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## Legal perspective on the effect of climate change on India's Irrigation sector

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### 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. There is a widespread view that a water crisis is looming on the horizon, particularly in the irrigation sector. This is a worrisome matter since irrigation is the largest user of water in our country and any major disturbance in the availability of irrigation water can seriously undermine India's food security. 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 irrigation sector and the ability of the Indian legal regime to deal with this threat.

**Keywords:** *Climate change, irrigation sector, 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 irrigation sector 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 irrigation sector due to climate change.

### 2. 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 variations <sup>[1]</sup>. Most significantly, the present climate change conditions can be directly linked to an increase in fossil fuel consumption leading to a rise in the atmosphere of the concentration of the *greenhouse gases* such as CO<sub>2</sub>, 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 environment <sup>[2]</sup>.

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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 years [3]. It is also causing changes in the climatic patterns across the globe.

### 2.1 Climate Change in India in the 20<sup>th</sup> 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 CO<sub>2</sub> 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 years [4]. The sea surface temperatures in the oceans around India have also warmed by 0.6 °C in the past 50 years [5]. 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 CO<sub>2</sub>.

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 increased [6]. During the past 50 years the heavy rainfall events have increased in Central India by over 50 percent [7]. 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 year [8], 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 [9]. 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 4<sup>th</sup> 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 years [10]. If in future in the next few hundred years, the sea level rises by 1 meter then almost 6000 km sq of India's land will be inundated. This will lead to 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 21<sup>st</sup> century. Studies indicate that by the end of the 21<sup>st</sup> 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 21<sup>st</sup> century on account of increase in CO<sub>2</sub>. 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 years [11]. 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 waves [12]. 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 situations [13]. 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 India [14].

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 agencies* [15]. 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 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 scarcity [16]. Thus the policy makers need to keep this scenario in mind while adopting any adaptation and mitigation efforts to combat climate change effects.

### **3. 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.

#### **3.1 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 water [17].

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 irrigation sector 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.

### **4. Irrigation Sector in India**

#### **4.1 Introduction**

Irrigation is the largest user of water in the country. If we look at things from a positive perspective, in a fairly short period of time, the production of food grains in the country went up from around 50 million tonnes to 260 million tonnes [18]. Roughly two-thirds of the increase in production came from irrigated areas, partly from groundwater-irrigation and partly from irrigation (largely dams and reservoirs). Thus we may note that irrigation undoubtedly played a crucial role in the dramatic increase in food production. Post-independence the

country has invested a huge amount of capital in the major and medium irrigation projects. Statistics reflect that while there were 346 large dams in 1950; there are over 5,100 now; with over 95% of them servicing irrigation projects <sup>[19]</sup>. A large proportion of the water sector budget (upto 80%) is used up for the development of large irrigation projects.

#### 4.2 Legal Regulation of the Irrigation Sector (excluding groundwater irrigation)

Irrigation law is one of the oldest areas of water law. Irrigation includes a variety of methods such as, canal irrigation, tank irrigation and irrigation through groundwater (groundwater irrigation will be studied in detail in the next section). Water being a 'State' subject under the Indian Constitution, the individual states have adopted Irrigation-related statutes which empower them to regulate the development and use of surface water within their territories. These irrigation acts reflect, in part, the varied irrigation practices of different climates and cultures across the country. These include relatively broad-based statutes, as well as a variety of legislation focusing on specific topics, including minor irrigation legislation, canal irrigation legislation, tanks irrigation legislations and embankments legislation. The significant feature of such acts being that water flowing in the rivers or even local streams cannot be impounded, used or diverted without government approval. These acts are supplemented with various government statutes or orders, deciding about the various aspects of water management within the state such as irrigation scheduling, regulations regarding groundwater extraction and also provision of penalties for violating such rules.

However, despite the existence of a plethora of legislations regulating irrigation since so many decades, the system is not fool proof. Canal water for irrigation is good when available, but unreliable. The supply is generally not provided in the time or the quantities needed. The systems are in many cases in disarray because of poor maintenance and operation. The farmer is dependent on the irrigation bureaucracy which is a control structure and is not, by orientation and training, service-oriented. The system is also amenable to manipulation and distortion by the influence of the rich and politically powerful.

In such circumstances, reforms in irrigation law have been proposed and introduced in various states over the past few decades. The focus of these reforms is on decentralization and participation in irrigation management (PIM) and the policy measures proposed center around the setting up of water user associations (WUAs) <sup>[20]</sup>.

#### 4.3 Impact of Climate Change on Irrigation

Climatic changes and increasing climatic variability are likely to aggravate problems for the Indian Irrigation system and in turn threaten the food security of the nation. Some of the potential effects of climate change on irrigation are summarized below:

- With the rise in the mean temperature in India and change in rainfall patterns, Indian agriculture is going to become more dependent on irrigation water rather than relying on periodic rainfall to meet their water needs. Indian farmers may also be forced to change their cropping patterns and seed varieties in order to adapt to the changed climatic conditions.
- The melting of glaciers in the Himalayas will increase water availability in the Ganges, Bhramaputra and their tributaries in the short-run, but in the long-run, the availability of water will decrease considerably <sup>[21]</sup>.

- A significant increase in runoff is projected in the wet season that, however, may not be very beneficial unless storage infrastructure is vastly expanded. This additional water in the wet season, on the other hand, may lead to increase in frequency and duration of floods.

#### 4.4 Potential of Existing Irrigation Related Legal Instruments in dealing with Climate Change

As already pointed out above, the irrigation system of our country is already suffering from a lot of problems such as poor infrastructure and maintenance, erratic water supply, unyielding bureaucracy, lack of technical know-how and lack of participation of end users in the decision making process. All these problems will become even more critical in the coming few decades in the light of climate change when the demand for irrigation water further increases. To alleviate the condition of the Indian farmers, many states across the country since the 1990s started adopting irrigation law reforms in order to give the farmers more participative role in deciding irrigation related matters. Given below are some of the irrigation law related obstacles that prevent in achieving the full potential in irrigation related activities:

##### 1. Lack of rights and remedies for the farmers under the PIM model.

As pointed out above several states in the recent past have come up with major policy and legal initiatives that have transferred some responsibilities of Irrigation Management from government agencies to the Water Users Associations (WUAs) <sup>[22]</sup>. The formation of these associations is now generally seen as the most effective strategy for ensuring farmer/users participation in management of water for irrigated agriculture. Typically all these laws delineate every command area under each of the irrigation systems and declare it as *Water Users area*. It then provides for establishing a Water User Association (WUA) for every Water Users area. Every WUA is to consist of all water users who are landowners in such Water User area as members. Water Users Association have typical functions like (a) to prepare and implement a *warabandi* (water turn) schedule for each irrigation season, (b) to prepare a plan for the maintenance, extension, improvement, renovation and modernization of irrigation system, (d) to monitor flow of water for irrigation, (e) to resolve the disputes if any, between its members and water users in its area of operation etc.

However, amongst these legislations there is no single legislation which specifically talks about the rights of the WUAs or of the individual water user <sup>[23]</sup>. These WUAs as such have no clearly defined right to receive water in bulk from the irrigation department for distribution among the water users. There is no mention of remedies or a redressal system in case the irrigation department fails to provide the water in bulk in any given season. In other words, there is no accountability of the irrigation department has been established through these statutes. Thus many of the WUAs today are paper entities because this minimum condition necessary for their existence i.e. maintenance of minimum flow by the department is absent.

##### 2. Inter-State River Water Disputes

Another major obstacle which impedes the development of irrigation projects in the country is that relating to inter-state river water disputes. The resolution of such conflicts sometimes takes decades and consequently the development of irrigation projects takes a backseat. The unresolved issues of water sharing particularly have a negative effect on the

lower riparian states.

The constitutionally mandated conflict-resolution machinery (adjudication under Art. 262 of the Constitution and the *Inter-State Water disputes Act 1956*, amended in 2002) seemed to be working well earlier, but has run into difficulties in recent years. Various River Authorities have been proposed, but not legislated or established as bodies vested with powers of management. Instead, river boards with only advisory powers have been created.<sup>[24]</sup> Hence, the state governments dominate the allocation of river waters. Since rivers cross state boundaries, disputes are inevitable in this institutional setting. *The Inter-State Water Disputes Act of 1956* was legislated to deal with conflicts, and included provisions for the establishment of tribunals to adjudicate where direct negotiations have failed. However, states have sometimes refused to accept the decisions of tribunals. Therefore, arbitration is not binding. Significantly, the courts have also been ignored on occasion. Finally, the center has sometimes intervened directly as well, but in the most intractable cases, such as the sharing of the Ravi-Beas waters among Haryana, Jammu and Kashmir, Rajasthan, and Punjab, central intervention, too, has been unsuccessful. An unambiguous institutional mechanism for settling inter-state water disputes does not exist<sup>[25]</sup>.

## 5. 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 Change<sup>[26]</sup> 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
- 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 doctrine<sup>[27]</sup>. 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.

### 5.1 Some Suggestions - Adaptation and Mitigation Strategies from Legal Perspective.

In order to minimize the adverse impacts of climate change on country's water 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.

### 5.2 Reform in Irrigation Sector

The long term planning for the development of irrigation systems (surface water and groundwater) should consider the variation in the availability of surface water and groundwater resources under changed climatic scenarios. Accordingly, in long run, cropping pattern and other land uses are likely to change. Improving the methods of surface irrigation, increasing irrigation efficiency by reducing the water losses from main canals, distributaries and water courses and sowing of less water consuming crops must be looked at. Conjunctive use of surface water and groundwater needs to be planned for irrigation under changed climatic scenarios for sustainable developments in the basins<sup>[28]</sup>.

To make the irrigation authorities more responsive, the WUAs must be given a guarantee of maintenance minimum flow in any given season and there must be remedies available for the WUAs in case there is failure on behalf of the department.

A quick and fair resolution of inter-state river water disputes is also necessary. The Draft National Water Framework Act, 2011 suggests that such conflicts must be resolved keeping in mind that all basin States in a river system are equal in rights-status, and there is no hierarchy of rights among them<sup>[29]</sup>. And the State-wise allocation of the waters of an inter-State river shall be governed by the principle of equitable sharing for beneficial uses. Such an approach for the resolution of inter-state river water disputes is welcome because till now there are no established principles and the tribunals established under the Inter-State Water Disputes Act 1956 work on case by case basis.

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.

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