

A circular logo with a blue and green color scheme. It features a stylized water drop or wave shape in the center, surrounded by the word 'WATER' in a circular arrangement. The logo is semi-transparent and overlaid on the title area.

# Water in British India: The Making of a 'Colonial Hydrology'

Rohan D'Souza\*

*Jawaharlal Nehru University, New Delhi*

---

## Abstract

The environmental history of India has moved on and considerably broadened since the first studies of Indian forestry were published. This essay surveys studies on water in British India, which it has clustered into three themes. While providing a rough description of some of the most important debates and discussions on the issue of colonial rule and its hydraulic interventions, the essay argues that interest on the subject must now attempt to pursue grand questions as well. Towards to this end, it is argued that much insight and theoretical traction may be gained from pursuing the conceptual notion of a 'colonial hydrology': the attempt to characterise the British experience as comprising an altogether distinct paradigm for hydraulic interventions.

---

Water in British India can be discussed in three overlapping but discrete clusters of concerns. The first and most substantially engaged debates have situated colonial irrigation strategies in terms of their environmental, political and economic contexts. The second cluster, closely shadowing the first, has explored aspects of 'decline', elimination and sometimes appropriation of a slew of 'traditional' water harvesting technologies. The third cluster of concerns, that is yet to achieve visibility, has aimed at identifying definitive patterns in colonial strategies towards hydraulic endowments. Put differently, the attempt is to characterise the British experience as comprising an altogether distinct paradigm for hydraulic interventions in South Asia; explanations that can perhaps be encapsulated under the broad rubric of 'colonial hydrology'. Part of this as yet incipient exercise involves, in my opinion, a departure from the emphasis on irrigation. In turn, this third cluster will explore colonial experiences with floods, drainage, wetlands, lakes, in-land river navigation, traditional fisheries, urban water supply, water legislation, cultures of water use, ideologies on 'river-improvement' and Multi-purpose River Valley development. In several ways, these themes listed above (indicative and not exhaustive), could then, presumably, help fill in many existing empirical gaps and thereby craft a rigorous theoretical approach to explore the relationship between colonialism and water. By a theoretical approach, I suggest that the subject of water in British India should, similar to works on forests or land policies, be able to shed light on

the broader dynamics of colonial rule. Thus, while this essay is centrally aimed at providing a general introduction to the main themes on water in British India, it will nevertheless also attempt to argue a case for the term 'colonial hydrology'; the claim being that much like 'scientific forestry' or the zamindari system on land, colonial economic and political imperatives defined and impacted the region's fluvial endowments in specific and unprecedented ways.

### *The Quest for Perennial Irrigation*

Whitcombe's monograph titled *Agrarian Conditions in Northern India*, published in the early 1970s, was arguably the first attempt at challenging the hitherto then received wisdom on colonial irrigation. In contrast to the belief that canal irrigation was overwhelmingly a positive contribution, *Agrarian Conditions* concluded the opposite. According to Whitcombe, the introduction of perennial irrigation in the semi arid plains of north-western India brought about adverse ecological consequences such as waterlogging and salinisation, destroyed traditional wells and inevitably these canals created some islands of plenty amidst a sea of epidemically swamped and 'depressed' peasantry.<sup>1</sup> In reply, almost a full 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 peasant's adaptation to new technologies, capacity for rational decision-making and the quest to maximise output, canals became a source for economic dynamism and constant innovation. Consequently, for Stone, despite several negative externalities, the canals released positive 'expansionary forces'.<sup>2</sup> In a slight remove from the pessimism versus optimism debate on the British canal system, Imran Ali in a study of the massive British canal colonies, established in the semi-arid plains of the Punjab between the late nineteenth and early decades of the twentieth century, indicated frictions between colonial economic agendas and their political aims. For Ali, the latent capacity for initiating dynamic capitalism in the canal colonies canals was defeated by the colonial state's continued embrace of traditional and archaic social institutions. Thus, the canal colonies witnessed a contradictory economic pattern in which growth was closely paralleled by underdevelopment.<sup>3</sup> David Gilmartin, in fact, in an earlier essay on the canal colonies, pointed to similar irreconcilable antagonisms between what he termed as 'scientific empire' and 'imperial science'. According to Gilmartin, while discourses on imperial science helped organise the productive control of nature for increasing revenue and expanding commercial agriculture, its 'transformative' potential was constrained by practices of scientific empire – harnessing science to craft and sustain political hierarchies and the exploitative character of colonial society.<sup>4</sup> In other words, two countervailing and contradictory discourses on science simultaneously acted to expand and stymie the potential for dynamic growth within canal colonies. Clearly, the

lively debates on colonial irrigation in British India have been concentrated on the semi arid interfluves of the north-west. On the other hand, studies on canal irrigation impacts in the south and the eastern deltas have as yet remained shy of taking on polarised positions. Studies on these regions have essentially looked at two aspects of the canal experience; a) productivity and the transition to commercial agriculture;<sup>5</sup> b) failures of private irrigation companies in the Madras and Bengal Presidencies.<sup>6</sup>

Studies on colonial canal irrigation, as surveyed above, however, still lacks a credible comparative analysis. In particular, a comparative exercise could throw light on why certain irrigation precepts were persisted with and how colonial irrigation practices were shaped by a cross pollination of ideas, evolved from varied ecological zones.

### *Water Traditions and Colonial Technology*

The second cluster of concerns have largely dealt with the schism between 'traditional' or indigenous water technologies and colonial hydraulic engineering endeavours, termed as modern systems.<sup>7</sup> Attention to pre-British irrigation organisation, design and operations, in terms of their relationships and status in a colonial context, was arguably first explored in an article by Nirmal Sengupta, in 1980. Sengupta primarily sought to explore the reasons for the 'decline' of the traditional *ahar* (tank) and *pyne* (channel) irrigation system in colonial South Bihar. According to Sengupta, the *ahar* and *pyne* network began to breakdown following the introduction of new revenue routines by the colonial administration. In particular, by facilitating and encouraging a shift from 'produce' to 'fixed' and then to cash rents, the colonial administration invariably upset an entire rhythm of procedures, protocols and duties between tenants and landlords over the question of the maintenance and servicing of the *ahar*-*pyne* system. In effect, while the rent burden historically for the indigenous irrigation system was factored as a 'land-water combine', the colonial revenue format realised claims only from 'land'.<sup>8</sup> In several ways, Sengupta set the tenor for subsequent works on the subject. In 1997, the Centre for Science and Environment, a Delhi-based non-governmental organisation, released a report titled *Dying Wisdom*, which had then put forward the most exhaustive survey on traditional or pre-British water harvesting systems in India.<sup>9</sup> Besides describing the functional details and varied operational aspects of these water structures and situating them in their regional and ecological setting, *Dying Wisdom* also sought to advance a larger historical claim; that traditional water harvesting systems in India declined or were substantially degraded by a range of colonial actions for rule and profit. Colonialism, in other words, by instituting private property, commodifying land, commercialisation, pursuing highly extractive revenue agendas and dismantling community control over natural resources caused the impoverishment of the rural populace at large and led to the decay and destruction of indigenous water harvesting systems.<sup>10</sup>

Subsequent scholarship, however, has questioned whether colonialism did indeed have such a sweeping impact on traditional water structures. David Hardiman, for example, in an excellent study on indigenous water systems in Gujarat argued that aspects such as commercialisation and peasant indebtedness were in fact processes that not only predated colonial rule in the region but were integral, ironically enough, to actually expanding well irrigation in the region.<sup>11</sup> In a recent study, David Mosse on exploring ecology and politics in South India argued that *Dying Wisdom's* belief that 'organic and autonomous villages' sustained stable water management practices cannot be historically validated. For Mosse, pre-British village communities were unstable entities driven by hierarchies and were shaped and impacted by larger processes of statecraft and regional politics. In effect, Mosse suggests that tanks in South India underwent various phases either of efflorescence or decline prior to colonial rule.<sup>12</sup> Lastly, the pronounced claim in *Dying Wisdom* that traditional water harvesting structures declined or disintegrated across the board in the colonial period has also been challenged. Thomas Rosin, in a meticulously argued essay, indicates that in western Rajasthan a series of complex groundwater irrigation and drinking water devices (*khaDin's* (silt-ponds), step wells, reservoirs and L-shaped embankments) remained functional and viable well into the colonial and post-colonial period. In other words, these systems were capable of 'overlapping' with other hydrological regimes. That is, Rajasthan's unique water harvesting systems rather than being displaced were instead 'overlaid' or coexisted with new types of modern hydraulic technologies, introduced by the British.<sup>13</sup>

Nevertheless, the above qualifications aside, the argument that a large number of traditional water harvesting systems declined or were marginalised in both relative and absolute terms still holds. Colonial water technologies such as weirs, dams and barrages, oriented towards delivering perennial irrigation for settled agriculture, in most instances, proved unable to not only coexist with traditional systems but were sharply aimed at eliminating the latter as well. Indu Agnihotri's insightful and prescient essay on the ecological and land use consequences of the canal colonies in Punjab revealed how British perennial irrigation did not, as widely held, simply bring water and increase agricultural productivity in hitherto desolate 'wastes'. Rather, according to Agnihotri, the colonial canal systems of the late nineteenth and early twentieth centuries overwhelmed, over ran and substantially eroded an existing vibrant pastoral economy in the region. These pastoral grouping, moreover, had also taken to seasonally cultivating crops, which were watered through a complex network of inundation canals.<sup>14</sup> In many other places as well, colonial canal lines were often deliberately situated in ways that supplanted other prevailing irrigation structures. In the Sone canal command in South Bihar, for instance, the engineering staff often consciously placed canal distributaries across existing *ahar* and *pynes*, with the intension of injuring or destroying them.<sup>15</sup>

*Debating 'Colonial Hydrology'*

Central to the third cluster of concerns on water is the attempt, in my opinion, to explore the possibility for outlining a grand theme approach such as the concept of 'colonial hydrology'. In other words, being able to characterise the colonial interventions in water as comprising a cogent and distinct hydraulic paradigm. A paradigm which involved fundamentally realigning land and water in new sets of social, political and ecological relationships.

At the level of technology, the British transformed many of the flood plains from previously being watered by seasonal or inundation canals to becoming sites for perennial irrigation works; involving the construction of permanent headworks across river beds with barrages and weirs.<sup>16</sup> These perennial canal systems were technologically unprecedented for harnessing of fluvial environments and were operated through a corpus of social rules, economic practices, rationalities about property and colonial administrative disciplines. These perennial canals, however, were assembled not merely as channels commandeering river flow but more significantly ended up fundamentally reorienting ecological relations between land and water, notably through 'irrigation science'. That is, the canal schemes represented not merely the commercial and revenue calculations for colonialism but were interventions that worked to order distinct social and physical colonial contexts. Involving, in the main, to paraphrase David Gilmartin, the historically unprecedented attempted creation of the 'colonial resource regime' through an admixture of irrigation engineering science, routines of land revenue and by the intended colonial 'control' of society and nature.<sup>17</sup> Thus, I would argue, the term colonial hydrology could perhaps best encapsulate the varied hydraulic interventions of colonialism to simultaneously alter South Asia's fluvial and social worlds.<sup>18</sup>

Along a similar plane, the second possibility that has hitherto not been substantially dealt with, in terms of a grand theme is the question of the dramatic alteration of British India's great drainage network.<sup>19</sup> The nineteenth century witnessed the systematic proliferation of flood control embankments, intended to contain rivers within their main channels. In addition, the colonial administration also constructed a vast number of roads, railway lines and bridges.<sup>20</sup> These structures had several consequences for drainage and epidemiology. While in Bengal and Bihar, for example, most of the natural drainage lines dropped from north to south, the roads and railways tracks were mostly constructed across them, running east to west. These constructions, in time, not unexpectedly, led to severe drainage congestion and were also accused of being the main sources for aggravating the spread of malaria.<sup>21</sup> Arguably, British hydraulic interventions, through the course of the nineteenth century, radically transformed a vast spectrum of pre-colonial hydraulic relationships that had defined and sustained complex equations between land and water. It is probable that studies pursuing grand

themes such as ‘colonial hydrology’ will yield and formulate the next crop of important and significant questions.

### Short Biography

Rohan D’Souza is Assistant Professor at the Centre for Studies in Science Policy, Jawaharlal Nehru University, New Delhi.

### Notes

\* Correspondence address: Rohan D’Souza, Centre for Studies in Science Policy, School of Social Sciences, Jawaharlal Nehru University, New Delhi-110067, India.

<sup>1</sup> Elizabeth Whitcombe, *Agrarian Conditions in Northern India: The United Provinces Under British Rule, 1860–1900*, vol. 1 (Berkeley: California University Press, 1972).

<sup>2</sup> Ian Stone, *Canal Irrigation in British India: Perspectives on Technological Change in a Peasant Economy* (Cambridge: Cambridge University Press, 1985).

<sup>3</sup> Imran Ali, *The Punjab Under Imperialism, 1885–1947* (New Delhi: Oxford University Press, 1987). Also see M. Mufakharul Islam, *Irrigation, Agriculture and the Raj: Punjab, 1887–1947* (New Delhi: Manohar, 1997).

<sup>4</sup> David Gilmartin, ‘Scientific Empire and Imperial Science: Colonialism and Irrigation Technology in the Indus Basin’, *The Journal of Asian Studies*, 53/4 (1994): 1127–48.

<sup>5</sup> G. N. Rao, ‘Transition from Subsistence to Commercialised Agriculture: A Study of Krishna District in Andhra, 1850–1890’, *Economic and Political Weekly*, 20/25–26 (1985): A–60–9. Also see G. N. Rao, ‘Canal Irrigation and Agrarian Change in Colonial Andhra: A Study of Godavari district, c.1850–1890’, *Indian Economic and Social History Review*, 25/1 (1988): 25–60.

<sup>6</sup> M. Atchi Reddy, ‘Travails of an Irrigation Canal Company in South India, 1857–1882’, *Economic and Political Weekly*, 25/12 (1990): 619–28; Pradipta Chaudhuri, ‘Peasants and British Rule in Orissa’, *Social Scientist*, 19/7 (1991): 36–42; Rohan D’Souza ‘Canal Irrigation and the Conundrum of Flood Protection: The Failure of the Orissa Scheme of 1863 in Eastern India’, *Studies in History*, 19/1 (2003): 41–68.

<sup>7</sup> Nirmal Sengupta argues that traditional or indigenous can be separated from modern irrigation systems by the difference in their participatory character. While traditional systems require extensive participation and cooperation amongst its users, modern systems are governed by formal and centralised bureaucratic management. This distinction, however, tends to convey the impression that systems prior to British rule were rooted in democratic decision making and principles of equity. A claim that ignores caste practices in water distribution or the use of forced labour in repair and maintenance. Secondly, it is sometimes difficult to draw a hard and fast line between ‘traditional’ and ‘modern’ irrigation technologies as several modern schemes have incorporated aspects from pre-existing structures. For our purposes, therefore, traditional will refer broadly to the systems that prevailed prior to British intervention. See Nirmal Sengupta, *User Friendly Irrigation Designs* (New Delhi: Sage, 1993), 10. Sandra Postel argues that irrigation’s modern moment found expression in the nineteenth century in British India. See Sandra Postel’s *Pillar of Sand: Can the Irrigation Miracle Last?* (New York: W.W. Norton & Company, 1999), 40–64.

<sup>8</sup> Nirmal Sengupta, ‘The Indigenous Irrigation Organisation in South Bihar’, *The Indian Economic and Social History Review*, New Delhi, 37/2 (1980), 157–87.

<sup>9</sup> Anil Agrawal and Sunita Narain (eds.), *Dying Wisdom: Rise, Fall and Potential of India’s Traditional Water Harvesting Systems* (New Delhi: Centre for Science and Environment, 1997).

<sup>10</sup> *Ibid.*, 262–311.

<sup>11</sup> David Hardiman, ‘Well Irrigation in Gujarat: Systems of Use, Hierarchies of Control’, *Economic and Political Weekly*, 33/25 (1998): 1533–44.

<sup>12</sup> David Mosse, *The Rule of Water: Statecraft, Ecology, and Collective Action in South India* (New Delhi: Oxford University Press, 2003).

<sup>13</sup> R. Thomas Rosin, ‘The Tradition of Groundwater Irrigation in Northwestern India’, *Human Ecology*, 21/1 (1993): 51–83.

- <sup>14</sup> Indu Agnihotri, 'Ecology, Land Use and Colonisation: The Canal Colonies of Punjab', *Indian Economic and Social History Review*, 33/1 (1996): 37–58.
- <sup>15</sup> *Report of the Committee Appointed to Enquire into the Administration of the Sone Canals*, vol. 1 (Calcutta: Bengal Secretariat Press, 1888), 12–20.
- <sup>16</sup> Herbert M. Wilson, *Irrigation in India* (Delhi: Daya Publishing House, 1989 [1903]), 78–81; D. G. Harris, *Irrigation in India* (London: Oxford University Press, 1923), 5–7.
- <sup>17</sup> David Gilmartin, 'Water and Waste: Nature, Productivity and Colonialism in the Indus Basin', *Economic and Political Weekly*, 38/48 (2003): 5057–65.
- <sup>18</sup> For a sense of the scale of hydraulic alterations introduced in the Bengal Presidency see W. A. Inglis, *The Canals and Flood Banks of Bengal* (Calcutta: The Bengal Secretariat Press, 1909). This is a meticulous compilation of colonial initiatives throughout the nineteenth century on irrigation, flood control works, navigation and drainage.
- <sup>19</sup> W. A. Inglis, *A Review of the Legislation in Bengal Relating to Irrigation, Drainage and Flood Embankments* (Calcutta: The Bengal Secretariat Press, 1902). Also see *Note by Lieutenant J. W. Ottley, R.E., reviewing the Canal Revenue system of Northern India and Bengal and making certain proposals with regard to the best system of management of Irrigation from the Soane Canals* in Richard Temple Collection. Mss. EUR f86/169. Oriental and India Office Collection (London: The British Library).
- <sup>20</sup> On flood control embankments, the literature has so far barely scratched the surface. For Bihar see D. K. Mishra, 'The Bihar Flood Story', *Economic & Political Weekly*, 32/35 (1997): 2206–17; Praveen Singh, "'Colonising the Rivers": Colonial Technology, Irrigation and Flood Control in North Bihar, 1850–1950', Ph.D. thesis (Jawaharlal Nehru University, 2003), 198–261. On the Orissa embankments, see Rohan D'Souza, *Drowned and Dammed: Colonial Capitalism and Food Control in Eastern India 1803–1946* (New Delhi: Oxford University Press, forthcoming).
- <sup>21</sup> An instance of colonial writings on the relationship between drainage and malaria is apparent in reports such as *Report of the Drainage Committee, Bengal (Presidency Division)* (The Bengal Secretariat Press, Calcutta, 1907).

## Bibliography

- Agnihotri, I., 'Ecology, Land Use and Colonisation: The Canal Colonies of Punjab', *Indian Economic and Social History Review*, 33/1 (1996): 37–58.
- Agrawal, A., and Narain, S. (eds.), *Dying Wisdom: Rise, Fall and Potential of India's Traditional Water Harvesting Systems* (New Delhi: Centre for Science and Environment, 1997).
- Ali, I., *The Punjab Under Imperialism, 1885–1947* (New Delhi: Oxford University Press, 1987).
- Chaudhuri, P., 'Peasants and British Rule in Orissa', *Social Scientist*, 19/7 (1991): 36–42.
- D'Souza, R., 'The Deltaic Rivers of the Bengal Presidency: The Political Economy of "Flood Control" in Colonial Orissa', Ph.D. Thesis (Jawaharlal Nehru University, 1998).
- D'Souza, R., 'Canal Irrigation and the Conundrum of Flood Protection: The Failure of the Orissa Scheme of 1863 in Eastern India', *Studies in History*, 19/1 (2003): 41–68.
- Gilmartin, D., 'Scientific Empire and Imperial Science: Colonialism and Irrigation Technology in the Indus Basin', *The Journal of Asian Studies*, 53/4 (1994): 1127–48.
- Gilmartin, D., 'Water and Waste: Nature, Productivity and Colonialism in the Indus Basin', *Economic and Political Weekly*, 38/48 (2003): 5057–65.
- Hardiman, D., 'Well Irrigation in Gujarat: Systems of Use, Hierarchies of Control', *Economic and Political Weekly*, 33/25 (1998): 1533–44.
- Harris, D. G., *Irrigation in India* (London: Oxford University Press, 1923).
- Inglis, W. A., *A Review of the Legislation in Bengal Relating to Irrigation, Drainage and Flood Embankments* (Calcutta: The Bengal Secretariat Press, 1902).
- Inglis, W. A., *The Canals and Flood Banks of Bengal* (Calcutta: The Bengal Secretariat Press, 1909).
- Islam, M. M., *Irrigation, Agriculture and the Raj: Punjab, 1887–1947* (New Delhi: Manohar, 1997).
- Mishra, D. K., 'The Bihar Flood Story', *Economic & Political Weekly*, 32/1 (1997): 2206–17.
- Mosse, D., *The Rule of Water: Statecraft, Ecology, and Collective Action in South India* (New Delhi: Oxford University Press, 2003).
- Note by Lieutenant J. W. Ottley, R.E., reviewing the Canal Revenue system of Northern India and Bengal and making certain proposals with regard to the best system of management of Irrigation from the Soane Canals*. Richard Temple Collection. Mss. EUR f86/169. Oriental and India Office Collection (London: The British Library).

- Postel, S., *Pillar of Sand: Can the Irrigation Miracle Last?* (New York: W. W. Norton & Company, 1999).
- Rao, G. N., 'Transition from Subsistence to Commercialised Agriculture: A Study of Krishna District in Andhra, 1850–1890', *Economic and Political Weekly*, 20/25–26 (June 22–29, 1985): A–60–9.
- Rao, G. N., 'Canal Irrigation and Agrarian Change in Colonial Andhra: A Study of Godavari District, c.1850–1890', *Indian Economic and Social History Review*, 25/1 (1988): 25–60.
- Reddy, M. A., 'Travails of an Irrigation Canal Company in South India, 1857–1882', *Economic and Political Weekly*, 25/12 (March 24, 1990): 619–28.
- Report of the Committee Appointed to Enquire into the Administration of the Sone Canals*, vol. 1 (Calcutta: Bengal Secretariat Press, 1888).
- Report of the Drainage Committee, Bengal (Presidency Division)* (Calcutta: The Bengal Secretariat Press, 1907).
- Rosin, R. T., 'The Tradition of Groundwater Irrigation in Northwestern India', *Human Ecology*, 21/1 (1993): 51–83.
- Singh, Praveen, "'Colonising the Rivers": Colonial Technology, Irrigation and Flood Control in North Bihar, 1850–1950', Ph.D. Thesis (New Delhi: Centre for Historical Studies, Jawaharlal Nehru University, 2003).
- Sengupta, N., 'The Indigenous Irrigation Organisation in South Bihar', *The Indian Economic and Social History Review*, 37/2 (1980): 157–87.
- Sengupta, N., *User Friendly Irrigation Designs* (New Delhi: Sage, 1993).
- Stone, I., *Canal Irrigation in British India: Perspectives on Technological Change in a Peasant Economy* (Cambridge: Cambridge University Press, 1985).
- Whitcombe, E., *Agrarian Conditions in Northern India: The United Provinces Under British Rule, 1860–1900*, vol. 1 (Berkeley: California University Press, 1972).
- Wilson, H. M., *Irrigation in India* (Delhi: Daya Publishing House, 1989 [1903]).