# Chapter 40
# Need for a Legal Framework for Groundwater Security in India

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**Abstract** India consists of only ~2% of the world's total land area but supports a large part (~19%) of the global population, thus being inherently stressed for natural resources for its citizens, e.g. safe and sustainable water. Securing water for nourishment, household purposes and food production relates to 'water problems', which can be classified as issues related to water quantity in terms of availability of sufficient quantity of the water (excessive water, e.g. flood and lack of water like drought), and issues of water quality, meaning that the available water should be of safe quality for human consumption purposes. In India, where water resource availability is extremely heterogeneous and is largely dependent on stability of the monsoonal rainfall, aggravating the water scarcity with predicted population growth is going to be a pivotal public health, socio-economic and political issue in near future. Groundwater is the largest resource of freshwater in this planet and India, whose availability is largely dependent on the geological and climatic set-up for an area. Groundwater use and food production are also strongly linked because irrigated agriculture is the primary consumer of global freshwater resources. Globally, being the largest consumer of groundwater resources and being the highest groundwater-irrigated country, by area, India is particularly vulnerable to water and food scarcity. Almost 85% of its groundwater consumption is linked to agricultural practices, which possibly has not much changed since the age of first human settlements in these ancient lands, millennia ago. Groundwater availability problems are likely to be exacerbated in the future by climate change. Thus, these water scarcity problems will most likely translate to food scarcity. In the present situation,

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A. Mukherjee (ed.), *Groundwater of South Asia*, Springer Hydrogeology,
https://doi.org/10.1007/978-981-10-3889-1_40

the lack of a holistic approach to understand the different facets of water cycle translates to the fact that water as an essential commodity is inevitably getting exceedingly scarce in India. Thus, there is a requirement to develop plans for assuring availability of suitable water for drinking and food production as a social security and democratic right for every citizen of India. This strongly entails a clear road map for groundwater security, under a legal framework, such that it focuses on water resources sustainability and the role of resource efficiency and environmental management in reducing risks, i.e. for more efficient and judicial use of water and proper preservation for future generations.

## 40.1 Introduction

As India (Chap. 1, Fig. 1.1) aspires to become a 'developed' country from a 'developing' country in the impending decades, it is imperative that all citizens of the country should be provided with the basic social securities. India consists of only ~2% of the world's total land area but supports a large part (~19%) of the global population (FAO 2013). And, in a country like India, where a large part of the total population is still below the poverty line and is deprived of being fed twice a day, assuring the minimum security of proper nourishment should be the first priority of any administration. However, even after sixty-seven years of the country's independence, this has remained as a long-sought dream. In this backdrop, the National Food Security Bill 2013 (Right to Food Act) was proclaimed. However, the inherent feeling is that this bill wouldn't be sufficiently able to secure the basic survival needs of Indian citizens. The reason being that even if in future, the administration is able to secure food for everybody, a more fundamental need for survival of life, i.e. *drinking water,* still remains unsecured. In this context, it is delightful to find that the present government has discretely focused on better water management and forwarded the proposition of supplying potable, pathogen-free drinking water for everybody. The budget declaration has also referred to setting up of enhanced irrigation schemes as 'Pradhan Mantri Gram Sinchayee Yojana' with motto of 'har khet ko paani', thereby reducing the farmers' dependence on unpredictable rainfall for cultivation. Even, the Ministry of Water Resource is being restructured and reorganized to better serve the citizens of our great republic. More related information regarding groundwater of South Asia is available in Mukherjee (2018).

While all of these above-quoted plans are very good-willed, there is a need for in-depth understanding of water security, as it will help us to go into a series of issues, based on evidence and cutting through many of the myths and alarmism around water scarcity. On the contrary, an unplanned, adventurous effort can severely further undermine the already dwindling water resource. Securing water for nourishment, household purposes and food production relates to 'water problems', which can be classified as issues related to water quantity in terms of availability of sufficient quantity of the water (excessive water, e.g. flood and lack of water like drought), and issues of water quality, meaning that the available water should be of safe quality for human consumption purposes. In India, where water resource availability is extremely heterogeneous and is largely dependent on stability of the monsoonal rainfall, aggravating the water scarcity with predicted population growth is going to be a pivotal public health, socio-economic and political issue in near future (Mukherjee et al. 2015). Groundwater is the largest resource of freshwater in this planet; however, its availability is largely dependent on the geological and climatic set-up for an area. Impending predicted climate change scenarios would further complicate the groundwater availability. It has been estimated in recent studies (Verma and Phansalkar 2007) that at the beginning of every hydrological year, 4000 billion $m^3$ of water enters the Indian hydrological system. Almost 2000 billion $m^3$ is lost in unaccounted processes, including evaporation, supply line leakages, flowing to very deep aquifers or escape by outflow to the sea. The remaining ~50% of water has an extremely skewed distribution with more than 60% being distributed in the great North Indian alluvial plains of the Indus–Ganges–Brahmaputra river systems, which accounts for only ~35% of Indian continental land area. Hence, the rest 65% of the land mass that includes most of southern and western parts of India gets only 40% of India's total annual water resource. Of these, the four monsoon months (June to September) account for 60–80% of the flow through either of the North or South Indian rivers, making it even more skewed distribution in a temporal scale. Consequently, these facts also indicate that the North Indian states are mostly in water-sufficient condition (Kumar et al. 2005). However, indiscriminate use of rivers and other surface water bodies in these states for disposal of sewage and industrial waste have rendered them non-potable (Mukherjee et al. 2011). Moreover, naturally occurring, elevated concentrations of non-point source pollutants such as arsenic, fluoride in groundwater (exceeding the World Health Organization's guideline value for drinking water) have put millions of people at risk (Bhattacharya et al. 2011). Arsenic pollution in the groundwater of Ganges Basin in West Bengal (and adjoining areas of Bangladesh) and its subsequent discovery in Bihar and Uttar Pradesh (Ramanathan et al. 2006) have been attributed as the greatest mass poisoning in human history. Recent discoveries also suggest existence of arsenic-polluted groundwater in wide areas of Brahmaputra Basin in the north-eastern states (Mukherjee et al. 2011). Hence, finding alternate, suitable and sustainable drinking water sources and/or methods have become priority in these areas.

Water use and food production are also strongly linked because irrigated agriculture is the primary consumer of global freshwater resources and accounts for ~90% of fresh groundwater consumption in the last century. India is particularly vulnerable to water and food scarcity (Scanlon et al. 2010) because of its large population (~1.2 billion) with projected increase by another 570 million in the next 50 years, temporal variability in precipitation (up to 80% of precipitation occurs from the southwest monsoon), and globally being the highest groundwater-irrigated country by area (585 $km^3$ of groundwater withdrawal per year) (FAO 2013). Groundwater-fed irrigated area has expanded from 30% of total irrigated area in 1960 to >60% of total irrigated area in recent years (558,080 $km^2$, i.e. about 19% of total area of India) and is likely to increase even further, as surface water supply decrease after many of the glaciers have melted. Groundwater availability problems are likely to be exacerbated in the future by climate change, with annual temperature estimated to increase by 3.3 °C by the end of the twenty-first century, and irrigation water demand to increase by 10% per °C. Winter precipitation is projected to decrease and summer precipitation to become more intense with fewer rainy days, further intensifying the hydrological cycle and potentially reducing groundwater recharge. Gross per capita water availability in India is estimated to decline from $\sim 1800\ m^3/a$ in 2001 to $\sim 1100\ m^3/a$ in 2050 (Gupta and Deshpande 2004). These water scarcity problems will most likely translate to food scarcity. Current groundwater production rates are over-drafting groundwater resources, particularly in North-western India (Rodell et al. 2009) and parts of Gangetic basin (Bhanja et al. 2013, 2016), where groundwater levels are alarmingly declining. The number of mechanized tube wells used for irrigation increased from 1 million in 1960 to ~19 million in 2000 (Deb Roy and Shah 2003). Further, unplanned irrigational groundwater extraction has also potentially gravely deteriorated groundwater quality, including spreading of pollutants like arsenic into previously unpolluted aquifers (Mukherjee et al. 2011).

The water security should focus on water resources and the role of resource efficiency and environmental management in reducing risks, i.e. for more efficient and judicial use of water. There are transboundary issues that are clearly important for national security, but more significantly makes a clear link between household access to water and sanitation and national security. Water-related diarrhoea is the biggest killer of life, killing more people than AIDS, TB and malaria. Although the UN Millennium Development Goal for water has recently been met, there are still billions of people without sanitation and safe water, who are mostly the poorest of our country. The previous administrations had implemented several initiatives like the ‘Rajiv Gandhi National Drinking Water Mission’ and ‘War for Water’ by Department of Science and Technology (DST). Several public sector organizations like the Department of Drinking Water of Government of India, Ministry Water Resources, along with central and state water investigation and public health agencies have also been constituted since 1951, in order to provide nationally integrated water and sanitation programmes. A country-scale aquifer mapping program has also been initiated in recent times. However, in spite of their untiring effort, the National Capital Region (NCR) of Delhi is suffering from acute water crisis in the recent summer months; parts of eastern India is going through almost alternate years of drought and flood, or the unresolved decade long legal battle for water sharing of the Cauvery river watershed. Much of these efforts are becoming ineffective because of lack of flow of knowledge between the various stakeholders that includes the scientists, who are evaluating the (surface and groundwater) resources, planners and decision makers at various levels (from national to block levels) and the end-user consumers. There is a great lack of unification for a holistic approach for water resource management and conservation.

A classic example is the Ganges (Ganga) River system (including Yamuna river), India’s primary river basin. In recent times, there have been a lot of positive initiatives (e.g. *Namami Ganga project*) by the administration and various other organizations to rejuvenate the river. The Ganges River, the fifth largest river in the world, together with its tributaries like Yamuna River, has been the lifeline of the Indian civilization in North India for at least last three thousand years. Ancient cities like Varanasi grew up in the banks of this river. Presently, the river system supports more than half-billion people, much higher than any other river in the world. In contemporary times, hundreds of cities and towns, in eleven states, have flourished in the banks of these rivers that provide them water for sustenance. However, in turn, sewage and industrial effluent discharge from these urban centres have largely destroyed the sanctity of these rivers. The river waters, which were used for ages as the primary source of drinking and domestic water, are now polluted to stupendous level, such that, according to recent estimates, about three thousand million litres of sewage are daily discharged to Ganga River alone. Analysed pathogens and inorganic chemical pollutant concentrations in the river water classifies it to be several times above maximum human consumption level. The organic chemical pollutant concentrations in these river waters, which are regarded to be much more poisonous than their inorganic counterparts because of their resistance to remediation by standard techniques, are yet to be analysed in details. It may be noted that many of the North American rivers are generally not used for drinking water purpose because of their organic pollutant contents that were introduced by industrial discharge at earlier days. These pollutants are extremely difficult to remediate by present-day treatment techniques and act as severe carcinogens. It is a fair assumption that the Ganges and Yamuna river waters are also largely polluted by these deadly poisons, so far being largely undetected. In spite of spending huge amount of money, several past administrative initiatives, e.g. National Ganga River Basin Authority (NGRBA), Ganga River Plan, Yamuna River Plan, have severely failed to restore the Ganges and Yamuna. One of the primary reason for this utter failure is that India's rivers face major issues not only due to untreated effluent input, but also due to reduction in water flow (from source and lateral inflow from groundwater) and less water carrying capacity (e.g. siltation). Problem lies in the fact that, while construction of dams and barrages have reduced the surficial river flow, reduction of groundwater discharge to the river beds due to irrigational abstraction has severely dwindled the river water resource. Further, embankment in various sections of these rivers, mostly in vicinity of the large cities (e.g. in Yamuna near NCR), has further reduced the groundwater inflow to the rivers, thus disturbing the natural flow regime. Hence, the planners should have a holistic approach of monitoring the water flow from source to sink, e.g. from Gangotri to the Bay of Bengal for the Ganges, through systematic monitoring by coupling the understanding of surface and subsurface hydrology, and through climatic feedback models, to precisely understand extreme scenarios, e.g. how to control the water quality during low flow in drought to compensate the excess effluents entering the Ganges?

In the present situation, the lack of this holistic approach of understanding of the different facets of the water cycle translates to the fact that water is an essentiality that is inevitably getting exceedingly scarce commodity in India. Thus, there is a requirement to develop plans for assuring availability of suitable water for drinking and food production as a social security and democratic right for every citizen of

India. The fact is that government should take up growth of water resource initiatives seriously, where water security should not only be focusing on the supply chain and securing water as a commercial input, or managing the social licence to operate, but also on the source preservation/conservation.

Many of the above-noted facts are already widely known and also appreciated (in various scales) by many stakeholders, including the present administration. However, the onus lies in implementing a successful preservation and utilization of water resource strategy, such that every citizen of India gets his or her fair share of the resource. This needs a very detailed planning the policy and governance strategies (Fig. 40.1). In 2010, the previous government planned to attain drinking water security in fifteen critical groundwater over-exploited blocks in states like Andhra Pradesh, Gujarat, Punjab, Rajasthan, Tamil Nadu and Uttar Pradesh, within subsequent three years. But the plan remained largely unaccomplished. Recent

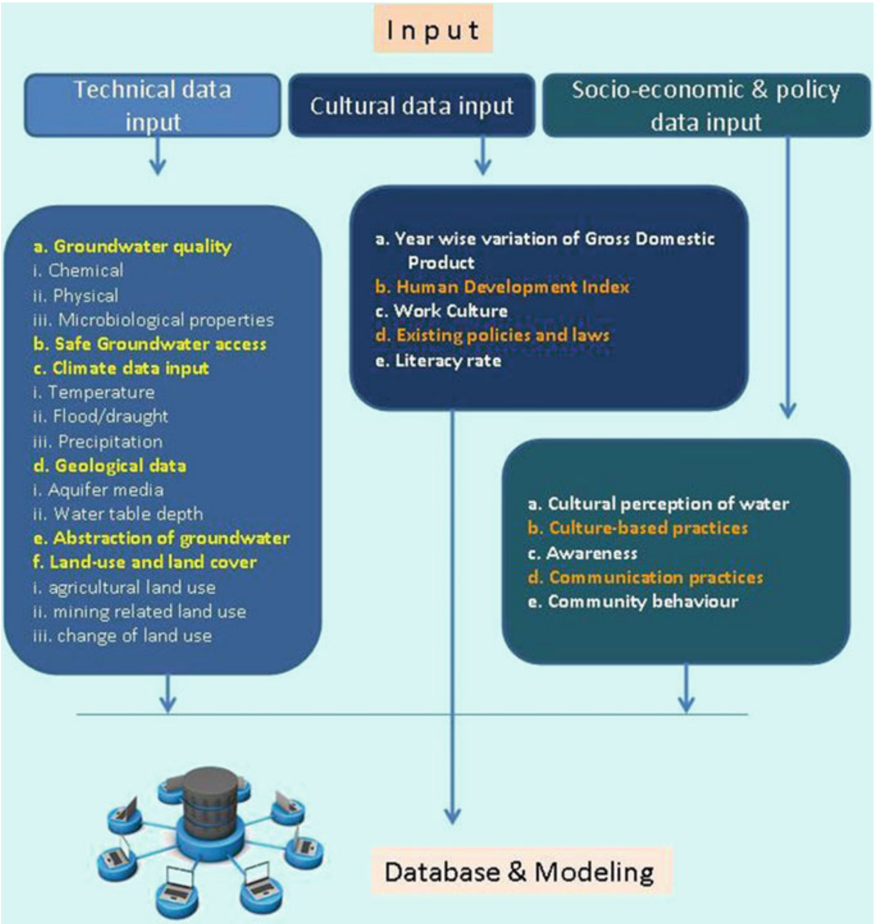


**Fig. 40.1** Schematic diagram of the expected input parameters required for informed data analytics and decision-based groundwater management

media reporting suggests that the present government plans to fast track this project, subsequently covering 1065 critical, water-stressed blocks. This can only be done by an intricate integration of knowledge from various related disciplines and plans, and their effective execution within an acceptable legal framework (Fig. 40.2).

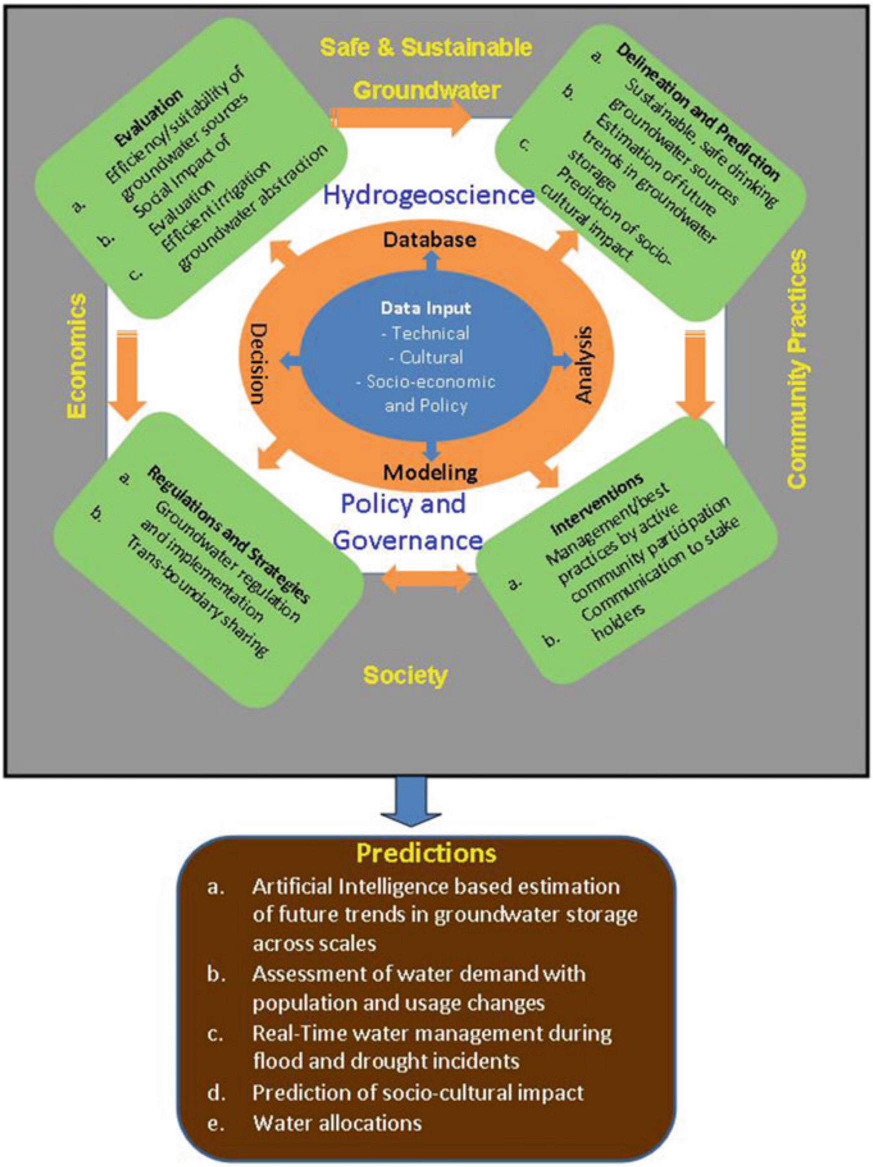


**Fig. 40.2** Conceptual model for integration of technical and societal knowledge in developing Socio-Economy based groundwater interventions and predictability for future safe and sustainable groundwater sources

Unplanned implementation might provide initial, short-term benefits but would further aggravate the situation and decline the water resource in the long run (e.g. the spreading of arsenic in previously unpolluted aquifers of Gangetic plain due to uncontrolled groundwater abstraction for irrigation and drinking purposes). Hence, if there is a real goodwill to build India to a developed country in the forthcoming years, it is necessary that the most essential requirement for the sustenance of the citizens of this nation, i.e. drinking water, be secured, with equal share to every inhabitant, in form of a National 'Groundwater Security' Bill or 'Right to Clean Groundwater Act'.

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