

1-1-2010

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Craig Adams, Book Note, Steven Solomon, Water: The Epic Struggle for Wealth, Power, and Civilization, 13 U. Denv. Water L. Rev. 443 (2010).

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Steven Solomon, *Water: The Epic Struggle for Wealth, Power, and Civilization*

Part IV looks at current trends in international water law. This part presents an evaluation of the judgments of court decisions in an effort to understand the direction of the law. Lilian Del Castillo-Laborde discusses the precedents that emerge with respect to the general principles of watercourses law, water management, navigation, and water boundaries. Maria Manuela Farrajota then develops a theory of water cooperation by looking at how state practice in the area of “water management” gives the term both substantive and procedural content. John Razzaque goes on to explore how public participation has become a key feature of modern day governance in the area of water law. Joseph Dellapenna then examines both the role of water as an economic good and the role of markets and pricing in the governance of water.

In Part V, the book ends with a successful attempt by the editors to bring together all the different strands of discussion in order to answer some of the key research questions identified in the book. With the aid of tables and figures, the editors summarize the factors leading to different water laws worldwide, the forces leading to convergence in water law, and the types and sources of key water law principles. The editors link water to a large number of challenges facing humans in the twenty-first century. In particular, they note that water is closely associated with health, food and agriculture, industry and energy, and ecosystems. The editors surmise that the emerging global climate disruption will dramatically alter the availability and reliability of water resources. The editors conclude that identifying and resolving these challenges is as much a problem for water lawyers as it is for hydrologists, engineers, and economists. Their proposed solutions include a need for the water law community to open up to other disciplines and enable cross-disciplinary fertilization to make water governance more successful; a need for institutional change in recognition of the growing importance of water knowledge (both natural science and social science) to making successful water law and policy; and a need for legal scholars to collaboratively develop new instruments, such as global multilateral treaties that adopt principles of fairness, to cope with these multiple challenges.

Meghana Shah

Steven Solomon, *Water: The Epic Struggle for Wealth, Power, and Civilization*, Harper Collins, New York (2010); 596 pp; \$27.99; ISBN 978-0-06-054830-8; hardcover.

Water: The Epic Struggle for Wealth, Power, and Civilization deals with the role of water in human history and provides an account of the challenges various societies face as a result of limited freshwater supplies and burgeoning populations. According to Solomon, water is “[e]arth’s most potent agent of change,” and he assigns it a leading role in the development of human civilization. The book’s overarching thesis is that, throughout history, leading civilizations were those with

the ability to overcome their natural water obstacles to control and manipulate available water resources to their benefit. Beginning with the birth of civilization, the author describes how early societies used canals and aqueducts to establish irrigated agriculture and easily available domestic water supplies. Progressing through human history, the book focuses on water breakthroughs such as seafaring navigation, steam power, and the ascendancy of the modern industrial society. The book culminates with our current age of water scarcity, which is creating new political and economic realities around the world.

Water consists of seventeen chapters, divided into four separate and distinct parts, a prologue, and an epilogue. The Prologue begins with a discussion of water breakthroughs associated with major turning points in history. Chapters One through Six comprise Part One of the book and discuss water's role in ancient history. Chapters Seven through Nine comprise Part Two of the book and describe the role of water in the ascendancy of western civilization. Chapters Ten through Thirteen comprise Part Three of the book and describe water's underpinning in the making of the modern industrial society. Chapters Fourteen through Seventeen comprise Part Four, the final part, and discuss potential global conflict due to freshwater scarcity. The Epilogue provides a capsule review of history's significant water breakthroughs and concludes with the author's point of view on present and future water policies that may alleviate water stress around the world.

The Prologue provides background on how prominent societies have invariably capitalized on their water resources for social and political control. Solomon describes how responses to water challenges shape every era. Specifically, the author begins with an example from 1763 when a British inventor's re-design of the steam engine became "the seminal invention of the Industrial Revolution." Through this invention, Britain was able to transform itself into a superpower, with a fearsome steam-and-iron navy and a dominant textile economy. The Prologue concludes with a discussion of the impending crisis of freshwater scarcity that is fast emerging on the world stage. As a result of overuse, increasing pollution, and expanding populations, the author suggests that a dangerous political fault line is emerging around the globe. Solomon posits that the societies that find the most innovative responses to the crisis will most likely come out as winners, while those who do not will fall behind.

Part One, *Water in Ancient History*, explains how the world's earliest empires — the Egyptians, the Romans, and the early Chinese — managed water resources to become what the author refers to as "hydraulic societies," which are land-based societies that focus on irrigation and agriculture and led by a centralized authoritarian government. Solomon describes Egypt's success over its mastery of the Nile River, which provided the region with a large source of irrigation water in an otherwise rainless region. The Nile's annual flooding created excellent farmland by depositing a thick, silty layer of topsoil. The Nile was also a rare two-way navigable waterway as its current and surface winds moved in opposite directions year round. This simple

feature allowed early Egyptian rulers to effectively exercise control over the whole of Egypt by regulating all transport of important people and goods.

Solomon next explains the Roman's success with water, which came in both mastering shipbuilding to control shipping in the Western Mediterranean, and from constructing a network of massive aqueducts and waterways to supply its urban populations with freshwater. As Solomon explains, Rome's provision of copious amounts of fresh public water cleansed the city of so much filth and disease that it set a standard of urban life unsurpassed until the sanitary revolution of the nineteenth century in the industrialized West. By providing its citizens with luxurious civil works projects such as public bathhouses, Rome's emperors created a democratic legitimacy that allowed them to control the population effectively for years to come. According to the author, this tool for exercising political power has been influential on modern liberal Western democracies.

From Rome, Solomon moves on to explain how China excelled as a hydraulic society in the 7th century by constructing the 1,100 mile-long inland Grand Canal, which linked the Yangtze and Yellow Rivers, thereby providing an essential source of irrigation and transport between the country's north and south. The Canal enabled China to ship vital rice supplies grown on the hillsides of southern China to its large population centers and army troops in the North. These shipments fueled China's expansion, allowing China to defend itself against the continual threat of raids on the Asian steppe. As the author explains, China's urban centers became hubs of entrepreneurship, scientific discovery, and industrial innovation nearly seven centuries before Europe's. During this era, China became a world leader in producing textiles and iron tools, and was the first to discover gunpowder. Solomon also notes another significant Chinese water infrastructure advancement: its use of locks on the Grand Canal. By impounding water between two locked gates, the Chinese were able to use hydraulic force to lift their ships up to five feet at a time. By employing a series of locks, the Chinese were able to ferry their ships across the region via the Grand Canal, which rose nearly 200 feet above sea level.

Part Two, *Water and the Ascendency of the West*, chronicles Western civilization's rise to unprecedented wealth and political order during the late fifteenth and sixteenth centuries. This section focuses on water's key role in Europe's ascent, specifically trans-oceanic sailing and the gradual harnessing of waterpower for industry. The author begins by explaining that the advent of trans-oceanic exploration ushered in a new era in which sea power and control of the world's trade routes became more important to global power than control over land. By deciphering the Atlantic Ocean's hidden pattern of trade winds and sea currents, Europe was able to sail back and forth across Earth's open oceans. This discovery, Solomon posits, launched Western civilization into its position as a global superpower. The author elaborates by discussing various landmark voyages made by

European explorers. He explains that through mastery of sea travel, Europe was able to consolidate its power by flooding foreign markets with its imports and by establishing unparalleled naval forces.

In the second half of Part Two, Solomon charts the rise of the Industrial Revolution and analyzes how England's use of hydrology, first with the water wheel and later with the steam engine, enabled the country to convert water's latent energy potential into a vehicle of productive expansion. By using condensed steam to power its factories, the author describes how England—nearly overnight—became the model of wheat production, textiles, mining, iron tool making, and weaponry. According to Solomon, the steam engine enabled England to grow its industrial sector by an average of 1-4% annually for over a century. The author believes that during the nineteenth century, Britain used this "water-energy resource nexus" more beneficially than any other nation.

In Part Three, *Water and the Makings of the Modern Industrial Society*, Solomon explains how the mantle of industrial prowess passed to America in the twentieth century. According to the author, America's rise closely paralleled its mastery of its two disparate hydrological environments: its rainy, temperate river-rich eastern half and its predominantly arid, drought prone, Far West extending from the Great Plains to the Pacific Ocean. The author begins this section by discussing how in 1825, the completion of the Erie Canal dramatically opened up America's interior by allowing freight to move quickly and cheaply from east of the Appalachian Mountains to the Midwest. By linking its waterway network with the Mississippi River, Solomon explains that America was able to unite a nation challenged by "splintering regional divisions, geographical impediments, slow travel and communication, and divergent economic and social organization."

In the second half of Part Three, Solomon shifts his focus to discuss how America developed its frontier west by constructing giant dams on most of its major western rivers. As the author describes, these major dams were extraordinarily successful not only because they provided valuable water storage for year round irrigation, but also because they generated vast amounts of hydroelectricity. As Solomon explains, this extra production of electricity tipped the scales in America's favor during World War II because it allowed America to produce more aluminum aircraft than any other country.

Lastly, the author briefly discusses how pumping water from the Ogallala aquifer allowed American farmers to cultivate a far greater portion of the high plains than ever before. This technique proved so successful that by the late 1970s "Dustbowl farmers" were growing 15% of the nation's wheat, corn, cotton, and sorghum. Because of overuse of the Ogallala aquifer, Solomon predicts that certain quantities will run out between 2020 and 2030. If this prediction is correct, it will inevitably result in a major shift away from agriculture in the region as supplies dry up.

The last quarter of the book, Part Four, *The Age of Scarcity*, is devoted to the present situation with water scarcity, and the dire issues it

poses. According to Solomon, water is replacing oil as earth's scarcest critical natural resource. As he points out, water is irreplaceable, whereas oil is ultimately substitutable. Furthermore, a link exists between water consumption and water infrastructure and the challenges of food supply, energy shortages, and climate change. Solomon predicts that as world population continues to soar towards nine billion, and as much of the third world moves towards increased consumption, demand for freshwater will outstrip supply. According to Solomon, the critical issue is that no new innovative breakthroughs capable of expanding usable water supplies on a large enough scale to meet demand appear anywhere on the horizon. Absent a long-term solution, the author states that the situation will lead to disastrously polluted or vanishing freshwater sources, and to violent human conflict.

Next, Solomon discusses various attempts by nations around the world to manage their water scarcity. In the Middle East, for example, the author warns that Egypt and the Nile basin's population continue to grow and are turning into a "hydrological time bomb" because its major dam—the Aswan High Dam—sits directly above major earthquake faults and because the dam's long-term environmental impacts continue to make farming downstream in the fertile delta less productive. In India, where many areas are without plumbing, raw sewage chokes the Ganges River with noxious filth and pollution. This river is the source of drinking water for hundreds of millions of Indians, and consequently, it is also the source of untold sickness and child mortality. The author then goes on to describe similar situations in countries such as Pakistan, Iraq, Israel, and China.

The final part focuses on the new politics of water in industrial democracies. In this section, Solomon discusses how America can use market forces to limit water consumption. Here, he blames government policy for setting artificially low water prices for American agribusiness, which encourages wasteful irrigation practices. Solomon argues that assigning water its fair market value will be force industry to find ways to use its allotted supplies more efficiently. According to Solomon, the West can maintain its preeminence only if it adjusts to the reality of freshwater scarcity. In this regard, America must implement policies to limit waste, and it must recognize that any further gains made in water productivity must necessarily be environmentally sustainable. Lastly, America must contribute to the development of water infrastructure in countries that are water poor because it is there that the potential for fundamentalist extremism is highest.

The Epilogue provides a summary of the author's thesis: the ability to overcome water obstacles underpins enduring civilizations. The author closes by arguing that because each nation's hydrological realities are unique, it will take flexibility and a myriad approach to create solutions tailored specifically to each region. According to Solomon, it will take further trial and error, but he is cautiously optimistic that we can meet the challenges facing us.

Craig Adams