# Water for Peace

Dr. M.G.R.
EDUCATIONAL AND RESEARCH INSTITUTE
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## *Opportunities and Challenges in Sustainable Water use and management*

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Water is Nectar of Life

- Life requires water to exist on all planets.
- One can survive without Electricity & Food for weeks, but can't survive without water

## Where do we go ?

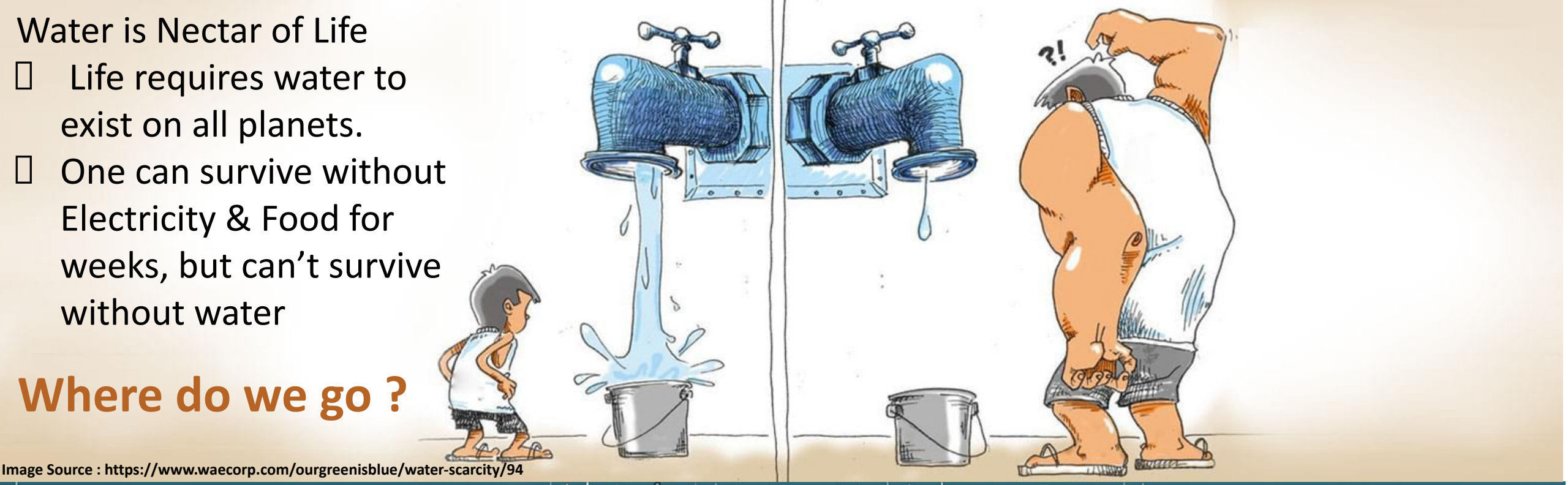
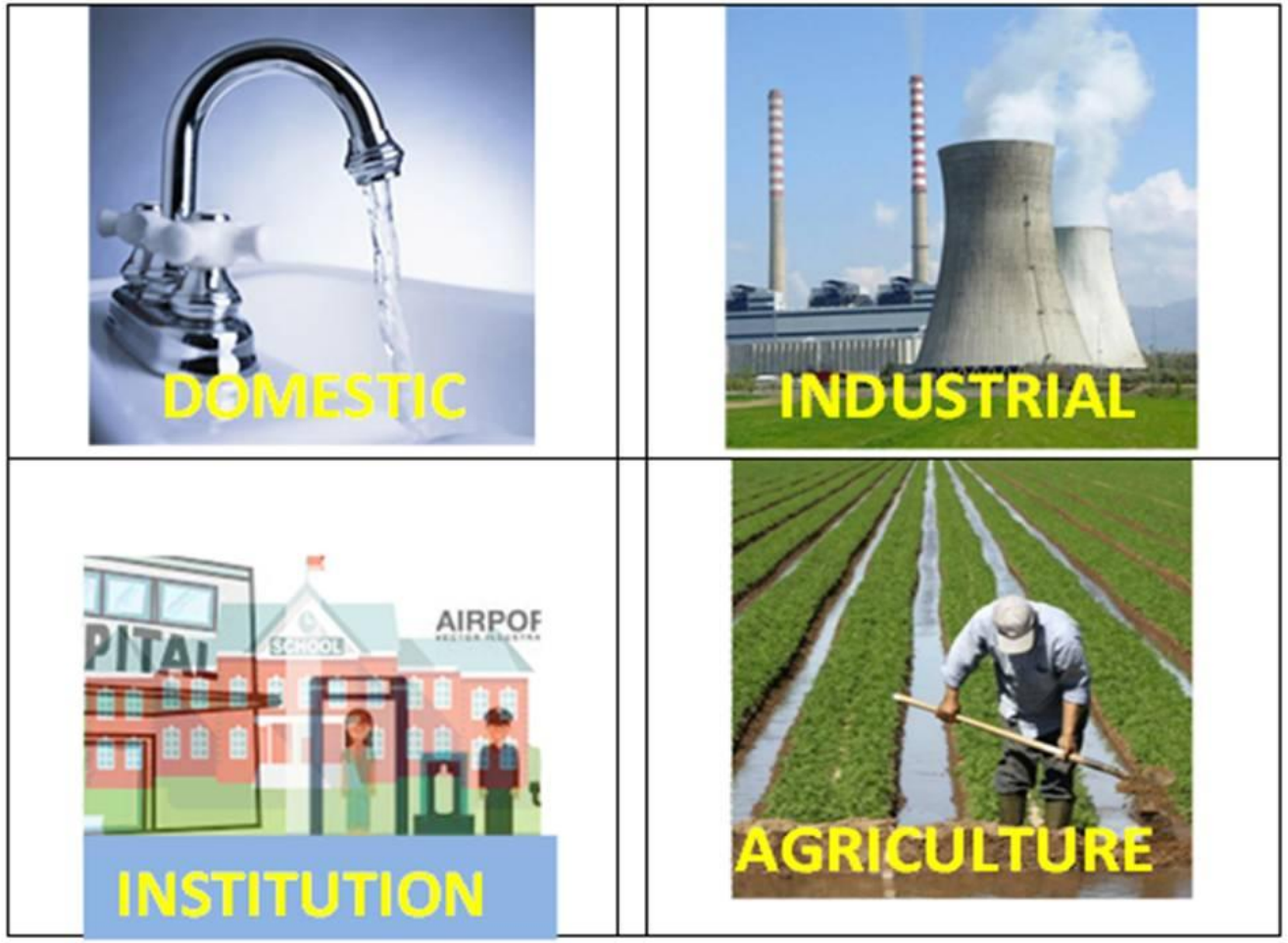


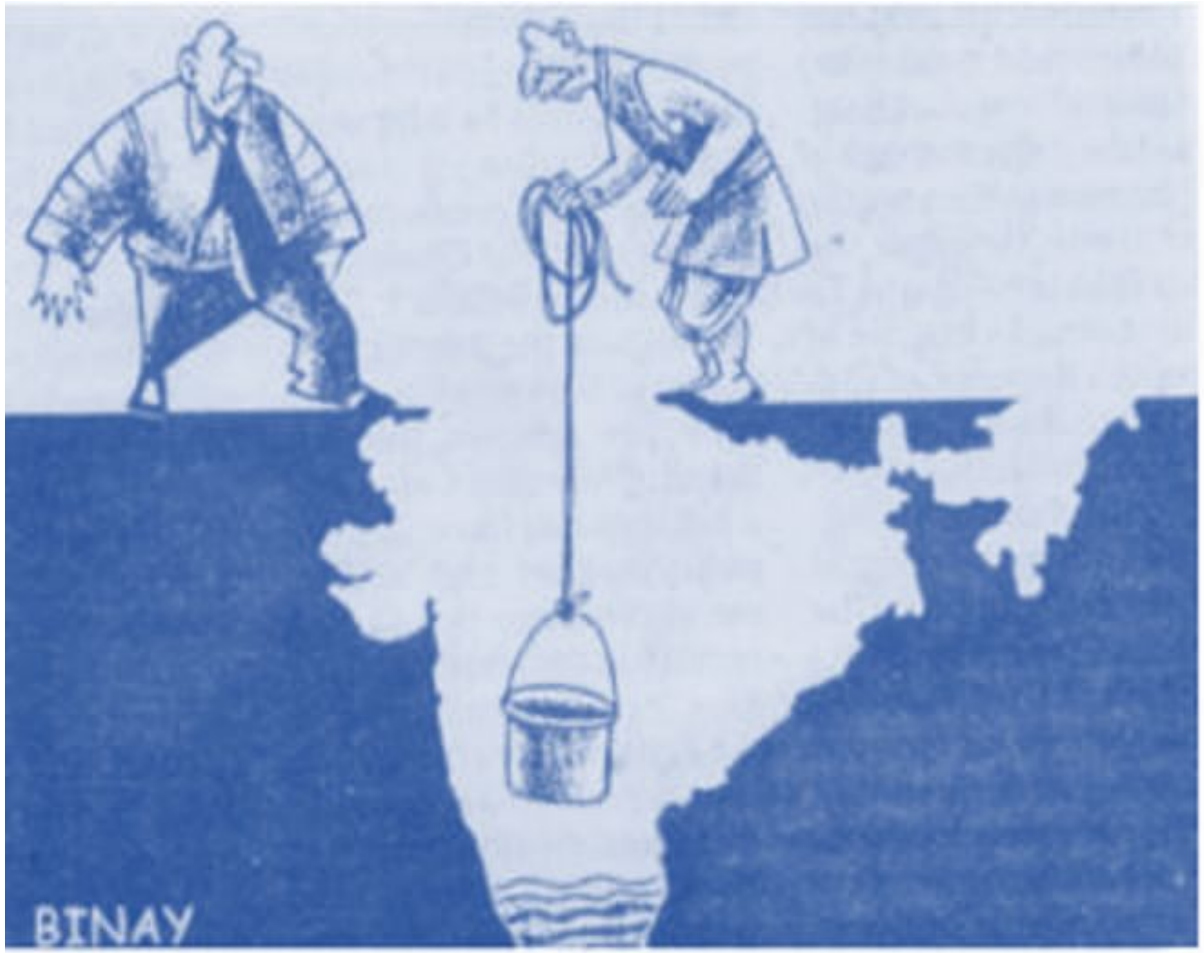

Image Source : https://www.waecorp.com/ourgreenisblue/water-scarcity/94

Image Source : Onkarnath Bhattacharya


- India's water table is declining across most regions.
- Groundwater is contaminated with toxic elements like fluoride, arsenic, mercury, and uranium.
- Major reservoirs in India have fallen to 21% of the average levels of the last decade.
- Hundreds of small and seasonal rivers are disappearing permanently.
- Perennial rivers are stagnating, affecting water availability.
- According to NITI Aayog's water quality index, India ranks 120th among 122 countries.

# Water Scarcity , Demand & Use



40 litres of waters to make a slice of bread

9 litres of water per minute going down the drain

1000 litres of water to produce 1 cup of milk

3400 litres of water to produce 1 kg of rice

2,700 litres for a cotton t-shirt

135 litres water to produce 1 egg

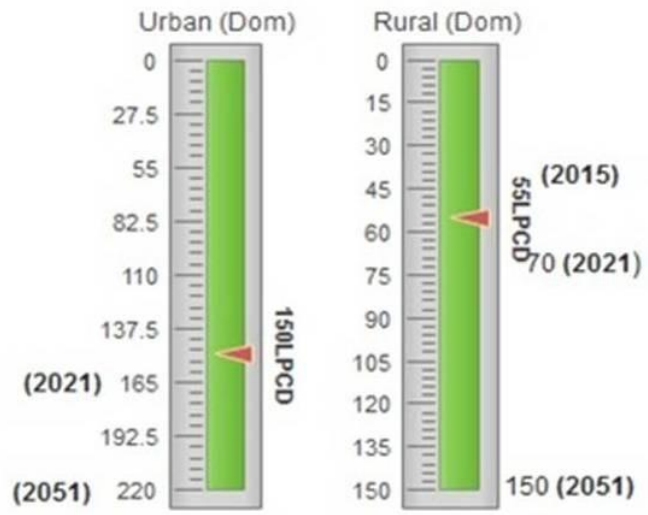
To produce one kg of beef 15000 litres of water is needed.

8000 litres of water to produce a pair of jeans

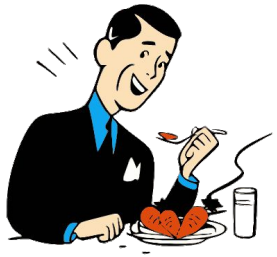
70 litres of water to grow a single apple

35 litres water to produce 1 cup of tea

140 litres water to produce 1 cup of coffee




It takes about 454,000 litres of water to manufacture a small car.



So a person approximately requires 5500 litres of water per day.

## Institutional Water Requirements


Source: https://nwa.mah.nic.in

## Industrial Water Requirements

**Water Consumption for Different Kinds of Manufacturing Industrial Units**

40 Kilolitres Water
Per Vehicle Manufactured

122-170 Kilolitres Water
Per Kilolitre Alcohol

80-200 Kilolitres Water
Per Ton Fertilizer

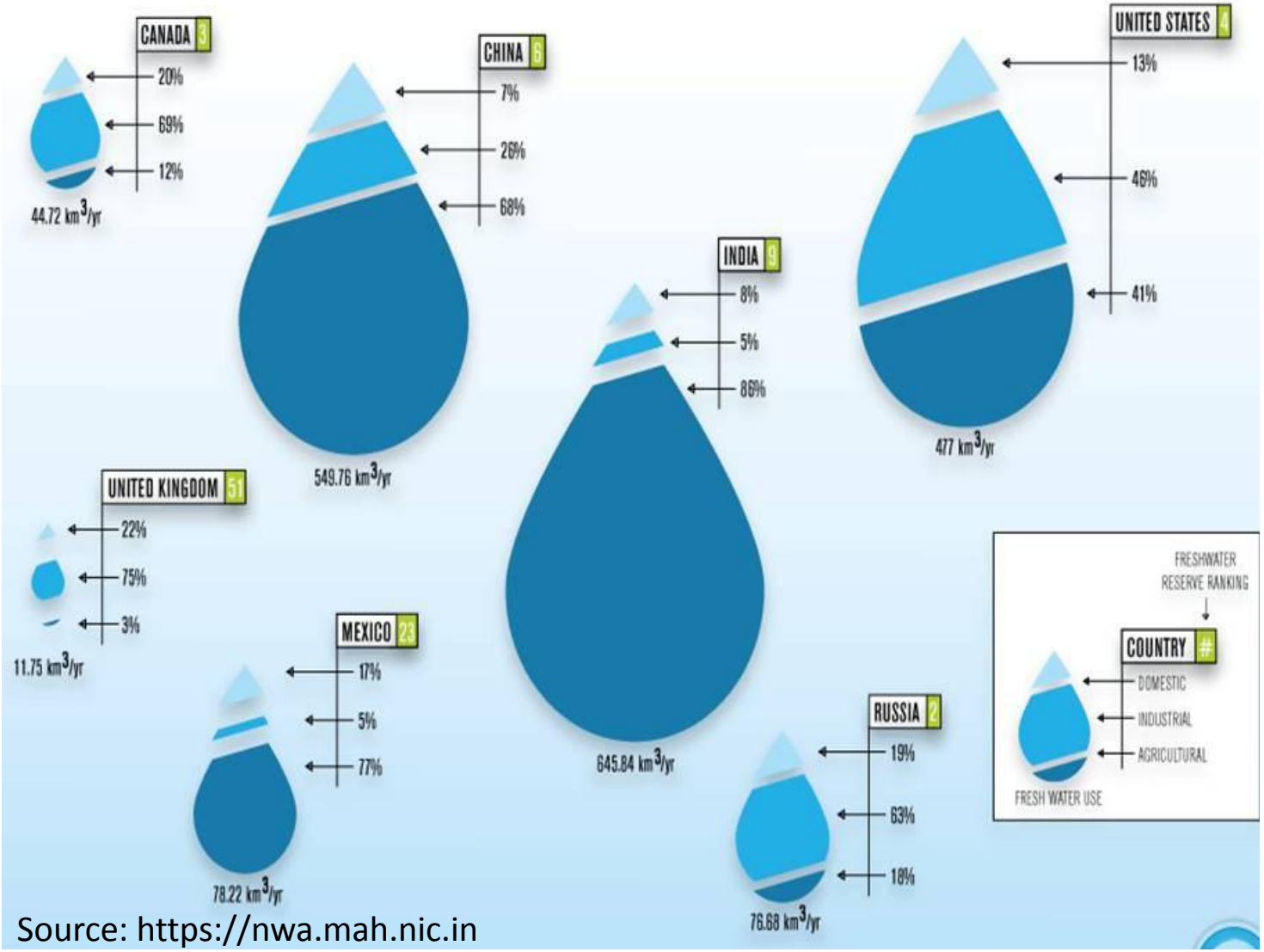
200-400 Kilolitres Water
Per Ton Paper

200-500 Kilolitres Water
Per Ton Steel

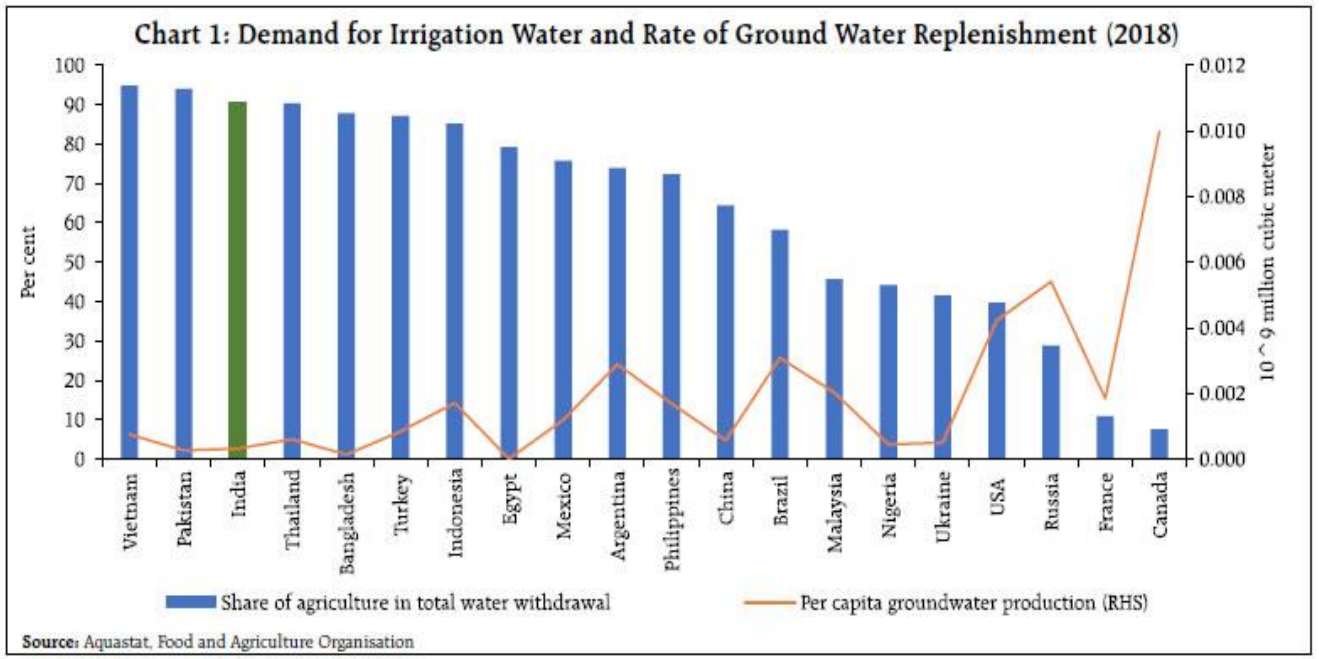
8-14 Kilolitres Water
Per 100 Kg Textile

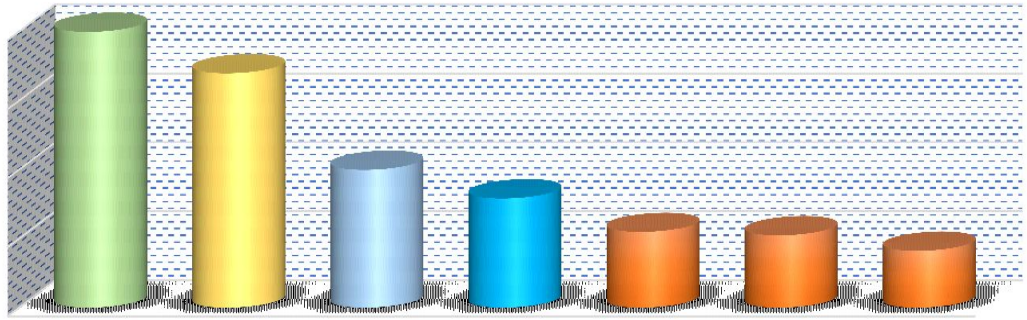
# Water Requirement for Agriculture

| Factors | Water Requirement | |
|---|---|---|
| | More Water | Less Water |
| Type of Crop |  Rice |  Bajra |
| Type of Soil |  Laterite Soil |  Alluvial Soil |
| Climatic Factors |  Hot and dry season |  Rainy Season |
| Type of Irrigation |  Flood Irrigation |  Drip Irrigation |
| Topography |  High slope farms |  Farms with flat terrain |

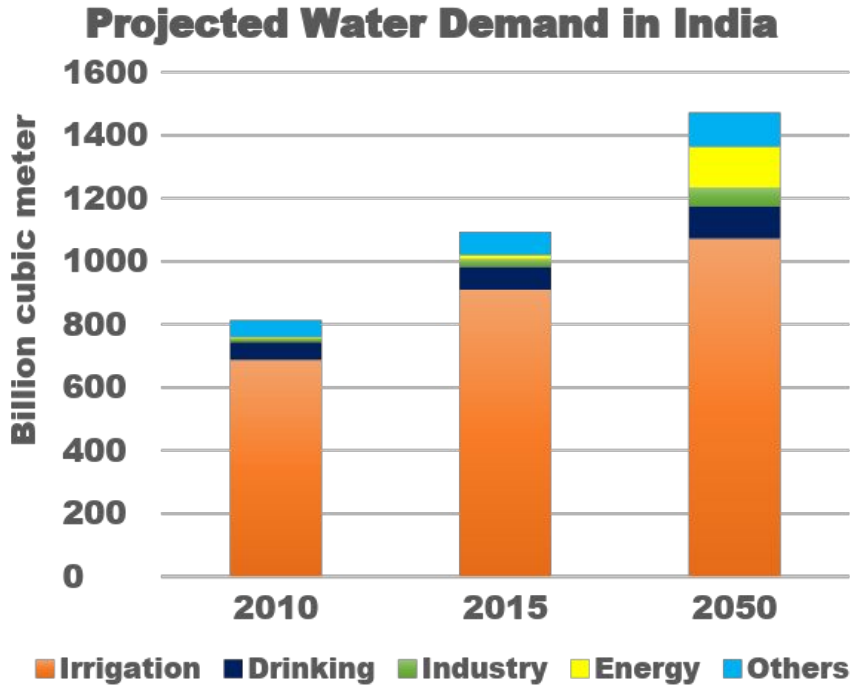


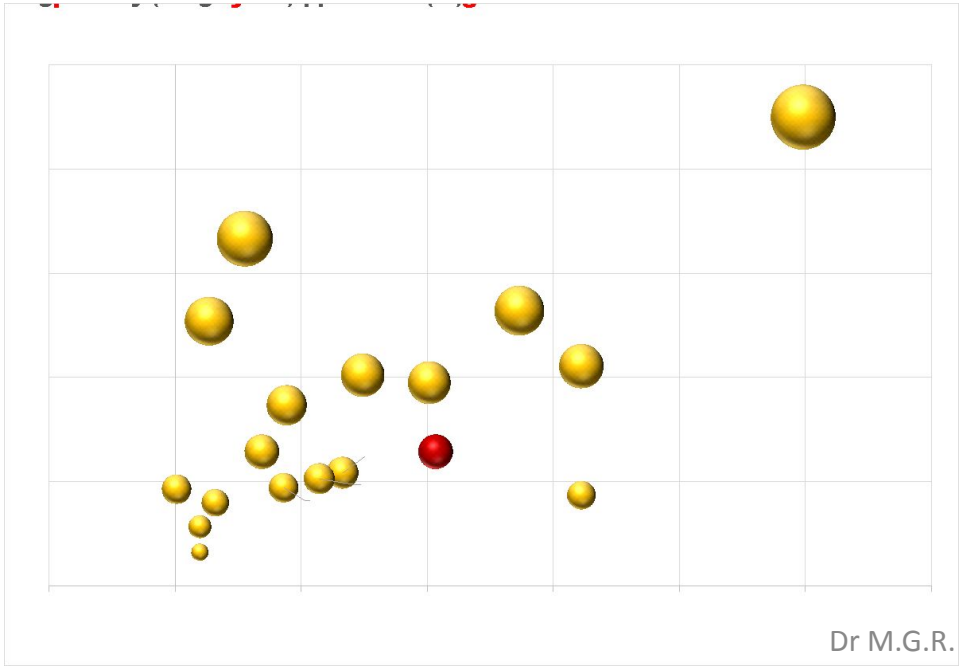

Source: https://nwa.mah.nic.in

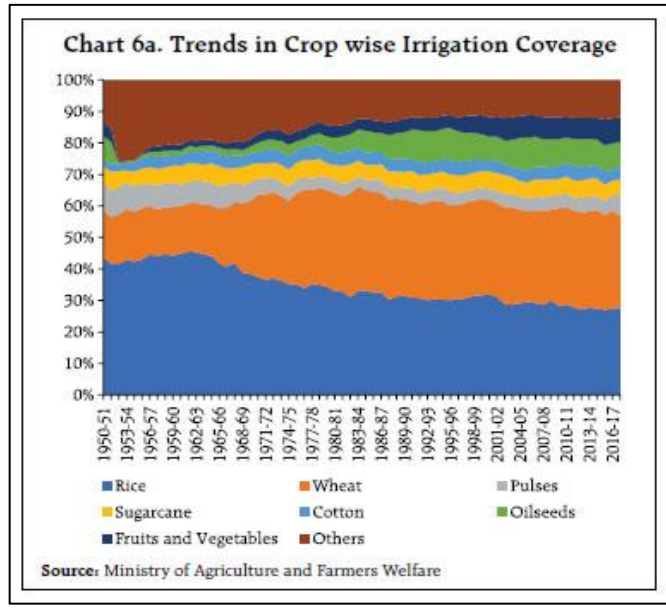


Source : https://www.rbi.org.in/Scripts/BS_ViewBulletin.aspx?Id=21004

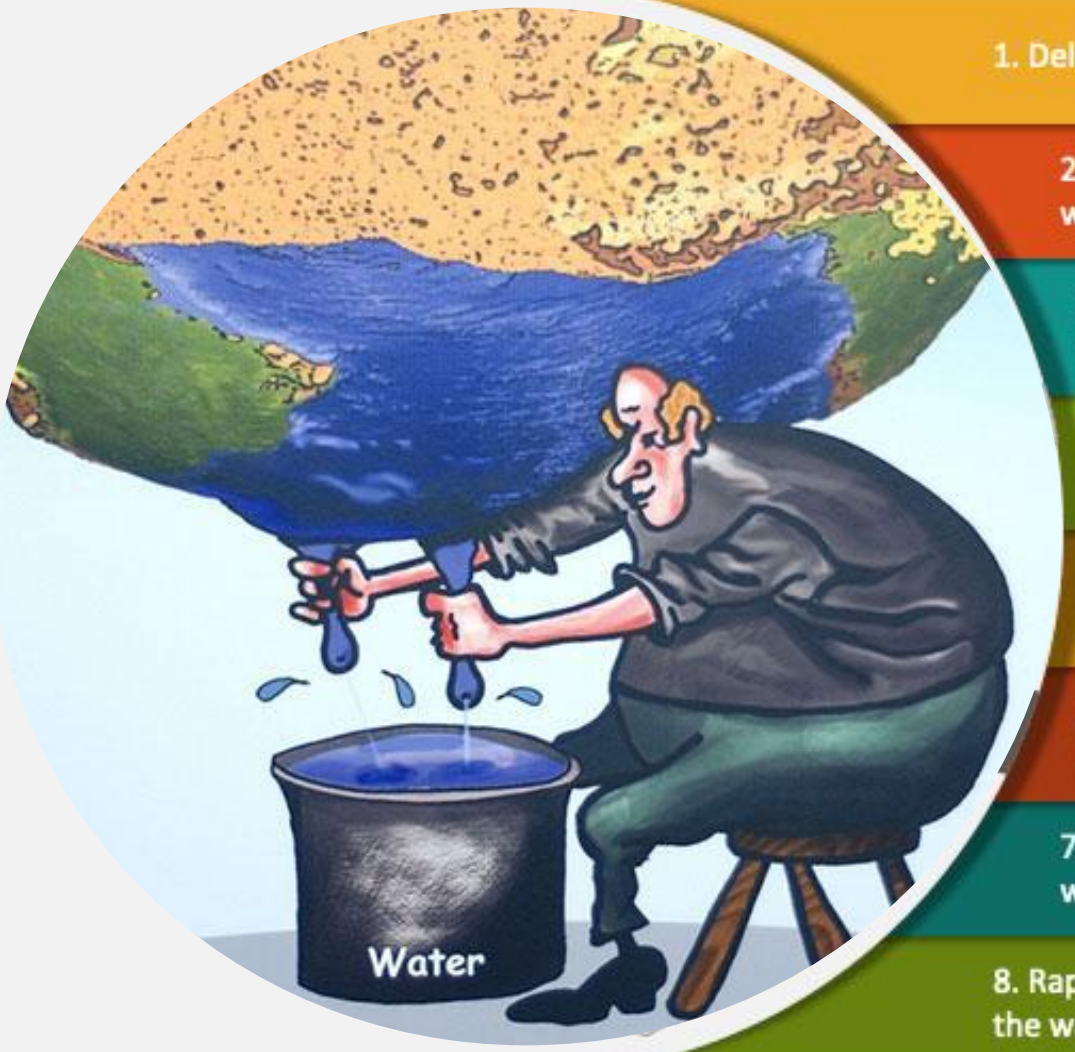


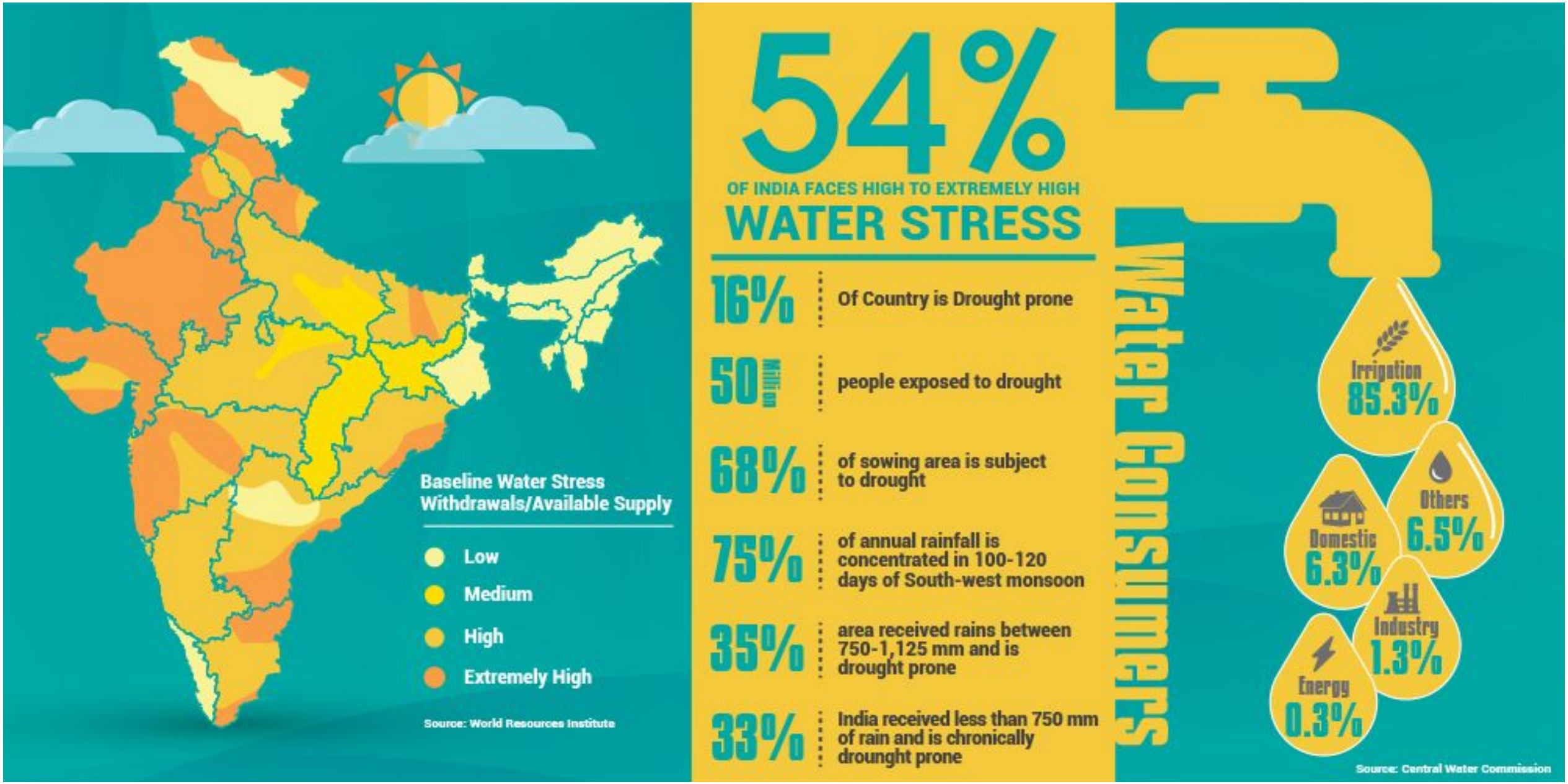


# WATER CRISIS IN INDIA

## Major Reasons of the Water Crisis in India

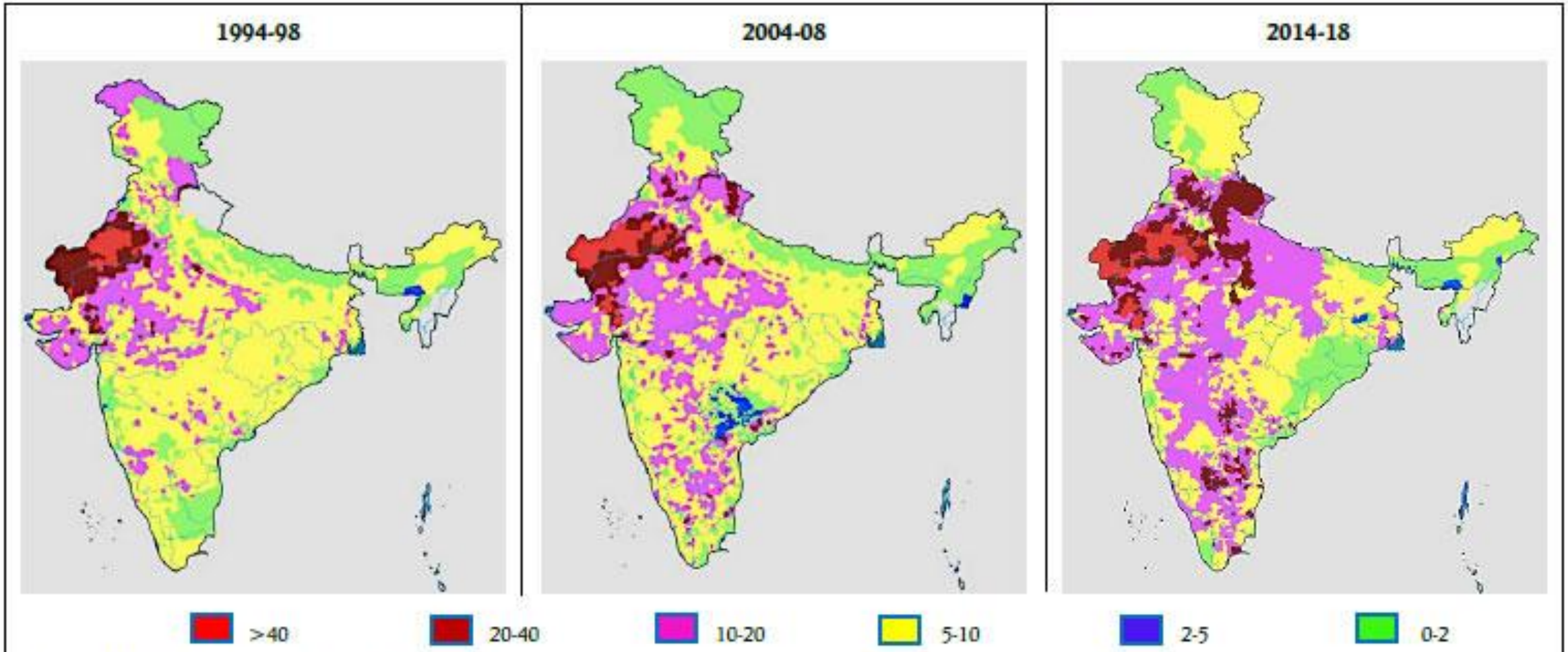



1. Delay in monsoon and change in pattern
2. Mismanagement in the demand and supply of water requirements
3. Careless and overexploitation of naturally available water resources
4. Unprecedented heat waves, which can become more persistent with climate change.
5. Reduced pre-monsoon rain due to weather variation
6. Depreciation in the water reservoir levels is also a cause of concern
7. Change in land use patterns has a significant impact on water availability
8. Rapid deforestation is also one of the important factors in the water crisis.


54%
OF INDIA FACES HIGH TO EXTREMELY HIGH
WATER STRESS
16% Of Country is Drought prone
50 Million people exposed to drought
68% of sowing area is subject to drought
75% of annual rainfall is concentrated in 100-120 days of South-west monsoon
35% area received rains between 750-1,125 mm and is drought prone
33% India received less than 750 mm of rain and is chronically drounght prone
Baseline Water Stress
Withdrawals/Available Supply
Low
Medium
High
Extremely High
Source: World Resources Institute
Water Consumers
Irrigation 85.3%
Domestic 6.3%
Others 6.5%
Industry 1.3%
Energy 0.3%
Source: Central Water Commission

## Chart 3: Status of Groundwater Level in India

(Depth of water table below ground level in meter)

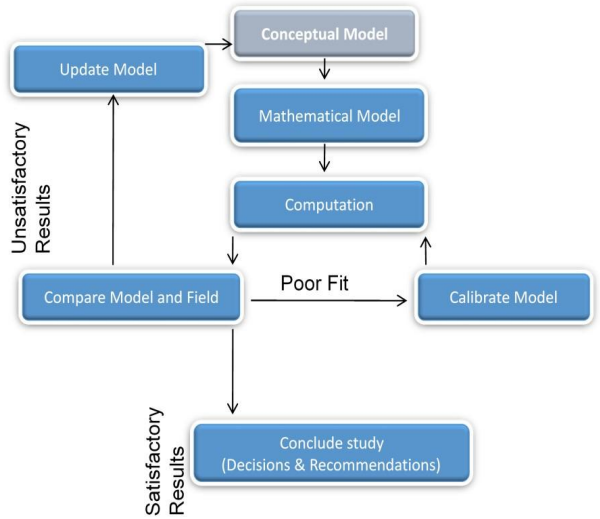


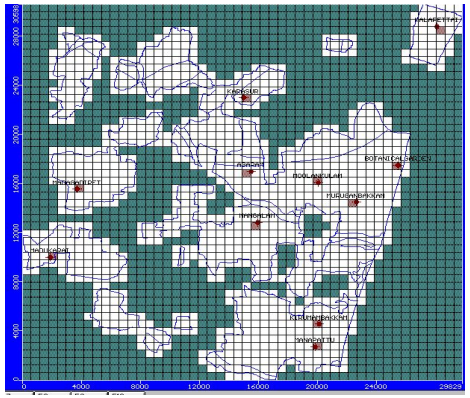

**Source:** India-WRIS, Ministry of Jal Shakti.

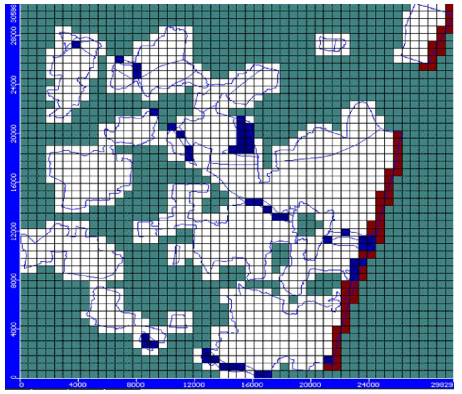
# CASE STUDIES CARRIED OUT IN MGR & INDIA

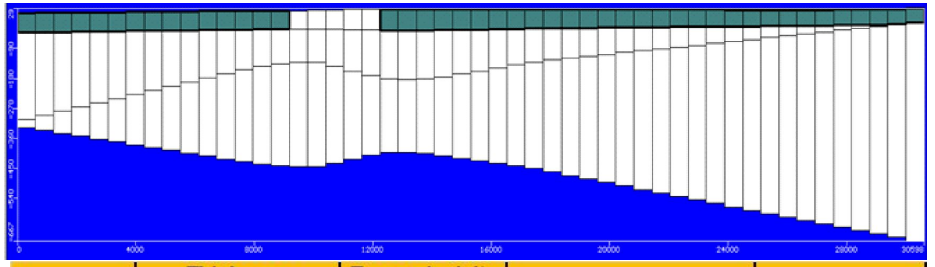
# Sea Water Intrusion In Pondicherry East Coast of India: A Scientific Modelling Approach

- To simulate and predict the Pondicherry coastal aquifer and howfar the seawater is intruded in the study region for the prescribed study period



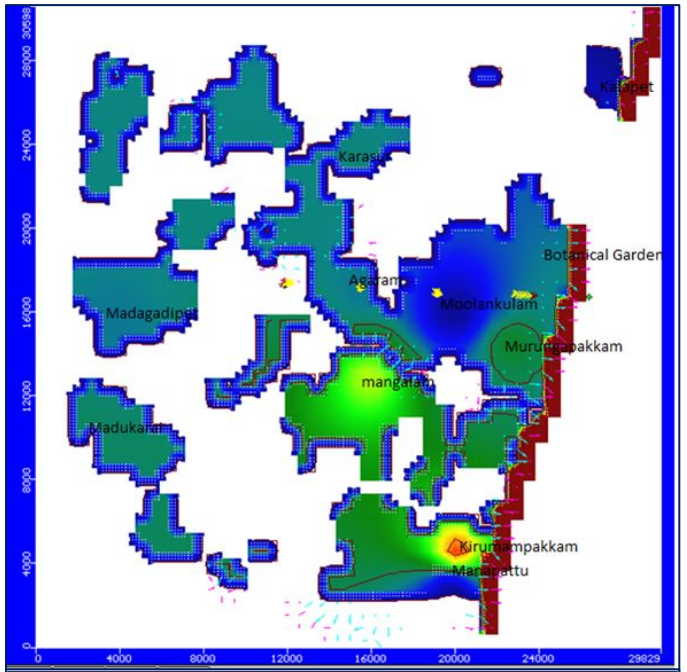



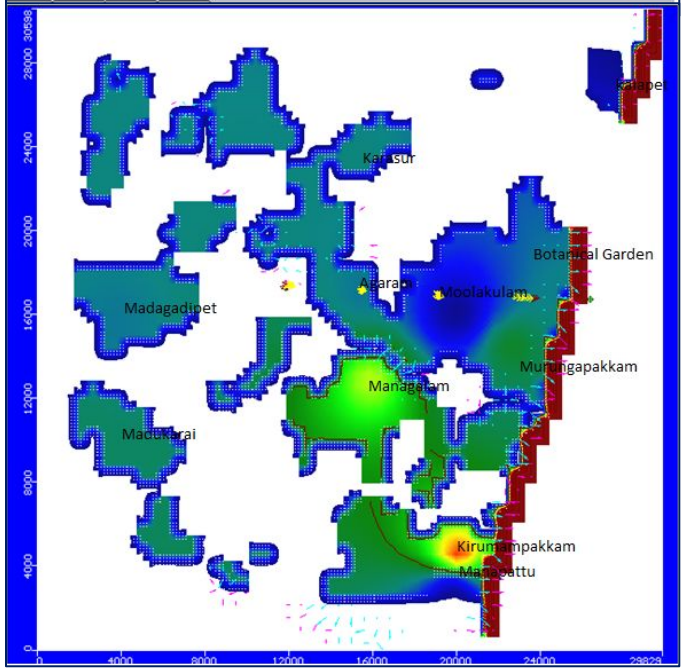




| Aquifer | Thickness m | Transmissivity $m^2$/day | Storativity | Specific yield |
|---|---|---|---|---|
| Alluvial | 5 – 34 | 275 – 770 | - | 6 - 15 % |
| Tertiary | 20 – 245 | 1000 – 2000 | $9.583 \times 10^{-5}$ and $8.9 \times 10^{-4}$ | - |
| Cretaceous | 38 – 92 | 100 – 2000 | $2.93 \times 10^{-5}$ to $1.36 \times 10^{-4}$ | - |

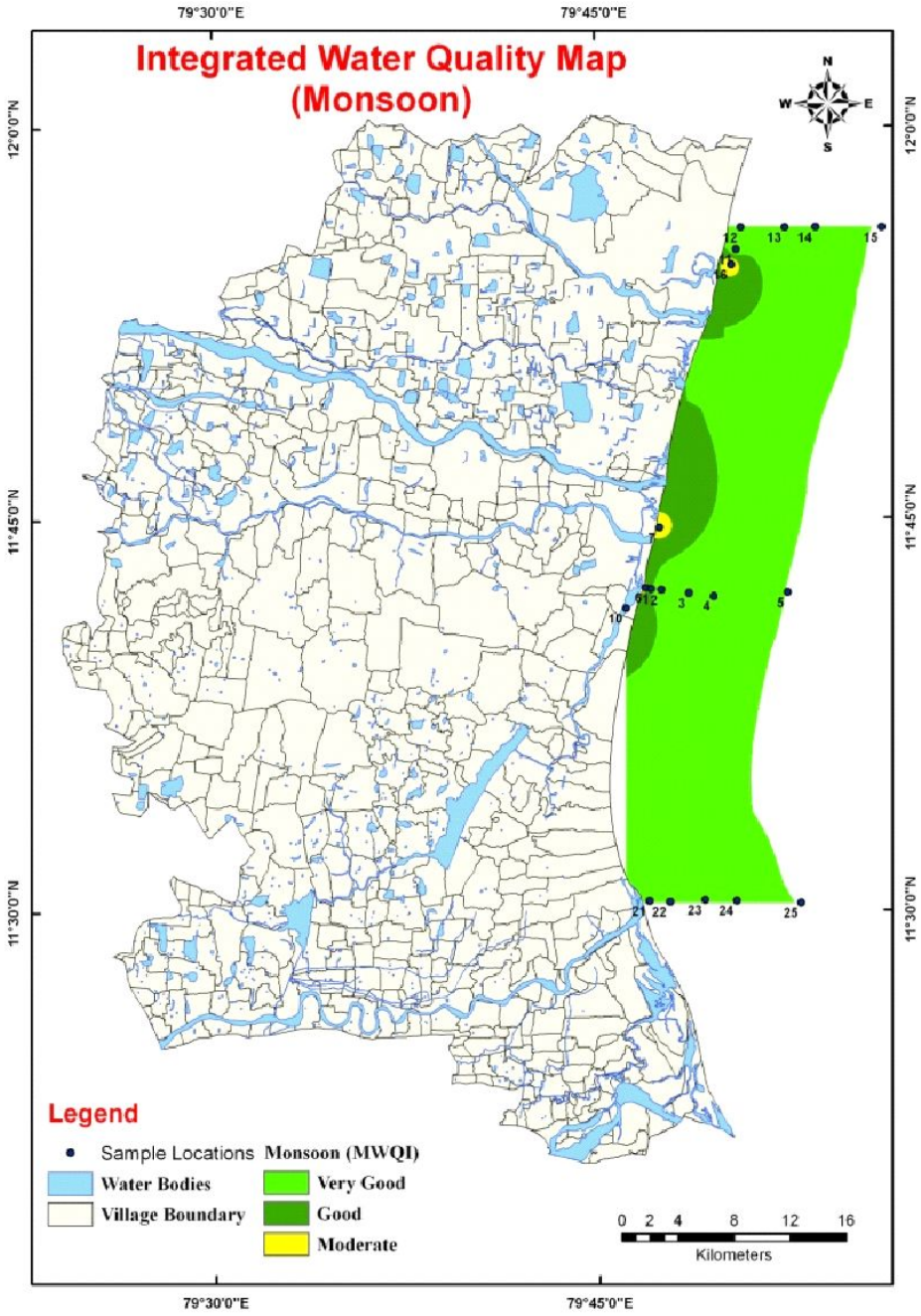
| Sl.No | Well name | X Coordinate | Y coordinate | EC* 1992 | EC* 2006 | EC* 2008 |
|---|---|---|---|---|---|---|
| 1 | Kalapet | 1175050 | 1142599 | 216 | 254 | 590 |
| 2 | Murungapakkam | 1169593 | 1128309 | 1900 | 1900 | 1900 |
| 3 | kirumampakkam | 1167044 | 1118406 | 3420 | 3420 | 3420 |
| 4 | Madukarai | 1148860 | 1123838 | 1658 | 1440 | 1440 |
| 5 | Moolakulam | 1166984 | 1129924 | 242 | 633 | 633 |
| 6 | Manapattu | 1166803 | 1116557 | 295 | 295 | 295 |
| 7 | Karasur | 1161955 | 1136810 | 1548 | 1548 | 1548 |
| 8 | Madagadipet | 1150648 | 1129377 | 1437 | 1437 | 1437 |
| 9 | Agaram | 1162441 | 1130821 | 1437 | 1437 | 1437 |
| 10 | Mangalam | 1162917 | 1126676 | 2880 | 2880 | 1150 |
| 11 | Botanical Garden | 1172419 | 1131334 | 1500 | 1500 | 1500 |




The model results with saltwater intrusion (~ 14 km) along the SW Pondicherry coast.

# Development of Integrated Marine Water Quality Index – A GIS Approach




| Parameter | Standards ($S_n$ & $S_i$) | Weightage (Wn) |
|---|---|---|
| $PO_4$-P (µmol/l) | 0.5 | 0.212 |
| $NO_3$-N (µmol/l) | 1 | 0.106 |
| $NO_2$-N (µmol/l) | 0.2 | 0.532 |
| $NH_4$-N (µmol/l) | 2 | 0.053 |
| DO (ml/l) | 4.5 | 0.024 |
| pH | 7.8 | 0.014 |
| Chl-*a* (mg/m³) | 2 | 0.053 |
| Sea Surface Temperature (°C) | 33 | 0.003 |
| Total Suspended Matter (mg/l) | 80 | 0.001 |

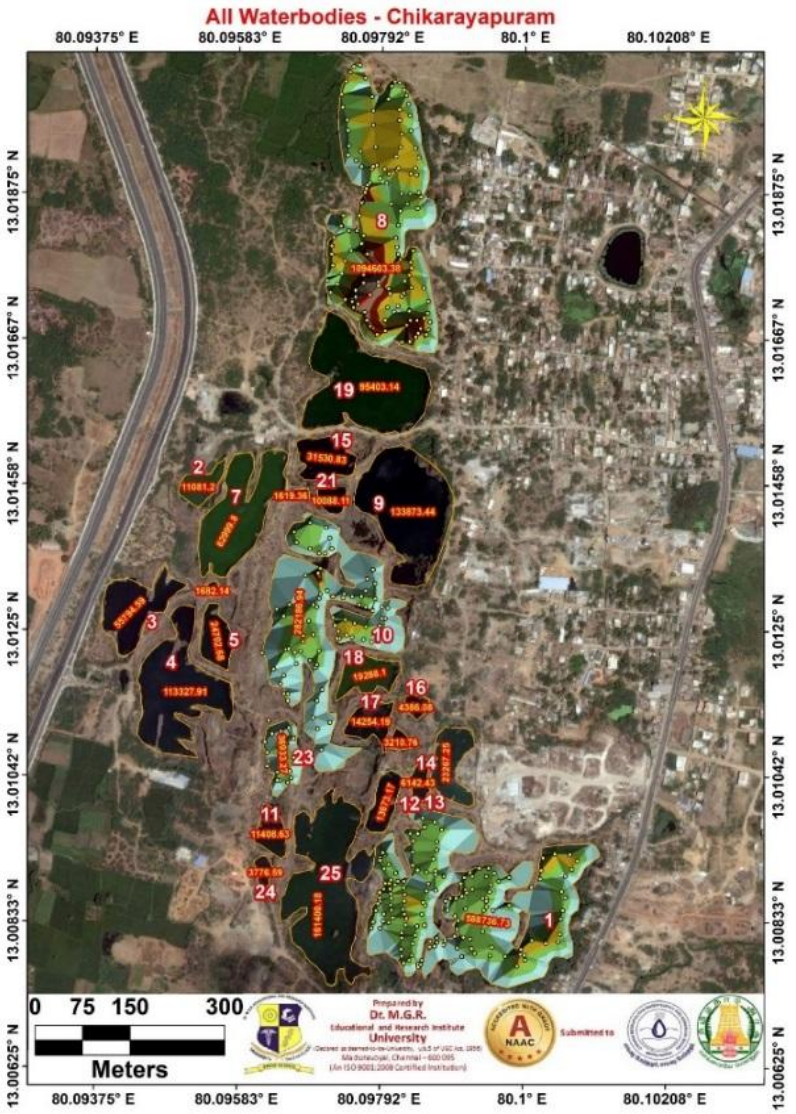
| Class | WQI Value |
|---|---|
| Very Good | < 160 |
| Good | 160-200 |
| Moderate | 200-240 |
| Poor | 240-280 |
| Very Poor | 280-320 |

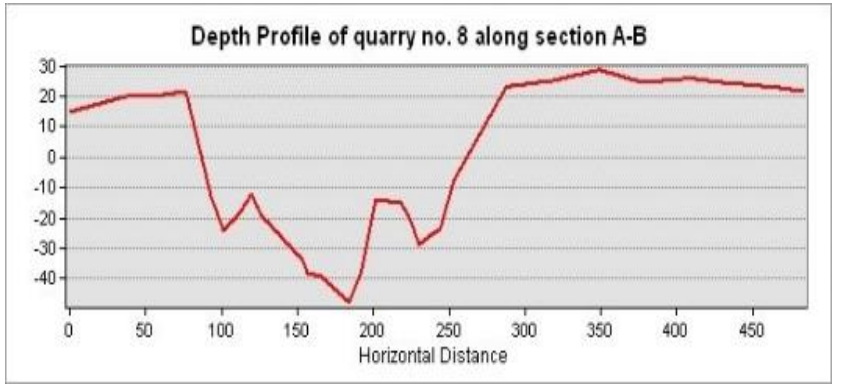
# HYDROGRAPHIC SURVEYS IN CHIKARAYAPURAM, PAMMAL AND TIRUNEERMALAI ABANDONED QUARRIES AND GIS APPLICATIONS FOR WATER RESOURCES CONSERVATION

## AIM AND OBJECTIVE

- To estimate the volume of water available in the abandoned quarries in and around Sikarayapuram, Pammal and Tiruneermalai region.
- To investigate the possibility of converting abandoned quarries as water storage reservoirs in future for water starving Chennai city.

*If the water level is maintained / stored up to 0 meter MSL the estimated volume of storage upon all the combined quarries is* 32,11,971.62 $m^3$

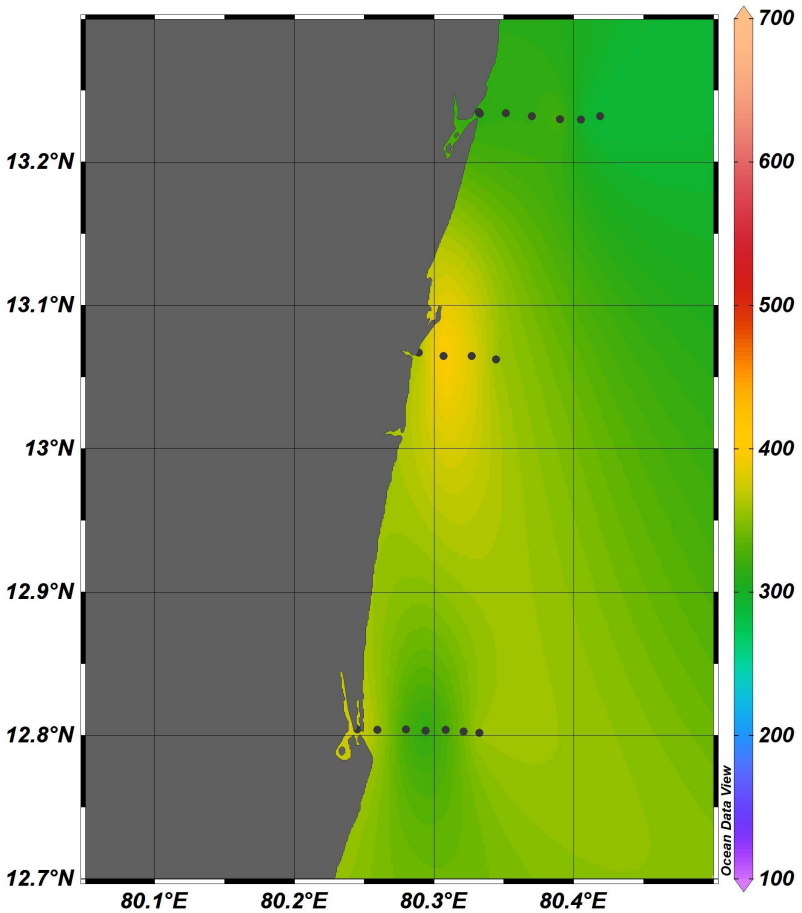



*Upto 5 m of MSL – 50,59,130.64 $m^3$*
*Upto 10m of MSL – 71,0,3941.70 $m^3$*
*Upto 20m of MSL – 1,56,54,703.79 $m^3$*

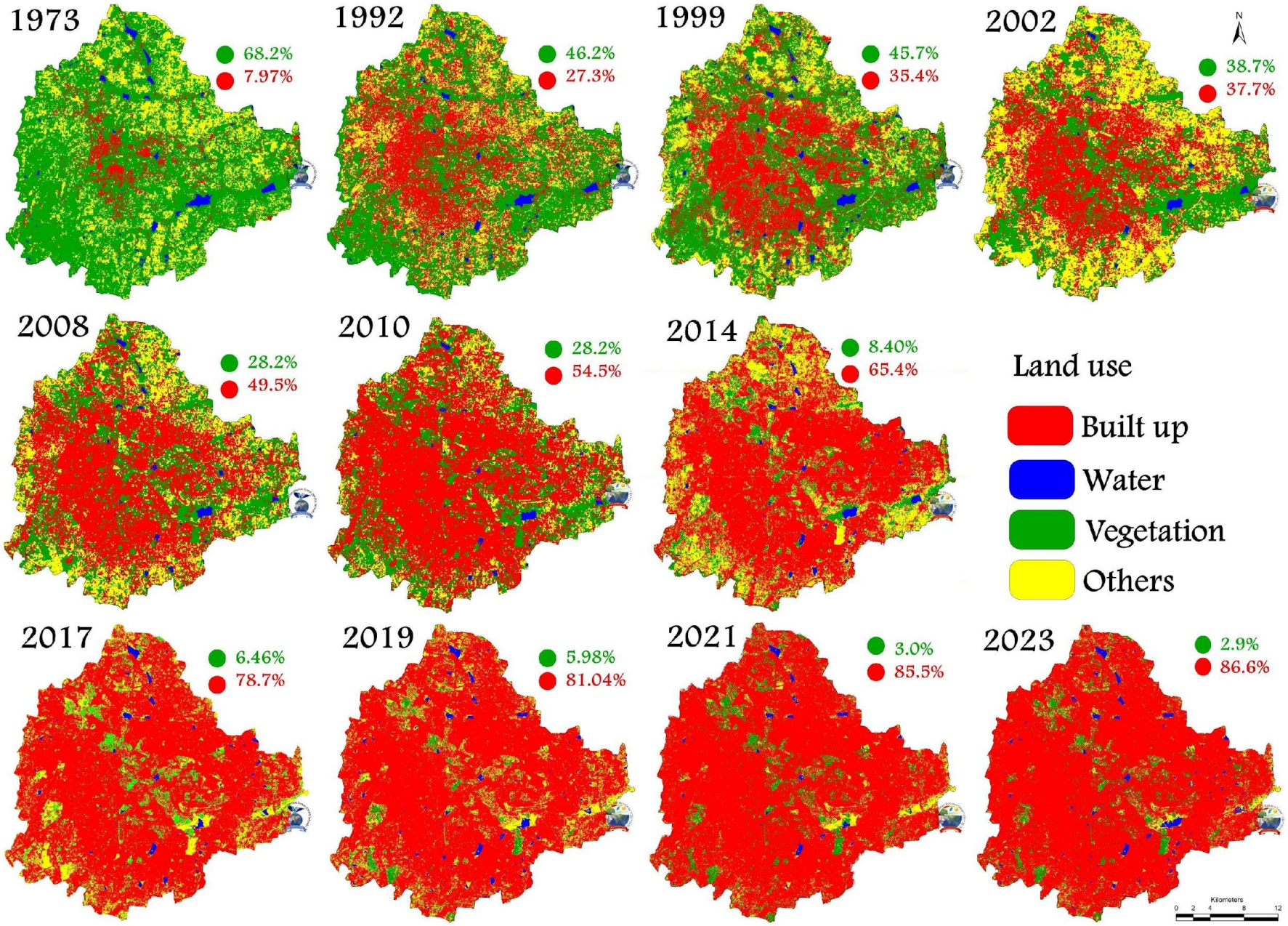
*Since the ground level elevation is close to 23 m from the MSL it is possible to store at least 0.55 TMC of water for water starving Chennai City.*

# Mrine Primary Production studies in Bay of Bengal




- Marıne prımary productıon, prımarıly drıven by phytoplankton, forms the foundation of oceanic food webs and supporting global fisheries. Additionally, it plays a crucial role in regulating Earth's climate by absorbing carbon dioxide and generating oxygen through photosynthesis.
- Average primary production for the Southern Bay of Bengal for the post monsoon season (February, 2023) is estimated as 339.08 mgC/$m^2$/d.
- OC4 algorithm in OCM-3 data is ~72 % (overall) accurate with reference to in-situ measurements.

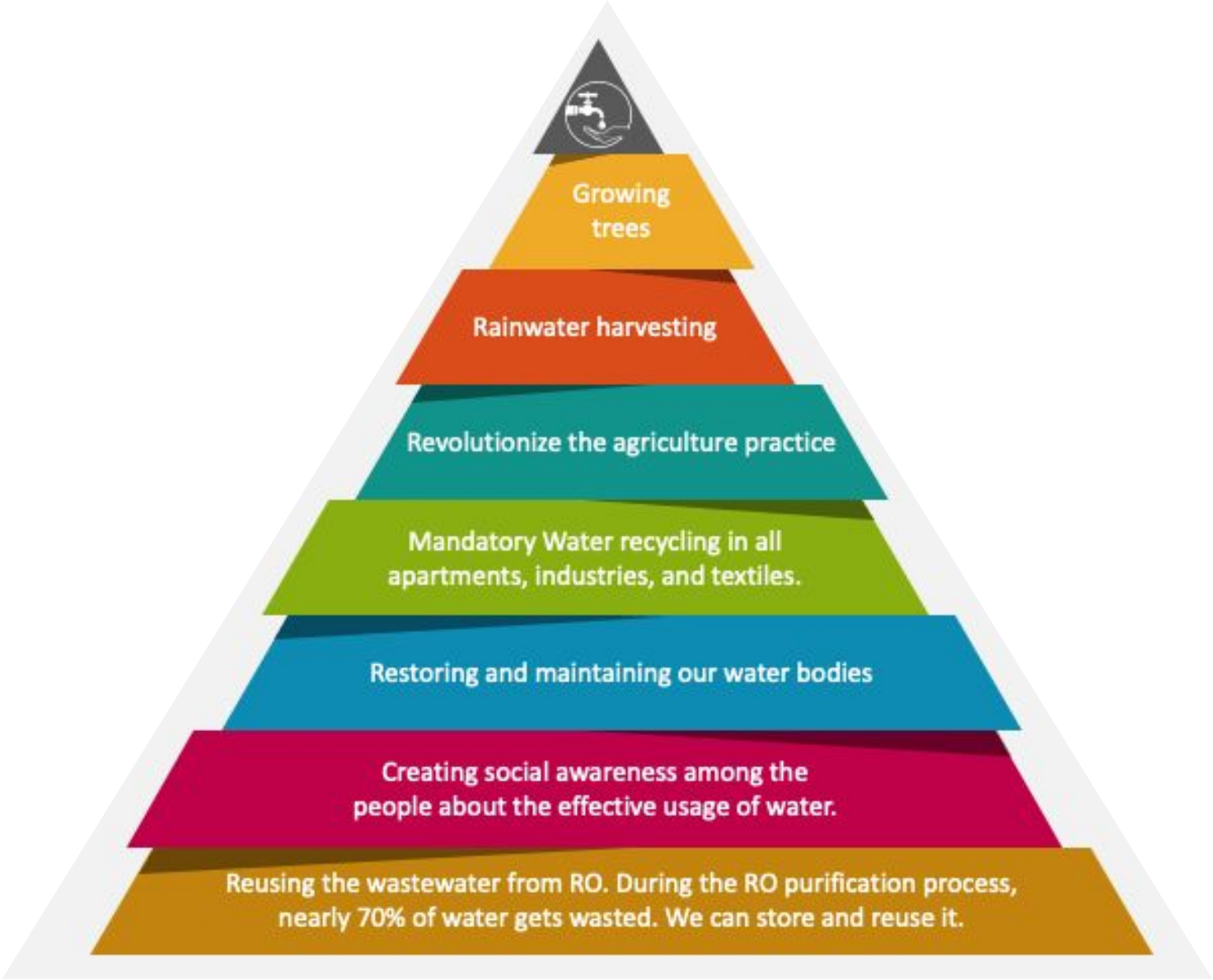
# Urban dynamics and its impacts on Water resources – Bengaluru




Source : https://wgbis.ces.iisc.ac.in/sdss/BUiS/

- Water spread area in Bengaluru decreased from 2,324 hectares in 1973 to just 696 hectares in 2023.
- Reckless concretization has led to a considerable shrinkage in water surface.
- 98% of lakes are encroached upon, with 90% being fed with untreated sewage or industrial effluents.
- Reduction in water surface area has adversely impacted groundwater recharge across Bengaluru.
- Built-up area in Bengaluru increased from 8% in 1973 to 93.3% in 2023.
- Remote sensing data reveals only 1.5 million trees support Bengaluru's population of 9.5 million.
- Insufficient tree cover to sequester respiratory carbon, indicating a need for enhanced green infrastructure.

# Measures to overcome the water scarcity



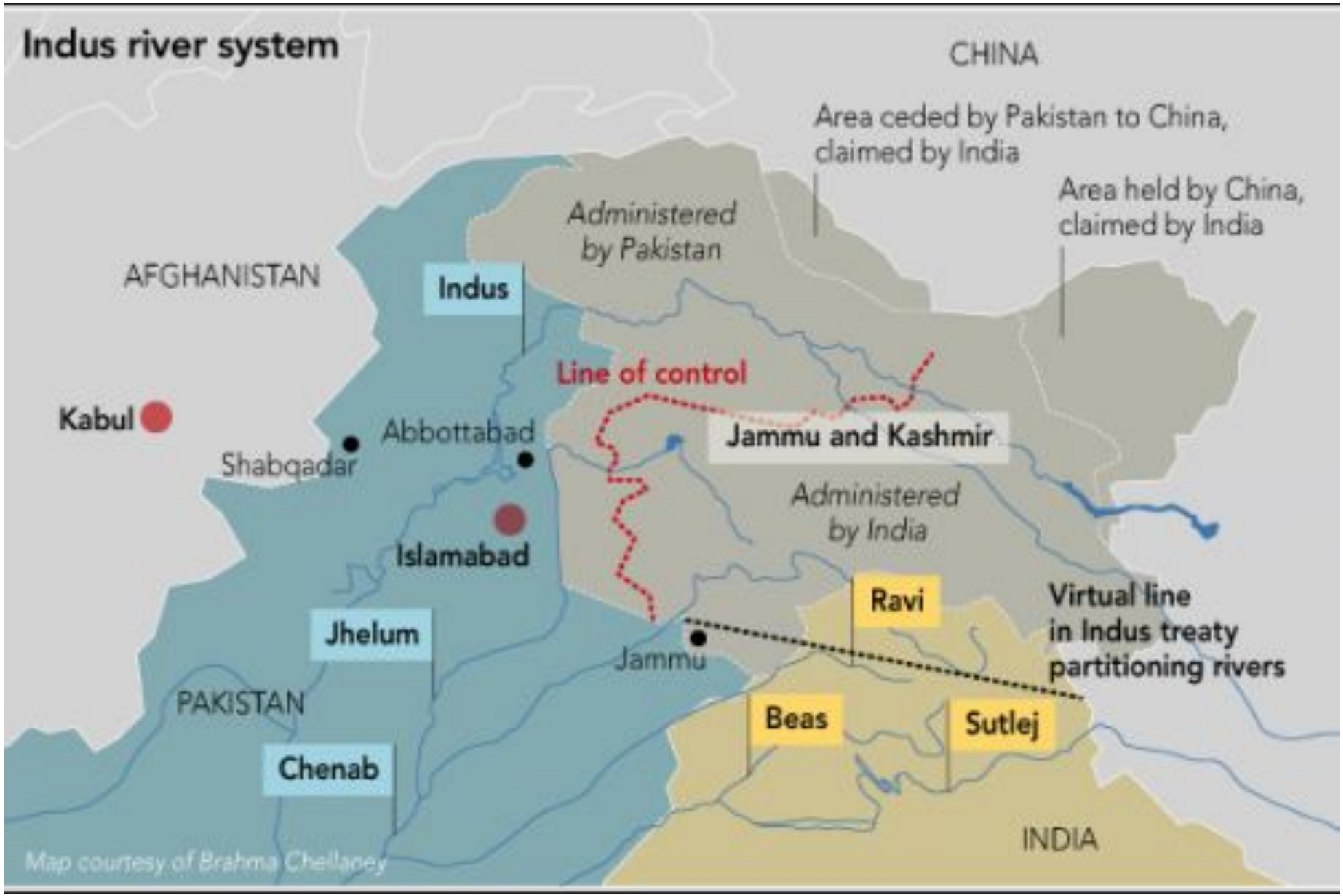
# Water as a Catalyst for Cooperation

## Trans boundary River Treaty

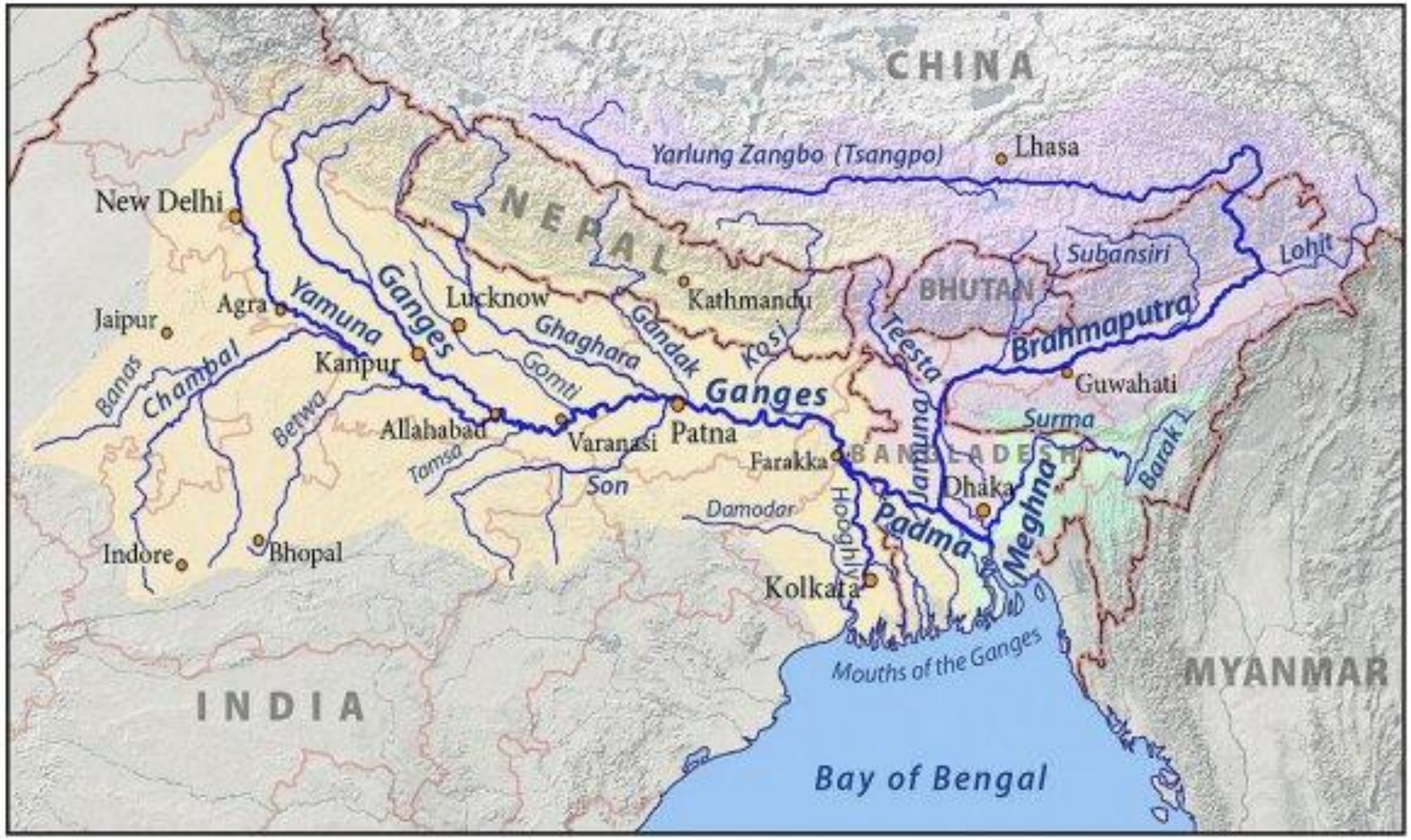
- India and Pakistan, India and Bangladesh, and India and Nepal have entered into bilateral treaties to create a framework for sharing the water of Transboundary Rivers.

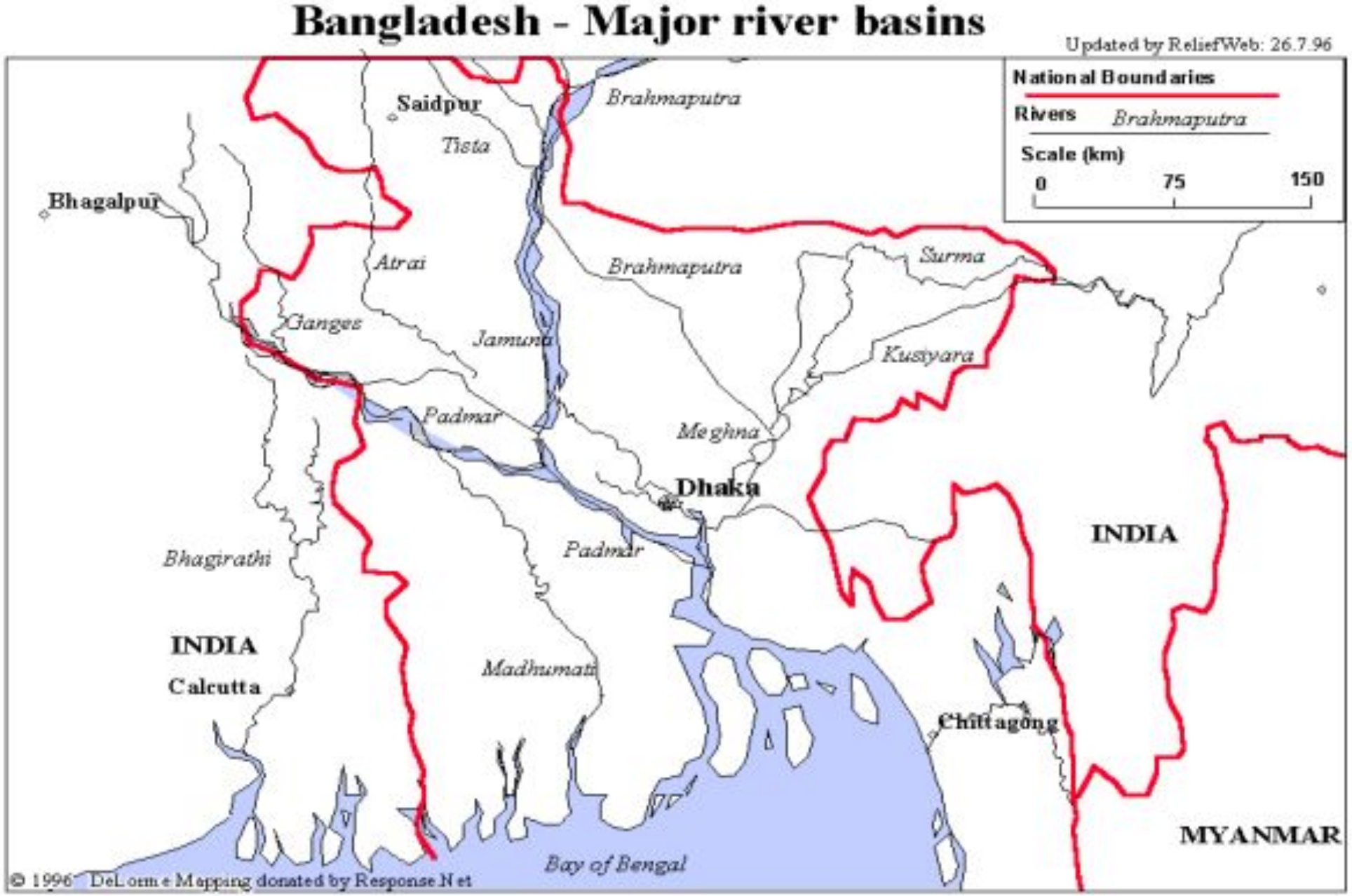
- **Indus Waters Treaty (1960):** One of the most notable examples of water cooperation involving India is the Indus Waters Treaty signed between India and Pakistan with the help of the World Bank. The treaty allocates the waters of the Indus River system between the two countries, facilitating cooperation and preventing conflicts over shared water resources.
- **Ganges Water Sharing:** Despite occasional tensions, India has engaged in discussions with Bangladesh regarding the sharing of the Ganges River waters. Various agreements have been reached over the years, including the Ganges Water Sharing Treaty of 1996, which has helped manage water resources and mitigate potential conflicts.

- **Teesta River Agreement:** Although an agreement has not been finalized, India and Bangladesh have been in negotiations over the sharing of the Teesta River waters for many years. This ongoing dialogue reflects a commitment to cooperation and diplomacy to address water-related issues and foster regional stability.
- **Brahmaputra River Cooperation:** India has engaged in discussions with neighboring countries like China and Bangladesh regarding the Brahmaputra River's waters. While challenges exist, there have been efforts to enhance cooperation through dialogue and information-sharing mechanisms to manage the river's resources effectively.
- **India and Nepal** signed treaties in 1954, 1959, and 1996 for water-sharing and project-development concerning the Kosi, Gandaki and Mahakali rivers respectively.
- **Inter-State River Water Disputes Tribunal:** Within India, there are numerous examples of states resolving water disputes through legal mechanisms like the Inter-State River Water Disputes Tribunal. These mechanisms provide a platform for states to address grievances and reach agreements, promoting cooperation and harmony within the country.
- Interestingly, there is no formal treaty that regulates the distribution of water from the


Indus river system
CHINA
Area ceded by Pakistan to China, claimed by India
Area held by China, claimed by India
Administered by Pakistan
AFGHANISTAN
Indus
Line of control
Kabul
Abbottabad
Shabqadar
Jammu and Kashmir
Administered by India
Islamabad
Ravi
Virtual line in Indus treaty partitioning rivers
Jhelum
Jammu
PAKISTAN
Beas
Sutlej
Chenab
INDIA
Map courtesy of Brahma Chellaney

# The Ganges-Brahmaputra Basin




Bangladesh - Major river basins
Updated by ReliefWeb: 26.7.96
National Boundaries
Rivers
Brahmaputra
Scale (km)
0
75
150
Saidpur
Tista
Brahmaputra
Bhagalpur
Atrai
Brahmaputra
Surma
Ganges
Jamuna
Kusiyara
Padmar
Meghna
Dhaka
INDIA
Bhagirathi
Padmar
INDIA
Calcutta
Madhumati
Chittagong
MYANMAR
Bay of Bengal
© 1996 DeLorme Mapping donated by Response Net

# New National Water Policy (NWP)

Drafted by committee of independent experts under Ministry of Jal Shakti in 2019.

**Highlights of NWP**

**Demand-side measures**

- Diversification of public procurement operations.
- Crop diversification crucial to address water crisis.
- Recommends including Nutri-cereals, pulses, and oilseeds.
- Incentivizes farmers to diversify cropping patterns, saving water.

**Reduce-Recycle-Reuse**

- Integrated urban water supply and wastewater management.
- Mandates non-potable use to shift to treated wastewater.

**Supply-side measures**

- Utilization of stored water in dams using technology.
- Expanding irrigated areas via pressurized closed conveyance pipelines.

**Supply through nature-based solutions**

- Emphasis on "nature-based solutions" for water supply.

**Sustainable groundwater management**

- Stakeholders empowered with aquifer information.
- Creation of protocols for effective groundwater management.

**Rights of Rivers**

- Priority to river protection and revitalization.
- Steps include re-vegetation, regulation of extraction, and drafting of Rights of Rivers Act.

**Emphasis on water quality**

- Water quality department in every water ministry.
- Adoption of eco-sensitive sewage treatment technologies.

**Reforming governance of water**

- Proposals to address issues between irrigation, drinking water, and surface/groundwater.

**Creation of National Water Commission**

- Unified multi-disciplinary, multi-stakeholder body for water management.
- Enduring partnerships with primary stakeholders.

# Jal Shakti Ministry and Initiatives

- Creation of **Jal Shakti Ministry** merging water-related ministries.
- Responsibilities include providing clean drinking water, resolving water disputes, and executing projects like **Namami Gange.**
- Launch of **'Nal se Jal'** scheme for piped water supply to every household by 2024.
- National River Conservation Directorate shifted to Jal Shakti Ministry for streamlined administration and management.

## Jal Shakti Abhiyan

- Collaborative initiative targeting water-stressed districts and blocks.
- Team comprising central government officers and district administration.
- Focus on water conservation, renovation of water bodies, reuse of water, watershed development, and afforestation.

Rajasthan: **Mukhya Mantri Jal Swavlamban Abhiyan** focusing on water conservation and harvesting in rural areas.
Maharashtra: **Jalyukt-Shivar project** aiming to alleviate water scarcity in 5000 villages annually.
Telangana: **Mission Kakatiya** for enhancing agricultural income through irrigation infrastructure development and tank restoration.

# Thank You