CURRENT SCIENCE

Volume 113 Number 7 10 October 2017

GUEST EDITORIAL

# Water resource management in India

Water is a key natural resource which is fundamental to life, livelihood, food, energy and water security and sustainable development.

India has more than 18% of the world's population, 15% of livestock, but only 2.4% of land area and 4% of renewable water resources. The average annual precipitation for India is about 4000 billion cubic metres (BCM). Average annual water availability for the whole country is about 1869 BCM. Topographical and other constraints further limit the utilizable quantity to about 1123 BCM. Rapid growth in the demand for water due to rise in population, increased pace of urbanization and industrialization is posing serious challenges in providing food and water security. Challenges in water management in India are to meet water needs, ensure environmental rejuvenation and sustainable development, all with large variations in availability and demands in space and time.

A country is categorized as 'water stressed' when available freshwater per capita per year is below 1700 $m^3$ and 'water scarce' if it falls below 1000 $m^3$. India's current average per capita water availability is 1410 $m^3$/year which is likely to drop to 1154 $m^3$/year by the year 2060 with a projected population of 1620 million. Average values hide real water stress in many regions since nearly two-thirds of our water resources are confined to the Ganga–Brahmaputra–Barak basins and there is large inter-annual variability in rainfall.

Water resources management requires, *inter alia*, online databases of key hydrometeorological data. We need to strengthen networks to measure rainfall, streamflow and other variables. At the stations, data needs to be observed by following standard protocols and after quality control checks, it needs to be uploaded in online shareable databases.

A river basin is the basic natural unit for assessment and management of water resources. Current assessments of water availability in various river basins are fairly old. These need to be updated by following better protocols and this exercise should be repeated every 5–10 years.

In many river basins in India, water allocation equals or exceeds the available water. Consequently, these basins frequently experience seasonal water scarcity. India has a monsoon type of climate and about 80–90% of the annual riverflows occur during four monsoon months. Hence, it is important to conserve monsoon flows for meeting the demands in the lean season. Transfer of water from surplus to deficit basins through interbasin water transfer is an attractive option to meet large water demands in a sustainable manner.

In our constitution, water is mentioned in the State List (List II) at Entry 17 which talks about water supplies, irrigation and canals, drainage and embankments, water storage and water power. Water is also mentioned in the Union List (List I) at Entry 56 which talks of 'Regulation and development of inter-State rivers and river valleys…'. Apparently, constitution makers wanted the local-scale developments to be the responsibility of the State Governments and involve the Central Government in regional/national-scale projects. Hence, both the Central and State Governments have to join hands for good water governance. This is clearly seen in case of disasters (e.g. flood) where structural measures such as dams and embankments are chiefly in the jurisdiction of State Governments and flood forecasts (a non-structural measure) are mostly issued by the organizations of the Central Government. Flood relief and rescue are shared responsibility. For medium and small projects, clearances are commonly given at the State level, whereas the Central agencies come into picture for major projects and those having inter-state and international implications. This division of responsibilities with fuzzy borders and considerable overlap has implications on water management in the country. Interstate water disputes are responsible for delays in implementing many projects besides other difficulties and we need a mechanism to quickly solve these. We have a well-articulated National Water Policy, but it does not help much in the present form.

India would need about 450 million tonnes (MT) of food grains annually by 2060. To increase food grain production from the present level of about 280 MT, we would require higher water use efficiency and higher food productivity, or 'more crop per drop'. Currently India has more than 4500 large dams which have helped attain self-sufficiency in food production, but the pace of development has slowed down in recent times due to environmental, rehabilitation and resettlement, and interstate issues. A critical factor in achieving food security would be to develop full irrigation potential in the country

and efficiently utilize the created potential. Agriculture sector is the dominant freshwater user in India but water use efficiency in irrigation is low. Extensive R&D is needed in all water uses to reduce demand and make water available for other sectors and environment. A moderate improvement in water use efficiency in agriculture will make available enough water to ease scarcity. It is important that micro-irrigation techniques are implemented on a large scale. The practices being followed in countries such as Israel and The Netherlands need to be replicated in India.

Recently, several schemes have been merged in the Pradhan Mantri Krishi Sinchai Yojna (PMKSY), which is yielding appreciable results in completing irrigation projects which were languishing due to various reasons.

Groundwater is a cheap and fairly dependable source of water. It has contributed immensely to increase the irrigated area and raise farmer's income. India has seen an exponential growth in groundwater use during the last few decades, which has improved food security. Groundwater is helpful buffer when rainfall is deficient or in drought prone areas. However, due to unchecked use of groundwater, water tables are rapidly falling in many parts and several blocks have become critical or overexploited (recharge is less than withdrawal). Strict regulation of groundwater use and harnessing it at a sustainable rate would go a long way in good water governance.

Two water-triggered disasters, floods and droughts, continue to hit India year after year. It is noted that we cannot provide complete protection against floods and droughts and people have to learn to live with them. A range of tools are needed to manage these extremes. We also need to develop methodologies for (a) long-range forecasts for planning, (b) real-time short-term forecasts of rainfall and stream flows, and (c) integrated real-time multi-reservoir operation by using these forecasts.

Waterscape in India is changing on account of growing urbanization and industrialization. Such changes are giving rise to increasing water demands as well as more pollution. Widespread water shortages and deteriorating water quality in many parts of the country are already impacting food productivity, health, environment and well-being. Release of untreated or partially treated effluents generated by cities and industries is degrading groundwater aquifers, and natural and man-made ecosystems. In too many cases, the polluters do not treat all the effluents prior to their release in water bodies either because the treatment capacity is inadequate or Sewage Treatment Plants (STPs) do not work, or deliberately. Every year, more than one lakh people die due to waterborne diseases in India. Obviously, we are paying very high social and economic price on account of poor water quality and sanitation and this needs to be checked.

Excessive use of fertilizers, and pesticides, and overexploitation of groundwater are also causing pollution. Many drinking water sources contain arsenic, fluoride and other harmful chemicals. Implementation of 'zero effluent policy' for industries would partly mitigate the situation. Unless appropriate mechanisms (supported by enabling laws) are introduced, our aquatic ecosystems would further deteriorate to the detriment of the society.

Spatial and temporal water availability and variation are likely to change in future due to climate change which brings a new level of complexity and challenges: changes in demand due to increasing temperature, change in precipitation pattern and intensity and increased magnitude, frequency, and extent of water related extremes. These changes are likely to manifest in a variety of ways: greater occurrences of floods and droughts, increased soil erosion and landslides, etc. India is highly vulnerable to the adverse impacts of climate change which will introduce new uncertainties and add to the existing challenges. We need to create infrastructure and revise design and operation practices to overcome additional stresses introduced by climate change. An early start will keep the costs down and reduce damages.

Presently water rates in India are very low; these could be used as an economic instrument for controlling water use and generate revenue for renovation and expansion of infrastructure. Rates for water use may be fixed such that they don't hurt the poor and induce all users to save water.

Meeting current and future water challenges requires robust policies and governance. Water is dealt with in a fragmented manner at the Centre and State Government levels. Most of the irrigation/water resources departments in the States are construction oriented. They lack the capability to embrace and use new technologies and have not realigned with the changing requirements. Due to increasing vacancies and post-cuts, these organizations are losing expertise as experienced staff are retiring without passing the baton to youngsters. Most of these departments lack capabilities in new fields such as water quality modelling, assessment of impacts of climate change, flood/drought forecasting and warning, etc. Even in academic and research institutions, such capabilities are confined to selected places. Since State Governments are the custodians of water, strengthening of State-level departments is a must for vibrant water governance. Institutions need to be restructured and made multi-disciplinary.

Some other governance-related matters requiring attention are: recycle and reuse of urban and rural water, revival rejuvenating of tanks and ponds, environmental flows, and water rights. With the emerging political will to make agriculture an engine of sustainable economic growth and to rejuvenate environment, it is imperative to pursue the best water governance so that water becomes a driving force in national development.

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