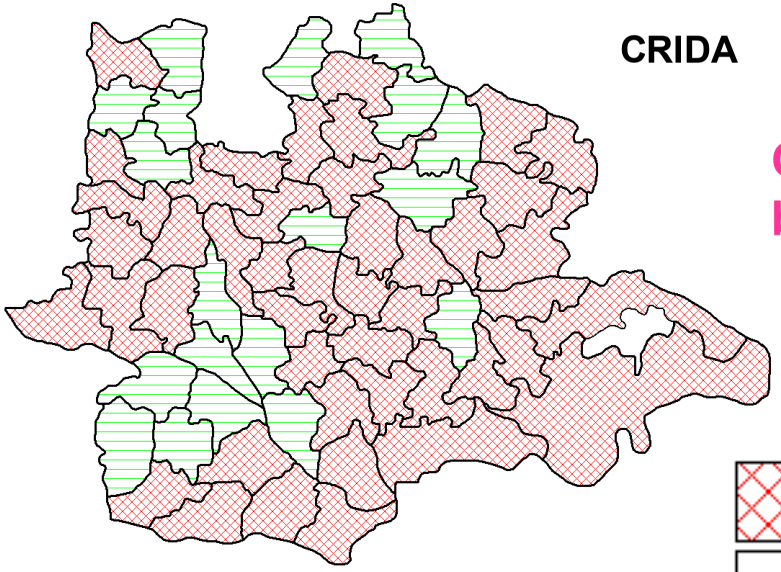
APPROACH - II

CRIDA's Methodology to identify drought prone blocks

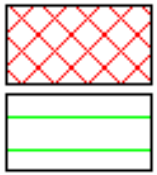


Delineation of Drought prone mandals
Results of the Pilot studies in Anantpur and Mahaboobnagar districts
by CRIDA & NRSA



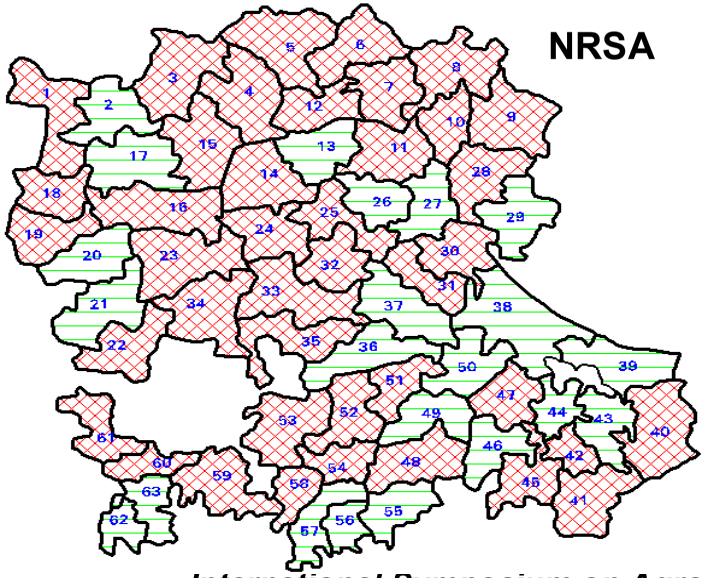


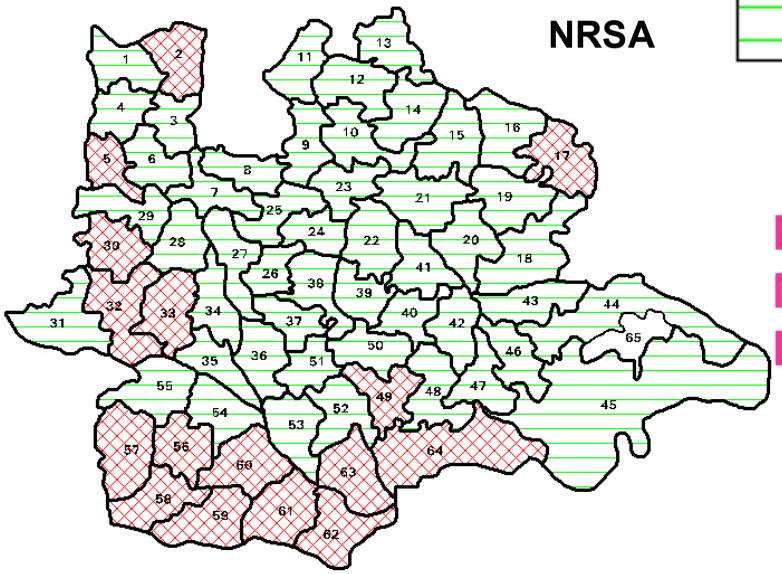
Composite index by CRIDA



More vulnerable

Less vulnerable





NDVI based Methodology by NRSA

Agreement between two approaches

CRIDA approach	NRSA approach	No. of blocks
Anantpur district		
More prone	More prone	46
Less prone	Less prone	3
More prone	Less prone	16 ?
Total blocks		57
% of agreement		86%
Mahaboobnagar district		
More prone	More prone	15
Less prone	Less prone	24
More prone	Less prone	23 ?
Total blocks		62
% of agreement		63%

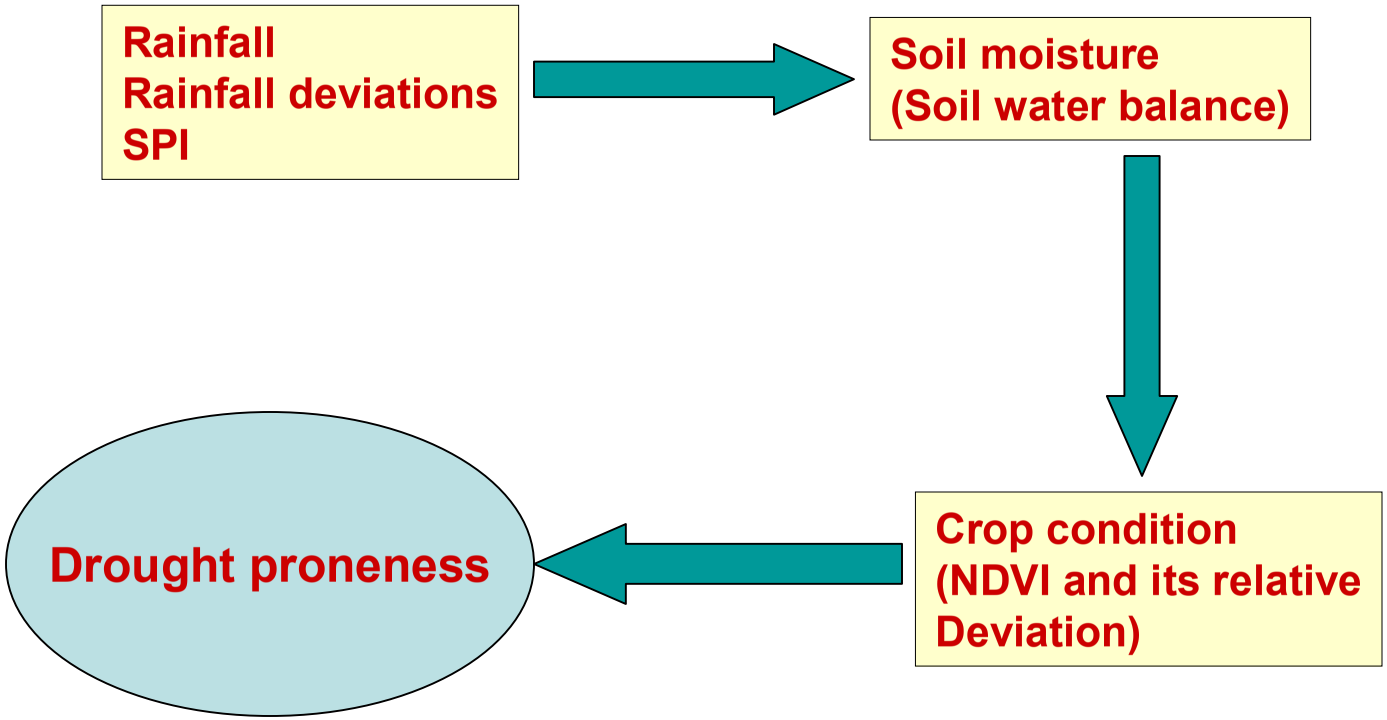
Satisfy the criteria of rainfall, Irrigation support and crop condition

Reasons for variation !!

- Rainfall – long period data base (25-30 years)
- NDVI – 7 years data base
- Some of these blocks fall in transition zones.
- Weights for rainfall and irrigation needs to be standardised
- Threshold limits for NDVI variability needs to be fine tuned.

Scope for further work - Standardization of criteria

- **Scientific approach**
- **Criteria should cut across various rainfall zones, agro ecological zones**
- **Complete and comprehensive criteria – rainfall, soil and plant**



Thank you