The Distribution of Water: In a Codified Law Context, Global Warming Context, and Agricultural Context

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Introduction

Water scarcity is a major problem in all parts of world; around 1.2 billion population of the world is without safe drinking water [7]. India holds the second largest population in the world at around 17 percent but it only accounts for 4 percent of the whole world fresh water resources [19]. Where there is a finite amount of a resources there will always be different elements of society, such as laws, economies, environmental needs, which try to implement that resource to the max. The distribution of freshwater in India fails to manage nor protect the resource. Understanding the problem of fresh water scarcity begins by considering the large distribution of water on the planet: around 71 percent of Earth's surface is water-covered, and the oceans full of saline water hold about 96.5 percent, water also exists in the air as water vapor, in rivers and lakes, in icecaps and glaciers, in the ground as soil moisture and in aquifers [20]. Only 2.5% of the globes water is freshwater, which is the amount needed for life to survive [20]. Quantitative water distribution problems are only growing since a missing legal framework for water management, global warming factors, higher need of food security for fast growing population. All of these factors point to our current wasteful usages of water as unsustainable. Sustainable development is development or growth that meet the needs of the current living beings needs while not compromising the needs of future generations [11]. The distribution and uses of current water goes against this, as our consumption of this resource exceeds the capacity of the natural systems to replenish and regenerate our use, we need to reevaluate and reform our uses of water for these generations to survive.

On an International and Domestic Level of Law

Whose water is it anyways? In current times, there seems to be a necessary legal element when discussing water as a resource and with a sustainable lens in mind to ensure universal drinking water and to conciliate water demand in our ever growing population. At an international level, it is commonly known there has been an importance on water regulations concerning navigation in international water, centered around solving problems regarding the sharing of high sea. However, these laws are limited and blurry on whether or not it reached to the regulation of water uses. It remains very difficult to spot a coherent body of comprehensive law concerning water. One of the first to attempt to cover this at a universal level was in 1977, where UN members at the Mar del Plata conference assessed their Action Plan recognised water as a right for the first time declaring "All peoples, whatever their stage of development and social and economic conditions, have the right to have access to drinking water in quantities and of a quality equal to their basic needs" [16]. However, water law(s) have to account for not only the rights of people but factor in environmental, and economic aspects. Above all of this, one of the central issues of water law(s) is regarding the access, management, and cleanliness available for use, and with current consumption of water in the energy generating sphere, this is an ever growing

concern. In India, water law is created of various parts. It includes international treaties, federal and state acts [17]. It also includes variety of less formal arrangements, as well as water and water-related policies further as customary rules [5]. At India's domestic level, the first codified law concerning water was implemented under colonial legislation concerns harnessing water for economic reasons, these focused on the use of navigation, for trade reasons, and irrigation, for agricultural reasons [17]. These irrigation laws are arguably the most developed in India's history since the colonial government saw the promotion of large irrigation works as central to its mission to use India's resources for their own profit and as a result, some basic layout of water law are applicable today originate from past irrigation laws. The focus on water laws have been evolving in the past decades, as factors alter the availability of water. Pollution levels have forced the hands to emphasis safe water delivery and to develop measures control water quality which meet regulation guidelines.

The human right to water is conceived differently in various countries. Once Independence was established in 1947, India was codiflying its fundamental rights by forming the nations Constitution; the right to water was not explicitly defined within its pages but has been adopted into Article 21 of the Constitution concerning the fundamental right to life [1]. The recognition of Article 21 within the Constitution has been ackolwolged in both state and federal level courts courts. This was put in practice in 1990, when the Kerala High Court in Attakoya Thangal, interpreted Article 21 of the Constitution, the right to life, as encompassing the right to safe and sufficient water and sanitation [2]. It is also interpreted "the Government is responsible to protect and preserve historical (water) tanks on the basis of 'sustainable development' and 'public trust' and under Article 2, A48, and A51, it is the Constitutional; obligation of the Government" [11]. In general, water law is largely state based. This is due to the Constitutional scheme, which since the Government of India Act, 1935 has in principle given power to the states to legislate in this area [2]. Thus, states have the exclusive power to regulate water supplies, irrigation and canals, drainage and embankments, water storage, hydropower and fisheries [3]. These prevailing laws surrounding water in India is made of the existence of variety compiling principles, rules and Acts which have been adopted over several decades. However, there is still a question of needing amendments. To simply *put* water into the Concurrent List would be enormously difficult to enact and would go against the persistent trends towards greater decentralization and federalism [17]. Changes or adding to water laws may merely mean politics could influence bolder inter-state leislate on water then is currently being passed, and with stronger backing of law [17]. This would allow for more state control on the distribution of water within its region, but the sanction of this could make matters more complicated as the *ownership* of water as a natural resource does not fall on state [17]. There are functions the state performs with the legislation power it is permitted: "the protect of the water sources and systems, promotes resources-conservation; ensures fairness and social justice; regulate the use of water from diverse sources; where necessary, undertake the provision of the 'water infrastructure' (to use the

language of the World bank); prevent or resolve conflicts; oversee quality; enter into treaties or agreements with neighbouring countries over common river systems and so on" [18].

Global Warming Context

Global water resource security poses a serious threat to the world population, even before factoring in the effects of climate change. Climate change causes and influences many earthly alterations in the natural flow of the environment. Such as, warming of the planet causing polar ice to melt into the sea, which turns fresh water into seawater [16]. Another effect of warming is the increasing amount of water the atmosphere holds, which in turn leads to more and heavier rainfall when the air cools [16]. Although more rainfall can add to fresh water resources, heavier rainfall leads to more rapid movement of water from the atmosphere back to the oceans, reducing our ability to store and use it. India is not a water rich country which is further challenged due to negative impact of climate change; therefore water distribution plays an ever active role on the environment. In many areas of the world rainfall is the main source for water. The rainfall is not reliable in general and it has become highly unpredictable due to these factors.

The rapid urbanization and industrialization has only added to this matter, as the climate change-related events of the past decades unfold [4]. Urban ecosystems which is growing in both demographic and population is seen all over the world has distinct effects of surface water [10]. Streets and impermeable surfaces cause permeable soils and vegetation loss, which cause the volume, velocity and temperature of runoff water to increased [10]. This alters the natural flow of rivers and changes the volume of water during dry seasons [10]. These Urban ecosystems are recognized as not self sustaining since they are dependent on outside sources and factors, which make them uncompleted ecosystems [12]. The consumption strain these areas cause lead to pollution, and is leaking into the already diminishing fresh water supply. Urban ecosystems create increases in the demand for power generation, which itself requires a lot of water. India's national electricity consumption has grown 25 percent within five years (2011-2016), using around 1,002 terawatt-hours (TWh); if the power sources for this are carbon-intensive, they will further sharpen the multiplying effects of climate change[13]. This increase demand in urban dwellings means companies traveling at greater distances to obtain resources, and will increase competition between urban and rural populations for the same pool of resources [15]. As 70 percent of India's population live in rural areas, cities use a comparatively smaller amount of water when seen in contrast of the agriculture usage, however this need for energy for domestic and not economical use brungs the importance of this fact into question [4]. The diatom where urban and industrial demand, being backed by greater purchasing power, has deprived agricultural users [10]. On the contrary, agricultural withdrawals have left human settlements and industries downstream short of water [10]. Water is used directly in hydroelectric generation and indirectly for a number of energy power, such as: generating steam turn turbines, pumping ground oils, in the storing of radioactive pollutants from power plant and to keep power plants cool. The uses) of water in these energy sectors negatively affects the quality of water by contamination. According to the World

Research Institute, power generation within the country is expected to grow from 1.4 percent to 9 percent between 2025 and 2050 (from 15 billion m3 to 130 billion m3 annually) due to urbanization needs [13]. This is a large shift in the distribution of water in India will have an effect on the environment. Water cycles are negatively affected in every type of energy production (as seen in the Table-2 *Key uses of water for energy and potential water quality impacts*) [15]. This table demonstrates the unsustainable and wasteful outcomes of distribution of water uses within energy sources. Not all of these forms of creating energy use fresh water resources, but it still damages the natural water replenishing cycles and adds to contaminated pollutants to bodies of water.

Table-2 Key uses of water for energy and potential water quality impacts [18]

Primary energy production	Uses	Potential water quality impact
Oil and gas	• Drilling, well completion and hydraulic fracturing • Injection into the reservoir in secondary and enhanced oil recovery. • Oil sands mining and in-situ recovery. • Upgrading and refining into products	Contamination by tailings seepage, fracturing fluids, flow back or produced water (surface and groundwater)
Coal	• Cutting and dust suppression in mining and hauling. • Washing to improve coal quality. • Re-vegetation of surface mines. • Long-distance transport via coal slurry.	Contamination by tailings seepage, mine drainage or produced water (surface and groundwater).
Biofuels	• Irrigation for feedstock crop growth. • Wet milling, washing and cooling in the fuel conversion process.	• Contamination by runoff containing fertilisers, pesticides and sediments (surface and groundwater). • Wastewater produced by refining.
Thermal (fossil fuel, nuclear and bioenergy)	• Boiler feed, *i.e.* the water used to generate steam or hot water. • Cooling for steam-condensing. • Pollutant scrubbing using emissions-control equipment.	Thermal pollution by cooling water discharge (surface water).Impact on aquatic ecosystems. Air emissions that pollute water downwind (surface water).Discharge of boiler blow down, *i.e.* boiler feed that contains suspended solids
Concentrating solar power and geothermal	• System fluids or boiler feed, *i.e.* the water used to generate steam or hot water. • Cooling for steam-condensing	.Thermal pollution by cooling water discharge (surface water). Impact on aquatic ecosystems
Hydropower	• Electricity generation. • Storage in a reservoir (for operating hydro-electric dams or energy storage).	• Alteration of water temperatures, flow volume/timing and aquatic ecosystems. • Evaporative losses from the reservoir

Directly taken from "Water Pollution Through Energy Sector. *Renewable and Sustainable Energy Reviews*" [15].

Climate change will additionally have negative impact on agricultural productivity due to: crop selection; time of cultivation, and irrigation methods [19]. Since the effects of subsidization of crops like rice, wheat and sugarcane, they constitute about 90 percent of India's crop production [19]. These same crops that are being subsidization consume the most water to

produce [19]. Rice, is one of the most exported crop and can consumes as much as 3,500 liters of water for a kilogram of produce [19]. The direct impact of climate change is not the only reason to be concerned about future fresh water scarcity. The increasing global population means more demand for agriculture, greater use of water for irrigation and more water pollution.The impacts of the growing population of the globe on water resources further pushes food security within the national and international spheres. Consumption rate further drives the economic bandwagon of national GDP.

On an Agricultural Context

This water to energy link is really a water to energy to food link, because a large portion of the energy and water consumption required to create food security for the rapidly growing and urbanizing population discrepancy. The economic sector is a multilayered issue as it drives how water is handled and how many policies are created. Water has a productive element in agricultural production, which drives India's economic development and gross domestic product (GDP). India is one of the biggest agricultural produce exporters in the world, this permits for large consumption of their water resources for irrigation and crop use, which is green-lighted by laws and bypasses many environmental concerns. Contributing around 7.68 percent of total global agricultural output and adding to the Indian GDP at around 17.9 percent (in 2014), agriculture is a driving economic force, along with food security, also provides livelihood for many [8]. However, only about 102 million hectares or almost one-third of the total cultivated area is irrigated, and water is loss due to evaporation, drainage, percolation, water conveyance, and excess use of groundwater [9]. Agriculture inefficiently uses much of India's water resources; irrigation infrastructure have explained over the years, as irrigation consumes about 84 percent of total available water [9]. Most of the irrigation water demand is met with the use of groundwater, to produces greater levels of agricultural production than would have been possible under rainfed agriculture, but at the expense of an excessive dependence on groundwater; this influences its over-extraction and, thereby threatens the sustainable development of agriculture and agriculture as an economic sector. Nonetheless, since it drives GDP, many state governments offer motivations to ensure availability of water for irrigation purposes, such as: State government of Punjab (Northern India) are offering free electricity for groundwater pumping [6]. In many regions due to inadequate rainfall, irrigation plays a key role in the drive to enabling and enhancing food production. The distribution of water used to supply the agricultural sector must improve to conserving water. The unsustainable way in which groundwater is used shows a demand for better management and supply measures for improved water use efficiency in irrigation of water.

Conclusion: The Hard Path Forward

Water, gives life to the world and Gaia herself. Water traces back to the heart of all living organisms and has been a key element to the location and structuring of human civilization for

thousands of years. Countless societies throughout time understood its importance; their need for water and planned their lives around it. Civilizations have grown and passed at the hands of water, but even with this knowledge, modern society still fails to value and manage the usage of water. The current way forward is not sustainable; and the data for future consumption needs and future availability does not match up. It is estimated in 2050, total water demand is forecast to reach 1 400 billion m3 [14]. The comparable annual figure for usable surface water capacity is around 690 billion m3 and potentially replaceable annual ground water capacity amounts to 433 billion m3 [14]. The unsustainable water distributions has been essential to both urban and agricultural growth everywhere in the world, with climate change accelerates reconforming this fact with this fact. Confronting this reality will likely need to be met with a international and domestic reform on our perspective of water distributions within sectors of society. The largeness of this problem requires an honest accountability of what has gone wrong and what must be done to protect the of rights people. It is imperative governments prioritize the quality and standards of life of its citizens and how this intersects with availability and access to their growing populations. Governments can further aid this by not subsidizing water intensive crops to farmers which offer short-term economic benefits at the expense of long-term stability. The shift to crops requiring less water, or can handle salted water, needs to be implement by both farmers and governments.Cities, meanwhile, can be very efficient in their water usage with small and large scale changes. An important effort which would reach across many different sectors would be investing in better infrastructure to prevent the staggering amount of purified water lost through leaking pipes. Agricultural producers must also adopt more water efficient irrigation methods, which use less fertilizer, and water intensive crops. In some cases this should involve pricing and rights-transfer schemes to encourage conservation, paired with water user groups to help smallholders navigate them. These are only small improvements can aid in diminishing the waste in these sections of water distribution sectors. However, when faced with a complex challenge, it is easier to ways to simplify the problem into something more manageable and tractable then to seek an equally complexing solution where more issues can stem; all problems are caused by solutions.

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