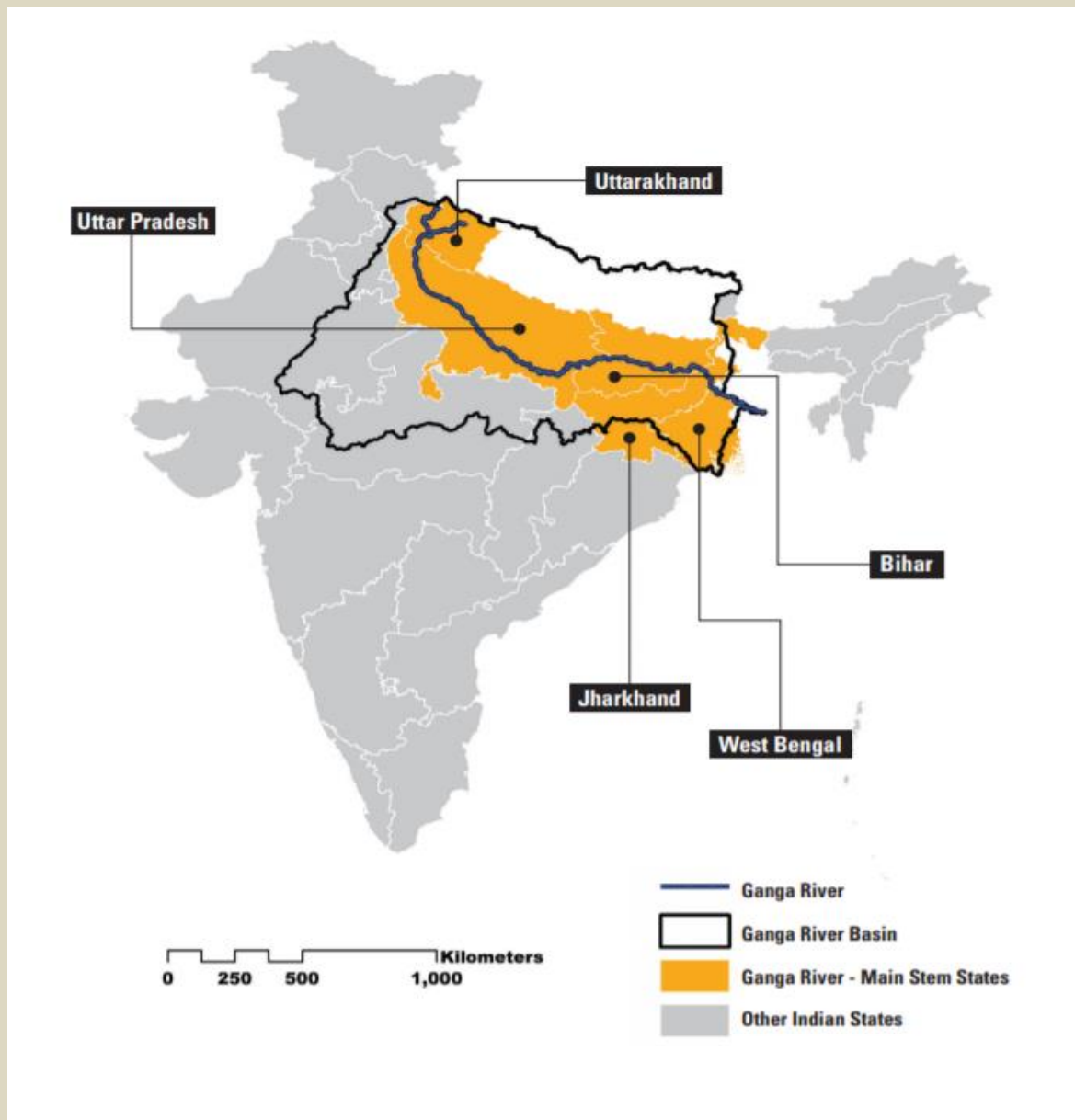


Ganga-A National River



The Himalayas are the source of three major Indian rivers namely the Indus, the Ganga and the Brahmaputra. Ganga drains a basin of extraordinary variation in altitude, climate, land use, flora & fauna, social and cultural life. Ganga has been a cradle of human civilization since time immemorial. Millions depend on this great river for physical and spiritual sustenance. People have immense faith in the powers of healing and regeneration of the Ganga. It is arguably the most sacred river in the world and is deeply revered by the people of this country. The River plays a vital role in religious ceremonies and rituals. To bathe in Ganga is a lifelong ambition of many who congregate in large numbers for several river centered festivals such as Kumbh Mela and numerous Snan (bath) festivals.

Location

Ganga basin is the largest river basin in India in terms of catchment area, constituting 26% of the country's land mass (8,61,404 Sq. km) and supporting about 43% of its population (448.3 million as per 2001 census). The basin lies between East longitudes 73°02' and 89°05' and North latitudes of 21°06' and 31°21', covering an area of 1,086,000 sq km, extending over India, Nepal and Bangladesh. About 79% area of Ganga basin is in India. The basin covers 11 states viz., Uttarakhand, U.P., M.P., Rajasthan, Haryana, Himachal Pradesh, Chhattisgarh, Jharkhand, Bihar, West Bengal and Delhi. The current focus of world bank funded National Ganga River Basin Projects (NGRBP) of NMCG is on five major states on the main stem of river Ganga namely Uttarakhand, Uttar Pradesh, Jharkhand, Bihar and West Bengal. The drainage area in each state is given in Table.

Climate

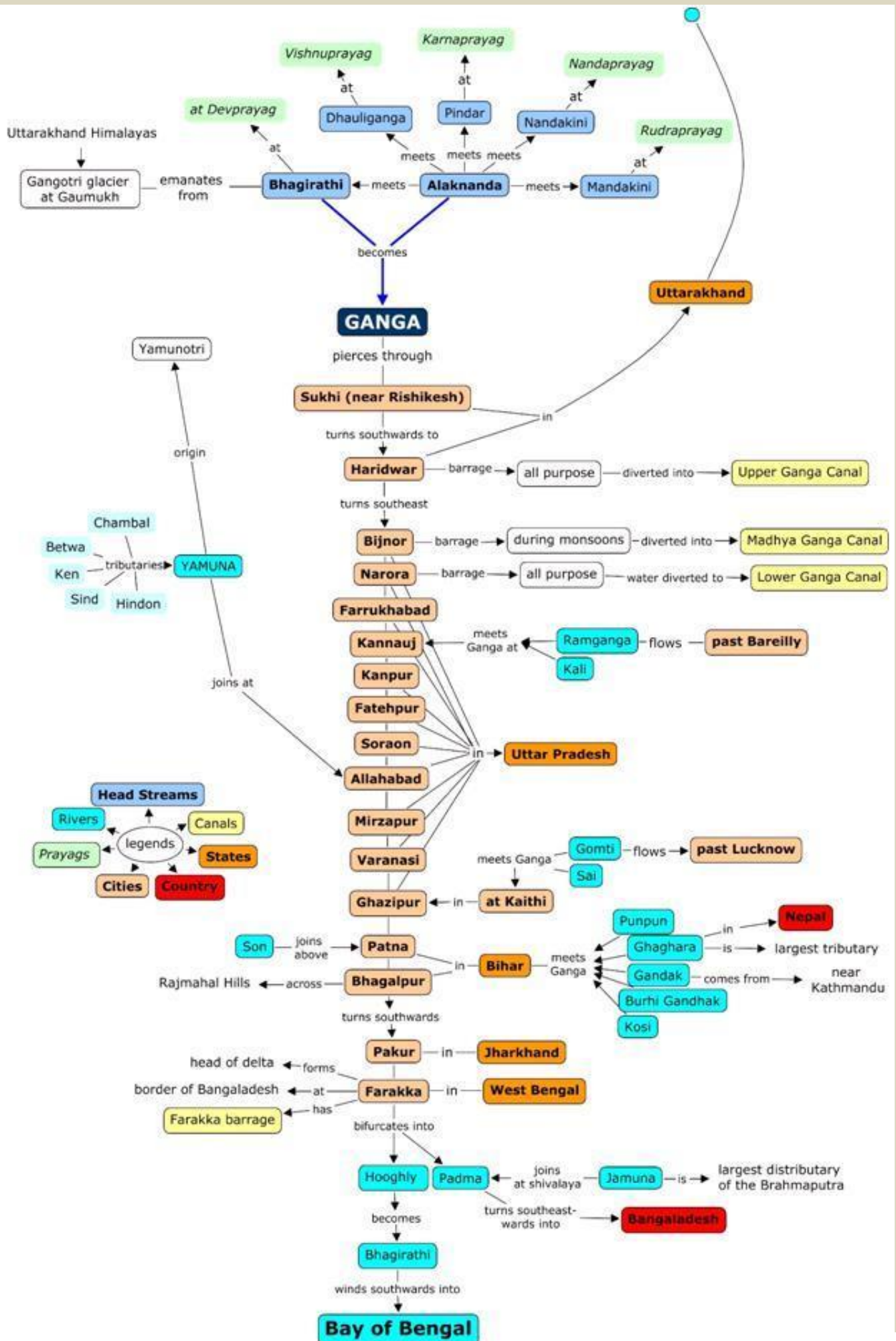
The annual average rainfall in the basin varies between 39 cm to 200 cm, with an average of 110 cm. Eighty percent of the rainfall occurs during the monsoon months i.e. from June to October. Because of large temporal variations in precipitation over the year, there is wide fluctuation in the flow characteristics of the river.

Course of Ganga

Bhagirathi is the source stream of Ganga. It emanates from Gangotri Glacier at Gaumukh at an elevation of 3,892 m (12,770 feet). Many small streams comprise the headwaters of Ganga. The important among these are Alaknanda, Dhauliganga, Pindar, Mandakini and Bhilangana. At Devprayag, where Alaknanda joins Bhagirathi, the river acquires the name Ganga. It traverses a course of 2525 km before flowing into the Bay of Bengal. It has a large number of tributaries joining it during this journey.

In Uttarakhand, Tehri dam has been built on Bhagirathi for hydropower generation resulting in regulated additional water discharge during the dry months. At Haridwar, Ganga opens to the Gangetic Plains, where a barrage diverts a large quantity of its waters into the Upper Ganga Canal, to provide water for irrigation. At Bijnore, another barrage diverts water into the Madhya Ganga Canal but only during monsoon months. At Narora, there is further diversion of water into the Lower Ganga Canal.

Further down, River Ramganga joins Ganga near Kannauj, adding additional water to the river. Yamuna confluences Ganga at the Sangam in Allahabad, making a major contribution to the river flow. Beyond Allahabad, Ganga is joined by several tributaries, most of which are from the north and a few from the south. In the stretch between Allahabad in U.P. and Malda in West Bengal, Ganga, therefore, has considerable flow. The Farakka barrage in West Bengal regulates the flow of the river, diverting some of the water into a feeder canal linking Hooghly to keep it relatively silt-free. Downstream of this barrage, River Ganga splits into two, Bhagirathi (Hooghly) on the right and Padma on the left. Bhagirathi (Hooghly) meets the Bay of Bengal about 150 km downstream of Kolkata. Padma enters Bangladesh and meets river Brahmaputra and Meghna before finally joining the Bay of Bengal.



Ganga River Basin Management Plan

A comprehensive River Basin Management Plan for Ganga is being prepared by the consortium of seven Indian Institutes of Technology (IITs) (Kanpur, Delhi, Madras, Bombay, Kharagpur, Guwahati and Roorkee). The Plan is being prepared with the objectives of taking comprehensive measures for restoration of the wholesomeness of the Ganga ecosystem and improvement of its ecological health, with due regard to the issue of competing water uses in the river basin. The wholesomeness of the river can be grasped in terms of four defining concepts: “Aviral Dhara” (Continuous Flow), “Nirmal Dhara” (“Unpolluted Flow”), Geologic Entity, and Ecological Entity.



External Funding and Funding Mechanism

The Central Government has approved the projects for 'World Bank' assistance to National Ganga River Basin Authority(NGRBA) for abatement of pollution of river Ganga' at an estimated cost of Rs.7000 crore. The Bank will support the Government of India by providing technical assistance and financing of US \$ 1 billion (approx. 4600 crore).The World Bank Board has approved this project on 31st May 2011.The Loan agreement with World Bank has been signed on 14th June 2011.Japan International Cooperation Agency (JICA) is supporting one project on Ganga in Varanasi worth Rs. 496.9 Crore on 85:15 basis.

Funding Mechanism

The investments required to create the necessary treatment and sewerage infrastructure would be shared between Centre and State Governments on 70:30 basis.The State Governments would be required to motivate ULBs for resource recovery and revenue generation. Also, the cost of Operations and Maintenance(O&M)for the initial five years in NGRBA projects would be shared between Centre and States in the ratio of 70:30 with a periodical review.

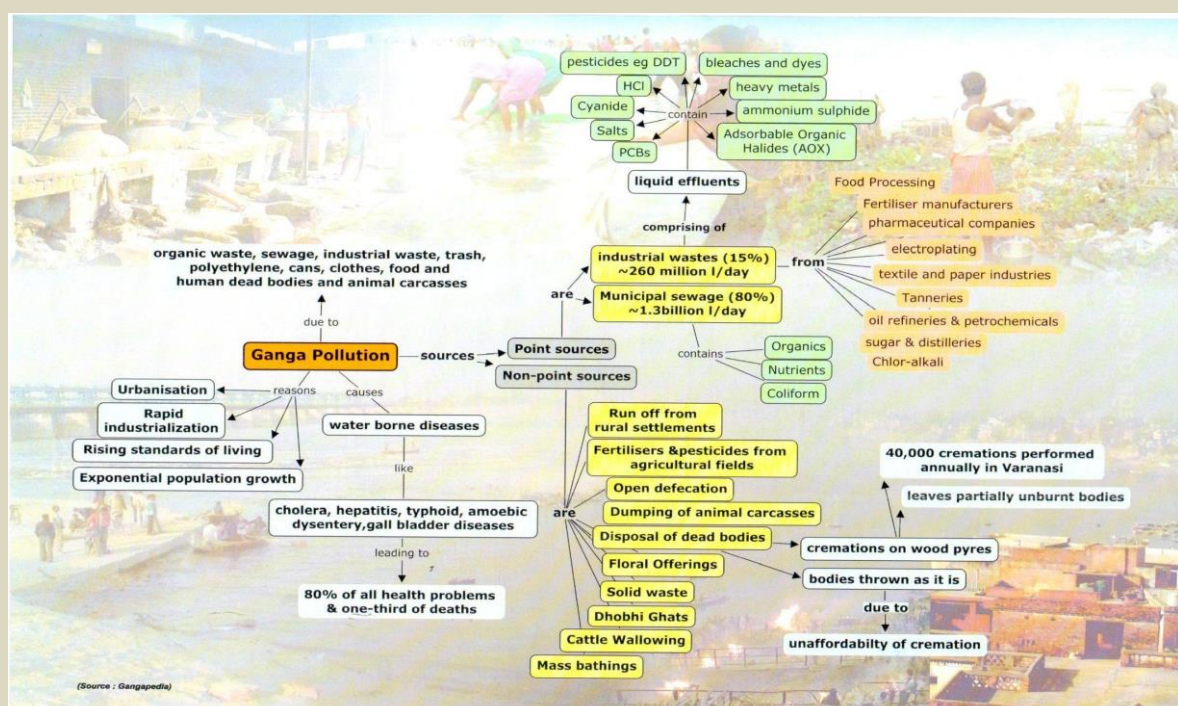
Hydrology of Ganga Basin

Rainfall, subsurface flows and snow melt from glaciers are the main sources of water in river Ganga. Surface water resources of Ganga have been assessed at 525 billion cubic meter (BCM). Out of its 17 main tributaries Yamuna, Sone, Ghagra and Kosi contribute over half of the annual water yield of the Ganga. These tributaries meet the Ganga at Allahabad and further downstream. The river has a problem of low flows between the Haridwar - Allahabad stretch. December to May are the months of lean flow in the Ganga.

On an average, each square km of the Ganga basin receives a million cubic meter (MCM) of water as rainfall. 30% of this is lost as evaporation, 20% seeps to the subsurface and the remaining 50% is available as surface runoff. The deep channel of the river bounded by high banks facilitates the passage of ground water as base flow. Annual flooding is the characteristic of all rivers in the Ganga basin. The Ganga rises during the monsoon but the high banks restrict the flood water from spreading. The flood plain is usually 0.5 to 2 km wide. This active flood plain is flooded every year. In addition to this the existing structures on the Ganga Basin also affect its discharge.

Pollution Threat



- Rapidly increasing population, rising standards of living and exponential growth of industrialisation and urbanisation have exposed water resources, in general, and rivers, in particular, to various forms of degradation. The mighty Ganga is no exception. The deterioration in the water quality impacts the people immediately. Ganga, in some stretches, particularly during lean seasons has become unfit even for bathing. The threat of global climate change, the effect of glacial melt on Ganga flow and the impacts of infrastructural projects in the upper reaches of the river, raise issues that need a comprehensive response.
- In the Ganga basin approximately 12,000 million litres per day (mld) sewage is generated, for which presently there is a treatment capacity of only around 4,000 mld. Approximately 3000 mld of sewage is discharged into the main stem of the river Ganga from the Class I & II towns located along the banks, against which treatment capacity of about 1000 mld has been created till date. The contribution of industrial pollution, volume-wise, is about 20 per cent but due to its toxic and non- biodegradable nature, this has much greater significance. The industrial pockets in the catchments of Ramganga and Kali rivers and in Kanpur city are significant sources of industrial pollution. The major contributors are tanneries in Kanpur, distilleries, paper mills and sugar mills in the Kosi, Ramganga and Kali river catchments.



Physiographic Aspects of Ganga Basin....

Structurally, the Ganga basin comprises of three large divisions of the Indian subcontinent, namely: the Himalayan fold mountains, the Central Indian highlands and the Peninsular shield, and the Gangetic plain. The Himalayan Fold Mountains include numerous snow peaks rising above 7000 meters. Each of these peaks is surrounded by snow fields and glaciers. All the tributaries are characterised by well regulated flows and assured supply of water throughout the year. The Gangetic plain, in which the main stem of Ganga lies, consists of alluvial formation and is a vast flat depositional surface at an elevation below 300 meters.

Soil Characteristics of Ganga Basin

-  *The Ganga basin consists of a wide variety of soils. While soils of the high Himalayas in the north are subject to continuous erosion, the Gangetic plain provides a huge receptacle into which thousands of meters of thick layers of sediments have been deposited to form a wide valley plain. The Deccan plateau on the south has a mantle of residual soils of varying thickness arising out of weathering of ancient rocks of the peninsular shield. Some of the soils are highly susceptible to erosion. Mountain soils, submontane soils and alluvial soils, covering 58% of the basin area, have very high erodibility; red soils covering 12% of the basin area have high erodibility, red & yellow soils and mixed red and black soils covering an area of 8% have moderate erodibility, and deep black soils and medium black soils covering an area of 14% have low erodibility. Shallow black soils and lateritic soils covering an area of 6% have very low erodibility.*
-  *Broadly, it can be said that soils in Haryana, Uttarakhand, Uttar Pradesh, Bihar, Jharkhand and West Bengal, through which the main stem of Ganga and all its tributaries flow, have very high erodibility.*

Demography of Ganga Basin

Demography has an important bearing on the state of the river as it is significantly affected by the population living within the basin. Average population density in the Ganga basin is 520 persons per square km as against 312 for the entire country (2001 census). Major cities of Delhi, Kolkata, Kanpur, Lucknow, Patna, Agra, Meerut, Varanasi and Allahabad are situated in the basin. The cities in the basin have large and growing populations and a rapidly expanding industrial base. The summary of urban population in the states covering Ganga basin is given in Table. It can be seen that between 2001 and 2011, urban population increased by 30% approximately. This trend is likely to continue. The pollution load is also expected to increase correspondingly.

S.No	States	No of Statutory Towns*	Urban Population(2001)	Urban Population(2011)
1.	Bihar	143		11,758,016
2.	Jharkhand	41	5,993,741	7,933,061
3.	Haryana	91	6,115,304	8,842,103
4.	Himachal Pradesh	58	595,581	688,552
5.	Madhya Pradesh	394	15,967,145	20,069,405
6.	Chhattisgarh	188	4,185,747	5,937,237
7.	Rajasthan	205	13,200,000	17,048,085

8.	Uttar Pradesh	670	34,539,582	44,495,063
9.	Uttarakhand	80	2,179,074	3,049,338
10.	West Bengal	138	22,427,251	29,093,002
11.	Delhi	6	12,905,780	16,368,899

Reference Link:.

❖ **Google Map-** <https://www.google.com/maps/d/viewer?oe=utf-8&client=firefox-a&ie=UTF8&hq&hnear=India&gl=us&hl=en&t=p&msa=0&ll=29.453947999999999%2C77.996063000000004&spn=11.688583%2C13.183594&z=8&source=embed&mid=1ej9TazwUYRFhQWacz6d6FqqBRfY>

❖ **Source--** <https://en.wikipedia.org/wiki/Ganges>

❖ **National Mission For Clean Ganga--** <https://nmcg.nic.in/>