Policy and Planning for Large Water Infrastructure Projects in the People’s Republic of China

by

Katherine R. James
Class of 2013

A thesis submitted to the faculty of Wesleyan University in partial fulfillment of the requirements for the Degree of Bachelor of Arts with Departmental Honors in Government

Middletown, Connecticut April, 2013
“What we call Man’s power over Nature turns out to be a power exercised by some men over other men with Nature as its instrument.”—C.S. Lewis, The Abolition of Man

“We don’t govern water. Water governs us.”—James G. Workman
# Table of Contents

List of Figures ........................................................................................................... 5

Acknowledgements ................................................................................................. 6

Introduction .............................................................................................................. 7

Predominant Theories of Chinese Water Policy ................................................. 11

Research Design ..................................................................................................... 20

Chapter 2: The Environmental and Political Context of Chinese Water Scarcity ......................................................................................................................... 24

Spatial-Temporal Characteristics of Chinese Water Supply … 27

Deep Drilling in the North China Plain ............................................................... 33

Groundwater Usage in the Northern China Plain ............................................ 35

Tibet—The Third Pole ........................................................................................... 37

Political and Institutional Context ......................................................................... 39

Case Study #1: The South-to-North-Water Transfer Project ................. 45

Project Details ........................................................................................................ 45

History of Project .................................................................................................... 47

Implementation Problems ....................................................................................... 49

Theoretical Analysis ................................................................................................. 58

Case Study #2: The Three Gorges Dam .............................................................. 65

Project Details ........................................................................................................ 65

Project History and Policy Making Process ...................................................... 67

Environmental Impacts .......................................................................................... 70

The Development Resettlement Policy and Its Effects ........................... 73
<table>
<thead>
<tr>
<th>Topic</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Theoretical Analysis</td>
<td>76</td>
</tr>
<tr>
<td>Case Study #3: The Nu River Project</td>
<td>84</td>
</tr>
<tr>
<td>Project Details</td>
<td>84</td>
</tr>
<tr>
<td>History of Project</td>
<td>86</td>
</tr>
<tr>
<td>Nature of the Nuijiang Prefecture</td>
<td>90</td>
</tr>
<tr>
<td>Theoretical Analysis</td>
<td>94</td>
</tr>
<tr>
<td>Conclusion</td>
<td>99</td>
</tr>
<tr>
<td>Policy Recommendation</td>
<td>104</td>
</tr>
<tr>
<td>References</td>
<td>114</td>
</tr>
</tbody>
</table>
LIST OF FIGURES

2.1: MAP OF MAJOR WATERSHED REGIONS IN CHINA…………………………..26
2.2: GROUNDWATER DEPLETION BY REGION……………………………………..29
2.3: MAP OF NORTH CHINA PLAIN………………………………………………..30
2.4: CONE OF DEPRESSION IN AN AQUIFER……………………………………..37
3.1: MAP SHOWING THREE MAIN ROUTES OF THE SNWTP………………..46
3.2: TRENDS OF PROPORTIONS OF MONITORED SECTIONS OF POOR WATER……..55
4.1: MAP OF COMPLETED THREE GORGES PROJECT AREA……………………65
5.1: MAP OF 13 ORIGINAL DAMS, NU RIVER PROJECT…………………………85
6.1: REACTIVE DISASTER MANAGEMENT APPROACH…………………………..106
6.2: PROACTIVE RISK MANAGEMENT APPROACH………………………………107
ACKNOWLEDGEMENTS

First and foremost, I would like to thank my professors at Wesleyan who have challenged me to think in ways I could have never imagined. My thesis advisor, Mary Alice Haddad, deserves particular recognition. Without her kindness, guidance, and insight, this thesis could not have come to fruition. Additionally, I would like to thank my friends and family for their constant support and patience throughout this entire process. To my parents—Mom, for your wisdom; Dad—your dedication to environmental protection has and will always be an inspiration to me. Additionally, I would like to thank my roommates, Tessa and Olivia for always lending a shoulder and reminding me that laughter is truly the best and cheapest form of medicine. This thesis is for you.
Chapter 1—Introduction

The 1949 victory of the Chinese Communist Party and subsequent formation of the People’s Republic of China (PRC) marked the beginning of decades of rapid state-sponsored industrialization. Although industrialization has bolstered the Chinese economy and elevated its presence in the global economic and political arena, emphasis on production and commercialization has led to the severe degradation of the nation’s environment, particularly when it comes to water.

The water crisis threatens the nation’s continued development as well as the wellbeing of its citizens. The OECD estimated that hundreds of millions of Chinese citizens drink water contaminated with inorganic pollutants like arsenic, excessive fluoride, and untreated factory wastewater. An estimated 119 million people lack access to safe drinking water. The northern provinces have been the most affected, as decades of unregulated environmental practices have significantly depleted water resources that were already fragile prior to industrialization. Regions north of the Yangtze River have always been drier than the southern provinces as droughts are a naturally occurring part of the climate. However, climate change and unchecked pollution have increased northern China’s proclivity to droughts. Environmental degradation in the northern provinces—especially the destruction and desertification of wetlands—has reduced the ability of the natural environment to respond to droughts as well as meet the growing demand for water from urban areas, agriculture, and industry. The higher temperatures and heat stress means that citizens and industry

---

1. Organization for Economic Cooperation and Development
operating in the region require larger amounts of water to function at normal levels. However, increasing droughts are decreasing the amount of groundwater and water runoff that is available for storage.

The World Bank estimates that the water crisis is costing China 2.3 percent of its GDP per annum. This figure is most likely higher, as it does not include ecological impacts and resource losses from pollution. Economic losses combined with increasing public outrage have forced the Chinese government to acknowledge and take steps to address water issues. The Chinese government has passed laws requiring investments in clean energy policies and technology yet still maintains its commitments to double the size of the economy in the next ten years and urbanize 350 million people. The crisis also has the potential to become a domestic and international security issue, as billions of people are dependent on Chinese rivers as a water source. Former Premier Wen Jiabao stated that: “the survival of the Chinese nation is threatened by the country’s shortage of water.”

Water stress and the increasing number of droughts in the Northern provinces have convinced policymakers that large-scale water infrastructure projects—like dams and transfer projects—are a necessity. Since 1949, China has constructed over 85,000 dams and reservoirs. Only 22 existed prior to the establishment of the PRC. An estimated 22,000 of these dams are considered to be large. This is three times

---

6 The International Committee on Large Dams (ICOLD) considers dams to be large if they are over 15 meters in height from the base of the foundation in the river (World Register of Large Dams, ICOLD).
the amount of dams constructed in the United States and five times the total in India. Few undammed rivers exist in China—the Nu River is the last truly free flowing waterway in the nation. Over-damming has fostered a cycle of chronic flooding and droughts and has significantly degraded domestic ecosystems in river areas. Additionally, the majority of dams in China were constructed for a hydrograph that no longer exists due to population growth, changes in evaporation rates and precipitation patterns, increased urbanization, flooding, droughts, salinization, and growing affluence among the general population.

This practice is puzzling, given the fact that these projects tend to disadvantage and dislocate certain groups as well as have long-term negative impacts on the surrounding ecosystems. The practice of dam building was condemned in a study conducted by the World Commission on Dams in 2000, which found that “in too many cases an unacceptable and often unnecessary price has been paid to secure those benefits, especially in social and environmental terms.” The report recommended a more comprehensive approach in water and energy development through small-scale decentralized supply systems and reducing overconsumption and waste. Following the report, many developed countries have begun the process of decommissioning dams and implementing more comprehensive approaches to managing scarce water resources, such as Integrated Water Resources Management (IWRM). However, China rejected the report and has since continued its practice of constructing mega-projects to alleviate water and energy supply issues. Given that an

international panel of experts denounced the practice of dam building, why has China continued to rely on the construction of large infrastructure to alleviate domestic water scarcity? This thesis seeks to answer this question by investigating three potential sources of influence on Chinese water policy making.

Scholars have been trying to understand why the Chinese government would continue to pursue such a costly water management strategy when better strategies are available. There are two main schools of thought that have focused on water policy in particular. The first of these argue that large infrastructure projects are favored as a method of water management because Chinese policymakers are primarily interested in rapid, short-term economic development. A second school of thought focuses on the long tradition of Chinese leaders harnessing water resources to maintain political control. A third perspective on water policy can be generated from scholars who study Chinese politics, and while they have not focused on explaining the heavy reliance of mega-projects in water policy, theories about bureaucratic politics might also explain China’s puzzling water policy.

This chapter will discuss will use these three theoretical perspectives to generate a number of testable hypotheses related to China’s water policy and offer an overview of the research design that will be used to test those hypotheses. The next chapter will provide the reader with a brief overview of Chinese water policy as well as the necessary background of the roots and causes of water scarcity. Chapters 3, 4, and 5 will discuss the South-to-North Water Transfer Project (SNWTP), the Three Gorges Dam, and the Nu River Project, respectively. Finally, the thesis will conclude with a synthesis of the observations made in Chapters 3 through 5 in order to present
the reader with a clear answer to the question. It will be shown that China’s reliance on large infrastructure projects is best explained as a result of political processes, specifically as a byproduct of the cadre system for official advancement. The final chapter will also offer a few policy recommendations that would enable China to develop water management strategies that better address its water scarcity needs as well as encourage more sustainable use of water in the domestic, industrial, and agricultural sectors.

**Predominant Theories of Chinese Water Policy**

*Economic Development—Water Infrastructure Creates Jobs*

The Chinese government continues to maintain its efforts and policies designed to sustain rapid economic growth. It could be argued that continued dependency on infrastructure to mitigate water scarcity issues is best explained as part of the Chinese government’s policy of promoting continued economic growth. Construction of infrastructure provides jobs, boosts the production of construction companies, and offers Chinese engineers and technocrats an opportunity to showcase their abilities to other major political and economic superpowers. Policies of economic growth that are implemented through a corporatist system of connected political, bureaucratic, and financial interests are generally found to be indicative of a developmental state.

The idea of the developmental state was first conceptualized by Chalmers Johnson to explain East Asian industrialization in the post-WWII era. Using post-WWII Japanese industrialization as an example, in *MITI and the Japanese Miracle,* 8

---

Johnson argues that the developmental state is the first step required for successful economic development and industrialization of any society. A state can develop regulations and policies aimed at increasing equality only after it has been a developmental state.\(^9\) State control of the economy is the defining aspect of a developmental state, as establishment of a credit-based system allows the state to exert influence over the patterns economic investment. This aspect of Johnson’s developmentalist theory is echoed by Theda Skocpol, who argues that the state’s manner of raising and using funds is the single most important factor in knowing its ability to create state organizations, employ staff, co-opt political support, invest in economic enterprises, and fund social programs.\(^10\)

In *The Environment and World History\(^11\)*, Kenneth Pomeranz applies Johnson’s concept of the developmental state to Chinese industrialization. He categorizes China’s commitment to increasing production outputs and state revenues as evidence of a “developmentalist project”. The developmentalist system is produced by government growth production policies that promote a relationship between increased state capabilities and more authoritarian human appropriations of the natural environment.\(^12\) According to Pomeranz, the developmentalist system in China is characterized by:

- Preference for keeping large numbers of people in rural areas

---

\(^9\) Ibid, 318.  
\(^12\) Pomeranz, 19.
• Encouragement of rural industry—both mechanized and manual—rather than establishing a purely agricultural countryside separate from industrial cities
• Central government that actively props up regions where the ability to live is both economically and ecologically vulnerable
• Central government that is less present in the economies of richer areas

The set of material conditions that exist in Pomeranz’s developmentalist system gives environmental protection a different significance in China than in more liberal traditions of governance. Pomeranz argues that China’s environmental problems are typical of a developing country, where increasing per capita income is the basic measure of success and government legitimacy. This is further supported by R. Bin Wong’s characterization of the fractal nature of the Chinese state and society. Wong argues that rather than being assigned different types of tasks, each level of government has the same agenda on a different scale.

If China’s current dependence on infrastructure development is best explained by economic theories of statist development, the three infrastructure projects that will be discussed should be designed with the primary goal being continued economic growth. The economic development model generates three hypotheses pertaining to large-scale water infrastructure projects in China:

**H1a:** Large water infrastructure project will promote economic growth in specific regions

---

13 Ibid, 119.
**H1b:** Natural resources will be calculated in terms of their monetary value: as sources of wealth or obstacles standing in the way of development

**H1c:** The economic costs of any given project will be less than the economic benefits

*Historical Tradition and Cultural Practices*

China has a history of manipulating the environment to increase state and military power. This is evidenced by Imperial-era projects like the Great Wall of China, which was designed to function as a buffer to prevent the nation from northern invasions. The Grand Canal was built to provide a more secure transportation route between the new capital in Beijing and the southern provinces, but it was also built with the goals of reproducing the Chinese empire and gaining control and management over the nation’s external resources. Intense deforestation, erosion, damaged ecosystems, and construction of large-scale water infrastructure projects all existed during Imperial China.

In his work *Oriental Despotism* \(^{15}\), historian Karl Wittfogel builds on Weber’s theories of bureaucracy and establishes the idea of the hydraulic society, claiming that all political power in Asia is derived from control of water resources. The theory of hydraulic civilization argues that any social or governmental structure that maintains power through exclusive control over access to water resources arises out of a need for water control and/or irrigation. This requires the establishment of a centrally coordinated and specialized bureaucracy, which makes the control of water supply and demand easier but also limits the ability for development of alternative

---

management solutions. Wittfogel believed that developing irrigation works led to the establishment of an organizational hierarchy for the coordination and direction of mass labor. Establishment of central governmental control meant that those in power were able to harness the labor of millions to build major infrastructure. Exploiting nature and subverting it for human use through construction of infrastructure historically led to immense political pay-offs for Chinese leaders. Therefore, Wittfogel establishes large infrastructure projects as a keystone of China’s “hydraulic society”. Wittfogel outlines five major conditions that exist in hydraulic societies. The ones that apply most to the three cases to be discussed in this thesis are:

- Environmental: arid or semi-arid conditions combined with a need for water to sustain grain production
- Organizational: Existence of large-scale cooperation
- Political: state leaders initiate the organizational apparatus of hydraulic order; direct internal and external activities have military characteristics.
- Social: stratification separates those involved in the hydraulic government from ordinary citizens (“mass”) 16

There is also a theory suggesting the existence of a cultural history in China of exploiting the natural environment. Both Elizabeth Economy and Judith Shapiro cite the Confucian tradition as one possible explanation for degradation of the Chinese natural environment. Confucius established that heaven, earth, and mankind govern the earth. Man must toil in order to realize the Earth’s potential and bring forth the

means needed for sustenance and the creation of an admirable material civilization. This philosophy established the precedent of the subversion of nature for man’s personal gains.

In *Mao’s War against Nature*\(^\text{17}\), Judith Shapiro argues that Mao-era policies of rapid industrialization are best understood as an extreme bastardization of Confucian philosophical and behavioral tendencies. The core of Mao’s views towards nature is best summed up as *ren ding sheng tian* (man must conquer nature).\(^\text{18}\) This is supported by language used in newspaper headlines during the Mao-era: “The Desert Surrenders”, “Chairman Mao’s Thoughts Are Our Guide to Scoring Victories in the Struggle Against Nature”.\(^\text{19}\) This rhetoric was used in many of Mao’s public declarations. He once stated: “‘Make the high mountain bow its head; make the river yield the way.’ It is an excellent sentence. When we ask the high mountain to bow its head, it has to do so! When we ask the river to yield the way, it must yield!”\(^\text{20}\) Mao also re-wrote the popular Chinese folklore story of Yu Gong, who leveled two mountains solely using axes and his son’s aid. Mao eliminated the ending of the story, which told of Yu’s aid from heaven, as he wanted to avoid contradicting the story’s main message concerning the power of the people to move mountains and change nature for their own use.\(^\text{21}\) Mao’s policy of *ren ding sheng tian* exhibits characteristics


\(^{18}\) Ibid, 67.

\(^{19}\) Ibid, 48.


\(^{21}\) Shapiro, 49.
of Wittfogel’s hydraulic society—much like the emperors of Imperial China Mao used the power of the masses to subvert natural resources.

The hydraulic society perspective generates two hypotheses about China’s water management policies:

**H2a:** New projects will be based on blueprints from old projects

**H2b:** Projects will be based on outdated technology or demographics

*Politics Drives Policy—Bureaucratic Politics and Cadre Advancement*

Thus far political scientists studying water politics in China have focused on anti-dam protests rather than on infrastructure development. Andrew Mertha’s *Water Warriors* (2008) is a very influential study that examines the protests that rose in opposition to several dams, showing how framing and political entrepreneurs helped create successful anti-dam protests. However, most water infrastructure projects either do not generate significant local opposition or that opposition fails. Many, many more infrastructure projects get built than do not get built. Although there are not specific theories about water infrastructure that focus on political rationale in the way that there are theories that focus on the economic and historical/cultural rationales, there are theories about Chinese politics that can be used to generate useful hypotheses about water infrastructure development. Theories about bureaucratic politics in general and Chinese models of cadre advancement in particular, can help us generate hypotheses that might help us understand why China continues to rely on large scale water infrastructure projects in spite of the very high costs and limited benefits.
Bureaucrats and a hierarchical chain of command are the centerpieces of the Chinese political system. In China’s command-and-control economy, they are the institutional basis for meeting development goals and the vehicle through which the state implements policies.

In Economy and Society\(^{22}\), Max Weber engages in a critical study of the bureaucratization of society. Weber developed the theory of bureaucratic management, asserting that establishment of a bureaucratic system as the most rational and efficient way of organizing a society.\(^{23}\) The purpose of this work was to relate the main forms of society—religion, law, household and political structures, stratification—to the economy. Weber felt that there was a reciprocal relationship between major forms of society and their economic provisions. Multiple factors are included in his discussion of bureaucratic theory, but the technical factors of bureaucracy are most applicable to the three infrastructure cases discussed. Weber posits that contemporary means of communication, which include public land and waterways, are the “pacemakers of bureaucratization.” Establishment of some kind of bureaucratic society is required for public and collective administration of infrastructure.\(^{24}\)

In a later essay titled “Bureaucracy and the Germs of Capitalism in China”, Weber uses China as a case study for his theory of bureaucratic management. He cites imperial China as an example of patrimonial bureaucracy in flood control, beginning with regulation of rivers and canal construction in the 22\(^{nd}\) century BC under Emperor Yu. Prosperity in imperial-era Chinese cities depended on the

\(^{24}\) Ibid, 213.
administration of domestic waterways by the emperor and his council. Weber concludes that power in imperial China was derived from the mandatory labor of subjects, which was essential for domestic flood control.\textsuperscript{25}

Weber’s hierarchical bureaucratic system can be closely connected to Susan Whiting’s theory that the formal system of evaluation (\textit{kaohe zhidu}) for official advancement at the local level creates perverse incentives by placing the greatest emphasis on concrete, measurable, and quantifiable achievements.\textsuperscript{26} The cadre system of development was initially implemented alongside Deng-era economic reforms during the 1980s. Originally, cadre evaluations included political thought, organizational and leadership abilities, familiarity with substantive issues, democratic work style, and achievements. However, in 1983 the National Organization Work Conference placed greater weight on tangible achievements, as opposed to work style or political attitude.\textsuperscript{27} This was largely designed to rescue cadres from the paralysis of the Cultural Revolution by actively marshaling local leaders to pursue specific goals. Performance contracts are made between the leading cadre and the Party secretary. Cadres are assigned performance targets, which are ranked internally as soft (\textit{yiban zhibiao}) and hard (\textit{ying zhibiao}). Soft targets are qualitative units that are difficult to measure, such as cultural or social development. Hard targets are quantifiable units drawn from national economic and social development plans. These targets are considered to be “bottom-line”—if local cadres do not fulfill GDP growth or foreign

\footnotesize{
\textsuperscript{27} Ibid, 101n62.
}
investment targets, it is unlikely they will advance politically, let alone retain their positions.28

Incentives are typically “high-powered”, meaning that positive performance means large payoffs for local officials and agents. The system of high-powered incentives structures competition so that an agent’s expected utility, which is expressed in monetary terms, increases with observed positive performance.29 In the case of Chinese water policy, the cadre system of advancement could help explain why officials continue to rely on large infrastructure projects to address water scarcity, domestic electricity shortages, and impoverished regions. Local cadre leaders may be incentivized to build mega-projects because they are easy to evaluate and are the solutions that will deliver the most immediate economic growth. Thus, implementation of such projects is the most likely to result in a bonus or a promotion—the perverse incentive in this case. The bureaucratic politics model generates three hypotheses pertaining to the construction of mega-projects:

**H3a:** Projects will be administered through hierarchical bureaucratic structures with the central government driving the policy decisions with little concern for local conditions

**H3b:** Large-scale projects will be favored over smaller scale solutions

**H3c:** Cadres will reap personal benefits—career advancement and monetary benefits—from promoting large scale projects

### Research Design


The thesis will determine which theoretical perspective best explains China’s heavy reliance on mega-projects to manage its water crisis by testing the hypotheses generated above. It will do this through close examination of three cases of large-scale water infrastructure projects to see which theory best explains China’s heavy reliance on mega-projects to manage its water crisis. The three cases—the South-to-North Water Transfer Project (SNWTP), the Three Gorges Dam, and the Nu River Project were selected because they are examples of contemporary infrastructure projects that all have widely publicized economic, social, and environmental costs. Choosing these three projects controls for a number of potentially confounding variables: they all have the same large scale, they all involve major water-related infrastructure projects, and they all are designed to address multiple environmental, energy, and developmental issues. They also have several areas of variation that make it possible to test the explanatory power of the competing theories: they are located in different regions, they involved different levels of international engagement, and they occurred in different time periods.

While a larger-n study might offer a more definitive test of the theories, because all three theories are concerned with the process of policy making, and not just its outcome, the case study method, in which close examination of the particulars of each development project are examined, is a more appropriate methodology for determining which of the competing theories best explains China’s reliance on large infrastructure projects in its water policy.

The SNWTP is a water transfer project comprised of northern, central, and western routes designed with the intention to move water from the southern provinces
to the parched northern provinces. This project began in 2002 and is currently under construction—the eastern and central routes are near completion and the controversial western route of the project is slated for completion in 2050.

The Three Gorges Dam, located in the central Hubei province, is the world’s largest capacity hydroelectric power station. The dam was built in stages between 1994 and 2009 for the purpose of expanding the shipping capacity of the Yangtze River as well as reducing flooding downstream through providing flood storage space. Although the Chinese government considers the project to be an historic engineering, social, and economic triumph, the dam flooded cultural and archeological sites, displaced 1.3 million people, and is thought to be responsible for significant environmental changes including rising incidences of earthquakes in the region.

The Nu River Project is a plan put forward by the Chinese government that calls for building four new hydropower plants on the Nu River in the southern Yunnan province. It was originally proposed in 1999, was put on hold in 2004, and was reinitiated in 2011. They are scheduled to begin construction in 2013, and completion is expected in 2015. When completed, the project is designed to expand domestic hydropower capabilities and increase water supply to Chengdu, the capital of the Sichuan province.

The hypotheses developed in the previous section of this chapter will be tested using material from each case study in order to test the three different theoretical explanations. The next chapter will introduce the environmental and political context
of China’s water resources in order to provide background for the three case studies in the following chapters.
CHAPTER 2—THE ENVIRONMENTAL AND POLITICAL CONTEXT OF CHINESE WATER SCARCITY

INTRODUCTION

China faces many environmental problems, but the water crisis currently facing the country is one of the most harmful and devastating cases of environmental deterioration anywhere. Water is critical for further economic growth and conversely, economic growth significantly impacts the availability and the quality of riparian resources. Rapid industrialization in China during the last thirty years has led to limited, overused, and polluted water resources, which have constrained economic growth as well as contributed to social tensions within the nation. The situation is particularly dire in provinces north of the Yangtze River, especially in the capital city of Beijing. The Chinese government has acknowledged that the developing water crisis has negatively impacted its economic development and has subsequently invested in constructing large-scale infrastructure projects in order to address these issues. However, these projects must be placed in the context of the environmental conditions of China’s riparian resources in order to understand their full significance and impacts. This chapter is designed to provide an overview of water scarcity in China. It begins with an ecological overview of China’s shrinking water supply and concludes with a sketch of the policymaking structures that are attempting to address the shortage.

Presently, northern China is relying on 10,000 year-old aquifers in order to meet demand; the increased reliance of such aquifers has caused ground cracking and
subsidence. Severe water pollution currently affects 75 percent of domestic freshwater resources and 90 percent of groundwater. Groundwater overexploitation is defined as use that leads to ongoing drawdown of the water table, degradation of water quality, and increasing the cost of abstraction or ecological damage. If the water table is too shallow, water logging and soil salinization occur. Low water tables increase the difficulty and cost of extracting water, which threatens food security. However, if the water table is too deep, vegetation is unable to reach water source and soil moisture is insufficient to sustain leafy growth.

Water scarcity is not new to China. The water crisis has been building for decades, as water supply is increasingly stressed by population growth. Presently, China is the world’s largest water user and accounts for 13 percent of global freshwater consumption. Although China is a large continental country with an ample water supply of 2800 billion m$^3$, the water occupation is about 2196 m$^3$ per capita annually. This is about one fourth of the global annual average of 8618 m$^3$

---

per capita. Additionally, total domestic water reserves have dropped 13 percent from 2000 to 2009.\textsuperscript{36}

China’s water resources can be divided into nine different river basins: the Yangtze, Yellow (Huang), Hai-Luan, Huai, Pearl, Southeast, Southwest and Northwest (Fig. 2.1).

Figure 2.1: Map of major watershed regions in China. Increasing darkness represents increasing water scarcity. 
Source: Y. Jiang, Journal of Environmental Management 90 (2009), 3185-3196

In China, the Ministry of Environmental Protection (MEP) is primarily responsible for assessing the quality of domestic water systems. Water resources in China are evaluated on a grading scale of I-V. Water that is given a grade I-III is

water that is safe for human consumption following treatment, grades IV-V refer to water that is only safe for industrial and irrigation, and water given a grade of V+ is unsafe for any use. Of the seven water systems in China, 55 percent had a water quality of grade I-III, 24 percent were graded IV and V, while 21 percent were graded V+.  

**Spatial-temporal Characteristics of Chinese Water Supply**

Domestic water resources are distributed unevenly in China, which has contributed to a North-South divide in resource access. Southern China has 81 percent of the country’s natural water resources; the northern provinces have the remaining 19 percent. The distribution of water resources within China is not compatible with the distribution of population, mineral resources, and arable land. Although the majority of Chinese water resources are located in the southern provinces, the largest need for water is in the northern and eastern provinces. Despite containing less than two-tenths of the country’s water supply, northern China accounts for 46.5 percent of the population and 40 percent of the total arable land.

Northern China is considerably drier since it receives far less rain than the southern provinces. This is critical to understanding water scarcity in China, since 98 percent of China’s surface water is recharged by precipitation. Thus, differences in rainfall levels reinforce and intensify the uneven spatial distribution of riparian

---

37 Xie et al, 113.
40 “General Survey of Water Resources...”
resources in the Northern and Southern parts of the nation. The maximum annual average precipitation is around 2000 mm along the southeastern coast to less than 200 mm in the inland northwestern provinces. The dry climate of the northern provinces further highlights the disparity in water resources between the north and south.

Climate change has further intensified the difference between northern and southern China. Inter-regional differences in precipitation have increased during the last century—presently rainfall in northern China is declining by 20-40mm per decade and increasing by 20-60mm per decade in the southern part of the country. Mainstream river flows are also declining in the northern river basins, contributing to the disparity in water resources. Although total annual precipitation is expected to increase to a certain extent, this will only occur in areas that already receive a significant amount of rain. The dry, northern provinces of China will experience higher evaporation rates, which will increase the already spatially uneven precipitation distribution. The scarcity is most dire in the North China Plain, which includes the major industrial cities of Beijing and Tianjin.

Looking at these statistics, it is clear why northern China has had so many problems with water scarcity. The large population density in the northern provinces means a large demand for water, which is mainly derived from groundwater. However, the uneven distribution has created intense water scarcity in many local

---

43 Xie et al, 11.
areas north of the Yellow River. The combination of high population and low rainfall has led to the overexploitation and depletion of groundwater resources in the region. Fig. 2.2 shows the varying degrees of groundwater depletion of each province in China.

Figure 2.2: Groundwater Depletion by Region. Darker regions indicate greater depletion. Source: China Water Risk

The map clearly indicates the overuse of available water resources in the Northern provinces, especially in the 3-H (Huang, Huai and Hai) water basins. Seventy percent of the North China Plain has been significantly impacted by the over-extraction of groundwater. The map also illustrates the stark north-south divide in water resource availability.

44 Jiang, 3189.
In the Hai River basin, groundwater withdrawal exceeds the recharge rate. This has caused recharge deficit of 40-90 mm per year, which has resulted in a steady and continuous water table decline of 0.5 m per annum. Overexploitation is particularly high in the municipality of Beijing, where groundwater tables have dropped by 100-300 meters.\(^{45}\) In total, the water table of the North China Plain is falling by an average of 1.5 meters per year.\(^{46}\)

Water scarcity in northern China is the product of overexploitation of groundwater, a naturally arid climate, and pollution from industrial, domestic, and non-point sources. Beijing currently has 230 m\(^3\) per capita of fresh water, which is below the world poverty mark.\(^{47}\) In the Hai River Basin, which is home to the major

\(^{45}\) Jiang, 3187.
cities of Beijing and Tianjin, 1.5 percent of China’s water resources support 10 percent of the population. Eighty percent of rivers in the Shanxi province have been rated “unfit for human contact.” Additionally, groundwater in the Hai river basin is over-extracted at a rate of 8.8 billion km$^3$ per year. 

Two-thirds of Beijing’s water supply comes from groundwater, and the remainder comes from surface water. The capital is already located in the drier region of northern China, but annual precipitation has decreased 30 percent since 2000. Additionally, overuse has left Beijing’s aquifers dangerously low. Citizens in villages outside of the city have to sink wells more than 1,200 meters into the ground in order to draw water.

Presently, Beijing uses 3.6 billion cubic meters (960 billion gallons) of water per annum, which far exceeds available local resources by over a billion cubic meters. Growth in both the population and city’s economy will only further escalate this water gap, and climate change will continue to disrupt snow and rain patterns in the region.

One of the most extreme cases of this is the Yongding River in Beijing and its neighboring province, Hebei. The Yongding is a main tributary of the Hai river system, and was once one of the most powerful rivers in northern China. It has been gradually losing water for the last 30 years as a result of numerous dams built upstream. These dams have limited the storage capacity of the river’s largest

48 Xie et al.
49 Xie et al, 18.
51 “Off the Deep End...”
reservoir, Guanting, which supplies Beijing with water. Although the Guanting can hold 4 billion m$^3$ of water, only 4 percent of its water storage capability is being used in present day.\(^5^2\) This occurs because the numerous large dams upstream, which consume most of the Yongding’s water supply before it can reach the Guanting reservoir. The Yongding also suffers from soil erosion and upstream pollution, which have significantly decreased the amount of available drinking water. Presently, the Yongding only meets industrial and landscape standards, as wastewater discharge from factories has further intensified water insufficiency in the north.

The Chinese government is paying farmers in Hebei to cut down on irrigation so the water supply of the Beijing municipality is sufficient. Farmers in the region have been forced to switch to growing corn, since it is a less thirsty crop than rice. Farm acreage has also been reduced to save water for the capital city. Perennial drought, pollution, and overuse of water resources have dried Beijing’s rivers and lakes and have lowered its water table. The city is struggling to meet the water demands of its 19.6 million citizens, and is currently transporting water at the expense of neighboring provinces in order to further delay the impending water crisis. In Hebei, this practice has contributed to the depletion of water sources, which in turn decreases opportunities in the agricultural sector.\(^5^3\)

The Huai River Basin, located in the eastern provinces of Henan, Anhui, and Jiangsu, is one of the best examples of the Chinese water crisis. Following the expeditious and largely unregulated industrialization that took place during the 1980s


\(^{5^3}\) “Off the Deep End...”
and 1990s under Deng Xiaoping, thousands of small factories were built in the Huai basin. Most of these factories did not operate systems for waste disposal, instead choosing to dump them directly into the river and its tributaries. Waste then collected in reservoirs and became increasingly concentrated over time as this practice continued, worsening the environmental state of the river. In both 1994 and 1998, the central government announced plans to clean up the Huai and shut down polluting factories, but little changed and toxic pollutants continued to build up in reservoirs.\textsuperscript{54}

In July 2001, heavy rains flooded tributaries of the Huai, which caused billions of gallons of water thick with garbage, yellow foam, and dead fish to flow into the Huai.\textsuperscript{55} Although many factories in the basin have been shut down, water still remains unfit for drinking, fishing, and in some cases, even for industrial use.

**Deep Drilling in the North China Plain**

One of the main reasons the Huai River remains unsuitable for fishing or drinking is due to the Chinese government’s policy of accumulating water in reservoirs for irrigation. Flooding north of the Huai River in the Hai River basin has caused significant waterlogging due to the government’s policy of accumulating water.\textsuperscript{56} The central government decided to implement drainage ditches—or new rivers—to help drain floodwaters following a bout of severe flooding during the 1960s. However, this policy decision was not as successful as they would have hoped and resulted in increased soil salinization in the basin.

\textsuperscript{56} Marks, 303.
In the 1960s, the central government decided to sink tube wells into ground water and aquifers all across the entire North China Plain. By 1985, 700,000 electrically powered wells had been sunk, which increased the amount of available irrigated land by over 40 million mu. In 2000, this number had increased to 3.6 million total wells, which were responsible for irrigating flat and ill-drained land. These wells actually increased the salt content of soil in the North China Plain and caused a salt crisis in farmland during the 1980s. In order to resolve this particular issue, wells were drilled at depths of up to 300 meters in order to bypass the now heavily polluted and salinated water tables. Presently, the survival of the agricultural sector in Northern China is completely dependent upon vast amounts of money and modern scientific knowledge—a solution that may not prove to be sustainable in the long term. In reality, they would have been better served by a mixed system of deep and shallow wells, combined with canals and ditches for irrigation purposes. This significantly less intrusive and more conservative policy will be revisited in the concluding chapter of the thesis.

Although the water and soil in the North China Plain have been meticulously managed by the central government to ensure continual usage, water shortages are still a very present part of life in this region. This is partially due to the massive growth of both Tianjin and Beijing in the last two decades. In the decade between the 2000 and 2010 censuses, Beijing experienced a 44 percent increase in population and

57 Ibid, 303.
jumped from a city of 13 million to a city of almost 20 million. The region is now more densely populated and developed, which has increased water demand.

**GROUNDWATER USAGE IN NORTHERN CHINA PLAIN**

In the last 50 years, groundwater has been key in expanding agricultural production in northern China. Sink well construction increased access and use of groundwater in the agricultural sector, which allowed for expansion into the northwestern provinces of Gansu and Inner Mongolia. Previously, these marginal, arid environments were unfit for agricultural production. This policy resulted in the creation of several oases completely dependent on groundwater as their primary water source for domestic, agricultural, and industrial purposes. Now, more than ever, formulation and implementation of sustainable groundwater use practices are key given the national policy of grain self-sufficiency, high demand for irrigation water, and the uncertain future of groundwater as a viable water source in China.

Forty percent of the total water used in the Northern China Plain is groundwater. Although this is not unusual, dependence on groundwater is problematic in this region given its present recharge rates. Bore fields and wells pump billions of meters of water per annum, which when combined with the region’s dams and surface water diversion schemes comprise most of North China’s water supply. However, northern China cannot afford to depend upon groundwater for drinking or irrigation purposes, as supply simply cannot keep up with demand.

---


59 Currel et al, 2.
Aquifers in northern China are mostly categorized as quaternary. They range from thick, unconfined aquifers in the large, inland river basins in the northwestern provinces to multi-layered, semi-confined, and confined aquifers. Many of these quaternary aquifers are comprised of palaeowaters, which were recharged thousands or tens of thousands of years ago. Palaeowaters are defined as groundwater resources that were recharged in pre-modern times under hydrological and climatic environments that are different from those present today. This is problematic due to existing strong evidence that there is little to no present-day recharging occurring in deep aquifers used for water supply in arid desert regions.

Additionally, major cones of depression have formed below cities as a result of the deep wells, offering further indication that extraction rates far exceed the aquifer’s capacity to recharge and release water from storage naturally. The confined aquifer of North China Plain depth to water reached 87m in depression cone below the city of Hengshui and 109m below Cangzhou (see Fig. 2.4). This rapid reduction in pore water pressures has caused land subsidence and fracturing throughout the region.

---

60 Ibid, 2
61 Ibid, 3.
63 Ibid, 3.
Groundwater has also been further stressed by the construction of reservoirs in the 3-H basin. Before reservoir construction, floodwater spread naturally from the river course and recharged shallow groundwater, which sustained vegetation. Reservoirs were designed to supply water to urban areas and irrigate agriculture in the Northern China Plain through the capture and diversion of mountain runoff. However, this practice caused a decrease in the spatial extent of surface runoff in regional recharge areas. No modern water recharging is occurring in the unnaturally shallow aquifers since the region has lost the periodic floods that would have contributed to replenishing the groundwater supply. This has contributed to water logging and soil salinization.

**TIBET—THE THIRD POLE**

Although water is more abundant in southern China, the state of riparian resources in the region is becoming worrisome. The southern rivers of the Yangtze,
Pearl, Lancang, and Nujiang are increasingly depleted due to a combination of rising demand and climate change.

The Chinese government is particularly concerned about the effect of climate change on the Tibetan Plateau. Often referred to as the Third Pole, the Tibetan Plateau is the third largest deposit of ice after the north and south poles. Additionally, the region’s riparian health has been severely affected by industrial activities. The mining and manufacturing industries have contributed to high levels of air pollution in the region, and deforestation has caused significant siltation and erosion.\(^6^4\)

The region has also been affected by climate change. In the last century, 82 percent of its glaciers have retreated and it has lost 10 percent of its permafrost.\(^6^5\) Rising evaporation and melting in the region is raising anxieties about the future of the region’s freshwater storage capacity.

This is especially concerning because Tibetan glaciers feed the Yangtze, Yellow, Lancang (Mekong), Salween, and Brahmaputra Rivers—rivers that over 2 billion people depend on. The confluence of these major rivers means that even a minor change in the water availability from the region will have a major impact on a quarter of all humanity.\(^6^6\)

Chinese authorities have now set their sights on harnessing Tibet’s water resources to combat the lack of freshwater in the arid North China Plain. The government has proposed constructing dams and canal systems in order to tap and


transport water from the Himalayan glaciers to the desiccated northern provinces. If implemented, the proposed developments would further stress this already fragile ecosystem, endangering the water security of billions of people.

In order to understand the arduous nature of large water infrastructure projects, a basic understanding of their environmental context is required. In recent decades, reliance on the construction of large water infrastructure projects—mainly dams and transport projects—has further exacerbated the dire environmental situation of China’s water resources. Construction of these projects has reached a tipping point where the costs far outweigh the benefits due to the nature of the environment they are built in.

**Political and Institutional Context**

The World Bank estimates that the water crisis is costing China 2.3 percent of its GDP per annum. This real figure is most likely higher, as it does not include ecological impacts and resource losses from pollution. Economic losses combined with increasing public outrage have forced the Chinese government to acknowledge and take steps to address water issues. Every five years, the National Committee of the CCP passes a series of economic and development principles in the form of “five-year plans”. The past decade has seen a growing emphasis on sustainable development in these national planning documents. The most recent five-year plan, passed in March 2011, emphasized quality growth in order to shift away from the previous decades of virtually unregulated economic expansion and towards policies

---

67 Xie et al, xxi.
of green growth and social stability. The plan also includes plans to slow the annual GDP growth rate from 10 percent to 7 percent.  

68  

The 2011 No. 1 Central Document—the annual policy document outlining China’s priority development issues—outlined plans to invest $600 billion over the next decade to fund water supply projects, water quality improvements, water and soil conservation, ecosystem rehabilitation, irrigation and managing increasing demand.  

69  

Sixty billion will go towards construction of the North-to-South-Water-Transfer Project and $22.5 billion is estimated to go towards protecting the Three Gorges Dam.  

70  

Although the Chinese Communist Party (CCP) has governed China since 1949, a single, central authority does not make its water policy. Officially, the 3,000 member National People’s Congress (NPC) is responsible for approving laws and national goals through approving five-year plans. However, the desire for policy consensus within the CCP has heavily impeded the development and implementation of environmental regulations, since, until recently, they have been secondary to economic expansion and development. China still lacks cohesive legal and administrative environmental regulations, as well as effective implementation of policies. Although the Ministry of Water Resources (MWR) is the principal national authority responsible for formulating water policy, there is no national consensus regarding water policy. This is partially due to competing and overlapping ministries.  


The Ministry of Environmental Protection (MEP), the Ministry of Water Resources (MWR), the National Development and Reform Commission (NDRC), the Ministry of Agriculture, Ministry of Housing and Urban Development, Ministry of Science and Technology, and the Ministry of Land and Resources all share jurisdiction over environmental issues, including water. Each ministry has a radically different perspective on development and environmental issues. For example, the MWR is primarily concerned with harnessing energy from and ensuring distribution of water resources, while the MEP focuses on pollution levels and ecological concerns. As a result, the MWR considers the Three Gorges dam a major achievement, while the MEP was highly skeptical of the project. Those advocating for sustainable development compete with other policymakers advocating a “pollute first, mitigate later” (xianwuran houzhili) approach. Furthermore, recent administrative decentralization efforts have made local implementation of environmental policy even more difficult, and the central government is currently working on improving its weak implementation capacity.

Although the construction of dams largely decreased following the critical World Commission on Dams (WCD) report in 2000, China has not shown any intention of changing its practice of building inordinate water infrastructure projects. The national government has preferred highly capital-intensive infrastructure projects as a primary method to alleviate the water crisis. The South-to-North Water Transfer Project, the Three Gorges Dam, and the Nu River Project are some of the most highly publicized projects.

---

71 Shapiro, 59.
Although the central government has continued to pass environmental regulations of increasing breadth and severity, implementation remains weak. China’s legal institutions tend to be vague and not well enforced by officials. Chinese environmental law and governance was virtually non-existent before the passage of the Environmental Protection Law of the People’s Republic of China in 1979. The law outlined “three magic weapons”—environmental impact assessments (EIAs), pollution discharge fees, and the “three synchronizations” policy of implementing pollution control during the design, construction, and operation phases of any project. No project can be approved unless its design, construction and investments meet national environmental protections standards. Compliance rates for EIAs are high, but this does not reflect their quality or the degree to which they are implemented. Many EIAs are actually completed after construction of a project has already begun, thereby making them less effective.

The Law on the Prevention and Control of Water Pollution, passed in 1996, set up a framework for the management of industrial and municipal pollution discharge. Although the new framework set up a series of obligations for management of these discharges by ministries at all levels of government, pollution discharge control has been difficult to enforce since discharge standards are not integrated with ambient water concerns or objectives. In 1997, the Law on Flood Control set up a framework for flood management designed to guard against as well

---

72 Ibid, 66.
as extenuate flood damage to ensure that flood defense is integrated into the national planning process.\textsuperscript{73}

The Water Law passed in 2002 set up a framework for water management. This included an integrated water resource management (IWRM) based approach to managing river basins based on measuring the flows of rivers, lakes, and groundwater. Quality and quantity management was designed to be coordinated between institutional organizations bound by obligations to collect and share data with both each other and stakeholders.

Although Chinese environmental law has grown considerably in scope, serious issues remain. The previously mentioned laws do not have a specific timeframe—their implementation depends on political will for institutional reform. Presently, there is not efficient communication between ministries. Lack of data sharing among the national and local ministries leads to overlap in responsibilities and conflicting opinions. Regulation implementation is further made difficult by strong government-local industry ties. The central government has constrained its ability to enforce environmental regulations nationwide by focusing on economic growth and mitigating the amount of unemployment and minority tensions. This is evidenced by the cadre evaluation system for advancement, which has created perverse incentives for bonuses and potential hierarchical advancement by giving economic and developmental goals greater weight in the assessment of officials. Local versions still share core characteristics of central governmental guidelines—highly specific performance measures to evaluate a diverse array of governance tasks.

Tasks vary by county, province, and region, but tend to emphasize township and village industry and agriculture—both areas that contribute to GDP growth and development.\textsuperscript{74}

The structure of the Chinese political system severely limits governmental efforts to enforce regulations and policies that will be possibly environmentally beneficial.\textsuperscript{75} The Chinese government continues to increase the prominence of environmental concerns in its rhetoric and in its lawmaking, but it seems to be undermining its own efforts by its attempts to mitigate the water crisis through dam building and other large infrastructure projects. What explains the contradictory nature of this policy? This question will be further examined in the next three chapters, which will each discuss the following infrastructure case studies: South-to-North-Water-Transfer Project (SNWTP), the Three Gorges Dam, and the Nu River Project (NRP).

\textsuperscript{74} Whiting, 106.
CHAPTER 3—CASE STUDY #1: THE SOUTH-TO-NORTH WATER TRANSFER PROJECT

PROJECT DETAILS

In order to alleviate water shortages in the parched northern provinces, the Chinese government approved the South-to-North Water Transfer Project (SNWTP) in 2002. The SNWTP is one of the largest and most costly infrastructure projects in Chinese history. The total project has a planned completion date of 2050, and will divert a total of 44.8 cubic meters of water annually.\(^7^6\) The project is estimated to cost between $52 billion and $70 billion US dollars, which is more than three times the cost of the Three Gorges Dam. When completed, the project will cover 1,300 kilometers of pipeline from the western Qinghai province to Hebei on the eastern coast, displacing an estimated 300,000 people in the process.

The SNWTP will mainly divert water from the Yangtze River to the Yellow (Huang) River and the Hai River, which are two parts of the 3-H plain. The project is

comprised of eastern, central and western routes (see Fig. 3.1).

The western route of the project—referred to as the Big Western Line—will divert water from the Yangtze River into the headwater of the Yellow (Huang) River. The central route will mainly divert water from the Han River—which is a tributary of the Yangtze—to the northern cities of Beijing and Tianjin. The eastern route is designed mainly to update the Grand Canal, which currently flows from Beijing to the southern city of Hangzhou. Each route will contain a group of canals, tunnels, reservoirs, pumping stations, and water crossing structures. Construction has already begun on sections of the eastern and central routes, since 80 percent of water deficits
in China occur in the Huang-Huai-Hai (3H) area. The western route is currently in planning stages.

The project is part of a national economic plan—the three routes run through many provinces, which each have their respective administrative powers and economic interests. The construction of the backbone infrastructure of the project is financed by a central government fund designed to cover the costs of construction, interest, and maintenance.

The main sources of controversy associated with the project have been high costs as well as the eventual displacement of at least 300,000 people to allow for the construction of the middle route. There has also been discussion among the international community about whether the project will actually succeed in mitigating northern China’s water shortage. Many scholars believe that the project will do more harm than good in the long-term.

**History of Project**

The SNWTP (*nan shui bei diao*) originated with Mao Zedong in 1952, who, when discussing domestic water supply issues, offhandedly remarked: “The south has plenty of water and the north lacks it, so if possible why not borrow some?” The Chinese government conducted some initial studies during the 1950s and the term for the project—*nan shui bei diao* (South-North Water Diversion)—appeared in a Political Bureau directive in 1958. From 1959 to 1961, the Chinese Academy of Sciences organized field investigations of water transfer in the upper reaches of the

---


Yangtze. The group of scientists, technicians, and engineers unanimously concluded that the engineering required to construct the western route was too difficult due to complex topographic conditions in the proposed Western Route area.

Following this investigation, the project was tabled until the droughts and water supply deficiencies in the North China Plain in the 1970s put water transfer back on the central government’s agenda. Water conservancy agencies conducted a series of studies along the route and released a preliminary planning report in 1976. In 1979, the Ministry of Water Conservancy supervised a group of scientists and technicians to carry out in depth research regarding the ecological impact of the proposed middle and eastern routes of the project.\textsuperscript{79}

A project planning office was established in the Ministry of Water Resources in 1979.\textsuperscript{80} In the same year, the Chinese Hydrological Society held a symposium in Tianjin where over two hundred experts, scientists, professors, and technicians gave presentations and exchanged opinions on a potential South-North transfer scheme. In October of 1980, the Chinese Academy of Sciences and the United Nations University co-sponsored a tour of the proposed central and eastern routes to discern possible impacts. However, the Chinese government did not seriously consider the project until severe droughts hit the northern provinces in the 1990s. The middle route of the project was made an official part of the central government’s agenda in 1994 following the MWR’s approval of the Feasibility Studies of the Middle Route Project


\textsuperscript{80} Zhang Yue, “Nanshui beidiao shui ziyuan guanli zenma gai” (How we should change our water resource management with South-North Transfer), Beijing Qingnian bao, March 2001, in Zhang Yue, 2004: 201-207.
as drafted by the Yangtze River Water Resource Committee.\textsuperscript{81} Additionally, the massive technological and economic transformations under Deng provided China with the capacity it needed to undertake a costly mega-project like the SNWTP. In 2000, then-President Jiang Zemin stated: “In order to radically alleviate the severe water shortage in the north, it is necessary to implement the South-North Water Transfer Project.”\textsuperscript{82} The State Council approved the eastern and central routes of the project in 2002.

**IMPLEMENTATION PROBLEMS**

Although the project was approved more than a decade ago, the eastern and central lines have only been partially completed. Implementation has been difficult due to unforeseen water pollution, resettlement issues, and potential environmental impacts. In the case of the SNWTP, these problems have been compounded by China’s recent economic growth, which make many of the assumptions on which the original project rested obsolete. However, Chinese officials have not recalculated the project to mitigate contemporary water issues and are continuing to push forward with Mao’s solution to water issues in the north.

Massive infrastructure projects like the South-to-North Water Transfer Project or the Three Gorges Dam have raised questions within China as well as the international community about the nation’s long-term priorities. According to a World Bank report, the SNWTP will mitigate water scarcity in the short-term, given


that “water scarcity will be acute and that the first stages of the SNWTP at least are justified.”\textsuperscript{83} Additionally, the social and environmental effects of the project are cause for concern. Exploiting natural resources without encouraging sustainable practices will not result in long-term economic prosperity. The SNWTP will also not assuage high groundwater withdrawal in the Northern provinces, as irrigation will remain the largest section of water use in the nation.\textsuperscript{84} This is primarily because cities tend to resort to more expensive methods of water acquisition, like building deeper aquifers or withdrawal from more distant rivers, in place of giving farmers compensation.\textsuperscript{85}

The South-to-North Water Transfer Project is a direct and non-controversial way of meeting priority demands and it can help contain environmental degradation to some degree. Water transfer in the Middle Route of the project is estimated to cause the average annual temperature to decrease by 0.10-0.24 C, and increase between 21-48 mm in average annual precipitation\textsuperscript{86}, which will lead to a more moderate climate. The Middle Route of the project is also expected to reduce the amount of water taken from groundwater supply, which will reduce the reliance in the region. Although both of these effects are beneficial, they only contain environmental degradation in the short-term.

Additionally, the implementation of the SNWTP has been troublesome because Chinese officials have not applied it to mitigating water scarcity in contemporary China. The calculations of the project during the 1950s are no longer

\begin{itemize}
\item \textsuperscript{84} Ibid, 11.
\item \textsuperscript{85} Ibid, 12.
\item \textsuperscript{86} Han-Chu Chen and Du Pengfei, “Potential Ecological Benefits of the Middle Route for the South-North Water Diversion Project”, \textit{Tsinghua Science and Technology} 13 (5) (2008): 717.
\end{itemize}
applicable as the demographics, economy and socio and political structure of the nation have changed fundamentally. The SNWTP may have been a more adequate solution to China’s water scarcity problem when Mao first proposed it half a century ago—when China’s population was 583 million people.\footnote{“Issues and Trends in China’s Demographic History”, Asia for Educators: Columbia, 2009, accessed December 11, 2011, \url{http://afe.easia.columbia.edu/special/china_1950_population.htm}.} Since 1952, China has experienced a population increase of more than 670 million people, which is greater than the present day combined population of Europe.\footnote{“Issues and Trends….”} Additionally, China’s nominal GDP has increased from $67.9 billion in 1952 to its present day $7.318 trillion\footnote{“China”, World Bank, 2011, accessed 10 April 2013, \url{http://data.worldbank.org/country/china}.} and the economy has grown at an annual rate of 10 percent over the last two decades.\footnote{Peter H. Gleick, “China and Water” in The World’s Water: 2008-2009 (Washington, D.C.: Island Press, 2009), 79.}

The way in which Chinese citizens operate within the political sphere has also changed—NGOs are now a significant presence in the country and Chinese citizens are much more outspoken regarding government policies they do not agree with. Environmental conditions within China have also changed drastically since the project was first proposed. Southern China now experiences water quality issues, given increased pollution in the Yangtze River. This has been a major problem in project implementation, as increased pollution levels in the south have significantly increased both the total cost of the project and its negative ecological effects. These issues are exemplified by problems in construction of the middle route of the SNWTP.

Construction of the middle route has been the most formidable aspect of the South-to-North Water Transfer Project, in part due to significant changes in the
demographics of the middle route since the project was first proposed in the 1950s. When completed, the route will divert water from the Yangtze in the south to the northern cities of Beijing and Tianjin. This requires elevating the existing Danjiangkou Dam from 162 meters to 176.6 meters and raising the reservoir from 157 meters to 170 meters. The main source of controversy for this section of the project is the fact that it will eventually relocate between 300,000 and 400,000 citizens in three years. Although this number seems relatively small given both China’s total population and the 1.2 million people relocated during the construction of the Three Gorges Dam, the nature of the planned relocation is intense. According to an International Rivers report, the Chinese government plans to relocate 330,000 people in 3 years, or roughly 110,000 people per year. This is on par with the Three Gorges Dam, which resettled 1.2 million people over ten years, which averages out to 120,000 people per year. Resettlement is controversial for many reasons. First of all, it involves tearing citizens away from places of ethnic, cultural, and familial value. Second of all, displacement will lead to an increase of the migrant population in urban areas. This is already a problem in major Chinese cities, which are already overcrowded. For many citizens living in the affected area, this will be their second displacement as the construction of the Three Gorges Dam relocated many citizens to the region. Displacement and resettlement as a result of middle route construction have occurred as a result of China’s rapidly growing population. The SNWTP

---

91 Fereidoun Ghassemi and Ian White, “Inter-basin Water Transfer in China”, in *Inter-basin Water Transfer: Case Studies from Australia, United States, Canada, China and India* (New York: Cambridge University Press, 2007), 310.

diversion project displacement area⁰ is five times larger than the displacement area of the Three Gorges Dam.⁹³

Reactions to resettlement along the proposed middle route have been mixed, especially since the decision was made without the inclusion of public opinion. In a survey conducted by International Rivers, local affected people stated: “We have received a policy brochure, but we did not know how the policies were made or how the compensation standards were set.”⁹⁴ The affected parties also have no input in the regions that they will be relocated to—they are required to relocate and build houses collectively. Chinese officials have failed to recalculate implementation of the middle route of the project on a socio-political level. Public participation in the Chinese political sphere has increased significantly since the time of Mao. If Chinese officials want to effectively construct the middle route of the project, they have to include some level of public input. There are also concerns about relocation given that the budget for resettlement of those affected by the construction of the middle route is relatively small. This poses problems for the future livelihood of local affected citizens living in the area. There are also ecological risks associated with relocation, as there will be an influx of citizens in areas that cannot accommodate any significant population increase. The problems that Chinese authorities have run into while constructing the middle route of the project prove that the SNWTP does not factor in the economic, social and political changes that have occurred in China since the

---

⁰ This term refers to the total amount of area to be subverted for construction of the project.
⁹⁴ “Resettlement in Action...”
project’s inception in the 1950s. Contemporary China is notably different from the China of Mao Zedong.

The entire focus of the SNWTP is the diversion of water from the water-rich southern provinces to the parched north. However, the state of water resources in the southern Chinese provinces—especially the Yangtze River—has changed drastically since Mao first proposed south-to-north water transfer. Scientists are worried that the SNWTP will only divert large amounts of polluted water to a new location. In the 1950s, the Yangtze was a plentiful and clean water resource. However, the river has become incredibly polluted as the result of China’s rapid industrialization and development in recent decades. For the first time, the southern provinces are experiencing water shortages as a function of industrialization and climate change. In 2007, over a million citizens in Southern China were without drinking water due to a severe drought that decreased rainfall between 20 and 35 percent and dried up reservoirs, wells, and significantly lowered levels in the major rivers of the Yangtze, Yellow (Huang), and Zhujiang. Additionally, an estimated 20,000 factories—half are located on the Yangtze—are dumping uncontrolled or marginally controlled pollutants into the rivers. The pollution in southern water resources will have the greatest impact on the eastern route of the project, since water will flow through the Imperial Grand Canal, which is heavily polluted with untreated wastewater from the Jiangsu and Shandong provinces. In order to mitigate pollution on the eastern route, government officials have set aside a third of the total route construction budget to

---

95 Glieck, 86.
96 Ibid, 81.
97 DeSalle et al, 7.
build water treatment plants and wastewater recycling centers.\textsuperscript{98} The cost of this endeavor is around 24 billion yuan.\textsuperscript{99} The general water trend in China is characterized by extended sections of poor quality (see fig. 3.2).

Figure 3.2: Trends of proportions of monitored sections with poor water quality for major Chinese river basins. Source: Jiang

Twenty percent of the Yangtze and Pearl basins have poor water conditions.\textsuperscript{100} Although this number is low compared to 50 percent in Yellow basin and 78 percent in Hai basin, pollution of southern water resources continues to increase. In the Pearl River basin, pollution degraded water resources in 2010 were 352 m\textsuperscript{3}, which has the

\begin{footnotesize}
\textsuperscript{98} Ibid, 7.
\textsuperscript{99} Ibid, 7.
\textsuperscript{100} Jiang, 3188.
\end{footnotesize}
ability to support a total of 2.54 million people.\textsuperscript{101} Decreasing water quality and quantity in southern China is further evidence of a project based on outdated demographics, as there has not been a recalculation of the base assumptions of the SNWTP to mitigate present water scarcity problems. Diversion of water from the south to the north may have mitigated northern water scarcity when the project was first proposed. However, increased pollution in the southern provinces means first that clean water is no longer plentiful in the south, and that the project may result in pollution conveyance, which will exacerbate rather than alleviate the northern provinces’ water quality and quantity issues.

Is there a way out of the SNWTP? The project has been presented as the only policy solution to palliate domestic water stress. There are, in fact, alternative measures to mitigating water scarcity within China that factor in the contemporary economic, political and social changes that have occurred in the last few decades. Changes in the domestic water pricing system aim to mitigate water scarcity at the societal level. Improvements in water use through more efficient irrigation methods as well as changes in the price of water can work to assuage problems of water scarcity in the Chinese industrial sector. Lastly, changes to the Chinese water management system can alleviate water quantity and quality issues at a governmental level.

Water expert Peter Gleick of the Pacific Institute writes that China’s “absolute scarcity of water is seriously aggravated by grossly inefficient use in some sectors.”\textsuperscript{102} Domestic water use in urban areas is particularly inefficient. This

\textsuperscript{101} Ibid, 3189.  
\textsuperscript{102} Gleick, 93.
inefficiency could be reduced through a better water pricing system. Presently, water prices are set low, which means that they cannot fully cover the full cost of water supply. Current household expenditures for water hover at around 1.2 percent of disposable income, which is lower than the 2 percent level that stimulates water saving behavior. In the city of Xi’an, located in the northwestern Shaanxi province, domestic water use is priced at 1.6 yuan per m$^3$ when the full production cost is 5 yuan per m$^3$. Chinese officials have been reluctant to raise water prices in the past, as water is viewed as a natural human right. Raising water prices has the ability to provide citizens with incentives to use water more efficiently. If the price of water increases, citizens will be more likely to conserve the resource because they want to conserve their disposable incomes.

As mentioned in the second chapter of this thesis, overuse of groundwater in the agricultural sector remains a large problem within China. Although the South-to-North Water Transfer Project has the potential to reduce reliance on irrigation and groundwater, it does not provide any incentives for farmers to improve irrigation efficiency in the long-term. Water productivity is the lowest in agricultural sectors because of excessive waste in irrigation systems—only 50 percent of water from primary canals reaches fields. Additionally, only 40 percent of water withdrawn for agricultural use is used. The irrigated area in Northern China is not likely to increase due to water scarcity—water saving agricultural practices could mitigate this

\[103\] Jiang, 3192.
\[104\] Xie et al, 37.
\[105\] Ibid, 26-27.
\[106\] Ibid, 26-27.
problem. Xi-Ping Deng et al outline the following components of water saving agriculture:

- Water-saving irrigation: use of irrigated farming practice with the most economical exploitation of water resources
- Limited irrigation: soil water deficit induced at non-critical growth stages and supplemental irrigation is supplied at critical growth stages
- Dry land cultivation: water saving agriculture for areas that do not lie within any irrigation network. Natural precipitation is used through runoff collection.\textsuperscript{107}

Implementing the tactics as outlined by Deng et al could make significant contributions to mitigating water scarcity in northern China by significantly improving water use efficiency in the agricultural sector. Groundwater scarcity and exploitation could also be mitigated by the employment of water pricing in the agricultural sector. According to a study conducted by the World Bank, a 100 percent price increase would result in a 17-21 percent reduction in water use, given that the price elasticities of water demand for irrigation are between -0.17 and -0.21.\textsuperscript{108}

The alternate solutions as outlined above demonstrate that other options for mitigating water scarcity exist that take the social and environmental affects of the problem into account. The South-to-North Water Transfer Project is not the only policy decision that the Chinese government can make in order to assuage water problems in the north.

\textbf{Theoretical Analysis}


\textsuperscript{108} Xie et al, 37.
THE SNWTP AND ECONOMIC APPROACHES

From the onset, it appears that Chalmers Johnson’s theory of the developmentalist state can be applied in the case of the SNTWP. China is a nation that was late to industrialize, and engaged in massive, rapid development of industry in order to be able to successfully compete against fully developed nations in the global economy. This theory can be applied to the general nature of contemporary Chinese environmental governance. Although the last decade has seen an increase in environmental regulations, Chinese environmental policy is still focused on finding technical solutions to solve environmental problems, rather than on focusing on policies that will encourage simpler, cost-effective, and sustainable solutions. Thus, although on the surface, it may appear to be transitioning towards a regulatory state, China is still in the developmental period.

Many scholars studying the SNWTP argue that there are other alternatives—like increasing the price of water or improving irrigation efficiency—that can alleviate water scarcity without the high costs and uncertain risks. If other options exist, why is the SNWTP touted as the only way to save the North China Plain? Measures were taken to implement higher water pricing schemes would have the largest effect on farmers, which would further increase the wage gap. Higher water prices would most likely result in mass migration to already crowded urban areas as farmers are forced to abandon their livelihoods and look for careers with more stability and higher income. This is indicative of Kenneth Pomeranz’s developmentalist project theory, as leaders would rather keep large numbers of people in rural areas in order to avoid potential instability that would likely result from
overpopulation in urban areas. Rural industrialization eases the environmental strain on urban areas—more people in the countryside decreases the need for additional transportation infrastructure and energy demand for shipping products from urban to rural areas. In this case, we also see evidence of the central government actively propping up a region where the ability to live is economically and ecologically vulnerable. The main purpose of the SNWTP is to provide the North China Plain with more water. As established in the second chapter, high population and low rainfall has led to the overexploitation and depletion of groundwater resources in the region. Propping up this region goes against the logic of state building, which would abandon the north as a backwater and focus on harnessing the resource wealth of the southern provinces. However, the SNWTP is touted as the project that will save the northern provinces, enabling them to continue agricultural production and further economic growth in the area.

**THE SNWTP AND HISTORICAL APPROACHES**

In the case of the SNWTP, the hydraulic society approach to understanding reasons behind the project is the most applicable of the historical theories outlined in the first chapter. Although the SNWTP is currently under construction, when completed it will be the largest construction project in history. A continued focus on mega-projects reinforces the idea of a powerful central government with exorbitant amounts of available wealth and resources at its disposal. The SNWTP meets the environmental, political, and social conditions for Wittfogel’s hydraulic society. The SNWTP has been promoted as a way to save the North China Plain—a semi-arid region that requires water to sustain grain production. The natural imbalance between
prime soil for grain in the northern provinces and an overabundance of water resources in the south has created a tradition of dependence on technocrats and engineering expertise to solve issues of resource allocation. The project has primarily been implemented by the central government and local government has been given limited implementation authority. Implementation of this project is military in nature, as it falls under the control of the Hydropower Command, which is a branch of the People’s Armed Police section of the People’s Liberation Army. There is a distinct separation between those involved in project implementation and ordinary citizens, as evidenced by a lack of stakeholder involvement in the resettlement policies associated with the middle route.

THE SNWTP AND POLITICAL APPROACHES

A centrally coordinated and specialized bureaucracy makes the control of water supply and demand easier, but hampers any development and implementation of alternative management solutions. This is found in this case—the SNWTP is completely under the authority of the central government.

The SNWTP is part of the national agenda. This means that implementation of project aspects falls into fulfillment of “bottom-line” targets for raising GDP growth set by the central government. The project falls directly under the authority of the Ministry of Water Resources, which is a central government authority. It was the centerpiece of the 10th Five-Year-Plan (2001-2005) and is a key part of Hu Jintao’s “Scientific Development Policy”, which uses a combination of engineering, technology, and modern policy to address Chinese resource challenges. Although supply is severely limited, water prices for non-agricultural use in the Beijing
municipality are one-sixth to one-tenth of what they should be. The marginal user cost of water should be reflected in the water resources fee component of the overall price. Changes to the water pricing policy would most likely be beneficial to alleviating some aspects of water stress in the north. However, the Chinese government has a technocratic approach to water control based on western models—the central government is in charge of multipurpose, basin-wide planning for the Yellow and the Yangtze.

The project also carries the promise of increasing economic output in the 3-H region. As outlined in the second chapter, the central government has been subverting crucial water resources from the neighboring province of Hebei to ensure water availability in Beijing municipality. This has significantly decreased the amount of water available for use within the province—farmers have been forced to switch crops and cut down on irrigation, which has decreased available opportunities in the agricultural sector. The SNWTP offers a solution to Beijing’s water scarcity issues—after diverted southern water reaches the North China Plain, both the industrial and agricultural output is expected to increase by an estimated 50 billion yuan per year and create between 500,000 and 600,000 new jobs. Once implemented, Beijing will no longer require Hebei’s water resources. Given the importance of gross value of agricultural output and infrastructure investment in national cadre evaluations, the promise of increased agricultural outputs is an incentive for cadre leaders in Hebei to implement the project. Additionally, the lack of citizen awareness in terms of the resettlement aspect of the project indicates that local officials are more concerned

with the satisfaction of their superiors. The SNWTP offers a short-term solution to the crisis with immediate effects—the negative externalities of construction will not be realized for several years. This makes the project highly attractive to officials who wish to retain their jobs or advance politically, as it provides them with a specific, quantifiable solution that is the most likely to guarantee that their region will meet bottom-line goals set by the central government.

Although aspects of the economic and historical approaches apply to this case, they are not perfect explanations and largely ignore crucial aspects of the project. The longevity of cities in Northern China—especially the capital, Beijing—depends on solution to their water issues. Economically, the project puts a growth trajectory in place that is fundamentally unsustainable. The Western route of the project is the only route that is designed to directly deliver water to the Yellow River Basin, which is the primary water source for the northern and western provinces. However, the route will not be completed until 2040 and China’s demand for coal is expected to grow by 1 billion metric tons—a thirty percent increase—in this time period. Additionally, the MWR estimates that national water consumption will increase by 1 percent per annum, mostly due to the development of coal reserves in the northern and western provinces. It is highly likely that demand will outstrip supply by the time the diversion project is completed. Additionally, the resettlement aspect of the project does not fit into Pomeranz’s developmental state. Resettlement has the potential to crowd areas that are already stressed, which will likely require additional financial aid

---

from the Chinese government. Regional disparities are likely to increase as the project siphons water—a crucial prerequisite for any kind of sustained growth—away from marginal areas towards urban metropolises. Additionally, the possibility of pollution diversion will require additional funds, which economically does not coincide with economic explanations.

Although the historical approaches appear to fully explain the project, reliance on infrastructure in this case is more indicative of officials adhering to policies dictated by the central government. Historical approaches also assert that water infrastructure is used by the central government to control the masses. In order to retain its power and ensure social stability within China, the CCP must implement policies designed to improve the overall quality of life in the North China Plain. However, the SNWTP carries many controversial aspects, including forced resettlement which would likely result in a rise of migration to urban areas. This aspect of the project will decidedly not ensure social stability, especially in rural areas.

A closer examination of economic and historical explanations shows that neither of these perspectives fully explains the reasons behind project implementation. In this case, political theories of bureaucratic management and cadre politics truly apply to all aspects of the SNWTP. This same outcome will be proven in my next chapter, which discusses the Three Gorges Dam.
CHAPTER 4—CASE STUDY #2: THREE GORGES DAM

PROJECT DETAILS

Located in the central Hubei province, the Three Gorges Dam and its related components comprise the largest amalgamated water infrastructure project in the world. The project is a unique case due to its scale and the controversies surrounding its environmental, social, and economic impacts.

The project stretches 2 kilometers across the Yangtze River, across the Three Gorges of Xiling, Wu, and Qutang (see Fig. 4.1).

![Map of the Completed Three Gorges Project area — including the location of the reservoir](http://www.ibiblio.org/chinesehistory/contents/07spe/specrep01s02.html)

The dam is 185 meters high with a total installed power capacity of 22,000 MWe, making it the largest power station in the world. Additionally, the project includes a reservoir that is 600 kilometers in length with a storage capacity of 40 billion cubic meters.\(^{111}\) Project designers claim that the dam will provide electricity and flood protection as well as improve navigation of the

---

Yangtze. This region of China has a history of devastating floods resulting in massive losses of life and farmland.

The project is also designed to improve shipping in the region. River navigation is the only cost-effective means of long-distance freight transport. The Three Gorges Dam increases water depth and improves navigation up to the city of Chongqing. The immense ship lock system of the dam allows large quantities of cargo to pass into the upper reaches of the Yangtze. Pre-construction, this amount hovered around an average of 18 million tons annually. In 2006, the new system made it possible for 50 million tons to move through.

The project was also designed to increase the total water supply in the long-term. The Yellow River (Huang He) is filled with silt and is running dry and policymakers believe that the Three Gorges reservoir could function as a potential water source if droughts and scarcity continue to be prevalent in the northern provinces.

Those in favor of the project argue that it is ultimately beneficial to the environment, claiming that the electricity produced by the dam would otherwise be produced by dirty coal-burning power plants. Those who oppose the project argue that any potential benefits of construction do not make up for the large-scale environmental and social transformations downstream of the dam.

---

112 Gleick, 140.
5 Chongqing is a municipal city of 28 million people located about 600 kilometers upstream from the Three Gorges Dam. It was previously part of the Sichuan province but was made a municipality in 1997. The city is the economic center of the upstream Yangtze basin.
113 Ibid, 144.
Assigning an approximate value to the total cost of the Three Gorges Dam has been difficult, but estimates made in the mid-1990s range from $25 billion (US) to $60 billion (US). The State Three Gorges Construction Funds, power revenues from hydropower facilities and the TGD project, as well as loans and credits from the Chinese State Development Bank (SDB) have funded construction of the dam.\textsuperscript{115} Global commercial banks and investment firms have provided the project with additional funding. The China Yangtze River Three Gorges Project Development Corporation (CTGPC)—set up directly under authority of the State Council—has $672 million (US) in assets and has primary ownership of the dam.\textsuperscript{116}

**PROJECT HISTORY AND POLICYMAKING PROCESS**

The idea of the Three Gorges Dam initially originated over eighty years ago with the father of modern China—Sun Yat-sen—who first proposed construction of a large hydroelectric dam across the Yangtze in 1919.\textsuperscript{117} He proposed constructing a dam to “store water, so that ships can sail upstream against the flow of the river, and the river can be harnessed for electric power.”\textsuperscript{118} The Kuomantang government began a preliminary investigation of the project but was disrupted by the Japanese invasion in 1937. Following severe flooding in the region in 1954, Mao promised he would hasten construction of a massive dam, stating: “A stone wall to be erected, to cut-off the cloud and rain from the Wushan Mountain; a lake with flat water surface is

\textsuperscript{115} Gleick, 141.
\textsuperscript{116} Jackson and Sleigh, 62.
\textsuperscript{117} Sun Yat-sen, *The International Development of China* (Shanghai: Commercial Press, 1920).
thus created in the high gorges.”\textsuperscript{119} The Jingjiang flood diversion project had been recently completed and was key in limiting overall flood damages in the Three Gorges region. However, authorities believed that relying solely on the diversion project for flood control in the middle and lower reaches of the Yangtze was unwise and that dams were imperative to ensure the safety of the region.\textsuperscript{120} During this time period, the government set up an administrative body called the Committee of the Changjiang Catchment Management to coordinate development activities in the Three Gorges area. Chairman Mao and Lin Yishan, the head of the Yangtze Valley Planning Office (YVPO) were two of the largest proponents of the dam. Lin Yishan had no formal training in water management but was instrumental in the development of the YVPO, which employed thousands of people hoping to make a career through participation and development of the Three Gorges project.

Over the next three decades, a series of large-scale investigations were organized as part of engineering feasibility and environmental impact assessments. Although the Three Gorges continued to be discussed during each Five-Year planning period, national conditions in China during the 1960s and 70s were not ideal for undertaking such a project.

Although plans for the Three Gorges were not fully realized until the 1980s due to financial and technical constraints, the government began construction on the Gezhouba dam, situated 40 kilometers downstream from


\textsuperscript{120} Heggelund, 22.
the planned Three Gorges site. The dam was used as a test to resolve any technical issues associated with the Three Gorges project.

In 1982, the central government—mainly the YVPO—revived earlier project investigations and conducted feasibility studies. In 1983, the State Planning Commission convened a conference of 350 experts to evaluate the results of the YVPO report and to thoroughly discuss all aspects of the dam. The committee concluded that the State Council adopt the YVPO report and move ahead with construction plans. Originally, the project was supposed to be 150 meters high. However, leaders in Chongqing were concerned that the dam would create sediment buildup in backwater regions, therefore complicating navigation and shipping. They proposed that the dam be 175 meters, which was preferable to Deng Xiaoping.\footnote{Ibid, 33.}

In 1986, the Chinese Ministry of Water Resources and Electric Power propositioned the Canadian government to fund research on the feasibility of constructing a dam in the Three Gorges region of the Yangtze. The study was conducted by a consortium of Canadian firms—CIPM Yangtze Joint Venture—and was supervised by the World Bank. In 1989, the Changjiang Water Resources Commission was charged with planning, designing, and conducting further research of the project. However, project implementation was not smooth—the Three Gorges faced serious opposition. In 1986, representatives from the Chinese People’s Political Consultative Committee (CPPCC) conducted a field trip to the Three Gorges region to meet with ministries and bureaus in cities that would be affected by the project. The
report they submitted to the State Council recommended that they halt the project. The project also received a considerable amount of backlash from citizens, journalists, scientists, and even bureaucrats. Despite clear opposition, the People’s Congress approved the project in 1992 and construction on the dam began in December 1994. The project was officially completed in 2009.\textsuperscript{122} Crackdowns on student demonstrations following Tiananmen Square in 1989 effectively silenced all opposition to the project. Additionally, extreme flooding in the region during 1991 highlighted the need for flood control infrastructure, which policymakers stressed was a key role that construction of the Three Gorges Dam would fill. Approval was also made easier due to high support from top leaders in the central government.\textsuperscript{123}

Central Commissions (\textit{weiyuanhui}) and leading groups (\textit{lingdao xiaozu}) directly under the authority of the State Council or the Communist Party apparatus were responsible for policy-making. The most authority rested with the State Council Three Gorges Project Construction Committee (TGPCC), which was headed by then-Premier Zhu Rongji. The committee was responsible for all work related to the dam project, which included overseeing construction, environmental, and resettlement work.\textsuperscript{124}

**Environmental Impacts of the Three Gorges Dam**

The potential environmental effects the project will have on the Three Gorges region are controversial and numerous. Proponents of the project argue that will have

\textsuperscript{123} Heggelund, 33.
\textsuperscript{124} Ibid, 34.
beneficial environmental effects in the long-term, as it will reduce the amount of coal burned annually in China. The Chinese government estimates that if the electricity generated by the dam were generated using coal instead of hydropower, it would burn 50 million more tons of coal and release 100 million tons of carbon dioxide (CO₂), 1.2 million tons of sulfur dioxide (SO₂), ten thousand tons of carbon monoxide (CO), and large amounts of particulate matter (PM₂·₅) into the atmosphere.¹²⁵ Forty billion yuan is estimated to go towards construction of 150 sewage treatment plants and 170 urban garbage disposal centers in order to reduce the annual amount of wastewater released into the Three Gorges reservoir.

The negative environmental consequences of the dam are numerous. Construction of the project has caused further degradation of the Yangtze River ecosystem, damage to fisheries, reduced sediment in the East China Sea, and has increased the risk of landslides and seismicity in the area. Many of the environmental problems in the region pre-date construction of the Three Gorges Dam, but the project has exacerbated, rather than improved, most of these issues. Scientific investigations were completed in order to prepare a baseline evaluation of plant and animal communities threatened by construction of the Three Gorges Dam. However, these assessments were completed during post-construction of the dam in 2007."¹²⁶

The Yangtze River basin is home to 36 percent of total freshwater fish species in China. Sharp declines in the region’s fish population had already occurred following completion of the Gezhouba dam in 1981. Major changes in the regional fish population are expected as consequence of changes in river dynamics, the

¹²⁶ Ibid, 143.
chemical and temperature composition of the water, and the character of the natural habitat and available food resources. Commercial harvest of four carp species was found to be between 50 and 70 percent below the 2002 pre-dam baseline.\footnote{Richard Stone, “Three Gorges Dam: Into the Unknown,” Science 321 (2008), 628.}

The dam has slowed the Yangtze’s current, which has led to a reduction in the total amount of sediment in the Yangtze River basin. The Yangtze typically contains large amounts of sediment from its upper reaches to the East China Sea and is crucial in supporting ecological processes and fishery productivity in the Three Gorges region. Since the construction of the Three Gorges Dam, there has been a significant decrease in downstream sediment, which has increased coastal erosion and changed the productivity of the area. Additionally, a slower current will increase the amount of pollution in the Yangtze. Prior to construction, the current moved quicker and could therefore flush out waste.\footnote{Deirdre Chetham, Before the Deluge: The Vanishing World of the Yangtze’s Three Gorges (New York, NY: Palgrave Macmillan, 2002), 187.}

When reservoirs fill with water, increased pressure is placed on local faults, which increases seismic activity. The Three Gorges region was already seismically active previous to dam construction. Although reports of seismic behavior have increased post-construction, Chinese officials have minimized the importance of seismic activity, stating: “no unusual phenomena which could disrupt the stability of Three Gorge Dams have occurred.”\footnote{“Full views of Three Gorges Project,” People’s Daily Online, November 30, 2007, accessed January 11, 2013, http://www.mwr.gov.cn/english/20071130/88209.asp} On July 13, 2003, a devastating landslide near Qianjiangping on the junction of the Yangtze and Qinggan rivers occurred. Twenty-four million cubic meters of rock and earth slid into the river, blocking flow and destroying 4 factories, 300...
homes and 67 hectares of farmland.\textsuperscript{130} This event was attributed to the Three Gorges Dam. The risk of landslides has been larger than officials expected, and is leading to the formulation of new resettlement efforts for at-risk citizens in the region. It is predicted that an additional 4 million residents living in the Chongqing municipality will need to be resettled in the next decade.\textsuperscript{131}

**The Development Resettlement Policy and Its Effects**

The mass resettlement associated with the Three Gorges Dam has been the most widely publicized and controversial aspect of the project. Before construction began, the Chinese Academy of Sciences acknowledged that the most devastating aspects of the project were resettlement of citizens living in inundated areas and increased population in urban centers.\textsuperscript{132} In order to construct the dam, two cities, eleven county towns, 114 townships, and numerous small villages were completely flooded with water.\textsuperscript{133} By the time the dam was officially completed in 2009, 1.35 million people, 17200 hectares of land, and 1500 enterprises had been either relocated or submerged.\textsuperscript{134}

The Three Gorges Project Resettlement Development Bureau is responsible for the decision-making, planning, and supervision of population resettlement of the Three Gorges area. Authorities in charge of resettlement in the region argue that it will ultimately be beneficial and claim that those who are resettled will be able to maintain their livelihoods. The Development

\textsuperscript{130} Gleick, “Three Gorges”, 145.
\textsuperscript{132} Ibid, 145.
\textsuperscript{133} Wanxian and Fuling
\textsuperscript{134} Jackson and Sleigh, 66.
Resettlement Policy was designed to give rural resettlers economic benefits through government-financed reclamation of higher elevation land, growing cash crops, and creating industrial jobs. Authorities cite the abundant natural resources of the area as potential sources of employment for those forced to relocate. The central government designated 40 percent of the total costs of the project to be used to aid displaced residents in their relocation. The policy is categorized as development-oriented resettlement, which links displacement with development measures in order to prevent impoverishment of relocated citizens. The official statement of resettlement was: “moving out, being stable, and becoming wealthy gradually.”

However, the resettlement has not occurred as smoothly as authorities hoped, mainly due to a shortage of available cultivated land, the delicate nature of the natural environment, and the underdeveloped economy of the Three Gorges area. Thayer Scudder outlines four stages of involuntary resettlement: 1) forced relocation; 2) adjustment of new settlers to a new location and occupation; 3) economic and community improvement, and 4) consolidation. Scudder posits that most involuntary resettlement cases do not move into the third stage and the population is eventually worse off economically. This theory applies to government-mandated resettlement policies associated with the Three Gorges Dam.

---

135 Qing, 45.
136 Jackson and Sleigh, 66.
The Three Gorges region is one of the poorest areas in China—literacy rates are low and the area has not received government funding since 1949. The region is also severely maldeveloped—forests have been destroyed and steep lands were converted to terraced fields in order to meet the needs of the 15 million people living in the area. Farmers make up forty percent of the total displaced population. Prior to construction of the dam, the state government estimated that sixty percent of farmers could continue working in their profession after relocation. Now, it appears that officials overestimated this figure, as the Three Gorges area is unable to sustain those who will be resettled. The environmental capacity of the region is already strained and will be exacerbated by increased population pressures, overplowing, deforestation, soil erosion, and effects on rural labor.\textsuperscript{139} Authorities stressed the large amount of land available for farm-use in the area. However, one-third of available land is on mountain slopes with a grade of 25 or higher, where the cultivation is prohibited under the Water and Soil Protection Act. This means that there is less land available and more farmers will be forced to make career changes than previously estimated. The population in the resettled area is already dense, averaging 296 persons per km\textsuperscript{2}.\textsuperscript{140} Additionally, the dam flooded 34,000 hectares of farmland, and the area is predicted to experience a grain shortage of 120-150 thousand tons per annum as a result.\textsuperscript{141}

\textsuperscript{139} Jackson and Sleigh, 65.
\textsuperscript{140} Compared to the national average of 130 people per km\textsuperscript{2}
The burden of resettlement has fallen under the responsibility of the Chongqing municipality. This has been problematic as Chongqing lacks the capacity to take in the large influx of resettled citizens and unemployment rates are already high in the municipality.\textsuperscript{142} The region also lacks the necessary funding required to accommodate those who are resettled, as it has not received the amount it was promised by the central government. This is a common theme in the resettlement policy surrounding the Three Gorges Dam—funds designated to ease the burden of resettlement tend not to reach their intended recipients due to local government corruption.

Instead, government officials appropriated significant portions of resettlement funds for personal use. A project audit revealed that 473 million yuan—nearly 9 percent of funds—had been misappropriated and used for personal gain.\textsuperscript{143} Poor local planning meant that relocated people had meager land plots, lost their jobs and social status. Additionally, the resettled population often gets farmland that is taken from those already living in resettlement areas, which raises new tensions and conflicts between the host population and the migrant population.\textsuperscript{144} Inadequate resources, local corruption, and poor preparation mean that it is unlikely that the third and fourth stages of involuntary resettlement—economic and community improvement and consolidation—will come to fruition.

\textbf{Theoretical Analysis}

\textsuperscript{142} Jackson and Sleigh, “Resettlement for China’s Three Gorges...”, 67.
Despite the global trend against constructing mega-dams, the Chinese government views the Three Gorges Dam as the most effective method to contain regional flooding while simultaneously increasing the amount of energy generated, improving transportation in the interior, as well as jump-starting the economy of one of the poorest areas in the nation.

**THE TGD AND ECONOMIC APPROACHES**

In 1994, when construction on the Three Gorges Dam began, then-Premier Li Peng stated: “[The dam] will demonstrate to the world that the Chinese people have the ability to build the biggest and most beneficial irrigation and hydroelectric project in the world at present…It…demonstrates the greatness of the achievement of China’s development.”

Peng’s remarks support arguments that the promise of increased GDP and continual domestic growth were key reasons behind project implementation.

The Three Gorges Dam contains several features of Pomeranz’s developmentalist project. The Development Resettlement Policy associated with the project is evidence of the central government supporting economically and ecologically vulnerable regions, as in-depth studies have shown that the human carrying capacity of the resettlement area around the Three Gorges reservoir was already full. Areas targeted to take in a large number of

---


* The human carrying capacity of an area is defined as: “the maximum number of people that a given land area will maintain in perpetuity under a given system of usage without land degradation setting in” (William Allan, *Studies in African land usage in Northern Rhodesia*, Rhodes Livingston Papers No. 15 (London: Oxford University Press, 1949)).
relocatees were already densely populated and mass relocation would result in competition for arable land and employment.

In this case, we also see the central government encouraging rural industry development in resettlement areas. Increasing per capita income is seen as a basic measure of success and government legitimacy. The Three Gorges Dam was built in an impoverished, poorly developed region of China. All measures and policies associated with the project, including resettlement, stress that it would drastically improve the livelihoods of citizens living in the area. We also see investment in inland industrial centers—like Chongqing—in order to ensure that surplus capital generated by rural areas can be transferred to coastal cities to build industry. The shipping benefits associated with the project are also designed to further urban inland development in the Chongqing municipality. This is further evidence of Pomeranz’s developmentalist state theory.

THE TGD AND HISTORICAL APPROACHES

The Three Gorges Dam displays the environmental, social, and political characteristics of Wittfogel’s hydraulic society. The reservoir attached to the dam is a potential water source for the North China Plain, which has semi-arid conditions and requires water in order to sustain grain production. The relocation policy has increased social stratification in the region by separating those involved in the hydraulic government from the “masses”. State leaders in charge of the dam initiated the organizational apparatus of hydraulic order.
At a celebration marking the end of the first construction phase of the project in 1997, former General Secretary Jiang Zemin made the following remarks:

Since the dawn of history, the Chinese nation has been engaged in the great feat of conquering, developing, and exploiting nature. The legend of the mythical bird Jingwei determined to fill the sea with pebbles, the Foolish Old Man resolved to move the mountains standing in his way, and the tale of the Great Yu who harnessed the Great Floods are just some of the examples of the Chinese people’s indomitable spirit in successfully conquering nature. The building today on the Three Gorges of the Yangtze River, which have no parallel in the world, will greatly promote the development of our national economy and prove to be of lasting service to present and future generations. It also embodies the great industrious and dauntless spirit of the Chinese nation and displays the daring vision of the Chinese people for horizons and a better future in the course of their reform and opening up.\footnote{China Three Gorges Construction Yearbook Compilation Committee, \textit{Zhongguo Sanxia jianshe nianjian}, 1998 (China Three Gorges Project Construction Yearbook, 1998) (Beijing: Zhongguo Sanxia chubanshe, 1998), 3.}

Jiang’s remarks reflect Mao’s \textit{ren ding shen tian} (man must conquer nature) ideology, as he makes reference to several traditional Chinese myths used by the former leader to emphasize man’s ability to subvert nature to his own benefit. His comments also serve to orient the project as a point of nationalistic pride around which Chinese can rally.

\textit{The TGD and Political Approaches}
The power of bureaucratic “expertise” over rights and opinions of local government officials and citizens is evidenced by the existence of the Three Gorges Project Construction Committee, which is a top-down, command-and-control approach to planning dam construction and subsequent resettlement policies. The committee instructed provinces, who then instructed counties. The TGPCC was embedded within the Party apparatus and headed by Zhu Rongji, who was at the time, the third-highest ranking official in the Chinese government. The top-down implementation of the project effectively closed the possibility of any negotiation between the central government and local authorities. Additionally, the party responsible for carrying out the resettlement policy was embedded in the party structure.

One of the main issues arising out of construction the Three Gorges project was corruption associated with the resettlement policy. Although the implementation of physical infrastructure was administered by the central government, it was not as involved in the resettlement process. The central government offered a series of regulations to follow, but policy formulation was largely left to local authorities. In many cases, local leaders used funds intended for resettlement compensation money to construct additional infrastructure projects. This strongly supports Whiting’s theory that the cadre system of evaluation creates perverse incentives—greater emphasis on economic growth incentivizes local officials to invest in infrastructure. Additionally, given the impoverished nature of the Three Gorges region, the majority of primary indicators in cadre evaluation criteria for the region are likely to be economic and development oriented. This is especially true given the central government’s Western
Development Plan, which was designed with the specific intention of developing infrastructure and enticing of foreign direct investment in China’s western provinces. Given the dam’s location in the transition zone between the developed eastern provinces and less developed western regions, the project delivers officials the opportunity to simultaneously coordinate the southeastern coast, support continual western development, and develop the mid-and-upper-reaches of the Yangtze River basin. Successful realization of this goal would likely gain recognition from the central government authorities.

The Three Gorges Dam may provide economic benefits—it lessens the overall impact floods have on the Chinese economy and will serve as an energy source. However, it is clear that the environmental consequences of resettlement were not given necessary attention until the Resettlement and Development Bureau of the TGPCC issued “Measures for administrations of resettlement construction projects with TGP”. An assessment tool was not used to measure the potential consequences of displacement and resettlement in the reservoir area environment.\(^{147}\) This is indicated by recent plans to relocate an additional 4 million people, which is expected to cost at least 200 billion RMB, doubling the total cost of the Three Gorges project.\(^{148}\) This is indicative of poor planning and contradicts the idea of the dam as furthering economic goals.

Additionally, the opportunity cost of inundating farmland in the region is high given the population density and small amount of available resources. The total cost could be decreased if the amount of inundated land were more evenly dispersed

---

\(^{147}\) Yao et al, 357.  
\(^{148}\) Webber, 161.
instead of concentrated in one small area. Although the original calculations made the project seem feasible and financially viable, uncertainties about the costs and benefits remain. Proponents of the project stress flood control and electricity supply, but it is possible that the benefits of the project will not be realized for decades. Meanwhile, the region has already begun to experience the ecological side effects from the dam. The central government has publicly admitted that the dam has caused environmental problems and plans to spend 99 billion RMB (16 billion USD) to address the negative effects.\textsuperscript{149}

Additionally, proponents of the project have argued that the reservoir will boost agriculture by providing more water for irrigation. Regardless of any possible economic benefits, the negative effects caused by the inundation of fertile farmland do not correspond with development-focused arguments. The flooded area accounts for ten percent of total grain supply, half of which is rice. In order to account for this significant loss, China will have to import higher volumes of grain and rice from other countries. This goes against China’s national grain policy, which calls for 95 percent self-sufficiency in order to shelter the nation from rising global prices and minimize reliance on imports.\textsuperscript{150} This policy has been a key part of the national economic plan since Mao. Citrus is more viable to grow in resettlement areas, but relocated farmers are unfamiliar with the crop, which will likely result in slower agricultural production yielding less economic trade.

If implementation of the Three Gorges is best explained as a way for leaders to control the masses, as many historical theories assert, how does one explain the

\textsuperscript{149} Ibid, 156.
resettlement policy? Resettlement in the region has the potential to cause large amounts of social instability. It is easy to taut the Three Gorges as a nationalistic project designed to remind citizens of China’s technological prowess, especially given its connections to Sun Yat-sen, the founder of modern China. However, this explanation largely ignores opposition to the project, as well as the environmental effects and the resettlement policy.

As demonstrated, economic and historical explanations do not fully account for the social and environmental issues associated with the Three Gorges Dam. In this case, political theories of bureaucratic management and cadre politics truly explain why this project was implemented. I will arrive at the same conclusion in the next chapter, which examines the Nu River Project.
CHAPTER 5—CASE STUDY #3: THE NU RIVER PROJECT

PROJECT OVERVIEW

In January 2013, the Chinese State Council announced its intent to dam the Nu River in the southwestern Yunnan province. The announcement came as a shock to domestic and international environmental groups, as it reopens a project that was put on hold eight years before. In August of 2003, the National Development and Reform Commission (NDRC) announced its plans to build a cascade of 13 hydroelectric dams and two reservoirs (see fig. 5.1) on the Nu River. The project was met with an unprecedented amount of resistance from environmental groups and the State Environmental Protection Agency (SEPA—now the MEP), given that the Nu is one of the last rivers in China free of large-dams, as well as an area high in ecological and ethnic diversity. In 2004, former premier Wen Jiabao announced suspension of the Nu River Project, “given the high level of social and environmental concerns over the large scale hydro project, further careful research is required in order to reach a scientific decision.”

---

* Also known as the Salween

Although the original plan was shelved, the local Yunnan government as well as hydropower developers Hainan and Datang continued to actively lobby to push these projects forward. The plan proposed by the State Council in January revives five out of the original thirteen dams—Songta (4200 MW), Maji (4200 MW), Yabiluo (1800 MW), Liuku (180 MW), and Saige (1000 MW). All five proposed dams are located in one of China’s most seismically active and geologically unstable regions, which has caused prominent geologists to voice concerns regarding the potential domino effect.
of dam failures in the event an upper dam collapses during an earthquake or extreme flood.\textsuperscript{152}

The decision to resume the controversial project stems from the government’s 12\textsuperscript{th} Five-Year Plan. The plan calls for the construction of over 60 new hydroelectric projects on three major rivers, which is part of the government’s effort to move away from relying on coal as a primary energy source.\textsuperscript{153} In 2012, China faced an electricity shortfall of 40 million kilowatts due to slow growth in the thermal power sector and dwindling coal supplies.\textsuperscript{154} Damming the Nu River is also part of the central government’s controversial Western Development Campaign (\textit{xibu kaifa}), which was designed to address gaps in economic development between the less developed, interior western provinces and the industrial eastern coast. The program mostly involves basic infrastructure construction, ecological construction, education, and social development.\textsuperscript{155}

**History of Project**

In the early 1990s, the State Planning Commission delegated a hydropower survey and design for the Nu cascade to the Beijing Institute of Hydropower Survey and Design and the East China Institute of Hydropower Survey and Design. In 1999, the NDRC officially adopted plans for hydropower development on the Nu River based on assessments of the national energy situation.


The first blueprints for the project included a cascade of 13 hydropower stations designed to produce an annual output of 102.96 billion kilowatt hours of electricity. When completed, the project was expected to generate about 8 billion yuan in tax revenue for the central government and 2.7 billion yuan for local government repositories. 156

The National Environmental Impact Assessment (EIA) Law went into effect in December 2003 and did not contain a grandfather clause. In August of 2003, the NDRC met to examine the “Nu River Middle and Lower Reaches Hydraulic Planning Report”. The proposal submitted by the developer, the Huadian Group, did not contain any information regarding the environmental impacts of the Nu River Project. The project was approved within two days. 157 Upon approval, Huadian tried to rush the State Council to approve the development proposal before the EIA law went into effect in order to free themselves from the constraints of the law.

Initially, local experts supported the project, citing it as an effective solution to alleviate poverty in the region. However, local residents raised concerns about the resettlement aspect of the project, given that it would tear them away from places of strong cultural and familial value and place them in a completely foreign economic environment. Opposition to the project originated downstream in Thailand and Burma, where eighty different groups issued public statements appealing to the PRC.

156 Meng, “Hydropower’s green excuse...”
to suspend construction plans. Their actions gained the attention of international
groups, who proceeded to petition then-President Hu Jintao to halt the project.\textsuperscript{158}

Additionally, the cursory nature of the proposal combined with Huadian’s
haste to get it through the approval process raised some concerns among key officials,
especially those at SEPA. Mu Guangfeng, the vice director of the Environmental
Impact Assessment Office and Director of SEPA’s Supervision Department was
particularly outspoken about his concerns. Mu’s opposition succeeded in stopping all
of Huadian’s momentum and delayed the process until December 1\textsuperscript{st} had passed. His
opposition also motivated others to voice their own disapproval.\textsuperscript{159} In February 2004,
then-Premier Wen Jiabao officially halted the project, announcing that: “such a large
hydropower station project that draws high social attention, and has environmental
controversy, should be cautiously studied, and scientifically decided.”\textsuperscript{160}

In February 2011, the central government revealed an updated, scaled-down
version of the Nu River dams as part of the 12\textsuperscript{th} Five-Year Plan, which includes goals
to add 140 GW of new hydropower capacity to meet renewable energy targets. The
new hydropower is designed to reduce coal-fired power from 73 percent of China’s
generating capacity to 67 percent as part of the central government’s effort to slow
growth of CO\textsubscript{2} emissions.\textsuperscript{161} Shi Lishan, the deputy head of the New Energy and
Renewable Energy Division of China’s National Energy Administration stated:

\textsuperscript{158} The Salween Under Threat: Damming the Longest River in Southeast Asia, ed. Yuki Akimoto
(Chiang Mai, Thailand: SEARIN & Salween Watch, 2004).
\textsuperscript{159} Mertha, 121-122.
\textsuperscript{160} Cao Haidong, “Nujiang de minjian baowei zhan” [The NGO Battle over Protection of the Nu River].
Economics (Jingji), May 2004.
\textsuperscript{161} David Stanway, “Analysis: China’s push for more hydropower tests limits,” Reuters, July 12, 2011,
idUSTRE7681LA20110712.
My belief is that development [on the Nu] is a must. Because the Nu’s upper and lower reaches are already built up, in the past some people have said that it is necessary to leave a stretch of free flowing river. I believe putting that theory into practice is not realistic. We expect that, on the basis of strong evidence, and after seeking the opinions of all parties, that we can press ahead with hydropower construction on the Nu River.  

Another aim of the project is to increase total domestic electricity supply. In 2012, China’s annual power consumption was 5.14 trillion kilowatt hours. Last year, power brownouts affected 24 provincial grids during peak seasons of electricity use. However, the new energy that will be generated by the dams will not stay in the Yunnan province, but will in fact be transported to Shanghai, Guangdong, and other eastern coastal cities.

Given the fragile nature of the environment and the high levels of ethnic diversity in this region, the proposed area of development is especially vulnerable to the negative consequences of dam construction. The region is highly seismically active, as the Nu runs along a major fault line that forms two major earthquake zones—Yunnan Southwest and Tengchong. Earthquakes in the region cause numerous landslides, mudslides, and falling boulders. Large rock debris are then gradually pushed down to the lower reaches to balance out the river bed. However, following dam construction, these debris will be caught and accumulate in the

---

162 Meng, “Hydropower’s green excuse...”
163 Yong, “Power Shortage...”
reservoir which will have significant effects on the duration and efficiency of the proposed dams.\footnote{Mertha, 36.}

The project is estimated to relocate at least 50,000 people. Although this number is relatively small in relation to the SNWTP and the Three Gorges Dam, it is still cause for concern, as members of small minority groups face a high possibility of relocation to an area they have not traditionally occupied where integration in populations with different languages, customs, and agricultural practices will be a challenge. “If people are forced to move around because of the projects, they are going to lose the way of life that makes them special,” stated one villager, an ethnic Tibetan. “It’s inevitable that people will lose their traditions if they move away.”\footnote{Jim Yeardley, “Dam Building Threatens China’s ‘Grand Canyon’,” \textit{New York Times}, March 10, 2004, accessed March 3, 2013, \url{http://www.nytimes.com/2004/03/10/world/dam-building-threatens-china-s-grand-canyon.html?pagewanted=all&src=pm}}

\textbf{NATUERE OF THE NUJIANG PREFECTURE}

The Nu River originates in the Qinghai-Tibetan Plateau and then flows south through the western Yunnan province, into Myanmar, and along the Thai border before draining into the Andaman Sea. The Chinese portion of the river is around 2000 kilometers long and flows through a steep gorge known as the Grand Canyon of the East.

The region is home to the Three Parallel Rivers (\textit{san jiang}), where the Yangtze (Jinsha), Mekong, and Nu rivers run parallel for over 300 kilometers, separated by steep gorges. The area was designated a UNESCO World Heritage Site in July of 2003. The region is often described as the epicenter for Chinese biodiversity, as it supports 6,000 plant species and is estimated to contain 25 percent
of global animal species.\textsuperscript{166} Nine out of the thirteen originally proposed dams are located in the Nujiang Lisu Autonomous Prefecture, most of which are in close proximity to the World Heritage Site border.

Given its physical isolation, the Nu Prefecture is less industrialized than other areas of the Yunnan province. The Nu-Salween watershed is home to 4 million people, most of who are subsistence farmers due to the steep nature of slopes in the area. Over 90 percent of the working population residing in Gongshan, Fugong, and Lushui counties depends on agriculture for their livelihood.\textsuperscript{167} All four counties in the Nujiang prefecture of the Yunnan province have been given national-level poverty designation, which means most of their revenues come from central government subsidies.\textsuperscript{168}

The region is also culturally diverse—26 out of the PRC’s 56 officially recognized ethnic nationalities reside in the Yunnan province.\textsuperscript{169} Eight out of the sixteen Yunnan prefectures are ethnic minority autonomous areas. The Nu area includes Nu, Lisu, Dai, and Tibetan minority groups. Ethnic minority autonomous regions tend to overlap with impoverished areas, which the central government sees as undermining national development goals.

The Nu River basin is an extreme case of this development problem as the area is both poor and ethnically diverse. Officials and scientists attribute the poverty of this area to “poor quality” (\textit{di suzhi}), “backward behaviors” (\textit{luohou xingwei}), and

\textsuperscript{166} Three parallel rivers of Yunnan Protected Areas,” UNESCO, accessed 3 March 2013, http://whc.unesco.org/en/list/1083
“lagging scientific and cultural development” (kexue yu wenhua daihou). Officials cite the swidden* agricultural method employed by farmers in the Nujiang Prefecture as evidence of the region’s unsuitability for human habitation.

Upon visiting the Nujiang prefecture, Fang Zhouzi, a prominent biochemist stated:

I did not see much primitive forest…I have seen patches of farmland on quite steep slopes. Locals call them ‘big character posters on the wall’ [gua zai qiang shang de dazibao]. Slash-and-burn is the method used to farm such land…We think that’s a very primitive and outdated method, but the head of Nujiang prefecture told us this is the most progressive method that suits the local condition. Why? Because the slopes are too steep to plow. And the soil along Nujiang is poor. Local people cannot afford to buy fertilizer, so they can only use fire to burn wild grass. And such land can’t be used after a few years, so they have to burn another patch. Moreover, the production of that kind of land is very low: 40 to 50 kilograms per mu is quite good. To support one person, five mu must be farmed.170

This is one of many examples of the Chinese government discounting ethnic practices regarding agriculture, land, and resource use in favor of reforms and development programs. Citizens in the Nujiang Prefecture, as well as the other Nu River Basin counties, rely on village-level conservation. This type of conservation is traditionally based in respecting nature while using it. Successful community-based conservation requires transparency, collaboration, and accountability to foster a

---

* slash-and-burn

170 Mertha, 137.
learning environment. This stands in stark contrast to official policy-making across all levels of government in China, which is characterized by a poor ability to share decision-making authority.

In the 1950s, swidden agriculture was the dominant method used by farmers living in the Nujiang prefecture. This technique depends on interrelation between cultivated and forested areas and requires no irrigation systems or shallow till, thus preventing soil loss and landslides that are common when planting in the region.\textsuperscript{171} During Mao’s Great Leap Forward during the 1950s, new systems of agricultural production—canals, paddy, terraced fields, and other components of irrigated agriculture—were introduced into the region in order to increase outputs. The campaigns failed because they were not region specific and ignored physical limitations to production goals. This is likely to happen again in the case of the Nu River dams—although local citizens are practicing subsistence living, when interviewed, most stated that they were satisfied with their way of life. Officials have cited the “primitive” agricultural practices of citizens as the reason the area is poor and underdeveloped, even though there is a wealth of literature suggesting that this practice has actually sustained inhabitation of this area for thousands of years. Those living in the Nu River basin actively practice risk management through working with nature and its associated risks, rather than attempting to conquer it completely through constructing dams.

The Yunnan province currently provides 10 percent of China’s hydropower. The Nu River Project has the potential to double this amount, as it has a capacity of

\textsuperscript{171} Kristen N. McDonald, Damming China’s Grand Canyon: Pluralization without Democratization in the Nu River Valley (University of California, Berkeley: 2007), 106.
20,000 MW and will provide 100-billion KW hours of electricity, which is equivalent to 50 million tons of coal.\textsuperscript{172} The Chinese government has started to frame hydropower development as a partial solution to domestic air quality issues.

The project is also promoted as something that will alleviate poverty in the region. The Western Development Campaign (\textit{xibu kaifa}), launched as part of China’s 10\textsuperscript{th} Five-Year Development Plan, provides the central government with a framework that legitimizes the construction of mega-projects in the Nujiang Prefecture. This development strategy is a key pillar in the Chinese government’s modernization agenda, as well as a standard to measure the success and legitimacy of the Chinese ruling elite.

Construction of large hydropower stations—referred to as Send Western Electricity East (\textit{xidian dongsong}), Send Yunnan Electricity Out (\textit{Yundian waisong})—are a central component of the western development campaign. This includes harnessing the hydropower potential in the six major rivers in the western provinces to increase hydropower from 17 percent of the national electricity grid to 40 percent by 2015.\textsuperscript{173} Entirely new regional constructions, like the Pan Pearl River Delta, have been created by the central government as a way to legitimize and naturalize large-scale power generation and transmission infrastructure.\textsuperscript{174}

\textbf{Theoretical Analysis}

The Nu River Project is a unique case. Although plans for development on the Nu River were reinstated in January of 2013, the project was one of the first mega-
projects to be halted in China. The project will be constructed in a relatively water-rich region in the Yunnan province, and includes a multitude of issues that relate to development in ethnic minority regions in China.

**THE NU RIVER AND ECONOMIC APPROACHES**

The decision to implement the Nu River Project does support some aspects of developmental state theories. The project is located in a poor, underdeveloped region lacking the high caliber of infrastructure found in the eastern coastal regions. Policymakers at the national level are focused on increasing economic output and furthering modernization instead of employing policies that are more regulatory in nature, and they have created the Western Development Plan, of which the Nu River Project is a part. The Western Development Plan has been a key part of the 10th, 11th, and 12th Five-Year Plans, as the western provinces in China account for 71.4 percent of total landmass but only 28.6 percent of population and 17.7 percent of total GDP.175 As stated earlier in the chapter, the project is expected to generate hefty amounts of tax revenue for both the central and local governments.

The proposed dams on the Nujiang are also evidence of Pomeranz’s developmentalist project. In this case, the Western Development Plan—a government growth production policy—is promoting increased central government involvement via increased infrastructure on the Nu. The Nu River Project is an example of the central government encouraging rural industry to rid local citizens of their backwards practices.

However, the project contains destructive economic, social, and political costs that far outweigh any potential benefits.

175 Mertha, 29.
Wittfogel’s theory of hydraulic civilization can also be applied to this case. Viewed through this lens, the Nu River Project represents the central government asserting its authority over peripheral provinces with large minority populations under the guise of poverty alleviation and infrastructure development. As Wittfogel stated, effective and complete control of domestic water resources guarantees that those in charge will be able to maintain their political power. Then-premier Xu Rongji believed that the Western Development plan would “strengthen national unity”, “safeguard social stability” and “control border defense”. Although the Western Development Plan is designed to promote economic growth in the maldeveloped Western provinces, it can also be seen as a way for the central government to exert control over its peripheral territories under the guise of infrastructure development. This tactic was used during Imperial China, especially with regards to the Grand Canal. The Nu River Project contains the organizational, political, and social aspects of Wittfogel’s hydraulic society. Constructing the proposed five dams on the Nu River will require large-scale cooperation between citizens, local authorities, the central government, and power and construction companies. The State Council initiated the project and local authorities in the Nujiang prefecture receive their orders from the political elite in Beijing. The National People’s Congress is the designated trustee for the ownership and utilization of China’s water resources; the State Council is responsible for reviewing and approving large-scale and controversial dam cases; the Ministry of Water Resources (MWR) reports directly to the State Council and is responsible for drafting water laws and regulations, controlling water allocation and

176 Grumbine, 31.
conservation and implementing flood and drought relief measures as well as guiding
dam development process. The top-down, fractal nature of Chinese politics has
further contributed to social stratification in the Nujiang prefecture—citizens, the
“mass”, were not involved in decision-making concerning dam development on their
river.

THE NU RIVER AND POLITICAL APPROACHES

Weber’s theory of bureaucratic management is easily applied to the Nu River
Project. As stated earlier in this chapter, the project is a key part of the central
government’s campaign to “Develop the West”. This campaign is indicative of
Weber’s patrimonial bureaucracy in flood control—prosperity in contemporary China
depends on the effective administration of domestic waterways by the State Council
and central government authorities.

China’s 18th Party Congress, which occurred in the fall of 2012, signified the
beginning of a mass turnover of top-ranking government and communist party
officials. The new political elite announced plans to implement the previously tabled
Nu River Project. Although local citizens remain fiercely opposed, it has received
overwhelming support from local government officials. Successful implementation of
the project is an easy way for officials to impress the new government headed by Xi
Jinping—it is quantifiable and will bring revenue to an impoverished area while
supplying the coast with electricity. Additionally, the project fulfills key parts of the
12th Five-Year Plan—namely the stipulations regarding significant increases in
hydropower capabilities and continuation of the Western Development Plan. The Nu
River Project meets both of these crucial, “bottom-line” objectives. If local leaders in
the Nujiang Prefecture meet these targets, it is likely that they will receive bonuses or a promotion.

Holes remain in the approaches outlined above. Although the project is designed to modernize the Yunnan province through the use of large-scale infrastructure, the Nu River Project marks one of the first times the central government has been involved in this particular region. If China truly embodied Pomeranz’s developmental state, it would be more involved more underdeveloped areas in order to increase total domestic average domestic GDP. Additionally, although the project is designed to increase electricity availability, most of it will be transported to the eastern coast. The Yunnan has a history of electricity shortages—if the Nu River Project were truly designed with the goal of furthering economic growth and development in the region, the electricity generated would be distributed within the province, not to the eastern provinces. Historical reliance on infrastructure does not account for the government’s decision to revisit the project.

Economic and historical approaches fail to take recent political events into consideration, which are crucial in understanding reasons behind implementation of the Nu River Project. In this case, the political theories explain why the project was put back on the national agenda. My next chapter will synthesize the evidence discussed in the past three chapters, which show that political theories truly explain why large infrastructure projects persist in China.
CHAPTER 6—CONCLUSION

This thesis has sought to address why China has persisted with a policy of constructing mega-projects to assuage domestic water scarcity and supply issues, in spite of their high social, political, economic, and environmental costs and a prevailing international understanding that large infrastructure projects are not the best way to manage water scarcity. It has found that while economic and historical factors play a role, the underlying explanation for China’s orientation toward large infrastructure projects to manage its water resources is political. Specifically, the cadre promotion system creates perverse incentives for officials to promote the construction of large infrastructure to further their own careers.

Deng Xiaopeng was instrumental in Chinese economic reconstruction following Mao Zedong’s Great Leap Forward. Deng is considered to be the architect of the Chinese socialist market economy, as he is responsible for decollectivizing agriculture, implementing a dual-price system in the industrial sector, opening the nation up to direct foreign investment, and establishing special economic zones. As a result of Deng’s massive reforms, Chinese GDP has grown an average of 10 percent annually over the last thirty years.177 Deng and his various successors have continually stressed the importance of infrastructure to strengthening Chinese developmental goals. Although most Western nations have halted dam construction after the World Commission on Dams (WCD) condemned the practice in 2000, China has not shown any intention to change its practice of building large and costly water infrastructures.

infrastructure projects. China in the post-Mao era has been synonymous with high annual GDP growth, rapid industrialization, and economic liberalization. When criticized about their policies by the international community, Chinese policymakers often argue that developed countries have gone through a policy sequence of pollute first and clean-up later, so China must follow the same path.  

The three explanations of mega-projects in China explain it as a function of a developing nation still focused on economic goals, a continuation of a centuries long tradition of relying on large infrastructure to resolve pressing issues, or a product of bureaucratic politics and the cadre system of advancement. Table 6.1 revisits the hypotheses proposed in the first chapter and indicates whether the hypotheses were confirmed or denied in each of the three cases.

Table 6.1: Hypothesis application

<table>
<thead>
<tr>
<th>Rationale</th>
<th>SNWTP</th>
<th>Three Gorges Dam</th>
<th>Nu River Project</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Economic Rationale</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>H1a: Infrastructure project will promote economic growth in specific region</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>H1b: Natural resources will be calculated in terms of their monetary value: as sources of wealth or obstacles standing in the way of development</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>H1c: Economic cost of the project will be less than the economic benefit</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Historical/Cultural Rationale</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>H2a: New projects are based on blueprints from old projects</td>
<td>x</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>H2b: Projects based on outdated technology or demographics</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Political Rationale</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>H3a: Large-scale projects favored over smaller scale solutions</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
</tbody>
</table>

---

H3b: Projects hierarchically administered by the central government without concern for local conditions

<table>
<thead>
<tr>
<th></th>
<th>X</th>
<th>X</th>
<th>X</th>
</tr>
</thead>
</table>

H3c: Cadres will reap personal benefits—career advancement and monetary benefits—from promoting large scale projects

<table>
<thead>
<tr>
<th></th>
<th>***</th>
<th>X</th>
<th>***</th>
</tr>
</thead>
</table>

As table 6-1 indicates, the theories related to cadre advancement and bureaucratic politics truly explain the decisions of those involved in the creation and implementation of water policy in China. This theoretical perspective helps explain all results in the table above; not only the ones generated by the bureaucratic politics model, but also those generated by the other theories. Additionally, the case studies revealed that although economic and historical factors certainly play a role in the creation of water policy, they alone would not have been enough to propel any given project forward. Rather, it is the incentive structure for party cadres that is the primary reason that water policy takes the detrimental form that it does.

The CCP dominates the Chinese government and People’s Congress hierarchies by controlling the personnel process. The system of evaluation for cadre advancement is completely under the party’s jurisdiction. Given the large and varied nature of the economic, environmental, and ethnic situations in China, the central government uses concrete achievements to assess cadre ability and political integrity.\(^{179}\) In all three cases we found that large-scale projects were favored over smaller-scale ones even when, as was the case in the Nu River, those smaller-scale projects had demonstrated their effectiveness over centuries. In all three cases,

---

\(^{a}\) Given that this project is still under construction, we cannot yet tell if this hypothesis holds.

\(^{b}\) It is too soon to tell if this hypothesis applies to Case #3, since authorities have not broken ground on the Nu River Project.

\(^{179}\) Whiting, 104n8.
although administrating the projects locally would have made more sense, allowing them to be developed to accommodate local conditions, the main project development and direction came from Beijing. Finally, in the one case for which we have data, there is clear evidence that cadres diverted funding intended for relocated citizens in ways that benefited them politically. In the remaining two cases, the SNWTP and the Nu River Project, because they are still ongoing or not yet implemented, we do not yet have clear evidence of this appropriation but can anticipate that it will occur.

In addition to finding strong support for the hypotheses, the cadre advancement explanation also sheds light on why some of the hypotheses generated from the economic and historical theories were also supported. The cadre advancement system does heavily rely on economic incentives, but those incentives are perverse, resulting in non-economically rational outcomes and rewarding historically outdated planning. This is especially true in rural, impoverished regions, where 70 percent of work targets are concerned with industrial performance. Not coincidentally, all three of the mega-projects studied here were in these rural areas where these kinds of targets dominate.

Furthermore, large infrastructure supplied cadre leaders in all three of the project regions—Hebei, the Three Gorges Region, and the Nujiang Prefecture—with solutions to water issues that can be quantifiably measured and evaluated by the central government. This creates a real-world version of Frederic Bastiat’s broken window fallacy—although the construction of infrastructure creates jobs and promotes industry growth, it also requires large amounts of financial investment, has

---

180 Li et al, 119n16.
negative environmental outcomes, and robs millions citizens of their socioeconomic livelihoods. In all three cases of water infrastructure, the projects alleviated short-term socio-economic and environmental problems in the region are exacerbating these same problems over the long-term.

Linking the political incentives of the cadre system to the historical theories argue that exclusive control over the access to domestic water resources by the government is a method used by leaders to gain power over their people, we can now explain why historically outdated projects—namely the SNWTP and the Three Gorges—are advocated and rewarded by central party leaders. The ideas for the projects discussed in the preceding three chapters originated and were discussed by the central government body for at least a decade prior to the beginning of construction. However, because bureaucratic politics is, by its nature, slow, by the time they are finally implemented, they run into unintended social, environmental, and economic issues because the environmental, economic, and social contexts have shifted dramatically since the project was originally proposed. Additionally, the projects have big names attached to them—the SNWTP originated with Mao and Sun Yat-sen first proposed the idea of a dam in the Three Gorges region. Officials are seen as fulfilling Mao’s vision for China’s future, and will in turn be given a promotion or financial rewards.

This thesis thus offers a theoretical contribution to our understanding of Chinese water policy. The prevailing explanations for China’s mega-projects have mostly been based in economics or history. This thesis offers a political explanation that helps explain why large water infrastructure projects remain prevalent despite
their many adverse effects. Although Andrew Mertha uses a political explanation to explain why a few dams are sometimes not built, the more important question to ask is: Why are so many still being constructed? That is the question that this thesis has sought to answer. The answer we have found is that the cadre advancement system has created perverse incentives that favor the development of large-scale infrastructure projects that rely on outdated technology to solve China’s water crisis. In building these mega-projects, however, Chinese policymakers have created more problems than they have solved. The following section offers a few concrete changes to water policy that would, even in the context of the current cadre advancement system, help improve policy in ways that would help protect the environment, improve economic development, and reduce social unrest.

**Policy Recommendation**

In terms of solving China’s water issues, this thesis offers policy recommendations that are not aimed at making major changes to China’s political system. Although democratization would likely solve many of the accountability and implementation issues, this is not a feasible solution in the near term. Instead, the recommendations offered here should focus on shifting the orientation of water policy away from reactive disaster management and towards proactive risk management. This shift is entirely possible within the current political framework and only requires minor modifications to both cadre incentives and bureaucratic organization to be successful.

All government-conducted major studies of the state of water resources indicate that water transfer is essential. Policymakers argue that the project must be
implemented as soon as possible in order to salvage the fragile agricultural sector in the North and continue domestic economic growth. Although the water transfer project will solve the problem of available water supply, it does not include any incentives to improve water-use practices in the agricultural, urban, and industrial sectors, which are crucial to addressing long-term resource issues.

There are several viable alternative solutions to mega-projects that would work towards solving water issues in the long-term. Presently, water policy in China uses supply-side solutions and reactive disaster management to address water issues. Supply-side management is structure-oriented and favors investment in large-scale solutions, as opposed to demand-side management, which relies on encouraging behavior change amongst energy or resource consumers to increase efficiency. Risk management is part of a demand-side approach to environmental policy that goes beyond the scientific objective evaluation of natural and anthropogenic-induced hazards towards a better understanding of social, economic, and political systems as risk generators. Scientific and technological approaches can provide policymakers with some strategies for risk mitigation but cannot determine which strategy is socially, politically, or economically acceptable. The traditional approaches to water management are problematic—too many agencies with conflicting issues share responsibility for managing a shared and crucial resource. Water resources management in China needs management that is focused and incorporates needs throughout watersheds, rather than by administrative boundaries. China has the

institutional structure, policy, regulatory framework, and emergency response network necessary to implement the risk management approach.

The Asian Development Bank defines disaster management as a reactive approach based on taking action and implementing policies after a problem has been acknowledged. This method applies to emergency situations and typically produces technical and economic solutions that are inefficient because they are made during times of stress, when time to adequately evaluate options and solutions is not available. This tends to sustain a governmental dependence on emergency relief measures, rather than focusing on solutions and policies that are resilient. The steps taken in this approach are summarized below (Fig. 6.1).

Figure 6.1: Reactive approach of Chinese water policy (adapted from Qingfeng Zhang et al, “Drying Up PRC” (Asian Development Bank))

This disaster-based approach to water management stands in stark contrast to the strategy of risk management. The practice of risk management in environmental policy is a proactive approach that is based on designing and executing measures and policies prior to the onset of a drought or other similar crisis situation. This strategy seeks to mitigate level of risk exposure through both structural and nonstructural

---

measures on an ongoing basis and is designed to prevent vulnerability of impacts in the long-term. Effective risk management looks at the expected damage a hazard can cause and the probability that this damage will occur again. This more proactive approach is best summarized in Figure 6.2 (below).

![Proactive approach to water management](image)

Figure 6.2: Proactive approach to water management (adapted from Qingfeng Zhang et al, “Drying Up PRC” (Asian Development Bank)

Water stress in the northern provinces has convinced planners that large infrastructure-heavy projects are needed. An Asian Development Bank report titled “Drying Up PRC” argues that planners in China use a disaster management approach in managing and forming solutions to water shortage issues. According to the report, the undertaking of a large and costly project like the SNWTP signifies that the Chinese government views the project as the only solution to solving the water crisis. Infrastructure carries an element of certainty for Chinese water planners—the problem in question will be solved because a structure has been designed and built to

---

ensure that a set amount of water will be delivered.\textsuperscript{186} Non-structural technical solutions, like conservation measures or demand management, tend to be viewed as ways that citizens can “help” instead of as real, valid supply options.

The reactive disaster management theory can be applied to arguments surrounding strategies for management of risk and uncertainty in traditional agrarian-based societies. The study of more traditional approaches for mitigating problems like droughts, flooding, and water scarcity is a crucial part of examining and understanding the policies and decision-making surrounding Chinese water infrastructure. The theory of the rational peasant as applied to traditional agrarian societies highlights the problems of institutional reliance on reactive environmental policies.

In his work, \textit{The Rational Peasant} (1979), Samuel Popkin argues that peasant societies should be analyzed by using the notion of the peasant as a rational actor. Popkin suggests that the peasant society is defined not by morality associated with the pursuit of moral goodness, but rather by the moral distribution of resources and actors in this environment actively practice risk management. This is mainly because the village does not typically provide any kind of extensive insurance or welfare support system, so citizens cannot afford to make “last-gasp responses.” Rather, their behavioral changes are best explained as a recognition and response to new opportunities driven by survival motives in a risky environment.\textsuperscript{187} Those actors concerned about their long-term security typically make secure exchanges where it is certain that all parties involved are able to maintain balance in the long run. Most

\textsuperscript{186} Zhang et al, 27.
\textsuperscript{187} Ibid, 33.
actors in an agrarian society operate on the safety-first principle—this theory assumes
that actors are risk-averse and focus on avoiding drops in profits as opposed to
maximizing yields. Theodore W. Schultz (1964) extended rational peasant theory to
contemporary societies and found that although natural disasters, like floods, famine,
or droughts, are sources of disequilibrium in traditional societies, they are also
disturbed by the construction of large infrastructure projects for flood control.\(^{188}\)

In *Peasant Economics* (1993), Frank Ellis also applies the theory of the risk-
averse peasant to agrarian societies. Due to highly unpredictable climate variations, a
high level of uncertainty characterizes farm households—especially those in the
tropics.\(^{189}\) Ellis also argues that the theory of the risk-averse peasant is strongly
associated with government interventions designed to remedy the adverse impacts of
risk aversion on production and growth in the agricultural sector.

The theory of the rational peasant is significant when applied to water
management practices in China, as it stands in stark contrast to historical arguments
of the existence of a hydraulic society. In many cases—especially when looking at the
Nu River Project—it is found that local villages often have long-established
established systems of risk management for water systems that are more effective
than the central government’s large infrastructure projects.

Close examination of water policy in China shows that the incorporation of
risk management strategies would prove beneficial and would address issues of water
scarcity, economic development, social stability, and cadre advancement. This policy
change does not require wholesale political change, but rather a few adjustments to

\(^{188}\) Ibid, 37.
\(^{189}\) Ibid, 80.
water policy that would be relatively minor in comparison to constructing large infrastructure projects.

One method to increase demand-side and risk management would be to change the water pricing system. As mentioned in earlier chapters, the price of water in urban areas is artificially low. On average, water in China is purchased at 40 percent below true cost.\textsuperscript{190} However, pricing mechanisms can indirectly increase the total available water supply by reducing overall water consumption and lowering the probability of shortages in the future. Currently, water pricing in China cannot adequately finance efficient utility management, nor can it support the long-term development of water resources. Prices need to be set so that they cover the marginal opportunity cost (MOC) of supply, which includes:

- **Marginal delivery cost**: cost that results from the production and delivery of an incremental unit of water to user; includes extraction, transmission, purification, and distribution processes

- **Marginal environmental cost**: cost of environmental externalities associated with water use, such as wastewater treatment

- **Marginal user cost**: value of water in alternative uses or the depletion cost

This is formally expressed as MOC=MDC+MEC+MUC.\textsuperscript{191} Adopting an MOC pricing approach will serve as a clear indication of scarcity to users as well as provide them with the tools necessary to adopt measures to use water resources more efficiently. In most water-scarce regions in China, the price of water utilities does not

\textsuperscript{190} Ghassemi and White, 307.

\textsuperscript{191} Xie et al, 122.
reflect depletion costs (MUC). Although raising the price of domestic water utilities in urban areas may not be the most desirable option to policymakers, including the marginal operation cost (MOC) is essential to better water management and planning practices.

The MOC can serve as a benchmark that can be used to aid the regional planning decision process and encourage consumers to indicate their willingness-to-pay as well as discourage water-intensive development in areas where the cost of water is high. Officials can overcome resistance to increases in water pricing by increasing efforts to involve stakeholders in the policy making process, such as establishing a transparent public hearing process. Reform to the water pricing market should also be gradual. In order to be most effective, this approach should also be applied to industrial and agricultural users.\(^{192}\) Reducing urban water use is crucial for long-term water saving mechanisms because it is the area where the water-energy nexus is most embedded and intense. Additionally, the possibility of a tragedy of the commons or freeriders will be lower in urban areas given that water use is metered and can be easily monitored.

This benefits of water pricing support the findings of James Workman (2009), whose detailed study of the Kalahari Bushmen in Botswana demonstrated that people are more inclined to use water sustainably if it were provided in small but inalienable amounts that can be sold, hoarded, or bartered in ways that are meaningful and useful to the local community.\(^{193}\)

\(^{192}\) Ibid, 123.

Changing irrigation practices is another way that policymakers could incorporate long-term solutions to resource issues. As mentioned in the second chapter, groundwater in northern China has deteriorated in quality and availability due to overdraft. Irrigation scheduling allows farmers to control both the timing and quantity of water delivery so that water application to crops aligns with sensitive growing periods. One of the ways this can be achieved is through the application of deficit irrigation, which is the deliberate application of less water than what is required by full crop demand.\textsuperscript{194} This would be appropriate in the North China Plain, as water, not land, is the limiting factor in agricultural production. A fifty percent reduction in irrigation water in grain-producing regions would only yield a ten percent reduction in total crops.\textsuperscript{195} A continued reliance on irrigation in farming will yield aquifer exhaustion, land structure collapses, and soil salinization. A groundwater monitoring system that establishes clear guidelines and allows for user involvement is necessary. The government needs to move away from policies designed to increase total water supply and redirect their efforts towards investment in water-saving technology.

Without changes to irrigation practices or water pricing schemes, water resources will continue to be scarce in the long-term. This is especially true given that population in the North China Plain as well as coal demand are expected to increase significantly by the time the project is completed. The SNWTP and other large projects would experience more long-term success if they were paired with changes to behavioral practices. China has low water productivity, which means that there is a

\textsuperscript{194} World Bank, \textit{Reengaging in Agricultural Water Management: Challenges and Options} (Washington, DC: 2006), 77.

\textsuperscript{195} Ibid., 78.
chance that China can take steps to reduce its overall water demand without slowing down the pace of development.

It is clear that China’s water crisis is not going away. The negative externalities of decades of unregulated industrialization will continue to persist if policymakers do not incorporate risk management into environmental policy. Demand-side management solutions can help address the root causes of the constant water shortages in the northern provinces and non-structural policy options can bring water-demand to levels that are sustainable in the long-term.

China’s central government is still trying to increase the total amount of water, rather than exploring ways that water can be used in a more sustainable way. China’s continued water issues have rendered supply-side, reactive disaster management insufficient. People, ecosystems, and economies have always and will always depend on water resources for both survival and prosperity. The Chinese have demonstrated their ingenuity in the economic sector. It is time for policymakers apply those same innovative ways of thinking by moving away from mega-projects and towards non-technical conservation practices to de-stress domestic water supply.
REFERENCES


Skocpol, Theda. "Bringing the State Back In." Items 36, no. 1-2 (1982).


**ONLINE SOURCES**


