

## A perspective on water security in India

Water security is the ‘capacity of a population to safeguard sustainable access to adequate quantities of acceptable quality water for sustaining livelihoods, human well-being and socio-economic development’. It also includes protection against water-borne pollution, water-related disasters, and preserving ecosystems in a climate of peace and political stability. Worldwide, major causes of water scarcity are population and demand rise, higher food and energy requirements, urbanization, changing lifestyles and diets that require more water, pollution of raw water sources and increasing industrial production. Water has a central place and role in ensuring a broader sense of security that involves complex and interconnected challenges.

In the last 50 years, the global population has increased from ~3 billion to more than 7 billion and water use has tripled. Over the next 25 years, the population is likely to increase by about 2.5 billion; demand for water will also rise. Adequate steps would be needed to provide water security, if it is not to be compromised due to these causes.

In India, challenges in water security arise due to a number of reasons. Highly skewed distribution of water availability in space and time leads to water scarcity, uncertainties in supplies, and disasters like floods and droughts. Water supply agencies face difficulties in ensuring sustainable supplies because sources go dry in summers, particularly in arid regions. Rise in population is leading to increasing demand for water and also falling per capita availability. Further, intense rainfall on steep slopes and young mountains generates floods and sediments which damage hydro-infrastructure. Large quantities of water are being withdrawn from surface and subsurface sources to meet needs of the society; often these withdrawals are not sustainable. The quality of water in most rivers in long stretches and in many aquifers is poor. When water is withdrawn from polluted sources, additional costs are incurred to treat it before supplying. This puts extra financial burden on water-supply networks. Scarcity of water also results in increasing competition/conflict among sectors and this is also detrimental to water security.

Any discussion about water security needs to consider all the uses of water that impact its availability and quality. Water has an important role in food and energy securi-

ties. Globally, agriculture accounts for about 70% of water consumption; in India it accounts for about 85–90% of water consumption. Food security exists when all the people, at all the times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and preferences for an active and healthy life. Due to erratic rainfall, irrigation is needed for optimum crop production. Irrigation increases resilience of the agricultural system, but excessive irrigation is harmful to the crops, environment and water security. Further, clean water is needed in processing agricultural produce, cooking and sanitation. Erratic rainfall and seasonal scarcity of water can cause food shortages. Floods and droughts, the two water-related disasters, are harmful to food security. Urban floods degrade infrastructure and adversely impacts water security.

Water is also a vital input in energy generation by various means such as hydro, thermal, nuclear and biofuel. Biofuels are water-intensive energy sources. Before large-scale use of biofuels to produce energy, it is necessary to study the water and land requirements and environmental impacts. Energy is an important input at various stages of food production and supply chain, right from pumping/treatment of water to food processing, transportation, storage and cooking. Therefore, it is helpful to recognize that water, food and energy sectors have strong interlinkages and dependencies and the traditional fragmented approach, where management decisions for each sector are taken in isolation, yields sub-optimal solutions. A nexus (the act of tying together) approach can enhance water, food and energy security. This approach integrates management and governance across various related sectors and on various scales (local, regional, national, etc.), reduces trade-offs and builds synergies. Without a nexus approach, attempts to secure the security of one resource independently might compromise the security of some other resource. The nexus approach can also address issues such as increasing disasters, land degradation, intensive agriculture, etc. River basin is a natural unit for nexus studies. A multi-disciplinary team is necessary for nexus studies.

In many regions of India, available water is inadequate to meet all the demands, more so in times of deficient

rainfall. Recycling and reuse of water mitigates the problem to some extent. In case of severe or multi-year droughts in India, water had to be supplied by unconventional means such as railways. For water security in these regions, infrastructure that can supply large quantities of water to drought-affected areas would be needed.

A challenge in providing water security is that India has a monsoon climate, and 75–80% of annual rainfall occurs in about three months in most parts of the country. Hence, conservation of flood flows is of utmost importance to provide security against floods and droughts. A range of options to conserve water can be explored: soil moisture, ponds/tanks, wetlands, subsurface aquifers, and dams of different sizes. Obviously, some options can effectively reduce vulnerability for events of moderate intensity only and for a small region. A comprehensive appraisal of all options is required to determine the best alternative for the given problem. Dams and reservoirs, depending upon their size, provide a range of benefits and help manage variabilities of higher magnitude and spanning multiple seasons/years. Large water storages aid in reducing vulnerability to short- and long-term climate variability and change. But they also have some harmful impacts, including fragmentation of rivers and displacement of populations. The social and environmental footprint of a dam can be large and nowadays, there is opposition to the building of dams. For planning and management of large projects, good practices have been suggested that consider sustainability from the early planning stages up to implementation, and seek stakeholder involvement at all stages. The female population has a critical and valuable role in providing water security.

Wastage of water due to leakages and thefts is quite high in some Indian cities, at times as high as 40% of the water supply. Evidently, such large losses impose huge burden on the finances, reduce customer satisfaction and harm water security. In recent times, losses in electric supply systems in some states have been reduced dramatically by new technologies and strict enforcement. Similar results can be achieved in water-supply networks, thereby positively impacting water security. Along with the supply side, demand management by adopting the right crops also improves water security. Transfer from surplus to deficit areas by virtual water should also be explored.

Water insecurity does not always arise due to scarcity of water. In many situations, a bigger challenge is to provide water to the users fairly and equitably. Wasteful use of any resource, including water, depends on frames of reference, lifestyle and behavioural patterns. Affluent sections of the society tend to be less careful in the use of resources. Behavioural changes in this class of users and equitable allocation are tough to achieve and pose institutional, political and administrative challenges. Firmly nudging these sections towards responsible resource utilization can significantly improve water security in the long term.

Since ecosystems have a key role in providing water, their protection and conservation are central to water security. Utilization of water for human welfare, food production and energy generation has environmental implications. Natural resources place upper limits on sustainable utilization of water resources. Crossing these limits may yield additional benefits in the short term, but in longer term costs exceed benefits.

The United Nations (UN) adopted 17 Sustainable Development Goals (SDGs) in 2015 to end poverty, protect the Earth and improve the lives and prospects of the people. The UN noted that 3 out of 10 people lack access to safely managed drinking water services. Women and girls are responsible for water collection in 80% of households that lack access on their premises. Among the SDGs, Goal 6 'Ensure access to water and sanitation for all' is directly concerned with water security. Water is a key constituent for many other goals. Article 6.1 of Goal 6 aims to achieve universal and equitable access to safe and affordable drinking water for all by 2030. According to the UN, between 1990 and 2015, the proportion of the global population using an improved drinking water source has increased from 76% to 90%. In India, more than 75% habitations get more than 40 litre of water per capita per day. However, many habitations have access to only poor water quality. Presence of arsenic and fluoride in water sources is a critical issue; sadly, prevalence of arsenic is increasing.

Right to Water has been protected by the Supreme Court of India as a fundamental human right under the Right to Life guaranteed by Article 21 of the Constitution of India. To provide drinking water security to the citizens, the Government of India has restructured the existing schemes into the Jal Jeevan Mission to provide tap water to every rural household by 2024. This scheme is popularly called 'Har Ghar Nal Ka Jal'.

Migration of water on and below the Earth's surface does not follow administrative boundaries. Therefore, many a times, the conventional paradigms do not work in water governance. Water security will be compromised due to climate change, and land use–land cover changes as the impacts will cause higher variability and disasters. Good water governance is essential to achieve water security. It requires strong and empowered institutions, and support from legislations and policies. A combination of nature-based solutions with 'hard' hydro-infrastructure often provides cheaper and lasting solutions. Integrated water resource management offers a broad framework to address water security issues comprehensively.

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