Future Ganga: Science Needs for Water Security

BY:

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River basin is a ‘geographical unit’ enclosing an area drained by streams and channels that feed a river at a particular point.

Ganga River Basin
Need for River Basin Management: Ganga Basin

- Ganga Basin – comprises of 11 states
- Mainstem flows through 5 states
- Pollution in Bihar cannot be managed until upstream states are managed
- Hence efforts between States cannot be disjointed – **a basin level planning is required**
- Ganga Action Plan (GAP) I & II successfully created 961 MLD treatment capacity but with limited visible change
- Learning from GAP – A holistic river basin approach required to manage the river Ganga

**State Wise Catchment Area of River Ganga**

- Rajasthan, 112496, 13%
- Bihar, 93580, 11%
- U.P., 241392, 28%
- M.P., 181066, 21%
- Chattisgarh, 17907, 2%
- Uttarakhand, 52988, 6%
- Jharkhand, 50389, 6%
- West Bengal, 71489, 8%
- Haryana, 34343, 4%
- H.P., 4317, 1%
Significance of Ganga Basin in India

Geographical coverage is the largest – 26% of India’s land mass

Most populated basin – hosts 43% of India’s population

38% of India’s total estimated utilisable water comes from Ganga Basin – highest amongst all

Nearly 40% of India’s total estimated replenishable ground water resources comes from Ganga Basin
Upper Stretch
Gangotri to Haridwar

Length: 294 km

Characteristics:
- River flows on steep bed
- Turbulent flow with high velocities
- Centre for pilgrim tourism & spiritual activities
- Mahaseer and Trout key species

Challenges:
- Disruption of natural flow due to several HEPs/dams
- Deforestation
- Loss of native medicinal and herbal plants
- Highly sensitive and fragile ecosystem and biodiversity
- High inflow of tourists
- Retreating Glaciers
Middle Stretch
Haridwar to Varanasi
Length: 1082 km

Characteristics:
- River enters into plains
- Wide river bed and flood plain
- Active breeding sites of turtles, crocodiles, Ghariyals, Gangetic dolphins, etc.
- Narora Atomic Power Plant

Challenges:
- Huge quantities of water abstraction and diversion
- High degree of pollutant loads from domestic, industrial, and agricultural activities
- Tannery clusters: Kanpur
- Ramganga and Kali – hotspot of pollution
**Lower Stretch**  
Varanasi to Ganga Sagar  
**Length:** 1134 km

**Characteristics:**
- Heavy sediment transport and deposition
- Meandering river and frequent change in channel path
- Active breeding sites of Gangetic Dolphins, etc.
- Sunderbans - a UNESCO World Heritage Site & home to Bengal Tiger

**Challenges:**
- Encroachment of river bed, sand mining, etc.
- Frequent floods and droughts
- Large point and non-point pollution load
- International disputes on flows and interventions
Efforts Towards Ganga Conservation

A Shift Towards Basin Based Approach

GAP I
- Launched in 1985
- Focus on Main stem of River Ganga
- 25 Towns Covered
- 260 schemes completed

GAP II
- Extended from GAP I in 1993
- Merged with NRCP in 1996
- Taken up works on four tributaries – Yamuna, Gomti, Damodar & Mahananda

NRCP
- Launched in 1995
- Covered 41 major Rivers of the country
- 8 Ganga basin rivers taken up viz. Betwa, Chambal, Gang.a, Mahananda, Mandakini, Ramganga, Yamuna

NGRBA
- Separate Authority for Ganga created in 2009
- Chaired by Prime Minister of India
- NMCG as an implementing body at center and SPMGs at states

Namami Gange
- Project under Separate Ministry for Ganga Rejuvenation
- All 11 Basin states covered
- Conservation measures for all tributaries of Ganga

- GAP : Ganga Action Plan
- NRCP : National River Conservation Plan
- NGRBA : National Ganga River Basin Authority
- NMCG : National Mission for Clean Ganga
- SPMGs : State Program Management Groups
‘Namami Gange’ – Holistic approach

- Duration: 5 Years 2015-16 to 2019-20
- Cost (2015-16 to 2019-20): Rs. 20,000 crores
- Includes ongoing projects and new initiatives
- Four-fold increase over the expenditure in the past 30 years
- Primary focus on pollution abatement
- Moving from ‘River Cleaning’ to ‘River Rejuvenation’
Efforts initiated under Namami Gange

100% sewerage treatment infrastructure for 118 Towns
Strict enforcement for Industrial pollution
Improved wood-based crematoria
Public Awareness/ Rural Sanitation

River Front Development
Massive Afforestation Drive
Treatment of drains
River Surface Cleaning
Suggested Areas for scientific interventions with the NGRBA/National Mission for Clean Ganga

- **Study of Gangetic Aquifer for better management of Ecosystem Services** and a clean and dynamic river system.
- Pilot testing of the ‘**Resource Recovery and Reuse**’ business models for reducing point and non-point pollution loads
- **Estimation of environmental flows** and strategies to meet the deficits under current and future scenarios.
- Development of a “**Ganges Basin Book**” which shall have peer-authored and reviewed chapters to address the following questions:
  - How much resources are sustainably available in the basin, where and when; and in foreseeable future?
  - Who have access to these resources and at what cost and which policies, institutions and mechanisms shall lead to improved benefit sharing and a healthy river system?
  - Which technologies, policies and institutions shall lead to higher achievements, a cleaner river system, reduced poverty and vulnerability and resilient ecosystems through the improved use of the resources?
Science needs in-
ALTERNATIVE WASTE WATER TREATMENT

- Energy Alternatives in Remote Habitats where power supply is unreliable
- Efficient Disinfection Systems to reduce F. Coli and T. Coli
- Different approaches for large cities and small towns
- Land Availability as a constraint
- Lower O & M requirement
- Reduced cost
- Recycling and Reuse
- Treating the water to the next use- Water Cascading
- Segregation of black, gray and storm water
- Sludge/waste management - reuse
Science needs in-
RIVER WATER QUALITY MONITORING

- Deploying of framework for integrated river monitoring for simulating river water quality for estimation of Waste Load for major discharges in
  - Upper Reaches (U/S of Haridwar)
  - Middle Reaches (Haridwar to Allahabad)
  - Lower Reaches (D/S of Allahabad)
- Developing the available mobile/GPS/Sensor based monitoring systems on test beds.
- Piloting rapid monitoring technology for appropriate pathogen indicator Assessment on identified river stretches
- Monitoring for assessment of Arsenic pathways in a selected basin stretch.
Science needs in-
INDUSTRIAL POLLUTION ABATEMENT

- **Four focus industries:**
  - Paper & Pulp
  - Distilleries & Sugar Mills
  - Tanneries
  - Textile
- Reduction in fresh water consumption
- Increased reuse of treated effluent with greater cost effectiveness
- Low cost chemical recovery
Science needs in-
APPLICATION OF REMOTE SENSING & GIS IN RIVER
CONSERVATION

- Unknown population growth in the cities along the river
- Loss of natural water bodies - encroachment
- Better management to use excess water flow in scarce seasons
- Application of Remote sensing to identify hotspots in river basin
- Can we index certain areas which contribute more to water demand and pollution?
- Impacts on biodiversity – satellite tracking for biodiversity migration, dispersal patterns – e.g. miniature tags for monitoring small fishes
- Ground water depletion – recharge systems – impact of agriculture – green revolution – sensor network deployment
- Identifying and estimating ground water abstraction
- Water quality standards – overlooks river health – how to define river health in terms of which parameters – geomorphology
- Data mining & inter-institutional collaboration - e.g. WRIS
- Integrating data from different sources -Mobile Apps, ground observations and remote sensing (optical, thermal, radar, etc.) for monitoring water quality
Science needs in- other areas

- Improved irrigation techniques to improve water use efficiency and lower cost
- Identify best combination of crop type & rotation patterns to promote better growth
- Improved and cost effective techniques for in-situ treatment of sewage flowing through drains
- Cost effective decentralized sewage treatment techniques
- Improved cremation practices to reduce wood consumption
- Promotion of comprehensive urban wastewater management through PPP model,
- Strategy support for the planning and implementation of the overall programme,
- Development of platform to foster capacity building and to facilitate information sharing between both Governments and relevant authorities.
- Knowledge exchange to use innovative technologies such as proposed 25km Thames Tideway Tunnel to capture most polluting sewer overflows which would otherwise spill into the river”
Thank You