Management of Water Distribution From different Resources of India

Dr . Pramod Prasram Gaike
Dept of Zoology Vasantdada Patil College Patoda
Tq- Patoda Dist – Beed. 414204. (MS)
pramodgaike0@gmail.com

Abstract
Water pollution is a major global problem which requires ongoing evaluation and revision of water resource policy at all levels (international down to individual aquifers and wells). It has been suggested that it is the leading worldwide cause of deaths and diseases and that it accounts for the deaths of more than 14,000 people daily (West, 2006; Pink, 2006). India, with a population of over a billion is the world's largest democracy, historically, civilization in India as around the world have largely evolved and developed around water bodies as most human activities, including agriculture and industry depend on water. The water situation in India seems to be going from bad to worse. Not only is there a growing scarcity of water in the country, the agriculturally important states like Maharashtra ,Punjab, Haryana, Tamilnadu and Rajasthan are facing a steady fall in their ground water levels. While the per capita availability of utilizable water in India in 1951 was 3,450 cubic meters in 1999 it came down to 1,250 cubic meters. This according to the Ministry of Water Resource is expected to decrease to 662 cubic meters per person in 2050. This paper attempts to focuses on water resource of India. A scene of distribution, trends of quality change, use, overuse and management strategies.

Key Words : Water Resources, India, Distribution, Management.

Introduction

Water is a finite but widely present resource. It is a good solvent, which makes it highly vulnerable to pollution. Despite its wide presence, water availability and demand at many places have high degrees of mismatch: spatial and temporal. Many a times, it is a challenge to provide water of desired quantity and quality at a desired place. This is especially true for monsoon climates where 70–90% of the annual rain falls in just 3–4 months. This leads to too much water and often floods in the wet season, and too little water and often droughts in the dry season. At times, enough water may be available but the quality may be so poor that it is of no use without treatment. Sustainable water management in India poses numerous challenges:

bridging the increasing gap between demand and supply, providing enough water for production of food, balancing the uses between competing demands, meeting the growing demands of big cities, treatment of wastewater, sharing of water with the neighbouring countries and among the co-basin states, etc. Each day, a person drinks 2–4 litres of water and uses 10–15 litres for other essential needs. Clearly, meeting the basic water needs is a governance problem. Globally only about 14% of all water use is for domestic needs (drinking, cooking, washing, etc.). Each day, a typical individual consumes food that requires 2000–5000 litres of water to produce. Hence, producing food for an additional 40 crore people in India, which may be added in next 40 years (the current population is 121 crores), will be a big challenge and calls for fundamental technological and management changes in the way we have been managing our natural resources.
At the time of Independence, India was faced with the dual challenge of enhancing food grain production and providing safe drinking water supplies. Irrigation development was a major investment priority in the five-year plans. Since 1951, India had made remarkable achievements in irrigation development (Bharadwaj 1990; Varghese 1990; Vohra, 1995). The net irrigated area had almost doubled during the period of 1951 to 1991 from 21 m. ha to 45.6 m. ha in 1991 (Vohra 1995). The annual food grain production increased from a meagre
50.8 million tons to 198 million tons in 1996-97. Substantial achievements had also been made in water supplies through the development of surface and groundwater resources. While at the time of independence, only 6.15 percent of the country's population had safe drinking water supplies (source: Five Year Plans as quoted in TERI 1998), by the year 1997, about 81 percent of the total population had access to safe drinking water supplies (CSE1997). However, the development had also brought to the fore several physical, social and management problems. In this section, we attempt to analyse the major water related problems that pose challenge to meeting the future water supply needs.

Fresh waters represent the main sources of safe water for household, agricultural and even industrial applications. They are required for drinking, cooking, recreational activities, farming, fishing etc., making them unavoidable for the evolution of society and civilization. Rivers are the most important freshwater resource available to the local inhabitants which are either unsafe or difficult to obtain and are severely stressed by poor management. These make access to clean water a serious problem, in some instances women and children need to walk for hours to fetch ordinary drinking water (Galadima et al. , 2011).

Water is vital to the existence of all living organisms, but this valued resource is increasingly being threatened as human populations grow and demand more water of high quality for domestic purposes and economic activities [UNEPGEMS, 2000]. The significance of water to human and other biological systems cannot be over emphasized, and there are numerous scientific and economic facts that, water shortage or its pollution can cause severe decrease in productivity and deaths of living species (Garba et al., 2008; 2010). Clean and plentiful water provides the foundation for prosperous communities. We rely on clean water to survive, yet right now we are heading towards a water crisis.

India receives annual precipitation of about 4000 km3, including snowfall. Out of this, monsoon rainfall is of the order of 3000 km3. Rainfall in India is dependent on the south-west and north-east monsoons, on shallow cyclonic depressions and disturbances and on local storms. Most of it takes place under the influence of south-west monsoon between June and September except in Tamil Nadu, where it is under the influence of north-east monsoon during October and November. India is gifted with a river system comprising more than 20 major rivers with several tributaries. Many of these rivers are perennial and some of these are seasonal. The rivers like Ganges, Brahmaputra and Indus originate from the Himalayas and carry water throughout the year. The snow and ice melt of the Himalayas and the base flow contribute the flows during the lean season. Lal mentioned that more than 50% of water resources of India are located in various tributaries of these river systems. Average water yield per unit area of the Himalayan Rivers is almost double that of the south peninsular rivers system, indicating the importance of snow and glacier melt contribution from the high mountains. Apart from the water available in the various rivers of the country, the groundwater is also an important source of water for drinking, irrigation, industrial uses, etc. It accounts for about 80% of domestic water requirement and more than 45% of the total irrigation in the country. As per the international norms, if per-capita water availability is less than 1700 m3 per year then the country is categorized as water stressed and if it is less than 1000 m3 per capita per year then the country is classified as water scarce. In India per capita surface water availability in the years 1991 and 2001 were 2309 and 1902 m3 and these are projected to reduce to 1401 and 1191 m3 by the years 2025 and 2050 respectively. Hence, there is a need for proper planning, development and management of the greatest assets of the country, viz. water and land resources for raising the standards of living of the millions of people, particularly in the rural areas.

Water resources of India

Although India occupies only 3.29 million km2 geographical areas, which forms .4% of the world's land area, it supports over 15% of the world's population. The population of India as on 1 March 2001 stood at 1,027,015,247 persons. Thus, India supports about 1/6th of world population, $1/50^{th}$ of world's land and 1/25th of world's water resources. India also has a livestock population of 500 million, which is about 20% of the world's total livestock population. More than half of these are cattle, forming the backbone of Indian agriculture. The total utilizable water resources of the country are assessed as 1086 km3. A brief description of surface and groundwater water resources of India is given belo

Surface water resources: In the past, several organizations and individuals have estimated water availability for the nation. Recently, the National Commission for Integrated Water Resources Development estimated the basin-wise average annual flow in Indian River systems as 1953 km3. Utilizable water resource is the quantum of withdrawable water from its place of natural occurrence. Within the limitations of physiographic conditions and socio-political environment, legal and constitutional constraints and the technology of development available at present, utilizable quantity of water from the surface flow has been assessed by various authorities differently. The utilizable annual surface water of the country is 690 km3. There is considerable scope for increasing the utilization of water in the Ganga–Brahmaputra basins by construction of storages at suitable locations in neighbouring countries.

*Groundwater resources: *
Groundwater resources are showing increasing signs of over-development in India. But, the national level statistics of groundwater development provides a rosy picture of the overall scenario. According to official statistics, only 30 percent of the rechargeable annual groundwater potential is so far utilised (Kittu 1995).
There are several factors contributing to the over-development of groundwater resources. They are lack of well-defined property rights, presence of subsidised energy for groundwater extraction, easy access to institutional financing for well development and rural electrification (Singh 1995; Moench 1995).

The annual potential natural groundwater recharge from rainfall in India is about 342.43 km3, which is 8.56% of total annual rainfall of the country. The annual potential groundwater recharge augmentation from canal irrigation system is about 89.46 km3. Thus, total replenishable groundwater resource of the country is assessed as 431.89%. After allotting 15% of this quantity for drinking, and 6 km3 for industrial purposes, the remaining can be utilized for irrigation purposes. Thus, the available groundwater resource for irrigation is 361 km3, of which utilizable quantity (90%) is 325 km3. The estimates by the Central Groundwater Board (CGWB) of total replenishable groundwater resource, provision for domestic, industrial and irrigation uses and utilizable groundwater resources for future use. The basinwise per capita water availability varies between 13,393 m3 per annum for the Brahmaputra–Barak basin to about 300 m3 per annum for the Sabarmati basin.

Water requirements of India

Traditionally, India has been an agriculture-based economy. Hence, development of irrigation to increase agricultural production for making the country self-sustained and for poverty alleviation has been of crucial importance for the planners. Accordingly, the irrigation sector was assigned a very high priority in the 5-year plans. Giant schemes like the Bhakra Nangal, Hirakud, Damodar Valley, Nagarjunasagar, Rajasthan Canal project, etc. were taken up to increase irrigation potential and maximize agricultural production. Long-term planning has to account for the growth of population. According to National Water Policy1, the production of food grains has increased from around 50 million tonnes in the fifties to about 203 million tonnes in the year 1999–2000. A number of individuals and agencies have estimated the likely. population of India by the year 2025 and 2050. According to the estimates adopted by NCIWRD, by the year 2025, the population is expected to be 1333 million in high-growth scenario and 1286 million in low growth scenario. For the year 2050, high rate of population growth is likely to result in about 1581 million people while the low growth projections place the number at nearly 1346 million. Keeping in view the level of consumption, losses in storage and transport, seed requirement, and buffer stock, the projected food-grain and feed demand for 2025 would be 320 million tonnes (high-demand scenario) and 308 million tonnes (low-demand scenario). The requirement of food grains for the year 2050 would be 494 million tonnes (high-demand scenario) and 420 million tonnes (low demand scenario). The availability of water in India shows wide spatial and temporal variations. Also, there are very large inter annual variations. Hence, the general situation of availability of per capita availability is much more alarming than what is depicted by the average figures. Estimates of India's water budget, i.e., annual flow of water available for human use after allowing for evapo-transpiration and minimum required ecological flow, vary considerably. The water budget derived from MoWR estimates, utilizable water of 1,123 billion cubic metres (BCM) against current water use of 634 BCM suggesting more than adequate availability at the aggregate level given current requirements. This is based on the Central Water Commission's estimates of India's water resource potential as 1,869 BCM. The standing sub-committee of MoWR estimates total water demand rising to 1,093 BCM in 2025, thus reaffirming a comfortable scenario.

More recent calculations based on higher estimates of the amount of water lost to the atmosphere by evapo-transpiration are much less comforting. Narasimhan (2008) has recalculated India's water budget, using an evapo-transpiration rate of 65 per cent, which compares with worldwide figures ranging from 60 per cent to 90 per cent instead of the 40 per cent rate assumed in official estimates. After allowing the same 48.8 per cent for ecological flows, his estimate of water utilizable for human use comes to only 654 BCM, which is very close to the current actual water use estimate of 634 BCM.

In addition to the fact that aggregate estimates suffer from data infirmities and arbitrary assumptions and are still being debated and contested, it is also important to emphasize that in a country of such immense physiographic, hydrogeological, and demographic diversity, and also vastly different levels of economic development (hence water use), water balances for the country as a whole are of limited value since they hide the existence of areas of acute water shortages and also problems of quality. What is required is a much more disaggregated picture, accurately reflecting the challenge faced by each region. The exact level at which regions need to be defined would depend on the purposes of the exercise, as also the unifying features of the region, such as basin and aquifer boundaries.

Water resources management in India

In view of the existing status of water resources and increasing demands of water for meeting the requirements of the rapidly growing population of the country as well as the problems that are likely to arise in future, a holistic, well planned long-term strategy is needed for sustainable water resources management in India. The water resources management practices may be based on increasing the water supply and managing the water demand under the stressed water availability conditions. Data monitoring, processing, storage, retrieval and dissemination constitute the very important aspects of the water resources management. These data may be utilized not only for management but also for the planning and design of the water resources structures. In addition to these, now days decision support systems are being developed for providing the necessary inputs to the decision makers for water resources management. Also, knowledge sharing, people's participation, mass communication and capacity building are essential for effective water resources management. Water conservation implies improving the availability of water through augmentation by means of storage of water in surface reservoirs, tanks, soil and groundwater zone. It emphasizes the need to modify the space and time availability of water to meet the demands. This concept also highlights the need for judicious use of water. There is a great potential for better conservation and management of water resources in its various uses. On the demand side, a variety of economic, administrative and community-based measures can help conserve water. Rainwater harvesting is the process to capture and store rainfall for its efficient utilization and conservation to control its runoff, evaporation and seepage another way through which we can improve freshwater availability is by recycle and reuse of water. It is said that in the city of Frankfurt, Germany, every drop of water is recycled eight times. Use of water of lesser quality, such as reclaimed wastewater, for cooling and fire fighting is an attractive option for large and complex industries to reduce their water costs, increase production and decrease the consumption of energy. This conserves better quality waters for potable uses. Currently, recycling of water is not practised on a large scale in India and there is considerable scope and incentive to use this alternative. Another strategy, which needs consideration, is changes in water pricing structures.

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