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SUPPORTING TRANSITIONS TO RESILIENT IRRIGATION SYSTEMS: FINDINGS FROM SOUTHERN KYRGYZSTAN

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BY

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Supporting Transitions to Resilient Irrigation Systems: Findings from Southern Kyrgyzstan

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This thesis presents findings from research conducted in Southern Kyrgyzstan, which followed nongovernmental organization (NGO) efforts to support climate change adaptation, and to support more "resilient" community-managed irrigation systems. Findings suggest that current NGO partnerships with Water User Associations (WUAs) frequently amount to financial and technical transactions, to preserve inherited infrastructure and resist disturbance. "Enhancing resilience" is pursued in an effort to maintain existing technical configurations of canals and water resources, despite altered socio-political and environmental conditions. Findings suggest increasing disassociation between irrigation constituents and the institutions and managers that are supposed to direct their grievances through legitimate democratic channels. Instead of being based on current irrigation practices and needs, decisions about allocating resources to technical components of the irrigation system seem to be based on desires to maintain past dynamics of resource access and distribution. The irrigation infrastructure and policies that were inherited from the Soviet era inherently favor those who were well-positioned after independence, while often disenfranchising others. Allocating resources to WUAs for technical projects to repair or maintain these configurations serves, at the same time, to maintain or even exacerbate existing local power and resource-access inequalities.

The research project presented here has sought to provide NGOs operating in this arena with some actionable recommendations, for how they might conceptualize and focus their efforts to "enhance resilience" for community-managed irrigation systems. The research finds the absence of locally-specific knowledge and information concerning current irrigation practice from decision-making represents a critical barrier and potential opportunity to fostering effective deliberation and supporting transitions to more resilient systems. Do to their ostensibly impartial status, technical experience, and cross-community interactions, NGOs could play an important role in helping co-create and aggregate locally-specific knowledge about post-independence water use and access, which has gone hitherto ignored to the detriment of equitable and forward-looking management opportunities. In this way, NGOs who partner with WUAs for irrigation projects should increasingly base that partnership on the collection and management of information about irrigation practice, land-use, water availability and other parameters, in order to help establish WUAs as local institutions grounded in responsiveness to local conditions.

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"Due to geographical conditions, water resources in all Central Asian states present and will present in the certain historical prospect a natural basis of development of economy, life of people and the society."

- President Kurmanbek Bakiev, Kyrgyz Republic Country Development Strategy 2009-2011, prior to his ouster by revolution in 2010.

"It is better to be at the head of the river, than to be the head of the village."

- Kyrgyz Proverb

CHAPTER 1: INTRODUCTION

Kara Kulja District rises from the fertile rim of the vast Ferghana Valley into the peaks near Alai Ku, which separate Northern and Southern Kyrgyz Republic (Kyrgyzstan). The District splits like a "V," veined by two rivers, the Kara Kulja and the Tar, which drain the high peaks of their respective watersheds and, at their confluence in the valley, form the Kara Darya River, a major tributary of one on Central Asia's largest, and most important rivers, the Syr Darya. Across this elevation gradient, from high peaks to gushing rivers and rolling hills, livelihoods vary in concert with the environment. In the mountains, Kyrgyz herders practice semi-nomadic pastoralism and small-scale farming. In the valley, a network of irrigation canals harnesses the potential of the rivers to turn an arid landscape into a patchwork of crops for fodder, food, and market. For hundreds of years, people here have adapted their livelihood practices to the constraints imposed by their environment, to carve livelihoods from a dry, continental climate with long, cold winters.

It can be difficult to imagine the degree of change that has occurred in Kyrgyzstan since the beginning of the 20th Century. In one hundred years this small area of Central Asia, where nomadic pastoralists had been grazing the same pastures since the time of Genghis Khan, was colonized by Russian capitalists, swept in to the Russian Revolution, converted into a settled Soviet satellite, restructured and incorporated into a centralized output-oriented economy, and, almost overnight, abandoned to independence as a

member of the global order with whom it had formerly been embroiled in a Cold War. The past twenty years since independence have brought an uncertain mix of reform and revolution, promise and disappointment, political rhetoric and violent conflict. The global forces that bring sweeping regime change to Central Asia interweave with local contexts and alter the relationships between individuals, their governments, and the institutions that determine rules and responsibilities for citizens, and in particular for the use of and access to Kyrgyzstan's natural resources.

Amidst such tremendous transformation, the practice of daily life continues. Change is felt, but it is also interpreted. The interactions and relationships that compose life in rural Kyrgyzstan offer a window into the processes by which people co-create the meaning of change, and in which possibilities for the future can be found. In the lower villages of Kara Kulja District, residents still depend on the waters that flow from the Kara Kulja and Tar Rivers, into the irrigation canals that course through their fields and make life possible for the crops that grow there. Water must be managed, and canals must be maintained. The institutions that have reconfigured or emerged in the space created by the collapse of the Soviet Union reflect and structure relationships, which determine the responsibilities and rights of water users and managers. Those roles are constantly negotiated. They are not only the product of formal institutional design, stamped onto the complex layers of identity that compose each rural village in Kyrgyzstan, but also bound up in the interrelationships by which institutions acquire meaning in context.

A variety of actors have sought to improve the functionality of water management institutions in Kyrgyzstan. Nongovernmental and international organizations have attempted to reestablish local sufficiency for water management decision-making and financing, through both large-scale institutional reforms and investment, and community-based infrastructure development projects, extension services, and planning initiatives. Thus, the reality of water management in Kyrgyzstan's rural villages today is a complex web of formal institutions designed by international organizations, shifting national priorities and capabilities, the development objectives promoted by NGOs and demanded by their funders, and ultimately, the transformations of these multi-scaled dynamics into daily practice by people who depend on successful agricultural production for their livelihood. None of these components of local water management exists in isolation from the interpersonal relationships that compose water access rights and responsibilities, and yet plans to install new institutions often proceed without awareness or regard for these complex, local dynamics. Without awareness of the daily politics, by which people negotiate their roles in a resource management system, large-scale plans to improve water resource management develop in isolation from the very practices and processes of water use and access that they seek to reform, and which ultimately determine their success.

In rural Kyrgyzstan, one lens through which to examine the gap between reforms promised by large-scale planning and the reality of local water management is the process by which people have interpreted and adapted Water User Associations, the local water management bodies created by national legislation, through international funding and in accordance with the international water management reform agenda. It is difficult

to describe a Water User Association, since describing the idealized design of the institution is wholly different from describing any given Water User Association found in a collection of Kyrgyzstan's villages. Nonetheless, Water User Associations are the institutions with whom NGOs most frequently partner to implement community-based irrigation development projects. Examination of that partnership offers an entry-point to offering NGOs some practical considerations with regard to the implementation of community-based resource management in rural Kyrgyzstan, which is the intent of this research.

This research project followed a particular development intervention to better understand the interplay between formal institutions, NGO objectives, and local practices. In the fall of 2011, the Mountain Societies Development Support Programme - Kyrgyz Republic (MSDSP KG), an implementing partner of the much-larger Aga Khan Development Network (AKDN), completed its first climate change adaptation program, through which local community members selected and implemented their own "climate change adaptation pilot projects." In Kara Kulja District, in a collection of villages situated at the confluence of the Kara Kulja and Tar Rivers, local leaders drew up plans for the rehabilitation of the dilapidated "Bulash" irrigation canal, which transports crucial water resources between three villages. A perception of summer temperatures rising, precipitation patterns becoming less predictable, and more-rapid snow and glacial melt were seen as further threats to already-precarious water security, inhibited by infrastructural deterioration and lack of resources. At the conclusion of the project, after trees had been cleared and sediment removed with the aid of a hired excavator, project

participants expressed their confidence in what seemed to them a triumph of co-management between local water users and MSDSP KG.

The following spring, during the early irrigation season after many crops had already been planted, the canal could not be opened, because a section had eroded, destabilizing its banks and threatening larger failure. Local managers appealed to another organization to fix the canal, which they did. Unfortunately, that project encountered additional structural setbacks, and the canal that had been identified as a crucial component of local water security in the face of climate change remained dry for the first six weeks of the irrigation season. In the meantime, local residents, especially those residents whose land happened to be located far from the head of the canal, wondered when they would finally begin to see water flow to their crops. As one farmer explains,

> There is a problem with Bulash aryk. Only the last two days we have had water. At the beginning of the season we had two days of water. Ayil Bashi (village head) or Ayil Okmotu (local council) said we will not have water for ten days. We had no water for one month. We are having problems with crops. Some things we cannot grow, and some things we already planted are dying. We prepared everything in order to grow rice, plowed, but now we cannot plant (Djani Talaap, June, 2012).

In effect, a project designed to improve water and food security in the face of observed and potential climate change, raised undue expectations for water access, which increased peoples' exposure to potential crop loss, as they had been assured that their canal would meet irrigation demands and thus planted the crops that would rely on it. Luckily for these farmers, there was more than average rain during the early spring season, and crop losses were mitigated. Nonetheless, this research embarks from the recognition that there

is something to be learned from an attempted partnership to confront uncertain environmental conditions, which did not proceed as initially hoped.

This research has sought to better understand whether the disconnect in this case between perceived project success and the reality of a perpetually crumbling canal can tell us something about a future water management regime characterized by increasing complexity, growing uncertainty, and populated by water users with varying levels of inclusion and exclusion from management decisions. The goal of this research is to explore the notion of "resilient" irrigation systems, as "enhanced resilience" was the goal of MSDSP KG's climate change adaptation project, and to consider tradeoffs implicated in the various pathways and barriers to direct a transition towards such systems. One thing that is clear from the mixed experience of reform that has characterized Kyrgyzstan during the last twenty years is that to imagine the institutions of the future, practitioners must pay more attention to the relationships, contexts, and practices that afford them meaning on a daily basis.

1.2 Research Questions

Irrigation management decisions involve the allocation of limited capital towards the maintenance and operation of geographically dispersed natural resources. As such, these decisions create winners and losers. In the course of international development planning and implementation, decisions rarely note the inherent imperfection of large scale plans, which are by definition political instruments designed to forward certain notions of resource access and distribution over others. Such plans can be co-opted through the

disproportionate influence of local elites, or subsumed by demands for expediency in pursuit of efficient and high-impact project implementation. This thesis has emerged from research in three inter-connected communities in Southern Kyrgyzstan, where non-governmental organizations (NGOs) have intervened in irrigation management, in the midst of profound social, economic, and ecological change. This thesis will seek to make more explicit the space between competing water interests and the irrigation management outcomes that they produce, in order to interrogate projects intended to enhance irrigation system resilience.

The research project investigates the following overarching question, designed to address practical concerns raised by development practitioners from MSDSP KG and AKDN at the outset of this study:

- How can development practitioners better engage with local institutions to promote more inclusive and effective deliberation for goal-oriented governance of community irrigation systems?

In answering this overarching question three related questions will be explored:

- What are the processes by which problems are described and solutions are formulated for management of irrigation systems at the community level?

- What are barriers to, and potential drivers of deliberation and strategic planning for irrigation system management at the community level?

- How can community-based NGO initiatives better support transitions to resilient community irrigation system governance? How might resilience be conceptualized in this context?

These questions have been formulated to achieve applicability to "development practitioners" who design, implement and fund irrigation development projects in communities. While practitioners work within the confines of donor-defined protocol and funding cycles, the thesis assumes that critically assessing the underlying assumptions that guide projects can help NGOs more effectively engage local communities. The goal of this project is to find widely applicable conclusions that are practical and useful for development professionals trying to improve their efforts towards organizational effectiveness in the face of global climate change. The impetus for this research springs from the fact that while numerous studies have pointed to the problems that confront local irrigation management institutions in Kyrgyzstan and other parts of Central Asia, and numerous others have criticized the role of international actors in contributing to those problems, few studies have approached these complex challenges from the perspective of development practitioners for whom progress today demands actionable recommendations. While partnerships between local management institutions and NGOs are among the most frequent and consistent means by which resource management projects occur in Kyrgyzstan, few studies seem to target directly this partnership.

The central research question points to a line of inquiry intended to yield conclusions and recommendations that positively shape engagement with local decision-making bodies by development practitioners. This thesis pertains to a context in which engagement is already taking place, with a view to enhancing that engagement as a means for greater inclusion in management decisions that will lead to more equitable outcomes. Involvement of development practitioners in local resource management processes is by

no means the only path to equitable community irrigation management. On the contrary, many commentators would suggest that such involvement constitutes a problematic aspect of modern natural resource management. Nonetheless, this research operates within a context, wherein NGOs currently maintain a profound role in the configuration, direction and financing of irrigation systems. The intention of this research is to provide suggestions, which might benefit the relationship between NGOs like MSDSP KG, who seek to foster transitions towards more resilient natural resource systems, and their local institutional counterparts, Water User Associations.

The research questions emerged as a product of collaboration, based on learning needs identified by MSDSP KG administrators, an implementing partner of the Aga Khan Development Network (AKDN). Collaboration has been a fundamental component of the research project, guiding the content of the investigation, its methodology, and ultimately the manner in which findings will be presented. In this way, the research project has aimed to bridge critical perspectives with pragmatic concerns in the pursuit of better irrigation management outcomes in the communities where MSDSP KG works.

It should be noted that MSDSP KG has held no direct oversight of the research project, its methodology, or its findings. The extent to which MSDSP KG's project implementation has overlapped with the research methodology has been entirely subject to the researcher's discretion. This thesis, while intended to be useful for organizations like MSDSP KG, is the product of research conducted independently, and its conclusions are the researcher's own. This distinction between collaboration and independent

research, and the methodology that underlies that relationship, is made explicit in the chapter relating to research design and methodology.

1.3 Problem Statement

The historical-institutional context for this research project (which will be explored in greater detail in the next chapter) is the reorganization of irrigation governance in Kyrgyzstan, as necessitated by the collapse of the Soviet Union's expansive, international bureaucracy. Kyrgyzstan has seen massive changes in the management and operation of its irrigation sector since the collapse of the Soviet Union. Institutions across scales have been called upon to fill the void of state central planning, which formerly managed all aspects of the coordination and operation of economic and agricultural life in urban and rural communities. As a result, a variety of institutions now bare the burdens of maintaining deteriorating Soviet-built infrastructure, and managing the resources that that infrastructure was constructed to capture and distribute. In many cases, responsibilities for conserving and providing fundamental components of local livelihoods, like water, have been left to local, community institutions during a time of rapid change. The imposed political and economic homogeneity of the Soviet era has been upset by the entrance of a variety of new actors into the irrigation sector and into Kyrgyzstani political life more generally. These actors bring with them multiple visions for a new nation, each of them seeking to carve some sense of progress out of the uncertainty of transformation.

Numerous actors have sought to influence the reorganization of Kyrgyzstan's irrigation sector, and their motivations are varied and often opaque. Interventions take place at scales ranging from national policy formulation to the rehabilitation of small on-farm irrigation canals. Amidst this spectrum of irrigation projects revolve government departments, large international NGOs, international banks, foreign governments, small local NGOs, private citizens, academic institutions, "unofficial" local institutions, "official" local institutions, and newly-formed associations that have been designed to codify individual rights and responsibilities for communal irrigation resources. These latter groups are Kyrgyzstan's Water User Associations (WUAs).

WUAs are the product of sweeping reform measures introduced through international nongovernmental organizations' (INGO) loan programs, and implemented through intensive involvement of both governmental agencies and international and local NGOs. WUAs have been positioned as *the* community institution with which implementing organizations most frequently partner to satisfy donor requirements for community-driven implementation of irrigation projects. In fact, many funding announcements explicitly require that implementing NGOs partner with and provide training for WUAs, as a prerequisite to receiving grants for irrigation projects. At the same time, the functionality, composition, and public acceptance of WUAs vary widely between and within communities and across regions. Many organizations that seek to work together with WUAs to improve community-based irrigation management face a challenge of determining what role these institutions can and should play in the formulation and implementation of development initiatives within the specific communities where they

work. While donors often demand that funded projects should include some aspect of "WUA training" and participation in decision-making, the specific nature of these activities is left to implementing organizations to determine.

The purpose of this study is to question current efforts to support transitions of irrigation systems towards greater resilience in the face of actual and potential disturbance from climate change. Current institutional arrangements are largely the product of previous development initiatives. This research suggests that these development initiatives view irrigation problems in particular ways and in accordance with certain problem-solving methods that predispose them to a limited set of solutions. This research suggests that this has come about largely as a result of an overabundance of attention to large-scale efforts to resist change and disturbance, which are compatible with historical irrigation development priorities for the region, and thus perpetuated by certain local interests. It will be argued that these methods forward a notion of "systemic resilience," which might not position community irrigation management institutions favorably, in light of the increasingly uncertain water regime that climate change analyses portend.

The research question stems from the observation that while WUAs might have been installed as a convenient point of entry for NGOs to engage with rural irrigation management, they should not be taken at face value as institutions inherently representative of all water using members of rural communities. Similarly, channeling conventional management decisions through local institutions such as WUAs does not ensure that those decisions reflect legitimate deliberative processes. In fact, this research

will show that without more explicit attention to the barriers and drivers of inclusive deliberation, NGOs' strategic planning attempts interpret "resilience" in a way that reinforces patterns of exclusion while potentially undermining opportunities for innovative local solutions.

1.4 Structure of the Thesis

The remainder of the thesis will set about to answer and explore the research questions that have been posed.

Chapter 2 will locate the research project within the historical and institutional context of water resource and irrigation governance in Central Asia.

Chapter 3 will provide a background assessment of the complex environmental and resource-use challenges that characterize the research site where this project was conducted. This chapter will also discuss research that documents the potential implications of climate change for the region's water resources and for irrigation management decisions and projects.

Chapter 4 will discuss the theoretical framework through which the research findings have been interpreted.

Chapter 5 will discuss the methods by which this research project was conducted, in addition to the emergence of the research from a specific development intervention conducted by MSDSP KG in Southern Kyrgyzstan, to "enhance community resilience to climate change."

Chapter 6 will present the findings from the research, which draw on and complicate the theoretical and practical foundations of supporting resilient irrigation systems for climate

change adaptation. Finally, this discussion will arrive at some conclusions and approach recommendations for future planning, development and implementation of projects within this field.

CHAPTER 2: KYRGYZSTAN'S IRRIGATION SECTOR – HISTORICAL AND INSTITUTIONAL CONTEXT

Overview:

This section will outline major historical chapters in irrigation management and development in Central Asia, in order to locate the present study within a larger narrative of periodic and unpredictable institutional growth, collapse, and reorganization. Kyrgyzstan and its Central Asian neighbors have a storied history with regard to the management of their water resources. Awareness of these macro-scale trends helps to elucidate the connection between local practices and global political changes and ideologies. Similarly, the institutions that exist for the management of irrigation in rural Kyrgyzstan today did not appear spontaneously, but emerge as part of, and in relation to, those institutions that preceded them.

2.1 Pre-Modern Irrigation in Central Asia

Water management and irrigation have been key issues for political leaders in Central Asia for hundreds of years, with written accounts of managed irrigation systems dating from the 9^{th}-13^{th} Century (O'Hara, 2000). These accounts attest to the role of water managers as key political figures among settled agriculturalists living and farming in semi-arid environments. O'Hara (2000) writes, "It is evident that the administration of scarce water resources was central to the way in which the social and political hierarchy

of settlements operated (428)." In fact, political power was directly linked to the responsibility to govern access and control of water resources. "Distribution of water at a village level was overseen by a water controller, the Mirab, who in turn was supervised by a village elder elected by the people," O'Hara writes. "It was the responsibility of the Mirab to ensure that everyone linked into the irrigation system received their fair share of water (428)." This system of responsibility for equitable distribution was hierarchically differentiated, just as irrigation canals were, and still are, differentiated by scale, with primary canals drawing water from natural sources, secondary canals branching off and delivering water to on-farm tertiary canals, which distribute water to fields. The head Mirab, or "Mirab Bashi," oversaw distribution and maintenance for primary canals, while secondary canals were managed by each village's Mirab (Herrfahrdt, 2006).

These elected officials received their salaries from peasant farmers, who paid according to their level of satisfaction with the water management system (Herrfarhdt, 2006). The physical demands of irrigation management fell to the users themselves, and access to water for irrigation was predicated on participation in common upkeep responsibilities. Herrfahrdt (2006) describes an early version of Central Asian irrigation management, in which resource users fulfilled differentiated maintenance and operation responsibilities depending on their access to water and physical position in relation to water sources,

> *Ketman*, water user associations comprising 3-4 villages, were responsible for the construction and maintenance of the irrigation system and for water distribution. Each village elected an elder (aksakal) who assumed overall responsibility for water management. When construction work became necessary, the *mirab bashi* and the *mirabs* conscripted the *ketmans* to do the work. Villages at the head of a water supply canal, which received more water, had to contribute more time and resources to construction projects. All water users were obliged to take part in

> annual maintenance work on the irrigation network. Individuals who refused to work were denied access to land and water.

This passage demonstrates that the "pre-modern" phase of irrigation management in Central Asia was characterized by a high degree of organizational capacity, managed by leaders accountable to their constituents, who in turn derived their resource access rights from upkeep and labor obligations, which served as an effective enforcement mechanism. In other words, local, decentralized, user-based forms of irrigation management are hardly a modern invention in a region that has depended on a reliable water supply for nearly one-thousand years. Canals dating from this period are still visible, and even operable, in rural Kyrgyzstan. In Central Asia's semi-arid environment, settled civilization has always relied on the distribution of water resources, so it is hardly surprising that political power and irrigation management have gone hand-in-hand for centuries.

2.2 Eastern Expansion

During the second half of the 19th Century, the Russian Empire expanded its reach into Central Asia, to stake its claim to the territorial borderlands of China (Kunakhovich). This was the so-called "Great Game" in Central Asia, wherein the spaces and cultures positioned between expanding empires became strategic conquests under the guise of civilizing missions. Eventually scientific, geographic and ethnographic expeditions, together with policies that granted elite status to Russian nationals willing to settle in Central Asia, led elements of the Empire to see the potential value in their new territory. No longer a swath of unknown and inaccessible hinterlands Central Asia's "empty"

spaces and rushing rivers came to look more and more valuable to an Empire in need of fertile lands to drive its economy. All that was required to turn the "Hungry Steppe" into immense fields of cotton was the redirection of mighty rivers – in other words, intensive irrigation.

Muriel Joffe (1995) presents an account of the conflict between Russia's industrial capitalists and colonial administrators in devising a system of large-scale irrigation in "Russian Turkestan," which ultimately led to a stalemate and a variety of unfulfilled plans. Large-scale irrigation development began in Central Asia at the beginning of the twentieth century, as Russia sought to expand its resource base, especially in order to develop a self-sufficient cotton industry, to wean the Empire from dependence on American exports, which were subject to volatility (Joffe, 367). Both bureaucrats and capitalists understood the potential gains in expanding the native irrigation systems in "Russian Turkestan," yet these groups differed over the proper course of action. Early experiments and failures by colonial administrators in constructing irrigation systems revealed the unique and demanding nature of the enterprise (Ibid, 369). However, the idea of turning over authority and land for private irrigation development ran counter to the nationalist objective of strict political control by regional governors. Joffe writes, "Russian entrepreneurs resented the government's apparent willingness to sacrifice their interests to the state's colonization policies and its desire to protect the native populations under its rule from the capitalist logic of irrigation (375-376)." In other words, unfettered and decentralized irrigation development stood in opposition to notions of centralized political colonization.

These conflicting purposes found voice in the halting development of the Russian Empire's new Water Law, over which negotiations between State Ministries, Capitalists, and Turkestan's regional Governor took shape. This law would only be passed in 1916, at which time any plans for Russia's colonial agricultural expansion were cut short by World War I and then the Bolshevik Revolution in 1917. Nonetheless, arguments for certain types of legislation, like that of A. V. Krivoshein, the head of the Chief Administration of Land Settlement and Agriculture who advocated that traditional water rights be restructured to reflect the Russian Empire's colonial ambitions, help to clarify the impact of national and international trends on local water use traditions. Joffe summarizes Krivoshein's argument for the reorganization of traditional institutions.

> He explained that the decline of the traditional patriarchal way of life in the region had eroded the customary base of water rights, while the appearance of "new forms of public and economic life, in particular the ever-pressing necessity to broadly expand colonization and the cultivation of empty state lands," assured that custom could not serve as the guarantor of these needs and interests. Consequently, the tsarist government had to introduce new principles which would protect the needs of the local population while furthering the state's interests. In particular, the state had to establish principles for allocating water as yet unclaimed by any user, what the legislation referred to as "free water (381).

At stake in arguments such as Krivoshein's, is not only the question of who has a right to access and use water, but more centrally the legitimacy of the social arrangements which underwrite water use and access customs. In this case, those social arrangements were subordinated to the priorities of an expanding empire, which were in turn divided between those of unfettered capitalist expansion and strict central, imperial control. Hill (2008), in his discussion of irrigation ideologies in South Asia during the period of British rule on the Indian Subcontinent, contends that early forays into large-scale

irrigation development were inextricably tied to the central ambitions of colonial rule. He identifies land revenue extraction, famine prevention and political security as among the most significant of these objectives within the context of ideologies driving irrigation development in India under British rule during the 19th Century (26).

While the Russian Empire's plans for fully developing Central Asia's irrigation-fed agriculture never came to fruition, they preceded a chapter in Central Asian history when existing political and social relations would be completely upended in the name of empire building. Political and economic priorities would be consumed by unyielding ideology, emboldened by an unprecedented international program of natural resource extraction, and achieved through the total disruption and reconfiguration of regional territories and local institutions.

2.3 Soviet Command and Control

Under Stalin, the areas of Central Asia previously controlled by the Russian Empire were divided into five distinct republics, incorporated into the Soviet Union. In 1953 Olaf Caroe wrote a piece for *Foreign Affairs* entitled, "Soviet Colonialism in Central Asia," in which he attested to the nature of this process and its purported justification. Caroe writes, "Stalin claimed that this delimitation of frontiers offered an excellent example of how the Soviets can be brought into closer touch with the masses. The time had come, [Stalin] said, when scattered fragments could be reunited into independent states (139)." Yet the reunion that Stalin envisioned was not one of renewed self-reliance and self-determination, and the means by which he endowed his republics with "independence"

betrays his true purpose, and continues to impact the management of regional resources today. As Caroe observed two decades after Stalin's cartographic experimentation,

> The map belies [Stalin]. The territories are inextricably tangled. The boundaries do not even divide language groups, and they cut across irrigation systems. The natural unit of the Farghana Valley is gerrymandered into three parts, distributed between Uzbekistan, Tajikistan, and Kirghizia. Pretty enough on a map, these convolutions are evidence of a policy of cantonization, conceived with the object of confusing ideas of local unity, and bringing the *disjecta membra* under the influence of stronger forces of assimilation from without (139).

With this arrangement Stalin managed to create an internally unworkable collection of new states, as well as regional tensions between them, ensuring that both national governance and international cooperation would be both necessary and completely dependent on Moscow's coordinative power. "Unification" of the republics meant unification under the ideological framework of the Soviet Communist Party, not self-determination (Caroe, 140). One of the central issues, to which Caroe alluded, was the management of a regionally integrated irrigation system to drive the expanding Soviet agricultural machine.

In Kyrgyzstan (or the Kyrgyz Soviet Socialist Republic), the main challenge for Soviet authorities was regulating the use and storage of water between its upstream sources in the Tien Shan and Pamir mountains, and the agricultural sites at lower elevations, which had been targeted for massive mono-cropping of cotton. The clearest means of achieving the central objective, increased production, was through a program of enormous infrastructural development, which would turn Kyrgyzstan's and Tajikistan's free-flowing rivers and patchwork irrigation canals into a regulated and heavily mechanized

system of use and storage, capable of exploiting vast quantities of water calibrated to the achievement of centrally-commanded production targets.

While unprecedented amounts of water were drawn for use in down-stream cotton fields, either by canals or stored in reservoirs, Kyrgyzstan's territory was divided into hydrological units and categorized to determine the amount of water needed for irrigation, depending on the climate, soil, and crop type. These categorizations still form the basis of regional water distribution standards today (Herrfahrdt 2006, 45). Since water use would now be determined, not by village leaders, in concert with the demands of their constituents, but by the calculus of large-scale agricultural production, administrative control over water resources had to be transferred from village users and their representatives, to the State and its representatives, primarily, the Ministry of Water (O'Hara, 429).

In effect, the Soviet "Five-year Plans" for resource and agricultural development obliterated any notion that water rights might be determined at the local level, since local water users were marshaled as State collective or cooperative farm employees whose function was tied to centralized and hierarchical, not local, production strategies. Not only had authority of the *Mirabs* and *Aksakals* been formally wrested from them by Soviet policy. Their crucial functions of ensuring the equitable distribution of irrigation resources, which underwrote their authority prior to collectivization, no longer held any weight once water users became agents of command and control State enterprise. In other words, the role that these figures played prior to the Soviet era was not taken over by new

political leaders; it was stripped of its meaning by a new sociopolitical system, wherein community decisions were determined at the national (now international) scale.

Beginning in the 1940's, Central Asia was reconfigured to serve the needs of water-intensive cotton production. While the Kyrgyz SSR contained only a modest portion of land that was suitable for cotton, the small republic bore crucial importance as a water source, wherein regulation could provide dependable irrigation resources and flood control for the semi-arid and heavily-cultivated republics downstream, as well as power hydroelectric generators to meet the needs of settled villagers during the region's harsh winters (O'Hara, 427). In Kyrgyzstan, these same water sources provided for the irrigation needs of collective (*Kholkhoz*) and state (*Sovkhoz*) farms, which specialized in fodder production for the Republic's ample livestock. Where the Kyrgyz had once practiced nomadic pastoralism, shifting between winter settlements and summer pastures delineated along family clan lines, they became the employees and residents of Soviet farms, where each individual specialized in a particular job function. The Kyrgyz SSR became a key supplier of meat and wool to the rest of the Soviet Union, which in turn provided consistent, state-regulated demand for those products.

The multi-purpose irrigation projects that fueled Central Asian agriculture and energy required the intensive application of technology and engineering, as well as a regionally-coordinated system of subsidies and regulations to ensure that enough water was released during the summer months by upstream republics to permit adequate irrigation for downstream cotton, yet not so much as to prohibit power generation in the winter. Since

Kyrgyzstan and Tajikistan control more than 80% of Central Asia's water resources (O'Hara, 426), regional planning had to account for the inherent tension between multiple uses, and did so by awarding subsidies to upstream countries from the profits garnered by downstream cotton production (Ibid, 430). These management policies did nothing to account for the massive environmental externalities created by unprecedented water exploitation, which will be discussed in the subsequent chapter.

2.4 Global Ideological Paradigms of Water Control

Central Asia's experience during the Soviet era with technological and institutional irrigation development imposed by large-scale top-down initiatives echoes a broader trend, which characterized water management internationally during the 19th and 20th centuries, and of which echoes can be seen to resonate in current water management policy. With the rise and expansion of the Soviet Union, irrigation development in Central Asia came to reflect the globally dominant engineering paradigm (Hill, 2008) that enabled large-scale, centrally managed irrigation projects throughout the world. In this sense, irrigation development in Soviet Central Asia emerged in concert with a global, political ideology of resource extraction, by which the world's major powers developed and applied the technical and organizational knowledge necessary to control and exploit water resources at unprecedented scales. In particular, this chapter of global water resource development coincided with, and depended upon, the ascension of engineering as the politically-empowered knowledge base from which solutions for water control could emerge.

The water-control-as-engineering perspective holds irrigation as a technical challenge, and relies on knowledge generated from hydrology, agronomy and other related disciplines to provide technical solutions to that challenge (Hill 2008, 23). Within engineering discourse, proper irrigation techniques follow from the proper application of engineering principles and technology, as derived from those academic disciplines, deemed legitimate by policymakers and agenda-setters; in the case of Soviet water policy, technical advisors responsible for achieving agricultural production targets, configured to build an independent Soviet cotton production system.

Hill writes, "The engineering discipline has sought and developed a form of technical knowledge or know-how based on practical instrumental rationality, and orientated towards the technical control of water and other physical processes for agricultural production (Ibid, 23)." Here, the primary objective in irrigation planning is efficient water control, where the means of "control" is technical expertise. With irrigation framed as an engineering problem, the ability to utilize engineering principles and technologies is prerequisite to the legitimate control of water.

Since these techniques are deemed to be universal, instrumental, value-neutral and rational, irrigation in this context is assumed to be devoid of political dimensions. In other words, the application of technology through prescribed engineering laws defines the practice of irrigation, wherein the goal is the efficient relocation of water for agriculture. That management practice, which had been a central basis of *political*

legitimacy in pre-modern traditions, becomes profoundly *apolitical* once the standard of legitimacy assumes purely technical dimensions.

Within this framework, those irrigation practices, which are place-based, instead of universal, or whose rules derive legitimacy from inter-personal, socio-political traditions, in fact are incommensurable with irrigation discourse at higher scales. Thus, local norms are not privileged, or even present, in national or international policy decisions, since they are not grounded in the language of engineering problems, but in subjective notions of kinship, reciprocity, networks, etc, which cannot be easily translated across scales or political jurisdictions, and thus prohibit effective and efficient centralized control of water resources. This paradigm of large-scale engineered solutions, which has enabled the unprecedented realization of international irrigation programs through centralized coordination, prohibits the legitimacy of irrigation practices, which would seek to employ alternative, locally oriented sources of knowledge, towards alternative outcomes. In the case of Soviet development in Central Asia, the discourse of international Socialism, which oriented institutions and individuals' positions within them towards the realization of hierarchical directives, provided the enabling mechanism for overhauling local institutional practices and ideologies.

In some cases, the outcomes generated by plans and policies operating from the centralized, engineering paradigm have been calamitous. The case of the Aral Sea Disaster, discussed later, is but one notable and relevant example. In other cases, national and international efforts to mobilize large scale irrigation resources in developing

countries have simply not achieved the water security or poverty alleviation goals that planners expected (Mollinga, 2007). In other words, the monomaniacal quest for pure technological rationality in water use has failed to achieve its goals, as evidenced by persistent, even increasing water insecurity throughout the world, and growing alarm over a "global water crisis" that motivates international policy discussions and reform measures today. In the case of Central Asia's post-Soviet Republics, any notion of ideological continuity or planning objectives was upended when the Soviet Union collapsed, virtually overnight, in 1991. These events coincided with growing demands for a new approach to water management, and the collapse of one system provided for the initiation of new directives, at the behest of new actors.

2.5 Independence, Collapse, Reform

Kyrgyzstan, along with four other Central Asian states that had been Socialist Republics of the Soviet Union, gained independence in 1991. The immediate impact of independence was economic crisis (Sehring, 2009, 67), as trade and production systems that had been integrated into the international Soviet economy disappeared. Among the most important of these systems for Kyrgyzstan's economy was what Sehring (2009) refers to as, "the unified Central Asian water-energy system (67)," the network of irrigation canals and hydropower stations, coupled with the incentive structures and subsidy agreements that made water cooperation and multiple-use agreements possible in the region under hierarchical Soviet authority.

Irrigation is prerequisite to settled agriculture in much of Kyrgyzstan. Estimates suggest that without irrigation, only ten percent of Kyrgyzstan's current agricultural land would be arable (Herrfardt, 2006). Independence, for the Kyrgyzstani irrigated agriculture sector, constituted an immediate and unanticipated transfer of responsibility for financing, managing and maintaining this vital and extensive institutional and infrastructural system to the new government (Herrfahrdt, et al., 2006, 47). In the immediate wake of independence and economic crisis, financial allotments from government to the water sector plummeted to 15% of what they had been in the 1980's (Sehring, 2009, 67). National and international policymakers responded with a suite of reforms, designed to stabilize and restructure Kyrgyzstan's political and economic system.

Understanding these attempts to resolve Kyrgyzstan's water challenges, necessitates consideration of new land ownership configurations, which redefined the relationship between people and cultivated agriculture in the early 1990's. Water institutional reforms accompanied, or often lagged behind, massive changes to rural agricultural production and land ownership regimes. Central to this process was the dissolution of state-owned (Sovkhoz) and collective (Kolkhoz) farms through a program of rural land redistribution and privatization (Herrfahrdt, et al., 2006, 47).

A series of laws on land rights – two versions of the '*Land Code of the Kyrgyz Republic* (1994, 1999)' and the law '*On Agricultural Land Regulation* (2001)' – established private ownership of land and clarified the rights and laws pertaining to land ownership,

sale, and lease (Eriksson, 2006, 18; Herrfahrdt, et al., 2006, 47). Land that was not distributed to individuals and families (approximately 25%) was turned over to *Ayil Okmotus* (local councils) (Eriksson, 2006, 18; Herrfahrdt, et al., 2006, 47). In this project's study site, Kashka-Djol *Ayil Okmotu*, each member of a family received .18 hectares of land (interview, Togotoi, April, 2012). In terms of irrigation management, this meant that canals formerly managed for the allocation of water to large collective farms, now bore the burden of supplying water to a proliferation of individual, private farmers with small, individual plots of land.

In a region where access to irrigation channels is a precondition for settled agriculture, the location of an individual parcel of land in relation to the irrigation canal that waters it is of central importance to the productive potential of that land. Indeed, this was the Soviet impetus for dedicating such intensive efforts to irrigation development and expansion in the first place. Thus, while the *Land Codes* and *Regulation* stipulated that families receive a standardized amount of land based on the number of family members, some parcels of land are inherently more desirable than others, depending on their proximity to a dependable water source. Hence, the Kyrgyzstani adage, "It is better to be at the head of the channel, than to be the head of the village." That the process of parsing out high quality land to some and not others was based on influence and not transparent proceedings, has been well documented (Herrfahrdt, et al., 2006, 48). The result, today, is that community members who occupied influential positions in the collective farms and during the process of privatization, benefit from their ownership of land located near upstream portions of irrigation canals, while those who were not well-connected at the

time of privatization tend to own land near down-stream portions of canals. Data from the research suggests that this lack of procedural justice, which resulted in discrepancies in distributional equality between individuals as well as between villages, continues to shape irrigation management practices today.

Land distribution and privatization, while problematic, were only two aspects of the broad suite of challenges facing Kyrgyzstan's newly sovereign government with regard to management of the country's water resources. Kyrgyzstan's position at the headwaters of Central Asia's largest rivers, and the competing water-use demands placed on those rivers, requires a degree of coordination, both domestic and trans-boundary, that the national government was ill-equipped to handle at the time of independence. National water administration departments had previously been organs of the Soviet, hierarchical water regime and not sovereign, agenda-setting governance bodies. Furthermore, where Kyrgyzstan's irrigation system had previously been tied to the regional, centrally-managed production economy of the USSR, now the new state was solely responsible for the maintenance and operation of its input-intensive water resource infrastructure, despite the collapse of that very economy which had previously supported it.

Sehring (2009) identifies three programs of water institutional reform, undertaken to address these deficiencies, which, in the course of their continuing shades of implementation, shape local irrigation practice today. These are: administrative reorganization, introduction of irrigation service fees, and transfer of local irrigation

management (105). Each has proceeded haltingly, with uncertain implications for individual irrigators.

2.6 Administrative Restructuring

The study site, Kashka-Djol, which will be more thoroughly described in the next chapter, comprises three villages incorporated into Kyrgyzstan's lowest administrative level, the *Ayil Okmotu*, or local council. This research focuses on three of four villages in the Ayil Okmotu: Togotoi (which villagers and maps sometimes refer to as Kashka-Djol), Djani-Talaap, and Djide. The climate change adaptation project conducted by MSDSP KG resulted in investments to a canal that distributes water to farmers in each of these three villages. *Ayil Okmotus* are subdivisions of *raiyons*, or "districts." Kashka-Djol *Ayil Okmotu* is part of Kara Kulja *raiyon*. At the next level of administration are *oblasts*, or regions, as in Osh *oblast*, of which Kara Kulja raiyon is a part. Kyrgyzstan's seven *oblasts* are the highest, sub-national administrative unit.

Administrative restructuring efforts sought to fill the vacuum created in the wake of Soviet dissolution through a combination of efforts to achieve integrated oversight of water management, as well as coordination between agencies responsible for the development of water-dependent economic sectors. These efforts have coincided with, and been heavily influenced by, international discursive and ideological calls for "Integrated Water Resource Management (IWRM)." In particular, they have sought to organize water resource management in Kyrgyzstan according to hydrographic, instead of purely administrative, boundaries, and to create mechanisms for cooperation and

coordination between water-using sectors of the economy (Sehring, 2009). Additionally, administrative reorganization efforts claim to be engaged in the clarification and simplification of administrative responsibilities, to ensure efficient, transparent and coordinated bureaucratic mandates (Ibid), within a bureaucratic apparatus that is characterized by the exact opposite.

Administrative restructuring of water management in Kyrgyzstan has been subject to a tortuous course of half-baked initiatives, bureaucratic squabbling, and international influence, periodically upset by political instability. As mentioned previously, the general intention, at least as expressed by international development initiatives, has been to achieve Integrated Water Resource Management (IWRM). *Integration* is meant to derive from a combination of hierarchical accountability, based on aggregated statistics of water demand at each functional level, with a program of subsidiarity, whereby water-use decisions are made at the lowest possible administrative scale, all in coordination with all water-using sectors of the Kyrgyzstani economy and according to hydrographic spatial organization, whereby administrative boundaries are determined in accordance with river basins.

The degree to which efforts to promote hydrographically-informed IWRM principles have been achieved remains contentious. Sehring (2009) notes that for the most part efforts to restructure Kyrgyzstan's administrative units along hyrdrographic boundaries have largely amounted to the renaming of existing bureaus, without substantive changes to their structure or mandate (121). For example, the *ObVodKhoz* has been renamed the

Basin Water Management Department, and yet its administrative territorial mandate has not been changed, and most people continue to refer to it as the *ObVodKhoz* (Sehring, 2009; interviews). Sehring (2009) notes that one explanation for this continuity is that *Oblasts* already corresponded more or less to river basin delineations. Nonetheless, superficiality characterizes many aspects of the coordinative and organizational reform that has been undertaken so far, as water management remains hierarchical, with mandates, particularly at the national level, arranged in convoluted, overlapping jurisdictions between bureaucratic entities (Sehring, 2009). The degree to which Kyrgyzstan's water sector has achieved the IWRM goals identified and promoted by outside actors is subject to debate, and remains the subject of continuing research (Adbullaev?, etc). Nonetheless, changes have occurred and continue to occur in the administration of irrigation resources at each scale of water use and management.

In Kyrgyzstan, the Ayil Okmotu maintains crop and irrigation records, which it sends to the Raiyon Water Administration, or *RaiVodKhoz*. The RaiVodKhoz, with the largest number of employees within the hierarchy of irrigation departments, maintains responsibility for actual water distribution to individual and collective farmers within the Ayil Okmotus (Sehring, 2009, 106). It also aggregates irrigation demands from its Ayil Okmotus and sends them to the Oblast Water Administration or *ObVodKhoz* (also renamed the *Basin Water Management Departments*). The ObVodKhoz coordinates usage of canals that flow between raiyons and oblasts, in addition to ensuring compatibility with international water use treaties (interview, Director, Osh *Basin Water Management Department*).

In addition to overseeing the coordination and distribution of irrigation water at various levels, administrative departments, from the district to the regional, now maintain responsibility for the maintenance and operation of irrigation canals at each scale. Canals are categorized as either primary, secondary, or tertiary, according to their size and proximity to rivers. Thus, primary canals take water from rivers and then branch into secondary canals. These transport water close enough to villages that they can be accessed by tertiary, or "on-farm" canals, which distribute water to crops. For the most part, maintenance and operation of primary and secondary canals is a raiyon-level responsibility; for this reason the RaiVodKhoz maintains the largest workforce within the irrigation management structure (Herrfahrdt, et al., 52). Despite its mainly supervisory, financial and coordinative function, though, the Osh oblast ObVodKhoz Director claims to maintain heavy equipment capable of responding to large-scale repair needs on a case by case basis (interview, Director, Osh *Basin Water Management Department*).

For on-farm canals at the time of independence, maintenance and operation responsibilities passed from collective and state farms to individual farmers, a situation that emerged as especially problematic. While secondary and tertiary canals were formerly designed to service single, large farm collectives with coordinated cropping schedules and watering demands that reflected a centrally managed production regime, now these same canals must service multiple, small farms, upon which individual families rely for subsistence and income. Thus, at the same time that the on-farm irrigation unit (the collective or state farm) dissolved, the task of coordination between

water users became significantly more complicated. In other words, the management apparatus from which irrigators received direction disappeared at the same time that the management task grew orders of magnitude more complex. As discussed earlier, the complications springing from this transition have only been compounded by the fact that land, within an irrigated landscape, is not created equal.

2.7 Irrigation Service Fees

Irrigation service fees (ISF) were first introduced in Kyrgyzstan by law in 1995; though they were not implemented until 1999, due to political resistance (Sehring, 2007, 283). With the imposition of these fees irrigators are meant to be charged according to the amount of land and type of crop that they water. These reforms, enacted to account for the massive reduction of funding available for irrigation operation and management at the national level, stipulated that the costs of management and operation for tertiary canals, which had previously been borne by collective and state farms, should form the basis of water-access rights by individual farmers. In this way maintenance and operation costs would incentivize collective management, as water access would be predicated on local farmers' collective commitment to generating sufficient investment in their local irrigation infrastructure through responsive and efficient local management.

As Sehring (2009) observes, irrigation service fees are often seen as a mechanism to incentivize greater water use efficiency for conservation objectives, since farmers are required to pay for the water that they use, and thus face incentives to use less; however, in Kyrgyzstan, as in most situations of economic crisis, ISFs were imposed to shift

responsibility for canal operation and maintenance away from the administrative financial vacuum created by independence and onto individual farmers (125). While farmers often refer to the system as "paying for water," the implication behind the ISF is not that irrigators must pay for the water itself, but for the provision of water through a system of managed infrastructure that requires periodic investment (Sehring, 2009, 125). Thus, the introduction of the ISF provides a means by which the state plays a decreased role in providing irrigation services to its constituents.

2.8 Transfer of Local Irrigation Management

The third program of water institutional reform, the transfer of local irrigation management to water users, echoes this same objective: decreasing the presence of centralized state administrative branches in local water use management and canal maintenance and operation. This aspect of irrigation reform, of which there are many comparable examples internationally, grew out of development plans put in place by large international nongovernmental organizations, namely, The World Bank and the Asia Development Bank. In recognition of the dire and worsening condition of Kyrgyzstan's vital irrigation infrastructure, these and other organizations allocated funds to the rehabilitation of canals and equipment. They did so with concurrent efforts to forward certain notions of 'good water governance,' in contrast to those that had been promoted by Soviet top-down administration. In other words, INGO involvement with water resource management in Kyrgyzstan sought to provide financial support for the application of an internationally-promoted governance agenda. As remarked previously, that agenda has been denoted Integrated Water Resource Management. Yet IWRM

remains a broad conceptual vision statement, with goals that are not necessarily descriptive of the implications of specific policy initiatives undertaken by organizations and policymakers, on behalf of communities and water users in Kyrgyzstan.

Within the scope of the present study, the transfer of irrigation management to local water users constitutes a central, contextual element of the relationship between MSDSP KG and irrigation management efforts, as it has manifested in the establishment and proliferation of Water User Associations (WUAs) throughout Kyrgyzstan. The World Bank's *On-Farm Irrigation Project*, initiated in 2002 and completed in 2008, mandated that in order for Kyrgyzstan to receive funding for canal rehabilitation and financial support for irrigation operation and maintenance, the government must establish WUAs as community partner organizations for rehabilitation and management efforts. In effect, these efforts transferred responsibility for on-farm irrigation infrastructure and management to 455 new associations of private farmers, in accordance with the distribution of funding and training to 63 of these WUAs (World Bank Implementation Completion and Results Report, 7). According to The World Bank's *Implementation Completion and Results Report*, the original intended number of WUAs to be created by the project was 160, while the original number of WUAs intended to receive financial support for canal rehabilitation was 80. Regarding the higher number of WUAs created, the report states,

> In view of the high demand for supporting the establishment of WUAs, the number of WUAs established during the project life eventually reached about 455 WUAs which is much higher than the target…covering all main irrigation raions of the country. Nevertheless, the budget actually spent for Component 1 at project completion was lower than foreseen: US$4.56 million versus US$6.2 million planned (3).

The report blames currency depreciation, contractors' failings, and "high price increases for civil works" for the reduction in number of WUAs receiving financial support (3). Thus, the first *On-Farm Irrigation Project* resulted in the creation of a large number of community partner organizations, of which approximately 15 percent were granted financial support for infrastructural projects.

At the conclusion of the *On-Farm Irrigation Project* in 2008, The World Bank launched its *Second On-Farm Irrigation Project*, in recognition that significant further development efforts were needed to "build the capacity" of the plethora of new institutions that had been incorporated by the first project. The most recent status report, from December 2012, suggests that efforts to build the capacity of WUA Support Units, which have been installed as official administrative bodies to train and support WUAs, are underway but have been subject to setbacks and challenges. The report states,

> The functioning of the government's Support Units (SUs) for the WUAs, who provide training and capacity building to WUAs, is improving following an increase in their budget for operational costs…However, there is a significant backlog in the training provided to WUAs, and currently the progress in WUA capacity building is not fully satisfactory. The WUA SUs urgently need to revitalize the training program, in order to build WUA capacity ahead of the 2013 irrigation season (2).

The picture here is one in which institutions have been created through top-down governmental and international efforts, while the operational capacity of these institutions remains vague and something of an afterthought.

These are the institutions, with which MSDSP KG finds itself in an often ambiguous partnership for the implementation of community irrigation management and development projects. MSDSP KG, in order to access funding for canal rehabilitation projects, must partner with and "develop the capacity" of WUAs and their support units. This strategy has been promoted as a pathway to IWRM, and yet it is hardly a guarantor of 'good governance,' as the abstract, ideal function of a WUA, as the fundamental water-management unit, differs considerably from the contextual practice of water resource management in a given community, where local politics structure daily practice.

WUAs are the institutions, which national reform measures and international development projects have positioned and promoted as central to the maintenance and operation of on-farm irrigation canals. To this point WUAs have been promoted as *the* viable alternative to centralized coordination of local irrigation systems for the achievement of sustainable, 'good governance' practices at the community scale of irrigation management and use. Yet, to assume that the registration of a WUA is tantamount to the establishment of good governance of a community's water resources vastly underestimates the complexity inherent in local natural resource management systems and institutions, and does little to establish helpful principles of engagement for potential partners with these associations.

The purpose of framing these reforms within a broader context of irrigation ideologies and practices in Central Asia has been to show that the assumptions motivating irrigation management are the product of ideas about what is the legitimate way to govern

resources, and not necessarily inevitable outcomes of well-accepted practices. In fact, the actual *practice* of water management at the community level has played a marginal role in the creation of managerial principles, which are determined at international scales.

Since independence in Kyrgyzstan, ideas about irrigation have changed rapidly, and actors with the resources to forward certain visions of 'water governance' have been able to do so. Yet at the same time, the substance of those visions is interpreted in specific localities, by individuals and groups who engage in the daily practices of irrigation management and water use. Thus, as the *Second On-Farm Irrigation Project* status report suggests, it is far easier to call for capacity building and better training of WUAs than it is to engineer a functional, decentralized water use and management system through large-scale planning. That such a program of decentralization has been attempted points to some of the underlying ideologies guiding international water governance discourse today.

During the second half of the twentieth century, increasing dissatisfaction with equity and efficiency in irrigation outcomes and questions surrounding the environmental sustainability of large-scale irrigation programs prompted the expansion of irrigation discourse to encompass social aspects of water management (Mollinga, 2007). This shift did not undermine faith in technical knowledge and practice. Engineering principles remain well-established. Instead, the distance between goals and outcomes in irrigation development was perceived to emerge from poor management practices. Proper management and governance came to be seen as prerequisite to the realization of

irrigation development goals, and both the technical and social domains became subject to engineered formulations (Mollinga, 2007, Hill, 2008). In other words, in response to the failure of large-scale engineering efforts to achieve their goals, planners sought to establish general management principles for the establishment of an irrigation environment, wherein technical practices could be more effectively applied.

Engineering and management perspectives, with regard to irrigation practice and policy, project two sides of the same basic assumption: that irrigation practice can be guided by universal principles, through the rational-instrumental application of technological, scientific and organizational principles (Hill 2008). The efforts to achieve IWRM principles in Kyrgyzstan, through the application of large-scale, organizational restructuring, reengineered institutions, and standardized fees confirms this tendency. WUAs have been created, such that with the proper degree of training they might achieve those benchmarks, against which INGO status reports measure their performance. The *Second On-Farm Irrigation Project* seems to be encountering unforeseen challenges in this effort. Findings from this research suggest that the status of WUAs is far less clear than project documents would suggest. For implementing organizations like MSDSP KG, who have been called upon to provide "capacity building" for these cursory institutions, the task at hand is difficult to define.

CHAPTER 3: RESEARCH SITE, ENVIRONMENTAL CONTEXT, CLIMATE CHANGE IMPLICATIONS

Overview:

This chapter situates the research site within the challenging "hydro-political" and environmental landscape of post-Soviet Central Asia, discusses how climate change might impact upon the region's water resources in the coming decades, and identifies some conclusions from the literature concerning the relationship between anticipated changes in water availability and anticipatory planning for water and irrigation management.

Potential climate change impacts for the region are discussed, in addition to how perceptions of potential impacts are likely to drive macro-scale planning measures. Finally, the collection of villages where research took place, Kashka Jol *Ayil Okmotu*, is described in some detail, in addition to an assessment of local observations of climate change, and how those observations might impact irrigation planning and development efforts at the local level.

3.1 Soviet Environmental Legacy

Central Asia's persistent water-related environmental challenges are made all the more daunting by their inherently trans-boundary, interethnic, and integrated characteristics, which all combine to create complex environmental, social and security dilemmas. The

most dramatic example of the ecological impact of Soviet central irrigation planning is the “Aral Sea Disaster.”

Until the 1980’s the Aral Sea, the world’s fourth largest inland body of water, was filled by the waters of the Amu Darya and the Syr Darya, of which the rivers implicated in the current study are tributaries (Sievers, 2002, 365). In line with the Soviet plans for large-scale agricultural production in Central Asia, these sources of the Aral Sea’s water have been diverted by canals to feed extensive lowland cotton production, or collected in reservoirs to regulate water flow for downstream use and hydroelectric power generation.

With regard to water resources, and the likely impacts to those resources of projected climatic change, a central dilemma to water users and planners in Central Asia are the conflicting water-use demands between upstream and downstream countries. Water management agencies are tasked with ensuring that their constituents use water in accordance with each country’s pre-established quotas, formulated during the Soviet era and still in use today. Coordinating water withdrawals such that they fall within these bounds is not enough though, since upstream and downstream nations use water for different reasons at different times of year. In other words, the timing and quantity of release from upstream reservoirs must be such that it allows for the realization of downstream water quotas later in the year, despite incomplete knowledge of what the status of water resources might be at that time. Not surprisingly, at a time when analysts fear changes to seasonality and runoff, the challenges posed by coordination, coupled with population growth in many areas, are vexing.

Kyrgyzstan and Tajikistan, while heavily dependent on irrigation, rely on winter water releases to drive their hydropower stations, which provide heat to their populations during frequently extreme winters. Uzbekistan and Turkmenistan rely on water resources for the intensive cultivation of cotton, for which irrigation requires water to be released in the spring and summer. This is not merely a macro-scale dilemma, but impacts upon local water users as well, since perceptions by water-management agencies of national water-management priorities directs management priorities towards certain types of irrigation development and away from others. Indeed, we can see that certain perceptions of water management are privileged in the research on water and environmental change as well.

3.2 Climate Change Outlook: Central Asia's Water Resources in the 21st Century

In September, 2012, Uzbekistan's President Islam Karimov drew international attention when he claimed that Tajikistan's plans to build the world's tallest (355m) "Rogun" hydroelectric dam could spark a regional water war. Karimov said, "Water resources could become a problem in the future that could escalate tensions not only in our region, but on every continent…I won't name specific countries, but all of this could deteriorate to the point where not just serious confrontation, but even wars could be the result (Reuters)."

Speculation over potential water conflict in Central Eurasia predates Karimov's warning, and has increased in light of growing concern over potential impacts of climate change for regional "hydropolitics." Karimov's alarmist reaction to Tajikistan's energy plans

helps to frame an important consideration, especially in light of the 2013 Year of International Water Cooperation: How can concerns over the region's future water availability helpfully be taken into account for present day planning and development? "Water cooperation" implies some sort of well-informed, goal-driven exercise in balancing competing demands. What are the limitations with which such a process must contend?

A recent study seeks to model and analyze the relationship between changing hydrological dynamics and potential water stress in the highly populated Syr Darya River basin and Ferghana Valley of Central Asia, with which the present research is concerned. The study (Siegfried et al, 2012), published in the journal *Climatic Change*, asks "Will climate change exacerbate water stress in Central Asia?" The goal of the article is to inform a process by which policymakers might anticipate and mitigate these threats.

Siegfried and his coauthors navigate between two views of the region's hydro-political future, one "optimistic" and the other "pessimistic." These represent opposite starting points for anticipatory planning for climate change and water management. The authors write,

> The pessimistic view is that a warming climate will reduce available water and, particularly if combined with rising water demand, increase the propensity for water-related conflicts among the riparian countries. Another, more optimistic view is that increasing temperatures cause a depletion of snow and glacier storage in higher altitude regions that translates into additional runoff, which at least in the next few decades, will avoid a deterioration of the supply-demand ratio (884-885).

In terms of Karimov's concerns, both Tajikistan and Kyrgyzstan have expressed increasing demand for water resources directed towards hydropower development. These demands stoke concerns over conflicting water uses for hydropower and agricultural, which introduce complexity in terms of when is a desirable time to release water from reservoirs. Certainly, a firm grasp of glacial and snow runoff dynamics would be a key input into an informed analysis of whether these competing and potentially increasing demands can be met in the coming decades, whether or not conflict might arise, and thus what would be the parameters of a cooperative water management process.

The report points to the unsurprising phenomenon that, "policy-makers in Central Asia (and elsewhere) act on their perception of existing and projected reality. Which of the two opposing views they believe in thus has important political implications (885)." In this light, there are important links between available information, international climate change discourse and anticipatory planning. The researchers' intention is to relieve some of the guesswork and speculation involved in formulating these "perceptions," such that water-related policy and planning might reflect more empirically-grounded and less paranoia-based (and fear-inducing) projections of future water stress and conflict. At the same time, it is important to bear in mind that any effort to determine climate change impacts is susceptible to its own problem framing biases, which might predispose its conclusions towards certain types of solutions. These will be remarked on subsequently.

The authors warn that an empirically-significant analysis, which would seek to determine whether runoff will increase or decrease in the short to medium term (by 2050), is

difficult to produce, "since runoff patterns of snow- and glacier-melt dominated rivers respond in complex ways to a warming climate (885)." Nonetheless, they are able to derive some conclusions.

The study paints a picture of a water regime characterized by change, yet without clear signals in terms of whether there will be more or less water in the next three to four decades. The authors' most intriguing conclusion, especially in light of Central Asia's water dilemma, is that, "the most important impacts of climate change in the Syr Darya basin emerge from significant changes in the seasonality of runoff (892)." Under certain modeled conditions for the Syr Darya catchment, "the runoff peak…shifts by 30–60 days from the current spring/early summer towards a late winter/early spring runoff regime." In an alternative simulation though, which inputs a less dramatic temperature change, this shift is "less pronounced and, especially for the high altitude catchments, hardly noticeable (893)."

For the authors, this finding confirms "the critical temperature sensitivity of the runoff regime in snow- and glacier-melt driven basins and how they may react to different climate forcings. It also points to large scenario uncertainty (893)." In other words, the most important climate change impact on water availability in the study site is likely to be a shift towards earlier peak runoff, yet the amplitude of this shift depends on interactions between temperature and runoff that are too sensitive and complex for the simulations to model precisely at this time.

Nonetheless, Siegfried et al. conclude with some recommendations that climate change adaptation initiatives might take into consideration in planning for future water resource management in the highly-populated and transboundary Syr Darya basin where this research project took place. With regard to the "optimistic viewpoint," they remark that "gambling on increased water availability due to climate-induced glacier- and snow-melt to solve the international water and energy allocation conflict would be a risky political strategy (896-897)." In other words, a strategy which assumes that increasing demand can be satisfied by natural variation and *laissez-faire* adaptation would be folly. Instead, the authors propose a program of proactive, increased infrastructural investment and "better management." They write,

> The seasonal shift in runoff, as projected by our model, is likely to cause serious problems, notably in unregulated subcatchments, that can only be addressed by targeted construction of new storage and conveyance infrastructure and better management (897).

Siegfried and his coauthors recommend a combination of increased water storage capacity, with "innovative" management approaches that take expected conditions into consideration. For example, the authors posit a system of compensation for water storage and release between upstream and downstream neighbors. They write,

> Compensation levels could…be tied to expected future climate variability, with water savings in the non-vegetation period preceding an expected below-average hydrological year (as determined by probabilistic forecasts) carrying a higher value for compensation than water-savings in normal or above-normal periods (897).

Here, the suggestion is that winter water conservation for upstream countries could be incentivized from a top-down management program that ties compensation levels to predicted water availability during the following season.

This study presents a fascinating example of the interplay between unpredictable change and complex socio-environmental systems. Despite their cautious approach to deriving firm predictions of climate change impacts, the authors concluding recommendations paint an optimistic picture of the capacity of targeted investment to counteract conflict-inducing variability in runoff patterns. There is reason to be wary of this conclusion, however, which the subsequent "Theoretical Framework" chapter will elucidate.

3.3 Description of Research Site and Canal System

Kashka Jol Ayil Okmotu is located within the Syr Darya basin, at the rim of the Ferghana Valley, the most densely populated region of Central Asia. Kashka Jol Ayil Okmotu is situated at the confluence of two rivers, the Tar and the Kara Kulja, which combine to form the Kara Darya, one of the Syr Darya's major tributaries. This is also a mid-upper section of the river basin described in the research pertaining to runoff changes, for which transboundary coordination of water resources between Kyrgyzstan and Uzbekistan constitutes a central challenge for water-management agencies.

The three villages in which research took place - Togotoi, Djani Talaap and Djide – are connected administratively, as villages of the same Ayil Okmotu. One other village, Oktyabr, is also a member of the Ayil Okmotu, but did not take part in the specific canal rehabilitation project that this research details. The reason for this is that the canal of interest – Bulash Aryk – begins near Togotoi, where it waters (how many?) acres of land, continues to Djani Talaap, where it waters (how many?) acres, and finally branches off to

the upper portions of Djide, where it delivers water to (how many?) acres of land. Thus, the decision to direct climate change adaptation resources towards the rehabilitation of a portion of this canal implicated water-management bodies and decision-makers from these three villages.

Villagers report that irrigation in this area has been practiced for hundreds of years. According to a man from Togotoi, "Uzgen canal was constructed around 10^{th}-11^{th} Century by the Karaganid people. Kyrgyz people moved south from Yenesei River Valley to escape from Ghengis Khan's rule." Uzgen canal, which many residents confirm has existed since before the arrival to the area of the Kyrgyz people, is the canal from which Bulash Aryk takes water. The same respondent notes, "Bulash Aryk Canal was constructed when people began to settle about 100 years ago." Thus, the canal system for this collection of villages consists of a combination of legitimately ancient canals and those that were constructed during Russian settlement and Soviet agricultural collectivization.

During collectivization, the villages in this region were incorporated into the same state farm, or "Sovkhoz," which went by the name of Kara Kulja Sovkhoz. This Sovkhoz included seven villages I total, and "Kara Kulja" remains the name of the District in which these villages reside today. According to one respondent, the Kara Kulja Sovkhoz was itself divided into a set of three "departments." Thus, according to the respondent, Oktyabr and Djani Talaap composed one of these departments, while Togotoi and Djide composed another. The function of these departments was not entirely clear from the

interview; however, it seems likely that villages in the same department would have coordinated irrigation, cropping and livestock schedules and resources, since departments were composed of villages in upstream-downstream relations to each other.

According to one villager irrigation in these villages is primarily directed towards animal fodder. At the same time, villagers suggest that the composition of irrigated land has grown murkier since the collapse of the state and collective farms. “People grow crops based on what their family decides,” said one villager, “but usually the first priorities are corn and wheat (corn for animals and wheat for bread). People grow lots of different vegetables.” These changing cropping patterns, which will be discussed again in reference to findings of shifting irrigation patterns, represent a vital shift from cropping schedules controlled by the Sovkhoz to vegetable and crop preferences of individual farmers. Importantly, the irrigation quotas, which determine how much water should be released into each secondary canal, continue to rely on statistics maintained since the Soviet era.

CHAPTER 4: THEORETICAL FRAMEWORK

Overview:

This chapter relates and discusses several concepts, which help to position the research project within the theoretical framework of "resilience thinking" for complex systems. The chapter begins with an exploration of how climate change complicates current natural resource management goals and directives. Next, irrigation systems are described as complex socio-technical systems. Finally, the belief that a problem can be definitely described and a solution clearly identified is challenged with notions of complex, or "wicked" problems. This leads to some concluding remarks concerning the way that "resilience," as a goal in strategic planning, might be reconsidered.

4.1 The Challenge of Climate Change Adaptation Planning

Climate change presents a complex problem for communities and practitioners hoping to facilitate strategic planning at the community level. First, climate change projections are bound by the fundamental, irreducible complexity of climate models (Adger et al, 2009, 343), as described in the research into runoff changes by Siegfried et al (2012). Uncertainty over local manifestations of global climate trends challenges planners and

practitioners to ensure for their constituents that proactive measures reflect likely, potential local manifestations of climate change. Effective planning demands that those measures correspond to reduced vulnerability or enhanced resilience to future climate change impacts, which cannot be fully known at the time of implementation. Therefore, the effectiveness of plans cannot fully be known at the time of their implementation, since their aim is to prevent the realization of negative conditions or to enhance positive gains from changes that have not yet occurred.

Second, expected changes to regional climate regimes will interact with systems, like irrigation, that are, themselves, complex, unpredictable, and intertwined with myriad social, environmental and political dynamics. Irrigation water users are not homogenous, interchangeable parts of a mechanical system. Instead, they are individual members of a diverse society, with different interests and values, which color their perceptions of how limited resources and the costs of managing them should be distributed. Furthermore, an irrigation system's performance depends on the performance of separate, but interconnected, systems. Watershed ecosystem processes, political institutions, and local, regional, national, and international economic forces can all impact, often in difficult-to-trace ways, the management and provision of irrigation infrastructure and services. It can be extremely difficult to differentiate those impacts that are the result of climate change, and those impacts that stem from other contextual drivers of change.

Ideally, natural resource management institutions composed of stakeholders (like WUAs in the case of irrigation management in southern Kyrgyzstan) exist to coordinate the

interests of resource users toward outcomes that are agreed to be mutually desirable and just, or at least the product of democratic procedures for decision-making. In this way, locally-derived natural resource management institutions avoid Garret Hardin's parable, *The Tragedy of the Commons*. Hardin's *Tragedy* depicts an open-access resource system, in which the aggregate impact of each resource user's best interest culminates in the degradation or even destruction of the resource supply. WUAs are seen as a coordinative, collective action-inducing mechanism to avoid this type of exploitation.

Yet, institutions claiming legitimacy based on good governance of natural resources are fundamentally involved in the adjudication of competing values and perceptions; access to resources is not equal, nor separable from normative justifications. Irrigation systems inevitably create at least some inequalities in resource security and access. The challenge to resource managers is to balance competing interests under conditions of limited resources and to manage, or mitigate, the inequality manifest in those limitations in a way that stakeholders deem legitimate.

But climate change further challenges this ideal in two critical ways. First, past climatic conditions are less applicable as baseline parameters of water availability from which to inform management decisions (Adger et al., 2011). The report by Siegfried et al. (2012) supports this conclusion, in that the authors suggest that proactive measures are required to ensure that future water needs will be met. According to many regional climate projections, assumptions regarding the timing or quantity of runoff for a given catchment, will no longer serve as legitimate inputs into water management calculations for a water

decision-making apparatus that is heavily dependent on water use and availability statistics.

Second, climate change impacts are likely to serve as amplifiers of current resource access inequality and risk. Research into the determinants of *vulnerability* to climate change has sought to determine what are the factors that position certain individuals and groups at greater risk of experiencing negative climate change impacts. Similar inquiries have sought to determine the factors that contribute to greater *resilience* in the face of expected disturbance (Adger et al. 2011). What these studies share in common is the notion that increasing uncertainty and climate variability, coupled with greater frequency of climatic extremes, is likely to pose the greatest threat to those who already occupy disadvantaged positions with regard to the provision of climate-sensitive natural resources. In this light, climate change is likely to exacerbate grievances felt by vulnerable individuals and populations, adding stress to the capacity of existing institutions to process those grievances through legitimate channels.

At the same time as they have made the task of resource managers and planners more complex, these concerns have the potential to orient resource systems towards better alignment with natural processes of resource development and provision, which are inherently subject to disturbance. In other words, institutions geared towards incorporating, rather than suppressing, uncertainty and disturbance might better reflect the system dynamics from which their stakeholders seek to benefit, making them more sustainable in the long term. Many current assessments of *resilience* focus less on

predictive measures to avoid disturbance, than they do on systemic patterns in response to unpredictable future conditions. This distinction will be developed further on in the chapter.

Shifting priorities towards uncertainty in climate disruption and impacts has led managers, practitioners and researchers to begin to explore planning tools and mechanisms, which build greater responsiveness into systemic function. They have also sought to determine the characteristics of systems, which predispose them to preferable outcomes in the face of indeterminate disturbance, and which reduce the risk of these disturbances to most vulnerable populations. The concept of *resilience*, which this chapter will explore in greater depth, has been a signal development in the exposition of these themes and goals.

First, though, it is necessary to consider frameworks, which view the practices and processes of resource use and management as bounded by the dynamics of systems. A systems view of irrigation use and management provides helpful heuristics to illuminate those aspects of social life, technological artifacts, materials, and actors, which shape irrigation practice and allow for the discernment of patterns and tendencies out of a complex suite of daily interactions. The next section will offer one framework, by which an irrigation system can be conceptualized.

4.2 Socio-technical Irrigation Systems

A conception of irrigation systems as socio-technical systems positions social relations centrally alongside the technical requirements of irrigation practice (Hill, 2008, 33). As Smith and Stirling (2008) point out, a socio-technical view "situates technology in the contexts that enable it to work (6)." From this perspective, the material and social components interact, to create certain forms of technological practice, which depend on and shape human interaction.

The dynamics of social relations and the capabilities of technologies interact in a way that is both constraining and opening up of alternative opportunities for social interaction. Smith and Stirling (2008) cite electricity, engendered by the exploitation of fossil fuels, which opens up pathways for the development of new practices, at the same time that it "excludes from certain patterns of development those without access to a new technology (6)." Thus, socio-technical systems provide for services that society values; however, these systems also condition ways of thinking about these services at the expense of others (Smith and Stirling, 6, 2008).

Smith and Stirling (2008) write, "A socio-technical systems perspective allows us to understand technology development and use in terms of the complex adaptive processes constituting the interdependencies between the material and the social (6)." This perspective provides a useful alternative to conceiving technology as the instrumental product of rationally-devised decisions about development. Complex and adaptive systems exhibit characteristics, which challenge instrumental views of technology as a

socially controlled collection of machinery. Complex interdependencies and adaptive processes stand in stark contrast to a world of technology in value-free isolation from the societies that implement and rely on it. The socio-technical systems perspective brings these challenges to perceptions of technology, which see it as both isolated from and subject to the societies that produce and implement it.

Smith and Stirling (2008) focus their explanation of socio-technical systems on that which enables the reproduction of a "socio-technical practice (6)." Thus, they remind us that, "New technologies never appear fully formed and in obvious working order (6)." The development of technologies and the reproduction of socio-technical practices depend on those concomitant investments in the creation of a "socio-technical landscape (6)," which enables certain socio-technical practices to flourish. Smith and Stirling write,

> Institutions are required to train engineers and provide facilities for developing particular styles of technology. These must in turn be linked to institutionally-structured market incentives, marketing possibilities and the specific needs of prospective consumers. Beyond this, broader social, demographic and ideological processes are at work. These include the cultural milieu in which the technology operates, where social movements, lifestyle expectations, environmental stresses and resource supply shocks can all exercise important influences on patterns of technology development and use (6).

This passage illuminates a notion of systems, in which the causal interactions between component actors, networks and institutions are complex and unpredictable; yet these are the forces that impact upon the acceptance, rejection, use, and management of technologies in everyday life. Technologies that reside within a landscape that provides for their reproduction become established as the technical components of a socio-

technical system. Social interactions both engender and emerge from technological development.

4.3 Resilience and Complex Systems

Socio-technical systems like the irrigation system researched here, are complex, adaptive systems that exhibit certain dynamics of growth, conservation, collapse and regeneration. These dynamics distinguish them from systems that are fundamentally stable, and which can be controlled by rigid or static decision-making based management. A useful heuristic to model these dynamic transformations is the "adaptive cycle (figure 1)," as developed by scholars involved with the Resilience Alliance,[1] based on foundational work by Holland (1995) in complex systems theory.

The basic premise of this model is that complex, adaptive systems can be characterized at certain times, as existing in relationship to a certain "domain of attraction (Folke et al. 2002)," which is not a single point of stability, but a dynamic general state. Complex systems, in contrast to earlier notions of assumed systemic stability, proceed through stages of growth, conservation, collapse

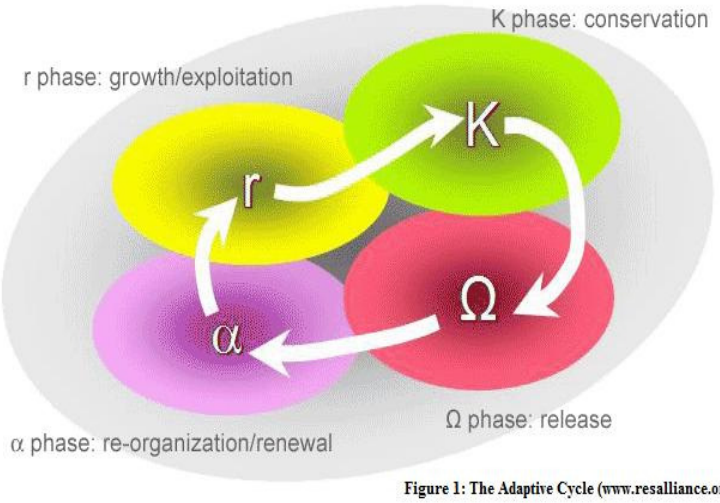

Figure 1: The Adaptive Cycle (www.resalliance.org)

[1] Resilience Alliance, www.resall

and regeneration, which reorient them in relation to different possible system states. Within this cycle, there remains significant room for different systems to experience these stages to different degrees, or even in different sequences.

The forces that drive systems through these stages are not easily controlled, nor are they always identifiable. Further, factors that drive change can interact with each other to create positive or negative feedbacks, which amplify or nullify systemic disturbance in unpredictable directions. The fundamental point is this: complex systems, for which managers used to assume stability and sought to mitigate disturbance, are actually characterized by dynamic, complex interactions, and they are dependent on disturbance in order to maintain their capacity to adapt to ever-changing conditions (Folke, et al. 2002, 15).

In a background paper for The World Summit on Sustainable Development in 2002 titled *Resilience and Sustainable Development: Building Adaptive Capacity in a World of Transformations*, Carl Folke et al. explore those aspects of "resilience thinking," which are especially pertinent in the context of sustainable development and natural resource management. The authors define resilience as a quality of systems that "provides the capacity to absorb shocks while maintaining system function (13)." Thus, resilient systems, faced with disturbance, are capable of processing that disturbance in such a way that the system's crucial functions persist. Folke et al. (2002) argue that resilience, as such, derives from three key determinants:

> a) the amount of disturbance a system can absorb and still remain within the same state or domain of attraction; b) the degree to which the system is capable of self-organization (versus lack of organization, or organization by external forces) and c) the degree to which the system can build and increase the capacity for learning and adaptation (13).

According to this formulation, the degree to which a system exhibits these traits determines its response to disturbance.

Folke et al. also suggest that in conceptualizing resilience, it is helpful also to consider its antonym, *vulnerability*. While scholars debate the meaning, usefulness, and implications of vulnerability as a characterization of individuals and groups (Tshakert, 2009), approaching vulnerability at the systemic scale, and as the opposite of system resilience, offers some clarity in both directions. According to Folke et al. vulnerability, like resilience, emerges from three factors: exposure, sensitivity and resilience (13). Exposure indicates that the system is positioned such that it is likely to encounter some sort of disruption or disturbance, as in the case of extreme weather events, or social unrest. Sensitivity is a measure of the relationship between the system in question and the nature of the disturbance. For example, an irrigation system might be particularly sensitive to drought, but potentially not as sensitive to high wind.

Discussions of systemic resilience and vulnerability relate a given system to the varying disturbance events or trends that is has, or is likely to experience. The nature of this relationship, as described by the various capacities of a system to process disturbance, determines the degree of transformation that the system will undergo and the negative and positive effects which might occur. Systems that lack resilience, yet are exposed to

periods of disturbance that interact with sensitive system components and processes, are more likely to experience loss of system function, or even transformation into a new "domain of attraction." When this happens, disturbance has altered the system's dynamics and functionality, shifting it into a new system state, and threatening the dependability of those services that the system formerly provided.

In the conventional view a well-managed system resists change and optimizes efficiency. From a resilience-focused perspective a well-managed system maintains the capacity to absorb, and even benefit from change, oftentimes relying on redundant (as opposed to efficient) mechanisms in place to ensure continued functionality in the face of unforeseen disturbance. Nonetheless, constructing a conceptual dichotomy between resilient and vulnerable systems only hints at some of the myriad challenges involved in purposive, "real life" efforts to "enhance resilience," with which this research is concerned.

4.4 The Wicked Politics of Enhancing Resilience

To this point in the discussion it has been argued that disturbance and systemic response to disturbance are fundamental aspects of long-term resilience for complex systems. This perspective stands in contrast to those which would posit disturbance as the enemy of long-term sustainability. Here it is suggested instead that the periodic experience of disturbance is a fundamental aspect of dynamic systems, such as irrigation systems, and their resilience in the face of change. The problem with this conception though, with

regard to natural resources, is that it neglects to account for the political aspects of resource management, which were touched on in the discussion of socio-technical systems. In this light, it will be argued that in socio-technical systems, resilience cannot be directly identified, but must be negotiated, as its determinants correspond to varying subjective system framings brought to bear by diverse stakeholders. In other words, asking a collection of water users to characterize the state of their irrigation system could yield as many "system states" as water users. This section presents a useful distinction between tame and wicked problems, to further explore this difference.

Horst Rittel and Melvin Webber, professors in design and planning at Berkeley, introduced a distinction between "tame" and "wicked" problems in their paper, "Dilemmas in a General Theory of Planning," published in 1973. More recently "wicked problems" have been referred to variously as "complex problems." Since Rittel and Webber's theoretical analysis, researchers, practitioners and managers have begun to recognize the challenge that this distinction places on traditional planning and problem-solving methodologies.

The general idea is this: a wicked problem differs from a tame problem in the sense that causality is problematic, problem definition is subjective, and optimal solutions are impossible. For tame problems, the definition of "what the problem is" corresponds to a consensus view that excludes other potential ways of defining the problem. For wicked problems, there is no consensus, but an array of competing problem definitions, which vary depending on one's position within the problem situation. For tame problems, once

the problem definition is known, a solution that corresponds to the resolution of that problem can be described. This is not to suggest that the solution will be easy, merely that it can be known in advance. Conversely, wicked problems do not allow for knowledge of the solution, but only knowledge of a suite of possible solutions, each dependent on the particular problem definition to which it corresponds. In this sense problem definition and goal formulation occur simultaneously.

Since there is no "*the* problem," there can only be sets of potential solutions, some of which might be mutually exclusive. Further, these are not solutions in the sense of a singular strategy that will produce the optimal result, since system performance is a subjective measure that will vary between stakeholders. In other words, what one stakeholder considers a solution might be held by another stakeholder as a deepening of the problem. For wicked problems, interventions within the problem situation change its structure and process, such that one effort to solve the problem might create new problems, or at least reveal new, problematic aspects of the situation that were not fully known at the outset. Thus, attempting solutions to a wicked problem is equivalent to a process of learning about previously hidden dimensions of the problem.

Finally, once a tame problem has been solved, its condition of having been solved is demonstrable. The solution is a logical progression toward that realization, which ultimately resolves the problematic situation. Thus, tame problems are characteristic of closed systems, their interactions contained within the processes and relationships that compose a single system. On the contrary, wicked problems are never solved, but only

improved, and even this is subjective. Further, wicked problems characterize open systems, for which the output of an intervention in one system could translate to an input for another, interconnected open system, triggering a cascade of unanticipated consequences that reverberate throughout these interconnected systems.

Thus far, the discussion has posited that the irrigation system of interest to this research is a socio-technical system, composed of complex interactions and relationships between social and technical context, practice and processes. For this system, it will be argued, the notion of "enhancing resilience" represents a wicked problem. This theoretical position opens up a set of challenges to value-free modes of goal setting, decision making and problem solving, which, despite broad recognition of the complexity of natural resource management, remain dominant today. Further, a theoretical challenge to notions of "tame," stability-oriented management, helps to unlock some of the aspects of climate change adaptation planning for resilience, which should help to inform a more nuanced and contextually-informed relationship between development interventions and local institutions for irrigation management and operation.

In the context of a socio-technical irrigation system, the complexity of social interaction compounds the current and impending challenge of climate change, and makes the goal of enhancing resilience subjective. First, the impacts of climate change will be borne unequally by different resource users in a given system. Vulnerability, the interacting condition of exposure, sensitivity and resilience, can be measured at the systemic level, as discussed, but it can also differentiate individuals or groups within a system. Since

irrigation systems are composed of users and stakeholders with different demands, situated in different positions with regard to water sources, and supported by unequal resources for risk-mitigation, the impacts of climate change will vary for different stakeholders. Thus, stakeholders will view themselves in varying conditions of vulnerability to climate change impacts, which will in turn alter their perception of the importance of and means to enhance systemic resilience.

Management of socio-technical systems is a means to arbitrate the inequality inherent in resource access and use under conditions of limitation. The impacts of climate change are likely to exacerbate those inequalities that already exist. In other words, climate change can be seen as a magnifier of current inequalities in resource access, making the task of incorporating the social aspects of resource management both more difficult and more crucial. For managers and practitioners, decisions about how best to enhance resilience to climate change require value-judgments regarding how, or whether, to alter the distribution of these unequal costs for their constituents. These challenges can be illuminated by a more incisive exposition of the parameters of resilience, as conceived in two different ways, which seem relevant to the distinction between tame and wicked problems.

As already stated, the goal of the project from which this study emerged was "to enhance community resilience to climate change impacts." The concept of resilience has developed over the last four decades or so (Holling, 1973), to emerge from ecological research and literature into the domain of complex social-ecological systems (Folke,

2006), and subsequently to socio-technical systems and transition management approaches (Smith and Stirling, 2008). Folke (2006) offers a helpful distinction between two ways that resilience might be conceptualized, which, in their distinction, have important implications for the way that goals related to "enhancing resilience" might be formulated. He perceives, in the literature, a difference between "engineering resilience," and "ecological resilience (Folke, 2006, 257)," each of which has given rise to distinctive ideas about how interventions in systems target positive outcomes in system function.

Engineering resilience pertains to the ability of a system to return to its "equilibrium state," following some experience of disturbance or perturbation in the system. Folke writes, "Engineering resilience focuses on behavior near a stable equilibrium and the rate at which a system approaches steady state following a perturbation, i.e. the speed of return to equilibrium (Folke, 2006, 256)." In this way, engineering resilience refers to a quality of stable systems, which might be subject to disturbance, but for whom the crucial measure is the time and resources required to return the system to its original state. Folke writes,

> Engineering resilience therefore focuses on maintaining efficiency of function, constancy of the system, and a predictable world near a single steady state. It is about resisting disturbance and change, to conserve what you have. As previously stated, the single equilibrium view has substantially shaped contemporary natural resource and environmental management with attempts to control resource flows in an optimal fashion (256).

The picture here, is one in which the fundamental character of the system - the way that it functions, the optimal outcome that it seeks to achieve, and the way that its component parts are arranged to contribute to the logical achievement of that function - is well established and accepted among decision-makers and stakeholders. Disturbance, here, is

a periodic challenge to the conservation of system function, and resilience is a measurement of the time and resources required to overcome that disturbance and return to a stable configuration. Folke writes, "The resistance to change is often addressed in terms of recovery, which is the time it takes to return to the previous state following disturbance (256)." Engineering resilience is a function of the resources available within the system, which can be deployed to return that system to its "normal" state.

Folke contrasts "engineering resilience" with what he calls "ecological" or "ecosystem resilience." Ecological resilience is more likely to characterize systems in which the causal effects of disturbance reverberate with complex interactions and feedback. Under these conditions the system's response and reconfiguration following unpredictable change cannot necessarily be engineered (Folke, 257). In fact, for systems characterized by complexity, disturbance becomes an aspect of the system itself. Folke writes,

> The system may look similar but it is not the same system, because like any living system it is continuously developing. For reasons like these, scholars involved with resilience in relation to complex adaptive systems increasingly avoid the use of recovery and prefer the concepts renewal, regeneration and re-organization following disturbance (257).

Complex adaptive systems, composed of heterogeneous parts and processes, incorporate the experience of disturbance to introduce new arrangements and relationships into the way that the system functions. In doing so, complex adaptive systems are not amenable to engineered responses to disturbance in order to return to the same state as before the disturbance occurred. Instead, highly resilient complex adaptive systems draw on disturbance to invigorate renewal and innovation, such that future disturbance events do not pose a threat to critical system functions.

These types of unpredictable and dynamic change pose significant challenges to irrigation managers, planners, and water-users especially in light of a water management legacy that has strongly favored and continues to instill an ethic of resistance to change through large-scale engineering. The chapter of this thesis that details results and analysis will seek to locate paths forward towards supporting transitions to resilient irrigation systems. This theoretical framework has sought to show that conceptualizing "resilience" as a quality of systems that is either apolitical or capable of being engineered, misrepresents the challenge presented by the unpredictable impacts of climate change.

CHAPTER 5: METHODS AND ORIGINS

Overview:

This chapter will discuss the qualitative methods by which this research project was conducted. The discussion will include a description and justification of the qualitative field data sampling, collection and analysis. Finally, this chapter will clarify the emergence of the research from a specific development intervention conducted by MSDSP KG in Southern Kyrgyzstan.

5.1 Qualitative Research Methods: Justification and Overview

This study employed qualitative research methods, in order to explore the complex, locally-constituted aspects of irrigation management in the study site. Qualitative methods were employed here, in order to derive actionable suggestions for local implementing organizations engaged in irrigation and natural resource-related projects under conditions of anticipated environmental and climatic change. Thus, the methodology has been designed in order to direct qualitative analysis towards pragmatic conclusions. In this light, participatory methods have been combined with primary qualitative data collection into a methodological approach that will be further clarified in this section.

This qualitative and pragmatic inquiry follows in the tradition of theorists like John Dewey, George Mead, and more recently, Juliet Corbin and Anselm Strauss, whose book, *Basics of Qualitative Research* (2008) served as a benchmark to guide the methodology. In discussing their philosophy of knowledge, Corbin and Strauss present a simple framework of their methodology. They write, "Knowledge arises through…acting and interacting of self-reflective beings (2)." For a study that is concerned with the *practice* of irrigation management, the notion that knowledge "arises through action and interaction" is apt.

Qualitative methods differ markedly from quantitative methods, such as cost-benefit analysis, in that they operate under the assumption that knowledge emerges from context and interaction, instead of in relation to a knowable, objective reality. In other words, qualitative analysis recognizes the social construction of knowledge in a world of untraceable complexity.

Corbin and Strauss describe their ontological foundation in a way that seems especially pertinent to the research topic at hand. For the authors, their methodology operates within,

> A world that is complex, often ambiguous, evincing change as well as periods of permanence; where action itself although routine today may be problematic tomorrow; where answers become questionable and questions ultimately produce answers (6).

In short, qualitative research seeks to capture complex, socially-constructed and interpreted phenomena, which are not amenable to quantitative description.

Further, Corbin and Strauss note that, "Typically the activity is precipitated by a problematic situation, where one can't just act automatically or habitually (2-3)." As has been noted in previous chapters, this research was precipitated by a complex, or wickedly problematic situation. The widespread recognition that Kyrgyzstan's rural irrigation sector required some sort of managerial or technical intervention in order for it to remain viable has prompted significant reflection by a variety of actors on what is the right thing to do. Yet these reflections are not amenable to easy formulations of inputs and outputs, since the parameters of the problem at hand are complex, dynamic and interactive.

A central thesis forwarded here, is that the right course of action might be clarified by considering how perceptions of the relationship between the social-political and the technological in irrigation *practice* structure stakeholders' interpretations of how irrigation institutions do and should function. In light of this argument, the veracity of the analysis rests within its usefulness in contributing to outcomes that stakeholders deem to be better than the "problematic situation" with which they were faced at the outset. Specifically, this research has sought to inform MSDSP KG's, and potentially other NGO's, projects related to strategic planning for natural resource management under conditions of anticipated environmental change or disturbance.

This type of end-goal reflects the foundational thinking of pragmatist John Dewey, whom Corbin and Strauss (p. 3) quote as follows. "The test of ideas, of thinking generally, is found in the consequences of the acts to which the ideas lead, that is in the new arrangement of things which are brought into existence (Dewey, 1929, p. 136)." This

research has sought to bring about better coordination between MSDSP KG and the Water User Associations with whom it has been called on to partner. In a sense, the aim of the research is to contribute to a "new arrangement" between these two, or perhaps an arrangement that is more self-aware of its conceptual foundations. The remainder of the chapter will discuss, in more detail, how this has been carried out.

5.2 Participant Observation, Project Evaluation

This research emerged from a partnership between the University of Central Asia's Mountain Societies Research Centre, the Mountain Societies Development Support Programme - Kyrgyz Republic, and the University of Montana. In coordination with these three institutions, a research/practitioner affiliation was arranged, by which primary field research was complemented by direct participation in community-based project implementation in Southern Kyrgyzstan. This section will clarify this dual-role research methodology, its justifications, limitations, and any instances in which the research process deviated from the prescribed methodology.

In order to analyze the partnership between NGO operations and community natural resource management institutions, I joined MSDSP KG's project team during the final three months of their twelve-month Climate Change Adaptation Project in Kara Kulja District, a mountainous administrative unit in Southern Kyrgyzstan. This project was housed within MSDSP KG's Local Governance Program; and so I committed my time as a participant to the fulfillment of project activities, under the direction of the Head of Local Governance. In this capacity, I was well-positioned to familiarize myself with the

project's methodology, activities, and target beneficiaries. I contributed to the development of project materials, such as pamphlets, videos, and donor reports. This involved reviewing project documents and communications materials, photographing project activities, writing project activity descriptions and case studies, and documenting MSDSP KG's climate change adaptation methodology, activities, and results during this first iteration of climate change adaptation programming. As such, this portion of the research project, from September to December 2011, employed "participant observation" methods, by which the researcher engaged as a participant in project activities.

In light of my position as that of both a participant and an outside observer, I was asked by MSDSP KG administrators to draw on my experience with the climate change adaptation project to develop and execute a final project evaluation. This evaluation had two main objectives: 1) to demonstrate to stakeholders the degree to which project activities contributed to the realization of project objectives and to the overall project goal; and 2) to inform future work. Thus, I sought to explore the impact of project activities on the goal of "enhancing community resilience to climate change impacts," and to derive, from the evaluation, aspects of project implementation that might be improved in subsequent iterations.

Evaluation tools were drafted and finalized in a memorandum of understanding with input and approval from the Executive Director of MSDSP KG. The evaluation employed a qualitative, participatory methodology, in which the researcher was involved as a project facilitator and information was acquired through individual and group reflection

by participants on project activities. Data was gathered through semi-structured interviews of key individual and group informants. Sampling targeted those respondents with particular knowledge of how and why project decisions were made, as well as project participants whose role in the community pertained directly to the project that was implemented. For example, in Kashka Jol Ayil Okmotu, where the irrigation project that this research details was carried out, sampling for the evaluation targeted project participants with irrigation-related responsibilities in the community.

In addition to individual and group discussions with participants in various phases of the project activities, the evaluator visited each of the pilot project sites where project leaders presented the results of their activities, as well as a final roundtable meeting to conclude the project term. Community leaders from villages without pilot projects attended these events. Residents who were not involved with project activities were also interviewed to gauge awareness of the projects and to gauge the range of opinions associated with climate change and adaptation. These interviews were largely impromptu meetings, based on random sampling methods, with those village residents that were willing and available to talk during visits to popular gathering places like markets, where both men and women could be approached for contributions, based on a set of structured interview questions.

Due to time constraints in both planning and implementation, the majority of project participants were not involved in analyzing the results of the evaluation. In a more participatory methodology, project evaluation would constitute a formal project activity, in which the data analysis process would offer a chance for project participants to reflect

on their involvement with the project and to consider ways that the project might be enhanced. Indeed, one recommendation for MSDSP KG was to focus more intently in future projects on this type of participatory knowledge management, to build iterative learning cycles into future project design. Analysis for this evaluation relied largely on the researcher's informal coding of interviews and meetings to derive common conceptual lessons for project facilitators. The majority of interviews were conducted in translation from Kyrgyz. The translator had strong familiarity with the project and local context and provided additional insight into comments solicited during interviews.

Once this evaluation was completed, submitted to MSDSP KG administrators and presented for discussion to project staff, I shifted away from direct participation in MSDSP KG project activities towards a more focused research project, to explore some of the questions raised during the participant-observation phase. The exception to this was that I continued to work with MSDSP KG staff to develop new grant proposals for future projects related to Natural Resource Management, Climate Change Adaptation, and irrigation. In this capacity, I continued to explore the parameters of the project funding and development process, which provided crucial context into the constraints and opportunities that implementing NGOs like MSDSP KG face in applying for and designing these programs, based on donor requirements.

5.3 Qualitative Study: Field Visits, Interviews, and Project Document Review

After the Climate Change Adaptation Project's evaluation findings were presented to MSDSP KG staff and administrators, I worked with the Executive Director to narrow down the focus of a more intensive research project. This project was designed to explore a small set of questions in greater depth than what is possible during the course of regular project implementation activities. These research questions, which were stated in the previous chapter, sought to target the relationship between NGO project planning and implementation for climate change adaptation, and the local institutions responsible for irrigation management in communities. One impetus for this focus was MSDSP KG administrators' interest in fostering better coordination and higher-quality participation in their project activities and with local, representative management institutions (specifically WUAs), as donors frequently request that projects reflect this type of coordination.

I conducted field-based research over the course of three separate visits to Kashka Jol, a collection of rural villages, incorporated into the same *Ayil Okmotu*, or Local Council. This portion of the research included several visits to each of the villages of Togotoi, Djani-Talaap, and Djide. I stayed with local families during four trips to this region, which ranged from periods of four days to one week. This field research began during the second half of March and continued through June, with visits to the villages alternating with time in the MSDSP office in Osh, working together with a translator (who was also present in the field) to transcribe and analyze the data collected. This research time period corresponded with the season for intensive repairs and clearing of the irrigation canals, which provided for opportunities to observe and interact with irrigators and farmers

during the time that they were focused on irrigation-related activities. During the course of my visits to these villages, I employed the following qualitative methods:

1. Semi-structured interviews, with approximately 45-50 individuals, either alone or in groups. Interviews were conducted to include irrigators who were engaged in canal rehabilitation projects, as well as villagers with knowledge of and interest in canal maintenance and operation processes and challenges. Thus, respondent sampling methods were based on either: a) involvement of interview subjects with canal restoration work at the time of the interview; b) the referral of community members who identified subjects as particularly knowledgeable; or c) an effort to balance the gender representation of the interview respondent distribution. These interviews included meetings with key informants involved with irrigation management at the community, district, and regional level. Specifically, I met with the Director of the Water User Association for Kashk Jol Ayil Okmotu, the Director of the Oblast (regional) Water Administration, with raiyon (district) water management personnel including the Director of the WUA Support Office, and with *Ayil Bashi* (Village Heads) and other government officials and elders from each of the three villages. Interviews ranged from short interactions of 10 minutes or less, to longer, more formal sessions of approximately one hour. Most interviews were between 30-40 minutes.
2. Observation of canal restoration projects, and "problem areas" (designated as such by village residents), distributed along the length, side channels, and fields of a canal, the "Bulash Aryk," which spans and services all three villages with

irrigation water, and which MSDSP KG's Climate Change Adaptation Project sought to rehabilitate;

3. Review of project documents and informal discussions with MSDSP KG staff related to the recent project on climate change adaptation, specifically focused on the work completed in Kashka-Djol Ayil Okmotu.
4. Review of project materials pertaining to non-MSDSP KG (ie. The World Bank, US Agency for International Development, etc) projects completed in the study site, as well as donor funding announcements and guidelines that were available for MSDSP KG project proposals.

These methods were drafted in consultation with the researcher's graduate committee, and submitted and approved by the University of Montana's *Institutional Review Board* in March, 2012.

5.4 Origins of the Research: MSDSP KG Climate Change Adaptation Planning Project

In 2010-2011, the Mountain Societies Development Support Programme – Kyrgyz Republic, a locally registered affiliate of the Aga Khan Foundation, implemented their first climate change adaptation project, titled "Increasing Rural Communities' Resilience to Adapt to Climate Change in Osh Oblast of the Kyrgyz Republic."[2] According to its proposal,

[2] Project Proposal, MSDSP KG.

> The goal of the project is to enhance the capacity of rural communities and local authorities in Kyrgyzstan to attain resilient and sustainable solutions to overcome the impact of environmental hazards, climate change, and socio-economic vulnerabilities on their lives and livelihoods.[3]

The project, which took place between October, 2010 and November, 2011, employed the following methodological activities to achieve this goal[4]:

1) Climate change analysis to understand changes in climatic patterns and impacts of those changes for rural people. This analysis combined a review of available meteorological data from meteo posts, as well as knowledge generated through peoples' reflections on the changes that they have experienced in their home climates during the last few decades. This latter knowledge source included information gleaned from visits by Project Leaders to all 49 villages of Kara Kulja District;
2) MSDSP KG worked with the Ministry of Emergency Situations in Kyrgyz Republic to deliver trainings related to the use of meteorological forecast data for community planning;
3) Selection of 12 target villages for implementation of the remainder of project activities;
4) Establishment of or coordination with "community interest groups" to raise awareness of the project and of climate change impacts and vulnerability;
5) Focused assessments of "vulnerability to climate change" and "resilience" in the selected target villages. Assessment methodologies were based on toolkits developed by Program Leaders in conjunction with the project donor, Christan Aid;
6) Development of "risk mitigation and climate change adaptation strategies" by community interest groups;
7) Implementation of "adaptation pilot projects" in 6 of the target villages, as selected by a project proposal competition;
8) Information sharing and awareness raising between villages not selected for project implementaiton and with communication materials distributed through local media outlets.
9) Evaluation of the project to determine whether objectives were met and to derive lessons learned for future programming.

As a participant/observer in the final stages of this project, I took part in activities related to the implementation of steps seven through nine, with particular focus on developing

[3] Proposal.
[4] Proposal.

sufficient knowledge of the project methodologies and outputs to design and implement the final evaluation described above.

In steps six and seven, local participants in MSDSP KG's climate change adaptation project at the research study site – Kashka Djol Ayil Okmotu - determined that the community assets most vulnerable to climate change were their water and irrigation systems, and formulated proposals to safeguard these community resources against the potential impacts of climate change. The process by which these determinations were made is not entirely clear, and seems to have been largely informal. According to one respondent, "The most important problem was water, everyone agreed. There are three villages watered by one canal. First, we counted how many hectares needed to be irrigated, then we made decisions about the canals (interview, Togotoi, November 2011)."

The "Climate Change Working Groups" developed pilot project proposals for potential funding by MSDSP KG. Hence, the "risk mitigation and climate change adaptation strategies" that participants developed in step six of the project methodology focused on the rehabilitation of infrastructure of the water system that the respondent quoted above mentions.

Climate change adaptation measures in the research site brought together MSDSP KG program implementation with community irrigation management institutions. For this reason, and for the purposes of framing the research around a single, specific (though

complex), community-oriented system, this research project has chosen to examine the unique demands of climate change adaptation programming, as manifest through the lens of community irrigation system management. In other words, this research project seeks to explore the implications of attempting to integrate climate change adaptation programming into the existent demands of irrigation management, since the program from which this research emerged sought to deal with each of these in a coordinated planning process.

In meetings with MSDSP KG and Aga Khan Foundation administrators, areas of particular learning needs were developed, for which an in-depth investigation of local planning and institutional coordination might be useful. These learning needs centered on questions of coordination between MSDSP KG and Water User Associations, in their effort to support transitions to more resilient irrigation systems under conditions of observed and expected climatic change. These considerations led to the development and approval of the research questions articulated in Chapter 1, and to the development and approval of the research methodology, as described in this chapter. Thus, the topics explored during the field study emerged out of a shared commitment to enhancing future programs.

CHAPTER 6: FINDINGS, ANALYSIS, RECOMMENDATIONS

Overview

This chapter presents findings from the research, drawn both from participant-observation in MSDSP KG's climate change adaptation project and through intensive field research in Kashka-Jol Ayil Okmotu. First, findings from the evaluation of MSDSP KG's climate change adaptation (CCA) project are presented as initial insights into the coordination between WUAs and NGOs for climate change resilience-oriented interventions. These findings serve as a preface to the exploration of the research questions posed in Chapter 1, clarified and contextualized throughout this report, and investigated according to the methods outlined in the previous chapter. This chapter concludes with an analysis of "barriers and opportunities" for MSDSP KG's and other NGOs' efforts to support transitions to resilient systems, with recommendations for enhanced coordination with local institutions for irrigation management and development.

6.1 Findings: MSDSP KG Climate Change Adaptation Programming Evaluation

During visits to the target villages for CCA project implementation and evaluation, divergent pictures of community involvement in project decision-making and implementation began to emerge. Those community residents with significant

involvement in the planning and execution of the project tended to view the co-management of "climate change adaptation pilot projects" as an innovative, exemplary approach to solving community problems. For example, according to one of these residents, who was centrally-involved in the project activities,

> Coordination between the foundation [MSDSP KG] and the people was perfect. People didn't believe that anything would happen, when they began to see bulldozers they began to believe. There are more canals to fix. Now, people would believe in another project. They are ready to contribute.[5]

This respondent's comment suggests that the missing component of collective action for canal repair work, which this community's representatives chose to address in their "adaptation pilot project," was peoples' belief in the capacity of their leaders to attract donor resources for investment in canal reconstruction.

In other words, for this respondent, the successful implementation of a climate change adaptation project amounts to securing financial and technical resources for infrastructure rehabilitation. In turn, the perception of enhanced legitimacy that accompanies local leaders' coordination with donors is seen as a means to drive wider community participation in canal maintenance and upkeep. Thus, in this case, the role of the Water Users Association is to serve as a coordinative mechanism between donor funds and village infrastructure. When it functions well, this mechanism drives community participation in and contribution to infrastructure development projects by convincing community members of the viability and potential benefit of projects. Potentially, without donor funding, efforts by local leaders to rally collective support for projects would be

[5] Michael Igoe, MSDSP KG, Climate Change Adaptation Project Evaluation Results, November, 2011.

disappointed, since community members would perceive them to be a waste of time and energy.

Interviews conducted in villages *outside of the project site*, revealed that village residents who were not directly involved with MSDSP KG's CCA project remained largely unaware and skeptical of anything that their community leaders were doing on their behalf to secure community natural resources considered to be vulnerable to climatic and other disturbance. One respondent in the District's administrative center voiced concerns that,

> The Ayil Okmotu doesn't ask people's opinions. They should solve the problems, but the Ayil Okmotu doesn't do anything. It is much better if five or six foreigners come and they will solve our problems.[6]

Echoing concerns that reverberate throughout rural parts of Kyrgyzstan, this respondent expresses a loss of faith in the capacity of local institutions to turn villagers' needs into meaningful action for the community.

Even in the case of MSDSP KG's project, local leaders felt that some community members doubted that funding would ever actually reach them. One respondent noted that,

> There was difficulty in organizing people who didn't believe that the project would happen. Next time we will not have this problem. There is more work to be done if we have funding.[7]

Here, the project participant notes that people did not believe that the goals of the project would be accomplished. His suggestion that future projects will garner sufficient

[6] Ibid.
[7] Ibid.

community buy-in forms the basis of his outlook on participatory project design and implementation.

This respondent's "theory of change" seems to be that a program of co-determined and co-managed projects by NGOs and community leaders will ultimately garner public support for projects, and thus inspire collective action for irrigation maintenance and development. The "work" that needs doing is already clear to these community leaders. In fact, they have already identified the projects that would be implemented in the future, and are eager to point them out. The obstacles to doing the "work" are funding, which NGOs can provide, and participation, through labor, which community members will begin to contribute once they see that their efforts are part of a system of consistent donor-supported, progress-oriented implementation. This seems to be the set of underlying assumptions that drives community leaders interest in participating in future "adaptation projects."

At the same time, the suggestion that "foreigners" should come and repair those things that local leaders do not repair points to a perceived gap between the grievances that community members articulate and the channels that are available to them through local institutions, to direct these concerns towards actionable planning and implementation efforts. In other words, local institutions like the Ayil Okmotu and Water User Associations do not appear to many residents to be viable mechanisms for *community-driven* actions to improve resource management systems.

Residents forego participation in local institutions, in favor of hoping that "foreigners" might intervene. Despite the highly-volatile nature of development project funding availability, residents seem to express more confidence in foreign funds to target community projects than in the efficacy of the "local" institutions that have been installed in the wake of Soviet collapse. Ironically, despite their skeptical perspectives concerning each other's willingness to coordinate – local leaders doubt residents' willingness to contribute, residents doubt local leaders' effectiveness and capacity – both groups seem to concur that the acquisition of foreign money is a fundamental prerequisite to collective action for irrigation system repair. Furthermore, the "successful" completion of the MSDSP KG project effectively reinforced this conclusion – that a continued relationship between local instituions and external donors and NGOs offers a pathway towards sustainable community canal maintenance.

A central finding of the Project Evaluation was that the perceived success of the MSDSP KG project may have been misplaced in terms of its contribution towards enhanced systemic resilience, because it emphasizes a mechanism of coordination between community leaders and MSDSP KG, not between community leaders and their consituents. The latter form of coordination, however, is implicated much more centrally in the capacity of the system to respond to disturbance, especially unforeseen disturbance, and to draw on its own components and interrelationships to reorganize and promote systemic learning.

Insights such as these, into the planning and implementation process that characterized MSDSP KG's first CCA project, led to some general conclusions, which were incorporated into the evaluation that was developed for program staff, donors and administrators. A central conclusion was this:

> At the conclusion of the project term the achievement most emphasized seems to be the completion of "adaptation projects," implemented with the intention of "adapting to climate change." This formulation has implications for both the sustainability and effectiveness of the project as a whole and should be reconsidered.[8]

To summarize, the project appears to have created an environment, in which the achievement of "adapting" or "becoming adapted," as facilitated through the transfer of funds between donors and community leaders, is emphasized over the "process of adaptation."

In order to illustrate this discrepancy, sections of the evaluation, which was conducted for MSDSP KG's CCA project, and which helped to frame the intensive research questions explored in this study, are presented here:

> Since the community adaptation plans are based on a set of physical interventions, each of which can be completed within a time-bound project term, MSDSP KG has defined adaptation for communities as the proactive achievement of tasks specified by the community leaders with whom MSDSP KG has established a partnership…When local authorities have completed their climate change

[8] Michael Igoe, MSDSP KG, Climate Change Adaptation Project Evaluation, November, 2011.

adaptation plans, does that mean that their constituents are no longer vulnerable to climate change?

In fact, it is the process of formulating an adaptation plan, which more directly addresses the concept of community resilience, as resilience is a measurement of the functioning of systems. This notion is even expressed at the national scale, where the United Nations Development Programme has suggested that the process of developing National Adaptation Programmes for Action is at least as important as the final document itself (UNDP, 2009). In other words, the project should focus on enhancing the resilience of communities to plan for and respond to the impacts of climate change, and not the ability of communities to implement a list of predetermined activities. Instead of focusing on whether the systems that allocate risks and resources to a community are resilient, this project has focused on providing those systems with the resources to create solutions.

A resilience-focused approach demands that MSDSP KG look into the process by which decisions are made at the community level, who is involved, who is excluded, and how are costs and benefits distributed across society? These are political questions, but so is it political to support the ownership of the adaptation process by certain community authorities. Having made these determinations, MSDSP KG should work with communities to develop adaptation plans in a way that emphasizes the sustainability, flexibility, equity and accountability of that process.

Based on the findings of this evaluation, the institutions that have been identified as primary authorities responsible for community adaptation planning face significant hurdles including distrust from their constituents based on perceptions of corruption and nepotism, disinterest in participation, no clear mechanism for flexible funding, a complicated institutional structure with overlapping mandates, responsibility for deteriorating infrastructure, a lack of clear accountability to stakeholders, and little experience with autonomous project management. One additional difficulty is that while this project sought to operate at the community scale, communities are governed locally at the sub-regional scale. Thus, community members complained of inequity even within their own governance units, suggesting that MSDSP KG has seen clear evidence of the need to examine and to work intentionally to strengthen the processes of community deliberation.

Those aspects of the project that have sought to confront these challenges (trainings, planning sessions, exchange visits, etc.) are promising contributions to enhancing adaptive capacity. However, the project has focused too much on creating visible results and not enough on developing the potential for flexibility and participation in community planning. Since the project design mandated that communities go from having little or no exposure to climate change adaptation concepts to the execution of specific projects based on ratified plans within the span of twelve months, greater emphasis seems to have been placed on accomplishing the project activities than on the constitutive processes of the

activities, which is antithetical to the idea of adaptation as a process-oriented goal.[9]

Based on these findings, which were presented to MSDSP KG, AKDN, and submitted to project donors, it was agreed that further inquiry into the nature of coordination between NGOs (specifically MSDSP KG) and WUAs to achieve a greater focus on supporting the systemic processes that contribute to resilience would be the focus of the intensive research methods, described in the previous chapter. The remainder of this chapter presents findings and analysis of this research.

6.2 A socio-technical system in transition

Chapter 4 presented a theoretical framework of irrigation as a socio-technical system. Irrigation systems seen this way - as complex, adaptive, socio-technical systems – are dynamic. Water control and the technologies that enable it are constantly changing, in response to the broad range of social, environmental, and political disturbances that impact upon them and provide the context for their successful or unsuccessful operation. When irrigators in Kashka Djol A.O. reflect on the changes that have occurred in their irrigation system during the last two decades, they often draw on comparisons, which link the physical capacity of their irrigation canals to the political changes that they have experienced. In Togotoi village, a man who works as a caretaker for a larger farming household reflects on this link between the political, social and technical systems that have characterized his landscape.

[9] Ibid.

> During the Soviet time there was much more water than now. I remember floating in the canal as a child (interview, Togotoi, May, 2012)," he says.

What is the implication of his memory of "more water" during the Soviet time?

Other respondents in the same village clarified,

> There has been no change in the river water level. The problem is with the condition of the canals (interview, Togotoi, May, 2012).

While irrigation infrastructure deterioration in Kyrgyzstan is well-documented, these recollections, which locate a working system within the social and political context of a former era and not in changes inherent in the material itself, should remind us to "situate technology in the context that enables it to work (Smith and Stirling, 2008)." Socio-technical systems change over time in response to the variety of disturbances that alter the interactions between components and actors in the system. These villagers' reflections demonstrate that a useful understanding of irrigation practice and management requires attention to broader structures than those that can be described as replicable, abstract physical characteristics or technical components of the built environment.

Viewing technology thus, as a component of a larger socio-technical system, with functionality implicated in a broad range of contextual factors, helps illuminate the challenge of enhancing systemic resilience. If, in order to realize their function, the physical structures of irrigation rely on a complex set of dynamic social interactions across scales of irrigation use and governance, then resilience is a function of the adaptive interactions between social and technical components, not merely of the inputs to and outputs of technical configurations themselves. In this sense, any intervention designed to enhance resilience, even if it is merely a technical intervention - in fact there

is no such thing, - inserts itself into a complex web of social and technological interactions. Simply put, interventions in socio-technical systems are political interventions.

Local and international NGOs in Kyrgyzstan demonstrate their recognition of irrigation systems' social components through the creation and training of Water User Associations and other governance interventions; however, these efforts seem primarily directed towards the maintenance of pre-existing technical configurations, not towards locally-oriented deliberation for strategic planning. Such governance interventions seem not to question the technical configuration of irrigation systems, assuming them to be value-neutral.

In other words, both NGO practitioners and local managers seem to perceive their challenge to be the generation of sufficient financial and material resources to maintain current technical configurations, not to create an environment wherein the political conflict and grievances inherent in those configurations can be questioned and resolved. It seems that this latter process should constitute a central purpose of local management institutions, not to mention a central component of resilient systems. We might ask, to what extent are these ostensibly *political institutions* actually engaged in shaping an accessible local political process?

International donor and NGO efforts focus on re-imagining and restructuring the social components of management, such that they might provide sufficient inputs for the

technical components to persist in their current state, thus maintaining their originally-intended level of water resource outputs. The suggestion seems to be that the role of local water-management institutions is to resist infrastructural deterioration. These decisions take place without critical reflection on the broader changes that have taken place within the relationship between these physical structures and their social contexts, which together compose the socio-technical irrigation system; yet these shifting relationships are clearly evident, and residents note them freely.

For example, a man in Togotoi village, remarking on the tendency of new irrigators to dig unsanctioned canals that deplete the "official" canals capacity, relates the technical means of water control to the shifting social context that he perceives. He says,

> If there are laws about digging aryks (ditches) and blocking canals people do not follow them. They say, 'I need water too.' … People think that democracy means that they can do whatever they want (Togotoi village, June, 2012).

Here, the functionality of the irrigation system, as enabled by institutional rules that determine the placement and use of physical structures, breaks down when individual irrigators assert their perceived rights to water by altering the system's physical structure. These perceived rights, it seems, are not sufficiently provided for under current system function. Irrigators doing "whatever they want," stands in contrast to irrigators conforming to prior rules and obligations.

In this example, irrigators confront an altered social context, which in turn alters their relationship to the socio-technical status quo. For these "rule-breakers," the configuration of technical water control systems inherited from the Soviet Union no longer serves their

interest, nor do they benefit sufficiently from abiding by past water-use conventions. Thus, with no institutional channel wherein they might express their desire for new arrangements, these actors engage in unsanctioned practices that create water-availability disturbances for others.

Though perceived by some as detrimental to systemic resilience, these unsanctioned canals can be seen from another perspective as adaptive measures, undertaken in response to the disturbance of socio-political change. The difference between what is adaptive and what is problematic rests within the competing interests of different individuals. This resident's description of the "problem" of new canals demonstrates how they have arisen in response to altered contextual conditions.

> The problem with the new aryks is that people have begun to irrigate land that was not irrigated during the Soviet Union when the canals were built. All un-irrigated land was owned by the government. When the government sold the land people chose to do whatever they wanted with it. Now they grow feed here like before, but they grow it for more animals and also to sell it. People realize that they can grow more fodder by irrigating the land (Togotoi, June, 2012).

In light of new opportunities and new incentives for individual agricultural production in the village, some irrigators upset the physical structure of the canal system in ways that undermine previous configurations and functions. For them, the socio-technical system has changed, prompting changes in their relationship to its physical and institutional components.

Those village residents, whose interests correspond with past configurations, perceive threats within this disruptive conception of the relationship between the individual and

the technological infrastructure. In turn, defenders of prior arrangements locate that disruption within a critical view of social context – 'democracy' as anarchy – to argue for the preservation of past configurations. The earlier respondent, critical of peoples' interpretation of 'democracy,' expresses his frustration with the disconnect between older water-use conventions - rules for digging ditches, etc. - and newer water-use practices - irrigating new land; yet his criticism is not of the technological structure's capacity to serve peoples' needs, but of peoples' misuse and alteration of that existing infrastructure. Furthermore, while the episode demonstrates divergent perceptions of the state of current technical arrangements, no arena seems to exist wherein these conflicting interests might be legitimately resolved, nor does the upset respondent offer a vision of 'democracy' somewhere in between people "doing whatever they want" and preservation of the status quo.

In fact, the upset respondent calls not for any kind of managerial or conflict-resolution effort, but for a *technical* intervention, directed to preserve the technology's prior function, while subverting new irrigators' efforts to access water. He says,

> We should build a new aryk [irrigation ditch] at the beginning of OVM [canal] that flows further downhill, and bypasses OVM. This way the canal will be new and clean; and also the aryks that people have dug will not be a problem, since they cannot reach farther downhill. The new canal would replace the old OVM canal and supply water to the fields and aryks that OVM used to supply… If they build the new canal, people who take water from the *problem aryk* will not receive water, so they will have to think about new things. People don't want to pay for electricity for pumps, but maybe they would if they didn't receive this water anymore (Togotoi, June, 2012).

Findings from the present research suggest that the prevailing tendency among both local managers responsible for maintaining system function, and NGO efforts to support these

management efforts, is to perceive the infrastructure that they have inherited as inevitable, static, and apolitical, while perceiving social dynamics as something that can be managed through institutional planning and design, or circumvented through technical fixes, in order to preserve the technological status quo.

In this way, the irrigation system is conceived of as the physical apparatus that exists and must be maintained or refurbished to serve its prior function, while the interacting social context plays a supporting role to the realization of those technical plans. What goes unmentioned are the political dynamics of water access and decision-making power that are embedded within the socio-technical configuration of the irrigation system, and against which "rule breakers" seem to rebel when they seek to alter that configuration. Conceptualizing the irrigation system of interest as a socio-technical system, calls into question current management approaches, which view the technology as apolitical, and the social as a means to maintain it. With this social-engineering lens, any notion that the system might be in a state of dramatic transition is obscured by a managerial distinction between the social, which must be reformed, and the technical, which must be maintained. The fact that current technical arrangements were drawn out of certain social norms and practices that enabled them to function, and which may be in a state of dramatic transformation, goes unnoticed.

At the same time, those actors with an interest in preserving the status quo of water resource access – namely, those who have benefited from the redistribution of authority and property – resist engaging with alternative visions of how a local water management regime might function. Given a choice between engaging conflicting understandings and

multi-dimensions of the “wicked problem of local water management,” or submerging these concerns through the application of donor funding to "tame" infrastructure projects, community leaders tend to choose the latter.

In this regard, irrigation decision-makers attend to their relationship with NGO project specifications – grant proposals, reporting requirements, in-kind payments, etc., while neglecting to address the divergent opinions of their rapidly diversifying constituent base through any sort of inclusive deliberative process. The result is an irrigation management regime that is increasingly out-of-touch and disengaged with the resolution of community grievances, whose formal institutions look upwards towards funding sources, instead of outwards towards the clarification of strategic community priorities.

The study site’s Water User Association appears to have become an important mechanism in channeling this relationship, between NGOs and infrastructural preservation, which is ironic, considering that the WUA was ostensibly created to resolve and aggregate water users’ concerns at the local level. Herein lies the paradox of top-down WUA creation. These institutions were designed, installed and supported by foreign donors in order to address the vacuum of local funding and management for irrigation resources, and yet the infrastructure that they were installed to manage was not created for the equitable distribution of water resources to individual irrigators. Thus, in an effort to dull the shock of systemic collapse, the implementation of an institution designed to resist change has also served to obstruct locally-adapted management practices, which would account for the massive transformation of socio-political conditions.

Such an approach favors resistance to change over a conception of resilience that embraces the rejuvenative influence of disturbance as a source of innovation and adaptive systemic function; and NGOs find themselves as a partner with WUAs, and with those who exert influence through them, in this resistance. This distinction, between resistance and resilience, has consequences for long-term strategic planning and for systemic response to future climatic change impacts.

The installation of WUAs, as mechanisms for the transfer of irrigation management to communities and for the implementation of irrigation service fees, has been seen as a pathway to optimize efficiency in the allocation of funding to systemic maintenance and operation during a time of acute resource limitation. As explained previously, at the time of independence national and regional governmental agencies lacked the capacity to address gaps in rural irrigation infrastructure and management, and so these responsibilities were transferred to water users themselves. Currently, WUAs still lack the financial and material resources to fully address their newfound mandate; yet international NGOs and policymakers are hopeful that, given time, these institutions will mature into well-managed, community-based agencies (interview, Head of Osh ObVodKhoz, March, 2012).

The problem is this: if Kyrgyzstan's operational capacity is overburdened by the demands of its inherited infrastructure, to the point that the national government can only satisfy 15 percent of the regional budget (interview, Head of Osh ObVodKhoz, March, 2012) and responsibility has been shifted to local communities, then the system is currently operating under conditions in which all of its inputs, from the community to the national

scale, have been stretched to their maximum level of application. Thus, private farmers and communities are currently being asked to direct their limited resources towards the maintenance of a system that has no reserve of funding to mitigate the impacts of unforeseeable shock. Another way of conceptualizing the meaning of independence for private farmers and rural families is as a massive transfer of exposure to risk. It is no wonder, then, that many community members choose not to pay irrigation service fees. Many studies have posited that Kyrgyzstanis balk at "paying for water" due to Islamic belief that water is a gift from God, and therefore that community institutions must work to overcome this tradition. Perhaps this trepidation is not a deficiency of local capacity, or solely the product of traditional values, but also an astute, contextually-aware indicator of systemic fragility, in which people choose not to invest.

6.3 Barriers and Opportunities for Supporting Transitions to Resilient Systems

So far an argument has been developed, which centers on the finding that Water User Associations, as mechanisms to coordinate external donor funding for irrigation infrastructure projects at the community scale, do not constitute *the solution* for sustainable management and operation of on-farm irrigation systems in the face of expected climatic change, increased incidence of disturbance over time, and shock. Instead, WUAs have served to forestall total irrigation systemic transformation in the wake of economic and political collapse, by allowing for the partial preservation of existing technical arrangements, despite massively altered socio-political contexts. In effect, technical interventions directed through WUAs are a means of short-term system stabilization and resistance to change, often advocated by those who gain from such

short-term stability, as opposed to a means of fostering reorganization of water resource management at the community level. In other words, WUAs are a source of resilience against disturbance for those members of the communities who remain well-served by the socio-technical arrangements that they inherited and who thus seek their preservation.

In this sense, the installation of WUAs, implementation of irrigation service fees (ISFs), and transfer of management responsibility to communities constitutes more a broad institutional starting point for efforts to enhance systemic resilience, than it does the ideal of an equitably-resilient system. In other words, the goal of supporting transitions to resilient community irrigation systems depends not on determining how irrigators can contribute to the proper functioning of the system that has been prescribed for them, but on how the conditions that are imposed by that system can be channeled towards interventions that make it more responsive to community needs and more amenable to legitimate democratic participation.

As has been stated here, a key challenge of rural irrigation reform in Kyrgyzstan today, is that it must deal with an irrigation system that was not originally constructed to serve individual communities, composed of individual private irrigators. Existing infrastructural configurations enfranchise those water users who were best positioned to acquire favorable land and status at the time of privatization and property redistribution. The system, and its management, was effectively inherited by former elites, not built according to the demands of a rising, locally-oriented agricultural sector. The challenge lies in supporting a transition to water-use and management practices that reflect the interests of a new socio-political community structure, despite the Soviet legacy of non-

local orientation and the technical arrangements that it engendered, and which continue to privilege Soviet-era community leaders.

The creation of WUAs was not a solution for the myriad challenges imposed by local irrigation system management. It was a mechanism to dull the edges of national systemic collapse. The "solution," or set of possible solutions, will be derived from evolutionary lessons about what does and does not work in a given community, as real people take, as their starting point, the configuration of actors, infrastructure, and institutions and experiment with them to find better arrangements and better practices over time. What will be MSDSP KG's role in this process, as it seeks to support a system that is less vulnerable to variability? Ultimately, whether efforts to enhance resilience are successful or not will depend on how institutions position systems with respect to the increased incidence of unpredictable change. The remainder of this chapter will discuss an alternative way of framing the "problem of climate change," which points to some strategic recommendations that MSDSP KG might consider.

6.4 Problem Structuring and Goal Envisioning

In terms of MSDSP KG's coordination with community irrigation management institutions, two sets of considerations must be taken into account in terms of framing an approach to climate change adaptation. "Problem structuring and goal envisioning" must take place both within MSDSP KG's organizational orientation towards climate change adaptation, as well as within participating communities at the outset of participatory project implementation. In other words, both MSDSP KG and the communities with

which it works face problems that require structuring in order to achieve goals that must be envisioned.

The purpose of coordination, between MSDSP KG and community institutions, is to take advantage of areas where NGO goals and community priorities overlap. These goals and priorities must be negotiated, and the process by which that negotiation takes place should garner more attention. Nonetheless, if MSDSP KG sets as part of its goal – "to support a process of deliberation, whereby community members can explicate different ways of framing 'the problem of climate change' and different goals for overcoming these problems" – then MSDSP KG will have built recognition of complexity (wickedness) into its climate change adaptation strategy. Of course, this is easier said than done; but there are some ways to imagine that current approaches might be improved.

Following from the argument that has been developed so far, regarding the distinction between predicting and resisting disturbance versus aligning systems to draw on disturbance as a source of renewal, it seems that articulating an organizational goal for MSDSP KG's climate change adaptation programming is within reach. MSDSP KG might consider its climate change adaptation mandate to be: "To coordinate with community institutions to put in place mechanisms that position climate-exposed systems more favorably, in anticipation of the climatic variation that they might experience over time." What is implied by structuring the organization's strategic goal in this way?

First, this approach would represent a departure from a programmatic structure that seeks to predict climate change effects and mitigate their impacts through technical

constructions. From a theoretical standpoint, the shift in MSDSP KG's goals would be away from resisting predictable change and towards better positioning water users in relation to unpredictable change. Chapter 3 described research, which convincingly demonstrates the challenge of describing in advance the effect of climatic change on Kyrgyzstan's water resources. A sound conclusion from this research though, is that over time, water users in Kyrgyzstan are likely to experience increased incidence of deviation from the water regime norm upon which current socio-technical practices are built.

Thus, a question around which community deliberations might revolve is: to what extent are current irrigation practices enabled by predictably stable environmental conditions? Structuring the deliberative approach in this way, helps elucidate the set of roles that MSDSP KG might play in coordination with local management institutions. As an example, we can imagine what this type of deliberation, focused on changes in seasonality, might look like.

The report by Seigfreid et al (2012), described in Chapter 3, suggests that runoff timing and seasonality is the environmental variable in Central Asia most likely to be effected by increased average temperature. Community-based deliberation for climate change adaptation planning might be structured around the question: If the timing of peak runoff is likely to become less predictable, what changes should be made in the way that the community irrigates its crops? This question would likely yield a set of sub-questions, which would indicate informational barriers to effective planning, which MSDSP KG could work with community institutions to overcome.

For example:

- What crops are currently grown by members of the WUA (that is, all irrigators in the community)? How much land is devoted to each? At what time of year are these crops planted? **Note**: This is information that Ayil Okmotus are supposed to have, and upon which they are meant to base the WUA irrigation service fees; yet their calculations are based on Soviet-era statistics, despite considerable changes in land-use and cultivation since that time.
- Which crops react most and least favorably to variation in amount and timing of irrigation? Which crops have to be planted ahead of time, prior to any indication of runoff conditions?
- What are the methods, by which community members predict and measure the timing and duration of runoff?
- Which of the community's fields are least and most affected by changes in runoff availability? **Note**: This question would likely elicit considerable disagreement, as it pertains to the equitable and inequitable distribution of water resources. Hence the need for MSDSP KG to invest in its organizational capacity for effective facilitation and conflict-resolution techniques.
- Do any members of the community engage in practices, intended to reduce their exposure to changes in runoff or seasonality? For example, have any community members experimented with water conservation or storage techniques? If so, have these experiments worked? If not, what would be the obstacles to this type of experimentation?

These are examples of questions that would form a knowledge platform, oriented towards enabling actions that increase flexibility and adaptability in the face of uncertain change,

over technical interventions designed to resist certain types of disturbance. The key difference between these two problem structures is that the one advocated here – positioning community systems more favorably in relation to uncertainty – would allow for communities to realize *benefits* from a climate change adaptation program, as opposed to simply mitigating the *impact* of change on their existing socio-technical arrangements. A central notion developed within the theoretical position established in Chapter 4, is that the latter does not constitute a sustainable approach under conditions of unpredictable change, since it reinforces path-dependent behavior, inhibiting the capacity of systems to respond to new conditions.

CHAPTER 7: CONCLUSION – SUPPORTING TRANSITIONS TO RESILIENCE

Historical interventions in natural resource management have shown – and theoretical contributions from complex systems research support – that ultimately, the capacity of planners to predict and suppress change will be outpaced and overburdened by the unpredictability of natural variation and extreme events. Repeatedly, when natural resource management institutions rely on technical reinforcements against variability, instead of taking measures to incorporate variability into system design, the result is increased vulnerability to unpredictable, extreme events – the very phenomena climate change is expected to multiply and amplify.

In this regard, MSDSP KG's climate change adaptation program could support community institutions first of all, by assisting in the development of more responsive and better-informed knowledge and information management systems, as platforms for better goal-setting, better decision-making, and better project design. As the CCA program in Kashka Jol Ayil Okmotu operated in its first iteration – as a means for community leaders to reinforce socio-technical practices – information about climate change and about the relationship between community systems and disturbance was more-or-less irrelevant. In fact, to the extent that community leaders were solely interested in preserving existing technical structures, new information in general was fairly irrelevant.

During the research visit, cursory land-use maps that were drawn up for the purpose of informing better planning were found virtually discarded in a pile in the WUA office, one of their frames shattered. It seems that such exercises in Kashka Jol were understood to

be necessary, but relatively uninteresting steps towards the satisfaction of donor requirements, in order to acquire funding for projects that were identified in advance of any form of deliberation regarding what should be done. This final observation corresponds to an interpretation of Water User Associations in Southern Kyrgyzstan, primarily as mechanisms for community leaders to acquire funding through the satisfaction of donor requirements. A CCA programmatic approach that established information and knowledge gathering and management as its first priority, prior to any discussion of technical project implementation, would make a direct contribution to the quality of deliberation that could take place within ostensibly deliberative institutions.

Since the creation and installation of Water User Associations has proceeded from top-down reform measures that favor standardized institutions for coordination with donor regulations, and not from grass-roots efforts to manage local conditions, local information regarding irrigation management and practice has played a minimal role. As a result, those statistics and descriptions that could form the basis of informed decision-making are either nonexistent or startlingly out of date. In place of gathering local knowledge as to what crops are being grown, which fields are being irrigated, and how much water is available in different places at different times, management efforts assume that the best course of action is to assume that current technical arrangements are satisfactory and to find the resources to uphold them. The findings from this research suggest that this approach might be favored by current managers, since they have inherited those positions and properties that were advantageous under past configurations.

Other community members face fundamentally-altered conditions, and the absence of democratic space through which to determine courses of action might be due, in part, to the absence of information about the current state of the system. In other words, as long as NGOs support efforts that emphasize the permanence of inherited technical configurations, management decisions can ignore evidence that the irrigation system is characterized by dramatic change. The result, based on evidence gathered here, is a resource system increasingly beholden to a smaller number of people, or subject to "unsanctioned" disruption by those who feel disenfranchised. The central conclusion regarding barriers and opportunities for supporting transitions to greater resilience (which also forms the basis of an actionable recommendation to NGO administrators) is that an enhanced platform of locally-specific information to support decision-making will be prerequisite to allocating resources in an equitable manner.

NGOs like MSDSP KG, as ostensibly impartial actors, can play a helpful role in developing the informational capacity in a large number of communities that are likely to face further transformation, both climatic and otherwise. Similarly, NGOs have knowledge management experience and expertise, which could help to revolutionize current systems of hand-drawn maps, outdated and static statistics, and generally inaccessible or unknown figures. Since they work both within and across communities, NGOs are in a unique position to couple their technical informational skills with an ability to aggregate information, for better use in informing larger-scale policy decisions that are better informed by local conditions than national or international political agendas.

Many NGO efforts are based on field studies already, but these efforts seem often to fall short of looking past calcified arguments about how many acres decades-old canals irrigate. In many cases these efforts achieve "community-based" legitimacy by assuming that the information gleaned from local managers about irrigation practices offers sufficient insight into local practice. What is truly called for, from the perspective of this research, is not the co-management of old structures, but the co-creation of new knowledge, which can serve to support infrastructure and policies that better reflect the interests of people whose ingenuity will determine how systems respond to change, both past and future.

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APPENDIX 1

Instrument Title: Individual Interview Guide

Below is a general guide that I will use to lead individual interviews. I may modify this guide as needed as the preceding focus group and interviews will inform subsequent interviews.

I. Introduction

- Explain the general purpose of the interview discussion and why the participant was chosen.
- Explain the presence and purpose of recording equipment.
- Address the issue of confidentiality.

II. Interview

A semi-structured interview will be conducted.

- Begin by eliciting subject's initial thoughts on the subject of irrigation canal maintenance and developing context of current project.
    - What kinds of crops do these/does this canal irrigate?
    - Who are the farmers who use these fields?
    - What kinds of irrigation projects have to be done each season?
    - What is the schedule for maintenance of irrigation canals, and when does irrigation begin?
    - What problems can arise if the work is not completed?
    - Is the work this season typical for yearly maintenance, or does work vary greatly from year to year?
- Explore the core themes related to Water User Groups: function, origin, structure, and network:
    - Sample questions related to **function**:
        - "Can you describe the work that you are doing, and explain why it needs to be done?"
        - "Are you working on this project alone, or are you working with other people on this specific project?"
        - "Does this groups of people work on other projects together?"
    - Sample questions related to **origins**:
        - "When did the group that you are working with on this project begin working together? Have you worked together before?"
        - "Did you begin working together to address a specific problem?"
    - Sample questions related to **structure**:
        - "How would you describe your relationship with the people that you are working with on this project? How do you know them?"
        - "How did you decide who should be involved in this group, and who made the decisions about who to involve in your projects?"
        - "How do you think each of you benefits from working as a group?"

        - "Have the individuals in your groups made any agreements with each other about who is responsible for completing certain tasks or providing certain materials?"
        - "How are decisions made within your group about what work needs to be done and when it should be completed? If you have made these kinds of agreements, how do you make sure that other members of the group follow through on their responsibilities?"
    - Sample questions related to **network**:
        - "Do you know of any other groups like yours, where people work together on projects like this one?"
        - "Do you participate in any other groups where you make decisions about irrigation, or work on canal projects?
        - "Are you aware of any current conflicts or problems related to irrigation in your village?"
    - Additional sample questions for **follow-up visit in June**:
        - "Who is responsible for the regulation and distribution of water in this canal?
        - "When was this canal opened? Have there been any problems with water distribution in this canal? Is this canal currently functioning as it should be?"
        - "Have you noticed any changes in this canal during the past 30 years? What has been the cause of these changes? Has anything been done to address them?"
        - "Have you noticed any changes in the Tar River during the last 30 years? Has anything been done to address them? Are there people who keep track of and disseminate river data?"
        - "How do you feel about the management of the canals in your community?"

End of Interview Core Questions: 30-45 minutes

As the time is drawing to a close, ask (if topics have not already been discussed):

1. Who are some of the people in your village who make decisions about irrigation canal maintenance and operation?

2. Can you think of examples of situations when important irrigation projects have not been completed?

3. Can you think of ways that international organizations have played a role in the way that irrigation canals are managed in your village?

4. What do you think are some of the most important challenges related to irrigation for people in your village?

5. Are there any changes that you would like to see in the way that irrigation canals and irrigation water are managed in your village?

III. Closing

Closing remarks: That's all the questions I have. Thank you for participating in this discussion. Can you recommend anyone else that you think I could speak with on this subject?