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Nations are challenged to access, harness, allocate, and sustain water availability amongst the complexity of physical characteristics of watercourses (Gizelis & Wooden, 2010). David A. Pietz's book, *The Yellow River: The Problem of Water in Modern China* (2015), demonstrates how China has reached a state of water insecurity and examines the global effect of this insecurity. Focused on China's Yellow River, the book aims to break down overarching factors that affect China's water security. The book is grounded in both physical and human geography that explores the central thesis of "how China reached a state of acute water insecurity and what it might mean for China and the global community" (p. 2). What is uncovered in Pietz's chronology of China's water use is that specific geographic and social *forces* facilitate a perpetual system of water governance of the Yellow River that has limited solutions. This book review will put into context the book's themes of addressing China's scarcity through two lenses of understanding. The first lens is that of historical perspective, with special emphasis on both the Mao and post-Mao waterscapes. The second lens builds upon the assumption of social 'forces' behind the historical growth of China. These forces are explained in the book as cultural patterns within a physical setting that dictate the social and physical aspects of water governance. In the context of the physical space of the Yellow River's limited waters, agriculture and high population densities set the scene for social stability competing with ecological viability.

Contemporary arguments regarding China's water challenges can be found in the topic of *allocation*. Pietz indicates allocation is only a component of the solution and that management choices neglect the historical legacies of cultural forces perpetuating competition for water. This review builds to this understanding in two presented sections that will discuss the themes of the book. The first section discusses how the physical settings of the Yellow River relate to the use of virtual water transfers that describe the hydrological aspects of water security in the book. Second, the nature/culture dialectic will discuss Pietz's anthropocentric theme of China's social motivations behind the manipulating of the hydrological cycle and river basin that constitute the Yellow River, resulting in limited solutions.

The Physical Settings and Virtual Water Transfers

The Yellow River flows from the Tibetan Plateau, often referred to as the "water tower of Asia" (p. 14). The book explains that because the Yellow River is set amidst a landscape of steep gorges in the North China Plain, climatic fluctuations occurring in the upstream portion of the plateau are of great concern in maintaining flows. Under the backdrop of scientifically acknowledged, qualitative understandings, environmental degradation such as land use change and how misunderstandings of sediment loading alters the course of the waterway is presented (Newson, 2009). The book generalizes these known scientific assumptions to focus more on the "forces" that Pietz argues are the motivation for societies to manipulate the basin's hydrological cycle. These forces include deforestation and conversion of other lands to become farmland to meet the food demands of China and economic market forces.

To conceptualize the ways in which the physical consequences of deforestation and land conversion affect actual water flows and allocation, the use of the concept of *virtual water* has been devised; the notion of virtual water is a major analytical tool used to contribute to the book's argument of how the Yellow River is globally connected to water scarcity. Virtual water is a concept developed by Allan (2011) that illuminates how embedded water, or the water used to produce products such as crops can be measured within the boundaries of certain assumptions of the produced metrics. The global perspective of how

one nation's crop production can be connected to the global platform is allowed through the concept of *virtual water flows* (Mekonnen & Hoekstra, 2011). Virtual flows offer a way to understand how the water abstracted from the hydrological cycle is embedded into products that then are shipped away from the river basin (Allan, 2011). The result of flows that exit the river basin altogether is that the hydrological cycle's natural way of producing water is diminished, and the local population must search other means of virtual water to make up for this loss (Allan, 2011). Pietz effectively uses this concept to address how the physical settings of the Yellow River are connected to local social conflicts.

Contemporary work using virtual water isolates water availability into color-coded categories: surface water or ground water (blue), soil water (green), and reused industrial water such as from hydropower generation (grey) (Allan, 2011). Pietz isolates the book's analysis inside surface water observations, which is typical of most studies that use virtual water to explain social tensions associated with water (Garrido *et al.*, 2010; Martinez-Santos, *et al.*, 2014). Other studies in scholarship indicate that focusing on only the blue water approaches of river basin analysis hides green water solutions (Allan, 2001; Mekonnen & Hoekstra, 2011). This point is minimally addressed in the book through basin rainwater runoff in association with soil permeability, justly explained by Pietz as a result of unreliable data for the region.

The Nature/Culture Dialectic and Limited Solutions

Pietz places great importance on the Maoist period because this is when the Yellow River becomes a symbol of ideation for Maoist policies inherent to the *forces*, which the book explains as *isms*. These forces are better identified as industrial-*ism*, construction-*ism*, and plan-*ism* (p. 154). These forces ushered in Soviet-modeled technology that created a disequilibrium amongst identifying equitable solutions to water governance. For example, the 1954-1955 Yellow River Plan offered a symbolic opportunity for the Chinese Communist Party (CCP) to heroically deal with Western influenced designs and Japanese constructed dikes of the downstream portion of the river (p. 159). Pietz explains how each opportunity to deconstruct symbolic physical features and construct CCP-designed features along the Yellow River was a way to show how the Maoist government was removing the icons of corruption of the previous ruling class. As the industrialism of the Yellow River continued, planning continued to construct dikes to improve shipping and "Make the Mountains Bow and the Rivers Yield," as one piece of propaganda evidence provided in the book states (p. 169). Problematically, the nationalistic planning for the Yellow River during the Maoist Period failed to consider the sedimentology of the river, hence perpetuating environmental degradation that is still being addressed in present times, which is why Pietz places such great emphasis on the Mao epoch.

The post-Mao reform era (1978-present) includes aggressive economic growth centering on technology. Primarily, the Yellow River is seen to be a *re-engineering* challenge in which solutions must facilitate economic opportunities for the CCP constituents. Hence, the book's *forces* that had driven the previous period's water governance plans resulting in environmental degradation are now being promoted as the central components of paradigms of thought that will find a solution to the Yellow River challenges. The desiccating of the Yellow River is becoming more severe, as the book points out. The longest dry up lasted 236 days in 1997, attributed in the book to upstream water diversion reservoirs constructed during the Maoist period. The book highlights the success of the Tennessee Valley Authority in managing water allocation and the flows of the Tennessee River and successfully demonstrates that the Tennessee Valley Authority was an influential model for constructing a "multipurpose" (p. 5) perspective for providing water allocation solutions. The text likewise asserts that the Yellow River, in contrast, has limited multipurpose water allocation solutions, which are found to be embodied by specific *trusts* that promise pollution control and

engineering options that produce additional water supplies and require adjustments to infrastructure systems (p. 291). The virtual water conversation interestingly enters into the arena of pollution, as basin water transfers of the nearby Huai River and full-tilt ground water abstraction of the Northern Plains are needed to make up for unusable water (Pietz, 2015). The text highlights the paradox that while economic forces drive China to feed the world, “the single greatest concern related to water in China is the continued capacity of China to feed itself” (p. 310). What is presently found in the North Plain is that industrial, agricultural and local groups provide competing demands on the Yellow River. The engineering solution to finding a compromise among these competing groups is water transfers (moving water from Southern China sources to the Northern landscape) (p. 311). This solution, however, leads to a paradigm of a Water-Food-Energy nexus, produced at a global level that introduces the need for solutions that are more mindful of the global impacts of the Yellow River, which only seem to be intensifying.

Conclusion

By using the Yellow River as a case study of global water security, Pietz effectively demonstrates how local water governance impacts global concerns. One caution against using case studies, however, is that effective solutions to address global challenges tend to become “pigeon holed” within the limitations of the study (Brecher & Harvey, 2002). Pietz’s book carefully straddles the line between the effective use and the limiting nature of case studies, effectively maintaining the clarity of the context of the challenges addressed in the case study while at the same time not sensationalizing the global relevance of the Yellow River. Pietz demonstrates how the physical hydrological cycle of the basin was manipulated for social interests and how the river reacted to these changes. In other sources of academic literature, this phenomenon is called the *hydrosocial cycle* (Linton & Budds, 2014). Pietz’s book finds itself in good company for those studying the nature/culture dialectic that contains subject material that goes beyond linear anthropocentric discussions to include the global significance of the symbolism that engineering solutions may offer. Yet more importantly, Pietz shows how these limited solutions can actually perpetuate myopic plans that offer solutions to only a select number of constituents while alienating others. As more studies similar to Pietz’s are produced, this observation will lay the foundation of how equity of water allocation will be defined as the global challenges of water security increase.

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