

Strategic Analysis Paper

8 October 2010

Water Security in India: The Coming Challenge

-Ms Anumita Raj*

In the latter part of the 20th century, oil was directly and indirectly responsible for most of the conflicts in the world. That trend continued into the beginning of the 21st century as well. However, one thing is certain, where oil was 'casus belli' for the last 60 years, in the coming decades, water will very quickly take its place. In Asia, booming populations, extreme poverty, rampant industrialisation and urbanisation, inefficient water use and increasingly, climate change have all had a negative impact on the overall water situation. India and China, with their enormous populace, are already facing several water related problems, and these problems are set to worsen considerably in the next 15-20 years.

In June of 2010, Strategic Foresight Group published its paper 'The Himalayan Challenge: Water Security in Emerging Asia'. In the paper, India's impending water scarcity is highlighted in stark detail. In the decades since its independence, India has been mostly cavalier with its precious water resources. Marked by inefficient use, and lack of storage facilities, India's relationship with its water resources has always been unsteady. As a result, in 2010, India finds itself in a precarious position, water-wise. And this situation has already impacted several other facets of Indian life, from agriculture and food security to the economy and livelihood. India's per capita water availability was 1,730 cubic metres per person per year in 2006, dangerously close to the 1,700 mark declared by the World Bank to be 'water stressed'. By 2030, the per capita water availability is expected to decline to 1240 cubic metres per person per year. This means that by 2030, India will be extremely close to becoming 'water scarce', a condition that is defined by the World Bank to be when a country's per capita water availability reaches 1000 cubic metres. India's water utilisation rate is 59 per cent, already far ahead of the 40 per cent mark that is set as the standard. A utilisation rate above 40 per cent means that the natural mechanisms in place do not have the capacity to recharge adequately. Basically, water is being used at a rate that is unsustainable.

India's water resources are a combination of groundwater resources and surface water resources. While rivers form the lifeblood of most of the cities, towns and villages across the country, groundwater is also vital to India's people. As a majority of the rivers in the country are not perennial, groundwater actually sustains much of the population during lean months. However, surface water resources are present in the country in much greater volume when compared to the groundwater resources.

India's Rivers

Of the different types of surface water resources, rivers constitute the most valuable and voluminous part. In India, rivers are classified as large, medium and minor. There are 15 large rivers, 45 medium ones and more than 120 minor rivers. India's rivers are usually described according to their origin – either as Himalayan and Peninsular or, East and West flowing. The majority of India's rivers are rain-fed, with the exception of those originating in the Himalayas. The Himalayan Rivers are perennial rivers, owing to the glacier melt that feeds them throughout the year. This makes them vital to India's fortunes year round. While other rivers in the country are seasonal in nature, due to their dependence on rainfall, the Himalayan Rivers flow all year round. Of these glacier-fed rivers, the Ganges and the Brahmaputra are the largest and most important. Between the two, their basins are home to roughly 400 million Indians, thus linking the rivers to the futures of more than a third of the country's population.

Moreover, given that the total water resources of India is 1900 Billion Cubic Metres (BCM), the fact that the Ganges (525 BCM) and the Brahmaputra (585 BCM) contribute 1110 BCM, or 58.5 per cent of the total water of India, makes them all the more valuable to the country. When viewed purely from the prism of utility and value, the Ganges and the Brahmaputra are the most important rivers in the country.

Groundwater in India

While rivers, particularly the Himalayan ones, are vital to the survival of India's population, its groundwater resources too are vital for a different reason. Since most rivers in India are not perennial, in several parts of the country, groundwater is the only constant source of supply. Since a majority of the population is engaged in agriculture as a profession, groundwater is often the primary source of irrigation. The volume of groundwater in India is inadequate to sustain a huge population, especially one that is industrialising and urbanising at such a rapid pace. The groundwater resources in the entire country total to roughly 433 BCM.

Excessive groundwater abstraction in India has become unsustainable. There are approximately 20 million tubewells in India, and over 50 per cent of agricultural land in the country is sustained by groundwater. The Ministry of Water Resources in India estimates that nearly 60 per cent of the groundwater has been developed. In urban areas, groundwater is the principal source of water, and tubewells are often dug several feet into the ground in order to keep up the high level of use. Increasingly, rainfall does not penetrate into the groundwater tables due to factors such as urbanisation and climate change. In a country so heavily dependent on groundwater, underground aquifers that are not replenished on an annual basis could be disastrous.

Climate Change and Water

The effects of climate change are now apparent all over the world. Impacts are being witnessed in every aspect of human security. In India, climate change is expected to impact the Himalayan Rivers in two distinct ways. One, the rising temperatures will likely affect the

glaciers at the mouth of rivers like the Ganges and the Brahmaputra, accelerating the rate at which they melt. Two, global warming will impact monsoon patterns in such a way that rainfall is more intense and heavy, but concentrated on fewer rainy days. A combination of these two factors has already started to seriously impact the two rivers that sustain themselves on rainfall and glacial melt.

The rate at which the glaciers in the Himalayas are melting has become a controversial topic over the last year. Due to differences in opinion between scientists, there has been an intense debate raging between all parties as to exactly what the effects of the glacial melting will be, as well as the exact speed at which they are melting. Most scientists agree that the glaciers are melting at a rate much higher than before due to the ill effects of global warming. The lack of meteorological data and comprehensive mapping of the glaciers has hampered most efforts to gather information. As to the rivers they feed, the effect of the glacial melt is hard to pin down with accuracy. It is expected that as the rate of melting increases, the flow of the rivers will actually correspondingly increase. However, this will likely not be a long term impact. As the glaciers melt quicker and they start to shrink at a rapid pace, in the long term, the volume of water contributed by them to the rivers will reduce. If this continues unabated, rivers like the Brahmaputra and the Ganges could become seasonal rivers.

At the same time, the rainfall patterns changing will compound the effect of climate change on the rivers. Any minor change in the monsoon pattern has an immediate and discernible effect on rivers. While glaciers allow the rivers to have flow throughout the year, rainfall is the major contributor the annual runoff or volume of the rivers. During the months from June to September, the high season for the Ganges and the Brahmaputra, the rivers experience over 80 per cent of their total annual runoff. Due to climate change, monsoon patterns are expected to become increasingly erratic, arriving unpredictably and withdrawing in a similar manner. Rainfall is also expected to become more intense and concentrated on fewer days, which will lead to adverse situations such as flash floods. At the same time, due to the fewer days of rain, adequate amounts of water will not percolate down to the groundwater tables, further jeopardising the precarious water situation. Increased temperatures will also increase the rate of evapotranspiration, the simultaneous movement of water from the soil and vegetation into atmosphere through evaporation and transpiration. This will actually reduce the actual amount of water that is available for human use.

Cumulative Long Term Impact

By 2030, the Ganges and the Brahmaputra will become an unreliable source of water for those that depend on it. This status quo is already somewhat evident, but will become increasingly apparent in the next two decades. While on paper, the two rivers' water quantity is not said to decline significantly, the situation on ground is different. Even as climate change factors jeopardise the long term future of the rivers, human neglect and inefficiency contribute to their decline. The Ganges is often counted amongst the most polluted rivers in the world. Due to industrial effluents, untreated sewage and other types of human waste being deposited directly into the river, in its present state, the Ganges' water

is not only unfit for drinking and bathing purposes, but also for agriculture, along several parts of its banks. While the Brahmaputra is not considered to be too polluted due to the relatively low level of industrialisation along its basin, it is expected that unchecked development in the region could change that.

Ripple Effect: Food Security and Agriculture

As in any agrarian society, a change in water security has a direct and immediate impact on agriculture. A majority of India's population, almost 58 per cent, is employed either directly or indirectly by the agriculture sector. About one-third of India's GDP is contributed by this sector. India's primary crops, rice, wheat and maize are all water intensive crops, especially rice. Already, across India, weak and delayed monsoons have caused havoc to India's farming prospects, reducing yield significantly each year. Farmers in India are hit with a twofold problem with regards to agriculture. Most crops are directly dependent on the monsoon. A delay in the monsoon or a truncated monsoon causes havoc with the natural cycle of the crops. In order to reduce this dependency and create more food security, farmers turn to irrigation, which is in turn dependent on both the river and the underground aquifers, which are also fed by the monsoon. Moreover, irrigation places a major strain on the water resources of India, depleting them at a rate faster than they can be replenished. This means that farmers are stuck in a 'damned if you do, damned if you don't' scenario, without any realistic way out. Farmers in drought-ridden states have been committing suicide at an increasing rate for the last decade or so, with no relief in sight. The government and the scientific community have spent several crores on finding new varieties of the main cash crops that can resist drought.

Apart from the immediate impact of lack of water on crops, there is also the problem of growing desertification due to depleting water resources. Lack of adequate water resources in once water rich lands will inevitably lead to desertification. While this trend has not yet reached a critical point in India, it is not inconceivable that this could happen in the near future. Both Nepal and China, who also have prominent Himalayan Rivers within their boundaries, have serious issues with desertification caused by rapidly diminishing water resources. This phenomenon has led to the loss of arable land, further exacerbating an existing threat to food security. If left uncontained, the water shortage in India could lead to arid lands being created through desertification, and the loss of agricultural land, that could be catastrophic to the economy.

Ripple Effect: Economy and Livelihood

Undoubtedly, the threat to food security will directly manifest itself in India's economy, especially considering the size of the contribution that the agriculture sector makes to the country's GDP. The rate of farmer suicides is likely to increase, not only placing an additional burden on the families of those farmers, but also on the community and state. Moreover, any new ventures or industries that wish to set up in India will strongly consider the availability of water for the functioning of their plants before they decide to invest in India. Apart from agriculture, there will also be an impact on the fisheries and aquaculture sector in India. All totalled, the lack of future food security will have an immediate and irreversible impact on the economy of the nation, as well as on the livelihood of hundreds of millions of

Indian workers, and their families, who depend wholly on the agriculture and fisheries sectors for their livelihood.

Ripple Effect: Health security

Water-borne diseases contribute to as many as 80 per cent of all disease in South Asia, and are caused largely due to a lack of access to clean water and sanitation. They take a heavy toll particularly on the health young children, who often do not fully recover from the effects of water borne-diseases. With significant sections of the Himalayan river basins lying in the tropical or subtropical region, this region is an easy prey to water-borne diseases due to the warm climate and annual monsoons. Hundreds of cases of water-borne diseases like cholera are reported every year. Vector-borne diseases like malaria will thrive when temperatures increase as a result of global warming. As temperatures increase and rainfall becomes more erratic and intense over fewer days, India is fast becoming breeding grounds for the disease-causing vector, the mosquito. The mosquito is also a vector in the case of dengue, one of the fastest spreading vector-borne diseases. Apart from the risks caused by increased temperatures, there are also the risks caused by a more intense rainfall, which could result in floods and water-logging in several places. Water-logged areas are potential breeding grounds for mosquitoes.

In India, polluted water sources are also a leading cause of water-related diseases. Especially in the Ganges basin, the poorest among the population often have no choice but to drink and cook with seriously polluted water, causing numerous diseases and stomach infections, like diarrhoea and dysentery. As these trends become more entrenched into the national cycle, in the future, they could cause epidemic like situations. Water shortages have an enormously devastating impact on human health, including malnutrition, pathogen or chemical loading, infectious diseases from water contamination, and uncontrolled water reuse. With the water supply slowly becoming inadequate to meet the growing demand for water, the availability of safe drinking water will decrease. Lack of safe drinking water could result in people using whatever water is available to them, including water tainted with sewage and agricultural runoff or even, contaminated water. People living in rural areas and urban slums will be more vulnerable to disease and infections since they do not have access to piped water and cannot afford to buy clean water. In the future, this cycle of diseases will place an enormous burden on the government, who will have to scramble to provide health care for all those affected, as well as prevent the situation from worsening.

Ripple Effect: Migration and Conflict

With several parts of the country becoming increasingly water scarce, especially in North India, millions of people will be forced to move away from their homes in search of work and water supply. In the next two decades, more and more rural residents will be forced to abandon their hometowns due to the lack of water resources, and the increase in extreme weather events such as floods. Lack of job security in the agriculture sector due to water shortages will also force many farmers to leave their villages and move towards urban areas. This phenomenon, known as environmental migration, will not be restricted to the Indian territories. Migrants from countries like Nepal and Bangladesh will likely move into India due to a serious shortage of water within their own countries, creating a serious human security

problem. This trend will worsen the tensions that are already prevalent in parts of the country over migrant workers. In urban areas, especially, towards where most rural migrants will likely gravitate, these tensions will exacerbate existing ethnic and social divides and increase crime rates. With an increased number of people competing for scarce resources and jobs, an anti-outsider mentality will start to take over, and create a backlash against migrant workers. This tension could manifest itself violently, given the appropriate circumstances and external pushes. While this 'locals versus outsiders' conflict is already prevalent in certain parts of the country, and to a large extent in most urban centres, future water shortages will push these conflicts to the forefront of national dialogue.

The Future

Strategic Foresight Group's paper 'The Himalayan Challenge: Water Security in Emerging Asia' focuses on all these issues, from the primary problem of water security, to all its secondary impacts on food, health and human security. The need of the hour is not only to recognise these problems as already being apparent, instead of a potential threat in the future, but also to act upon that recognition. Unless solutions are found at the micro and macro levels simultaneously, in a country the size of India, it is unlikely that this serious and looming threat will be resolved. Apart from the crisis in the Himalayan River basins in India, there is a parallel threat in the countries of China, Nepal, Bangladesh and even Pakistan. Lack of water will mean food shortages in these countries, which India will have to contend with on a regional level. Workers who have lost their farmland in Bangladesh or Nepal will likely migrate to India, causing a serious security threat to the country. Any instability in these countries will lead to further instability in the region, of which India is the most prominent entity. Most importantly, since all the Indian Himalayan Rivers are transboundary in nature, the problem will not be truly solved unless the solution is also transboundary. Long term solutions will be found only through joint action and collaboration. Even if the water crisis in somehow staved off in India, unless it is resolved in Nepal or Bangladesh as well, it is not likely to matter. When discussing water problems in India, policy makers often speak in nebulous terms, implying that the problem is not immediate or already in our midst. This mindset will first and foremost have to change, as the problems are already here, and their consequences have already started to affect Indians across the country.

***About the Author** - Anumita heads Strategic Foresight Group's 'Himalayan Water Security Initiative', focusing on issues pertaining to India, China, Bangladesh and Nepal. She is also a member of the 'Asian Horizons' team, working on emerging trends in the South Asian and Southeast Asian regions, specifically in India. Prior to this, she was a principal researcher on SFG's publication 'The Himalayan Challenge: Water Security in Emerging Asia'.

Anumita earned her MA in Diplomatic Studies from the Diplomatic Academy of London, at the University of Westminster. For her Masters degree, Anumita completed her dissertation titled "The Impact of 24-7 News Coverage on India's Foreign Policy". She was also the Deputy Editor for her University Newspaper, 'The Smoke', where she wrote a fortnightly column on the US Presidential Election, 2008. Anumita completed her Bachelors Degree in Mathematics from Stella Maris College, receiving her degree from the University of Madras.

Any opinions or views expressed in this paper are those of the individual author, unless stated to be those of Future Directions International.