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Perspectives

The Flow of Empire

Comparing Water Control in China and the United States

DONALD WORSTER

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Donald Worster is considered one of the founders of, and leading figures in, the field of environmental history, both in the United States and other parts of the world. He completed his PhD at Yale University in 1971 and now holds the position of Hall Distinguished Professor of American History at the University of Kansas, where he has been a member of the faculty since 1989. Formerly the president of the American Society for Environmental History, Worster has served on a number of editorial boards and is a founding editor of the Environment and History book series published by Cambridge University Press. Worster's main interest lies in the emerging field of environmental history—the changing perception of nature, the rise of conservation and environmentalism, and the impact of the natural world on human society. He was a fellow at the Rachel Carson Center for Environment and Society in 2011.

His books include *Nature's Economy: A History of Ecological Ideas; Dust Bowl: The Southern Plains in the 1930s; Rivers of Empire: Water, Aridity, and the Growth of the American West; A River Running West: The Life of John Wesley Powell; A Passion for Nature: The Life of John Muir;* along with several books of collected essays, including *The Wealth of Nature: Environmental History and the Ecological Imagination,* which together have won more than a dozen book prizes.

This essay is based on a talk Donald Worster gave at the second summer school of the European Society for Environmental History, which took place in Venice in June 2011.

The Flow of Empire: Comparing Water Control in China and the United States

Water; Culture; Politics. Only the water part of that triad would be strange to most historians. Culture and politics is what history has long been about, as we are strongly reminded whenever we pick up a journal of academic history. This essay, however, will seek to put also water and the environment, or in other words, nature and the natural world, into the histories we write and to begin talking about the limits and opportunities that nature sets for human cultural evolution.

Over the past few decades I have based my work as a historian on two basic assumptions, nowadays both rather obvious, but initially they took me a while to discover. First, the study of the human past, or what we call history, has fundamentally been about how cultures change over time and how those changes have made an economic, political, and social difference. We historians have never been able to *explain* those cultural changes very well, but we have managed to show how such changes in a people's values, perceptions, and attitudes underlie the distribution of power, the rise and fall of religions, the relationship between the sexes, and the technologies that power our civilizations, to name only a few of the greatest consequences.

My second assumption came in the late 1960s when I was a history graduate student and an environmental activist. Rather suddenly, it came to me that the natural environment is not irrelevant to that process of cultural change but vitally connected to it. Cultures do not emerge in a material vacuum. Like biological species, cultures evolve in specific times and places, struggling for survival, and adapting or not adapting to the world around them. They are rooted in particular ecologies, specific sets of natural resources, and the material elements of earth, air, water, and fire. They evolve in dynamic interplay with the nonhuman world, a process full of conflict, failure, and success.

And those two assumptions, I submit, lie at the heart of what we call *environmental history*. It is a new perspective that brings cultural history and all its political ramifications together with nature's reality. More narrowly, it is an integrative perspective that brings cultural and political history together with water, so that the flow of water, the flow of ideas, and the flow of power merge into one.

This essay will look briefly at the world's two greatest surviving empires, the United States and China, and examine those empires' approaches to water, the source of life itself. One of those empires has been trying to manage and conquer water for a few thousand years, the other for little more than three centuries. Both have attempted and both have succeeded in radically transforming their rivers and other water systems, but in that process they have radically transformed themselves as well. That in simplest terms is my theme: what we do to nature or rivers or water, we do to ourselves. Both regimes are probably destined to last a long time, and we need to know what their history of conquest over water has been and what that history will allow them to do with their water resources in the future. The pursuit of empire, I will argue, is a trap as well as a gateway.

A few years ago I came down the great Yangtze River of China on a ferry boat (Figure 1)—just a few weeks before the devastating summer floods of 1998. The Yangtze, or the Chang Jiang, is one of the three longest rivers in the world and one of the three largest in flow. Its discharge into the China Sea averages some 35,000 cubic meters (approx. 1.34 million cubic feet) per second, an average that at times it has far exceeded. Much of that flow, however, is silt washing down from the mountains and hillsides.

Figure 1 (l.): Ferry boat on the Yangtze River (Donald Worster)

Figure 2 (r.): Hillside by the Yangtze River (Donald Worster)

Already, at the river port city of Chongqing where we came aboard our boat, the river was thick with mud, the residue of soil erosion, as well as chemical pollutants, and it became more turbid and polluted as it flowed down the 300-plus miles to Yichang, where we left the boat.

I came by this slow and by no means elegant mode of travel to see the fabled Three Gorges before the massive Three Gorges Dam, which was being completed near Yichang, inundated them (Figure 3). I wanted to see the green mountains rising from the water, the hillside towns along the way (many of them now emptied or flooded), and the construction site itself (a new city of 50,000 workers).

Figure 3 (l.): Map showing location of the Three Gorges Dam (University of Texas Libraries, The University of Texas at Austin)

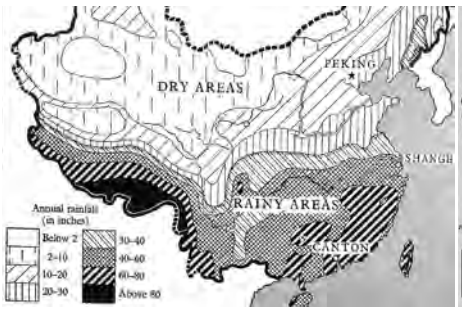
Figure 4 (r.): The Three Gorges (Donald Worster)

The Three Gorges Dam, the largest such project in the history of the world is, in a sense, nothing new. It emerges out of two thousand years of Chinese history. Behind its construction lie a strong cultural momentum, logic, and tradition, all antedating the present Communist era. Three Gorges is, in fact, the latest feat in a long series of Chinese efforts to control the flow of water. Relative to the state of wealth and technological development, the new dam may not even be the greatest project in that history.

For an American, China's record of water engineering offers several striking parallels. I cannot think of another country in the world that seems closer to the US in scale of water engineering or ambitions. In the fourth volume of his magisterial work, *Science and Civilisation in China*, published in 1971, the Cambridge University historian Joseph Needham declared: "The story of the hydraulic works of China is nothing short of an epic."[1] To him, an old-school Marxist, it was at the heart of Chinese technological civilization, a glorious past full of promise for the socialist future. Before the nineteenth century, he argues, no country, no empire anywhere could match China's ability to control and manage its surface water.

1 "Part III: Civil Engineering and Nautics," in *Science and Civilization in China*, Vol. 4, *Physics and Physical Technology*, ed. by Joseph Needham et al. (Cambridge: Cambridge University Press, 1971), 378.

Among the many available maps of China, the one shown in Figure 5 is among the more interesting, at least for anyone living in the arid West of the United States. It shows a country slightly larger in area—3.7 million square miles compared to the 3.6 million of the United States. But, as in the United States, a powerful rainfall line divides the country into two halves—one wet, one dry, one enjoying a great abundance, the other wracked with scarcity. In contrast to the US, where the rainfall line runs north to south roughly along the one hundredth meridian, that line in China runs east to west (Figure 5).



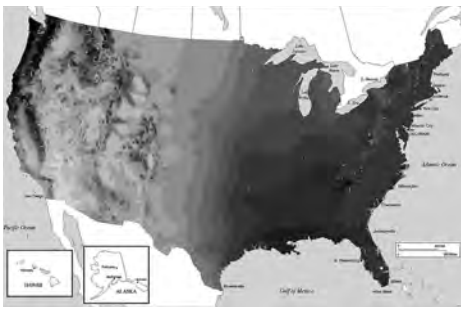


Figure 5 (l.): Map showing annual rainfall in China (Joseph Needham, Science and Civilization in China, vol. 4, part III, 218)

Figure 6 (r.): Map showing annual rainfall in the United States (University of Texas Libraries, The University of Texas at Austin)

This is the famous 20-inch rainfall line, which the western explorer and geologist John Wesley Powell pointed out more than a century ago separates an area that can grow crops without irrigation from an area where irrigation is required. Actually, as far as rice is concerned, the most important grain crop of China's past and present, the *thirty*-inch line is more significant, for it has marked the northern limit of wet rice cultivation. (To be sure, the northeast region of China does manage to grow a semi-wet rice crop.) Whichever line we choose, the 20- or 30-inch isohyetal, beyond it lies a China that is mainly dry—a northern country where wheat and millet can be grown, but where drought is a recurrent threat and human starvation an age-old specter.

Fortunately the Chinese possess several great rivers that flow *through* or *near* this subhumid country, affording some relief from the dry climate. And then they have constructed an immense artificial river to bind together the wet and dry regions. In the past, this served as a means of transportation; in the future, if the engineers have their way, a new artificial river will provide for northern water supply. It is not too much to say that controlling those rivers, overcoming the critical problem presented by nature, has been the foundation of China's expansion and China's stability. A long succession of dynasties has come and

gone, each contributing to the water-control system, with the present Communist government representing only the latest of those regimes.

After the Yangtze, the second major river of the country, which runs over most of its course through the dry area, is the Yellow River, or the Huang He. It begins up on the Qinghai Plateau and drains a basin three times that of the Colorado River of the American Southwest. Much of its upper and middle basin consists of loose, highly erodible loess soils, and thus the river carries a huge load of silt, far larger than that of the Yangtze. This silt it deposits downstream, raising its bed higher and higher year by year. Though its flow is seldom very large, it too is a dangerous river. It has never wanted to stay put in its bed but has wandered over the land, shifting channels, flooding the countryside, and wreaking devastation.

Figure 7: Yellow River - Huang He (Hou Wenhui, July 2004)

The core area of the Chinese imperial state first emerged in the Yellow River's long valley, particularly in the stretch that lies immediately to the west and east of the ancient capital of Xi'an. The lesson that China's rulers learned early on was one that they are still following today: If you want to gain and hold power over the people, you must gain and hold power over the natural environment. Floods must be controlled. Droughts must be mitigated. Dry lands must be irrigated. And rivers must be used for transportation. Nature, in short, must be subdued.

Joseph Needham quotes from the *Kuan Tzu*, a tome dating back to the second or third century BC, which urges rulers to overcome the harmful influences of water. A river "running wild," advises the book, "injures men. When it injures men, there arises great distress among them. In great distress they treat the laws lightly. Laws being treated lightly, it is difficult to maintain good order. Good order lapsing, filial piety disappears. And when people have lost filial piety, they are no longer submissive."[2]

There, in a nutshell, is the lesson that all imperial states seek to absorb and use to their advantage. A stable, law-abiding, contented population cannot be achieved without controlling the wildness and the lawlessness of water flowing across the land.

The chief strategy of control pursued in premodern China was channelization and embankment building along the river floodplains to constrict the turbulent flow and move water downstream faster. There were two competing philosophies, Needham argues, of where to place the embankments or dikes and constrain the current. Civil engineers who followed Confucian principles believed in establishing a tight, rigid control—high and mighty dikes built as close to the river as possible; while Taoist-inspired engineers advocated low dikes set far apart, giving the river more space to meander. As Chia Jang, the prominent Taoist engineer of the Han dynasty, the first great empire, wrote: "'Those who are good at controlling water give it the best opportunities to flow away, those who are good at controlling the people give them plenty of chance to talk.' During twenty centuries," summarizes Needham, "the two schools contended."[3]

Needham's distinction between the schools of thought in the history of Chinese water engineering is overly simple. Chronologically, many of the major hydraulic projects appeared well before the so-called schools of Confucianism or Taoism. For example, the first dam and artificial reservoir AnFengTang in Anhui Province (southern China) was built from 598–591 BC, a half century before Confucius was born. Philosophically, integration between the two ways of thinking occurred over time. Most importantly, ancient Chinese water projects were designed for practical needs, not according to abstract philosophical ideas.

Many modern scholars argue that traditional Chinese society pursued a harmonious relationship with nature and that this ethos was embodied in their water engineering

2 Ibid., 223.
3 Ibid., 235–36.

projects. But they idealize that relationship. The much admired "take no action" philosophy advocated by Taoist philosophers was never truly followed in Chinese politics or in environmental policies, and the end sought by both engineering schools and throughout traditional Chinese society was one and the same. Control over water meant control over people.

We cannot review here all the achievements of Chinese water control, ancient and modern, but one especially monumental project must be mentioned: the Grand Canal, a project that began in 486 BC and was completed around 1300 AD. During the high period of its construction in the early seventh century, more than a million men and women were conscripted into a forced-labor corvee. Also known as the Traffic River, it was a man-made waterway that ran from the Hangzhou-Shanghai area north toward Beijing, a distance of over one thousand miles. In places the Grand Canal was as deep as thirty feet, and it could carry the very large boats, heavily loaded with grain, demanded by the imperial authorities in Beijing. Although it linked the wet area to the dry area, the Grand Canal was not so much a means of moving food for the masses from an area of abundance to one of scarcity as it was a means of moving taxes from the periphery to the capital.

Figure 8: Hand-drawn Chinese map of the Grand Canal (Needham, Science and Civilization in China, vol. 4, part III, figure 901 or plate CCCLXXVI)

Whatever cultural purposes it pursued in controlling the flow of water, whether stopping floods, irrigating dry fields, or collecting taxes, the Chinese empire achieved its ends by assembling vast armies of workers. Just as the local landlords called on their peasants to work their fields, the imperial state summoned peasants to do the labor needed to con-

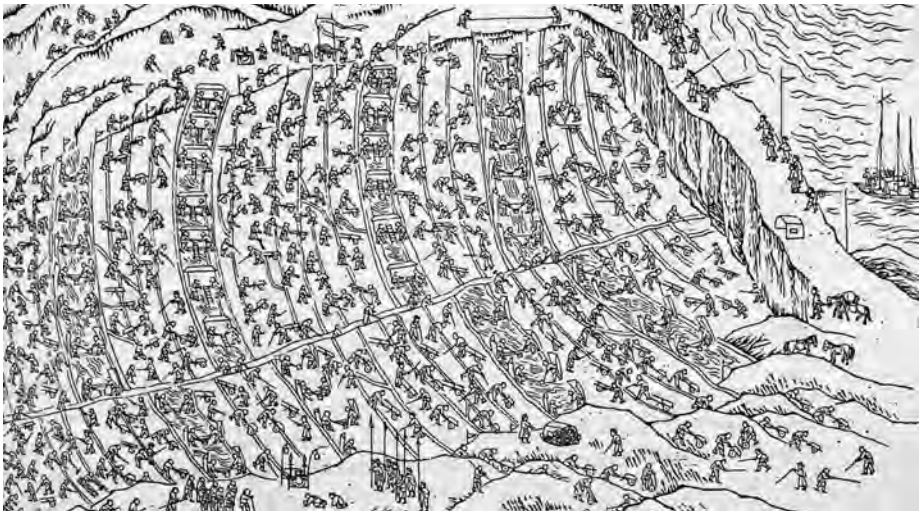


Figure 9: Drawing (1833-42 AD) by hydraulic engineer Lin-Chhing, showing the organization of labor during the cutting of a canal (Needham, Science and Civilization in China, vol. 4, part III, 262)

trol nature. Figure 9 is a drawing from the autobiography of Manchu hydraulic engineer and high official Lin-Chhing, dating from about 1830–40 AD, showing a multitude of men at work cutting a canal through to a river, all organized and managed with military efficiency. The men form an ant-like army with shovels and wheelbarrows.

It is common knowledge that, despite such imperial triumphs over nature, China eventually fell victim to invaders from Europe and declined into a slough of poverty and malnutrition that finally brought on the Communist Revolution in 1949. Water control alone was not sufficient to keep the empire safe from its enemies, or to keep good order and a submissive populace. Yet until the twentieth century no other nation could show such impressive achievements in hydraulic engineering. Even France, the established leader among European nations in water control, could not show canals as long or as large as the Grand Canal right up into the 1890s. And no other empire throughout human history has endured for as long and as tenaciously as China's. The environmental foundation of that empire, it bears repeating, was the control of water.

No one, to my knowledge, has ever placed the model of Chinese water control alongside that of the United States for comparison, but doing so would throw a revealing light on the North American experience. For one thing it would show that the United States, alone of modern nations, has surpassed the Chinese achievement. The young

nation's ability to control water on a large scale has been stupendous and has come with astonishing speed. From a country that had at the beginning only the barest foothold along the Atlantic shore, it quickly moved toward a water empire that was continental in scope. By the twentieth century, the USA had come to define the global standard in water engineering, as China once did, and eventually China began to emulate the American example, for better or for worse.

What do you do when you are a tiny population, no larger than that of Denmark, living strung out along an eastern tidewater? What do you do when you have freed yourself from one empire (the British Empire) and have dreams of building an empire of your own? How do you begin?

The American answer, flashing on like a light bulb around the year 1800, was to think about rivers, asking: How many rivers are there in North America? Where do they go? What can they be made to do? The early history of the nation concentrated on water.

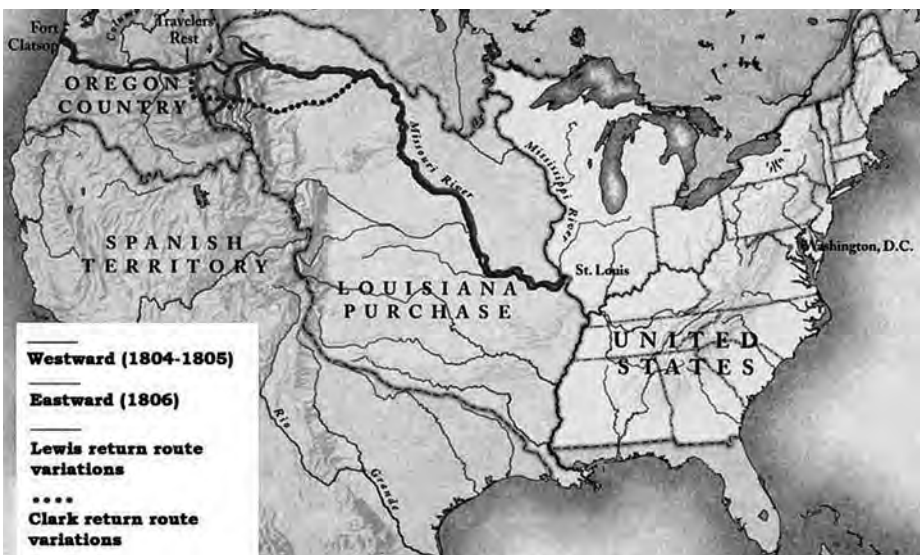


Figure 10: Lewis and Clark expedition route map (Frank Salonius: www.franksrealm.com)

The first national boundary on the West was the Mississippi, and the first national priority, one might argue, was to get to the Mississippi, and having gotten there to go beyond. That is why the so-called "voyage of discovery" of Meriwether Lewis and William Clark,

launched in the year 1804, was far more than a courageous adventure or a military exercise; it was a vital public mission that expressed and defined the imperial ambitions of the new nation: Go down the Ohio to the Mississippi, President Thomas Jefferson told Lewis and Clark. Go up the Missouri as far as you can. Look for a broad watery highway to the Pacific that can connect North America to the China trade.

Figure 11: Grain boat on the Erie Canal (http://www.eriecanal.org/boats-2.html)

All the while the young nation was trying to figure out how to tie those rivers together into a common network that could support cities, industry, and commerce. Gaps in nature's order must be filled. Beginning with the Erie Canal completed in 1825, which linked the Hudson River Valley to the immense inland sea of the Great Lakes, the United States began to fashion a water regime to rival ancient China's.

By the middle of the nineteenth century one could float a boat from New York to the Mississippi by a multiplicity of routes. Rivers and canals stitched together diverse ecological regions into a single consumer market. Although the railroads eventually eclipsed that achievement, the American system of inland waterways, lakes, locks, and dikes unites the country even today. Imagine how Americans would live, or sustain their economy, if that linked system of waterways was suddenly filled with dirt. To be sure, Americans no longer depend much on man-made canals; the Erie carries water but is only a recreational amenity. But stand at the ports of St. Louis, New Orleans, Chicago, or Buffalo and you will soon realize how much the nation still depends on wa-

ter transport. Or stand at the inland seaports of Tulsa, Oklahoma, or Lewiston, Idaho, and realize how hydraulic engineering has contrived to float barges deep into the landlocked interior.

With the launching of the Tennessee Valley project in the 1930s, designed for flood control and transportation, the interior South for the first time came to be truly part of the American system. Before that, the South, except along the Mississippi, had been left out. Now that changed, and cities once in the backwater—Huntsville, Alabama, or Chattanooga, Tennessee—became international ports of call.

But the greatest challenge to imperial visionaries came when the nation began to move farther inland, beyond the 20-inch rainfall line into the arid West, first crossing the Great Plains where the rivers become more and more shallow and farther apart and then encountering stark brown deserts where life had only a tenuous hold. Unlike China, the United States acquired and came to inhabit its arid region last.

The first core areas of empire were established in the humid East, and the drive for American empire was stymied when it arrived in the West. Here rivers tend to run in deep canyons that have been carved out of rock over millions of years. Paradoxically, the flow in those enormous canyons is small; though except in the Great Basin, it is never as small as it is in the sprawling western and far northern uplands of China, where rivers hardly exist at all and where the water rapidly evaporates before it can leave the area.

Small they may be, mere trickles compared to eastern rivers, but the upper Missouri, Snake, Rio Grande, and the Colorado have all presented more and better imperial possibilities than one can find over much of the Chinese territory.

The conquest of arid America, a phrase that became the title of a book published in 1900 by the journalist William Smythe, is in large part a story of American empire hesitating for a while, then boldly entering and extravagantly building. As Smythe promised effusively in his book's prefatory poem: "*The nation reaches its hand into the Desert.* The barred doors of the sleeping empire are flung wide open to the eager and the willing, that they may enter and claim their heritage!"[4]

4 William E. Smythe, *The Conquest of Arid America* (1905: reprint, Seattle: University of Washington Press, 1960), frontispiece, "Emancipation." Italics in original.

States like Montana and Alaska would remain on the margins of the reclamation and hydroelectric empire that Americans would create out of western rivers. The key areas would emerge farther south and west: along the main stem of the Columbia River, in the Central Valley of California, and down the Colorado River into the Southwest and southern California. Development of water resources in those parts of the West would become the foundation of a powerful economy and political order to rival that of the eastern states. It would also far surpass any desert regimes in the rest of the world or, indeed, anywhere in world history—surpass them in terms of capital investment, engineering expertise, agricultural production, industrial output, and metropolitan growth.

Figure 12 (l.): View of the Hoover Dam from the Nevada side (UNLV Libraries, Special Collections)

Figure 13 (r.): Completed Hoover Dam (Thierry Meurgues via flickr)

The milestones in that achievement all date from the 1930s onward, but especially after World War II. It began with the completion of Hoover Dam in 1935 (Figures 12 and 13). Standing 221 meters high (or 726 feet) from bedrock, Hoover was the first modern high-rise dam in the world. It occupies a position in the history of hydraulic engineering comparable to China's Grand Canal. Although it helped stabilize the water supply for the Imperial Valley of California and prevented floods, its main purpose was to generate electricity for Los Angeles and eventually for Las Vegas, Nevada. Nature began to pay tribute to those budding desert metropolises.

The strategy of making hydroelectric power, instead of agriculture, pay the construction bills proved very successful. Wherever irrigated agriculture has been relied on to justify large federal construction projects, it has been an economically irrational

Figure 14 (l.): Las Vegas skyline (David Grant via flickr)

Figure 15 (r.): Glen Canyon Dam (Pascal Redeo via flickr)

investment. Irrigated agriculture has had to be heavily subsidized. Yet so powerful has been the dream of turning the desert into green croplands, that almost any subsidy, any irrationality has been tolerated. Accountants, after all, do not design empires.

Dam after dam followed Hoover: Grand Coulee, Bonneville, Fort Peck, Garrison, Flaming Gorge, Glen Canyon (shown in Figure 15), Oroville, Shasta… the list goes on and on. Today the United States counts fifty "major" dams (roughly the size of Hoover), over five thousand "large" dams, and about 100,000 dams in all. They are distributed all over the country from New England to Arizona, though most of the major dams are either in the western states or the Tennessee Valley.

As Patrick McCully writes in his book *Silenced Rivers: The Ecology and Politics of Large Dams*, those structures are much more than massive machines to generate electricity and store water. "They are concrete, rock and earth expressions of the dominant ideology of the technological age; icons of economic development and scientific progress to match nuclear bombs and motor cars."[5] I would add that in this century, and particularly in the American West, the large dam has become the dominant symbol of humankind's power over nature.

5 Patrick McCully, *Silenced Rivers: The Ecology and Politics of Large Dams* (London: Zed Books, 1996), 2ff.

The environmental costs of that empire have been as severe as the technological achievement has been impressive. Heavy pollution of waterways has come in its wake, a degradation that persists even after billions of dollars in government clean-up money. Devastation of freshwater fish and riparian habitat has occurred and continues largely today. The Missouri River, for example, one of the most heavily engineered rivers in the world, was in 1997 ranked number one on the nation's endangered rivers list (in 2011, the most endangered river was listed as the Susquehanna River). Siltation and salinization are common throughout the system.

Figure 16: Map of endangered rivers in the United States. (America's Most Endangered Rivers® by American Rivers)

Despite these environmental costs, the model of American river development has moved overseas to influence similar construction projects throughout the world. Where China tended to live as a world unto itself, with little impact elsewhere, the US water regime has gone international. And now, astonishingly, the biggest dams, the biggest reservoirs, the biggest canals, and the biggest plans for the future are no longer found in the United States. Since around 1970 other countries have begun to surpass the US hydraulic projects in the scale of their ambitions.

Hoover Dam has fallen to number fifteen on the list of the world's highest dams. Higher structures have been constructed in Russia, Switzerland, India, and Latin America. None of America's reservoirs now rank in the top twenty worldwide. In terms of hydroelectric generating capacity, Grand Coulee has dropped from first to fourth; the

biggest projects are in Brazil/Paraguay (Figure 17) and Venezuela. And now the Three Gorges Dam in China will surpass all water projects anywhere. The wheel of history has come around, and China is once more taking the global lead in grandiose engineering and in environmental destruction.

Today there are some 36,000 large dams in the world. They are so numerous, so large, and so heavy that they are having a measurable impact on the rotation of the earth

Figure 17: Itaipu Binacional Dam (located on the border between Brazil and Paraguay; the largest operating hydroelectric facility in terms of annual generating capacity) (Fabio Pinto Almeida: http://www.eoi.es)

on its axis. China has fully half of those large dams, all built since 1949.[6] Worldwide, an area the size of California has been inundated by reservoirs like the one backed up by the Three Gorges Dam. Man-made water flow has covered fertile farmlands, towns and cities, marshes and wetlands, and whole forests. Why? The obvious answer is that the rest of the world has observed the incredible success that the United States had in its short history as an empire—has observed what this country has done with its rivers—and has determined to do the same.

We might compare human empires to the evolutionary history of the giant saguaro, a species of cactus. The saguaro is an imposing structure in the plant kingdom: tall,

6 In 1950, the International Commission on Large Dams reported that there were 5,268 large dams (over 15 meters/49 feet) in the world, 22 of them in China. By the end of 2008, there were 5,443 large dams (over 30 meters/98 feet) built or under construction in China.

with branching columns and twisty limbs covered with spines, it is a plant that has evolved in places where the rainfall is less than ten inches a year. But it has never managed to get itself transplanted across the ocean and established in the dry lands of sub-Saharan Africa. There are no saguaros, indeed no native cactuses of any kind, in Zimbabwe or South Africa. However, another genus of plants, with radically different genetic origins, a genus called the *euphorbia*, has evolved to fill the niche of a saguaro cactus. Likewise tall, fleshy, and able to store water in its tissues, the *euphorbia* is for all practical purposes a cactus for Africa. Something similar in cultural evolution happens when nations begin to strive toward the control of water, and indeed the control of nature in general. However different their cultural heritage may be, they begin to look remarkably like one another. A dam in China looks like a dam in America, and the dam-builders look like one another too.

All such empires develop hierarchies—gradations of power that are unequal and often highly complex. They give rise to rulers and the ruled, exploiters and the exploited, the powerful and the powerless. This hierarchy is the inescapable result of accumulating the muscle needed to command water to flow wherever a nation wants it to go. Such power over nature requires, in the first place, the massing of a pool of labor, which can either be accomplished by something like a military draft or by flourishing a bundle of capital and hiring workers and machinery. Second, it requires the massing of sufficient technological expertise—knowledge, engineering, and skill.

Large institutions with that capital and expertise at their disposal emerge to do the work of controlling the flow of water. They may wear the name of government or a private corporation—of the Inland Waterways Commission or the Tennessee Valley Authority or the Bureau of Reclamation or the Imperial Irrigation District. They may speak English or Chinese, Italian or Hindi. They may come out of different cultural heritages. But through convergent evolution those agencies of water control are strikingly similar in their function and in their ideology.

Compare the construction of Three Gorges Dam and that of Hoover Dam, and you will find plenty of similarities. The processes look familiar; so does the housing for the thousands of workers, the managerial class, and the authority of technical experts. To be sure, one can find a few distinctions in the way in which capital has been ac-

cumulated and deployed; in the United States, large private corporations pooled their financial resources and the federal government paid them and supervised the work. Corporations in China, in contrast, have in the recent past almost always been state entities, and in theory at least their machinery and workers were owned directly by the people. An interesting difference, but how truly important is it?

But let's get out of these past waters and ask, as a final question, what can we learn from history that will be useful for water policy today? What do China's dikes and levees, its Grand Canal and Three Gorges Dam say about that country's possibilities for the present and future? What do America's dikes and levees, its California Aqueduct or Grand Coulee Dam, say about what may be possible for future human-nature relations?

In 1994 the Commissioner of the Bureau of Reclamation, Dan Beard, declared, "the dam building era in the United States is now over. The opportunity for any future projects is extremely remote, if not nonexistent."[7] What a change of rhetoric! Forty years earlier, Beard's predecessor had promised that we would soon achieve "total control" over western rivers. Now, we are told, no more dams. Note carefully that Commissioner Beard did not claim that the entire hydraulic system would disappear—that the nation would no longer manage rivers, control floods, channelize streams, or irrigate dry lands. Nonetheless, the commissioner spoke words that thrilled many environmentalists, who over the past couple of decades have grown increasingly critical of the old imperial attitudes toward water and natural systems.

And now we have begun to hear from some circles even more radical thoughts about water, rivers, and their uses:

- The Missouri River, people are beginning to say, should no longer be run merely as a barge canal but be restored to the rich natural habitat that Lewis and Clark discovered. The Army Corps of Engineers promises at least to study the prospects for restoring wildlife habitat along this river.
- A scholarly book appears with the title, *The Los Angeles River: Its Life, Death, and Possible Rebirth*. Its author Blake Gumprecht writes that this river, "deprived of its surface flow and kept in place by concrete," is now hidden over much of its course

7 Marc Reisner, "The Fight for Reclamation," *High Country News*, 20 March 1995.

"by houses, factories, parking lots, and streets." It is little more than a flood-control channel. Now a movement is afoot by the Friends of the Los Angeles River to restore that river to a more natural state.

- A few years ago one of the oldest dams in the United States, the Edwards Dam on the Kennebec River in Maine, came down while the Secretary of the Interior, a governor, and a local mayor stood watching enthusiastically, along with a crowd of fishermen, environmentalists, and television camera crews. The dam was a small, privately owned structure that generated a small amount of hydroelectricity, not enough, noted a writer, to "light the warehouse at L. L. Bean."[8] One hundred sixty-two years ago a dam was first thrown across the rapids here. It instantly stopped fish from coming up river to spawn; there had been one million migrating shad a year before the dam said "no entry." A state official has promised that, with the dam removed, most of that fish migration can be restored, and striped bass and Atlantic salmon can come back to the river too. Will this be the dawn of a restored Kennebec, liberated from the water empire after nearly two centuries of subjection?

Perhaps the boldest challenges to the water empire come from those who want to begin tearing down dams. They would add to Commissioner Beard's words, the declaration: "and now the dam-*removal* era has begun." Mostly they are talking about aging dams that would cost more to repair than remove. One target that is not so very old, however, stands at the top of the list: Glen Canyon Dam on the Colorado, completed in 1963, drowning nearly two hundred miles of sculpted canyons under the slack waters of Lake Powell. As incredible as it would have seemed in the 1960s, and still seems to Utah politicians, little knots of people are asking that Glen Canyon Dam, one of America's leading icons of "economic development and scientific progress," be knocked down and the Colorado River restored to its ancient course.

There is no predicting what will come of these new ideas. Now and then new cultural perceptions and ideas about nature do emerge and sweep through a society like microbes, altering its ecology and technology. This may be one of those unpredictable changes that will spread to astonishing proportions. Americans like to believe that such radical change of direction is always possible, and perhaps even to be expected. Why should our water history continue to enforce its mandates on the environment and us? Why not a new era—a revolution—on the horizon?

8 John McPhee, "Farewell to the Nineteenth Century," *The New Yorker*, 27 September 1999, 44.

US culture celebrates what the economist Joseph Schumpeter has called "creative destruction." The speed with which the Americans created a network of canals and then abandoned many of them for the railroad, and then abandoned the passenger railroad for the private automobile, may be offered as examples. Such a culture that constantly throws out new ideas, regularly discards the old, and regards change and innovation as high virtues, might change its thinking and create radical alternatives to a water controlling apparatus like a dam or barge canal. It might to decide to bring back salmon in the old abundance, bring back the Colorado River from extinction, and bring back the wild Merrimack and the wild Ohio. So environmentalists, optimists at heart, like to think.

Much as I might want to agree with those radical ideas, as a historian I feel the powerful hand of the past lying on the present, preventing radical change. I see still in existence a hundred more dams on the Kennebec above Edwards Dam, and across the nation I see thousands of other technological structures still standing. I see entrenched economic interests and firmly rooted attitudes of conquest. I see growing populations that demand more and more from the natural environment. I remember too that empires over nature, perhaps even more than empires in a strictly political sense, can have exceptionally long lives. They are not easy to overthrow or abolish. I wonder whether China's example of successive dynasties may prove relevant to America.

In the case of China we have a long-lasting tradition of controlling and commanding water. It has survived one group of rulers after another. Today a flood sweeps away the dikes, and a hundred thousand laborers once again rush out to put them back again. Canals clog and fill with silt, and the laborers dredge them clean. Once in place, the structures of hydraulic control have a tendency to endure through many vicissitudes of political and cultural change. A dam or canal may go out of use here and there, but the empire over nature becomes a way of life that defends itself tenaciously against change.

So too may be the future of the American conquest, of this once wild and unruly continent and that of other nations over their flow of water. The control that has been achieved will not easily be relinquished. Millions of people have settled in floodplains, expecting the government to protect them, or they have moved into deserts, expecting water to flow to their faucets and swimming pools. Desert metropolis as large as Phoenix, Las Vegas, and Los Angeles (their combined populations are over fifteen

million) depend utterly on the managed flow of the Colorado and other western rivers. Agricultural and industrial interests demand more water than ever, along with more electricity, and they are in a powerful position to get their demands filled. All advanced technological societies have inherited a structure of power over the natural world that we are unlikely to give up any time soon. However, we may want to believe in our talent for creative adaptation; the past controls us more than we want to admit.

Granted, there are possibilities for change in the way in which we manage the waters of Planet Earth. We may clean up rivers better than we have done. We may tear down a dam that is no longer very useful. We may, in selected places, even restore some portion of the devastated salmon and shad runs, or preserve a few remnants of a lost natural world. But we must also realize that the history of any empire is a history of resistance to sweeping change—a history of profound inertia. And the dreams of truly radical change are often only dreams and not realities.

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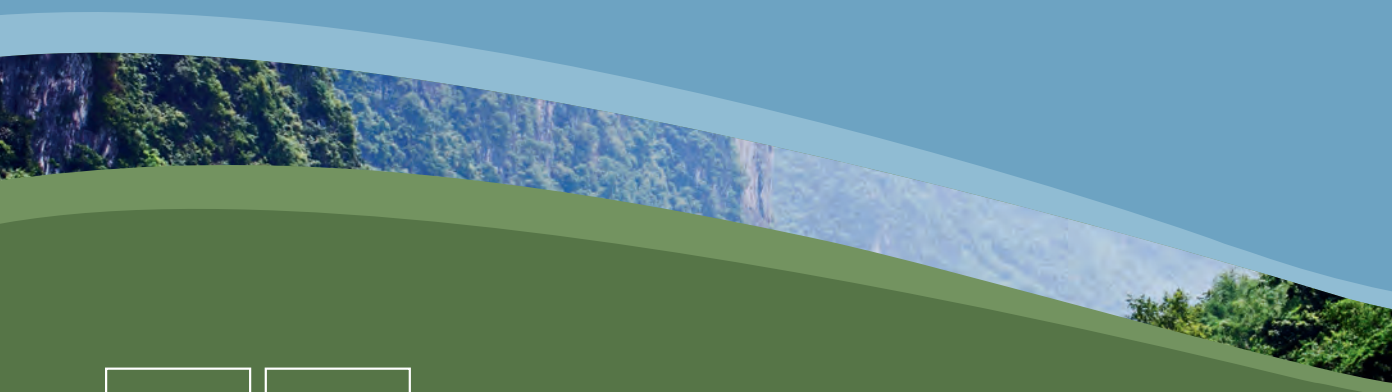

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