Hydro Logic: Water for Human Development

AN ANALYSIS OF CHINA'S WATER MANAGEMENT AND POLITICS

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Needless to add, I am responsible for all errors and views expressed in this report.

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1. China: Freshwater and Human Security

"The next World War will be over water ."

–Ismail Serageldin, Vice President, World Bank[1]

Water is transboundary in nature, not just in terms of political boundaries, but also through all forms of life and matter in the biosphere. As former Israeli Prime Minister Levi Eshkol said: "Water is like the blood in our veins." The survival of all flora and fauna depends on it. As much as the land we live on and the air we breathe in, water is critical for our survival and development. Adequate and continuous supplies of usable water for consumption are essential for food security and economic development. The uneven distribution of fresh water in both space and time, in addition to the continuously increasing demand, have caused crisis situations in many parts of the world. In the year 2000, for example, 1.1 billion people lacked access to safe water, and 2.4 billion did not have access to any form of improved sanitation services.[2]

Rising population and economic development have put such pressures on most resources that scholars and global leaders warn about their impacts on the planet's carrying capacity. Consequently the concept of "sustainable development" has become a buzzword today, with all kinds of conferences and institutions promoting it from local to the global level. Interestingly, water as a global environmental issue has an "orphan status." So are concepts like human development and security. Although issues such as access to safe water are clearly essential to global human security, these have not yet received serious attention in international environmental initiatives due to the dominance of developed country agendas (climate change, etc.) and the different set of agendas that dominate the interests of foreign ministries (as opposed to water or environment ministries) that formulate foreign policies.[3]

Currently, water issues are far more serious to developing countries than developed countries. Unlike developed countries that do not see water as a critical issue at least in the foreseeable future, developing countries lack the economic and technological

resources to "tap" water and to meet demands for safe drinking water and to fight widespread epidemics like cholera and malaria. For example, Asia's "Continental Average Water Availability" is the highest in the world, with 13,510 km3/year (North and Central America has 7,890 km3/year, and Australia and Oceania has 2,360 km3/year), yet its "Continental Per Capita Water Availability" is the lowest, with only 3.92 km3/person/year (North and Central America has 17.4 km3/person/year, and Australia and Oceania has 82.2 km3/person/year).[4]

Water crisis in China

China is a typical example of the ironic state of high water availability accompanied by low per capita availability.[5] Although "Annual Renewable Water Resources" of China (2829.6 km3/yr) are one of the highest in Asia (and the world), its population of 1.26 billion people (largest in the world) make the "most precious resource" more precious than in most other countries.[6] Water problems are particularly serious in North China, where the per capita water resources are half that of the global average and one-quarter of the national average.[7] This region (particularly northeastern China) is one of the more intensely cultivated, industrialized, and densely populated regions of the planet. Northern China has only 20 percent of the country's water resources, but is home to 65 percent of the country's arable land and half of its industry. Its three main rivers that flow eastward into the North China Plain—the Hai, the Yellow, and the Huai—have been running dry for extended periods of time in the recent years and the trends are only getting worse. The drying of sections of the Yellow River, for example, "increased from 70 days in 1992, to 122 days in 1995 to 133 days in 1996 when a 579-kilometer-long stretch of the river dried out."[8]

Water shortages are such that over 60 million people do not get enough clean water for their daily needs[9] and in 1995, 400 of 595 Chinese cities had water shortages.[10]

> "Further evidence of the gravity of the water situation in the North China Plain can be seen in the frenzy of well drilling in recent years. At the end of 1996, the five provinces of the North China Plain-Heibei, Henan, Shandong, and the city provinces of Beijing and Tianjin-had 3.6 million wells, the bulk of them for irrigation. During 1997, 99,900 wells were abandoned as they ran dry. Some 221,900 new wells were drilled. The desperate

> quest for water in China is evident as well drillers chase the water table downward … As water tables fall, springs dry up, streams cease to flow, rivers run dry, and lakes disappear. Hebei Province once had 1,052 lakes. [Now o]nly 83 remain."[11]

The situation is equally grave from the angle of quality. In 1998, only 18% China's major rivers classified as having "good" quality water.[12] Viewing water issues from the perspectives of both shortage and pollution, the water problem in China qualifies as a crisis considering the physical size/volume and the number of people involved. The situation becomes far more complicated when one takes the different dimensions of water management together: pollution control, urban water supplies, energy, irrigation, flood control, public health, eco-system protection, land use planning, etc. Problems of water management have become so severe and intractable that many scholars have sent warning signals to Beijing about the serious environmental and political threats these problems pose to China's political economy and its people.[13]

Occupied Tibet plays a major role in China's, and indeed Southeast Asia's water supplies. Much of China's rich water resources originate there. The Tibetan Plateau is the source of at least eleven major transboundary rivers in Asia, including the Indus (*Senge Khabab),* Sutlej (*Langchen Khabab*), Kamali (*Macha Khabab*), Arun (*Bumchu*), Manas, (*Lhodrak Sharchu*), Brahmaputra (*Yarlung Tsangpo*), Irrawaddy, Salween (*Gyalmo Ngulchu*), Mekong (*Zachu*), Yangtze (*Drichu*), and Yellow (*Machu*). (See Fig. 1) No other constellation of river systems supports such a large human population—at least one-quarter of the world's people depend on rivers that flow from the Plateau. Apart from the perennial base flow provided by the snow melt waters of the Tibetan Plateau, the headwaters provide the base of the rivers' food-web through nutrients and organic material to downstream ecosystems. While the Tibetan Plateau, as a source of Asia's major rivers, is important for its downstream influences, it is also important in its own right as geologically and biologically distinct and diverse ecosystems. Headwaters support rich and varied species of plants and animals compared to other drainage basins. Not surprisingly, the biodiversity on Asia's largest and highest headwaters can be compared to that of the Amazon Rainforest.

Fig. 1. Tibet in Central and East Asia. Courtesy: John Isom.

The Tibetan Plateau is one of the least developed regions of the world. Like the native peoples of the American rainforests, Tibetans are an ecological ethnicity—a "people who have developed a respectful use of the natural resources and consequently a commitment to creating and preserving a technology that interacts with local ecosystems in a sustainable manner."[14] Large scale projects that are designed to change the course of nature, like the Brahmaputra Diversion Project (See Chapter 3) are counter to the Tibetan people's fundamental values of respect for nature and the sentient beings it supports. The catastrophic impacts of projects like the Brahmaputra Diversion Project, Yangtze Diversion Project, and the Mekong Cascade Dams (all discussed in Chapter 3), that have been imposed without consultation to the local people begs the question: in whose interest are these projects undertaken?[15]

Human development

"How can we possibly give priority to the *means* of living, which is what treasures and wealth are, over the *ends* of good and free human lives?" argued Amartya Sen and Sudhir Anand, making a case for the primacy of human interest.[16] Following such intellectual traditions, this report argues that the end served by natural resource management and development projects should be to benefit people. In other words, it calls for the "*the primacy of the human interest above any other—state, ideological, economic, or bureaucratic*."[17]

Furthered by the United Nations Development Program, the term "human development" can be defined as the process of expanding people's choices to lead lives they value.[18] "It is about creating an environment in which people can develop their full potential and lead productive, creative lives in accord with their needs and interests."[19] In the pursuit of "economic growth," economic statistics like Gross National Product or National Income have become "development indicators" to states. Governments around the world pursue the increase in these "development indicators" assuming there will be a "trickle down" effect of the economic growth to their citizens. Such assumptions have now become increasingly disputable in terms of the experiences observed in the actual world. On the contrary, it is arguable that the world has witnessed a "trickle up" effect as the gap between the rich and poor keeps increasing. The human development approach offers an alternative vision of development which downplays economic statistics and uses a "human develop index" to rank countries on the basis of how well they fulfill basic human needs such as access to water, health care, education, and political participation.

The human development approach puts fairness and justice at the forefront. The Chinese government, like many other governments, presents a rosy picture of its citizens enjoying economic prosperity while at the same time maintaining its unflinching commitment to preserving the integrity of the "motherland" by depriving its critics of their basic human rights and freedoms. Falun Gong practitioners, pro-democracy activists, and occupied peoples like Tibetans and Uighurs all suffer persecution under China's iron fist, as do those who oppose environmental destruction for short-term economic gains.

Bias and discrimination are not unique to China. From the ancient "Greek philosophers [who] presented some of the most far-reaching analyses of individual freedom and autonomy,"[20] without hesitating to leave out slaves and women, to the most developed countries like the United States, there are groups and sections of society (Native Americans, Black Americans, "homeless people," etc.) that are very often discriminated against and disenfranchised. Such discrimination and bias are unacceptable to the human development approach. As the Human Development Report 2000 argued: "Any society committed to improving the lives of its people must also be committed to full and equal rights for all."

The concepts of fairness and justice are directly applicable to China's water management (and development) approach. Very often people are arrested for voicing concerns about impacts of development projects on their livelihood in China. The millions of Chinese people whose families and livelihoods have been permanently displaced due to construction of large-scale projects in the last half a century call for social justice. Similarly, the Tibetan people accuse China of undertaking, without their knowledge and approval, large-scale infrastructure projects in occupied Tibet that are primarily designed to benefit "foreign" interests.[21] "The absence of control over policies that sculpt their short and long-term prospects, or even forums for free discussion of government policies, is perhaps at the heart of Tibetan people's opposition to the so-called "development" that is sweeping their land."[22] Denial of opportunities basic to human development like access to the resources needed for a decent standard of living and political freedom leads to "human poverty" and not "human development."[23]

The concept of human development also has direct implications to the broader principles of resource management. Human development is directly related to sustainable development. As Sen and Anand argued that it would "be distinctly odd if we were deeply concerned for the well-being of the future—and yet unborn—generations while ignoring the plight of the poor today. The moral obligation underlying sustainability is a conjunction to preserve the capacity for future people to be as well off as we are."[24]

Sustainable development thus implies protection of the interests not just of future generations but also that of deprived contemporaries. Human development and sustainable development complement each other: gender development and maternal education, for example, have direct impact on the quality of life and agency of later generations.[25]

Purpose of the report

This report contends that profound changes are needed in China's mainstream water management paradigm to address the growing water crisis, avoid catastrophic environmental damage, and preserve the possibility for sustainable development in the affected regions of China and the lands it occupies. This report expresses concerns with China's ideological predilection and bureaucratic bias towards large scale structural fixes like construction of dams and water diversions. Specifically, the report expresses concerns about three projects—the Yangtze Diversion Project, Brahmaputra Diversion Project, and Mekong Cascade Dams—that could cause irreversible impacts on the fragile ecosystems of the Tibetan Plateau, which supplies freshwater to hundreds of millions of people downstream in other Asian countries. It argues that these projects are being planned and built in the interest of large businesses and bureaucracies, and not human beings. It calls for a shift away from these mammoth projects and presses policy makers and scholars to put human development at the heart of the policy agenda.

2. The Anatomy of China's Water Crisis

China has substantial water resources.[26] Despite its huge population of 1.26 billion[27] people, its per capita water resources are 2,343 m3/person/year, substantially above the internationally accepted definition of water scarcity (i.e., 1000 m3/head/year).[28] It also has an extensive body of environmental law with an elaborate organizational structure (Fig. 1) to protect its natural environment and resources. Yet still the water problem in China has reached a crisis point.

China's water problems can be described from several angles: (1) *distribution* of water and population, to provide a snapshot of the problem; (2) environmental *policy and law*, to sheds light on institutional frameworks designed to deal with the issue; (3) the enforcement *structure and governance* that carry out these laws; (4) *economic trends and reforms* that directly affect water demand and management; and (5) the government's predilection for *large structural solutions*.

Distribution: Water and People

As China's relatively high per capita water resources suggest, water would be reasonably plentiful were it not for the effects of uneven spatial and temporal variations in population density and availability of freshwater. Water problems are particularly serious in the areas of northern rivers—those north of and including the Yellow River (*Machu* in Tibetan)[29]—due to lower per capita water availability, lower rainfall, frequent episodes of drought and floods, pollution and higher demands.[30] (See Table 1)

This regional inequality of water availability is exacerbated by the precipitation pattern. Precipitation is highest in the southeast part of China (Pearl River basin and delta with more than 2,000 mm per year), decreasing as one moves northwest.[31] The northern rivers have generally lower flow with higher variability than the southern rivers. In addition to topographic and geomorphologic factors, this has made north China one of the most flood-prone areas in the country and indeed in the world, with flood damage estimated at nearly 30% of the national total.[32] Furthermore, about 70% of China's total annual

precipitation occurs during the flood season: that is to say, about two-thirds of the total amount of water resources can be attributed to flood run off.

Rivers	(Billion m3/year) Total of surface water and ground water	(m3/person/year)
Northern		
Song-Liao	193	1,704
Hai-Luan	42	358
Huai	96	505
Yellow/*Machu*[33]/Huanghe	74	750
Southern		
Yangtze/ *Drichu*/Chang	961	2,388
Zhu/Pearl	471	3,327
Southeast[34]	259	3,938
Southwest[35]	585	31,914
Interior Basins[36]	130	5,271
	2,8121	**2,343**

Table 1. Average Renewable Water Resources Availability in China. Figure source: World Bank (2001)

Population pressure and concentration of heavy industries[37] in north China, particularly northeast China, are the main contributors to the pollution[38] and over-utilization of northern rivers. Almost three-quarters of the population live in the eastern half. North China's agricultural sector is affected by severe and increasing water shortages. The situation is particularly bad in Huang He, Hai and Haui rivers, also called the 3-H rivers, where there have been reports of riots and social disruptions over water.[39]

> There were social revolts along the Huai River, so the State Council [China's Cabinet] had to react," one retired senior government official told me, recalling the most dramatic government crackdown on pollution to date. The Huai region, located about 200 miles northwest of Shanghai, is the most densely populated of China's seven major river basins: 110 million inhabitants share 108,000 square miles of land. The river had been severely polluted for years, but it got drastically worse in July of 1994, when a sudden flood of toxins turned the river black and deadly for weeks. Hundred of thousands of people were left without drinking water, several thousands were treated for dysentery, diarrhea, and vomiting, and 26 million pounds of fish were killed.[40]

Policy and Law

Official environmental policy and positive laws for the protection of environment really developed in the post reform period in China.[41] In 1978, reform leaders amended China's constitution to include the protection of the environment. In 1979, China's first environmental law, the Environmental Protection Law was promulgated. This was followed by a series of environmental regulations. At the same time China established environmental agencies at the national, provincial, and local levels to implement these regulations and to monitor their progress.

However, China's environmental law suffers from major assumptions that do not exist in present-day China. Drafted in the early reform period, these laws presuppose a centrally planned and orderly economy.[42] This fundamental discrepancy widens the difference between the ways these laws are expected to be enforced and how these are actually implemented.

> [T]he laws presuppose a common national commitment to the goal of environmental protection [where as the only national commitment is really rapid economic growth which is detrimental to the environment] and a higher degree of administrative cohesion than currently exists. It is assumed that subnational units of government will want to meet, if not exceed, national set environmental standards. Little attention is focused on environmental problems that transcend a single jurisdiction. The laws presume that local environmental protection bureaus, which report principally to the local government officials, will successfully coordinate with the [S]EPA. … Even within single subnational units of government, the laws fail to anticipate the possibility that certain governmental interests, particularly those of departments with major economic possibilities, might diverge sharply from those of local environmental protection officers.[43]

Many of these laws overlap and contradict each other, subjecting them to different manipulations and confusions.[44] These laws also lack specificity and provisions for conflict resolution and water allocation, which are at the core of water issues in China today.[45] These flaws in China's legal doctrine are accompanied by a set of problems related to enforcement mechanisms of these laws.

Structure and Governance

As Lieberthal observed, "much of the environmental energy generated at the national level dissipates as it diffuses through the multi-layered state structure, producing outcomes that have little concrete effect."[46]Authority and responsibility are delegated through a hierarchical chain of command by function and rank, causing major obstacles in implementing environmental laws. For example, the Ministry of Water Resources, a principle organ responsible for national water resources management, is on the same rank as a province and thus lacks the authority to issue necessary binding orders to provinces because in China, units of the same rank cannot issue binding orders to another.[47] Therefore, in order to operate effectively between organizations of the same authority or of different functional bureaucracies in China, extensive consensus building becomes necessary,[48] making the system more cumbersome and less efficient. Furthermore, there is no institution with sole responsibility for water supply, management, and water pollution laws—the management of China's water industry is split among different ministries and the municipal and provincial government water resource-bureaus (discussed further in chapter 4).

Another unique Chinese style of governance is its dual system of authority – "vertical"(*tiao* in Chinese) and "horizontal" (*kuai* in Chinese). Vertical lines of administration would be the Environmental Protection Agencies (EPAs) at each level of the political system (national, provincial, city, local, etc.) and horizontal lines of administration, for this purpose, would be the territorial EPA offices of the same rank or level. *Tiao* lines of administration operate to implement functional goals (in this case, to protect the environment, or rivers from pollution); *kuai* operates to serve the needs of the locality it governs. One of the most notable thrusts of the reforms has been to make the *tiao* serve *kuai*, making central-level functional units such as the Ministry of Water Resources less powerful than territorial governments, which are far more interested in achieving economic development rather than environmental protection. Hence the result is that the entrepreneurs (local territorial officers) typically control the regulators (local environment officers).[49]

Reforms and primacy of economics

Chinese leaders want to transform the economy into a technologically dynamic, efficient engine of growth. In order to mobilize people's entrepreneurial skills, especially those of territorial leaders, the Chinese government made an uncodified deal that essentially says, "each level of government will grant the level just below it sufficient flexibility to enable the lower level to grow its economy rapidly enough to maintain social and political stability."[50] With this, there were other changes in the governance of the system like "making *tiao* serve *kuai*" which provided territorial officials power, flexibility, and incentive (in the form of economic gains, promotions and other benefits) to focus on rapid economic growth. As a result, local environmental issues became secondary in importance to economic growth for these officials, who could now basically control the regulators (e.g., EPA officials).

China is one of the fastest-growing economies in the world and the trend of growth is likely to continue for some time. "Most of the growth in industrial output in the future is likely to be within the non-SOE [state owned enterprises] sector, which SEPA and the EPBs have the least capacity to regulate …"[51] And with these trends, further increase in water demand can be safely predicted. Another important development of the reform measures is the mushrooming of township and village enterprises (TVEs). There are about 25 million autonomous small- and medium-sized TVEs, and these are considered to be the most dynamic and fastest-growing segment of China's growing economy.[52] These are often directly linked to local political authorities, and their ambiguous legal status allows them to operate outside effective national-level control of pollution and other imposed externalities.[53] These TVE's discharged approximately three billion cubic meters of wastewater into China's water systems in 1998.[54]

Large Structural Solutions

An important facet of China's water problems is the government's predilection for large-scale structural solutions to address these problems. Before the Chinese Communist Party came into power in 1949, China had only 23 large and medium-scale dams and

reservoirs.[55] Today after 53 years, China has 22,000 of the world's 45,000 large dams (those more than 15 meters in height). Excluding small farm-scale irrigation dams and mini and micro hydropower units, China has about 85,000 dams/reservoirs, with a total storage capacity of more than 460 billion cubic meters.[56] In the era of "dam decommissioning," where large dams are being decommissioned because of their social, environmental, and economic costs, China continues to be one the most active dam building countries in the world with more than 90 dams of over 60 meters in height and 180 dams of all sizes currently under construction.[57] The next two chapters will discuss China's obsession with grandiose structural solutions in more detail.

The cases discussed in the next Chapter provide a glimpse into the nature of large-scale structural solutions China is undertaking. Chapter 4 will highlight another case, and discuss how most of the prominent Chinese communist leaders are trained as electrical engineers, and tend to see construction of dams, particularly large dams like the Three Gorges Dam, as a mark of pride for socialism and the Party.[58]

Conclusion

In examining China's paradox of water abundance and scarcity, its extensive environmental protective measures and the crisis state over water, one thing becomes clear: China's water problem is far more complex than a case of severe distribution imbalances. Serious structural, legal, and policy changes are required to manage China's water problems more efficiently.

From our limited analysis, within the matrix of natural distribution of water and population, law, governance, economic trends, and governmental and people's practices, we can conclude that the prospects for solving China's water crisis are rather bleak. Its legal system for the protection of environment is weak in relation to the economic priorities it has set for itself and the gravity of the water problem. In order to solve China's water problems, the government needs to reframe its laws to fit the country's changing economic system, and the realities of a "glocalized" world.[59]

3. Harnessing Tibetan Rivers

If one looks at a three-dimensional physical map of Asia, the landmass of Tibet, the largest and highest plateau in the world, stands above the rest of Asia.[60] (See Fig. 2). It has an average elevation of over 4,000 meters above sea level, expanding more than 1.5 million square miles. It has some of the highest mountain ranges in the world with vast glaciers, making it the perennial headwaters to many international rivers in Asia (See Fig. 3).

With 104,500 cubic meters of freshwater per year, Tibet ranks fourth in the world for availability of freshwater.[61] "Net hydrological flows in Tibet total 627 cubic km per year. This comprises roughly six percent of Asia's annual runoff and 34 percent of India's total river water resources. Historically, negligible utilization rates in Tibet meant that nearly all of this water was transferred to countries in downstream basins including India, Nepal, China, Bangladesh, Pakistan, Bhutan, Vietnam, Burma (Myanmar), Cambodia, Laos and Thailand."[62] The quantity of water in many of Asia's rivers is at the mercy of the monsoon rains, which are a significant source of Asia's freshwater. However, Tibet lies in the rainshadow area of the Himalayas. So the water that comes out of Tibet is mostly derived from snowmelt originating from glaciers with a total area of 42, 946 sq. km, supporting the base flow of these rivers.

Much of the critical discussions about China's "development" plans for Tibet revolves around exploration and exploitation of mineral and oil resources and the construction of large-scale infrastructure facilities. Little known and discussed are China's extensive plans to harness Tibet's rivers, which have the world's greatest hydroelectric generation potential. And even less known are China's plans to divert the perennial waters of the Tibetan Plateau to its thirsty northern regions. This chapter outlines three of China's many ambitious plans to exploit rivers that flow from the Tibetan Plateau, highlighting their ecological and transboundary implications.

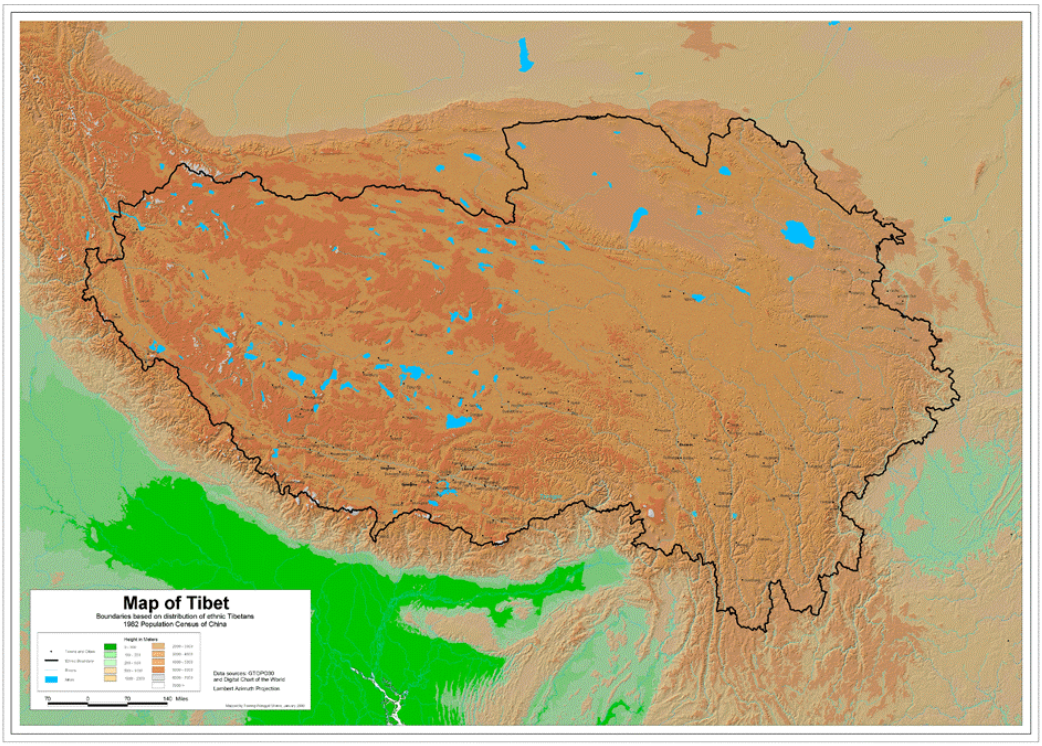

Fig. 2. Map of Tibet. Courtesy: Tsering Wangyal Shawa.

Fig. 3 Tibet. Courtesy: John Isom.

Yangtze (Drichu in Tibetan) Diversion Project (South-North Water Transfer Project)

The most ambitious of China's plans to meet the growing scarcity of water in its northern cities, the Yangtze (Drichu, in Tibetan) Diversion Project will become the world's longest and largest water transfer project ever built. First conceived by Mao Zedong more than 50 years ago, China has now decided to push ahead with the "mammoth" South-North Water Transfer Project (SNWTP). This involves diverting waters from the Yangtze River thousands of kilometers to the thirsty north from three routes--eastern, central, and western—each serving critical purposes of the overall plan.

The construction of the 1,200-km-long Eastern Route, starting at Jiangsu Province and passing through the provinces of Anhui, Shandong and Hebei to finally supply the Tianjin Municipality, is scheduled to begin this year and finish by 2010.[63] At an estimated total cost of US$7.25 billion (including clean-up costs), the Eastern Route for the SNWTP is considered "the cheapest and easiest" to construct.[64] This leg of SNWTP alone is estimated to divert 17 billion cubic meters (BCM) of water annually.[65] Ironically, the main environmental problems associated with this route have to do with environment clean-up, rather than environmental impact. The various cost estimations of the clean-up and pollution prevention work along this route alone show figures ranging from 35% to 50%+ of the total project.

The Central Route will be slightly longer than the Eastern Route, stretching from the Danjiangkou Reservoir on the Han River in Hubei Province all the way to Beijing. Including the resettlement expenses, the total cost of the route is estimated around US$10 billion. After the completion of the two-phase construction, the route will have a flow capacity of 20 BCM of water annually,[66] through a 1,241- km-long canal.[67] Two issues with the Central Route are generally noted: engineering issues, especially siphoning the channel underneath the Yellow River, and the relocation of 250,000 people who will be displaced by the project. Although the displacement of people is considered to be the most controversial issue of the route, considering the fact that the figure is not even a quarter the number that are being displaced by the controversial Three Gorges Project

(discussed in the next chapter), it is doubtful that this issue is going to stop Beijing from going ahead with the project.[68]

The Western Route from the Tibetan Plateau is going to be the most expensive and difficult of the three routes. After considering plans to divert waters from different sources including the Mekong River (*Zachu*), Salween (*Gyalmo Ngulchu*) and Yangtze (*Drichu*), China has finally decided to divert waters from three tributaries of the Yangtze: *Thogthon Chuwo* (Tongtianhe in Chinese), *Ngagchu* (Yalong in Chinese),[69] and *Gyarong Ngulchu* (Daduhe in Chinese) in three phases.[70] (See Fig. 4) Work for the Western Route is likely to begin sometime after 2010.

Fig. 4. Western Route (red lines). Source: Ministry of Water Resources. Map: John Isom.

The total cost of the Western Route is estimated to be at least US$37 billion by the Ministry of Water Resources. According to US Government reports released on April 2001, "China currently has no answers" for the engineering challenges posed by the *Bayan Ha Ri*[71] Mountains (Bayankala Mountains) that separate the rivers.[72] Furthermore,

the elevation of the bed of Yellow River is higher than that of the corresponding section of Yangtze by 80-450 meters.[73] Currently, plans are to build at least three dams—one on the *Ngagchu* with a height of 175 meters, another on the *Thogthon Chuwo* with a height of 302 meters, and a third on the *Gyarong Ngulchu* with a height of 296 meters. (Currently the world's tallest dams are Rogun Dam (335 m) and Nurek Dam (300 m), both on Vakhsh River in Tajiskistan.) A series of tunnels and aqueducts more than 300 km long have been planned through the *Bayan Ha Ri* Mountains. It is not known whether China continues to consider use of the infamous "peaceful nuclear explosions" as a means for tunnel construction, like in the case of the Tsangpo Diversion Project (discussed later in this chapter). The flow capacity of these tunnels is 20 BCM annually.

Apart from the immense engineering challenges, high costs, and the potentially disastrous ecological consequences of the project and its construction, the Western Route will be accompanied by other problems, such as a short work season; transportation of water through a sub-zero environment; and construction of tunnels and aquifers through high mountains in remote locations and at high altitudes (well above 3000 meters, or 10,000 feet). However, these challenges are likely to be overlooked considering the politicized nature of the project and the Chinese government's pride in the construction of such grandiose projects. Moreover, there are strong political forces in favor of the project in Central China, necessitated by water shortages in the provinces of Gansu, Ningxia, Shaanxi, Shanxi, and Inner Mongolia that threaten social stability. Authorities want to give the Western Route proposal "a politically soft landing," since many locales in these provinces along the upper/middle reaches of the Yellow River have had their hopes raised by the project.[74]

Implications

Research by experts of the Ministry of Water Resources agree with one of the arguments made in the previous chapter that the South-North Water Transfer project, by itself, will not suffice to resolve water shortage problems in north China.[75] In fact, many scientists are outright critical of these projects and propose small-scale projects as more appropriate and cost-effective approach. Xu Qianqing, former vice chief engineer at the Ministry

critiqued the South-North Water Project and warned about the great likelihood of poor-quality construction and the possibility that construction might never be completed at all. Even if completed, he warned that "the price of water might be too high for users to accept. If this occurs the project might not earn enough for operation and repairs."[76]

The headwaters of the Yangtze and Yellow Rivers on the Tibetan Plateau consist of an intricate network of tributaries that cover a total area of more than 600,000 square kilometers, which includes headwaters of the adjoining Mekong and Salween Rivers.[77] Development in these ecologically fragile mountain valleys is bound to impinge upon the water rights of people living downstream along the middle reaches of Yangtze in China, and those in the countries of Thailand, Laos, Burma, Vietnam, and Cambodia. This region has been described as a "gene bank" due to its rich biological diversity and pristine environment, but so far no environmental impact assessment of the project has been carried out. Wu Qianqing, former vice chief engineer at the Ministry of Water Resources, noted that little research has been done on the effects on the region from which water will be removed. This is especially true for the Western Route of the project.[78]

Brahmaputra (Yarlung Tsangpo in Tibet) Diversion Project

The Yarlung Tsangpo River is the largest river of Tibet and the highest river in the world with an average altitude of 4,000 meters. It flows eastward in southern Tibet for over 2,000 kilometers and then bends south to enter into India (as the Brahmaputra) and then into Bangladesh, from where it enters the Bay of Bengal. At the easternmost point of the river in Tibet, the Great Bend, China has planned another big project, "part of a national strategy to divert water from rivers in the south and west to drought-stricken northern areas."

"The Yarlung Tsangpo gorge is eight times as steep as and three times as large as the Colorado in the Grand Canyon. The river descends over 3,000 meters in approximately 200 km and this constitutes one of the greatest hydropower potentials anywhere in the world."[79] The Great Bend of the Yarlung Tsangpo where the project is being planned is

one of the least developed, most pristine areas of the world. Sacred to the local Tibetans, the Bend is believed to be the "home to the Goddess Dorjee Pagmo, 'The Diamond Sow,' Buddha's consort."[80] The Tsangpo project includes building the world's biggest hydroelectric plant with the world's biggest dam that would generate twice the electricity produced by Three Gorges.[81] A planned 40,000 Megawatt hydroelectric plant at The Great Bend of Yarlung Tsangpo would dwarf the potential of even the largest power stations in operation today. "By comparison the largest power station in operation today is Itaipu in Brazil, with a total installed capacity of 12,600 Megawatts. Three Gorges Dam, currently under construction on the Yangtze River, will have a capacity of 18,200 Megawatt."[82] The waters of the Tsangpo will then be diverted thousands of kilometers across the Tibetan Plateau to northwestern parts of China, into the provinces of Xinjiang and Gansu. Plans also include use of "peaceful nuclear explosions" to blast a tunnel more than 16 kilometers in length through the Himalayas. The construction of this multi-billion dollar project is tentatively scheduled to begin in 2009, the year the Three Gorges Dam is scheduled for completion.

Implications

This project represents a direct threat to the water security of people living downstream in India and Bangladesh. As the controversial July 2000 breach of a natural dam in Tibet which led to floods and left over a hundred people dead or missing in Arunachal Pradesh, India indicated, people downstream are extremely vulnerable to what goes on upstream in Tibet.[83] Precipitation in the region is "too much" (80%) during the four monsoon months (between June to September), and "too little" (20%) for the remaining eight months.[84] China will withhold water for power generation and irrigation during the dry season, but would be compelled to release water during the flood season. Diversion of large quantities of water to China's northwest would be even more devastating for farmers and fishermen downstream.

There are similar catastrophic ecological implications of this project. The reservoir for a dam with a capacity of 40,000 Megawatt would create a huge artificial lake, several hundred kilometers long, inundating vast areas of virgin forests and numerous unrecorded

species of flora and fauna. The Tsangpo gorge area is said to be home for more than 60 percent of the biological resources on the Tibetan Plateau. Similarly, there would be irreparable impact on the Tsangpo's 126 fish species, and to the thousands of other aquatic life forms that it supports, especially at the delta.[85] Farmers would also be affected as much of the nutrient-rich sediment would be deposited at the reservoir rather than downstream. The potential use of nuclear devices to create tunnels for the project raises further serious concerns about the environmental impacts of such a project to the local region and those living downstream.

The Mekong (Zachu) Cascade Dams

The Mekong flows through almost all the countries in mainland Southeast Asia. Not surprisingly, it is the longest river in that region, and twelfth longest in the world. From its source in the snow-covered mountains of the eastern Tibetan Plateau, it runs over 2,610 miles south, flowing across Yunnan Province of China, forming the border between Burma[86] and Laos, and much of the border between Laos and Thailand, then flowing across Cambodia and finally into southern Vietnam, where it forms a delta to enter the South China Sea.

The Chinese government has planned a series of 14 dams on the Mekong River to develop the hydroelectric potential, all of which are being planned in Yunnan province. These include at least 4 dams—Liutongsiang, Jiabi, Wunenglong, and Tuoba—in the socalled Dechen (Chinese *Deqin*) Autonomous Prefecture, a traditionally Tibetan region.[87] Compared to the Tennessee Valley Authority dam system in the United States, the Mekong dams would be 12 times higher in terms of elevation and 13 times greater in total installed capacity.[88] Of the 14 dams, Manwan Dam is completed, two are under construction—Dachaoshan Dam, which began construction 1996, is scheduled to be completed sometime next year, and construction of Xiaowan was slated to begin last year and to be completed by 2013. The remaining four (Nuozhadu, Mengsong, Gonguoqiao and Ganlanba) are expected to begin sometime after 2010. (See Table 2)

Implications

The Mekong River directly affects the lives of more than 50 million people in six countries, who depend on it for agriculture, fish, water, tourism, and other social, economic and cultural activities. "About 90% of the riparian population are engaged in agriculture (principally rice cultivation) and it is now widely recognized that wild freshwater fishes from the Mekong and its tributaries are the single most important source of animal protein in the diet."[89]

The construction of these dams will significantly reduce the amount of silt flow, adversely affecting farming downstream. The Mekong River is the third most biodiverse in ichthyofauna (fish) with about 1,000 known species of fish.[90] The Mekong Cascades (for that matter any dam) will adversely affect the fish population in two ways: disruption of migrations and impoundment effects.

> Impoundment has an impact on water quality, as water held back behind a dam is de-oxygenated, cooler and deprived of sediment compared with free-flowing water. There is thus a change in water quality for some distance below a large dam. Moreover, impoundments hold back water during the wet season and release it during the dry season. While farmers wanting irrigation water may welcome such a feature, fish that are seasonally adapted to changed water flows, and whose migrations are partly triggered by natural regimes, are likely to suffer from such effects.[91]

The Mekong River Commission reports that the "overall" impacts of the Manwan, Dachaoshan and Jinghong dams will be negligible. Perhaps the "overall" impacts of these three dams are indeed negligible, but, even just hydrologically speaking, the construction of other dams is expected to have major impacts on the downstream discharge. Xiaowan Dam, which began its construction last year, will have about 20 times the active storage of Manwan and Dachaoshan combined.[92] Thus, major changes in the downstream hydrograph are bound to occur. And "[w]hen Nuoshadu is added to the system the mean dry season discharge near the Yunnan-Laos border is estimated to total 1,869m3/sec, an increase of 1,180m3/sec or 171 percent."[93] In addition, official figures show that the construction of these dams will result in displacement of more than 68,000 people and inundation of approximately 25,000 acres of land.[94]

Dam	Construction time (Construction period)	Installed Capacity MW)	Dam Height (meters)	No. of people to be relocated
Liutonsiang	6 years	550		
Jiabi	6	430		
WunengLong	7	800		
Tuoba	9	164		
Huangdeng	9	186		
Tiemenkan	9	178		
Gonguoqiao	7	750	130	4,596
Xiaowan	Jan 2002 - 2013	4,200	284.5	28,748
Manwan	8 (completed in 1996)	1,500	132	3,042
Dachaoshan	7 (Completion prd: 2003)	1,350	120.5	5,200
Nuozhadu	12	5,000	260.5	14,800
Jinghong	8	1,350	118	1,700
Ganlanba	4	150		58
Mengsong	6	600		230

Table 2. Mekong Cascade Dam Profile. Source: Hori (2000).

Conclusion

> Since the founding of the People's Republic of China, our government has exercised the leadership of the people of the whole country to construct water conservancy works on a large scale and has gained great achievements. However, water-related problems are still hindering the Chinese economic and social development.[95]
>
> -Zhang Chunyuan. Vice Minister, Ministry of Water Resources, China

The snow-capped peaks of the Tibetan Plateau provide a base flow to at least ten international rivers, supplying freshwater to a significant proportion of human population. The headwaters of Asia's major river systems will not remain unexploited for long. The three Chinese government projects on the headwaters of Brahmaputra, Yangtze, and Mekong clearly bear testimony to the Chinese government's obsession with large-scale structural solutions to China's water and energy crisis. For the Chinese government, the question is not whether to build these projects, but how.

These projects are being done on scales that have never been attempted before in the history of mankind, and without much scientific study or consultation. Interestingly, the impact assessments for these projects are done on the recipient side and not on the region from where the water would be diverted, or dams built. Although there are many ways to skin the scientific cat, it is not a mystery that large-scale water diversion or hydroelectric projects have significant human, hydrological, and ecological implications downstream.[96] If completed, these projects will cause irreparable harm to the lives of millions of people and thousands of aquatic species that depend on these rivers for survival. And the water rights of other riparian states are not a factor for China in making decisions about these projects.

There is a fundamental difference between the construction of these projects from the construction of projects such as the Eiffel Tower or the Taj Mahal. These "mammoth" projects are being built to control the most precious resource for people's survival and development. The Tibetans who live on the Tibetan Plateau will not be benefited by these projects, and they do not have any recourse since the military occupation of their country by China. Ironically, it is arguable that these projects are also not meant to benefit the Chinese people. The millions of Chinese people who have been evicted from their homes and villages to make way for their government's obsession with large-scale projects bear witness to this. These projects represent classic examples of the domination of economics over environment, bureaucratic politics over human interest (see chapter 4), and "man" over nature, at a very large scale and over a very critical resource.

4. The Politics of Water Management in China

This chapter uses the Three Gorges Dam project to provide a framework for understanding China's predilection for large-scale projects in general, and concludes that the bureaucratic interest of China's water-industrial complex is benefited by, and hence supportive of, all the large-scale projects in China.

The Three Gorges Project

Three Gorges Dam involves erecting the biggest dam in the world on China's longest river, the Yangtze. This giant edifice will be 185 meters tall and will stretch approximately two kilometers across the river. It will create a reservoir the length of Lake Superior (over 600 kilometers) that will allegedly displace nearly two million people. It entails 26.43 million cubic meters of concrete work, twice that of the world's current largest water control project, the Itaipu project in Brazil.[97] The dam is situated in Sandouping, north of the city of Yichang in Sichuan Province.

Benefits of the project

The stated purposes of the Three Gorges Project are threefold: generation of electricity, flood control, and improved navigation along the river. The government hopes that the most direct economic benefit of the project will accrue from its energy generation. The government estimates that electricity produced by the 18,000 MW dam will generate US$62 billion a year, which is expected to pay off all loans and interest associated with the project within three years after going into full operation.[98] The project promises to boost the economy of eastern and central China and the eastern part of southwest Sichuan province by creating millions of jobs.[99]

Many independent energy analysts, however, have a different story to tell:

> A 1998 study by the Batelle Memorial Institute (a Washington-based energy policy think-tank), the Beijing Energy Efficiency Center, and China's Research Institute, calculated that power from China's large hydrodams costs about six to seven cents per kilowatt-hour, compared to less than four cents for gas-fired combined cycle plants, four to five

> cents for new coal plants, and over seven cents for nuclear power, excluding transmission and distribution costs.[100] Three Gorges power is expected to be even more expensive, at 8.4 cents per kilo-watt hour.[101] But 8.4 cents per kilowatt-hour still isn't the final cost of Three Gorges power as it doesn't include transmission and distribution costs.[102]

In addition, demand for energy generated by the dam is likely to fall short of supply.[103] "With thousands of state enterprises shutting down, electricity consumption dropped sharply in 1998, and many power plants are running well below capacity."[104] There is also a gradual increase in private production of energy that is expected to be available in abundance and at low prices by the time the dam is completed.

Construction of a mammoth dam like this one, the great wall across Yangtze, provides temporary employment to a large number of people.[105] Dam-building is an industry in itself in China, employing tens of thousands of skilled, semi-skilled, and unskilled laborers. Critics say one reason why the construction of the Three Gorges project was launched is because Gezhouba dam was nearing completion, and the authorities had to find replacement jobs for workers.[106] Following this logic, it makes sense that the construction of the Brahmaputra diversion plan, which would require even more workers, is scheduled to begin shortly after the anticipated completion of the Three Gorges project in 2009.[107]

Flood control is of highest priority to China among water issues,[108] and the dam is regarded "as the most effective and permanent solution" to Yangtze floods.[109] However, this reasoning also seems flawed. Much of the flood waters in the middle and lower reaches of the Yangtze actually flow from tributaries that join the river below the dam site.[110]

The project is also estimated to increase navigation on China's most important waterway by five fold.[111] An intricate system of ship locks is being built to enable even ocean-going freighters and 10,000-ton towboats to penetrate 1,500 miles inland, thereby bringing prosperity to the people of interior provinces, especially in the new municipality of Chongqing.[112] However, US engineers who were hosted at the construction site by the

president of Three Gorges Development Corporation (TGDC) are highly skeptical, due to engineering defects that include those on the ship lock system.[113] It is certain that the amount of water downstream from the dam site will decrease and water quality will be altered, hampering navigation and other downstream activities like fishing irrevocably. There are also other social and environmental costs that have been largely ignored by the government, such as those related to displacement of massive numbers of people.

Externalities

Critics of the dam say that by 2009, the project will have resulted in the displacement of nearly 2 million people, whereas Chinese government sources at present give 1.2 million as a figure.[114] In either case, it is the largest human relocation effort in world history. The rural population among those resettled loses the most—they get compensated the least, and they will have to move to less fertile hilly surroundings with scarce irrigation facilities. Promises made to them of non-agricultural jobs under the "developmental resettlement" policy are proving to be an illusion as the local industries have hired all the people they need, and worst of all, the bureaucracy seem most indifferent to their grievances.[115] One piece of government literature on the Resettlement Program, for example, mentions that the reservoir "will partially or wholly submerge two prefectural cities, 11 county-seats, 114 towns and 1,599 factories," and completely ignores to mention that the reservoir also submerges over one thousand villages![116]

The reservoir will also inundate 136 archaeological sites and cultural relics, 30,000 hectares of fertile agricultural land, and adversely affect endangered species of fish such as the white fin dolphin.[117] Scientists are saying the government is overlooking water pollution and siltation problems that could result from the project.[118] By slowing the flow of its water, the reservoir may become a giant cesspool, storing 265 billion gallons of raw sewage each year.[119] Silt accumulation at the dam will have grave impacts, not just on the dam by jamming sluiceways (thereby making it vulnerable to collapse in a severe flood), but also on the morphology and stability of the alluvial channels downstream in the long run.[120]

Gleick sums up the "enormous ecological impacts" of the dam:

> The fish resources of the Yangtze river are abundant and quite vulnerable. Major changes in fish populations are likely because the dynamics of the river, the chemical and temperature composition of the water, and the character of the natural habitat and food resources available for these fish species will be altered. The dam itself will block migration of fish and spawning grounds for up to 172 different fish species. A number of species will not be able to adapt to the new environment and may suffer a dramatic reduction in numbers. In particular, the project will seriously affect the fish species in the middle reach of the Yangtze River, which is a major breeding area for four rare native fishes. Of special concern are the Chinese sturgeon and Chinese freshwater dolphin, which inhabit only the middle and lower reaches of the Yangtze river. The breeding of sturgeon has already been affected by the Gezhouba Dam, and the Chinese dolphin has been reduced to a few hundred in number. Concern has also been expressed for the Siberian crane, which is endangered and depends on overwintering habitat in the middle and lower Yangtze that will be affected by the dam.[121]

The controversies surrounding the project led to the withdrawal of financial support from international lending organizations like the World Bank, Asian Development Bank, and the US Export-Import Bank. Now the Chinese government has to come up with all the money, which is estimated to be anywhere from a staggering US$24 billion to US$70 billion.[122]

The politics of the Three Gorges Dam

As Dai Qing, the audacious critic of the project points out, the logic of the Three Gorges Project is purely political. The strong political thrusts behind the project (and most of China's other large-scale water control projects) include Party leaders' fondness for large engineering solutions, supported by ideological and nationalistic propaganda and the bureaucratic interests of influential governmental bodies and industries.

Party leaders and large dams

The first proposal to build a dam at Three Gorges dates back to 1919 by Sun Yat Sen, the father of modern China.[123] Later Mao Zedong started envisioning a big dam across the

Yangtze. This vision is said to have inspired him to compose a poem. He even suggested that he might resign as chairman of CCP to work on the project.[124] In March 1958, opposing plans to build a series of small dams on the Yangtze's tributaries in favor of one large dam, Mao officially endorsed the project. However, the nation got so preoccupied in the turmoil of the Great Leap Forward (1958-1960), the subsequent three-year famine, and the Cultural Revolution (1966-1976) that the plan was shelved indefinitely.[125]

Next came Deng Xiaoping. In 1980, he inspected the proposed site and two years later, he pledged to proceed with the project. In 1984, specific proposals were drawn up by the newly formed Yangtze Planning Council under the State Council for erection of the dam. However, objections to the project were raised by different sources, including the Chinese People's Political Consultative Conference (CPPCC).[126] An investigation group was established to prepare a report on the impacts of the project in 1985, with the group concluding that the 1984 proposals were over-optimistic and unrealistic, and that the project would be an unnecessary disaster.[127] Political opposition to the project did not last long, however. In 1989, the Party leaders who opposed the project, including Party General Secretary Zhao Ziyang lost their positions and the role of red specialists like the then-Premier Li Peng became much stronger. Consequently, the project was given a final approval, and this became "Li Peng's pet project."[128] He heads the Three Gorges Project Construction Committee, the main body representing the State Council, set up in 1993. Scheduled to be completed by 2009, construction work is now in its second phase of three phases and is going on smoothly according to recent reports.[129]

This project, then, is presented as being built in memory of key party leaders—Mao Zedong, Zhou Enlai and Deng Xiaoping by its 'promoters.' Opposition to this project, thus, is simply not tolerated by the Party, as happened in the case of Dai Qing, who was imprisoned for 10 months for publishing Yangtze! Yangtze!, a book expressing the views of 40 top Chinese scientists who opposed the dam.[130] It is impossible to reach higher level Party leadership without subscribing to the mainstream ideology of the Party. Many officials show their unquestioned support for these projects to climb up the bureaucratic ladder.[131]

Ideology and propaganda

Certain cultural historical factors feed into the mainstream ideology. There are strong historical credentials that support Chinese leaders' grandiosity in their approach. For example, Chinese engineers solved hydraulic problems of running a south-to-north canal link across the eastward flowing Yellow River and the Yangtze more than a millennium ago.[132] Chinese leaders and the party-controlled media cite these historical credentials to rally people's support for these projects by instigating nationalistic and ideological faith in such projects. Jiang Zemin's November 8, 1997 speech marking the successful damming of the Yangtze for the project makes it amply clear. He calls the event "… a remarkable feat in the history of mankind to reshape nature and exploit natural resources," and the project implementation is an "age-old dream … [come] true" which "proves vividly once again that socialism is superior in being capable of concentrating resources to do big jobs."[133] He goes on to say:

> Since the twilight of history, the Chinese nation has been engaged in the great feat of conquering, developing and exploiting nature…the tale of the Great Yu who harnessed the great floods [is an example] of the ancient Chinese people's indomitable spirit in successfully conquering the nature. Such ancient water conservation project as Dujiangyan completed over 2,000 years ago and the Grand Canal built in the Sui Dynasty all played important role in the socio-economic development of their respective time period.[134]

The promoters of these projects portray these projects as their responsibility to continue and surpass the work of their ancestors, with a conviction that large dams will bring economic benefits and "modernization" to the country. Wen Jiabao, who is tipped to be the next prime minister is quoted as saying, "In the 21st century, the construction of large dams will play a key role in exploiting China's water resources, controlling floods and droughts, and pushing the national economy and the country's modernization forward."[135]

Bureaucratic politics

The management of China's water industry is split amongst three ministries—the Ministry of Water Resources, the Ministry of Construction, and the Ministry of Machine-Building Industry—and municipal and provincial government water-resource bureaus. The responsibilities of these three ministries match their names: the Ministry of Water Resources plans for reservoirs and river projects, and allocates water to industry and cities; the Ministry of Construction administers large public works projects; and the Ministry of Machine-Building Industry is charged with partial oversight of the water engineering equipment sector.[136] The close functional relationship between these ministries and other institutions provides them with a similar interest—promotion and expansion of their activities. The larger and more the number of water control projects there are, the better it is in the interest of China's water bureaucracy and industry, that comprises tens of thousands of governmental bodies, agencies, and institutions, providing economic and professional support to millions of people. These bureaucracies and businesses will stress the functional purposes of the projects—whether it is generation of electricity, jobs, or safety from floods.

Owing to the close association of powerful governmental institutions, and the Party elites with these institutions in the water sector, one observes an informal alliance of interest amongst these groups that could be labeled China's *water-industrial complex*. The water-industrial complex would then represent the informal alliance of the water-related institutions and businesses that influences government policy. This is only superceded in terms of power and size by China's military-industrial complex.[137] Just as many critical scholars blame the 'military industrial complex' for the insane defense expenditures in China (and in other countries like the U.S.[138]), there are similar patterns of bureaucratic interest and informal power associations in China's water-industrial complex that could provide strong politico-economic explanations for China's obsession with 'mammoth' projects despite widespread domestic opposition.

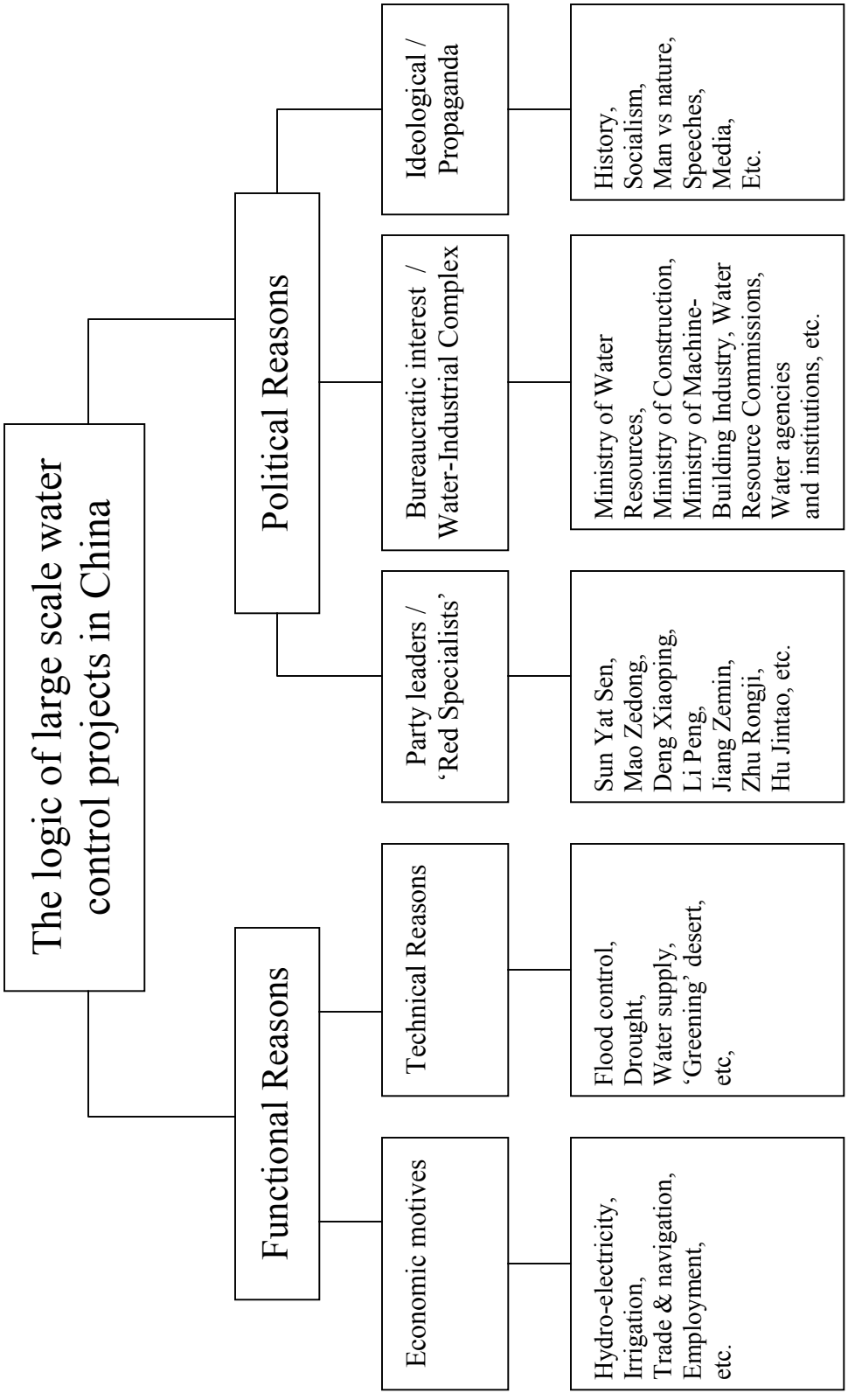

Fig. 5. The logic of large scale water control projects in China

Conclusion: a conceptual framework

The discussion of the Three Gorges Project in this chapter offers a conceptual framework for us to understand why the Chinese government is undertaking these grandiose projects. The following diagram presents the simplified framework.

The logic of large-scale water control projects in China can be grouped under two broad categories—functional reasons and political reasons. Functional reasons include the primary purposes of these projects, which could be subdivided into two groups—economic motives and technical reasons. Economic motives are the direct monetary gains the project is expected to generate. The economic motives of the Three Gorges Project, therefore, include an annual expected return of $62 billion a year, improved trade and navigation along the river. Technical reasons are those associated with the practical purpose of the projects, e.g., water transfer, 'greening' desert, and flood control.

As presented in this chapter, the political reasons provide a stronger explanation for the choice of a single large dam despite the availability of more viable alternatives. These reasons provide an explanation for China's obsession with large scale projects despite, as evident from the case study, the fact that such "mammoth" projectd do not make economic, ecological, or practical sense.

As evident by the depiction of the Three Gorges Dam as being built in honor of China's key leaders like Mao Zedong and Deng Xiaoping, there is a close association between large scale water projects and the Chinese Communist Party, the single party government since the inception of the People's Republic of China in 1949.[139] Party leadership has been dominated by 'hydro-engineers' and the trend still continues as evidenced by the professional background and mindset of leaders like Hu Jintao (an hydraulic engineer) and Wen Jiabao, who are slated to take over as the next President and Prime Minister of China.

The Party's track record of large scale projects, its key leaders' professional association with the water industry, and the existence of an extensive network of water bureaucracy

and businesses make a strong case for the existence of an informal alliance between these groups supporting policy decisions that favor their common interest. The bureaucratic interest of China's water-industrial complex is perhaps the most important reason for the continuing emphasis on large-scale projects, from a politico-economy perspective.

The analytical framework provided here does not claim to provide a complete explanation. It has been constructed for analytical purposes to provide one explanation for China's predilection for large-scale projects. As common sense would suggest, a combination of all these reasons contributes to these outcomes. Although functional reasons are grouped separately from political reasons, every reason is political in nature. Different projects attain varying economic or political significance. Our case study has attained a high level of political and ideological importance to China because of the historical involvement of key Party leaders as compared to, for example, the Yangtze Diversion Project. However, all things being equal, the bureaucratic interest of China's water-industrial complex will be strong behind all the large-scale projects, making it the common denominator and hence the most important factor. The strength of China's water-industrial complex is able to overcome domestic criticisms, including those from governmental bodies such as CPPCC, National People's Congress and the State Environmental Protection Bureau.[140]

The world's skepticism about large dams was confirmed by the World Commission on Dams'[141] report, Dams and Development: A New Framework for Decision-Making,[142] considered to be one of the most authoritative studies on the subject.[143] Similarly, the world is moving away from large-scale structural solutions towards watershed management approaches. The global water management paradigm in general is evolving towards non-structural, integrated river management to meet basic human needs (drinking water and sanitation) and for maintaining the ecological integrity of the environment and watersheds.[144] Today, in countries like the United States, large dams are being decommissioned at rates faster than they are being constructed. These trends have not yet reached China, despite its costly experiences.

5. Water Management towards Human Development

> The most basic capabilities for human development are to lead long and healthy lives, to be knowledgeable, to have access to the resources needed for a decent standard of living and to be able to participate in the life of the community.
>
> -UNDP[145]

As pointed out in the introductory chapter, solutions to China's water problems can be approached from two angles—technological fixes and policy reforms. There has been an overemphasis on technological fixes, specifically large-scale engineering fixes to water problems in China. Unless drastic reforms are made in policy and management practices to balance the present overemphasis on technological fixes, there could be a serious price to be paid by all parties that are directly or indirectly connected by these rivers.

It is beyond the scope of this report to offer technical solutions to the water crisis that envelopes China. Its key purpose is a simple one: to signal a need for a shift in the direction of water policy and practice towards the promotion of human security and development by highlighting the flaws of and identifying the vested interests behind the dominant water management practice in China. To point towards the direction water policy and practice in China need to head in order to achieve the dual goal of human development and ecological preservation, this final chapter highlights some of the characteristics of integrated water resource management that fit these goals well. First it is important to analyze the role of different actors, particularly the state's role in resource management.

The State: Environment or Development?

As noted in Chapters 3 and 4, China's environmental governance system and the bureaucratic politics within the state are ill-equipped at best to solve water problems and a key exacerbator of these problems at worst. Water policy decisions at the national level are dominated by political (bureaucratic) and economic interests of the water-industrial complex, overshadowing the professional position of the State Environmental Protection

Agency. Consequently, state decisions on water issues are in favor of a vested interest that perpetuates large-scale structural fixes. Much owing to the reforms to facilitate the national goal of rapid economic growth, China's environmental governance at the national, provincial, as well as local levels is weak, favoring entrepreneurs and officials seeking economic growth rather than environmental protection (See Chapter 3). These structural limitations call into question the state's role as the key (if not the only) actor in finding and implementing solutions to China's water (environmental) problems.

China's case is not a unique one. The contradiction in the state's dual role of developer and protector of the environment has been observed in many cases.[146] This contradiction has typically exacerbated environmental problems and hindered international environmental initiatives.[147] "The most powerful agencies within the state are precisely those agencies that have derived their institutional power from control over such environmentally damaging activities as energy generation (i.e., coal and hydro-electric sources), intensive cash-crop production, large-scale logging or mining."[148] The state agencies charged with the responsibility of protecting these resources or the environment are the newer, less budgeted, less staffed, and least powerful agencies. And state foreign policies are least reflective of the policies of environment ministries, which are subordinated by powerful ministries such as trade, defense and foreign relations.

Although the environmental protector role of the state has been gaining attention in the last few decades, it is naïve to think that this contradictory role of the state will balance out evenly in the near future. This is particularly true in developing countries where rapid economic growth is the main national goal. States will continue to see their role as a developer as more important for both economic and political reasons, and this role will be fulfilled most often at the cost of the environment. To concerned policy makers and citizens, this raises substantial questions about the fate of the environment and natural resources, especially from a sustainable development perspective, as the government agencies of environmental protection are clearly ill-equipped with political power and technical expertise (amongst other things) to promote "sustainable development" by themselves.

Towards an Integrated River Basin Approach

Each river is unique in terms of its hydrology, flow patterns, assimilative capacity, and many other important natural and human-induced characteristics. These differences necessitate, for one thing, different river basin agencies for each river.[149] Hardly a new concept, river basin agencies manage water according to "watershed principle" (watershed being defined as the area of land that drains into a stream or lake). Such initiatives represent what have been termed "holistic" approaches to resource management. The river basin approach is based on the acknowledgement that rivers (or water for that matter) know no political boundaries. China has seven river basin commissions, each working on integrated management of the entire basin. However, these are only administrative departments under the Ministry of Water Resources, and hence have only advisory roles without any authority. "Recent developments show that Chinese planners believe market forces to be more effective in managing water problems than through river basin commissions,"[150] so there is a lack of necessary political will in China at present to approach river management from a river basin or watershed paradigm.

Policy experts from the World Bank have recommended "Integrated River Basin Management" strategies as potentially a more effective approach for China.[151] "Integrated management" approaches provide a framework for participation and the balancing of <u>all</u> relevant viewpoints and interests in the planning and management of resources, increasingly recognized as a legitimate way of managing water resources for sustainable development.[152] "Watershed initiatives" that have proliferated in Oregon, United States in the last two decades are a good example of such a management approach. "Watershed initiatives are ad hoc, voluntary associations typically featuring both governmental and non-governmental actors organized together to collaboratively seek new strategies for addressing water and related natural resource problems at physically relevant regional scales."[153] This approach, although not unknown, ought to be somewhat interesting to Chinese policy makers who are seeking solutions beyond their compartmentalized bureaucratic approach. In fact, these initiatives represent a direct "response to historical and socio-political trends that have resulted in increasingly

ineffective forums and processes of resource management decision making, and that have subordinated the role of local stakeholders in problem-solving efforts."[154]

"Watershed initiatives" come under "integrated river basin management," which by extension would come under "integrated water resources management." "Integrated water resources management," thus, "is a framework for planning, organizing, and controlling water *systems* to balance all relevant views and goals of stakeholders."[155] Following are some of the broader benefits of such an approach of water management for China (and other related parties) in no particular order.

Non-zero sum approach

Approaches like large-scale water transfers are zero sum in nature. Under a zero sum situation, one party gains or wins at the loss of the other party. Grandiose water control projects like the South-to-North Water Diversion Project would benefit a certain section of North China's urban and farming population at the cost of the supplying region's loss of precious water and ecological resources. An integrated approach to water management, on the other hand, can be a "win-win" situation for all as it balances out the various competing uses of water and the views and interests of the various stakeholders and parties.

In the human interest

Integrated approaches are a respite from "top down" management approaches, which tend to be dominated by the vested interests of large bureaucracies and businesses detrimental to human interest and ecological integrity. Integrated river basin approaches are more prone to promoting human development and ecological preservation. Under this approach, traditionally alternative "soft solutions" that use "technologies with a human face" such as indigenous water harvesting methods and small-scale hydro projects are given preference over economically expensive, environmentally and socially destructive fixes like those discussed in Chapter 2.

Open, inclusive, and transparent platform

These approaches provide an open platform for all parties—state, non-governmental organizations, grassroots actors, stakeholders, and multilateral institutions to exchange views and formulate policies of water management. Theoretically, such an approach would also provide typically disenfranchised peoples like the Tibetans an opportunity to have a say in the policies that affect their daily lives, which is essential for human security and development.

International implications for transboundary riparian issues

Transboundary riparian issues are a result of problems that cut across elements of hydrological cycles and political boundaries. These issues typically arise when human action in the area of the upper riparian states adversely affects the quality and quantity of water available to the people downstream. The principles of integrated river basin management could also serve as models for multilateral river basin management frameworks, such as the Mekong River Commission. Although the Mekong River Commission is acclaimed to be a major achievement towards cooperative international effort for managing a river basin for sustainable development, it is clear from its achievements and activities in the last seven years that the Commission has a long way to go towards "sustainable development" practices. Amongst other criticisms (such as the non-cooperation of the upper riparians—China and Burma, and the dominance of more powerful signatory members like Thailand), the Commission has been criticized for "institutional rigidity," exclusion of stakeholders in decision-making, and focus on large infrastructural needs of the state.[156] An integrated approach could solve some of these limitations of the Mekong River Commission and other multilateral frameworks in achieving sustainable development of water and related resources in the river basin.

Local autonomy

One of the social costs of a "top down" management approach is loss of local autonomy. Centrally planned and operated projects like the South-to-North Water Diversion Project adversely affect local people's livelihoods, particularly at the point of diversion. For example, although the Tibetan people living in the area of the western route of the South-to-North Water Transfer Project (*Amdo* and *Khampa* Tibetans) have been using these

waters for centuries, the construction of the project will result in the loss of their traditional water rights to the Chinese "state." China's large infrastructure projects in Tibet have typically resulted in marginalizing traditional Tibetan livelihoods, making the poor and the disenfranchised worse off.[157] Therefore, it is arguable that these projects contribute to "human poverty" (defined as the denial of opportunities most basic to human development) rather than "development." Integrated approaches, on the other hand, represent the opposite—a "bottom up" approach that fights human poverty by providing people (stakeholders) a say in the way resources on which their livelihoods depend are to be used.

Qualitative focus

More enlightened scholars and leaders around the world repeatedly point to ethical values as the "missing link" towards sustainable development and global responsibility.[158] As the tradition of human development seeks to bring a much-needed qualitative focus to the mainstream opulence-oriented approach to economic progress, integrated water resource management brings in a similar focus to the mainstream engineering-oriented approach to water management. Values like respect for aquatic and other related life forms, water conservation, and water quality are central to this emerging water management paradigm.

"*Sound" economic approach*

Two aspects of the economics of integrated resource management make it an exemplary approach. Owing to the focus on eco-friendly solutions that use "soft" technologies, this approach is affordable, often even at the local level. Furthermore, owing to the participation of different stakeholders, this approach gives recognition to (and perhaps inclusion of) various costs that are often ignored in the mainstream economic approach. For example, "[m]ass transfer of water is often justified by considering only the direct cost of transporting water. Seldom are the values of services forgone by the exporting region due to reduction of their water availability, i.e. the opportunity costs of exported water analysed."[159] Similarly, there are various environmental and social costs that should be given proper recognition while assessing various alternative projects, if not included in the total costs due to the technical difficulty of cost estimation.

Avenue for new strategies

The mainstream approach has been towards continually expanding supply to meet rising water requirements for industrial and agricultural production (at least in the last five decades in China). Such an approach is now considered an "unrealistic solution" due to rising political sensitivity and "environmental stress" due to the dual trends of economic growth and population explosion. Alternative strategies such as promoting efficient use of available water, changing cropping patterns, better management of watersheds, proper water pricing, demand management, etc. lack the sufficient political support necessary to be taken up in the present water management practices. The complex nature of China's water crisis calls for a paradigm shift towards approaches that are open to different kinds of solutions and new experiments. Facilitation of dialogue between stakeholders and interested parties could lead to new and ingenious strategies that are efficient, effective, inexpensive, and environment friendly.

Conclusion

The issues related to water management problems in China are complex. This report does not claim integrated water management will solve China's water problems. The main reason for choosing this approach is because this paradigm comes closest to the values that this report seeks to further in China's water management paradigm—fairness, human interest, and sustainability. Although Chinese political and bureaucratic realities do not leave much room for such approaches, this report posits that the situation is only going to get worse unless serious institutional and policy changes are made. Current development priorities and the water management paradigm and mechanisms are clearly ill-equipped to solve its obdurate water problems. The developments in the institutional structure and water management approaches in countries such as Mexico and Brazil point to the fact that such changes are indeed possible. For example, previously a part of Ministry of Agriculture (the largest consumer of water), Mexico's National Water Commission is now a decentralized institution under the Ministry of Environment, Natural Resources and Fisheries. The planning and management of water resources now start at the local level based on the principles of integrated river basin management.

The basic argument this report seeks to make is that the end of development and resource management policies should be to promote the human development at a sustainable level. Meeting the basic needs of people, particularly of our deprived contemporaries is the most important element of human development. Large-scale development projects that feed the interests of powerful bureaucracies and businesses are fundamentally counter to human development. The noted expert on global water issues, Peter Gleick said, "[s]uccessfully meeting human demands for water in the next century will increasingly depend on the non-structural solutions and a completely new approach to planning and management."[160] Other than a shift to non-structural solutions, this report asserts that the empowerment of people with choices for water use and management will benefit all, be it a farmer in the deserts of Xinjiang or a nomad on the Tibetan Plateau.

Endnotes

[1] Jeffrey Rothfeder, *Every Drop For Sale, Our Desperate Battle Over Water in a World About to Run Out,* (Penguin Putnam, 2001), p. 99.
[2] United Nations Development Program, "Human Development Trends," *Human Development Report:2002,* (http://www.undp.org/hdr2002/facts.html).
[3] Asit K. Biswas, "Water for Sustainable Development," Biswas, and Tsuyoshi Hashimoto (eds.), *Asian International Rivers,* (Oxford University Press, 1996).
[4] Peter H. Gleick, The World's Water: 2000-2001, (Island Press, 2000), pp. 25 and 26.
[5] "China," People's Republic of China, includes the militarily occupied nation of Tibet, and other areas lived by other peoples such as Uighurs and Mongolians.
[6] Source for "Annual Renewable Water Resources" : Ibid., op. cit., p. 201. Source for population figure: The World Bank. Year 2000 census. (www.worldbank.org).
[7] The world average per capita water resource is 1,000 m3/person/year and China's per capita water resources of 2,343 m3/person/year. See, The World Bank, *China: Air, Land, and Water,* August 2001, p. 52. The per capita water resource in North China is 556m3. See, Zhang Guanghui, *Water Shortage Problems and Strategies for Water Sustainable Utilization in China,* Ministry of State and Land Resources.
[8] U.S. Embassy Beijing Report, *PRC Water: Waste A Lot, Have Not: The Problem Is Policy Not Technology,* (November 1997).
[9] Elizabeth Economy, "Painting China Green: The Next Sino-American Tussle," *Foreign Policy,* Vol. 78, No. 2.
[10] "An overview of Chinese Water Issues," *China Environment Series,* (1997), p. 47.
[11] Lester R. Brown, "Worsening Water Shortages Threaten China's Food Security," *Earth Policy Institute,* (October 4, 2001).
[12] World Bank, *China: Air, Land, and Water,* (2001). See, Table 3.1 on page 48.
[13] See e.g., Jih-Un Kim, Drifting on the Drying Water Pool: China's Water Scarcity and It's Political Foreboding," *Asian Perspective,* Vol. 25, No. 1, 2001, pp. 133-135; Jack A. Goldstone, "Imminent Political Conflicts Arising from China's Environmental Crises," *Environmental Change and Acute Conflict,* No. 2, (December 1992).
[14] Pramod Parajuli, "How Can Four Trees Make a Jungle?," *Terra Nova: Nature and Culture,* Vol. 3, No. 3, 1998, p. 7.
[15] It is legitimate to be skeptical about the attribution of human traits to things not human like large organizations, or to speak of such organizations with the language we use to speak about humans. To avoid this analytical fallacy, for the purposes of this report, be it known that when "state" or "China" is referred to with human traits, we mean those governmental officials charged with setting and enacting policies (itself). Courtesy: Gary L. Scott & Craig L. Carr, "Are States Moral Agents?", *Social Theory and Practice,* Vol. 12, No. 1, (Spring 1986), p. 75.
[16] Sudhir Anand & Amartya K. Sen, "Sustainable Human Development: Concepts and Priorities," *Occasional Papers* (8), Human Development Report Office. (http://hdr.undp.org/docs/publications/ocational_papers/Oc8a.htm)
[17] Mel Gurtov, *Global Politics in the Human Interest,* (Lynne Rienner Publishers, Inc., 1999), p. 76.
[18] See, Human Development Report: 2002, *Deepening Democracy in a Fragmented World,* (http://www.undp.org/hdr2002/); Arab Human Development Report:2002, *Creating Opportunities for Future Generations,* (http://www.undp.org/rbas/ahdr/english.html); etc. For works representing the human development school of thought other than the Human Development Reports published by UNDP, see, e.g., Mahbub ul-Haq, "Human Rights, Security, and Governance," *Peace & policy,* Vol. 3, No. 2, (Fall/Winter 1998); Caroline Thomas & Peter Wilkin, *Globalization, Human Security, and the African Experience,* (Lynne Rienner Publishers, Inc., 1999); T. Matsurnae and L.C. Chen (eds.), *Common Security in Asia: New Concepts of Human Security,* (Tokai University Press, 1995); Robert C. Johansen, *The National Interest and the Human Interest: An Analysis of U.S. Foreign Policy,* (Princeton University Press, 1980); Peter Stoett, *Human and Global Security*, (University of Toronto Press, 1999); Rob McRae and Don Hubert (eds.), *Human Security and the New Diplomacy*, (McGill-Queen's University Press, 2001); Cristobal Kay (ed.), *Globalization Competitiveness and Human Security*, (Frank Cass, 1997); etc.
[19] Human Development Report:2001, p. 9.
[20] Anand and Sen, loc. cit.

[21] See e.g., Tibetan Government in Exile, *Height of Darkness: Chinese Colonialism on the World's Roof,* (December 2001); Tashi Tsering, *Globalization To Tibet*, (Tibet Justice Center, July 2002); etc.
[22] Tsering, ibid.
[23] The 1997 Human Development Report defines human poverty as the deprived state of "opportunities and choices most basic to human development …—to lead a long, healthy, creative life and to enjoy a decent standard of living, freedom, dignity, self-respect and respect for others." See, *Human Development to Eradicate Poverty,* p. 15. For discussions on the relation between people's participation and human development, see, Human Development Report: 1993, *People's Participation.*
[24] Anand and Sen, loc. cit.
[25] Ibid.
[26] For the purposes of analysis, this paper will include Peoples Republic of China's illegally occupied nations of Tibet, Xinjiang, and others in "China."
[27] Year 2000 census. The World Bank. (www.worldbank.org).
[28] The World Bank, *China: Air, Land, and Water,* August 2001, p. 52.
[29] Tibetan names for the rivers will be in italics. The Chinese name for Yellow river is Huanghe.
[30] See. Ministry of Water Resources, The World Bank and AusAID, *China: Agenda for Water Sector Strategy for North China,* 2001.
[31] Gerhard K. Heilig, *Can China Feed Itself?: A System for Evaluation of Policy Options,* The International Institute for Applied Systems Analysis, *(http://www.iiasa.ac.at/Research/LUC/ChinaFood/index_m.htm).*
[32] Ministry of Water Resources, The World Bank and AusAID, *China: Agenda for Water Sector Strategy for North China,* 2001, p. 8.
[33] Tibetan names of rivers will be in italics, followed by Chinese names, henceforth.
[34] Min Chiang and others.
[35] Brahmaputra/*Yarlung Tsangpo*, Mekong/ *Zachu*/Lancang Jiang, Salween/ *Gyalmo Ngulchu*/Nu Jiang, Red/ Yuan Chiang.
[36] Tarim, Ili, Ertix/Irysh and others.
[37] Industrial waste water discharge accounted for 75% of waste water in China in 1989 (See., Wang Jusi, "Water Pollution and Water Shortage Problem in China," *Journal of Applied Ecology,* Vol. 26, No. 3, (Dec., 1989), pp. 851-857.) Interestingly, the quantity of industrial waste water discharges has been decreasing since the latter half of 1990's (World Bank statistics).
[38] The main pollution indicators in these rivers are permanganate index, non-ionic ammonia, Biological Oxygen Demand (BOD), petroleum, etc.
[39] See e.g., Kim, loc. cit.; Mark Hertsgaard, "Our Real China Problem," *Atlantic Monthly,* November, 1997. (www.theatlantic.com/issues/97nov/china.htm); etc.
[40] Hertsgaard, loc. cit.
[41] For discussions of environmental law and policy in China, see, Ma and Ortolano, loc. cit.; Wang Hanchen and Liu Bingjiang, "Policymaking for Environmental Protection in China;" William P. Alford and Yuanyuan Shen, " Limits of the Law in Addressing China's Environmental Dilemma;" The effectiveness and Efficiency of Environmental Policy in China;" Robert P. Weller and Peter K. Bol, "From Heaven-and-Earth to Nature: Chinese Concepts of the Environemt and Their Influence on Policy Implementation" in Michael B. McElroy, Chris P. Nielson, and Peter Lydon (Ed's.), *Energizing China: Reconciling Environmental Protection and Economic Growth,* (Harvard University Press, 1998), pp. 371-499); Ross, loc. cit.; Lestor Ross, "Environmental Policy in Post Mao China," *Environment,* Vol. 29, No. 4, May 1987; Lester Ross, "Environmental Law and Policy in China: Prospects for Research," *China Exchange News,* Vol. 18, No. 4, December 1990.
[42] Wei Lianchun, "Occupational and Environmental Risk Factors for Asthma in Rural Communities in China," *International Journal of Occupational and Environmental Health,* No. 44, 1994.
[43] Alford and Shen, op. cit., p. 411.
[44] Ibid.
[45] See supra note 18; Kim, loc. cit.
[46] Kenneth Lieberthal, "China's Governing System And Its Impact on Environmental Policy Implementation," *China Environment Series,* The Woodrow Wilson Center publications.
[47] Ibid.; Kim, loc. cit.
[48] See, Kenneth Lieberthal and David M. Lampton, *Bureaucracy, Politics, and Decision Making in Post-Mao China*, (University of California Press, 1992).

[49] See Lieberthal, op. cit., p. 4.
[50] Kenneth Lieberthal, "China's Governing System And Its Impact on Environmental Policy Implementation," op. cit., pp. 4-5.
[51] Ibid., op. cit., p. 63.
[52] Panayotou, op. cit., p. 443.
[53] Chris P. Nielsen and Michael B. McElroy, "Introduction and Overview," McElroy, Nielsen, and Lydon (Ed's.), op. cit., p. 20.
[54] The World Bank, China: Air, Land, and Water, op. cit., p. 54.
[55] See e.g., Shui Fu, "A Profile of Dams in China", *The River Dragon Has Come!,* Dai Qing, John G. Thibodeau, & Philip B. Williams (Eds.), (ME Sharpe, 1998), p. 22.
[56] Source of figure on the number of dams from The World Commission on Dams, "China," *Dams and Water: Global Statistics,* (http://www.dams.org/global/china.htm). Source of figure on the total storage capacity of China's reservoirs, from Zhang Chunyuan, Vice Minister, Ministry of Water Resources, *Sustainable Utilization of Water Resources in China.*
[57] Figure source: The World Commission on Dams.
[58] See, Jiang Zemin's speech marking Yantze Damming for Three Gorges Project, November 8, 1997, (http://www.china-embassy.org/Cgi-Bin?Press.pl?gorges02).
[59] The dialectic term "glocalization" is a combined notion of globalization and localization. It recognizes the increasing interaction between global and local forces. Hence, a "recognition of the greater importance of the local and global levels compared with the interposed national level. Even more important is the shift of emphasis from units, entities, or actors towards the flows, interactions, linkages, and bonds among them." See, for a very interesting discussion on "glocalization" and *Reflections on Water: New Approaches to Transbounday Conflicts and Cooperation,* Joachim Blatter and Helen Ingram (Eds.), (The MIIT Press, 2001).
[60] What the present government of China describes as "Tibet" refers only to the so-called Tibet Autonomous Region created in 1965 and represents only about half of Tibetan peoples' Tibet.
[61] Environment and Development Desk, Department of Information and International Relations, *Tibet 2000: Environment and Development Issues,* p. 19.
[62] Ibid.
[63] "The Channel within Jiangsu Province, up to the border with Shandong, is already basically finished, complete with pumping stations, as is the segment with the North Yellow River to Tianjin." See, US Embassy (Beijing), *Issues Surrounding China's South-North Water Transfer Project,* (April 2001).
[64] Ibid.
[65] US Embassy (Beijing), "South-North Water Transfer Ready to Start Work," *Beijing Environment, Science and Technology Update,* (November 16, 2001).
[66] US Embassy (Beijing), *Issues Surrounding China's South-North Water Transfer Project,* (April 2001).
[67] Ministry of Water Resources, People's Republic of China, *Brief Introduction of the Planning for South-to-North Water Transfers,* (1995).
[68] Figure source: ibid. There are also plans to divert water from the Three Gorges Dam into the Danjiangkou Dam for the future. See, e.g., Liu Changming, *Environmental Issues and the South-North Water Transfer Scheme of China,* United Research Center for Water Problems, The Chinese Academy of Sciences.
[69] The Ertan Dam (240m in height) is also on the *Ngagchu* River. The Ertan Project also boasts Asia's largest underground powerhouse and one of the world's longest diversion tunnels (1167m in length).
[70] Courtesy: Thinley Norbu, Steven Marshall, and Tsering Yankey for help research on Tibetan names of rivers and mountain ranges.
[71] Bayankala is a Mongolian name. The Tibetan names include *Bayan Ha Ri* and *Bayan Rigyue*. However, the local Tibetans in that region call it *Trala* (krta la). Courtesy: Tsering Yangkey. Personal communication. July 14, 2002. In the *Tibet: Environment and Development Issues (1992),* the name for *Bayan Ha Ri* is *Yagra Tagtse* Range. It is common to have different names to a single river or mountain range in Tibet due to differences in local dialects and interpretations.
[72] US Embassy (Beijing), *Issues Surrounding China's South-North Water Transfer Project,* (April 2001).
[73] Ministry of Water Resources, People's Republic of China, *Brief Introduction of the Planning for South-to-North Water Transfers,* (1995).
[74] US Embassy (Beijing), *Issues Surrounding China's South-North Water Transfer Project,* (April 2001).

[75] US Embassy, *Issues Surrounding China's South-North Water Transfer Project,* loc. cit.
[76] US Embassy, *PRC South to North Water Project,* (April 2000), loc. cit.
[77] Figure source: US Embassy, *PRC South to North Water Project,* (April 2000). For an excellent profile of the watersheds of Yellow, Mekong, Salween, and Yangtze, see, Carmen Revenga, Siobhan Murray, Janet Abramovitz, and Allen Mahmond, *Watersheds of the World: Ecological Value and Vulnerability,* (World Resources Institute and Worldwatch Institute 1998), pp: 2-81, 2-92, 2-97, and 2-104.
[78] US Embassy, *PRC South to North Water Project,* (April 2000).
[79] Tibetan Government-in-exile, *Tibet 2000: Environment and Development Issues,* p. 29
[80] Peter Heller, "Liquid Thunder," *Outside,* (July 2002), p. 85.
[81] Damien Mcelroy, "China Planning Nuclear Blasts to build hydro Power," *China's People Daily,* Issue 1976, (Sunday 22 October, 2000). During the mid-1980's there were also reports of plans to construct a series of 11 dams around the "Brahmaputra loop." See: Tibetan Government-in-exile, *Tibet 2000: Environment and Development Issues,* p. 29.
[82] Tibetan Government-in-exile, *Tibet 2000: Environment and Development Issues,* p. 29
[83] See, "Breach in Tibet Dam Caused Arunachal Floods," *Times of India*, (July 8, 2000); "India Blames Flash Floods on Chinese Dam," *Agence France Presse,* (July 10, 2000); "Arunachal floods—dam breach in Tibet, China 'hushed' it up," *Indian Express,* (July 10, 2000).
[84] Suresh R. Chalise, "Water Resource Management in the Hindukush Himalaya: An Overview," *Waters of Life: Proceedings of the Regional Workshop on the Local Water Harvesting for Mountain Households in the Hindu Kush-Himalayas,* (International Center for Integrated Mountain Development, 1999).
[85] Carmen Revenga, Siobhan Murray, Janet Abramovitz, and Allen Mahmond, *Watersheds of the World: Ecological Value and Vulnerability,* (World Resources Institute and Worldwatch Institute 1998), pp: 2-81, 2-92, 2-97, and 2-104.
[86] This essay does not use the name "Myanmar" given to Burma by the military junta government in 1988. "Burma" is used in accordance with the Burmese National League for Democracy, the United States Government and many other countries, and leading publications including *The Far Eastern Economic Review, The Bangkok Post, The Washington Post.*
[87] For a map of the 14 dam sites, see Hiroshi Hori, *The Mekong: Environment and Development,* (United Nations University Press, 2000), p. 202.
[88] Ibid.
[89] David Blake, "Proposed Mekong Dam Scheme in China Threatens Millions in Downstream Countries," *World Rivers Review,* International Rivers Network, (June 2001), p. 4.
[90] Philip Hirsch, "Mekong Fisheries: A Hidden Resource," *Geodate,* Vol. 11, Issue 4, (September 1998).
[91] Ibid.
[92] David Plinston & He Daming, "Water Resources and Hydropower in the Lancang River Basin," *Policies and Strategies for Sustainable Development of the Lancang River Basin,* (Landcare Research New Zealand Ltd. May 2000), pp. 241.
[93] Chapman, Damming, loc. cit.
[94] Department of Strategy and Planning, State Power Corporation of China. As cited in David Plinston & He Daming, op. cit., p. 242. The total area inundated figure is given as 149,564 mu's, which is converted into acres by multiplying by 0.165 as 1 mu is $1/6^{th}$ of an acre.
[95] Zhang Chunyuan, *Sustainable Utilization of Water Resources in China.* US-China Workshop, April 1999, US-China Water Resources Management Program, (http://www.lanl.gov/chinawater/documents/zhangchunyuan.pdf).
[96] There scientific reports that would speak counter to the position of this paper. For example, Plinston and Daming's report argues that argue that the dam projects will benefit the downstream riparian states, from a very biased and limited perspective (hydrological).
[97] "Some Facts about the Three Gorges Dam", (http://www.china-embassy.org/Cgi-Bin/Press.pl?gorges04)
[98] See e.g., "Three Gorges Project and China's Economy", loc. cit.; "Three Gorges Project Seeks Extra Funding", *Xinhua*, (March 16, 1999).
[99] "Three Gorges Project and China's Economy", (http://www.china-embassy.org/Cgi-Bin/Press.pl?gorges03)
[100] As footnoted in Adams & Ryder: Guo Yuan & Jeff Logan et al., *China's Electric Power Options: An Analysis of Economic and Environmental Costs* (Batelle Memorial Institute, June 1998), p. 82.

[101] As footnoted in Adams & Ryder: Jeff Logan of the Batelle Memorial Institute calculated the price of three Gorges power based on the following assumptions: a capital cost of $30 billion or $1,650 per installed kilowatt, a 9-year construction period, a 12-percent interest rate, a 53-percent capacity factor, and operation and maintenance costs of 0.5 cents per kWh.
[102] Adams & Ryder, loc. cit.
[103] See e.g., ibid.; James Kynge, "New Doubts Over Chinese Plant", *Financial Times,* (March 10, 2000), available at (http://www.irn.org/programs/threeg/001009.doubts.html).
[104] Adams & Ryder, loc. cit.
[105] See, charts showing "changes in age structural distribution of the Chinese population in %" and "forecast on the labor resources of China (1981-2000), Bouchan, op. cit., pp. 10&11.
[106] See "Three Gorges Project: A Symbol of Uncontrolled Development in the Late Twentieth Century", Dai Qing, Qing, Thibodeau, & Williams (Eds.), op. cit., p. 11-12.
[107] Damien Mcelroy, "China Planning Nuclear Blasts to build hydro Power," *China's People Daily,* Issue 1976, (Sunday 22 October, 2000).
[108] Working Group on Environment in US-China Relations, "An Overview of Chinese Water Issues", *China Environment Series,* Aaron Frank, (Ed.), (Woodrow Wilson Center), No. 2, (Summer 1998), p. 46.
[109] "The Three Gorges Dam and China's Energy Dilemma", Qing, loc. cit.
[110] See e.g., David Goodman, "Damming the Yangzi", *China Now,* No. 126., (Autumn 1988), p. 15.
[111] "A Dream for Generations to Come True", *The Three Gorges Project: A brief Introduction*, (http://www.china-embassy.org/Cgi-Bin/Press.pl?105).
[112] Formerly a part of Sichuan province, described by the World Bank as the world's largest single metropolitan area with a population of about 43 million, including some six million city residents. See., Decades Needed to Develop China's Backward West", *Reuters,* (January 5, 2001).
[113] Leonard S. Sklar & Amy L. Luers, "Report on a Site Visit to the Three Gorges Dam, Yangtze River, Hubei Province, China", (http://www.irn.org/programs/threeg/sklar.html).
[114] Compare figures provided by Chinese government sources e.g. "Some Facts About The Three Gorges Project", (http://www.china-embassy.org/Cgi-Bin/Press.pl?gorges04), to figures provided by the International Rivers Network, "Three Gorges Dam Specifications", (http://irn.org/programs/threeg/991228.3gspecs.html). Also see, A Zich, "Before the flood: China's Three Gorges," *National Geographic,* Vol. 192, No. 3, (1997), pp. 2-33.
[115] See e.g., Wu Ming, "Disaster in the Making?: Major Problems Found in the Three Gorges Resettlement Project", *China Rights Forum,* (Spring 1998), pp. 4-9; Wu Ming, "Resettlement Problems of the Three Gorges Dam: A Field Report", (http://www.irn.org/programs/threeg/resettle.html).
[116] See, "Three Gorges Resettlement Program Enters Key Stage", *Xinhua*, (January 12, 1997). The same news article is also reprinted on the internet by the Chinese government, see, (http://www.china-embassy.org/Cgi-Bin/Press.pl?255). According to Boning, op. cit., p. 41., 326 townships and 1,351 villages will also be submerged by the reservoir.
[117] For a detailed discussion on submergence of these archaeological cites, see, "The Danger to Historical Relics and Cultural Antiquities In and Around the Three Gorges Area: Interviews with the Director of the National History Museum of China Yu Weichao", Dai Qing, Qing, Thibodeau, & Williams (Eds.), op. cit., pp 124-142. Also, see "Letter to Jiang Zemin Concerning Archaeological Sites, August 8, 1996", Appendix F, Qing, Thibodeau, & Williams (Eds.), op. cit., pp. 214-219.
[118] See e.g., Luna B. Leopold, "Sediment Problems at Three Gorges Dam" University of California, Berkeley, (http://www.irn.org/programs/threeg/leopold.html).
[119] Jonathan Spence, "A Flood of Troubles", *The New York Times Magazine,* (January 5, 1997), p. 34.
[120] See, Ibid. and Leopold, loc. cit.
[121] Peter Gleick, "The Status of Large Dams: The End of an Era?," Peter H. Gleick, *The World's Water: The Biennial Report on Freshwater Resources (1998-1999),* (Island Press 1998), p. 90.
[122] In "Three Gorges Project Seeks Extra Funding", *Xinhua* (March 16, 1999) the total cost is mentioned to have been estimated at 203.9 billion yuan (24.6 billion US $). Dai Qing, one of the leading voices on the project says some estimates run up to 72 billion US$, see, James L. Tyson, "Ardent Foes Takes on China Dam", *Christian Science Monitor,* Vol. 89, No. 243, p. 1.
[123] The Kuomintang government, under Chiang Keisheik tried to follow up on Sun Yat Sen's proposal in the 1940's. Experts were invited from the United States (US), and signed agreements with the US

government to jointly design the dam, to be dropped later due to economic crises. See, "Chronology of Three Gorges Project", (http://www.china-embassy.org/Cgi-Bin/Press.pl?gorges05)

[124] See footnote, "Three Gorges Project: A Symbol of Uncontrolled Development in the Late Twentieth Century", Dai Qing, Qing, Thibodeau, & Williams (Eds.), op. cit., p. 13.

[125] In 1970, work started on the construction of Gezhouba Dam as a part of the Three Gorges Project. Gezhouba Dam is built downstream from Three Gorges site further near the city of Yichang. However, China was economically in such shambles by the late 70's that its "red specialists" (Chinese leaders trained in the Soviet Union as engineers) were unable to carry on with the construction project.

[126] David Goodman, "Damming the Yangzi", *China Now,* No. 126., (Autumn 1988), pp.13-15.

[127] Goodman, loc. cit.

[128] See, Kari Huss, "More Dam Troubles", *Far Eastern Economic Review*, (October 20, 1994), p. 70.

[129] See e.g., "China Says Huge Dam Project Is Going Smoothly", *New York Times,* (October 26, 2000); Table 1.2: Construction Phases in "Three Gorges Project: A Symbol of Uncontrolled Development in the Late Twentieth Century", Dai Qing, Qing, Thibodeau, & Williams (Eds.), op. cit., p. 15.

[130] "Party rule in China is theoretically a means to an end—it is the vehicle for representing the wishes of the proletariat and establishing a communist society. In reality, the Chinese political system is not a 'dictatorship of the proletariat' [as laid out in the constitution] but a 'dictatorship of the party-state." See, Shaun G. Breslin, "China: Developmental State or Dysfunctional Development?", *Third World Quarterly,* Vol. 17, No. 4, (1996).

[131] Qing, "The Three Gorges Dam and China's Energy Dilemma"

[132] See, "A Flood of Troubles", Jonathan Spense, *New York Times Magazine,* (May 1, 1997), p. 39.

[133] See, "Jiang Zemin's Speech Marking Yangtze-Damming for Three Gorges Project," (November 8, 1997), (http://www.china-embassy.org/Cgi-Bin/Press.pl?gorges02).

[134] Ibid.

[135] Mcelroy, loc. cit.

[136] Dylan Tanner, "Opening the Floodgates," *China Business Review,* Vol. 25, No. 2, (Mar/Apr 1998).

[137] For a chart of "China's Defense Industrial Bureaucracies and Trading Corporations," see, Mel Gurtov & Byong-Moo Hwang, *China's Security: The New Roles of the Military,* (Lynne Rienner, 1998, p. 154. For discussions on China's military-industrial complex, see, Solomon M. Karmel, *China and the People's Liberation Army: Great Power or Struggling Developing State?,"* (St. Martin's Press, 2000); David Welker, "The Chinese military-industrial complex goes global," *Multinational Monitor,* Vol. 18, No. 6, (June 1997); S.V. Lawrence, "Inside Beijing's Arms Bazaar," *U.S.News & World Report,* Vol. 111, No. 4, (July 7, 1991); etc.

[138] The term military-industrial complex has its origins in the US. See, C. Wright Mills, *The Power Elite,* (Oxford University Press, 1956); Kurt Hackermer, *The U.S. Navy and the Origins of the Military-Industrial Complex, 1847-1883,* (Naval Institute Press, 2001); Sam C. Sarkesian (Ed.), *Military-Industrial Complex: A Reassessment*, (Sage Publications, 1972); Bruce Brunton, "A Historical Perspective on the Future of the Military-industrial Complex," *Social Science Journal,* Vol. 28, No. 1; etc.

[139] Gezhouba dam, for example, was built as a "birthday present" to Chairman Mao. Interestingly, it took 19 years to finish, 14 years more than estimated, and cost 5 billion Chinese yuan whereas the estimated cost was only 1.35 billion yuan. To add to it this dam is associated with low electrical generation, water pollution and navigational tie-ups.

[140] See, Peter Gleick, *The World's Water: The Biennial Report on Freshwater Resources (1998-1999),* (Island Press 1998), p. 92.

[141] Initiated by the World Bank and the World Conservation Union (IUCN), the World Commission on Dams was set up to "review the development effectiveness of large dams and assess alternatives; develop a framework for assessing options and decision-making processes for water resources, energy services and development; and develop internationally-acceptable criteria and guidelines for planning, designing, construction, operation, monitoring, and decommissioning of dams."

[142] The World Commission on Dams, *Dams and Development: A New Framework for Decision-Making,* (Earthscan Publishers, November 2000).

[143] The report is endorsed by international organizations like the IUCN, World Bank, United Nations Environmental Program, Asian Development Bank, Rivers Watch East and Southeast Asia, World Waters Council, World Health Organization, etc; and by hundreds of NGOs from all over the world, like the Berne

Declaration (140 NGOs from 39 countries), Rivers Watch East and Southeast Asia (more than 50 groups from 15 countries), etc. However, there are also national (such as Russian National Committee of Large Dams) and international organizations (International Commission on Large Dams) that has disagreements with the report.

[144] See e.g., Peter Gleick, "The Changing Water Paradigm: A Look at Twenty-first Century Water Resources Development," *Water International,* Vol. 25, No. 1, (March 2000), pp. 127-138; Peter Gleick, "The Human Right to Water," *The World's Water: 2000-2001,* (Island Press, 2000), pp. 1-17; McCully, loc. cit.; Christopher L. Lant (ed.), *Human Dimensions of Watershed Management,* (American Water Resources Association, 1999); etc.

[145] Human Development report: 2001, p. 9.

[146] For a more detailed analysis of state's dual role of developer and protector of the natural environment, and how it may be reflected in intra-state and inter-state conflict, see Raymond L. Bryant and Sinead Bailey, "The State," *Third World Political Ecology,* (Routledge 1997), pp. 48-75.

[147] For readings covering state's role at international environmental initiatives, see e.g., Andrew Hurrel and Benedict Kingsley, *The International Politics of the Environment: Actors, Interests and Institutions,* (Clarendon Press 1992); Ken Conca and Geoffrey D. Dabelko (Ed.), *Green Planet Blues: Environmental Politics from Stockholm to Kyoto,* (Westview Press 1998); Gareth Porter and Janet Welsh Brown, *Global Environmental Politics,* (Westview Press 1996);etc. For readings covering specific ways in which state policies have contributed to environmental degradation, see e.g., Philip Hurst, *Rainforest Politics: Ecological Destruction in South-East Asia,* (Zeb Books 1990); Robert C. Repetto and Malcolm Gillis (Eds.), *Public Policies and the Misuse of Forest Resources,* (Cambridge University Press 1998); etc.

[148] Ibid., op. cit., p. 62.

[149] There are three basic "design options" for a river basin agency – committee, authority, and commission. A committee generally coordinates high level policy and strategy but has no role in daily operation. An authority is the strongest intervention absorbing all or most of water and related functions in the basin. And a commission generally deals with the following tasks – policy, strategy, planning, data collection and management, monitoring, specification of standards, and related matters. See, The World Bank, *China: Air, Land, and Water: Environmental Priorities for a New Millennium*, pp. 65-66.

[150] Courtesy: Ma Jun. Telephone conference interview. June 2002.

[151] The World Bank, *China: Air, Land, and Water: Environmental Priorities for a New Millennium,* pp. 64-65.

[152] See, Economic and Social Commission for Asia and the Pacific, United Nations, *Guidelines on Water and Sustainable Development: Principles and Policy Options,* (1997).

[153] Douglas S. Kenney, "Historical and Sociopolitical Context of the Western Watersheds Movement," Christopher Lant (Ed.), *Human Dimensions of Watershed Management,* Monograph No. 20, American Water Resources Association, (1990), p. 493.

[154] Ibid.

[155] Neil S. Grigg, "Integrated Water Resources Management: Who Should Lead, Who Should Pay?," ibid., op. cit., p. 528.

[156] Tashi Tsering, *Mekong: Managing a Transboundary River,* Tibet Justice Center, (2001). Available online at http://www.tibetjustice.org/reports/mekong.pdf.

[157] See, e.g., Tibet Information Network, *China's Great Leap West,* (November 2000); Department of Information and International Relations, Tibetan Government-in-exile, *Tibet 2000: Environment and Development Issues;* Steven D. Marshall and Susette Ternent Cooke, *Tibet Outside the TAR: Control, Exploitiation, and Assimilation. Development with Chinese Characteristics* (CD-Rom), The Alliance for Research in Tibet; Tashi Tsering, *Globalization To Tibet,* Tibet Justice Center, (2002); J. Charles, *Livelihoods Lost?: Globalization, WTO Accession and the Future of the Tibetan People,* Free Tibet Campaign, (http://www.freetibet.org/menu.htm); etc.

[158] See The Dalai Lama, *Ethics for the New Millennium,* (Putnam Publishing, 1999); Green Cross International, *Globalization and Sustainable Development: Is Ethics the Missing Link?,* (February 2002); Peter H. Gleick, "The Changing Water Paradigm: A Look at Twenty First Century Water Resources Development," *Water International,* Vol. 25, No. 1, (March 2000), pp. 127-138; etc.

[159] Asit K. Biswas, "Long-Distance Water Transfer: Problems and Prospects," Asit K. Biswas, Zuo Dakang, James E. Nickum, Liu Changming, (Eds.), *Long-Distance Water Transfer: A Chinese Case Study and International Experience,* (United Nations Library 1983), p. 10.

[160] As cited by The World Commission on Large Dams, *Dams and Development: A New Framework for Decision Making,* p. 3.