ASSESSING INSTITUTIONS FOR AQUATIC ECOSYSTEM PROTECTION: A CASE STUDY OF THE OLDMAN RIVER BASIN, ALBERTA

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ABSTRACT

ASSESSING INSTITUTIONS FOR AQUATIC ECOSYSTEM PROTECTION: A CASE STUDY OF THE OLDMAN RIVER BASIN, ALBERTA

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Policies to protect aquatic ecosystems have proven difficult to implement. This is particularly so in semi-arid regions where water supplies are limited and demands high. The failure of such policies has serious consequences both for aquatic ecosystems and for the people who depend on them.

This research investigates the factors that shape the development and implementation of policies for aquatic ecosystem protection in a semi-arid region. It does so by integrating insights from political ecology, human ecology and common property scholarship in a novel theoretical framework that helps to unravel the complex web of cultural, historical and political processes underlying environmental institutions. This integrated framework guides an empirical investigation in the Oldman River Basin (ORB), Alberta. Evidence gathered from 72 documents, 56 key informant interviews, and personal observations from 14 conferences, workshops and watershed tours reveals two sets of eight factors that have impeded progress toward aquatic ecosystem protection in the ORB. The first set of factors focuses on broad contextual influences. These include 1) the ongoing decentralization of water management in Alberta; 2) historically-entrenched positions of power; 3) micro-politics among key actors and organizations; 4) cultural history and identity; 5) application of legal mechanisms; 6) existing water infrastructure and allocations; 7) current aquatic ecosystem condition; and, 8) climate

change and future water availability. The second set of influences, referred to as implementation factors, explain the limited extent to which aquatic ecosystem protection policies are being implemented. These include 1) clarity of the actors' roles; 2) communication; 3) the definition of key terms; 4) funding and organizational capacity; 5) leadership; 6) the formal institutional environment; 7) data and monitoring; and, 8) public education.

An assessment of the relative significance of these two sets of factors indicates that, in many cases, the contextual factors contradict the course of action recommended by study participants and in the documents reviewed for overcoming the barriers identified as factors affecting implementation. Alternative recommendations are made which have major implications for water management in the ORB. In addition, these recommendations speak to the importance of considering context in human-environment research.

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Few projects of this scope are ever completed without the support of many others. This project was no exception and I wish to thank a few of those people now.

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PREFACE

This thesis is organized in manuscript format. Following an introductory chapter, three manuscripts of publication quality and length are presented which detail the research findings. These are followed by a concluding chapter which draws together the principal findings of the total research effort.

As outlined in the introductory chapter (Chapter One), authorship of the third manuscript (presented herein as Chapter Four) is shared between the student and his thesis supervisor. In keeping with Department of Geography guidelines, it should be noted that the manuscript is dominated by the intellectual effort of the student.

LIST OF ACRONYMS

AAFRD	Alberta Agriculture, Food and Rural Development
AIPA	Alberta Irrigation Projects Association
ASRD	Alberta Sustainable Resource Development
BAC	Basin Advisory Council(s)
CPR	Common Property Resource(s)
DFO	Department of Fisheries and Oceans
FIT-FIR	First-in-Time, First-in-Right
GOA	Government of Alberta
ID	Irrigation District(s)
IRP	Irrigation Rehabilitation Program
ORB	Oldman River Basin
OWC	Oldman Watershed Council
PWAC	Provincial Water Advisory Council
SSRB	South Saskatchewan River Basin
WCO	Water Conservation Objectives
WPAC	Watershed Planning and Advisory Council(s)
WSG	Watershed Stewardship Group(s)

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CHAPTER ONE

INTRODUCTION

1.1 Research Context and Scope

Turner (2002: 52) notes that, "perhaps more so than any other field of study… geography has invested large amounts of intellectual energy in search of its identity..." In human-environment geography, this has been characterized by an enduring tension between scholars advocating a so-called critical approach (e.g., Watts 1983; Bryant and Wilson 1998) and those who are committed to a more applied research focus (e.g., Coppock 1974; White 1985; Turner 2002). Critical human-environment scholarship has been credited as being "excellent at exposing deeper [e.g., political economic] processes" (Castree 2002: 362) but, due in part to its preoccupation with high-level theorizing, it sometimes falls short of producing results and recommendations that matter outside of the academy. Applied human-environment scholarship (e.g., policy-based research), by contrast, is geared more towards making a difference on the ground and tends not to question to the same degree as its critical counterpart "the parameters of existing norms, power relations and values" (Castree 2002: 362).

With the aim of addressing this tension and to realizing the sort of intra-disciplinary unity envisioned by Butzer (2002), this research attempts to find common ground between these disparate positions. In so doing, it follows the example of geographers such as Batterbury and Horowitz (forthcoming), Rocheleau, *et al.* (1996) and Zimmerer and Young (1998). It does so by weaving together insights from the three sub-fields of political ecology (recognized for its critical stance), human ecology, and common property resources (both of which take a comparatively applied focus).

The selection of these three sub-fields (as opposed to others) flows from the literature on institutional analysis and the designation of institutions as the unit of analysis for this research. Defined as humanly-devised mechanisms that structure and guide human interaction, institutions can be both formal (such as rules, laws, constitutions) and informal (such as enduring patterns of behaviour, conventions and self-imposed codes of conduct) (Ostrom, *et al.* 1994; Agrawal and Gibson 1999). They can be both enabling (e.g., incentives) and disabling (e.g., sanctions). In either case, institutions have been singularly identified as "a necessary starting point for connecting socially differentiated communities with biologically differentiated environments" (Peet and Watts 2004: 25). Furthermore, Ingram, *et al.* (1984: 323) identify institutional factors as being "among the most formidable obstacles to the development and implementation of feasible water resource programs." As the empirical component of this investigation (described in detail below) aims to better understand the factors affecting the implementation of policies for aquatic ecosystem protection in a semi-arid region, an emphasis on institutions is necessary.

It is important to note, however, that research on institutions has been criticized in recent years: for focusing too much on either formal or informal institutions, rather than seeing the two as integrated (Mehta, *et al.* 1999); for neglecting to adequately consider the biophysical/ecological context within which institutions are situated (Scoones 1999); and for focusing too intently on functionalist interpretations of institutions as formal rules to the neglect of historical patterns of development (Johnson 2004). In each instance, such approaches to institutional analysis have been deemed unsatisfactory. Insights on institutional analysis in the three sub-fields of human ecology, political ecology, and

common property scholarship specifically show considerable promise for helping researchers to overcome these challenges. Drawing on these insights, this research seeks to bridge previously distinct approaches to the study of institutions. In so doing, it ties into broader debates in geography about the merits of pure versus applied research (Rocheleau, *et al.* 1996; Turner 2002) and, as is outlined in the methodology section below, the merits of studying phenomena that are general versus those that are particular (Harrison 2005; Burt 2005; Castree 2005a). At the same time, the focus on institutions allows for a connection to key themes prevalent in the literature on environmental governance — a concept which refers to those processes of governing that extend beyond just government to include a range of public and private actors in environmental policy- and decision-making processes. As the transition from centralized management to water governance unfolds in many Canadian jurisdictions, a better understanding of participatory watershed planning processes can offer insights into the strengths and limitations of these new approaches. This is especially so in reference to policies developed through research that considers, for example, the role of multi-stakeholder and community groups in the implementation of policies for aquatic ecosystem protection in semi-arid regions.

1.2 Empirical Context

Aquatic ecosystems include the variety of plants and animals that live in or adjacent to freshwater lakes, rivers and wetlands (Andrews 1987). Collectively, they are credited with providing a number of goods and services on which humans depend and which are difficult, expensive or impossible to replace with human-made alternatives (United Nations Environment Program 2003; Cork and Proctor 2005). Examples of such goods

and services include clean water and air, flood mitigation, soil fertility, and genetic resources (to say nothing of cultural, spiritual, and aesthetic values and uses) (Baron, *et al.* 2002; Cork and Proctor 2005; Butler and Oluoch-Kosura 2006). Moreover, for many people, aquatic ecosystems are an essential source of food and are connected to the sustainability of livelihoods on continents the world over (Chong 2005). As such, aquatic ecosystem protection should not be a concern limited to environmentalists intent on saving nature. Rather, it should be at the very centre of the debate on sustainable water management (Dyson, *et al.* 2003).

Aquatic ecosystem protection is particularly important in semi-arid regions where watersheds are characterized by intensive water use and the existence of large- and small-scale water control structures (e.g., dams, weirs, etc.). Although enabling increased capacity for water storage and purveyance during dry periods, such structures have had significant adverse effects on the health of aquatic ecosystems due, for example, to habitat fragmentation and reductions in flows during sensitive periods. Aquatic ecosystem protection in these settings can take many forms, including the removal or modification of dams to allow for fish passage; the alteration of water release schedules to restore seasonal variability (e.g., during spring spawning periods); and the reallocation of water resources of sufficient quality and quantity to sustain aquatic species (Bednarek 2001; Richter, *et al.* 2003; Dyson, *et al.* 2003). In addition, it can also entail modifying land and water use practices to minimize the negative effects that these have on the amount, timing, and quality of available water resources. This modification could include, for example, reducing water contamination caused by run-off through regulating

the use of pesticides and agricultural fertilizers, or by relocating livestock operations and grazing areas away from watercourses.

In light of growing concerns about the need to protect the health of aquatic ecosystems and, by extension, the human populations that depend on them, many jurisdictions around the world have created policies and legal mechanisms to protect the aquatic environment (Ferng 2007). Examples can be found in South Africa (King and Brown 2006), Australia (Schofield and Burt 2003; Gardner and Bowmer 2007), Tanzania (Wallace, *et al.* 2003), and England and Wales (Petts 1996). Similar processes are underway in Canada, including in the West where population growth, droughts, and agricultural and industrial development are placing increasing demands on water supplies and, in the process, increasing risks to humans and aquatic ecosystems (Alberta Environment 2003).

Regardless of the intended positive outcomes that such initiatives aim to generate for both humans and ecosystems, laws and policies aimed at protecting the aquatic environment are, in many jurisdictions, proving exceedingly difficult to implement. Conflict is a common result (Gillilan and Brown 1997; Brunner, *et al.* 2005; McDaniels, *et al.* 2005; Wester, *et al.* 2008). As Dyson, *et al.* (2003: 2) note,

> Taking steps to manage [water on behalf of aquatic ecosystems] brings into focus the struggle over access to and ownership of water and water rights. In systems where water is already over-allocated, the challenge of [providing] environmental flows may include reallocating or conserving water from existing private users and returning it to the river. Before starting to work on environmental flows [to protect and/or restore aquatic ecosystems], one therefore needs to realize that a wide range of stakeholders will have to be involved.

Recognition of the wide range of stakeholders or actors affected by policies designed to protect aquatic ecosystems further highlights the interconnectedness of social and ecological systems and draws attention to the diversity of factors that need to be understood before healthy aquatic ecosystems can be realized in many semi-arid watersheds.

A number of factors have been identified in the literatures on water and environmental management which help to explain why such policy initiatives experience difficulty or fail (see Acheson 2006). For example, while some have pointed to the configuration of property rights and formal institutions as the key determining factor (Slaughter and Wiener 2007), others highlight conditions of a broader political, economic and cultural nature within which water management policies are embedded (van der Lee and Gill 1999). Some scholars have pointed out the shortcomings of governance arrangements through which such policies are often formulated, implemented and enforced (Brunner, *et al.* 2005). Others assert that a misalignment of human perceptions and values with environmental goals is at least partially to blame (Burmil, *et al.* 1999).

Although regional differences in study sites could account for some of this variation, the range of possible explanations raises fundamental questions about what bearing the theoretical and analytical approach taken by the researcher has on the kinds of factors revealed. For example, contributors to the literature on environmental management have noted that studies undertaken from a political ecology perspective seem predisposed towards highlighting the kind of broad, contextual (e.g., political economic) forces that make entrenched management systems resistant to change (Armitage 2008). In contrast, the explanations of common property scholars often focus

on the role that property rights play in how people use and abuse natural resources (Johnson 2004), while the work of human ecologists has tended to provide explanations that are tied more closely to the complex and non-linear dynamics of social and ecological systems (Marten 2001). In short, the range of perspectives captured within these human-environment sub-fields would seem to support the claim that, "What one finds is contingent on what one looks for, and what one looks for is to some extent contingent upon what one expects to find" (Gerring 2007: 53).

Considered in tandem with the above discussion regarding the challenges of implementing policies for aquatic ecosystem protection, this observation helps to highlight two critical questions: 1) What are the factors that shape the development and implementation of policies for aquatic ecosystems protection?; and 2) given the range of theoretical and analytical approaches used by human-environment scholars to study such phenomena, how can one best go about identifying these factors? The answers to these questions are vital for addressing the challenge of aquatic ecosystem protection in semi-arid regions and, by extension, for sustaining the human populations that rely on them. Without these answers, we are likely to continue down the road of biodiversity loss — to our detriment and possibly to our peril. This thesis explores these critical questions.

1.3 Purpose and Objectives

The purpose of this research is twofold. First, it aims to reconcile key conceptual and theoretical insights and approaches that human-environment geographers and scholars in cognate disciplines use to study the social and ecological dimensions of human-environment interactions. Second, it aims to identify the factors that affect the

development and implementation of policies for aquatic ecosystem protection in a water stressed semi-arid environment. While providing a fertile testing ground for the conceptual work, the case study presents an opportunity for the researcher to effect positive change at the community level, which is a key priority.

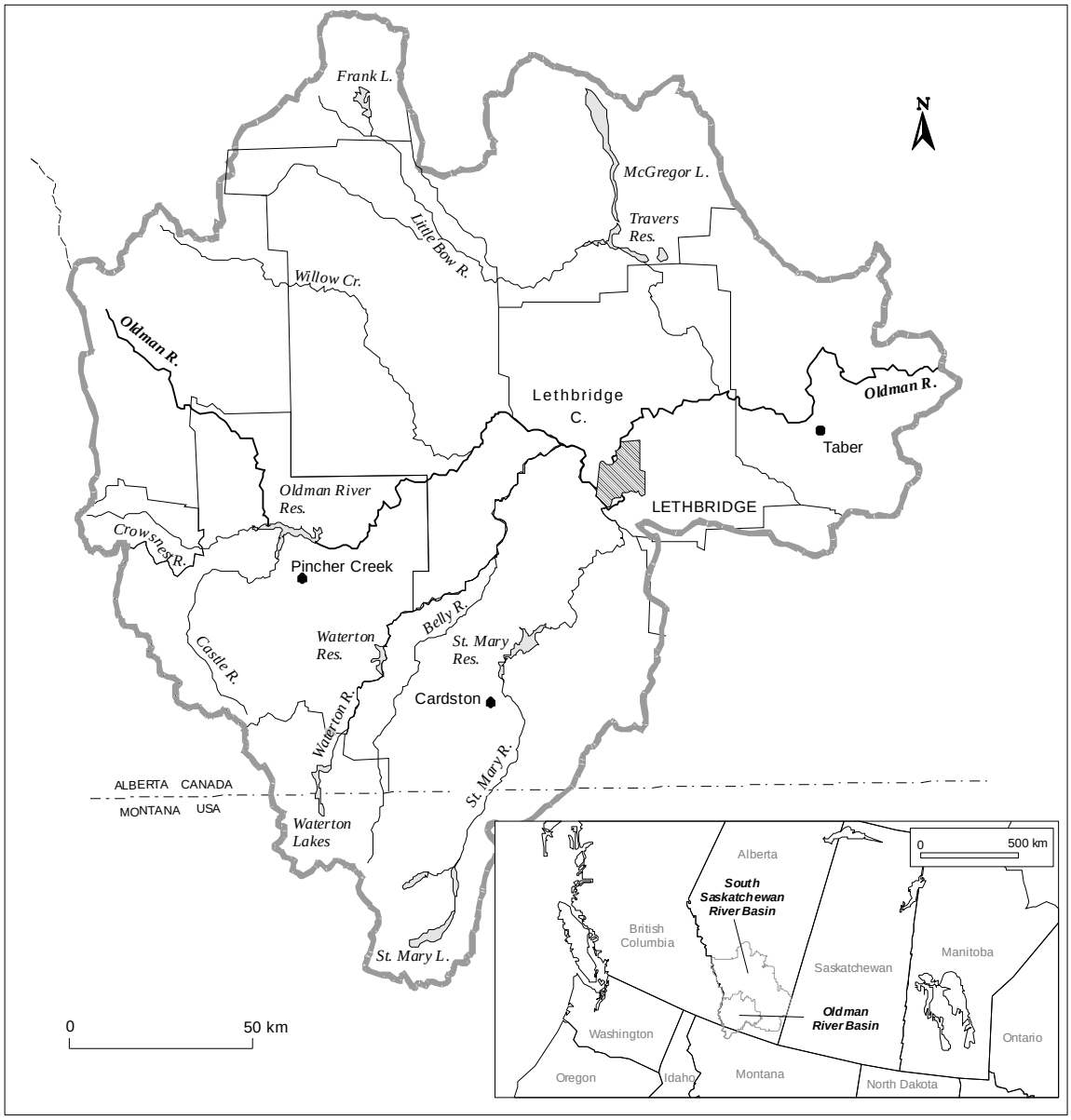
The research uses a case study of the Oldman River Basin (ORB) in Southern Alberta to satisfy the second aim (see Figure 1.1). This is a region where a long history of water allocation for the principal purpose of agricultural irrigation has left little water with which to satisfy ecosystem needs.

The study has five specific research objectives:

1. To develop a theoretical framework that expands upon previous conceptualizations of institutions by drawing together insights from human ecology, political ecology, and the scholarship on common property resources;
2. To utilize this framework to characterize the institutional context for water management in Southern Alberta as it pertains to the protection of aquatic ecosystems in the ORB;
3. To identify the factors that shape the development and implementation of policies for aquatic ecosystem protection in the ORB and to reflect on the relative significance of these factors;
4. To offer recommendations for adapting existing institutions (and/or for introducing new ones) to better serve the goal of aquatic ecosystem protection in the ORB; and,

5. To reflect critically on the suitability of the theoretical framework adopted for this research and on how the framework might be improved for future research applications.

Figure 1.1: The Oldman River Basin



Modified from Ivey, *et al.* (2006)

The remainder of the chapter provides an overview of the methodology and methods used in the empirical portion of the research. The thesis is organized around three papers. The final section of this chapter provides an overview of each paper and an explanation of how all three fit together to address the aims of the research.

1.4 Methodology

Whether interested in phenomena that can be generalized across populations or those that are more context specific, human geographers have in recent years tended to favour a case-based research approach. In this regard, Castree (2005b) describes two archetypal and opposing worldviews which tend to underlie one's affinity for small-N case studies or large-N cross-case studies.

> On the one side, a nomothetic perspective presumes an ontological regularity in both pattern and process between otherwise different contexts. On the other side, an idiographic worldview accents the contingent and enduring differences that make 'context' no mere 'modifier' of ostensibly general processes. [In the latter view,] geographical difference 'matters'…not just for its own sake but also because it has *constitutive* effects on processes, rules and regulations that are 'stretched' over wide spans of space and time (Castree 2005b: 541).

Moreover, while small-N case studies generally do not support the generalization of empirical results, they excel at maintaining the rich texture of individual cases. Gerring (2007: 48) notes that, in a case study,

> the researcher is able to probe into details that would be impossible to delve into, let alone anticipate [in a cross-case analysis]. [The researcher] may also be in a better position to make judgments as to the veracity and reliability of the respondent.

Based on these observations, and on the nature of the research objectives, a (small-N) case study approach was chosen.

The Oldman River Basin was selected as the specific study site based primarily on the political climate in Alberta at the time of the research, but also on the biophysical and regional character of the watershed. The provincial government's release of *Water for Life: Alberta's Strategy for Sustainability* in 2003 established three priorities for water management in Alberta (Alberta Environment 2003). These priorities include 1) a safe, secure drinking water supply; 2) reliable quality water supplies for a sustainable economy; and, perhaps most importantly for this research, 3) healthy aquatic ecosystems. In addition, *Water for Life* signaled a major shift from a historically-entrenched system of centralized government control over water resources to a distributed "shared governance" model. The details of this shift and the progress made to date towards *Water for Life's* three primary goals are discussed in Chapters Three and Four. What is important to note here is simply that this political climate provided a fertile environment within which to pursue the research objectives (Alberta Environment 2003; Bankes and Kwasniak 2005; Alberta Water Council 2007; Alberta Wilderness Association, *et al*. 2007).

The biophysical and regional character of the Oldman River Basin also made it the ideal study site. The combination of its semi-arid climate (Alberta Agriculture, Food and Rural Development 2000), its long history of water development and use (de Loë 2005), and its limited and shrinking water supply (Rood, *et al.* 2005) amidst growing water demands (Alberta Environment 2003) make the Oldman River Basin one of the most challenging regions in Canada to implement the goal of healthy aquatic ecosystems. The ORB's location at the headwaters of the South Saskatchewan-Nelson River system carries with it the added responsibility of management decisions and actions that affect downstream communities in neighbouring provinces.

Based on the case study literature, the research area was bounded both spatially and temporally (Stake 1995; Creswell 1998; Yin 2003). The spatial scale of the analysis was defined by the geographical boundary of the Oldman River Basin. The main temporal focus was on the recent development of aquatic ecosystem protection as a policy initiative in Alberta. However, in order to trace the development of water resources and institutions in the ORB, the researcher elected to extend the temporal boundaries to cover just over a century (i.e., the period during which irrigation development took place). The importance of historical evidence is one of several factors that guided the selection of methods used for data collection and analysis. These are summarized below and are further explained in the papers represented as Chapters Three and Four.

1.5 Methods

A wide array of data sources is commonly used in case study research (Stake 1995). These sources include interview transcripts, documents, audio-visual materials, electronic resources, newspapers, archival information, photographs, etc. Of these potential sources, three were selected as being most directly relevant to the research objectives, most accessible to the researcher, and sufficiently varied to enable internal verification of findings via cross-referencing and triangulation (Lincoln and Denzin 2000). These methods included: 1) document review, 2) key informant interviews, and 3) personal observations. Specific details about each of these methods, their relationship to one another, and how they were used are presented in detail in the papers comprising Chapters Three and Four. To avoid unnecessary repetition, they will not be recounted here. Instead, the following summary is intended only as an overview of the research methods used in the entire study.

Data collection began in July 2006 and concluded in September 2007. Upon completion of the first field season, a portion of the gathered data was run through a trial analysis (based on the method of analysis outlined below). The purpose was to assess how the research methods, the analytical framework (see Chapter Three) and methods of analysis would perform in concert. Upon the successful completion of this preliminary analysis, data collection continued over the course of two subsequent field seasons for a total of sixteen weeks spent in the study area. Prolonged engagement in a research setting is, according to Creswell (1998), one way to enhance the reliability of qualitative research. Other methods were also utilized to achieve this same end, including the triangulation of data sources, external audits of the researcher's work, and the use of a descriptive narrative in the reporting of research findings. This includes, for example, direct quotations from study participants in papers presenting the research findings (Chapters Three and Four in the thesis).

Data were collected from 72 documents, 56 semi-structured key informant interviews, and written observations from 14 conferences, workshops and watershed tours. Following recording, organization and transcription, the data were subjected to a process of content analysis, with attention being given both to primary and to latent content (Tonkiss 2004). During this process, common themes and ideas were grouped first through open coding and then by axial coding. Open coding was guided by categorical headings provided by the analytical framework (described in Chapter Three). The main categories were then divided into sub-categories via axial coding and a process that Seale (2004) describes as the "constant comparison" of individual observations within each category and sub-category. In those instances where an observation or

quotation seemed to fit into more than one sub-category, a practice was adopted of placing the data into all appropriate categories. For example, if a quotation described changes to the condition of aquatic ecosystems as a result of climate change, the quotation would be placed under the category entitled Aquatic Ecosystem Condition and then replicated under the category entitled Climate Change and Future Water Availability. Finally, the sub-categories (or factors as they are referred to later) were organized into two groups, one consisting of broad contextual factors, the other of factors affecting the extent to which aquatic ecosystem protection policies are being implemented in the ORB. It should be noted that, during both the transcription and coding processes, data that were irrelevant to the study (e.g., small talk during interviews regarding the weather, directions to the bathroom, etc.) were omitted.

The outcome of the data analysis process was a series of eight contextual factors and an additional nine factors affecting the implementation of policies to protect aquatic ecosystems in the Oldman River Basin. To help verify the analysis, a copy of the results was sent to a group of seven study participants who represented the major water users and interests (excluding First Nation interests) in the study area. While a representative of the Blood Tribe participated in the initial round of interviews, no First Nation representatives contacted were available to participate in the follow-up discussions. Referred to in the literature as "member checking" (Creswell 1998), the process of verifying results in this manner is yet another way to enhance the trustworthiness of qualitative research. Follow-up discussions with these group members resulted in only one major change. Group members agreed unanimously that the category entitled "Market Distortions" was misplaced as an implementation factor and should, instead, be

integrated into the category entitled "Historically-Entrenched Positions of Power." It is important to note, therefore, that the ninth factor was not merely collapsed into another implementation factor, but rather it became a part of one of the eight contextual factors. A review of the data revealed that, in the initial rounds of coding, much of the data that appeared under the sub-category "Market Distortions" had also been sorted under "Historically-Entrenched Positions of Power". Based on this high degree of consistency, the change was deemed appropriate and the results amended accordingly. The final eight contextual factors as well as with the eight implementation factors are presented in the papers in Chapters Three and Four, respectively.

1.6 Organization of the Thesis

The remainder of the thesis comprises four chapters. The first of these, Chapter Two, presents a paper entitled *In Search of Common Ground: Grappling with Three Approaches to Institutional Analysis in Human-Environment Geography*. This paper draws upon the work of human ecologists, political ecologists, and common property scholars to evaluate and synthesize the theoretical terrain that underlies this research. Importantly, it is argued in this paper that, despite historical differences, opportunities now exist to advance the scholarship on human-environment interactions by linking insights from all three fields. In so doing, the paper lays the groundwork for the analytical framework presented in the second paper (Chapter Three). In addition, it introduces the concept of institutions, which constitutes the unit of analysis for the empirical investigation that follows. It is important to note that Chapter Two aims to explore the vast array of possibilities that open up as a result of this integration, rather than attempting to narrowly define a single set of ideas. That said, the continuation of

this breadth of focus in subsequent papers was not possible given the scope of the project. As such, only some of the conceptual insights raised in Chapter Two are used to frame the empirical investigation that follows. The remaining ideas and insights (e.g., those expressed in Section 2.5) are revisited briefly in Chapter Five (in the process of highlighting opportunities for future research) and will be pursued directly in future publications. Prepared as a manuscript, this chapter was written for the audience of the journal *Annals of the Association of American Geographers*. It will be submitted (as will the other papers outlined below) in a slightly revised form (e.g., with minor revisions and formatting changes) following the successful defence of the thesis.

Building on the theoretical groundwork laid in Chapter Two, the next chapter is a paper entitled *Water, Politics and Aquatic Ecosystem Protection in the Oldman River Basin*. This paper presents an analytical framework which, when applied to a case study of the Oldman River Basin, helps the researcher to identify eight broad contextual factors upon which aquatic ecosystem protection in the Oldman River Basin hinges. The paper satisfies the first research objective; partially addresses the second and third objectives (i.e., to describe the institutional context of, and identify factors that contribute to the success or failure of, efforts to protect aquatic ecosystems in the ORB); and lays essential groundwork for the research findings presented in the fourth chapter. The paper comprising Chapter Three was prepared for the audience of the journal *Geoforum*.

Chapter Four is a paper entitled *Water Governance in the Oldman River Basin, Alberta: Advancing the Goal of Healthy Aquatic Ecosystems*. It presents and evaluates eight factors which, based on an analysis of the data gathered, are identified as affecting the implementation of policies for aquatic ecosystem protection in the Oldman River

Basin. In addition, reflections are offered on the relative significance of these eight implementation factors and the eight contextual factors described in the previous chapter. In so doing, the paper comprising Chapter Four satisfies the third research objective and offers recommendations for adapting existing institutions (and/or for introducing new ones) to better serve the goal of aquatic ecosystem protection in the ORB (thereby satisfying the fourth research objective). Co-authored with the researcher's academic supervisor, Rob de Loë, this chapter was prepared for the audience of the journal *The Canadian Geographer*.

While each manuscript is written as a stand-alone piece, all three are nested in a way that builds on the results and ideas presented in the previous manuscript. As such, the order in which the chapters are presented is intentional. Although some repetition from one paper to another is unavoidable (e.g., in terms of the background of the study site, research methods used, etc.) the challenge of preparing a manuscript option thesis was deemed by the researcher to have significant professional and pedagogical benefits.

The concluding chapter reflects critically on the suitability of the proposed theoretical framework for this and future research applications – thereby satisfying the fifth and final research objective. It also draws attention to strengths and weaknesses of the research, identifies topics in need of further investigation, and offers concluding remarks.

Finally, a series of appendices at the end of the thesis provides a detailed list of actors involved in the development and implementation of policies to protect aquatic ecosystems, presents the interview guides used in the study, outlines the characteristics of

the interview subjects, and summarizes conferences and workshops attended as part of data collection.

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CHAPTER TWO

IN SEARCH OF COMMON GROUND: GRAPPLING WITH THREE APPROACHES TO INSTITUTIONAL ANALYSIS IN HUMAN-ENVIRONMENT GEOGRAPHY

2.1 Abstract

Over the past several decades, contributors to human ecology, political ecology, and commons scholarship have made important and distinct contributions to the study of institutions. Due in part to major differences between the three fields' respective purposes, methods and theoretical roots, their insights have seldom been integrated. However, over the past three decades, two important developments have occurred (i.e., the rise of non-equilibrium ecology in the natural sciences and post-structuralism in the social sciences) which have begun to erode some of their major differences. Three examples used to illustrate this point include the coalescence of the three fields around the themes of complexity and uncertainty, context and scale, and knowledge, difference and plurality. Collectively, these developments signal an opportunity for integrating a range of insights on institutions from these three human-environment sub-fields. Such integration could provide many benefits to scholars interested in studying institutions and help to defray the high costs of maintaining the current status quo of intellectually fragmented perspectives.

2.2 Introduction

The study of institutions is experiencing somewhat of a renaissance in many social science disciplines (Rhodes 1997; Johnson 2004; Hotimsky, *et al.* 2006), and geography is no exception. The challenge for human-environment geographers, and their colleagues in cognate disciplines, is that the academic literature on institutions is fragmented into

distinctive views such as those espoused by human ecologists, political ecologists, and common property scholars.

For instance, in recent decades, human ecologists working on analyses of institutions have been quick to apply insights from "new" (i.e., non-equilibrium) ecology to the study of institutions while devoting considerably less attention to some related social considerations (such as power relations and political economic context) (Conley and Moote 2003; Frame, *et al.* 2004). Meanwhile, political ecologists have focused on how historical and social differences (e.g., gender, culture, wealth, race, age, etc.) influence one's environmental perspectives and practices but, at least until recently, they have failed to adjust their models with newer understandings of how ecosystems work (Zimmerer 1994; Walker 2005).

The resulting "applied" character of the work of human ecologists has afforded them great influence in public policy circles (as compared to the work of their counterparts in political ecology). However, according to Nadasdy (2007), their policy measures have often fallen victim to external processes for which they did not account. Meanwhile, the more critical and theoretical nature of the work of political ecologists has provided them great insight into the reasons that policies fail, but has left them somewhat disconnected from the policy realm, where their ideas often seem impractical and lost in verbiage (Walker 2007).

This diversity of approaches to the study of institutions in human-environment geography would be healthy if the respective insights of these approaches were considered together. Doing so would likely furnish an interesting and comprehensive view. However, the work of scholars in human-environment sub-fields is seldom read

outside of its respective academic audience (Castree 2002) — the consequences of which can be quite serious. These include missed opportunities for capitalizing on the conceptual advances made by scholars in each sub-field such as, for example, human ecologists' impressive use of insights from non-equilibrium ecology to guide analyses of human-environment interactions — a noted weakness of some political ecology research. Moreover, the observation that some sub-fields are better represented than others in policy circles raises questions about what important insights are being left out of public policy discussions. For all of these reasons, consideration of the extent to which such insights can be integrated, and why anyone would bother doing so, is warranted.

The objective of this paper is to explore the history of these three sub-fields in an attempt to map the schisms that have deterred their integration in the past and to assess opportunities for integrating them at the present time. In the process, some key differences among human ecology, political ecology, and commons perspectives on institutions are identified and situated in a historical context. Although these perspectives have seldom been integrated in the past, it is argued that two major intellectual developments — namely non-equilibrium ecology and post-structuralism — now present new opportunities for doing so. Finally, the benefits of integrating insights (and the potential costs of ignoring opportunities for doing so) are highlighted. Before any of this can be accomplished, however, some contextual details and definitions are required.

2.3 Definitions and Approaches to Institutional Analysis

Although many different definitions of the term exist within the academic literature (Mehta, *et al.* 1999), institutions have been described as the "systems of rules, decision-

making procedures, and programs that give rise to social practices, assign roles to participants in these practices, and guide interactions among the occupants of the relevant roles" (Young 1999: 27). Institutions can be both enabling (e.g., incentives) and constraining (e.g., regulations), both formal (e.g., laws) and informal (e.g., customs) (Mehta, *et al.* 1999). Conceptually, and in an environmental context, institutions have been characterized as the mediating link between humans and the natural environment (Berkes, *et al.* 2003) — a necessary starting point for connecting socially differentiated communities with biologically differentiated environments (Peet and Watts 2004). It is no surprise, then, that this topic is of interest to human-environment geographers. Evidence of this interest appears in (at least) three broad interdisciplinary bodies of scholarship to which human-environment geographers contribute: human ecology; political ecology; and common property resources.

The term human ecology is used in the broadest sense to refer to a science of human-environment interactions (Dietz, *et al.* 2003) which "studies the relationships between people and their social and physical environments" (Johnston, *et al.* 2000: 352). Binding this field together is the propensity for extending concepts from ecology into the social realm for the purpose of explanation (Johnston, *et al.* 2000; Marten 2001; Lawrence 2003; Matthias 2005). For instance, recent works have drawn heavily on such ecological concepts as adaptation (Walters and Hilborn 1978; Lee 1993; Berkes and Jolly 2002; Brunner, *et al.* 2005), resilience (Carpenter, *et al.* 2001; Folke 2006), vulnerability (Gallopin 2006; Adger 2006; Smit and Wandel 2006), and panarchy (Gunderson and Holling 2002) to give a few examples.

Political ecology also "seeks to understand the complex relationships between nature and society" (Watts 2000: 257) but it does so through the lens of ecologically rooted social science and the principles of political economy (Peet and Watts 1996).[1] The emphasis here is on challenging apolitical explanations of human-environment interactions and environmental degradation (Robbins 2004). Some key concepts that have helped to shape research in this field include marginalization (Blaikie 1985), entitlement (Sen 1981), moral economy (Scott 1976), livelihoods (Scoones 1998), social justice (Rocheleau, *et al.* 1996), knowledge and power (Peet and Watts 1996).

The literature on the commons (a.k.a. common property resources [CPRs]), "[is rooted in] the belief that property and property relations have a strong bearing on how people use, manage and abuse natural resource systems…" (Johnson 2004: 407).[2]

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[1] The relationship between political ecology and political economy can be confusing and is worth clarifying. Political economy is a theory that, in the broadest possible terms, is rooted in the belief that "the political and the economic are irrevocably linked" (Johnston, *et al.* 2000: 593). Political economy's rise to prominence during the 1960s and 70s fueled the development of what is known as "the radical movement" in geography, where the discipline became more closely aligned with "critical" insights from sociology, political science and related social science disciplines than it was in previous decades. Political ecology, by contrast, is not a theory – but rather a field (or body of scholarship) that focuses intently on the nexus between social and environmental issues. Although heavily influenced by political economic theory, political ecology has evolved to draw on a number of theoretical lenses (including [but not limited to] political economy). Due partly to the close ties between the theory of political economy and the field of political ecology, the two terms often appear in close proximity — which can lead to no end of confusion unless one is familiar with their respective meanings.

[2] In his rich characterization of commons scholarship, Johnson (2004) notes the existence of a second voice that competes to be heard in the commons literature. This alternative body of work on the commons, which he refers to as "entitlements" scholarship, takes as its main normative compass poverty reduction and the alleviation of social injustice, as opposed to the ecological health of the commons which is held dear in the mainstream commons literature. It is interesting to note, however, that many of the same scholars and studies that are cited as contributing to the entitlements literature are also cited as contributing to political ecology. Sen (1981), Blaikie and Brookfield (1987), Goldman (1998) and Leach, *et al.* (1999) all appear in Johnson's (2004) appraisal of entitlements scholarship and in Peet and Watts' (2004) synopsis of political ecology.

Research by human-environment scholars in this field has aimed to characterize, describe and, at times, develop the rules by which people access and use natural resources that are held in common (for example - air, water, the atmosphere, etc.) (Ostrom 1990; Ostrom 2003).

Although contributors to all three fields have focused on institutions as a unit of analysis, they have often gone about it in different ways. For instance, human ecologists hold largely to the precepts of what Mehta, *et al.* (1999: 13) describe as "mainstream" institutional theory, which tends "to view institutions in functionalist and managerialist terms…[where institutions are considered to be] rules, regulations and conventions imposing constraints on behaviour to facilitate collective action." Similarly, the literature on the commons also adopts a functionalist interpretation of institutions.[3] Political ecologists, by contrast, tend to view institutions "in more processual and dynamic terms…as the product of social and political practices…" (Mehta, *et al.* 1999: 13). This is not to say that human ecologists do not consider social and political processes in their analysis of institutions; in fact they do, and often explicitly so. The difference between these two approaches, according to Nadasdy's (2007: 216) appraisal of human ecology

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While being much indebted to Johnson's insights on commons scholarship, this paper adopts the convention of using the term "commons" to refer to mainstream (or "collective action") commons scholarship, while including "entitlements" scholarship under the broader heading of political ecology.

[3] Research in the human ecology and commons traditions are complementary in many respects — each drawing on insights and concepts advanced in the other. While some reviewers have grouped the two fields under a single heading (e.g., Goldman 1998), they have been kept separate here for the purpose of this discussion due to their distinctive theoretical cores. That said, it is likely that the reader will note many similarities in the way that these two fields are characterized, particularly with regard to their respective purposes and methods.

scholarship on adaptive co-management is that, unlike political ecologists, human ecologists

> largely ignore the broader political economic context within which environmental management institutions are themselves imbedded…Thus, while [human ecologists] clearly recognize that it is the economic imperatives of modern extractive and agro-industries that are the root cause of the management 'pathologies' that lead to decreased resilience and ultimate [socio-ecological] collapse, their proposed solutions do not address these larger issues at all.

This is not to say, however, that Nadasdy's critique applies equally to all human ecologists, or that some cross-over in the three fields does not occur. In fact, it does occur, particularly between human ecology and commons scholarship (see Armitage 2008 regarding links between commons governance and the literature on resilience in social-ecological systems and complex systems theory [i.e., human ecology]). Nevertheless, the approaches to institutional analysis held by most contributors to these three bodies of scholarship are, in many ways, distinctive.

In their critical review of institutional theories used to study environmental change, Hotimsky, *et al*. (2006: 44) draw comparison between what they term as the utilitarian/functionalist approach (which draws inspiration from the discipline of economics) versus the power-distribution/legitimacy approach (which, they claim, links to insights from sociology). Although the authors do not focus on the three interdisciplinary bodies of scholarship specifically outlined here, their analysis is nonetheless instructive with regard to distinguishing between the human ecology/commons approach (shaped, in part, by institutional economics) and the political ecology approach (which is often informed by critical social theory).

With reference to the former (i.e., human ecology/commons) the authors explain that:

> Academics [working in this tradition] will seek to design arrangements that alter the structure of (dis)incentives that actors face in order to produce successful environmental outcomes: a process termed "crafting"…In this way, a rational manipulation of preexisting institutional arrangements by social actors becomes a real possibility...

In the case of political ecology:

> Academics who favour this logic contextualize environmental challenges in historical, political, cultural, and bioregional frames…This requires a greater attention to the "embeddedness of individual and social action, and the historical, political, sociocultural, and ecological specificity of human-environment interactions and institutions" (McCay 2002: 362).

To help expand upon these differences, it is useful to examine each field's respective purpose, methods, and theoretical roots.

2.4 Discordant Histories

Examples exist of individual scholars whose work spans the customs and conventions of political ecology, human ecology and common property scholarship. Historically, however, these three fields have been characterized by a number of key differences.[4] These include: 1) a division of general purpose between critical (e.g., political ecology) and applied (e.g., human ecology and commons scholarship) perspectives; 2) divergent methodologies (socio-historical versus deductive); and 3) heterogeneous theoretical roots in the areas of social theory, ecology, and economics,

[4] It should be noted that the characterizations of the three fields outlined in this section draw particularly from historical accounts, with an aim to provide the clearest possible contrast relative to more recent depictions of each field which surface in the following section on non-equilibrium ecology and post-structuralism.

respectively. At the risk of oversimplification, Table 2.1 attempts to summarize these differences.

Table 2.1: Summary of the Discordant Histories of Political Ecology, Human Ecology, and Common Scholarship

Sub-field	Purpose	Methodology	Theoretical Roots
Political Ecology	Critical (see Walker 2007)	Structural-Historical (e.g., Watts 1983b)	Social Theory (e.g., Peet and Watts 2004)
Human Ecology	Applied (see Peet and Thrift 1989)	Deductive (see Goldman 1998)	Ecology (e.g., Holling 1978)
Common Property Resources	Applied (see Agrawal 2001)	Deductive (Johnson 2004)	Economics (Ostrom, *et al*. 1994)

2.4.1 Purpose

With regard to purpose, human ecology can be characterized as an applied field which stresses practical outcomes such as policy formulation and resource management. An often-cited example of such research in geography is the work on risk and natural hazards by Gilbert White and his colleagues (for a review of this work, see Burton, *et al.* 1978). White strongly believed that the purpose of the academy and of scientific research was to serve the public good. As such, his work took on a decidedly applied character. This approach earned him (and the Chicago school of resource geography that he developed) the distinguished status of "geography's outstanding success story in the academic-governmental arena" (Emel and Peet 1989: 62). Although human ecology has continued to evolve in the three decades since the zenith of White's work, the focus on practical application that exemplifies his approach remains a cornerstone of the field.

Commons scholarship also has an applied focus. This is evident in the "institutional design" work of such notable scholars as Elinor Ostrom (1990) and Robert Wade (1988) (for a synopsis and critique of these and other works on CPRs, see Agrawal [2001] and Goldman [1998]). The commons literature is replete with facilitating conditions and design principles for crafting effective institutions to deal with commons dilemmas.[5] Much like the case of human ecology, the affinity for practical outputs in commons scholarship has contributed to its uptake in both policy circles and the academic arena (Agrawal 2001).

Political ecology is characterized by a critical perspective and seems more intent on describing and critiquing the politics of society-nature relationships than in devising practical outcomes such as management actions or policy recommendations. For example, one of the earliest texts in this literature (Blaikie and Brookfield 1987) highlights the apolitical nature of most research on common-property institutions (as outlined above). In it, the editors argue that any investigation of common-property resources requires close attention to place- and resource-specific institutions because these are inherently political in nature and have situationally-dependant social repercussions. While raising a number of important insights, the political nature of political ecology (compared to the relatively apolitical nature of human ecology and commons scholarship) has also attracted some criticisms. These include a propensity for making "a priori judgments…about the importance or even primacy of certain kinds of

[5] It is important to note that, despite colloquial assertions to the contrary, commons scholarship (as well as human ecology for that matter) is far from atheoretical. Both fields draw heavily on rich theoretical and empirical sources — they just do so with tangible, practical (and, arguably, uncritical) motives in mind.

political factors in the explanation of environmental changes…" (Vayda and Walters 1999: 167) and for failing to provide practical outputs that might be useful in policy development (Walker 2007).

The relationships that exist between the three fields touch on a much broader tension that exists in the academy between critical and applied perspectives, which has been variously described by geographers as the rift between "critical and problem-solving" approaches (Castree 2002), and as the difference between "environmental managerialism and political economy" (Bryant and Wilson 1998). This point of contention is further reflected in the methodologies of the three fields.

2.4.2 Methodology

Johnson (2004) captures the methodological tension that exists between critical and applied perspectives in his characterization of "collective action" versus "entitlements" scholarship on the commons (the former being referred to in this paper as the commons and the latter under the heading of political ecology). Johnson (2004: 410) argues that collective action (i.e., commons) scholarship is rooted in a deductive approach intent on developing an "empirically-grounded theory of social action," in which societal behaviour can be reduced to an amalgam of individual decisions (i.e., methodological individualism).[6] In contrast, according to Johnson, entitlements researchers (i.e., political ecologists) see societal institutions as far more complex, contested, and indivisible into their component parts. The tension between the two is "a divergence between a social science which seeks to build theory on the basis of scientific empiricism [i.e., commons

[6] Noteworthy here is the fact that human ecology tends also to follow a deductive model, which is not particularly surprising when one considers its roots in the natural sciences.

scholarship] and an ethnography which rejects the universalism that underlies the scientific approach" [i.e., political ecology] (Johnson 2004: 428). In short, this methodological dichotomy characterizes a contest between science and history; a search for law versus a search for meaning (Geertz 1973 in Johnson 2004). It is important to realize, however, that while the structural-historical "entitlements" approach outlined by Johnson extends to many political ecologists, the field is far too broad and diverse to be restricted to a single methodological approach. Still, this example highlights the type of methodological issues which can distinguish critical from applied perspectives in human-environment geography and which can colour the approach taken to the study of institutions by scholars in the three fields discussed here. Where this dualism begins to unravel, however, is in the theoretical roots that underpin scholarship on the commons, political ecology, and human ecology.

2.4.3 Theoretical Roots

Human ecology has its roots in ecology and simple systems theory. As early as the late 1940s, concepts used by community ecologists to explain ecosystems (for example - carrying capacity, balance, homeostasis, etc.) were incorporated into the lexicon of human ecology and applied to studies of social phenomena. By the 1970s, however, the explanatory powers of systems theory were increasingly being criticized by some in the academy as being incapable of addressing problems of a broader political nature. Thus, there was a shift of emphasis (for some) toward more critical theoretical perspectives (see Chorley 1973; Emel and Peet 1989). Hazards research was met by the rise of Marxist political economy in geography (Barnes and Day 1995) — which seemed more capable

than simple systems theory of explaining the social and political dimensions of human-environment interactions. As Watts (1983a: 240) explains,

> in spite of the recognition by Kates, White and others of the strategic importance of social causality, they [had] no social theory capable of addressing social process, organization or change.

It was from this shift toward more radical and politically astute perspectives that political ecology emerged in geography, partially in response to the perceived failings of human ecology. As such, political ecology essentially traded a once-strong link with ecology for a new focus that was chiefly concerned with the politics of the environment (Zimmerer 1994; Vayda and Walters 1999). So effective was this movement away from ecology that it has given cause for both supporters (e.g., Walker 2005) and critics (e.g., Vayda and Walters 1999) alike to ask where, if at all, the ecology in political ecology is to be found? Zimmerer (1994) draws attention to the fact that, during the late 1970s and early 80s, in the great rush to dispose of all things systems-based, political ecology (and human-environment geography) failed to recognize the development of "new" (i.e., non-equilibrium) ecology as a distinct entity and, as a result, 'threw the baby out with the bath water' (see non-equilibrium ecology below). Thus, while much human ecology was criticized for failing to address broader social and political issues, political ecology ended up relinquishing human-environment geography's grip on ecology (Zimmerer 1994). As such, both fields seemed to mimic the strengths of their respective theoretical roots (i.e., human ecology showed strengths relating to concepts drawn from ecology and political ecology in the social theory of political economy).

Like political ecology, research on the commons also emerged from political economy in the 1980s — albeit with a focus that was positive, rather than normative (Alt

and North in Ostrom 1990). Taking its theoretical bearing from work on institutional economics, this body of scholarship focused initially on the accumulation of empirical evidence to dispel Garrett Hardin's (1968) "Tragedy of the Commons" thesis and, later, on the development of an alternative socio-economic theory of the commons.[7] Commons scholars conclude that Hardin's insistence on either state or market intervention to avert such "tragedies" is inadequate. Instead, they champion the assertion that many solutions exist to cope with commons dilemmas — favouring solutions that build on the collective action of local land users (Ostrom 1990). This body of work has benefitted from an impressive amount of scholarly attention, both directly (by scholars specifically interested in preserving the commons) and indirectly (from heightened attention to institutions in the economic sub-field of new institutional economics). It has, however, also come to be criticized for being apolitical (see Mosse 1997; Cleaver 2000) and for relying on outdated understandings of ecological dynamics (Scoones 1999). Much like in the case of human and political ecology, the strengths of early commons scholarship seemed to mimic those of its theoretical underpinnings (i.e., institutional economics) and proved to be less capable in areas that are better supported in the other two fields (i.e., ecology in human ecology and social theory in political ecology). This is an important point to which I will return in greater detail in the discussion section.

The disharmony that exists between the rationalist assumptions that underlie commons scholarship and the political focus of political ecology presents further challenges to integration. While many political ecologists view an individual's decision

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[7] Goldman (1998) summarizes Hardin's thesis as the belief that "selfish individuals using common-pool resources will over-consume to the detriment of all."

making processes as time- and context-specific and informed by a host of (at times conflicting) motivations, commons scholars have been noted to view individuals as rational and predictable thinkers, motivated largely by economic factors. The strong belief in economic rationality that underlies commons scholarship has come under fire from political ecologists on several fronts. For example, it has been argued that a person's decisions and actions are often informed by an array of motivations that extend beyond economic self-interest to include such factors as culture (McCarthy 2002; Nightengale 2003), religious ideology (Cleaver 2000) and moral economy (Douglas 1987), to name only a few examples. Still others have criticized the methodological individualism that informs the institutional-economic approach, arguing: 1) that a person's choices are often motivated by cultural and societal norms versus individual self-interest (Mosse 1997); and 2) that society cannot be reduced to its component parts. While these critiques help to illustrate some of the underlying tensions that inform the different approaches taken to the study of institutions in commons scholarship and political ecology, other examples highlight key differences with human ecology. For instance, human and political ecologists have, historically, failed to agree on what constitutes the very nature of human-environment (a.k.a. society-nature) relations. On the one hand, human ecologists maintain that humans can be thought of as only one of many species in a broader global ecosystem. Political ecologists, on the other hand, see human society and its relationship with the natural world as far more complex. From the latter perspective, Watts (1983a) has argued that, by adhering to an ecologically-based systems approach, human ecologists reduce the role of humans to that of "atomized individuals or organisms…roughly synonymous with a top carnivore" (Watts 1983a:

234). Instead, he, like many political ecologists, champions a broader social theory that enables a more sophisticated understanding of society-nature relationships.

Taken on the whole, the perspectives and debates that are rooted in these varied positions raise important questions as to whether or not insights from the three fields can be linked and, if so, why anyone would bother attempting to do so. Over the last three decades, two important developments have occurred in the natural and social sciences that shed some light on these questions and have begun to erode some of the major differences between the three fields.

2.5 Finding Common Ground: Post-structuralism and the "New" Ecology

The advent of new (i.e., non-equilibrium) ecology in the biological sciences and post-structuralism in the social sciences have had a significant impact on the three fields studied. Moreover, these intellectual developments have led to the coalescence of all three fields around similar areas of emphasis.

Although non-equilibrium ecology emerged during the 1970s (see Botkin 1990; Levin 1999), it was slow to take hold. Before this time, the classical paradigm of equilibrium ecology (referred to by Scoones 1999 as the "balance of nature" perspective) held sway. From this early vantage point, ecological systems were seen as closed systems characterized by a naturally stable state, complete with a specific carrying capacity from which withdrawals of resources (for example, fish harvests) could be made before the systems would fall out of balance and collapse. Translated into resource policy, equilibrium ecology provided the theoretical grounding for the development of a host of command-and-control style resource management instruments (Holling and Meffe

1996) including catch quotas for fisheries, wildfire suppression in forests, and linear flow regulation in rivers. Wu and Loucks (1995: 439) note that "the theories and models built around these equilibrium and stability principles… misrepresented the foundations of resource management, nature conservation, and environmental protection." This became increasingly evident and, eventually, impossible to ignore as managed ecosystems collapsed (see, for example, Ludwig, *et al.* [1993] re: Atlantic cod fisheries; Holling and Meffe [1996] re: the death of native fish species on controlled rivers, forest ecosystem collapse due to fire suppression policies, and several others). Based on these early failings and on continued empirical research, ecologists began to recognize whole new levels of depth and complexity within ecosystem functions (see Pickett, *et al.* 1992). Natural systems were found to have not just one but many states or "ways to be" and, in time, a shift away from the balance of nature concept and towards an outlook that is better characterized by the metaphor "the flux of nature" (Pickett, *et al.* 1992) became apparent in ecological theory. In contrast to earlier beliefs, this "non-equilibrium" understanding of ecological processes focused on such characteristics as complexity, uncertainty, variability and change. Natural systems came to be seen as open and characterized by dynamism and change. Emphasis was increasingly placed on determining how the non-linear dynamics of ecosystems are affected by the interaction of fast- and slow-moving processes and by variations in spatial and temporal scale (Folke 2006). As non-equilibrium ecology developed, a whole new language began to emerge to describe the various elements being discussed, including such terms as variability, resilience, self-organization, cascading effects, sensitivity and surprise (Scoones 1999). This revolutionary rethinking of ecological theory had substantial implications for the

field of ecology and, in time, also served to reorient the thinking of many social scientists interested in the relationships between humans and their environment.

At about that same time, in most social sciences (although later in human-environment geography), post-structuralism began to question and challenge the way that many scholars had understood the workings of social systems up to that point. To simplify matters greatly, structuralist thinkers, on the one hand, focused their attention on the structure and mechanisms underlying society (for example, Marx's superstructure) in an attempt to make generalized observations about how these mechanisms shape social interactions. Post-structuralists, on the other hand, called such generalizations into question and, in so doing, highlighted the inherent complexity of social interactions (Murdoch 2006). As Peet (1998: 215) notes,

> Post-structural theory understands society to be a system of power and expresses extreme skepticism about totalitarian politics…Post-structural theory…takes the side of marginal groups, values difference over sameness, and [focuses on] identity rather than class politics…"

If structuralists can be seen as interpreting societal interactions as predetermined by closed, generalizable, and deterministic structures, post-structuralists can be seen to characterize them as open, context-specific, and historically-situated — and always shaped by relations of power. Regardless, it is important to note that few geographers would readily self-identify with either of these categorizations. This is particularly true of post-structuralism which is often used to refer to a broad array of intellectual ideas and epistemic communities that "do not share a common credo" (Harrison 2006).

Nevertheless, as defined here, post-structuralism and non-equilibrium ecology collectively have had a significant effect on the ways that human-environment scholars

approach the study of human-nature relations and the institutions that mediate them. Just as non-equilibrium ecology characterizes ecosystems as complex, post-structuralism portrays social relations in the same manner.[8] These changes in thinking have helped to erode old arguments among human ecologists, political ecologists and commons scholars and to establish common ground between them. Evidence of this is manifest in recent work in each of the three fields and can be illustrated with reference to three examples: 1) greater appreciation of complexity and uncertainty; 2) specific attention to context and scale; and 3) increased sensitivity to sources of knowledge, difference and plurality (summarized in Figure 2.1).

2.5.1 Complexity and Uncertainty

As outlined in the introduction to this paper, human ecologists were relatively quick to pick up on the shift toward non-equilibrium based understandings of ecosystem functions. Of particular note was the advent of "complex systems" and "social-ecological systems" theory in human ecology — a conceptual viewpoint which holds that, while social and ecological systems are complex and distinct, they are inextricably linked (Berkes and Folke 1998). This development symbolized a considerable shift from earlier, simple systems-based understandings of humans merely as the "top carnivore" in a global ecosystem (Watts 1983a) and served to bring human ecology's conceptualization of human-environment interactions much closer to the views espoused by political ecologists.

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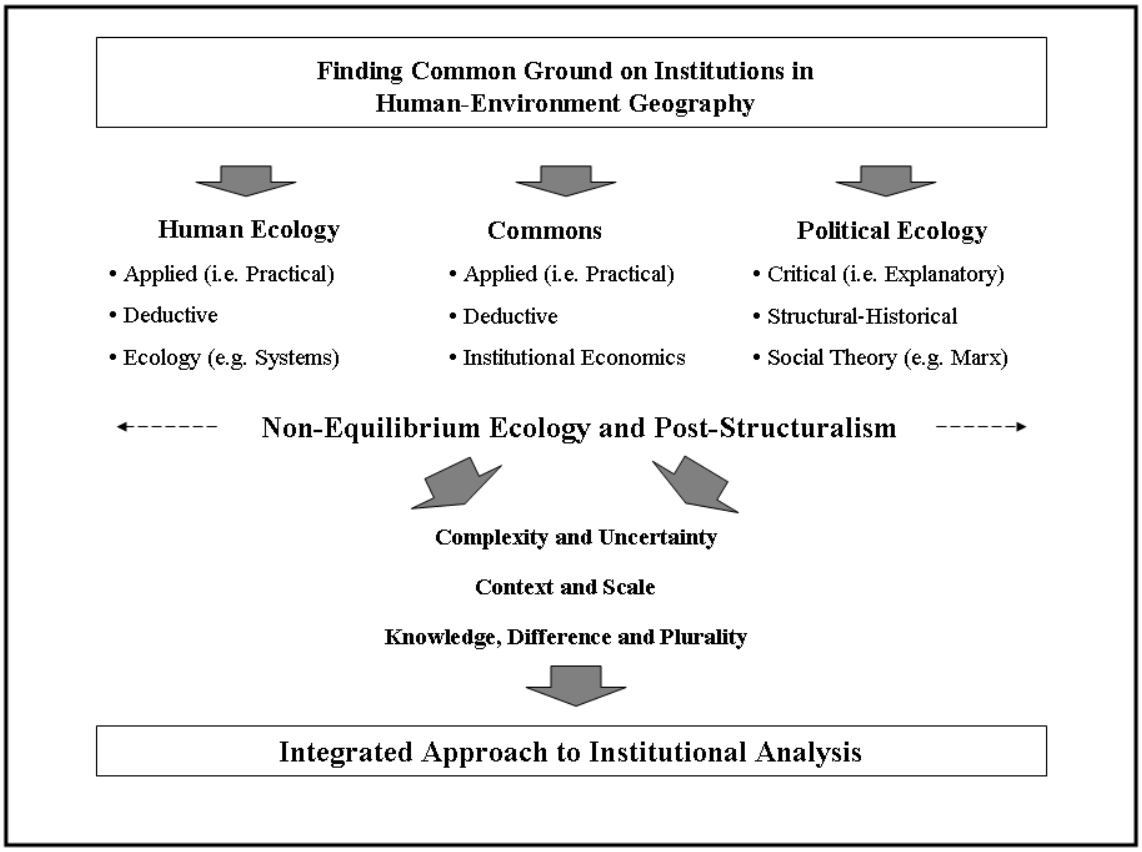
[8] It is important to note that the deconstruction of myths and meta-narratives that lies at the core of post-structural thinking is not done for its own sake. In post-structural narratives, deconstruction is meant to draw attention to the particular, the marginalized and the specific – but it stops short of rejecting outright the prospect of social progress (thus its distinction from postmodernism).

Figure 2.1: Finding Common Ground on Institutions in Human-Environment Geography



Although criticized in the past for failing to incorporate non-equilibrium ecology into their analysis (Scoones 1999), recent contributors to the commons literature show signs of change in this regard. Consider, for instance, Wilson's (2002: 351) work on accounting for scientific uncertainty and ecosystem complexity in the design of common-pool institutions. Drawing on a fisheries example, Wilson argues that,

> we have [in the past] wrongly characterized our knowledge of the natural environment and, consequently, have viewed the uncertainty and learning problem as if it were a typical engineering problem. As a result, we have created institutions and administrative procedures ill adapted to a solution of the conservation problem…Complex adaptive systems do not lend themselves to long-term prediction consistent with the needs of sustainability because of their changing, complex, and usually nonlinear relationships.

In a still more recent example, Dietz, *et al.* (2003) unpack the requirements of what they call "the adaptive governance of complex systems," presenting this as one way forward with respect to governing the commons. The authors' use of the concepts of adaptation and complex systems clearly demonstrates the uptake of ideas from non-equilibrium ecology into the scholarship on common property resources.

This recent coming together of ideas around complexity and uncertainty begins to hint at an increasing compatibility among commons scholarship, human and political ecology, but where the three fields find still greater congruence is in recognizing the importance of context and scale.

2.5.2 Context and Scale

Recognition of the inherent complexity, uncertainty, and variability of social-ecological relationships also seems to have highlighted the importance of two themes that have long been of central importance to geographers, namely context and scale.

Of late, human ecologists have increasingly focused their attention on the local level and the concept of community in environmental management (Pinkerton 1989; see Armitage 2005), and on how local activities interconnect with ecological (Folke, *et al.* 1998) and political (Cash and Moser 2000) activities at different scales. An understanding of these so-called "cross-scale institutional linkages" is predicated on nesting institutions both vertically (within local, regional, national, and international arenas) and horizontally across a landscape of overlapping social and ecological interactions (Berkes 2002; Young 2002). Resonance with these emerging insights and foci is further evident in political ecology. Although some political ecologists have questioned the usefulness of "community" as a conceptual unit (see Agrawal and Gibson

1999), there has been an observable shift toward community-based research (see Corbridge and Kumar 2002; Rocheleau and Roth 2007) and attention to fine-grain politics at the micro scale (i.e., micro-politics — see Schroeder and Suryanata 2004; Carney 2004). In this instance, attention to institutions, power-dynamics and micro-politics is again situated in vertical "chains of explanation" (Blaikie and Brookfield 1987) with recent calls for greater attention to the horizontal plain in what Robbins (2004) calls "networks of explanation." Although situated in two separate bodies of scholarship, the concepts of cross-scale institutional linkages and networks of explanation highlight emerging synergy between human and political ecology.

Commons scholarship also focuses on the local level in its promotion of local institutional arrangements over state- or market-driven mechanisms (although not to the exclusion of the other two). Most commons scholarship calls for a polycentric locus of control (Ostrom 1990) where responsibility for resources is shared across multiple scales [for example - local, regional, national, and international]). Recently, this scholarship has also become concerned with linking local and global institutions for protecting the commons (see Dietz, *et al.* 2003; Berkes 2006). Once again, these developments in commons scholarship are complemented by distinct but related advances in political ecology. For example, in the literature on the politics of scale, Swyngedouw (1997) highlights the interconnected nature of local and global scales and offers the concept of "glocalization" as a way of coming to grips with cross-scale processes that are neither exclusively local nor global, but rather some combination of the two. Further insights can be found in feminist political ecology (and feminist geography more generally), including Marston's (2000) call for attention not only on local level micro-politics, but

also to interactions at the household level (where gender plays a potentially significant role in decision formation and access to resources).

These examples further highlight opportunities for linking scholarship from the three fields to broaden the range of conceptual tools available to scholars studying institutions.

2.5.3 Knowledge, Difference and Plurality

Knowledge, difference, and plurality present a third and final example of topics that have increasingly received attention from scholars in all three fields and which hint at the potential for linking their respective insights. For example, both human ecologists and commons scholars have acknowledged that diverse perspectives and sources of knowledge exist that help to inform our understanding of human-environment interactions. Whether in the form of expert (Western) scientific knowledge, Traditional Ecological Knowledge (TEK), expert, lay or local knowledge — multiple perspectives are seen as having potentially important insights to offer that can help to guide and improve resource management decisions. Recognition that knowledge is always partial and never free of uncertainty is evident in the call for "adaptive management" pioneered by many notable contributors to the human ecology literature (for example, Holling 1978; Lee 1993). Recently, scholars in this field (as well as political ecologists) have begun to grapple with the challenges that arise from attempts to integrate distinct forms of social and ecological knowledge (see Nadasdy 2003). Political ecologists have not only paid credence to the knowledge and stories of culturally diverse and socially marginalized groups, but they have also taken the analysis of knowledge claims to an epistemological level. Peet and Watts (2004: 20) assert that "any sophisticated political ecology must

contain a phenomenology of nature…[which] take[s] seriously Blaikie's (1985) point that environmental problems can be 'perceived' in a variety of ways." Further, they (along with Scoones 1999) note that recent work in political ecology has taken this consideration to the next level, first by focusing on the power relations that give shape to discourses of environmental management, and then by linking these diverse sources of knowledge to actual ecological conditions. Scoones (1999: 497) notes that,

> it is the interaction between these two perspectives — socially constructed perceptions and representations and real processes of biophysical change and ecological dynamics — that is key to policy and practice.

Scoones' point about needing to link social representations with real processes of biophysical change is extremely important, and one that I will return to momentarily in the discussion and conclusion.

To summarize, the coalescence of the three fields around the themes of complexity and uncertainty, context and scale, and knowledge, difference and plurality suggests that opportunities exist for integrating a range of available insights. Further to this, however, is evidence which suggests that such integration is not only possible — but in some cases, already on-going. For example, some contributors to the human ecology literature have indicated a willingness to incorporate insights from political ecology into their work (see Berkes 2004; Slocombe 2004). Others have argued for the extension of the economic analysis of institutions (found in the commons literature) to include other more politically-oriented factors such as an interrogation of "institutions of power" (Goldman 1998) and the inclusion of "symbolic interests [that are] normally rejected as economically irrational" (Mosse 1997). Still others have begun to actively experiment with such integration. These include Robbins (2000) and Agrawal (2001) in their work

on institutions (which builds on insights from the commons literature), Peterson (2000) in his attempt to link political ecology and the concept of resilience, Rocheleau and Roth's (2007) appeal for "a working coalition" of scholars in human and political ecology on the study of networks and relational webs, and Armitage (2002; 2008) in his work to draw together insights from political ecology, commons scholarship and complex systems theory. While these examples provide clear evidence that the three fields can be (and in some cases, are being) linked, the question remains as to what benefits would accrue from doing so. This question is addressed in the concluding section.

2.6 Discussion & Conclusion

The diversity of perspectives on institutions that exists within human-environment geography and cognate disciplines (only three of which are discussed here) presents tremendous prospects for furthering this area of research. They also present tremendous challenges. Before the affects of non-equilibrium ecology and post-structuralism were felt in human ecology, political ecology, and commons scholarship, the prospects of somehow linking their respective contributions seemed bleak. In light of recent developments, however, it would appear that some hope for linking insights does exist (Hotimsky, *et al.* 2006) and may, in fact, be beneficial for all three fields. Although no single approach represents "the missing piece" (Armitage 2008), their collective potential to further our understanding of human-environment interactions is significant. While attempts at integration would require scholars to confront the difficult challenge of bringing together the work of human ecologists, political ecologists, and commons researchers, there are compelling reasons as to why this challenge should be met (see Table 2.2 below).

Firstly, it would be a gross oversimplification to suggest that the fields of human ecology, common property resources, and political ecology are exclusively tied to ecology, economics and social theory respectively. (For example, White's work on natural hazards demonstrates a clear connection with economics, as also do numerous works that have emerged over the years in political ecology (including Blaikie [1985]; Scoones [1997], etc.). Nevertheless, a review of writings in each of the three fields reveals a degree of strength and consistency between each field and its respective theoretical roots: human ecology with non-equilibrium ecology; commons with economics; and political ecology with critical social theory.[9] As outlined previously, Scoones stresses the necessity of linking social reproductions (such as knowledge and values about ecosystems) with real biophysical processes (thereby making the point that, regardless of the values that inform one's interactions with non-human nature, complex ecosystems still have some very real limits). To this, many others in the literature on human-environment interactions (e.g., Pritchard and Sanderson 2002) add the need to include an understanding of economic processes (which Scoones may well have subsumed under social reproductions). Only with an appreciation of social, ecological and economic context and processes can one begin to develop a comprehensive understanding of human-environment interactions. That said, as has been noted by various critics of these three fields, each is in some way deficient when it comes to addressing these three key themes (for example, political ecology lacks ecology [Walker 2005], commons scholarship [Blaikie and Brookfield 1987] and human ecology [Emel

[9] I use the term "critical social theory" to refer to social science scholarship that is critical in a broad political sense. This is not to be confused with the narrower sense of the term that is often used to refer to the work of Frankfurt school critical theorists.

and Peet 1989] are apolitical, etc.). Thus, it logically follows that linking insights from all three fields could substantially strengthen the depth of ones' understanding of human-environment interactions. Drawing on concepts and insights from economics, ecology and critical social theory, an integrated approach could enable one to advance (in new and exciting ways) the *raison d'etre* of human-environment geography — to develop a better understanding of human-environment interactions.

Table 2.2: The Benefits of an Integrated Approach to Human-Environment Scholarship

- The incorporation of insights from non-equilibrium ecology into investigations of human-environment interactions would help to overcome the continued use (by some) of antiquated ecological models and concepts (see Zimmerer 1994; Scoones 1999; Walker 2005).
- Greater sensitivity to pertinent sources of social difference would help to address the failure by some to fully appreciate the role of social difference (e.g., age, gender, caste, etc.) in shaping environmental institutions (see Leach, *et al.* 1999).
- Increased attention to socio-historical context and to the plurality of perspectives that inform the development of institutions would help to capture more fully the myriad of issues and perspectives that lead up to current institutional practices (see Johnson 2004).
- Closer attention to the complex, non-linear dynamics of social-ecological interactions would help to produce analyses that better reflect the true complexity of society-nature relationships (see Mehta, *et al.* 1999).
- The integration of insights from human-environment sub-fields has the potential to overcome the historic tension between critical and applied scholarship and to make valuable contributions to both theory and practice (see Rocheleau, *et al.* 1996).
- Closer attention to context (e.g., political economic) would help to overcome the tendency of some human-environment scholars to down-play the importance of the broader political economic context within which environmental management institutions are themselves imbedded (see Mosse 1997; Cleaver 2000; Nadasdy 2007) and, in so doing, to advance the *raison d'etre* of human-environment geography (i.e., to better understand human-environment interactions).

Secondly, recent works by feminist political ecologists demonstrate that avenues exist for overcoming the traditional schism between critical and applied scholarship. In their critique of scientific knowledge, Rocheleau, *et al.* (1996: 289) caution against the uncritical separation of "knowing and doing" and of "formal and informal" knowledge — as this separation can mask differences in gendered knowledge. The implication for research on institutions is that the feminist political ecology approaches "derive theory from practical experience, [thereby] avoiding the pitfalls of maintaining a strict distinction between theory and practice." This line of thinking demonstrates a clear departure from old rivalries between critical and applied perspectives in human-environment geography and speaks to the potential for finding common ground between institutional research that was once divided by such dichotomies. In so doing, it harkens to Robbins' (2004: 13) calls for an integrated approach to the study of society-nature relations that not only wields the "hatchet" of critique, but also plants a "seed" for "reclaiming and asserting alternative ways of managing [resources]…". This leads to my third and final point.

Rather than engaging in a protracted discussion about the relevance of different forms of academic research, consider for a moment the importance of sharing insights with the world outside of the academy. Notwithstanding Castree's (2002) interesting observation that the findings of both critical and applied human-environment geographers seldom register outside of their respective academic audiences, human ecologists and commons scholars (together with other theoretically-aligned scholars and professionals) seem to have been very successful at inserting their ideas into public policy discussions and documents. Take, for example, any number of recent national or international policy

and program documents that embrace the concepts of adaptation, vulnerability, resilience, or capacity building, e.g., the Climate Change Adaptation in Africa program of the United Kingdom's Department of International Development. The ties between these strands of human-environment scholarship and public policy remain as strong now as they were in the 1970s, when Gilbert White was making such effective inroads into the policy realm. My point is that if one believes that an understanding of social, ecological and economic processes is necessary to fully appreciate human-environment interactions and, if one acknowledges (as many critics have) that each of the three fields of human-environment scholarship outlined here is deficient in some regard in its treatment of ecological, economic, or social theory, it raises the question as to what is being left out of the policy dialogue. As noted earlier, two decades of post-structuralist and feminist scholarship have highlighted the crucial importance of understanding the differences among and between social actors and the enormous bearing that this has on human-environment interactions. But, if critiques that peg human ecology and commons scholarship as "apolitical" are accurate, and if Brosius (2006) is correct in his assertion that many scholars are only now awakening to the fact that environmental management is much more political than it was once thought (by some) to be, one has to wonder if these important insights are being adequately represented in policy dialogue and in the "crafting" of institutions that shape human-environment interactions. If not — and to borrow from Robbin's hatchet and seed metaphor — it would appear that the public policy interface between the academy and society at large may be failing to reap the rich fruits that have been nurtured and cultivated by critical scholarship on human-environment interactions.

Moreover, ignoring opportunities for integration could have a number of negative consequences. As noted in Table 2.2 above, these include producing analyses 1) that are unnecessarily fragmented, 2) which only partially reflect the true complexity of society-nature relationships; and 3) which perpetuate an understanding of institutions that is less accurate and complete than is possible given available insights.

Although it is unlikely that the weaving together of ideas from human ecology, political ecology and commons scholarship will satisfy everyone, for those willing to embrace the challenge of sifting though the inherent complementary and sometimes contradictory characteristics that underlie these three fields, the prospect of finding common ground from which to explore institutions in human-environment geography shows great promise.

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CHAPTER THREE

WATER, POLITICS AND AQUATIC ECOSYSTEM PROTECTION IN THE OLDMAN RIVER BASIN: AN INTEGRATED INSTITUTIONAL ANALYSIS

3.1 Abstract

Institutions are enshrined within a complex web of cultural, historical and political processes. To be comprehensive, institutional analyses require attention to these contexts. This paper illustrates how the insights of scholars working within different sub-fields of human-environment scholarship (namely political ecology, human ecology and common property resources) can be brought together to produce an analysis that teases out important contextual insights which, in the process, help to bring about a deeper understanding of institutions than would be achieved by using a single analytical lens. This integrated approach is used in an empirical investigation of the factors that underlie efforts to protect aquatic ecosystems in the Oldman River Basin, Alberta. Based on evidence gathered from the analysis of 72 documents, 56 key informant interviews, and personal observation from 14 watershed workshops and conferences, eight contextual factors are identified which help to explain the slow progress made toward the stated policy goal. These include 1) the ongoing decentralization of water management in Alberta, 2) historically-entrenched positions of power, 3) micro-politics among key actors and organizations, 4) cultural history and identity, 5) application of legal mechanisms, 6) existing water infrastructure and allocations, 7) current aquatic ecosystem condition and 8) climate change and future water availability. The paper concludes with a discussion of the significance of these findings and of the integrated analytical framework.

3.2 Introduction

Critical environmental scholars have long advocated for the inclusion of broad political economic factors in assessments of human-environment interaction (Turner 2002; Castree 2002). The rationale for this approach stems from a belief that, by adopting perspectives too narrowly focused on a single environmental issue, scholars often fail to integrate discrete problems into a broader political, economic and social context (Blaikie and Brookfield 1987; Bryant and Wilson 1998). This is problematic because, as Imperial and Yandle (2005: 500) note, "the performance of policy instruments often depends less on their formal properties than on the political and administrative context within which they operate." Scholars who fail to account for over-arching contextual factors have been accused of developing solutions that fail to address the underlying issues that are at the root of many environmental problems. For instance, Nadasdy (2007: 216) argues that some human-environment scholars continue to "take for granted the broader political-economic context…that [gives] rise to the notion of and need for resource management institutions in the first place…[and thus]…their proposed solutions do not address these larger issues at all." To minimize the potential for such oversights, sensitivity to contextual factors is essential, both in environmental research and for the development of environmental policy.

This message has been echoed in the literature on institutions. For instance, Ostrom, *et al.* (1994: 37) note that

> While many [institutional] analyses are undertaken without an overt attempt to address how these deeper factors affect the situation of interest, theorists interested in institutional questions have to *dig deeper* to understand how rules combine with a physical and cultural world to generate particular types of situations (emphasis added).

With close attention in institutional analysis being given to the patterns of interaction among the various actors involved in environmental decision making, this process of "digging deeper" (to use Ostrom, *et al.*'s terminology) is said to help the researcher to understand those underlying factors which may not be readily apparent but which, nonetheless, inform the positions and actions of actors (Ostrom, *et al.* 1994). Without this depth of understanding, it is often more difficult to interpret why people make the decisions that they make and why they interact with the natural world in the ways that they do. This can expose researchers and policy makers to the risk of developing recommendations that are ill-suited to addressing the actual underlying problem(s).

The need for contextual analysis can be illustrated with reference to the challenges and conflicts that have arisen in many semi-arid regions regarding aquatic ecosystem protection (Gillilan and Brown 1997; Schofield, *et al.* 2003; McDaniels, *et al.* 2005; Swainson 2006; King and Brown 2006; Gardner and Bowmer 2007; Ferng 2007). Motivated, in part, by a growing recognition of the finding that the health of ecosystems has direct effects on human well-being (Gleick 2000; Baron, *et al.* 2002; United Nations Environment Program 2003; Butler and Oluoch-Kosura 2006), proposed initiatives aimed at protecting and restoring aquatic environments have included such strategies as the removal or modification of dams to allow for fish passage, the alteration of flow regimes to restore seasonal variability, and the allocation of water resources of sufficient quality and quantity to sustain aquatic species. The problem that arises is that, in many semi-arid regions, the allocation of water resources has long since surpassed most estimates of what constitutes an ecologically sustainable level (Dyson, *et al.* 2003). Although aimed at generating positive ecological outcomes, such policy initiatives are

often interpreted by existing water users as hostile, and thus they sometimes result in conflict (Brunner, *et al.* 2005; Slaughter and Wiener 2007; Wester, *et al.* 2008). In an effort to understand such circumstances, close attention to context (e.g., political, historical and ecological) helps to characterize the underlying nature of such resource conflicts, and can highlight potential solutions for overcoming these challenges.

This paper seeks to identify and explain the contextual factors that shape the development and implementation of policies for aquatic ecosystem protection in a water-stressed, semi-arid region of Alberta, Canada. In so doing, it seeks to address head on critiques that find human-environment scholarship to sometimes down-play the "political economic context within which environmental management institutions are themselves embedded" (Nadasdy 2007: 216). To accomplish this, a novel analytical framework is developed which weaves together insights from common property scholarship, human ecology and political ecology for the expressed purpose of "digging deeper" to draw out the sorts of political, economic, cultural and physical conditions that underlie formal institutions. Such factors are significant because, as noted by Ostrom and others (1994; Imperial and Yandle 2005, etc.), it is the underlying contextual factors that often make institutions so complex and messy in the first place and, in the present example, that make the implementation of aquatic ecosystem protection so very challenging. Finally, the paper illustrates how the work of scholars in various human-environment sub-fields can be brought together to produce an analysis that teases out important contextual insights that might not otherwise be apparent.

3.3 Analytical Framework

3.3.1 The Institutional Analysis and Design Framework

In their efforts to understand and explain the socially- and politically-mediated interactions between humans and their natural environment, many scholars have turned to institutions as a unit of analysis (Ostrom 1990; 2005; 2007; Agrawal and Gibson 1999; Robbins 2000). Described as the "systems of rules, decision-making procedures, and programs that give rise to social practices" (Young 1999), institutions can be enabling (e.g., incentives) and constraining (e.g., regulations), both formal (e.g., laws) and informal (e.g., customs) (Mehta, *et al*. 1999). The underlying logic of institutional analysis suggests that by developing an understanding of institutional rules and conventions, one can begin to gain insight into the success or failure of certain initiatives aimed at environmental change. Regarded by some scholars as "a necessary starting point for connecting socially differentiated communities with biologically differentiated environments" (Peet and Watts 2004: 25), institutions are an appropriate unit of analysis here because so many of the concerns surrounding aquatic ecosystem protection are rooted in the formal and informal rules associated with this policy goal, and in the relationships that exist among the various actors involved in water governance in the Oldman River Basin.

Several formal frameworks for institutional analysis can be found in the literature (Ingram, *et al.* 1984; Cullivan, *et al*. 1988; Greif 1998; Imperial 1999; Sproule-Jones 1999; Bandaragoda 2000; Cady and Soden 2001; Sabatier, *et al.* 2003). Likely the most well-developed and oft-cited is the Institutional Analysis and Design (IAD) framework developed in the field of common property resources (CPRs) by Elinor Ostrom and her

colleagues (Ostrom, *et al.* 1994). This framework was selected as a foundation on which to build for this investigation because of its explicit focus on context (biophysical, cultural, etc.) and its increasingly strong grounding in ecology (discussed below).

To use the IAD Framework, analysts begin by identifying what Ostrom (1990) refers to as the Action Arena which identifies the various actors involved in the issue under study and their patterns of interaction with each other. Once the Action Arena has been defined, three categories guide the investigation of contextual factors 1) Attributes of the Community; 2) Rules-in-Use; and, 3) Attributes of the Bio-Physical World. Collectively, these emphases provided direction to the empirical investigation and give a structure to report findings.

Conventionally, the IAD Framework has been used in conjunction with the theoretical tenets of rational choice, game theory, and organizational theory (Johnson 2004). More recently, however, insights from non-equilibrium ecology – and their application to human-environment interactions in the field of human ecology – have been drawn into this theoretical mix (see Imperial 1999; Dietz, *et al.* 2003). The incorporation of such "new" ecological insights begins to address earlier critiques of commons scholarship as being dependant on outdated understandings of ecological functions (Scoones 1999) and has produced a body of work that addresses in a serious way both ecology and policy development. For all of its merits, however, the body of work on the commons which underpins the IAD Framework has also been criticized for 1) relying too heavily on economic rationality as a determinant of human behaviour (Mosse 1997; Cleaver 2000), 2) tending towards ahistorical analysis (Johnson 2004), and 3) providing insufficient attention to the uneven distribution of power among actors (Blaikie and

Brookfield 1987; Goldman 1998). These issues can be addressed by updating the framework with insights from related human-environment sub-fields.

3.3.2 Building on the Foundation of the IAD Framework

Although presented in the literature as deficiencies of commons scholarship, the above critiques also present an opportunity for linking existing insights with other bodies of human-environment scholarship, such as political ecology, which address these issues explicitly. Armitage (2008: 7) notes that, while the commons and human ecology[1] literatures provide the normative principles of environmental governance (e.g. participation, accountability, leadership, and trust), political ecology

> …help[s] to reveal the challenge of actualizing these principles…[by drawing attention to] the contextual forces that make entrenched, top-down management systems resilient to change [including, for example, the uneven distribution of power among actors].

In light of political ecology's focus on what Armitage describes as underlying "contextual forces," a number of significant benefits would result from incorporating insights from political ecology into the IAD Framework. Moreover, doing so would seem to address many of the critiques of commons scholarship outlined above and, at the same time, furnish a "deeper" understanding of the contextual factors affecting efforts to protect aquatic ecosystems in the Oldman River Basin. These benefits include closer attention to 1) the uneven distribution of power among actors; 2) alternative explanations

[1] Specifically, Armitage refers to the literatures on common property resources and resilience thinking. For the purpose of this paper, reslience thinking is considered to be a subset of the broader human ecology literature, which is also seen to address such topics as adaptation (Walters and Hilborn 1978; Lee 1993; Berkes and Jolly 2002; Brunner, *et al.* 2005), resilience (Carpenter, *et al.* 2001; Folke 2006), vulnerability (Adger 2006; Gallopin 2006; Smit and Wandel 2006), and panarchy (Gunderson and Holling 2002), to give a few examples.

of human behaviour that extend beyond economic self-interest; and, 3) the historically-situated events and processes that contribute to contemporary institutions and practices. Each of these is described briefly below.

First, regarding power, "institutional arrangements have differential effects on the positions and power of various policy actors because they alter the relative importance of the resources they posses" (Majone 1989). With an explicit focus on micro-politics at the local level (e.g., Agrawal and Gibson 1999), and on how local politics connect to the broader regional and global political economy, the literature on political ecology has much to offer in this regard in that it digs deep into the underlying context of environmental policies and social action to provide a richer understanding of the patterns of interactions among actors (an explicit focus of the IAD Framework).

Second, political ecology's focus on the effects of social difference (e.g., gender, age, culture) on environmental decision-making provides additional tools for understanding the motivations for human behaviour. For instance, contributors to the literature on political ecology have demonstrated how one's decisions about the environment are often mediated by an array of motivations that extend well beyond economic self-interest to include such factors as religious ideology (Cleaver 2000) and moral economy (Douglas 1987). The incorporation of such insights would enable a far more nuanced understanding of the environmental choices made by actors in the Oldman River Basin regarding aquatic ecosystem protection and would, at the same time, address the reported over-emphasis on economic rationality in some commons research.

Third, the emphasis placed on environmental history in much political ecology research could help to overcome the tendency towards ahistorical analysis in commons scholarship. Johnson (2004: 420) notes that

> Contrary to [commons scholarship], which explains commons dilemmas (and their resolution) in terms of (individually) calculated responses to structural incentives…[political ecologists] understand and explain the degradation of common pool resources in terms of a historical process grounded in the privatization and commercialization of local resource systems.[2]

The incorporation of insights from political ecology would help to address this shortcoming. In addition, it will help to furnish a "deeper" understanding of the contextual factors affecting efforts to protect aquatic ecosystems and, it is hoped, provide the depth of analysis necessary to avoid the development of solutions that fail to address important underlying issues.

Figure 3.1 illustrates what the framework would look like when configured to incorporate these insights. Those familiar with the original IAD Framework will note the absence of evaluative criteria for examining transaction costs and overall institutional performance. While these criteria are important for "crafting" solutions to institutional problems (Ostrom, *et al.* 1994), they are not particularly well-suited to helping one understand institutional context. For this reason, and for sake of simplicity, they are not incorporated here. For the purpose of this study, the framework is configured to enable a

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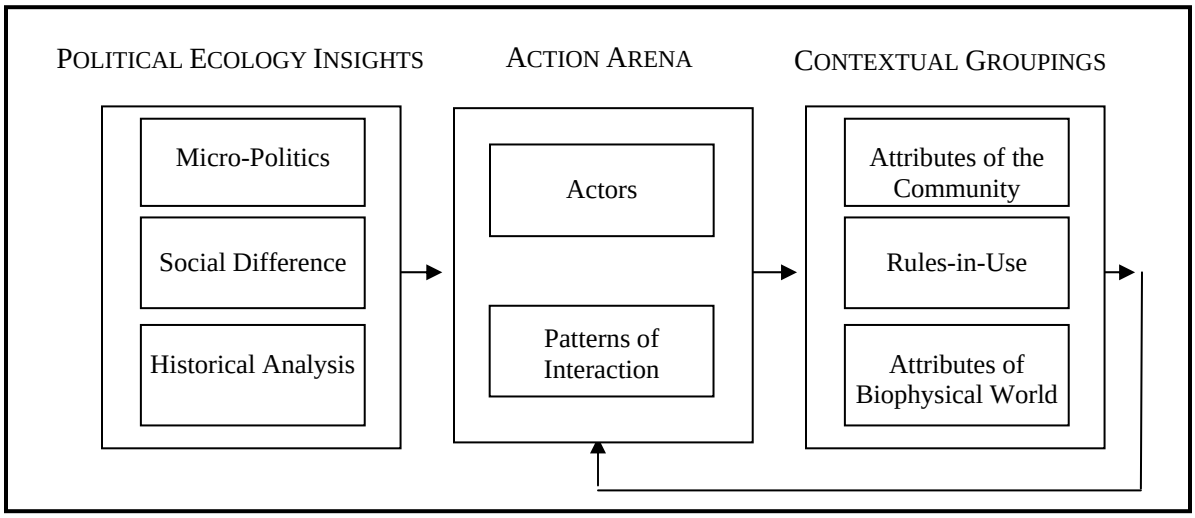
[2] Johnson (2004) uses the terms "collective action" and "entitlement" to describe two distinct bodies of thought which compete for a voice in the literature on common property resources. Interestingly, many of the same scholars and studies that are cited as contributing to the entitlement literature are also cited as contributing to political ecology (for example, Sen [1981]; Blaikie and Brookfield [1987]; Goldman [1998] and Leach, *et al.* [1999] all appear in Johnson's appraisal of entitlements scholarship, and in Peet and Watts' (2004) synopsis of political ecology). This paper uses the term commons to refer to mainstream (or collective action) commons scholarship, while including entitlement scholarship under political ecology.

deep contextual analysis of the factors that shape the development and implementation of policies for aquatic ecosystem protection in the ORB.

Figure 3.1: A Framework for Contextual Institutional Analysis



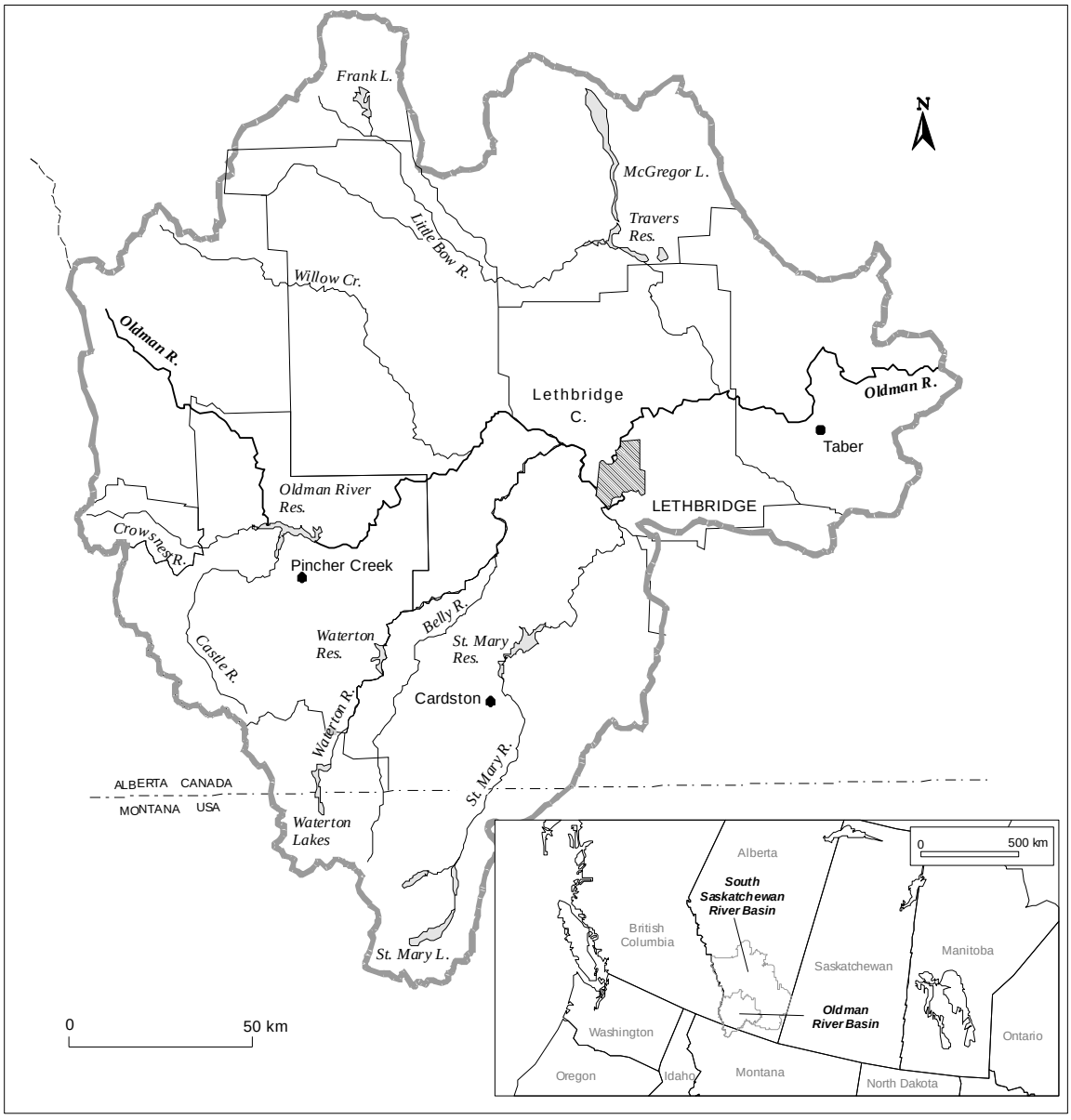
3.4 Background: The Oldman River Basin (ORB)

The Oldman River and its tributaries originate in the eastern rocky mountains of Alberta and Montana (see Figure 3.2), flowing east through forested mountain cordillera and the fescue grasslands of the foothills before moving eastward across the plains. The plains region comprises approximately 80% of the land area in the ORB, most of which has now been converted to agricultural and industrial uses (Alberta Environmental Protection 1996). At approximately 1.5 million cubic decametres (dam^3), the mean annual discharge for the Oldman River is modest relative to other Canadian rivers (e.g., about 10% of the Ottawa River and only 5% of British Columbia's Fraser River) (Glenn 2000). Nevertheless, its waters play a critical role in supporting the region's rural economy.

The climate of the ORB is subject to a high degree of inter- and intra-annual variability. Mean annual precipitation averages 30 - 45 cm (Alberta Agriculture, Food and Rural Development 2000). Approximately 40% of all precipitation falls as snow during winter and the remaining 60% as rain — primarily during the months of May and June (Agriculture and Agri-Food Canada 2007). The combination of snowmelt and heavy rains in late Spring results in 60% of the annual flow occurring between mid-May and mid-July (Alberta Environment, Water Resources Management Services Planning Division 1984; Thiessen and Linder 1989). In some years (e.g., 1953, 1964, 1975, 1995, 2002), spring storms have resulted in considerable flooding. However, extensive periods of drought are also common (e.g., 1917-1926, 1928-1939, 1977-1979, 1983-1989, and 2000-2001) (Gilpin 2000; Agriculture and Agri-Food Canada 2007).

The population of the basin is approximately 160, 000 and growing. In the period between 2001 and 2006, the population of Lethbridge (Southern Alberta's major urban centre) grew by 10.8% (from 67, 374 to 74, 637) – marginally above the uncharacteristically high provincial average of 10.6% (Statistics Canada 2007). With this population expansion, non-irrigation water use is expected to grow by 80% over the next 50 years (Hydroconsult EN3 Services Ltd. and Canadian Resource Economics Ltd. 2002), thereby further taxing an already stressed system. At present, an estimated 2,292,401 dam^3 of water is allocated to a range of users (e.g., municipalities, irrigation, commercial, petroleum, etc.) (Alberta Environment 2007b) with some river reaches identified as over-allocated (meaning that allocated volume exceeds natural flow five years out of ten) (Southern Alberta Environmental Group 2004).

Figure 3.2: The Oldman River Basin



Modified from Ivey, *et al.* (2006)

The most pertinent piece of legislation pertaining to water allocation and aquatic ecosystem protection in Alberta is the *Water Act* (Water Act R.S.A., 2000). This statute assigns responsibility to the Minister of the Environment for the allocation and protection

of water resources (Alberta Environment 2002). Among other things, the *Water Act* performs four functions that relate to the discussion below:

1. it entrenches in law a modified system of prior appropriation (meaning that senior licence holders receive all of their allocated water before more junior licencees receive any of theirs) (Percy 2004).
2. it requires the Minister of Environment to "establish a strategy for the protection of the aquatic environment as part of the framework for water management planning for the province" (s.7);
3. it makes provisions for the establishment of basin-specific water management plans which, once approved, must be taken into consideration by the Director of water allocation at Alberta Environment when making water allocation decisions; and
4. it facilitates the development of a water transfer system which enables licencees to transfer their water rights to another use on a permanent (i.e., transfer) or temporary (i.e., assignment) basis.

Although a water management plan for the ORB is still in its developmental stages, a plan for the South Saskatchewan River Basin (of which the Oldman is a part) has been approved (Alberta Environment 2006). Under this plan, a water market system exists in the study area.

In 2003, after extensive public consultation, the Province of Alberta released *Water for Life: Alberta's Strategy for Sustainability* (Alberta Environment 2003). This non-binding strategic plan outlines Alberta's vision for water management. It lays out three primary goals: 1) safe, secure drinking water; 2) reliable, quality water supplies for a

sustainable economy; and, 3) healthy aquatic ecosystems. Regarding its emphasis on healthy aquatic ecosystems, *Water for Life* pledges that "Albertans will be assured that the province's aquatic ecosystems are maintained and protected" (Alberta Environment 2003). This commitment responds to public input gathered during consultations prior to the release of *Water for Life*, which was reaffirmed in a subsequent round of public consultation held in 2007 (Alberta Water Council 2008a). Nevertheless, despite the concerns voiced by the public, recent reviews of the implementation of the *Water for Life Strategy* (Alberta Wilderness Association, *et al*. 2007; Alberta Water Council 2007a) confirm that efforts to achieve the goal of healthy aquatic ecosystems have fallen far behind schedule. In short, between the launch of *Water for Life* in 2003 and the completion of this research in fall 2007, the commitments made on paper have not translated into any significant improvements for aquatic ecosystems in the Oldman River Basin. An analysis of the contextual factors that affect the success or failure of efforts to protect aquatic ecosystem protection in the ORB begins to explain why this is so.

3.5 Methods

Three primary methods were used to gather data in the Oldman River Basin: 1) document analysis; 2) key informant interviews; and, 3) personal observations. Documents reviewed include federal and provincial policies and legislation, technical reports, watershed plans, and written historical accounts of water development in the study area — totaling 72 sources in all. In addition, digital resources such as educational videos and websites were consulted. These documents provided important background information on aquatic ecosystem protection in the ORB, helped to identify subjects for

key informant interviews, and provided a means to verify and examine in closer detail salient points raised during the interviews.

Between June 2006 and September 2007, a total of 56 face-to-face interviews were conducted, ranging in length from three-quarters of an hour to six hours, with a median length of 1.5 hours. Interviews provided an opportunity to obtain clarification on specific topics and to investigate recent developments not included in the written documentation. Interview subjects were selected strategically on the basis of their identification as central actors in water governance in the ORB. For the first round of interviews, subjects were selected based on their identification in the documents reviewed. During and after the first round of interviews, a snowball sampling technique was applied in which respondents were asked at the end of each interview to identify up to five other people whom they considered to be centrally involved with the issue of aquatic ecosystem protection in the Oldman River Basin.

The subjects identified in this process represented a broad range of organizations and groups including environmental non-government organizations (n=10), First Nations (n=1), industry groups (including the irrigation sector) (n=7), academics (n=9), private consultants (n=2), formal watershed partnerships (such as the Oldman Watershed Council) (n=10), as well as provincial (n=15) and federal (n=2) government officials. While everyone identified as being centrally involved with the issue of aquatic ecosystem protection in the ORB were contacted for an interview, some requests were declined. Actors contacted but not interviewed included representatives from some watershed stewardship groups in the rural municipalities. To augment the interview process, and to address any potential negative effects to the representativeness of the study, watershed

tours and workshops were attended in several rural sub-watersheds which provided opportunities to speak casually with rural residents, officials, and watershed group members. Notes taken during these events were entered as observations in the researcher's field journal and later included in the analysis. As for the interviews, the process of recruiting and interviewing ended when, consistently, no new names were offered and when subsequent interviews no longer yielded significant new findings.

Personal observations were used to corroborate written and verbal accounts. Observations varied in nature and ranged from photographs of significant biophysical features, to written notations about a participant's body language and intonation when responding to a specific question, to insights gained while attending presentations and watershed tours in the ORB. In total, over 500 photographs were taken and 14 conferences, workshops and watershed tours were attended.

Data analysis began with the transcription of audio-recorded interview texts and written observations, as well as the preparation of document summaries. Collectively, these were reviewed both for primary and latent content and sorted into the categories (or groupings) laid out in the Framework (i.e., the Action Arena, Rules-in-Use, Attributes of the Biophysical World, etc.). Within each category, data were further divided into sub-categories under each of these groupings. For example, all information pertaining to Attributes of the Biophysical World was grouped together. Following this, all data dealing with climate change were grouped together under the sub-category entitled Climate Change and Future Water Availability. At the same time, data pertaining to the current conditions of aquatic ecosystems in the ORB were grouped into a separate sub-category, under the heading Aquatic Ecosystem Condition. In each case, the data

grouped in sub-categories were cross-referenced with supporting evidence from each of the three data sources outlined above. In total, eight sub-categories were identified and are presented below as eight contextual factors affecting efforts to protect aquatic ecosystem protection in the ORB.

Before these results were shared, a summary of the findings was sent to a group of seven study participants for the purpose of verification. Collectively, these seven individuals represented all major water management interests involved in aquatic ecosystem protection in the ORB (i.e., those who had the most to gain and/or lose from the implementation of policies for aquatic ecosystem protection in the ORB including, for example, environmental advocacy groups and the irrigation sector). Follow-up interviews were conducted with each of these seven individuals to confirm interpretations of the data and to refine understanding of the eight contextual factors identified. During these discussions, pseudonyms were assigned wherever direct quotations were used in order to protect the identity of the study participants.

3.6 Results

Table 3.1 lists the eight contextual factors identified through the data analysis which help to explain the positions and actions of actors centrally involved with the issue of aquatic ecosystems protection in the Oldman River Basin. Each factor is discussed in detail below under the main headings of the IAD Framework described earlier (i.e., the Action Arena, Attributes of the Community, Rules-in-Use, Attributes of the Bio-Physical World). In each case, care is taken to "dig deeper" to understand "how rules combine with a physical and cultural world to generate particular types of situations" (Ostrom, *et*

al. 1994: 37) and how these situations affect the implementation of policies aimed at aquatic ecosystem protection in the ORB. Of particular note in this regard is the overt attention paid to the role of history, power and culture in shaping these underlying factors. All three data sources discussed above were used in the identification of each of the eight factors. In each of the sub-sections below, selected examples are used that illustrate the application of the framework in this case study.

Table 3.1: Contextual Groupings and Factors

Grouping	Factors
The Action Arena	• Decentralization • Historically-entrenched positions of power • Micro-politics
Attributes of the Community	• Cultural history and identity
Rules-in-Use	• Application of legal mechanisms
Attributes of the Biophysical Environment	• Existing water infrastructure and allocations • Aquatic ecosystem condition • Climate change and future water availability

3.6.1 The Action Arena

The concept of the Action Arena helps the researcher to identify the various actors involved in the issue under study and the patterns of interaction that exist among actors. The purpose in this section is to discuss the contextual factors that influence the patterns of interaction among actors involved in aquatic ecosystems protection in the Oldman River Basin. These include the ongoing decentralization of water governance in Alberta, historically-entrenched position of power within water management in Southern Alberta, and the micro-politics that give shape to transactions among key actors and organizations.

Decentralization

Water for Life points to the development of formal water partnerships (described below) as a key action for realizing the three goals of the water strategy (i.e., safe, secure drinking water; reliable, quality water supplies for a sustainable economy; and, healthy aquatic ecosystems). The Alberta Water Council (the provincial-level partnership formed under *Water for Life*) consists of 24 members representing such diverse sectors as industry (e.g., irrigation, mining, oil and gas), non-government (e.g., environmental, watershed planning and advisory councils, etc.), provincial government (e.g., Alberta Environment, Alberta Agriculture, Food and Rural Development, Alberta Energy, etc.), and other governments (i.e., federal, municipal, Aboriginal) (Alberta Water Council 2008b). Aside from the Alberta Water Council, formal partnerships include eight Watershed Planning and Advisory Councils (WPACs) working at the watershed level and over 140 Watershed Stewardship Groups working locally (Alberta Water Council 2008a).

The development of these formal partnerships has had a significant effect on water management in Alberta in recent years and reflects a shift toward shared water governance through a process of decentralization. In this context, shared governance refers to "a governance structure where both government and external parties share responsibility for development and delivery of policy, planning, and programs or services…" (Alberta Water Council 2007b: 1). The term decentralization is used to describe the process of shifting responsibility from a centralized water management model to a shared governance structure. For example, WPACs (represented in the study area by the Oldman Watershed Council) have been assigned the task of researching and developing Watershed Management Plans for their respective watersheds. However, four

years into the *Water for Life* implementation process, considerable confusion still exists as to the extent to which these watershed plans will ultimately be adopted and implemented by government. Although the *Water Act* states that approved watershed plans must be considered by the Director when making water allocation decisions, the extent of such consideration remains unclear. This is a serious concern because, as noted by Nowlan and Bakker (2007: 33), "if approval [of a watershed plan] is not forthcoming, participants would have no method to implement the plan, and no mechanism to appeal any failure to implement." The lack of transparency on this and other issues tied to the decentralization of water management in Alberta is an increasing source of frustration for many of the actors involved. Expressing his concern over what might become of the WPACs in the future, one Alberta government representative noted the following:

> I watched the precursor to the WPACs [the Basin Advisory Councils (BACs)] fall apart when they came to the realization that they had no real decision-making authority. And there is enough carry-over from the BACs to the WPACs that you would think people would recognize that the [same old] pitfalls still exist.

Several observations highlight the gravity of this issue. These include the recent formation by the Shared Governance and Watershed Planning Framework Project Team, a sub-committee of the Alberta Water Council designed to bring clarity to questions of accountability in watershed planning and governance. Moreover, an entire half-day of the 3rd Annual Watershed Planning and Advisory Council Summit (March 2007) was devoted to this issue specifically, and included presentations by four invited speakers followed by a breakout session to discuss what authority a watershed management plan should have (i.e., advisory or mandatory). Time will tell if the delegation of responsibility to local watershed partnerships will be accompanied by a commensurate

delegation of authority. In the meantime, most of the decision making power remains in the hands of the provincial government, one of two groups of actors in long-held positions of power and influence in the history of water development in Southern Alberta.

Historically-Entrenched Positions of Power

Among the actors involved in aquatic ecosystem protection in the ORB, two (the Government of Alberta and the irrigation districts) emerge as having the most power and influence relative to other water users and interest groups. While the irrigation sector holds more water use licences than any other group in Southern Alberta, the Government of Alberta holds legal title to all the water in the province and controls the major on-stream dams and storage reservoirs. Since 1940, the provincial government has been an important developer of water resources (de Loë 2005), developing considerable irrigation infrastructure in Southern Alberta in the latter half of the 20th century. This includes such sizable projects as the St. Mary River Dam (at a cost of $26,556,000 in 1949 dollars), the Waterton Dam (completed in 1961 at a cost of $43,589,000 including its related irrigation works) and the Oldman River Dam (completed in 1992 and representing a $350,000,000 provincial investment) (Gregorash 1996; de Loë 1997). Much of this public expenditure was justified by the logic that, because the benefits of irrigation are widespread, the public financing of irrigation development projects was justified (de Loë 1997). In short, the history of water development in Alberta reveals that, the Government of Alberta (following on the example of, and often with financial support from, the federal government) has long been committed to the expansion of irrigation, often on a large scale.

As the primary beneficiaries of irrigation development projects, irrigation districts (and some private irrigators) came to occupy positions of considerable importance in water management in the ORB. Today, 87% percent of allocations (measured by volume) are licenced for irrigation purposes, compared to 4% and 3% for commercial and municipal uses respectively (AMEC Earth and Environmental Limited 2007), and this is likely to increase over the next several years. Despite government-imposed restrictions on the growth of irrigation districts (SSRB Water Allocation Regulation 1991) and the closure of the Oldman River Basin to further licence allocations in 2006, irrigation is expected to be the largest growth sector (in terms of water use) in Southern Alberta between 2010 and 2015 (AMEC Earth and Environmental Limited 2007). More importantly, although seemingly contradictory to the closure of the basin by the provincial government, this growth is supported, in part, with provincial funding. For instance, the Irrigation Rehabilitation Program (IRP) administered through Alberta Agriculture, Food and Rural Development (AAFRD) represents an ongoing $100 Million dollar cost-sharing initiative between government and the irrigation sector aimed at increasing water use efficiency in Southern Alberta (Gregorash 1996; Johnson, *et al.* 2003). Under the IRP, costs for irrigation improvements are shared, at a ratio of 75:25, between the Alberta government and irrigation districts respectively. The primary means of realizing these efficiency gains is through the conversion of surface canals into far more efficient sub-surface pipelines. In view of the considerable losses to evaporation and sub-surface leaching from old surface canals, the shift to pipelines results in water savings. While this is clearly desirable from a water conservation standpoint, from a strictly ecological perspective the reduction in the number of surface canals means a

commensurate reduction of riparian habitat and a decrease in surface run-off back to the river. Thus, programs such as the IRP demonstrate that the Government of Alberta's commitment to irrigation development is not merely historical, but ongoing — despite having potentially negative effects on the very aquatic ecosystems which *Water for Life* purports to protect.

A number of study participants (particularly environmental advocates) expressed frustration with the current bias of provincial subsidies for agricultural water use that promote development that is considered, by some, to be ecologically unsustainable. When asked what measures could be taken to help realize the goal of healthy aquatic ecosystems, one respondent noted that

> The removal of subsidies is the first step…When the government gets in the business of being in business, you get market distortions…it needs to be subsidy neutral…that would be a start. I would bet that we would see a huge change in our rivers just with that simple solution… But you'll get a big push back from the irrigators on that one.

The likelihood of such wholesale change in Alberta is questionable, however. In his coverage of the 2008 provincial election (in which the conservative government won its 11th consecutive majority), Globe and Mail columnist Roy MacGregor (2008) cites a number of political experts and electoral candidates as saying that, although the opinion polls consistently show an appetite for change in Alberta, come election time, people are highly reluctant to actually vote for it.

Collectively, the history of water allocation in the ORB highlights that, for much of the past century, the Government of Alberta and the irrigation districts have been the two main actors involved in the development of water resources and, as such, they now occupy positions of greater influence relative to other water users and interest groups in

Southern Alberta. This is significant because it helps to further illustrate the historically-entrenched position, practices and norms that underlie discussions about aquatic ecosystem protection in the ORB. Moreover, it is precisely the kind of insight that is drawn to the surface by the IAD Framework's focus on the patterns of interaction that exist among actors, and by the emphasis on the uneven distribution of power that is so prominent in the literature on political ecology.

Micro-Politics

While the history of irrigation development provides important context to efforts to protect aquatic ecosystems in Southern Alberta, the micro-politics that exist among actors adds another important dimension. For instance, it is misleading to refer to the "Alberta government" as a single entity. Some study participants used the term "government" to refer specifically to elected officials who formed the government in the legislature, while others used the same term to describe the provincial ministries staffed by civil servants. Regarding the latter, many study participants saw the apparent lack of unified purpose and integration among Alberta government ministries as a serious barrier to aquatic ecosystem protection.

In March 1999, representatives from the ministries of Energy, Environment, and Sustainable Resource Development signed an agreement to integrate (where appropriate) their policies, align and share their information, and streamline their regulatory processes (Government of Alberta 1999). As far as policies affecting water are concerned, this has not happened. For example, while Alberta Environment leads the charge on *Water for Life* (released in 2003), Alberta Sustainable Resource Development is working on an *Integrated Land-Use Framework*. While the former focuses attention on watershed

planning, the latter champions land-use planning. Thus, conflict between the goals of the two policies can be problematic. An example of this would be when establishing priorities and practices for the management of riparian areas. Whereas the *Land-Use Framework* might lay out one set of guidelines, *Water for Life*, because of its commitment to protect aquatic (and riparian) ecosystems, could quite likely call for a different set of guidelines. At this point, it is unclear how the two policies would relate, and how such inconsistencies would be dealt with.

While some study participants called for greater integration between ministries, others suggested that *Water for Life* be scrapped altogether. As one noted, "The *Water for Life Strategy* was required but now it contributes to the fragmentation of policy…*Water for Life* has to die, or at least evolve to include the *Integrated Land Use Framework.*" Unfortunately, the close inter-ministerial relationship required to resolve such policy fragmentation is, according to one senior government official, still a long way off.

Similar tension exists among (some) provincial and federal government departments that deal with aquatic ecosystem issues in the ORB. For example, considerable animosity was reported to exist between Alberta Environment and the Federal Department of Fisheries and Oceans (DFO). Although no one was willing to speak on the record about this strained relationship, representatives from both organizations spoke informally about this issue with the proviso that the audio-recorder be turned off. Most provincial government representatives (and landowners) consulted admitted that, at least initially, DFO's presence in Southern Alberta was not welcome. Some lamented that, since DFO's arrival, one has to go through two bureaucratic processes (under the provincial

Water Act and the federal *Fisheries Act)* in order to satisfy environmental regulations before conducting any work that involves an instream element (e.g., fixing a culvert). This has caused considerable frustration among landowners, which only adds to the animosity. As one respondent noted

> You'll hear the old-timers [complain] that it takes five days of paper work and a six-month waiting period for one day of fieldwork. And, if you want to continue your work one stream over – it's another guy that you have to deal with! So it gets a little frustrating.

Upon closer examination, however, a number of informal alliances was found to exist between provincial and federal governments, and between representatives from provincial ministries. These add important texture and detail to the local context of aquatic ecosystem protection in the ORB. For example, the arrival of DFO in Alberta helped to shore up the position of Alberta's Fish and Wildlife Department (a division of Alberta Sustainable Resource Development) which, for reasons of declining funding and staffing capacity, was stretched to meet its fisheries management duties in the late 1990s. As one Alberta government representative noted,

> Water quantity is the biggest issue in [Southern Alberta]. So [Alberta] Environment was always the much bigger brother that wouldn't listen to Alberta Sustainable Resource Development. But when DFO turned up, Alberta Environment had to change its tune. It could push aside [ASRD], but not DFO. So suddenly, ASRD had some input that they didn't previously have, even if the proponent [of the development being discussed] was Alberta Environment.

Moreover, although formal communication between (some) provincial government agencies was reportedly poor, personal observations told a different story. For instance, some of the biologists from Alberta Environment, Sustainable Resource Development, the Alberta Conservation Association and the (Federal) Department of Fisheries and Oceans often get together after work (e.g., on Fridays) for drinks and conversation.

While seemingly disconnected from the formal business of the day, it was evident that some of the best resource- and idea-sharing among organizations occurred at these informal meetings.

These sorts of nuanced details about informal alliances are furnished by digging deeper in the micro-politics of water management in the Oldman River Basin. Importantly, they have potentially significant implications for the protection of aquatic ecosystems. If left unchecked, the latent tension and lack of integration that formally exists between government agencies could hinder progress towards the goal of healthy aquatic ecosystems. However, if nurtured and developed, these connections and alliances could have a positive effect on aquatic ecosystem health.

3.6.2 Attributes of the Community

Within the IAD Framework, the grouping entitled Attributes of the Community is said to encompass the shared norms of behaviour, level of common understanding, and homogeneity of preferences within groups of actors (Imperial and Yandle 2005). With the addition of insights from political ecology, attention is drawn to the ways in which these traits are situated in a socio-historical context, as illustrated below by the cultural history and identity of some inhabitants of the Oldman River Basin.

Cultural History & Identity

The cultural history of rural residents in Southern Alberta (some of whom have family ties that stretch back for generations) is linked in many ways to the history of water development in Alberta. For many people of both European and First Nations descent, the personal connection to land and water in the ORB has left an indelible mark that is steeped in a history of hardship endured by many prairie families.

Although deemed by surveyors as unsuitable for agricultural use only a few decades earlier (Gilpin 2000), by the turn of the 20th century, the ORB and its surrounding area were being promoted by Dominion of Canada officials as "a potential agricultural paradise which needed only the 'touch of the plow' to transform the soil" (de Loë 2005: 98). Settlers were encouraged to develop and expand irrigated agriculture and, for roughly a century, were provided with administrative and financial incentives from the government to do so. During this period, the idea that water was being "wasted" if allowed to flow downstream was not only entrenched in policy (de Loë 2005), but also in the psyche of settlers in the ORB. Despite government subsidies, however, many families had to endure extensive periods of drought and economic depression together with the crop failure and loss of livestock that was associated with it (Palmer 1990). And regardless of considerable efforts, family farming has not always been particularly lucrative. For example, in 2005, small- and medium-sized farms in Canada could be expected to supply their owners with only 10-30% of family income (Statistics Canada 2005).

Despite the challenges faced by farmers in Southern Alberta, when asked at what point one should simply abandon the farming profession, one group of attendees at a watershed stakeholders meeting responded with a resounding "Never!" For them, the merits of farming and ranching in the region extended well beyond – and in some cases defied – economic rationality. As one irrigation sector representative noted

> If you asked the majority of our farmers, they'd like to see the rivers left alone too. But right, wrong or otherwise, people are making their lives and living out of this irrigation industry that has been around for 100 years now…[As such] the aquatic ecosystem element of *Water for Life* can't be taken in isolation from reality and from broader societal goals.

When viewed in the context of a century-old tradition of irrigation farming, spanning many long periods of drought, one can begin to gain a deeper understanding of how an individual's connection to water in the ORB might extend beyond economic self-interest to include one's cultural history and identity. A number of personal observations further support, in more subtle ways, the importance of the Oldman River to local people. These include the prominent featuring of the river in local artwork and iconography as is reflected in the name of the local radio station (FM 107.7 – The River) and also in a scene portrayed in a large stained-glass window at St. Martha's Catholic Church in Lethbridge which depicts a river flowing through a thriving agricultural landscape. A similar connection also seems to exist for local First Nations peoples who have occupied the basin for up to 11 000 years (MacGregor 1981).

Two First Nations groups call the ORB home. The Piikani (or Peigan Nation) occupy reserve lands of approximately 110 000 acres located midway between the towns of Fort Macleod and Pincher Creek (Indian and Northern Affairs Canada 2008). The Kainai (or Blood Tribe) with administrative offices in the town of Standoff, occupy the largest reserve in Canada at 355 000 acres, 200 000 of which are under cultivation (Blood Tribe 2008). Although both groups have been actively involved in water development projects in the ORB in the past, neither has been formally included in recent discussions of aquatic ecosystem protection in the ORB. This is a concern because the history of the ORB has shown that failing to adequately involve First Nations communities in water management and planning initiatives can have significant negative effects.

For instance, when in the late 1980s and early 1990s the provincial government proceeded to construct the Oldman Dam, representatives from the Peigan Nation

protested so fiercely that shots were fired and the Royal Canadian Mounted Police had to be called in to quell the ensuing acts of civil disobedience (which included the use of a bulldozer to reroute water around an irrigation weir) (see Glenn 2000). In a more recent example the effects of which have yet to been fully tested, Blood Tribe officials have insisted that despite provincial claims to the contrary, First Nations water rights extend to the middle of the river in reaches that boarder on reserve lands. This presumed exemption from provincial statutes is based on the fact that First Nations treaty rights in Canada are constitutionally protected and, thus, that First Nations water rights fall under federal rather than provincial jurisdiction. Although this matter has yet to be resolved by the courts, in the meantime, it has potentially significant implications for aquatic ecosystems. For instance, if water management practices on or around reserve lands are inconsistent with whatever measures are put in place to protect aquatic ecosystems, negative downstream impacts could result. Of more immediate concern, however, is the limited extent to which First Nations communities have been involved in discussions of aquatic ecosystems protection in the ORB.

Recent discussions of aquatic ecosystem protection arise out of the *Water for Life* process which assigns responsibility for watershed planning to the WPACs (such as the Oldman Watershed Council). Although a position exists for a First Nations representative on the OWC Board of Directors, it has proven very difficult to fill and remains vacant at the time of writing. As one OWC representative noted, "First Nations should have a role [in aquatic ecosystem protection] but we have been unsuccessful in working together yet". This apparent lack of First Nations involvement could be related, in part, to the distinction between federal and provincial jurisdiction (*Water for Life* being

a provincial initiative), but further evidence than is available here is required in order to confirm this assertion. Despite numerous requests to officials from both First Nations groups, only one interview with a First Nations representative (a former Chief of the Blood Tribe) could be arranged. Nevertheless, the account of this one individual (as well as those of eight non-native study participants who were able to comment knowledgably on First Nations involvement in discussions of aquatic ecosystem protection) helped to highlight the fact that consideration of cultural connections to water will be an important factor in determining the success of policies to protect aquatic ecosystems in the ORB.

3.6.3 Rules-in-Use

Imperial (1999) notes that, in order for institutional analysis to be effective, the analyst must cultivate an understanding of the rules that individuals actually use in their interactions with one another and with the natural world. Importantly, this includes not only formal rules (e.g., laws) as they are written, but also the ways in which they are interpreted, acted upon, and enforced. In the Oldman River Basin, the application of legal mechanisms designed to protect aquatic ecosystems is an important factor pertinent to understanding the progress (or lack thereof) made towards the goal of healthy aquatic ecosystems.

Application of Legal Mechanisms

The *Water Act* makes possible the setting of water conservation objectives (WCOs) that establish a target flow to remain in the river so as to protect aquatic ecosystems. Two tools outlined in the *Water Act* help Alberta Environment to meet WCOs. These are a 10% conservation holdback on all licence transfers and the right to cancel old licences that are no longer in use. In the former, 10% of the total volume of water indicated in a

transfer arrangement can be withheld and left in the river to help meet the WCO. In the latter, water reclaimed through licence cancellations can be designated for return to the river. Although both of these tools were in use in the study area, they resulted in limited positive changes to the health of aquatic ecosystems (Wenig, *et al.* 2006). Two primary reasons were highlighted by study participants and in the documents reviewed: the current legal interpretation and application of WCOs; and, the ineffectiveness of available legal mechanisms for meeting WCOs in heavily-allocated basins such as the ORB.

Unlike biologically-determined instream flow needs (see Clipperton, *et al*. 2003), water conservation objectives are set via community deliberation and thus reflect societal values regarding how much water should be left in the river. This pits the biological requirements of aquatic species in any given river against current and future economic development. For most river reaches within the SSRB, the amount of water set aside for ecosystems in a WCO is actually far less than the amount specified in biological studies. For example, one Alberta Environment biologist interviewed recounted a recent experience where he and his colleagues were invited to a community meeting in the Red Deer River Basin regarding the setting of a WCO. After presenting their findings and demonstrating how the community's proposed WCO would fail to meet the necessary instream flow needs for channel maintenance, water quality, fish habitat, and riparian vegetation, the community still voted to uphold the proposed WCO despite all evidence against it. The outcomes of such decisions were directly observed in the study area — where, in July and August 2006, by leaping from exposed rock to exposed rock, the researcher literally crossed sections of the southern tributaries of the Oldman without ever getting his feet wet. Indeed, the current interpretation and application of WCOs in

Alberta has been characterized by some as "a perversion of the statutory intent" (Droitsch, *et al.* 2007) because WCOs do not currently deliver on their promise to protect aquatic ecosystems.

Once a WCO is set, the mechanisms available to actually satisfy it have also proven largely ineffective. Due in part to the limited number of transfers conducted to date, and also to the fact that the holdback is only enforced at the Director's discretion, very little water has actually made it back to the river via this mechanism. Of the 24 transfers made in the ORB between January 2006 and March 2008, only five were subject to the 10% holdback. This represents a volume of 2,343 dam^3 (Alberta Environment 2008b) or roughly 0.01% of total allocations.

The cancellation of licences has not proven to be particularly effective either. In all, 42 licences have been cancelled in the ORB between January 2006 and March 2008. These cancellations amount to a combined volume of 81,870 dam^3 (or roughly 3.6 % of total allocations) (Alberta Environment 2008a). However, rather than being applied directly to the WCO, this water became "unallocated." What this means is that the benefit of the additional flow is shared equally across all existing license owners (including any WCO licences that may exist). The net effect is that all licences become only marginally more secure in dry years when the aquatic environment is in most dire need. Moreover, because most WCO licenses have a fairly junior priority number, they are among the first to be cut off during periods of extended drought (Wenig, *et al.* 2006).

Some study participants worried that, from an ecosystem perspective, attempts to clawback old and unused licences actually do more harm than good. For instance, considering the licence transfer system in effect in the ORB, if license holders are unable

to demonstrate that they are putting their licenced allocation to beneficial use, then they are more likely to transfer (i.e., sell) it to a neighbor, rather than let it be recalled. As one government biologist noted

> If I am in a position to sell my water, it's because I wasn't using it. Perhaps when I got the licence I was using flood irrigation. Now I'm using drop pivot which uses far less water. So now I can sell the excess. So water that was being left in the canal as return flow to the river, is getting pulled out for consumptive purposes. This has the potential to be a major shot to aquatic ecosystems.

In any event, the current interpretation and application of legal mechanisms in the ORB would appear to be having little positive effect on the health of aquatic ecosystems.

3.6.4 Attributes of the Biophysical World

The biophysical attributes of the ORB are the final group of contextual factors identified as affecting the development and implementation of policies to protect aquatic ecosystems. With the support of insights from human ecology, the IAD Framework helps to draw the researcher's attention to the complex and non-linear characteristics of the biophysical world. Within this grouping, three factors were noted, including 1) existing water infrastructure and allocations; 2) the current condition of aquatic ecosystems; and, 3) uncertainty surrounding climate change and future water availability.

Existing Water Infrastructure and Allocations

Although some groundwater extraction occurs in the headwaters, most water users in the Oldman River Basin rely on surface water. At present, an estimated 2,292,401 dam^3 of water is allocated (Alberta Environment 2007b), with allocated volume exceeding total natural flow five years out of ten in some river reaches (e.g., in the Southern Tributaries) (Southern Alberta Environmental Group 2004). To help meet the

range of water needs in the ORB (e.g., municipal, industrial, recreational), water management infrastructure has undergone extensive development over the past hundred years. In the words of one Alberta government official, "every drop east of the foothills is under our control." Control structures include large dams and reservoirs on every major river, small reservoirs on various other tributaries, and numerous weirs and control structures throughout the basin. Complementing these is an extensive and expanding network of distribution canals and pipelines (totalling over 8,000 km in length) which moves water from the rivers and reservoirs to crops in the neighbouring irrigation districts (Alberta Agriculture, Food and Rural Development 2000). According to one Irrigation District representative, by the late 1990s, all optimal on- and off-stream storage sites in the ORB had been developed, and other sites with the potential for small future storage facilities had been explored (Alberta Environment 2005). Several study participants noted that the heavily-altered nature of the basin must be factored into discussions of aquatic ecosystem protection, because a return to some natural pre-development status is impossible.

Aquatic Ecosystem Condition

Dams and other water control structures have impacted heavily on aquatic and riparian ecosystems. For instance, at many locations throughout the ORB, fish passage has been blocked by dams, thereby resulting in extensive habitat fragmentation. The dominant style of earthen dam used in the ORB releases water from the bottom of the large reservoir that forms behind it. This has significantly impacted the habitat of downstream species, most of which are highly sensitive to water temperature variations for many stages of their life cycle.

Wetlands, which collectively occupy approximately 5% of land area in the ORB, are an important source of habitat for many aquatic species (Oldman Watershed Council 2007). This figure, however, is much reduced over the past century due to the drainage of wetlands for urban development and agricultural expansion. One presenter at the 2007 WPAC summit (an environmental strategist from Alberta Environment) estimated wetland loss in the "white zone" (i.e., the agricultural area that comprises most of Southern Alberta) to have reached approximately 64% of native wetland. It is important, however, to recognize the efforts of many landowners (often in partnership with Ducks Unlimited) to restore wetlands in the ORB (Alberta Irrigation Projects Association 2007).

Similar restoration projects are underway in select riparian areas throughout the basin, many of which have been undertaken by private landowners in partnership with Cows and Fish (Fitch and Ambrose 2003). For example, the researcher visited several ranches in the foothills region where off-stream watering facilities were set up so as to keep cattle out of the riverbed in order to enable the regeneration of riparian vegetation. (This was particularly important to ranchers living downstream of town sites where channelization and the removal of upstream riparian vegetation was thought to have caused increased bank erosion on downstream farms during heavy spring rains — sometimes resulting in damage to or loss of fences, roadways and even buildings). Approximately 80% of the wildlife in the prairie region relies on riparian areas for some, if not all, of their life cycle (Oldman Watershed Council 2007). In the past, surface canals and reservoirs provided valuable sources of riparian habitat and they continue to do so today. However, with the shift from surface canals to pipelines for the sake of efficiency gains, much of this riparian habitat has been lost or is being threatened. One

recent assessment of aquatic and riparian condition in Southern Alberta (Alberta Environment 2007a) classified numerous river reaches in the ORB as being between "healthy with problems" and "unhealthy," based on available water quality, riparian health, and hydrological data. A second assessment (Golder Associates Ltd. 2003), based on the professional opinions of scientists and water managers working in Southern Alberta, found rivers in the ORB to be "moderately impacted" to "degraded" (the latter pertaining specifically to the Southern Tributaries of the Oldman River, including the Waterton, Castle and St. Mary Rivers). While some evidence suggests that water quality is improving in certain river reaches, the overall trend is expected to decline as instream flows are reduced by continued water extractions (Alberta Environment 2007a).

Climate Change and Future Water Availability

The final contextual factor is tied to the inherent uncertainty that exists concerning the potential effects of climate change on future water availability. Considerable evidence now exists which suggests that climate change will have an adverse effect on the ORB. It is anticipated that temperature increases of 3 - 6°C will be accompanied by stronger and increasingly variable weather events (Hofmann, *et al.* 1998; Lemmen and Warren 2004), decreased snow pack accumulation (Bruce, *et al.* 2000), and drier summer conditions characterized by higher rates of evaporation (Hofmann, *et al.* 1998; Sauchyn 2007). Peak annual flows are expected to occur earlier in the year with a corresponding decrease in summer levels when agricultural demand is greatest (Lemmen and Warren 2004; Byrne, *et al.* 2006). Others have noted that, compared to previous centuries, the last hundred years on the prairies has been uncharacteristically wet, sheltered from the long (e.g., decadal) periods of drought that appear to have been common in Southern

Alberta in centuries past (Schindler and Donahue 2006; Sauchyn 2007). Some have gone so far as to predict that

> in the near future[,] climate warming, via its effects of glaciers, snowpack, and evaporation, will combine with cyclic drought and rapidly increasing human activity in the WPP [i.e., western (Canadian) prairie provinces] to cause a crisis in water quantity and quantity with far reaching implications (Schindler and Donahue 2006: 7210).

Glacial recession is not a primary concern in the Oldman River Basin, as the vast majority of the headwaters originate from melting snowpack and spring precipitation. Nevertheless, analysis of stream flow data in several Alberta rivers shows a mean flow reduction of 22% over the past century (Rood, *et al.* 2005) and an estimated 84 % reduction in summer flows in the SSRB (according to estimates published in the Globe and Mail on April 3rd, 2006). The implication is that, if the historic trends of stream flow reductions continue, ecosystems, along with industrial and domestic water users, will be negatively affected.

Predictions about climate change and future water availability are pertinent to aquatic ecosystem protection because they influence the views and perceptions of actors and shape discussions about aquatic ecosystems protection in the ORB. For example, following a presentation on climate change forecasts for Southern Alberta at the 2007 Alberta Irrigation Projects Association AGM, several members of the audience emphatically voiced the need to "build more storage!" (i.e., dams) to capture the forecasted increase in winter and spring rains and to remediate the anticipated loss of soil moisture during the summer months. Such influences and perceptions are significant because, as one study participant from the environmental sector noted,

> the landowners are the people who will decide how and if [aquatic ecosystem protection] is going to work for us. [All one can do is] put information in the hands of landowners and then let them decide. We encourage people to think about ecology but, [without any legal mechanisms in place] what they do about it is totally up to them.

3.7 Discussion & Conclusion

In the study of institutions, it is simply not enough for analysts to review formal laws and policies. A clear understanding of the contextual factors that underlie environmental decision-making processes, discussions and actions is imperative. As noted in the case of the ORB, so much of what informs the positions, actions and views of actors is rooted in other considerations that may not be readily apparent.

For instance, recognition of the uncertainty and frustration that accompanies the shift from centralized water management to a decentralized, shared governance model in Alberta provides important clues about the patterns of interaction among actors. Further insights on this topic can be gleaned from the historically uneven distribution of power among actors involved in water governance in Alberta and the micro-politics that mediate their interactions (e.g., animosity versus informal alliances between and among federal and provincial agencies). An understanding of these deeply-rooted (and often-concealed) issues and perspectives helps not only to explain why progress on aquatic ecosystem protection in Alberta has been so slow to date. It also brings into focus some of the issues that need to be addressed (e.g., the relationships that exist between and among government agencies) if acceleration action on aquatic ecosystem protection is to be achieved.

Attention to the attributes of the community under study, including its history and "cultural politics" (to borrow a term from McCarthy [2002]), also reveals other important

insights in the case of the ORB. For instance, the history of water development in Southern Alberta highlights connections to water that, for some senior licence holders, extend well beyond economic self-interest to include family values, tradition, and identity. Recognition of this fact is immensely important in order to move forward with the goal of healthy aquatic ecosystems. It suggests that economic incentives alone may not be enough to convince people to alter their water use practices to better serve the needs of aquatic ecosystems. Incentives and strategies that appeal to values other than financial security may well be required in light of deep personal and historical connections to water in ORB.

Attention to unpacking the rules-in-use (as opposed to formal, written rules alone) also provides important insights into peoples' decisions regarding water allocation and aquatic ecosystems in the ORB. For instance, considering the importance given to aquatic ecosystem protection in the provincial water strategy (Alberta Environment 2003), one might find it odd that, between January 2006 and March 2008, the Director elected so infrequently to apply the discretionary 10% conservation holdback (i.e, on only five out of 21 approved water transfers). In so doing, some argued that the Director missed an opportunity to better meet the targeted Water Conservation Objective (WCO) by not reclaiming previously allocated water. However, when one takes into account the long history of government support for irrigation development in the ORB and the relative importance assigned to different water uses in Southern Alberta (e.g., ecological instream flows versus ongoing and future economic development) the Director's decisions and actions seem to be relatively in line with the overall local priorities. The implication is that, despite their existence, legal mechanisms designed to protect aquatic

ecosystems in Alberta may, in practice, be largely ineffective. Alternative mechanisms (such as making the 10% conservation holdback mandatory in all but a narrow and well-defined set of circumstances) may be necessary if the goal of healthy aquatic ecosystems is to be realized.

Finally, close attention to biophysical context revealed details and dimensions that might otherwise have been missed and which are immensely important to determining the factors that shape the development and implementation of policies to protect aquatic ecosystems in the ORB. For example, it was noted that the uncertainty about the future effects of climate change sometimes influences the tone and character of water management discussions, and often with direct consequences for aquatic ecosystems. A specific case in point involved the use of climate change predictions by some irrigation development proponents as justification for building new dams (i.e., to capture the forecasted increase in spring rains and to offset the expected dryer summer conditions). Although the likelihood that any major new dams would be built in the ORB is greatly diminished relative to previous decades (given the lack of ideal sites for such projects and the considerable public outcry that would no doubt result from major new proposals), the prevalence of such arguments, nevertheless, results in further strain to the relationship between aquatic ecosystem advocates and irrigation lobbyists. The end effect could well make the sorts of novel collaborations required to implement aquatic ecosystem protection all the more unlikely.

While a number of potential pitfalls do exist in trying to be too comprehensive in one's analysis (see Mitchell 2008; Ostrom 2007; Honadle 1999), a clear grasp of contextual factors can prove immensely valuable when trying to accurately identify the

kinds of solutions and recommendations necessary to overcome many of today's environmental problems. As noted above in the case of the ORB, such recommendations could include, for example, the development (or modification) of legal mechanisms that do a better job of supporting stated policy goals than do those currently in place. Other possible solutions include the development of incentives and strategies that appeal to a broader range of values other than mere economic self-interest. In so doing, the careful consideration of context in institutional analysis would not only help to counter characterizations of environmental management (e.g., Bryant and Wilson 1998; Nadasdy 2007) as a field of study that sometimes downplays the importance of context, it could also aid in the realization of policy goals.

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CHAPTER FOUR

WATER GOVERNANCE IN THE OLDMAN RIVER BASIN, ALBERTA: ADVANCING THE GOAL OF HEALTHY AQUATIC ECOSYSTEMS

4.1 Abstract

The links between ecosystem health and human well-being are becoming increasingly apparent. In the context of water management, where this link is especially strong, policies aimed at addressing aquatic ecosystem protection are being developed in many jurisdictions. Although well intentioned, such initiatives often prove difficult to implement — particularly in water-stressed, semi-arid regions where the demand for water for human consumption is high. This paper reports on an empirical investigation of the factors that shape the development and implementation of policies for aquatic ecosystem protection in a semi-arid watershed in Western Canada. Careful attention is given to the cultural, political, and historical context within which water management occurs in this region. Eight critical factors are identified and evaluated. These include 1) clarity of actors' roles; 2) communication; 3) definition of key terms; 4) funding and organizational capacity; 5) leadership; 6) the formal institutional environment; 7) data and monitoring; and, 8) public education. These considerations directly influence the extent to which policies for aquatic ecosystem can be implemented successfully in Southern Alberta. The paper concludes with reflection on the importance of broad contextual factors (e.g., cultural, social, ecological, historical) in water management research, and offers recommendations for addressing them during policy formulation and implementation.

4.2 Introduction

The neglect of aquatic ecosystems is a concern in most parts of the world (Gillilan and Brown 1997; Falkenmark and Rockstrom 2004; King and Brown 2006). Gleick (2000: 132) notes that one of the greatest failings of twentieth century water policy was "the failure to understand the connections between…the health of natural ecosystems and human wellbeing." As causal links between human wellbeing and ecosystem quality become more evident (Baron, *et al.* 2002; Butler and Oluoch-Kosura 2006), so too does awareness of the range of goods and services provided by water dependant ecosystems (Acreman 2001; Ferng 2007). For example, ecosystems are known to provide services such as clean water and air, soil fertility, livable climates, genetic resources, and cultural, spiritual, and intellectual experiences (Baron, *et al.* 2002; Cork and Proctor 2005). The value of such ecological services is, according to Cork and Proctor (2005), at least partially rooted in their role in supporting our lives, their inexpensiveness, and our inability to replace them with human-created alternatives.

In response to growing concerns over the deterioration of aquatic ecosystems, many countries around the world are taking action. For example, Tanzania (Wallace, *et al.* 2003) and England and Wales (Petts 1996) have formally recognized the freshwater needs of ecosystems (Ferng 2007). South Africa (King and Brown 2006) and Australia (Schofield and Burt 2003; Gardner and Bowmer 2007) assign priority water rights to the aquatic environment (Ferng 2007). Unfortunately, initiatives such as these are proving exceedingly difficult to implement and often produce considerable backlash from affected water users (Gillilan and Brown 1997; Brunner, *et al.* 2005; McDaniels, *et al.* 2005; Wester, *et al.* 2008).

The ongoing conflict among farmers, First Nations groups, and environmental interests in the Klamath River Basin in Oregon and California serves as a potent illustration. In the summer of 2001, the United States Bureau of Reclamation suspended the delivery of water to irrigation farmers in the Upper Klamath River Basin. It did so based on its legal obligation under the *Endangered Species Act* to maintain sufficient flows in the Klamath River to protect endangered fish species downstream (Slaughter and Wiener 2007). The result was a backlash from many irrigation farmers and their supporters which was characterized by acts of civil disobedience, including the use of crowbars and acetylene torches to open the headgates of an irrigation canal (Brunner, *et al.* 2005). Although political pressure eventually forced the Bureau of Reclamation to release some water to irrigators, the legal and political battles that followed led to two very unfortunate outcomes: both fish *and* crops died (Johnson 2005).

What factors account for the failure to implement policies and practices for aquatic ecosystem protection? In the case of the Klamath River, Slaughter and Wiener's analysis reveals that the lack of private ownership of water rights (and the constraints this poses for engaging in water trading and/or community negotiations) is a major factor fueling this prolonged water conflict (Slaughter and Wiener 2007). Other researchers, working in different jurisdictions, have noted the failure of decision-makers to account for the broad political-economic context within which water management policies are situated. For instance, van der Lee and Gill (1999) reported that decision-making methodologies used in Australia to determine water allocation among competing uses commonly disregarded broader social and cultural factors.

With the aim of developing a better understanding of the factors that affect the implementation of policies designed to protect aquatic ecosystems in semi-arid regions, this paper reports on an empirical investigation of the Oldman River Basin (ORB) in Southern Alberta. While drawing specifically on a Western Canadian case study, many of the challenges identified will resonate with the experiences of water managers elsewhere in the world where finding the balance between human and ecosystem needs for water is a major challenge. Eight factors affecting policy implementation are identified through the analysis of documents, key informant interviews, and personal observations (described below). The cultural, historical and political context within which these aquatic ecosystem initiatives are situated is central to the analysis. The paper concludes with a series of recommendations which are intended to advance the goal of aquatic ecosystem protection in the Oldman River Basin.

4.3 Methods

Case studies can preserve the texture and detail of a research problem and allow for in-depth exploration of research phenomena (Gerring 2007). A case study approach was used in this research because this methodology lends itself well to an exploration of the relationships between locally-identified factors that shape the success of policies for aquatic ecosystem protection and the context within which these factors are situated. The Oldman River Basin (ORB) in Southern Alberta, Canada, was selected as the study area. The ORB is a semi-arid watershed with a relatively new policy designed to protect the health of its aquatic ecosystems. Thus, it provided the ideal biophysical and political conditions for this study.

The research was conducted between July 2006 and September 2007. Data collection was spread over three field seasons totalling sixteen weeks in all and drew on three primary sources of data: 1) documents; 2) key informant interviews; and, 3) personal observations. Field visits were used primarily for conducting interviews, attending conferences and workshops, and recording personal observations.

Documents reviewed include federal and provincial policies and legislation, technical reports, watershed plans, and written historical accounts of water development in the Oldman River Basin — totaling 72 sources in all. Additional digital resources such as educational videos and websites also were consulted. Document selection was based initially on relevance to the research topic, with subsequent sources identified during the interview process (described below). These documents provided important background information on aquatic ecosystem protection in the ORB, helped to identify contacts for key informant interviews, and provided a means by which to verify and examine in closer detail salient points raised during the interviews.

A total of 56 semi-structured interviews were conducted with key actors and officials representing a range of organizations and groups including environmental non-government organizations (n=10), First Nations (n=1), industry groups (including the irrigation sector) (n=7), academics (n=9), private consultants (n=2), formal watershed partnerships (such as the Oldman Watershed Council) (n=10), as well as provincial (n=15) and federal (n=2) government officials. In keeping with the key informant method, interview participants were purposively selected (Tonkiss 2004). The initial selection occurred during the document analysis phase and was followed by snowball sampling (Bloch 2004) once the interview process had begun. A standard protocol of

questions was used to guide each interview. Audio-recordings were made and hand written notes were taken by the researcher in order to summarize the discussion and to record observations about the study participant's intonation, tone, and body language. All interviews were conducted face-to-face and ranged in length from three-quarters of an hour to six hours, with a median length of 1.5 hours. At the end of each interview, study participants were asked to suggest other individuals who played key roles in water governance in the Oldman River Basin, and who could make a valuable contribution to the discussion.

All actors suggested as potential interview subjects were contacted for an interview. However, due in part to the seasonal timing of the research (e.g., during harvest), meetings with representatives from the rural municipalities and watershed stewardship groups proved difficult to arrange. To compensate for this, a number of rural watershed tours and workshops were attended which provided an opportunity for informal conversation with rural landowners and watershed stewardship group members. Unfortunately, the researcher was only able to secure an interview with a representative from only one of the two First Nations reserves in the ORB. No additional opportunities existed for informal discussion with First Nations representatives. The interview process as a whole was concluded when no new names were suggested and when subsequent interviews no longer yielded substantive new information.

Personal observations were used to corroborate written and verbal accounts. These included observations drawn from both verbal and non-verbal cues recorded during the interviews (noted above), notes from conversations with landowners during watershed tours and workshops, and a series of photographs depicting various aquatic and riparian

management projects, water management structures, irrigation equipment, etc. In total, over 500 photographs were taken and 14 conferences, workshops and watershed tours were attended.

After transcription, the data were sorted thematically into eight emerging categories based on a combination of open and axial coding (Seale 2004). Each category was triangulated with evidence from all three data sources and was then assigned to one of two broad groups: 1) contextual information; and, 2) factors affecting the success or failure of aquatic ecosystems protection in the ORB. This method of analysis was conducted on a trial basis on a sub-set of data gathered during the first field season and subsequently applied to the complete data set.

Once the analysis was complete, the results were sent to a subset of study participants for the purpose of review and verification. Of the subjects interviewed, seven were selected to participate in follow-up interviews who collectively represented the major interests in aquatic ecosystem protection in the Oldman River Basin (e.g., the irrigation sector, the environmental sector, the Oldman Watershed Council, etc.).

The next section presents a summary of the research findings, including contextual information. The factors that shape the development and implementation of policies for aquatic ecosystem protection are evaluated in the section that follows.

4.4 Context

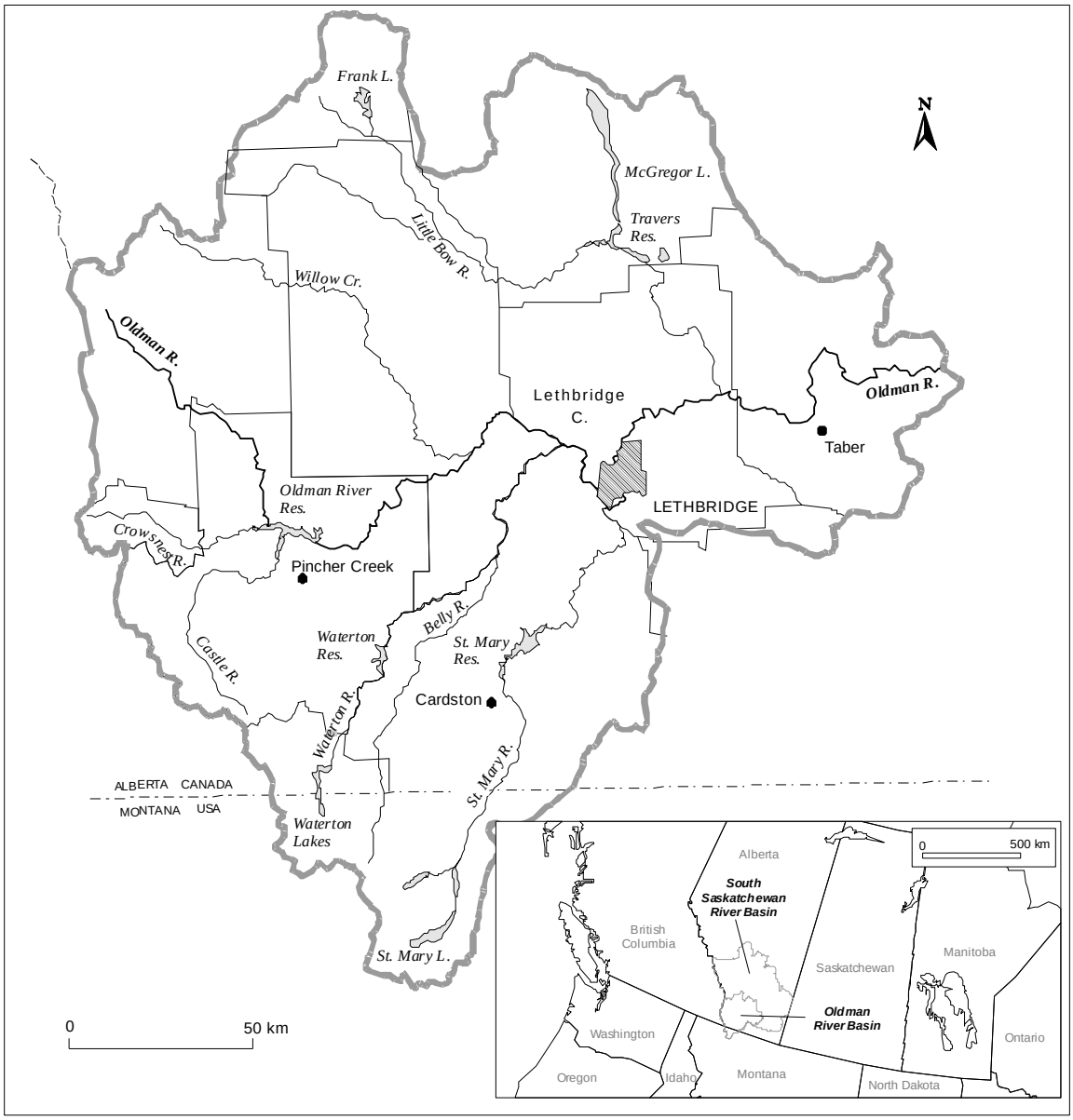
4.4.1 The Oldman River Basin

The Oldman River and its tributaries originate in the eastern rocky mountains of Alberta and Montana, and flow eastwards across the plains (see Figure 4.1). The plains

region comprises approximately 80% of the land area in the Oldman River Basin (ORB). At approximately 1.5 million cubic decametres, the mean annual discharge for the Oldman River is modest. Nevertheless, its waters play a critical role in supporting the region's rural economy. The climate of the ORB is subject to a high degree of inter- and intra-annual variability. Thus, streamflow is characterised by high flows from snowmelt and heavy rains in late spring (mid-May and mid-July), and low flows during the hot dry summers that are typical in the region (Alberta Environment, Water Resources Management Services Planning Division 1984; Thiessen and Linder 1989). Annual mean precipitation averages 30 - 45 cm (Alberta Agriculture, Food and Rural Development 2000). Drought is not uncommon, periodically lasting for multiple years (e.g., 1917-1926, 1928-1939, 1977-1979, 1983-1989, and 2000-2001) (Gilpin 2000; Agriculture and Agri-Food Canada 2002).

The population of the basin is approximately 160 000 and growing steadily (Statistics Canada 2007). Largely due to the fact that almost half of the population is concentrated in the city of Lethbridge (74, 637 people), the remainder of the basin has a distinctly rural character. Agriculture is important. This sector accounts for over 60% of all total irrigated agriculture in Canada (Harker, *et al.* 2004). An extensive and expanding network of dams, distribution canals and pipelines has been constructed to move water from the rivers and reservoirs to adjacent crops in irrigation districts. Today, 87% percent of total allocations (measured by volume) in the Oldman River Basin are licensed for irrigation purposes, compared to 4% and 3% for commercial and municipal uses, respectively.

Figure 4.1: The Oldman River Basin



Modified from Ivey, *et al.* (2006)

The scale of water development in the ORB has significantly affected the health of associated ecosystems. Assessments of aquatic and riparian conditions in the basin have identified numerous areas as being "healthy with problems" or "unhealthy", as well as "moderately impacted" and, in the case of the Southern Tributaries of the Oldman River, "degraded" (Golder Associates Ltd. 2003; Alberta Environment 2007). The first two

classifications are based on best available water quality, riparian health, and hydrological data (Alberta Environment 2007); the latter two on the professional opinions of scientists and water managers working in the water management sector in Southern Alberta.

With the growing realization that the limits of allocable water have been reached in the ORB (Alberta Environment 2004), and with the anticipated effects of climate change looming on the horizon, restrictions have now been placed on the growth of irrigation districts in the ORB (SSRB Water Allocation Regulation, 1991). Additionally, in the summer of 2006, a moratorium was placed on further licence allocations (AMEC Earth and Environmental Limited 2007).

4.4.2 The Culture and History of Water Development in the Oldman River Basin

To understand the factors affecting the development and implementation of policies to protect aquatic ecosystems in the Oldman River Basin today, it is important to gain an appreciation of the rich cultural and historical context within which water resources in Southern Alberta have been developed. Due, in part, to its harsh and variable climate (Palmer 1990; Agriculture and Agri-Food Canada 2002), farmers in Southern Alberta (as in many other parts of the Western North America) sometimes have had to struggle to survive. In his account of Alberta's growth and development over the past century, Palmer (1990) describes extensive periods of drought and economic depression endured by farmers. During such periods, crop failures and livestock losses have been commonplace.

The importance of water for agriculture was recognized early on in Alberta's history. Indeed, by the early 1900s the notion that water was "wasted" if allowed to flow downstream had become ingrained in the policy and psyche of settlers in the ORB. If

climate change predictions are correct, then farmers will not have an easier time in the future. It is anticipated that temperature increases of 3 - 6°C on the Southern Prairies (Saunders and Byrne 1994; Bruce, *et al.* 2000) will be accompanied by stronger and increasingly variable spring rainstorms, decreased snowfall and snow pack accumulation, and drier summer conditions (Sauchyn 2007). Peak annual flows are expected to occur earlier in the year with a corresponding decrease in summer levels when agricultural demand is greatest (Byrne, *et al.* 2006).

Governments have long supported the agricultural community in Southern Alberta through their involvement in irrigation development. Initially irrigation development was led by the private sector in Alberta. However, by 1930 the provincial government was forced to step in and to invest heavily in irrigation development in order to sustain the fledgling economy and population of the province's southern region[1]. Indeed, by 1940, the provincial government (with support from the federal administration via the Prairie Farm Rehabilitation Administration) was not only guiding and facilitating irrigation development in Southern Alberta, but also had become its leading proponent and developer (de Loë 2005). Thus, for much of the past century, irrigation farmers in the ORB received considerable financial support from governments to expand agricultural production. Today, 75% of funding for infrastructure development and upgrading within Alberta's 13 irrigation districts is paid for by provincial taxpayers (Irrigation Water Management Study Committee 2002).

[1] The rather dramatic increase in provincial involvement in the development of water resources around 1930 was at least partially motivated by the transference of natural resources from federal to the provincial governments in Canada in 1929.

4.4.3 The Institutional Context for Aquatic Ecosystem Protection in the Oldman River Basin

The *Water Act* (R.S.A., 2000) is the most important piece of water-related legislation in Alberta. It vests in the Crown the right to divert or use water (R.S.A. 2000, W-3); it entrenches in law a system of prior allocation (a.k.a. first-in-time, first-in-right, or FIT-FIR) which ensures that senior licencees receive 100% of their allocated water before more junior licencees receive any of theirs (Percy 2004); and it makes provisions for a water trading system. Significantly for this research, the *Water Act* requires the Minister of the Environment to "establish a strategy for the protection of the aquatic environment…" (s.7).

In 2003, after extensive public consultation, Alberta released *Water for Life: Alberta's Strategy for Sustainability* (Alberta Environment 2003b). This non-binding strategic planning document outlines Alberta's vision for water management now and into the future and is the key motivator of initiatives to protect aquatic ecosystems in Alberta. The document lays out three primary goals: 1) safe, secure drinking water; 2) reliable, quality water supplies for a sustainable economy; and, 3) healthy aquatic ecosystems. *Water for Life* also highlights key directions and actions for achieving the above goals, including the establishment of three types of partnerships:

- The Alberta Water Council (AWC);
- Watershed Planning and Advisory Councils (WPACs — of which there are currently eight including, in the study area, the Oldman Watershed Council); and,
- Watershed Stewardship Groups (WSGs).

Members of the AWC and the WPACs include representatives from industry (e.g., irrigation, oil and gas), governments (municipal, provincial, federal and Aboriginal governments), and non-government organizations (e.g., environment, habitat conservation, etc.). The WSGs, by contrast, are largely composed of landowners who live in small sub-watersheds (e.g., Beaver Creek within the Oldman River Basin). The respective duties of these bodies include the following:

- AWC — examines and prioritizes water issues, provides expertise on specific issues, provides advice and shares information with the WPACs, WSGs and other sectors, consults the public concerning possible solutions to water issues, and makes recommendations to the Government of Alberta.
- WPACs — assess current watershed conditions, produce State of the Watershed Reports, develop watershed management plans, collaborate with landowners "on-the-ground," support the WSGs, and present issues to the AWC.
- WSGs — take action "on-the-ground," promote best management practices, provide input on WPAC activities, and participate in State of the Watershed reporting (Alberta Environment 2003b).

The naming of partnerships as a key direction of the *Water for Life Strategy* speaks to an underlying shift toward more distributed water governance, or "shared governance" as it is referred to in Alberta (Alberta Water Council 2007b).

Governance refers to the sharing of responsibility (among government, public, and private actors) for the development of policies that advance the common interest through open decision-making structures (Brunner, *et al.* 2005). The working definition endorsed

by the AWC is consistent with this perspective. Shared governance, according to the Council, "refers to a governance structure where both government and external parties share responsibility for development and delivery of policy, planning, and programs or services." In this configuration, government retains accountability (Alberta Water Council 2007b).

Presently, the Oldman Watershed Council (OWC) is in the final stages of completing its *State of the Watershed Report* for the ORB, which is due for release in fall 2008. Once the assessment is completed, the focus of the OWC will shift to developing a watershed plan. In the meantime, a plan for the South Saskatchewan River Basin (of which the Oldman River Basin is a part) has been approved (Alberta Environment 2006). This plan provides some guidance on such issues as the transfer of water licences and restates the need to strike a balance between consumptive water uses and aquatic ecosystems. With support from environmental organizations such as Cows and Fish[2], some Watershed Stewardship Groups have already begun working to improve aquatic and riparian ecosystem conditions at selected locations throughout the basin. The year 2007 marked the end of the short-term implementation targets for *Water for Life*. In a recent review of progress made towards those goals, the *Alberta Water Council* found that "progress toward the strategy's three goals has not been balanced, or equal, during the first four years of implementation" (Alberta Water Council 2007a: 5). While progress towards the goals of *Safe Secure Drinking Water* and *Reliable Water Supplies*

[2] Cows and Fish is the name of Alberta's Riparian Habitat Management Society which strives "to foster a better understanding on how improvements in grazing management on riparian areas can enhance landscape health and productivity for the benefit of cattle producers and others who use and value riparian areas" (Cows and Fish 2008).

for a Sustainable Economy has been "good" and "generally on track," insufficient emphasis has been placed on the goal of *Healthy Aquatic Ecosystems*. This finding was further reflected in the allocation of funding from senior government toward the protection of aquatic ecosystems (relative to the other two goals of *Water for Life*). Of Alberta's $33.1 billion dollar budget for 2007, roughly 0.5% ($200 million) was committed to *Water for Life*. Of that $200 million, $1.23 million was allocated to Alberta Environment for work on healthy aquatic ecosystems – compared to the $159.3 million (roughly 77% of 2007 *Water for Life* spending) that the Ministry of Infrastructure and Transportation (MIT) received for capital improvements related to municipal water treatment systems (Alberta Wilderness Association, *et al*. 2007; Government of Alberta 2007a; Government of Alberta 2007b). These figures highlight the relative importance of water on the political agenda in Alberta and, specifically, the limited attention paid to aquatic ecosystems therein. Some study participants commented that this gross discrepancy in spending is a reflection of the difference between problems that are relatively easily resolved through investment and engineering improvements and those that are far more socially contentious and divisive.

4.5 Results

Using the methods outlined earlier, eight factors emerged from the data that contribute to the success or, in most instances, the failure, of efforts to protect aquatic ecosystems in the Oldman River Basin. These eight factors are discussed below.

4.5.1 Clarity of Roles

Water for Life attempts to lay out the roles and responsibilities of each of the three primary partnerships proposed under the strategy: AWC, WPACs, and WSGs (see Alberta Environment 2003b). Legal responsibility for water management decisions clearly rests with the crown (*Water Act*, R.S.A., 2000). What remains unclear, however, is the authority, accountability and relational responsibilities of the other actors involved. Of the eight WPACs that presented their primary successes and challenges for the past year at the 2007 WPAC Summit, five cited the lack of clarity about their role as one of the top two challenges that they faced (the second most frequently mentioned was funding, which is discussed below).

For instance, WPACs are now emerging in many watersheds across the province and, as one might anticipate, their delineation by watershed boundaries does not integrate well with existing political boundaries including those of municipal districts. As such, when the Director is faced with making a decision about a given licence application, he/she may have conflicting voices to contend with. In the words of one AWC representative,

> How do you make sure that you always have the [municipal level] political support to implement basin plans? What happens if the OWC puts something in their watershed plan that prohibits development in the headwaters region and then the plan gets approved by the Minister? If Joe Millionaire from Texas comes sauntering in with ideas for a development to build a huge hotel in the headwaters that will lower taxes, increase employment opportunities, improve the roads, etc., how is a municipality that is struggling under its current tax base going to say no?

With four such watershed plans already underway, some urgency surrounds the need to address the current lack of clarity about relational roles and responsibilities among actors. Considering that the natural ranges of many aquatic species cross

administrative boundaries between municipalities, it would only take one incident of municipal non-compliance with a watershed plan to seriously compromise efforts to protect aquatic ecosystems downstream.

4.5.2 Communication

The absence of clearly defined relational roles manifests itself in a number of communication challenges. From the perspective of the WPACs, this issue is of particular importance as it constrains the productivity of partnerships with the AWC and the WSGs. Until actors develop an understanding of what information needs to be shared and how to share it, these challenges are likely to persist. Exacerbating this issue were instances observed by the researcher of conflicting evidence and knowledge claims. This was especially so in regard to a range of subjects pertinent to aquatic ecosystem protection (e.g., minimum instream flow requirements, statistics on overall water use and availability in the ORB, climate change predictions, etc.). Furthermore, the sheer volume of information that is amassed at each level (local, regional, provincial) accumulates very quickly, thereby further exacerbating communication problems. For example, a database of relevant studies was compiled to assist the Oldman Watershed Council in one of its many projects, namely the development of their State of the Watershed Report. At the time of writing, the database included 3271 entries specific to the Oldman. When one multiplies that by the eight WPACs currently in operation, all of which are charged with producing State of the Watershed Reports, one can begin to appreciate the amount of information being processed. One OWC representative noted the following:

> Communication is a major problem – even though people are trying. For example, Mayors and Reeves meet once a month but, how much can you say in a 5-minute brief — particularly when most people in attendance don't have

> enough background knowledge to know what an [instream flow need] is anyway...There are lots of meetings, but [little actual communication].

Lack of familiarity with technical language is a by-product of the diverse backgrounds and perspectives that actors bring to the table. On any given committee, membership can include irrigation farmers, livestock producers, academics, economists, professional biologists, environmental lobbyists, engineers, and bureaucrats, to name only a few. Given this diversity, it is not surprising that the people involved do not speak a common disciplinary language. This issue is particularly evident in discussions of aquatic ecosystems because of the technical nature of much of the pertinent information. In order for discussions about aquatic ecosystems to be effective, one irrigation sector representative noted, "biological conditions need to be translated into terms that a manager, or a politician, can make sense and use of." Translations and clear communication of scientific concepts is vital to the effective integration of science and policy (Lee 1993), and thus is a prerequisite for successful aquatic ecosystem protection.

4.5.3 Definitions & Terminology

Despite the regular inclusion of glossaries and terms of reference in water policy documents (Alberta Environment 2003b), considerable confusion still exists around the definition of key terms. Of particular concern to interview respondents was the apparent lack of agreement on a definition for the term "healthy aquatic ecosystem" — the very thing that *Water for Life* purports to address. The issue here is twofold.

First, confusion exists as to the scope of the term aquatic ecosystem due, in part, to differences in terminology appearing in key water management documents, such as *Water for Life* and *the Water Act*. *The Water Act* does not define aquatic ecosystems.

Instead, it defines something called the "aquatic environment" which (when one follows the chain of definitions for key words used in *the Act*, see Table 4.1) excludes irrigation works such as reservoirs and surface canals. This has potentially significant ramifications for aquatic ecosystems because 1) the *Water Act* purports to protect the "aquatic environment," not "aquatic ecosystems" as laid out in *Water for Life*; and, 2) as was noted during interviews, for more than half of each calendar year, there is more water (and habitat) in irrigation canals and storage reservoirs than there is in the rivers and lakes in Southern Alberta. The practical implications of such definitional minutiae became very evident to the researcher while on an irrigation district (ID) tour. Upon spotting a beaver swimming across a reservoir, the district manager conducting the tour explained to the group that, within that particular ID, there existed a $40 bounty on beavers (muskrats, by comparison, were only worth $15). Incentive programs designed to eradicate certain aquatic and riparian "pests" have clear repercussions for the health of aquatic ecosystems.

Table 4.1: Definitions of Key Terms Used in Alberta Water Management

Term	Definition	Source
Aquatic Ecosystem	An aquatic area where living and non-living elements of the environment interact. These include rivers, lakes and wetlands, and the variety of plants and animals associated with them.	Alberta Environment 2003b: 28.
Wetland	Wetlands are formed in depressions or low areas where the ground is saturated with water or is flooded. Alberta has five types of wetlands: bogs, fens, swamps, marshes, and ponds.	Alberta Environment 2003b: 31.
Riparian Area	The area along steams, lakes and wetlands where water and land interact. These areas support plants and animals, and protect aquatic ecosystems by filtering out sediments and nutrients originating from upland areas.	Alberta Environment 2003b: 29.

Term	Definition	Source
Aquatic Environment	The components of the earth related to, living in or located in or on water or the beds or shores of a *water body*, including but not limited to (i) all organic and inorganic matter, and (ii) living organisms and their habitat, including fish habitat, and their interacting natural systems (emphasis added).	Alberta Water Act, section 1(1)h
Water Body	Any location where water flows or is present, whether or not the flow or the presence of water is continuous, intermittent or occurs only during a flood, and includes but is not limited to wetlands and aquifers but does not include except for clause (nn) and section 99 "water body" that is part of an *irrigation works* if the irrigation works is subject to a licence and the irrigation works is owned by the licencee, unless the regulations specify that the location is included in the definition of water body (emphasis added).	Alberta Water Act, section 1(1)ggg
Works	Any structure, device or contrivance made by persons, or part of it, including a dam and canal, and (i) land associated with it, and (ii) mitigative measures associated with it, and includes anything that is defined as a works in the regulations for the purposes of this Act.	Alberta Water Act, section 1(1)mmm

The second definitional issue is tied to the persistent use of the term "healthy" in *Water for Life* to describe the desired state of aquatic ecosystems. In an ecological context, the term healthy has proven particularly difficult to define (Rapport 2004). This presents serious problems when it comes to implementing policy. As one environmental consultant interviewed noted,

> Aquatic ecosystem health is such an airy-fairy term and, until we come up with a solid method with which to measure it, they [the politicians] are going to be loath to fund it…the Ministers are scared.

Recent work commissioned by Alberta Environment in Edmonton explores this issue and recommends that the Alberta government adopt a "pragmatic" approach to

defining aquatic ecosystem health (Whitford 2005). During the course of this research, all inquiries revealed that the definitional details of what constitutes a healthy aquatic ecosystem had not yet been determined. As a result, "healthy aquatic ecosystems" in Alberta can be expected to look very different depending on the definition and limits that are eventually adopted.

4.5.4 Funding & Organizational Capacity

Virtually all interview respondents raised serious concerns about funding and organizational capacity with reference to both government ministries and watershed planning and stewardship groups. These concerns were echoed in informal conversations with WPAC representatives at the conferences and workshops attended. To illustrate, WPACs (along with WSGs and the AWC) are charged with the task of identifying solutions to watershed issues in Alberta (Alberta Environment 2005). Considering the magnitude of this assignment, one might expect to see a substantial flow of resources from the provincial government to the WPACs. This has not happened. Of the $200 million that the Government of Alberta devoted to *Water for Life* programs in 2007, roughly 1.6% ($3.25 million) was used to fund the WPACS (Alberta Wilderness Association, *et al*. 2007). This amounts to 0.01% of Alberta's $33.1 billion dollar budget for the same period. It is noteworthy, however, that even at this level, funding for watershed organizations in Alberta exceeds that of comparable organizations in many other provinces in Canada.

Concerns over capacity and funding extend into government ministries as well. As one representative from the environmental community noted,

> The actual funding that has come through for implementing *Water for Life* is dismal. And it's not Alberta Environment's fault, especially considering all of the cuts that they and Sustainable Resource Development have had to sustain over the past decade. We need a signal from the top that the funds will be there. If we can't invest in our environment now when we're richer than ever as a province, then when? We need some leadership that can deliver resources to fuel action.

One example of how this affects aquatic ecosystems protection directly is in the development and sustained implementation of monitoring programs (discussed in more detail below). It is a commonly held tenet of ecological science that, due to the complexity of ecosystems, a great deal of uncertainty exists in our understanding of ecosystem dynamics. Thus, management actions should be seen as experiments based on the best available knowledge, with the proviso that policy adaptation occurs as new evidence becomes available (Holling 1978; Lee 1993). Without the funding and personnel to conduct the monitoring required to gather this new evidence, science-based adjustments to the management of aquatic ecosystems simply cannot occur.

During the course of this research, the Government of Alberta announced the creation of a Water Resources Institute with a $30 million budget and an agenda to support water related research. It remains to be seen if these funds will be made available only to Universities or to all groups and organizations involved in watershed stewardship and research (e.g., Cows and Fish, WSGs, etc.) and how much of it will translate into actual improvements in aquatic ecosystem health.

4.5.5 Leadership

In addition to the provision of much-needed funding, several study participants noted that senior government officials need to provide leadership by creating a working environment that is conducive to experimentation with possible solutions to watershed

issues. The current climate of fear of failure is reportedly preventing any real innovations from taking root.

A tangible example of this attitude exists in the operation of dams controlled by the provincial government. The technical knowledge required to manage flows below dams so as to benefit aquatic and riparian ecosystems is well documented (e.g., McMahon and Finlayson 1995; Richter and Thomas 2007). The problem is that these practices would deviate from most of the current operational plans and also that such experiments would produce inevitable risks that not everyone is willing to take. As one Alberta Environment representative noted:

> periodic overbank flows are needed for cottonwood regeneration. But…even though the dams are not designed as flood control structures…there is a public expectation that we will manage property damage when we can. Flood relief [has, in the past,] cost the provincial and federal governments millions of dollars…so you can imagine how proposals for intentional flooding would go over. *Water for Life* points us in that direction but, the political support for taking such risks has yet to follow. So, for now, we are moving very cautiously.

A general observation made during the interview process was that people seemed cautiously optimistic about the prospects for leadership on water management issues from the newly elected Premier and his chosen Minister of the Environment. Although seldom expressed directly, such comments were often made in a tongue-and-cheek sort of a way that signaled a residual dissatisfaction with some of the previous politicians who held those positions (one of whom, for example, was said to be "a bit weak," "a light weight", and having "no affect on the system.")

4.5.6 Formal Institutional Environment

The goal of healthy aquatic ecosystems laid out in *Water for Life* is merely that — a goal. According to many of the study participants, until the goal is quantified and entrenched in law, the condition of aquatic ecosystems is unlikely to improve. As one Alberta government scientist noted, "The law in Alberta says that we are going to use the water — and we are. The environmental stuff is short on teeth…and the only mechanism worth its salt is legislation...Otherwise it is not enforceable." As a result, much of the work that has been done in the past regarding aquatic ecosystems has ended up as what one study participant termed "shelf art".

Further complicating the prospects for aquatic ecosystem protection is the Government of Alberta's promise to respect all existing water licences and to hold their priorities sacrosanct throughout the *Water for Life* implementation process (Alberta Environment 2003b). In water-stressed basins such as the Oldman, this leaves precious little water with which to improve the quality of aquatic ecosystems. As background to the study of instream flow needs for the South Saskatchewan River Basin (Clipperton, *et al.* 2003), a team of Alberta government scientists modeled a series of possible flow configurations to determine how available instream flows could best be used to maximize benefits to aquatic ecosystems (Alberta Environment 2003a). According to an interviewee representing the Alberta government, what they found was that, "it almost didn't matter what the scenario was, the benefit was within a very narrow band – and the reason was that we have to meet existing licences and apportionment. So, without changing those, our hands are kind of tied. There's just no water left."

In order to operate within the terms of existing licences and the current water allocation system (FIT-FIR), environmental advocates would need to purchase high priority licences and then allow the allocated water to remain instream for the benefit of aquatic ecosystems. However, the legal mechanisms that would enable such actions currently do not exist in Alberta. Under the *Water Act*, only the province of Alberta can hold an instream licence. If adopted, recommendations made under the *South Saskatchewan River Basin Water Management Plan* would see the *Water Act* amended to enable private groups to purchase instream licences. This would result in immediate benefits for aquatic ecosystems in the form of much needed increases to instream flows. But as one senior government official noted, "getting the *Water Act* amended can be a very political process. It can take months or even years depending on how MLAs think it will sell in their [particular] jurisdiction." This position was reified by former Alberta Environment Minister Lorne Taylor in an open email discussion with an Alberta-based environmental advocate as part of the 2006 Rosenburg International Forum on Water Policy. In response to a question regarding the possibility of amending Alberta's historic first-in-time, first-in-right system of water allocation (which assigns the vast majority of senior water rights in the ORB to the irrigation sector), Mr. Taylor responded by saying that "there is no willingness on behalf of the holders of the right for any changes that would alter their position. As a result, governments are not interested in investigating the possibilities because of the political reality" (Taylor 2006). As such, the potential benefits of such legal reforms for aquatic ecosystems could still be a long way off.

4.5.7 Data & Monitoring

Three specific data-related concerns were repeatedly raised by the study participants and confirmed via personal observation and document analysis. They are 1) insufficient integration of existing and emerging data; 2) the inconsistent nature of monitoring programs; and, 3) the insatiable appetite that some people have for more data.

Although several organizations conduct research and monitoring programs pertinent to aquatic ecosystems in the Oldman Basin (e.g., provincial and federal government ministries, environmental NGOs, stewardship groups, First Nations, anglers groups, Universities, etc.) the resulting data are not systematically organized or shared. Compounding this problem, frequent funding interruptions render ineffective many of the proposed and on-going long-term monitoring programs in the basin. As one contributor noted, "We are up against a basic human failing which is the inability to appreciate the value of monitoring." As a result, data records are often incomplete, inconsistent or even non-existent.

Finally in this context, as noted by an interview subject representing the irrigation sector, "the desire to know everything that there is to be known about something before we do anything about it is a major problem…we cannot afford to spend another decade studying and admiring the problem." Unfortunately, evidence suggests that "getting the science right" does not necessarily mean that management will follow the scientific conclusions. In the Red Deer Basin, for example, when presented with clear and defensible data regarding the required instream flows to protect the aquatic environment, one Alberta government scientist explained that community actors knowingly chose to set their water conservation objective well below the recommended level because doing

so would allow for continued economic development. As another Alberta government scientist noted, “science does not change people’s values”.

4.5.8 Education

Public education was seen by many as a necessary precursor to positive environmental change. As one representative of the Oldman Watershed Council noted

> There are three stages to aquatic ecosystem health, only the last of which is a positive change in the ecosystem itself. But that won’t happen until there is a policy change or legislation change. And before that, there needs to be an attitude shift – and that is where public education and awareness programming comes in.

Such sentiments were echoed at many of the watershed conferences and workshops attended where one presenter noted that “we can double the amount of research but, if we don’t help people to understand how to use what is already known and to transform it into policy and action, then what is the point”? At another event, the Director of the Oldman Watershed Council shared the results of a survey regarding water management in the ORB which revealed that only 25% of survey respondents even knew what *Water for Life* was all about.

Considered essential for driving forward with the goal of healthy aquatic ecosystems is the development of some baseline knowledge throughout the ORB. Two study participants noted that such knowledge should include a shared understanding of some basic ecological processes; the status of water and aquatic health; the extent to which human well-being and livelihoods are tied to healthy aquatic ecosystems; and the public’s options for getting involved and sharing their own ideas and solutions. Despite a widespread belief among study participants that most people in the Basin want to do the right thing for the environment, several acknowledged that education will be a very slow

process. Many saw education as a task that the Oldman Watershed Council would eventually focus on more intently but, despite accomplishments by some of the OWC working teams to date, the full potential of a watershed education program has yet to be realized in the ORB.

4.6. Discussion & Conclusion

Many of the factors identified in this paper are corroborated by other water management studies on topics as wide-ranging as groundwater protection to the implementation of integrated water management. For instance, Rousseau, *et al.* (2005) found that, in order for the implementation of integrated water management in the province of Quebec to be successful, support is necessary in the form of additional financing, clarification of jurisdictional status and roles, enhanced communication among actors and organizations, and enhanced scientific capacity and data availability. In another case, de Loë and Kreutzwiser (2005) identify a number of implementation gaps in their assessment of groundwater protection in Ontario. These gaps include concerns over leadership, the provision of financial resources, institutional arrangements, and the availability of technical data. There exists, however, few examples of research that captures in a single study the breadth of factors identified herein. This internal breadth or diversity of findings is very useful when it comes to considering the relationships that exist among the various factors identified.

Several study participants commented on the interconnections that they saw among the factors identified. For instance, a senior administrator with Alberta Environment in Lethbridge commented that, “if we can just address the communication

challenges, issues tied to the clarity or roles and definitions and terminology will likely follow suit." Another interview participant thought that by eliminating market distortions, many other water management issues would no longer exist. Although hesitant to rank the various factors identified, several cited public education regarding aquatic ecosystems as a top priority, claiming that the early adoption of effective education programs has the potential to set the stage in order for other important changes to occur. For instance, a senior administrator at the Oldman Watershed Council noted that "increased public awareness through education is key to overcoming barriers. As water becomes a more prevalent issue, more funding and capacity will become available." Others noted the importance of establishing among residents of the ORB some sort of baseline literacy on issues pertaining to aquatic ecosystem protection.

If, as one study participant noted, *Water for Life* has brought aquatic ecosystems into public eye in Southern Alberta, then it would seem reasonable to conclude that increased attention to public education would be timely and could help to advance the goal of aquatic ecosystem protection in the ORB. However, when considered in concert with the other factors identified, some significant challenges begin to surface.

For example, considering the current state of confusion over the relative roles and responsibilities of actors involved in water management in the ORB, it is difficult to say who would (and indeed could) take on such a responsibility at this time. Many saw education as a task that the Oldman Watershed Council would eventually focus on more intently but this raises the issue of organizational funding and capacity.

With the exception of two paid staff and a handful of Directors who are compensated for their time by the government agency that they represent, most of the

contributors to the OWC are volunteers. Of these volunteers, many (if not most) have full-time jobs and other commitments (e.g., family) that limit the amount of time and attention that they have available to support such an initiative. Moreover, with funding for the WPACs stretched as it is between current priorities (such as the development of *State of the Basin Reports* and *Watershed Management Plans*), it is difficult to see how a comprehensive education program could be funded under current conditions. Even if the funding and trained staff were available, the immensity of the task looms large given the dominant water management priorities in the ORB.

This can be illustrated with reference to the issue of leaving water instream to enhance aquatic ecosystem health. It was noted that if water is going to be made available for aquatic ecosystems, then it is going to have to come (at least in part) from the irrigation sector — as there simply is not enough water left in the river to do it any other way. A problem that arises is the continued adherence to the idea that water is "wasted" if allowed to flow downstream. To overcome such a historically-entrenched mindset through the use of public education alone would be a remarkable pedagogical accomplishment. This is not to say that education should not be pursued aggressively. However, the range of factors identified would seem to strongly suggest that some other mechanisms (e.g., laws, incentives, etc.) will also be necessary to help change attitudes toward aquatic ecosystems in the foreseeable future.

More important than the relationships among the eight factors identified as affecting the implementation of policies designed to protect aquatic ecosystems in the ORB are those occasions in which the factors seem incongruent or at odds with the contextual information presented (e.g. the cultural, political and historical context within which the

factors are embedded). For instance, in response to the apparent lack of sufficient funding and leadership for implementing aquatic ecosystem protection in the ORB, a number of interview respondents recommended that action be taken by the provincial government to remedy the problem. Examples included the following:

- The Government needs to provide political support for experimentation in order to enable innovation in water management operations.
- We need a signal from the top that the funds will be there…We need leadership that can deliver resources to fuel action.

A similar sentiment was evident in the documents reviewed:

- The provincial government must act as the leader and the accountable party in implementing the water management strategy (Alberta Environment 2002).
- The Government should adopt a plan to restore river flows in areas where it has been deemed beneficial for aquatic ecosystems (South Saskatchewan River Basin Advisory Committees 2004).
- The Government of Alberta should accelerate action and investment, and take stronger bolder steps to safeguard Alberta's water resources (Alberta Water Council 2008).

This reliance on the provincial government to take up a position of central authority — to lead, to fund, and to act — surfaced repeatedly during the interview process, document analysis, and the watershed tours and workshops attended. At first glance, such recommendations would seem to address the constraining factors identified (e.g., lack of leadership, insufficient funding, etc.). However, in light of the contextual

circumstances, the likelihood of their being implemented seems questionable. Consider, for example, the Government of Alberta's environmental track record over the past 100 years; its meager financial contributions to aquatic ecosystem protection to date relative to the other goals of *Water for Life*; its longstanding and ongoing financial support for irrigation development; and its clearly-expressed intention to retire from its role as centralized environmental manager in favour of a more broadly-based "shared governance" model.

When one considers the contextual evidence, it seems unlikely that the provincial government is positioned to lead, act on, or fund in a serious way any major new initiatives tied to aquatic ecosystem health. Doing so would seem not only to contradict the Government's past actions, but also its current commitments and practices. For instance, the Alberta government's promise to hold existing licences sacrosanct during the implementation of *Water for Life* and its reported disinterest in investigating the possibility of making amendments to the existing allocation system is problematic. It leaves one wondering where the water needed to satisfy all three of the strategy's ambitious (and at times contradictory) goals (i.e., safe, secure drinking water; reliable, quality water supplies for a sustainable economy; and, healthy aquatic ecosystems) is going to come from. As was so aptly stated by one Alberta Environment representative, "without changing [the existing licences], our hands are kind of tied. There's just no water left." Moreover, the tentative way in which the existing legal mechanisms for increasing minimum flows have been developed (based on community established Water Conservation Objectives (WCOs), rather than on biologically determined in-stream flow needs) and applied (i.e., the very limited use of 10% conservation holdbacks and license

cancellations to meet the WCO target) seem also to suggest a hesitance on the Government's part to make good on its commitment of providing Albertan's with healthy aquatic ecosystems. This is not to say that this important policy goal should be abandoned, nor that the provincial government does not have a major role to play in the work that lies ahead. Clearly, it does — especially considering that the push to protect aquatic ecosystems in Alberta is, after all, a provincial policy initiative. The contextual information does, however, raise doubts about the likelihood of the provincial government taking the lead on aquatic ecosystem protection, despite many of the study participants' apparent faith in that outcome. A different expectation might seem warranted. A common message underscored in the literature on environmental governance suggests that "the burdens and benefits of conservation should not be borne by, or accrue to, just one level" (Lebel, *et al.* 2008). Moreover, Sampford (2002: 79) notes that "effective governance is [often] hampered by the continuing presumption of the State as central actor" – a presumption that appears to dominate in Southern Alberta in the context of aquatic ecosystem protection.

A different approach would involve encouraging the actors in Alberta's three water governance partnerships (i.e., the AWC, WPACs, and WSGs) to embrace more fully the shift to shared governance by more aggressively exerting their position at the governance table. This would entail furthering their ongoing efforts to:

1. provide leadership rather than waiting for it;
2. engage with neighbours and citizens on the ground for the purpose of mutual learning and to nurture the existing sense of cooperation among actors;

3. decide collectively on how partners can most effectively communicate and support one another rather than waiting to be told what their respective responsibilities will be;

4. organize actions on the ground to improve the health of aquatic ecosystems now rather than waiting for more data and more studies which have been shown to have little effect on people's values; and

5. seek out and take advantage of less conventional partnerships, sources of funding and incentive programs while continuing to pressure the provincial government for much needed resources.

Such recommendations would seem to take a more realistic account of the context of water management in Southern Alberta and, in the end, could more quickly result in the kind of positive ecological change that the goal of healthy aquatic ecosystems is intended to produce.

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CHAPTER FIVE

CONCLUSIONS

This chapter retraces the major points and contributions of the preceding chapters and summarizes the major research findings contained in each. In addition, it provides an opportunity for critical reflection on the theoretical framework used to guide this research (thereby satisfying the fifth and final research objective) and on the methodological challenges encountered in the process. Finally, the implications of this study for future research are considered.

5.1 Purpose and Objectives

The purpose of this research was twofold. First, it aimed to examine and to reconcile some of the diverse conceptual and theoretical insights and approaches that human-environment geographers use to study the social and ecological dimensions of human-environment interactions such as those which influence the health of aquatic ecosystems. To accomplish this, a theoretical framework was developed which drew on insights from a range of perspectives in human-environment scholarship in an attempt to address a number of deficiencies reported in the literature (and detailed below) regarding the field of environmental management generally and the analysis of institutions specifically.

Second, the study aimed to identify and assess the relative significance of the factors that shape the development and implementation of policies for aquatic ecosystem protection in a water stressed semi-arid environment. The Oldman River Basin was selected as the study site where three specific research objectives were explored. These

objectives were to: utilize the theoretical framework to describe the institutional context of water management in Southern Alberta as it pertains to the protection of aquatic ecosystems in the ORB; to identify the factors that shape the development and implementation of policies for aquatic ecosystem protection in the ORB and to reflect on the relative significance of these factors; and to offer recommendations for adapting existing institutions (and/or for introducing new ones) to better serve the goal of aquatic ecosystem protection in the ORB. Two sets of eight factors were identified. The first set focused on pertinent contextual conditions of a cultural, political and ecological nature, while the second set focused more narrowly on the factors directly affecting the implementation of policies to protect aquatic ecosystems in the Oldman River Basin specifically.

Collectively, the results of the research were organized into three chapters, each presented in manuscript form. Although intended to stand alone as discreet publications, the order and progression of the manuscripts is both intentional and imperative, as each manuscript provides the foundation on which the following manuscript is built.

- The framework presented in Chapter Three is predicated on the argument made in the preceding chapter regarding the new opportunities that now exist for linking once disparate human-environment sub-fields (i.e., in the wake of post-structuralism and the advent of non-equilibrium ecology). Without this rationale, the analytical framework could rightfully be dismissed as what Johnson (2004) refers to as one of the many (poorly thought out) “marriages of convenience” that characterize such attempts at integration.

- Likewise, the factors presented in Chapter Four are predicated on the broader contextual factors presented in Chapter Three. As reflection on the relative significance of these two groups of factors reveals, the careful consideration of context is essential if recommendations to address the implementation factors are to be accurate and effective. Thus, the potential usefulness of recommendations for enhancing aquatic ecosystem protection outlined in Chapter Four is largely dependant on the contextual factors discussed in Chapter Three.

To further illustrate these points, and to help retrace the major points and contributions of each manuscript, a summary of key findings is presented below.

5.2. Key Findings

5.2.1 Theoretical Framework

A theoretical framework capable of addressing two broad sets of critiques identified in the environmental management literature was required for this research — the first regarding the state of environmental management as a field of study, and the second regarding the study of institutions specifically. Regarding the former, central to this research was the goal of producing outcomes that are both critical and applied (Castree 2002), both theoretically robust and actionable at the community level. In so doing, this research simultaneously addresses critiques of environmental management as a field of study that is intent (merely) on solving discreet environmental problems (Bryant and Wilson 1998) and critiques of critical environmental scholarship as lacking any real policy relevance or connection to problems on the ground (Walker 2007). It accomplishes this task by paying careful attention to the broad contextual factors

(discussed in Chapter Three and summarized below) within which policies to protect aquatic ecosystems in the ORB are situated, while at the same time focusing on the end goal of generating practical recommendations and contributions that are useful at the community level (discussed in Chapter Four and summarized below).

The logic of an integrated approach also informed the analytical focus on institutions, which aimed to overcome a number of critiques highlighted in the literature on institutional analysis. These critiques characterize many institutional analyses as focusing too intently on formal or informal institutions without seeing the two as integrated; relying too heavily on economic rationality as a determinant of human behaviour (Mosse 1997; Cleaver 2000); tending towards ahistorical analysis (Johnson 2004); and providing insufficient attention to the uneven distribution of power among actors (Blaikie and Brookfield 1987; Goldman 1998).

Three bodies of scholarship to which human-environment geographers contribute (i.e., human ecology, political ecology, and common property scholarship) were found to contain insights that, when integrated, provided the necessary theoretical guidance to overcome these shortcomings. In addition, the marriage of ideas from these three fields helped to achieve the desired balance between critical and applied perspectives, where the critical perspective is represented by political ecology, and the applied perspective by commons scholarship and human ecology.

To organize these three perspectives into a single analytical framework and to address the critiques of institutional analysis outlined above, the Institutional Analysis and Design (IAD) Framework was modified and updated. Capitalizing on links already made between the field of human ecology and commons scholarship in recent years (e.g.,

Imperial and Yandle 2005) insights from political ecology were integrated into the existing structure of the IAD Framework through the focus on history, culture and micro-politics).

The analytical framework guided an empirical investigation in Southern Alberta's Oldman River Basin. Specifically, it established key focal points for inquiry, and structured the way the data were analyzed and reported. In total, 72 documents were gathered and reviewed, 56 semi-structured key informant interviews were conducted and transcribed, and personal observations from 14 watershed tours, conferences and workshops were recorded. These data were then subjected to a rigorous process of content analysis with attention given both to primary and latent content (Tonkiss 2004). The major categories in the revised IAD framework (e.g., the Action Arena, Rules-in-Use, Attributes of the Community and of the Biophysical World) were used as organizers during the initial coding process. Each category was then divided into a number of sub-categories in a process that Seale (2004) describes as the "constant comparison" of individual observations within and between each category and sub-category. The results were further organized into two groupings, one containing broad contextual factors (e.g., factors relating to cultural history and identity in Southern Alberta) and the other containing factors affecting implementation which explain the extent to which policies for aquatic ecosystem protection have been implemented in the ORB specifically (e.g., the current lack of clarity surrounding the relational roles and responsibilities of the actors involved in discussions of aquatic ecosystem protection). For purposes of verification, results were shared with a subset of study participants who represented major interests in the basin. The final outcome is summarized below.

5.2.2 Contextual Factors

The focus on contextual factors was undertaken out of a desire to "dig deeper" in order to gain an understanding of "how rules combine with a physical and cultural world to generate particular types of situations" (Ostrom, *et al.* 1994: 37). Of specific note in this regard was the role that history, power and culture played in shaping the contextual factors which, collectively, inform discussions among the various actors as to how (and even if) provincial commitments to protect aquatic ecosystems health should be implemented in the ORB. Table 5.1 summarizes the contextual factors, elaborating on each with just a few of the examples drawn from the empirical data that was gathered and analyzed.

Table 5.1: Summary of Contextual Factors with Examples

Category	Sub-Category (Factors)	Example
The Action Arena	• Decentralization	• Delegation of responsibility without commensurate delegation of authority. • WPACs have no recourse if their recommendations are not adopted and implemented by government.
	• Historically-entrenched positions of power	• Uneven distribution of power among actors (e.g., irrigation sector versus environmental interest groups). • Irrigation sector controls rights to 87% of allocated water in the ORB. • Perpetuation of government support for irrigation sector development said to put environment at a disadvantage.
	• Micro-politics	• Fragmentation between provincial ministries has resulted in policies that may conflict with one another (e.g., *Integrated Land-Use Framework* and *Water for Life*). • Although there is some indication of informal networks that, if nurtured, could have positive effects for aquatic ecosystems, tension still exists

Category	Sub-Category (Factors)	Example
		between federal and provincial government agencies.
Attributes of the Community	• Cultural history and identity	• Connections to water extend beyond economic potential to include cultural identity. • First Nations consultation on the issue of aquatic ecosystem protection has been limited. In addition, the First Nations position on the Oldman Watershed Council remains vacant.
Rules-in-Use	• Application of legal mechanisms	• The current interpretation and application of Water Conservation Objectives (WCOs) is seen by some to be "a perversion of the statutory intent" because they do not protect aquatic species as they were supposed to do. • Legal mechanisms in place to help meet WCOs (i.e., 10% conservation holdbacks and the cancelation of licences no longer in use) have proven largely ineffective thus far in the ORB.
Attributes of the Biophysical Environment	• Existing Water Infrastructure and Allocations	• Water is heavily allocated and, in some river reaches, over-allocated. • Rivers are extensively regulated through dams and reservoirs.
	• Aquatic Ecosystem Condition	• Dams have had a negative affect on aquatic ecosystems by altering the timing and temperature of flows. • Aquatic ecosystem condition was rated as unhealthy and degraded in many river reaches in the ORB.
	• Climate Change and Future Water Availability	• Existing climatic variability makes supplies uncertain and undermines ability to protect aquatic ecosystems. • Climate change will have an adverse effect on water availability in Southern Alberta.

The analytical framework used was an invaluable guide for identifying these contextual factors. In its original form, the IAD Framework's focus on actors and their

patterns of interaction helped the researcher to perform such important tasks as defining the parameters of the case study, while insights about ecosystems variability helped the researcher to understand some of the problems posed to ecosystems by dams and reservoirs in the ORB (e.g., natural variability versus the regulation of linear flows). The further incorporation of insights from political ecology provided a number of important lenses (i.e., micro-politics, history and culture) through which to process the data. For instance, the focus on micro-politics helped the researcher to identify alliances (between seemingly disparate government agencies) which, if nurtured, could have positive affects for aquatic ecosystems in the ORB. Likewise, the focus on history helped to highlight such important details as the historically-entrenched positions of power occupied by some actors relative to others. Finally, the emphasis on culture revealed connections to water that (for some study participants) go well beyond (and in some cases, defy) economic self-interest to include family tradition and identity.

5.2.3 Factors Affecting Implementation

In addition to the contextual factors outlined above, nine factors affecting the implementation of aquatic ecosystem protection policies (later reduced to eight) were identified. As in the case of the contextual factors, the factors affecting implementation were based on the analysis of the three data sources and were later verified through a process of member checking. During this process, the verification group members advised the researcher that one of the factors noted as affecting implementation (i.e., Market Distortions) was misplaced and, should instead be integrated into the contextual factor entitled "Historically-Entrenched Positions of Power." This change was made and the resulting eight factors affecting implementation were presented in Chapter Four.

Together with a few examples drawn from the data set, these factors are summarized below in Table 5.2.

Table 5.2: Summary of Factors Affecting Implementation with Examples

Factors	Example
Clarity of Roles	• Relative responsibility of actors is unclear. • Some worried that the enthusiasm of WPAC volunteers would wane if a clear relationship was not evident between their recommendations and the decisions taken by government. • Buy-in from some actors (e.g., municipalities) regarding aquatic ecosystem protection has been limited to date.
Communication	• Insufficient clarity of roles and responsibilities manifests in confusion about the composition and purpose of communication channels (e.g., some actors were unclear as to what to report and to whom? Others were unsure of what resources were available from other actors and/or how to access these resources?) • Technical jargon stymies the communication process (e.g., biological versus political). • The sheer volume and technical nature of available information on aquatic ecosystems in the ORB makes it difficult to digest and share in a timely and concise fashion. • Some of the available information (e.g., the report detailing the instream flow requirements of aquatic species in Southern Alberta) actually stymies communication by bolstering the position of some actors (environmental advocates in this case) while alienating others (i.e., irrigation sector representatives).
Definitions & Terminology	• Some key terms, including "healthy aquatic ecosystems," are still undefined. • Inconsistent use of terminology in key pieces of water management policy and legislation. • Regarding the definition of aquatic ecosystem protection, current (and at times, conflicting) enforcement of provincial and federal laws and policies pertaining to fish and fish habitat make it difficult to discern if man-made structures such as canals and reservoirs are to be included in, or exempted from, policies for aquatic ecosystem protection.

Factors	Example
Funding & Organizational Capacity	• Insufficient funding to implement healthy aquatic ecosystems goal of *Water for Life.* • Under current funding regime, WPACs must rely heavily on volunteer labour. • Positions cut from government ministries with mandates tied to water and aquatic ecosystems during the 1990s have not been replaced and, with the devolution of many water management responsibilities to organizations such as the WPACs, some felt that it is unlikely that they will be replaced now.
Leadership	• Limited support for innovation and risk taking (e.g., experimenting with dam operations to better support aquatic ecosystems). • Government fear of upsetting or offending irrigators was seen by many as a major barrier to aquatic ecosystem protection. • A strong Minister with the ability to secure funds for aquatic ecosystem protection from the Treasury Board was seen as essential. At the time of the research, many felt that such an individual was not in place (although a Ministerial change occurred toward the end of the research which might have changed people's views). • Seen by some as an opportunity for change, the pending retirement of some government officials involved in water and ecosystem management in Alberta was lamented by others as a major loss of knowledgeable and experienced leaders.
Formal Institutional Environment	• Ecosystem advocates have their hands tied due to the extent of existing allocations, the closure of the basin to new water licences, and the Government's promise to hold existing licences sacrosanct. • Only the provincial government can hold instream licenses, meaning that the ENGO (or any other) sector cannot use the existing water market to help support aquatic ecosystem protection even if they could afford to. • Policies for aquatic ecosystem protection in Alberta have no legal teeth and legislative changes to remedy the matter tend to take a long time and are highly political. • *Water for Life* lacks a sufficiently detailed implementation plan.
Data & Monitoring	• Monitoring programs are inconsistent and unintegrated. • Data gaps exist that complicate aquatic ecosystem

Factors	Example
	protection. For instance, little is known about the relationship between groundwater and aquatic ecosystems in the ORB. • At the same time, scientific uncertainty and the need for more data are sometimes used as an excuse for inaction, when it has been demonstrated in the context of aquatic ecosystem protection in the ORB that science does not change people's values.
Education	• Insufficient knowledge exists at the community level regarding basic ecosystem processes. • Developing this knowledge, and changing historically-entrenched attitudes, will take a long time. • Education is essential, but it is unlikely to be very effective if it is not complemented by other programs and mechanisms that encourage people to change their attitudes and behaviours (e.g., economic incentives, extension programs, etc.).

Once again, the modified IAD Framework accentuated important elements that might otherwise have been missed. For example, the Framework's emphasis on actors and their patterns of interaction led to the development of interview questions about the relational roles and responsibilities that various actors played (see Appendix Four for a list of interview questions). These questions, in turn, led to findings such as a lack of clarity about roles and responsibilities as well as the communication challenges that occur as a result. Insights drawn from the literature on political ecology helped to extend the reach of the original IAD Framework beyond its original capabilities. For instance, in this case, the focus on micro-politics helped to draw to the surface some of the subtleties of the relationships that exist between environmental advocates and irrigation sector representatives and how scientific uncertainty is sometimes used as an excuse for inaction. Sensitivity to culture revealed that, among senior government officials, there was a culture of fear of upsetting powerful irrigation lobby groups, as was evidenced in

the promise to hold all existing licenses sacrosanct during the implementation of *Water for Life* (thereby "tying the hands" of ecosystem advocates). Finally, the focus on history helped to explain how cuts to funding and government personnel tied to water and ecosystem management in the 1990s have resulted in data gaps and capacity issues that impede progress towards aquatic ecosystems protection in the Oldman River Basin.

5.2.4 Reflections on the Relative Significance of Contextual and Implementation Factors

Although hesitant to rank the various factors identified, a number of the study participants offered comments on the interrelations between factors. One respondent noted that poor communication was at the root of many of the factors identified. Another felt that the removal of historically-entrenched market distortions (that favour irrigation development over aquatic ecosystems) would have positive effects on a number of other factors. Several identified education as a top priority, stating that by raising awareness of watershed issues, effective education programs have the potential to trigger other positive changes including increases in funding and organizational capacity.

In many cases, the contextual information provided greater depth and richness to the factors identified as affecting implementation. For example, contextual details about the ongoing shift toward decentralized water management in Alberta helped to provide important background to the frustrations reported by some study participants in the ORB regarding confusion about their roles and responsibilities relative to the various other actors and organizations involved in aquatic ecosystems protection. Similarly, historical information detailing the evolution of water development in Southern Alberta and the provincial government's long history of supporting and promoting irrigation development helped to explain why people's "hands are tied" when it comes to implementing policy

initiatives aimed at aquatic ecosystem protection in the ORB (i.e., because there is very little water left).

In other cases, however, the contextual information seemed to call into question recommendations made both by study participants and in the documents reviewed for overcoming barriers presented as factors affecting implementation and even seemed, at times, to suggest divergent courses of action. For instance, in response to the apparent lack of sufficient funding and leadership for implementing aquatic ecosystem protection in the ORB, a number of interview respondents recommended that action be taken by the provincial government to remedy the problem. However, considering the contextual evidence presented (including the Government of Alberta's environmental track record; its limited financial support of aquatic ecosystem protection to date; its longstanding and ongoing subsidization of irrigation development; and its clearly-expressed intention to retire from its role as centralized environmental manager), it seems unlikely that the provincial government is positioning itself to lead, act on, or fund in a serious way any major new initiatives tied to aquatic ecosystem protection. While pressure on provincial officials to address the factors identified as affecting implementation should still be pursued (especially considering that the push to protect aquatic ecosystems is a provincial initiative), the contextual evidence would seem to suggest that an alternative (or at least a complementary) approach might be prudent.

5.3 Recommendations

An alternative approach to aquatic ecosystem protection in the ORB would be for the actors in Alberta's three water governance partnerships (i.e., the AWC, WPACs, and

WSGs) to embrace more fully the shift to shared governance by more aggressively asserting their position at the governance table. This would entail:

1. **Providing leadership rather than waiting for it.** By looking through the lenses of culture and history provided by the analytical framework used in this study, the Alberta government's lack of an implementation plan for *Water for Life*, its reported fear of offending powerful irrigation lobbyists, its promise to hold irrigation licences sacrosanct throughout the *Water for Life* process, and its ongoing subsidization of the irrigation industry start to come into focus. The combination of these events would seem to suggest that the provision of leadership for aquatic ecosystem protection is not a high priority for at least some senior government officials at the present time. As such, the goal of healthy aquatic ecosystems might be realized sooner if those concerned about environmental protection were to work together as a unit to devise an implementation plan that would command attention and action. One way to go about this would be to form a Healthy Aquatic Ecosystems working team at the WPAC level to complement ongoing efforts to establish a similar team at the provincial level. Such an approach would enable closer attention to local conditions and ecological issues specific to the ORB (rather than trying to work with an implementation plan that ignores the natural variability among the province's watersheds). One possible project that this team could investigate is the potential for developing a certification program for irrigated crops not unlike the dolphin-friendly tuna or forest stewardship council certification programs. Such a program could provide consumers with the option to purchase Canadian grown foods that were produced and cultivated in an ecologically sensitive manner.

2. **Furthering efforts to engage with neighbours and citizens on the ground for the purpose of mutual learning and for nurturing the nascent sense of cooperation that exists among actors.** Although some animosity still remains among actors (e.g., between some existing water users and those lobbying for aquatic ecosystem protection), several members of the Oldman Watershed Council reported that, on the whole, a spirit of trust and collaboration is evident among actors in the ORB. Considering the deep cultural connections that many people have to water in the ORB, commitment to continued collaboration is vital if water management practices are to be changed to better support the aquatic environment. Some activities are already underway which, if centrally coordinated, could be targeted more explicitly at nurturing a common purpose and cooperation among residents in the ORB. Examples include the work of Cows and Fish (in partnership with landowners and watershed stewardship groups) and the annual Holding the Reigns workshop hosted by the OWC Rural Team which provides landowners with a forum to ask questions and to voice their concerns. Additional initiatives could include farm, sub-watershed and watershed level competitions to search out the best home-grown innovations for protecting aquatic ecosystems. As noted earlier in the context of education, the OWC may not currently have the capacity to single-handedly take on such a responsibility. However, with the support of partners involved in education and agricultural extension in the watershed (e.g., Cows and Fish, the Alberta Conservation Association, the Alberta Irrigation Projects Association, Waterlution, etc.) and with funding from less conventional sources (e.g., the Prairie Farm Rehabilitation Administration, Environment Canada, Municipal Districts, etc.) the

OWC might at least be able to act as the central coordinator. The proposed furthering of efforts to engage with neighbours would help to foster the burgeoning sense of good will among actors and could be used to draw in those who continue to be on the periphery of discussion of aquatic ecosystems protection, such as municipal officials and First Nations communities.

3. **Deciding together on how partners can most effectively communicate and support one another rather than waiting to be told what their respective responsibilities will be.** The emphasis on micro-politics in this study revealed examples of where there exists informal networks, alliances, and channels of communication, even among organizations whose formal relationship is characterized by tension. Given the amount of overlap among representatives who sit on WSGs, WPACs, and the AWC, it is likely that similar networks exist within and among the three levels of watershed partnership in Alberta (i.e., provincial, watershed, and sub-watershed). These networks should be nurtured wherever possible to take advantage of opportunities to better coordinate aquatic ecosystem protection across scales. A natural starting place is with those individuals who actually sit on watershed partnerships at more than one level. This group could be enriched by adding some of the leaders from around the watershed who are either already involved with related initiatives (e.g., the *Integrate Land-Use Framework*, the Clean Air Strategic Alliance) or who have extensive personal and/or business networks. From there, one could begin to map the existing networks (perhaps in a modified community-mapping exercise), identify any major gaps, and then begin to devise a communications plan from there.

4. **Organizing actions on the ground to improve the health of aquatic ecosystems now, rather than waiting for more data and more studies which have been shown to have little effect on people's values.** While the provincial approach to aquatic ecosystem protection outlined in *Water for Life* is an exciting idea, it has proven to be very slow to implement. As one study participant noted, "the only measurement that matters is the health of the river. After four years of working with *Water for Life*, I can't think of a single thing that's been done [at the provincial level] that amounts to a physical improvement in the health of aquatic ecosystems." Drawing again on the reported sense of good will that exists currently among actors in the ORB, and on the impressive (although localized) achievements of select watershed stewardship groups (e.g., the Beaver Creek Watershed Group), some well-planned, locally-driven initiatives are far more likely to have a positive effect on the aquatic ecosystems in the short-term. Examples include bio-engineering projects to restore eroded river banks, river and shoreline clean-ups, and/or a project to map ecosystem initiatives by sub-watershed and to target cleanup efforts strategically so as to have the greatest positive affect. Such initiatives would, no doubt, have important collateral benefits (and could even be tied into) recommendation #3 regarding engaging with neighbours and fostering cooperation.

5. **Seeking out and taking advantage of less conventional partnerships, sources of funding and incentive programs while continuing to pressure the provincial government for much needed resources.** The uneven distribution of power among actors highlighted by the focus on history and micro-politics in the analytical framework show that, in recent decades, the Alberta government has been far more

interested in developing natural resources than conserving them. If the current pace and scale of oil sands development in ecologically-sensitive areas is any indication, it would seem that this is still the case. As such, those interested in pursuing aquatic ecosystem protection in a serious way would be well advised to think creatively about other ways to leverage funding and support rather than waiting for the Alberta government to alter its course. This could include the brokering (by WPAC representatives) of a partnership between irrigation districts in the water-stressed southern region of the province (e.g. the ORB) and the ever expanding group of oil companies operating in the (comparatively) water rich north. It is clear from recent news headlines that oil companies are under increasing pressure from environmental groups to reduce (or at least, remediate) their considerable water intake and carbon output (to say nothing of the scrutiny that they are under from investors to demonstrate corporate social responsibility and environmental stewardship). An example of one such partnership could have oil companies subsidizing an incentive program that encourages irrigators in sensitive river reaches to leave water instream during low-flow periods. Such a program would not only serve the needs of irrigators and aquatic ecosystems in water-stressed parts of Southern Alberta (by providing the former with increased financial security when the risk of crop failure is highest and the latter with much needed instream flows), it would also provide opportunities for oil companies to remediate their water intakes (in a no-net-loss kind of arrangement). Moreover, it would also help to supply wetlands with the precious water needed to support wildlife and to sequester the carbon produced by the refinement and consumption of petroleum products and, at the same time, enable

oil companies to gain points with investors for supporting aquatic ecosystems as compensation for those ecosystems disturbed by in situ bitumen extraction and upgrading activities. Although oil companies have, understandably, balked at levies and taxes from the provincial government in the past, this alternative scenario would have tangible benefits for the two main parties involved (not to mention aquatic ecosystems) and, for the most part, would leave the Provincial government out of the picture. In light of all the available contextual evidence, such an approach would seem more likely to result in improvements to aquatic ecosystem health in the ORB than would a reliance on government intervention alone.

5.4 Contributions

Integral to the design of this research is the goal of producing outcomes that are both theoretically robust and practically useful. The study aims not only to wield the "hatchet" of critique, but also to plant "seeds" for "reclaiming and asserting alternative ways of managing [resources]" (Robbins 2004: 13). As such, the research makes a valuable contribution to the literatures on human-environment geography and institutional analysis, and to discussions of aquatic ecosystem protection in the Oldman River Basin.

Regarding the academic literature, the study heeds the call for closer attention to the political, economic or cultural forces that underlie and give rise to environmental management processes (Bryant and Wilson 1998; Peet and Watts 2004) and affirms Nadasdy's (2007) argument that careful attention to contextual factors can greatly enhance the precision and accuracy of proposed solutions to discreet environmental

problems. Moreover, through the integration of concepts and insights from human ecology, political ecology, and common property scholarship, it is anticipated that the research will make a valuable contribution to ongoing discussions about the possibilities for linking insights from diverse human-environment sub-fields (Peterson 2000; Berkes 2004; Slocombe 2004; Armitage 2008). This approach will also make a novel addition to the burgeoning literature on first world political ecologies (Robbins 2002; Natcher, *et al.* 2004; McCarthy 2005; Schroeder, *et al.* 2006) by demonstrating how insights from political ecology can, in an integrated fashion, be brought to bear on studies of human-environment interaction in North-America (a context seldom explored by political ecologists). Finally, the research provides an example of how to overcome some of the more substantive critiques raised in the literature on institutional analysis in recent years (regarding, for example, a tendency for analyses to be ahistorical [Johnson 2004], and for providing insufficient attention to the uneven distribution of power among actors [Blaikie and Brookfield 1987; Goldman 1998]).

On a practical level, the description of the factors that shape the development and implementation of policies for aquatic ecosystem protection in the ORB has already begun to affect change in a positive way on the ground in Alberta. For instance, the presentation of the preliminary research findings at the Oldman Watershed Council's AGM in March 2008 has, reportedly, helped to stimulate discussion as to how to proceed with the implementation of aquatic ecosystem protection in the ORB. This is a timely addition to the discussion as the OWC is preparing to shift its focus from State of the Basin reporting to water management planning later this year. A final report on this research will be delivered to the OWC upon completion of the thesis requirements.

In addition, the results have had a positive effect at the provincial level. For instance, through the network of contacts established during this study, the researcher was invited on two occasions to share the preliminary findings with members of the Alberta Water Council as they worked to prepare (at the request of the Alberta's Minister of the Environment) recommendations for how best to "renew and resource" the *Water for Life* Strategy. Although only one of the many sources consulted for input, the researcher's views are reflected in the AWC's final recommendations:

> the Council recommends that while all three goals and directions [of *Water for Life*] continue to be supported, that more emphasis be placed on achieving the goal of *Healthy Aquatic Ecosystems* in an effort to energize the strategy's implementation as a whole (Alberta Water Council 2008: 8).

In the weeks following the release of the report to the public, the AWC has begun setting up a new working team to define terms of reference for aquatic ecosystem protection. The researcher has also been asked to provide input and to present his final research findings to this group.

5.5 Research Limitations and Challenges

An important prerequisite to moving forward on any new research initiatives is to first examine the strengths and weaknesses of current and past research efforts so that future projects may benefit from lessons learned. For this reason, and to satisfy the fifth and final research objective, consideration is given to the suitability of the theoretical framework used for this research and as to how it might be improved in future research applications. In addition, the methodological challenges and limitations of the present study are considered, as also are opportunities for future research.

5.5.1 Reflections on the Theoretical Framework

The range of theoretical texts consulted for this research has opened up for the researcher what might be described as a career's worth of interesting and engaging questions and ideas. As such, the present project only begins to scratch the surface on what may be possible by linking insights on human-environment interactions, and by exploring how these linkages might serve to advance our understanding of environmental issues in the future. A number of these were touched on only briefly in section 2.5 but, suffice it to say that each of the three fields considered (i.e., human ecology, political ecology, and common property resources) offers a wealth of interesting insights which, for sake of manageability, could only be sampled here. This wealth of insights and opportunities will serve as an inspiration and a point of departure for subsequent investigations and publications.

The analytical framework that resulted in this instance from the combination of insights from these three fields proved invaluable in many respects. First, it helped the researcher to identify what was important and where to look for answers (starting with the identification of the action arena, and moving out from there to the rules-in-use and to the attributes of the community and biophysical environment). Second, infused as it was with the critical stance of political ecology, the framework enabled a thorough investigation of context complete with considerations of culture, power and history, while at the same time retaining the practical focus on "crafting" solutions to discreet environmental problems which is at the heart of much commons scholarship and human ecology. Third, it helped to establish a broad interpretation of institutions, both as functional rules and as historically-rooted patterns of behaviour and to overcome many

critiques of contemporary institutional analysis research. Finally, it provided a structure with which to guide the initial analysis and coding of the data gathered and for reporting on the main research findings.

For all of its merits, however, the framework was also limited in some regards. For instance, during the coding of both the contextual factors and the factors affecting implementation, the framework provided little guidance for dealing with those instances where data seemed to fit under more than one sub-category (i.e., factor). As a result, the researcher opted to replicate data where necessary so that it could be included under more than one sub-category. This seemed to work fine provided that a decision was made prior to the reporting stage regarding which factor the data in question would qualify (i.e., to avoid using the same example to illustrate more than one factor). A better solution might have been to develop a series of tightly defined indictor criteria to accompany each of sub-category as it was established. This might have helped to refine each sub-category to a point where data could only be included under one heading and, in the process, might have added additional rigor and transparency to the data analysis.

5.5.2 Reflections on the Research Design

Several challenges and inherent limitations emerged from the chosen methodology and methods. Regarding the former, as acknowledged in Chapter One, all case-based researchers must eventually choose between depth and breadth, between knowing more about less, or less about more. A case study approach (as opposed to a cross-case approach) was selected for this research based on its ability to preserve the rich texture of the individual case of interest (Gerring 2007). The trade off is that, although a single case study permits analytical generalization to the bodies of theory used to guide the

research (Yin 2003), opportunities for generalizing the empirical results are minimized. While the selection of a single case study builds this inherent limitation into this research, in retrospect, it was the right choice.

In addition to this methodological limitation, some minor challenges arose relating to the selected research methods. These are also worthy of mention and will be considered by the researcher when planning future projects. For example, with regard to the interview process, only those who agreed to participate were interviewed. As a result, some sectors or organizations that potentially have an important role to play in aquatic ecosystem protection in the ORB were less represented in the study than the researcher had hoped.

For instance, meeting with representatives from the rural municipal districts and from the watershed stewardship groups proved difficult. A number of possible reasons for this exist — not least of which was the scheduling of field seasons which unintentionally conflicted with a number of seasonal on- and off-farm priorities. To illustrate, the accidental coincidence of the researcher's field seasons with the busy planting season, harvesting season, and calving season may have contributed to the loss of potentially valuable interviews with some rural residents. Fortunately, the researcher was able to mitigate these losses by having previously interviewed study participants act as referees, by volunteering his services on-farm or in-stream on a work-while-we-talk basis, and by attending a number of watershed workshops and watershed tours in rural areas where the researcher could speak informally with rural landowners and officials. However, realizing that not everyone is in a position to take such measures, careful

consideration of scheduling and the use of other strategies to limit such challenges should be considered.

Another group that was under-represented in the research was First Nations. Although repeated attempts were made to meet with informed representatives from both First Nations groups in the ORB, only one interview (with a former Chief of the Blood Tribe) was conducted. As a result, the findings presented in this thesis that pertain to First Nations involvement in formal discussions of aquatic ecosystem protection are based as much (or more) on the accounts of eight non-native study participants as they are on the first-hand accounts from First Nations representatives themselves. Unfortunately, no opportunities existed for informal meetings with First Nations representatives (as in the case of rural residents above) due in part to the apparent isolation (by choice or otherwise) of First Nations peoples from water management planning in the ORB. In retrospect, the more aggressive use of existing contacts as referees to help secure interviews might have helped matters. Alternatively, the hiring of a local First Nations student as a research assistant might also have afforded the research greater access to First Nations representatives than he was able to secure on his own. Such lessons and considerations come with experience and will be incorporated into the design of future research projects.

5.6 Opportunities for Future Research

Research limitations and challenges aside, this research project proved to be most rewarding and, in the end, highlighted a number of exciting opportunities for future research. As noted above, this project only begins to touch on the array of possibilities

that exist for linking insights on human-environment interactions such as those housed in the literatures of human ecology, political ecology and common property scholarship. Much potential exists for further developing these ideas and for exploring other frameworks that draw on the collective insights of these and other human-environment sub-fields.

From an empirical perspective, much work remains to be done in the Oldman River Basin. For instance, as noted above, the perspectives of First Nations people regarding aquatic ecosystem protection in the ORB are still largely unknown. Addressing this matter in a subsequent investigation might prove beneficial. In the meantime, as the staged implementation deadlines of *Water for Life* regarding healthy aquatic ecosystems continue to come and go, the urgency of aquatic ecosystem protection continues to grow (as does public support for this issue in some sectors). But this does not make the implementation process any easier. Research into lessons learned in other semi-arid regions regarding the implementation of aquatic ecosystem protection would make a valuable contribution to discussions in the ORB. Additionally, the varied regional character of Alberta presents a number of opportunities for further research into the factors affecting the implementation of policies for aquatic ecosystem protection. For instance, the rampant pace of petroleum development in Northeastern Alberta (also rich with wetland habitat) would provide a fascinating case for investigating progress towards protecting healthy aquatic ecosystems in that region.

Finally, with the depth of understanding furnished by this single case study, it would be interesting now to take a different methodological approach to a related research problem. The example noted above, regarding public policy innovations for aquatic

ecosystem protection in other semi-arid regions, might lend itself to the sort of cross-case analysis that was not selected for this research but which could offer a different and potentially interesting perspective on this important and emerging issue.

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APPENDIX ONE – ACTORS INVOLVED IN AQUATIC ECOSYSTEM PROTECTION IN THE OLDMAN RIVER BASIN

Actors & Groupings	**Relation to Aquatic Ecosystems Protection in the Oldman River Basin**
Government	
Alberta Environment	• primary agency responsible for the allocation and protection of water resources • administers the *Water Act* and shares responsibility for the *Environmental Protection and Enhancement Act* (which promotes wise use of the environment)
Alberta Sustainable Resource Development	• administers the (Alberta) *Fisheries Act* (which regulates fishing and fisheries in Alberta), the (Alberta) *Wildlife Act* (which provides protection for endangered species) and shares responsibility for the *Environmental Protection and Enhancement Act*
Alberta Agriculture, Food and Rural Development	• administers the *Irrigation Districts Act* (which establishes the rules and procedures for the formation, operation and dissolution of Irrigation Districts) and supports the agricultural sector
Department of Fisheries and Oceans Canada	• responsible for protecting fish and fish habitat via the administration of the Federal *Fisheries Act* and *the Species at Risk Act* as it pertains to aquatic species
Prairie Provinces Water Board	• committee of federal and provincial representatives that jointly administer the *Master Agreement on Apportionment* which sets inter-provincial flow requirements
Industry	
Irrigation Districts	• similar to a municipality, with an elected board that manages irrigation within a designated area • Nine Irrigation Districts (IDs) exist in the Oldman River Basin: Mountain View, Leavitt, Aetna, United, Magrath, Raymond, Lethbridge Northern, Taber, and St. Mary.
Alberta Irrigation Projects Association	• participates in education and outreach, policy development and research activities • serves as collective representation for all 13 Irrigation Districts in Alberta
Non-Government Organizations	
Cows and Fish	• Alberta's Riparian Habitat Management Society • works with landowners to find ways to develop on-farm practices which benefit riparian ecosystems

Actors & Groupings	Relation to Aquatic Ecosystems Protection in the Oldman River Basin
Alberta Conservation Association	• arm's length, government-funded organization which conducts extensive research and monitoring of aquatic ecosystems in the ORB
Southern Alberta Group for the Environment	• committed to increasing awareness of environmental issues in Southern Alberta
Ducks Unlimited	• conserves, restores and manages wetlands for waterfowl
Trout Unlimited	• conserves, protects and restores coldwater fisheries and their watersheds
Bow RiverKeeper	• not-for-profit organization concerned with protecting and restoring the Bow River (and, to some degree, surrounding watersheds)
Academia	• social and natural scientists from various universities in Alberta and beyond who contribute research to water management and planning processes in the ORB
Watershed Partnerships	
Alberta Water Council	• examines and prioritizes water issues, provides advice and shares information with the WPACs, WSGs and other sectors, makes recommendations to the Government of Alberta • occasionally referred to as the Provincial Water Advisory Council
Watershed Planning and Advisory Councils	• produce State of the Watershed Reports, develop Watershed Management Plans, collaborate with landowners on the ground, support the WSGs, present issues to the AWC • represented in the study area by the Oldman Watershed Council
Watershed Stewardship Groups	• take action on the ground, promote best management practices, provide input on WPAC activities, and participate in State of the Watershed reporting

APPENDIX TWO – DISTRIBUTION OF INTERVIEWS

Actors and Groupings	**Number of Interviews**
Government	**N=17**
Alberta Environment	12
Alberta Sustainable Resource Development	2
Alberta Agriculture, Food and Rural Development	1
Department of Fisheries and Oceans Canada	2
Industry	**N=7**
Irrigation Districts	4
Alberta Irrigation Projects Association	2
Other Industry	1
Non-Government Organizations	**N=19**
Cows and Fish	2
Alberta Conservation Association	1
Southern Alberta Group for the Environment	2
Ducks Unlimited	1
Trout Unlimited	1
Bow Riverkeeper	1
Academia	9
Alberta Wilderness Association	2
Watershed Partnerships	**N=10**
Alberta Water Council	4
Oldman Watershed Council (WPAC for study area)	6
Watershed Stewardship Groups	0
Other	**N=3**
Private Consultant	2
First Nations Communities	1
Total	**N=56**

APPENDIX THREE – LIST OF ATTENDED CONFERENCES, WORKSHOPS AND WATERSHED TOURS

Start Date (d/m/y)	**Event and Location**	**Description**
28/07/06	Bow River Watershed Tour Calgary, AB	Guided by a member of the Alberta Water Council, this personal tour provided an overview of water management issues in Southern Alberta.
29/07/06	Waterton River Watershed Tour Waterton Area, AB	Guided by a senior administrator from Alberta Environment, this personal tour provided an introduction to the Southern Tributaries of the ORB.
04/08/06	Oldman River Watershed Tour Fort Macleod -Taber, AB	This self-guided tour was undertaken to see first-hand some of the water management structures and practices used for irrigated agriculture and livestock management in the ORB.
11/08/06	Pincher Creek Watershed Tour Pincher Creek Area, AB	Guided by representatives from the Pincher Creek Watershed Group and Cows and Fish, this watershed tour provided opportunities to talk casually with landowners and representatives from several Watershed Stewardship Groups in the ORB.
12/08/06	Crowsnest Pass Watershed Tour Crowsnest Pass, AB	Guided by staff from the Canadian Department of Fisheries and Oceans, this personal tour provided an introduction to the headwaters region of the ORB.
21/02/07	Trout Unlimited, Southern Alberta Chapter Meeting Lethbridge, AB	Organized around a presentation by Alberta Conservation Association staff regarding Trout Population Assessment in the Oldman Drainage, the meeting provided an opportunity to speak informally with local anglers and naturalists.
22/02/07	Oldman River Dam Tour Pincher Station, AB	Guided by a senior operations manager with Alberta Environment, this personal tour provided an introduction to dam operations in the ORB and insights into the controversy surrounding the development of the Oldman Dam.

Start Date (d/m/y)	**Event and Location**	**Description**
01/03/07	Water Planning and Advisory Council Summit Calgary, AB	The WPAC Summit provided an opportunity to meet and speak casually with WPAC representatives from across Alberta regarding the primary challenges that they face.
04/03/07	Alberta Irrigation Projects Association (AIPA) Annual General Meeting Calgary, AB	The AIPA AGM provided an opportunity to speak with irrigation sector representatives regarding aquatic ecosystem protection and to gain a general understanding of the priorities and concerns facing Irrigation Districts in Southern Alberta.
15/03/07	Oldman Watershed Council Annual General Meeting Lethbridge, AB	The OWC AGM provided an opportunity to learn about a range of topics related to aquatic ecosystem protection in the ORB (e.g., water quality assessments, monitoring programs, etc.). In addition, it enabled informal discussions with concerned residents of the ORB.
07/09/07	Oldman Watershed Council Stakeholders Meeting Cardston, AB	The OWC Stakeholders Meeting provided another opportunity to meet with landowners and representatives from Watershed Stewardship Groups in the ORB.
14/09/07	Andy Russell Wilderness Park Fundraiser Lethbridge, AB	Hosted at the University of Lethbridge, this fundraiser presented opportunities for follow-up discussion with university officials and other actors who had been interviewed.
17/09/07	Walter & Duncan Gordon Foundation Water Forum Calgary, AB	The Gordon Foundation Water Forum provided an opportunity to attend a series of presentations on the implementation of *Water for Life* and the shift toward water governance in Alberta.
18/09/07	Western Irrigation Tour Strathmore, AB	Guided by a senior WID official, this group tour provided insights into the priorities and workings of an Irrigation District in Southern Alberta.

APPENDIX FOUR – MAIN INTERVIEW GUIDE

1. To begin, I was hoping that you could tell me a little bit about what you and your organization do with regard to water management in the Oldman River Basin (ORB).

2. How has Alberta's *Water for Life* Strategy affected water management in the ORB? How (if at all) has the goal of healthy aquatic ecosystems specifically affected the work that you and your organization do?

3. What actions have been taken to protect aquatic ecosystems in the ORB to date and what future actions are planned?

4. Who are the key people / organizations involved in designing, implementing, monitoring and enforcing the protection of aquatic ecosystems in the ORB? What relationships exist between these people / organizations? How do these relationships contribute to the success (or potential failure) of aquatic ecosystems protection?

5. How does the water management decision-making structure function in the ORB for issues pertaining to aquatic ecosystem protection? What level of coordination occurs between the various individuals / organizations involved in implementing aquatic ecosystems protection at the different administrative levels (e.g., local, provincial, national) in Alberta?

6. What are the principal mechanisms that are used to facilitate aquatic ecosystem protection in the ORB? What mechanisms, if any, should but do not exist at present?

7. What key pieces of policy and/or legislation that guide your work intersect with those designed to protect aquatic ecosystems? How do these pieces of policy and/or legislation relate to one another and to the protection of aquatic ecosystems in the ORB?

8. How is the health of aquatic ecosystems measured and how will it be monitored to determine success (or otherwise)?

9. What barriers, if any, exist to the successful implementation of aquatic ecosystem protection in the ORB?

10. What further steps (if any) should be taken with regard to water management in the ORB in order to better protect aquatic ecosystems? Please explain your response.

11. Aside from yourself and your colleagues in [this organization], which three-to-five people or organizations would you say are most centrally involved in or concerned with aquatic ecosystem protection in the ORB? [Who would you suggest that I contact there to request an interview?]

12. You have given very generously of your time today. [I understand that you have helped other students with their research projects in the past. Based on your experiences,] what can students such as myself do to make the products of our research efforts more useful to you? What kinds of outcomes would you most like to see?

APPENDIX FIVE – FOLLOW-UP INTERVIEW GUIDE

The purpose of this meeting is three-fold. First, I wish to update you on the status of my research project and on my progress toward its completion. Second, I would like to ask you a few questions in order to get a sense of your initial reaction to / impressions of the results summary that I mailed to you. Third, I would like to ask you a few question pertaining to the relative significance of the factors identified, and to seek any additional clarity that may be required.

1. The project is progressing on schedule…Our discussion today will help to draw the analysis phase to a close.

2. Have you had a chance to review the results summary that I mailed to you? What were your general impressions of it? Do you believe it to be an accurate characterization of the factors affecting the success or failure of aquatic ecosystem protection in the ORB? Did you notice anything that seemed to you to be an error? Were there any omissions made? What (if anything) surprised you about the findings? Do you have any questions or concerns based on what your have read?

3. What relationship(s) exist between the various factors identified? Did any of the factors identified strike you as being more important, or more pressing, than the others? Please explain your answer. Which factors (if any) deserve the most urgent attention? How else might you prioritize, or describe the relative significance of, the factors identified?

Thank you once again for your support and assistance.