

In this paper, I shall examine the history of water management and allocation in the Yellow River Basin. Throughout China's history, political ideology has strongly affected water management; traditional planning focused on flooding and there was enough water for the users. Today, rather than flooding, water demands and scarcity rank as the top government priorities. Consequently, the Chinese government has altered its programs from engineering oriented management to more holistic resource management, aligning its policies with that of more progressive nations.

This paper is divided into time periods. Within each period, a brief historical background introduces the ideology of the times followed by a discussion of the water management and water allocation during that era.

Introduction

The Yellow River is the second longest river in China. The river receives the name from its muddy color, which results from heavy silting along its path. The Chinese have historically referred to the Yellow River as the "River of Sorrows" because flooding often destroyed lives and crops. Throughout the formation of the People's Republic of China (PRC), this has remained the major catastrophe presented by the Yellow River¹. However, it is also the "Cradle of Chinese Civilization" and has long been linked with China's political, social, and economic development.

Pre-People's Republic of China

Water management of the Yellow River has been dated back to the 20th century B.C. by early historians. Levees and canals have been recorded and listed by various sources, including Y'ang K'uan were initially built solely for flood prevention. However, beginning with the Chou Dynasty around 1100BC, they were used strategically in warfare, since their destruction caused flooding and ruins to large areas².

¹ Greer, 3

² Greer, 25

The Han Dynasty consolidated much of China in 206 B.C. and was responsible for instituting and formalizing management patterns at all levels of Chinese society and government including water management patterns that continued throughout the 1900's³. This oversight of water management on a much larger scale than before, evidenced by a Han national water administration.

Water Resource Management

Before the Han Dynasty, when kingdoms were small, water administration had been mostly local. Due to smaller territories, the scope of the projects was narrow, usually only addressing one local water issue⁴. The Hans created the new office of Director of Water Conservancy (Tu Shui) under the Ministry of Public Works. This office became the planning and controlling body for all nationwide water management. Through its offices, water managers conceived of comprehensive flood management, starting a trend towards the basin-wide planning seen today.⁵

The Hans established the now longstanding tradition of extensive water works construction in China. They were labor intensive, using only man-power and wheelbarrows. Renovation of old water works projects also became important during this dynasty. The Hans realized that need to continuously maintain and upkeep each project due to the constant re-silting of the Yellow River. Large scale projects and continued maintenance from this day continued into the 20th century.

It is important to note that successful management, even then, occurred only with the successful coordination between national and local offices. During the Han Dynasty, the national agencies were responsible for the overall planning and coordination of the water works projects, and controlled projects concerned with flood control and transport. It remained the local agencies' responsibility to provide the labor necessary for the construction and operation of the designated project as well as the financing and management of irrigation projects. Difficulties arose in this coordination from bureaucratic myopia. Local officials were

³ Greer, 28

⁴ Greer, 31

⁵ Greer

concerned only with flooding in their reach of the river and failed to consider the downstream consequences of their own actions⁶.

Another important aspect of Chinese water management was the mobilization of its people. Progress and success in these times was often measured by the efficiency and size of the labor force. The more centralized and effective the government was, the larger the labor force that worked on each project. The main labor method was called corvee. Directed by the central government, corvee labor required peasants to work on water projects during their winter. The argument was, since the harvest would be saved from summer flooding, the farmers were beneficiaries of their own labor. It is debated whether peasants were forced to work, or if agreed that the work would benefit their harvest during the crop season.⁷

In the early 1900's, foreign interest in the Yellow River brought western ideology to the management of the Yellow River. Hydraulic engineering steered the river management towards a more basin-wide approach. Western influence was instrumental in starting several inter-provincial water management agencies, including the Chih-Li River Improvement Commission. It and the newly established Yellow River Consulting Board undertook monitoring, surveying and initial planning on the yellow river basin as a whole. Also during this time, Chinese students studied western engineering abroad in greater numbers than ever before. The most prominent of these exchange students was Li Yi-chih, who became the first engineer to advocate a single basin-wide agency to tackle the problems of the Yellow River. His advocacy led to the founding of the Yellow River Water Conservancy Commission (YRWCC) in 1933. Operating directly under the central government, YRWCC was responsible for all aspects of the Yellow River. However, never granted fully responsibility in water management and lacking autonomous control, the agency was unable to perform the necessary work⁸. The YRWCC later gave way to the Yellow River Conservancy Commission (YRCC), which was founded in the Hebei, Henan, and Shandong region in 1946. The YRCC was also founded with the philosophical influences of the Li Yi-chih. The YRCC became official basin management agency in June of 1949 and put

⁶ Greer, 35

⁷ Greer, 80

⁸ Greer, 45

under the Ministry of Water Resources. Like its predecessor, the YRCC did not gain full autonomy of a governing body, although it did serve to settle disputes along the river.⁹

Water Allocation

Historically, flooding has been the main issue of the Yellow River.

In 1949, the Yellow River Basin only used 7.4 billion m³ of an estimated annual average runoff of 58 billion m³.¹⁰ With relatively low populations and little industry, water has always been plentiful in this region.

Founding of the People's Republic of China 1949-1958

In 1949, Mao Zedong and the communist party formed the People's Republic of China (PRC). According to Ma (1999), victory against the Japanese in World War II, the defeat of the Kuomintang, and the successful creation of the PRC gave China the belief that it was invincible¹¹. If so, they extended this ideology towards the Yellow River, which they believed they could finally conquer, and so the PRC sought to harness the river's energy and prevent disaster. This human-versus-nature philosophy dictated much of the water resources management in the beginning of the People's Republic of China.

Communist association also brought much early support from the Soviet Union, which promoted large-scale and capital-intensive water projects.¹² It is not surprising that the slogan at the time was, "big diversion, big irrigation."¹³ This philosophy differed largely from previous Chinese management, which had never before invested heavy capital into its river control.

Water Resource Management

A long-range water conservancy plan didn't exist for China prior to the formation of the PRC. A national

⁹ Giordano, ??

¹⁰ Fu, 4

¹¹ Giordano

¹² Chi, 39

¹³ Giordano, ??

water conservancy conference in 1949 called for the country “to carry out investigation and research work on water conservancy with a view to preparing data for formulating a long-range construction plan.”¹⁴

Much of these plans were carried out in the 1950’s in various conferences on soil and water conservation held by the Yellow River Conservancy Commission.¹⁵ Their roles were to create public awareness on the river, and see the importance of conservation in the management of the river. In particular, in 1953, “the Decisions on the Yellow River Training” emphasized that water and soil conservation was the key to creating the Yellow River into a beneficial river.

These discourses and conferences led to the set up of soil and water conservations throughout the basin. These conservation stations, committees, and bureaus focused on studying terrace farms, banks, forestation, and dams along the Yellow River.¹⁶

In 1955, the Russians developed the first five-year plan for the establishment of permanent control and unified development of the Yellow River¹⁷. Entitled “Multiple Purpose Plan for Permanently Controlling the Yellow River and Exploiting its Water Resources,” it planned to achieve this through the large-scale, capital intensive Russian led projects that typified Chinese development of the time. The plan promoted basin-wide development and emphasized power-generation and flood control. The plan called for 156 large construction projects, including the 46 large dams along the river. The Yellow River Water Conservancy Commission was responsible for the coordination of this program¹⁸. In particular, the agency led the large-scale survey work necessary to set up for the future construction of the projects. During this time, many permanent agencies, mostly under the authority of the YRWCC, were created to assist in this survey work.¹⁹

The Chinese also relied on traditional mass mobilization for large-scale construction Huge numbers of workers were called, especially during the slack season of November to December and February to March,

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¹⁵ YRCC 8

¹⁶ YRCC 8

¹⁷ Chi, 39

¹⁸ Greer, 53

¹⁹ Greer,

resembling much of the previous corvee labor system. Labor forces of up to 180,000 moved earth for flood protection, dredged channels, and planted trees for levy protection and erosion prevention.²⁰ These groups were organized into mutual aid teams, or agricultural cooperatives, where labor goals and motivation were used by the organizing Provincial River Affairs bureau. Payment came as work points, which could be converted for grain. All the workers in each team or cooperative received a share of the total outcome, and the more that one worked relative to others, the higher the percentage one received²¹.

Water Allocation

Article 6 of the State Constitution of 1954 states that the state has eminent domain over water flow²². Also, first users in time and location have priority before others in water usage. Thus, farmers at the upper reaches of the Yellow River had unlimited withdrawal rights at this time. They did not have to negotiate with others downstream because the users downstream did not have any say in water use above it. Upstream authorities did not need to confer with downstream users during water projects.

A sign of the new basin-wide focus of the Yellow River can be seen in the discussions on plans for inter-basin water transfer. Mentioned in a 1955 announcement, this plan was spurred due to a relative lack of water in the basin, especially compared to the South²³. The Russians confirmed this in 1959, when they declared that most of the river was being fully used, and no further cultivation and irrigation systems could be set up without additional water. However, the plans were never executed after Chinese officials declared that the water shortage problem was alleviated through other measures. One measure was more efficient use of groundwater. A second measure taken was increased water storage in small and medium reservoirs. These two actions, coupled with the fact that China was still uncertain if the project was feasible from a technical and economic standpoint, prevented the plan from conception²⁴.

²⁰ Greer, 79

²¹ Nickum, 24

²² Nickum, 25

²³ Greer, 58

²⁴ Greer, 61

However, the water allocation plans drawn for the transfer (Figure 1), offer insight on how water was distributed among economic sectors during this point. Water users included the provinces of Hebei and Anhui which are not in the river basin. The total water used during this was 23.69 billion m³.²⁵

From the figure, it is seen that agriculture accounted for almost 81% of the basin's water use, with 19.18 billion m³ of water. This was followed by 9.2% of the water being used for industrial and municipal purposes. If the transfer had been approved, an addition of 29.37 billion m³ of water would have been available to this region. 84% of this water would have been allocated to agriculture, as the motivation for the transfer was to increase irrigation and cultivation in the region.

1958-1965 The Great Leap Forward

In 1958, China embarked on its Great Leap Forward, hoping to achieve technical and economic accomplishments with quicker and greater results than before. It is likely that the Great Leap Forward may have been motivated by uncertainty towards Soviet assistance²⁶. Soviet-Sino relations deteriorated in the late 50's, culminating with the Soviets pulling their technicians and advisors out from China. These advisors included Yellow River planners, who took the master plans for the Sanmenxia dam with them. Soviet funding and assistance for the newly established nuclear program in China was also terminated. This, plus the failure of the Sanmenxia dam, led China to spend more money on the nuclear program and less on water resources. Consequently, large-capital projects were put aside in favor of low cost, locally funded projects²⁷.

Mao wanted to mobilize peasants in an effort to gain public support and political strength. He focused on promoting notions of efficient use of resources and agricultural production as means of attaining economic independence. This led to the new socioeconomic entity of the commune. Each commune averaged 5000 households and was a self-sufficient production unit. Communes were built and established in the countryside

²⁵ Greer, 64

²⁶ Poon

²⁷ Chi, 41

and enabled China to execute labor intensive projects with very little capital.²⁸ These communes would play a big role in the Yellow River Basin development during this movement.

Still, the Great Leap Forward turned out disastrously and lasted only 2 years. Its plans, coupled with natural disasters, left China suffering social unrest and famine. From 1961-1965 China was domestically occupied restructuring and recovering from the Great Leap Forward. In this period, the country started to turn away from pure engineering, and focused instead on revising and rehabilitating the river, drainage, and irrigation plans.²⁹

Water Resources Management

The problems of the Yellow River during this time were the same as before, with flood control remaining the chief priority. Silt erosion also gained recognition as a potent problem of the river when the Sanmenxia dam failed in its first two years. In response to China's break with the Soviet Union and the failure of the dam and various other water projects, China shifted its attention to improving existing water works projects³⁰. Water management strategy changed to what might be termed a fast-paced, low capital-intensive system, similar to China's traditional measure.

China's response to the loss of Russian advisors and money and subsequent dam problems led to quicker responses. The country started to depend on local initiative and commune self-reliance to carry out projects. In a list of decisions regarding irrigation in late 1957, the government stated its primary focus was on small-scale projects. Medium scale projects were of secondary importance, and large scale projects would only be implemented when absolutely needed³¹. The "Directive on Water Conservancy Work", issued on August 29, 1958, echoed these sentiments. China wanted quicker, more economical results by the 1960's.

Low capital projects were made possible by communes, similar to the corvee labor responsible for much

²⁸ Chi, 22

²⁹ find

³⁰ D4, 2

³¹ j39

pre-PRC construction. The labor costs of commune built projects was absorbed into the payment system, as all wages were made in work points or grain. Points were assigned to individual farmers by the amount and difficulty of the work done. These points determined the farmer's share of the overall harvest. Thus, no costs are were incurred by the government using this manual labor³².

Water Allocation

A key slogan in Mao's "General Policy" of 1960 was "Agriculture is the foundation, industry the leading sector."³³ This summarized the national policy that emphasized agriculture's importance in China's economy. Light industry, followed by heavy industry, were of secondary importance in the economy. It was viewed that agriculture paved the way for light industry, which in turn allowed for heavy industry to exist³⁴. At this time, this was not heavily contested, as agriculture was the definite backbone of the economy. Industry was heavily regulated, so agriculture had little competition from the industrial sector at this time for water.

1966-1980 The Cultural Revolution/Deng in Power

The review and reflection of the poor national management that started after the Great Leap Forward was cut short by China's Cultural Revolution³⁵.

Deng Xiao Peng led China in 1978 and started China's second revolution. The commune system, which were based more on politics than on planning and design, were cut as China changed from a command to a market economy. "Household responsibility systems" replaced the communes, which was a euphemism for private farming. More power was given to individual farmers, and government control decentralized. Farmers had to give a percentage of their yield to the government, but the rest of the harvest was free for them to sell on the open market³⁶. Food production increased. Water resource funding continued to decline during this

³² Nickum, 22

³³ Nickum 26

³⁴ Chi, 26

³⁵ Greer, ??

³⁶ Essentials of Comparative Politics

period.

Water Resources Management

Village based water management systems started to form in this decade, as the communes were disbanded. These systems dealt with canal maintenance and water allocation between the villages.³⁷

Little was shared with the outside world during the Cultural Revolution. It appears from later information that much of what happened during this time was a continuation of the early 60s.

Water Allocation

As little information was shared with the outside world at this time, changes or specifics in water allocation at this time period is not known. Presumably, the water allocation at this time did not change much from before.

1980-1989 Reforms

Reforms swept the country throughout the 80's, and water management felt the change. Legalism was the trend, and in 1982 China introduced a new constitution. This constitution was significant as it defined China's new legal approach to decision making.

In the 1980's, a much higher demand was put on water supply from the industrial and domestic sector. China's agriculture sector also grew with fast paced growth of the country. Thus, heavy use at the upper and lower reaches due to these growing demands made water scarcity the major problem of the Yellow River in the 1980's.

Water Resource Management

During this period, the government made important management changes and restructured the state

³⁷ Giordano

council. The Yellow River Conservancy Commission was upgraded to a vice-ministry level, directly under the Ministry of Water Resources. This, in theory, gave the agency more power and control over the Yellow River Basin.

The state also issued a series of laws and plans that continue to affect water management in China. The new Chinese Constitution passed in 1982 was important because it reiterated that the State had ownership of all the water resources. This spurred a long line of national legal documents governing water, including the Water Law, which was passed in 1988. These many documents now provide structure for China's Water Program.

With specific regard to the region, the Second Yellow River Basin Plan was approved in 1984. Its main focus was silt erosion control, as opposed to flood control and power generation, which was the focus of first plan established in 1954.

Water Allocation

Under the Water Law, the right of water will be allocated by the central government to regions and water use targets. The government also monitors and manages water use. The departments that the central government allocates the water to are then in charge of further distributing the water using market or economic considerations.

Conflict among the water users along the Yellow River made the central government realize the need for a water allocation institution. A scheme was presented in 1989 after 5 years of study and negotiations with the basin's provinces. The plan designates the allocation of water for all provinces and autonomous regions in the Yellow River Basin. It allocated 37 billion m³ of the 58 billion m³ total runoff to 11 riparian provinces. The other 21 billion m³ was to remain in the stream for ecological purposes such as sediment transport and to help break down pollution³⁸. The allocations can be seen in the first column of Table 2. The same plan also requests that all provinces carry out water saving measures, and form individual water usage plans based on the "Available Supply Water Distribution of the Yellow River".

³⁸ Wang

1990 – Current

By the mid 1980's, China started allowing private industries to operate. Although heavily regulated at first, government oversight lessened, resulting in China's industrial growth in the 90's.³⁹ This growth changed the face of China's economic system. This in turn, brought increased demand for available water from other economic sectors. A more developed economy also leads to more wealth and expansion. Wealthier people have increased demand for meat products. Thus more grain feed was necessary, and agricultural water usage increased.⁴⁰ Furthermore, increased industrial output increased pollution, decreasing water quality. Water shortages in the Yellow River occurred at all reaches, and the Yellow River ran dry at times in response to all of the above.

The 1990s also was a drought decade in the Northern Plains, exacerbating the water shortage problems. This was the first time in history that shortage was the main issue with the Yellow River, as opposed to the ever-constant flooding problem.

Water Resource Management

For the first time in the history of the basin, water scarcity was a greater threat than flooding. River management had to focus on more than one issue and resulted in a more integrated water resource management. YRCC's duties grew to include sediment control, flood prevention and water scarcity in the lower reaches and delta management, amongst others. While the management of the Yellow River grew more complex and broad, the YRCC did not have a system in place to adequately manage all of its assigned duties. To make things more complicated, local governments controlled their own engineering projects and facilities. Thus, management and control of the river is not well defined and coordinated.⁴¹

Also, despite the disappearance of many smaller rivers throughout the 80's and 90's, little environmental

³⁹ Comparative (web)

⁴⁰ Giordano

⁴¹ Fu

and ecological concern was expressed. Only in the 80's did environmental awareness begin to grow and around the mid-90's did journals begin publishing article about this problem. Thus, by the late 90's public and scientific outcry could no longer be suppressed or ignored as people started to realize the value of water in the ecosystem.⁴²

Recognizing the need for a new institutional strategy and policy guiding China's water management, the Ministry of Water Resources introduced the concept of resource water conservancy in 1999⁴³. This resource oriented water management plan seeks to provide new criteria for measuring water resource success. The concept of "water resources management" was redefined, downplaying the role of engineering in managing the water to the management of water as a resource. New values included in this management vision include protection, conservation, ecological benefits, and public health⁴⁴. The country hopes to change people's perception of the phrase so that they understand and appreciate the value of water.

The goal of the new approach seeks to assess costs not just from an economic and social perspective, but from a holistic view of the Yellow River Basin. To do this, governing power will be transferred from the central authorities to local and provincial bureaus, enabling greater autonomy in deciding what the best market instruments are for given areas. These market instruments can then take a more comprehensive account of agriculture, domestic and industrial water supply, water quality, and water conservation. This approach also calls for both the reshaping of the public's view of water and treating water as a valuable resource.

Water Allocation

While 21 billion m³ of water was designated to stay in the river in the allotment plan of 1987, the actual discharge was only 17 billion m³ the first six year of 1990.⁴⁵ Shandong and Inner Mongolia continuously overdraw water from the river, facing little consequence.⁴⁶ Not only did some provinces take more than their

⁴² Wang

⁴³ Baruch, Boxes

⁴⁴ Boxer

⁴⁵ Fu

⁴⁶ Wang

allotment in the 1987 plan, the 90's saw many draught years. Available water never reached the expected 58 billion m³. Thus, in 1997, the river ran dry for over 226 days⁴⁷. This led many downstream provinces to turn to other sources of water. In response, the YRCC was given more money and authority to resolve these issues. The YRCC suggested water quantity scheduling in the Yellow River as a means to avoid unfair and ecologically destructive water use.⁴⁸ These laws restrict the upper reach's access to water by updating the 1987 allocations⁴⁹. Each province's water allocations were decreased a fixed proportion to retain the original ratios of yellow River distribution. The overall proportion of the Yellow River was still divided as before, but all users had less to draw.

These laws also detailed the Yellow River Conservancy Commission's responsibilities in the allocation of the river. The YRCC is to monitor water use and manage and regulate the Yellow River. It is also to examine usage applications and grant approval to only those that plan for conservancy. Lastly, the YRCC is to supervise the readjustment of the pre-determined allocation of the water using real-time data.⁵⁰

However, this new allocation scheme included stipulations in which certain areas could get more water during droughts without protecting from arbitrary decisions of reallocation. For example, in 2002, China experienced severe drought. But, in accordance with the newly written water distribution plan Shandong province sent a delegation to Beijing. Led by the Vice Chief of the province, the Shandong delegates asked for 1.8 billion m³ of extra water. The State Council approved .8 billion m³ to be taken without consideration of the upstream users who also suffered drought.⁵¹ No money or fees were incurred in this transaction, but the province that complained the most gained the most, while those that didn't complain lost a lot.

Local bureaus allocate water assigned to them by the YRCC to the various economic sectors. Figure XX shows water allocated for 1997. Agriculture is clearly still the largest use, despite the preferences local

⁴⁷ Xinhua news 2003-10-23

⁴⁸ "Management measures of water quantity scheduling in mainstream of Huang River" 1998, "Annual Distribution scheme for Available Water Quantity in Mainstream of the Huang River" 1997

⁴⁹ Wang

⁵⁰ new article.

⁵¹ Wang

authorities give to the faster-growing industrial sector. Water has a higher economic value when used for industry, and local bureaus want to increase their industrial production. Therefore, new sources of water are almost always assigned and allocated to industry. However, as agriculture is still responsible for feeding China, water once assigned to agriculture is rarely taken away.⁵²

China's amendments to the Water Law in 2002 were encouraging. Although the State remains the owner of all water, this law gave river basin commissions greater power in allocation and centralized control over all diversion projects. The changes also included a concept of "withdrawal rights", requiring permits and fees for the withdrawal of water⁵³. While water rights trading was not mentioned, this is a step in that direction.

Present

No alleviation for the water stress in the Yellow River Basin is in sight, and all studies suggest that they will only be exacerbated in the upcoming years. Population and industry demands are expected to increase for all areas in the basin. Using business-as-usual scenarios to examine water use in 2050, it is calculated that industrial water use will almost double the 2000 numbers (8.4 to 14.8 billion) and domestic water use will increase from 2.9 to 7.5 billion tons of water.⁵⁴ These changes clearly far surpass the allowable volume drawn water.

Currently, many changes are continuously taking place in the management level to address these growing fears. These changes continue along the resource oriented lines that China has now aligned itself with. Ideas such as water pricing has been around, though much improvement is needed, while ideas such as water rights are new and are not yet a part of the management system.

Water Pricing

One method in which the Chinese administration is trying to address its water scarcity is through water

⁵² USDS,

⁵³ Wang

⁵⁴ JBIC

pricing reforms. The current structure is based on a planned economy, and not suitable for the socialist market economy that China is emerging into. Water was always free to farmers until 1979, when the government started charging for the use of water.⁵⁵ However, the current water prices do not reflect the actual cost of water as the government subsidized the prices⁵⁶. This is a large reason why the water value is underestimate in Northern China.

Social unrest is feared to result from a possible shift in pricing structure. In rural areas, farmers make less than \$130 a year, and any increase in agricultural water prices may not be affordable. Also, China has many little farms, and it is difficult to determine the amount of waters each individual farm uses. The fact that they pay for the amount of irrigated land, and not based on how much they use provides them little incentive to conserve water⁵⁷.

The price elasticity of water is also unclear for the Yellow River Basin. Preliminary results indicate that northern China may have inelastic water needs⁵⁸. This seems to be particularly true for the farmers. One possible suggestion for this is that the current prices are so low that unless there is a large hike in the fees, the farmers will not really notice the price change. Another possibility is that this may also be a consequence of the fact that most farmers do not know how much they pay for water. Farmers in China pay all their fees to the local treasure in a lump sum, so water fees become just part of a bill that includes local taxes and education.

Urban water fees are also in the midst of change. On one hand, public awareness is increasing, helping increase water prices and re-use rates. However, the structure is also not market based and inadequate tariffs and revenues result. Again, there is little incentive to save water, as users do not pay the full cost of the water⁵⁹.

Chapter 3, Condition 20 from “Policy of Water Resource Industry” calls for cost readjustments of water based on changes in supply cost. While this falls short of full cost pricing of water, this is a step in the right

⁵⁵ somewhere

⁵⁶ World Bank

⁵⁷ USDA

⁵⁸ USDA

⁵⁹ USDA

direction. The principle of rational benefit charge was discussed to account those who may not be able to pay the full cost, thus special accommodations may be made for farmers.

Overuse is another problem with the current system. There is very little in place to prevent provinces from taking more than their allotted share of water. Thus, in “Policies for Water Industry, Guiding Suggestions Concerning Reforming Water Price and Prompting Water Saving” (2000), overuse fees was discussed. This and other legislation want to achieve raising costs as volume of water increases.

Water Rights

A system of water rights may be introduced to China soon, which will better the management of water use of the various regions in the Yellow River Basin. It’s being discussed and debated by China’s government, as well as various international development agencies, including the World Bank, the Asian Development Bank, and the United Nations Food and Agriculture Organization.

Currently, the State owns all the water rights along all rivers and water trading is prohibited by law⁶⁰. However, water rights are a potential first step to make provinces pay for extra water. For example, if a system of water rights were in place, places like Shandong could pay an upstream province for the water rights of the additional water. The current clause in the distribution plan allows for provinces to plead their case and get more free water at the expense of others. Because the nation owns the water rights, the upstream provinces fully lose in this process.

Water rights can provide a virtual market in which the policy decisions are dealt with fairly. Exchanges can then not only be made between provinces, but also between the varying sectors, such as industry and agriculture.

The current system of top-down water allocation does not create an incentive for provinces to conserve and use less water. Provinces fear that they will be allocated less water if they do not use all that is given them. Therefore, they sometimes make diversion projects to show that they are fully using their allotment⁶¹. They

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⁶¹ Wang

are not rewarded for conservation, and are rather fearful that their allocation will not meet future needs. With a system such as water rights in place, each province will have an incentive to conserve, as they can sell the right to their unused water.

Conclusion

Throughout history, China's water management in the Yellow River has been based on prevailing political climate. More recently however, major change, economic as well as environmental, has brought new conditions to an old system and region, forcing the current Chinese government to forego more traditional, engineering based resource planning. The current policies are not sustainable because continued high rates of growth are placing heavy demands on the available water; demands that cannot be met indefinitely. There is insufficient regulations to govern growth and mandating conservation