



## AN ABSTRACT OF THE THESIS OF

Andrea L. Carson for the degree of Master of Science Name in Water Resources Policy and Management presented on June 10, 2014.

Title: Investments in People and Technology: Public Participation in the Remediation of Dian Lake in Yunnan, China.

Abstract approved:

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From the 1960s to 1990s, the water quality of Dian Lake (滇池), China's sixth largest freshwater lake located outside the capital of Yunnan Province, Kunming City, rapidly declined causing livelihood disruption, decreased water availability, and biodiversity loss. Despite significant investments in remediation efforts, only small water quality improvements have been made. In basins where no technical solution seems to eliminate the existing water quality issues, Integrated Water Resource Management and Adaptive Management frameworks suggest stakeholder involvement, collective action, and knowledge sharing are important to the lake basin management process. However, in China's authoritarian government system, these factors may be limited. Therefore, through semi-structured and informal interviews, this thesis examines the available opportunities in the pollution control and remediation efforts at Dian Lake for knowledge sharing and collective action between

organizations involved in the restoration and pollution control efforts and the residents of two residential areas bordering Dian Lake: Yanjia Village and Haikou Township. The qualitative assessment also includes an investigation into the organization representatives' rationale for the inclusion or exclusion of villagers within the management process as well as the villagers' awareness of and beliefs about the process. The resulting discussion examines how the rationale for villager inclusion, coupled with the villagers' beliefs and current opportunities available to them in the management process compares features necessary for the success of IWRM and Adaptive Management frameworks as suggested in the literature.

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Investments in People and Technology: Public Participation in the Remediation of  
Dian Lake in Yunnan, China

by  
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I understand that my thesis will become part of the permanent collection of Oregon State University libraries. My signature below authorizes release of my thesis to any reader upon request.

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Andrea L. Carson, Author

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## Investments in People and Technology: Public Participation in the Remediation of Dian Lake in Yunnan, China



### INTRODUCTION

Natural resource management has become more complex as demands for more sustainable management have changed the management style from protecting one resource for one purpose to multiple resources for multiple purposes. Natural resource management frameworks such as Adaptive Management and Integrated Water Resource Management (IWRM) have been created to address this desire to manage resources for different interests. Most research on adaptive management and integrated water resource management (IWRM) frameworks has been conducted in Western countries where frameworks components such as stakeholder involvement, collective action, and knowledge sharing are at least entertained if not mandatory or invited; only a few studies have been conducted in countries where these components may not necessarily have a place within resource management approaches due to cultural and political climates. Although there has been a distinct shift towards IWRM and

Adaptive Management in Western countries, the transition towards this management in authoritarian governments like China can be more challenging. The top-down nature of Chinese politics often prohibits social actors from playing an influential part in the regulatory process (VanRooy et al., 2012).

Surprisingly, a call for a more integrated approach to resource management, particularly in regards to water, was made in the 2002 Water Law of the People's Republic of China. The integrated planning refers to the inclusion of economic and social development but in the context of protection the water resources for both quantity and quality. Although this 2002 Water Law of the PRC describes an integrated approach to planning and the Environmental Protection Law of the People's Republic of China describes how protection and improvement of the Chinese natural resources can be accomplished, neither policy explicitly states how the public, or other stakeholder groups for that matter, are incorporated into these plans. Instead, the policies focus on taking economic and technical approaches to manage the quantity and quality of the resources. The only inclusive component for stakeholders groups other than the government in these policies are those related to the limits on pollution and consequences for polluters. The tasks within the policies are delegated to the many layers of government spanning from local to national. Additionally, there is no requirement for public inclusion within the policy making or implementation process. This lack of inclusion of public participation coupled with reported ineffective collaboration and delegated responsibility has hindered the progress towards achieving an integrated approach to management of water resources (Song et al., 2010). Since Wang et al. (2013) argues that stakeholder involvement, knowledge sharing, and cooperation on “temporal–spatial and political boundaries have been shown to be vitally important to the

successful development and implementation of watershed management planning” (p. 587), an absence of these factors within a countries policies and consequently within their management approach can reduce the effectiveness of an integrated management approach.

To further investigate the current state of integrated and adaptive management within China, I chose to examine stakeholder involvement, collective action, and knowledge sharing in the context of the policy-making and implementation process taking place to remediate Dian Lake. Dian Lake, the largest lake in Yunnan, China, has been identified within China’s Ninth Fifth Year Plan, as a national priority for remediation. Since the 1970’s, the dominant environmental problem in the Dian Lake watershed has been high levels of nutrient loading resulting in eutrophication. Beginning in the 1990’s efforts to mitigate the pollution and restore the lake to its historical pristine conditions have been implemented. As small improvements to Dian Lake water quality have been made and many of the point sources of pollution have been addressed, the pollution control and remediation efforts must now focus on addressing the non-point source pollution while also taking into account a growing population and continuing drought.

Many studies specifically focus on the technological and biological approaches to fixing Dian Lake. Few studies focus on the social or policy approaches to fixing Dian Lake. Those studies focusing on social aspects such as enforcement and regulation have found that there are barriers preventing successful public participation. Therefore, the overall purpose of this study was to investigate the existence of these 3 characteristics within the pollution control and remediation efforts at Dian Lake in Yunnan, China.

Focusing on two stakeholder groups at Dian Lake, local villagers and formal organizations working on restoration projects at Dian Lake, my research questions are:

- What role do these two stakeholder groups play in the management of Dian Lake?
- What are the beliefs of local villagers about the management of Dian Lake – including the sources of pollution, the remediation project in place, and the satisfaction with project outcomes thus far?
- From the perspective of formal organizations, what is the rationale for including or excluding villagers in the management process?

Before delving into the justification for creating and the findings for these questions, this chapter is intended to provide readers with the necessary background information on the socio-political, ecological, and biophysical changes of the Dian Lake watershed.

### **Background on Dian Lake**

Dian Lake, (滇池; *Diān Chí*), also known as Dianchi Lake or Kunming Lake (昆明湖; *Kūnmíng Hú*) is located in the Yunnan-Guizhou Plateau of Southwest China (Figure 1). As part of the larger Jinsha River drainage basin (an upper stream of the Yangtze river), Dian Lake plays an important role in regional water support, local micro-climate adjustment, the maintenance of biodiversity, and environmental protection of the Great Mekong Sub-region (GMS) (Zhao et al., 2012; Gong et al., 2009).

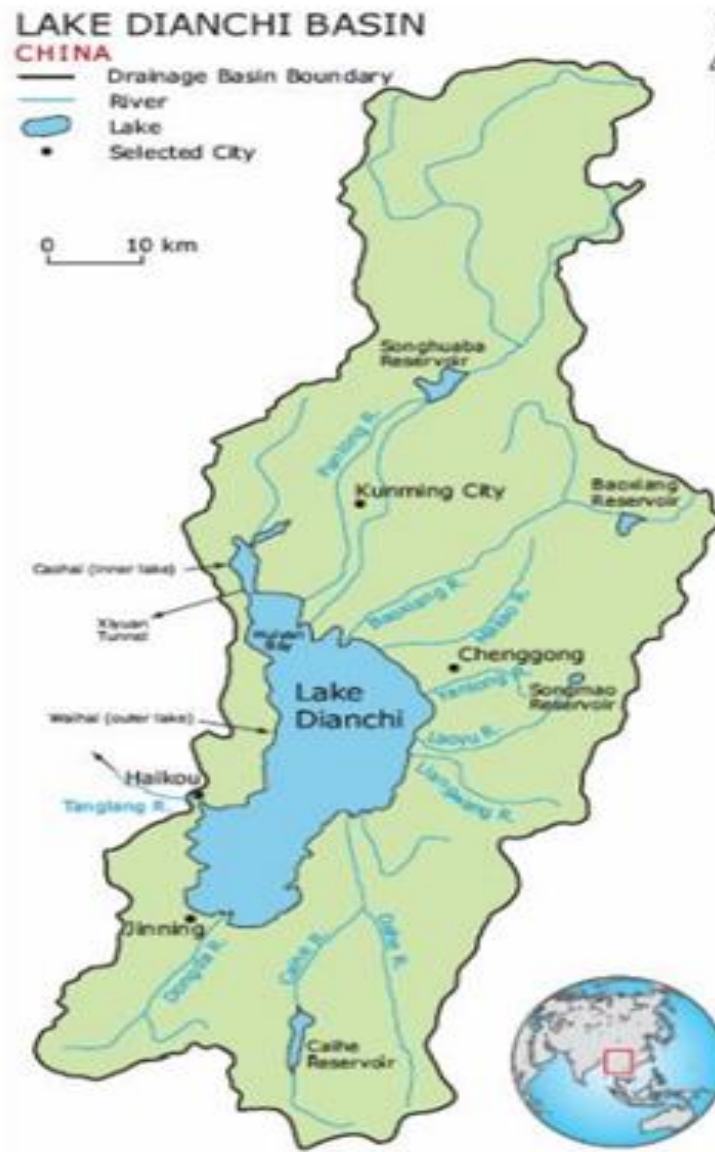


Figure 1. Geographic location of Dian Lake in Yunnan Province, China

### *Biophysical and Geophysical Features of Dian Lake*

#### Landscape:

At the geographic coordinates of 102°29' to 103°01'E longitude and 24°29' to 25°28'N latitude, the Dian Lake watershed has an average altitude of 1880 m (Zhao et al., 2012). Formed

naturally by tectonic activity, the Dian Lake drainage area is characterized by mountains, terraces and dammed river valleys (Jin et al., 2006). Almost 70% ( $2030 \text{ km}^2$ ) of the drainage area is highland. Slightly more than 20% ( $590 \text{ km}^2$ ) is classified as plains, while the lake itself occupies 10.3% ( $300 \text{ km}^2$ ) of the whole drainage basin area (Jin et al., 2006, p. 161; Mu, 2006). Dian Lake is China's 6<sup>th</sup> largest freshwater lake with a total surface area of approximately  $300 \text{ km}^2$ , total volume of 1.56 billion  $\text{m}^3$ , mean depth of 4.4 m, and maximum water depth of 10.9 m (LakeNet, 2011; Jin et al., 2006; Tanaka et al., 2013). Although the exact number varies by source, more than 20 rivers flow in Dian Lake while the only natural outlet from Dian Lake is the Tanglang River at Haikou Township (Global Environment Facility, 2002). With rivers flowing from the east, north, and south, Dian Lake, located within the Kunming Municipality, receives water that flows through farmlands, towns, villages, and phosphate mines (Jin et al., 2006). Dian Lake is divided into two parts by an artificial causeway. The significantly smaller, inner part of Dian Lake called Caohai occupies 2.7% of the lake surface and the outer part, Waihai occupies 97.3%.

#### Climate:

The lake region lies within the wet monsoon climatic belt of northern sub-tropic zone. This southeast monsoon climate area is characterized by a warm rainy season during the summer and autumn with the dry season in winter and spring (Tanaka et al., 2013). The thermal regulation provided by the lake helps to create a pleasant regional micro-climate characterized by warm winters and cool summers (Jin et al., 2006). The average air temperature of this region is  $14.5^\circ\text{C}$  with the highest air temperatures reaching  $19.7^\circ\text{C}$  in September and lowest air



temperature is 7.5 °C in January. The annual mean precipitation is 1007 mm (Tanaka et al., 2013). These conditions create suitable for the growth of various terrestrial and aquatic species (Mu, 2006).

Since there are no significant groundwater transfers bringing water into the basin, precipitation is the only source of water for the lake's drainage basin. The basin experiences an uneven distribution of rainfall in that 82% of the total annual water resources for the basin are provided during the rainy season (Jin et al., 2006). This uneven seasonal rainfall consequently affects surface runoff into the basin. Recently, the annual mean precipitation in the basin has been much lower than the average. In 2011, the annual precipitation was 462 mm which is extremely low compared to the average annual mean precipitation of 1007 mm. The lower annual mean precipitation levels caused by a drought that began in 2009 and continues today coupled with the uneven seasonal precipitation distribution in the Dian Lake water basins has caused water shortages (Tanaka et al., 2013; Jin et al., 2006). As an economy reliant on forestry and agriculture, this water shortage is restricting Yunnan's economic growth (Yang & Zhou, 2013; Qin, 2013).

#### Biodiversity:

Until recent decades, the lake basin was considered a 'hotspot' of freshwater biodiversity and contained a large number of endemic species (Jin et al., 2006; Global Environment Facility, 2002). Species richness and composition have both changed radically over the past 60 years (Du et al., 2011). Before the mid-1960s, endemic species such as the small carp, white minnows, yellow tail, and golden line fish were used for commercial purposes; however "the introduction

of nonnative fish and plant species in combination with declining water, loss of natural habitats, competition for food and living space, and possibly introduced diseases and parasites have threatened the indigenous fauna and flora and resulted in the apparent extinction of at least some of the endemic species” (Global Environment Facility, 2002, p. 1). Other studies have found that other types of aquatic species have also declined during this time period. A compilation of studies collected by Du et al. (2011) showed that there has been a significant decline in the freshwater molluscan communities and their community compositions, often used as pollution indicators, from 1990s to the early 21<sup>st</sup> century. According to Yang et al. (2004), the area inhabited by aquatic macrophytes, which are aquatic plants visible to the naked eye, decreased from 90 to 6.8% of the lake area from the 1950s to the early twenty first century. Others studies found the area covered by this aquatic vegetation to be even lower (Yu et al., 2000). Gong et al. (2009) found that the number of diatom species, a common type of phytoplankton and an abundant high-quality food source for herbivores, decreased from 21 to 9 during that same time period.

### *Socio-economic Features of Dian Lake*

The Yunnan lakes, of which Dian Lake is the largest and most well-known, have been described as “the pearls on the plateau” because of their importance for water resources and economic development (Whitmore et al., 1997). Dian Lake basin is the most active area of socio-economy in Yunnan province (Li et al., 2012) and is also the direct water source for many of the cities, towns, and villages (Zhang & Liu, 2003; Mu, 2006). The Dian Lake basin area covers 2,920 km<sup>2</sup> with a total population of 308 million people in 2001 (Liu et al., 2004). Within

this basin are the Kunming Municipality, 18 towns, and 22 villages (Zhang & Liu, 2003; Global Environment Facility, 2002). In the Kunming Municipality the population is highly urbanized, “with a density of 23,600 persons/km<sup>2</sup> in the urban part, 34 times higher than the province’s average” (Jin et al., 2006). Kunming City, the highly urbanized area to the north of the lake, is the provincial capital as well as the center for industry and economic development in Yunnan Province. The Dianchi watershed area comprises only approximately 0.7% of Yunnan Province, but is responsible for 24% of the gross domestic product (GDP) of Yunnan Province (Pan & Gao, 2010). The agricultural output and industrial output from the Dian Lake basin accounts for 32.05 and 44.35% respectively, of the province’s total economic output. Meanwhile, the rural areas have developed many agricultural crops and are known for their largest ‘high-class’ flower trading market (Jin et al., 2006). Zhao et al. (2012) concluded that “the total watershed plays an important role in Great Mekong Sub-region (GMS) cooperation.” The development of agriculture, industry, and urbanization has changed the freshwater biodiversity structure and other ecologically-valued characteristics of the lake.

#### Change in Land Use:

The industrial and economic development has changed the land use and land cover within the Dian Lake basin. Due to the large amount of economic development and urban sprawl in the basin, a large portion of the historically agricultural land was turned into developed land, especially near the shores of Dian Lake (Zhao et al., 2012). At the same time, since the agricultural land has transformed into developed areas, agricultural lands expanded into the north and south of the watershed and were transformed from forested land. As a result of a lack of

proper planning and illegal exploitation of Dian Lake waterfront lands, the concentration of urban development coupled with some industrial factories and government construction sites built around the lake has caused serious pollution and destroyed the ecosystem around the lake (Gong and Li, 2003; Mu, 2006).

In addition to land cover, the land use within the basin has also changed. In the 2000s the cropping varieties began to shift from the dominant paddy rice-broad bean cropping system to vegetables and flower plants in greenhouses near the coastal area of southeast Dian Lake. The importance of this shift is that there is a higher dependence on nitrogen- (N) and phosphorus-based (P) fertilizer with the cultivation of vegetables and flower plants. The paddy rice-broad bean cropping system was less dependent on N and P fertilizer (Tanaka et al., 2013). According to a study by Duan et al. (2003), the amount of applied chemical fertilizer around Dian Lake is higher than the national average level in China. These types of changes have changed the nutrient loads in surface runoff into Dian Lake.

#### *Changes to Water Quality in Dian Lake*

The sections above have focused on the changes to the biophysical and socioeconomic conditions in the Dian Lake basin. The changes have not positively affected Dian Lake but rather have degraded the quality and functionality of the lake. This next section will further explain what changes these socioeconomic and biophysical conditions have caused to happen in Dian Lake.

Water quality and water quantity issues have developed within the last few decades at Dian Lake as a result of the uses of Dian Lake itself and the surrounding land use. Rated Class II

in the 1960s and declining to below Class V in the 1990s, the water quality rating for Dian Lake is currently Grade V, which renders Dian Lake unfit for fishing and swimming although still suitable for agricultural use (Ediger & Hwang, 2009; The World Bank, 2006). Chen et al. (2002) identify two reasons for the eutrophication of Dian Lake, the first being natural processes: “as a large shallow plateau lake, the local climatic conditions of high irradiation and temperature, the clear rainfall seasonal patterns, as well as the slow hydrological exchange rate, lead to Dianchi liable to eutrophication” (p. 1). For plateau lakes such as Dian Lake, the tributaries that flow into the lake outnumber those that go out of the lake. As a result, the water renewal period is much longer and inputs of salts and other substances could easily accumulate in the lake (Wang & Dou, 1999). Zhang et al. (2013) also attributed the fragile ecological conditions, shallow water level, insufficient inflow, and the age stage of the lake to the pollution in the lake. Chen et al. (2002) describes the second reason for eutrophication to be anthropogenic: “the catchment runoff drains a significant amount of N and P nutrients into the Dianchi Lake via over twenty rivers which pass through towns and villages, farmlands and phosphate mines” (p. 1).

Before development opportunities arrived, Dian Lake had been used for drinking and swimming (VanRooij, 2010). The earlier development projects and reclamation areas around the shoreline of the lake destroyed a significant amount of the natural environment around Dian Lake. The change in land use increased the nutrient loads traveling into the lake while simultaneously reduced the capacity of the lake to mitigate the effects of these nutrients (Global Environment Facility, 2002). Additionally, the development of proper infrastructure for waste water treatment lags behind the rapid economic development in the region.

The lake receives a large portion of untreated wastewater from Kunming. According to the Kunming Environmental Protection Bureau (2001), Kunming City contributes 75% of the total wastewater discharges. In a study conducted by Liu et al. (2012) it was found that “over half of the municipal domestic wastewaters and almost all domestic wastewaters in rural settlements of the Yunnan plateau are not treated before they are released into the environment ” (p. 868). The lack of waste water treatment facilities has become one of many reasons the lake has become increasingly eutrophic, particularly at the northern end in Cao Hai (Global Environment Facility, 2002). According to Zhang and Liu’s study (2003) on nonpoint source pollution at Dian Lake, “apart from industrial and urban pollution sources, rural non-point source pollution is regarded as one of the major source of pollution in Dianchi” (p. 4). Most of the non-point source pollution is from agriculture surrounding Dian Lake. In fact, it is estimated that 70% of the nutrient load comes from agricultural diffuse pollution (The World Bank, 2006). The Kunming Environmental Protection Bureau estimated that approximately 21% of the total nitrogen and 32% of the total phosphorus that flow into Dianchi are from the nonpoint sources in the surrounding areas (KEPB, 2006). These different sources of pollution have resulted in hypereutrophic conditions characterized by extensive algal blooms (LakeNet, 2011).



These algal blooms are a result of eutrophication. According to Smith et al. (1999), “eutrophication is the process by which water bodies are made more eutrophic through an increase in their nutrient supply. The most common effects of increased N and P supplies on aquatic ecosystems are increases in the abundance of blue algae blooms that steal nutrients and oxygen away from other plants and animals causing them to die. This process eutrophication also causes water level qualities to drop. When eutrophic conditions occur, there can be substantial economic effects (Carpenter et al., 1998). The people who have depended on Dian Lake for its ecosystem services may now need to consider balancing economic development with environmental degradation.

In 2000, blue-green algal blooms covered approximately 20 sq. kilometers of the lake surface. According to VanRooy (2010), many different sources contributed to Dian Lake’s eutrophic conditions: “the combination of industrial pollution, municipal waste discharge, soil

erosion, and various kinds of nonpoint pollution from chemical fertilizers, solid wastes, and pesticides used in horticulture severely atrophied the lake's water" (p. 368). Sediment analysis conducted by Xiong et al. (2010) showed that the last 100 years of human activities on the lake is the most evident time period of sediment change in the sediment records. They found that "the dramatic changes in organic matter composition during this stage are attributed to enhanced algal productivity caused by an increase in nutrient supply, due to modern urbanization and industrialization" (Xiong et al., 2010). During 1988–1992, Total Nitrogen (TN), Total Phosphorus (TP), and Chemical Oxygen Demand (CODMn) were 1.44, 0.11, and 7.91 mg/l and then rose to 2.61, 0.18, and 10.21 mg/l in 2009–2011, respectively (Liu et al., 2012). Phosphate content has been greatly reduced in Caohai; however, the water quality in Waihai is actually still deteriorating despite large investments on eutrophication control (Chen et al., 2002).

### *Fixing Dian Lake*

The causes of eutrophication are many causing scientists to debate which aspects of management to focus on. A study of water quality degradation in the Yunnan Plateau lakes suggested that nutrient mitigation could be most successful if it were focused on industrial wastewater and domestic sewage control in industrial areas, urban areas, and rural settlements. (Liu et al., 2012). Other scholars however reported that since about 1/3 total nitrogen (TN) and 1/4 total phosphorus (TP) were provided by non-point source (NPS) pollution in Dian Lake, then NPS pollution from agriculture and rural could be the key focal points for fixing Dian Lake (Feng & Wang, 2008; Cao et al., 2004; Sun et al., 2010; Tanaka et al., 2013; Lu & Wang, 2008). Whatever the cause of the eutrophic conditions, it "has been detrimental to the development of the industry, agriculture, and to the health of residents around the area" (Lu & Wang, 2008).



Steps have been taken in recent years to control the main municipal and industrial point pollutions sources as well as focus on specific inner pollution sources. Beginning in the 1996 with the Ninth Five-Year Plan, Dian Lake has been designated as one of the Chinese government priorities as part of the “three rivers and three lakes” initiative. Projects, focusing primarily on different remediation mechanisms, have been created. These mechanisms include: water diversion, water treatment plants, waterway cleanups, mechanical harvesting and chemical control of algae, selective removal of nutrient-rich water, agricultural pollution treatment, ecological system restoration, and sediment dredging (Xiao, 2010; Design and Research Institute of Water Resources and Hydropower in Yunnan Representative, personal communication, 2013; Kunming Daily, 2008; Chen et al., 2002). Water diversion projects, known as the Dianchi Lake Water Project (滇池补水工程), diverts fresh water from unconnected rivers in order to dilute the water in Dian Lake and provide another source of water in times of drought (Scully, 2013). Water treatment plants aim to treat wastewater before it is poured into Dian Lake. Cleaning the water ways include efforts of cleaning up garbage in the rivers that flow into Dian Lake and implementing ecological methods such as planting water hyacinth to absorb excess nutrients. Agricultural pollution treatments include efforts to decrease the area of farmland surrounding Dian Lake, choosing crops that require less fertilizer, and controlling the use of fertilizers. Ecological system restoration includes planting riparian buffers and protection areas around the lake (Li, 2013) and returning farmland and development areas to their natural states. Dredging sediment is aimed to clean or remove silt which holds in harmful chemicals and nutrients that have settled at the bottom of Dian Lake. Other expensive attempts, such as introduction of invasive plant species to pumping ozone into the lake (Scully, 2013) and the creation and

enforcement of legislation and regulations (Chen et al., 2002) have also been carried out. In 2014, Party Secretary Qin Guangrong (秦光荣) announced that 55 billion yuan would be earmarked to combat water pollution over the next five years, with a large portion of that money designated for clean-up efforts at Dian Lake (Sally, 2014).

In regards to other relevant policies that have aided in the protection of Dian Lake, the Yunnan Dianchi Lake Protection Ordinance was passed in 2012 to specifically strengthen the protection and management of Dian Lake. The document describes the protection of Dian Lake as a comprehensive plan that incorporated sustainable development. This specific document, unlike other policies, actually calls for the government to educate the public and increase their awareness related to environmental protection. On a more national scale, policies such as the 2002 Water Law of the People's Republic of China and the 1989 Environmental Protection Law have been put into place to improve the protection efforts on water resources. Both policies help to protect the existing water resources and prevent the degradation of its quality but also are meant to achieve a sustainable use of the resources that also allows for national economic and social development.

As a result of these efforts, the discharge of point source pollution has gradually decreased; however, non-point source pollution remains a problem at Dian Lake (Lu & Wang, 2008). By controlling non-point sources such as rural solid waste, domestic sewage, soil erosion from the plateau, and nitrogen/phosphorous loss from the field (flower and vegetable plantation), the negative effects of non-point source pollution including could be reduced (Lu & Wang, 2008). However, Zhang et al. (2013) declared that long period of eutrophication in the lake has affected the sediment in the lake; this sediment will prove to be another major source of pollution.

These studies generally show that the remediation of Dian Lake will not be an easy task, but rather a complex task addressing many sources of pollution.

Zhao et al. (2012) summarized that studies have found that “physical, chemical, biological, and systematic engineering methods and policies have been implemented to manage the environmental deterioration of the Lake Dianchi watershed” but that “the deteriorated status of the water quality and the environment have not been changed significantly, and the watershed continues to face multiple ecological crises” (p. 3844). Zhao et al. (2012) also concluded that the “sole dependence on industrialized methods will make it difficult to fundamentally change the status of the water quality and environmental deterioration. Alternative approaches are needed to fundamentally address this problem” (p. 3844). Party Secretary of the Kunming Dianchi Administration Mawen Sen identified strengthening the integration of towns, communities, and residents into the supervision and management of Dian Lake as well as the increasing environmental and legal awareness through publicity as two of the needs for addressing pollution problems at Dian Lake (Kunming Daily, 2008). The sentiments of these experts identify the missing component to the Dian Lake management approach: social engineering and civil science.

Many quantitative, technical, and biological studies have been conducted on Dian Lake, producing recommendations for the remediation of the lake. Although, the need for stronger supervision and environmental awareness are often cited as weaknesses in the current management plan; few studies have been conducted on these topics. Even fewer studies focus specifically on the public involvement in the management process at Dian Lake. Therefore, this study takes steps toward addressing the social aspects of the water quality management at Dian

Lake by examining public perceptions and public participation within the management process of Dian Lake.



## LITERATURE REVIEW

Over one billion dollars from the Chinese government, the World Bank, and from other smaller Global Environment Funds have been invested in mechanisms to improve the quality of the lake (The World Bank, 2006; Jin et al., 2006). These investments, pollution-control and restoration projects, and policies, and campaigns to protect this lake have slowly made an impact on the wastewater and industrial pollution and nutrient runoff that have caused this eutrophication (Turner, 2006; Jin et al., 2006). These minimal improvements caused by efforts to increase regulation and technical responses have been documented in many lake basins around the world (ILEC, 2005). In response to these findings, it has been argued that while technological responses can have profoundly positive effects on lakes, technological responses on their own are not sufficient.

New natural resource frameworks have been created to address this stagnation in improvements. Whereas traditional resource management approaches, using hierarchical systems and isolated decision-making processes have been criticized for their inability to incorporate important stakeholder values and to handle the increasing complexity of the natural resource

management issues, new resource management frameworks have encouraged integrated, participatory, and transparent management processes. According to the definition of stakeholders as presented by Avramoski (2004), stakeholders “are individuals or representatives of a group who make use of, have an impact on, or are impacted by the issue of concern” (p. 1). Studies suggest that the sustainable management of natural resources cannot occur until the current management regimes begin to focus on more adaptive and integrated resource governance (Pahl-Wostl et al., 2007a,b; Folke et al., 2005). Two frameworks that do this are Integrated Water Resources Management and Adaptive Management. According to these two management approaches, stakeholder involvement, collective action, and knowledge-sharing can be valuable and beneficial to the management of natural resources.

Although most research on adaptive management and integrated water resource management (IWRM) frameworks has been conducted in Western countries, few studies have reported a shift in management frameworks in China to begin to reflect the characteristics of these new natural resource frameworks (Song et al., 2010). In many examples of successful resource management, the general public are stakeholders involved in collaboration and knowledge sharing; however in China’s authoritarian system, societal actors such as the general public play a limited role in the management process.

Therefore, using stakeholder involvement, collective action, and knowledge sharing as indicators of IWRM and adaptive management frameworks, this study examines available opportunities in the pollution control projects at Dian Lake for knowledge sharing and action between restoration project planners and the residents of two residential areas bordering Dian Lake: Yanjia Village and the Haikou Township; the beliefs of the villagers about the

management process; and whether villager participation is perceived as necessary in the management process at Dian Lake.

To investigate the main research question of this project, I drew on relevant theory and the findings of previous research efforts on management approaches in Dian Lake and China. The following body of literature describes the two natural resource frameworks I am applying – integrated water resource management and adaptive management – and describes the relevance of the factors being investigated in this study to the management outcomes at Dian Lake. In this next section I first provide an overview of natural resource management approaches. Second, I identify the common characteristics between the management approaches that might offer insights into the factors important to the management of Dian Lake and I explain how these characteristics can be beneficial to resource management if used.

### **Integrated Water Resource Management**

Recognizing the inadequacies of previous management approaches, the field of natural resource management, particularly water resource management, has begun to replace this traditional, top-down, isolated management approach with one that is flexible and centered on multi-level coordination (Bressers & Kuks, 2003; Pierre & Peters, 2000). Multiple examples of such natural resource frameworks have been created. This next section will introduce two of these frameworks and will illuminate the commonalities between them that are relevant to this research.

As one of the most commonly used water resource frameworks, Integrated Water Resource Management (IWRM) is a bottom-up, decentralized, participatory approach to environmental governance (Margerum, 1997). IWRM, as defined by the Global Water

Partnership Technical Advisory Committee (GWP TAC) (2000) is “a process that promotes the coordinated development and management of water, land and related resources, in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems” (p. 5). IWRM works to balance the interests of the stakeholders in order to create a coordinated, sustainable, holistic approach to water resource management (Medema et al., 2008). This approach allows for knowledge production and uses a variety of perspectives, representing multiple resource uses and interest in order to successfully develop a common environmental vision that addresses the interests of all stakeholder and can be achieved through integrated, watershed-based policies and programs (Singleton, 2002; Blomquist & Schlager, 2005).

As a framework, IWRM is not necessarily implemented in the same way in different countries because of their development stages and political contexts, which means that the same benefits may not be derived in all cases (GWP TAC, 2000). This variability in outcomes makes studying this framework in China different from those studies of IWRM in the United States and other Western countries.

There are subsets of IWRM that focus specifically on either river or lake basins. These subsets are fittingly called Integrated River Basin Management and Lake Basin Management. Both of these frameworks can be applied to an assessment of the management processes of Dian Lake since Dian Lake is part of a larger river basin system but also is a lake basin within that system. The development of IRBM in China is described as an “institutional learning process within the existing administrative and hydrological context, as well as a paradigm shift towards



adaptive and sustainable water management” (Song et al. 2010, p. 505). Therefore, focusing on Adaptive Management and IWRM seems to be appropriate for this study.

Lake basin management focuses on addressing the root causes for problems in lakes which, according to the World Lake Vision (2003), include: 1) increased demands for developing and using lake resources due in part to population growth and economic development, 2) limited public awareness and understanding of human impacts on lakes, 3) insufficient governance and accountability systems and 4) inadequate mechanisms for managing international lake systems. The longer retention period of lakes also provide a challenge for lake basin management; plans need to be created with long term goals that at the same time are flexible to adapt to changing values and new knowledge that may be found (ILEC, 2005). As these are the common problems found in lake basin management and conveniently, many of the problems found at Dian Lake, it would make sense that the solutions address these issues.

### **Adaptive Management**

Adaptive management approaches differ from traditional management approaches in that they are better able to react to change and respond to environmental threats because of the different approach to learning associated with this approach (Bormann et al., 1994; Tompkins & Adger, 2004). Adaptive management, as defined by Kusel et al. (1996) is “a process for acting deliberately under uncertainty by increasing opportunities to develop new information and redirecting management actions in a timely manner” (p. 612). Kusel et al. (1996) continues on to state that “compared to traditional approaches to resource management, adaptive management is more responsive to changing conditions of and demands on ecosystems” (p. 611).

In cases of communities facing climate change, such as Dian Lake, a community's adaptive capacity can allow it to build resilience and reduce its vulnerability to the effects of climate change. Resilience can be built through collective action where stakeholders work together with a government agency to address resource management as well as other mechanisms such as new technological approaches (Tompkins & Adger, 2004). Bormann et al. (1994) suggest that collaboration, coordination and information sharing among all interested parties, including the public is required for successful adaptive management of ecosystems. Similar to Bormann et al.'s argument (1994), Pahl-Wostl et al. (2007c) states that the true complexity in water systems needs to be addressed by a "move from technical management to true integration of the human dimension and making management more adaptive and flexible to make it operational under fast changing socio-economic boundary conditions and climate change" (p.51).

Rather than limiting active participation to scientists and managers like traditional management approaches, integrated adaptive management includes a more active role to the public. The inclusion of the public then allows social values and public contributions to be incorporated into the original technocratic approach. The importance of stakeholder involvement throughout this process has been shown to improve the quality and perception of decisions made at each step (Shindler & Cheek, 1999). Not only can Adaptive Management be used to strengthen the water management decisions made, but it can also allow for the public to learn about information related to ecosystem processes and management decisions.

### **Common Aspects of IWRM and Adaptive Management**

IWRM focuses on integration and coordination in the process of organizing and producing knowledge to create sustainable solutions to complex water resource issues. The Adaptive Management framework focuses on handling uncertainty in the same process. While there are differences in the IWRM and Adaptive Management frameworks as highlighted in Medema et al. (2008), both frameworks are created with the goal of capturing the best way “to organize knowledge production for sustainability in natural resource use under conditions of complexity” (p. 31). This literature review focuses on the similarities between the two frameworks.

Stakeholder involvement, knowledge sharing, and collective action are the three common, necessary components that lead to integrated and adaptive management approaches. Stakeholder involvement is the key component that contributes to the subsidiary components of knowledge sharing and collective action. The next section will discuss these aspects in further details and then discuss the benefits of stakeholder involvement, knowledge sharing, and collective action for management outcomes.

### *Stakeholder Involvement*

These two frameworks are based upon the assumption that stakeholders are in some way participating in the decision-making and implementation processes of natural resource management. Furthermore, the key to both collective action and to knowledge sharing is the involvement of stakeholders. While in traditional management approaches the public is often excluded, in new management approaches, public participation is often encouraged. The rationale for the value of public participation in a decision is three-fold: 1) It fulfills a democratic role, 2) citizens can have knowledge relevant to be decision-making and 3) involvement can

increase support for outcomes and facilitate implementation (Larson & Lach, 2008). Involving the public through communication, education and public awareness can also be important to changing their behavior (ILEC, 2005).

In the water resource management approaches, questions arise as to who within the public should be involved in lake management (Larson & Lach, 2008). When describing the ‘public’ in public participation, the public may include drainage basin ‘citizens’, business people and industrialists, farmers and agriculturalists, environmentalists, non-governmental organizations, international organizations and professional societies, funding agencies and even governmental entities in some cases (ILEC, 2005). The decision of who is involved in resource management is an important one and can significantly impact the outcomes of policies and management decisions. Many scholars believe broad representation of interests is important (e.g. Korfmacher, 2001) so that decisions are representative of the interests of those affected by a decision (McComas, 2001). When considering the make-up of stakeholder groups, they are largely composed of political elites (Lubell, 2004) or of the interested, available, and compatible (Smith, 2013). According to an analysis of lake basin management approaches across the world, “different stakeholders are involved in different phases of the lake management process, and this stakeholder participation takes place at different levels of governance—community, local, national or international, or a mix of these” (p. 48).

One key challenge in stakeholder involvement relates to determining the proper level of public participation. The Global Environment Facility (2010) identified that “one of the most difficult elements of effective lake management is the shift from considering “people” as a homogeneous and passive citizenry that “receives governance,” to one recognizing “people” as

active participants in the process of lake management” (p. 47). How the public participates in the process can differ depending on the specific context of each resource management situation.

Even when public participation may be encouraged, public participation may turn out to be symbolic rather than meaningful. In many cases, although public participation may be invited or encouraged, the local people may have no actual power or influence on the decision-making process (Cooke & Kothari, 2001). The requirement for meaningful public participation is “to provide the information and data needed to make the public aware of the magnitude of given lake problems, and the public’s role in both causing and solving them, as well as the ultimate environmental and socioeconomic consequences if the problems are ignored” (p. 47). While many of these management approaches recommend including the public participation and describe meaningful participation, there are various forms in which public participation can take (IAP2, 2007; Arnstein, 1969; The World Bank, 2000). As an example of a hierarchical scale for participation related to lake basin management, the World Bank (2000) has identified 4 types of participation. In ascending order, from least influence to most influence, they include: (1) information sharing (one-way communication); (2) consultation (two-way communication); (3) collaboration (shared control over decisions and resources); and (4) empowerment (transfer of control over decisions and resources). For sustainable outcomes, higher levels of decision making are required (Schouten & Moriarty, 2003).

The forms of participation can vary depending on the circumstances, capacities, interests, and needs of lake stakeholders (ILEC, 2005; Larson & Lach, 2008). While public participation is included in these different management approaches, others would argue that not all participation is good, or that a higher level or more participation is automatically better. Therefore, while

public participation may be important to these frameworks, the level of participation and type of participation will depend on the resource management context. For example, studies show explains that in countries still in earlier stages of economic development, improving environmental protection may not mean that more democratic participation or transparent processes are necessary. Rather, organized, autonomous, and willful state actors focused on imposing stringent regulations on polluting projects and activities may be the key to improving environmental protection (Rock, 2002; Tang et al., 2005). The value, degree, and placement of public participation within the process will also depend on the interests, skills and knowledge of the public in question (Kusel et al., 1996).

Stakeholder involvement brings several benefits. One valuable benefit of active involvement of the public is social learning, an essential mechanism for achieving integrated water resource management (Tippett et al., 2005). Social learning means that stakeholders need to be well informed and learn new skills (Tippett et al., 2005). Additionally, public involvement reduces the likelihood of agencies being dominated by one narrow set of interests Tang et al. (2005) because including the public helps to avoid path-dependence and tradition by questioning approaches that scientists and managers tend to favor (Kusel et al., 1996). Since the main tenet of adaptive management is creating flexible, dynamic policies and plans in order to better the outcomes, this increased flexibility and knowledge generation is imperative for achieving adaptive management goals.

The inclusion of individuals, groups, and communities in decision-making processes can improve the outcome of management efforts (ILEC, 2005; Narayan, 1995; Prokopy, 2005). Smith (2013) found that “many watershed improvement efforts fail because they do not take into

account the needs, constraints, and practices of local people (p. 53A). The overall quality and legitimacy of the management scenarios can be improved with early and fair stakeholder involvement (Joborn et al., 2005).

### *Collective Action*

As discussed above, natural resource management approaches advocate collaboration between scientists, managers, and the public. Collaboration, or collective action, in terms of stakeholder involvement, is one of the higher levels of public participation which allows for the public to have a great impact on the decision making and implementation processes. Collective action, can be brought about through utilizing and building social capital, which is described as “relations of trust, reciprocity, and exchange; the evolution of common rules; and the role of networks” (Adger, 2003, p.389). By building social capital, the state is more likely to exhibit collaborative behavior in resource management that can create a more adaptive management system (Adger, 2003). The lack of social capital is usually the reason that policy interventions are not successful (ILEC, 2005). Often, trust, frequent communication, reciprocity, and norms help to form social capital. Social capital then manifests itself as collaboration, knowledge sharing, networks and common interests (Lubell & Scholz, 2001; ILEC, 2005; Libecap, 1994; Ostrom, 1990).

The connectedness and networks that form between groups are the avenues through which information can be exchanged. In facing uncertainty, the capacity for people to innovate and adapt their technologies and practices to new conditions is important. As was mentioned previously, uncertainty and innovation are addressed through knowledge generation and sharing.

Evidence has shown that stakeholder involvement in collective action creates social capital in the forms of trust and support. Without the support of the general public, an analysis of lake basin management found that it is usually impossible to implement effective management (Pretty & Ward, 2001). A study by Propst et al. (2004) found that the type of participation and the level of empowerment will affect the attitudes of those involved. When the public is more cooperative when a policy is implemented, implementation may be smoother and less costly as well as less time consuming (Randolph & Bauer, 1999; Pretty & Ward, 2001). The public have been found to be more sympathetic to administrative decisions and less resistant when citizen participation has been used to create policies which reflect their preferences (Irvin & Stansbury 2004; Newig et al., 2005).

Involving stakeholders in the management process as active participants rather than as receivers of information is way in which to overcome a lack of acceptance by the stakeholders and build trust (Olsson & Berg, 2005; Kusel et al., 1996). Giving stakeholders a larger role in management decisions may not only increase acceptance of management projects but can also increase their willingness to take responsibility Bormann et al. (1994), sense of ownership (Trudel et al., 2002), compliance (Pahl-Wostl, 2009) and awareness (Muhandiki & Ballatore, 2007). The form of the roles may differ depending on the context and opportunities available, however, the creation of interest in and commitment to improved lake basin management is essential to improved management (ILEC, 2005). By creating interactions among actors, shared visions of the resource, and trust, Heikkila and Gerlak (2005) suggest that the transaction costs of interactions among diverse stakeholders can be significantly reduced.



By trusting in the common rules, norms, and sanctions individuals can be more confident to invest in collective and group activities (Pretty & Ward, 2001). In the context of resource management at Dian Lake, this trust in others can be useful in collective action towards pollution control and behavioral changes. Pretty and Ward (2001) also explain that “mutually-agreed sanctions ensure that those who break the rules know they will be punished” (p. 211).

### *Knowledge Sharing*

These management frameworks include active roles for the public because the public can be used a source of information and knowledge that is not usually represented by scientists or managers. ‘Hard’ information or ‘scientific’ information, while important and crucial to the management plans and monitoring programs, is not the only type of information important to lake basin management. Socio-economic information, knowledge of culture values, memories and experiences of indigenous people living in lake basin communities and citizen’s view of the resources are also valuable for devising and implementing policies (ILEC 2005; Kusel et al. 1996; Trudel et al., 2002). One of the main components in both IWRM and adaptive management approaches is the knowledge-acquisition, knowledge-sharing and knowledge-generation that occur between participants in order to increase the efficiency of decision-making. Webler et al. (1995) explains that the acquisition of knowledge can occur in many ways including:

- learning about the state of the problem (information and knowledge); learning about the possible solutions and the accompanying consequences (cause-effect relations, predictions); learning about other peoples' and groups' interests and values (information, explanation); learning about one's own personal interests (reflection); learning about methods, tools, and strategies

to communicate well and reach agreement (rhetoric, decision theory, small group interaction); and practicing holistic or integrative thinking. (p. 446)

While knowledge sharing can often benefit the management decisions themselves, it can also help to teach the public. Communication, education, and building of awareness can all attribute to the social learning of the public. Public and stakeholder participation can initiate social learning processes which create opportunities for shared understanding and learning (Garmendia & Stagl, 2010). Webler et al. (1995) defines social learning as the “process by which changes in the social condition occur--particularly changes in popular awareness and changes in how individuals see their private interests linked with the shared interests of their fellow citizens” (p. 445). This process is very different to consultation, in which the options to be decided on are developed by ‘experts’ and presented to stakeholders for comment. Encouraging social learning implies emphasis on the process of developing options and involving different stakeholders in making decisions (Tippett et al., 2005).

The educational benefits of public participation have been examined in many studies (Sabatier, 1988). Involving stakeholders in the knowledge-sharing process can bring several benefits, including an increase in public support for policy and an increase in social learning. The constant, iterative process of social learning aids in managing complex natural systems and increases the ability of the management system to respond to change. The ability to address this complexity is the core of adaptive management (Tippett et al., 2005). By involving people in the process through environmental and social impact assessments, decision-makers gain access to knowledge which will allow for the final decision to be more fitting to the community context and values and to fully address a resource governance problem (Pahl-Wostl, 2009). Additionally,

learning which policies are favored by local citizens can help administrators to avoid creating unpopular policies which might fail because of a lack of public support. Finally, with the introduction of new information, a gradual change in belief systems can occur and may eventually be reflected in policies (Sabatier & Jenkins-Smith, 1993).

### **Conditions for Framework Application**

Throughout this chapter, the subject of context dependent participation has arisen. Studies show that there are ideal and less than ideal conditions for citizen participation. Although many of the new management approaches call for public participation, it is important to recognize that public participation may vary in level and in necessity depending on the characteristics of the situation. The conditions under which these two approaches are best applied are discussed below.

Ideal conditions for citizen participation often include: situations where problems are relatively severe (Lubell et al., 2002), improvements are feasible (Ostrom 1990; Ostrom, 2001), long term visions of resource benefits and use are shared (Ostrom 1990; Ostrom, 2001), representatives for the public are chosen carefully, decision-making is transparent, there is clear authority in decision making, competent and unbiased group facilitators, regular meetings, and adequate financial resources to support the group process during the potentially long learning and decision-making process (Irvin & Stansbury, 2004), the population is better educated, better informed, and wealthier (ILEC, 2005).

Studies have identified circumstances in which public participation may not be necessary or effective (Lawrence & Deagen, 2001; Irvin & Stansbury, 2004). In these cases, top-down administration may be more beneficial because it promotes better efficiency. Although many

studies have applied the IRWM and adaptive management frameworks, both frameworks have been criticized as not living up to their ambitions (Medema et al., 2008). For example, Biswas (2004) has argued that the kind of institutional and organizational integration demanded by IWRM may not be possible. Walters (1997) found that out of the 25 major planning exercises for adaptive management that he has participated in, only two could be considered well planned. Many of the difficulties in applying these frameworks have been taking them from theory to practice.

While there are many benefits that can come from public participation, other studies question the need for public participation or provide reasons why public participation may not be as beneficial as theorized. These management approaches also have limitations to be considered. Cleaver (2001) found that there is little empirical evidence to support the argument that participation leads to successful project outcomes. Additionally, while including public participation and building trust and support may reduce transactional costs or dissent in management decisions, Irvin and Stansbury (2004) argue that the per-decision cost of citizen participation is more expensive than the decision making of a single agency administrator. Involving public participation can be time consuming and inefficient (Lawrence & Deagen, 2001).

Another argument against public participation is that although public participation is meant to invite a variety of views and knowledge into the decision making process, the people most likely to participate in the process are most often strongly biased participants, those who are strongly affected by the decisions or those who have the means or the time to participate regularly and therefore may not be representative of the public (Irvin & Stansbury, 2004).

Decisions may end up favoring the interests of the most powerful or persuasive participants rather than the wider public (Irvin & Stansbury, 2004). The inclusion of the public in the decision making process may also create resentment if the public feels as if their opinions have been ignored (Davis, 1996).

### **Applying IWRM and Adaptive Management to Dian Lake**

Despite these caveats to the application of Dian Lake, the application of these two frameworks can at a theoretical level, help to approach the complex resource management issues currently at Dian Lake. IWRM and Adaptive Management frameworks were specifically chosen to analyze the situation at Dian Lake because of the specific ways in which they can be applied. IWRM was chosen for its holistic approach and ability to address issues at the land-water nexus which become particularly important when considering that non-point source pollution is a significant problem in the Dian Lake watershed. Adaptive Management was chosen for its ability to address climate change and the need for a reduction in vulnerability since Yunnan is currently experiencing significant droughts which can negatively impact the resource-dependent economy of Kunming.

Although there has been a distinct shift towards IWRM and Adaptive Management in Western countries, the transition towards this management in authoritarian governments like China can be more challenging. The top-down nature of Chinese politics often prohibits social actors from playing an influential part in the regulatory process (VanRooy et al., 2012). While these management approaches have gradually become a national priority in China (Song et al., 2010), the integration of these management systems in China has not been rapid or easy. Song et al. (2010) argue that “the progress toward IRBM is being essentially hindered by responsibility

and power issues at all relevant levels, as well as ineffective coordination and public participation in the Chinese context of an economy-dominated development mode” (p. 500). Citizen involvement is minimal because of the restricted flow of information, the fear of political persecution, and individual, institutional, and regional interests that resist change. In Western countries where these difficulties exist, Wang et al. (2013) argues that stakeholder involvement, knowledge sharing, and cooperation on” temporal–spatial and political boundaries have been shown to be vitally important to the successful development and implementation of watershed management planning” (p. 587). They make the argument that while different governance systems operate in China, the same principle could apply.

Case studies of Dian Lake have helped to shed light on the circumstances surrounding this particular water pollution management project. Many studies specifically focus on the technological and biological approaches to fixing Dian Lake. Few studies focus on the social or policy approaches to fixing Dian Lake. Those studies focusing on social aspects such as enforcement and regulation have found that there are barriers preventing successful public participation. A study focusing on the regulation of land an pollution at Dian Lake found that local village movements and protests were prevented by the local government. The local government, which has some degree of independence from higher levels of government, has limited the amount of democratic participation occurring in the Dian Lake basin (Van Rooij, 2010). At the same time, NGOs have had quite a limited role in this area (Van Rooij, 2010). Nonpoint source pollution, a large contributor to pollution in Dian Lake, has been recognized as involving significant uncertainty (Zheng & Keller 2007) and arguments for more information about the nonpoint source pollution (Wu & Zheng, 2005) and information acquisition in general

have been made. Therefore, adding to the existing literature and investigating public participation in regards to the management of Dian Lake seems necessary and relevant.

As this literature review has shown, the effectiveness of participation depends upon the process and the methods through which public participation and other stakeholder input is collected and utilized. Using the common characteristics of integrated water resource management and adaptive resource management as variables for analysis, this research will be one of the first projects to investigate the opportunities for the involvement of stakeholder groups in the management of Dian Lake and the implication for management outcomes based on the results of this investigation.



## METHODS

This research project employed qualitative methods, which allowed for an examination of the factors that encouraged or prevented public participation in the management process at Dian Lake. The application of the IWRM and Adaptive Management guided the development of interview foci and lens of analysis for the case study. This examination of multiple levels is required to understand how the conditions of stakeholder involvement, collective action, and knowledge sharing can influence the decisions and outcomes made by the stakeholders in the management process of Dian Lake.

### **Data Collection**

Interviews were conducted between October and December 2013. Interview length varied from three to thirty minutes for villagers and one to three hours, with an average length of around two hours, for formal organization representatives. Because most respondents could not speak English, my research team, which consisted of myself, a research assistant and a translator, administered the interviews in Chinese. The interview questions were translated from English to Mandarin and then read to the respondents in Mandarin by either my translator or research



assistant. My knowledge of both written and spoken Mandarin at the time of this study was conversational, and although I was often able to ask follow-up questions to participants' interview responses, my limited knowledge of Mandarin made it impossible for me to conduct this research without the assistance of a translator. Additionally, verbal or written consent was obtained from each research participant depending on their preference. The translated interviews were audio recorded, then transcribed in English.

### *Villagers*

I conducted field research in the two case-study sites of Yanjia Village (严家村) and Haikou Township (海口镇) in the fall of 2013. The rationale for choosing one town and one village was to represent a typical town and a typical village around Dian Lake. These particular sites were chosen in consultation with collaborators in Yunnan who were familiar with the Dian lake case. These villages both lie on the edge of Dian Lake which increased the likelihood that the villagers at these sites would interact with the lake. Additionally, the sites were purposely chosen for their geographic locations. Haikou Township sits at the only natural outlet of Dian Lake and on the opposite side of the lake is Yanjia Village which sits on the northeast corner of Dian Lake near two of the largest rivers running into Dian Lake.

Because I lacked access to local population censuses, I utilized convenience sampling to recruit the sample population (Bernard, 2006, p.191-192). Given the short time frame of this research project and difficulties in building rapport with local village residents, I felt that short, informal qualitative interviews were the most appropriate method for collecting data at the two case study sites. I conducted informal field interviews with villagers ( $n = 31$ ) including village

leaders, business owners, fishermen, farmers, tradesmen, local government workers, teachers, and retired workers to investigate their awareness of issues and opportunities related to the pollution and management of Dian Lake as well as their beliefs about the management efforts. While the sample population cannot be considered representative of the populations at the two sites, the sample populations from the two sites are reflective of the broad spectrum of villagers that live at these sites. Some of the interviews with the villagers were group interviews; therefore the total number of respondents (n=49) is greater than the number of interviews. Interviews followed a standard structure, but each interview was tailored to the specific individual(s) being interviewed. Some of the interviews were incomplete and were therefore excluded from the data analysis. Table 1 illustrates the demographic breakdown of the villager interviews including occupation, gender, and associated village. The interview code number within the table is indicative of the code assigned to the interview, not the number of interviews conducted.

The interviews with the villagers included questions regarding communication between the villagers and government related to the management of Dian Lake, the awareness and beliefs of villagers regarding the management process and change in the lake, and the types of opportunities the villagers participated in related to protecting or polluting Dian Lake.

Table 1 Respondent demographics from Yanjia Village and Haikou Township

Interview Code Number	Number of Respondents	Occupation(s)	Site Location	Gender
702_0014	1	Village Leader	Yanjia Village	Male
702_0016	1	Business Owner	Haikou Township	Female
702_0022	1	Fisherman	Haikou Township	Male
702_0024	2	Tradesman	Haikou Township	Male
		Farmer	Haikou Township	Female
702_0027	2	Teacher	Haikou Township	Female
		Teacher	Haikou Township	Female
702_0029	1	Fisherman	Haikou Township	Male
702_0030	1	Business Owner	Yanjia Village	Female
702_0033	3	Farmer	Yanjia Village	Female
		Farmer	Yanjia Village	Male
		Farmer	Yanjia Village	Male
702_0034	4	Farmer	Yanjia Village	Female
		Farmer	Yanjia Village	Female
		Farmer	Yanjia Village	Female
		Farmer	Yanjia Village	Male
702_0035	2	Retired	Yanjia Village	Male
		Retired	Yanjia Village	Male
702_0037	2	Farmer	Yanjia Village	Female
		Farmer	Yanjia Village	Male
702_0039	1	Government Worker	Yanjia Village	Male
702_0040	2	Retired	Yanjia Village	Male
		Retired	Yanjia Village	Male
702_0041	1	Fisherman	Yanjia Village	Male
702_0044	1	Business Owner	Haikou Township	Male
702_0047	1	Government Worker	Haikou Township	Male
702_0048	1	Business Owner	Haikou Township	Female
702_0049	1	Retired	Haikou Township	Male
702_0050	1	Tradesman	Haikou Township	Male
702_0051	1	Farmer	Haikou Township	Female
702_0052	1	Farmer	Haikou Township	Female
702_0053	1	Government Worker	Haikou Township	Male
702_0055	1	Farmer	Haikou Township	Male

Table 1. 2 Respondent demographics from Yanjia Village and Haikou Township. (Continued)

702_0056	1	Government Worker	Haikou Township	Male
702_0058	1	Business Owner	Haikou Township	Female
702_0061	6	Farmer	Yanjia Village	Female
		Farmer	Yanjia Village	Female
		Farmer	Yanjia Village	Female
		Farmer	Yanjia Village	Male
		Farmer	Yanjia Village	Male
		Farmer	Yanjia Village	Female
702_0062	1	Farmer	Yanjia Village	Male
702_0063	1	Farmer	Yanjia Village	Male
702_0064	2	Farmer	Yanjia Village	Male
		Farmer	Yanjia Village	Female
702_0065	2	Retired	Yanjia Village	Male
		Retired	Yanjia Village	Male
702_0066	2	Business Owner	Yanjia Village	Male
		Business Owner	Yanjia Village	Female

### *Formal Organizations*

With the help of my research associates at the Yunnan Health and Development Research Association (YHDRA) and Kunming University, I used a purposive sampling method to select the representatives of formal organizations, with the goal of obtaining a representative sample of organizations involved in the management process. However, a representative sample was not achieved; many representatives of formal organizations were difficult or impossible to contact because of the sensitivity of the issue. Instead, I conducted a series of key-informant interviews with a wide variety of institutions involved in the Dian Lake management process: Institute of

Dianchi in Kunming (Research/Consultation Institution) ; Kunming Institute of Ecology (Research Institution); Design and Research Institute of Water Resources and Hydropower in Yunnan (Research Institution/Construction); Kunming University (Academic Institution); and Green Kunming (NGO); each of these organizations interacted with the government differently and had different roles to play in the management process.

I conducted semi-structured field interviews ( $n = 6$ ) with representative of formal organizations to investigate the process of decision making and implementation, knowledge collection and dissemination, and their perspectives on public participation. Interview questions explored the relationships between different actors, the identification of action levels, and their roles within the management process, and the reasoning behind including or excluding public participation. One interview was a follow-up interview as this respondent was also used for a pilot interview. Interviews followed a standard format, but each interview was tailored to the specific individual being interviewed. My original intention before being introduced to the current political atmosphere in China was to interview government officials as well as organization representatives. When this became impossible due to restrictions, I chose to interview the available organizations representatives and focus primarily on the villager interviews. The research team conducted interviews within the offices or preferred location of the organization representatives. Saturation was achieved with the villagers; however, due to limitations of time and access, saturation was not achieved with the formal organization representatives. Reaching saturation indicates that the sample size is large enough that no new information is gleaned from interviewing more respondents within the population.

### **Data Analysis**

I analyzed the qualitative data collected both during semi-structured and informal interviews by coding interview data topically and thematically using Nvivo 10 (Bernard, 2006). Using an open coding technique (Bernard, 2006), as well as creating general themes derived from reading the literature as suggested by Miles and Huberman (2004), I coded my interviews. Themes within the interviews were patterns of ideas or topics within the interviews. Although the research questions were created to investigate particular aspects of the natural resource management framework literature, the open-ended questions allowed for other themes to emerge through the interviews. Therefore, the open coding technique during data analysis allowed for any of these emergent themes to be included in the analysis. This open coding technique also included coding for themes suggested by the literature. I then utilized this qualitative data as well as field notes to inform my analysis. Through an inductive approach to my analysis, I was able to explore the answers to my three research questions: 1) What role do these two stakeholder groups play in the management of Dian Lake?; 2) What are the beliefs of local villagers about the management of Dian Lake?; and 3) From the perspective of formal organizations, what is the rationale for including or excluding villagers in the management process?

### **Methodological Limitations**

This research project presents four main limitations: 1) low participation rates by some groups and a lack of saturation; 2) the inherent bias associated with convenience samples; 3) willingness for participants to answer honestly; and 4) the research team's own bias.

The sample population of villagers included a large number of occupations and was fairly representative of gender seen while at the villages. As described earlier, the two different sites chosen are thought to be representative of the 'norm' of villages and towns found around Dian

Lake. As a result, conclusions about villagers can be considered representative of villagers living around Dian Lake. However, villagers may not be considered representative of those people living within the City of Kunming itself.

The same level of confidence cannot be assigned to the formal organization representative. Formal organization representatives consisted of individuals associated with the management of Dian Lake. Due to the many different types of organizations within the management process as well as the limited access to these organizations, conclusions based on the formal organizations cannot be considered representative of the population. Despite the lack of saturation achieved, the findings related to formal organization is at least a start to explore what I might find if I continued to investigate.

While the villager interviews are thought to be a representative sample, it is important to note that the villagers were sampled by convenience; thus, the sample may be biased to those occupations that tended to be most accessible during my visits to the villages. Accessibility was biased to those villagers in building with open doors near the roads and villagers interacting nearby the lake.

One of the concerns and challenges to conducting research in China is building enough rapport with the respondents to be given access to their honest opinions rather than their guarded responses. As a scientist from a foreign country, I was not often as trusted as I first anticipated I would be. Additionally, my living situation in Kunming, rather than in the villages among the villagers, made it difficult to build rapport with the villagers. My research team tried to overcome this challenge by easing into interviews with light conversation, the pouring of tea, or reassurances of confidentiality. The respondents were also encouraged to decline answering any

questions which they felt uncomfortable answering. Fortunately, the presence of my native Chinese research team members aided the building of rapport. Multiple visits to the villages also helped. My research team began to be recognized by villagers and more people were willing to speak with us upon our return to the villages.

The group interviews conducted with the villagers could have either created a desirability bias where villagers might also have been afraid of answering honestly because of the fear of repercussions or judgment from their fellow villagers. However, since the group interviews were conducted within heterogeneous groups, the groups interviews seemed to actually increase the villagers' comfort levels with answering questions. When approaching individuals for interviews, they may have been more hesitant and apprehensive to answer our questions, but in the group interviews the answers were not attributed to one person and thus the villagers' fear of retribution may have lessened.

Finally, the research team had to be aware of their biases and develop strategies to minimize the impact of bias on the interviews. Interview questions were designed to be open-ended and neutral, so that responses were not preferentially presented to the respondents. The research team also attempted to remain neutral in dress, tone and body language and not give opinions during the interview process.





## RESULTS

### **Villagers as Stakeholders**

In many examples of lake basin management, the public are considered stakeholders; however in China's authoritarian system, societal actors such as the general public may play a limited role in the management process. In this thesis, the 'public' specifically refers to the villagers living around Dian Lake. The results of this thesis examine the rationale for why the villagers are either included or excluded from the management process, the opportunities that exist to include them in the management process because of this rationale, and the effects these opportunities have on the villagers' beliefs about the management process and ultimately the management outcomes. This first section of the results discusses the relationship the villagers have with Dian Lake as a way to justify their characterization as a relevant stakeholder group to the management process at Dian Lake.

The people who live in Haikou Township and Yanjia Village have been witnesses to the changes, both within and around, Dian Lake. The township of Haikou was developed around the three channels that run through the town, acting as the exit to Dian Lake. The village of Yanjia

sits upon the edge of the lake and has streams of water running throughout the town, emptying in the lake. Therefore, the villagers of Haikou Township and Yanjia Village are not unaware of their proximity to Dian Lake, but rather are reminded every day as they travel through their towns and live their daily lives. While all the villagers I spoke to were aware of their proximity to Dian Lake, their interaction and reliance on the lake appeared to depend on their occupation.

Depending on the specific interactions a villager had with the lake, their description of the affect the changes in the lake have had on their life varied. However, almost all of the villagers I spoke with were able to describe how the physical changes have affected their daily lives. All villagers had been affected by their limited use of the lake. Before the pollution became substantial, villagers were able to drink the lake water, fish, and swim in the lake. Now, with the change in water quality villagers must look for sources of water elsewhere and must also pay for that water, affecting them financially. An old farmer in Yanjia Village was able to explain that “decades ago we could go to swim and fish in Dianchi but now we cannot do that. I miss this” (702\_0063). A restaurant owner in Haikou Township remembered, “In the past time they would transport water from Dianchi to drink. Now we don’t drink water from Dianchi. We pump water from reservoirs in the mountains” (702\_0016). Another group of farmers in the village of Yanjia described that since they have lived by Dian Lake their entire lives, “we know the process. The government projects to fix Dianchi have not been very useful. This has had a bad effect to our income” (702\_0034). Many of these villagers and their families have lived next to Dian Lake for generations. Over the past few decades, the deterioration of the lake has affected their recreational, domestic, and economic uses of Dian Lake. Due to the longevity of living near

Dian Lake, many of these villagers have childhood recollections of previous uses and have therefore been first hand witnesses to the change.

Not only has the deterioration of the water quality of the lake affected the villagers' daily lives, but so have the restoration efforts. The villagers have been asked to change their behavioral habits and also to support restoration efforts. A village leader of Yanjia Village explained that as part of the restoration efforts, Dianchi protection boundary markers were installed. As he pointed out to the protection area he said, "in the protection area you can grow crops as you like but you cannot build houses there. Originally I wanted to build a restaurant here but it is forbidden" (702\_0014). Villagers have also been asked to contribute up-front funds and time to the restoration efforts, the village leader also explained, Mayor Qiu He "ordered people to grow trees along the rivers but our government doesn't buy the trees for us. We have to buy them ourselves" (702\_0014).

Therefore, as witnesses and victims to this change, the villagers of the township of Haikou and village of Yanjia should be considered stakeholders in the management process of Dian Lake. Now that the rationale for considering these villagers as stakeholders, has been presented this next section will explore the roles of stakeholders.

### **Roles of Stakeholder Groups in Management Process**

One of the main investigations of this research was the role of different stakeholder groups in the management of Dian Lake. For the purposes of this thesis I am focusing on the role of two groups in the management process: local villagers, and formal organizations including academic institutions, research organizations, consultation firms, and NGOs. This section will explore the known opportunities available for the villagers in the management process as

explained through the collection of interviews with organizations and villagers. The opportunities have been broken down into opportunities for knowledge sharing and opportunities for action.

### *Opportunities for Knowledge Sharing*

Opportunities for knowledge sharing are characterized in this paper in two ways. First, they are opportunities available for villagers to contribute their opinions, knowledge, or other insights to inform the decision-making or implementation processes related to Dian Lake. Second, they can be opportunities for information to be shared with the public, which could include but is not limited to decision-making or implementation opportunities, rationale for decisions or implementation choices, pertinent regulations, and project impacts. Essentially, knowledge sharing here is evaluated as opportunities for the public to learn about Dian Lake and the management decisions and for the public to inform those management decisions.

As a result of the interviews with organization representatives and villagers, knowledge sharing is broken down into four processes: Informing Decisions; Seeking Information; Being Told Information; and Living Around Dian Lake. As may be evident from these four types of knowledge sharing, the level of participation varies. This variation will be discussed further in the next chapter. In this chapter, I describe the specific ways in which villagers can participate in these types of knowledge sharing, separating them by the organization representatives' input and then the villagers'.

The first process in which knowledge sharing occurs is in informing decisions. In this paper, ‘informing decisions’ means that information is collected in order to brainstorm projects or to help answer feasibility questions before the implementation of existing projects.

Two of the organization representatives mentioned ways in which they knew that the public could participate in the decision-making portion of the water management process. The representative from the Design and Research Institute of Water Resources and Hydropower in Yunnan explained that the villagers’ local knowledge can be utilized to make site-specific decisions for projects. The representative explained that when researchers arrive at a site, they give the public an opportunity to “actively show their opinions to provide suggestions. For instance if the institute want to know the historical flaws in the area, the water disasters, the ways of the rivers, they should ask the public. The public can give the most specific and targeted information” (702\_0008). This representative also explained that the public can give their input and help to inform project decisions by filling out an environment evaluation report available online.

Giving input through a questionnaire administered throughout a village can be another way that villagers can be help to inform decisions. These villagers can describe to these institutions the losses they would experience if they were to be relocated. This information is then written into a report and given to another government department which deals with the relocation of Chinese citizens. Project feasibility is based upon the input of the villagers.

The representative from Green Kunming also described existing regulation created by the state council which requires the government to hold meetings regarding any projects that might affect the profits of the public. These meeting are designed for the public to take part in and

discuss. However, the representative from Green Kunming went on to say that in practice, this does not occur in the way it was intended. The representative explained that either a small village will be asked to give their opinions or most of the time, the government consults within the government to make decisions: “government makes a decision, discusses in our government, and the government itself says ‘yes I agree, we can do that’” (702\_0067). Another meaningful way in which groups can impart their thoughts to the government where citizens peaceably protest through art or sitting in streets to arouse awareness and show their opinions. Furthermore, the representative of Green Kunming stated that villagers could also give their input to the process by appealing to the government to increase its transparency so that the villagers could gain access to more information. When I asked the villagers how they could become involved in the protection process, none of the villagers mentioned knowing of opportunities to provide input or help to inform decisions.

In regards to informing decisions that will result in projects or policies to help fix Dian Lake, most input is collected from representatives of academic institutions, government departments, research institutions, and county and district Dianchi Protection Bureaus. These different organizations may suggest project ideas; provide technical advice or support and data; test project feasibility; and investigate environmental and social impacts. They have been assigned these roles by the government.

The second process that allows opportunities for knowledge sharing for villagers is ‘seeking out information’. ‘Seeking out information’ is meant to convey an opportunity in which villagers want more information about Dian Lake and find avenues through which to gain information. The information sought out in this process is often available but not directly

presented to the villagers. Instead, the villagers need to take action to gain access to this information.

Organization representatives described ways in which their organization or other organizations provided opportunities in which the public, if they took the initiative, could find or seek out more information. The available opportunities for villagers to become informed that were mentioned by the organization representatives' were: citizens attending activities during a certain week each year in which different institutes and the government hold activities for the public to attend, and reading books or other materials that have been published about the lake. The villagers stated that if that if they want to found out information on their own, they would utilize the resources available to them: the media and fellow villagers: "There is not a lot of direct formal information but I could look on TV and newspaper and [the TV or newspaper] tells primarily what they [the government] are doing through their actions such as feed the fish, water hyacinth, tell them not to pollute, and remove the people living around Dianchi" (702\_0044). The options identified by the villagers are very local options. They did not identify sources of information that could not be accessed outside of their villagers. Nor did they identify the same opportunities as the organizations.

Another type of knowledge sharing that was commonly recognized in the interviews was 'being told information'. This category encompasses instances where information is directly given to the villagers. Villagers in many cases do not have a choice but to listen to this information.

The representative of the Design and Research Institute of Water Resources and Hydropower in Yunnan noted that villagers could become informed by reading the notices put in

villages that might explain how they will be affected by a project. The representative from Institute of Dianchi in Kunming also described the publishing of written materials for the public.

Meanwhile, villagers recognized that the villagers who work for the government, such as the villagers who are hired to clean out the garbage and water hyacinth for Dian Lake, are required to attend meetings with the government. A villager hired by the government to clean out the water hyacinth reported “the government will ask me to attend a meeting. In the meeting [they] will tell me the goals and methods of fixing Dianchi. And the government will tell me, ‘if you find any enterprises pouring water into Dianchi we will set some regulations to determine if the water is so polluted or not. If it is, we will punish that enterprise’” (702\_0039). When asked how she could gain access to information, a restaurant owner in Haikou replied:

The government will give paper to us. To the enterprise and restaurant, the government will give a written document. But the people who live here- they will have a meeting and talk to them. Those families who have a communist member in their home- the communist will have to attend meetings but maybe for the common people they don’t have to [go to the meetings].  
(702\_0016)

Villagers also noted that the government would on rare occasion place several notices in the villagers. Government slogans posted on walls also serve as a way the government communicates with the public about their expectations. A shop owner in Yanjia Village stated, “the government officials don’t talk with us but they will put up pictures or slogans about Dianchi” (702\_0066).

The final process of knowledge sharing that emerged from the interviews was ‘living around Dian Lake’. This process encompasses interactions with the lake including daily tasks



and observations. This knowledge is oftentimes the way in which villagers become informed on the management process of Dian Lake when they are not told information directly.

When asked how villagers could learn more information about the ongoing efforts to fix Dian Lake, the representative from the Institute of Dianchi in Kunming believed that villagers could increase their awareness regarding Dian Lake if they took advantage of the new bicycle path installed around Dian Lake.

Oftentimes when the villagers explained how they knew of information related to what projects were being implemented on Dian Lake or what the main pollution sources were, the villagers would reply that they had not been told this information but rather witnessed these things happening. A young farmer in Yanjia Village was explaining that the water was cleaner because the Dianchi Administration Bureau had used fish to clean the water. When asked how he knew this information, the farmer responded: “I live here so I know that. I saw them put the fish in” (702\_0062). Similarly, a government worker who cleans the water for a living explained that he didn’t need to tell his family about his work in relation to cleaning Dian because, “we all live here and can see the work” (702\_0056). A barber in Haikou summed up his information sources: “It is not a formal relationship or communication [between me and the government]. I can also see things happening, for instance I can see the government feed the fish, or not pour polluted water, or move the people” (702\_0044).

The majority of these opportunities are the government providing the information in one form or another; however, the two factors I am focusing on in my categorization are the direction of this communication and at what part of the process this information is used or received.

### *Opportunities for Action*

Opportunities for action are characterized in this paper in two ways: First, opportunities for action can be actions and behaviors that can be taken to potentially improve the condition of Dian Lake. Second, opportunities for action can be characterized by opportunities in which villagers choose to avoid behaviors or actions that could potentially harm the condition of Dian Lake.

As a result of the interviews with organization representatives and villagers, opportunities for action were described as four different processes: Contributing to Government Efforts; Reporting Problems; Listening to Regulations; and Supporting Efforts. Similar to opportunities for knowledge sharing, the level of participation varies. This variation will be discussed further in the next chapter. In this chapter, I describe the specific ways in which villagers can participate in these types of opportunities for action, separating them by the organization representatives' input and then the villagers'.

Taking proactive steps to change the project outcomes is one of the ways in which the public can participate in the water management process. One of the most hands-on approaches to aiding in the restoration of water quality in Dian Lake is 'contributing to government efforts'. None of the organization representatives mentioned any opportunities in which the public could actively contribute to the restoration of Dian Lake through joining government efforts via employment.

Villagers on the other hand mentioned two ways in which villagers could actively contribute to government efforts to fix Dian Lake: working as a water cleaner or planting trees. A man who identified as one of the leaders of Yanjia Village explained that Mayor Qiu He

ordered people to grow trees to plant along the waterways. Although the villagers were ordered to plant these trees, they were also considered financially responsible for these trees. Another group of farmers in Yanjia Village also recognized the government's request for the villagers to plant trees annually. During my interviews, I also came across several men who had been hired by the government to clean out the water hyacinth and garbage floating in the water. Villagers also identified this option in which the government hires local villagers to clean the water daily.

A different type of opportunity for actively participating in the management process was 'reporting problems'. While reporting problems could be considered a type of knowledge sharing, I considered 'reporting problems' to be an opportunity for action rather than an opportunity for knowledge sharing because reporting problems was often times accompanied by a description of villagers scouting out problems and requesting reaction- all of which I believe are more actions than they are sharing knowledge. At the same time, reporting problems does not influence decisions regarding policy and management before implementation. Rather, reporting problems is essentially putting villagers in a supervisory role.

The representative from Green Kunming described quite a large role for the villagers if they were willing to take it on: the villagers could find problems and report them. The representative from Green Kunming was the only one of the organization representatives who identified the potential for proactive participation by the public. According to the representative:

The most useful ones [roles of the public] are to apply to the government, to ask them to open their information or ask them to carry out the law. According to the regulations of our state council, they [the villagers] must be given a reply within a certain time but if they call or write a letter, they can't tell [when they will receive a response]. (702\_0067)

Citizens can also submit an application to the Environmental Bureau and require a response from this organization about a particular issue they have addressed in the application. They can also call the Environmental Protection Bureau in the districts to report issues. The villagers are also able to write letters to the courts to protect their rights if projects or environmental problems are harming them. According to the Green Kunming representative, citizens can also participate in Dian Lake Care Day where they can go monitor the quality of the water. They also inspect the pipes leading into the lake and if they happen to see the polluted water pouring out of the pipes, the citizens can call and report the problem. As an NGO, Green Kunming works to help facilitate this type of participation. They work to encourage the public to take action and participate in the process. The villagers I spoke to did not mention that they were aware of the same avenues, or any similar avenues, that the representative of Green Kunming discussed.

A common opportunity for action that emerged from the interviews was ‘listening to regulations’. This opportunity can be characterized where the actions stem from a mandate or request from the government to act, or stop acting in a particular way. By following the government’s orders, which often meant to not throw garbage or sewage into Dian Lake, the villagers are able to participate in the process.

When asked about the place of human behavior in the management plans of Dian Lake, the representative for Kunming University believed that the public’s behavior could make a difference. In particular, the representative stated “people can increase their awareness about their protection and one of the most important things is to not pour their sewage water into Dianchi” (702\_0012). The representative of the Dianchi Lake in Kunming Institute of Ecology

Authority explained by following the government's orders, the villagers could help to fix Dian Lake:

At the first period of the project, the public do not know so much about the reason [for the projects]. But they just follow the government's orders. During the project the government will advertise the effect of the project. And when the project is finished they can understand how it affected their lives. (702\_0006)

Villagers in both Haikou Township and Yanjia Village also consistently recognized that the main actions they could take to help fix Dian Lake include listening to the government's order and not polluting by pouring their sewage or throwing garbage into Dian Lake. Often times, not polluting Dian Lake was the only action they believed they could do to help protect the lake: "we can do nothing to fix Dianchi, to protect Dianchi. Just not pollute" (Retired Men, 702\_0035).

Tied closely to many of the other opportunities for action, particularly listening to the government, the fourth process that allows opportunities for action for villagers is 'supporting efforts'. 'Supporting efforts' is meant to convey an opportunity in which villagers support the government by going along with what they are asked to do. When asked how the villagers could help fix Dian Lake, the most frequent response from the organization representatives centered around providing support for the government's projects. When asked what he believed the general public can do to fix Dian Lake, the representative of Kunming University replied, "under the lead of our government, the public can support their [the government's] job. They can work as volunteers to do some propaganda jobs. Secondly, those project to return the land into lakes and wetlands, they can help to fulfill that task" (702\_0012). With regards to returning the land into lakes and wetlands, the representative of Kunming University was alluding to the government moving villages back away from the shores of Dian Lake. Similar to the

representative from Kunming University, the representative from Design and Research Institute of Water Resources and Hydropower in Yunnan believed that while the public may not necessarily take a hands-on role in the actual restoration projects because these are being completed by professionals, their value instead is to be supportive of the government works: “the people support the government's work so when the government asks them to return their plant land to the lake, they will allow it. Even if they get allowance it is still hard for them” (702\_0008). The organization representatives believed one way in which the villagers can support the government is to allow themselves to be relocated without complaint. The villagers referred to support as admiration of the government’s work or spreading the word about their work

Before moving onto the rationale for why public participation is important to the management process, it is important to note that while many institutions and villagers could list opportunities available to them for knowledge sharing and action, a reoccurring theme was that both organizations and villagers expressed that they felt as if the villagers could do next to nothing to help fix Dian Lake and could not identify the types of information that would be the most valuable for the public to have. The representative from Institute of Dianchi in Kunming was of the opinion that only the local residents living next to the lake would be able to action to fix Dian Lake; otherwise there is nothing for the public to do. Mirroring the response of the Institute of Dianchi in Kunming representative, villagers also felt that there was nothing to be done by themselves, but rather by the government. This belief will be further discussed in this next section discussing villagers’ beliefs about project efforts.

The following section will discuss the villagers' awareness of and beliefs about management of Dian Lake, including sources of pollution, project efforts, potential benefits of remediation efforts, satisfaction with project outcomes, and responsibility for remediation efforts.

### **Villagers Awareness of and Beliefs about the Management of Dian Lake**

This next section discusses the awareness level of the villagers and their beliefs about the management of Dian Lake. By discussing these factors, a better picture will hopefully be painted for the villagers' motivations to be a part of the management process.

As discussed in the literature, knowledge sharing and collective action are important factors in the management of natural resources. Awareness and support were stated as two of the larger benefits of stakeholder inclusion. By investigating the villagers' awareness of the sources of pollution, and project efforts, we can begin to understand where they see themselves fitting into and helping the management process.

#### *Awareness of Villagers*

The villagers were asked to describe what they believed caused Dian Lake to become polluted. The level of awareness of pollution levels varied from no knowledge at all to the identification of specific sources. The causes for pollution were often described as places or groups of people rather than chemicals or biological processes. The sources of pollution therefore were often considered to be anthropogenic rather than natural.

When looking at Dian Lake, the villagers understood that the green growth on the lake was algae. The identified sources of pollution were often factories, human waste, and most often the people in the city of Kunming. A fisherman in the township of Haikou identified a

papermaking factory and peoples' waste as two sources of pollution that have been cleaned up: "Now they are making centralized treatment for the people's waste but in the past they used to pour it into the river. There used to be a papermaking plant nearby. When I was young, it polluted the river heavily. At that time the river was smelly but then the government removed the factory and the water is better" (702\_0022).

An often reoccurring theme in the village interviews was the belief that the source of the pollution is the city of Kunming. An old woman farmer from Haikou described the changes she saw in the quality of the water: "Decades ago, the water here was very clean. When you looked down you could see directly what is under the water. In the past there are some polluted waters coming here from Kunming city and they pour the polluted water here. But then the government took some measures and funded a lot to fix the river" (702\_0024). Farmers in Yanjia Village believed that the pollution comes from "the modern toilets in Kunming city. Mainly from the city because in our village we can use our waste as fertilizer" (702\_0061). When asked about the use of fertilizers, farmers would admit to using the fertilizers but made no recognition that their fertilizers could affect the water quality of the lake. Regardless of whether the villagers could identify a source of pollution, a large portion of the villagers believed that they were not the source of the pollution or contributed a very little portion of the pollution.

The recognition of these villages as a source of pollution was limited:

We use the water from Dian Lake to plant and we drink and wash from the dam and well. There are several pollutions from here, from life that get sent to Dianchi. The main pollution is from Kunming City. Kunming city put the pollution into the water and water flows into Dian Lake. Dian Lake is the 'waste treatment plant'. The garbage comes from the waste treatment plants from Kunming and the plants pour their garbage into Dianchi. We never



pollute Dian Lake. The main pollution is Kunming City. We only contribute a little pollution. (702\_0033)

Although not a dominant theme within the interviews, a restaurant owner from Haikou was able to make a direct connections between village life and the pollution in Dian Lake: “Maybe there are some buildings around Dianchi which poured some garbage into and there are small villages around Dianchi that our government does have the time or energy to treat them. So maybe there are some people who poured their waste water into Dianchi” (702\_0048).

As a different measure of awareness, I was interested in investigating what types of restoration efforts the villagers were aware of. The villagers’ knowledge of project efforts includes their knowledge of specific efforts as well the money spent to pay for these efforts. Couched within this discussion is villagers’ awareness of their role within the project efforts.

In terms of recognizing the efforts the government itself was taking, individual villagers were not able to state more than one or two of the many government efforts being taken to fix Dian Lake; at the same time, detailed knowledge related to those efforts were limited. One man selling flowers in Yanjia Village summarized this sentiment perfectly:

Even though the village has built the sewer system, the villagers don’t know how to use it. Some people have come before to teach us the technology but I still don’t know how to use it. I just know it is useful. I received no information from the government. (702\_0033)

However, the awareness of the villagers as an entire stakeholder group was quite broad. Villagers recognized that the government had removed nearby factories in the past that helped to reduce the amount of pollution running into Dian Lake. Some were able to describe reclamation policies while others were able to describe the government’s efforts to hire villagers to help. Villagers recognized the regulations and penalties awarded if factories or people were caught

polluting or participating in other forbidden activities. Villagers also noted the government efforts to fix the fish populations in the lake. Others talked about the sewage treatment plants being installed in their villages.

Tied to the specific efforts of the government was the recognition of money spent; however, the villagers were not quite sure as to what this money was being spent on or that the money has been useful. A barber shop owner in the town of Haikou explained that “although government has spent lots of money we don’t know how the government has spent the money” (702\_0044).

In regards to the level of awareness of project efforts that the villagers can be involved in, a previous section already alluded to the public awareness of opportunities available to them. To summarize those previous findings for the sake of discussing the villagers’ awareness of the available opportunities, the majority of the opportunities acknowledged by the villagers in regards for opportunities for action were listening to regulations and supporting the government. In regards to knowledge sharing, a reoccurring theme was that villagers commented on being told information and living around Dian Lake.

Discussing the villagers’ awareness of the potential benefits of fixing Dian Lake is another important component to the larger consideration of their motivation to be a part of the management process. When asked how they believed their lives would change if Dian Lake was fixed, villagers stated that they would gain access to clean drinking water, would have improved living conditions, and an improved sense of happiness. Villagers also cited potential economic benefits to fixing Dian Lake. A man sitting at a small shop with a group of men in Yanjia Village spoke on their behalf:

It will be good for us if it is cleaner because the air will be fresher and we can open some restaurants and hotels. There will be more tourists here. Because if the tourists are rich they can drive here by themselves or they can take a bus or bicycle and it is very convenient. (702\_0065)

A man working at a barber shop in Haikou stated, “First, it would improve the scenery. And when we look at the clean water, we are happier. And if cleaner we can use the water again” (702\_0044). Finally, an old woman in Yanjia Village stated with reservation, “When the water is clean, we can drink. If it is clean again maybe we can drink again. But is that possible? Maybe not” (702\_0037).

This last woman’s sentiments ties into the next section focusing on the villagers’ beliefs about the management of Dian Lake. While the awareness of the villagers is important to the wealth of knowledge and understanding of the process, their beliefs about the management process may also have a significant effect on their motivations to become a part of the process and belief in their ability to fix Dian Lake.

### *Beliefs of Villagers*

Literature shows that the inclusion of the public can change their beliefs about the process and outcomes, whether their input and contributions are highly integrated into the solution or not. Therefore, the villagers were asked about how they felt about the project efforts, and the progress being made in Dian Lake. From the interviews, beliefs about villager responsibility and the necessity of cleaning Dian Lake also become evident.

Many of the villagers expressed their opinions related to the likelihood of progress occurring in the water of Dian Lake. While a few responses were hopeful, the majority of

responses from the villagers were either sad or defeated. Villagers were sad because they recognized that even if significant improvements to the lake were to occur, these changes would not occur in their lifetimes. A fisherman in the township of Haikou told me: “I don’t know if I can see that water clean again before I die” (702\_0029). An older man in Yanjia Village said, “We cannot fix Dianchi in one or two generations, it will take a long time. The government should do a good job. But there are several million people living in Kunming now and we worry how they can stop that pollution” (702\_0040).

Tied to their feelings about the progress towards improvement of the water quality were their impressions of the project efforts. The villagers recognized that the government was making efforts to fix Dian Lake. However, the satisfaction levels with these efforts varied. One woman who was pleased with the progress stated that after the Mayor Qiu He became involved, she had seen results: “The water is cleaner, the people are wealthier, and everything is better, but I don’t know what specifically he has done” (702\_0058). One fisherman from Haikou noted that while he recognizes that the government has taken many measures to treat the water, he is not satisfied with the results. Others noted that the government efforts were not particularly useful. The sentiment seemed to be that if the government cannot carry out an effective project then the people cannot do anything which leads to a sense of incapability: “The high level officials don’t set a good example, the people below won’t do anything useful. They are mad and unsatisfied with the government behavior. The general people have no information to do anything and don’t want to do anything” (702\_0065).

While effectiveness or usefulness of the projects were most often discussed, the dissatisfaction and anger regarding compensation also was brought up in interviews as well. The

compensation in question was in regards to compensation for an annual tree planting in the village of Yanjia. A group of farmers explain, “the government will ask us to plant trees around Dianchi. Every year everybody should plant 400 trees we get only 1900 yuan. We don’t think that is enough and we are lied and cheated by the government” (702\_0061).

Overall, the feelings about the government efforts seemed to be more negative than positive.

As touched upon in the section discussing opportunities for the public to get involved, a large portion of the public believed that there was nothing for them to do to help fix Dian Lake. This belief affects their sense responsibility for taking actions to fix the lake. Teachers from Haikou stated that “the government should take the main responsibility to fix Dianchi. As the general public, we can behave ourselves. For example when we go feed the seagulls, we won’t throw the plastic everywhere and instead throw in trash bins. But our government should pay for it and hire people to clean the water. Except to behave ourselves, we can’t do anything. It’s not that we don’t want to do, but we can’t do anything” (702\_0027). A fisherman from the township of Haikou said, “The people here are not able to take part in fixing Dianchi” (702\_0022). A flower seller in Yanjia stated, “We think it is good for the government to treat Dianchi. Our government should try their best to do their job because as the common people we can just think and not actually do it” (702\_0033). A large portion of the public identified the government as the main group responsible for the restoration of Dian Lake, not themselves.

An interesting and important theme began to emerge during the interviews with the villagers: the necessity of fixing Dian Lake (or lack thereof). A portion of the villagers made comments regarding the necessity of fixing Dian Lake: “Of course it [cleaning Dian Lake] is important. It will make life comfortable. Especially the environment and [it would make life]

easier to live” (702\_0062). While many villagers would explain how their live had been affected by the change in water quality and the benefits they could gain from fixing Dian Lake, others had become used to the current state of usage and felt that fixing Dian Lake was not necessary. A fisherman from Haikou stated quite succinctly his indifference for fixing Dian Lake: “the government barely does something not to pollute the water, protect the water. And if the government will fix Dianchi, the people here will say good. But if the government doesn’t fix Dianchi, we don’t think it’s bad. We are not so concerned about this issue” (702\_0022). The necessity of fixing seemed to be directly linked with the specific villager’s perception of whether progress had been made, or would ever be made with Dian Lake.

This section addressed the beliefs of the villagers in regards to the management process. Now, this next section will describe the organization representatives’ rationales for why the public should be excluded or included in the management process. Following this section, the discussion chapter will then summarize what these different components mean for the role the villagers see themselves playing in the management process and its effect on the project outcomes.

### **Rationale for Villager Exclusion or Inclusion**

This next part of the analysis explores the organization representatives’ rationale for why villagers are considered or not considered in the water management process at Dian Lake. In the context of the larger umbrella management of Dian Lake, the organization representatives discussed their rationale for including or excluding the public in the different parts of the decision-making and implementation processes. Depending on the portion of the management process being discussed, the rationale for the inclusion of villagers’ in the process was evaluated

differently. The sections of the management process described by the organization representatives when asked about the reasons for the inclusion of public participation were collecting public input, implementing projects, or informing the public. Outside of specific parts of the management process, the rationale for public participation extended to a larger discussion of the role of changes in human behavior versus technology and placing responsibility to fix Dian Lake.

Starting with collecting input to inform decisions, the reasons for the level of villager inclusion in the context of collecting input were mainly described in terms of necessity and government-related considerations. During the brainstorming process for new projects, public input was deemed unnecessary. The representative of the Institute of Dianchi in Kunming reported that his office, one of the only offices tasked with brainstorming new restoration projects for Dian Lake, only considered the input of the scholars and representative of organizations who are members of the Institute of Dianchi in Kunming. The academic institutions and other organizations associated with the Institute of Dianchi in Kunming are those institutions that were invited by the government to join because of their interest in protecting the Dian Lake environment. The representative of the Institute of Dianchi in Kunming explained that these academic scholars and organization representatives come together to report their research findings and offer suggestions for solutions to problems the government presents the Institute of Dianchi in Kunming with addressing. The representative's rationale for not needing to include other sources of input, including the public's was that "we consult with many members. Our members come from different occupations and types of society. We don't need to go out [for other sources of input]" (702\_0002). This representative recognized that the scholars were not

talking to the public. The representative did state that the government organizes annual activities where common citizens of Kunming can give suggestions.

The representative of the Dian Lake in Kunming Institute of Ecology Authority stated a different reason for why public input was not typically sought out. The representative explained that collaboration with the public is not possible in China “because there are so many people in China the government can only make the main plan and they can hope it will work. It is hard to penetrate into every people and every community because funding is a problem” (702\_0006). Essentially, this representative argued collaboration with the public is limited because of financial resources and limited capacity of the government. Related to the representative of the Dian Lake in Kunming Institute of Ecology’s rationale for why public input is not sought after, the representative of Green Kunming believed that the political restraints of China are the reason that public opinion is not sought out more often. The representative of Green Kunming believed that the government did not include the public in the projects or collect their opinions because of the way their dissenting opinions may reflect on the lower government officials:

If our government wants to hold a meeting they should invite many people but they don’t. According to our state council’s regulation, the government should but they don’t because if they invited too many people and got their advice or suggestions, they will have more trouble. [...] The local government just wants to avoid trouble in their work. (702\_0067)

Therefore, the representative believed that the public opinion is considered to be a hassle more than a benefit.

While the other representatives gave reasons for why they did not accept public opinion themselves or for why they believed the public was not included from the government’s perspective, the representative of the Design and Research Institute of Water Resources and



Hydropower in Yunnan strongly believed that public input is quite valuable for helping to create projects. In this representative's view, public input is most valuable when needing to gain village-specific information for project implementation. The representative of the Design and Research Institute of Water Resources and Hydropower in Yunnan explained that by telling the public of the necessity and the importance of the project and what they plan on doing, the public will receive them well:

They will give the researchers a very warm welcome and actively show their opinions to provide suggestions. For instance if the institute wants to know the historical flaws in the area, the water disasters, the ways of the rivers, they should ask the public. The public can give the most specific and targeted information. [...] They could also, according to the public opinions', know how big the scale of the project should be. It will help them make their work more pragmatic. (702\_0008)

The second portion of the process referred to by organization representatives was project implementation. Their stated reasons for inclusion or exclusion of the public from project implementation were mainly associated with the amount of impact the public can have and the perceived role of the public.

The representatives of the Institute of Dianchi in Kunming, the Dian Lake in Kunming Institute of Ecology Authority, and Design and Research Institute of Water Resources and Hydropower in Yunnan believed that the amount the value of the public in implementation is quite small. Putting a positive spin on her opinion however, the representative from the Dian Lake in Kunming Institute of Ecology Authority commented that even though the only steps that the public can take to help fix Dian Lake are small ones, "everyone can do [the little small things], and they can have a big influence" (702\_0006).

While the representative from the Design and Research Institute of Water Resources and Hydropower in Yunnan could identify that the public was important to giving specific information to build the project or fix an issue, the public's role in actively fixing Dian Lake is limited: "the public won't take part in the project directly because it is done by the professional departments but the public should want Dianchi to be treated and also support the government works." The representative believed that while the public may not necessarily take a hands-on role in the actual restoration projects because these are being completed by professionals, their value instead is to be supportive of the government works (702\_0008). The representative of the Institute of Dianchi in Kunming echoed the rationale that the implementation is the government departments' job. To further emphasize the belief that the representative from the Institute of Dianchi in Kunming believed that it is not the public's job to implement projects, the representative believed that only the government and scholars had the ability to fix Dian Lake. The representative did clarify that he "would never say the regular people are not important [to fixing these types of problems] in China. They just don't have that ability" (702\_0003).

Believing that "it is good for the citizens to take part in the action," the representative from Green Kunming expressed her concern that "if our government cannot do their job in advance our citizens cannot take really useful attention into this behavior." Therefore, the representative from Green Kunming ultimately echoed the other representatives' opinions that the potential for public impact is rather small and that the role of the government in the implementation phase supersedes that of the public.

The last portion of the process focused on by the organization representatives was the dissemination of information to the public. The publicizing of information was thought to be necessary by some of the organization representatives and unnecessary by others.

The value of telling the public the importance of a project being implemented, according to the representative of the Design and Research Institute of Water Resources and Hydropower in Yunnan is the traditional knowledge that can be collected from the villagers if the project is being planned for their village.

When asked whether telling the public information about the projects was important, the representative from the Institute of Dianchi in Kunming responded: “they don’t need to tell the public” (702\_0002). He believed that the only benefit of the informing the public is to increase their awareness. The representative from Dianchi Lake in Kunming Institute of Ecology Authority also believed that the value of informing the public lied in their awareness. The representative explained that she though informing the public was valuable for giving “the public hope that Dianchi is developing better and better. [...] In the past few years it was hard to carry out those projects to fix Dianchi, But now it is easier because the public awareness was promoted.” The representative also believed that by letting the public know how Dian Lake pollution will affect their daily lives, they will protect Dian Lake themselves.

An author of a book about the environmental history of Dian Lake, the representative of Kunming University believed that if the public were to learn about the environmental history and understand the historical and present conditions of the lake, they will know what behaviors and actions are right and wrong. Similar to the sentiment of the representative of Kunming University, the representative from Green Kunming believed that informing the public about

projects at Dian Lake helps them take action to fix it: “If only you know it, you care about it. If only you care about it, you love it. If only you love it, you will take actions to protect it” (702\_0012).

To also help explain the role of the public in the management process of Dian Lake, the perceived responsibility for polluting and cleaning the lake were also investigated. The organization representatives believed that everyone had a responsibility to clean and protect Dian Lake, but that the government has the main responsibility of carrying out projects and passing policies that would aid in this process.

A prime example that summarizes this point was made by the representative of Green Kunming:

Our government cannot enforce all of their regulations strictly. If they did, our villagers and our citizens would have more ways to really take part in the process. It is really essential for our government to protect peoples’ profits. [...] If the government always does that [does not properly compensate the public for their help], our villagers will lose their enthusiasm to protect Dianchi but they [the government] are first concerned with their own profit. And talking about the citizens in Kunming, [...] they cannot build a pipe themselves in their house. Our government should do that and then they will carry it out. But if our government doesn’t want to do that job, what can they [the public] do? (702\_0067)

The representative of Kunming University made the point that while the public should be involved in the process, without the government aiding them and taking the first steps to enable, they cannot do anything. Therefore, the first responsibility and capability lies with the government, not the public.

The representative of the Design and Research Institute of Water Resources and Hydropower in Yunnan did express one key action that he believed the public was responsible

for: “their responsibility is to fill out the environment evaluation report. We will put it on the internet for a month and if nobody says ‘no’ then we will carry out the project. It is their [the publics’] responsibility” (702\_0008).

Another factor that was brought up often within the interviews with the organization representatives was whether human behavior changes or technological changes would be the solution to fixing Dian Lake. In the case that human behavior was believed by organization representatives to not be the key, this belief would also help to explain the rationale for why organization representatives did not believe public could or should participate in the management process. The organization representatives had differing views on which would provide the better solution.

The representative of Design and Research Institute of Water Resources and Hydropower in Yunnan believed that while changes in choices- such as the type of laundry detergents used- could help to improve the quality of the lake, these choices could not be strongly enforced therefore the representative concluded:

We can only fix Dianchi with technologies. It is hard to divide clean water from polluted waters in the old districts because those buildings are built many years ago and don’t have the right pipes. So they want to collect clean water like rainfall and polluted water in other pipes but this cannot be achieved in all of the districts and only with those collecting programs can they finally fix Dianchi. That is technical. (702\_0008)

The representative’s point is behavioral changes are harder to regulate and enforce so that infrastructure change, while not necessarily easier to do, may be the answer to fixing Dian Lake. The representative of Green Kunming also pointed out that without the technological fixes, that only the government can provide the local people do much of anything to help fix Dian Lake:

I think that if our government cannot do its job in advance our citizens cannot take really useful attention into this behavior. For example the government should try to take some measures to divide the polluted water from the rain or clean water. The government needs to do this. Without that, the citizens cannot do anything really useful. (702\_0067)

While the representative from Green Kunming places the blame on the government, the ultimate problem is actually the capacity to change the technology. On the other hand, the representative of Kunming University believed that “even though we can solve problems with modern technology, without human participation, we cannot use them and have success” (702\_0012). Taking these different pieces into consideration, the discussion section will try to address how the rationale of the decision-makers, the opportunities available because of this rationale, and the awareness and beliefs of the villagers affect their motivation and ability to participate in the process. The discussion will also include a final discussion on the implications for management outcomes based on the inclusion of the public based on the literature.



## DISCUSSION

This discussion will focus on an explanation of why the rationale for villager inclusion is important in China, what the available opportunities mean for villagers' participation; how villagers' beliefs affect their motivation to become involved; and what these mean for the outcomes of the management of Dian Lake.

### **Implications of Rationale for Villager Inclusion**

In many countries with an authoritarian political system, such as China, environmental regulations, economic development, and policies have largely been initiated by government officials from the 'top-down' (Tang et al., 2005; Wang et al., 2013). While China is slowly transitioning to an integrated water management system (Song et al., 2010); public participation is not well developed (Wang et al., 2013). The openness and responsiveness of a country's underlying political institutions will determine the degrees of public participation present in their environmental management systems (Tang et al., 2005). Since the literature shows that Chinese governmental officials and policy entrepreneurs are in charge of creating regulation and deciding

how the institutions they work in will function, examining their viewpoints of public participation helps to explain why policies and projects either include or exclude the public.

A study focusing on the public's role in using Environmental Impact Assessments (EIA) in Mainland China and Taiwan found that government bureaucrats design EIA processes in order to make them administratively convenient to implement, less likely to arouse opposition, and with little oversight by the public (Tang et al., 2005). Viewed as burdensome to implement, the EIA limits public participation and transparency. Other studies, not related specifically to China, found that even when environmental decision-making is open to the public, the utilization and integration of the public input is often inadequate or not taken seriously (Blahna & Yonts-Shepard 1989; Rosenbaum, 1976). In order for public participation to be beneficial to the process, it must be genuinely integrated into the process and must be valued as all other information used to make decisions (Kusel et al. 1996).

The investigation into formal organizations' rationale for including or excluding the public identified perceived benefits and drawbacks to including the public in the management process regarding Dian Lake. It also addressed the topic of necessity (or lack thereof) of including public participation and barriers to including. Similar to the Tang et al. (2005) study, one of the representatives believed that public participation was not included due to the burden that arises with dealing with opposing opinions. While other studies have found that public input is not taken seriously, my findings suggest that when the government specifically requests input from the public, such as when researchers went out to villages to learn their local knowledge, it was taken quite seriously and viewed as valuable. When input is not requested but still collected, the authenticity of the opportunity for collecting input may be circumspect. The level of



necessity for public input during the brainstorming and policy creation process was overall quite low. During the project implementation process, public participation was also viewed as unnecessary primarily because the actions that the public were perceived to be capable of carrying out were viewed to have little impact on the improvement of water quality. In regards to the rationale for publicizing information to the public, the largest benefit was increasing public awareness which some representatives believed would motivate the public to care about and protect Dian Lake. Representatives believed that while everyone had a responsibility to clean and protect Dian Lake, the government had the main responsibility and capability to carry out projects and pass policies. This belief stemmed primarily from the rationale that many of the solutions to the Dian Lake problem did not reside in public choices or actions but rather in larger technological changes and government projects.

One of the identified barriers to the implementation of public participation is the perception that the public are not aware of environmental problems (Ker Rault & Jeffrey, 2008). However, in place-based groups such as the villages next to Dian Lake, the awareness of the environmental problems is rather self-evident. As discussed, the villagers often become informed on issues through their interactions with and around Dian Lake. Furthermore, their site-specific knowledge related to most critical problems, place-based needs, and feasibility recommendations indicate another type of place-based awareness that can be invaluable to the process. The villagers are ripe with place-based awareness; they simply need to be utilized.

While one of the representatives of organizations could identify the benefits; the benefits for including the public in project implementation and in other opportunities for collecting public input were minimal at best. Based on the literature which states that policies will reflect the

views of government officials and policy leaders, decision-makers will include the public in the management process when they feel it is beneficial to do so. These results would then suggest that the opportunities for knowledge sharing and action that include the public will most likely be based on opportunities that would increase public awareness and contribute site-specific information.

### **Villagers Awareness and Beliefs**

The villagers' awareness of pollution sources and project efforts helps to illuminate the villagers' perception of the stakeholder groups responsible for the degradation and remediation of Dian Lake. The investigation into these topics also helps to explore whether the citizens care enough to actively participate in the management process or whether resources would be better directed toward implementation and more technical solutions.

Villagers believed that the source of the pollution did not stem from their own villages but rather from factories around Dian Lake and, primarily, from the wastewater of the city of Kunming. There was no recognition of the pollution that may come from using fertilizers on crops in the villages. While Kunming may in fact be the largest source of pollution, the source of pollution is not the focal point of this section, but rather the perception of responsibility and blame and what this means for villager action. The interviews with the villagers suggest they do not associate themselves with polluting Dian Lake, therefore they do not believe they are responsible for fixing Dian Lake.

Furthermore, their lack of awareness for how to fix Dian Lake also adds to their hesitation to assume responsibility for cleaning Dian Lake. Other than being able to not pollute Dian Lake or perhaps work as a government employee, the villagers were largely unaware of

other opportunities available to them for action. Villagers were aware of certain types of government efforts. Some government efforts were perceived to be successful, particularly the removal of industries around Dian Lake. But many of the efforts they were aware of were not perceived as successful. The efforts considered particularly useless were the small-scale sewage treatment plants installed and the release of fish into Dian Lake. The fact that villagers are aware that large sums of money have been spent on only moderately successful projects, but only minimal improvements have been made in the water quality of Dian Lake, may be contributing to their rationalization that there are not many actions they can take to make a difference. A perceived lack of ability and perceived lack of responsibility would seemingly lead to a real lack of motivation for the villagers to participate in the management process at Dian Lake.

Dissatisfaction with government efforts also stemmed from compensation difficulties rather than perceptions of effectiveness.

While the villagers clearly were aware of the potential benefits that could be gained from the improvement of water quality at Dian Lake, their hope that these improvements will occur in a timely manner, or at all, is dwindling. Their dwindling hope coupled with their growing indifference suggests that their motivation to become involved in the management process may also be very low. If the villagers are no longer concerned with fixing Dian Lake because they have become used to the condition and believe they cannot take actions that will make a difference, then the likelihood for engaged participation is quite low. The IWRM and adaptive management frameworks are based on the principle that participation of the people is necessary for change and success. But while public participation may be touted as the key to success, what happens if the public are not motivated to become involved?

The public's willingness to participate is partially based on a strong interest in increasing efficiency of efforts (Ker Rault et al., 2013). Although there was a reoccurring theme of a growing indifference and dwindling hope, villagers 1) were able to recognize the benefits of Dian Lake and 2) were not satisfied with current efforts. Therefore, while attitudes towards the management process are more negative than positive, the positivity or negativity of villagers' beliefs about the management process can actually be viewed as indicators of willingness to participate. The villagers then only need to be enabled to do so. One of the challenges to increasing the villagers' willingness to participate, particularly in regards to decreasing nonpoint source pollution, is their investment in their crops and economic development. In China, the villagers do not own the land on which they live; therefore, sustainably producing crops on the land, without the use of fertilizer, may not be of an interest to them since they are not guaranteed their land in years to come. Furthermore, the use of fertilizer helps to produce better crops and the farmers may not be interested in sacrificing their profit for the protection of Dian Lake.

Although the motivation for the villagers to become involved in the management process is quite low, the authoritarian system within China may actually be beneficial. Since many of the opportunities for involvement are created and mandated by the government, the cultural and political environment of China means that the villagers would be obligated but also more inclined to participate. Evidence of the impact of top-down environmental politics already exists. When asked about what they could do to help fix Dian Lake, the villagers often responded that they would stop polluting Dian Lake because of government regulations but also the avoidance of punishment. While this type of participation is not necessarily proactive nor does it greatly empower the villagers, it serves as an example of how the villagers can be motivated to act.

Research suggests that attitudes will improve with increased participation (Larson & Lach, 2008). This research suggests that social capital, in the forms of trust and support, can be built through more involved participation. Changes in government behavior such as fair compensation may also change villagers' attitudes to be more positive.

Since the villagers rely on the government to fix Dian Lake, there is a social capital component based on the trust that villagers have in the government. The pre-existing reliance on the government could explain why command and control management approaches have been put into place in China. In some cases command and control approaches are more likely to succeed in certain situations. Since the management process at Dian Lake resembles command and control approaches in many ways, an evaluation of the components that create successful command and control features seems appropriate. The requirements for successful command and control approaches are as follows (Global Environment Facility, 2010):

The number of individuals or units to be managed are small or there are easily monitored points e.g. landing beaches or sites for fish catch; the institutional structure to monitor and enforce sanctions exists and is effective; there is a reasonable level of "social capital," and individuals and society have respect for government and institutions; there is a sense of "shared responsibility" for management of the lake basin and its resources.  
(p. 37)

After looking at these requirements, the Dian Lake situation does not perfectly fit these criteria. Not only are there many point and nonpoint sites surround Dian Lake which creates difficulties for monitoring and a large population to manage; but also the institutional structure, although it exists and to some level has been fairly effective, is not capable of monitoring and enforcing pollution levels as much as necessary. There is also only a superficial shared responsibility for the management of the lake basin and its resources. While the Chinese

government has tried to create this sense of shared responsibility through propaganda and posted slogans stating that ‘everyone has a responsibility to protect Dian Lake’; the beliefs of the villagers suggest they view the responsibility for the management of the lake to be the governments’ rather than theirs. There is a reasonable amount of social capital however which explains why the command and control approach could potentially work. However, these other aspects would need to be improved. Based on the findings of this study, I would argue that whether using command and control or collaborative approaches- the citizen ‘buy in’ is actually quite important and can help with either approach.



While the Chinese government has set many standards and taken many steps forward in trying to improve the quality of Dian Lake, perhaps the reason for such slow improvement and stagnation may be the lack of these requirements for command and control and also the lack of requirements for active integrated management approaches.

### **Opportunities for Knowledge Sharing and Action**

Looking at the descriptions for the opportunities for knowledge sharing and action, there are differences in the perceptions of the groups in the perceived opportunities available to the villagers. When asked about the different opportunities available to the public for knowledge sharing, the organization representatives were aware of opportunities for informing decisions that the villagers were not aware of. This discrepancy could perhaps be explained by the fact that many of the opportunities for informing decision occur at site-specific locations for the specific purpose of informing projects occurring in that village. The villages studied in this thesis may not have undergone projects in which this type of knowledge assessment needed to be performed. Perhaps the other opportunities for informing decisions, such as the open public meetings, are not known by the villagers because of the infrequency of communication from the government and organizations to the public. While the organization representatives and the villagers did not identify the same avenues for villagers to seek out additional information, informing villagers, or living around the lake, they both were able to identify available opportunities. Informing villagers and living around the lake were the forms of communication most often spoken of by the villagers and least often spoke of by the organization representatives.

This discussion of knowledge sharing is couched in a larger conversation of power and impact. There is wide variation in the type of information and the timing of information sharing. This variation stems from the level of impact the villagers are allowed to have and by the direction of communication. Within the opportunities available for knowledge sharing, the majority of the opportunities are created by the government in a way that they would control the flow of information between themselves and the villagers. However, certain kinds of knowledge sharing allowed for the public to be more involved and be a louder voice in the management

process. In some cases, such as collecting information, the organizations and the government are inviting public input. There is an opportunity for public feedback to be used before the project has been planned and implemented. Opportunities for two-way dialogue and an exchange of ideas can occur. However, while public opinion may be invited (i.e. through public hearings or reporting problems), this information may not actually be utilized. Rather than being a form of collaboration or at the very least legitimately involving the public in the process, it could in fact be symbolic in nature or seen as ‘tokenism’ rather than a true form of empowerment. In the context of evaluating the public’s involvement, collaboration or collective action is only one level of public participation. On the opposite side of the spectrum from collaboration, informing the public is often a one-way line of communication from the government to the public in which the government controls the content. An example of this low level of empowerment, high government control opportunity would be the notices in the villages and the worker meetings. During these opportunities, the message has already been created and villager feedback was not collected.

The direction of communication is important for the creation of mutually created understanding (ILEC, 2005). By opening up a two-way exchange of communication in the public participation process, cooperation and enhanced understanding can be created between different groups in the lake basin (ILEC, 2005). While two-way communication and the creation of mutual understanding are not obviously present at Dian Lake, other forms of communication such as education and awareness are. Interestingly, the greatest stated importance of public participation to the management of Dian Lake was increasing awareness; the types of knowledge sharing often identified by the villagers were those that fit this description of awareness, thus



showing a connection between organization representatives' beliefs and the management outcomes.

The authoritarian Chinese government may be hesitant to open up communication in way that will jeopardize the distribution of power within China. My results show that the villagers are not necessarily interested in gaining more power within the management process; rather, they are frustrated with their inability to act stemming from a lack of knowledge of how to act and lack of communication with the government. Similar to another study on public participation in watershed management, I argue that meaningful participation at Dian Lake, shouldn't be viewed as the public's pursuit of power over decisions and the output. Instead, public participation should be the pursuit of power to communicate and define the problems prior to determining the solutions (Ker Rault et al., 2013).

One way in which the government has not necessarily shaped the dialogue directly is in the villagers' interaction with Dian Lake. In this category, there is no direct line of discourse and thus the villagers are collecting information from each other and from witnessing the activities closest to them that occur around the lake. This opportunity for knowledge sharing leaves room for individual interpretation and seems to be the basis for villagers' beliefs and awareness of Dian Lake management processes. The infrequency of the direct communication with government then is overshadowed by this other, more frequent type of information dissemination. While not tied to a discussion of public participation but rather to villagers' perceptions, "people's perceptions of the watershed can be somewhat related to their working environment. Their level of involvement and understanding of watershed issues and progress play a role in defining their perceptions" (Wang et al., 2013, p. 603). The implication of Wang et al.'s findings

for this research is that villager awareness may be tied to their perceptions and experience in the watershed. I am furthering this argument by showing that many of the villagers I interviewed lived and worked around Dian Lake. While some villagers owned restaurants or shops and did not depend upon or interact with the lake other than associating it with scenery and drinking water, other villagers, particularly government workers, farmers, and fishermen interacted with the lake on a daily basis for their livelihoods. Thus, the information they gained through living around Dian Lake and witnessing the changes and projects affects their awareness and beliefs about the projects and progress occurring.

Similar to opportunities for knowledge sharing, opportunities for action range in timing and type of opportunity. Actions can be taken by villagers that are proactive, responsive, or supportive. In cases that I would classify as proactive, the villagers have not been asked to take action, but rather initiate the action on their own. An example of a proactive action would be the reporting of problems. Meanwhile, a responsive opportunity for action is an opportunity in which the government has asked villagers to take action and the villagers carry that action out. Many of the opportunities for action described by the villagers fall into this category. Actions under ‘contributing to government efforts’ and ‘listening to regulations’ would be considered responsive. Finally, supportive opportunities for actions can be exemplified by villagers complying with the governments’ requests for relocation.

Often information sharing and consultation, one-way communication and two-way communication respectively, are considered less influential than collaboration and empowerment in terms of types of public participation (World Bank, 2000). The evidence presented in this thesis suggests that a shared control over decisions and resources and the transfer of control over

decisions and resources has not occurred at Dian Lake. Evidence of public participation is present at Dian Lake, which suggests that the government and formal organizations are working towards a more receptive governance approach where the public are consulted. To reach truly sustainable outcomes, however, the transition needs to continue where the approach is even more collaborative and less top down.

In the larger pictures of the restoration efforts at Dian Lake, many of the identified opportunities for action do not fall under the umbrella of the main focuses of the Dian Lake management plan as discussed in Chapter 1. Only three of the identified opportunities would contribute to the projects that are currently being implemented: planting trees and allowing the migration of villagers for ecological system restoration and working for the government to clean the waters. While agricultural pollution treatment is one of the main foci for Dian Lake, neither the villagers nor the organization representatives mentioned opportunities related to this project as an opportunity for public engagement. Looking at the management plan in place, clearly the reliance on villagers as a key part of that plan is small. Their available opportunities for action are not considered to be a primary focal point. The opportunities for information sharing that could be used to help inform those projects are also rather minimal. The lack of opportunities for public participation is interesting considering that enforcement is such as needed component of management at Dian Lake.

Some other water-management based studies in China have echoed some of my findings, while others have come to different conclusions. A study of the management at the Dian Lake basin found that capital investments and management improvements were supported by “an active program of citizen’s involvement and public dissemination of water quality information”

(ILEC, 2008; p. 7). Similar to their findings, citizens were beginning to be charged user fees for water usage. However, the evidence of public dissemination of water quality information was not prevalent and only a small number of well-known opportunities for citizen involvement exist. A study regarding public participation within watershed management in China also found that under the current system of governance, public participation is not well developed:

There is no appropriate mechanism for people to participate in decision making or even to contribute their knowledge, nor is there any efficient way for them to express their concerns about watershed construction projects that may affect their livelihoods or well-being. (Wang et al., 2013, p. 602)

My findings, however, do suggest that there are ways in which villagers can express their concerns and contribute knowledge. The lack of awareness of the villagers of these opportunities but the identification from the organization representatives' that they do exist serves as a prime example of how these opportunities are under developed and underutilized. A further investigation into the utilization of the public input would need to be conducted.

The lack of active involvement of stakeholders can affect the management outcomes. Since active involvement of stakeholders can result in social learning, an essential component for achieving integrated water management, the lack of active involvement may hinder that process. In order to maximize the benefits of public participation, stakeholders need to be well informed and need to learn new skills (Tippett et al., 2005). In the case of the villagers in Yanjia Village and Haikou Township, the villagers stated quite often that they were not told lots of information and were not sure what to do to help fix Dian Lake, beyond not personally polluting the lake. Active engagement of place-based groups helps to overcome trust and credibility issues often faced by government (Connick and Innes, 2003). In Dian Lake, it appears a level of trust does

exist in that the villagers are relying on the government and not themselves to fix Dian Lake. They have ascribed responsibility to the government for this task. However, in terms of credibility, the villagers have been left largely unsatisfied with the pace of the lake recovery, planting seeds of doubt of whether the problem will ever be fixed or where the money is being spent for the remediation.

### **Implications IWRM and Adaptive Management for Dian Lake**

Public participation within the Integrated Water Resources Management and Adaptive Management frameworks is used as a source of information to create sustainable solutions that address uncertainty in the management of complex water resource issues. For Dian Lake and its surrounding watershed, uncertainty of water quantity and quality will only be increasing in the years to come if drought conditions continue and water use continues to increase. Including the public living around the lake in the management process can potentially improve the management outcomes, and ultimately the quality of the water and the quality of the life of those living around Dian Lake.

The level of social learning that is requisite for integrated water resource management is not present at Dian Lake. While the opportunities for villagers to become informed on issues are available, the awareness and frequency of these opportunities are quite low. The information needed to gain new skills in order to maximize the public participation is certainly lacking. If the villagers better understand the magnitude of the problem and, perhaps more importantly, their role in both causing and solving the problem, the benefits to public participation can be substantial. In the case of Dian Lake, while waste water treatment is a pressing issue, as studies have shown, non-point source pollution is also a significant contributor to the degradation of the

lake. Since most of these nonpoint sources are harder to monitor and regulate, the villagers' awareness of their contribution to this pollution and the ways to reduce their pollution could be quite valuable to the remediation of Dian Lake. By including the villagers, the produced regulations may be more likely to fit into the villagers' needs and interests. If the villagers consider themselves as part of the process, perhaps their beliefs the remediation of Dian Lake would also be more positive.

IWRM and adaptive management approaches also emphasize the importance of knowledge sharing and generation for new policies and solutions. While I previously discussed the importance of social learning for the villagers; I now discuss the importance of social learning for the formal organizations and government. Social learning, different from consultation and informational communication, requires higher levels of participation such as collaboration and empowerment. Therefore, in the case of Dian Lake, while the government is currently consulting villagers for certain types of information, the villagers are not contributing their local knowledge to the actual decision making process. The scientists and managers, as represented by the formal organization representatives, often have access to technical information. While valuable, developing options and involving different stakeholders and their knowledge is necessary for solutions to be responsive and able to address complexity.

As discussed throughout this thesis, context is important. Not all stakeholders should be or need to be involved in all the phases of the lake management process. As we see from the evidence presented in this thesis, there are many more opportunities for involvement at certain phases than at others. In some cases, the political elite are better suited to make decisions than the villagers, but the villagers should have a place in the process as well. While the organization

representatives largely believe that the main role of the villagers should be in building awareness and supporting government actions, the literature suggests that for successful IWRM, the level of involvement in these processes is quite important and should be higher. I did find some evidence that villager knowledge is valued and utilized; increasing the use of relevant villagers' knowledge will only help to support outcomes and facilitate implementation. As of now, the villagers are what might be considered a largely passive citizenry, findings ways in which to make the villager participation more meaningful is crucial for the success of an integrated, inclusive, and successful management plan.



## RECOMMENDATIONS AND CONCLUSION

The transition from top-down to more participatory approaches to management in a country that has limited exercises of democracy may be difficult but not inconceivable. Often participation is a catch-all term, but public participation should be contextual. It seems irresponsible to discuss increasing participation without establishing opportunities for participation that are contextually relevant and suitable. Therefore, the recommendations set forth here for achieving stakeholder involvement, collective action, and knowledge sharing are written with the Chinese political and cultural context in mind.

The opportunities I see to be the most relevant to the management process at Dian Lake are primarily knowledge-based opportunities that can eventually lead to action-based opportunities. The communication between the villagers and the formal organizations should be improved. First, the government and organizations need to increase the frequency of communication. Villagers reported seldom hearing from the government about water quality or about remediation efforts. Using the avenues already available to them, the government could simply post notices in the villages more frequently. The notices could contain information on



water quality or perhaps updates on newly implemented restoration projects. Similarly, media seems to be underutilized. Villagers reported that they would turn to sources of media for more information. The media could use positive messaging to arouse positive sentiments from the villagers while at the same time publicizing relevant regulations regarding Dian Lake. The media portal could also be used to build awareness around the significance of Dian Lake to economic development, health, and the ecosystem. Using this type of messaging could not only create more positive beliefs regarding the management process, but also raise awareness and educate the villagers. By better understanding the laws in place and the significance of Dian Lake, the villagers would be able to better support the government's efforts but also help to supervise others' actions. Using these avenues, government still can control the message while also creating opportunities that can benefit them.

Second, other knowledge gaining and sharing opportunities should be promoted. While the organization representatives could identify available opportunities that would constitute higher levels of participation, the villagers were not aware of these opportunities. For example, the representative of the Institute of Dianchi in Kunming mentioned that an annual week-long festival was held to educate the public about Dian Lake, but none of the villagers I spoke with mentioned this event. Therefore, the educational opportunities already in place need to be publicized to a broader audience or brought to that audience. The representative of Green Kunming also described avenues through which villagers could report problems and require a response from the government. If these avenues of communication were promoted better, the empowerment of the villagers could be greatly improved along with the villagers' beliefs about the management of Dian Lake.

Third, creating opportunities in which villagers can learn new skills should be a regional priority. The villagers said time and again how they did not know what they could do besides not pollute Dian Lake. However, there are many tasks the villagers could take on if only they knew how to do them or what they were. Therefore, the government could tap into this resource of villagers if only they would enable them with information on what they can do. Essentially, a ‘psychological mechanisms’ can be established that can help to change cultural values and establish new norms of acting that would help to protect Dian Lake. By establishing a discourse between government and the public, the public can feel included in the process and perhaps even be encouraged to create their own anti-pollution campaigns or other social movements to influence other members of the public to help fix Dian Lake. The villagers should be utilized for their supervisory capacity. They could eventually achieve a form of self-governance, which I consider an opportunity for action. If villagers were better educated on the regulations in place and encouraged to help, the villagers could be the eyes and the ears for the government in terms of monitoring pollution within villages. Since enforcement of regulations is one of the main challenges of managing Dian Lake, an investment in the villagers could aid the government in overcoming this challenge. In situations where resources are difficult to monitor and management relies on sanctioning institutions, a participatory approach in developing management proposals may promote cooperation (Cavalcanti et al., 2010). Additionally, I believe increased awareness and education regarding non-point source pollution would also then enable villagers who farm to consciously reduce or carefully regulate their fertilizer application.

Fourth, in addition to increased frequency of communication and promotion of existing opportunities, the direction of communication needs to be improved. While increasing frequency

of communication may rapidly improve awareness of issues and change in beliefs, including educational opportunities in which villagers learn new skills begins to address higher levels of participation and public impact. Authentic participation requires a two-directional conversation in which villagers are not only consulted but they are integrated into a discussion, starting at the beginning not as an after-thought at the end. While the representative from Green Kunming stated that requirements are in place for public-forums to discuss projects, the villagers were not aware of these opportunities. If opportunities exist but are not utilized then the knowledge generation that is so valuable to both IWRM and adaptive management frameworks are being squandered. Often, “the main hurdle to public participation is not that the public is uneducated and lacks interest and knowledge in water management challenges. Rather, the main hurdles for implementing public participation may be that the wider public is not structured in stakeholder groups and that the decision-making culture does not encourage the involvement of interested parties (Ker Rault et al., 2013, p. 117). Therefore, I recommend that the villagers are integrated into the decision-making culture, keeping in mind that in China, this may be a slow process. Public forums are not the only way to integrate the public into the management process; villager knowledge and opinions can be integrated through scholarly research on the public that can then be used to inform decisions, or perhaps even through the local village workers who can speak on behalf of the villagers at the meetings held by the government for the workers. Often scholars working for government institutions are not necessarily allowed the same freedoms in terms of choosing research topics because of the need for highly applicable and feasible projects. Their research, which is produced for policy makers, is often dictated by existing information needs. However, scholars within academic institutions who are not receiving direct funds from the

government nor need to conduct research for a specific project in mind have a greater opportunity to explore areas of research that suites their specific interests. Therefore, when these scholars within academic institutions are invited to participate in the brainstorming and policy making sessions, they are the scholars who might be able to offer their findings related to more of the social aspects that are not often considered when thinking about solving water pollution problems at Dian Lake.

Fifth, in regards to action based opportunities, I recommend the government take advantage of the non-governmental institutions already in place. If these groups were given funding to increase their capacity to reach out to the public, the NGOs could take some of the burden off of the government in terms of instructing villagers on new skills and methods to participating. Since certain NGOs are already playing this role to some degree, increasing their capacity to create further opportunities would be a resourceful way to make these necessary improvements.

Since one of the barriers to inclusion is dissenting opinions, the villagers and NGOs should reconsider how they decide to voice their opinions. Individual appeals to the government may not be enough; rather, the government may take notice of more organized appeals for input opportunities and changes in management. The representative of Green Kunming recognized opportunities for villagers to write letters to the public; while responses to these appeals are required, actions produced through these appeals may not be carried out.

Additionally, objective reports submitted through NGOs may also be a more formal way in which the public can submit their opinions and suggestions. By presenting the government with information that addresses the needs and opinions of the public through the lens of how

meeting these needs and considering these opinions could also benefit the government could be a more effective way in which these two different stakeholder groups can communicate.

The next set of recommendations will address changing beliefs and increasing motivation and willingness to participate. First, the key to creating a positive change in their beliefs about the management process and increasing willingness to participate is strengthening social capital between villagers and between villagers and the government. The IWRM and adaptive management frameworks are based on the principle that participation of the people is necessary for change and success. Since motivation for participation is rather low in China, improving attitudes is necessary in order to establish a public willingness to participate. The low morale of the villagers seems to be based on the perception of a lack of capability, a lack of awareness of responsibility, loss of hope, and frustration over government requests. The first three of these can be improved upon with increased communication and education as described above. Another way in which morale might be improved is through incentives. Punishments are in place to motivate people to act in accordance to the law; however, if individuals or local groups could be rewarded for taking positive action, the villagers may be motivated not only to follow regulations but to go out of their way to voluntarily protect Dian Lake.

Second, to address frustration with government requests, such as paying for the annual planting trees, the solution may be financial rather than educational. Although many of the opportunities for action are required or strongly encouraged by the government, the people are frustrated because they are not fairly compensated when promised that they would be. By improving the compensation mechanisms, the Chinese government might be able to easily smooth out the frustration of the villagers and improve the morale.

Finally, perception of shared responsibility needs to be strengthened. Although a superficial belief of shared responsibility is present and social capital in the form of trust and support for the government is present, there is a clear divide and difference in perception of ‘ownership’ of responsibility. I recommend that the government takes steps to integrate the interests of urban and rural people so that the villagers do not see themselves as clearly separate from the City of Kunming and the pollution the City creates. The integration of villagers into remediation efforts will also help to close the gap between the perceived separation of government and the villagers. I believe this can be done first by increased propaganda that emphasizes the common interests of the people. For instance, the recognized benefits of Dian Lake would benefit all; this message could be utilized to not only create a shared sense of responsibility but of ownership and pride in Dian Lake. A study on fishermen’s willingness to cooperate in resource management reported that fishermen would contribute more if they believed others would contribute as well (Cavalcanti et al., 2010). Therefore, I recommend building on a shared interest rather than a shared responsibility.

One of the most important, but most difficult, sets of recommendations is the set related to changing how the formal organizations value public participation. Without convincing the formal organizations of the public’s value, a change in opportunities for knowledge sharing and action may not take place. In order for the organizations and government to recognize the value of public participation, they first need to identify roles, beyond awareness, that the public can play. I would suggest they begin to create projects not only based on technological advancement but on behavior change. As the ‘low-hanging fruit’ of projects are extinguished, more efforts

may be turned to addressing non-point source pollution and enforcement. Addressing this type of pollution and management approach may then act as a catalyst for greater public inclusion. Furthermore, collaborating between different governmental departments and water management organizations within Yunnan may also aid in promoting the value of the public. For instance, the representative of the Design and Research Institute of Water Resources and Hydropower in Yunnan could easily explain the benefits of utilizing villagers' knowledge. Similarly, the representative of Green Kunming was more in tune with the opportunities available to the public and believed that public participation was important. However, the other representatives did not deem it as necessary. When these representatives with knowledge of the benefits of public participation collaborate with other organizations, perhaps their positive outlook on participation will begin to spread.

Finally, the rationale for public participation may also be influenced by a cultural exchange with other countries. If the Chinese government looks to other lake management approaches across the globe, it may find IWRM and adaptive management approaches to be relatively pervasive. Scholars from outside of Yunnan and outside of China may consult with China and provide management advice that incorporates greater involvement of the public.

## CONCLUSION

The aim of this research was to examine the difference in the roles of these two stakeholder groups in the remediation of Dian Lake, the beliefs of local villagers about the management of Dian Lake, and the factors determining the inclusion or exclusion of villagers in the management process. The field work I conducted with formal organizations dealing with the remediation of Dian Lake and villagers living in Yanjia Village and Haikou Township allowed

me to explore the existence of and interaction between the three common components of Integrated Water Resource Management and Adaptive Management frameworks in the context of the management process at Dian Lake.

While neither resource management frameworks used in this research nor the increased active public involvement they encourage are panaceas, the application of these factors to the management process of Dian Lake offers insights to how the management process in Dian Lake can be improved. The literature shows that higher levels of involvement and building of social capital lead to better attitudes towards regulations provide greater chances for knowledge sharing and creating sustainable, adaptive outcomes.

Using semi-structured and informal interviews with these stakeholder groups, my research demonstrates that there is evidence of some public participation opportunities; however in order for IWRM and adaptive management to be successful, the Chinese government would still need to create opportunities for collaboration and empowerment more than informational and consultation opportunities currently existing. My results suggest that the opportunities currently available embody lower level types of participation in terms of participation with public impact. While some opportunities of higher impact do exist, they are not well known by the villagers. Increased promotion of currently available high impact opportunities could be an easy way in which to begin to encourage participation among villagers. My research also shows a lack of knowledge of what to do to fix Dian Lake and lack of understanding of the role pollution from villages play in polluting Dian Lake. If communication between these formal organizations and the villagers improved, the villagers could gain new skills in which to help the remediation, better understand how their lifestyles choices impact Dian Lake, and even improve



their beliefs about the remediation of Dian Lake. To begin a conversation about these opportunities to integrate the public into the management process in order to produce even greater results, the information from this thesis will be communicated to my research team in China and disseminated to any of the interested formal organizations interviewed during this thesis process. Additionally, this research will be presented at a conference focusing specifically on IWRM in order to open up my findings to an even wider audience and hopefully reach out to others investigating these new management approaches in China.

Communication will be more likely to improve if formal organizations are able to recognize the value of public participation. Fortunately, the benefits of including villagers in the management have been recognized by some. However the institutional decision-making structures currently in place incorporate technical stakeholders and provide only limited avenues for traditional knowledge. The combination of both technical, scientific data with traditional knowledge can improve the effectiveness of projects as well as improve the relations between these two different stakeholder groups. By incorporating villagers into the enforcement portions of the management process, the government can utilize the villagers' surveillance capacity. The potential to reduce nonpoint source pollution can also be substantial. Hopefully other organizations will recognize the benefits of this largely untapped resource of villagers and this will be reflected in the opportunities available to the public in the future.



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