FEDERALISM AND INTER-STATE RIVER WATER DISPUTES IN INDIA

Amit Ranjan
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This book examines the Union-State and inter-State relations concerning water issues in India. It analyses the federal structure in India and looks at its effectiveness in addressing the inter-state river water disputes in the country through three cases: the Cauvery, Krishna and Mahadayi Rivers water dispute. It probes into the physical, political, legal and constitutional measures taken by the Union government and the states to deal with the inter-State and Union-State tussles over inter-State river waters. The author studies the debate over centralisation and decentralisation of water resources, as well as the inter-state river water disputes that have aroused feelings of sub-nationalism in many regions of India. Finally, this book also examines socio-political tensions over multipurpose water projects and other supply-side infrastructures, and their efficacy in addressing India’s increasing water problems.

This book will interest researchers and students of Environmental Politics, Political Science, Public Policy, Environmental Geography, Indian Politics, South Asian Studies, Environmental Economics, Environmental Policy, River Management, and Resource politics.

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Amit Ranjan
For Shanaya
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Introduction

In 2014, after India Rivers Week meeting in New Delhi from 24 to 27 November, Delhi Declaration was adopted and issued by the participants and organisers. In that declaration, it was rightly accepted that “a poor understanding of rivers lies at the heart of the widespread abuse of rivers. The first step in any effort for the revival of rivers must be a proper understanding of what a river is”.

The declaration provided a comprehensive definition of a river that reads:  

A river is more than a channel carrying water; it is also a transporter of sediment; it is also the catchment, the riverbed, the banks, the vegetation on both sides, and the floodplain. The totality of these constitutes a river. A river harbours and interacts with innumerable organisms (plant, animal, and microbes). It is a natural, living, organic whole, a hydrological and ecological system, and part of a larger ecological system. A river is also a network of tributaries and distributaries spread over its basin and the estuary.

It is essential to know that all rivers are not similar. For example, there are several differences between rivers in tropical and temperate areas. Tropical rivers such as Amazon carry enormous amounts of sediment along with their waters. Also, tropical rivers have a channel within a channel. Even within the tropics and monsoonal tropic regions, each river has a unique characteristic that has taken years to evolve due to constant interaction with ecological surroundings.

Whatever physical and morphological differences rivers have, all share a common political character: they flow freely without any care for a sovereign boundary. However, since their formation, states and societies have taken all possible measures to tame the rivers to draw maximum benefits. Historians have examined the regulation of water resources to understand the character of ancient states and societies.

Karl Wittfogel (1896–1988), a German sinologist and a member of the German Communist Party before the Second World War (1939–1945), examined a relationship between the irrigation system, society and politics to explain the control of oriental States’ Governments on the water bodies.

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After giving up his ideological bent towards communism, Wittfogel believed that State-controlled economies of Soviet bloc countries were more authoritative than the “traditional” Asian governments. In his book *Oriental Despotism: A Comparative Study of Total Power* (1957), Wittfogel observed that the ancient States of the orient were despotic, whose base lay in strong control over the “hydraulic” structures. Wittfogel added that oriental despotic States draw attention to the agromanagerial and agro bureaucratic character of civilisations. To provide evidence of a despotic way of managing water systems in ancient oriental States, Wittfogel described the functioning of *Subak* (irrigation unit) in Bali, Indonesia, where, as he observed, the Ruler and Minister of Revenue (sedhan agong) used to decide when and how to supply water to them. The official head of a cluster of *Subak* units used to supervise the water supply. The local unit chief, the *Kilan Subak*, was to coordinate with the individual peasants, who swore a solemn oath to submit to regulations even though their rice fields *sawah* were flooded. Conflicts were frequent between *subaks*. An exact date of beginning of the *Subak* system is not known; however, according to R. Gory, some evidences suggest that irrigation in Bali existed since AD 600, while others suggest that the *Subak* system was present even in year 800 of the Saka Calendar, or AD 882.

Countering Wittfogel’s thesis, American anthropologist, Clifford Geertz finds that *subak* was a differentiated, corporate, self-contained social organisation explicitly devoted and exclusively to irrigated farming, mainly (though not exclusively) of paddy. Water control in *Subak* was overwhelmingly local and democratic in nature. *Subak* collectively owned dams and canals and was also a religious unit. It had an elaborative ritual system whose focus was rice goddess cult. The *Subak* Chief was elected by the members of the unit. There was a *Subak* Council, consisting of all members with a single vote irrespective of the size of their holding. The Council was responsible for formulating general policy within the limits of the written constitution. It also had the power to elect various officials. *Subak* was not a collective farm. An individual was his own master. Further, on centralisation of the water system and irrigation, Robert C. Hunt and Eva Hunt find a different control system in their study of rural Mexico. The irrigation system in Mexico was embedded in the local-national linkages of states.

In ancient India, contrary to the central tenet of the theory of Oriental Despotism, society kept on changing. Before Wittfogel, James Mill, a 19th-century English historian, and Karl Marx, political, social and economic philosopher, talked about Oriental Despotism to elaborate their argument on India and the Asiatic Mode of Production. French philosopher Montesquieu talked about an ecological basis to Oriental Despotism in Asia. On India, historian Romila Thapar observes that empires in ancient times were of short duration. Only Mauryan Empire (321 to 185 BC) is qualified to be called an imperial system. Private property in land existed at the time of Mauryan Empire, and nobody could forcefully seize the land. In an Indian classic, *Arthashastra*, Kautilya wrote that even though highly productive, land seized by noble should
be liberated. He warned that the possession of land could make the noble powerful enough to create difficulties for people from the State.\textsuperscript{13} The hydraulic machinery played marginal role in State’s affairs. Large-scale, state-controlled irrigation system was rare at that time. Aid for irrigation consisted of wells and tanks, built and maintained either by wealthy landowners or through cooperative efforts of the villagers.\textsuperscript{14} Kautilya had mentioned about 30 departmental heads and 18 high officers needed for various state economic and administrative activities, but none to look after irrigation works.\textsuperscript{15} Nevertheless, during the Mauryan rule, the governors of Saurashtra took steps to repair the embankment of the Sudarsan Lake. The first important indication of the process by which a King claimed landownership is found in the ancient Indian text, \textit{Manusmriti}, written between 2nd century BC and 3rd century AD.\textsuperscript{16} In the modern times, \textit{Manusmriti} is considered as an “extremely regressive”\textsuperscript{17} text that denigrates women and promotes casteism. \textit{Manusmriti} mentions 18 works that a king had to perform. One of his works was to sell goods or land not possessed by him.\textsuperscript{18} \textit{Manusmriti} also says that if someone proves his right over land, the King should keep one-sixth or one-twelfth part of that property and return the rest to him.\textsuperscript{19} Ram Sharan Sharma writes that several Western scholars propounded the theory of Oriental Despotism mainly to serve the purpose of colonial aggression. He finds that royal rights in land developed in the early medieval years when feudal property in land developed. However, the intermediate landlords he created limited the King’s dominion over soil.\textsuperscript{20} As the irrigation system is linked to agriculture, an important component of ancient India’s economy, and helped in society’s formation and evolution of the ancient state system, it is necessary to know the agricultural practice at that time. This will also give a glimpse of state-society’s interaction to manage waters and rivers in early India.

During the Indus Valley Civilisation (3300 BC to 1300 BC) many evidences prove that agriculture was well practiced and it helped in settlement of population on the bank of the Indus River. In southern Punjab’s arid and semi-arid regions, Sind (now called Sindh) and Kutch, the Harappans cultivated wheat, barley, cotton, peas, gram, sesame and possibly mustard. At Surkotada in Kutch, finger millet (ragi) and Italian millet were identified, and at Lothal and Rangpur in Kathiawad were found impressions of rice husk. However, agricultural productivity was not very “high” during those times.\textsuperscript{21} Before the modern irrigation facility was introduced, lift irrigation was used to irrigate the lands in the Indus region.\textsuperscript{22} In some places, such as at Mohenjodaro, there was a Great Bath with water channels leading to and from it.\textsuperscript{23}

Vedic period (1500-1000 BC) followed the Indus Valley Civilisation. The early Aryan settlements in the sub-continent were in eastern Afghanistan, Punjab and parts of the present western Uttar Pradesh. In the \textit{Rigveda} (collection of Vedic hymns), western tributaries of the Indus River, Gomati (modern Gomal), the Krumu (modern Kurram) and the Kubha (modern Kabul) are mentioned. The Suvastu (Swat), the most important river mentioned in the \textit{Rigveda}, is in the north of Kabul.\textsuperscript{24} There is also frequent
mention of Sindhu (the Indus), Ganga and Yamuna, Drishadvati (Ghaggar) and the five rivers which collectively gave Panjab its name: the Shutudri (Sutlej), Vipas (Beas), Parushni (Ravi), Asikni (Chenab) and Vitasta (Jhelum). The geographical knowledge of early Aryans was not extended beyond the Yamuna. In Rigveda, the Hindu God Indra has been praised for “freeing of the rivers” from demons. In the “battle of ten Kings”, Bharata chief Sudas, grandson of Divodasa, defeated a confederacy of ten Kings at the bank of the Parushni (Ravi) River. The Bharatas won the battle by breaking a natural dam on the river. After the victory, the Bharatas marched on the banks of River Yamuna, where they defeated local King Bheda. Sudas eventually settled along the bank of the Saraswathi River and celebrated their victory.

Vedic and Post-Vedic (1000 to 500 BC) literatures, major mythological epics (Ramayana and Mahabharata), and all other major writings of the early and late ancient India had highlighted the significance of rivers. For example, in his version of Ramayana, Tamil poet and scholar Kampan (AD 1180–1250), in his poem The River, describes water as they are gathered by the clouds from the seas and then rain down and flow as floods of the Saryu River down to Ayodhya (a city in eastern Uttar Pradesh), where Hindu God Rama is claimed to be born. Water has been used to symbolise the story of Ramayana. Notably, water, the source of life and fertility, is an explicit part of the Tamil literary tradition. In Mahabharata, Ganga River was the mother of the Kuru prince Bisham, and is regarded as the holiest river that washes away all the sins of human beings.

Even the word “Hindu”, a religion followed by around 80 percent of Indians, originated from “Sindhu” (Sanskrit word for Indus River). Contrary to the Hindu nationalists’ claim that Hinduism is sanatan (eternal) religion, historical evidences show that the word “Hindu” did not occur until about 14th century. The term “Dharma” was used in an ethical sense and not as a religion. After the Indus and North-Western borderland regions became part of the Achaemenid Empire of Iran in the mid-first millennium BC, the area was referred to as Gandara, and Hind[dl]ush. The Indo-Greeks pronounced the Indus River as Indos. The Arabs referred the area beyond Indus River as al-Hind, and the people living in the region came to be called Hindu.

In DD Kosambi’s observation, early Indian history has a tribal basis. For Ram Sharan Sharma, tribal society has many variations. Tribalism may continue or be followed by different forms of State and class society, but it appears universally. He has used historical materialism method to explain stages of economic development in India. Since the 6th century BC, material advantages such as surplus production of food grains, urbanisation and growth of trade and commerce mainly led to the formation of territorial states in ancient India. Most of those territorial states were strategically located on the banks of rivers. It is apt to observe that many ancient States were built, religion matured and trade flourished on the bank of the Ganga River. In Arthashastra, Kautilya had mentioned about land dependent on rain and flowing water (river) and observed that a smaller tract with a flowing river was always preferable. Regular water flow ensured the production of crops. According to
Kautilya, all waters of the state belonged to the King and the users had to pay taxes for withdrawing waters for irrigation purposes. Tax could be exempted for three, four or five years if waterworks were cleaned and were ready for use. A limited number of embankments were allowed to be privately owned. The owners enjoyed the right to sell or mortgage. In case they were not used for five years, ownership rights lapsed. The landowners were allowed to give water to other parties in exchange for produce. In the absence of the owner, either charitable individuals or the people of a village look after the structure. To protect other persons’ fields, according to Arthashastra, the release of water from dams without a legitimate reason, the obstruction of legitimate use of water by others, the obstruction or diversion of the watercourse and the building of waterworks on the land belonging to someone else were all prohibited.

Sixteen big States known as mahajanapadas, each comprising several agricultural settlements (janapadas), existed in ancient India: Gandhara, Kamboja, Assaka, Vatsa, Avanti, Shurasen, Chedi, Malla, Kuru, Panchala, Matsya, Vajji (Vrijji), Anga, Kashi, Koshala and Magadha. Chandragupta Maurya (321–297 BC) founded Maurya dynasty in Magadh (situated in the present Indian state of Bihar). Its capital was Raigir which was shifted to Patliputra (modern-day Patna) during the reign of Udayin (460–444 BC). In ancient India, Buddhism and Jainism emerged as dissenters against the institutionalised beliefs and values. At that time, the middle Gangetic Basin used to receive an average annual rainfall between 114 and 140 centimetres. A greater use of iron tools led to the spread of agriculture in the region. The peasants used effective tools for cultivation to produce a greater surplus of food grains and indirectly helped in the growth of towns. But the most important reason that helped the towns grow was the movement of Macedonian King Alexander the Great’s (336–323 BC) army in parts of India and interaction with local population and Kings: it opened many trade routes and possibilities of mercantile relations between north-west India and West Asia.

During that period, the saṅgha (the collective body of Buddhist monks) had interests in water and land management. Shaw finds that almost every hilltop throughout her study area bears the remains of a Buddhist site, with an associated habitational settlement and sometimes an irrigation reservoir at its base. Shaw’s work shows that 10 out of 16 recorded reservoirs directly refer to monastic sites. Of them, the most prominent example is the one immediately to the south of Sanchi Hill. These were built between the 3rd and 2nd centuries BC to increase agricultural output and support the increased population levels.

The decline in Buddhism and Jainism by 400 BC was accompanied by a decline in agricultural activities in the region. The decline of Buddhism and Jainism, as Phillipe Cullet and Joyeeta Gupta believe, was possibly because of water shortage, the decline in soil fertility and/or the growth of the human population. During the Gupta period (4th AD to 6th AD) and after that until about AD 1000, lack of resources once more led to worshiping individual animals and trees with a focus on conservation. It was a period of low trade and urbanisation.
Muslim invasions in India started in the 8th century, and by the 10th century Muslim rulers established their kingdoms in parts of India. However, it was only in 1206 that centralised Muslim rule was established in India after the Slave dynasty (1206–1290) was set up by Qutub-ud-din Aibak. Slave dynasty was succeeded by the Khalji dynasty (1290–1320), Tughlaq dynasty (1320–1413), Sayyid dynasty (1414–1451) and Lodhi dynasty (1451–1526). In 1526, Zahir-ud-Din Muhammad Babur defeated the last Lodhi king, Ibrahim Lodhi, and founded Mughal empire. Mughals ruled over India from 1526 to 1857. During the rule of Muslim rulers, canals were constructed to transfer water for irrigation purpose. One of the Sultans under whom many significant water works were done was Feroz Shah Tughlak (1351–1388). Under his reign, new perennial canals and waterways were introduced, leading to increase in food production. In 1355, Western Yamuna Canal was constructed under him, followed by another canal from the Sutlej to Hisar. He constructed four waterways: from Sutlej to Hisar, Sutlej to Ghaggar, Ghaggar to Firuzabad, and the Mandvi and Sirmour Hills to Hansi in Haryana. Under him, many old riverbeds were turned into irrigation canals, such as the Chitrang and the Wah. The riverbed of the Sarasawati River was converted as a link canal for Ghaggar-Firuzabad waterway. Despite such significant works, Feroze Shah wished to be remembered for his Islamic credentials.

Successive Mughal kings provided funds to repair and build irrigation systems to increase the land under irrigation so that crops could be produced. Akbar (1556–1605) revived the Western Yamuna Canal in 1568. He also contributed to the development of other canals. Akbar’s son Jehangir (1605–1627) brought waters of the Ravi River to the gardens in Lahore (now in Pakistan). He also built Juhi Shahi canal from the Lar River in Sindh to Nur Bagh in Srinagar. One of the important canals constructed during the Mughal period is Shah Nahar (Upper Bari Doab Canal), built by Shah Jehan (1628–1658) in the year 1693 to carry the water of Ravi River from Rajpur (or Shahpur) to Lahore. From the same point, one canal ran to Pathankot, another to Batala, and a third to Haibatpur. Those canals accrued “Great benefit” to cultivate the region. Then, a small canal was cut from Tavi River to irrigate a garden of Shah Jehan’s favourite noble, Ali Mardan Khan, at Sodhra near Wazirabad in the Upper Rechna Doab which benefitted the entire region.

In pre-colonial India and the early days of British rule in South India, water was mainly distributed according to the political power exercised by different groups within local community users. In ancient Tamil Nadu, the kings built small dams and tanks that were managed by local population. In AD 150, Chola King Karikalan built Kallanai Dam on the Cauvery River in Thanjavur district. It was remodelled by the British in the 19th century. The dam still exists. In Tamil Nadu, tank system exists since 300 BC. The number of tanks and canals increased during the Pandya (4th -3rd BC) and Chola times (750–1300 AD). They are regarded as the precursor to developing the riverine canal system in the 11th century.
operated within a political-military system, exposing them to the possibility of destruction. There were village assemblies and tank committees in ancient times, particularly for Brahman villages. A *Kudimaramat* system, prevalent in the pre-British period, had fallen into disuse during the British period due to the introduction of the ryotwari system. It was a system under which villages maintained tanks with group work. When the colonial ruler took over the political control in South India in the late 18th and 19th centuries, three kinds of irrigation works of importance existed, including tanks, small embankments, and large *Anicuts* (dams to divert the direction of water flow). Tanks were in bad shape because the individual landlords failed to maintain them. The British colonialists started looking for ways to control irrigation systems so that they could earn revenue. In their effort to control the irrigation system, the British experimented with the reintroduction of the pre-colonial system. The colonial Government needed “traditional” autonomous village tank institutions for public works administration. Where they did not exist, such systems were reinvented through laws or missions such as the Madras Public Works Commission of 1869–1870. The tanks were to be repaired. The British tried to reintroduce *Kudimaramat* system but could not succeed. In 1869 and 1883, *Kudimaramat* Bills were drafted to enforce the law. The act, however, failed and was dropped because enforcement of the law depended on an impossible task of proving in court *Kudimaramat* practice existed in any particular village. The colonial state required social group(s) to help them in the extraction of revenue from agriculture, so they forged relationships with Indian elites.

In Eastern India, Nirmal Sengupta finds, *Ahars* and *Pyne* (traditional agricultural system made of various channels and retention ponds used to manage waters) were widely used in South Bihar till the 20th century and were controlled by *Zamindars* (landlords). The expenses of making and repairing the canals and reservoirs were entirely “defrayed” by the *Zamindars*. There was a collective system called *goam* in which every cultivator had to supply one man per plough to turn out on certain occasions and carry out the physical works. *Zamindar* was responsible for declaring the date of *goam*. They even coerced the unwilling participants to work. By an amendment of the Private Irrigation Works Act in 1939, government officials successfully intervened in the maintenance of irrigation systems.

Soon after their arrival in India, the East India Company (EIC) made all attempts to tame and exploit rivers for commercial and transportation purposes. For instance, soon after setting their foot and attaining strength in Bengal and particularly in Calcutta (now Kolkata) the British aimed to master the Hooghly River. By the late 18th century, British managed to develop accurate charts and intervene to deepen river channels to make Hooghly more navigable to facilitate the development of Calcutta as a colonial metropolis. James Rennell, who sketched a map of Bengal, was doubtful about having a successful engineering intervention to deepen Hooghly. However, the then new generation of British Engineers were confident that they could tame the river with investment and improved techniques.
To use the river for commercial purposes and trade, an earlier attempt to develop a harbour was made by Benjamin Lacam, an erstwhile British draftsman-turned-private merchant, who arrived in Calcutta in 1760. He proposed to build a harbour on the Eastern side of Hooghly, on a narrow channel creek, 26 miles inland from the Bay of Bengal. However, he could not succeed because in 1776, the EIC decided to withdraw the land patch granted to him in 1774. A case was filed by Lacam that was settled in 1806. In short, Lacam could not fulfill his dream of making money by using Hooghly’s waters; however, over the years, the region, including the marshy sediments on the banks of Hooghly, was developed by the British.

Problems of the colonial state concerning water centred around four key issues such as (1) ensuring a rate of return, (2) maintaining political stability, (3) maintaining agricultural productivity and (4) creating user-interest groups ready to pay for water. In North India, an early thought to control and use the Indus River for commercial purposes came into the mind of James Burnes, a Scottish doctor, and brother of Diplomat Alexander Burnes, during a visit to Hyderabad, Sindh. Burnes published the first account of Sindh that had ideas of turning Indus into a great highway of commerce. Under the 1832 treaty negotiated by Colonel Henry Pottinger, the first resident, with Ranjit Singh, the Indus River was thrown open to commerce with the proviso that no armed vessels or military stores should pass through. The treaty of 1832 was brushed aside in 1838–1839 after Shah Shuja Durrani (1803–1809 and 1839–1842) forced Sindh to pay arrears of Tribute. After years of fighting, in 1843 Sindh was annexed by the British, while they sieged Punjab in 1849. After annexing Punjab and Sindh, the British colonial rulers constructed a series of canals. Through those canals, the British transformed six million acres of deserted land in Punjab into one of the richest agricultural regions in Asia.

Sir Arthur Cotton played a significant role in the planning and constructing early irrigation projects in India (mentioned below and in following chapters). Another name is of Sir Proby Thomas Cautley who was connected with the construction of the Ganges River Canal, the “first purely British work” designed to irrigate the whole Doab. From 1847 onwards, projects for dams and canals in the Godavari River Delta were pursued. The second phase of canal planning commenced after 1858, focusing mainly on the projects’ private investors. The East India Irrigation Canal Company was founded in 1861 and the Madras Irrigation Company in 1863. However, after the famines of the 1870s, public interest in irrigation rose again, and a new phase of canal building was undertaken with public investment.

In terms of technology, the British built perennial canals with headworks that could withstand the floods. The headworks did not extend across the entire stream or were constructed first as “weirs” and later as “barrages” (weirs surmounted by movable gates). The idea behind the use of such technology was to “head up” the water sufficiently in times of low flow so that it would pass into the “head regulator” of the canal and, at the same time, allow unobstructed flow in times of flood. The colonial
rulers looked old structures as in state of “backwardness”, “traditional,” and centuries old. The British rulers believed they could transcend these structures’ limitations by implementing their relatively “superior” science and technology. They transformed rivers into a commodity that had to be controlled, tamed and turned into a water source for artificial “rivers” (canals). The colonial state was the primary funder for such irrigation networks. By 1870s, canals were almost entirely controlled by white British and Scottish engineers of the Public Works Department, created by administrative reforms of the 1850s and 1860s.

The colonial rulers developed a vast irrigation network despite critique from irrigation experts such as Sir William Willcocks. Such irrigation networks helped the colonial government to earn enormous money in form of revenue. By 1892, the British had constructed nearly 43,800 miles of canals and distributaries in India, irrigating around 13.4 million acres at a capital cost of INR 382.6 million with a return revenue at 4 to 5 percent per annum on the investment. In the following years, some drops in revenue returns from irrigation gradually led to a diversion of investment into the railways. But soon, subsequent droughts in certain parts of India raised the demand for irrigation works. As a result, in 1895–1896, the total capital outlay on irrigation works increased by 33 percent over the 1885–1886 allocation, doubling the irrigation capacity. Increased investment in irrigation led to rise in colonial revenue. However, it was still old works “of native origin” and not the British structures that brought in the revenue.

After an unsuccessful soldiers’ rebellion in 1857 in which many Indian princes also fought against the British, the British Crown took over the administration of India. The British Crown began to consolidate its power by focusing on famine relief and the need to maintain the resource base of trade. The Crown also began to invest in and regulate canals and irrigation facilities. The British colonial law on water after 1857 had two main strands. First, control over water and rights to use water were regulated through the progressive introduction of common law principles that emphasised landowners’ rights to access water. Riparian rights over surface waters allowed landowners the right to take a reasonable portion of the flow of a watercourse. However, landowners had virtually unlimited right to access to groundwater under their land holdings. Easements Act (1882) was enshrined. Second, since the EIC days, the colonial rulers enacted a series of regulatory statutes, including laws to protect and maintain embankments, acquire land for embankments and entrust the Controller to implement laws such as Embankment Regulation 1829 and Bengal Embankment Act 1855. There were other laws to regulate canals for navigation purposes and levying taxes on the users, river conservation and rules on ferries and fisheries such as Northern India Ferries Act 1878 and Indian Fisheries Act 1897. Regulations were also enacted recognising local practices and rules in villages.

On the impact of the irrigation system developed by the British, Elizabeth Whitcombe observes that introducing a perennial irrigation system in semi-arid plains of North-Western India brought negative ecological
consequences in the form of waterlogging, salinisation and destroyed traditional wells; overall, it created a “depressed peasantry” in those areas.\(^{92}\) Whitcombe’s monograph *Agrarian Conditions in Northern India*, published in the early 1970s, challenges the hitherto wisdom of colonial irrigation. In contrast to the belief that canal irrigation was overwhelmingly a positive contribution, Whitcombe terms them “costly experiment”.\(^ {93}\) Almost a decade later, Ian Stone, in his monograph *Canal Irrigation in British India*, sought to stand Whitcombe’s claims on its head. For Stone, colonial irrigation, when viewed primarily in the context of the peasants’ adaptation to new technologies, capacity for rational decision-making and quest to maximise output, became a source for economic dynamism and constant innovation. Ian Stone observes that the canal irrigation system had a positive impact, as it changed the agriculture system in north India.\(^ {94}\) He observes that the British engineers were well aware of the problems in those areas and reengineered the canals in the late 19th century to overcome them. He denies that the wells deteriorated to any serious extent and suggests that the only enduring problem was a great increase in the incidence of malaria in the region, which seriously impacted local people’s lives.\(^ {95}\) Countering Stone, Patricia Collins argues that adverse environmental effects continued to be seen in areas of canal construction, whether in the Ganga-Jamuna Doab region or in Punjab and the Indus valley. She finds this is largely because of financial constraints that led to canals being built on the cheap quality materials, with little provision for adequate drainage.\(^ {96}\) With the help of irrigation system, the colonial rulers, as Bhattacharya’s work shows, reshaped agrarian world and colonised it. Social orders and community bondings were reordered to achieve colonial government’s objectives. \(^ {97}\) Imran Ali, in his study, finds that the existing social stratifications and hierarchies in Punjab were projected in the canal colonies developed by the British. The “superior” castes were politically and economically dominant. They pursued elite occupations and the means of production were concentrated in their hands. On the other hand, the “inferior castes” were at disadvantageous position and exploited by the “superior castes”.\(^ {98}\)

Michel provides three reasons for choosing the Indus basin. First, generation of revenue. Second, the desire to prevent droughts in the region. One of the early works British carried out in the region was improvisation of Western Jumna canal. Third, the rehabilitation of the loyal soldiers of the Sikh army, which was defeated in 1846 and disbanded in 1849.\(^ {99}\) The Canal Colonies were mainly situated in tracts designated as crown wasteland. Since the landowner was the state, it controlled the canal system, water source and agriculture depends on the ruling authority’s will.\(^ {100}\) The State distributed the land in Canal Colonies to the loyalist castes and loyal soldiers. In the process, a class system was formed where some got land (on a lease, not on a hereditary basis), while others were made a part of it to do menial works. An assured supply of water in the Canal Colonies turned them different from non-canal colonies. Hence, even when the harvest failed
in different parts of the region due to lack of water availability or some other reasons, in Canal Colonies, fields were sown, and there was always something to take to market. Such arrangements helped to bring prosperity in the region, though lopsided one, which overhauled the agrarian structure and rural set-up in Punjab. Lands of original inhabitants, who had lived previously largely as pastoralists, were taken without any compensation.

There were nine Canal Colonies in British Punjab. Their names were: Sidhnai (Multan), Sohag Para (Montgomery, now called as Sahiwal), Chenab (spread in Gujranwala, Jhang, Lyallpur, Lahore and Sheikhupura districts), Chunian (Lahore), Jhelum (Shapur), Lower Bari Doab (Montgomery and Multan districts), Upper Chenab (Gujranwala, Sialkot), Upper Jhelum (Gujrat) and Nili Bar or Sutlej Valley Project (Sialkot, Montgomery and Multan). One of the chronic problems canal colonies had, as Michel points out, was waterlogging. The Punjab Irrigation Department was more concerned with decreasing waterlogging than increasing water supplies for irrigation. Waterlogging in the lower Chenab Canal had a serious problem since 1908. To study the issue and look for remedial measures, in 1922 an irrigation laboratory was set up, followed by the Irrigation Research Institute at Lahore in 1930.

The early years of the 20th century saw changes in technology that led to a tilt in interest in building dams instead of canals. Reinforced concrete was invented in France in 1868, and by the turn of the century Portland cement had been improved and could be used for large dams. By the 1930s, earthmoving equipment that revolutionised the dam building was available. It made the building of an earth-fill or rock-fill dam almost anywhere possible. The building cost of dams was substantially reduced. In India, the new techniques were first used in building the 214 feet Mettur Dam built on the Cauvery in the early 1930s.

The invention of new technology also made the British to invest in hydro-power for flour mills on the Western Jumna Canal at Karnal, Delhi and Hissar. The mills brought in total revenue of nearly 23 percent on the capital outlay. Encouraged by results, the first electrical waterpower plant was set up by the Darjeeling municipality in 1897. After the USA's multipurpose Tennessee Valley Authority (TVA) gained popularity, dams were planned on similar lines. TVA's formula was applied at the Krishnaraja Sagar hydroelectric station, which was completed in 1931. Then, the works on Bhakra Nangal were conceived during the colonial days. The first Multipurpose River Valley Development (MPRVD) planned was the Damodar Valley Project on the TVA lines. As a result of their growing interests, by 1950 more than 200 dams that could be called large, according to the International Commission on Large Dam definition were built in India. Apart from dams, in the 1940s the British engineers also turned their attention to the alternative of groundwater exploitation through well irrigation.

In South India, a real change in the irrigation system and river planning started mainly due to the initiatives taken by Arthur Cotton, who joined the
Madras Military Engineering Corps in the 1830s. Cotton changed the government’s approach and attitude toward the rivers. In 1838, Cotton began a series of hydraulic initiatives to improve rivers’ revenue-yielding potential across the Madras Presidency. One of the early projects Cotton recommended was building of a dam across the bed of the Coleroon River to the Cauvery between 1836 and 1838. Arthur Cotton supervised the full project, while the construction of the upper Coleroon anicut in 1836 was under his brother, Major H.C. Cotton. Arthur Cotton ensured the construction of Dowleshwaram Barrage in 1850 before he retired to England. Decades after Cotton retired, in 1970, the barrage was rebuilt and officially named after him. Another mammoth construction endorsed by Cotton in the 1850s was, now called, Prakasam Barrage on the Krishna River in Vijayawada. These constructions, along with other, changed the irrigation pattern and fortune of the people of the region. Due to such a significant role, Cotton is still revered in large parts of Telangana and Andhra Pradesh. Arthur Cotton museum was built in the Rajahmundry District. The museum was inaugurated in 1988 by the then Chief Minister of Andhra Pradesh, N.T. Rama Rao. Cotton’s statue has been built in different parts of the region. According to some estimates, there are about 3,000 such statues in East and West Godavari and Krishna districts of Andhra Pradesh.

In Hyderabad’s Tank Bund, there is a statue of Cotton along with other great Telugu heroes such as freedom fighter Alluri Seeta Rama Raju et al.

The British also controlled water system through technology in cities such as Bengaluru (earlier Bangalore). Around the year 1799, the colonial authority took control over tanks. To meet the rising water demand, the Municipal and Public Works Departments considered deepening of reservoirs or building new ones. By 1885, as Bengaluru’s water supply was running low, the colonial government set up piped infrastructure to bring

Figure 0.1 Sir Arthur Cotton’s statue at Tunk Bund, Hyderabad, Telangana.
Photo credit: Anagha Lakshmi
water from the sources as far as 30 kilometres away from the city, including from the Hesarghatta and the TG Halli Reservoirs. But such arrangements could not fix the problems for a very long period.\textsuperscript{118}

In short, the British colonialists used all tactics to tame rivers, water bodies, and control irrigation systems in colonial India through technology. Some of the hydraulic infrastructures built by the British created disputes between the regions. A few, out of a total number of river water disputes began during the colonial years, continues in postcolonial times.

**River Water Disputes in India**

According to Central Water Commission, Government of India’s body that deals with basin planning in the country, there are 20 river basins, of which 12 are major and 8 are composite.\textsuperscript{119} Of the total territory in India, about 90 percent is drained by inter-state river basins.\textsuperscript{120} Along with many big and small tributaries, the Ganga River makes the largest basin in India.\textsuperscript{121} Its basin size is 1,086,000 square kilometres, and catchment area is 1.09 million square kilometres.\textsuperscript{122} Ganga River Basin is spread to Bangladesh, and some of its tributaries join it after flowing from Nepal into India.

Some of the important Indian rivers, such as Sutlej and Brahmaputra, have their source of origin in Tibet in China. In fact, rivers originating in Tibet and flowing into India contribute about one-third of the country’s water supply. Hence, Chinese hydro infrastructure projects on transboundary rivers

![Figure 0.2 Ganga River in Patna, Bihar.](image)

Photo by the author and Pushpam
flowing into India concerns New Delhi. However, contrary to popular perceptions, Tibet-originated rivers become fatter after landing in the Indian plains where their tributaries join them. In addition to China, India also has disputes and issues with South Asian riparian neighbours. India and Pakistan share waters from the Indus River System (Indus, Sutlej, Jhelum, Chenab, Beas, Ravi). Mediated by the World Bank in 1960 India and Pakistan signed the Indus Waters Treaty (IWT) to share the waters of the Indus River System. W.A.B Iliff, then vice president of the World Bank, signed the treaty for the purposes specified in Articles V and X and Annexures F, G and H of the treaty. Although the IWT has survived wars, military tensions, and everyday verbal spat between India and Pakistan, situation is turning grim over the shared waters. In January 2023, using Article XII (3) provision, India sent a notice to Pakistan to update and modify the IWT. India and Bangladesh share 54 rivers. In 1996, India and Bangladesh signed a treaty to share waters from River Ganges. The 1996 treaty will expire in 2026, as it was signed only for 30 years. The two countries remain in dispute over sharing of waters from the Teesta River. In 2011, India and Bangladesh agreed on an interim agreement on the distribution of Teesta water between them. The interim agreement gives 42.5 percent water to India and 37.5 percent to Bangladesh. The agreement has not been implemented yet. India has issues with Nepal over multipurpose projects and annual flooding. Bhutan has expressed some concerns over India-aided hydroelectric projects in the country.

Transboundary river issues and disputes have bearings on Union-state water relations in India. Chinese projects in Tibet largely impact the downstream in the Indian state of Arunachal Pradesh. Even the Indian State of Assam has often flagged impact of hydro projects in the upper stream of the Brahmaputra River on the state. Consequently, India has raised water issues with China. On Indus River System and IWT, in 2018, the then Chief Minister of the Indian state of Punjab Captain Amrinder Singh supported the idea of stopping the flow of water to Pakistan from eastern rivers. People from the Indian side of Jammu and Kashmir largely feel that their waters were divided between India and Pakistan without consulting them. Between India and Bangladesh, the Indian State of West Bengal plays an important role in water-sharing issues. For instance, the Government of India is ready to implement an interim agreement of 2011 on the Teesta River, but the West Bengal government is against it. Eventually, in 2015, the Union government agreed to West Bengal’s position and maintained that it would not advance without taking the state government into confidence.

Fights and tensions over inter-state river water sharing are likely to escalate in future because of the widening demand–supply gap and accelerated effect of climate change. Increase in water demand is due to addition in country’s population which require more waters for food crop production, industrial activities and domestic consumption. In April 2023, India has taken number one spot, leaving China behind in population. At present, India’s population is more than 1.42 billion. In 2011, per capita, water availability in India was 1,544 cubic metres, which declined to 1,486