The Future of Water in India

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Introduction

In September, the Intergovernmental Panel on Climate Change (IPCC) published their Special Report on the Ocean and Cryosphere in a Changing Climate. They found, with very high confidence, that the oceans have warmed, the cryosphere is shrinking, and global glaciers are rapidly melting. Since every person on Earth relies either directly or indirectly on the ocean and cryosphere, understanding how they are changing is vital to determining the impacts on food and water security, ecosystems, and human security.

This paper seeks to explore the future of water in India, the soon-to-be most populated country in the world. India supports 17 percent of the world’s population with only 4 percent of the world’s freshwater, meaning the country is in severe risk of water stress. Demand continues to rocket as supply lowers due to temperature spikes and dryness. Indeed, per capita availability has fallen by 70 percent since 1950.

This paper focuses on three areas: the potential scarcity of clean water, Himalayan ice melt, and rising sea-levels. It highlights aspects in which a warming world will create significant challenges for the future of water in India, compounded by poor governance and resource management at the national level. Such challenges may lead to fragmented communities and potential violence.

Water Scarcity

Water is the key to sustaining human life and scarcity of water due to droughts and increased temperatures or excess caused by monsoons and cyclones are likely to affect livelihoods and human health. The global water crisis has been the subject of many papers. According to Pathak et al (2014), “the hydrological cycle is intimately linked with changes in atmospheric temperature and radiation balance. A warmer climate may lead to an intensification of the hydrological cycle, resulting in higher rates of evaporation and increase of liquid precipitation. These processes, in association with a shifting pattern of precipitation, may affect the spatial and temporal distribution of runoff, soil moisture, groundwater reserves etc. and may increase the frequency of droughts and floods”.

Much of India’s water availability comes from ground and surface water that accumulates as a result of monsoon rainfall. It is thought that the future holds more intense monsoons but less overall rainy days and a decrease in precipitation in some regions. This gives rise to shorter periods of intense floods and arid periods over the summer months. As these weather events become more frequent, water availability and reliability become increasingly questionable as contamination from bacteria, cyclones and floods as well as human waste make the limited resources even more dangerous. Using Kerala as a case study, researchers found increased occurrences of floods in winter and autumn with increased probability of water scarcity and drought in the spring.

Inefficient practices have further reduced both the quantity and quality of resources. Wasteful water harvesting and overuse in farming have caused the depletion of the water table in all
agricultural regions, especially in Punjab where it has breached the 70ft level. Such scarcity makes irrigation near impossible.\(^7\) Continuing to plant water leaching crops is pushing the table lower whilst increasing the arsenic content of the groundwater. Future climate change is expected to exacerbate this problem as higher temperatures would increase increase evaporation and further lower the water table.

Moreover, India’s large basins, the areas from which all water flows into particular rivers, are vital to the water supply for most of the country. Yet, even at current usage levels, many face physical scarcity (water withdrawals over 60 percent of potentially utilizable resources).\(^8\) The projected decline in runoff of two thirds for the Sabarmati and Luni basins will place additional stress on water management whilst also increasing pressure on relations between states that rely on them. As temperatures rise, these basins become much more difficult to extract water from, rendering them economically scarce. This means that although water may be extracted through development projects, the investment required is not viable. By 2050 most basins are expected to face economic or physical scarcity, resulting in “serious ramifications not just in terms of food, income and livelihood, but also in social and political spheres”.\(^9\)

The 2013 drought exemplifies these ramifications. The sustained arid conditions reduced water availability and prevented vital institutions from having sufficient access to clean water. Hospitals in Delhi had to cancel surgeries because they could not sterilise instruments, clean operating theatres or allow staff to wash their hands.\(^10\) Problems are amplified by poor resource management and devastating climate events combined with severe financial constraints. India’s lack of adaptive capacity will continue to endanger the lives of millions unless policymakers and investors act with pragmatism.

**Himalayan Glacial Melt**

Glacial melt causes extremes throughout the year. Spring and summer melt overwhelms mountain villages, causing an excess. However, limited glacial runoff in the colder months leads to scarcity. Therefore, it becomes very difficult to create a steady flow year round.

Hydrological cycles in Northern India are determined by monsoon rains in the summer and the melting of snow and ice cover in the Himalayas, known as the “Water Tower of Asia”. As climate change intensifies, however, glaciers and snow cover are changing, creating a series of knock-on effects to water resources. Researchers have investigated the sensitivity of the region to climate change with the expected runoffs and flows predicted based on several future climate scenarios. The Himalayas feed into all major rivers in Asia and sustain the lives of half of humanity.\(^11\) According to the IPCC, however, these glaciers are receding faster than any other part of the world.\(^12\) The Gangotri glacier, the source of the Ganges, has receded between 20-23 miles per year, whilst other glaciers retreat more than 30 miles every year as temperatures warm.\(^13\)

The stability and reliability of glacier-fed rivers such as the Indus and Brahmaputra become challenged as flows increase during high-temperature springs possibly causing banks to burst. Changing the flows of these large rivers will alter irrigation, therefore having a knock-on
effect on food production in the river basins, affecting the livelihoods of 209 million in the Indus basin and 62 million in the Brahmaputra basin. Environmental insecurity can also manifest if retreating glaciers cause a melt so severe that the run-off washes away towns. This was the case in Uttarakhand in 2013, a Northern state bordering Nepal, when monsoon rains accompanying spring melt led to the swelling of the river that swept away temples and apartment buildings and killed over 40 people.

The variability between seasons causes a couple of issues: firstly, increased water flows threaten to inundate the low reaches of the Ganges and Brahmaputra, whose banks are home to millions and have a history of catastrophic flooding. This will likely result in loss of livelihood, as this area is known for agricultural production and potential loss of life. Secondly, because these regions are resource-scarce and extremely remote, if river run-offs decrease as predicted, local water crises become a real possibility and India’s notoriously poor water management and efficiency mean quick solutions are improbable.

The contribution to the discussion by Chevuturi et al (2016) illustrates this point clearly by using the Northern region of Ladakh as a case study. This area is unique as it is a high altitude, dry desert with cold temperatures and is heavily reliant on water flows from the mountains. Research showed a warming trend with reduced seasonal precipitation, making it highly sensitive to temperature changes. Threats due to increased glacial melt put 80 percent of farms at risk of flooding in the summer months, whilst limited water in the colder months cannot sustain crops (Ibid).

Excessive meltwater can trigger flash floods rapidly and retreating glaciers can destabilise surrounding areas, causing landslides. Furthermore, predictions under the assumption of a 1.5°C rise find flood peaks to increase by 20 percent for the Ganges and 30 percent for the Brahmaputra compared with 1995. These areas are particularly vulnerable because the impacts are at such extremes: initial widespread flooding proceeded by extended periods of drought. It is here, in these small mountain villages, that we can see the clearest examples of climate injustice, as they bear the full brunt of the pollution they did not cause.

**Sea Level Rise and Floods**

Rising sea levels and increased flooding are perhaps the biggest threats to come from climate change. As temperatures increase, ice melts and water levels rise, threatening to engulf coastal towns and villages and cause mass displacement and loss of life. Initial predictions expected a sea level rise of over 59cm by 2100, but current rates will likely exceed this by a wide margin. According to Pandve (2010), a sea level rise of a metre would inundate up to 5763km of India, as many cities lie only a few feet above sea level, making severe coastal floods more likely.

Furthermore, the Asian Development Bank specifically identified the highly populated, urban coastal cities as the most at risk for climate change. India’s 7500km coastline is especially vital; it is home to millions who inhabit the megacities of Mumbai and Chennai which are at the centre of India’s financial endeavours. Studies by the National Environmental Engineering Research Institute found that climate change is likely to cost over 35 billion
rupees (a little less than 500 million USD) of damage to Mumbai as well as displace a large proportion of the 18 million inhabitants.

The vulnerability to climate change in districts on the East coast, including adaptive capacity and exposure to hazards, has also been studied. Findings suggest a negative effect on socio-economic and bio-physical indicators in 10 districts to the point of being considered alarming. Such clear threats to economic and health security have also been found by Rao et al (2008), who developed a coastal vulnerability index using remote sensing. They found that 80 percent of the coastal state of Andhra Pradesh was under high risk of inundation. The ramifications for human security are enormous. The loss of invaluable land means a loss of livelihood for fishers and farmers as the soil is ruined, and breaches of community security and environmental security as floods wash away entire towns. Unfortunately, many of the people most likely to be affected are those in the depths of poverty, who have minimal capacity to adapt, thus rendering them socio-economically vulnerable.

Regional climate models show increased exposure to tropical cyclones, monsoon precipitation and storm surges are likely in coastal areas such as the Bay of Bengal. There, projections based on future climate estimates expect the number of cyclones between 2071-2100 to almost double compared to the baseline period of 1961-1990. Seasonal cycles of sea-level rise coincide with monsoon rains, meaning prolonged periods of inundation. Studies on Kolkata show that monsoon rainfall and river swelling already cause disruptive flooding, with increased frequency and intensity of climate extremes expected to barrage the “megacity” in the future.

Using Karnataka state as an example, Dwarakish et al (2009) calculated the coastal vulnerability index (CVI) to know the high and low vulnerable areas using conventional and remotely sensed data. Through analysis and modelling of this data, they found that 42.19km² and 372.08km² of the land area will be submerged under 1m and 10m inundation levels respectively. These figures alone may not reinforce the gravity of the situation, but these areas are used for residential and recreational purposes, and agricultural production, meaning the lives of millions will be disrupted.

**Water Wars**

The term “water war” broadly refers to the build-up of tensions over scarce water resources amongst countries and groups that often manifest into violence as they seek to safeguard the limited assets. Many argue that water wars are simply the result of pre-existing socio-economic and political hostilities that escalate into physical violence, with resource disputes acting as the final catalyst.

Barnett and Adger (2007) argue that as weather variability and extreme events such as droughts gradually become normality, the strain on resources becomes so strong that conflict is likely. India has faced increased hostility for water both from groups within and outside its national borders.
Externally, ongoing disagreements with Pakistan provide cause for concern. Both nations have a history of tension, but water availability has divided them further. In 2016, Pakistan warned of a potential water war, saying it would treat the revocation of the Indus Water Treaty, an agreement to regulate water flows and resolve disputes, as a “hostile act against Pakistan”. Yet, Prime Minister Narendra Nodi has called for cooperation, asserting that “blood and water cannot flow together,” reaffirming that disputes over resources are more a failure of politics than of scarcity itself. Nonetheless, river systems in the Brahmaputra, Ganges and Indus all have a history of regional conflict and therefore must be treated with caution.

Moreover, India has a history of water hostility with Bangladesh. India built a barrage to divert a portion of the Ganges off its course towards Calcutta, therefore causing degradation of groundwater, reducing water availability and dangers to public health. In recent years, disagreements over the Teesta treaty, a bilateral arrangement, have risen as Bangladesh seeks to increase their claim to the river.

Internally, intra-state violence due to water has intensified dramatically. Widespread unrest occurred in Bangalore in 2016 after a court ruled that more than 12,000 cubic feet of water per second had to be released downstream to Tamil Nadu to help combat drought. Inefficient resource management has escalated into large scale riots, resulting in violence between people of each state. This is perhaps a worrying snapshot into the future, as over one billion Indians are estimated to face water scarcity for at least one month per year.

**Conclusion**

To say that the state of water in India is concerning is an understatement. Vast areas and the populations that live within them are being starved of water as the average temperature warms. Hundreds of millions of Indians already suffer from water stress. Climate change will only make this worse. Poor governance over the precious resource combined with irresponsible usage practices compounds the effects of an already endangered national water supply.

In regions that experience increased flooding and glacial melt, short-term spring-time excess is met with limited capacity to store and clean water, causing immediate inundations in the warmer months and scarcity in the colder ones. Such flooding has worrying implications for health, livelihoods, homes, and food security. Hostilities rise to the surface and groups with pre-existing grievances are tipped over the edge when having to compete for a limited yet essential resource. Without immediate and widespread investment into water infrastructure and profound changes to governance and policy, a changing climate will add significantly to an already difficult situation.

**Notes**

1 Ibid


Ibid


