

Water Crisis in China: Drying River, Shrinking Lake

Introduction

The total amount of water resources in China ranks sixth in the world. The amount of water resources per capita and per unit cultivated land is far less than the world average for the country's dense population and vast territory. These spare water resources is distributed uneven both temporally and spatially and does not necessary coordinate with the distribution of population, cultivated land, and mineral resources. Southern part of China has sufficient amount of water and insufficient land but north has sufficient land and insufficient water in the North. The south of the Yangtze basin contains 80.4 percent of water resources of China, though support 53.5 percent of the population, 35.2percent of the farmland and 54.8 percent of GDP of the whole country. (Basic Readiness of preparation Work for South-to-North Water Transfer Project, Ministry of Water Resources November 14, 2000). Therefore, it makes per capita availability of water 3480 cubic meters. This part of China has “more people, insufficient land, well-developed economy and relatively rich water resources” (ibid).

The Northern part to the Yangtze River has 44.4 percent of the population, 59.2 percent of the farmland, 43.4percent of GDP, but only 14.7 percent of water resources less than southern part. It leads to less per capita availability of water i.e. 747 cubic meters. Now, given the situation if north and southern part of China, one could easily calculate that northern part of China “suffers the most serious contradiction of water demand versus supply and most serious unmatched condition of water resources with economic and social development” (ibid). In addition, north China is facing “water shortages and related environmental degradation”. The sole responsibility is equally share between decreasing “runoff from the mountainous parts of the region and water resources become overcommitted, serious water and environmental problems”. Thus, the region has problem of drying-up of rivers, decline in groundwater levels, degradation of lakes and wetlands, and water pollution (Xia et al 2007).

Not only water consumption but as well wastewater discharge have been increasing with the economic development. The crisis of water supply is aggravated by the decrease of clean water sources most of which have been polluted. It still

remains as an arduous task to ensure the modernization process in China against the risks of floods and the shortage of clean water sources.

China nevertheless, supports one-fifth of the world's population with only 7 percent of global water resources. Therefore, per capita water availability is among the lowest in the world. Above all the majority of available water is concentrated in the south makes the situation even worse to the north and west to experience regular droughts. Thereby, it causes severe sandstorms and increasing desertification. Rivers, lakes and underground aquifers in northern China are literally drying up due to overuse. Consequently, it not only approaches towards water crisis but at the same time threatening food security¹ and health. The drying river and severe drought have “dropped the grain harvest in 2001 to 335 million tons, down from the all-time high of 392 million tons in 1998” (Brown 2001:1). Pollution deviates China’s situation even worse. According to SEPA, 70 percent of lakes and five of China's seven largest rivers are so polluted that they are no longer suitable for human contact (Crystal Davis, December, 2007).

Global warming is also deepening China’s water crisis. The glaciers of the Qinghai-Tibet plateau in western China are melting at an alarming rate. Analyzing four decades of data from nearly 700 weather stations, experts estimate the glaciers are shrinking seven percent each year due to global warming. Since the 1980's the plateau has warmed over two degrees Fahrenheit (approx – 16.67 degree Centigrade)—a rate twice as fast as the rest of China. This trend is being seen in ice covered regions around the world due to the ‘albedo affect’² (ibid).

There are about 1360 million cubic kilometres of water on the earth (See table 2.1). If all the water on the planet –from the oceans to, lakes and rivers, the atmosphere, underground aquifers, and what is locked up in glaciers and snow could be spread evenly over the surface, the earth could be flooded to an overall depth of some three kilometres. More than 97 percent of this water is in the oceans. The rest –

¹ To produce an adequate diet for a human being for a year requires about 300 tonnes of water or nearly a tonne a day. See, Clarke:1991, 3

² Ice and snow are highly reflective of sunlight, but with melting, more solar radiation is absorbed into the exposed earth, causing warming to occur at an accelerated rate.

about 37 million of cubic kilometres –is fresh water but most of that is of little use since it is locked in icecaps and glaciers. Current estimates are that about 8 million cubic kilometres are stores in relatively inaccessible ground water, and about 0.126 million cubic kilometres are contained in the lakes and streams.

The rain that falls on the land averages some 725 mm a year. In some places it rains gently throughout most of the year and in others torrential rains occur for one or two months a year, the rest of the year being almost rain free. In some places, such as the Atacama Desert, rainfall is effectively zero; and there are places on tropical forests where there are more than 5 meters of rain a year. In the world’s arid regions, where more than 600 million people live, rain fall is less than 300 mm a year (Clarke 1991: 9-10).

Table 2.1
Water on Earth’s surface

Reservoir	Volume (million cubic km)	Percentage of the total
Oceans	1.370	97.25
Ice Caps and glaciers	29	2.05
Groundwater	9.5	0.68
Lakes	0.125	0.01
Soil moisture	0.065	0.005
Atmosphere	0.013	0.001
Streams and Rivers	0.0017	0.0001
Biosphere	0.0006	0.00004

Source: Based on data provided by Clarke (1991: 8)

Rainfall is balanced every year by the world’s run-off³. Far more rain is evaporated than ever reaches the sea via the rivers. Total rainfall on land areas amounts to some 110,000 cubic kilometres a year, of which about 70,000 cubic kilometres are evaporated. Thus, only about a third of all rainfall ever reaches a river or stream on average. In some places, where evaporation rates are high, the proportion of rainfall

³ The amount that flows out to sea via rivers and streams – and the amount that is evaporated from the land surface to and released from the foliage of plants (together called evapo-transpiration).

that is transformed in to run –off is much less. In Africa, as a whole, only about one-fifth of all rainfall is transformed into o run off. And in some of the world’s drier river system, only a small percentage of rainfall reaches a river. (Ibid: 10)

The long term mean annual precipitation, in China, is 648 mm, of which 44percent forms the river runoff (at 2711.5 billion cubic meters) 56percent is lost in the evapo-transpiration from surface water bodies, plants and soils and the phreatic water evaporation (Ministry of Water Resources, PRC Report 2004-05). The long term mean annual river runoff depth for the whole country is 284 mm, of which 25 percent is supplied by groundwater, equivalent to 71 mm of water depth. The long term mean annual volume of evaporation and transpiration for the country is 364 mm, of which only 3 percent is the phreatic water evaporation in the fresh water areas of the plains, is usable by means of groundwater withdrawal (ibid).

Water at Risk

Demand for water is growing at annual rate of 10.1 percent by cities and 5.4 percent by industry⁴. The total amount of water consumption all over the country in 2004 was 311.1 billion cubic meter, among which the agricultural water consumption accounted for 77.0percent, the industrial water consumption accounted for 9.3percent, the domestic water consumption accounted for 12.1 percent and the ecological water consumption accounted for 1.6percent (Ministry of Water Resources, Water Bulletin 2004). The per capita consumption of water in Shanghai rose by 35 percent and demand for water in Guangzhou increased by more than 25 percent in a short period of time from 1988 to 1994 (China Statistical Yearbook 1998) . It is the reason why Ministry of water Resources of China has predicated a “serious water crisis” (*Xinhua News Agency*, 16 November, 2001) in 2030 when the population reaches 1.6 billion leading China’s per capita water respire declined to the World Bank’s scarcity level.⁵

⁴ The greatest proportion of water resources is consumed by agriculture. China consumes about 460 billion cubic meter of water annually, of which 87 percent is used for agriculture, 6 percent for house hold purposes, and 7 percent for industry. See Mohamed Kassas , “Water Everywhere: Is There Enough to Drink”, Accessed on 5 February 2008

www.actionbiseince.org/environ/lessons/kassasslessons.pdf

⁵ As defined by World Bank in its 1992 World development Report, water scarcity is a severe constraint when annual renewable water resources supply is less than 1,000 cubic meter per capita and water scarcity exists when there is less than 2,000 cubic meter per capita.

Malin Falkenmark⁶ distinguishes four different causes of water scarcity (Clarke 1991: 2):

1. Aridity, a permanent shortage of water caused by a dry climate;
2. Drought, an irregular phenomenon occurring in exceptionally dry years;
3. Desiccation, a drying-up of the landscape, particularly the soil, resulting from activities such as deforestation and over grazing; and
4. Water stress, due to increasing numbers of people relying on fixed levels of runoff.

Though, Malin's categorization of water scarcity has incorporated all the components, but still believe that he has disregarded, most important factor in contemporary world of water scarcity- water pollution to add to in his categorization, though he, to a length has dealt with this. And therefore, in addition to these four types, the following point will be value addition to the categorization.

5. Contamination, a more common in contemporary world, due to industrial and agriculture wastes, pesticides and animal manure and the leaching of solid waste directly into the rivers and streams (World Bank 1997: 90).

Out of these, the first two relate to the climate and the rest three to changes that result from human activities. This study highlights the last three whereby it would showcase the approaching water crisis in China vis-à-vis quest for water from rivers and lakes.

Cradle of Civilizations

It is hard to underestimate the importance of water to society. The earliest forms of civilization developed along with the banks of such rivers as the Tigris and the Euphrates, The Nile, the Indus and the Huang he. Irrigation was the economic force that drove these societies and the rivers that supplied their irrigation water, the essential requirement for survival.

These early civilizations managed to transform the "hydrological chaos" of the great river valleys into the well organized and regularly watered fields, meadows and gardens which, in the Tigris- Euphrates valley, were known mythologically as Garden of Eden. As for example, the Harappa's of Indus Civilization, by 2500 BC had drainage channels to take away foul water, constructed from burnt bricks and wells. And the societies who failed to manage the critically important water resources adequately collapsed and the very example is Mesopotamian civilization.

⁶ He is associated with Stockholm Natural Science Research Council.

China has a network of rivers consisting more than 1,500 rivers each drain 1,000 sq km or larger areas (See table 2.2). These large rivers, mostly originated from the Qinghai-Tibet Plateau, and drop greatly from the source to the mouths. As a result, China is rich in water-power resources, leading the world in hydropower potential, with reserves of 680 million kW.

China's rivers can be categorised as exterior and interior systems. The catchment area for the exterior rivers that empty into the oceans accounts for 64 percent of the country's total land area. The Yangtze, Yellow, Heilong, Pearl, Liaohe, Haihe and Huaihe rivers flow east, and empty into the Pacific Ocean. Here, study will deal with some of important rivers of China in regard to their impact on Chinese societies. In addition, process of deterioration of Chinese rivers vis-à-vis modernization and approaching water crisis which is central theme of this study will be discussed.

Table 2.2
Distribution of Water Resources in China

Region	Area (square km.)	Annual total rainfall Cubic meter/year × 10 power 9	Amount Cubic meter/year × 10 power 9	Total (percent)
Heilongjiang Basin	9,03,418	447.6	135.2	4.81
Liao he Basin	3,45,027	190.1	57.7	2.05
Hai he and Luan he Basin	3,18,161	178.1	42.1	1.50
Yellow River	7,94,712	369.1	74.4	2.65
Huaihe Basin	32,9211	283.0	96.1	3.42
Yangtze River Basin	1,80,8500	1936.0	961.3	34.18
Pearl River	5,80,641	896.7	470.8	16.74
Rivers in Zhejiang, Fujian and Taiwan Provinces	2,39,803	421.6	259.2	9.22
Rivers in south-west China	8,51,406	934.6	585.3	20.80
Rivers in Inland regions	3,37,4443	532.1	130.3	4.63
Total	9,54,5322	6188.9	2812.4	100

Huang He (The Yellow River)

The importance of the Yellow River is depicted by Han dynasty there are hundreds of rivers in China, but there are only four major ones. Of these the Yellow is the most prominent (River Notes, History of the Western Han: 206BC-8 AD). It could be more clear when one see the significance of the Yellow River in the birth of Chinese civilization. This is the reason why Chinese have traditionally called the Yellow River⁷ as “Mother River”.

Ironically, over the centuries the Yellow River not only regarded as China’s saviour but also as its sorrow. The river often causes devastating floods on the plains of its lower course due to elevated river bed. The reason behind this elevated river bed is siltation in the Yellow River. It is estimated that 1.6 billion tons of sediments annually received by the river. This is three times of amount of sediments of the Nile, the Mississippi and the Amazon combined. Therefore, the river is now referred as ‘floating Yellow earth’. Ma Jun argues that the river water is so silted up that one – half of a bowl of its water will be sediments. He goes further to describe how much Yellow is silted up by saying that if the river’s water were used to build a beam 2 metre by 1 meter, it would stretch from the earth to the moon. It led to creation of dykes along with the river in the lower reaches. Consequentially, the bed of river rises accordingly and even some places main channel is 20 meters above the surrounding countryside. Thus, poet Li Bai of Tang dynasty (618AD- 907AD) describes “the Yellow River come flowing from sky”. But this embankments were unknown to

⁷ The 4,827 km-long the Yellow River originates from Kunlun Mountains and flows generally eastward across northern China through a series of gorges, bringing ‘life’ to the arid north and finally discharges into the Gulf of Bo Hai. It is named for the vast quantities of yellow silt it carries to its delta. And thus carrying the special meaning for Chinese: the yellow earth, the yellow emperor, and even the yellow coloured skin of the people. These are the cultural sign that have caused people throughout history to assign as almost divine status to the murky waters of the river (Ma 2004:3).

earlier dynasty and it confirmed by River Notes of Western Han whereby it explicitly says that “there used to be no embankments along the Yellow River but at that time there were numerous lakes and ponds in low laying places to hold the over flow of during the rainy seasons so we did not have floods”. Thus, it is clear the process of siltation is not ‘long, natural and slow process but a result of man’s tampering attempt to conquer and harness the nature’ (Ma 2004: 5). Nevertheless, the process of harnessing the nature was not so hurried till the establishments of People’s Republic of China. The new government was determined to end the century old problem of flooding once and for all and their impetuosity merged. It means that they became obsessed with reservoirs as way to control the floods and provide water for both agricultural and industrial uses. ‘Harnessing the nature’ dance begins with Mao Zedong and was inspired by the thought of Xunzi’s ideas that by understanding the laws of nature man could overcome nature.

In the very first five year plan (1953-57) of China, the Ministry of Water resources of China and The Yellow River Hydrology Committee (*Huanghe shuili weiyuanhui*) get the approval of Three Gate Dam⁸ project done with help of Soviets. In addition, there were other forty-six separate hydroelectric power projects from Longyang Gorge in Qinghai province to further downstream, running parallel to Three Gate. Unfortunately, the Sino-Soviets relation turned sour and all the projects, supported by Soviets, went into coma. Ironically, the three gate project was not included in the list and continued and started working in 1960. But the plan did not work; three gate dam was unable to clean the Yellow River from the sediment. The dam filled up with 1.91 billion tons of sediment and only 1.12 billion tons washed away (Ma 2004: 10). In order to harness more and more, there were 3,300 large and small reservoir built on the river and its tributaries. Corollary, the Yellow River dried up in the summer of 1972 and more frequently, six times in the 1970s, seven in the 1980s and seven during the first eight years of 1990s. So it was difficult to flush the sediments to sea because it needed 21 billion cubic meters of water. Thus, it left a very fine deposit of earth that can be easily blown by the winter winds and deposited

⁸ The Three Gate Gorge Dam is at the juncture of Shaanxi, Shanxi and Henan provinces. It is less than 400 meter wide and is a marvel. There are two rocky islands that spilt flow into three sets of rapids namely ‘the Three Gate’ and each with different name- Gates of Ghosts, Gate of the God and Gate of Man.

elsewhere in large, shifting sand dunes posing a serious threat to prosperous North China plain (ibid,13). In 1950s the volume of water in the Yellow River has decreased by 75percent, so that the once-mighty river has been reduced to a more or less seasonal body of water that usually dries up 800 kilometres before reaching the sea (Aiyar 2007).

In addition, the desertification of delta which causes soil erosion led the crisis even more serious. The forest cover, in the basin of The Yellow River, has dramatically dropped to as low as 7 percent. Resultant, the soil erosion has affected some 75,000 square kilometres of land drained by The Yellow River. (Ma 2004: 24) Even the crisis has deepened, when the tributaries of the Yellow River and others affected by the same desertification and soil erosion. This led disappearing of thousands of lakes in Qinghai that nurture the Yellow River (*Xinhua News Agency*, 9 October 2001). As a result, water flow into the river's mainstream, Yellow River Water Resources Committee predicted, in the first seven months of 2003 is to be 8.2 billion cubic meters, 5.5 billion cubic meters less than during its worst previous dry season in 1997, and probably the lowest in five decades. The another reason for low flow, according to Professor Hong Shang chi, was mainly due to a huge increase in water consumption by the industrial and agricultural sectors in its drainage area and dry weather (ibid).

Along with the reduction in volume of water, has come a decline in the water's quality. Even when the river is flowing, its water has become virtually useless in the many places along the lower reaches. A study, in 1994, shows that potable water was available in only 31 percent of the entire drainage area of the Yellow River. Most of that was in undeveloped, pristine areas to west of Longyang Gorge in Qinghai province. For 4,507 kilometres of its entire length, the river has no potable water with toxicity levels at category IV and V or above (Ma 2004:16).

In January 1999, near the Xiaolangdi Reservoir, due to construction work half a meter thick layer of foam spread across the river channel and down for the several kilometres, polluting the water so badly that purification plants in many large cities like Henan and Shandong provinces had to shut down, cutting off the water supplies to several million people (Ma 2004: 37). This led to investigation which confirmed that almost every single stream along with the Yellow River- from Qinghai to Gansu,

to Ningxia, to Inner Mongolia, to Shaanxi, Shanxi and Henan- was a source of pollutants but the majority of them were coming from Fen River.⁹

A report on Yellow River Water Resources confirmed that only 33.3 percent of the water is category 3 or we say safe for drinking, aquatic breeding, fisheries or swimming has declined from 40 percent in the 1990s. More than 4.35 billion tons of waste water was dumped into the Yellow River in 2005, about 88 million tons more than last year, according to the report (*Xinhua News Agency* 13 December 2006). ‘Pollution turns Yellow River red’ when waste water from a heating station near the city of Lanzhou contaminated the river (BBC News, 22 November 2006).

All together and married with other problems, it has created the water crisis in basin of The Yellow River. In 1999, it ran dry for forty days disrupting shipping and commerce and it has become regular phenomena in the Yangtze River. It has affected the livelihoods of basin people, deteriorating health and challenging the development of the regions.

The Yangtze River

The Yangtze¹⁰, 6,300 km long, is the largest river in China, and the third largest in the world, next only to the Nile in Africa and the Amazon in South America. It has been nick named as the “golden waterway,” is a transportation artery linking west and east.

⁹ The Fen River Valley is Shanxi’s most important industrial and agriculture area. The hillsides are all barren and etched by an endless array of gullies. The towns and villages are uniformly gray and punctuated by rows of tall chimneys belching out black smoke that wafts down each small valley and ends up in the large one.

¹⁰ The river begins its journey from Gelandandong Mountains on the Qinghai- Tibetan Plateau. It runs through generally south through Sichuan Province into Yunnan Province. Then, it flows northeast and east across central China through Sichuan, Hubei, Anhui, and Jiangsu Provinces to its mouth in the East China Sea, about 23 km (about 14 mi) north of Shanghai. The river drained a fifth of total China’s land by flowing through eleven provinces. In addition, its more than eight tributaries make basin in other eight provinces making the double of catchment areas (More than 1,683,500 sq km) of the Yellow River. The principal tributaries are the Han, Yalong, Jialing, Min, and Tuo He, on the North and on the south, the Wu; at Zhenjiang, the Grand Canal links the Yangtze to the Huang He (the Yellow River).

The official name for the entire river is Chang Jiang (Long River) or Yangtze River. Interestingly, the Chinese name the Yangtze for the last 480 or 645 km of its course, the portion traversing the region identified with the Yang kingdom (about 10th century BC). From Its upper reaches to Yibin, the river is called the Jinsha River (Golden Sand) and various other names are applied in the provinces it traverses. Based on “The Yangtze River”, www.china.org.cn. Accessed on 23 January 2008.

The natural channels of the river benefits excellent navigations. The areas of the middle and lower Yangtze River have a warm and humid climate, plentiful rainfall and fertile soil, making them important agricultural regions also providing favourable condition for industry too.

Economy

The economy of this area is a mix of agriculture and industrial. The livelihoods of a large section of people depend on agriculture. Inland cities, although such as Wuhan and Chongqing and the coastal region Shanghai are among China's most important industrial centres. The lower basin and the delta are among the most economically developed areas in the country. Mineral resources include reserves of iron ore near Wuhan and Nanjing and such deposits as coal, copper, phosphorus, gold, oil, and natural gas in Sichuan province.

The basin shares nearly half of China's crop production, including more than two-thirds of the total volume of rice. In addition, the basin also produces like, cotton, wheat, barley, corn (maize), beans, and hemp. The fertile land of the basin and the climatic conditions are extremely positive to agriculture.

Fisheries

The Yangtze River and its associated tributaries and lakes are home to several types of fishes. The fishing trade is widely developed and thereby supports livelihood for a large section of the population of the region. There are some 30 species which have economic significance, especially carp, bream, Chinese perch, gapers and lamprey. But the white and black amur, flatfish, and spotted flatfish have greater importance for economic purpose. But a research jointly conducted by the Chinese Academy of Sciences, the Ministry of Water Resources and the World Wide Fund for Nature, found that the annual harvest of fish in the river fell from about 500,000 tonnes per year in the 1950s to 100,000 tonnes in the 1990s (Beijing dips its toes in troubled waters Aiyar 2007).

Navigation

The Yangtze River is the principal navigable waterway of China. This reduces the cost of many products due to transportation through waterways is less than road and air. The river links many coastal and major cities with transportation link and Nanjing, Wuhan, and Chongqing work as server to this traffic network. The Yangtze is joined to navigable stretches of the Huang He and the Huai, Wei, and Hai rivers by the Grand Canal, which is further connected with the seaports of Hangzhou and Tianjin (“Yangtze River”, Encyclopaedia Britannica Online 2008).

The river’s 2,700 km has intensive cargo and passenger traffic. Nevertheless, large ships can travel only up to Wuhan, and craft of up to 2,000 tons can reach Yichang. Before Three Gorges Dam, smaller vessels could travel as far as Pingchuan, but the Dam has increased the length. Water routes in the Yangtze basin total about 56,300 km (ibid).

Most of the river’s discharge, accounting for approximately 90 percent of the total flow, comes from the tributaries of the middle and lower courses. When the average discharge in the delta is 31,150 cubic meter per second, it is 23,980 cubic meter per second in Wuhan, 14,980 cubic meter per second in the end of the Three Gorges area and “just” 1,980 cubic meter per second in the upstream areas. Due to the monsoon rains in summer the discharge reaches its maximum value in August, when devastating floods often occur, and its minimum water level in February (Encyclopaedia Britannica 2000).

The perilous floods of June 1998 hit the entire Yangtze River basin that took the lives of 4,000 people and cost the economy \$36 billion (Becker, *Asia times* 26 August 2003) . This attracted the attention of leaders of China as well of many environmentalists. It was, though not the first flood hit the Yangtze before there were several floods like of 1980, 1981, 1991 and 1996. Earlier the flood water or excess water of Yangtze was absorbed by the great wetlands of the Huguang plain¹¹. As the modernization process took devil forms and started the reclaiming the lands of lakes and rivers of Yangtze valley in order to plantation. Water Resource Ministry of China puts very appropriately the cause of 1998 flood “when numerous lakes were filled up for farming in the decades of struggle between the people and water for low laying

¹¹ *Hu* in Chinese means ‘lakes’ and *guang* refers to a broad area. In addition, *hu* refers to two water bodies in the region called *Yun* (Cloud) and *Meng* (Dream).

land along the Yangtze River , the retention capacity was much reduced and the flood situation exacerbated”. Nonetheless, filling of lakes brought immense prosperity to Huguang -Hunan and Hubei province of China considered as major grain procedures of China and thus regarded “Huguang harvests could feed all under the heaven’. Ironically, it also brought more frequently and more severe floods (Ma 2004: 49). It pushed the people living on the banks of river to climb up in the valley. Naturally, In order to settle down, they begins to burn and cut the tree. This led the situation even worse and the ecological cycle came to disturbed. In the rainy season, the soils washed away due to loosening of the soil. The soil erosion become common phenomenon and forced people to move deeper and deeper in to the forest and continue the cycle of destruction. Nevertheless, the desertification took the wild form after the establishment of PRC. Apart from other raison d'être which have been discussed earlier, one of the foremost factors to blame for scarification of forests is establishing “third front”¹². Altogether, caused immense siltation predicament in the Yangtze River too, which turns the flood even more frequently and severe.

The siltation problem is not only associated with main river but it has evenly affected all the tributaries of the Yangtze River. The entire Min River valley gets more than 100 million tons of sediments annually even siltation in its tributaries has been doubled or some time triple (Ma 2004: 66). The Yalong-Jinsha river valley has been hit badly by mudslides during normal rainy seasons. In other words, it led to a substantial increase in the amount of the sediment in the Yalong River and silting up the Yangtze River. In 1993, the Longchuan a tributary of the Jinsha soil erosion affected 4500 square kilometre of the river valley. Finally, it discharges 6.2 million sediments into the Jinsha River every year. Subsequently, the annual flow of tributaries of the Yangtze has been declined substantially. The annual flow of the Yalong and Dadu river valley has been decreased from 14.8 billion cubic metres in the 1950s to 13 billion cubic metres. As fact of matter, the average annual flow of the Yangtze has dropped 100 billion cubic metres. Now the droughts have become more frequent to the Yangtze basin than floods. The salinity level in the valley has been rose dramatically making worse condition for agriculture. Thus, fifty-nine cities of the

¹² The Sino-Soviets relation soured in the 1960s. To counter the soviet attack, China developed a fallback military strategy and part of this was third front. It is an area of munitions factories and other industrial projects safely established in the deep forests of China.

Yangtze valley suffered from inadequate water supply in 2002 and officials' fears that serious problems for water transport will soon arise (*China Daily*, 4 March 2003).

In addition, there are 20 billion tons of various toxic wastes in the Yangtze River turning the water once compared to 'mother's milk' into venom. The reason, factories special power plants were often build along the river and without treatment facilities for waste water, water gas and industrial waste. Indeed, the factory used the rivers for drainage (Economy: 2004, 47)

It absorbed more than 40 percent of the country's waste water, 80 percent of it untreated, said Lu Jianjian, from East China Normal University. Yuan Aiguo, a professor with the China University of Geosciences said to *Xinhua News Agency* that just 31 percent of the water is of first or second class quality, with 35 percent under the third class. Yuan warned that with no measures taken to curb pollution it was possible the river would have 70 percent water below the third class in three to five years (*China Daily*, 30 May 2006). Even in some cities polluted water supplied to meet daily needs of people as one resident of Nanchang District complaint reads, "The tap water stinks and has a yellowish colour, the whole family has not taken a shower for two days," said Shi Xiuying (*Xinhua News Agency*, 1 June 2007).

The 2007 annual report on Yangtze River protection and development shows that more than 600 kilometres of the river are in critical condition. The report says almost 30 percent of its major tributaries, including the Minjiang, Tuojiang, Xiangjiang and Huangpu rivers, are seriously polluted. The report says the river's annual harvest of aquatic products dropped from 427,000 tons in the 1950s to about 100,000 tons in the 1990s (*China Daily*, 14 April 2007).

A separate study by the Yangtze River Water Resources Commission shows cities along the river discharge at least 14.2 billion tons of polluted water every year, 42 percent of China's total (ibid).

The water level at Shanxi hydrometric station, downstream of Yichang, stood at 38.52 meters on August 10, 1.65 meters lower than the average for August in past years, while the level monitored at the Hankou hydrometric station in Wuhan was 22.12 meters, 1.82 meters below the precious figure. Experts said this is because the river valley has had less rainfall this year than in normal years (*People's Daily*, 12 August 2000). And this is nothing but merely a side effect of desertification.

To solve the sedimentation problem and flood of the Yangtze, various school of thought have come up with different opinion. As Ma Jun described, one school of thought believe that it could be simply overcome by raising the embankment several meter higher. But it would be more problematic to raise the embankments of the Yangtze River as the Yellow River. No doubt, the Yangtze will be second ‘Hanging River’ in China. Instead of treating the sediment and floods, it will make the problem more serious. Second group suggests that diverting the river’s water into two ancient courses of Hubei would equally distribute the flood waters between Hunan and Hubei.(Ma: 2004, 86) . It will create more problems like resettlement of mass for these areas to other higher reaches and above all this is not practically and economically feasible. The third approach is both feasible but could cause inter provincial and international conflict. According to this, three major rivers- the Jinsha, Lancang (Mekong) and Nu (Salween) could be exploited near their headwaters at their confluence in Yunnan province by building diversion channels and underground waterways that would connect them (Ma: 2004,86).

There is a Chinese saying that “when misfortune reaches the limit, good fortune is close at hand’. And it seems Chinese government has heard the saying and move toward making Yangtze good fortune. By adopting, these approaches still the vain, to build the Three Gorges Dam¹³ on the Yangtze River to solve the siltation and flood problem and also create electricity and irrigate the land form the reservoir. Though, the construction of the three gorges dam has been much debated in China and outside due to their feasibility and environmental problem. When now it has already started working, the debate has been stopped. As the benefits of dams inscribed by the government, has many folds. They are flood controls, power generation, navigations, and in addition the project will promote the development of fishery in the reservoir, as well as tourism and recreational activities. It will evidently improve the water quality of the middle and lower reaches of the river during the dry

¹³ The TGP was approved by the NPC in 1992 and formally launched in 1994 on the Yangtze River, one of the longest rivers in the world. The Three Gorges is renowned for its beautiful scenery with high mountains and deep gorges, for its myths and culture, as well as for the quality of its oranges. The dam site is situated at Sandouping, Yichang County, Hubei Province.

season and create favourable conditions for the South-to-North Water Transfer¹⁴ (Three Gorges Dam). The issues of debate still haunted the mind of Chinese people¹⁵. The questions remains whether the good fortune is close at hand or the limit of misfortune is yet to come.

The Pearl River ((Zhujiang)

“The estuary of the Pearl River is becoming a ‘desert’ where our future generations won’t find fish to eat.”

- Liang Song, the former head of the State Oceanic Administration’s South China Sea Branch in 2001 (Ma 2004: 168).

The Zhujiang (the Pearl) River is the largest river in south China.¹⁶ The Pearl River valley, which covers an area of 452,616 square kilometers, has an annual precipitation of 1,500-2,000 mm. The Pearl River Delta has a network of rivers, fertile soil, abundant natural resources and a dense population. It originates from Xijiang, one of the largest river systems in south China. The nicked name "Pearl River", indeed, is Pearl of South China fostering booming cities such as Guangzhou, Huai, and Jiangmen in the entire delta region.

Table 2.3
Wastewater quantities and percentages treated by the year 2000

				Wastewater			
Quantities cubic meter/year × 10				Percentage		Percentage treated	
Year	Industrial	Domestic	Total	Industrial	Domestic	Industrial	Domestic
1980	22.54	7.54	30.16	75	25		

¹⁴ For more details on SNWT Project, read http://news.xinhuanet.com/english/2003-08/14/content_1027109_2.htm accessed on 5 April 2008

¹⁵ For more details of the debate read, Dai Qing, *Yangtze! Yangtze*

¹⁶ The Pearl River is 2,215 kilometres long and formed after the confluence of three rivers-the Xijiang, Beijiang and Dongjaing. Its name comes from pearl shells having been found in the section that flows through the city of Guangzhou.

1981	23.79	6.36	30.2 7	79	21		
1982	23.94	7.73	31.0 0	77	23		
1983	23.88	7.11	30.9 3	77	23		
1984	25.13	7.16	32.3 9	78	22		
1985	25.74	8.54	34.1 5	75	25	22	2.43
2000	56.10	21.70	77.6 0	72	28	70	30

Source: Wang Jusi (1989: 852).

Despite the largest rainfall in the region, the Pearl River started deteriorating because of untreated waste water from the industrial cities situated along its bank, where the only concern is making money and the environment is not even on second place. According to the National Marine Environmental Monitoring Centre, the Pearl River dumps 8,655 tonnes of heavy metals, 65,637 tonnes of nitrates and ammonia, and 59,853 tonnes of petrol into the sea each year (“China”, *Asia News*, 5 December 2005). The Hong Kong Polytechnic University and Guangzhou Institute of Geochemistry under the Chinese Academy of Sciences research shows that “a kilogram of shrimp contained 0.835 milligram cadmium, more than 16 times of the national standard (0.05 milligram). The content of lead in fish was 2.2 mg per kilo, also exceeds the national standard, 1 mg per kilo” (*China Daily*, 1 December 2005). According to Liu Chen, director of the Protection Bureau of the Pearl River Water Resources Commission, efforts by cities like Guangzhou "will go to waste if nothing is done downstream" and "If we also continue to pollute the water at its source, all the efforts of cities downstream will be wasted" (“China”, *Asia News*, 5 December 2005).

The Huai River

The Huai River is 680 mile long with numerous tributaries deeding into the mainstream from all sides. The Huai river valley consists 120 million hectare of arable land and a population of over 150 million people by flowing through the

middle of the China¹⁷. Until the 12th century AD the Huai flowed unimpeded and rather calmly into the Yellow sea. But the eco-destruction in the middle reach of the Yellow river finally caused it to change course and take over the Huai waterways for 650 years (Ma 2004: 148).

The regions has been known for its “rich supply of grain, cotton, oil and fish , the river basin has over the past two decades become hole to tens of thousands of small factories. Paper and pulp mills , chemical factories, and dyeing and tanning plants, employing anywhere from ten to several thousand people, have sprouted all along the banks of river and its tributaries , driving much of the economic dynamism of the region and the nation” (Economy 2004: 2) and dumping their waste into the Huai River. In late July, the fertile Huai River Valley known as China’s breadbasket- was the site of an environmental disaster. Heavy rains flooded the river’s tributaries, flushing more than 38 billion gallons of highly polluted water in to the Huai (*Xinhua News Agency*, 7 August 2001) that made, in Anhui -a downstream province; the river water was thick with garbage, yellow foam and dead fish.

The history of the Huai River is full with disastrous floods and target of Chinese leader to harnessing the Huai. The flood of July, 1950 prompted Mao Zedong to control the Huai River by damming the river and divert the water. Mao was familiar with the peasants uprising against existing regimes and source of new emperor from the regions¹⁸ and he was in no mood to experience such an uprising on the very onset of ‘New China’. In addition, Mao had believed that these projects will boost the Chinese economy and begins his Great Leap Forward by organising a mass movement under the slogan “let the high mountains bow their heads and let river water yield”. It constructed some no fewer than 195 dams along the river (Becker 2001). In order to surpass the industrial development of Great Britain and United States, Mao launched his Great Leap Forward campaign. Great leap forward to a large extent exploited the natural resources and leaving China on the verge of

¹⁷ The Huai River is a natural demarcation line between China’s North and South. The Huai river valley including Anhui, Jiangsu, Shandong and Henan Provinces is a fertile region in eastern China. It is roughly the size of England with a population of over 150 million people, all of whom depend on the Huai for their water supply. The Huai River originates in Henan’s Tongbai Mountain and flows east for over six hundred miles through Henan, Anhui and Jiangsu provinces before confluence with the Yangtze River.

¹⁸ A memoir published by Qian Zhengying a former Minister of Water Resources reviled the fact.

environmental crisis. In order to achieve agriculture and industrial self-sufficiency, China engaged in herself to reclamation of land for the purpose of agriculture (Mao 1977, 5:279) and cutting trees to create 'steel' in backyard furnaces (Mao 1958).

Despite relatively high average annual rainfall of thirty-four inches, many parts of this river basin are also prone to drought (Zhang: World Bank Report, 2-3). In 1999 and 2000, the Huai River ran dry for the first time in twenty years. The local economy was hit hard with crops ruins and thousands of fish dead (Economy: 2004, 7). Regions with intensive industrialized have rivers with such "low flow rates that any waste water discharged into them will constitute a major portion" (Li Jaisan 1987: 9 - 15).

Lakes and Reservoirs

China is a country of many lakes¹⁹ and reservoirs. A bird eye on the status of lakes would be sufficient to show emerging water crisis in China. I have dealt with some of important lakes of China, facing serious drought problem. Xinjiang has 483 reservoirs with a total capacity of 8.5 billion cubic meters. This is larger than Xinjiang's annual average river flow (Ma 2004:93). According to the statistics, total water storage of 462 large reservoirs and 2771 medium reservoirs all over the country was 221.9 billion cubic meter by the end of 2004, 2.5 billion cubic meter higher than that at the beginning of the year (Ministry of Water Resources, China Water resource Bulletin 2004)

One of the major lakes in this region is Manas Lake covering area of 550 square kilometres in 1950s. The affect of economic development also felt here, when a series of reservoir were built along the upper reaches of Manas River to irrigate the land. It led to water crisis in Manas Lake. The similar experiences were felt by Ulungur Lake. The construction of dams on the Kuitun River cut the sources of water to Abi Nur Lake bordering Kazakhstan. However, it has not dried up completely but has shrunk from 1200 square kilometre to 500 square kilometres in the past fifty years. Thus, the number of lakes has been reduced from fifty-two lakes, in the 1950s, in the Xinjiang covering more than 5 square kilometres in size, with a total surface area of 9,700 square kilometres compared to total area of 4,000 square kilometres in 1970s (Ma 2004:94).

The distribution of lakes in China is highly unevenly distributed (see table 2.4). The western part of China consists more of lakes in area as well in holding capacity of water. Qinghai- Tibet Plateau captures roughly 50 percent of Chinese lakes and stores about 45 percent of fresh water. Eastern Plains covers roughly 30 percent of country's

¹⁹ Over 2300 of lakes have areas over 1 square km, and the total area of all the lakes reaches 70988 square km, accounting for about 0.8percent of the total area of the country, with a total storage capacity of 707.7 billion cubic meter, of which fresh water storing capacity amounts to 225 billion cubic meter. Besides, there are in China 86825 reservoirs, with a total storage capacity of 413 billion cubic meters. The two add to a total of 638 billion cubic meters of fresh water, forming one of the most important fresh water resources in the country, playing a major role in supplying drinking water for the people as well as water for industrial and agricultural production, and aquaculture. See, Lakes in China-Research of Their Environment.

lakes and stores 31 percent of fresh water of China. Yunnan-Guizhou Plateau has only 1.5 percent of China's total lakes areas with only 12 percent of fresh water.

Table 2.4
Distribution of lake area and storage of China

Lake district	Lake surface area (km ²)	Percentage to country's lake acreage (percent)	Lake storage (10 ⁹ cubic meter)	Fresh-water storage (10 ⁹ cubic meter)	Percentage to total fresh-water storage (percent)
Qinghai-Tibet Plateau	36889	51.4	518.2	103.5	45.8
Eastern Plains	21641	30.2	71.1	71.1	31.5
Mongolia Xinjiang Plateau	9411	13.1	69.7	2.35	1.0
Northeastern plains and mountains	2366	3.3	19.0	18.85	8.3
Yunnan-Guizhou Plateau	1108	1.5	28.8	28.8	12.7
Others	372	0.5	2.0	1.5	0.7
Total	71787	100	708.8	226.1	100

Source: "Lakes of China" (2000).

The Etsina Lake²⁰ used to get its water from a river originated from Qilian Mountains of Gansu Province. The Hei River also used to feed the Gaxun Nur and Sogo Nur. The irrigation campaign of Great Leap forward to make the Xinjiang arable land had dried up these all river simultaneously.

Lake Tai is third largest lake with area covering around 36,500 square kilometres bordering with Jiangsu, Zhejiang and Anhui Provinces and extending to more than thirty cities and towns, including Shanghai. It has been used for dumping industrial and agriculture waste for 25 years. It has estimated that some 3 million tonnes of chemical fertilizers and 100 tonnes of pesticides are used in the lake regions. It led the water quality to gradually deteriorate and people near the lake regions were warned not to drink the water.

²⁰ This is in the north-western part of the Alashan Plateau in the western part of Inner Mongolia. The Lake area was formed in a delta of the Hei River and was the only green spot between the desert in Xinjiang and Inner Mongolia.

Conclusion

The drive for rapid economic growth since 1949 and then strained by economic reforms of 1978, has skyrocketed the demand for water in agricultural, industrial and even consumption by the people of China. Years of drought, desertification, soil erosion and water pollution have further deepened the water crisis.

Water pollution has become China's most pressing environmental issue. A World Health Organization survey found that 80 percent of human illnesses are related to water pollution. Every year over 25 million children die due to polluted drinking water – more than are made refugees by war. Environmental security, as a new aspect of national security, has been attracting increasing international attention. It means ensuring that the environment is free from threats to the basic necessities for human survival and growth (Yongchen Wang, *China Dialogue*, 7 March 2007).

Overall, the water scarcity and pollution will harm the Chinese economy by desiccating or polluting cropland, forcing investment into large river diversion projects and clean up efforts. In addition, the inland migration driven by water scarcity and pollution will contribute to growing tensions in both rural and urban areas of China. It will also engage China into an international conflict with her neighbouring countries on the issue of river water and migration attracted by water scarcity and pollution.

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