

SOCIO-ECONOMIC AND ENVIRONMENTAL ISSUES ASSOCIATED WITH URBAN WATER MANAGEMENT IN INDIA

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ABSTRACT

Rapid urbanization, urban migration and tremendous rise in population make water management a challenging issue in the unscientifically planned urban centres of India. Globalisation and associated industrialisation boost the growth of cities, create new urban centres and promote uncontrolled migration, with large impact on the environment. Both surface and groundwater resources have been highly deteriorated. Natural water purifying systems like wetlands and paddy fields have been extensively destroyed for residential and industrial purposes. Cities lack adequate treatment and waste disposal systems. Competition for reliable water leads to conflicts among urban inhabitants and also among urban-suburban and urban-rural populations. Living condition of urban poor and thousands of migrants and illegal residents become worse. Overuse and misuse of water further shortens the availability. Coastal cities face a threat from the impact of climate change, sea level variations and salinity intrusion. Administration often fails to provide uninterrupted and reliable water supplies in time and in sufficient quantities. India lacks a comprehensive and appropriate urban policy and an impartial and strong political will to implement it.

Key words: urbanization, water quality, climate change, socio-economic issues, urban water management

INTRODUCTION

Twentieth century witnessed a wonderful tenfold increase in the world's urban population. Today, 50 percent world's population lives in urban centres, compared to less than 15 percent in 1900. In 2000, there were 387 above million population cities and 18 with more than 10 million inhabitants. In the latter half of the last century, most of the growth in the world's urban population was in low- and middle-income nations such as India. By 2000, Asia alone had nearly half the world's urban population and more than half its million cities. Increasing water demand in urban centres and pollution and overdraft of surface and groundwater in urban area have impact not only on the city life, but also on agriculture and rural population, as the water is drawn from distant watersheds (UN-HABITAT, 2006). Managing urban water becomes challenging, as the demands increase and availability decreases due to degradation of available water resources and changes in climate.

Table 1: Urban Agglomerations/Towns by Class/Category

Class	Population Size	No. of UAs/Towns
Class I	1,00,000 and above	393
Class II	50,000 - 99,999	401
Class III	20,000 - 49,999	1,151
Class IV	10,000 - 19,999	1,344
Class V	5,000 - 9,999	888
Class VI	Less than 5,000	191
Unclassified		10*
All classes		4378

Source: Census of India – 2001.

Situation is worse in India. Exploding population, rapid urbanization and uncontrolled migration make providing reliable water to the urban population a difficult and complicated task. Indian population has crossed 1 Billion and is still growing, expected to stabilise only at 1.5 billion by the year 2050. The net addition of urban population during 1991-2001 has been 6 million, with a percentage decadal growth of 31.2%. The percentage of urban population to the total population stands

at 27.8. There has been an increase on 2.1% points in the proportion of urban population during 1991 – 2001. There were 4378 cities and towns in India as on 2001 (Table 1). Indians make up 16.7 per cent of the world’s population with an annual growth rate close to 2%. In Delhi and Chandigarh, almost the entire population is urban. In big states such as Tamil Nadu and Maharashtra, now almost half of the population live in urban centres (Table 2). About 10.5 % of the national population live in the million plus 35 cities. Mumbai with a population of more than 16 million is now the world’s fourth-largest urban area followed by Kolkata. Studies (citymayers.com) indicate that by the year 2020, 12 out of the 100 largest cities in the World will be in India, Mumbai being 2 in the list (Table 3).

Table 2:Urban agglomeration of India

Rank	Urban Agglomeration/City	Population (million)	Rank	Urban Agglomeration/City	Population (million)
1	Greater Mumbai	16.37	19	Ludhiana (MC)	1.40
2	Kolkata	13.22	20	Kochi	1.35
3	Delhi	12.79	21	Visakhapatnam	1.33
4	Chennai	6.42	22	Agra	1.32
5	Bangalore	5.69	23	Varanasi	1.21
6	Hyderabad	5.53	24	Madurai	1.19
7	Ahmedabad	4.52	25	Meerut	1.17
8	Pune	3.75	26	Nashik	1.15
9	Surat	2.81	27	Jabalpur	1.12
10	Kanpur	2.69	28	Jamshedpur	1.10
11	Jaipur (MC)	2.32	29	Asansol	1.09
12	Lucknow	2.27	30	Dhanbad	1.06
13	Nagpur	2.12	31	Faridabad (MC)	1.05
14	Patna	1.71	32	Allahabad	1.05
15	Indore	1.64	33	Amritsar	1.01
16	Vadodara	1.49	34	Vijaywada	1.01
17	Bhopal	1.45	35	Rajkot	1.00
18	Coimbatore	1.45		Total	107.88

Source: Census of India – 2001

Table 3: Indian cities among the 100 largest cities/urban areas in 2020

Rank	City/Urban area	Average annual growth, 2006 to 2020, in %	Population in 2020 (millions)
2	Mumbai (Bombay)	2.32	25.97
3	Delhi	3.48	25.83
11	Calcutta	1.74	18.54
28	Bangalore	2.79	9.92
32	Chennai (Madras)	1.68	8.88
35	Hyderabad	2.21	8.61
39	Ahmadabad	2.73	7.78
41	Surat	4.99	7.72
43	Pune (Poona)	3.46	7.53
78	Jaipur	3.60	4.79
86	Kanpur	2.53	4.44
100	Lucknow	2.72	3.89

Source: citymayors.com

Because of social and economic reasons there has been tremendous increase in migration to cities. Urban economy has far bypassed most of the country's 600,000 villages. Associated with globalisation, there has been a shift in industries from developed countries to developing countries like India, as the labour, energy and natural resources are cheap. As a result, the base of the Indian economy is being shifted from agriculture to industries. Negligence to the agricultural sector affects the job security of millions of rural poor, in addition to the food security. Uncertainties in rural life compel the population to migrate to cities in search of a better livelihood. According to the National

Sample Survey Organization (2007), about 50% of the farmers think about leaving agriculture, if they find any alternate livelihood.

2. THE URBAN WATER ISSUES IN INDIA

2.1 Deterioration of resources

Most of the existing water supply schemes in India were designed and installed decades earlier and are now highly inadequate to meet the increasing demands. The growing Indian cities are not well-planned to accommodate the current population and water supply and waste disposal are becoming increasingly difficult. Untreated domestic wastes deteriorate both surface and groundwater resources. Water is highly contaminated from a variety of pollutants including toxic materials, from automobiles, households and industries. Even the urban air pollution alters the water chemistry. Water treatment mechanism in all cities is quite insufficient and inadequate. Improper design of drainages and their poor maintenance cause urban flooding, and the logged water infiltrates into groundwater. Cities located near rivers receive agricultural, industrial and domestic pollutants from far inland. The industrial belt of Eloor in Kochi city is one of the world's 'top toxic hot spots', where unchecked pollution has led to higher rates of death and disease (the Hindu, 2004). Several factories release pollutants manifold the permissible limit into the River Periyar near Kochi. They include deadly insecticides and pesticides.

The urban water supply and sanitation sector is suffering from inadequate service, widening gap between demand and supply, poor sanitary conditions, deteriorating financial and technical performance and after all, an operating mechanism without much sincerity. According to Central Public Health Engineering Organisation (CPHEEO) under the Ministry of Urban Development, nearly 90% of urban population has access to potable water supply. But in most cities, the supply is highly erratic and unreliable. Transmission and distribution networks are old and poorly maintained. Loss in distribution system is very high, more than 50% in some cities. Low pressures and intermittent supplies allow back siphoning, which results in contamination of water in the distribution network. Pipelines for water delivery run closer to pipelines for waste disposal. They also run through dirty canals and sewerages. Frequent power failure and low and unsteady voltage affect pumping of water. Water is available for only on few hours in a day in most Indian cities. Six days of continuous power failure in Palakkad, Kerala created serious water crisis in April 2007 (Pioneer News Service, 2007). India's electricity requirement is expected to double in about 5 years from now, adding to the crisis in cities (Subramaniam, 2007).

According to the World Bank (2001), among the million plus populated Asian cities, Chennai and Delhi are ranked as the worst performing metropolitan cities in terms of hours of water availability per day, while Mumbai and Calcutta are ranked as second and fourth worst performers respectively. Many cities such as Bangalore and Chennai carry water from far away rivers and lakes. Rising demands create more dependency on groundwater and the current rate of extraction using tube wells is not at all sustainable. In cities like Kochi where recharging is not difficult, the quality of groundwater is a problem. Most of the individual houses in Kochi have open wells, but the presence of pollutants and bacteria are above safety limits. In Delhi, nearly 10-15 % water is from groundwater reserves and remaining from the Yamuna River. Around 40% of the population of Bangalore depends on groundwater. (www.rainwaterharvesting.org). In the coastal cities such as Kochi, Mumbai, Chennai and Calcutta, overextraction through deep bore wells leads to salinity intrusion in groundwater. Unscientific storage system in Chennai causes tremendous water loss due to evaporation.

2.2 Climate change impact

Anomalies in global climate pattern pose serious threat to the urban water that is already under stress from human impact. Changing rainfall seasonality and severity of extremes affect major parts of India. Melting of Himalayan glaciers may cause both floods and droughts in north India. Weakening of winter monsoon in Kerala and highly seasonal nature of rainfall in the east and west coast affect water availability in all cities in those regions (Nair, 2006). Exceptionally heavy rainfall of 94.5cm in a day occurred in Mumbai on 26 July 2005. Highly seasonal rainfall creates floods, as the drainage pattern is insufficient and the natural flood water evacuation systems such as canals, paddy fields and wetlands have been widely destroyed. Changing frequency and intensity of depressions and cyclones is a threat to the coastal cities. Flash floods and storm surges may further deteriorate the water quality. Even a small rise in sea level may inundate large areas of the coastal cities.

To assess the situation in near future, changes in water availability in different states and territories of India has been estimated (Table 4) as per predicted change in climate and population, using the water balance procedure of Thornthwaite (1948) and Thornthwaite and Mather (1955), modified by Nair (1987) and based on the climate change scenario of IPCC and the report of the Census of India. Water availability is calculated from the water surplus that represents excess water from precipitation after evapotranspiration and soil moisture recharge. Computing water balance for urban centres alone is of little practical use, as all cities bring water from far away sources.

Table 4: Changes in water availability in different States of India

States	Per capita water availability (M ³)		States	Per capita water availability (M ³)	
	Year 2005	Year 2035		Year 2005	Year 2035
Andhra Pradesh	138	52	Mizoram	9566	2519
Arunachal Pradesh	30318	8882	Nagaland	4386	760
Assam	1095	322	Orissa	0	0
Bihar	283	202	Punjab	30	10
Delhi	0	0	Rajasthan	0	0
Goa	4732	2718	Sikkim	36662	15084
Gujarat	285	127	Tamil Nadu	224	113
Haryana	0	0	Tripura	1206	399
Himachal Pradesh	8562	4558	Uttar Pradesh	954	397
Jammu & Kashmir	3909	2073	West Bengal	243	102
Karnataka	3125	1570	Andaman&Nicobar*	50112	12325
Kerala	3542	2113	Chandigarh*	0	0
Madhya Pradesh	2411	941	Dadra&Nagar Haveli*	5098	1826
Maharashtra	277	101	Daman & Diu*	1620	659
Manipur	3768	1301	Lakshadweep*	78	25
Meghalaya	20237	7950	Pondicherry*	129	44

*Union territories

In almost all parts of India, seasonal water deficiencies show an increasing trend and the surpluses show a decreasing trend. Present per capita water availability from surplus of 2150m³ (not fully utilisable) will be reduced to 972m³ in 3 decades (table 4). Even today, Capital Delhi, three other states and 1 union territory have no annual surplus water from precipitation. India with different climate regimes, characteristics of the water cycle variables differ from one region to the other and these are reflected in the water availability. The northeast States and the Bay Islands have high values of per capita availability. But, tremendous population growth in these regions will reduce the availability up to one-fifth in 3 decades. Rather than total amount, rainfall seasonality and antecedent moisture conditions determine the water availability and even slight rise in temperature considerably

reduces it. However, in India, population increase is a more serious issue compared to the effect of global warming on water resources.

2.3 Social, political and economic issues

Administrative mechanisms fail to find a solution to urban water problems, due to political and financial reasons. Gap between the water demand and deliveries often leads to severe conflicts among different classes of people. Situation is more serious in the mega cities and is likely to go worse in the coming years. Water disputes over allocation have halted water related development activities in India for decades. Some of the severe conflicts such as the 200 years old Cauvery issue could not be solved even with the orders of the tribunals and the Supreme Court. This is mainly because of the vested regional politics that keeps the issue sensitive for temporary gains. Even inside the city, there is inequity in water supply - 70 per cent of Delhi gets less than 5 per cent of the water, while parts where government officials and the richest reside get a 400-500 litres per capita daily.

Unaccounted population in slums create social and environmental issues. Urban slum areas are home to more than 40 million Indians or 22.6% of India's urban population. More than 600 Indian towns and cities incorporate slum areas. Mumbai has the largest slum population of more than one million (48.9%) (www.citymayors.com). Major hurdle in slum removal is the vote bank politics. Politicians compete to provide them with ration card or right for vote so that it is difficult for the local governments to evacuate them. Attempts for slum removal have not become a success till now. When they are offered new houses, they often sell or rent it and return to slums. If the entire slum is removed, there will be a shortage of workers for low class works like cleaning.

The CPHEEO has estimated that INR1729 Billion is required for complete coverage of the urban population under safe water supply and sanitation services by the year 2021 (<http://cpheeo.nic.in/>). Government may be compelled to access financial resources from the market and to incorporate the private sector in urban development programmes. Even when the Governments struggle for money to implement water supply schemes, they fail to collect the money for the water already supplied. The Kerala Water Authority has to get dues of 2Billion rupees, which is 0.8Billion rupees more than the functioning expenses of the Authority in a year, from the big flats and hotels in the cities of Kochi and Thiruvananthapuram and other urban and rural governments. Financial loss due to theft of water in the State may be more than this. The Kerala Water Authority is losing two to three million litres of water through illegal diversion. Certain groups collect water in big tanks that is available at nominal rate to domestic connections and sell at higher rates in water short areas. An interesting fact is that the Authority's expenditure in collecting 1 rupee water charge through contractors is 1.6 rupees (mangalam, 2007).

Development projects in India always lag for even decades due to administrative, legal and social problems. Corruption and misappropriation of money, slow administration, non-cooperation among various Government Departments, vested political interests etc are hurdles in urban water development schemes. All this happen when there are challenges ahead such as globalisation, industrialisation and climate change. Industrialisation and urbanization are dividing the society in terms of income and facilities. Industrial overuse and destruction of water bodies for special economic zones has already invited violent protests. Climate change has already shown impacts in different parts. National river linking project may be against the interest of water rich states. All these may worsen disputes over water allocation. Another serious issue is the sneaking of terrorists into big cities. They may target water storage and delivery systems.

2.4 Government policies and initiatives

Government is trying to overcome the financial constraints in water development in different ways. The Ministry of Urban Development has initiated institutional, fiscal and financial reforms. One of the key elements in the policy is enhancing the productivity of urban sector that contributes 60% to GDP. The Central Government has advised the States to minimize subsidies and to place urban development plans and projects on a commercial format and to collect additional taxes to minimise the difference in cost of operation and income. Municipalities issue tax-free bonds to find money for infrastructure development. Government is also seeking private sector participation in providing reliable water supplies and to train the stakeholders. It is thinking of amending existing laws for the increased transparency and accountability of utilization of public funds for the development of urban sector. Removal of the restrictions in foreign direct has invited hot debate in certain states over the conditions put forward by the investing agencies that is against the policies of some political parties.

Government is taking measures to ensure the efficient management of cities, aimed especially at better infrastructure and alleviation of urban poverty. Ministry of Urban Development is planning for a City Challenge Fund for the improvement of urban economy and an urban academy to carry out study and research on urban matters such as water supply, sanitation, transport, urban governance, finance, etc. The 74th Amendment of Constitution Act 1992 aimed at better governance and urban management gave much freedom to the urban local bodies. India has developed national urban transport policy and national housing policy. But, in spite of the rapid growth in urban sector and worsening issues in different urban sectors, country has not developed an appropriate urban policy incorporating all sectors. The task forces constituted for this purpose could not function satisfactorily. Though water is a hot matter, even the national water policy of India (2002) has not considered urban water issues as serious. The National Commission of Urbanisation has already pointed out the critical deficiencies in the various items of infrastructure, issues of the urban poor, the acute disparities in the access of basic services, deteriorating environmental quality and the impact of poor governance. To realise the vision of slum-free cities, the Centre has constituted a national core group on urban poverty to draft a holistic policy regarding livelihood, shelter and basic amenities. Government is planning to create a 'Special Fund' of 28000 Million rupees in the 11th Plan (2007-12) to meet provisions providing water supply, sewerage, roads, drains and sanitation services in the unauthorised colonies, community and miscellaneous services (the pioneer 29-3-07).

Major water projects are under way in the megacities. Mumbai is trying to minimise impact of urban floods through the 12Billion rupees Brihanmumbai Storm Water Drain Project aimed at overhauling the city's age-old drainage system by widening and deepening drains to increase its storm-water carrying capacity. In Delhi, the Yamuna action plan to tackle the river pollution is going through its second stage, lagging by almost five years and causing waste of millions of rupees (Down to earth, 2005). Urban water demands continue to grow because of significant population increases and the establishment of new urban centres. Even with the implementation of aggressive water conservation programs, providing adequate water supply will become more and more complicated.

3. CONCLUSION AND SUGGESTIONS

Rapid urbanization and uncontrolled urban migration make urban water management a very challenging issue in India. Changes in government policies and social setup make more and more population urban dependent. Demands in water increases sharply in all cities whereas, the available resources are being fast deteriorated. Changing climate conditions and conflicts over allocation adds to the water crisis. Slow and incapable administrative mechanism often fails in providing basic facilities, controlling illegal settlements and in preventing degradation of resources. Since population is fast rising and agricultural production is falling, another agricultural revolution may become necessary. Measures for food security always demand more water and this will further cut the water supplies to the cities.

Level of pollution in urban centres, especially near industrial sites is far above all safety limits. Industrial outflow is to be continuously monitored (industries release water in the night during tides). Polluting industries should be severely penalized. Innovative and cost-effective methods are to be employed in urban water purification, stormwater harvesting and stormwater treatment. Wells, ponds and incoming canals to cities are to be protected to maintain water quality and water availability. Careless disposal of solid wastes obstructs water flow in the drainages and is a major reason for urban water logging. Cities should have adequate mechanism for the timely removal of wastes and treatment of wastewater. Recent ban on thin plastic carry bags have some positive effect on this. Households should minimise the usage of detergents and also of fertilizers and pesticides in gardens. Use of biofertilizers and biological pest control are to be encouraged. Household waste may be segregated from industrial waste so that less toxic water can be treated and then used to non-drinking purposes. Water treatment is expensive for the local governments, but collecting money from the poor for this is unjust. Small treatment plants may be made mandatory for posh residential areas and big industries, or the expense for treatment to be met by additional tax from the high income group that consume most of the water.

Measures are to be taken to reduce the theft and misuse of water. A special squad is necessary for this. It is imperative that the Kerala Government is planning to make penalties for illegal water diversions by apartments and commercial complexes harsher by amending existing rules. The proposal is to incorporate penal provisions of two years' imprisonment and a fine of upto 100000 rupees in the Kerala Water Supplies and Sewerages Act to tackle large-scale diversion of water from the grid of the Kerala Water Authority (KWA) (Pioneer News Service, 2007). But, many such rules and regulations have become farce because of the monitory and political influence. Amount of potable water misused by a rich family in a day may meet the demands of a poor family for a week or more. In houses with swimming pools, the usage is manifold. Studies indicate that less than 10% of the population uses water sufficient for 50%. An average four member family in the state of Kerala use nearly 200 litres of freshwater for flushing toilet alone. There should be a mechanism to supply treated wastewater for the purposes like flushing, gardening, car washing etc. An appropriate tariff is to be fixed, charging heavily for overuse, while providing water free to the extreme poor. In cities like Bangalore, price of water from private parties is not affordable even to middle class families.

Since groundwater provides considerable share of water supply in many cities, it is important to ensure its recharge. Concreting in unnecessary parts of premises is to be discouraged. Instead, either tiles with gaps in between or gravel is advisable. This will also lessen the severity of floods. Paddy fields and wetlands are natural water purifiers and flood controllers and they have to be protected from further encroachment. Deep borewells are to be banned immediately. In coastal cities, they invite salinity intrusion. In rich rainfall zones, rainwater harvesting should be made mandatory for all buildings. Several States such as Kerala have already done this.

Water disputes can be solved only by consensus, equity sharing and impartial political decisions. Administration is to be made stricter and corruption free and different departments should be more cooperative in implementing projects and avoiding delays. Better institutional capacity and good governance could improve the urban life. Planners should be able to foresee the changes in land-use, population and climate in coming decades. Water development schemes for the city should be separated from the remaining area. In urban planning, separate guidelines should be there for the wet and dry cities. What works for Mumbai need not be ideal for Chennai.

Low voltage and lack of timely availability is a major issue that affects pumping in some states like Kerala. In peculiar topographies such as this state, water from the upper areas may be transferred through pipes by gravitational force alone. Tremendous amount of water is lost in conveyance. This may be minimized by the proper maintenance of the existing pipelines and the using pipelines instead of open canals.

Since government sector in India is of low efficiency and reliability, private sector participation becomes necessary for the success of development projects. Government should have a control over them. Aid from the multilateral agencies for urban water development is always with conditions. They are against subsidies. But, in a country like India with millions below poverty line, one cannot ignore the realities in society.

With the current rate of urbanization and urban migration, governments will have to struggle hard to provide basic necessities, especially water. There should be a strict control in urban migration and the spreading of slums. This can be done by provide facilities in satellite cities and shifting industries to out of the city limits wherever possible. For rehabilitation in slums, it is better to provide free accommodation rather than giving permanent ownership, to avoid the renting and selling of houses. Requirements of the thousands of people coming to the city for work during daytime are to be counted. India urgently needs a comprehensive and appropriate urban policy with maintaining urban water quality and ensuring satisfactory supplies of water as important objectives.

A joint effort of the governments, civil society and the private sector and an impartial political interest with a national vision only can save the urban centres of India from the current crisis.

REFERENCES:

- Census of India (2001): Census of India, Government of India, <http://www.censusindia.net/>
- Down to earth (2005): **The political economy of defecation**, *Centre for Science in Environment publication*, April 26 release.
- IPCC (2001): Third Assessment Report: Climate Change 2001, Intergovernmental panel on climate change, <http://www.ipcc.ch/pub/reports.htm>
- mangalam.com (2007): News report, *Mangalam daily*, 30may
- Nair, Shadananan (1987): Hydrometeorological studies of Kerala state in relation to the Western Ghats region, *PhD thesis submitted to the Cochin University*, 180pp
- Nair, Shadananan (2006): Development of Strategies to Face Climate Extremes in India, Proc. International Conference on the Problems of Hydrometeorological Security, Moscow, 26 - 29 September, 80pp
- National Sample Survey Organization (2007): *Survey report*
- National water policy of India (2002) Ministry of water resources, Government of India, 10pp
- Pioneer News Service (2007) **Harsher penalties for water theft on cards**, *Daily pioneer* 1 May
- Pioneer News Service (2007): Palakkad goes without power for six days, *News report* 1 May
- Subramaniam, Kandula (2007): Demand for power, energy use to double in four years, *Indian Express*, 30 April
- The Hindu (2004): News report, *The Hindu Publication*, Chennai 03 July
- Thorntwaite, C J. (1948): An Approach Towards the Rational Classification of Climate. *Geogr.Rev.*, 38 (1).
- Thorntwaite, C J. and Mather, J R. (1955). The Water Balance. *Publ.in Climat. Lab. of climat.*, 8 (1).
- UN-HABITAT (2006): Water: a shared responsibility, *chapter 3water and human settlements in an urbanizing world*, 28pp
- World Bank (2001): Background Paper - *International Conference on New Perspectives on Water for Urban & Rural India - 18-19 September, 2001, New Delhi*
- www.citymayors.com/statistics/urban_2020_1.html
- www.rainwaterharvesting.org