SAARC
Disaster Management Centre (IU)

IWMI International Water Management Institute

CGIAR

GUJARAT INSTITUTE OF DISASTER MANAGEMENT
BUILDING RESILIENCE

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UNITED NATIONS
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Regional Workshop
on
Assessing Drought Risks using Earth Observation Data
&
Launch of South Asia Drought Management System (SADMS)

Utility of SADMS tool for operational drought decision support across South Asia

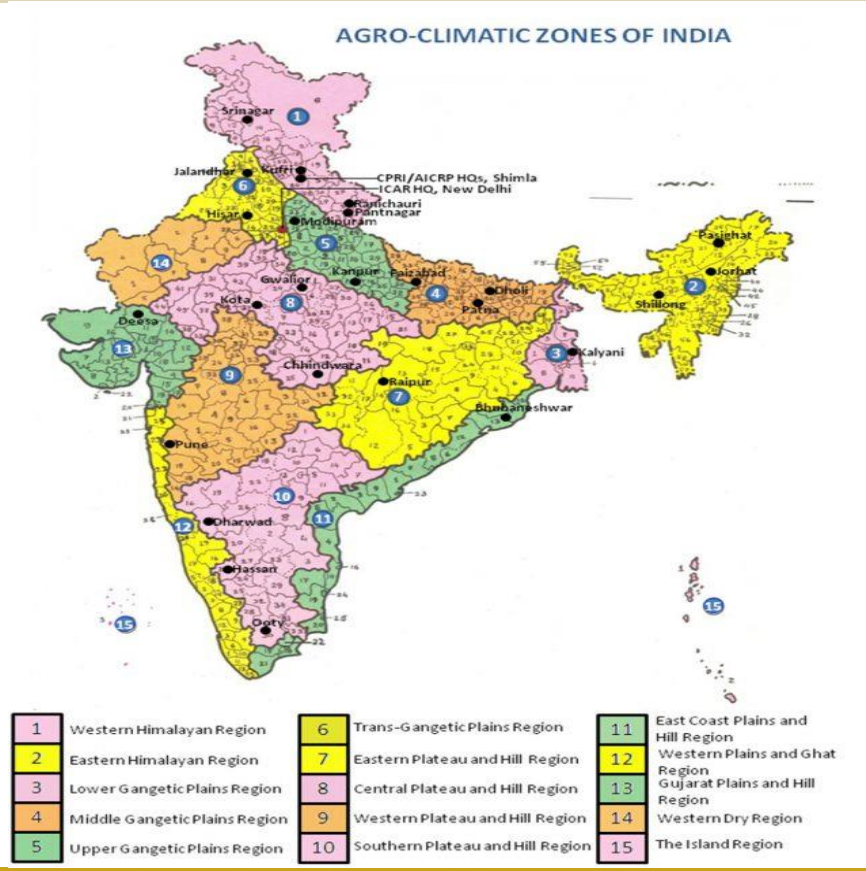
Date: 31st August to 2nd September, 2022

Gandhinagar, Gujarat, India

Anup Kumar Srivastava
National Disaster Management Authority (NDMA)
Ministry of Home Affairs, Government of India

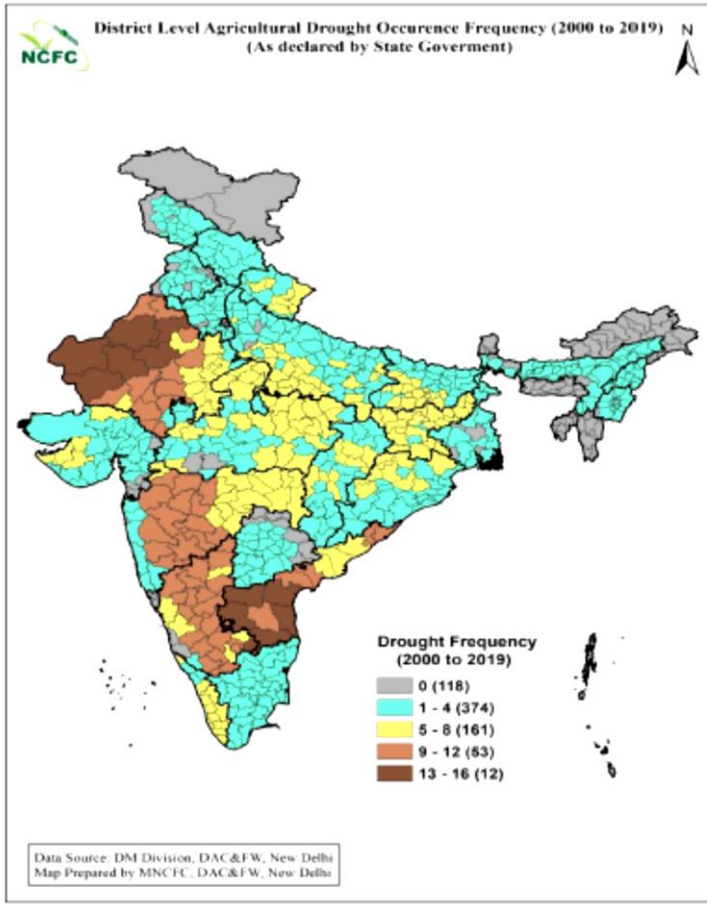
Session – II Earth Observation data for Drought Monitoring - India

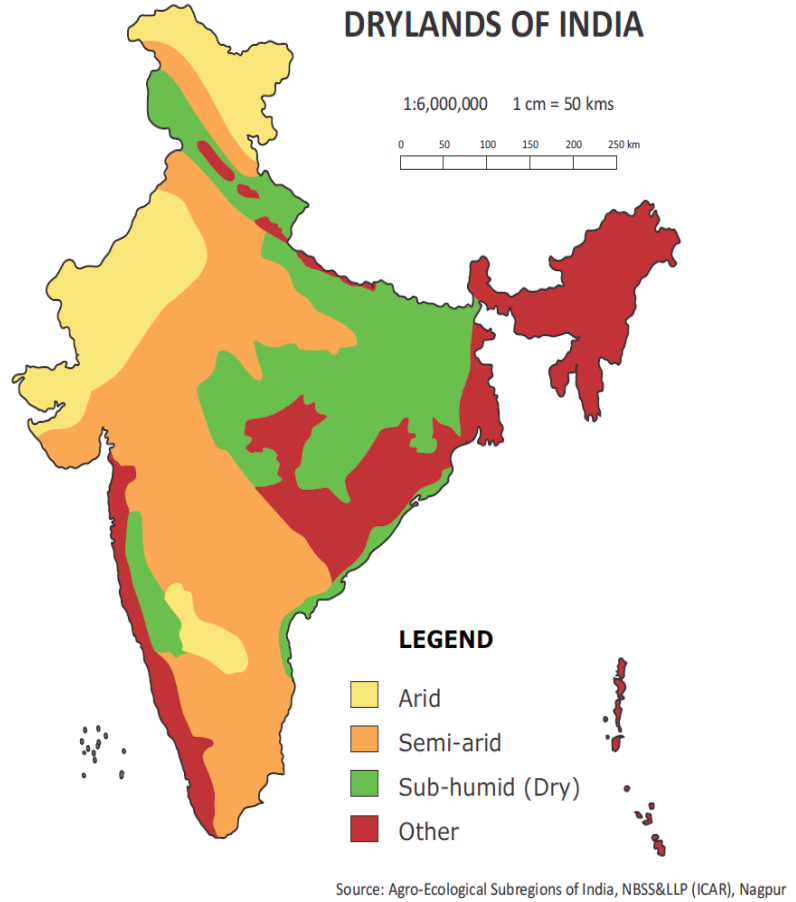
- Total Area of the Country 32,87,263 Sq.Km
- Around 68% is drought prone and vulnerable to drought
- 50 million people are annually affected.
- 33% area has less than 750mm
- 35% area has rainfall 750 - 1125mm
- 70 million hectares of rain-fed areas,
- About 40 million hectares are prone to scanty or no rain



Unique Features of Drought

- Slow onset of monsoon
- Impacts on large area
- Impacts are cumulative
- As there is no structural damage, impacts are difficult quantify
- No single indicator to assess drought
- 6 climatic zones and 15 Agro-climatic zones in India





Source: Agro-Ecological Subregions of India, NBSS&LLP (ICAR), Nagpur

Arid RF00-400mm	Semi-Arid RF400-600	Dry Sub-humid RF600-1000	Humid & Above >RF1000mm
50.8mHa (15.8%)	123.4mHa (37.6%)	54.1 mHa (16.5%)	99.9mHa (30.44%)

Drought History and its Impact

Period	Severe Droughts
1801-1825	1801, 1804, 1806, 1812, 1819, 1825
1826-1850	1832, 1833, 1837
1851-1875	1853, 1860, 1862, 1866, 1868, 1873
1876-1900	1877*+, 1891,1899*+
1901-1925	1901*, 1904, 1905*, 1907, 1911, 1918*, 1920
1926-1950	1939, 1941*
1951-1975	1951,1965*, 1966, 1971,1972*, 1974
1975-2015	1979*, 1982, 1985, 1987*+, 1988, 1992,2002, 2012, 2015

Drought Impacts:

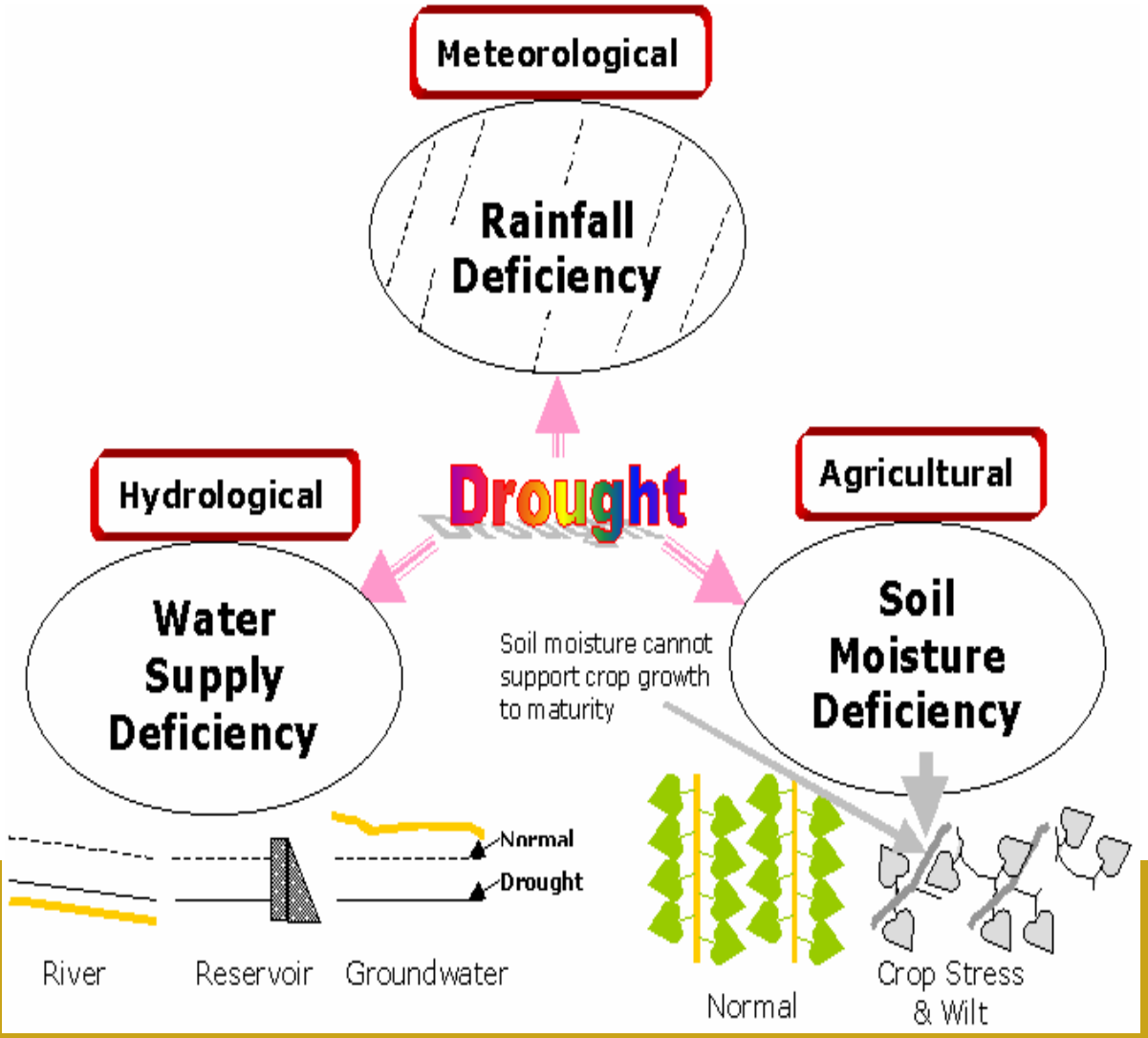
- Crop losses & Food insecurity and Malnourishment
- Scarcity of Drinking Water
- Livestock & Fodder
- Migration & unemployment
- Health & Education
- Losses of Economy and increasing poverty

- **Financial losses for severe drought**

  Last 11 years (2010-11 to 2020-21) –

  Rs 55949.34 Cr. (Ave. Rs5086.30Cr.)

Current capabilities of drought monitoring using earth observation data



SN	Using earth observation data	Indicators
1	**Rainfall**	Rainfall Deviation, SPI, Dry Spell
2	**Crop Sown Area**	Deviation from Normal
3	**Satellite based crop condition Using Remote Sensing and GIS techniques**	NDVI, NDWI, VCI, MAI, PASM
4	**Water resources**	
A	**Stream flow**	SFDI
B	**Ground water levels**	GWDI
C	**Reservoirs**	Storage
5	**Others Socio-economic Impacts***	Ground truething

Using Drought monitoring Parameter

Parameters	National	State	District	Field
A. Meteorological				
Delay in the onset of monsoon	D	D	D	D
Rainfall	D	D	D	D
Dry spell during sowing period	D	D	D	D
Dry spells during critical crop-growth periods	D	D	D	D
B. Hydrological				
Water availability in reservoirs	W	W	W	D
Water availability in tanks	F	F	F	D
Stream flow	F	F	F	D
Ground water Level	S	S	S	S
C. Agricultural				
Delay in sowing	W	W	W	W
Sown area	W	W	W	W
Crop vigour	F	F	F	W
Soil moisture deficit	F	F	F	F
Change in cropping pattern	W	W	W	W
Supply and demand agricultural in puts	W	W	W	W
D=Daily; W=Weekly; F=Fortnightly; M=Monthly; S=Seasonal (pre-andpost-rains)				

Examples of the drought monitoring applications

Indicators	Normal	Deficient or Moderate Drought	Long Deficient Or Severe Drought	Extremely Def. Or Extreme Severe
Rainfall deviation	± 19%	-20 to -59%	-60 to -99%	-100%
Dry Spell (less than 50%RF in each weeks)	<3 week	4-6 week	> 6 week	
Standard Precipitation Index (SPI)	±0.99	-1.0 to -1.49	-1.50 to -1.99	<-2.0
Remote Sensing - NDVI & NDWI deviation	0.6 to 1.00	-0.5 to 0.0	-0.1 to -0.50	-0.6 to -1.00
Vegetation condition based Index (VCI)	60-100%	40-60%	0-40	
Area under showing of the normal sown area for end of July/August	85%	<85%	<75%	
Percent Available Soil Moisture (PASM)	76-100%	51-75%	26-50%	0-25%
Moisture Adequacy Index (MAI)	76-100%	51-75%	26-50%	0-25%
Reservoir storage Index (RSI)	Up to 20%	-30 to -40%	-40 to -60%	-60 to above
Ground water Drought Index (GWDI)	>-0.15	-0.16 to -0.45	-0.45 to -0.60	<-0.60 to
Steam Flow Drought Index (SFDI)	<0.01	0.01 to 0.05	0.05 to 0.2	0.2 to 0.5

Drought Identification and determination

Mandatory Indicators		Impact Indicators				Other Indicators	Category of drought
Rainfall Indices		Agriculture	Remote Sensing	Soil Moisture	Hydrology	Socio – economic	Moderate / Severe
Rainfall Deviation (RFdev) or SPI	Dry Spell	Crop Area Sown	VCI or NDVI Deviations	PASM / MAI	SFI / RSI / SGWI	Others (Fodder Price, Migration, Drinking Water)	

This format used for identifying drought affected areas and category

- *Severe drought: if all the selected 3 indicators are in Severe category*
- *Moderate drought: if two of the selected 3 indicators are in 'Moderate' or 'Severe' class.*
- *Normal: all other.*

Multi-sectoral usage of available Drought Monitoring systems

Central Drought Relief Commissioner (CDRC):

Drought Management Cell in the DM Division - collate information for diverse sources monitor drought conditions, issue advisories, and coordinate with other ministries of the Central Government, State Governments and relevant agencies

***Crop Weather Watch Group* -** act as an inter-ministerial mechanism, weekly monitoring

Central Agencies	Drought Monitoring/Management
Ministry of Agriculture Cooperation & Farmers' Welfare	Overall coordination, Inter-Ministerial Crop Weather Watch Group (CWWG), Leading IMCT for Drought Assessment
India Meteorological Department	Weather Forecasting, Rainfall Data
Central Water Commission	Monitoring Storage situation in Major Reservoirs
DAC&FW (MNCFC) and ISRO	Provide technical and satellite based inputs on drought parameters
ICAR- CRIDA, CAZRI, IARI	Technical input and Contingency planning
Ministry of Animal Husbandry & Fisheries	Livestock health; Fodder availability
DOLR/ MOWR/DAC&FW	PMKSY-Watershed Development-Water Harv. Str. /Irrigation/Water Use efficiency
National Institute of Disaster Management	Capacity Building and documentation

Action for Drought Management

- Policy and plan related – National Guidelines, Plan, State/District plan
- Early warning and dissemination
- Inter-agency coordination and convergence with different Min./Dept. and groups at National/State/District/Village
- Prevention, preparedness measures -State/District/Village
- Mitigation and Response Measures – National/State/District/Village
- Relief and rehabilitation – Nodal ministries and department
- Capacity Building; Education & Awareness through ATIs
- Research and development

Future needs

- Drought Risk and Vulnerability Assessment & mapping using Remote Sensing and GIS Techniques
- Integrated schemes and program for drought management
- Conversance with different groups, agencies
- Modify Indigenous Knowledge and sharing Best Practices
- Community based Practices, Self-Help Groups
- Climate Change Adaptation and mitigation
- Institutionalization of Drought Management Centers
- Capacity Building; Education & Awareness

Expectations

- To bring Regional cooperation on a common platform for drought management
- Strengthen by building connections between key actors to share experiences
- Domain specific forecast model for South Asia regions
- Disseminate of Early Warning and advisory
- Experience sharing for develop policy and plan,
- Capacity Building of professional in specialized areas to tackle issues related to Drought Management

Thank you