

The impact of climate change on India's Groundwater resources: A Legal Perspective

Taniya Malik

LL.B., LL.M., UGC-NET & JRF, Ph.D. Scholar, Faculty of Law, University of Delhi, India

ABSTRACT

Water is essential for the survival of mankind and a most basic need. With the rapid industrialization and urbanization, the water resources in the Indian subcontinent are increasingly becoming vulnerable to the impact of climate change, particularly the groundwater resources. There is a widespread view that a water crisis is looming on the horizon. This is a worrisome matter since groundwater is used extensively for irrigation and drinking water purposes in the rural areas. Whatever term we choose to employ, it is clear enough that water is going to be a major area of concern for the users and policy makers alike. This article is an attempt to highlight the impact of Climate Change on the India's water resources particularly the groundwater resources and the ability of the Indian legal regime to deal with this threat.

Keywords: Climate change, groundwater, India.

1. INTRODUCTION

Fresh water resources are essential for the survival of mankind. Since the dawn of civilizations, human settlements have always emerged and prospered around the great rivers such as the Nile, the Euphrates, the Indus, the Ganges and the Hwang Ho. The significance of water cannot be denied as water is the prime resource for sustaining life on earth. The domestic, agricultural and industrial uses of water are multiplying day by day and this phenomenal increase in demand for water in diverse fields has resulted in its scarcity. An ever-increasing water shortage and declining water quality because of water pollution over the last few decades has drawn the attention of the policy makers to the inherent water scarcity in our country and has raised concerns over our ability to meet the water requirements of the future generations. To further complicate the problem, the water resources in the Indian subcontinent are increasingly becoming vulnerable to the impact of climate change.

In the next few decades, our country will witness an increasing stress on the water resources due to climate change. Changes in climatic conditions will affect demand, supply and water quality. The hydrological cycle which includes processes such as evaporation and precipitation, are predicted to shift with climate change, and can have important implications for fresh water supply for drinking water, rain-fed agriculture, groundwater supply, forestry, biodiversity, and sea level. Thus disputes over water resources will become a common place.

There is a widespread view that a water crisis is looming on the horizon. Whatever term we choose to employ, it is clear enough that water is going to be a major area of concern for the users and policy makers alike. This article is an attempt to highlight the impact of Climate Change on the India's water resources particularly the groundwater resources and the ability of the Indian legal regime to deal with this threat. Such an analysis of the potential of the Indian water law instruments to withstand the threat posed by climate change is necessary for evolving adaptation strategies in order to combat the future challenges in the country's water sector due to climate change.

1. ADDRESSING THE PROBLEM: WHAT IS CLIMATE CHANGE AND WHAT WILL BE ITS POTENTIAL EFFECTS ON INDIA'S WATER RESOURCES?

The term climate change refers to long-term changes in temperature, humidity, clouds and rainfall and not to day-to-day variations¹. Most significantly, the present climate change conditions can be directly linked to an increase in fossil fuel

¹ Inter-governmental Panel on Climate Change, *Climate Change (2007) Scientific Basis*, Cambridge University Press, (2007)

consumption leading to a rise in the atmosphere of the concentration of the greenhouse gases such as CO₂, Methane, Nitrous Oxide and Fluorinated gases etc. This rise in the concentration of the greenhouse gases triggers the greenhouse effect causing an increase in the global temperatures which in turn has farfetched consequences on climatic conditions of the earth and its overall environment².

The Inter-governmental Panel on Climate Change (IPCC) was created by the UN to provide an authentic understanding of the climate change induced by human beings and indicate the ways to mitigate this climate change or adapt to it. The IPCC in its 2007 report has estimated that during the past 100 years the global mean temperature has increased by 0.74°C. The IPCC Report has also highlighted that the increase in global mean temperature has caused a rapid decrease in the Arctic sea ice and an increase in sea level by around 17cm during the past 100 years³. It is also causing changes in the climatic patterns across the globe.

2.1 CLIMATE CHANGE IN INDIA IN THE 20TH CENTURY:

To better understand the phenomenon of climate change in India, let us examine the various climate change indicators that have shown a change in pattern over the last 100 years. This regional climate change in the India is influenced both by global factors such as Increase in CO₂ concentration and local factors such as change in land use, industrialization and urbanization. So far as the variation in **temperature** is concerned, the Indian Metrological department has recorded that the All-India annual mean surface air temperature has increased by 0.51°C in the past 106 years⁴. The sea surface temperatures in the oceans around India have also warmed by 0.6°C in the past 50 years⁵. It has also been observed that increase in surface temperature has been higher in some urban areas than in rural areas. This is because of storage of heat in concrete buildings and roads in urban areas. The increase in temperature in many urban areas during the past 100 years is both on account of urbanization and the increase in CO₂.

As far as **rainfall** in India is concerned, the All India summer monsoon has not shown any significant trend in the last 100 years but simultaneously extreme rainfall events have increased⁶. During the past 50 years the heavy rainfall events have increased in Central India by over 50 percent⁷. There has been a decrease in winter snowfall in Western Himalayas during the past 20 years. All these factors suggest that there has been a change in rainfall patterns in the country, albeit minute. Another aspect of climate change causing much concern is the impact of global warming on **glaciers**. In most parts of the world the glaciers are retreating. We must remember that glaciers can advance or retreat due to natural causes. However during the last 50 years, many Himalayan Glaciers have retreated more than 10 meters per year⁸, which is much faster than the gradual retreat of the glaciers due to natural causes. During the past 25 years the Gangotri glacier has retreated by around 500 meters. One needs to remember that in the Indian Himalayas, small glaciers (area less than 1 sq. kilometer) have been more retreating rapidly as compared with large glaciers and there is a danger that many small glaciers may disappear completely in the next 50 years. This phenomenon is going to have far reaching consequences on the Himalayan ecology and environment and poses a great threat to the fresh water resources of the northern part of the country.

Another associated effect of the climate change is the rise in **sea level** along the coast line of the country. An increase in sea surface temperature will lead to an expansion of sea water and hence an increase in sea level. In addition, ice melting from glaciers will lead to further increase in sea level. As estimated by the IPCC, during the last 100 years, the global sea level has increased by around 170 mm. The IPCC 4th assessment report has indicated that that by 2100 the maximum sea level rise globally will be around 0.5 meters. In India, West Bengal and Kolkata are most vulnerable to sea level rise. According to studies, the sea level in Kolkata has increased at the rate of 5.22 mm/yr during the past 50 years⁹. If in future in the next few hundred years, the sea level rises by 1 meter then almost 6000 kmsq of India's land will be inundated. This will lead to

² Regional climate change can be caused by both local and global factors. This difference is very important because if regional climate change occurs on account of local factors then these changes can be mitigated by local actions. On the other hand, if climate change is occurring because of global factors, then efforts for mitigation have to be initiated at global level.

³ *Ibid.*

⁴ Indian Meteorological Department (IMD), 'Annual Climate Summary', National Climate Center, Pune (2010)

⁵ Rajeevan, M., Bhate, J., and Jaswal, A.K., 'Analysis of variability and trends of extreme rainfall events over India using 104 years of gridded daily rainfall data', *Geophysical Research letters*, 35, (2008)

⁶ Rajendren, K. and Kitoh, A. 'Indian summer monsoon in future climate projections by super high-resolution global model' *Current science*, at p 1560-1569 (2008)

⁷ Goswami, B.N., Venugopal, V., et.al., 'Increasing trend of extreme rain events over India in a warming climate', *Science*, 315, (2006)

⁸ Kulkarni, A.V., Bahuguna, I.M., et.al, 'Glacial retreat in the Himalayas using Indian remote sensing satellite data', *ICurrent Science*, 92, pp.69 -74, (2007)

⁹ Unnikrishnan, A.S. and Shankar, D., 'Are sea-level-rise trends along the coasts of the north Indian Ocean consistent with global estimates', *Global and Planetary Change*, 57, pp. 301-307, (2009)

wide scale human displacement along the coastal areas and will have negative effects on the livelihood of the people. Further the ground water quality along the coastal areas will also suffer.

Thus, based upon the above facts we can conclude that the threat posed by climate change is not purely theoretical or based upon mere conjectures. The change is already happening, albeit slowly. This trend of climate change will further continue into the 21st century. Studies indicate that by the end of the 21st century, the surface air temperature over India will increase but the magnitude of the increase varies between 2 to 4°C. As a result of global warming, the Indian monsoon rainfall will increase in most regions of India in the 21st century on account of increase in CO₂. This increase in will have adverse effects on the Indian agriculture and the cropping patterns. Studies have also shown that such an increase in temperature will cause a large increase in mortality due to heat waves in Asia. Further the increase in surface temperature and changes in rainfall patterns may lead to an increase in vector-borne diseases. Already there has been a large increase in malaria and dengue in India during the past 40 years¹⁰. In conclusion one can expect more heavy rainfall events, higher sea level and more severe heat waves in the future. Agricultural production will also be hampered by the increase in heavy rainfall events and heat waves¹¹. Thus the country needs plan strategies for adaptation and mitigation of the consequences of climate change at the earliest.

2.2 IMPACT OF CLIMATE CHANGE ON INDIA'S WATER RESOURCES

We already know that many parts of India are already experiencing water stress. Even without climate change, satisfying future demand for water will be a major challenge. Climate change, in conjunction with other changes occurring in the country such as rapid urbanization and industrial growth, will have serious implications for India's water resource. To combat climate change, on June 30, 2008, the then Prime Minister Manmohan Singh released India's first National Action Plan on Climate Change (NAPCC) outlining existing and future policies and programs addressing climate mitigation and adaptation. The plan identifies eight core "national missions" running through 2017. The National Water Mission constituted under India's NAPCC summarizes the overall impacts of Climate Change in India as, "the projected climate change resulting in warming, sea level rise and melting of glaciers will adversely affect the water balance in different parts of India and the quality of groundwater along the coastal plains." The Ministry of Water Resources has indicated in its 2009 report that the impact of climate change will result in the intensification of spatial and temporal variations in water resources resulting in severity in floods and drought like situations¹². In other words, scenarios stemming from increased frequencies and intensities of drought and floods will become a common feature. Risks to future water availability and reliability are among the most damaging expected impacts of climate change in India¹³.

The Ministry of Water Resources has also projected that Climate Change is likely to affect water resources due to changes in precipitation and evapo-transpiration. Rising sea levels may lead to increased salinity intrusion into coastal and island aquifers, while increased frequency and severity of floods may affect groundwater quality in alluvial aquifers. Increased rainfall intensity may lead to higher run off and possibly reduces recharge. Climate change presents a significant challenge to the urban water management agencies¹⁴. The urban water infrastructure, consisting of water supply systems and sewage networks, , pumping systems, groundwater pumping, and recycling of wastewater, is vulnerable to stresses caused by climate change. Most cities in India depend on surface water sources for municipal water supply although locally a large number of city residents rely also on groundwater. The first level of impact of climate change on urban water supply is through the depletion of surface and groundwater sources, because of reduction in stream flows and reduction in recharge due to rainfall. An indirect effect of climate change is an increase in water demand, because of rise in temperatures, for the same given population. Increasing intensities of rainfall along with unplanned development of cities exacerbate the already critical problem of urban flooding. Climate change impacts on water will have significant repercussions for the agriculture sector as well. The impact of agriculture on climate change will be two pronged: crops will be affected due to changing temperatures, precipitation and humidity levels and they would also need more water as evapo-transpiration increases. For

¹⁰ Bhattacharya, S., Sharma, C., Dhiman, R.C., and Mitra, A.P., 'Climate change and malaria in India', *Current Science*, 90, pp. 369-375 (2006)

¹¹ Srinivasan, J., 'Impacts of Climate Change in India', in Dubash, Navroz K., ed. *Handbook of Climate Change and India: Development, Politics and Governance*, at p. 38, Oxford University Press: New Delhi, 2012

¹² Ministry of Water Resources, 'Comprehensive Mission Document of National Water Mission under National Action Plan on Climate Change', Government of India, vols. 1 and 2 (2009)

¹³ Kulkarni, H., and Thakkar H., 'Framework for India's strategic water resource management under a changing climate' in Dubash, Navroz K., ed. *Handbook of Climate Change and India: Development, Politics and Governance*, at Pg. 328, Oxford University Press: New Delhi, 2012

¹⁴ Mujumdar, P.P., 'Implications of Climate Change for Water Resources' Management' in *India Infrastructure Report - Water: Policy and Performance for Sustainable Development* at p. 24 (Infrastructure Development Finance Company) (2011)

some crops better water management could help adapting to the changes. For others, the changes in cropping methods, varieties and patterns may have to be changed.

In addition to all these effects of climate change in India, the water demand for agricultural, household, recreational, industrial, and environmental use is rapidly increasing. Despite the bleak outlook, the water resource sector has not received the priority attention that it merits. There is a growing shortfall of water in the Indian Subcontinent and future threats imperil water supplies and ecosystems throughout the entire region. Indeed, the World Bank has warned that India is on the brink of severe water crises with most of its states living under the stress of water scarcity¹⁵. Thus the policy makers need to keep this scenario in mind while adopting any adaptation and mitigation efforts to combat climate change effects.

2. WATER LAW INSTRUMENTS IN INDIA AND THEIR POTENTIAL TO ADDRESS THE THREATS POSED BY CLIMATE CHANGE : AN ANALYSIS

Before we move on to a detailed discussion on the potential of the water law instruments in India to address the challenge posed by climate change, we must have a brief introduction of the water laws operating in our country, as given below.

A BRIEF OVERVIEW OF WATER LAW IN INDIA

Regulation of water in our country is not of recent origin. Water is essential for the survival of mankind and regulation of water has been an important concern for the ancient Indian rulers. However it was only in the colonial period that some emphasis was laid on formal water law in India. The colonial government started taking a direct interest in water law in the nineteenth century. This included laws for the protection and maintenance of embankments, regulation of ferries and fisheries. The colonial government also gave a lot of attention to the regulation of irrigation and this led to the adoption of various enactments, including the Northern India Canal and Drainage Act, 1873. On the whole the colonial laws tended to focus on the economically productive uses of water and did not consider themselves either with environmental considerations or with the social aspects of water¹⁶.

However, many changes in the water law of the country have taken place since independence. Economic considerations have now given way to the environmental and social aspects of water. The issue of water pollution started gaining momentum in the 1970s. Further on the policy makers as well as the judiciary have taken measures for ensuring access to drinking water for each individual and for recognition of the fundamental right to water of every individual. To further augment India's water resource management, many water sector reforms and water law reforms have been envisaged.

Constitutional provisions dealing with 'Water' So far as the constitutional position is concerned, water is primarily a State subject under the Indian Constitution. Even after independence, the Constitution of India retained the basic scheme of the Government of India Act, 1935 and gave states a leading role in water regulation primarily because water related issues vary under local circumstances. Under the Indian Constitution of 1950, States have power to legislate (State list, entry 17), with respect to the following subject:

"17. Water, that is to say, water supplies, irrigation and canals, drainage and embankments, water storage and water power, subject to the provisions of Entry 56 of List 1."

However this does not mean that the Union has no role to play. Firstly with respect to the adjudication of inter-state river water dispute, Art. 262 allow the Parliament to legislate on this issue. This has led to the adoption of the Inter-state River Water Disputes Act, 1956. Secondly, the Union has taken action under the Art. 252 of the Constitution of India which allows the Parliament to adopt legislation in any field in which the states are competent to legislate, provided the states have given their consent. This was the basis for the adoption of the Water (Prevention and Control of Pollution) Act, 1974. Thirdly, the Union has used less formal mechanisms to aid the states into adopting certain measures, such as the rural water supply programs. The National Water Policies of 2002 and 2012, the National Action Plan on Climate Change (NAPCC) and the National Water Mission under its aegis are such policy initiatives that deal with the efficient management of the India's water resource. Thus the regulation of water occurs both at the central and the state level. Having acquired a brief understanding of the water laws operating in our country, we move further with our discussion. Next in this section we shall discuss in detail some of the aspects of India's groundwater resources which have become critical in the light of the threat posed by climate change within the country. We shall also see in detail the legal instruments and the policy initiatives taken by the government for their regulation and management and whether these measures are sufficient in light of the changed circumstances.

3. GROUND WATER

¹⁵ Briscoe, John., *India's Water Economy: Bracing for a Turbulent Future*, Report No. 34750- IN (Washington, DC: World Bank, 2005)

¹⁶ Cullet, P., and Koonan, S., *Water Law in India : An introduction to the legal instruments*, at p.2, Oxford University Press, India (2011)

A new anxiety that has emerged in recent years relates to ground water. While irrigation was earlier associated with dams, reservoirs and canals, there was an unforeseen and unplanned explosion of groundwater exploitation from 1980s onwards, and this has been a significant factor in the increase in agricultural production. Since the 1960s and 1970s it has been observed that the share of surface water irrigation to the net irrigated area in the country has decreased while the share of ground water irrigation has increased¹⁷ (see figure 1 below).

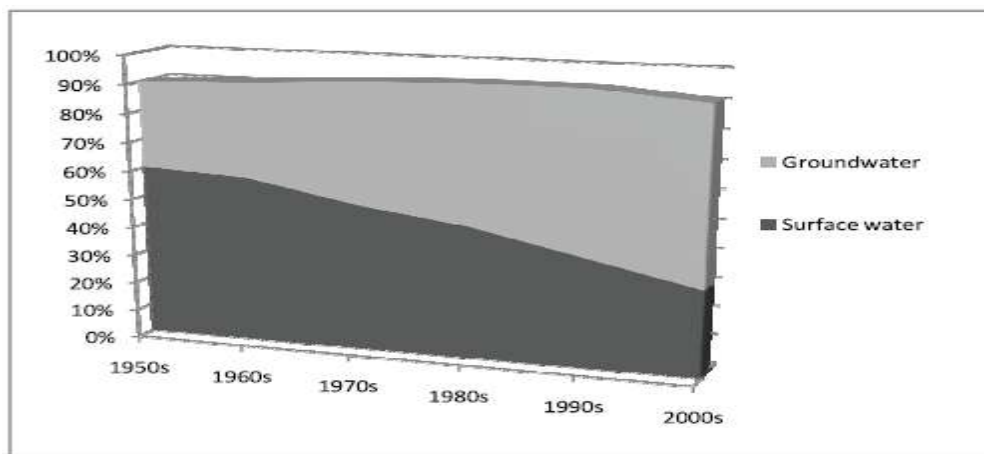


Figure 1. Decade-wise trend of shares of groundwater and surface water to Net Irrigated Area - an aggregated National Picture (Source: Indian Agricultural Statistics, 2008)

A disturbing trend emerging in the agriculture sector is that although over the years the net irrigated area in the country has increase, the share of canal irrigation in the net irrigated area has been falling while the share of ground water irrigation has been constantly increasing (see Figure 2 below). This is despite the fact that India has spent more than Rs 150,000 crores for the development of major and medium irrigation projects during the period 1990-2008¹⁸.

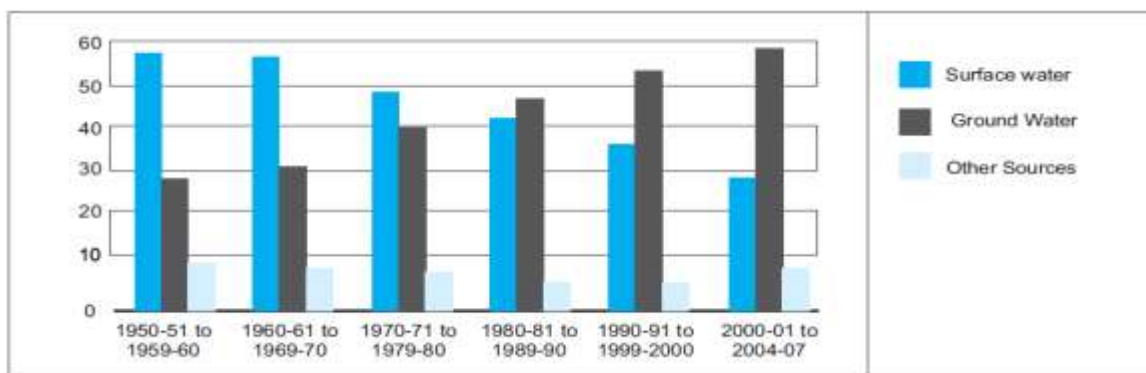


Figure 2: Decade-wise Share of Surface Water and Groundwater in Net Irrigated Area¹⁹ (%)

In fact, this sporadic rise in ground water irrigation had made India the largest ground water user in the world by the 1980s and by the beginning of the 21st century, South Asia alone had more area under groundwater irrigation than rest of the world combined²⁰. In many ways this groundwater overuse has many disturbing consequences and it undermines the potential of the groundwater resources to act as 'drought buffer' in areas where there has been an overexploitation of this resource. So far, two national groundwater assessments have been carried out, in 1995 and 2004. For the purposes of assessment, administrative units, mostly 'blocks', are classified into safe, semi-critical, critical and over-exploited categories. Between 1995 and 2004, the proportion of districts in the semi-critical, critical and over-exploited categories has

¹⁷ Indian Agricultural Statistics, Ministry of Agriculture (2008)

¹⁸ See *Supra* note no. 13 at p. 330

¹⁹ Indian Agricultural Statistics, Ministry of Agriculture, cited in Kulkarni, H., S. Krishnan, and P.S. Shankar. 'India's Groundwater Challenge and the Way Forward', *Economic and Political Weekly*, vol. XLVI, no. 2, pp. 37-45, (2011)

²⁰ Shah, T., 'Taming the anarchy: Groundwater governance in South Asia, Resources for the Future', at p. 310, Washington DC and International water Management Institute, (2009)

grown from 9% to 31%, area from 5% to 33% and population effected from 5% to 35%²¹. Moreover, these studies do not take into account the groundwater quality status, clearly significant for rural drinking water requirements.

4.1 LEGAL REGULATION OF GROUNDWATER USE

Over the last few decades, extensive, and sometimes indiscriminate, extraction of groundwater has resulted in significant depletion and contamination. In addition to agriculture, the nation's expanding industries, such as textiles, construction companies, and bottled water plants, are also heavy users of groundwater. This alarming situation has triggered different law and policy responses. Traditionally, in the context of groundwater use, a number of common law principles linking access to water and rights over land are still prevailing in India. Under common law, the basic principle was that access to and use of groundwater is a right of the landowner. In other words, it is one of the rights that landowners enjoy over their possessions²². The inappropriateness of this legal principle has been rapidly challenged during the second half of the 20th century with new technological options permitting individual owners to appropriate not only water under their land but also the groundwater found under neighbors' lands. Further, the rapid lowering of water table in most regions of the country has called in question legal principles giving unrestricted rights to landowners over groundwater.

As a result of the rapid expansion of groundwater use, the central government has been encouraging the state governments, through the Ministry of Water Resources, to adopt groundwater laws by formulating and circulating the Model Bill to Regulate and Control the development and Management of Groundwater, which was first framed in 1970 and has since then been revised in 1992, 1996 and 2005. The primary thrust of the Model Bill is to drastically expand state control over groundwater by instituting registration for most of the groundwater infrastructure and requiring permits for groundwater use in overexploited areas. Presently, no states have adopted the entire Model Bill, but many have borrowed some of its primary features. A few states – Andhra Pradesh, Bihar, Goa, Kerala, Himachal Pradesh, Lakshdweep, Puducherry, Tamil Nadu and West Bengal – have come up with a separate groundwater legal framework. Two states – Maharashtra and Karnataka – have groundwater law focusing specifically on drinking water. Other states are either in the process of adopting a groundwater law, or have rejected the idea, at least for the time being.

For the purposes of regulation, investigation, management, and development for groundwater, the central government constituted the Central Ground Water Board (CGWB). Later, after the passing of the Environmental Protection Act, 1986 (EPA) by the central government the Supreme Court of India, in the landmark case of *M.C. Mehta v. Union of India*²³, , under Section 3(3) of the EPA, directed the central government to create a federal regulatory body to deal specifically with groundwater extraction problems. After *M. C. Mehta v. Union of India*, the central government created the Central Ground Water Authority (CGWA) in 1997 to oversee and implement federal groundwater regulation. The CGWA is empowered to control groundwater “development and management” across India, “especially by new industries and projects in over-exploited areas.” The CGWA oversees a registration process for entities that construct wells, and it has authority to grant or deny clearance for industrial undertakings and other groundwater development projects. The CGWA may also notify regions that are drafting groundwater and designate them as being either “overexploited” or “critical.” By notifying a region, the CGWA may restrict the use of wells in those areas and require registration of any well in the depleted area. Although granted a breadth of power, the CGWA is generally viewed as having had little practical impact since its creation²⁴.

4.2 EFFECT OF CLIMATE CHANGE ON GROUNDWATER RESOURCES

The climate change has the potential to negatively impact the groundwater resources. These effects are summarized below:

- Along the coastal areas, the rising sea levels may lead to increased salinity intrusion into coastal and island aquifers, while increased frequency and severity of floods may affect the groundwater quality in alluvial aquifers.
- Increased rainfall intensity may lead to higher run off and possibly reduced recharge. As part of the hydrologic cycle, it can be anticipated that groundwater systems will be affected by changes in recharge (which encompasses changes in precipitation and evapo-transpiration), potentially by changes in the nature of the interactions between the groundwater and surface water systems, and changes in use related to irrigation²⁵.

²¹ Central Groundwater Board, ‘Dynamic groundwater resources of India’, Central Ground water board, (2006)

²² Aguilar, Daniel, ‘Groundwater Reform in India: An Equity and Sustainability Dilemma’, *Texas International Law Journal*, Vol. 46:623, (2008)

²³ (1997) 11 S.C.C. 312

²⁴ Cullet, P., *Water Law, Poverty and Development: Water Law reforms in India*, Oxford University Press, India (2009).

²⁵ Shah, T., ‘Climate change and groundwater: India’s opportunities for mitigation and adaptation’ at p.4, *Environment Research Letters* 4 (2009)

- In coastal West Bengal, Sundarbans (mangrove forest) are threatened by saline intrusion overland, affecting its aquifers. The precarious balance between freshwater aquifers and sea water will come under growing stress as sea levels rise. Coastal aquifers are thus likely to face serious threats from climate-change-induced sea level rise.

4.3 POTENTIAL OF EXISTING GROUNDWATER LEGAL INSTRUMENTS IN DEALING WITH CLIMATE CHANGE

As has already been pointed out the groundwater resource is already under a lot of stress because of over-exploitation and this situation will be further worsened in the coming few decades when there would be reduced recharge of groundwater in the light of the changes caused by climate change. Thus any water resource management policy of tomorrow ought to give special attention to the regulation and management of ground water resource. Given below are some of the legal and policy impediments that any groundwater law reform ought to keep in mind:

1. LACK OF EQUITY IN ACCESS TO GROUNDWATER RESOURCES

There is a major equity imbalance in the system. The current common law property system gives absolute ownership rights over groundwater to landowners while leaving non-landowners with little protection. This is probably the greatest flaw in the groundwater system in terms of equity. This antiquated nexus of landownership and groundwater rights fails to adequately protect the water needs of the millions of poor Indian citizens who are landless. Abolishing the rule of absolute groundwater ownership by landowners and implementing a less rigid ownership structure that allows non-landowners to hold rights to groundwater would greatly enhance equity interests²⁶. However, the deep-rooted nature of the absolute ownership rule makes overturning the rule a difficult task.

2. DIFFICULTIES IN ADMINISTRATION

The central-level water regulatory bodies, the CGWB and the CGWA, and also the authorities existing at state level are considered to be administrative failures. The reason is obvious – in a country with more than 21 million groundwater extraction structures, the sheer number of groundwater extraction structures that the CGWA is supposedly monitoring makes full implementation all but impossible in the absence of vast central government institutional support²⁷. Despite the good intentions of the legislature, the authorities are grossly underequipped with databases, machinery, and technicians necessary to give the law any sort of meaningful implementation. Further hindering successful implementation, research suggests that corruption is especially high in India's water management sector.

Another common criticism of both the Model Bills and the state level legislations in general is that their implementation problems are attributable to lack of empowerment of the local-level governing bodies. The acts rely solely on a top-down, state-level enforcement approach for millions of wells while ignoring the crucial role that the local-level governing bodies can play.

4. CONCLUSION AND SUGGESTIONS

Climate change is expected to produce water stresses in several parts of the country. The water management policies—both at the central and at the local administrative levels—must account for uncertainties due to climate change, and, include the worst possible scenarios pertaining to climate change in their plans. There is increasing acknowledgment by the government of the importance of climate change issues in water resources management in the country. The National Water Mission proposed in the National Action Plan on Climate Change²⁸ listing out the following priority actions:

- Focus on conserving water;
- Minimizing wastage and ensuring equitable distribution of water;
- Recycling of wastewater to meet a large part of water needs in urban areas;
- Adoption of new and appropriate technologies such as desalination for coastal cities;
- Basin level management strategies in consultation with states;
- Enhanced storage and rain water harvesting to augment ground water recharge; and

²⁶ Aguilar, Daniel, 'Groundwater Reform in India: An Equity and Sustainability Dilemma', *Texas International Law Journal*, Vol. 46 (2008) at p. 638

²⁷ *Ibid.* at p. 639

²⁸ Prime Minister's council on Climate Change, *National Action Plan on Climate Change*, Government of India, 2008

- Optimizing efficiency of existing irrigation systems.

In addition to the National Action Plan on Climate Change (2008), the National Water Policy, 2012 has also stressed upon the need for better management of India's water resources in light of climate change. In order to cope with climate change, the NWP, 2012 calls for increasing water storage in its various forms, namely, soil moisture, ponds, ground water, small and large reservoirs. It also highlights the need for adoption of compatible agricultural strategies and cropping patterns and improved water application methods to deal with increased water variability and shortage in the coming few decades. The NWP of 2012 also suggests the need to evolve a National Water Framework Law as an umbrella statement of general principle for water governance within the country and to treat water as a community resource held by the state under the public trust doctrine²⁹.

It should be pointed out that The Draft National Water Framework Act, 2011 also calls for treating water as a common pool resource held by the state under the public trust doctrine. Thus there is definitely a shift in approach of the lawmakers and policymakers alike so far as treatment of water is concerned. Water resources are seen today as subjects of community rights for common enjoyment of all rather than objects of private enjoyment. Such a line of thought is progressive and definitely needs to be put into action. These constitute a comprehensive list of actions planned. The challenge is to implement the actions, especially at the local level because the local communities will be more vulnerable to water stress caused, among other factors, by climate change.

5. SOME SUGGESTIONS - ADAPTATION AND MITIGATION STRATEGIES FROM LEGAL PERSPECTIVE.

In order to minimize the adverse impacts of climate change on country's water resources there is a need for developing rational adaptation and mitigation strategies. Although our country has adopted a specific water mission under the NAPCC (2008) we must understand that mere adoption of such policies is not sufficient to address the problem of climate change and some legal and institutional reforms must also be put in place so that we are better prepared for the future. Some these reforms are discussed below.

Reform in Drinking Water Supply Augmenting drinking water supply in rural and urban areas is the need of the hour. It is a social issue as well because when there is lack of such facilities, particularly in the rural areas, the burden falls upon the women and children to fetch for clean drinking water. As far as the legal status of the right to drinking water is concerned, although the judiciary has recognized it, the legislature has not played its part in giving content and force to this right. This issue needs to be addressed quickly and right to drinking water must become a justiciable right. The Draft National Water Law Framework Act, 2011 also guarantees a right to water, not just to humans but to livestock or other domestic animal or bird as well so that they have sufficient and safe water to meet the requirement of water for life³⁰. So far as the priorities in water allocation are concerned, both The Draft National Water Law Framework Act, 2011³¹ and the Draft Model Bill for the Conservation, Protection and Regulation of Groundwater³² (2011) have pointed out that the state must ensure that water for life needs are met first, followed by water required for all other uses. Such an approach is most welcome in climate change scenario when there will competition in the various sectoral uses of water. This will ensure that the basic drinking water needs of the masses are given precedence over any other use of water.

Reducing Wastage and Recycling of Water and Controlling Water Pollution Last but not the least, social awareness campaigns must be run aimed at reducing the wastage of water at rural and urban levels. Sewerage treatment plants for the recycling of water must be encouraged in urban areas. The penalties for the violation of the Water (Prevention and Control of Pollution) Act, 1974 must be made more stringent and the hitherto practice discharging untreated industrial effluents in rivers must be totally prohibited. The scope for market based instruments (MBIs) for industrial pollution abatement must be explored. Fiscal instruments, such as pollution taxes or marketable pollution permits though also coercive, provide incentives to factories for adopting least cost pollution abatement technologies.

²⁹ The *Public Trust Doctrine* primarily rests on the principle that certain resources like air, sea, waters and the forests have such a great importance to the people as a whole that it would be wholly unjustified to make them a subject of private ownership. The said resources being a gift of nature, they should be made freely available to everyone irrespective of the status in life. The doctrine enjoins upon the Government to protect the resources as trustees for the enjoyment of the general public rather than to permit their use for private ownership or commercial purposes.

³⁰ Sec 10 of the Draft National Water Law Framework Act, 2011

³¹ Sec 11 of the Draft National Water Law Framework Act, 2011

³² Sec 10 of the Draft Model Bill for the Conservation, Protection and Regulation of Groundwater (2011)

Institutional Reforms in Water Resource Management Another challenge in the water sector is to bring in institutional reforms and collaborations. There are far too many institutions dealing with various aspects of water, as related to climate change: the India Meteorological Department (IMD) that is primarily the custodian of all meteorological data, the Central Water Commission which in charge of the hydrologic data, apart from being an approving authority for major water resources projects, the state water departments, government and private hydropower corporations, state and central Pollution Control Authorities, agricultural departments, irrigation departments, city development agencies, municipal bodies, the private water industry, and so on³³. Bringing them together to evolve integrated adaptive responses to climate change is necessary.

We must still remember that all is not lost and we must look at the challenge posed by climate change as a unique opportunity to revisit our irrigation resources in terms of understanding, planning and management. It is understandable that the strategies outlined above are complex and require coordination between not only communities, governments, institution and departments but across disciplines of expertise including science, technology, engineering sociology, economics and ecology. This process no doubt is a challenging task, but seems the way forward, especially if India needs to take on the dual challenge of mitigating climate change and bridging existing gaps in water governance and management in irrigation sector.

³³ See *Supra* note no. 15 at p. 27