



## The irrigation technozone: State power, expertise, and agrarian development in the U.S. West and British Punjab, 1880–1920



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### ABSTRACT

Many of the world's deserts were transformed by irrigation expertise at the beginning of the 20th century. An irrigation “technological zone” emerged to facilitate the circulation of engineering expertise and the territorial expansion of the U.S. and British imperial states. Hydraulic engineers considered themselves globally connected technicians providing practical solutions to the political problems of poverty and famine. Although premised on the neutrality and universal applicability of scientific principles, the practices and environmental expertise of irrigation engineers were firmly rooted in regional state/society formations, which sought to increase agricultural production and induce settlement with irrigation. This paper analyzes the globalization of irrigation expertise through a relational comparison of the irrigation narratives of the British Punjab and the Western U.S., 1880–1920. The analysis demonstrates that the irrigation technological zone was significantly formed by place-based dynamics that, in turn, shaped irrigation as a mode of environmental expertise.

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### Introduction

In the final decades of the 19th century a vanguard of irrigation engineers in the service of expansionary states pushed into frontier deserts (arid and semi-arid regions) across the globe, including in parts of the U.S. West, British India, Mexico, Egypt, South Africa, and Australia. The introduction of large scale modern irrigation created new relationships between experts, state power, and agrarian development at the beginning of the 20th century (Molle et al., 2009). As Smythe (1969/[1899], pp. 45–47), the visionary founding editor of *Irrigation Age* magazine, opined, “[t]he change which irrigation brings amounts to a revolution . . . Tilling the soil by rainfall is by comparison, like a stage-coach to a railroad, like the tallow dip to electric light”. Engineers deployed irrigation expertise as a revolutionary force, introducing dramatic social, technological, and ecological changes across the world. Irrigation engineers believed that expertise about irrigation could be generated and applied scientifically to catalyze economic and social development. This belief in the civilizing and universally applicable qualities of irrigation expertise united irrigation engineers into a global fraternity.

But environmental expertise does not operate or circulate in a political vacuum (Robbins, 2012). Analyzing how expertise shapes socio-environmental change requires attention to the spatial circulation of environmental expertise as it interacts with the spatial fixity of state formation (Peloquin, 2013; Larner and Laurie, 2010; Klingensmith, 2007). This is especially true when expertise concerns a complex socio-ecological process like irrigation that is shaped by global processes as much as by regional specificity. Thus distant regions undergoing environmental transformation through irrigation projects must be understood as being connected through a globally emergent network of irrigation expertise, but without forgetting that each region is unique. Thus the interaction between expertise and state authority is shaped by regionalized dynamics. We situate irrigation in the interplay between state authority and environmental expertise to ask: How did region-based dynamics shape the differentiation of irrigation expertise at the historical moment when the spatial circulation of irrigation expertise reached global proportions? We argue that the political form taken by state authority, whether imperialism or liberal democracy, crucially mediated the ways in which irrigation expertise was produced and implemented during the early 20th century.

We employ a relational comparative analysis to examine the expansion of modern irrigation expertise into the U.S. West and British India. Our objective is to analyze the globalization of professionalized irrigation expertise at the beginning of the 20th century. We employ the concept of the “technological zone” to illustrate

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how irrigation was shaped by region-based dynamics between state authority and expertise. Barry (2001) developed the concept of the technological zone, or technozone, as a way to understand the spatial circuits of technological practices. A technozone denotes the spaces within which the differences between specific technological practices and procedures have been reduced (Barry, 2006, 2001; Dunn, 2005, 2004). The concept of the technozone was developed to explore connections between government, technology, and politics in the specific context of the current moment of neoliberal globalization. This paper moves the concept beyond its focus on the standardization of technological practice in late 20th century neo-liberalization. We understand the technozone not as an accomplished fact, but as a tendency toward standardization that is continuously interrupted by region-based dynamics. We adopt the concept of the technozone because it is a process driven by its internal contradictions. Moreover, we shift the focus of the concept from circulation of technique to pay more attention to the circulation of specific forms of expertise. The technozone concept is useful for understanding irrigation because of its key geographical feature: technozones do not necessarily correspond to political boundaries. Technozones provide a way to consider the spatiality of scientific expertise without making any assumptions about the nature of those relationships such as proximity, contiguity, or core-periphery.

The technozone, understood as the interrupted tendency toward technological standardization over space, lends itself to the method of relational comparison (Hart, 2006, 2002) since both are attuned to processes of internal differentiation. Relational comparative analysis does not ask how cases are similar or different, nor does it aim to isolate and identify specific causal factors. Rather, it asks how regions have produced each other over time and space, and how the uniqueness of regions is produced out of common structural pressures and opportunities (Hart, 2006, 2002). Our relational comparison of British Punjab and the U.S. West illustrates the national, regional, and sub-national structural processes that animated historical and technological change. The arid and semi-arid regions of the western U.S. (hereafter “U.S. West” or simply “West”) and northwestern British India, specifically the Punjab, shared a prominent role in the development, discussion, dissemination, and experimentation with irrigation engineering as a technology of governance and a mode of development. Irrigation in British Punjab and the U.S. West developed in relation to each other as part of a “complexly structured differentiated totality, in which distinctions are not obliterated but preserved” (Hall, 2003, p. 127). Relational comparison helps us frame our analysis of the globalization of irrigation as a “totality” that is differentiated by the divergent forms taken by state power.

A modified version of the concept of the technozone, operationalized through a relational comparative analysis, provides the foundation of our conceptualization of the spatiality of irrigation expertise. Engineers in India and the U.S. sought to change, reshape, and manipulate ‘virgin’ deserts through irrigation. We argue that irrigation engineers, acting within the structures of their regional political economic context, applied scientific expertise according to the exigencies of the state form they were operating in – whether the paternalistic geopolitics of British imperial consolidation, or the expansionary territorial nationalism of the U.S. As advocates of territorial expansion and national settlement, British and American engineers strove to increase the infrastructure of irrigation on otherwise ‘undeveloped’ land by installing dams, diversions, canals, wells, weirs, sluices, aqueducts, flumes, siphons, falls, pumps, and various means of water measurement. Yet despite their common goals, their shared technical language, and the presumed universal rationality of their expertise, the application of engineering expertise created differentiations within the emerging irrigation technozone.

We first discuss how water geographers and environmental historians have discussed the relations between water, social change, technology, and expertise. Karl Wittfogel’s legacy is crucial to our tracing of this literature. We then situate the concept of technozone in relation to this literature. Next, we outline our cases and draw upon specific irrigation narratives to illustrate spatially differentiated relations of power, highlighting how states irrigated the frontier according to regional context. This section also briefly discusses the method of relational comparison. We follow by discussing how contradictions internal to irrigation management contributed to differentiations in the irrigation technozone between in the Punjab and the West. We conclude by considering the contribution of the multi-sited technozone to relational historical comparison.

### Irrigation, social power, and technozones

Karl Wittfogel’s thought on the political dynamics of “irrigation societies”, or social formations strongly shaped by the infrastructures and institutions of water control, continue to shape theory about the relations between water, state power, and administrative bureaucracy. Wittfogel (1957) maintained that large-scale water control, especially in arid regions, led to the centralization and concentration of power in the hands of the state. His comparative study of “hydraulic civilizations” led to the theory of “Oriental Despotism,” which argued that the control over the lifeblood of a society by the state would lead to political despotism. Wittfogel reasoned that the absence of private property in Asia enabled the state to move unopposed into large-scale water control and to establish despotic rule over society. Wittfogel’s theory is painted in broad brush-strokes, and his mechanistic linking of water control and political despotism has been roundly critiqued for making a universal proclamation about water control and society based upon cherry-picked and misconstrued case studies (Wescoat, 2000; Smith, 1987; Peet, 1985). Nevertheless, Wittfogel described “a dialectical relationship between large-scale irrigation systems and centralized state power” (Linton and Budds, 2014, p. 4) and represents an early iteration of the ecological Marxist dictum that nature and human labor are always in a process of mutual production. Wittfogel’s hydraulic thesis, specifically the theme of tying the command over water to its social implications, contributes to insights that remain powerful today.

Worster (1985) describes the culture of water and power in the West by expanding on and incorporating Wittfogel’s hydraulic thesis. Worster argues the U.S. West is ecologically the “natural home of American Empire” (p. 259) where capitalist values and physical water scarcity are used to justify rule and concentrate authority. For Worster, the West is the embodiment of modern hydraulic society where large-scale water manipulation has produced a “techno-economic order” (p. 6) ruled by a power elite. Worster claims that this elite power is not held by the state alone, but is an alliance between the public sector and the private sector who have a view of water as “purely and abstractly a commercial instrument” (p. 52). Both groups share a drive to dominate and remake nature, and in the course of cooperation they reinforce each other’s values and status. While Worster sees power residing with small concentrated power elite, Sheridan (1995) points to the complex of institutions outside the domain of water, including market led development at the local scale, to argue that power of water management elites in the U.S. West is more widely dispersed. Nevertheless, they agree that after a period of private capital leading irrigation development in the West, “water control itself ultimately became the task of the federal government” (p. 46).

Many of Wittfogel’s formulations concerning water control, state formation, and social power have been fruitfully elaborated

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