Future Ganga: Science Needs for Water Security

BY:

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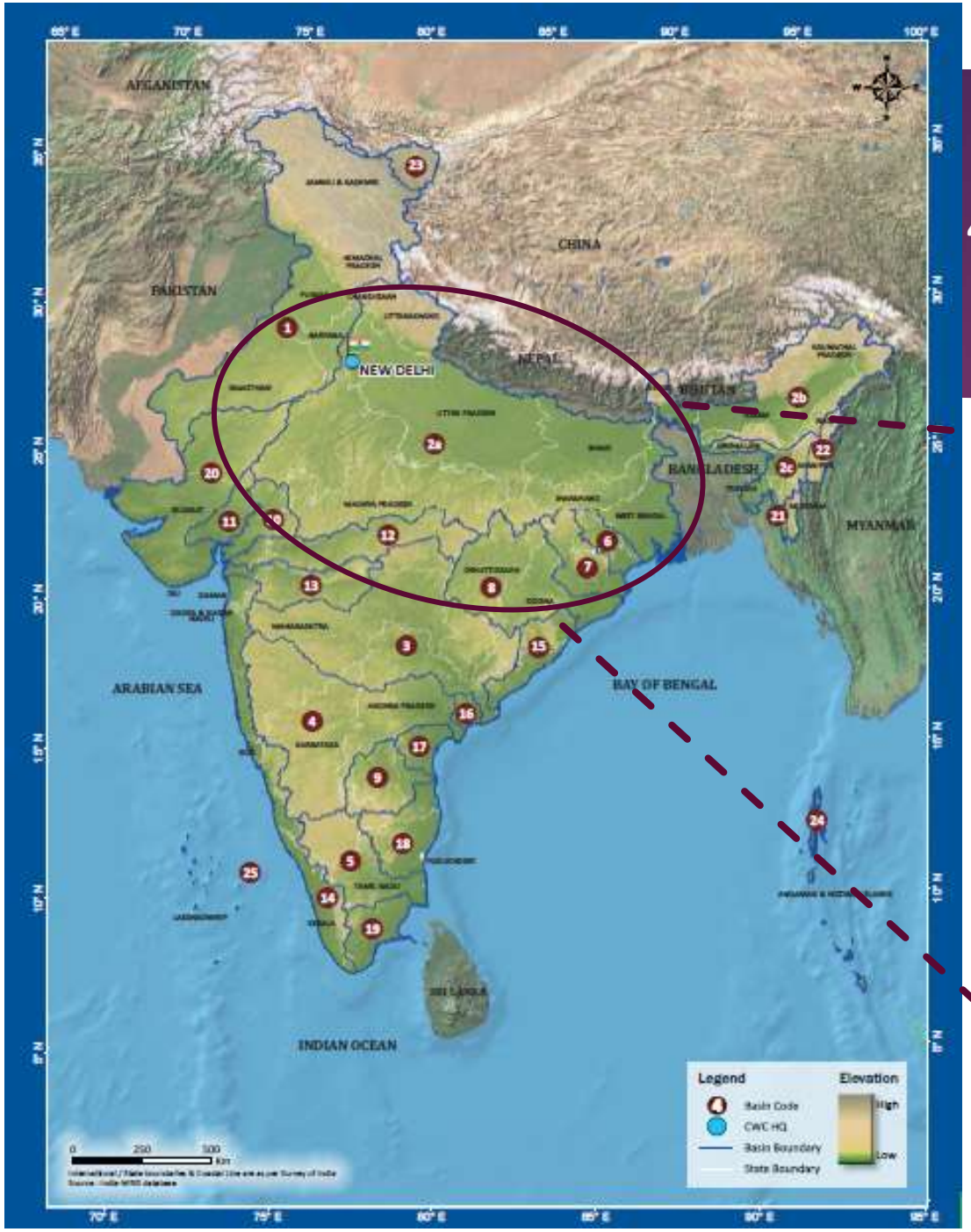
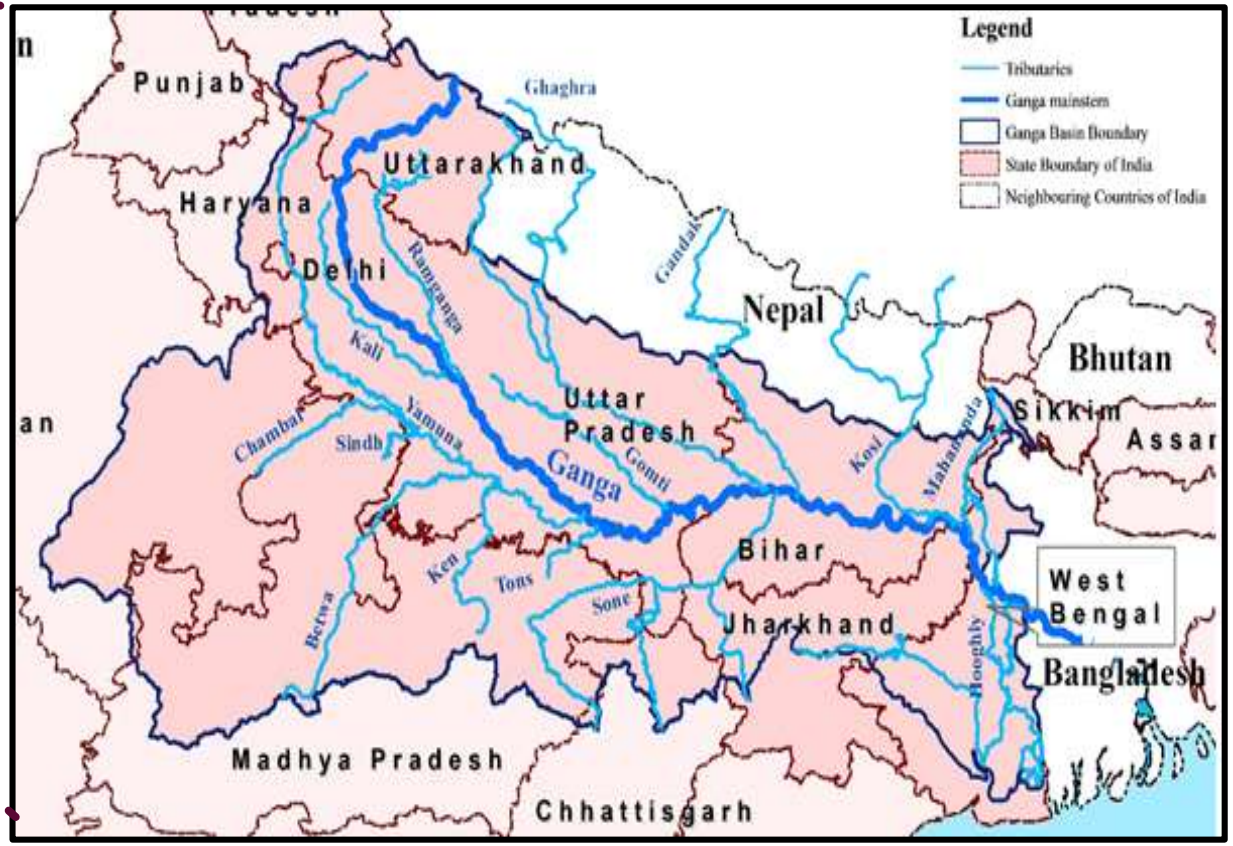
Ganga River Basin

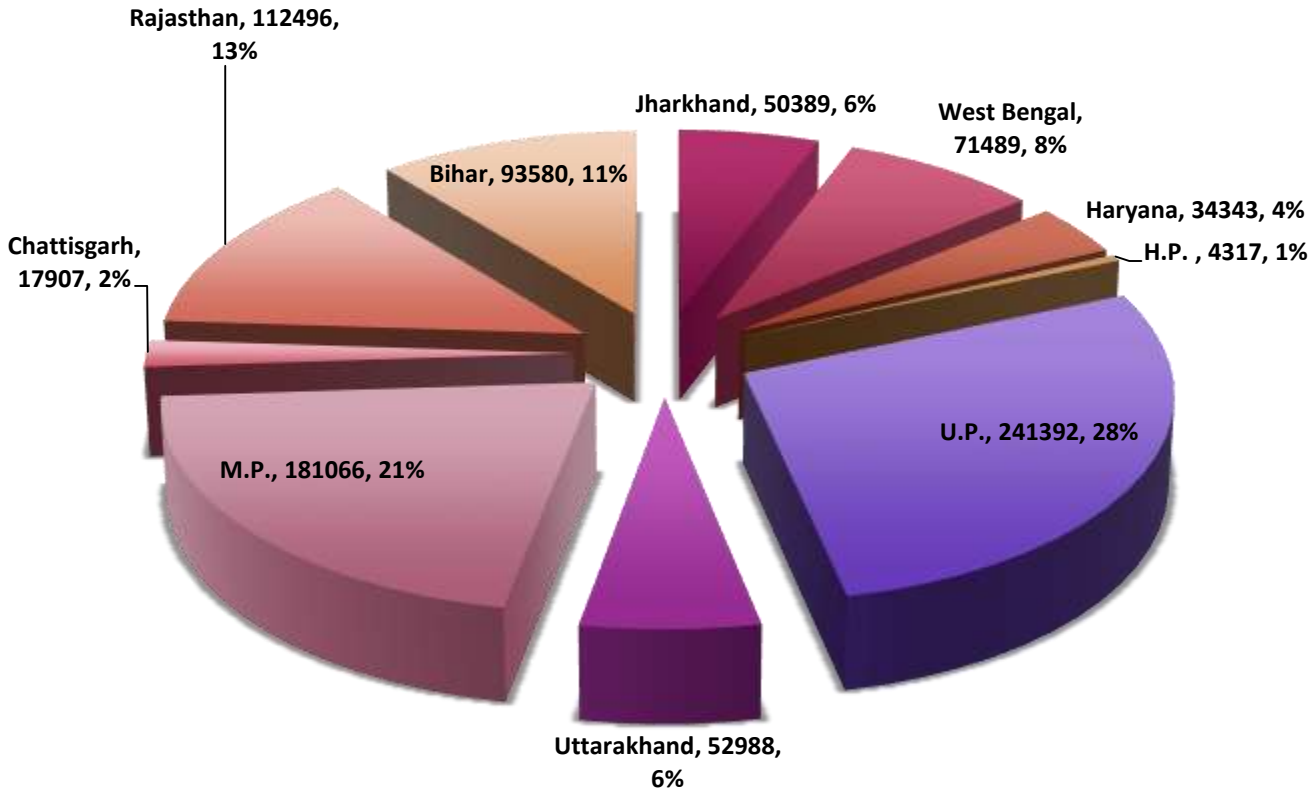
"River basin is a 'geographical unit' enclosing an area drained by streams and channels that feed a river at a particular point."





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



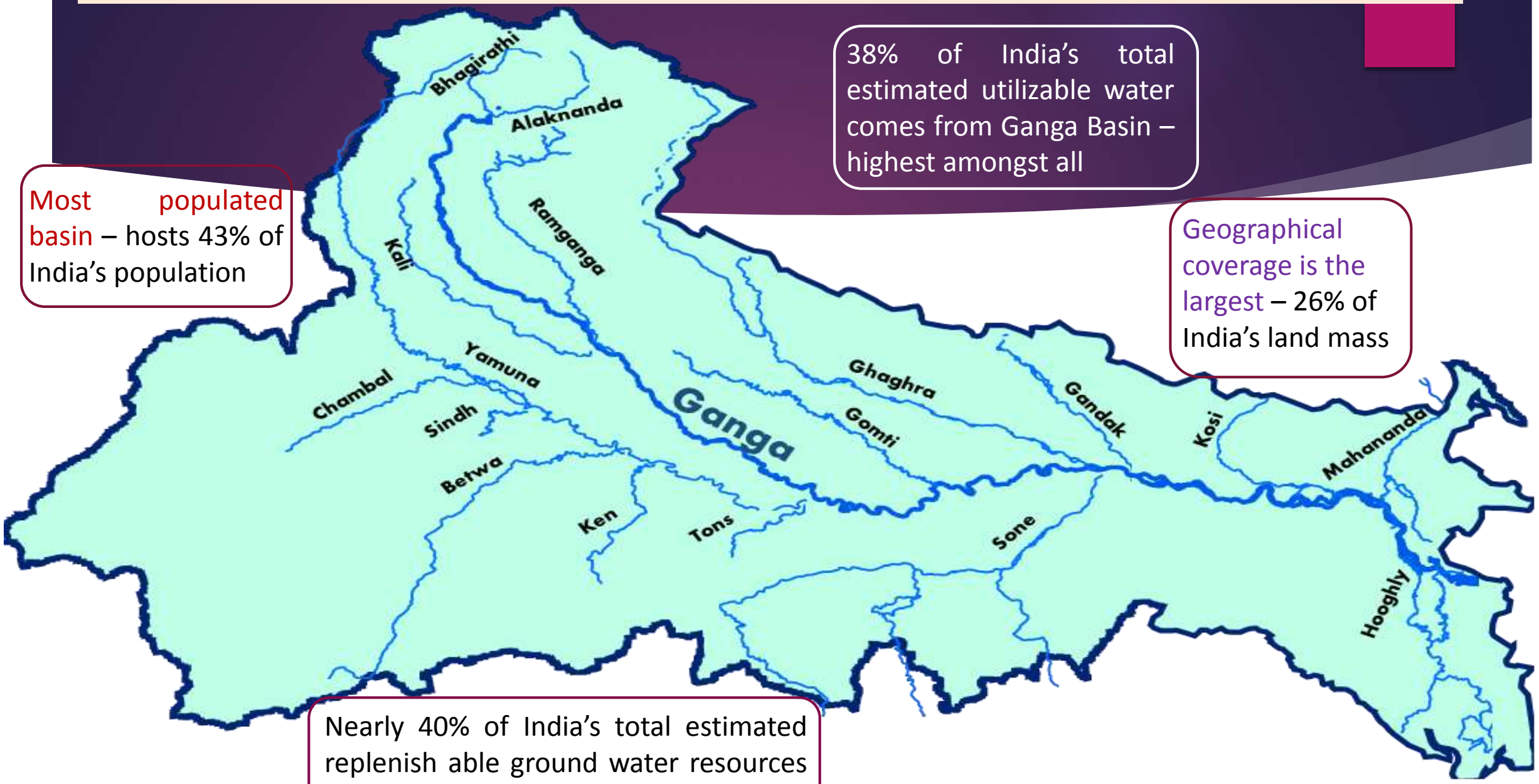
State Wise Catchment Area of River Ganga

Significance of Ganga Basin in India

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

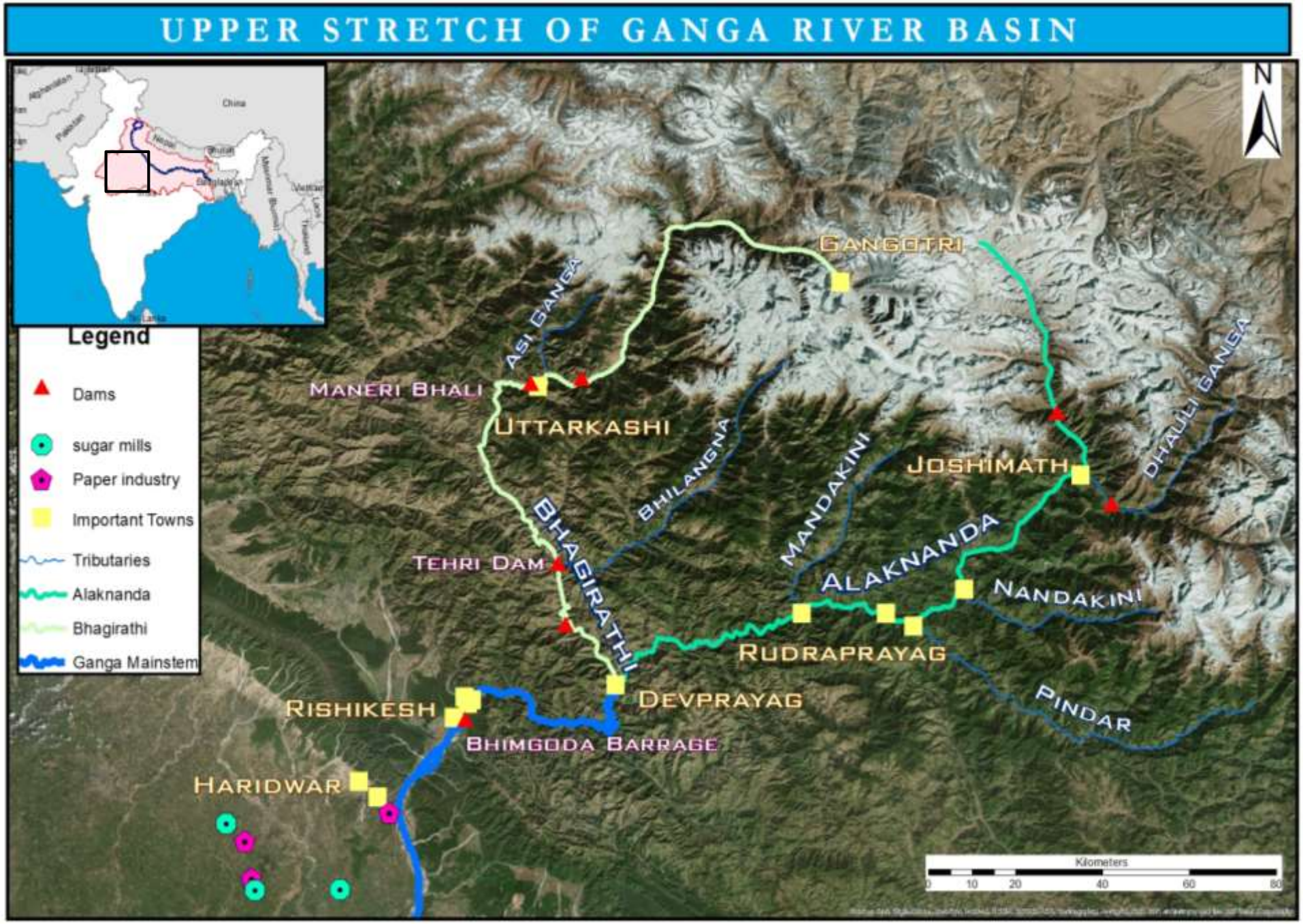
Most populated basin – hosts 43% of India's population

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



Nearly 40% of India's total estimated replenish able ground water resources comes from Ganga Basin

UPPER STRETCH OF GANGA RIVER BASIN



Upper Stretch

Gangotri to Haridwar

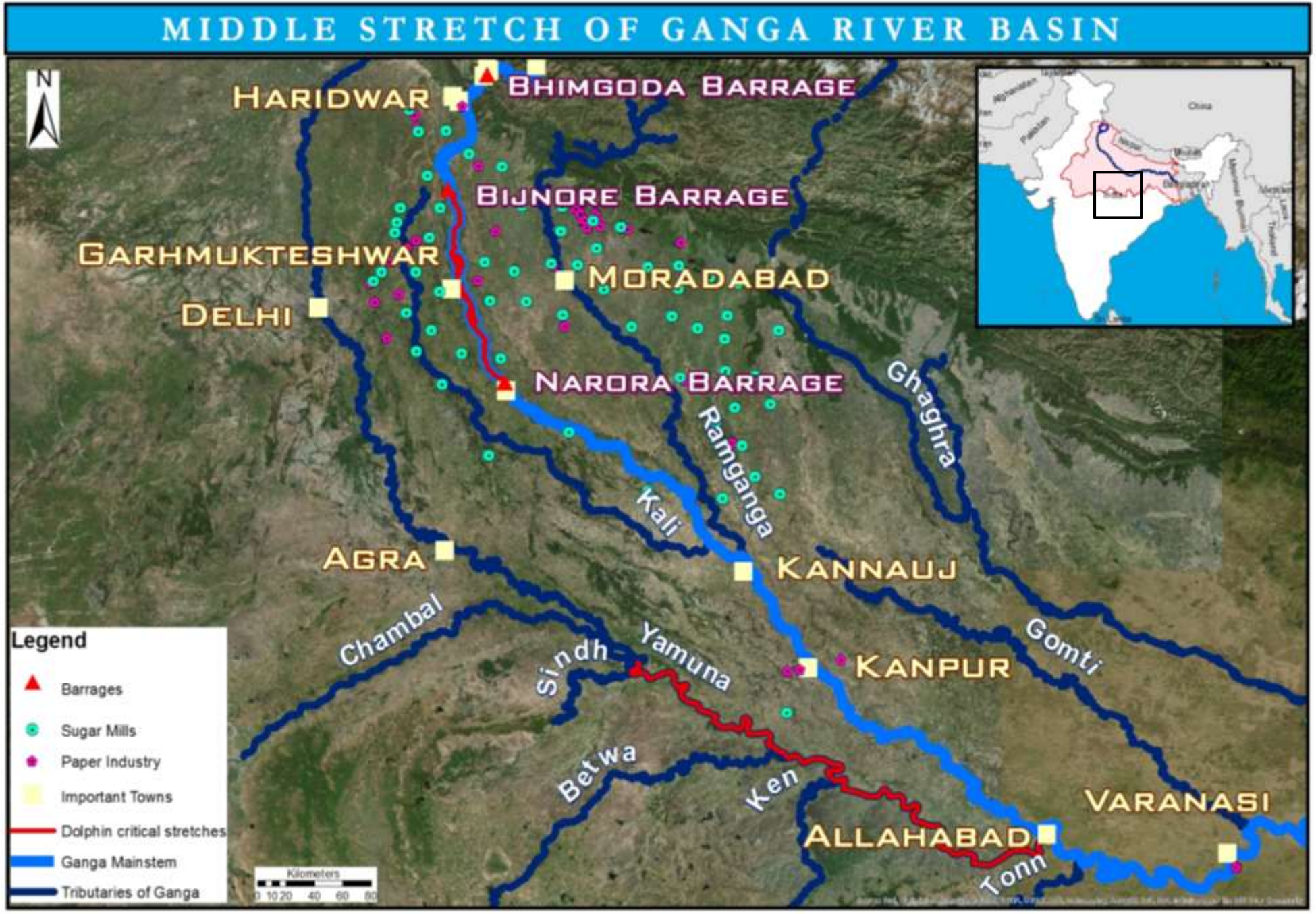
Length : 294 km

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



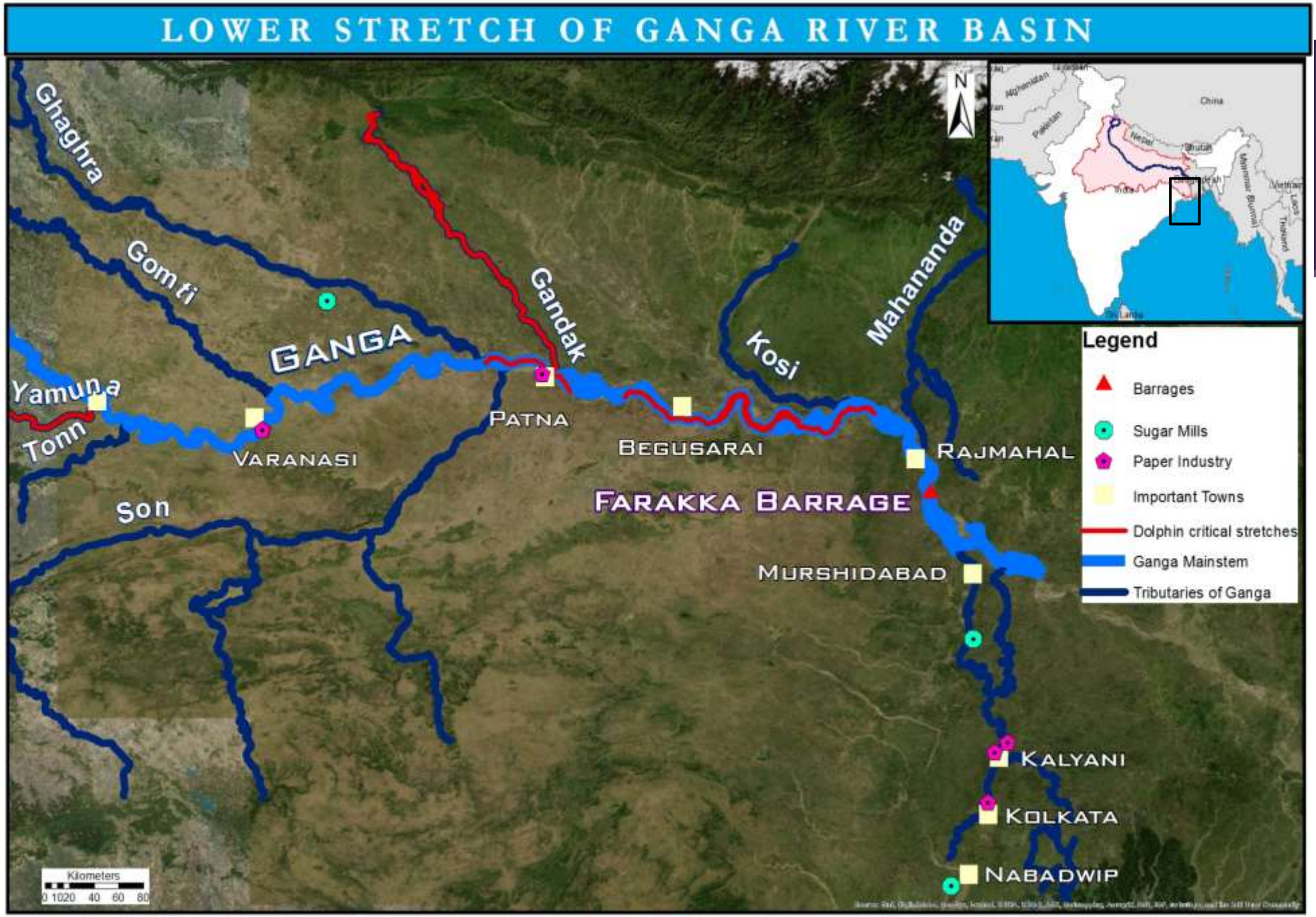
Middle Stretch
Haridwar to Varanasi
Length : 1082 km
Characteristics:

- ✓ 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 OF GANGA RIVER BASIN



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’**

- River Surface Cleaning
- Industrial Pollution
- Rural Sanitation
- Crematoria
- Connecting People with River
- Water Quality Monitoring
- Biodiversity Conservation
- Municipal Sewage Management

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.
- River water quality assessment using Bio-monitoring and Toxicological Studies in selected stretches of River basin.

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