



*International Conference on
Hydropower and Dams*

Development for Water and Energy Security – Under Changing Climate
7-9 April, 2022
Rishikesh

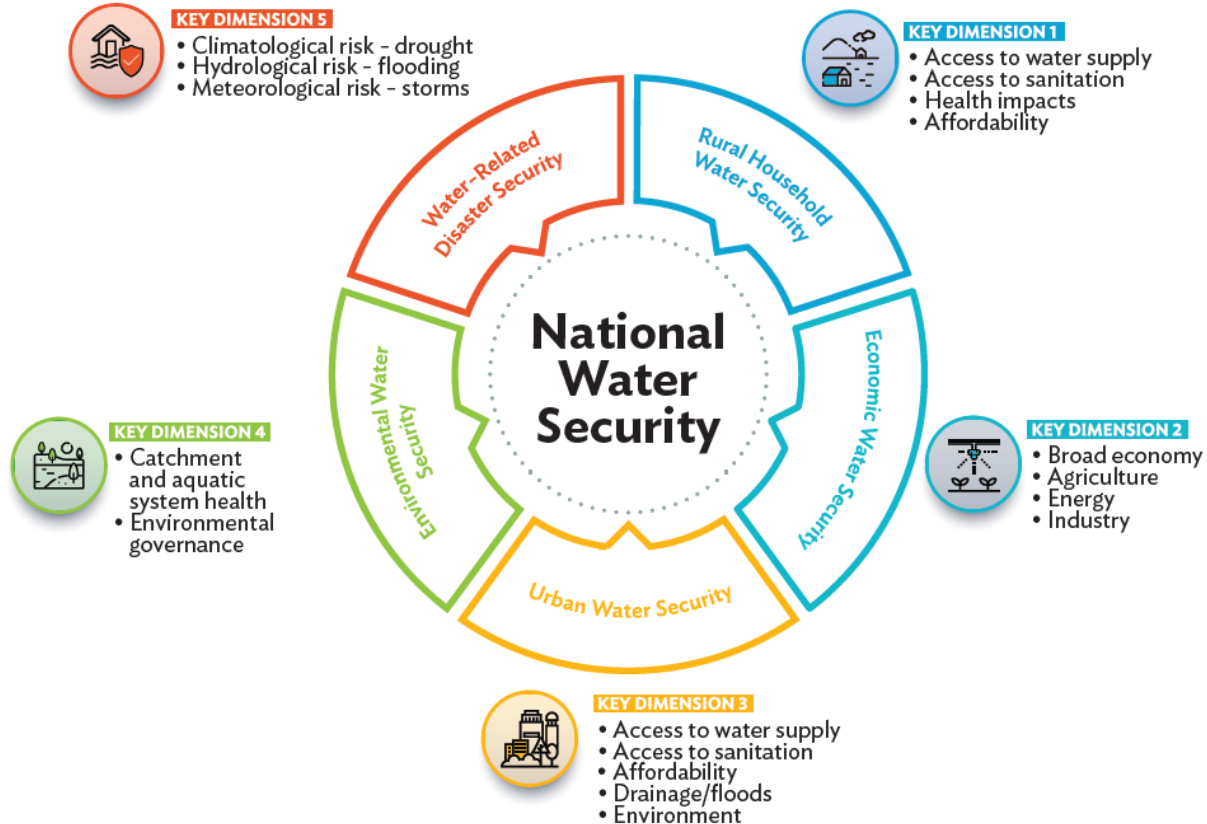


NEED FOR STORAGE DAMS FOR WATER SECURITY

J. Chandrashekhar Iyer

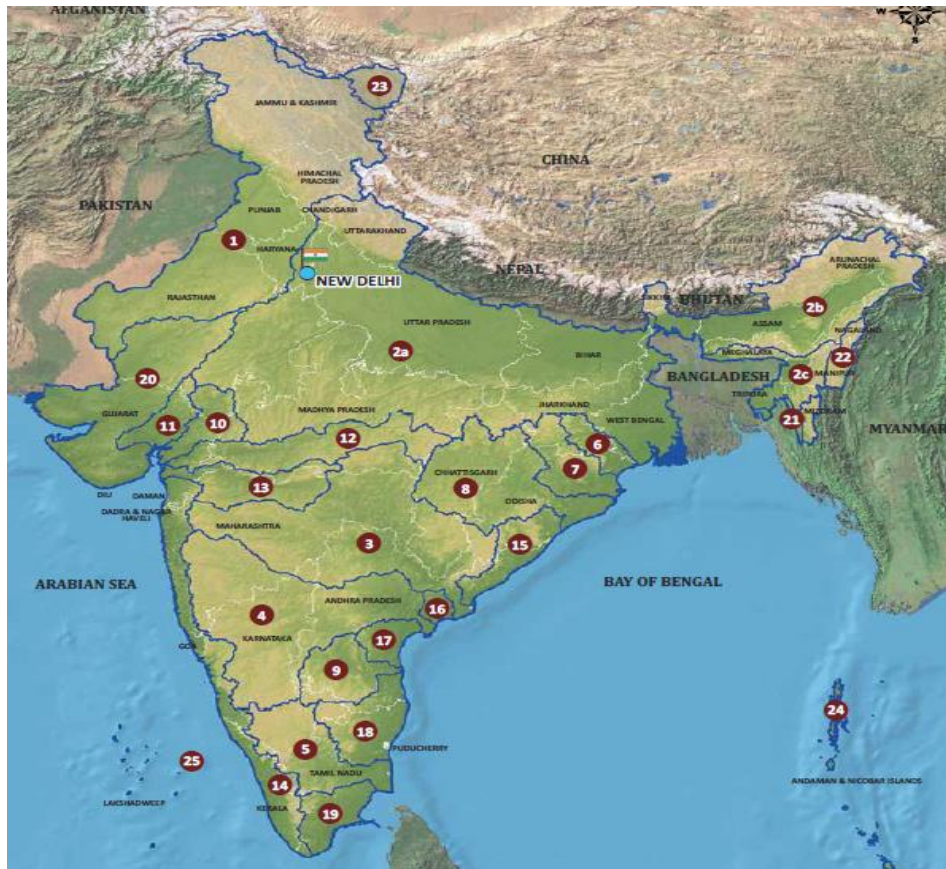
Member (Design & Research), Central Water Commission
& Ex-officio Additional Secretary to Government of India
Department of Water Resources, RD & GR, Ministry of Jal Shakti

Key Dimensions of National Water Security

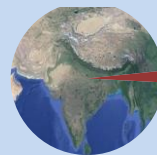


Indian Water Resources Scenario

(Source: CWC and NRSC combined reassessment study report (2019))



Share in World Resources



Land(2.4%)



Water(4%)



Human (17%)

Total Precipitation
3880 BCM

Total water availability
1999 BCM

Total Utilizable Water
Resources 1137 BCM

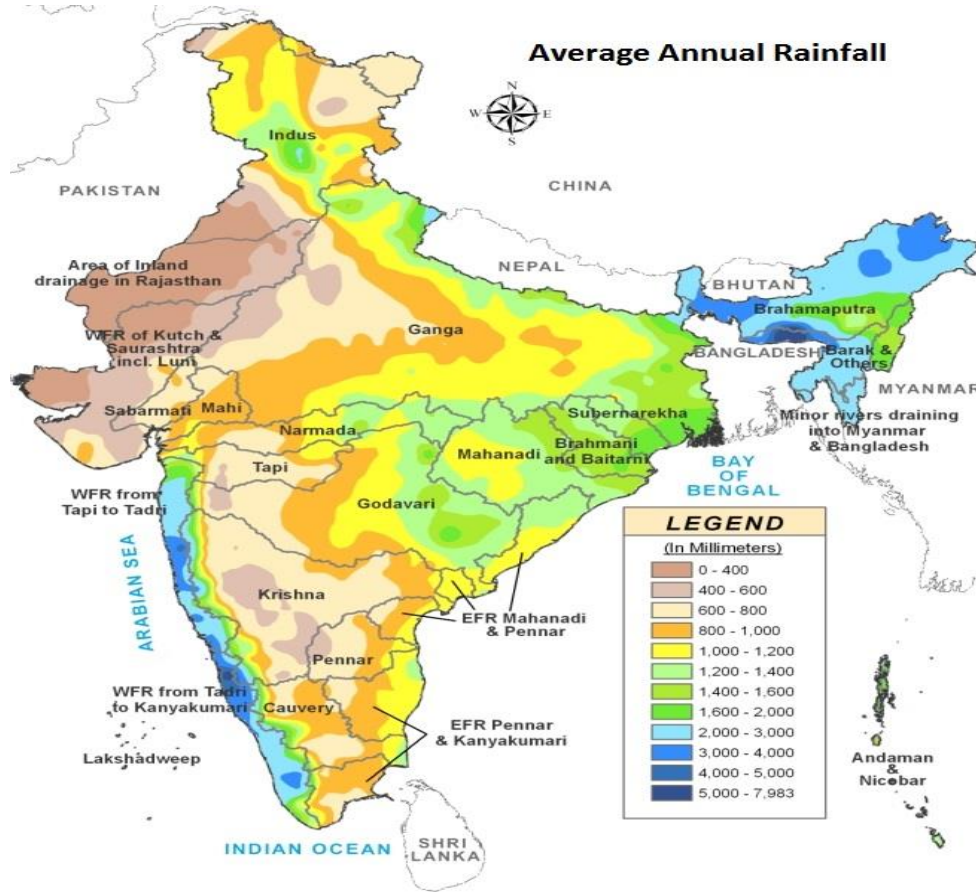
Surface Water 690 BCM

Ground Water 447 BCM

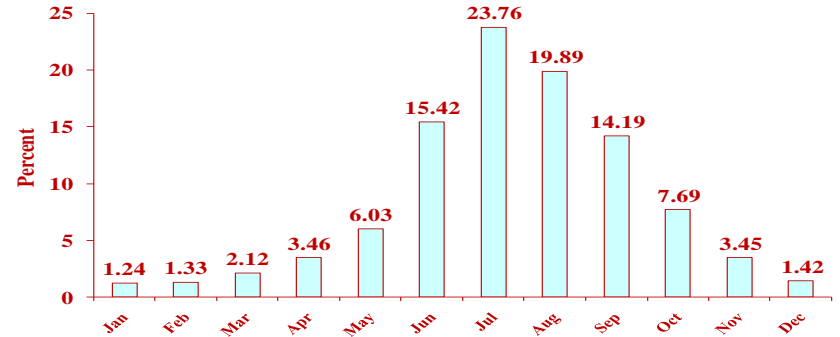
Current Utilisation 450 BCM

Current Utilisation 243 BCM

Spatial & Temporal Variation of Rainfall



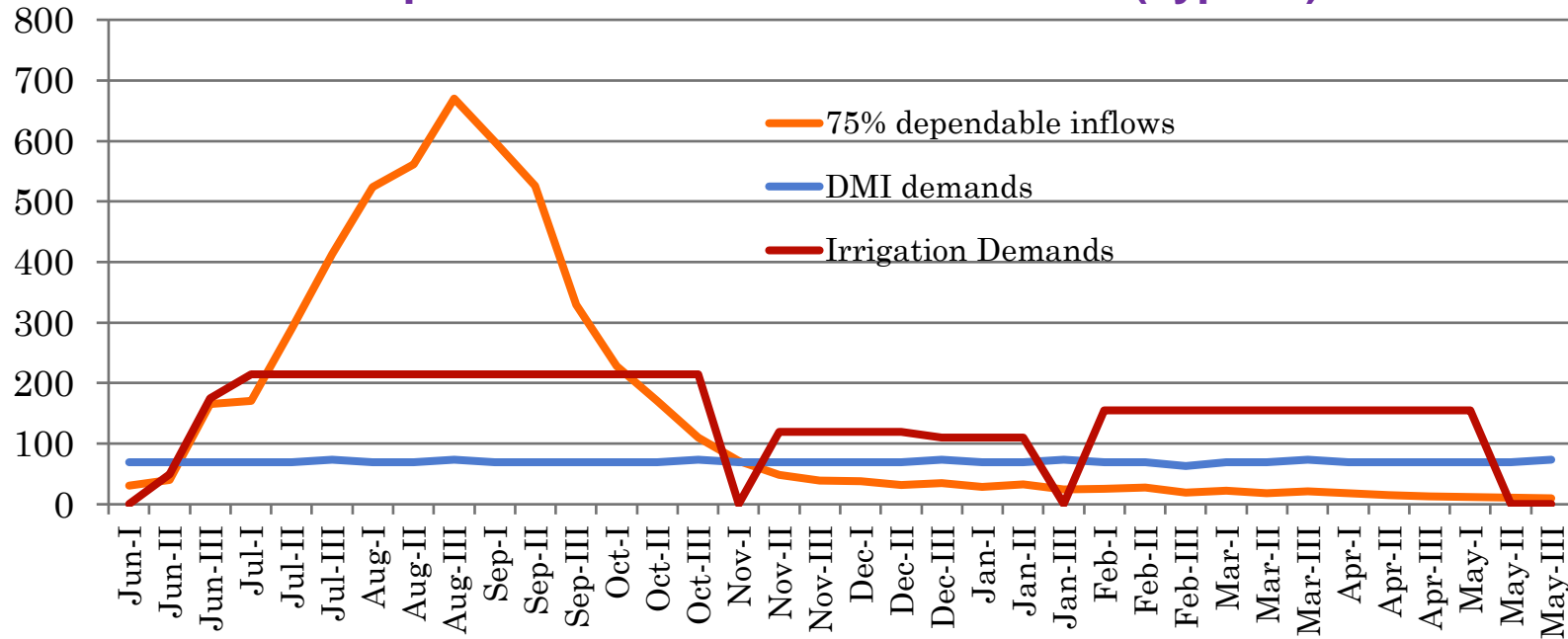
Precipitation during June to September 3000 BCM (75%)



Rainfall in mm		
Avg.	1,170	All India
Max.	11,000	Mawsynram, Meghalaya
Min.	100	Western Rajasthan

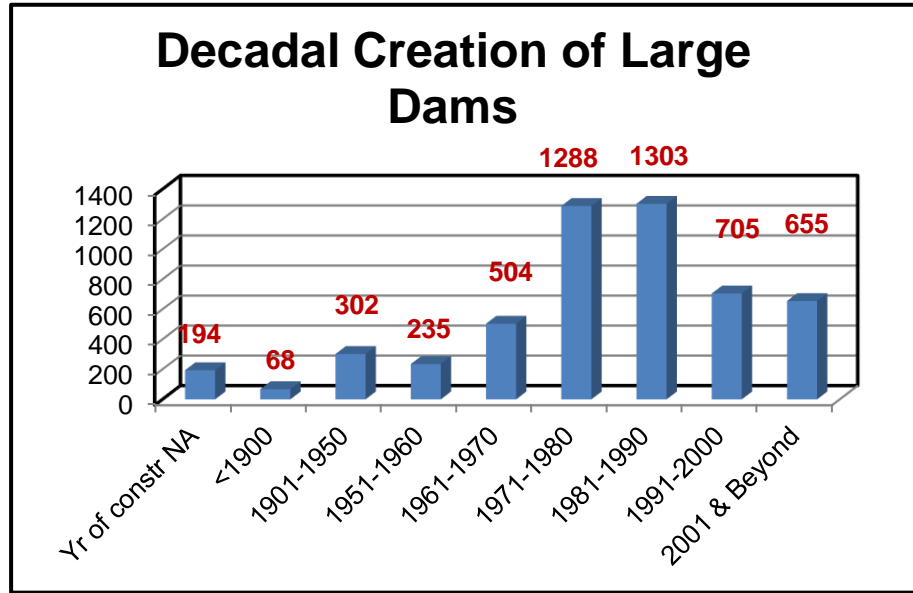
Availability Vs Demand

75% dependable inflows and demands (Typical)



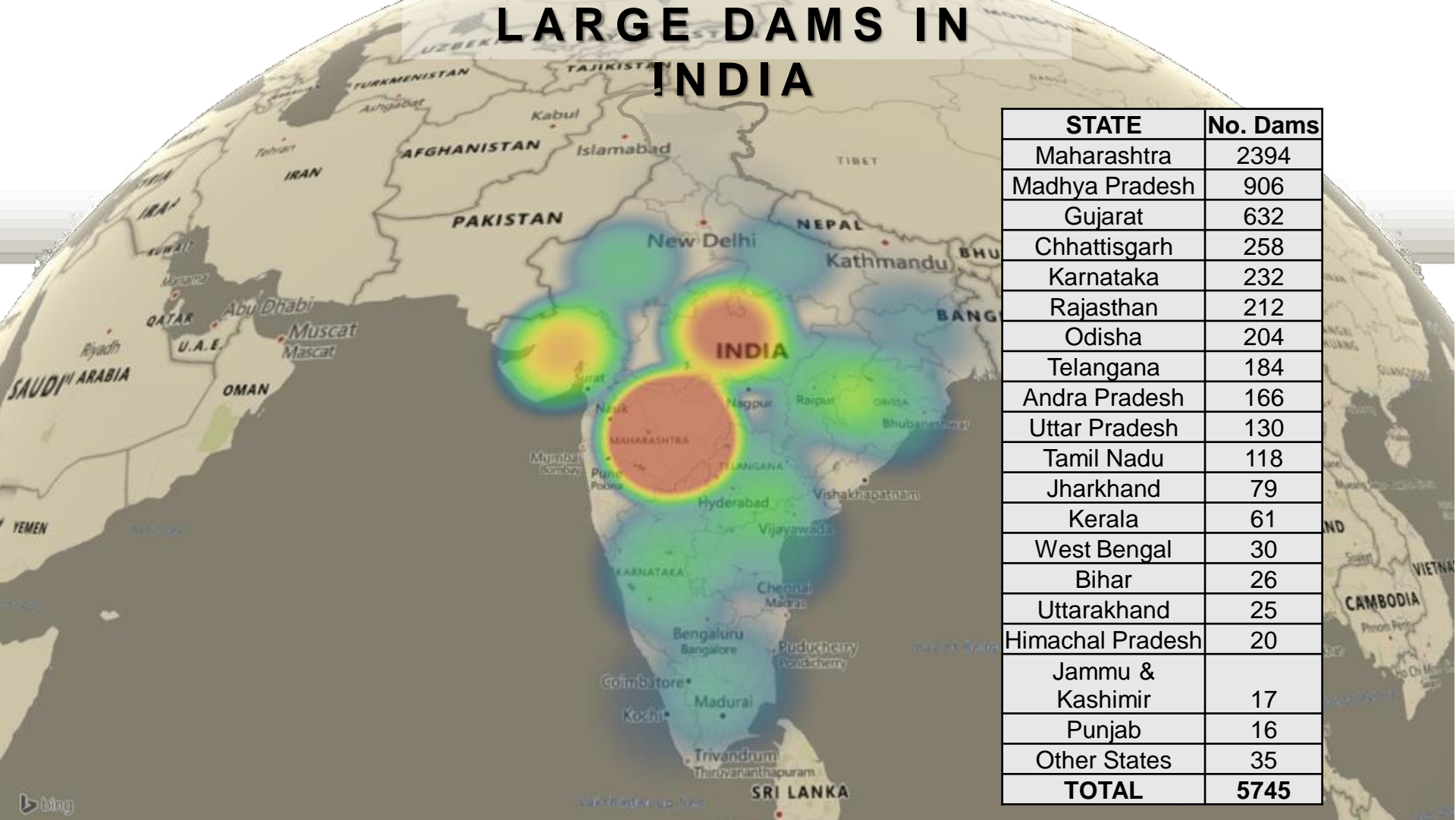
Without storage, difficult to meet the consumptive demands for the whole year from the rainfall that occurs in just about 100-150 hours per year. Even Kharif season flows vary a lot on day to day basis. Without the backup of storage, even Kharif crop is not secured.

CREATION OF STORAGES IN INDIA



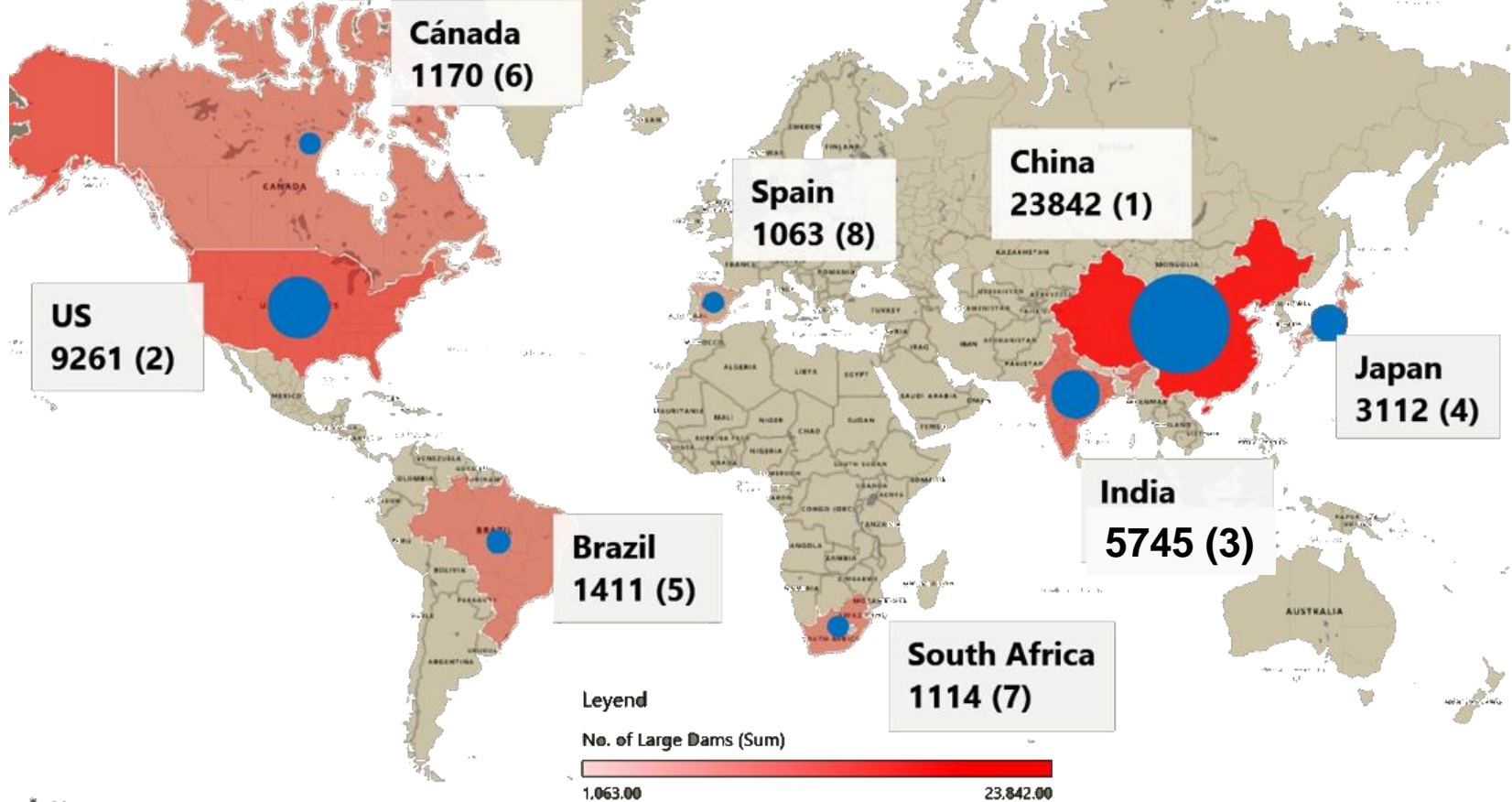
Sl No.	Item	Capacity (BCM)
1	Storages already created	253.388
2	Projects under construction	50.959
	Total	304.348

LARGE DAMS IN INDIA

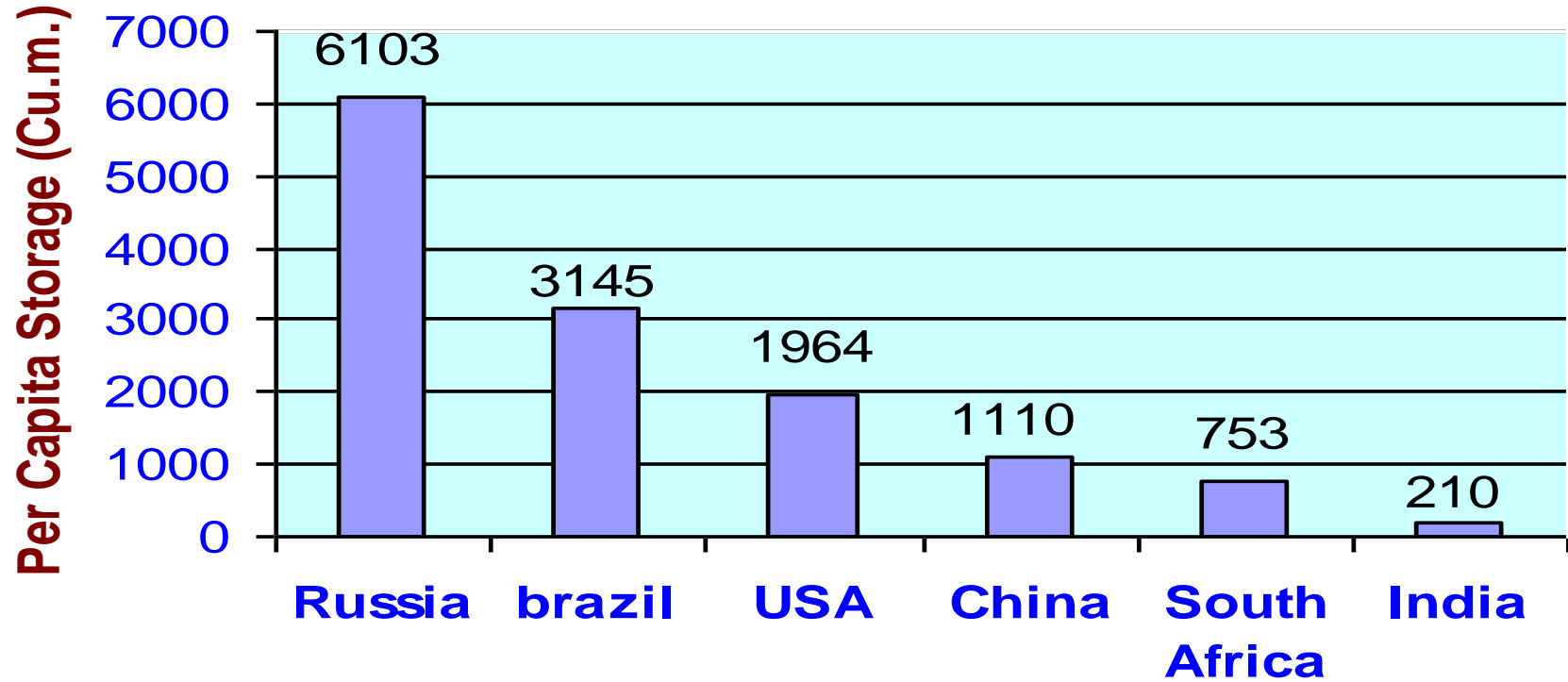


STATE	No. Dams
Maharashtra	2394
Madhya Pradesh	906
Gujarat	632
Chhattisgarh	258
Karnataka	232
Rajasthan	212
Odisha	204
Telangana	184
Andra Pradesh	166
Uttar Pradesh	130
Tamil Nadu	118
Jharkhand	79
Kerala	61
West Bengal	30
Bihar	26
Uttarakhand	25
Himachal Pradesh	20
Jammu & Kashmir	17
Punjab	16
Other States	35
TOTAL	5745

LARGE DAMS WITH ECONOMY SIZE WORLDWIDE (TOP 8)

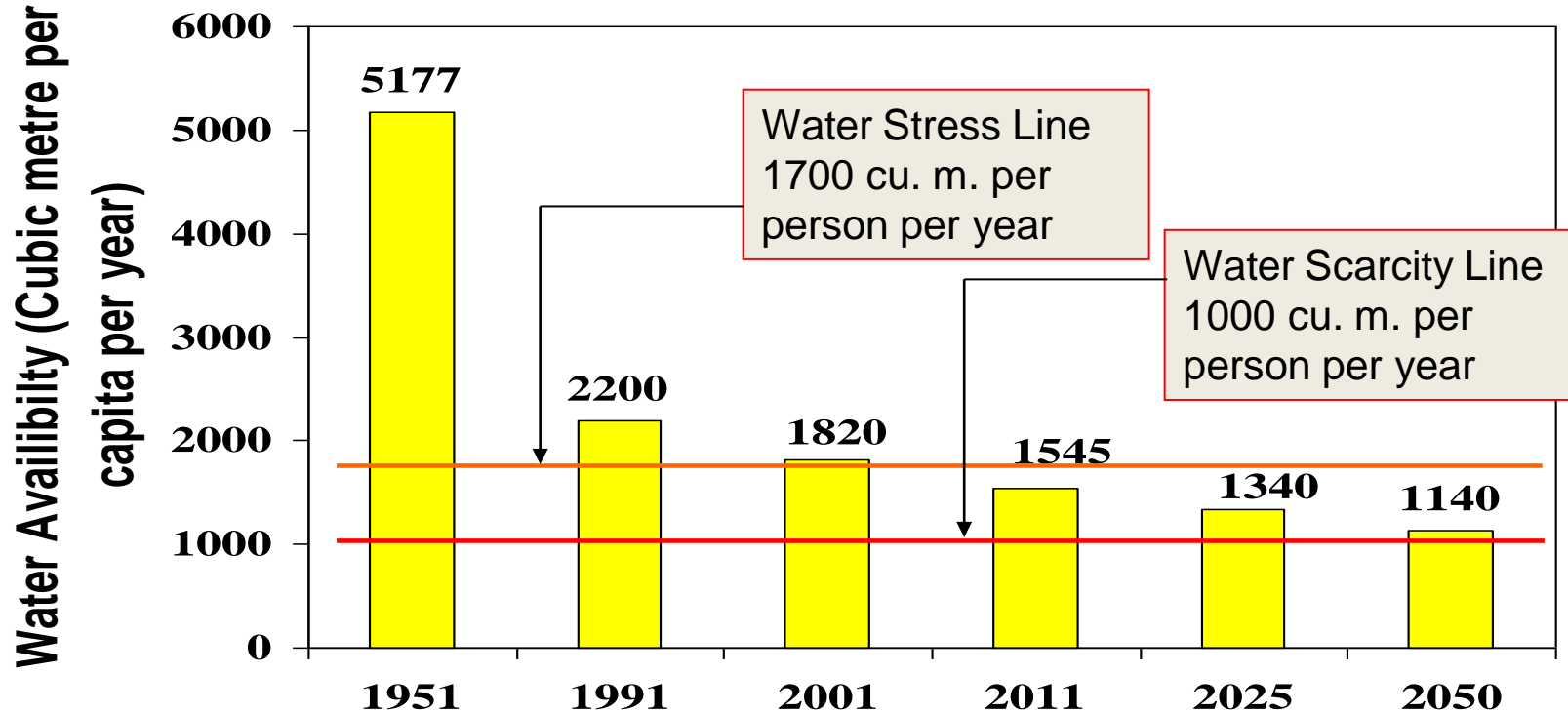


Per Capita Storage



Per Capita Water Availability(National Average)

World's average per capita water availability \approx 7600

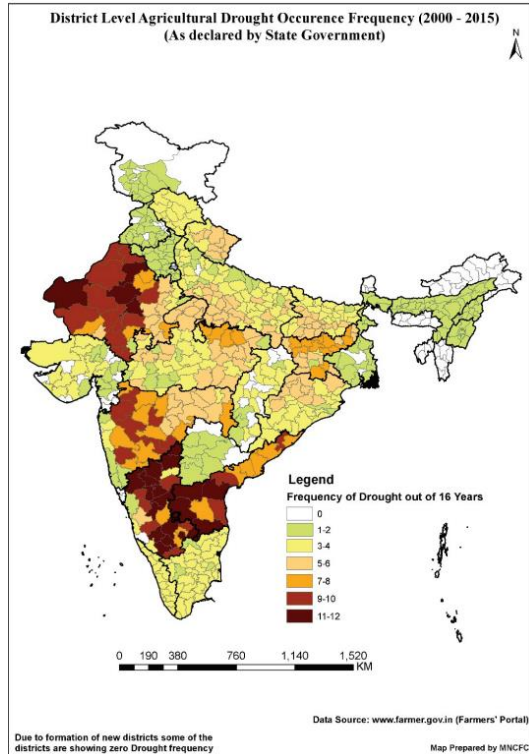


Sector-wise Future Demand Scenario (BCM)

Sector	Probable Water Demand as Projected by NCIWRD (1999)	
	2025	2050
Irrigation	611	807
Domestic	62	111
Industry	67	81
Energy	33	70
Others	70	111
Total	843	1180 *

* Against utilizable water resources of 1121 BCM

Drought prone area



- Every year almost all the reservoirs in India approach minimum live storage levels during May and June.
- The meagre storages available in May and June, about 10% of the live storage capacity, are just adequate for drinking and pre-sowing / nursery preparations.
- Success of Kharif and Rabi irrigation depends upon inflows during June – October period.
- The successive droughts worsens the situation leading to famines.

68% of cropped area is vulnerable to drought

33% - Chronically drought-prone

35% - Drought prone

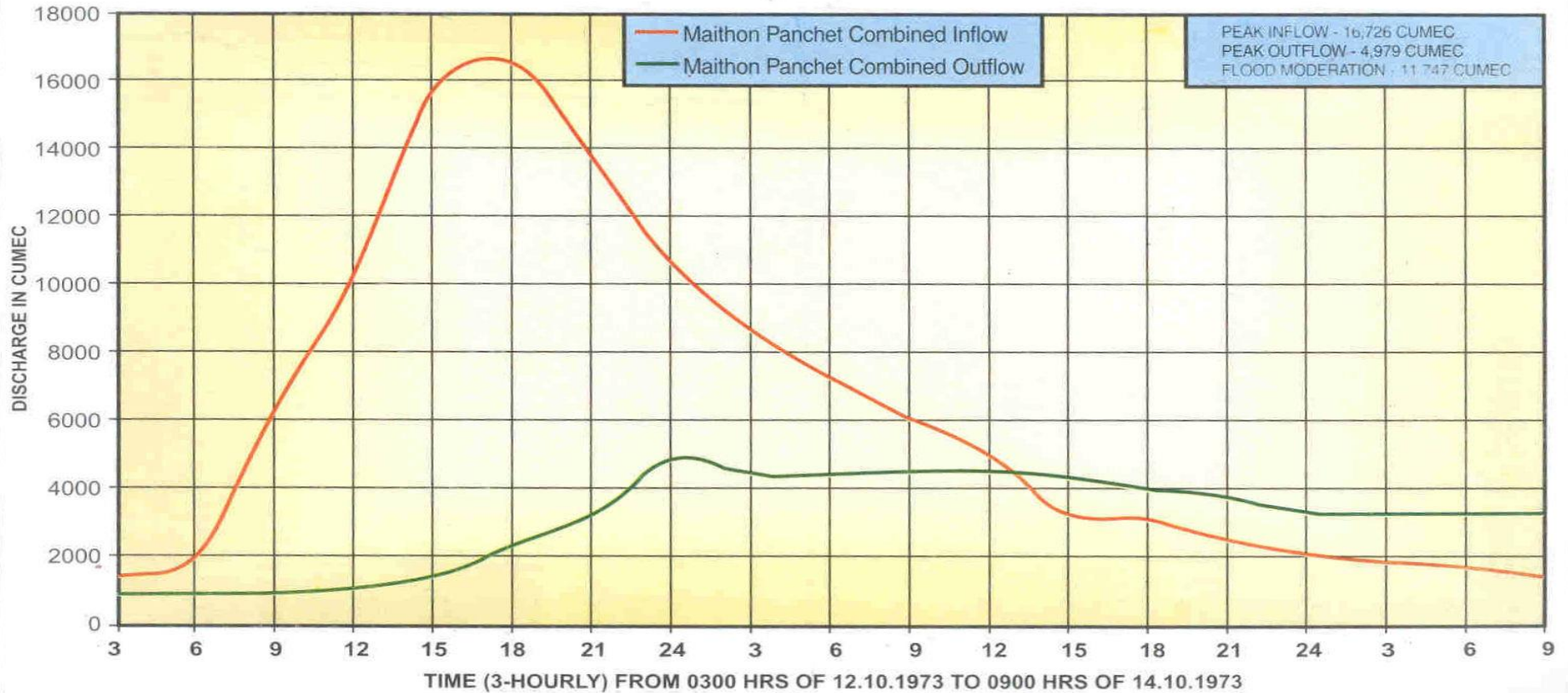
Flood Prone Area



As per National Flood Commission, around 40 Million Hectare area is flood prone in India.

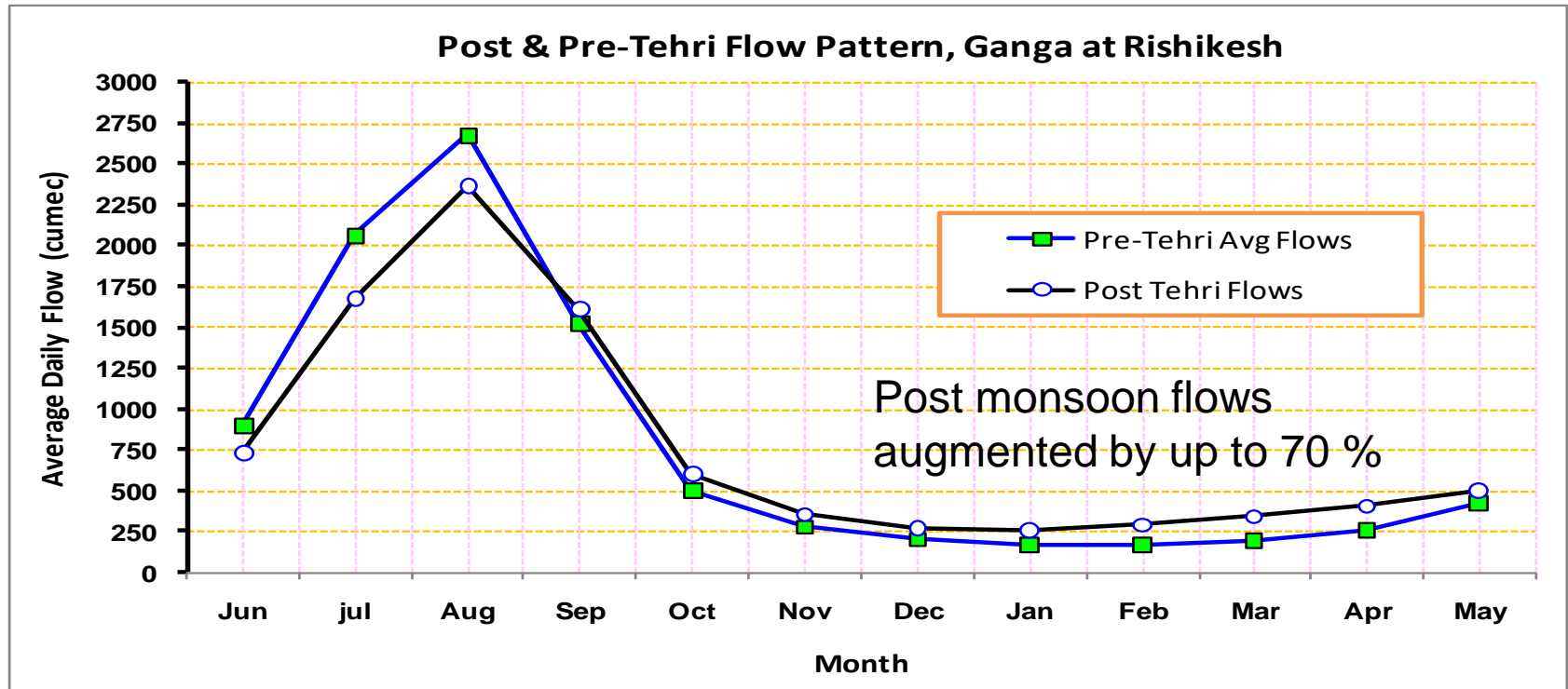
Flood Moderation in DVC System

FLOOD MODERATION OF 1973 MAJOR FLOOD

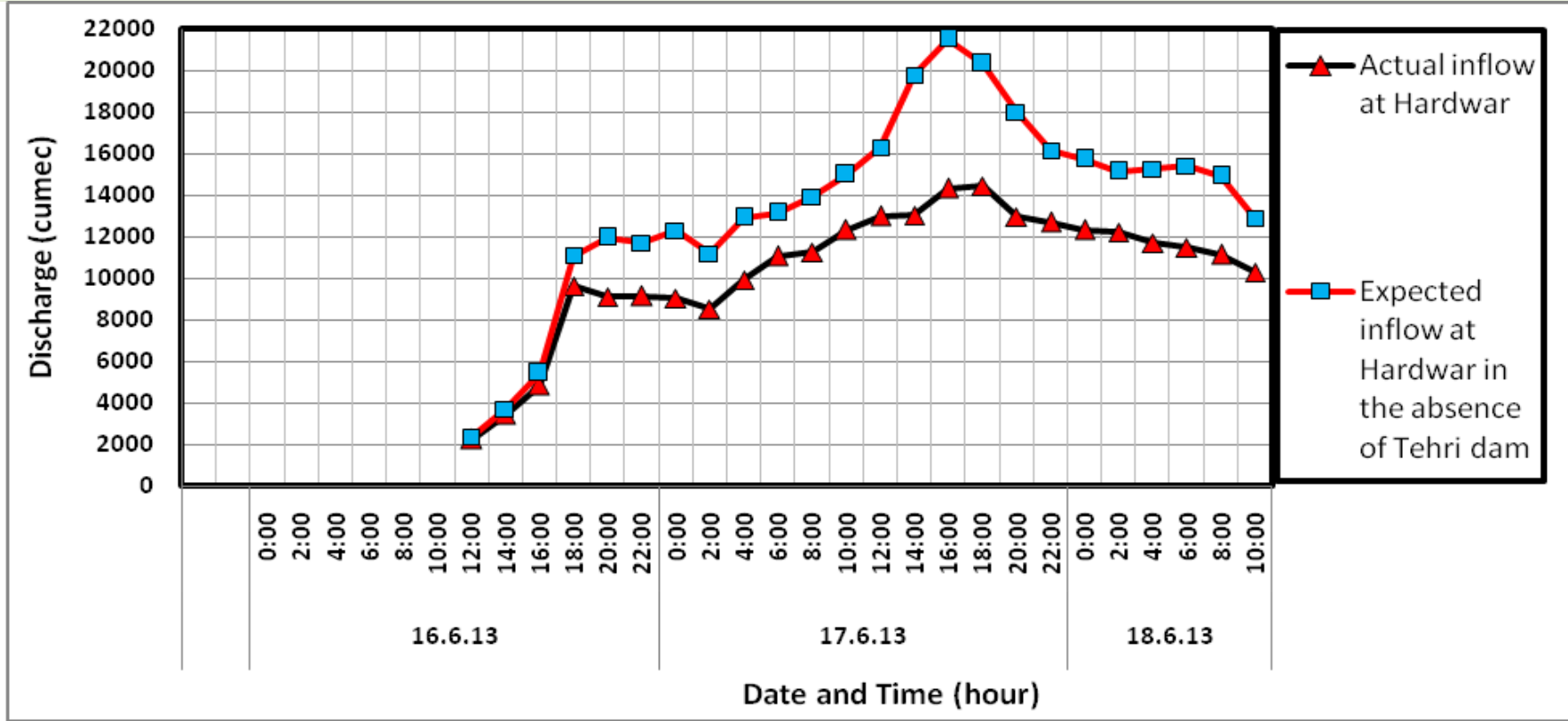


Pre and Post Tehri flow pattern at Rishikesh

Tehri dam commissioned in July 2006, Multipurpose project (3.54 BCM Gross, 2.615 BCM live storage, provision of 2.70 lakh ha additional irrigation, stabilization of 6.04 lakh ha command in U.P., Drinking water 162 MGD to Delhi, 108 MGD to U.P., 1000 MW power



Flood mitigation by Tehri dam during 2013 flood



Tehri dam mitigated flood peak by 7000 cumec and saved Rishikesh and Haridwar from flood devastation

Comparison

Key Benefits	Large Storage	Small Storage	ArRe/RWH
Flood Moderation	Yes	Little or none	None
Spatial variability	Yes	Little or none	None
Temporal Variability	Yes	Little or none	Little
Cost per unit storage	Medium	High/ Medium	Low
Land per unit storage	Moderate	High/ Moderate	Low
Evaporation Loss (%)	Low	High	--
Irrigation benefits	2 or 3 crop	1 crop	--
Hydropower	Yes	No	None
Drought Resilience	High	Little	Little
Support for e-flows	Yes	Little	None
Infrastructure & employment	Yes	Little	None
Navigation	Yes	None	None
Recreation/ fisheries	Yes	Little	None
Life	100-200 years	10-50 years	--

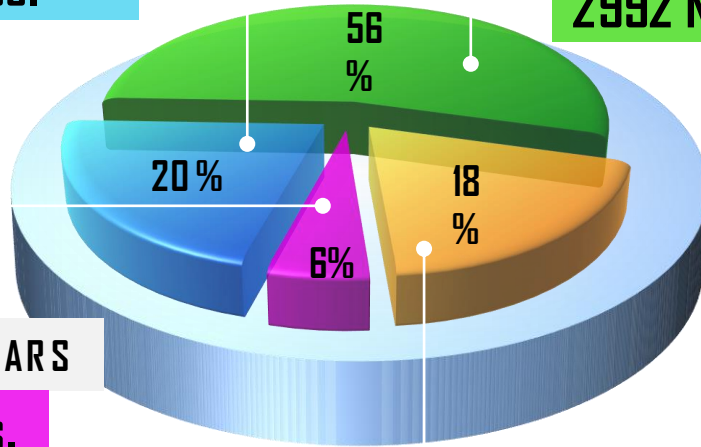
AGE OF INDIAN LARGE DAMS

< 25 YEARS

1083 Nos.

25 To 50
YEARS

2992 Nos.



> 100 YEARS

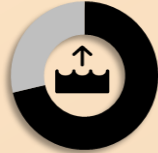
293 Nos.

50 To 100
YEARS

973



**STRUCTURAL
MEASURES**



**HYDROLOGIC
SAFETY**



**HYDRO -
MECHANICAL**



**SEEPAGE
REDUCTION**



**STRUCTURAL
STABILITY**



**BASIC
FACILITIES**

**NON-STRUCTURAL
MEASURES**



**DAM BREAK
ANALYSES &
INUNDATION
MAPS**



**EMERGENCY
ACTION PLANS**



**O&M
MANUALS**



**INSTRUMENTATION
& MONITORING**



**DAM HEALTH &
REHABILITATION
MONITORING**



**SEISMIC HAZARD
ANALYSIS
INFORMATION
SYSTEM**

Climate Change - Implications on WR



Decline in the glaciers in the Himalayas



Increased drought & flood events – same amount of rainfall in shorter duration



Increased saline intrusion of coastal & island aquifers due to rising sea levels



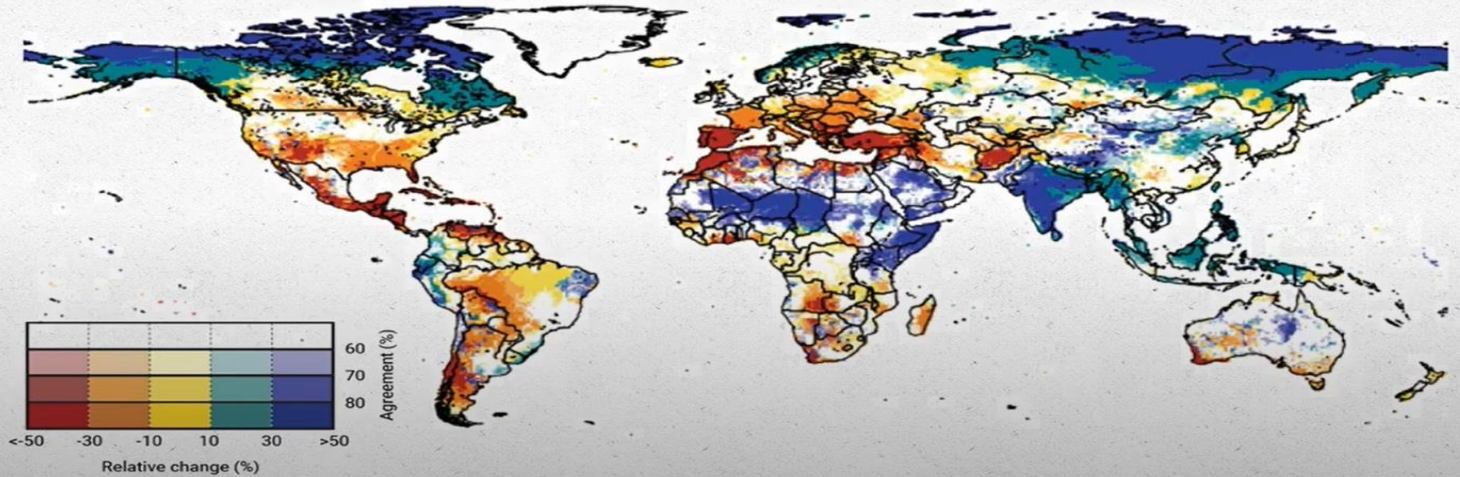
Impact on Water Quality

Climate Change – Trends in Water Availability

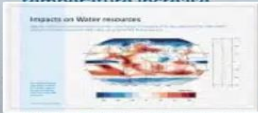
Impacts on Water resources

Figure 8 Climate change scenario trends in water availability

This figure depicts the relative change in annual discharge at 2°C temperature increased with present day (RCP 8.5)



Note: This figure depicts the relative change in annual discharge at 2°C temperature increase



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Ref: The United Nations World Water Development Report 2020

**thank
you...**

Aim at providing water...

- **of the right quality.**
- **in the right quantity.**
- **at the right place.**
- **at the right time.**
- **at the right price.**