

Understanding Drought: A Case Study of India

SVRK Prabhakar

Climate Policy Researcher, Climate Policy Project
Institute for Global Environmental Strategies, Hayama, Japan
prabhakar@iges.or.jp, sivapuram.prabhakar@gmail.com

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Note: Draft presentation subject to final modifications

Organization of This Talk

- What is drought in India?
- How vulnerable is India to drought
 - The past & Present
- Drought management in India
- Major issues in existing drought risk mitigation in India
- Climate Change Scenario
- What needs to be done?

20 min

Q&A

8 min

Q&A

Drought Classification by IMD

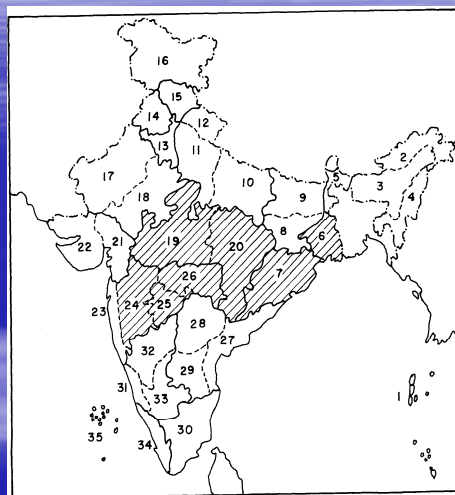
Aridity Index:

$$\frac{PE - AE}{PE} \times 100 = \frac{\text{Water Deficit}}{\text{Water Need}}$$

The departure of **Aridity Index** from the normal value is expressed in % and accordingly drought in a **Meteorological Sub Division** is categorized as

- Severe (more than 51%)
- Moderate (26-50%)
- Mild (up to 25%).

Meteorological Divisions in India

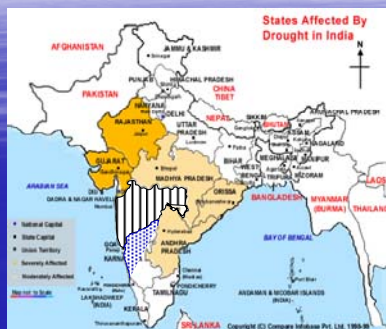


- India is divided into **36 Met Sub Divisions** based on the homogeneity of climate

All India Drought

If area affected by one of the above two criteria for drought either individually or collectively is **more than 20%** of the total area of the country.

What are Drought Prone Areas?



Map showing drought prone states in India

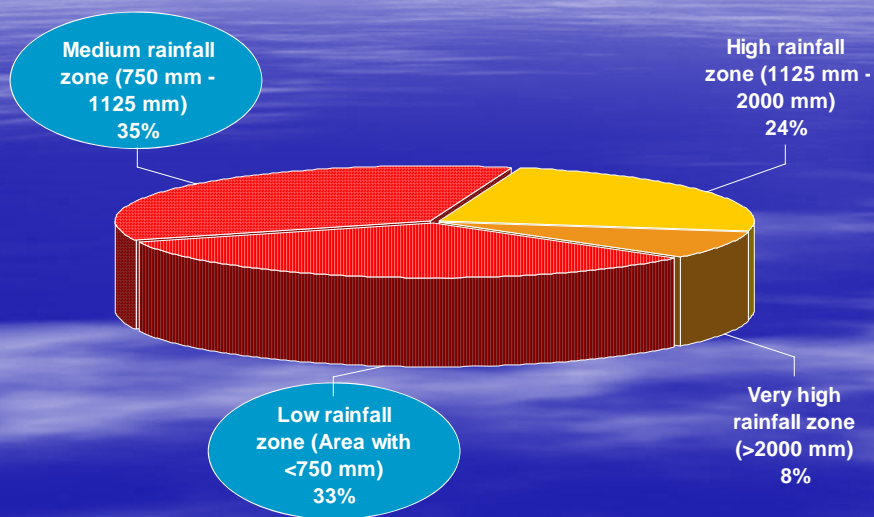
Central Water Commission,
Ministry of Water Resources:

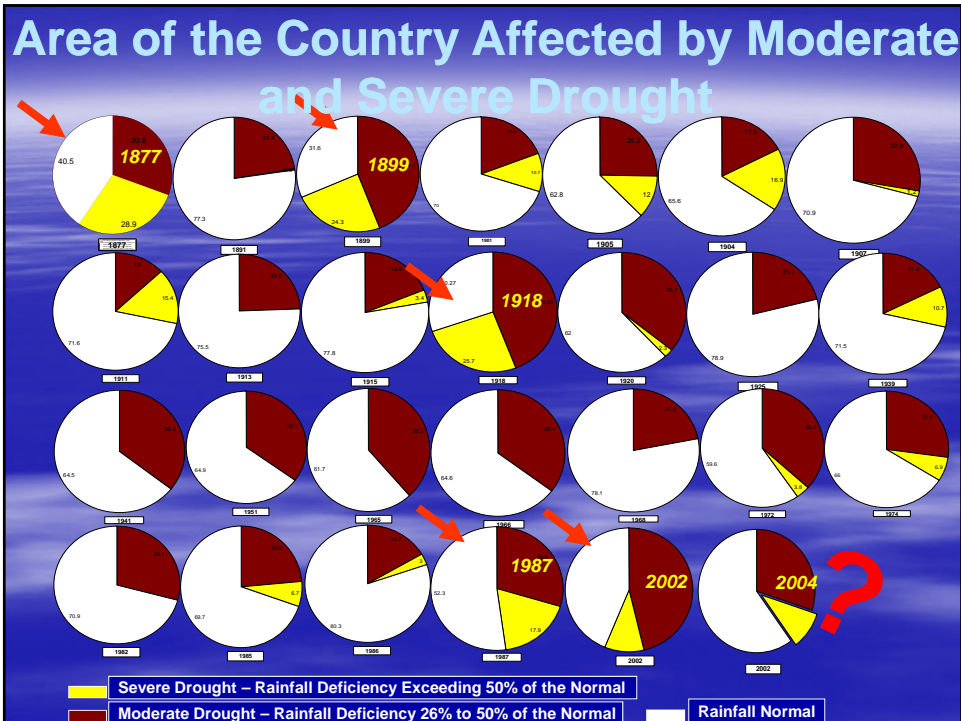
An area is drought affected when the annual rainfall is less than **75%** of the normal in **20%** of the years examined and have less than **30%** of the cultivated area under **irrigation**

- **16%** of India's total area is drought prone
- On an average 191 of 543 districts are affected by drought
- More than **68%** of the Land is vulnerable to drought
- 50 million people are annually affected by drought

India's Drought Vulnerability

Spatial Distribution of Rainfall





Drought Frequency

Meteorological Sub-Division	Frequency of Deficient Rainfall (75% of normal or less)
Assam & NE Region	Rare, once in 15 years
WB, West MP, Konkan, Madhya MAH, Kerala, Bihar & Orissa	Once in 5 years
SIK, East Rajasthan, Vidarbha, Gujarat, East & west UP	Once in 4 years
Tamilnadu , J&K	Once in 3 years
Royalaseema, Telangana & West Rajasthan	Once in 2.5 years

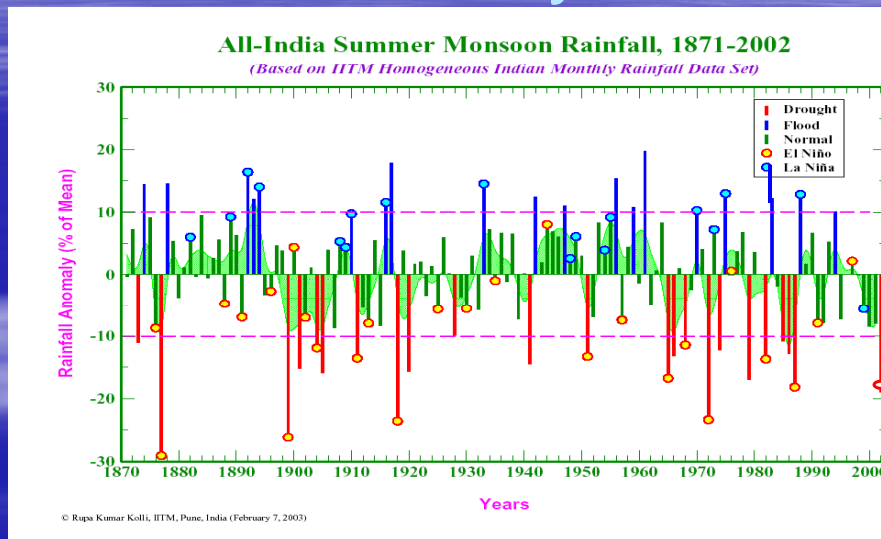
Reasons

India's Rainfall Distribution

- India receives its annual rainfall in four spells:
 - Pre-Monsoon(March-May) --10.4 %
 - **SouthWest Monsoon (Jun-Sept)--73.3%**
 - NorthEast Monsoon(Oct-Dec) -- 13.3%
 - Winter Rains (January-Feb.) -- 3.0 %

Reasons

Monsoon - Inter-seasonal Variability



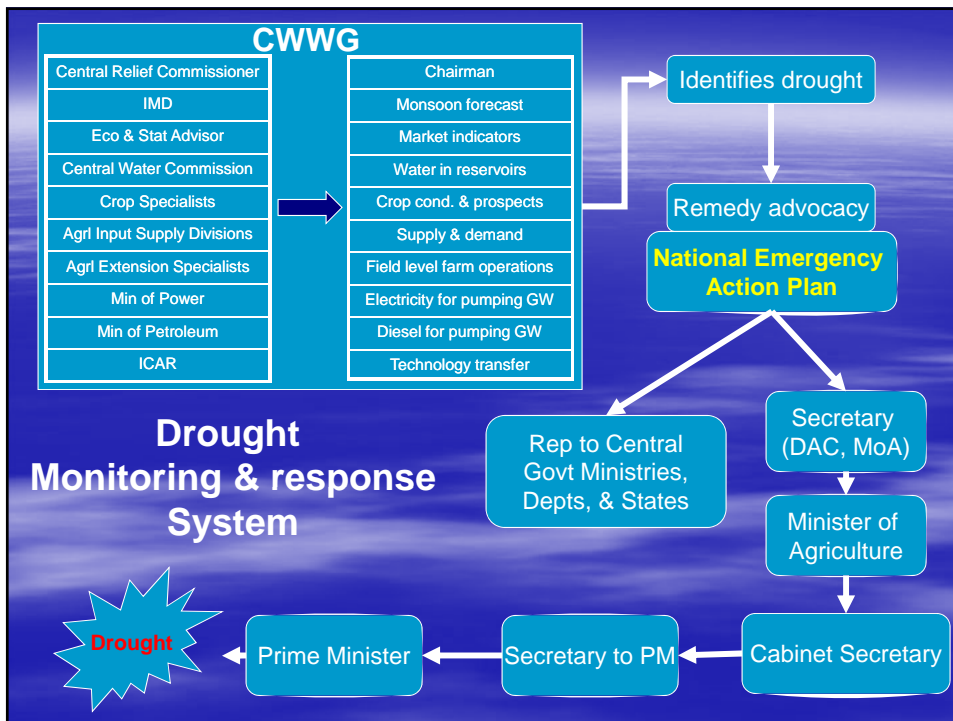
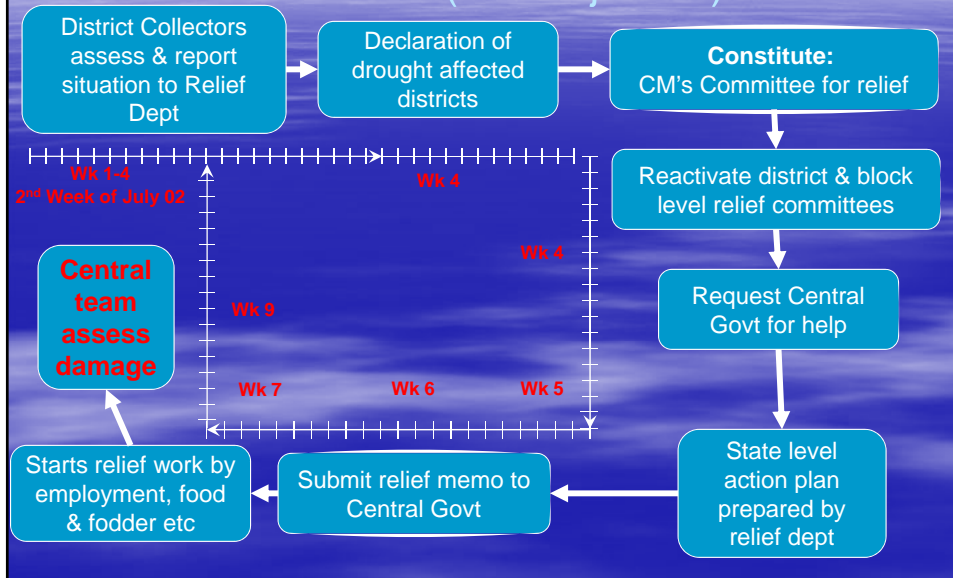
Drought Management in India

Center and State

- Drought management is a state subject.
- The role of Central Government is limited to responding to the request of the state governments
- However, state governments often depend on the central government for assistance

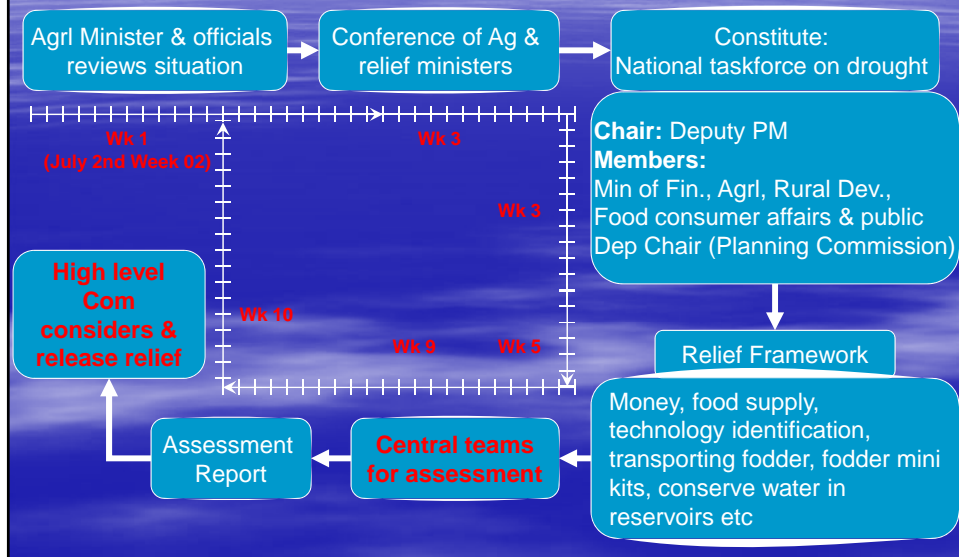
Drought Response!

State Level (E.G. Rajasthan)



Drought Response!

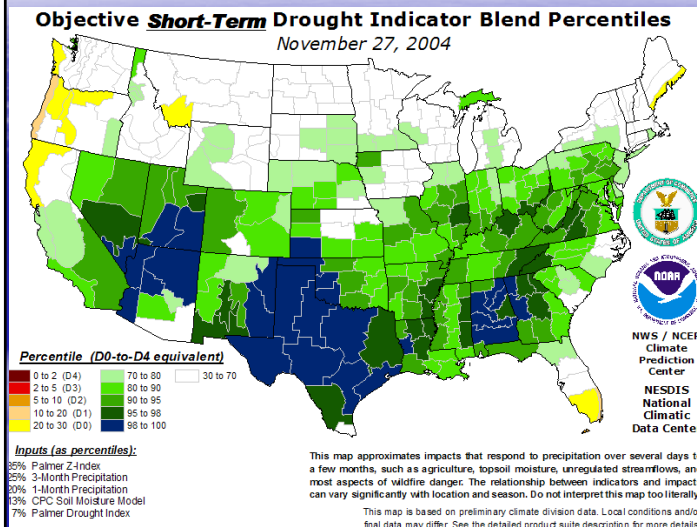
National Level



Drought Risk Mitigation

- **Drought Prone Areas Programme (DPAP)**- 180 districts of 16 States (Rs. 19.0 billion)
- **Desert Development Programme (DDP)** -40 districts of 7 States (Rs. 8.5 billion)
- **Community development programmes:**
 - Food for work Programme
 - Employment Assurance Scheme (EAS) (Rs. 16.0 billion)
 - Jawahar Gram Samridhi Yojana (JGSY) (Rs. 16.5 billion)
 - Pradhan Mantri Gram Sadak Yojana (PMGSY) (Rs. 25.0 billion)
 - Swarnajayanti Gram Swarozgar Yojana (SGSY) (Rs. 5.0 billion)
 - Antyodaya Anna Yojana (AAY)
 - National Old Age Programme (NOAP)
 - Annapurna Scheme (Rs. 3.0 billion)
 - Integrated Child Development Scheme (ICDS)
 - Mid Day Meal for School children

Monitoring & Assessment



India is yet to develop such a monitor

USDA Drought Monitor

Weather Bulletins

- **Daily weather bulletins:** once in every evening and twice during monsoon season
- **Agrometeorological advisory services:** twice a week for farmers to take up agricultural operations

External Assistance Policy

- No formal appeal is issued on behalf of the Government, directly or through any other agency, for assistance
- Relief offered on voluntary basis accepted and acknowledged as a sign of international solidarity
- Areas of assistance are Nutrition, Health, Community capacity, Water harvesting etc.

Major Deficiencies

- Largely response based systems
- Mitigation programs
 - Top-down approach
 - Limited peoples participation
 - Sustainability of project outputs is a problem
- National policy
 - No clear national policy on drought mitigation
 - Ad-hoc response mastered over time
 - Poor early warning mechanisms
 - Delayed response (9 weeks)

Drought Early Warning - Problems

- Poor long range and medium range weather forecasting precision
- No end-to-end linkage in weather information dissemination and use (sectoral utility information)
- Outdated numerical weather forecasting systems

Relief Financing

- Calamity Relief Fund (CRF)
 - For immediate relief and rehabilitation of natural calamity victims
 - 75% Central contribution and 25% state contribution and administered as grant-in-aid
 - A high level committee will decide on the amount to be given to each state for a specific calamity
 - The fund is often not sufficient
 - Decisions are highly politically influenced

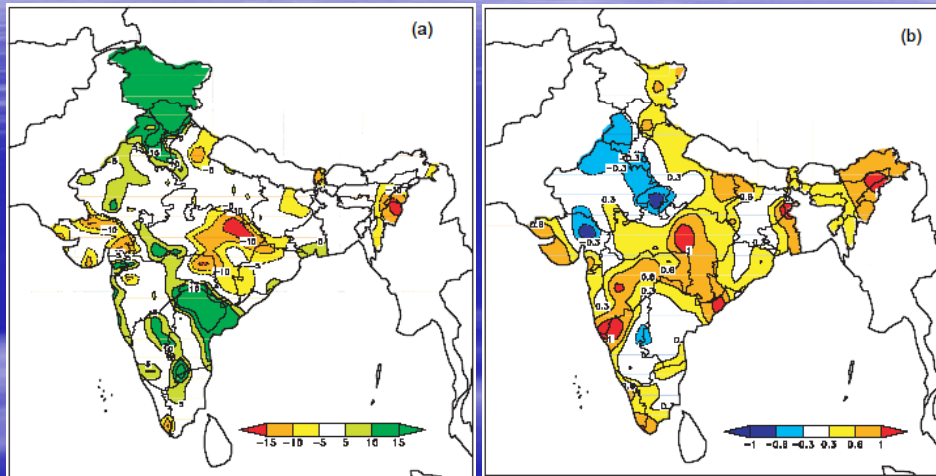
Relief Financing

- 'National Calamity Contingency Fund (NCCF) Scheme'.
 - A corpus of Rs 5000 million
 - To be given to states for relief and reconstruction
 - To be recovered by levy of surcharges
 - A high-level committee recommends the amount to be given to the states

Climate Change and India's Drought Vulnerability

India's Climate Change Scenario

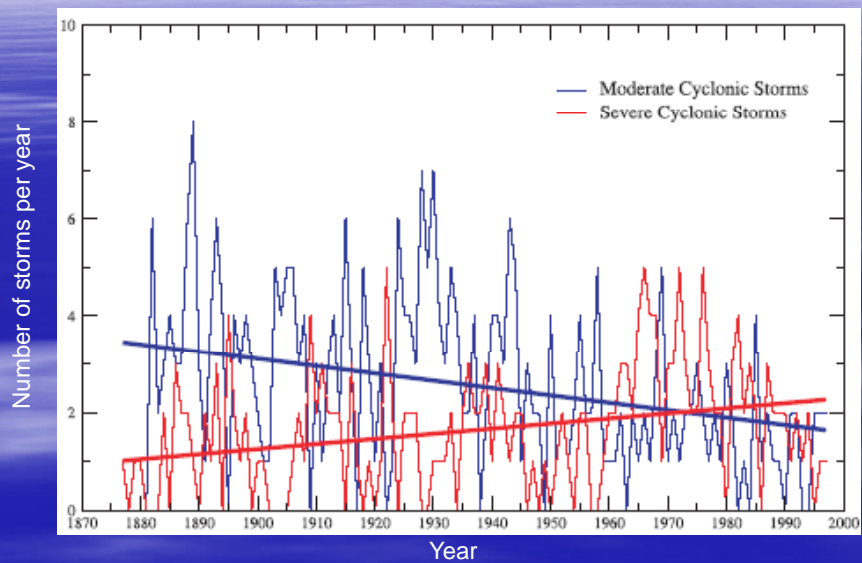
Historic Analysis



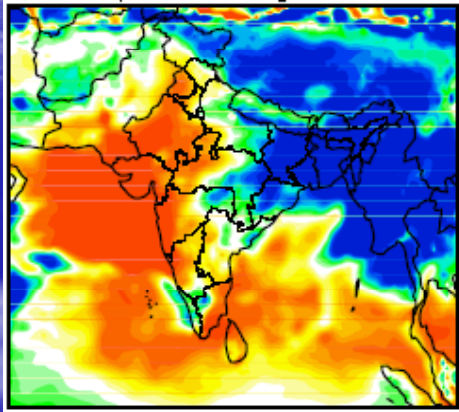
(a) summer monsoon rainfall (% of mean/100 years)

(b) annual mean surface temperature during 1871-1990.

Observed Extremes: Cyclone Storms



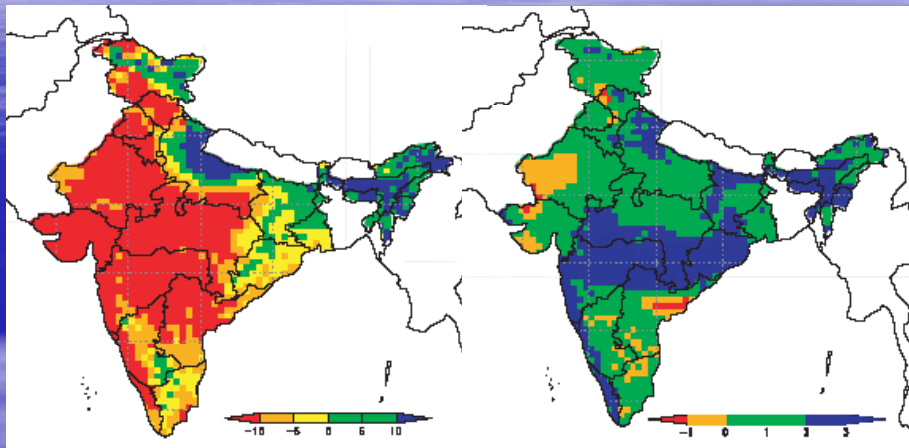
Future Projections



Had RM2 model projections for rainfall for the period 2041-2060

- General increase in warming with generally more warming in Northern States of India (2-5°C till the end of 21st Century)
- No consistent results in rainfall projections with some models showing increase while the other models a reduction in rainfall.

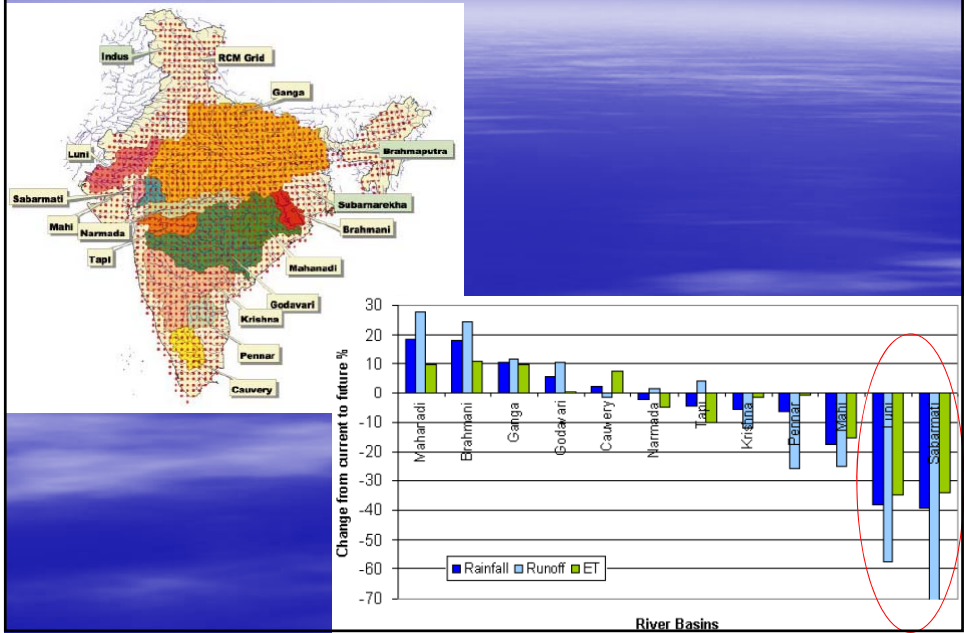
Rainfall Intensity and Duration



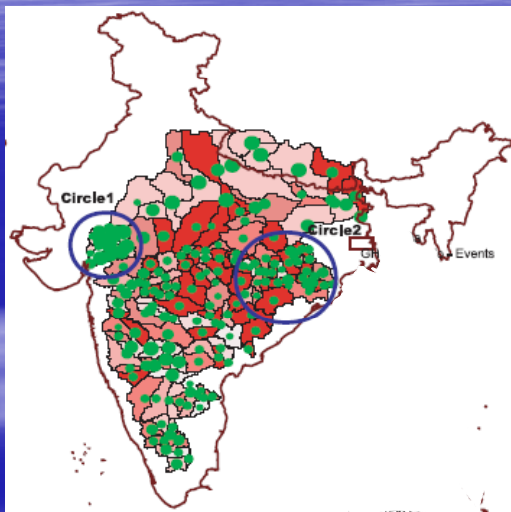
Number of rainy days for duration for the period 2041-2060

Rainfall intensity (mm/day) during the period 2041-2060

Surface Water Sources



Projected Drought Conditions



- There is a general increase in drought conditions in the western India
- Less number of consecutive drought years
- More drought weeks in western India

What Needs to Be Done?

- Community adaptation to climate change
 - Number of studies in India on vulnerability and coping mechanisms
 - Less number of studies linking climate change and drought risk mitigation measures
 - It is important to understand how the past vulnerabilities leads to future vulnerabilities and how the gap can be bridged

What Needs to Be Done?

- Policies at various levels
 - A comprehensive **drought risk mitigation policy** for the country considering future climate variability
 - **General awareness** among communities on the future scenarios and developing a sense of responsibility towards natural resource management
 - Proper dissemination of **climate information** to communities with 'what it means to them'
 - Planned adaptation to reduce the impacts
 - Proper land-use planning
 - Water pricing ...