Who Gives a Dam?

An analysis of the role of various stakeholders in creating water infrastructure projects geared toward adapting to the impacts of climate change on agriculture in Canterbury, New Zealand

"*Whiskey is for drinking;*
Water is for fighting over"
-Mark Twain

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Abstract

Anthropogenic climate change will have a drastic impact on the agricultural communities of the world and the people who rely on them for sustenance. Climate change adaptation plans for agricultural systems are crucial in ensuring the future productivity of agricultural land. Canterbury is an agricultural region within New Zealand, a country whose economy is based on agricultural exports. Climate models predict that Canterbury will receive less precipitation, experience higher temperatures, and become increasingly windy due to climate change (O'Donnell 2007). The implementation of adaptive agricultural strategies within Canterbury is essential to maintaining agricultural and economic viability within the region. One such adaptive strategy is the development of water storage infrastructure on the major alpine rivers that bisect Canterbury. Climate change models predict that the flows of these rivers will increase as precipitation increases in the Main Divide, where the headwaters of these rivers lie (O'Donnell 2007). These infrastructure projects would increase irrigation water reliability and availability within Canterbury, provide recreational opportunities, and create economic growth within the community. These projects, however, are also extremely controversial due their expense, impact on lacustrine and river ecosystems, cultural ramifications for the Māori, and effects on recreational opportunities.

This study focuses on two questions: What is the perceived role of various stakeholders in creating water infrastructure geared toward adapting to the impacts of climate change on agriculture in Canterbury and do these stakeholder relationships retard or facilitate the creation of these strategic, adaptive projects? This study explores these questions through the analysis of 41 semi-structured qualitative stakeholder interviews. These interviews were analyzed using a qualitative social collaborative approach. The analysis of these interviews revealed that stakeholders universally believed that the theoretical participation of a full suite of stakeholders was essential in the creation of multi-user, adaptive water storage infrastructure, but that the funding and legislative structures in place within Canterbury causes stakeholder relationship to be combative instead of collaborative. This study also found that the stakeholder relationships present in Canterbury retard the development of strategic, adaptive water infrastructure.

Introduction

Anthropogenic climate change is a global, irreversible reality. A recent study done by the National Oceanic and Atmospheric Administration found that the effect of elevated levels of atmospheric carbon dioxide on climate will persist for over a thousand years after emissions have stopped (Solomon et al. 2008). The climate of our planet is going to change even if we cease emitting greenhouse gases. In spite of global initiatives to curb greenhouse gas emissions, global carbon dioxide emissions are increasing. Our atmosphere currently has a carbon dioxide concentration of 385 ppmv, 37.5 % higher than preindustrial concentrations (Solomon et al. 2008). This increasing carbon dioxide concentration has already begun to have a significant impact on global climate.

Average global temperature has increased by 0.6º C (+/- 0.2º C) in the last century and will rise another 1.8º C – 4.0º C in the next century (IPCC 2007). The annual average global surface temperature has been the warmest on record for eleven out of the past twelve years (O'Donnell 2007). This warming trend manifests differently on a national and regional scale (Cline 2007). From a macro-perspective, the globe will experience fewer cold nights, more frequent warm spells/heat waves, a higher proportion of total rainfall from heavy rains, increased intense cyclone activity, extreme sea-level rise, and the movement of extra-tropical storms toward the poles with a shift in wind behavior (O'Donnell 2007). As a society, we must begin to rigorously examine the projected impacts of climate change on a global, national, and regional level, and work with these predictions toward climate change adaptation and mitigation strategies.

This study focuses on agricultural adaptation to increased drought frequency and intensity due to climate change. Water storage infrastructure development as an adaptive strategy

to climate change induced drought is the emphasis of this study. This thesis focuses on two central research questions: What is the perceived role of various stakeholders in creating water infrastructure geared toward adapting to the impacts of climate change on agriculture in Canterbury, New Zealand and do these stakeholder relationships retard or facilitate the creation of these strategic, adaptive projects? This study focuses on the role of stakeholders in the creation of water infrastructure because the development and implementation of adaption strategies is dependent on the participation and engagement of a wide range of community stakeholders. An examination of the role of stakeholders in the process of promoting or preventing the development of adaptive water infrastructure is imperative to understanding how adaptive strategies can be developed and implemented.

This paper will explore these central research questions using the following format: Within this introductory section I will discuss the broad impacts of climate change on agricultural systems, explore the differences and synergies between climate change mitigation and adaptation strategies, and outline general strategies for agricultural adaptation to climate change induced drought. Following this section I will introduce the research site of this study, Canterbury, New Zealand, and describe the relevant economic, agricultural, social, cultural, and political characteristics of Canterbury. I will then formally present my central research questions. Following this, I will describe the qualitative methodology I used in this study. Following the presentation of my methodology, I will describe the role of specific stakeholders (i.e. government, private sector, civil society groups, and farmers) in the creation of water infrastructure in Canterbury. In each of these stakeholder interface sections I will begin by providing relevant historical and contextual information about the role of that specific stakeholder group. I then will present my findings by describing the themes that I identified in

my qualitative interviews around the role of that specific stakeholder group in developing water infrastructure in Canterbury. I organized the findings of my study by separating the four specific stakeholder interfaces, because it is essential that the reader understand the factors influencing the role of each specific stakeholder group in the creation of adaptive water infrastructure. By understanding the relevant background information, as well as the identified themes for a specific stakeholder, the reader can better understand how these stakeholder groups interact and how relationships between stakeholders promote or prevent the development of water infrastructure geared toward adapting to the impact of climate change on agriculture. Following these four stakeholder sections I will discuss my research questions, drawing on my findings to elaborate on these central questions, suggest strategies for moving forward, and discuss the potential of collaboration and conflict processes.

The Impact of Climate Change on Agricultural Systems

Agriculture is an essential aspect of human civilization and is exceptionally vulnerable to the regional impacts of climate change. Agricultural systems will be impacted heterogeneously depending on the regional manifestation of climate change (Rosenzweig Tubiello 2007). Climate change will affect agricultural systems through a variety of factors such as: increased concentrations of carbon dioxide in the atmosphere, increased temperatures, increased intensity and frequency of extreme weather events, altered availability of water, impacted soil fertility, and altered biotic factors that impact crop productivity. In the context of this study, the impact of climate change on agriculture due on to changes in temperature and water availability is most relevant to an examination of water storage infrastructure as an adaptive strategy to climate change.

Increased Temperatures: The nuanced impact of climate change will vary regionally, but a general warming trend will be experienced globally. Increased temperatures can lead to a potentially longer growing season. A longer growing season allows for earlier planting that can potentially cause accelerated growth, earlier maturation, and earlier harvesting. In some locations, depending on the extent of warming and availability of water and nutrients, the planting of multiple crops per season may become feasible. This potentially beneficial impact of increased temperatures, however, could become a negative impact if the frequency and severity of extreme hot temperature events increases (Rosenzweig, Hillel 1998).

Sustained and/or extreme high temperatures can potentially injure crops, leading to decreased productivity. This impact is exacerbated by water stress, which typically accompanies heat stress. Additionally, high solar irradiance and increased hot, dry winds which are common components of heat waves, can further intensify the damage incurred to plants during these extreme events. Cropping systems in temperate and tropical regions are especially susceptible to this phenomenon (Rosenzweig, Hillel 1998). Crops currently grown near their heat tolerance limit may be decimated by an increase in extreme high temperature events (IPCC 2007).

Water Availability: Climate change will have a dramatic impact on the distribution of precipitation across the world and how that precipitation is stored (IPCC 2007). The availability of water is the single most important factor in determining the productivity of crops. Therefore, the extent to which precipitation patterns change due to climate change may be the largest determinant of the future productivity of crops within a given region (Rosenzweig 1998). Shifting precipitation will leave some areas prone to prolonged periods of drought. These droughts can have a devastating impact on crop yields, especially if they occur during key developmental stages. Changes in precipitation patterns will also affect stream flows and

groundwater recharge. Additionally, increased temperatures will cause the retreat of glaciers and reduce the amount of water stored as snow during the winter months, reducing glacier and snowmelt in the spring (Mata, Budhooran 2007). Many drought-prone regions supplement summer rainfall with irrigation sourced from rivers, streams, and underground aquifers. These sources of irrigation water will be jeopardized in many regions due to the impact of climate change on precipitation patterns and winter temperatures (Rosenzweig, Hillel 1998).

Agricultural Adaptation to Climate Change

Climate change is impacting and will continue to impact the global climate. When designing strategies aimed toward grappling with the impacts of climate change it is important to distinguish between mitigation strategies and adaptation strategies.

Mitigation strategies are focused on reducing or offsetting greenhouse gas emissions (Kenny 2005). In the context of agriculture, mitigation strategies are extremely important because of the significant levels of greenhouse gases such as carbon dioxide, nitrous oxide, and methane that are emitted as a product of agricultural practices. In addition to these emissions, the conversion of forest and other land cover into agricultural land uses is another significant source of greenhouse gases (IPCC 2007). Agriculture, as a sector, is responsible for significant emissions of greenhouse gases, but also provides opportunities for mitigation through carbon sequestration via soil and plants (Mata, Budhooran 2007). Strategies geared toward curbing agricultural greenhouse gas emissions and encouraging agricultural carbon sequestration are essential elements in responding to climate change. However, climate change is irreversible on a human timescale, and therefore these mitigation strategies must be coupled with sound adaptive strategies (Solomon et al. 2008).

In *Adapting to Climate Change in Eastern New Zealand*, Gavin Kenny (2005) defines agricultural adaptation to climate change as "actions we take individually or collectively to address the effects of climate change (5)." Adaptive strategies are geared toward minimizing the negative effects of climate change on agriculture and maximizing the positive effects. Adaptation is not geared toward preventing all damages and the implementation of agricultural adaptive strategies will incur some costs (IPCC 2007). Adaptive strategies focus on increasing the stability and resilience of an agricultural system, not on increasing absolute productivity. Adaptive strategies must be designed to appreciate the variance in agricultural systems, regions, and the predicted impacts of climate change as decided by different climate change models. In addition to this, communities and specialists must acknowledge that every agricultural system is vulnerable to local conditions and all risks will never be eliminated (Rosenzweig Tubiello 2007).

Agricultural adaption to climate change is conceptually simple. However, the true adaptive capacity of a region is determined by its complex social, political, economic, and environmental context. A region's adaptive capacity is contingent on the impacts of climate change on the weather of the area, the agricultural systems present in the region, its scientific/technical resources, its financial capabilities, and its institutional constraints. Adaptive strategies must be designed and implemented on a regional level as well as focused on specific impacts of climate change on the agricultural system (IPCC 2007).

This paper will focus primarily on adaptation strategies geared toward grappling with the effects of reduced water availability on agricultural systems General strategies for agricultural adaptation to climate change induced drought are two-fold: social and technical strategies. The social component of these adaptation plans includes educating communities about the predicted impacts of climate change and the ramifications that will have on the economic, cultural, social,

and agricultural landscape of that region. Additionally, adaptive plans must work with farmers to create strategies that are financially feasible, effective, and socially responsive (Schimmelpfennig et al. 2000). From a technical perspective, a variety of adaptive techniques have been designed in an attempt to potentially alleviate the impact of decreased precipitation within a region. Some of these techniques are: an increase in water use efficiency on farm (irrigation, processing, and stock water), the use of water conservation technologies, the increased utilization of waste water on farm, operational changes to dams and reservoirs, updating/building irrigation infrastructure, and increasing on-farm and off-farm water storage through reservoirs or storage ponds (Mata, Budhooran 2007). Many of these strategies require significant initial investment, but in cases where the probability for drought will be significantly higher, this investment may prove to be profitable in the long-term (Rosenzweig, Hillel 1998).

The equitable, efficient, and effective management of water resources in regions where water may become scare due to climate change will be an essential component of any adaptation effort. Water resource management must be integrative, looking at different sources of water (groundwater and surface water) for a variety of sectors (industrial, commercial, agricultural, and municipal) (Mata, Budhooran 2007). Integrated water resource management must engage a wide variety of stakeholders in order to create effective adaptive strategies that appreciate diverse community values. The participation of various stakeholders (government, farmer, private sector, and civil society groups) is an essential element of agricultural adaptation to climate change, and specifically in the development of adaptive water storage infrastructure.

Study Area

This study will look at the role of stakeholders in creating water infrastructure that is geared toward adapting to the impacts of climate change within Canterbury, New Zealand. New Zealand is a small island nation in the South Pacific with approximately four million inhabitants. It has a temperate climate with significant regional variation in weather. These regional differences are due to the significant impact of the surrounding ocean and its mountainous terrain. Generally, precipitation in New Zealand falls on a west-east gradient, with more rainfall occurring on the west coast and less in the east (O'Donnell 2007).

Climate change models predict New Zealand will experience an increase in temperature of 0.5-0.7ºC by 2030, and 1.5-2.0ºC by the 2080s (O'Donnell 2007). In addition to this, global circulation models predict that the west-east rainfall gradient will become more distinct, westerly airflows will become stronger, and storminess will increase (IPCC 2007). Overall, the net amount of precipitation within New Zealand is predicted to increase from 4.79 mm annually to 5.03 mm annually (Cline, 2007). The impacts of climate change within New Zealand have already become visible. Glaciated areas have been reduced by 23-32 % in the past century and South Island glacier length has receded by 38% (O'Donnell 2007).

Climate change will have deep and persisting impact on the economy of New Zealand. The economy of New Zealand is dominated by agricultural exports, exporting approximately 22 billion dollars of agricultural and forestry products, representing 65% of New Zealand's total exports (MAF 2007). This heavy economic reliance on agricultural exports makes New Zealand unique among many first world nations. It also makes New Zealand's economy particularly vulnerable to the negative impacts that climate change may have on the agricultural sector. When

assessing the impact of climate change within New Zealand, it is essential to examine impacts regionally due to the climatic and agricultural differences between regions. Canterbury on the east coast of the Southern Island is one of the regions within New Zealand that will be negatively affected by climate change.

Canterbury is home to 10,001 farms and generates 15% of New Zealand agricultural exports (Jenkins 2006, O'Donnell 2007). It is a region that is both economically invaluable to New Zealand and severely dependent on water for agricultural and economic viability. Global circulation models predict that climate change will cause a decrease in summer precipitation, an increase in temperature, and stronger westerly airflows. The intensity and progression of these effects varies according to the global circulation model used for the assessment (O'Donnell 2007). The impact of these changes on agriculture and Canterbrian water resources will be immense. Due to less summer precipitation there will be a greater incidence of drought. There will be decreased water in rivers in late spring and early spring due to reduced snowmelt as a result of higher temperatures. Strong westerly winds, warmer temperatures, and decreased summertime precipitation will cause soil moisture to decrease, damaging crops. Drier conditions in Canterbury will lead to a higher reliance on irrigation, placing further stress on limited ground and surface water resources (Griffiths 1990). Climate models predict that an increase in overall potential evapotranspiration deficit in Canterbury due to climate change in the 2080s will lengthen the irrigation season to longer than twenty-one weeks annually (O'Donnell 2007). Intermediate climate models predict that severe droughts which currently occur once every twenty years will increase in frequency to once every ten or fifteen years (Mulan et al. 2005). Given that the increase in the frequency and intensity of droughts that is the greatest threat to

agriculture in Canterbury, this paper will focus on the development of water infrastructure that attempts to lessen the negative impacts of climate change induced drought in Canterbury.

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Characterization of Canterbury

Geographic Characteristics: Canterbury is the largest region within New Zealand, covering approximately 42,000 km^2. The foothills of the Main Divide represent the western border of Canterbury. These foothills slope down into the relatively flat, fertile glacial outwash that is the Canterbury Plains. Six major alpine rivers bisect the Canterbury Plains carrying snowmelt and precipitation from the Main Divide: the Hurunui, Waimakairi, Waiau, Rakaia, Rangitata, and Waitaki River (Dommisse 2005). Canterbury's water resources also include an underground aquifer system, lowland streams, and a network of smaller foothill-fed rivers such as the Waipara, Ashley, Selwyn, Opuha, Opihi, Orari, Parwora, Waihao, Hurunai, and Hakataramea (O'Donnell 2007) (Figure 1). Canterbury relies on these alpine rivers, aquifers, foothill rivers, and smaller lowland streams to satisfy its water needs.

Figure 1: Canterbury, New Zealand (Christchurch I-Site 2008)

Economic Profile: Canterbury is heavily reliant on the revenue it receives from its land resources. Raw and processed agricultural products account for 70% of Canterbury's total exports. Direct agricultural goods only account for 5% of Canterbury's gross regional product, but the processing and export of these goods plays a substantial role in Canterbury's economy (O'Donnell 2007). Climate change poses a considerable threat to the economy of Canterbury because of its dependency on primary production.

Agricultural Profile: Agriculture in Canterbury is intensive and extensive. Historically, Canterbrian agriculture consisted of dryland sheep and beef farming. However, there has been a significant transition in land use from dryland farming to cropping and dairy systems. This land use change has been due to the falling prices of wool and lamb, and a concurrent increase in dairy prices. This expansion has been rapid with a three-fold increase in dairy farm conversions since 1995. Dairy farming now represents 5.4 % of rural land use in Canterbury (Jenkins 2006). Irrigated arable farming has also been an expanding rural land use, though the rate of growth has slowed since 2001 (Jenkins 2006).

The conversion from dryland farming to dairy and intensive arable systems has come with an explosive growth in irrigation. Canterbury is the most irrigation dependent region in New Zealand with 70% of all irrigated land in the country. Since 1985 there has been a 270% increase in land developed for irrigation (Jenkins 2006). This increasing dependence on irrigation has lead to increased stress on both the surface and groundwater resources of Canterbury. This stress on water resources will only be magnified as the amount of precipitation decreases, westerly winds increase, and temperatures rise due to climate change (O'Donnell, 2007). As the impacts of climate change begin to accelerate and intensify within Canterbury, water will become increasingly valuable within this agricultural economy (Environment

Canterbury 2008). Fortunately, however, the flows of the six major alpine rivers are expected to become more reliable due to climate change. Climate models predict that there will be increased precipitation on the West Coast where the headwaters of these rivers lie, increasing the average flows of these rivers. This increased reliability in alpine river flows is the key to regional agricultural adaptation to climate change within Canterbury. The development of water storage infrastructure within Canterbury that captures and stores water from the major alpine rivers will be crucial if traditional pastoral, dairy, and cropping agricultural systems are to be sustained within this region in the face of climate change.

Water Infrastructure: Within Canterbury, there are 540,000 hectares of land permitted for irrigation and 206,881 hectares presently being irrigated (Jenkins 2006). Water used for irrigation is sourced from groundwater wells and/or run-of-river water schemes. Farmers relying on groundwater for irrigation are largely independent, whereas farmers who are part of run-of-river irrigation schemes are part of a coalition of farmers working in collaboration with the local government to manage their irrigation scheme (Domisse 2005). Independent groundwater irrigation has been the dominant form of irrigation development in recent years. This trend, however, has slowed due to the over-allocation of groundwater from aquifers underlying the Canterbury plains. No more groundwater irrigation development is allowed in these "red zones" (Jenkins 2006). Run-of-river schemes in Canterbury were developed by central government during the early to mid twentieth century. All shares in these schemes have been distributed to local irrigator-famers. The over-allocation of groundwater, coupled with the full subscription of all run-of-river schemes has pushed many irrigator-farmers and local politicians in Canterbury to promote water storage projects.

Water storage can be in the form of on-farm storage ponds, dams, or the augmentation of existing highland lakes (Dark 2008). These projects, however, are expensive, can have a significant impact on the river or lacustrine ecosystem, can eliminate or amplify recreation opportunities, can alter the cultural values of the water body, and negatively or positively affect local communities. This study is focused on the role of stakeholders in creating large-scale adaptive water infrastructure that minimizes the negative environmental, social, and cultural impacts associated with water infrastructure and maximizes the adaptive capability of Canterbury. Large-scale water infrastructure is defined in this study as water infrastructure that has a capacity for reliably irrigating an area over 500 hectares.

Social Characteristics: Canterbury has a rural-based economy with an urban-based population. According to the 1996 census over 85% of Canterbury's population lived in an urban area (New Zealand Census 1996). The largest city in the South Island, Christchurch, is located in Canterbury.

Cultural Characteristics: Within Canterbury there are two distinct cultural traditions: Māori and the descendents of the British settlers. Māori, specifically the Ngāi Tahu tribe, have territorial rights over Canterbury. The Ngāi Tahu have been in New Zealand for approximately 1500 years (Ngāi Tahu 2008). British settlers came to New Zealand in the late eighteenth century. When these settlers claimed New Zealand as a British colony in 1840, the Treaty of Waitangi was developed between the Māori and British settlers. This treaty promised many rights to the Māori, but its interpretation and translation have been a significant issue of contention since its authorship (Hayward 1998).

Political Landscape: Within Canterbury there is an intersection of three levels of government. As an overarching entity, central government has a key role in determining national standards for

natural resources, allocating funds for research and infrastructure development, and providing leadership to regional government. The regional government within Canterbury is known as Environment Canterbury. Environment Canterbury is responsible for the management and regulation of the air, water, land, coastal environments, hazardous waste, nature hazard mitigation, and transportation systems (Environment Canterbury 2009). Environment Canterbury is staffed by a combination of elected district councilors, appointed directors, and field staff. The role of Environment Canterbury is primarily regulatory, enforcing national polices on a regional scale. Lastly, within Canterbury there are ten district councils. These district governments are responsible for managing waste, education, parks, and other local issues. The interaction of these scales of government and their evolution overtime has sculpted the way water infrastructure has or has not been developed in Canterbury.

Research Questions

The primary scholarly questions that this paper addresses are both descriptive and evaluative in nature. These questions are: What is the perceived role of various stakeholders in creating water infrastructure geared toward adapting to the impacts of climate change on agriculture in Canterbury and do these stakeholder relationships retard or facilitate the creation of these strategic, adaptive projects? Through these questions, I am interested in exploring the dynamics that exist between the government (regional and central), farmers (irrigating and dry land), civil society groups (conservationists, recreationalists, and special interest groups), and invested members of the private sector (consultants).

Methodology

I examined the above questions through the collection and analysis of forty-one qualitative interviews with stakeholders throughout Canterbury, New Zealand. I collected these semi-structured interviews from September to December 2008. I generated a list of interview questions that were specific to the four stakeholder groups (see Appendix 1). These classifications were: civil society, private sector/academic, farmer, and government. When interviewees occupied more than one stakeholder position (i.e. a farmer who was a politician), I created a hybridized interview question list that explored the differences and links between the two perspectives. Interviewees were identified through community networking, attendance of the Irrigation New Zealand conference, and review of regional planning documents. A complete list of interviewees and their respective affiliations can be found in Appendix 2.

I analyzed these interviews using a collaborative social research approach. This approach incorporates working with stakeholders in a situation where action is needed, such as the case of agricultural adaptation (Berg 2004). Following collaborative social research methodology I transferred my interviews into text and coded these interview transcriptions according to identified themes. I identified themes by initially coding all transcripts by stakeholder role. For example, within a transcript when an interviewee discussed the perceived role of government, a distinct code (color) was used. This process was replicated for all stakeholder roles across all transcripts. For example, within the transcript of John Greenslade, a Canterbrian farmer would coded as such with green demarcating the role of farmers, pink demarcating the role of government, and blue demarcating the role of the private sector:

> Well it is really hard for the farmer group to get together the money. I think that it should be everyone. I mean the government is going to benefit from it so if they could put money in that would be good and they are going to get it back in taxes

> and overseas exports. You need expertise to know what they are doing, you need to have the farmers to say they want and then maybe you can have the government come in and put a little bit of money up which they will benefit from it as well

Then within each of these stakeholder codes I identified recurring themes and coded the interview transcripts using these stakeholder themes. For government stakeholders, I found three recurring themes: leadership, the Resource Management Act, and rural/urban divide. For civil society group stakeholders, I found two recurring themes: the power of the civil society groups and conflict versus collaboration. For farmer stakeholders, I found two recurring themes: the beneficiary of water infrastructure and the ability of farmers to finance water infrastructure. For private sector stakeholders, I found two recurring themes: science as fact and the adversarial system. I then generated categorical graphs that display how many stakeholders expressed specific opinions about key themes. These graphs can be found in Appendix 3. Using these themes, I looked for relationships, commonalities, differences, and patterns between or among stakeholder groups.

The Political Interface-How Government Influences the Creation of Water Infrastructure

The modern role of government in the creation of water infrastructure is rooted in a powerful historic and legislative context. This historic and political context intimately informs stakeholder perceptions around what is the optimal role of government in the developing, funding, and regulating water infrastructure and why that optimal role is not realized in the modern context. Understanding the role of government in the creation of water infrastructure is critical to understanding how climate change adaptation can be facilitated or prevented from a government perspective. Additionally, an examination how the current role of government in

creating water infrastructure arose is essential in framing what the optimal role of government could be. Within this section, I will elaborate on the historic role of government as well as the core legislation that currently dictates the modern role of central, regional, and district government in the creation of water infrastructure projects geared toward adaptation to climate change in Canterbury. I will then present and elaborate on the themes identified in the stakeholder interviews around the role of government in this process: leadership, the Resource Management Act, and the urban/rural divide.

Background

The Programs and Legislation of Central Government:

Historically, central government was the driving force behind the development and funding of irrigation schemes within Canterbury. The Ministry of Public Works used taxpayer dollars to design and develop water storage infrastructure and irrigation canals (races) throughout New Zealand. The Ministry of Public Works became active in building water infrastructure during 1930s Depression era in order to create jobs, stimulate the economy, and increase the agricultural productivity of the region. Within Canterbury, the Ministry of Public Works constructed the Rangitata Diversion Race (RDR), a 67 km race that runs between the Rangitata and the Rakaia Rivers. The RDR powers two power stations, producing 92 gigawatt hours of electricity during the winter irrigation season. The RDR also supplies water to three community irrigation schemes, providing over five hundred farms with water for stock and irrigation (Hopkinson 1997). This project came at a tremendous cost to central government. In 1996 dollars the RDR cost approximately 78 million dollars NZ, but fifty years later it is estimated that the RDR generates approximately 74 million dollars in economic revenue in the district (Englebrecht 1996). The RDR was the largest water infrastructure project developed by the Ministry of Public

Works, but the Ministry was also responsible for developing the off-farm infrastructure for all community irrigation schemes in Canterbuury with the exception of two more recently developed schemes (Freeman 2004). The Ministry of Public Works was dissolved in 1984 when New Zealand went through a period of deregulation as it transformed into a free-market economy (Jenkins 2006). Since that time the involvement of central government in the development of water infrastructure has been far more limited. Currently, central government supports the development of water infrastructure through a two programs which offer limited funding for research: The Sustainable Farming Fund and the Community Irrigation Fund.

The Sustainable Farming Fund (SFF) provides money for applicants interested in promoting sustainability within a land-based sector. SFF has a specific funding division that reviews projects that attempt to adapt to the negative impacts of climate change. The SFF, however, will only fund feasibility studies for water infrastructure projects, and applicants must pay half of the cost of these feasibility studies (Sustainable Farming Fund 2008). The Community Irrigation Fund (CIF) has the explicit charter of helping "agricultural producers and rural communities adapt to climate change." They promote community irrigation schemes by offering funds for "activities that generate investor and/or community support for community water schemes" (Community Irrigation Fund 2008). SFF funds feasibility studies for irrigation schemes and the CIF funds the community engagement around development plans of the process. Neither the CIF nor the SFF fund the consenting process through the RMA for the proposed scheme or the structural development of water infrastructure.

In addition to these two funding programs, central government issues overarching environmental legislation that offers leadership and basic standards to the regional governments. The most important pieces of legislation that guide local governments around resource use are

the Local Government Act and the Resource Management Act. This act mandates that local government (regional councils) work with their communities to create "community outcomes" with an emphasis on environmental issues (Kelley, Slaney 2006). This act transfers additional responsibility onto local authorities to develop strategic policies around resource use and to work with stakeholders toward community-oriented goals. The Local Government Act delegates water management decisions to the regional government in order to foster the creation of "self-governing communities" (Jenkins 2006). This additional responsibility, however, is not accompanied by additional funding. Local governments within New Zealand only account for approximately 10% of all government spending, whereas in many other countries local governments spend 30-50% of all government spending (Memon, Thomas 2006). The Local Government Act highlights the increasing decentralization of New Zealand government and the key role that local government has in grappling with regional resource issues.

The most significant way in which Environmental Canterbury (the regional government) regulates the use and development of natural resources is through the Resource Management Act. The Resource Management Act (RMA) is the cornerstone of environmental legislation within New Zealand. It was developed in 1991 by the central government. When the RMA was enacted it was heralded as one of the most progressive, holistic pieces of environmental legislation in the world (Freeman 2004). The RMA is a framework by which National Policy Statements, which state the national objectives and standards for natural resources, are translated into regulatory reality. The RMA can be administered on the national, regional, or district level of government, depending on the type of resource involved (Environmental Defense Society 2008). The RMA is considered a tool by which the environmental impacts of any development or resource use projects are assessed. The RMA covers a wide variety of issues such as building a

home, dealing with noise pollution due to a neighbor, or getting a water consent for a new irrigation scheme. Any activity that has an environmental impact must pass through the RMA system. Within this process the applicant must assess all of the effects that their project will have on the environment and avoid, minimize, or mitigate these negative impacts. Before the RMA tribunal grants a resource consent to an applicant, the application is announced to the community. Any community member has the opportunity to submit an objection with the tribunal. All objections submitted are heard in a hearing and the applicant must address the concerns of the objector. If an accord cannot be reached between the RMA tribunal, applicant, and objector(s) then the case is moved onto the Environment Court. Once a case is moved onto the Environment Court, the case is reheard and a decision is made. In rare cases, if a decision is not reached in Environment Court, then the case is heard by the High Court (Ministry for the Environment 2008). All expenses incurred in this process are borne by the applicant. These expenses include the cost of the hearing, the fee of all consultants needed for impact assessments, the payment of lawyers, and the expense of addressing the additional issues brought forth by objectors. The Resource Management Act is an over-arching legislative framework that looks at environmental issues from a variety of perspectives and invites the participation of the community in the process. The RMA, however, does have significant weaknesses that can be seen most clearly through the lens of water consents given for groundwater wells used for providing irrigation water in Canterbury.

The Resource Management Act dictates that water is allocated on a first-come-first served basis. Therefore, water consents are given on the basis of when they were filed, not on the effectiveness or efficiency of the water use. The RMA establishes limits and manages on-property impacts, but it does not encourage best practices. Additionally, cases are heard

individually and not in the broad context of resource availability; when the impacts of a development project are assessed in a tribunal the cumulative impact is not accounted for (Jenkins 2006). Groundwater is a finite resource, but under the RMA, a groundwater consent is not considered in the context of all the other water consents already in place. The shortsighted nature of the RMA has significant impacts on the broad, long-term management of water resources in Canterbury. The RMA is also a slow, costly, and bureaucratic process that stands as a significant obstacle to groups with limited financial and human resources. Additionally, the role of private specialists in the resource consenting process leads to a system of adversarial science, to the detriment of the community and the environment (Jenkins 2006). I will elaborate on the role of adversarial science and the private sector in the creation of water infrastructure projects in Canterbury later in this paper.

The Strategic and Regulatory Role of Environment Canterbury: Environment Canterbury, above all else, is the regulatory authority of Canterbury. As the primary administrator of the Resource Management Act, Environment Canterbury is responsible for issuing water consents and monitoring existing consents. Additionally Environment Canterbury must have the scientific expertise to know the state of the resource (available water), establish environmental flows (the water flow that must remain in the channel in order to sustain ecosystem values), and monitor water quality (Jenkins 2006). Its role is immensely important in regulating water use in Canterbury.

In addition to this regulatory role, Environment Canterbury is responsible for the creation and implementation of Regional Policy Statements and the Canterbury Strategic Water Study. Environment Canterbury designs Regional Policy Statements that operate as resource management practices within Canterbury. These statements address water quality and quantity

as well as a wide range of other resources. The Regional Policy Statements are subordinate to the National Policy Statements. Environment Canterbury modifies Regional Policy Statements as National Policy Statements change. Just like National Policy Statements, Regional Policy Statements are only made meaningful through the RMA process.

The main strategic document created by Environment Canterbury pertaining to the development of water infrastructure as a means to adapt to climate change is the Canterbury Strategic Water Study. The Canterbury Strategic Water Study is a four stage study in which the water resources of Canterbury are quantified, the current and future demand (largely for irrigation) is estimated, water storage options are explored, and extensive stakeholder meeting around water storage are held. Currently, the study is in its fourth stage. The need for additional water storage has been identified, possible locations have been researched, and now stakeholder perceptions are being evaluated. The Canterbury Strategic Water Study is part of a larger Proposed Natural Resource Regional Plan, but it has been taken on by an independent taskforce due its significance to the livelihood of Canterbury (Canterbury Water Management Strategy 2008).

The Role of District Government-The RMA and The Mayoral Forum: District governments are responsible for administering the Resource Management Act for development that affects the district alone. In the context of water infrastructure development, the water for the infrastructure project is consented by the Environment Canterbury, but the actual building of the infrastructure would be consented through the district government.

District governments do not generally have a role in natural resource strategic planning within New Zealand. However, mayors from the ten districts of Canterbury have come together to form the Mayoral Forum. The Mayoral Forum is the major funding and political force behind

the Canterbury Strategic Water Study. The collaboration between Environment Canterbury and the Mayoral Forum reflects the significance of water resources to the people and economy of Canterbury, and the extent to which that resource is viewed as scarce and vulnerable to climate change.

Findings

In relation to the role of government in the development of water infrastructure projects that are geared toward adapting to the impacts of climate change within Canterbury, I identified three major themes that were present across interviews and across stakeholder groups. These themes were the leadership obligation of government, the Resource Management Act, and the urban/rural divide.

Leadership:

The role of central, regional, and district government as developers of water infrastructure projects is a deeply contentious issue among stakeholder groups. The perceptions around government involvement are temporally distinct. Perceptions around the past involvement of government are distinct from perceptions of the current role of government entities, and these in turn, are different than perceptions of the optimal or future role of government in the development of water infrastructure that attempts to adapt to the impacts of climate change. The historic role of government was viewed differently among farmer stakeholders. Farmers who benefited from the projects of the Ministry of Public Works felt positively about the historic role of government. All stakeholders groups universally expressed a negative perception of the current leadership role of central, regional, and district government (Figure G1). The stakeholder perception of what the optimal role for government should be was

divided between pro-water infrastructure development stakeholders and the less development oriented stakeholders.

Historically, central government was the key promoter and investor in water infrastructure development. Graeme Robertson, an irrigator-farmer described his perception of the Ministry of Public Works, "The Ministry of Works …were just a whole bunch of kids that just liked tinkering around with big irrigation projects. And the government philosophy in those days was that that was good." Many irrigated farmers continue to profit from the infrastructure that was put in by Ministry of Public Works. Rod Thompson, an irrigator-farmer in North Canterbury asserted that, "I have to say that any luck that I have had in farming is due to good luck and government subsidies." All farmer stakeholders do not share this positive perception of the historic role of Ministry of Public Works. Phil McKendry, an irrigator-farmer with an independent groundwater well, explained the negative perception of the Ministry of Public Works held by many stakeholders, "The days of the Ministry of Public Works are still imprinted on people's minds because we built huge pieces of infrastructure that nobody needed and nearly sent the country broke." The Ministry of Public Works led rural development projects, but with taxpayer funds, which they overspent. Direct beneficiaries of Ministry of Public Works projects (irrigator-farmers on run-of-river schemes) were the only stakeholder group that expressed universally positive views around the historic role of central government. There are divergent perceptions among farmer stakeholders around the work of Ministry of Public Works, but perceptions of farmer, civil society, private sector and government stakeholders around the modern role of government were far more aligned.

The dismantling of the Ministry of Public Works not only marked the end of government funding and development of water infrastructure, but also the end of governmental leadership

around strategic water resource planning at the central, regional, and district level. This void is only now beginning to be addressed twenty years later. Government officials interviewed at the regional and national level asserted their statutory responsibility. Murray Doak, a policy analyst with the Ministry of Agriculture and Forest noted, "Government's role is just to administer the act. By and large, it has all devolved to regional government." Central government informs water policy with large overarching legislation that is administered at the regional scale. The effectiveness of these policies is commented on by John Greer, a senior analyst with Ministry of Agriculture and Forest, "The thing about the central government policies, yeah they are grand policies but when you start to look at the effect that they will have on the ground and how much traction they will have, it's not much." These central government officials emphasize how the current institutional arrangement places both the regulatory and strategic responsibilities on the regional governmental level. Bryan Jenkins, the chief executive of Environment Canterbury explained the rationale for this regional leadership:

> The government's role is very much a regulatory role. Which means that any government sort of strategic work or infrastructure development work was all particularly diminished, and certainly the way that regional councils were set up in the water role was really to define the rules for determining the adverse effects of privately initiated development…If you are going to deliver on sustainability it has to be on the regional level where there is some coherence between the economic, social, and environmental boundaries.

As highlighted by Bryan Jenkins, Environment Canterbury has been charged with both regulatory and strategic roles around water resources, but regulatory responsibilities have superseded strategic responsibilities.

Across government farmer, civil society group, private sector, and government stakeholder groups, there was a negative perception of the lack of regional leadership in the area of strategic water resource management. Among farmers, both irrigating and non-irrigating,

frustration was a universal theme (Figure G1). Chris Dennison, the chairman of a community irrigation scheme expressed this view, "We have had problems and looked to ECan (the regional authority) for some leadership and they say, 'Oh no no no we can't do that!'" Phil McKendry, an irrigator-farmer commented on similar frustrations with the regional authority, "The way the whole regulatory environment has evolved, there has been twenty years of ad-hoc development of water resources and only now is Canterbury Regional Council getting ready to take a planning role." Numerous stakeholders stated that the lack of leadership from Environment Canterbury has had negative impacts on water resources, the environment, and the economy of Canterbury. Ben Curry, the CEO of the Rangitata Diversion Race noted, "I think part of the problem certainly in this area here is that…the regulatory authority has issued out resource consents pretty freely for the last 20 or 30 years and now they are like 'Oh shit. We have might have an ecological, environment issue." This frustration was expressed across the private sector, civil society groups, and farmers. Among interviewees there was a universal perception that the current role of regional and central government in the development of water infrastructure and water resource strategies was not constructive. However, stakeholder perceptions about the optimal role of regional and local government in this arena were widely divergent within and across stakeholder groups.

Most stakeholders discussed the potential role for government leadership in terms of governmental funding of the development of water infrastructure. Stakeholders associated with aspirant water infrastructure projects (farmers and pro-irrigation civil society groups) felt that government has a larger role in funding and developing infrastructure. Terry Heiler, the chairman of Irrigation New Zealand stated that, "The future of Canterbury has got to come from a leadership by government at all levels, that we need to do these things (water storage projects)

and we need to do them now and we need to invest in them now." John McCaskey, an irrigator-farmer commented on the role of government in funding water development, "I think that it is critical. It has got to finance it." Stakeholders who felt that there should be governmental leadership in the development of infrastructure often justified that belief on the grounds that the development of infrastructure benefited the community and country. Malcolm Miller, a regional planner with Environment Canterbury stated, "The ones (water infrastructure projects)…serving a community use could have central government contributing to the cost of it." Pat Morrison, an irrigator-farmer expressed similar views, "The government, yes if it is of national importance, it should be government (funded)." A number of private sector and farmer stakeholders supported a moderate funding role for government. Bob Englebrecht, an agricultural consultant commented that, "It should be a combination of central government and perhaps regional government with farmers making contributions as well." Some farmer stakeholders felt that government did not need to take a funding role. Ian McKenzie, chair of the Ashburton Water Trust said, "The role of government is to allow us to do this stuff. I don't know if they necessarily need to fund us." Rod Thompson, an irrigator-farmer commented that, "You are flogging a dead horse. We're never going to get money out of the government for this." Government stakeholders generally avoided asserting what the role of government should be, but rather, emphasized what role the central and regional government currently have and the uncertainty of government's future role in funding water infrastructure projects.

In summary, stakeholder perceptions around the role of government leadership in water resource planning and water infrastructure development are distinct across past, present, and optimal roles. Farmer, government, civil society, and private sector stakeholders universally felt that the current role of government in these processes was sub-optimal, but the views of these

stakeholders about what was the optimal role was divided between pro-water infrastructure development stakeholders and the less development oriented stakeholders.

The Resource Management Act:

The Resource Management Act (RMA) is an overarching piece of legislation that directly affects the development of water infrastructure within Canterbury. Stakeholder perceptions around the RMA are deeply connected to their views about the role of government in developing water infrastructure in Canterbury because the RMA is the way in which central, regional, and district government directly affect the development of these projects currently. The RMA is a contentious issue between stakeholder groups, and represents one of the main areas of conflict within the debate of what is role of various stakeholders in the development of water infrastructure within Canterbury.

The divergent opinions surrounding the RMA are centered on the distinction between the limitations of the RMA as a piece of legislation and the deficiencies of the body administering the RMA. The key limitations of the RMA, as expressed by various stakeholders, are that the RMA is not strategic, too costly, too restrictive, too inclusive, and too general.

The RMA is not a strategic piece of legislation. Bryan Jenkins, the CEO of Environment Canterbury elaborated on this limitation:

> If you only did work under the RMA then your chances at getting community outcomes that are sustainable are limited…We do have some challenges with the RMA in that it is too legalistic, based on probative evidence approaches instead of precautionary environmental management approaches, and it doesn't do well with cumulative effects. And to be fair to the legislation it was written in the late 1980s when those effects (water resource over-allocation) weren't problems in Canterbury.

The inability of the RMA to facilitate strategic, sustainable development is a perception expressed across stakeholder groups. Chris Todd, the South Island Field Officer of Forest & Bird

commented, “We (Forest & Bird) have some reservations, but we do think that it is important to be strategic because the whole system of first-come, first-served can lead to some pretty bad decision-making.” The inability of the RMA to produce strategic water resource outcomes is viewed negatively across stakeholder groups.

The RMA is a process that requires applicants to hire lawyers and consultants in order to assess the effects of the proposed development. Bob Englebrecht, an agricultural consultant, elaborated on this process, “The money is being spent on lawyers and experts when it is preventing things that could be useful to the community from happening. So we have got to change, not necessarily the RMA, but try to get it to be much more effective.” The amount of money spent on renewing or applying for new water consents and development projects was universally acknowledged as being excessive across stakeholders, though it was emphasized by stakeholders who were applicants within the RMA systems such as farmers and irrigation scheme promoters. Jane West, an irrigator farmer expressed how great the cost of the RMA process can be, “So far we have spent 48,000 dollars and I still don’t have a water right and that doesn’t include lawyers fees. And that is just a carryover of what we had before. And that is just to get the right to just keep doing what we did before.” The costly nature of the RMA is a significant limitation of this process.

Stakeholder groups that tend to be pro-water infrastructure development (farmers, agricultural civil society groups) generally assert that the RMA is too restrictive. Rob Gould, a dry land farmer stated, “It (RMA) is very restricting. It is hard to build new irrigation, building dams, or building ponds. We can only move a few specks of dirt without a resource consent.” Stakeholders who feel that water infrastructure is not always beneficial, however, do not share this view. Chris Todd, the South Island Field Office of Forest & Bird presented a different

perspective, “1% of things gets turned down (by the RMA). So for the developers it is pretty effective.” This perception of the RMA facilitating or retarding the development of water infrastructure is one key area of difference between stakeholder groups who value development versus stakeholder groups who prioritize environmental values.

Another limitation of the RMA that is viewed differently by different stakeholder groups is the assertion that the RMA is too inclusive. The RMA process is open to the community. Therefore, all community members are welcomed to object or comment on development proposals. Ross Little, a councilor with Environment Canterbury commented on this aspect of the RMA, “The RMA is set up to be very inclusive, so everyone can have a say…regardless if they know anything…but the trouble is that those parties can then become part of the process and cause the applicants, at times, undue costs, huge costs…There are a lot of resources being spent around having a democratic process or an inclusive process.” Stakeholders who tend to be applicants in the RMA process assert that inclusion is positive, but it can be negative when it is cause excessive costs and delays. Graeme Robertson, an irrigator-farmer stated, “The system is open to abuse…For example, if someone has a genuine gripe, you can’t charge them $100,000 an objection because that might be the cost of it… It does appear that the process is too easily subverted or diverted.” Stakeholder groups that tend to be objectors to development projects such as Forest & Bird and Fish & Game view the inclusive nature of the RMA positively. This relationship will be elaborated on in the civil society interface section.

The last limitation of the RMA as a piece of legislation that is broadly mentioned across stakeholders is the blanket use of the RMA act. All development projects, from the building of a house to the construction of a small water-harvesting pond to the development of a multi-million dollar dam, are all subject to the same consenting procedure. Among farmer stakeholders, the

RMA is a viewed as too costly and troublesome for small water infrastructure development. Belinda Gould, an irrigator-farmer discussed her experience with applying for a consent for a small water harvesting pond, "We still have to go through exactly the same resource consent as someone who is pumping thousands of liters straight out of the ground. In fact, even more, because people like Fish & Game want to get involved because they want to count the fish (in our small water harvesting pond). They found one goldfish that my little girl put in there a year ago." Among most farmer stakeholders, the RMA is viewed as being overly difficult and costly. Among stakeholders who support the consenting of large water infrastructure development projects the same perception is felt. Derek Crombie, a development consultant commented on this, "The RMA doesn't differentiate between someone who wants to put down a bore hole in their backyard and this project (a large proposed infrastructure project called Central Plains Water). The approach is more or less the same for both. By its nature and by the legislation is doesn't fit well and I think to be fair, a project like Central Plains is outside what the RMA has really been able to cope with." The RMA is viewed as being overly general and ill-suited to either scale of development.

Beyond the limitations of the RMA as a legislative document stakeholders asserted that the way in which the RMA was administered by the regional and district governments was another significant constraint. Pro-water infrastructure development stakeholders generally viewed the administration of the RMA as too biased toward environmental values (Figure G2). Chris Bolderston, a irrigator-farmer stated this perception, "The RMA is a central government document that is implemented and regulated by regional governments who put their own bloody spins on things depending on what color suit the joker wears who is implementing the roles." Jay Graybill, the Chief Executive of the South Island branch of Fish & Game expressed a very

different view of implementation bias, "I have to say I think, unfortunately, that there was a mentality within the councilors (who administer the RMA) not to stand in the way of development in terms of making use of our water." The perceived implementation bias of the administering governmental body once again reflects the perspective of the stakeholder around the development of water infrastructure development. In summary, the RMA process is perceived to have significant limitations across stakeholder groups, though the perception of what those limitations are differs depending on the stakeholder's opinion of water infrastructure development.

Rural/ Urban Divide:

A theme that was present across interviews was the division between rural and urban populations. Among all the themes identified in this study the relationship between urban and rural communities was the most contentious. This theme relates to the role of stakeholders in developing water infrastructure because of the power of urban populations in selecting political officials, as well as their ability to object to development proposals through the RMA process. This study was rural-centric, with the vast majority of interviewees residing in rural communities, therefore a full analysis of this theme is not possible. From a rural perspective, frustrations with the urban population are focused around two main areas of contention: the voting power of the urban populace and the perception of agriculture held by urban communities.

The vast majority of Canterbury residents live within the urban centers. It is in these cities that the most votes are cast, the most Environment Canterbury councilors are appointed, and campaigning for central government elections is focused. Among farmers, Environment Canterbury is viewed as being dominated by its urban constituents. Chris Dennison, an irrigator-farmer and chairman of a community irrigation scheme explained this perspective:

> So ECan tends to be very urban-centric and that is because of the nature of the district where most of the rate payers are living in Christchurch. And so their elected representatives are living Christchurch and so their interests are city based…Most of the issues that the regional council deals with are rural based…It is quite an ironic situation that those who have the least to do with the resources have the most to do with them.

This farmer perception is also extended to central government. Phil McKendry, and irrigator-farmer elaborated on this relationship, "There are 50,000 votes in Auckland to be lost if the government is viewed as helping farmers rape the rivers, which we don't, but that will be the headline. There are only a couple hundred votes coming from here (rural Canterbury)." This perception was held universally among farmer stakeholders. Government stakeholders who were interviewed confirmed that this perception by the rural community was common, but often expressed that they felt this perception was misguided (Figure G3).

This negative perception held by farmer and rural stakeholders extends beyond the power of urban populations at the polls, but also to the perceptions of the urban community around Canterbury agriculture. Among farmer stakeholders it was commonly asserted that urban populations has been misled by media and anti-agriculture campaigns funded by Fish & Game, a major recreational lobbying group. Ian McKenzie, the chair of the Ashburton Water Trust expressed this perception:

> The people of Christchurch have been poisoned against farming…The dairy industry, despite being the only industry which has kept the economic development in this country going for the last three years has been the brunt of some pretty nasty attacks by politicians and people from the city, driving their Mercedes to drop off their precious little kids off, thinking, 'Oh yeah I am going to vote green because they are going to hunt dairy farmers who are the guys doing all the damage to the environment and emitting all the carbon.' Well that is a joke isn't it?

This rural/urban division has been growing as a result of these types of "attacks" and the rural reaction to this negative publicity. Terry Heiler, the chairman of Irrigation New Zealand, elaborated on this division:

> There is a disconnect, a growing disconnect between metropolitan Christchurch and the hinterland…They are more tribal, rural tribal, urban tribal**…**A lot of farmers do not like going to town and getting bam-blasted by their urban cousins for being spoilers of the environment, because of what they read in the paper. There is a lot of misinformation around. So it is unhappy times. It is like a family squabble really.

This urban/rural tension has significantly influenced the development of water infrastructure geared toward adapting to the impacts of climate change within Canterbury. This growing divide manifests in the polarization of rural and urban communities around water infrastructure development, which is a process that requires collaboration.

In summary of the political interface, the perceptions of the role of central, regional, and district government in the development of water infrastructure in Canterbury are spilt across discussions of its past role, present role, and optimal role in leading water infrastructure development and management of water resources. All stakeholders viewed the current role of government in the creation of water infrastructure and water management as ineffective and suboptimal. This perception was most commonly expressed in terms of the limitations of the Resource Management Act and the government body that administers the act. Lastly, rural stakeholders such as farmers, rurally based civil society groups, governmental officials, and private sector stakeholders emphasized the division between urban and rural perceptions around water infrastructure development and how that disparity informs government policy around water resources.

The Civil Society Interface-How Civil Society Groups Influence the Creation of Infrastructure

Civil society groups represent a diverse range of interests and perspectives around water resources and water infrastructure development with Canterbury. These stakeholders play a key role in promoting or preventing the creation of water infrastructure geared toward adapting to the impacts of climate change. In this section I will introduce the key civil society groups in Canterbury that actively influence water infrastructure development. I will then present and elaborate on the themes identified in the stakeholder interviews around the role of civil society groups in this process: the power of civil society groups and collaboration versus conflict. I will explore these themes in the context of Central Plains Water, an aspirant water storage infrastructure project in Canterbury.

Background

The civil society groups of Canterbury can be classified into five categories: conservationist, recreationist, Māori, agricultural, and commercial. In this section I will introduce the key groups in each area.

Conservationist: There are numerous conservation groups within Canterbury. Many groups are small and focused on a specific environmental issue. In the context of water resources there are numerous groups passionate about preserving a specific body of water such as the "Save the Waitaki River" Society. For this project, however, I focused on large conservation groups that were invested in conservation efforts across Canterbury. The main conservation group I identified was Forest & Bird. This civil society group has over 40,000 members across New Zealand, and has an established division focusing on issues within Canterbury. Forest & Bird

generally seeks to preserve native biodiversity in New Zealand, but its specific focus shifts as the interests and concerns of its members evolve (Forest & Bird 2008).

Recreationist: There are two primary recreational groups within Canterbury: Fish & Game and the New Zealand Recreational Canoeing Association. Fish & Game is an organization with a statutory mandate to protect freshwater sports fish and game birds. It receives its funding through hunting and fishing licenses (Fish & Game 2008). It is an extremely important player in the development of water infrastructure projects within Canterbury, and is a common objector within the RMA process. Fish & Game is traditionally viewed as an anti-agriculture group due to its use of negative media campaigns targeting the dairy industry. New Zealand Recreational Canoeing Association (NZRCA) is an organization that seeks to protect the whitewater resources of New Zealand for recreational purposes. NZCRA members are largely urban-based and vehement objectors to water infrastructure development.

Māori: Ngāi Tahu has two branches that actively participate in halting or promoting the development of water infrastructure development within Canterbury. There is a cultural branch, which looks after the intrinsic value of natural resources. Māori believe that all natural resource and human beings carry life force (mauri). The degradation of the environment is a degradation of mauri. This strong spiritual connection to water deeply informs the perspective of Māori stakeholders around water infrastructure development.

The other relevant branch of Ngāi Tahu is the commercial branch. This part of the organization focuses on the profit-generating aspects of Māori holdings as dictated by the Treaty of Waitangi. The second article of the Treaty of Waitangi gives the Ngāi Tahu a legal right to water resources in Canterbury. In this article the English text states, “The Queen guaranteed to Māori the undisturbed possession of their properties, including their lands, forests, and fisheries,

for as long as they wished to retain them" (Ngāi Tahu 2009). The Ngāi Tahu have used the ownership rights given to them in the Treaty of Waitangi as grounds for preventing water development projects which they feel threaten the mauri of that water source. Additionally, Ngāi Tahu has used their legal priority over water resources to advocate for irrigation schemes specifically for Ngāi Tahu owned farming enterprises.

During my fieldwork I was unable to interview Ngāi Tahu representatives from either branch. Their participation, however, is crucial in the creation of collaborative multi-user water infrastructure.

Agricultural: Irrigation New Zealand and Federated Farmers are the two leading civil society groups committed to advancing the interests of rural communities across Canterbury. Irrigation New Zealand (IRNZ) works toward the development and implementation of efficient irrigation throughout New Zealand. IRNZ works in the policy arena as well as at the farm level of the farm. Farmer and corporate members of IRNZ buy shares in the organization and IRNZ advocates on their behalf (Irrigation New Zealand 2008). Federated Farmers is the leading rural-sector lobbying group within New Zealand. It is a highly organized group with regional and industry divisions. Federated Farmers is owned by its members and works in the government as well as in communities to promote sustainability and productivity in New Zealand agriculture (Federated Farmers 2008).

In addition to these agricultural advocacy groups there are a number of sectoral research groups that are funded through a compulsory levy on farmers within their sector. These groups include: Foundation for Arable Research, DairyNZ, and Meat and Wool. These research groups conduct research relevant to their focus sector and provide resources to their constituent farmers.

Every seven years farmers vote to decide whether to continue funding these research institutes (Craigie 2008).

Commercial: Commercial groups are distinct from agricultural civil society groups in that their interest is in water infrastructure that provides revenue independent of its application in irrigated agriculture. Within Canterbury, electricity companies are the largest for-profit commercial interests that affect the development of water infrastructure. Meridian and Trust Power, the two largest stakeholder electricity companies in Canterbury often work in collaboration with irrigation scheme developers to make dual-purpose schemes. Conversely, however, Trust and Meridian Power both will object to new infrastructure development or contest existing water consents if they view these projects as threatening existing hydroelectric generation or preventing new hydroelectric projects. Within this study I was unable to interview a representative in any commercial civil society group.

These civil society groups all play a critical role in the determining how Canterbury adapts to climate change. They do this through objecting, promoting, or working collaboratively for the development of water infrastructure that is geared toward adapting to the impacts of climate change on Canterbury.

Findings

Within this study I identified two major themes surrounding the role of civil society groups in the development of water infrastructure projects geared toward adapting to the impacts of climate change. These themes are the power of civil society groups in this process and collaboration versus conflict. I will explore these themes through the lens of the Central Plains Enhancement Scheme.

Central Plains Water:

The Central Plains Enhancement scheme, commonly called Central Plains Water, was initiated in 2000 by the Christchurch City Council and the Selwyn District Council. These government entities funded the initial feasibility studies. The objectives of Central Plains Water (CPW) are seven fold:

1) provide a reliable irrigation supply, even during droughts
2) meet the irrigation needs of farmers within the scheme area for the next 100 years
3) bring balance back to the groundwater system
4) provide security against climate change
5) promote the most efficient, economic and environmentally sensitive farming practices
6) future proof the region's economic base
7) enhance the region's ecological and recreational resources (CPW 2007)

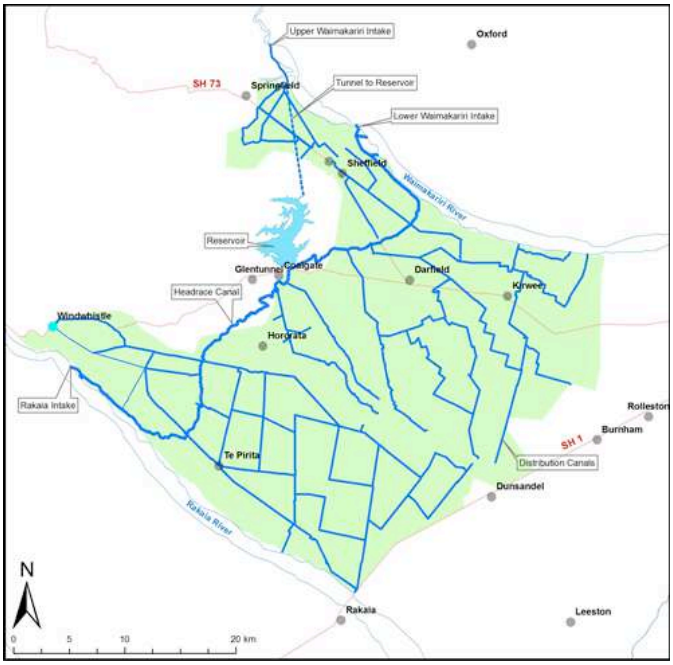


Figure 2: Proposed Central Plains Enhancement Scheme (CPW 2007)

The Central Plains Water project has an estimated construction cost of $409 million dollars and includes extracting of water from two major alpine rivers (Rakaia and Waimakariri River). That water will then be stored in a large reservoir and delivered to farms via an extensive network of canals and irrigation channels. CPW, if developed, would provide reliable irrigation water to over 60,000 hectares of agricultural land (Figure 2). After the initial feasibility studies of this

project the Christchurch City Council and the Selwyn District Council handed over the management of CPW to a board of directors. Pat Morrison, the current chair of the CPW board explains this transfer of scheme leadership, "They found that some people were opposed to it. So being good politicians…they got scared about being involved and so they set up a trust and two councils." The CPW scheme has been an aspiring water storage infrastructure project for nearly ten years. In that time the board of CPW has spent over ten million dollars on the RMA process. These ten million dollars have come from substantial donations from farmers as well as loans taken out by the board of CPW.

The Power of Civil Society Groups

The underlying reason for the inability of CPW to get through the consenting process is that, in the words of senior Ministry of Agriculture and Forest policy analyst John Greer, "it lost track of stakeholders and became seen as farmer driven." When the board of CPW submitted their application for a water consent under the RMA process the regional council received over 1500 objections from the community. Civil society groups lodged the majority of these objections. In the most extreme case, Sinlait, a commercial group, as well as Ngāi Tahu took the board of CPW to high court in order to secure priority over water from the Rakaia and Waimakariri River. The role of civil society groups in promoting and preventing the development of Central Plains Water reflects the power of civil society groups in this process.

Recreational, conservationist, agricultural, commercial, and Māori civil society groups all play a pivotal role in determining where, if, and how water infrastructure is developed within Canterbury. Across stakeholder groups individuals asserted how getting the input of civil society groups which represent interests across the spectrum is essential in water infrastructure development projects. CPW has struggled in the process of consenting because, as John Wright,

the chairman of an irrigation company expressed it, “Central Plains told people what they were doing. It did not engage them.” The involvement of key stakeholder groups such as Fish & Game, Ngāi Tahu, and Forest & Bird are crucial elements of any water infrastructure scheme. Angus McKay, a councilor with Environment Canterbury elaborated on this perspective, “There are two ways to push water infrastructure development forward. One is to hire all the consultants and lawyers with a bucket load of money and the other way is to work through the issues with the community.” Stakeholders universally asserted the power of civil society groups in the promotion or prevention of water infrastructure development, but perspectives around this power being a positive or negative influence was highly contentious among stakeholders. Farmer and pro-irrigation civil society groups negatively depicted the influence of civil society groups (specifically recreational, commercial, and conservation civil society groups) on the creation of water infrastructure projects. Conservation and recreational civil society groups depicted their power and influence in the development of water infrastructure positively (Figure CS1).

Conflict versus Collaboration

Civil society groups are universally regarded as an essential element in the process of developing water infrastructure. However, farmers, civil society groups (recreational, conservationist, and agricultural), consultants, and government officials universally emphasized that civil society groups have been collaborative as well as uncompromising in the creation of water infrastructure. Their role, as being collaborative versus combative depends on the proposed project and involved parties. In the case of CPW, the relationship between recreational, conservationist, commercial, and cultural civil society groups and agricultural interest groups has been antagonistic. Derek Crombie, the project manager for CPW described the process CPW has gone through in attempting to achieve collaboration, “If we could get consensus with interest

groups we would. We have had close to a thousand one-on-one or group meetings to try and reach consensus." From the perspective of one of those opposing civil groups, Fish & Game, Jay Graybill explained their perception of the process CPW has employed, "Our usual experience with irrigation companies (CPW) is they say lets work together on this and what we have come to learn is, let's work together on this is code for you give us the water that we want and whatever is left can stay in the river. Well I don't call that working together." These perspectives reflect the conflict that is present between these stakeholders. Ben Curry, the CEO of the Rangitata Diversion Race, commented on the underlying tension that exists between conflicting civil society groups:

> Water is not just…a commercial tool, it is not like oil for example…it has got huge recreational, cultural, ecological values. It is not just farmers who are interested in water. Everyone is interested in water. People who want to swim in rivers, people who want to fish in the rivers, people who want the water for spiritual, cultural values. And all those aspects must somehow be molded into some national policy and we have not had. And curing world hunger is easier to be honest with you.

Despite the different perceptions held by civil society groups around the value of water, many stakeholders still expressed a belief that collaboration is possible (Figure CS2). Lionel Hume, a policy analyst with Federated Farmers expressed the possibility of collaboration in this process, "There is conflicting interests but my feeling is if we are smart and get on the providing more water storage track, we can keep irrigating and keep water in rivers to provide for biodiversity requirements." This perspective was very prevalent among pro-water development civil society groups. Tom Henderson, an irrigator-farmer and the chairman of the Opihi Augmentation Society, described how important getting total civil society group collaboration in the creation of the Opuha Dam, the only privately developed dam in New Zealand was, "One of the first challenges was to simply convince the whole community that this would be a hell of a good idea.

That was always one of the biggest hurdles. All sections of society came to realize that this is something that if it was done right, would be good for everyone." Civil society group representatives, with the exception of conservation groups, expressed the belief that collaboration could lead to mutual gain. Conservation civil society groups largely asserted that water infrastructure development was detrimental to native flora and fauna, and therefore mutual gain was not a foreseeable outcome.

Central Plains Water, after nearly ten years and ten million dollars invested in the consenting process, will most likely never be built. The difficulties experienced by this project are the result of the inability of the board of CPW to engage and collaborate with civil society groups. This case study reflects the power of civil society groups in promoting or preventing the development of water infrastructure projects within Canterbury. In moving beyond the CPW case study and toward collaborative water infrastructure development, stakeholders, with the exception of conservationists, expressed that stakeholder collaboration toward mutual gain is possible and desirable in the creation of adaptive water infrastructure in Canterbury.

The Farmers Interface-How Farming Communities Influence the Creation of Water Infrastructure

Farmers play a key role in the creation of water infrastructure in Canterbury. They have been the main promoters of water storage infrastructure development since the deregulation of the government in the late 1980's. The ability of farmers to develop water infrastructure is limited due to the financial structures and legislative system in place in Canterbury. In this section, I will briefly describe how community irrigation schemes are managed currently as well as the limitations that face farmers interested in developing in water infrastructure. I will then introduce and elaborate on the themes identified in the stakeholder interviews around the role of

farmers in the process of water infrastructure development: the beneficiary of water infrastructure and the ability of farmers to finance water infrastructure. These themes will be explored through a discussion of the Opuha Dam, the only privately developed water storage infrastructure project in Canterbury.

Background

When the Ministry of Public Works was dismantled in 1984, all of the irrigation schemes that it had been built and managed were sold for one dollar to the farmers who used the water from that scheme. Small non-profit irrigation companies now manage the community irrigation schemes that were acquired by the farmers. All farmers pay for water from the scheme per irrigated hectare. The irrigation scheme company interfaces with Environment Canterbury, maintains off-farm irrigation structures, and bills farmers for the water they use. Farmers are responsible for the annual per-hectare fee as well as all on-farm costs of irrigation development.

Farmers have driven all water infrastructure projects that have been proposed since the deregulation of the government. However, due to the tremendous capital costs associated with these projects, as well as the political and social constraints inherent in these projects, only one water infrastructure project has been developed in the last twenty years.

Findings

Within this study I identified two major themes pertaining to the role of farmers in developing water infrastructure that is geared toward adapting to the effects of climate change in Canterbury: the beneficiary of water infrastructure and the ability of farmers to finance water infrastructure. I will explore these themes through the case study of the Opuha Dam, the only water storage project that has been developed privately within Canterbury.

The Opuha Dam

The Opuha Dam was built in 1999 and was a landmark project in New Zealand. It was the first water storage structure built by the private sector and it incorporated electricity generation, a fish hatchery, and irrigation water storage. The Opuha Dam is located in South Canterbury and irrigates over 10,000 hectares. Alan Hubbard, one of New Zealand's wealthiest businessmen, as well as a small number of community investors financed the construction of the Opuha Dam. The regional government also provided one million dollars in order to ensure that the dam was built large enough to accommodate additional water in order to maintain environment flows within the Opihi River. The financiers of the Opuha Dam paid 250 dollars a share. Since 2005, when the investors sold all shares to irrigator-farmers, the value of these shares has risen to 1500 dollars a share. A study conducted in 2006 found that the Opuha Dam provided an additional 41 million dollars to regional gross domestic product and had created 480 jobs. This study also found that there were more salmon and trout (non-native game fish) within the river due to a decreased frequency of mouth closures in the Opihi River due to low flows (Aoraki Development Trust 2006). The Opuha Dam has had a negative impact on the native flora of the river corridor (Todd 2008).

Many of the government, civil society group, farmer, and private sector stakeholders interviewed believed that the Opuha Dam exemplified what was possible with community-driven, privately funded water infrastructure development. Tom Henderson, the head of the Opihi Augmentation Society comments how the Opuha Dam worked toward a community outcome:

> We had a representative of every group that you could think of that has an interest in water or the environment…We had to get the support of everyone so when we put in an application we didn't get any objections…When that group represented the whole community, they had had a say all the way. They were more than ready to support it when it came time to get a consent, everyone was totally supportive.

The creation of the Opuha Dam was made possible by a community process but also by a series of special circumstances such as the willingness of a wealthy benefactor to invest heavily in a risky venture. Many of the same stakeholders who asserted that the Opuha Dam was emblematic of what was possible with community water infrastructure development also acknowledged that it was unique and not easily reproducible. The Opuha Dam, as a case study, highlights some of the key issues facing farmers interested in developing water infrastructure.

Beneficiary

One of the key reasons that the Opihi Augmentation Society was successful in constructing the Opuha Dam was that there was a community perception that the Opuha Dam was a multi-user dam. Traditionally, communities view water infrastructure as only benefiting irrigator-farmers. The Opuha Dam challenged that perspective by engaging the community, involving a diverse suite of commercial and recreational civil society groups, and courting political investment. The South Canterbury community came to view the Opuha Dam as benefiting the whole community through job creation, recreational opportunities, and increased economic resilience in the farming sector. Graeme Robertson, an irrigator-farmer discussed this community approach, "The Opuha Dam has been a great example of various parties: Fish & Game, Māoris, and environmental groups as well as farmers and electricity generators working together to secure the multiple uses of water." This level of community engagement and sense of mutual benefit is rare in the context of water infrastructure development.

One of the key perceptions that differentiated stakeholders was the question of: Who is/are the beneficiary(ies) of water infrastructure? Farmer stakeholders, pro-irrigation civil society groups, and rural government stakeholders generally expressed the belief that the benefits associated with water infrastructure were spread through the community, region, and nation

(Figure F1). John Wright, the chairman of an irrigation company and irrigator-farmer, stated that, "You can argue all day around if intensive agriculture is good for the environment, but when it all boils down it would all come back to agriculture is good for the nation." This perception that intensive, irrigated agriculture drives the national and regional economy in addition to enriching individual farmers was prevalent among these stakeholders. Derek Crombie, the project manager of Central Plains Water elaborated on this perspective:

> People will say that this is just a get rich scheme for farmers. That is a very superficial view. They are the initial beneficiary, I suppose, in that they will be able to increase production, but they have to invest to do that. They are not getting anything for nothing. But the real beneficiaries are the wider community…So there is a huge spread of the economic benefit. Should all of the risk and all of the funding come from the rural community? My view is that it shouldn't. I think that because the benefits of a scheme (CPW) this big are so significant that there is really almost a national impact.

This broader sense of beneficiary held by farmers, pro-irrigation civil society groups, and rural government stakeholders is present not only in the discussion of water infrastructure development but also in the interplay between environmental and irrigation interests. Ian McKenzie, the chairman of the Ashburton Water Trust, highlighted this tension, "Most environmentalists would say that it (Rakaia River) needs more water and we reckon that we can't afford to just leave the water in the river because that would have a dramatic effect on the community of Ashburton. Probably on the order of 50 million dollars a year lost in income and there is no point, no one wins anything if you just turn off the economic tap." This belief that economic growth from increased irrigated agriculture is something that benefits the general public is a key element in understanding the tensions that exist between stakeholders around the creation of water infrastructure in Canterbury.

Conservation and recreational civil society group stakeholders as well as some dry land farmers shared the belief that the farmer was the sole beneficiary of water infrastructure (Figure F1). Jay Graybill, the Chief Executive of the South Island branch of Fish & Game stated:

> There have been a real push to increase agricultural development, and in my view, our water resource had been sacrificed to the economic benefit that comes from farming as an activity…I'm of the view that the cost to the environment, in terms of degrading the quality of those streams has been done for the economic gain that farming causes and that is not to say that economic gain is bad. We would all like to share in the economic gain, even me. But I do say, and a question that I challenge farmers on a lot is: Is the economic gain in itself worth degrading the environment that we all want to live in and enjoy?

From the perspective of Jay Graybill and similar stakeholders, farmers are the beneficiaries of irrigation. Additionally, this economic benefit is being derived from a common good, water, at the expense of the environment and the stakeholders that value the environment. The differing perspectives around the identity of water infrastructure beneficiaries underpin many of the stakeholder discussions around water infrastructure development and funding.

The Opuha Dam was able to avoid this contentious and fundamental disagreement, because it included key stakeholders in the initial phases of planning and development. Additionally, the environmental movement within South Canterbury had not gained significant political traction at the time that the Opuha Dam was consented and built. Many stakeholders asserted that the Opuha Dam was a classic example of a community-driven, multi-user water infrastructure project, but that its development occurred due to converging unique circumstances which could not readily be reproduced.

Funding

Underlying any discussion about water infrastructure development is a parallel discussion about the funding mechanisms present for that development. As discussed earlier, water infrastructure development is current funded by private interests. A small sampling of stakeholders, largely government, private sector, and irrigator-farmer stakeholders expressed the belief that farmers are able to fund the creation of water infrastructure development (Figure F2). Rob Craigie, a project manager at the Foundation for Arable Research stated, "I think that farmers would be prepared to pay for it …They have paid with the Opuha." Many of the stakeholders who held similar views as Rob Craigie about the ability of the farming community to pay for the development of water infrastructure also cited the challenges that face farmers interested in investing in water infrastructure. Phil Everest, a farm finance consultant, highlighted one of those challenges, "Well the difficulty is that you have an inter-generational cost. It's huge for storage and the present financing structure doesn't cover that." The development of water infrastructure will increase the viability of agricultural systems across generations but at an incredibly high initial cost. From the perspective of a farmer, they must pay for shares within the aspirant water development as well as on-farm development of irrigation equipment. Rod Thompson, the former chairperson of an irrigation company commented on the level of debt incurred by farmers investing in water infrastructure, "We put people into multi-million dollar borrowing situations that are going to damn near bankrupt them selling the whole idea. I always felt a bit guilty about that, but you can't foresee the future." The water infrastructure project that Rod Thompson referred to never received a water consent and therefore was never constructed. Those farmers who invested heavily in that project lost their money and never received a scheme. The high cost and uncertainty of water infrastructure development is a large barrier facing agricultural communities who are interested in developing

water storage. Grant McFadden, a retired policy analyst with the Ministry of Agriculture and Forestry, elaborated on this reality:

> There is a tendency in current thinking around Canterbury or around Christchurch to say, 'well the principal users are going to be agriculture, so they should fund the thing while providing for the needs of other people at the same time'. It is simply not practical or realistic, because as soon as you look at the numbers for putting in storage infrastructure and redistribution systems you find that agriculture hasn't got a hope in hell of having the profitability to fund other interests as well. It just can't be done. It wouldn't even come near it.

Grant McFadden touches on one of the key difficulties that water infrastructure development projects face, which is that there is a community demand for water infrastructure projects to be multi-user and collaborative, but only the farmers are willing to spend money on its development. The Opuha Dam was able to satisfy the needs of the community and be profitable because of the significant investment of a single investor. Most infrastructure projects, however, are unable to attract large investors due to the high-risk, long-term nature of water infrastructure investment.

Water infrastructure is expensive and difficult for farmers to finance alone. This reality, however, has only been magnified in the face of the current credit crisis. I conducted the majority of my fieldwork in October, November, and December of 2008. During this time access to credit was severely reduced within New Zealand and globally. Many stakeholders referenced the decreased potential of agricultural communities to fund expensive projects such as water infrastructure development. Ben Curry, the CEO of the Rangitata Diversion Race Ltd. commented on this phenomenon, "These guys have to build their systems with mega-bucks. Mega, mega bucks and particularly with what is going on in the world at the moment, how willing are banks to lend two, three, four hundred million dollars?" This perception was echoed across stakeholders who supported the development of water infrastructure. Additionally, many

of these stakeholders used the reduced access to credit as a vehicle by which to suggest how other governmental financing structures such as loan guaranteeing or taxpayer investment could be used to finance the future development of water infrastructure projects.

In summary, farmers have been the key promoters of water storage infrastructure development since the deregulation of government. As evidenced by the Opuha Dam, farmers have been successful at developing water infrastructure under limited circumstances. Their ability to do so in the future, however, is uncertain due to the absence of appropriate funding structures as well as the reduced access to credit currently. Stakeholder's perceptions of who should fund water infrastructure was deeply informed by their perception of who is the beneficiary of this water infrastructure. Stakeholders who felt that farmers could and should fund the creation of water infrastructure generally believed that farmers were the sole beneficiaries of that development. Stakeholders, who had a broader sense of who benefits from water infrastructure, also believed that a broader suite of stakeholders than simply farmers should fund water infrastructure development.

The Private Sector Interface-How Consultants Influence the Creation of Adaptive Water Infrastructure

The private sector has a key role in the development of water infrastructure geared toward adapting to the impacts of climate change. These stakeholders are responsible for the creation of studies that analyze the feasibility, design, and impacts of water storage infrastructure. In this section I will discuss the role that private sector stakeholders have in the development of water infrastructure through the adversarial process of the RMA. I will then introduce and elaborate on the major themes identified in stakeholder interviews around the role

of private sector stakeholders in the development of water infrastructure: science as fact and the adversarial system.

Background

The private sector represented within this study are consultants who are specialists within a water infrastructure related field. These consultants play a pivotal role in the creation of water infrastructure due to their assistance designing and managing aspirant water infrastructure projects as well as their adversarial role in the Resource Management Act process. Consultants represent a crucial perspective within this study, that of the "expert" or the "scientist". These consultants are paid to perform studies and produce reports around feasibility, design, and effect that reflect reality. In an ideal system, science is objective, but within Canterbury and adversarial systems generally, science is often skewed by the client's expected/desired outcomes and pocket book.

The adversarial process embedded within the RMA has produced scientific controversy and retarded the production of science for the public good. Consultants within New Zealand are generally paid significantly more then government scientists, and therefore human and financial resources are often focused on private ventures. Within the RMA process this often creates sub-optimal outcomes. In October of 2008, the Environment Court overthrew the ruling of Environment Canterbury, which had rejected a series of applications for groundwater wells in a region were the aquifer water was over-allocated. The hydrological consultants did not provide evidence that there was sufficient water within the aquifers for addition abstraction, but rather demonstrated the uncertainty of the Environment Canterbury's groundwater models. The water consents were given, not because there was sufficient water, but because there was a margin of error in the hydrological calculations (Gorman 2008). The adversarial role of consultants within

the RMA can lead to biased scientific studies, incredible expenditure by the applicants, and sub-optimal policy decisions.

Findings

Within this study I identified two major themes around the role of the private sector, specifically consultants, in developing water infrastructure within Canterbury: science as fact and the adversarial system.

Science as Fact

Government and private sector stakeholders universally highlighted the uncertainty that is inherent in science (Figure PS1). John Bright, a hydrologist with Aqualinc, a small engineering firm, comments on the nature of the scientific process, "Now a group of scientists will never agree. That is the nature of science. There will always be confrontation etcetera etcetera etcetera. That is how things improve. " This perspective stands in sharp contrast to the perception by many farmer and civil society groups stakeholders who view science as absolute (Figure PS1). Derek Crombie, a development consultant, comments on the expectation of these stakeholder groups, "People are looking for a degree of certainty that is probably unrealistic. They want an absolute number for a situation that is just not able to be modeled to that degree of accuracy." John Bright and Derek Crombie are both private sector stakeholders who generate studies used by farmer and civil society group stakeholders to explore resource availability and legitimize development proposals.

The different perceptions of the degree to which science is fact reveals one of the underlying conflicts within the adversarial system that affects the development of water infrastructure in Canterbury. Warwick Greene, an irrigator-farmer explains his perception of science, "Science has got to define the dos and don'ts. It has got to take the hype and hysteria out

of decision-making. Science has got to largely decide. It is a black and white case." Science as a rational and concrete entity that should decide policy was a common theme among civil society group and farmer stakeholders. Ian McKenzie, the chairman of the Ashburton Water Trust passionately explained how science must inform decision-making:

> I should say regional councilors have the attitude that this is what they believe regardless of other science. (This) is frustrating because if they are so bloody stupid that they don't have a sense of what is going on and continue to label white as black in spite of the fact that the science shows that it is brightly white and not black then you can't make any progress.

The disconnect around the perception of the certainty of science between applicant stakeholders (civil society groups and farmers) and the stakeholders who create the science (private sector) and make policy decisions (government) represents one of the key challenges in the adversarial system.

The Adversarial System

Private sector stakeholders interviewed universally acknowledged that their responsibility to their client was their top priority. Bob Englebrecht, an agricultural consultant, elaborates on this sense of obligation, "Our (consultant's) first obligation, my first obligation is of course to my clients, and my second obligation has probably been my voice as the community." Bob Englebrecht illuminates the concept that underpins the adversarial process; the obligation of the expert is to the client, not to the quality of scientific inquiry. Chris Dennison, the head of an irrigation company, comments on the impact that this client obligation has on science generated in the adversarial system, "Usually when you are employing someone to work on a report for a civic issue, you are employing them on the basis of expected outcomes. And so the material is expected to support the expected outcome. Now if there are other material that doesn't support that well…" The power of expected outcomes in science generated as part of the adversarial

system is significant. Greg Whyte, a water resource consultant, describes what occurs when studies do not fit the expectations of the client, "You can't twist your client's arm. That is the situation we are in really. We can make a recommendation but they don't have to take it really." Through the adversarial system, the obligation of the consultant to his/her client and the outcomes expected by those clients results in misleading scientific studies and suboptimal policy decisions.

All stakeholders interviewed viewed the adversarial system as being ineffective and excessively expensive (Figure PS2). From a governmental perspective, the increasingly legalistic and adversarial RMA process has led to an overturning of sound policy decisions. From the perspective of farmers, the adversarial system is costly and protracted. Phil McKendry, an irrigator-farmer, elaborates on this perception, "You go off and get your lawyers and experts and fight for a development and then you meet at the next development and the next development. It is bloody nuts unless you are a lawyer or a consultant or a scientist. The environment is no better off with the current process and the country is worse off." Civil society groups who view the adversarial process as a necessary evil share this perspective. Jay Graybill, the Chief Executive of the South Island branch of Fish & Game discusses this, "FG doesn't enjoy the adversarial sort of arena. But we feel that we are almost put in the position of not having any choice and it does get frustrating to have to push these things through the various hearings and through the environment court and quite often it does get to be one expert's opinion against something else." Stakeholders universally asserted that the adversarial system leads to suboptimal outcomes (Figure PS2), and yet all stakeholders felt they had no option but to participate due to the structure of the RMA.

Private sector stakeholders, specifically consultants, play a critical role in the creation of water infrastructure within Canterbury. They are the "experts" and provide scientific studies that legitimize or challenge water infrastructure development. Stakeholders who produce these scientific studies (private sector stakeholders) view these studies differently than stakeholders who commission these studies (civil society groups, farmers, and government stakeholders). Private sector stakeholders acknowledge the inherent uncertainty that exists within scientific work, while other stakeholders assert that science reflects reality and represents fact. This is a key disconnect between stakeholders. Additionally, across stakeholder groups the role of the private sector in the adversarial system is seen as being negative due the high cost, comprised scientific integrity, and delays inherent to adversarial systems.

Discussion

In this section I will explicitly address my central research questions: What is the perceived role of various stakeholders in creating water infrastructure geared toward adapting the impacts of climate change on agriculture in Canterbury and do these stakeholder relationships retard or facilitate the creation of these strategic, adaptive projects? In my analysis of these two respective research questions I will draw on my thematic findings in order to discuss these questions and suggest strategies for moving forward. Additionally, I will discuss the Canterbury Strategic Water Study and strategies for moving beyond the limitations of this planning document and toward the development of adaptive water infrastructure in Canterbury. I will conclude this section with a broad discussion of consensus and conflict processes and a brief introduction of future steps for research in this field.

What is the perceived role of various stakeholders in creating water infrastructure geared toward adapting the impacts of climate change on agriculture in Canterbury?

All stakeholders, across all stakeholder groups, acknowledge that the participation of all stakeholders is essential in creating water infrastructure with optimal community, economic, cultural, and environmental outcomes. The theoretical role of private sector, government, civil society group, and farmer stakeholders is to ensure that the needs, concerns, and desires of those they represent are considered and integrated into the development of water infrastructure. The theoretical role of various stakeholders emphasizes positive, progressive interactions between stakeholders in the process of water infrastructure development in Canterbury.

The actual role played by various stakeholders in the creation of water infrastructure is a far more fluid and contentious topic than the potential role of stakeholders in this process. The actual role of stakeholders is deeply informed by the legislation and funding structures that orient the interactions between stakeholders around the creation of water infrastructure in Canterbury. A key example of this is the impact of the RMA on the relationship between farmers and civil society groups. Ideally, the ecological, cultural, and social values affected by a proposed development would be considered through the involvement of civil society groups with the RMA process. Applicants, generally farmers, would work with those groups through the RMA process to collaborate and work toward an optimal outcome. In reality, the collaborative approach of the RMA has generated a costly, protracted process, which often polarizes communities. The RMA, due to its funding mechanism (where the applicant pays all costs) and adversarial process (which promotes conflict through legalistic decision making), has warped the perceived collaborative stakeholder roles into combative relationships.

Perceptions around the role of various stakeholders in the funding of water infrastructure are deeply connected to stakeholder perceptions of who the beneficiaries of these schemes are. Most stakeholders acknowledge that the beneficiaries of water infrastructure should pay for its creation. Those who saw water infrastructure as generating national benefits emphasized the role of government as a funding body. Those who saw farmers as the sole beneficiary largely felt it was the farmer's responsibility to fund these projects. This disconnect is a central obstacle to defining the optimal roles of stakeholders in developing water infrastructure projects.

In summary, there is no specific stakeholder group whose responsibility it is to fund these projects, but rather it is the responsibility of the beneficiary to fund these projects. A redefinition of who the beneficiary of these water infrastructures is, especially in the face of a changing climate, must occur in order for the role of stakeholders in funding water infrastructure to become more concrete and defined. This redefinition of the beneficiary of water infrastructure must appreciate the wide-reaching impacts of climate change on agriculture in Canterbury and the effect this will have on the broader Canterbury economy. This discussion must be oriented around the Canterbury's economic dependence on agriculture and incorporate economic studies of what the projected impact of climate change will be on gross regional revenue. Additionally, this redefinition of beneficiary must include a redefinition of infrastructure, emphasizing a multi-user structure that minimizes negative environmental impacts, maximizes recreational opportunities, expands Canterbury's adaptive capacity, and maintains cultural values.

Do these stakeholder relationships retard or facilitate the creation of these strategic, adaptive projects?

Within Canterbury, stakeholders have become increasingly polarized around the issue of water infrastructure development. This is true within stakeholder groups as well as across

stakeholders groups. These combative relationships are fostered through the legislative process that oversees the creation of water infrastructure, the Resource Management Act. These antagonistic relationships retard the creation of strategic, multi-user water infrastructure projects that are geared toward adapting to the impacts of climate change.

These combative relationships have arrested the development of strategic water infrastructure within Canterbury for the past twenty years. Additionally, the lack of any strategic leadership from government at the central, regional, or district level has led to the unwise use of water resources across Canterbury. This has manifested most clearly in the unmonitored release of groundwater consents for independent irrigation development through the RMA process. Currently many of the aquifers underlying the Canterbury plains are over-allocated and groundwater is being used at an unsustainable level. This situation will only intensify as irrigation demands increase due to climate change and land use changes. The over allocation of many groundwater and surface water sources as well as the projected impact of climate change on Canterbury necessitates the creation of a strategic, overarching framework that looks at water resource use, environmental impacts, and development from a region-wide perspective.

Moving Forward: The Canterbury Strategic Water Study

The Canterbury Strategic Water Study (CSWS) is an attempt by the regional and district government to create an overarching plan for water resources in Canterbury. The CSWS is progressive, looking at potential water infrastructure development from a multi-user, collaborative perspective. The CSWS employs water resource specialists to investigate potential water storage infrastructure sites across the region and evaluate these options from an environmental, economic, social, and cultural perspective. Additionally, the CSWS highlights the impact of climate change on Canterbury and the developers of the CSWS used climate

change projections as an integral part of their planning process. The CSWS is collaborative and inclusive; two of the four planning stages of the CSWS are devoted to stakeholder assessments and engagement. The CSWS is the overarching, strategic framework that Canterbury has lacked.

The CSWS, however, also reflects many of deficiencies of that have characterized Canterbury water management for the past two decades. Most importantly, it has no statutory backing. All Environment Canterbury councilors, district government officials, and central government representatives on the CSWS council have no responsibility to honor the strategic plan produced. Additionally, the CSWS has no formal funding mechanism. The planning stages completed thus far have been paid for by the discretionary accounts of government officials and supplemented with pro bono work done by consultants. Implementation of the CSWS and the creation of the recommended adaptive water infrastructure will require enormous sums of money. The source of this money is unknown, and this is the greatest obstacle facing the CSWS.

The CSWS also reflects the slow, bureaucratic nature of Canterbrian water resource management. The CSWS has actively been in development for nearly seven years and currently is just initiating its fourth stage. This protracted plan development period is especially meaningful because the CSWS is an uncontroversial planning document with no statutory backing. Therefore, when looking beyond the development of the CSWS to the implementation of its strategic recommendations, it is unlikely that under the current legislative system these adaptive strategies will be implemented in the next few decades, if at all. This lengthy process does not respond well to the immediate challenges facing Canterbrian water resources such as the over-allocation of ground and surface water as well as the negative impacts of impending climate change.

The creation of strategic, multi-user water infrastructure is a critical element of agricultural adaptation of Canterbury to climate change induced drought. The CSWS is the overarching plan that is necessary for moving forward with water resource management and climate change adaptation within Canterbury. However, in order for the CSWS to be effective it must transcend the limitations listed above and expand the community understanding of leadership, collaboration, and infrastructure in the context of climate change in Canterbury.

The role of government in the creation of water infrastructure must be re-evaluated and re-invented in order to move towards a strategic framework for agricultural adaptation to climate change. Central, regional, and district governments must work in coalition to lead Canterbury toward agricultural adaptation to climate *and* work toward the implementation of these strategies across the region. Water storage infrastructure will be a key element of any agricultural adaptation plan, and government must play a leading role in ensuring that this infrastructure is developed in a way that minimizes environment impacts, maximizes adaptive potential, and is economically feasible. Government must be a visionary agent in this process with a long-term, holistic perspective. Individuals, specifically farmers, are often unable to do this type of long-term strategic planning due to financial limitations and limited access to information and adaptation resources. Governments must aid individuals and communities to transcend their particular circumstances and look at the long-term, broader outlook. These adaptation strategies are not profitable on a traditional investment timescale and in many cases will not increase profitability, but rather, minimize losses in productivity to climate change. Due to this financial reality, it is essential that government take a leading role in driving adaptive infrastructure development. Government does not necessarily have to be the traditional or sole funding entity,

but it must work with the community to insure the accessibility and availability of equitable funding structures.

The creation of water infrastructure that is geared toward adapting to the impacts of climate change within Canterbury must be collaborative, and involve a diverse suite of stakeholders. However, this process, while being inclusive must also be effective and timely. The RMA as a legislative tool is uncommonly inclusive and collaborative, but this often comes at the cost of responsiveness and timeliness. The RMA process must be streamlined or a separate process for strategic water infrastructure must be designed in order to facilitate the implementation of adaptive strategies. As part of this streamlined system diverse stakeholder input should remain a crucial component to development, but the adversarial process must be eliminated. A panel of "friend of the court" specialists who generate relevant research could be a possible strategy for avoiding the adversarial system. Additionally, key stakeholder representatives could present their concerns relating to water infrastructure development. This would eliminate unconstructive redundancy, lowering costs and minimizing delays. The process for the implementation adaptive suggestions of the CSWS must streamline the RMA collaborative process, balancing inclusivity and timely progress.

In order for Canterbury to move beyond the current combative, ineffectual system of water infrastructure development a redefinition of water infrastructure is necessary. Water infrastructure has traditionally been used within Canterbury to increase the profits of farming enterprises. This narrow definition of water infrastructure must be expanded in the light of climate change. Water infrastructure must be viewed as an adaptive strategy not only for agriculture but also for the economy of Canterbury. Additionally, this water infrastructure must be viewed from a multi-user perspective and incorporate environmental, cultural, social, and

agricultural considerations into its development. A public understanding of the role of multi-user water infrastructure in the adaption of Canterbrian agriculture and economy is essential. This redefinition of infrastructure is intimately connected to a redefinition of the beneficiary of water infrastructure as discussed earlier. A broader definition of adaptive water infrastructure and the beneficiary of this infrastructure must cross the rural/urban divide, and if this dialogue occurs, it will redefine the relationships that exist between stakeholders around the creation of adaptive water infrastructure in Canterbury. This discussion must focus on the broad agricultural and economic impacts of climate change across Canterbury and the ramifications of these effects.

The Canterbury Strategic Water Study is the water resource management tool that Canterbury needs. The CSWS, however, is paralyzed by many of the same factors that have prevented strategic water management in Canterbury for the last twenty years. In order for the CSWS to move forward there must be an expansion in governmental leadership at the central, regional, and district level around agricultural adaptation to climate change. The CSWS must be given statutory backing and a multi-source funding portfolio that reflects the cross-community benefits of adaptive water infrastructure must be developed and implemented. The CSWS must retain its inclusive, collaborative nature, but it also balance this stakeholder process with effectiveness and action. Additionally, the CSWS must avoid the adversarial system that characterizes the RMA system in order to retain its strategic integrity. Most important, however, is an expansion in the public understanding of adaptive water infrastructure and the beneficiaries of this infrastructure. The CSWS, as a planning document, provides the tools for realigning stakeholder relationships and developing water infrastructure that helps Canterbury adapt to the impacts of climate change on agriculture, but it will only be an effective plan if the government and community enables this strategic tool.

Collaboration and Conflict: Is it even possible?

This study focuses on agricultural adaptation to climate change in a situated context whose scale and specificity allows for a meaningful analysis of complex economic, social, political, cultural, and biological forces. This situated research, however, also speaks to the larger process of agricultural adaptation and the role of collaboration and consensus in sculpting that process. The structural forces that influence collaboration and consensus within Canterbury will be present, in alternate forces, in regions across the world. By looking at the process of collaboration and consensus more generally, this case study can be applied to a larger global community.

In collaboration and consensus models there is are two divergent views of society. From one perspective, society is an "integrated whole". This perspective, championed by sociologist Emile Durkeim, asserts that society is composed of independent structures that are closely intertwined. In this consensus model, these societal structures (i.e. religion, government, the family) must cooperate and work together in order for that society to be sustained. Therefore consensus is a basic necessity of society and is based on shared basic values.

The opposing view of society asserts that societies are defined by conflict. This perspective, supported by theorists such as Karl Marx, asserts that society is divided into groups with unequal resources. These resource and power inequalities are embedded within the society, and therefore conflicts of interests are inherent between these groups. Society is therefore defined by conflict, consisting of a stable balance of opposed groups.

This study reveals that within the context of Canterbury there are consensus and conflict processes occurring simultaneously. In the context of agricultural adaptation to climate change, the consensus processes within Canterbury are rooted in shared values. Some of these values, as

reflected by this study, are inclusivity, community gain, and economic, social, and ecological sustainability. The individual perception of what these values mean and their relative priority may differ, but these basic values are shared among stakeholders. The Opuha Dam project was successfully developed, because it focused on these shared values and shaped its development planning and stakeholder engagement phase around these values.

Conflict processes within Canterbury, in the context of the development of adaptive water infrastructure, are oriented around economic gain, environmental preservation, and the "ownership" of water. These areas of conflict are manifested in rural/urban hostility, the RMA process, and other arenas that challenge ownership, livelihoods, and the environment. These areas of fundamental conflict may never be eliminated through collaboration. Therefore, it is essential that consensus processes appreciate the complexity of conflict and focus on areas of shared values.

The consensus and conflict duality that is present within Canterbury will be present within every community and will universally inform the process of agricultural adaptation to climate change. If collaboration and consensus do coexist, a discussion of how to appreciate areas of conflict and focus on methods for emphasizing strategies for consensus is essential in the creation of agricultural adaption plans to climate change.

Consensus processes do not have to eliminate areas of conflict, but rather this process must work toward mutual gain (which includes some key compromises) instead of a traditional win-win goal used in negotiations. This process of building consensus must be based on education, dialogue, and understanding. I believe that within the Canterbrian context as well as a broader context consensus is possible, but it will be a consensus outcome that appreciates the enduring conflicts that exist between stakeholders.

Future Steps

This study sought to examine the roles of stakeholders in the creation of adaptive water infrastructure within Canterbury, New Zealand. This study could be expanded in breath and depth through further work within this area. Additional fieldwork that captures the perspectives of the urban Canterbrian population as well a fuller suite of Canterbrian civil society groups could yield further insight into this topic. Additionally, this work could be expanded spatially to include a large system for analysis. Lastly, climate change adaptive strategies other than water infrastructure could be examined through a similar methodology and would provide interesting insight into this field of research.

Conclusion

Climate change is an irreversible global reality. Adaptation to climate change will become an increasingly important aspect of strategic planning at the global, national, and regional scale. Climate change adaptation plans for agricultural systems will be a crucial part of ensuring the long-term productivity and viability of these systems. In order for agricultural adaption plans to be optimally effective, a wide range of community stakeholders must be included in the development and implementation of these adaptive strategies. The participation of a diverse suite of stakeholders in this process is imperative because of the broad social, economic, environmental, and cultural impacts of climate change and the far-reaching nature of many adaptive strategies that respond to these climate change impacts.

This study examined the role of stakeholders in the creation of water storage infrastructure as an adaptive strategy geared toward mitigating the impacts of climate change induced drought on agriculture in Canterbury, New Zealand. Through the use of qualitative

interviews I explored the role of farmer, private sector, government, and civil society group stakeholders in the creation of adaptive water storage infrastructure. Additionally, I explored how these stakeholder roles and relationships promote or prevent the creation and implementation of this adaptive strategy. I found that stakeholders universally acknowledged the value and importance of complete stakeholder participation theoretically, but that the legislative framework and funding structures within Canterbury transform these theoretically positive interactions into antagonistic relationships between stakeholders. These antagonistic stakeholder relationships have paralyzed the creation of adaptive water infrastructure within Canterbury.

Through this study I was able to identify changes that must occur in order for Canterbury to even begin to agriculturally adapt to the impacts of climate change. These essential changes include: a revision of legislative processes in order to balance inclusivity, manage the quality of scientific input, and streamline climate change adaptive projects; an increased level of government leadership in strategic water management; a realignment of stakeholder relationships through wide-scale stakeholder engagement and revision of the adversarial system; and a broadened community understanding of adaptive water storage infrastructure through community education and dialogue. The Canterbury Strategic Water Study, if empowered by the Canterbrian community, can achieve these goals. Agricultural adaption to climate change is possible within Canterbury and in other places around the world. However, in order for adaptive strategies to be optimally realized a feasible, powerful, and effective strategic planning tool must be developed and implemented. The participation and engagement of stakeholders is central to this process.

Acknowledgments
Dr. Liz Safran, Dr. Jim Proctor, Dr. Greta Binford, Katherine Hoglund, Pete Vidito, Willy Lefernik, All of the interviewees, Belinda Gould, Annika Jablonski, The Hendersons, The Williamsons, and Rachael Lipinski

Appendix 1

Private Sector/Academic Interviews

-What is your name?
-What is your position?
-What is your research area?
-What do you view as the largest issue for Canterbury water resources?
-Looking into the future, what water resource issues do you see arising for Canterbury?
--Do you think that climate change will/does affect the availability of water in Canterbury?
-If yes, how? -If not just general questions about future.
-Do you see some of this as a significant issue facing the future vitality of farming?
-Do you know of anything is being done to address these issues?
-Do you think it is possible to adapt to future water issues?
-On what timescale?
-In your opinion whose responsibility is it to implement programs i.e. government or growers?
- What do you view as your role as a **researcher** in this process?
-What do you view as the role of community groups i.e. fed farmers, IRNZ, Fish & Game?
-What is the role of government in the implementation of new water projects that deal with climate change mitigation?
-What do you see as the role of the individual farmer?
-What do you see as the greatest challenge in this process?
-Contacts?

Civil Society Group Interviews

-What is your name?
-What is your position?
-What does your organization do?
-What do you see as the greatest challenge for your organization?
-What is the prevalent issue for your consistency?
-Do you think that climate change will affect the availability of water in Canterbury?
-Do you see this as a significant issue facing the future vitality of farming?
-Do you know of anything that is being done by your organization or others that attempts to grapple with this issue?
-On what timescale are these actions being looked at?
-In your opinion whose responsibility is it to implement programs that deal with mitigating the effects of climate change on Canterbury's water resources?
-To fund these programs?
-What do you see as the role of groups like yours in implementing these programs?
-What do you see as the role of individual farmers in implementing these programs?
-What do view as the role of science in this process?

Farmer Interviews
-What is your name?
-Tell me about your operation.
-What is(was) your greatest motivation in farming as a livelihood?
-What are the greatest challenges for your farm?
-Do you think that climate change will/does affect the availability of water in your region?
-If yes, how? -If not just general questions about future.
-Do you see some of this as a significant issue facing the future vitality of farming?
-Do you know of anything that you are doing or someone is doing to begin to address these issues?
-Do you think it is possible to adapt to future water issues?
-In your opinion whose responsibility is it to implement programs i.e. government or growers?
-In your opinion whose responsibility is it to fund these programs?
--What is your role as a farmer in these projects?
-What is the role of community groups (i.e. Fed Farmers, Fish & Game, IRNZ) in the creation, funding, and implementation of these projects?
-What is the role of government (central and regional) in creating, funding, and regulating water projects that deal with climate change mitigation?
-What is the role of science in the creation of new water projects that deal with climate change mitigation?
-What do you see as the greatest challenge in this process?
-Contacts?

Policy Interviews
-What is your name?
-What is your position?
-What is the role of your department in managing Canterbury's water resources?
-What do you view as the largest issue for Canterbury's water resources?
-Do you think that climate change will affect the availability of water in Canterbury?
-Do you see this as a potentially significant issue facing the future vitality of agriculture in Canterbury?
-What is being done to address these issues?
-What do you view as the greatest challenge in the process of creating policy that grapples with this issue?
-In your opinion whose responsibility is it to implement programs that deal with mitigating the effects of climate change on Canterbury's water resources?
-To fund these programs?
-What do you see as the fundamental role of government in creating, funding, and regulating these projects?
-What do you see as the role of the individual farmer in implementing these programs?
-What do you see as the role of community groups (Fed Farmers, Fish & Game, IRNZ) in implementing these programs?
-What do you see as the role of science in this system (adversarial vs non-adversarial)?

Appendix 2

Interviewees

Name	Stakeholder Type	Affiliation
Rob Gould	Farmer (DL)	
Tim Gould	Farmer (IR)	
John McCaskey	Famer (IR)	Glenmark Wines
Greg Whyte	Private Sector	DHI
Lionel Hume	Civil Society/Academic	Federated Farmers
Warwick Greene	Farmer (IR)	
Ian McKenzie	Civil Society/Farmer (IR)	Ashburton Water Trust
Phil Everest	Private Sector	Everestt Consultants
Willy Lefernik	Civil Society/Farmer (IR)	Federated Farmers-Dairying Division
John Wright	Civil Society	Barhil-Chertsey Irrigation Scheme
Terry Heiler	Civil Society/Academic	Irrigation New Zealand/ Lincoln Univ.
Rob Craigie	Academic	Foundation for Arable Research
Bryan Jenkins	Policy	Director, Environment Canterbury
Graeme Sutton	Civil Society/Farmer (IR)	Irrigation New Zealand
Andrew Dark	Private Sector	Aqualinc
John Bright	Private Sector	Aqualinc
Mike Hodgen	Civil Society/Farmer (DL)	Hurunai Irrigation Scheme
Tom McFarlane	Civil Society/Farmer (IR)	
David West	Civil Society/Farmer (IR)	Lake Hood Committee
John Greenslade	Farmer (DL)	
Ross Little	Policy/Farmer (DL)	Environment Canterbury
Angus McKay	Policy/Farmer (IR)	Environment Canterbury
Ben Curry	Private Sector	Rangitata Diversion Race
Phil McKendry	Farmer (IR)	
Rod Thompson	Farmer (IR)	
Bob Englebrecht	Private Sector	Englebrecht Consultants
John van Polano	Farmer (IR)	
Chris Bolderston	Farmer (IR)	
Grant McFadden	Policy	Ministry of Forestry and Agriculture
John Greer	Policy	Ministry of Forestry and Agriculture
Chris Todd	Civil Society	Forest and Bird
Jay Graybill	Civil Society	Fish & Game
Tom Henderson	Civil Society/Farmer (IR)	Opuha Dam Ltd.
Chris Dennison	Civil Society/Farmer (IR)	Waitaki Irrigaiton Scheme
Pat Morrision	Civil Society/Farmer (IR)	Central Plains Irrigation

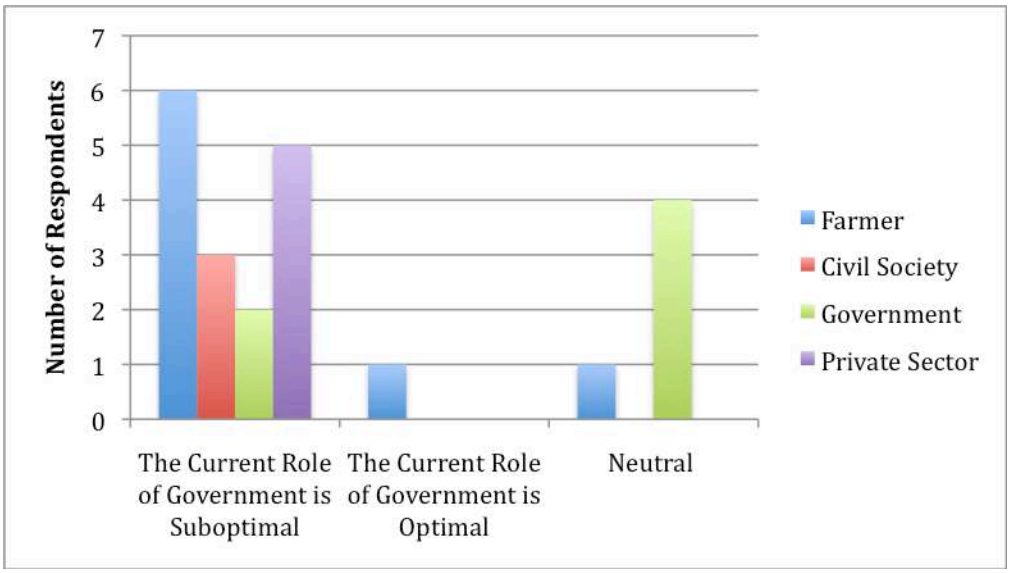
Cathy Begley/Derek Crombie	Private Sector	GHD-Central Plains Irrigation
Murray Doak	Policy	Ministry of Forestry and Agriculture
Belinda Gould/Jane East	Farmer (IR)	Muddy Water Wines
Mike and Claudia Weesing	Famer (DL)	Pyramid Valley Wines
Malcolm Miller	Policy	Environment Canterbury

Appendix 3: Categorical Analysis of Data

These categorical graphs represent the quantitative data underlying the key qualitative observations of each identified theme as highlighted in the findings section. These graphs are not an exhaustive representation of the all observations made within each identified theme, but rather, represent the key observations within each theme.

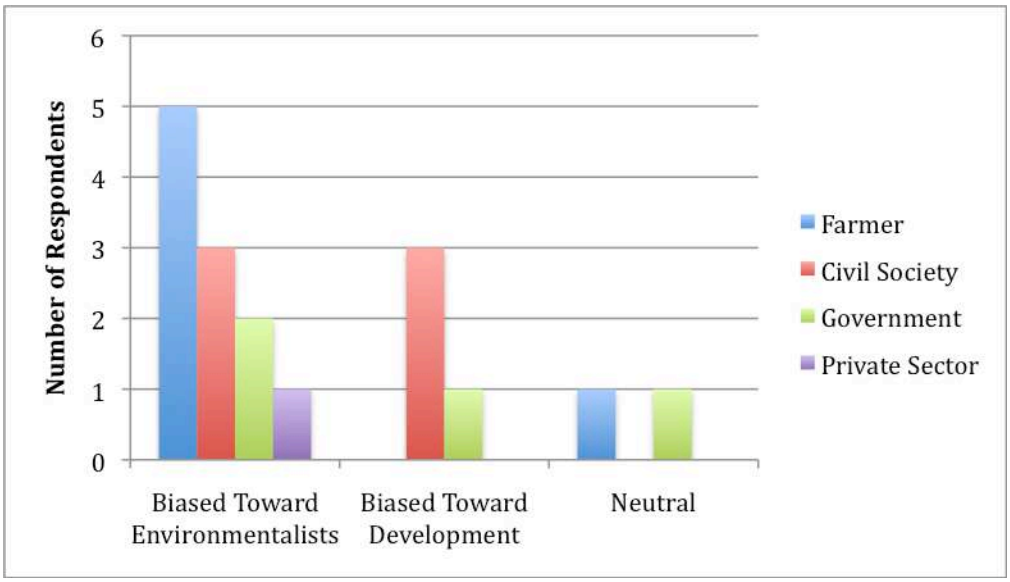
<u>The Political Interface</u>

Figure G1:
The Current Role of Government is Suboptimal



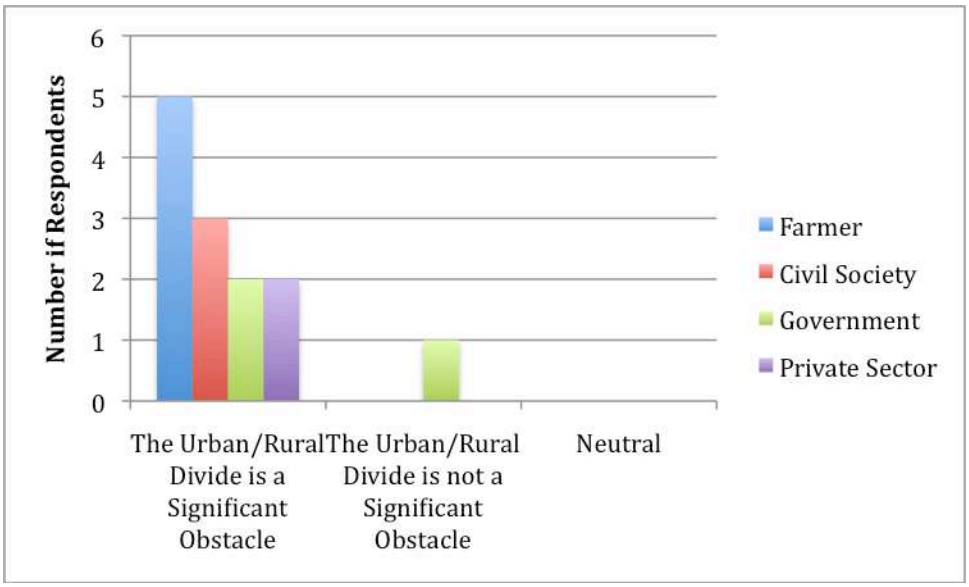
Total Respondents: 22

Figure G2:
The Resource Management Act is Biased



Total Respondents: 17

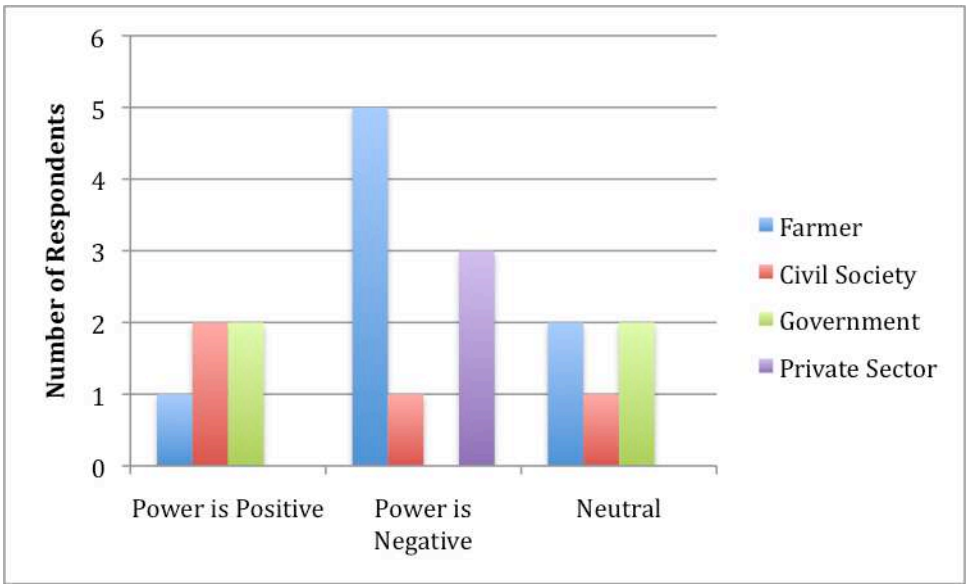
Figure G3:
The Urban versus Rural Divide is a Significant Obstacle to the Creation of Adaptive Water Infrastructure



Total Respondents: 13

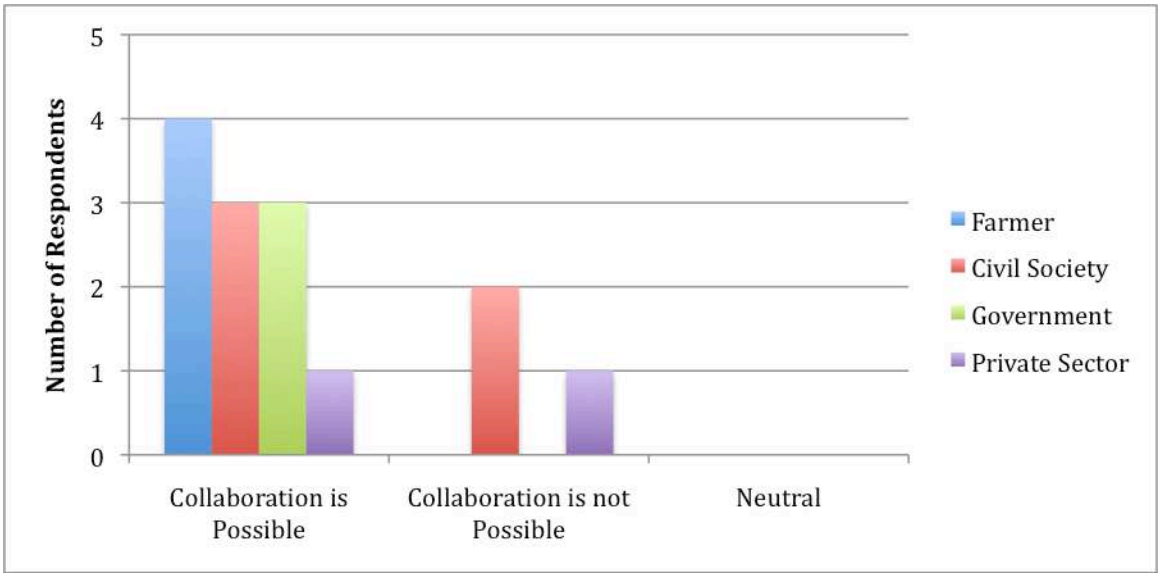
The Civil Society Interface

Figure CS1:
The Power of Civil Society Groups is Positive, Negative, or Neutral



Total Respondents: 19

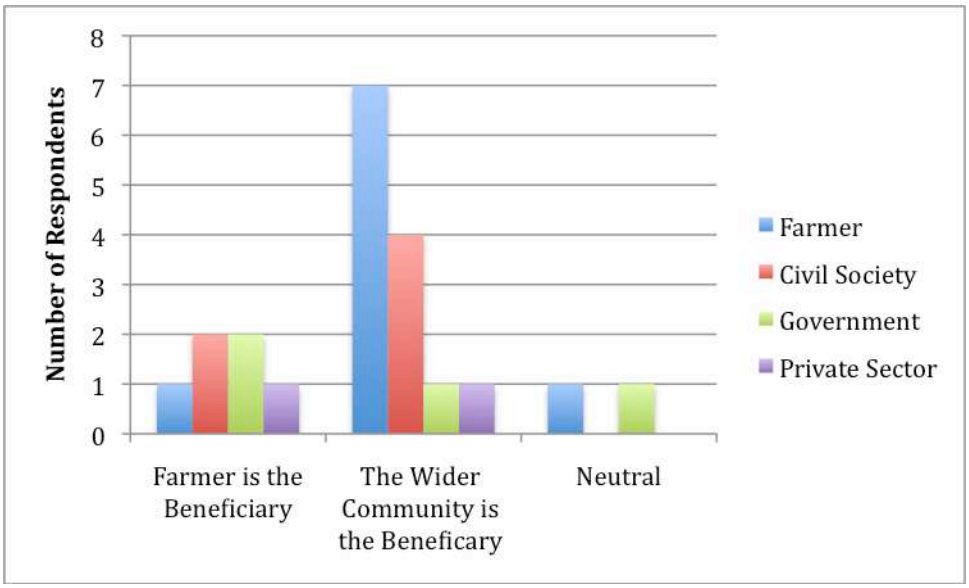
Figure CS2:
Collaboration between Civil Society Groups is Possible



Total Respondents: 14

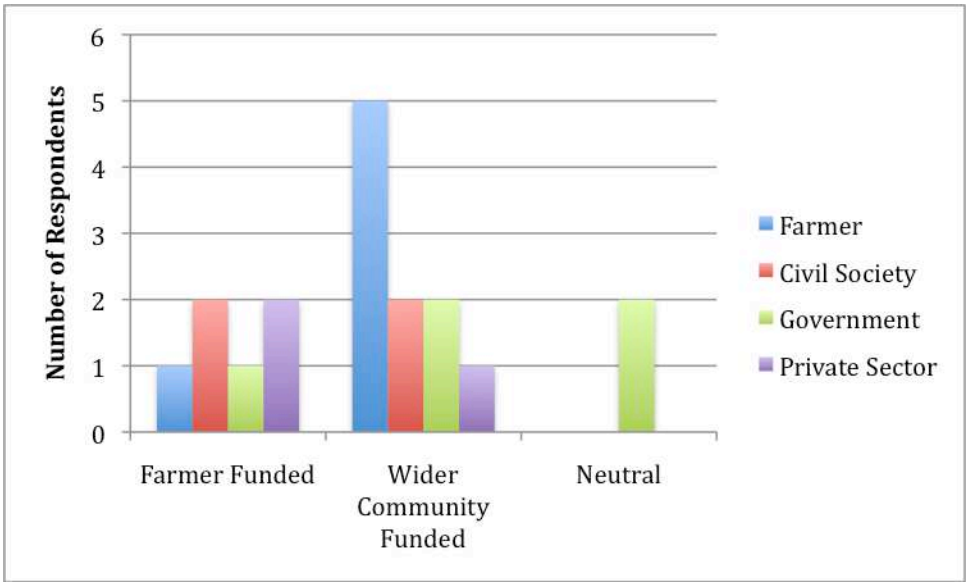
The Farmer Interface

Figure F1:
The Beneficiary of Water Infrastructure is the Farmer versus the Wider Community



Total Respondents: 21

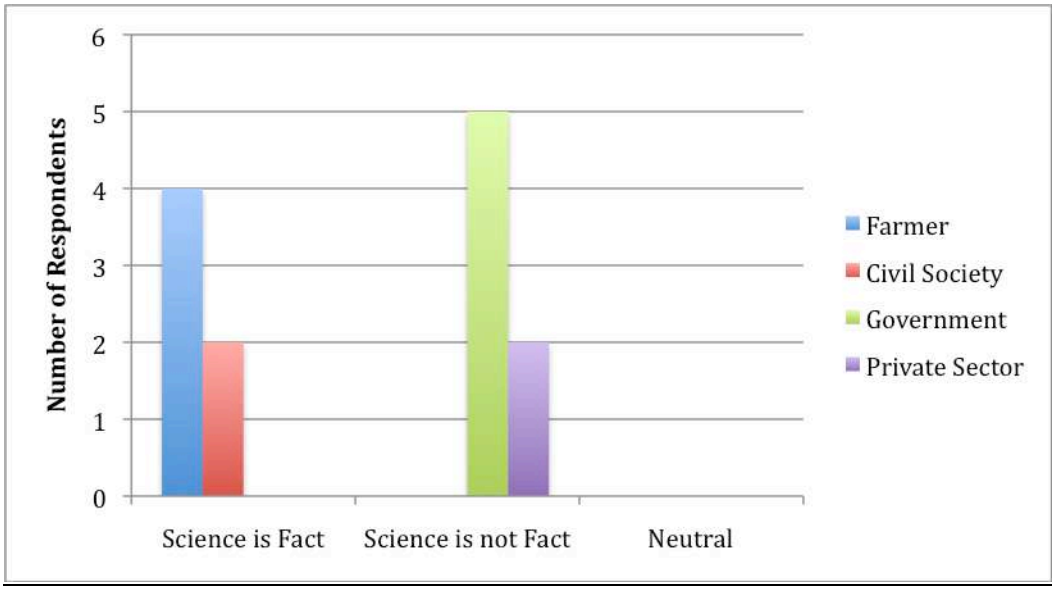
Figure F2:
Water Infrastructure should be funded by Farmers versus the Wider Community



Total Respondents: 21

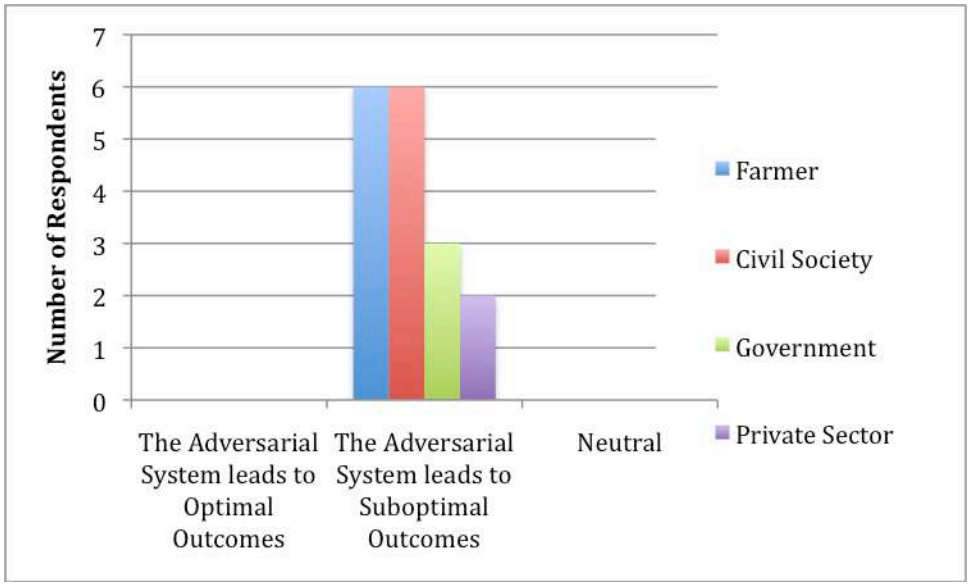
<u>The Private Sector Interface</u>

Figure PS1:
Science is Fact



Total Respondents: 13

Figure PS2:
The Adversarial System Leads to Optimal Outcomes



Total Respondents: 17

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