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The Duty of Water: Land, Labour, and the Racialisation of Waste in Colonial and Contemporary Punjab

Maira Hayat

Keough School of Global Affairs, University of Notre Dame, Notre Dame, IN, USA, mhayat@nd.edu

Abstract: In our present changing climate, water governance is fast becoming a matter of concern everywhere, but especially in the Global South, which has long been the object of (mis)understandings of state failure and dysfunction. A common characterisation of "bad" water governance calls attention to the waste of water. In this article I show how contemporary development discourse and practice around the waste of water articulate conceptions of bureaucratic labour, farmer capability, and the suitability of irrigation practices, recalling a prior moment in colonial water governance. Examining the development of the "duty of water" in the context of canal irrigation infrastructure in colonial Punjab, I argue that seemingly "technical" measures and metrics of water governance are rooted in a colonial grammar, and show how the duty of water articulated racialised classifications of natives as wasteful, their places as waste, and of their labour, both agricultural and bureaucratic. While the tendency has been to view colonial irrigation as a battle with nature, I emphasise it instead as a battle of British with native labour to contribute to conceptualisations of environment and bureaucracy inseparable from, and incomplete without, an understanding of racialised labour. Today, figurations of labour have changed, but the underlying view of labour impeding, not enabling, governance, continues.

Keywords: water, labour, waste, racialisation, Pakistan

Introduction

Following Pakistan's devastating floods in 2022, which left a third of the country submerged, the question of water governance has elicited renewed concern, commentary, and criticism. A recurring theme in these conversations is that of wastage. For a country predicted to face a growing water shortage as the Himalayan glaciers melt, the waste of water—whether runoff to the sea or due to inefficient irrigation management—is frequently debated. Consider, for example, the following articulations of worry, lament, and responsibility: in November 2017, Pakistani newspapers reported that the country was "dumping water worth approximately $21 billion into the [Arabian] sea each year" (Gurmani 2017). The year before it was reported that Pakistan was "wasting 30 million acre feet (MAF) river water annually by sending it into the sea, causing billions of dollars loss to the country" (Dawn 2016). Both the 2007 and 2013 editions of the *Asian Water Development Outlook* state that "If some of the Asian DMCs [developing member countries] face a water crisis in the future, it will *not* be because of physical

scarcity of water, but because of inadequate or inappropriate water governance" (Asian Development Bank 2007:32; 2013:4).

Whether water is flowing to the sea, or because it is not producing higher yields, or generating the revenue it could be, it is being wasted. Water is not doing what it could and should be—that is, water is not doing its duty. Waste, then, is an incomplete category. In order to understand if and how something is being wasted, it is necessary to consider the duty (or duties) that are not being performed.

In this article, I argue that contemporary development discourse and practice around water wastage articulates assessments of bureaucratic labour, farmer capability, and irrigation practices, recalling a prior moment in colonial water governance. I place the "duty of water"—and the panoply of associated terms such as agricultural efficiency, irrigation efficiency, and water productivity—within a longer lineage of the project of "disposing things" (such as land, water, labour) in the "right manner" (Foucault 1991; Li 2007; Moore 1999). Reading contemporary development and irrigation literature alongside historical material, I show how contemporary measures and metrics are rooted in projects of colonisation, dispossession, and settlement.

Waste has been productively viewed by scholars in relation to value (Gidwani 1992, 2013; Gilmartin 2003), work (Gilmartin 2003), disorder (Douglas 2002), indigeneity and law (Cantor 2017; Curley 2019; Gilmartin 2015), and labour and race (Resnick 2021; Vasudevan 2019). David Gilmartin (2003), examining what the concept of waste did for both engineering theory and the state's revenue administration in colonial Punjab, has distinguished between "imperial science" and "scientific empire", positing that while engineers saw individual producers, revenue officials tended to see village communities (Gilmartin 1994). In a study of how the British represented and applied the concept of waste in colonial Bengal, Vinay Gidwani (1992:40, 43) has shifted the focus from waste as a category of land use to waste as a representation of the inferiority of the colonised vis-à-vis the colonisers.

I extend this work, arguing that we gain deeper insight into how water, land, and labour were articulated, by going beyond dualities such as coloniser/colonised and individual producer/village community, and show that racialisation required *myriad* distinctions. At stake in racialising classifications were perceptions of environments, general (India or "the East") as well as more proximate (Western or Eastern or Northern or Southern Punjab); constructions of and comparisons between tribes, castes, races, and religions; and relations between categories such as moneylender/tenant and Hindu/Muslim. I delve into these classifications and contradictions—the play of "linked essentializations", to borrow from Gidwani (1992:43)—to ask, for instance: How did the Muslim-ness of the indebted, and Hindu-ness of the moneylender, affect the moneylender/borrower and native/outsider classifications in colonial Punjab? And how did a purported *human* tendency to waste water interact with the specific wastefulness of Indians, and especially of Muslims?

I employ the engineering measure of the "duty of water" to narrate the colonisation and settlement of Punjab as articulating racialised classifications of natives and their places as waste and wasteful, and their labour—native agricultural *as*

well as bureaucratic. By situating the duty of water within the broader colonial grammar of extracting, arranging, administering, and teaching, I write against the tendency to examine irrigation science and practice apart from settlement and revenue literature. As well, by attending to the role of governmental labour—divided among the implicit British engineer and a native petty establishment—in the construction, design, and maintenance of irrigation infrastructure, I expand existing scholarship beyond its view of irrigation as a battle with nature, to a conceptualisation of it as a battle of British with native labour.

Punjab was the last province to be colonised by the British, and it constituted the western periphery of the Indian empire. Indeed, Punjab was the chief recruiting ground for the native army, and its population supplied soldiers and constables for service in Burma and colonies in the Straits, China, and Africa (Lyall 1896:287). Whenever a part of India was annexed, British officials went about "settling" it. Settling meant assessing the land revenue and establishing a regime of rights in the land (Douie 1985:2). Colonisation, as I detail below, entailed bringing people onto the lands. Today, Punjab is Pakistan's most populous province, agricultural heartland, as well as the centre of the country's canal irrigation network.

John Clibborn (1909), Principal of Thomason Civil Engineering College at Roorkee, in his textbook *Roorkee Treatise on Civil Engineering: Irrigation Work in India*, notes that the Indian irrigation system was started by officers who had visited and studied Italian irrigation, and that the Egyptian irrigation system was founded on Indian practice. He considered Italy the "parent country in the science of the distribution of water". Within irrigation discourse in India, the unique significance of Punjab was frequently commented upon: Chief Engineer S. K. Gurtu (1927) described Punjab as the "pioneer of irrigation" in India, where the distribution of water was "carried to a science".

The first time I came across the "duty of water" (henceforth DoW) was in 2015, during my dissertation fieldwork in Pakistan's Punjab. I was at "the Secretariat", as the main building of the Punjab Irrigation Department is commonly referred to, going through books and correspondence kept in Siddiqui sahib's office.[1] Siddiqui sahib was an engineer with decades of service at the Department and one of my first research interlocutors. I paused when I came upon the following passage in the *Manual of Irrigation Practice*, used among my bureaucrat interlocutors at the Department, describing how the water allowance of each canal outlet (*moga* [see Figure 1]) is engineered according to the following specifications:

> The outcome of all considerations of the duty of water, intensity proposed, crop ratio, water availability, etc., is the fixing of the water allowance. Water allowance [of each outlet] may be defined as the number of cusecs of the outlet capacity authorised per 1,000 acres of culturable irrigated area.[2]

Finding the language of duty vis-à-vis water unusual, I began to trace the travels of the measure.[3] When I asked about engineering textbooks my interlocutors might remember from their college or departmental training days, I was referred to texts such as *Irrigation and Water Power Engineering* (Punmia and Lal 1992), *Irrigation Engineering* (Sharma 1944), and *Irrigation Outlets* (Mahbub and Gulhati 1951). Punmia and Lal's (1992:48–51) text defines the DoW as representing

Figure 1: *Moga* is the name for the outlet. It is also called sluice, turnout, and offtake in some of the academic literature. The outlet is constructed to deliver the designed discharge of water from distributaries to agricultural fields through water courses. It is also the node in the infrastructure which marks the end of the Irrigation Department's property and jurisdiction. (source: photograph by author)

the "irrigation capacity of a unit of water", and Mahbub and Gulhati (1951:32) define it as the "area irrigated during a base period divided by the mean supply utilised in cusecs".

Amid these rather bland descriptions, I was also finding texts such as the American engineer O. W. Israelsen's 1932 *Irrigation Principles and Practices*, that described the DoW as "a relic" of early irrigation terminology, "really misleading", and a "misnomer" that ought to be "discarded" (Israelsen 1932:297).[4] W. P. Alexander, of the Ewa Plantation Company in Oahu, writing in *The Hawaiian Planters' Record* in 1928, also described the need for a "rational terminology" that could be understood by all, and to achieve which, "the ambiguous term 'duty of water' brought to America from India by engineers [must] be eliminated" (Alexander 1928:129). Thus began my attempt to trace how, and whether the language, measures, and metrics of water use had changed and travelled across colonial projects.

To build my analysis in this article, I assemble evidence from a study of irrigation texts from the British colonial period, engineering journals, archival material from the British Library and the Irrigation Research Institute Library at the Punjab Irrigation Department, recent World Bank literature, and nearly a decade of ethnographic research in Punjab's irrigation worlds. First, I examine contemporary discourse around water and its waste to set the stage and stakes. In situating the "duty of water" within a colonial grammar, I seek to join critical studies of

development (Akhter 2022; Moore 1999; Pierre 2019). I then outline a trajectory of the spread of the DoW across colonial projects. The next three sections examine key engineering texts to show how race and caste were considered "disturbances" to the system. Instead, I show how race and caste were integral to the system—from its design and construction, to its maintenance and perceived failures and inadequacies. I do this by detailing the settlement and colonisation of Punjab. The article's final section deepens the analysis of race and caste by including bureaucratic labour. The article thus joins a rich literature on colonial irrigation (Ali 1988; Bhattacharyya 2018; D'Souza 2006; Gilmartin 1994, 2015; Mustafa 2001; Ramesh 2018; Wescoat 2013a, 2013b), and expands it by focusing on the DoW and emphasising racialised labour as integral to conceptions of the environment and bureaucracy.

Setting the Stage, as the Bank Does

In 2019, the World Bank Group's Water Global Practice published a report titled "Pakistan: Getting More from Water". Describing water security as the outcome—social, economic, and environmental—of management, the foreword begins by noting that "Water security is an important and growing challenge for Pakistan" (Young et al. 2019:ix). The report ends by emphasising that while there are financial and infrastructural challenges, "the fundamental challenges are ones of *governance*" (ibid., emphasis added). Pakistan's governance challenge comprises "inadequate" and "incomplete" legal and policy frameworks. The policy inadequacies, in turn, are a function of unclear institutional mandates and a "lack of capacity" in water institutions (ibid:xviii).

Pakistan, we are told, is not water secure despite being well endowed with water: "only 16 countries have more water" (Young et al. 2019:xv). Measuring water-dependent agriculture, hydropower generation, poor water management, and environmental degradation in US dollar terms, it states that "Pakistan gets a poor economic return from its significant water resource" (ibid.). One of the factors compromising water resource management is "low water productivity in agriculture" (Young et al. 2019:xvi), rendered as "an indicator of the economic output per unit of water withdrawn from the environment" (ibid:8). High national levels of water productivity are correlated with water allocated to "high-value sectors of the economy" (ibid.). Pakistan's water productivity, at $1.38/cubic metre of water withdrawn from the environment, is low. Water productivity is then disaggregated into agricultural water productivity—this too, at $0.37/cubic metre of water withdrawn, is low in Pakistan (ibid:90). Responsible for agricultural water productivity lagging behind that of most other countries is "little improvement in water use efficiency and very little intensification or transition toward higher-value crops" (ibid:xvi). Responsible for low water use efficiency, in turn, are poor irrigation service delivery, and low hydraulic efficiency of water distribution.

Now consider an earlier World Bank report, "Pakistan's Water Economy: Running Dry" (ibid). This report often came up during my fieldwork in Punjab Irrigation offices. It begins with a list of "sobering facts", including: "heavily overstaffed bureaucracies, whose productivity is low and whose appetite leaves insufficient

funds for system maintenance and operation" (Briscoe and Qamar 2006:xviii); water management rendered as "monopoly + discretion – accountability = corruption" (ibid:xix); and "crop yields, both per hectare and per cubic meter of water … much lower than international benchmarks" (ibid.). Irrigated agriculture in Pakistan is not efficient, and to make the point, wheat yields are compared between the US and Indian and Pakistani Punjab. Pakistan's productivity relative to India and California is "3:6:10 per unit of land" and "5:8:10 per unit of water" (ibid:30). Such assessments support the conclusion that "to get more from less—more crops, more income, more jobs per unit of water", "a lot more efficiency ('crop per drop') can be squeezed out of the system" (ibid.).

"Hopeful facts" include "scope for increasing water productivity" ("Pakistan can get much more product—crop, jobs, income—per drop of water" [ibid:xxi]) and "the emergence of a new class of progressive farmers, who are shifting to high-value crops (which produce far more income and jobs per unit of water), introducing new crops and agricultural technologies, and putting unprecedented pressures on the irrigation departments to become more accountable and efficient" (ibid.).

Analysis of such reports does not tell us how measures of efficiency and productivity are enfolded within narratives and mobilised in particular projects by the World Bank. For this we need to consider genres of writing other than reports. Let us turn, then, to a different genre, the Project Information Document (PID). The 2011 PID for the Punjab Irrigation Productivity Improvement Program (PIPIP), a $423.5 million project, credits "Pakistan's Water Economy: Running Dry", the 2006 publication I discussed above, with leading to a "major shift" in Pakistan's irrigation and drainage sector and motivating the current reform agenda (World Bank 2011). A 2012 PID for PIPIP attributes inefficient use of water to "manifestation of institutional weaknesses due to near exclusive control by the public sector entities characterized by the usual inefficiencies of centralized bureaucracies, lack of corporate skills and poor client (farmer) focus and accountability" (World Bank 2012a). It describes PIPIP's main objectives as improving water productivity, which, we are told, will "translate into greater agricultural output per unit of water used, and will be achieved through improved physical delivery efficiency, irrigation practices, crop diversification and effective application of inputs" (ibid.). PIPIP's most succinct description, as provided on its website, describes its aim as:

> … getting maximum productivity out of every drop of irrigation water by weaning farmers away from the traditional and wasteful flood irrigation to more modern methods like drip and sprinkler irrigation systems, which in turn will encourage crop diversification. (World Bank 2012b)

The attempt to increase productivity by arranging water use practices, land, farm and governmental labour, and other inputs "better", however, is far from a new project. It is in fact the very project—to realise the duty of water—through which I will narrate the settlement and colonisation of Punjab under British rule in the following sections.

Determining and Defining Duty

In 1890 the US Geological Survey, with support from the American Society of Civil Engineers and the Institution of Civil Engineers, organised a tour of irrigation works in India, Italy, France, and Egypt for Herbert M. Wilson. Wilson would go on to serve as Chief Engineer of the US Geological Survey and Bureau of Mines. Comparing duties on the Punjab canals in India that he learnt about, with those back in the US, in the *Transactions of the American Society of Civil Engineers*, he described the duty of water (DoW) as the area of land which a fixed unit of water (such as one cubic foot per second of flow) would irrigate (Wilson 1890:227).[5]

A 1905 Bulletin by the Agricultural College Department at the University of Wyoming, defined the DoW as the term "applied ordinarily to the amount of water used by the irrigator of average skill in irrigating a crop" (Fleming 1905:3). The author, B. P. Fleming, wrote that the prevalent understanding of it was that a stream of water flowing one cubic foot per second during the irrigation season would suffice to irrigate 70 acres of land. As this mode of expression left the length of the irrigation season unspecified, a more "rational" expression according to Fleming was the depth, in inches or feet, to which the water would be applied. He cautioned that the amount of water represented by the "accepted duty of water" ought not to be confused with the "water requirement of the crop". The duty of water was "merely that amount of water which, in the opinion of the practical irrigator, is what is required" (Fleming 1905:4). Therefore, the DoW was a quantity likely to vary with the skill and judgement of the irrigator, diverse conditions of soil, temperature, drainage, etc. The "average irrigator" in Wyoming, wrote Fleming, was a "highly practical person", who seldom had to trouble with practising economy in the use of water. Compared to "thickly settled and inadequately watered portions of the west" (Fleming 1905:5), for Wyoming irrigators the question of what quantity of water would bring the largest yield was one of speculative interest. But the time was not distant, Fleming surmised, when present practices would yield to more advanced methods—when land and water had acquired the economical value they were certain to. Fleming's study was one of a range being conducted at experimental stations set up by the US Department of Agriculture and State Agricultural Colleges to "fix the economical duty of water" (Hammatt 1919).

Experiments were not the only way to get at this duty. In a 1919 issue of the *Transactions of the American Society of Civil Engineers*, W. C. Hammatt described his own analytic method to do so. Noting that the DoW had no hard and fast definition, with some considering it to be average annual quantity applied in a particular locality or on particular soils, and others considering it to be the minimum quantity that would produce crops under given conditions with the greatest efficiency, Hammatt (1919:201) set himself the challenge of dividing the water into its various uses and making a separate determination of each use. To segregate the water from the soil, he carried out pan experiments that entailed sinking pans in the soil, or through tube wells, to understand soil dryness, evapotranspiration, and percolation (Hammatt 1919:210). His was a search for samples to be able to distinguish net duty on the land from gross duty from the point of water supply.[6]

Others, too, were writing about the difficulty of separating water from the land and measuring a value for it in abstraction from the land. Such "difficulties of measuring flowing water at a cost commensurate with its value", frustrated securing a "uniform and correct" standard or unit of measurement of water (Wilson 1890, 1909). Thus, wrote Wilson, water was not sold like other commodities with an "intrinsic value" by the pound, yard, or gallon and "some other device has always been employed, such as charging a higher rental, or a higher cash selling price, for lands to be irrigated; or putting a charge of so many dollars/acre on the land served, as a water-right, or by some similar and equally unsatisfactory method, whereby the amount of water going with the land is not specified and remains always a point of contention between the purchaser and vendor".

In 1904, experiments to determine waste of water by cultivators in irrigating their fields were underway in Punjab. These experiments were led by R. G. Kennedy (later Chief Engineer, Punjab), and were informed by his recently completed tour to study water use practices in the US. Positing that the duty of any canal must be inversely related to the loss of water, Kennedy (1905) broke down the loss into absorption, evaporation, and waste. Absorption and evaporation were largely unavoidable, and thus attention and effort turned to reducing waste—the loss on farmers' fields—that was due to farmers doing more waterings than needed and "carelessness generally". In these experiments, plots of land were divided into those under canal management and those under cultivators' management and their outturn, in maunds of grain per acre, compared. The purpose was to determine the "avoidable waste" of water by cultivators from their laying on of more water than was required. The experiments were conceived as competitions between the experimenting officer and an ordinary cultivator, with the former aiming at maximum economy of water.

Nearly half of the experiments failed, owing to rain, grasshoppers, and "unsuitable men" conducting the experiments. The results confirmed what Kennedy noted we "already knew from theory and experience"—that furrows helped, and that it was in the first watering that water was most "recklessly" applied by farmers. Executive Engineer F. E. Kanthack, commenting on the experiments, noted pessimistically that the zamindar would proceed in the "usual wasteful method which he generally in fact almost universally adopts" (in Kennedy 1905:5).[7] One statement in a brief note in 1906 by Chief Engineer E. H. Pargiter, stands out for trying to indicate what else might have been going on in heavy first waterings: Pargiter noted that zamindars might be using more water on the first watering to check the growth of weeds—a particular problem was an onion-like weed on wheat fields. But weedy specifics attracted little attention in comparison with the widespread belief that cultivators were wasteful (Kennedy 1906:1).

The belief that cultivators were wasteful of water long predated the experiments. In 1875, an Executive Engineer, J. S. Beresford, noting the discrepancy between "theoretical" and "actual" duty, and warning that if duty was not increased, many canals would be financial failures, had already concluded that the widest room for improvement was on village watercourses (Kennedy 1905). Beresford's likening of canal systems to machines and the calculation of their efficiency, finding that most waste occurred on village watercourses, made its way

into successive editions of Wilson's text, *Irrigation Engineering* (first published in 1893). Such determinations of waste, I show next, were also already part of a larger pedagogical project: teaching cultivators to be economical.

Inducing Economy

Obtaining the maximum duty from water was something that could be taught—it was a lesson in economy, and a proportionate irrigation rate could deliver the lesson. Inducement to economy in the use of water was a major theme of the *Report of the Indian Irrigation Commission, 1901–03* (RIIC 1903). Evaluating the varying rates of irrigation water across provinces in India, the authors of the report worried that no inducements were offered to cultivators to economise and reduce wastage of water. The "true method", according to some, was to sell the water by measure at the bank of the distributary channel on the assumption that under this system the "self-interest of the cultivator would induce him to make every effort in economising water" (RIIC 1903:91). A special committee constituted to look into the problem of water wastage concluded that it is "to the determination of a unit by which water can be equally distributed, and to the invention of a machine by which such units can be discharged in a given time, that we have to look for a fair and economical expenditure of the canal supply" (ibid.).

Attempts towards this end—that true method, that unit, that machine—had repeatedly been made in India. In 1854 a modification of the Italian system was introduced on part of the Ganges canal to sell water by module. But it was a failure from the beginning:

> it was bound to be … The cultivators on the Ganges canal were not used to irrigation and looked on the module with considerable suspicion. They had no idea of the quantity of water required for the irrigation of an acre … worst of all, there was no effort made nor could it be made, to sell to each peasant cultivator the small measure required for his small plot of land, and there was not that cooperative spirit among the people which would have enabled them to partition out to each holding its proper share of the measure sold to the village. (RIIC 1903:91)

Distributing water by volume was what happened at an advanced civilisational stage. Kennedy, in a department circular in June 1906, wrote that the ordinary villager had not "yet reached that standard of civilisation necessary where each set of shareholders in a watercourse would have to manage, distribute, and assess each separate landholding, according to the water supply received" (Kennedy 1906:3). The Irrigation Commission report had also concluded that the Indian cultivator is used to "since time immemorial paying a revenue dependent on area and nature of crops. This is intelligible to him, a contract for a given supply of water is not" (RIIC 1903:95).

Much later, in 1920, the level of civilisation requisite for administering water by volume was still a distant goal. For instance, F. W. Woods, Chief Engineer of Irrigation, thought that:

> The evidence points to the conclusion that the amount of water consumed per unit of area depended more upon the care or lack of care displayed by the irrigators than upon any other consideration … there is no evidence that the actual cultivator has been given any incentive to economise … until people learnt to appreciate the advantages of irrigation … the rates would be low. The people would certainly require some education in the value of irrigation before they can be induced to pay even a low water rate [and] wasteful arrangements based on immemorial usage must not be allowed to stand in its way. (Woods 1920b:8, 16, 138)

Public Works Department proceedings contain frequent references to the time needed to make native cultivators replace reliance on water with their own labour. For instance, the 1907–08 Report of the Colonies Committee emphasised: "Improvement of the duty of water was a matter of time and of labour and if the people were … accustomed for years to use water instead of labour they needed time to replace the former by the latter" (Colonies Committee 1908:128).

Amid such views was also the recognition that a difference between actual requirements and an average duty was inevitable, and that there was only so much that refining would do to bridge it. John Clibborn, in his textbook, the *Roorkee Treatise on Civil Engineering* (1909), while noting that a duty of 300 acres per cusec (one cubic foot per second) was "generally accepted as a fair figure to work by" in northern India, cautioned against "too many refinements", noting that there were multiple other "disturbing influences" which could modify the results of even the "best arranged systems" (Clibborn 1909:117, 118). Disturbing influences for Clibborn included, "variations in rainfall, caste of cultivators [and] changes in the classes of crops grown…". In India, he wrote, "the influence which race and caste has on cultivation is most marked" (ibid.). In a text spanning nearly 600 pages, race and caste appear once.

The next section shows that these "disturbing influences" were integral to irrigation, and in doing so, emphasises irrigation as one part of a larger colonial project that was pedagogical, punitive, and extractive.

Classifying Colonists

So how was this system, that race and caste "disturbed" according to Clibborn, arranged? The construction of perennial irrigation canals was meant to irrigate the higher lands ("*bar*") in western Punjab—to create the "canal colonies". These canals were designed to draw river water throughout the year, unlike existing inundation canals that drew water seasonally, when rivers were in flood. To understand how *bar* lands were viewed, consider the following description of the bar between rivers Jhelum and Chenab (Purves 1918):

> the same rainlessness, the same dryness of the air and the same deep spring level which made cultivation impossible without artificial irrigation. The tract was covered with a low scrub jungle, sometimes dense and elsewhere scattered and thin. Here and there were small patches of indifferent dry cultivation in local hollows where rainfall water was expected to collect.

With the canal, the "old order of things in the Bar with its vast stillness, its boundless growth of stunted vegetation of no economic value, its thirsty land and dry air, its sparse and scattered inhabitants of thieving junglis have passed away forever and in their place is to be found life, bustle and activity, an endless panorama of flourishing crops and vigorous plantations, an invigorating atmosphere and streams of animating waters, a great and growing population, a sturdy peasantry, expanding towns and flourishing industries".

With the canal colonies, the colonial administration sought to foster the creation of "healthy agricultural communities of the best Punjab type" (Beazley and Puckle 1926; Douie 1914). As the Punjab Financial Commissioner wrote, "It is important in these colonisation schemes, that each village community should be made, as far as possible, homogenous".[8] But while villagers were kept "as homogenous as possible", neighbouring villages might be composed of "widely different elements" (Wace n.d.). On the one hand, it was sought to preserve "the Punjab tradition" of peasant farmers, and on the other hand, an "ideal" Punjab was being curated in the colonies (Figures 2 and 3).

As the canal infrastructure was put in place, Settlement Officers would select "peasant colonists" from all over Punjab, after which Colonisation Officers would allot parcels of canal colony land to the selected colonists. The Settlement Officers, also described as "recruiting agents" in the archival records, had to travel far and wide in Punjab, spread the message about the availability of "new" land, and convince agriculturalists to move long distances and set up new lives and livelihoods. Here is how one Settlement Officer, J.A. Grant, did his work:

> having sent word the night before, the next day all those interested (would-be settlers) came up in a body. I would separate into wards and make the men of each sit in a long row, the fathers next to their sons, and brothers next to one another. Walking down the row I could then easily see the men who were physically unsuitable. Many old dotards and mere boys [were rejected] … His colour would often betray the habitual opium-eater, and his general experience (more especially his hands) the *jawan* who had been in the army or in Burma, and who, cutting his name after a few years spent with a regiment, had come home to the village, but had never done a hand's turn of honest work behind the plough. Such men would never do good in the [canal colonies] … A show of hands is a simple method for discovering the real workers among the community.

James Douie's preferred method as Settlement Officer (he would go on to become Governor of Punjab) was looking "at their chests instead of at their hands" (1914:616)—the purpose, after all, was sending "vigorous men" to the colonies. In every allotment some extra land would be given to the leading man, whom the "band of colonists" would follow. Colonisation Officers commanded great power also. Their duties included preventing encroachment; securing orderliness and sanitation "foreign to the settlers"; ensuring that the colony provided itself with trees to replace the natural growth destroyed in the process of colonisation; managing "mutual jealousy of colonists and nomads"; and curbing the "predatory habits of the nomads". The "essential qualifications" of a successful

Figure 2: The caption reads: "The Bar Before Colonization." The description underneath the image reads: "Here the Bar is seen in its natural condition before the introduction of canal irrigation. At this site the jungle growth in the foreground is less than usual. The ragged clumps of trees are characteristic." (source: South Asia Commons; reproduced by permission of Coherent Digital, LLC)

peasant colonist were that he be "willingly resident", young, of "good agricultural stock", and "comparatively poor" (Dobson 1915:4).

Alongside this discourse of essential qualities were the multiple categories of colonists according to which land was distributed: for instance, *ghoripal abadkars* were "service grants", meant to acknowledge and reward service to the state *and* to secure loyalty and service to the state. Such horse-breeding grants were often given to ex-soldiers, and depended on familiarity with horses and their management, more than on a "special aptitude for the business of agriculture" (Dobson 1915:6). Granting irrigated land for agriculture was a fix for those who had done their labour as soldiers. The Bari Doab Canal, for example, was begun in 1850 with a view to providing a livelihood for the Sikh soldiers disbanded after the annexation of Punjab (Ottley 1894:1).

Land was also awarded to grantees of a "superior class"—these "yeomen grantees" were recruited from "good landowning families with considerable ancestral holdings", a class rich in "credit and resource and including many men of undoubted intelligence and enterprise". This "capitalist element" was introduced into colonies in the hope of attracting "men of substance", who by "example, precept, and outlay of money and brains [would] contribute to the commercial development" of the colonies (Canal Colonies Report 1911:5).

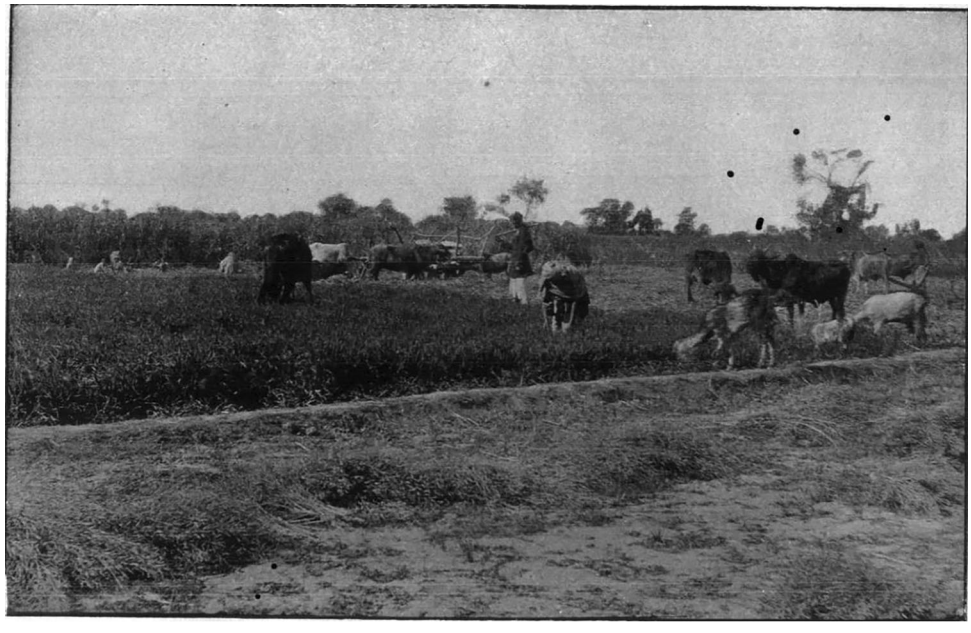

Figure 3: The caption reads: "The Bar After Colonization." The description underneath the image reads: "This illustrates what Government waste lands will look like when irrigation is developed in a few years' time. This illustration speaks volumes." (source: South Asia Commons; reproduced by permission of Coherent Digital, LLC)

Another category of land grants was to the "criminal tribes" population, totalling about four million people. Segments of these "disorderly classes" were concentrated into settlements where they were subject to supervision and "assisted to gain a decent livelihood". In Punjab there was a deliberate policy of concentrating the settlements of criminal tribes in localities with a demand for labour outside the settlements (Canal Colonies Report 1911:157; Yang 1985).

A booklet proclaiming successful reform of criminals and their settlement in the canal colonies includes before and after images, depicting "newly rounded up criminals", the objects of reform, and "reformed" natives (Singh 1920). Captions under the "before" images include: "Some of the Bhedkuts rounded up in 1917" under an image of men, women, children, and their animals, and "Newly received Bhedkuts" under an image of children, women, and men—one of whom appears to be holding up his folded hands, in a gesture that is typically associated with asking for forgiveness. Captions under the "after" images include: "Bhedkuts after 2 years' residence in Settlement" under an image of men and women in changed dress, and "Bawarias of Mughalpura Settlement in working dress" under an image of men and boys in uniform. I detail these to emphasise that irrigation was not just about providing water—to land or to people. It entailed ordering people off lands; onto lands; and policing, surveilling, and enforcing that order. The images, then, exhibited the success of the canal colonies; today, they provide a glimpse of the aesthetic of colonial order, and the violence that upheld it. As

well, they serve to check sanitised accounts of colonial science and administration.

Multiple categories of land grants were only one classificatory scheme, as the business of classification was an accommodating one. Another classificatory system was the distinction between "protective" and "productive" irrigation works. Consider the aforementioned *Report of the Indian Irrigation Commission* (RIIC 1903), which had the mandate to investigate whether irrigation was a protection against famine. The Report expressed the hope that the additional security conferred by the provision of irrigation water may "tend to develop amongst [people] that prudence and practice of thrift without which irrigation of itself will be of little permanent or lasting value" (RIIC 1903:126). It is this aspect of the project—to develop prudence and thrift—that I turn to next. I will show that the trope of thriftlessness was a function of a colonial imaginary that racialised Muslims as wasteful relative to thrifty Hindus, and held a racialised disdain for the Hindu moneylender.

Thriftlessness: The Indian, the Peasant, the Muslim

> …in the Punjab the most marked characteristic of the Hindu was thrift, of the Sikh bravery, of the Buddhist honesty, and of the Mahomedan pride. (Ibbetson 1883:102)

Thriftlessness was a problem of the colonised, and was not unique to Indians, of course. In *The Dual Mandate*, Frederick Lugard (1922:47, 294), for instance, commenting on land ownership policy with reference to what Africa needed, Africa which was "where India was many years ago", discussed the need to "preserve an ignorant peasantry from the consequences of its own improvidence". Native thriftlessness was related to the native inability to think "longer term". But how, specifically, was it racialised in the Indian colony? Once again, through the play of intersecting categories, of "linked essentialisations". Vis-à-vis categories such as "the Indian peasant", the discourse went something like this: Darling (1925:65) described "the Indian peasant" as against "the prudent man"; "in a good harvest … the latter lays by for the bad … but the former is not made that way. Almost literally he takes no thought for the morrow, and from time immemorial this has been the way of the East". Lt. Col. J. B. Hutchinson, Commissioner and Superintendent of Lahore Division, was of the view that the "Indian peasant cares nothing about the distant future, which he thinks may be left to take care of itself, so long as he is not troubled in the present. I can suggest no remedy. Improvidence is what we wish to check, but the Indian likes to be improvident, and dislikes attempts to reform him".[9] Curbing thriftlessness and the indebtedness it would cause, could thus be rendered as a question of "protecting people against themselves" (Wace, quoted in Young 1898).

The need to save agriculturalists from themselves was felt to be particularly acute in Punjab. This led to the Punjab Alienation of Land Act (PALA) of 1900, that Norman Barrier (1967:355) has described as "the greatest single piece of social engineering ever attempted in India". The PALA's proclaimed purpose was to disallow the use of land as collateral, and thus to "protect the colonist against

his own imprudence by making his rights in land inalienable" (Young 1898; Barrier 1965). It prohibited market transactions in land to people other than members of "agricultural tribes", seeking to preserve the "old agricultural tribes of political importance who were being displaced by the *bania*" (Annual Report on the Working of the PALA 1903:2). While most land tenure arrangements in colonial India introduced some form of private property, not all natives were considered advanced enough to deal with the market and its dangers. The Punjabis could not be trusted, yet, to steward either money or land to be able to realise its "true" value, and so the legislation, as a "remedial" measure, aimed to check the alienation of land from agricultural to non-agricultural classes.

From the outset, however, it was not clear who would fall into the categories to be protected—soon, a circular from the Financial Commissioner's office had to be issued with lists of agricultural tribes for each district. Then, the local government was empowered to determine the status of an agriculturalist. Part of the trouble lay in not being able to find a "vernacular rendering" that would clarify the difference between a member of an agricultural tribe and an agriculturalist (1902)—it felt like a "contradiction" to Indians, it was noted by officials, to refer to a "Brahman or Mahajan as a *zeraat pesha shakhs* (a person who does agriculture)". Three years later, reports on the working of PALA were still noting the difficulty of defining membership in agricultural tribes.

Undergirding these classifications was the belief that there was something about wastefulness specific to Muslims. The Muhammadan, noted Darling, has a "natural contempt for accounts" (1925:68); he went on to describe Muslim "incompetence in money matters" (1925:69). Darling served as Assistant Commissioner and Financial Commissioner in Punjab. His *The Punjab Peasant in Prosperity and Debt* (1925) and *Wisdom and Waste in the Punjab Village* (1934) are well known accounts of what was perceived as the indebtedness problem. Mackworth Young, Lt. Governor of Punjab, had already noted in 1898 that the "indebtedness of Punjab agriculturalists has been under discussion for 36 years".[10] S. S. Thorburn, Settlement Officer, Commissioner, and then Financial Commissioner, wrote in his *Musalmans and Money-Lenders in the Punjab*: "the Musalman peasant is a short-sighted and long-suffering animal" (1886:51). Thorburn's Muslims were mostly spendthrift and improvident, while Hindus were "the reverse" (1886:157). He claimed to be able to tell the religion of a house owner by the "greater idleness, poverty, and pretension, which mark the Musalman" (1886:16); just as he could tell a Hindu's thrift from his "domestic economies" (1886:38). Overall, Mahomedanism had had an "evil" influence on Punjabi villagers for Thorburn (1886:16). Edward Maclagan (1926:143) too, in his Punjab Government gazetteer of Multan District, described the "naturally less hospitality" and more "carefully regulated" charity among the Hindus than Muhammadans.

Meanwhile Kirars, "the Jews of the country", were thought to have a "special natural aptitude for earning and saving money" (Thorburn 1886:158). Thorburn distinguished between three castes of money lenders in Punjab—Bania, Khatri, and Arora—all of whom were "necessarily Hindu". So how did he account for Muslim money lenders such as Khojas in Chiniot and Sharakpur? Their money lending "derive[d] from the time when they were Hindus" (1886:210). Contempt

for Hindu money lenders was also a function of seeing them as "outsiders": Punjab, wrote Thorburn, was "not the original habitat" of the Bania (1886:37).

While Jats were the "marrow and soul of the peasantry", as opposed to Rajputs, who as "aristocrats" were among the worst cultivators, Jats were not a uniform category. The Sikh Jat was more adventurous and commercial; the Hindu Jat was more frugal and stubborn; and the Muslim Jat was more patient and less industrious. Jats were also differentiated by place: the Jat in Ludhiana was addicted to gambling, and in Ferozepur to drink and dissipation. Categories were understood in relation to other categories; for instance, the Arain, "by tradition and instinct" a market-gardener, had a "physique less sturdy than that of the Jat and a mind as narrow as the plots he cultivates" (Thorburn 1886:48).[11]

There was a whole range of discursive infrastructure—legislation, gazetteers, census reports, books by colonial officials—furthering and exemplifying such categorising. For instance, a 1904 gazetteer first listed all the agricultural Muhammadans—stating that Musalman are "original landowning, agricultural, and pastoral tribes, as well as most of the menial classes"—and then the *kamins* (menial and artisan classes) (Punjab Government 1907). A 1923/24 gazetteer described inhabitants of Multan as "less alert" and "less industrious" than "the ordinary Punjabi"—indeed, there was a "pervading air of slackness about the inhabitants of this district" (Maclagan 1926:142). Much earlier, the Report on the Punjab Census of 1868, had described Mahomedans as "more given to agricultural pursuits than Hindoos, who are more skilled in industrial and professional occupations" (Miller 1870:30). The 1881 Census Report described Meos as "inferior" agriculturalists when compared to their Hindu neighbours—the point where they "chiefly fail is in working their wells, for which they lack patience" (Ibbetson 1883:261). But it was not just how people worked that determined their agriculturalist credentials—how "their" women contributed, or not, was key. Gujar, for example, were described as being "lazy", "wretched" cultivators, whose women did not do fieldwork. But Gujars everywhere were not the same—those in Jumna districts were different from those in Ferozepur, and those of the hills were unlike those in the plains.

The categories were not unchanging. The 1881 Census Report noted, for example, that after the canals, conditions were slowly approaching those in England. Due to the new irrigated conditions, the Jat Sikh had reached a "point of development probably beyond anything else of the kind in India … it is as if the energy of the virgin soil of the Bar had passed into his veins and made him almost a part of the forces of nature which he has conquered". After all, the canals were replacing the "immemorial life of India, primitive, isolated and fatalistic" with the "new life brought in by Pax Britannica, prosperous progressive and modern" (Darling 1925:128).

The introduction of perennial irrigation was thought to be dangerous, too, in its effects on how much and how well natives worked. Darling (1925:80) noted that men getting water from wells would be more "frugal"—for it required effort in raising the water—than those depending on canals, for "what is gained with difficulty is spent with care". In parts of Punjab, he wrote, "Sudden acquisition of wealth due more to good fortune [a reference to the canal irrigation project] than

to effort, has partially demoralised the people, stimulating extravagance dissipation and drink" (Darling 1925:79). Jon Wilson, Settlement Commissioner of Punjab, comparing the means of irrigation of the lower Bari doab, worried: "it is better for the physical health and moral character of the people that they should have to labour on their wells than that they should sit idly watching the canal water flowing over their fields" (RIIC 1903:36).

The engineers shared such concerns. E. S. Bellasis, who had served as Superintending Engineer in the Irrigation Branch, in his 1913 *Irrigation Works: The Principles on which Their Design and Working should be Based, with Special Details relating to Indian Canals and Some Proposed Improvements*, wrote that "A cultivator whose watercourse is always running full may waste great quantities of water, but if he knows that it is only to run for a few days out of a fortnight he will use the water carefully" (Bellasis 1913:25). In his testimony to the Irrigation Commission, Col. L. J. H. Grey (Superintending Engineer, Bahawalpur state) described anxiety around a "natural tendency" among cultivators to close wells and take the "much easier flow".

Amid such perceived disturbances and dangers, how was the system thought to work? In the next section I address this question by examining the role of governmental labour.

The Ideal Irrigation Officer

> The value of the colonies as a training ground for the ablest and most energetic of the younger Punjab officers has been very great. (Douie 1914:614)

The Irrigation establishment in India was initially a branch of the Public Works Department, created in 1854. Its staff of engineers (military and civil) was made up of the following ranks: Chief Engineers at the top of the bureaucratic hierarchy; then Superintending Engineers; then Executive Engineers; and then Assistant Engineers. In 1873, with the passage of the Canal and Drainage Act, the office of the Executive Engineer (XEN) was invested with magisterial powers for the purpose of initiating and trying cases of crime. Officials in the XEN's office, such as the Deputy Magistrate, now had primarily judicial duties. Thus Clibborn's (1909) textbook stressed that the Executive Engineer ought always to be on the move, trying cases "on the spot".

To outsiders, the policing element in the work of the irrigation bureaucracy was an especially stark feature of Indian irrigation. Herbert M. Wilson (1891:166), lamenting that in the US engineering services were dispensed with after construction was complete and supervision fell to those without engineering knowledge, described the superior maintenance and supervision of irrigation works in India, where overseers, patrols, and engineers walked sections of canals daily, performing "police duty", reporting on and preventing damage by "heedless or vicious persons" and cattle tramping over ditches. It was this "superintendence", noted Wilson (1891:167), that kept canals up to the highest state of efficiency, and officials' "magisterial and police powers" enabled canal officials to arrest and punish offenders: "On the vigilance and skill" of the patrolmen "largely depends the

successful operation of a canal system".[12] The "successful manager" of a large canal division, the "ideal irrigation officer", was a hybrid position (Gilmartin 1994; Lewis 2007). Colonial India called for such officials—part magistrates, part executives; part engineers, part revenue officers; neither full engineers, nor full revenue officers.[13]

One area where the tensions in what could be demanded of engineers became particularly stark was that of valuation. For example, it was felt that irrigation officers ought to "keep as strict an account of the disposition of every cubic foot of water entering their canals as they keep of the cash which they draw from the government treasury" (RIIC 1903:102). Such an officer would be:

> constantly inspecting every part of the system, looking after both his public works, subordinates on the canal works and banks, and his revenue establishment in the fields and villages, and hearing all the petitions and complaints of the cultivators … his main concern would be to get the most he can out of the available supply, not only by localising waste from government channels or village water-courses but also by constant adaptation of the distribution to the requirements of the moment or of the locality. (RIIC 1903:103)

A particularly divisive element was the division between two distinct mandates: who would assess and who would collect water charges? This was a question of dividing jurisdiction between the Revenue and Public Works Department authorities: how much of the land revenue was attributable to the water input, and therefore, 'really' a question of the value of water?[14] The Canal Colonies Committee could not reach consensus. One view was that the irrigation officials only had the duty of supplying water, and the revenue officials were in charge once the water left the canals and entered farmers' fields (Colonies Committee 1908). The opposing view was that irrigation officers ought not to think that their duty was done when they had supplied a certain discharge of water; they ought to be knowledgeable about and responsible for the "duty the water [they had allocated] was performing".[15] Col. E. H. Rivett-Carnac, a committee member, noted in his comments that if assessment functions were taken away from the Irrigation Department, then canal officers would not have the same "interest and inducement to get the greatest amount of duty out of the water provided" (Colonies Committee 1908:95). Another committee member, Michael Young, noted that irrigation engineers should not cease to take an interest in the "economic results of their labours" and become indifferent to the duty of canal water, which it was feared they might if they were not themselves to determine whether full water rates should be paid (or remissions granted in times of famine, drought, or price slumps).

Governmental labour was not only divided between departments—it was also divided between the British and natives (the "petty establishment", or staff). In recruiting the petty establishment, Clibborn (1909:vii) advised that peons and orderlies ought to be from "pensioned native soldiers", and the "ideal refuse of the bazaars who are always anxious for these appointments should be avoided" given the large sums of money they had to handle.

The infrastructure itself was built upon assumptions of how "petty native" officials behaved. For example, Bellasis (1913) advised against "direct minors"—branches taking off from a canal directly, instead of from a distributary of a canal—because these would afford manipulation of the supply easily and "without detection", and the making of private arrangements with irrigators. Repeatedly, Bellasis (1913:68) stressed that the agency of native subordinates had to be guarded against for its potential to give rise to "corruption on a colossal scale".

The point in the infrastructural network at which this anxiety became most stark was the outlet (*moga*). The outlet was where the water passed out of departmental jurisdiction and into village watercourses.[16] The positioning of outlets was usually determined after discussion with cultivators,[17] and involved learning by doing and seeing. Frequently, after one or two years of working, their size and location necessitated adjustment; as Bellasis (1913:67) wrote, "there is no way of arriving at the proper size for an outlet except trial". This uncertainty as to the proper location and size of an outlet was a consequence of the variability of the duty of water on the watercourse. This, in turn, was due to the fact that the discharge of an outlet depended on the difference between water levels in the distributary and the watercourse. Attempts to address this in the form of temporary outlets, such as providing gates or shutters for outlets, were not sufficient as they could be closed or lost by "boys or malicious persons or neighbours". Masonry outlets, as an alternative, could help. "The essential principle", however, wrote Bellasis (1913:126), was "to remove power from the hands of the subordinates".

Masonry outlets, too, while advances upon spouts (*kaccha naka*), were inferior to modules (a device for ensuring a constant discharge of water from one channel to another irrespective of water level in each) which promised to be a "great power for good" (Nicholson 1920:3; Ward 1917). This was primarily because they promised centralisation of distribution in the hands of the "highest paid officials"—reducing the petty establishment and employing instead a "higher class man on a motor-bike for instance" (Ward 1917:40).

Despite noting that distributive inequalities among cultivators (whereby tail-end irrigators received less than their share) were something the "Government, or at least the Irrigation Department, has no particular direct interest in", Bellasis (1913:135) wrote that an engineer who took an interest in this part of his work would "not allow matters to remain long [thus]". Here, the engineer appears as a rather heroic individual figure, apart from the government and department. Such an engineer would equalise irrigated percentages and adjust outlets. "A distributary, when once its outlets have been carefully adjusted, attains to something approaching perfection in its working", wrote Bellasis (1913:135), and the working of such a distributary causes "great satisfaction to the engineer and not the least ingredient in this is the knowledge that he has wholly destroyed the power of this native subordinate"—the engineer, then, not just against nature, but the *British engineer* against his *native subordinate*.

But while the infrastructure was imagined to be built against natives, it *required* them. Consider, for instance, Clibborn's detailed description of and instructions for laying down the infrastructure, as in the work of the Demarcation Observer (DO). The DO had to identify the true direction of flow of drainage.

Clibborn (1909:49) instructed that DOs always take some respectable cultivators with them, men who "from long experience know perfectly well how the rain water flows off every field in the village". This could only be done by asking "intelligent locals, walking about trial lines, and marking points with ranging rods". For determining the record of highest flood marks, too, engineers had to trust local tradition: "by enquiring from a large number of individuals, comparing results, and exercising a wise discretion, a fair guess at the truth may generally be made, and the outcome of local inquiries can with advantage be compared with the floods known to have occurred on rivers having similar characteristics" (Clibborn 1909:135).

Clibborn (1909:59) described true engineering as the adapting of means to ends. A canal project, he stressed, does not aim at the "scientific accuracy of a trigonometrical survey". Instead, it required minute detail of the ground surface: "A perfect working plan cannot be drawn from theory alone, it requires long experience tempered with a thorough local knowledge to design with confidence works calculated to stand the test of time and the enormous strains of large bodies of water passing with high velocities through, above, and below them, founded … on unstable and treacherous soils" (Clibborn 1909:129). Locals were a problem, but their knowledge was necessary.

Native labour not only constructed the infrastructure, but was also integral to its maintenance. Silt clearance, for instance, was done under a system of *chher* or statutory labour (Maclagan 1926:201). Tenant rates varied by if they provided chher—the usual arrangement was "at the rate of one man for 96 days for every 30 acres irrigated". If chher was not "given", a charge of eight annas per day was imposed. On canal excavations, the arrival of German Lubecker excavators occasioned energetic exchange at the 1913 Engineering Conference in Simla. Some engineers hoped that the new machines would replace "Pathan donkey labour" and the "various inconveniences" accompanying "exotic Pathan labour" (Public Works Department 1913:302). Others were of the view that "though an unruly labour to deal with, they do a good day's work and one wishes there was more labour which could produce a similar outturn" (Public Works Department 1913:120). Construction work on larger structures such as barrages was the charge of contractors, with little supervision by the Public Works Department. The Report of the Royal Commission on Labour in India, for instance, advised that wages be specified and contractors disallowed from employing children younger than twelve years old. Others, comparing the work to docks and mines, considered fourteen to be the appropriate minimum employment age in irrigation works (Royal Commission 1931:192).

George Davidson, in his 1875 report for the US Coast Survey, described how all excavations were made by hand-labour and materials carried in baskets—"the slow progress thus made by the basket-carriers was probably never witnessed in our own country in the transfer of earth from one place to another". Observing the Lower Ganges Canal, Davidson (1875:19) described the men, women, and children who removed earth, sunk wells, and became divers in the process, but marvelled at the energy of the Europeans urging the operations forward.[18] Wilson's text for the US Geological Survey, Irrigation in India, in which Davidson is cited, also commented on the "slowness of native methods" in India (Wilson

1903: 194), noting the effect on British engineers: contending "so long with the carelessness of the native labourer and his lack of interest in learning new ways" had led to the "average engineer" to give up the "struggle of trying to teach him to use modern appliances" (ibid.).

Conclusion

Recently, Jane Guyer et al. (2010) noted that as numbers proliferate, they seem to "hang in mid-air, unconnected either to a grammar or a grounding". My article responds to this observed tendency by tracing how the DoW has been enrolled in multiple projects: colonisation, settlement, postcolonial development, and increasingly, reform occasioned by climate change. It makes the case that any discussion of water efficiency is incomplete without attending to the racialisation of labour, whether as thriftless, unknowing, martial, slothful native agriculturalists or corrupt native bureaucrats. While the language of thriftlessness, ability, and industriousness is no longer current or acceptable, the underlying grammar—of classifying and arranging people, their labour and land, to get more from water—persists.

In contemporary times, the path to better water governance is peopled by easily misled farmers, conniving rural elites, irresponsible media, and corrupt bureaucrats and politicians—figures presented in the 2019 World Bank report I discussed earlier, to explain the failure of a decentralisation reform programme at the Punjab Irrigation Department. The reform had three goals: decentralisation and eventual privatisation; farmer-led management at the distributary level of canal systems; establishment of water markets and water trading entailing delinking water rights from land ownership.[19] Troubled by "why small farmers who stood to gain from these reforms objected", the report concludes that an information vacuum and misinformation were at play: "Central government was ineffective at communicating to small farmers how they would be empowered by management decentralization. Instead, small farmers were swayed by local irrigation department officials and *patwaris* ([lowest tier of] revenue officers), supported by a media narrative dominated by the rural elite and large farmer lobbies" (Young et al. 2019:63–64). Farmers make an appearance here but as easily misled or in need of convincing about their own empowerment. Some responsibility is placed at the feet of media narratives dominated by "rural elites and large farmer lobbies", some at the irrigation department: "PIDs [provincial irrigation departments] acknowledged the decrepit state of the irrigation system they were tasked to manage, but neither accepted responsibility for the situation, nor felt that institutional transformation was required" (Young et al. 2019:64; see also Hayat [2020] on the devaluation of work).

A curious picture emerges: everyone appears to be against the reform, except the "small farmers", who, more than opposed, are misled by politicians, rural elites, and the media. It is not that the report does not have a narrative. A section titled, "Political Economy of Irrigation Governance", begins by outlining the colonial-era foundations of irrigation infrastructure and law in Pakistan (Young et al. 2019:63). Despite political, economic, and demographic change, the report

tells us that there has been "continuity across a century and half in the public administration of irrigation by state and provincial governments, which adopted the colonial legislation" (ibid.). Political economy does the work of setting the stage: "lack of financial sustainability of irrigation and its reliance on subsidies, poor performance of hydraulic infrastructure, low agricultural water productivity, widespread rent-seeking and corruption, and poor administration that has enabled illegal water trading and theft" (ibid.). As well, political economy explains the failure of the reform.

Instead of attempting a comprehensive historical survey of Punjab irrigation, this article has had a specific focus: to show that seemingly objective "technical" measures and metrics of water governance are rooted in a colonial grammar, and that the DoW as one such articulated racialised classifications of natives, and their places and labour. Scholarly discussions of the concept are rare, and the tendency has been to focus on water and land as distinct resources that were progressively enrolled in colonial projects of revenue generation, property creation, dispossession, science, and administration. Charting the changing meaning and deployment of the DoW among engineers, in engineering texts and archival records, as well as in tensions between departments, demonstrates how "water" was stabilised as such, *as* it was valued.

An engineer like Israelsen (1932:297) disliked the idiom of "duty" for it mistakenly implied an "obligation on the part of the water". However, as I have shown in this article, designs on water, whether part of colonial or postcolonial national projects, have always set goals and metrics for water as if water has a duty—as if there is an obligation on the part of the water. The language of duty, I would go further, is actually less disingenuous than current idioms that self-represent as objective, technical—qua true—and modular in the sense of being completely comparable and unrelated to any politics or any place. Ultimately, then, the duty of water could not satisfy the desire for the standardisation of definition, because it showed too clearly that at stake was not a definition or measure, but a claim on water. Like any claim it was conjunctural and contested.

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Siddiqui sahib who passed away in April 2023. Siddiqui sahib was the first person whose office I was welcomed into in 2015, and a teacher and mentor since. This article is dedicated to Siddiqui sahib.

Data Availability Statement

Data sharing not applicable to this article as no datasets were generated or analysed during the current study. However, I will be happy to share with researchers the historical material that I do have in my possession.

Endnotes

1 Siddiqui sahib had decades of service at the department, across multiple bureaucratic tiers and across the province. He passed away in April 2023. This article is dedicated to him.

2 *Manual of Irrigation Practice*, Department of Irrigation, Government of Punjab (copy with author).

3 In one of its earliest uses in the study of the fuel efficiency of steam engines in 1760, John Smeaton, a civil engineer, termed his measure the duty of the engine: "the duty of a pumping engine is equal to the number of pounds of water that are raised one foot in height by the engine's pump when one 84.0 lbm bushel of coal is burned in the boiler" (Balmer 2011:452; Wescoat 2013a, 2013b). In the early days of steam power, comparison of engine performance was based on the engine's "duty", calculated as the number of pounds of water raised one foot high for each bushel of coal consumed.

4 A copy of this is held by the Irrigation Research Institute of the Punjab Irrigation Department. 30 copies of the book were provided by Israelsen to the College at Roorkee in 1955 during his year of teaching in India. He also visited Lahore and taught Pakistani engineers as part of a SEATO programme.

5 Using revenue reports, Wilson concluded that the Punjab canals had done the following duty/second-foot entering at the head: 70–150 acres irrigated, producing a water rate or revenue of $40–100. The duty on the supply utilised was 90–200 acres, and $70–125/second-foot, while the water rate charged/acre irrigated was 70c–$1.15. Meanwhile, in the US, the revenue received was $1.5–3/acre irrigated, which was equivalent to a duty of 80 acres/second-foot and $120–240/second-foot utilised. In 1849, Baird-Smith had estimated a DoW of 218 acres/cfs (Baird-Smith 1849). By the time of Clibborn's textbook in 1909, he was using the figure of 300 (Clibborn 1909:11). Also see Wescoat (2013a, 2013b).

6 In 1925, the *Transactions of the American Society of Civil Engineers* published a report by the DoW committee for determinations of duty in water-right adjudications. It began with noting that the quantity of water which may represent a reasonable standard of beneficial use was a question of opinion rather than of law, and what was reasonable was a function of time. Reasonableness tended towards reduction in the quantity of irrigation water used/acre of land—a "continually higher standard of practice"—as rising land values led to increased average yields. Among the factors affecting the duty of water listed in the report were: the soil, character of crops, climate, preparation of land, cost of water, and the skill and attention used by those applying the water.

7 While the above treatments of duty pertain to canal water, John Clibborn (1909), in his treatise on irrigation work in India, began the DoW conversation with wells. He defined the duty of well water as the number of acres/annum/season that could be irrigated for each cubic foot/second of discharge of the canal channel, but since well water discharge was not permanent the duty was calculated/lift. Rendering the quantity of water raised by different lifts in terms of foot-tons per head per hours of useful work, he defined "useful work" (as distinguished from "gross work"), as the actual water raised—the weight of the lift, rope friction, etc. Clibborn (1909:23), then discussed who worked better in this arrangement: bullocks or men, noting that all men did not work the same: cultivators "naturally work steadier and harder than hired labor".

8 Nigel Wace's (n.d.) records of his father's notes on colonisation as a CO for 11 years. He served in the Indian Civil Service from 1917 to 1939, and from 1940 to 1947. In the *Punjab Colony Manual*, Beazley and Puckle (1926:213) write: "That every colonist must settle on his land and build himself a house has always been for peasant colonists a law of the Medes and Persians".
9 Memo dated 14 July 1896, "Report on peasant indebtedness and land alienations to money-lenders in parts of the Rawalpindi division", S. S. Thorburn. Esq., C.S. Commissioner and Superintendent, Rawalpindi Division.
10 Nor was indebtedness an agricultural problem alone. The Report of the Royal Commission on Labor in India noted that indebtedness was not confined to the industrial worker and was in fact fairly general throughout India (Royal Commission 1931:227).
11 The varieties of thinking around racialisation are also exemplified in the genre of the census report: Ibbetson (1883), in the *Report on the Census of the Panjab taken on the 17th of February 1881*, wrote that Meo were inferior to their Hindu neighbours as agriculturalists. This was not just a function of them being Meo though. Meo were inferior agriculturalists chiefly because of how they worked their wells and for which they lacked patience. The Khanzadahs, too, are described as not first-rate agriculturalists, the seclusion of their women giving them a disadvantage beside most other castes. The Gujar was a "wretched cultivator", but the Gujar everywhere was not the same; the Awan "strenuous but slovenly cultivators" and essentially a peasant race. The Jat, with his "sturdy independence and patient vigorous labor", was preeminent in agriculture, and his women and children worked in the fields too. Each of these characterisations noted if the women and children worked in the fields or not. For Ibbetson, these details and differentiations culminated in the conclusion that caste in India, the coupling of community of blood and community of occupation, was what was known as rank or position in England. After the canals, Ibbetson wrote, conditions were slowly approaching those in England.
12 There were other differences too: Wilson (1890:221) compared the same challenge—inducing sufficient immigration to irrigated lands—in the US and in India. While for "our desolate wastes of the west", he wrote, the trouble would be finding enough settlers to make the works pay, in India "there is no lack of people, yet old and conservative customs and a fondness for the places in which families have lived for generations" meant that it would be difficult to "overcome prejudices and superstitions and induce them to leave their ancient associations and tribes".
13 The Department was divided into four branches: Buildings and Roads; Irrigation Works; Railways; and Accounts.
14 Irrigation rates were a point of tension between the revenue and irrigation authorities. Clibborn (1909:33) noted that the revenue authorities thought the rates were too low. In his opposition to this view, he invoked cultivators in India having "absolutely no system of self-insurance … their usual custom is to spend all they can make in favourable seasons, and borrow at a ruinous rate of interest when times are hard".
15 T. H. Higham, the Chief Engineer: "The canal officer is naturally anxious to show as much canal revenue as possible" (PWD Proceedings 1896).
16 While Bellasis (1913:126) writes that "after the water has entered the watercourses the canal officials have nothing to do with its distribution", this was not so easily settled. In part because there was (as discussed above) disagreement among the colonial administration (between revenue and irrigation authorities), and in part because jurisdiction was not only a physical matter (ending at the outlet for example) but also a temporal one. This meant that if a dispute arose between cultivators, the *zillehdar* (revenue official of Irrigation) would be called upon to mediate the distribution of water.
17 In the settled parts of the Punjab (mostly east Punjab). However, in the canal colonies, where "new" land was settled, the arrangement of watercourses was a government project.
18 Unsurprisingly, Davidson (1875:9) noted that the "qualities of the English governing race in India are almost identical with those of our own people".

19 The aim was to transform irrigation to "an equitable, sustainable, and participatory management model" (Young et al. 2019:63). Recent literature discussing the reform programme includes Hayat (2020) and Ali (2020).

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