

COMMON POOL RESOURCES AND STATE INTERVENTION:
WHY, WHEN AND HOW

by

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Abstract

The objective of this dissertation is to understand why, when and how a state or other agent should intervene in a common pool social-ecological system. The answers to these questions provide the building blocks of an intervention framework to assist policy analysts identify institutional failure related to the appropriation of a common pool resource and design appropriate institutional change. The dissertation rejects the use of institutional paradigms such as centralization or decentralization and follows a problem based approach to institutional change. The Institutional Analysis and Development framework provides the research's methodological structure.

The common pool resource intervention framework is developed in three parts. The first building block is developed by answering the 'why' and 'when' questions through a review of common pool resource and institutional literature. The result is an institutional failure model to assess the risk of resource degradation and identify its sources. The second building block is devised through a review of institutional change literature and the role of the state within that change. The outcome is a typology of state intervention modes that guides the intensity of intervention, if intervention is necessary. Finally, to understand how to intervene, the dissertation undertakes a content analysis of 16 case studies of institutional change within common pool resource social-ecological systems. The outcome is the third component of the framework: a set of intervention properties providing a structure and method of intervention. Chapter 7 provides a test case using the commercial harvest of salal in British Columbia.

The intervention framework is intended to bridge theoretical literature with the practical requirements of resource managers. The research and test of the intervention framework shows that a problem-based approach is a useful method to respond to common pool resource dilemmas. By avoiding the top-down application of institutional paradigms as panaceas, the method can avoid scale-mismatch when resource degradation is threatened and unnecessary intrusion when intervention is unwarranted. The results contribute to institutional theory by revealing properties of social change and providing links between institutional forms in time.

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Dedication

I dedicate this dissertation to my dad who is no longer with us and unable to share this achievement with me, at least in this world, and to my daughter Ysanne who will one day reach for her own dreams, dreams that I will share with her.

Chapter 1. Introduction and impetus for research

1.1. Introduction and problem statement

The institutional and property rights literature on common pool resources describes various conditions under which successful property regimes may evolve. But what happens when this natural evolution does not occur, property regimes dissolve, or competing and detrimental uses have well defined rights that take precedence? The backdrop for this study is British Columbia, Canada, where the commercial harvest of non-timber forest resources (NTFRs) occurs on *de facto* open access or under-managed public and private land, amidst a well defined timber tenure and forest management system. Appropriators lack coordination and the provincial government struggles to understand if a problem exists, and if so to identify appropriate policy responses. This is but one case. Common pool resources are ubiquitous and their expanding regional and global relevance present a diverse set of complex and critical policy considerations. In Acheson's (2006, p. 3) paper on institutional failure he concludes that while government is a necessary and inevitable participant in natural resource management, its failures suggest there is room for improvement. To meet this challenge he poses two questions for researchers to pursue: "How much government do we need? What kind of government do we need?" (Acheson 2006, p. 130). This dissertation provides one viewpoint.

There are a variety of frameworks and models that provide descriptive and diagnostic input to improve our understanding of the many characteristics of common pool resources and their stewardship. There is also a detailed deconstruction of institutional rules that describe the way in which we shape our interactions with others and the resources we use. This detailed and fundamental work has moved our understanding of the use of common pool resources and the

commons from cursory and simplistic to in-depth and complex. However, the challenge facing policy analysts and decision makers (within government or local user groups) is how to take this body of information and move from an understanding of the particular common pool issue to the specification of some form of management regime and its underlying rules. How do we get from institutional point A to institutional point B? The theoretical spectrum is at one end too broad and at the other too narrow. A link between these two levels is necessary if we are to deal effectively with Acheson's questions or challenges posed in the previous paragraph.

The research in this dissertation focuses on common pool resources in a range of open access situations. It seeks to understand why a state should intervene in a common pool resource market, when a state should intervene, and how a state may intervene and structure the way in which it approaches the common pool resource management problem? Thus, what is the state's role in managing a common pool resource? The dissertation argues that common pool resource policy development should not start with a particular institutional paradigm, but should be built based on the problem at issue, recognizing the institutional and contextual nature of the particular common pool social-ecological system. State intervention has a range of intensities, or modes that must be matched with the particular problem and situational complexity. Subsequently, it is important to understand the underlying problem, the source of institutional failure, and the necessary intensity of government intervention prior to entering the process of institutional design.

To answer why and when a state should intervene, the research uses inputs from a variety of disciplines to develop an evaluative tool to understand a common pool resource social-ecological system under stress, the sources of that stress, and whether or not some form of

state intervention is warranted. The research then pursues the latter question of how to intervene by exploring the literature for clues about the roles states play across locations and common pool resources, thereby helping to identify and define elements of state intervention and guide the structure and process of an intervention approach. Through this work three building blocks emerge to form an intervention framework: 1) an institutional failure model; 2) a typology of intervention modes; and 3) a set of intervention properties to guide the policy development. Combined, these components form a common pool intervention framework that provides guidance to policy analysts and decision makers and bridges the current gap in the literature on common pool resource regime development. Applying these lessons to NTFRs in British Columbia then serves as a test case.

1.2. Impetus for research

The impetus for this research comes from observations of and attempts to develop an appropriate policy for the management of NTFRs in British Columbia. The term “non-timber forest resources” describes a heterogeneous collection of products found in the forest, other than those used for pulp, lumber or other solid wood products. They are used for a variety of reasons from commercial exploitation, to non-commercial subsistence and traditional uses. Non-timber forest resources, and certainly those in British Columbia, are characterized by a highly complex and challenging management context. British Columbia’s large landbase (93 million hectares of which 60 million hectares are forested and 25 million are managed for industrial timber production), its low population per hectare and many remote regions create numerous opportunities to enter and exit areas unobserved. The province’s more centralized management of natural resources also elevates the responsibility for monitoring appropriators and the enforcement of rules to a more centralized authority faced with typical capacity

challenges such as funding and staffing levels necessary to maintain the appropriate levels of presence. As a result of these management challenges and heterogeneous resource characteristics associated with NTFRs, British Columbia's provincial government has chosen not to introduce a management regime for any of the so-called non-timber forest resources. At the user level, appropriators have found little common ground to successfully introduce informal common property systems to manage access or levels of exploitation, and for some NTFRs extraction levels and incentives are consistent with open access common pool resource theory.

There are some minor but notable exceptions to this lack of management, but they occur over small areas and are surrounded by under-managed *de facto* open access public lands. For example, the provincial *Forest Act* has numerous tenure types and provides one of these, Community Forest Agreement tenures, the non-exclusive right to manage and charge fees for NTFRs on public tenured land. However, these tenures do not necessarily include the right to manage NTFRs nor does the *Forest Act* provide the right to limit access (B.C. Ministry of Forests and Range, *Forest Act*). The value of this NTFR component in this community tenure is questionable. There are no other public land examples, but on Nisga'a treaty lands in northwestern B.C., the Nisga'a Lisims government manages the habitat and harvest of pine mushrooms (Nisga'a Lisims Government, see www.nisgaalisims.ca). Some large private industrial forest landowners attempt to control access to some of their lands by providing for exclusive access contracts, but much of the private land base is deemed too difficult to control. Private landowners appear to be uninterested in monitoring and evaluating the value of the NTFRs coming off their land base, regardless of its revenue potential. Contrary to expectations, however, appropriators will invest in the resource on open access public lands if they feel confident that no one will find "their" patch. The provincial government in B.C. will also invest

in the *de facto* open access and highly valued pine mushroom resource (Tedder 2008). For example, edible wild mushroom or salal harvesters will tend a “secret” patch, leaving sufficient volume behind to ensure next year’s harvest or next week’s. First Nations also have a long history of managing a broad array of forest resources for their personal, ceremonial and commercial needs (Turner 2001).

The result of this inconsistent approach to managing NTFRs is that some species are predictably being over-harvested and degraded (e.g., commercial quality salal, conifer boughs, mosses), there is conflict among commercial users and between commercial and non-commercial users (wild berries), and little investment in the resource occurs. Is the provincial government avoiding a serious problem with potentially tragic consequences by choosing not to intervene in the use of NTFRs on public land? Not all NTFRs pose a problem. Some NTFRs in some areas attract little attention and local harvesters do little damage to the resource. In other areas where significant pressure is placed on one or two NTFR species damage can occur. However, timber harvesting is the dominant activity, planning does not consider NTFR values, and industrial forestry activity can denude the landbase of harvestable product for at least two decades.

In addition, because of its low profile and unorganized participants the issue of NTFRs lacks political salience and does not appear high on government’s agenda, and when it has entered into decision making and policy development, implementation has invariably failed (Tedder draft manuscript). The provincial government has yet to consider incorporating NTFRs into management requirements that would lead to more compatible management between timber and non-timber species. Overcoming the challenge of restricting access also confounds

management efforts for most NTFRs. Finally, First Nations are currently participating with the provincial and federal governments in treaty talks that may see rights and title to resources, including NTFRs, pass to First Nations' governments. As a result, First Nations need to be full participants in any discussion regarding management options such as tenure rights to NTFRs. It is clear that the current institutional format is not meeting the needs of NTFRs or the people who depend upon them.

The study of common pool resources considers these types of resources and management challenges. Common pool resources are often found within open access situations where there are no or few restrictions on their use or within a commons, an area or resource open to members of a community. It is this 'commons' area that Hardin (1968) depicted the "Tragedy of the Commons," where the absence of private property or state control would inevitably lead to resource ruin by the very people who rely on the resource. Using the reasoning from Olson's (1965) Logic of Collective Action, it was further assumed that larger more heterogeneous groups would fail to cooperate in the provision of public goods. Naturally, these concepts sufficiently supported the contentions of property rights theorists that privatization, or at the least state control, was a necessary condition to avoid this ruin and achieve allocative efficiency (Demsetz 1967; Alchian and Demsetz 1973).

Commons scholars rose to challenge the assumptions underlying these perspectives (Ciriacy-Wantrup and Bishop 1975), leading to a recognition of the collaborative capacity of local communities. However, Ostrom (2007b, p. 3) notes that designing rules to govern common pool resources often continues to rest on two core but erroneous assumptions: 1) users are "norm-free, short-term, maximizers of immediate gains who will not cooperate" and 2) government

officials have the information and motivation to design efficient and effective rules to sustain the use of a common pool resource over the long term. The theory of common pool resources, common property or the theory of the commons, developed to challenge the pre-conception that users are unable to find or maintain enduring solutions to the use of a commons. The focus on the commons has led to a significant contribution to institutional theory and how customs, norms and rules influence our daily activities and the way in which we interact with others. There is as yet, however, no conclusive institutional theory of the commons providing the predictive ability to guide regime design (Schlager 2007). The development focus on common property systems for resource management or community-based natural resource management is not always successful (Campbell et al. 2001; Blaikie 2006) and reliance on the decentralized management concept has fallen into the same paradigm trap as previous privatization and centralization movements. Common property systems are now one of the possible property rights approaches. Thus the “struggle to govern the commons” remains (Dietz et al. 2003).

Within the commons literature, few studies consider the role of the state, other than as the source of inappropriate policies that have led to user displacement and subsequent resource degradation (see Lam 1996; Brown 2000; Acheson 2006), or as an agency to reduce transaction costs (see Baland and Platteau 1996; Birner and Wittmer 2004). As a result, Agrawal (2002) argues that while “the role of the state and overarching structures of administration have been decisive under many historical circumstances in governing common pool resources. ... the nature of local-state relations requires more careful exploration. ... as yet we do not have a systematic examination or clear understanding of variations in these relationships and how these variations affect the nature and outcome of common-pool resource management” (p. 58). Poteete and Ostrom (2002) state that “many forest management policies have been adopted

without consulting prior research on the factors that are associated with successful forest management by national, regional, or local governments or by local groups themselves.” The intent of this research is to explore that literature and the relationships between governments and common pool resources, then to devise a framework that can be used by policy analysts to develop an approach to manage a common pool resource found within various open access situations.

1.3. Methodological approach and research framework.

The institutional analysis and development (IAD) framework provides the methodological structure for this dissertation. The IAD framework is described as a “metatheoretical map” depicting the variables that structure human interactions at multiple scales from constitutional to operational levels (Kiser and Ostrom 1982; Ostrom 2005). The IAD framework has been used to identify “the key variables to undertake a systematic analysis of the structure of the situations that individuals face and how rules, the nature of the events involved, and community affected these situations over time” (Ostrom 2005, p. 9). The IAD framework is multi-disciplinary and can be used to test or investigate a variety of theories. Ostrom (2005) has devoted a book to the IAD framework and only a cursory outline of its inner workings is possible here.

The IAD framework’s core variable is the action arena, in which actors with certain perceptions of the world around them find themselves in certain decision situations. These actors interact with others, further shaping these decisions. Also shaping these actors and the situations in which they find themselves are physical and material conditions, attributes of the community, and rules. Through this interaction there are certain outcomes that feed back directly into the

action arena and filter through and influence the physical, community and rule variables. The action arena and its actors and action situations have additional sets of variables and relationships that can be used to help explain in more depth particular action situations and outcomes.

Actions occur at multiple levels of interaction. Action and decision structures are found at the operational level, where those actors who are involved in, for example, some extractive activity, go about their business making decisions regarding the actions they choose to or not to take. Ostrom (2007a) uses the descriptors of provision, production, distribution, appropriation, assignment, and consumption to describe these operational situations. The IAD also depicts a collective choice level, where actions and decisions occur that structure and direct what is or is not allowed at the operational level. Ostrom (2007a) uses prescribing, invoking, monitoring, applying, and enforcing to describe collective-choice situations. At a constitutional choice level actions and decisions are made that affect who participates in the collective choice level among other parameters that influence decision making at the collective-choice level. The same descriptors used for the collective choice level are used for the constitutional choice level. Ostrom has expanded the levels of analysis to include a meta-constitutional level that allows the analysis of multi-state institutions that influence and shape actions at the constitutional level. This dissertation focuses on the collective choice and operational levels of analysis, the interactions among actors and the rules that exist or emerge to guide or prescribe the way in which actions are carried out.

The theoretical foundation for this dissertation is common pool resource theory and its neo-institutional perspective. Common pool resource theory is itself influenced by behavioral,

transaction cost, and property rights economics theory, policy and governance theory, social constructivist and embeddedness theory, and collective action theory. How does this theory inform the way in which a government should intervene in the extraction of common pool resources? When does the theory suggest that intervention is even warranted? The challenge in this type of dissertation where an attempt is made to move from the theoretical to the practical is trying to benefit from a variety of theoretical approaches and concepts, without falling into a theoretically inconsistent and non-sensical multidisciplinary trap.

1.4. Organization

The story to unfold in the following pages is intended to lay the foundation for the development of tools that can assist a policy analyst in his or her effort to solve a common pool resource dilemma facing a community, larger state or other governance unit. Chapter 2 introduces the underlying theory behind the concepts of institutions, property rights institutions, common pool resources, and the role of the state in forming, supporting, and maintaining institutions for natural resource management. The introduction of institutional definitions and components – their source of legitimacy, influence on individual choice and socially relevant collective action – and role in the functioning of markets and transactions will form the backbone of identifying institutional failure and seeking solutions.

In Chapter 3, the discussion turns to institutional failure related to these concepts, thereby leading to the introduction of an institutional failure assessment model. Identifying potential sources of failure in relation to the particular social-ecological system becomes an integral part of not only determining the likelihood of resource degradation (i.e., if a problem exists), but also in identifying the pathway of intervention. Chapter 4 discusses these concepts in terms of

institutional change, and the role of the state in that change leading to the development of a typology of state intervention intensities or modes. Chapter 5 presents a content analysis of 16 case studies of common pool resource and institutional change. This work results in the identification of intervention properties that links through an engagement process the rationale for and mode of institutional change with the finer designation of rules and other regime characteristics for the management of a common pool resource.

These three elements are combined in Chapter 6 to form an intervention framework that can address a common pool social-ecological system under stress or one that is underdeveloped. This is no simple task and the uncertainty and variability of common pool resource social-ecological systems requires intervention at the appropriate scale and scope along geographic, ecological, social and temporal lines. The framework does not pretend to offer the answer to the institutional question of state intervention; rather, it provides an approach that a state agency may use to structure how it organizes, seeks new and uses existing information in the emerging management of a resource system. Chapter 7 tests the model using the commercial harvest of salal in British Columbia. Chapter 8 concludes the dissertation providing a short summary, conclusions and theoretical musings.

Chapter 2. Institutional fundamentals

2.1. Introduction

Chapter 2 introduces institutional theory in general, and in particular relating to common pool resources and the anthropogenic use of those resources. The theoretical material presented in this chapter establishes the basis for the theoretical discussion in Chapter 3, institutional failure, and Chapter 4, institutional change, the lessons from which combine to form the intervention framework presented in Chapter 6. The current chapter begins with a description of a common pool social ecological system, which encompasses the action arenas of interest in this study. It then provides an institutional primer introducing the basic elements of institutions, followed by a more detailed description of institutions vis-à-vis market, collective action, and governance.

2.2. A common pool resource social-ecological system

This dissertation focuses on the way in which common pool resources are exploited and the management regimes we devise and attempt to implement in order to place limits on that exploitation. Our objective is to ensure not only the ecological health of the broader resource system, but also for society to benefit from the efficient and equitable use of the particular resource. A social-ecological system describes this conceptual relationship between resources and the communities who rely on them. Identifying the social-ecological system of interest provides the starting point to understanding the contextual nuances of a common pool resource and how we coordinate its current and future use within that context.

The definition of a “social-ecological system” used here follows Berkes and Folke’s (1998) and Berkes, Colding and Folke’s (2003) use of the term to acknowledge the interdependent link

between social and ecological systems. A social-ecological system “emphasizes the integrated concept of humans-in-nature” (Berkes et al 2003, p. 3). A social-ecological system “is an ecological system intricately linked with and affected by one or more social systems” (Anderies et al. 2004, p.3). The social and ecological links present within any particular system are vertically linked to other systems, and are horizontally embedded within some other broader system. Thus how we perceive and learn to adapt to changes in our social-ecological environs requires this systems understanding.

Berkes et al (1998, 2003) provide a number of examples describing social-ecological systems and their dynamic nature. A social-ecological system can be small such as a community forest. Pinkerton (1998) examines the case of a First Nations community practicing ‘holistic’ forestry in a small area of British Columbia, amidst a larger industrial focus on timber production. Social-ecological systems, however, are not restricted to small local ecological systems and their dependent communities. For example, Kendrick (2003) examines the co-management of Caribou over a large area in northern Canada. The effects of emerging issues, such as climate change occurs within a larger social-ecological system, encompassing smaller scale systems such as those presented in Pinkerton (1998) and Kendrick (2003).

Social-ecological systems are also dynamic changing over time in response to events within or outside the particular system. Adaptation and change is a ‘natural’ or fundamental characteristic of a social-ecological system, leading to new linkages and relationships. These linkages within social-ecological systems and between other systems have emergent properties. The emergent nature of a social-ecological system suggests a rather challenging endeavor to unpack its components in an effort to understand the evolution of any particular system.

Nonetheless, this chapter attempts to introduce and define some of the institutional concepts that describe a common pool social-ecological system, before delving into the more dynamic nature of social-ecological systems, their institutional form, failure and change.

Of interest in this dissertation are common pool resource social-ecological systems found in open access, limited-user open access or undermanaged situations where either resource use may be threatened by degradation or social benefits are being squandered. Common pool resources, as will be introduced in the following pages, present some interesting challenges as local appropriators or governing agencies look to ensure that some coordinating regime is able to provide a sustainable flow of benefits to society.

2.3. Institutions theory primer

Any particular society consists of individuals pursuing various means of subsisting, or obtaining various basic human wants and needs of value. As individuals banded together for protection or to more effectively hunt or grow crops they needed some way of coordinating their actions. Eventually, larger coordinating mechanisms were needed to ensure protection and certainty to a larger group, with the subsequent evolution of governing entities in various forms. However, a coordinating mechanism was not chosen out of some selection of various approaches. Norms and customs among individuals evolved over time and when particular problems arose or changes in the social-ecological system occurred those norms or customs changed in response. Today, the result is a complex system of coordinating mechanisms, or institutions, that bind individuals into a more cohesive and predictable society. The following section provides a short primer of institutions, what they are and how they coordinate social-ecological interactions,

their formal and informal characteristics, and how they help to establish a level of predictability of individual actions.

2.3.1. Definition of institutions

Institutions reflect what we believe to be right and wrong, and influence how we act as a result. Institutions in this sense are not physical entities such as universities or a medical facility for example. North (1990) defines institutions as “the rules of the game in a society or, more formally, ... the humanly devised constraints that shape human interaction ... they structure incentives in human exchange, whether political, social or economic ... [and they shape] ... the way societies evolve through time... (p. 3). North (1990) argues that institutions reduce uncertainty as we go about our daily routines and coalesce as either formal laws established by a governing authority, or evolving informally as customs or norms of practice. Ostrom (2005) notes that institutions provide an organizational form of “repetitive and structured interaction...” leading to individual “choices regarding the actions and strategies they take, leading to consequences for themselves and for others” (p. 3). Bromley (Bromley 2006, p. 31) states that “institutions are the means whereby the collective control of individual action is given effect,” but disagrees with North that institutions only reflect constraints. Bromley (2006) sees “institutions as both liberation and restraint of individual and group action” (p. 32), thus, what may be a constraint to one individual is a liberation or opportunity for another. For example, a rule limiting access to a stream for a chemical mill, provides an opportunity for its neighbours to have access to cleaner water. Institutions guide our actions, but also establish a relationship to others, in some cases the right or power to do something potentially over the objections of others.

Institutions, or individual and social constraints and opportunities, can be further disaggregated into component parts. Bromley (2006) separates institutions into three classes: norms and conventions; working rules; and property relations. Norms and conventions are “noncodified through generally accepted regularities in behavior that bring order, civility, and predictability to human relationships” (Bromley 2006, p. 51). Adherence to norms and conventions are embedded within our social development and include, for example, social manners or culturally driven expectations of who is the head of a family unit. Working rules move beyond the informal to the formal and legally established rules that are accompanied by the “expectation of legal sanction” (Bromley 2006, p. 51). Here Bromley considers the dual relationships, or legal correlates, created by rules and the rights that emerge, i.e., a rule establishes a condition to do, and conversely not to do something – the rights, duties, privileges, and liabilities that are created flow from these conditions.

Crawford and Ostrom (Crawford and Ostrom 1995; Ostrom 2005) also provide finer detail using “shared strategies, norms and rules” to define the opportunities and constraints faced by individuals (Ostrom 2005, p. 137). Crawford and Ostrom (1995) consider that shared strategies, norms and rules all include some condition of what an individual may, must or must not do in any particular circumstance. Rules are differentiated from a norm or strategy through the inclusion of some form of consequence for the transgression of a rule. These need not be differentiated by their formal or informal sources. This finer more detailed depiction of institutions provides a clearer sense of their emergent properties and the influence these properties have on the motives and incentives of individuals. This perspective helps us understand how an individual’s expectations contribute to a coordination of actions, the sources of institutional failure and in the re-construction of institutional approaches.

Coordination

Institutions provide a coordinating function among individuals and groups and are pervasive throughout our daily activities. For example, institutions exist to ensure automobile traffic flows in a predictable manner; they evolve to guide the way in which we negotiate an economic transaction whether at a department store or for the merger of two companies, they also emerge to structure the way in which we exploit our natural resources and how individuals benefit from the value of property. Schmid (2004) defines institutions as “sets (networks) of ordered relationships (connections) among people that define their rights, their exposure to the rights of others, their privileges, and their responsibilities” (p. 6). A myriad of exchanges occur for a variety of reasons across a variety of settings creating the need for multiple sets of institutions, thus as individuals join to form a society, institutions join to form systems of governance and norms of behaviour. These individual “sets of ordered relationships” are embedded within multiple levels and are a source of emergence (Schmid 2004, p.6). This emergent nature of institutions indicates a dependent relationship among its components, but also suggests a measure of unpredictability in crafting or designing institutions. As the discussion in this dissertation unfolds the challenge associated with structuring coordination within a social-ecological system will become clear.

In terms of our use and reliance on natural resource, Dietz et al (2002) define institutions as the humanly devised rights, rules and responsibilities that define, legitimize and underlie our relationship with each other and the resources we exploit and consume. Coordinating mechanisms in resource management are broadly described as (1) markets through competition and private property with the private sector as actor, (2) collective action through local-level

management with the 'community' sector as actor, and (3) government policy through regulation, with the state sector as actor (Rasmussen and Meinzen-Dick 1995; Wang and Van Kooten 2001; Acheson 2006). Institutions are necessary for markets to function, they establish how transactions are negotiated and take place, how policy is developed and implemented, and they help to create and are created by collective action. Successful institutions then would be those that coordinate users in an effective, efficient and equitable manner leading to the ecologically and socially appropriate use and investment in a resource or resources, or perhaps more encompassing the governance of a social-ecological system.

Formal and informal characteristics

The previous discussion noted the division of institutions into formal and informal concepts, but there is debate over this formal/informal divide. North (1990) discusses formal and informal constraints, but notes their often similar functions and overlapping nature as they reflect more complex, interdependent relations among actors. Guha-Khasnobis et al (2006) outline a range of formal and informal concepts in the literature and attempt to clarify the confusion over formal-informal definitions by proposing that "the formal-informal continuum apply strictly to the continuum between relatively high and relatively low levels of the reach of official governance mechanisms..." (p. 7). They stress that identifying a sector or institutional structure as formal or informal does not necessarily indicate order versus chaos, or good versus bad, nor does it suggest that only government can establish effective rules. In that vein, Ostrom (1990) defines informal and formal rules as 'rules-in-use' versus 'rules-in-form.' In her work, Ostrom focuses on rules-in-use as a more accurate reflection of the rules that shape and influence actual outcomes of resource use at the operational level, or decision making at the collective-choice level. Rules-in-use may be based on rules-in-form, filtered through the bureaucracy in its

implementation of formal laws, then filtered again as individuals further operationalize the laws based on their own interpretation, incentives and associated pay-offs. Rules-in-use, therefore, can reflect a wide range of operational realities from formal or informal prescriptions to more guided or facilitated levels of exploitation.

The formal/informal debate also focuses on the perceived legitimacy of institutions. North (1990) notes that institutional 'legitimacy' involves the acceptance, through informally based coercion, cultural expectations and sanctions, of formal laws and penalties consistent with larger social groupings and levels of economic and social interaction. Formal institutions are purposeful, created to meet some need, while informal institutions are said to be spontaneous, and non-deliberative (Schmid 2004). We tend to consider government's legislatively established laws as an indication of legitimacy, but legitimacy at the operational level is more a function of the ability to shape actions; influence at this level can come from formal and informal local level community-based sources. Acheson (2003) in his description of the evolution of the management regime for lobster fishing in Maine provides an example of the flow from informal to formal institutional structure. The current system juxtaposes a century of fishing effort, locally devised rules, and methods of allocation with the federal and state government conceptions of an appropriate regulatory regime. For many years, conflict between local users and state/federal authorities shaped and/or hindered the achievement of a joint solution. Often these user-community derived institutions are not recognized by a local or central governing authority, thus are often disregarded, ignored or simply misunderstood by policy makers and development practitioners.

Predictability of individual actions

Institutions and their underlying rules, norms and strategies provide some clarity in how actors will choose to conduct themselves within any particular social setting. Yet within any particular belief system or custom the methods of interaction will vary. Indeed, within any system of norms and customs individual emotions and capacity to understand and digest incomplete information will lead to variations in how interactions will unfold (Schmid, 2004). Predictability in actions comes from the level of 'rationality' of the individual. Neo-institutional theory adopts the perspective that the individual or actor within any situation is assumed to be while perhaps not perfectly rational, at least boundedly rational (Howlett and Ramesh 2003). A boundedly rational individual has imperfect information and lacks the cognitive capacity to understand and process all relevant information, identify and evaluate all potential outcomes of a given action, and make choices based on utility maximization or some other optimization outcome (Forester 1984). Understanding the likelihood of individual action under various conditions and constraints is a fundamental element to the analysis of institutional form, intentional design and the development of institutional change.

The institutional context within which an individual is situated further influences not only the way he or she makes choices, but also in the way problems are framed and answers sought (Wettersten 2006). Knight (1992) adopts the rational actor model, but not necessarily as a self-interested utility maximizer, but one who acts "intentionally and optimally to achieve toward some specific goal" within the particular setting (p. 17). These actions are further influenced by ones environment and the actions of those within the same action arena. A less than comprehensively rational person may make choices based on societal norms of reciprocity and altruism, as such will not maximize a narrower concept of utility, but may as Knight argues at

least strive for some specific goal. This individual finds him or herself acting within layers of embedded rules, norms and strategies. Peters (1987), McCay (2002) and Steins and Edwards (1999) note the analytical importance of recognizing the individual's interdependent relationship with the decisions and actions of others and ones institutional environment, thus tempering the self-serving rational actor of agency based theories on one side and the socially conscious community driven individual of structure-based theories on the other. These authors refer to the embeddedness of individuals within a broader social and institutional context. The way individuals make choices are influenced by their rational nature to achieve something, but rationality rests within a broader set of social influences which will alter the way they frame the situation in which they find themselves.

Institutional primer conclusion

This institutional primer focused on defining institutions as presented in the literature, focusing on interactions among individuals, the coordination of individuals as they interact within social ecological systems, the formal and informal nature of these coordinating institutions, and the predictability that institutions bring to our understanding of individual and group actions.

For the purposes of this dissertation, resource-related institutions are defined as the norms, strategies and rules that emerge to coordinate the way in which individuals, groups, associations and other entities interact to achieve some individual or group objective or action outcome within a social-ecological system. Thus institutions have a purpose; they have a function that changes at a variety of time scales to deal with social-ecological change. Three fundamental coordinating mechanisms were noted in the previous discussion: the market, collective action, and governance through government and policy. The remaining sections of Chapter 2 delve

more deeply into these three categories to provide a basis for the institutional failure and change discussions that follow in subsequent chapters.

2.4. Market coordination

This section focuses on two market characteristics relevant for this dissertation: property rights institutions and common pool resources. These two characteristics provide the basis for subsequent discussion in Chapters 3 and 4 regarding institutional failure and institutional change, respectively. The following section opens with a discussion of property rights followed by an examination of common pool resources and the added complexity they bring to resource management.

2.4.1. Property rights institutions

Picture a forest with open access for all to enjoy and all to exploit. Hardin (1968) argued that under such a picture (or a commons pasture as he described) the resource would be over-exploited and destined for ruin. Coordinating users via property rights, whether private or state-based rights, were considered necessary to avoid such a tragic outcome and encourage investment in the resource. Property rights as we have learned in the ensuing years come in many shapes and forms, but the fundamental tenet remains that property rights are necessary to avoid a “Tragedy of the Commons” where resources are sufficiently valued to attract consumptive interest. This section introduces a particular institutional form of property rights, notably rights in real property or land, their underlying theory and role in the use of natural resources.

The concept of property rights in economic and institutional theory establishes a coordinating link between property and the incentives of the rights holder to use the property and its benefit flow in a particular manner. Bromley (1991, 2006) considers property relations as a fundamental institutional arrangement. Bromley (1991) states that “property ... is a benefit (or income) stream, and a property right is a claim to a benefit stream that the state will agree to protect through the assignment of duty to others who may covet, or somehow interfere with, the benefit stream” (p. 2). While “property” holds value and provides a flow of benefits, it is a property “right” that establishes an individual interest in that property and its social context. Property rights do not simply establish a relationship between a person and a thing: a “right is a triadic relationship that encompasses the object of my interest ... plus all others in the polity who have a duty to respect my right” (Bromley 1991, p. 15). While philosophers have argued about the source of rights, the perspective taken in this dissertation is that property rights are “human inventions” (McKean 2000, p. 29) establishing the rights, rules and obligations between and among individuals.

What constitutes the flow of benefits from property can come in a variety of forms, but does not necessarily flow free and unfettered. Drawing from a number of previous authors, Haley and Luckert (1998) describe a property right as the “socially sanctioned and enforceable claim of an individual or group to the benefits (pecuniary or non-pecuniary) flowing from property subject to the conditions society places on an asset or service” (p. 126). These authors note that the benefits a rights holder enjoys or the value of a resource or land need not be defined in monetary terms (i.e., pecuniary), but can also accrue through the simple act of enjoyment, such as the pleasure one derives from hiking, or via the knowledge of a forest’s existence, for example. Property rights are often used as policy tools and a means to attain certain social

objectives not necessarily in sync with private objectives. The role of the state in the sanctioning, enforcement, and truncation of rights provides an avenue to attenuate negative effects (externalities) of property use, or to direct social and economic development. This 'intrusion' into the market also introduces the possibility of policy failure in government's attempts to set objectives and devise rules for that use – rules being a precursor to rights.

How do property rights influence the functioning of markets and the way in which we exploit our natural resources? To economists, complete and unfettered property rights are one component contributing to the efficient allocation and use of resources.¹ In the absence of well defined property rights, it is argued, a market failure can occur. A market failure is some failing of the market to attain efficient resource allocation and maximum benefits. Chapter 3 defines and discusses market failures in more detail.

There is a range of property rights types observed within social-ecological systems, providing an indication of who holds the rights to benefit from the property and the defining characteristics of those rights. A typology of property rights generally includes private property rights, common property, state property, and open access or no property rights (Bromley 1991; Hanna 1996; Grafton 2000). The economics literature considers well-defined, exclusive and comprehensive property rights as necessary conditions for the efficient use of resources.

Arguably, the most exclusive are private property rights, where an individual or entity controls decision making and is able to enjoy an unfettered flow of benefits. State property rights as the name suggests has the state holding the rights to the land and making decisions in the public (or state's) interest. Under state-based rights, use is often allocated to private entities using

¹ Other components include competitive markets, complete markets, perfect information, and no transaction costs.

tenures in the form of short- or long-term usufruct rights or profit-a-prendre.² Common property rights are private rights held in common among a group or community of people. Open access indicates the lack of property rights where no one has an exclusive right to the benefit stream, but then no one is excluded from capturing those benefits. Open access is not only present in “unclaimed areas” such as the open ocean; it can also be present in state or private property where the owner is uninterested in or unable to control access – this form of open access is often referred to as *de facto* open access. Limited-user open access is a situation where a community of users may have exclusive rights to some property, but have no rules regarding extraction activity, thereby potentially leading members to over-exploit the property as if it were open access. The more integral element of the property regimes in Table 1 are the owner characteristics and the implications for decision making.

Table 1: A typology of property rights

Property right	Open access	State property	Common property	Private property
Owner	None	Citizens	Collective	Individual
Decision maker	everyone	polity	members	owner

Given there are more than one type of property right, what is it that makes one property right type more effective than another? Demsetz (1967) and Alchian and Demsetz (1973) proposed a theory of property rights arguing that property rights emerge to internalize externalities – an externality being a manifestation of a market failure. To illustrate the efficiency of private property rights in this manner they contrasted their theory of private property with the inability of “communal rights” to overcome externality related costs, thereby being unable to alter the

² Profit-a-prendre is the legal right to use and profit from someone else’s property. A usufruct right is the right to profit from the use of another person’s property, but with the expectation that no damage will occur to the land or property being used. Examples include forest tenures allocating the rights to harvest timber in British Columbia, to the traditional *ejido* system in Mexico.

incentive of individuals to over-exploit and under-invest in the resource. The key feature in well defined private rights is the ability of the rights holders to exclude others, subsequently allowing the holder to reap the benefits of investment, and also to appropriately reflect the external costs (externality) of property related choices. Thus both the private property rights holder and society in general, at least theoretically under assumed ideal conditions, are better off.

The theory of property rights, that the more private the rights the greater the incentive to seek the most efficient allocation and use of resources for society, supports the contention that the privatization of commons and open access lands is necessary. Writings by Gordon (1954) and the article by Hardin (1968) in which the “tragedy of the commons” theory gained ascendance supported either privatization or centralization of “the commons.” Commons, communal ownership, or common property were not included in the typology of property rights and were considered to reflect open access, thus leading to “tragic” consequences. Dales (1968), however, differentiated common property with more open access property by discussing restricted and unrestricted common property, and focused on unrestricted common property, for example the air and water, under a policy of “anything goes” that posed a serious threat to the environment. No further discussion was provided on restricted common property and Dales went on to argue that because property rights are “antecedent to economics, since it is property rights that define the economist’s goods and services” the state needs to define property rights to the unrestricted commons (Dales 1968, p. 185). The property rights literature led to the focus on the necessity of state or private rights to replace any commons type systems of coordination. The state became a central source of change, especially in the developing world where in many areas the system of property rights remained crude and non-conforming with the existing Eurocentric theory.

Common property was thus disregarded as a legitimate means to coordinate resource users. Common property, the commons, and open access were lumped together as an ineffective source of economic efficiency, and more likely a source of inevitable market failure and resource degradation. However, as the literature now well argues, the state is not the only source of effective property rights and many examples of the *de facto* establishment of common property rights also exist (Ciriacy-Wantrup and Bishop 1975; Ostrom 1990; Trosper 1998; Grafton 2000), many of which have been part of indigenous societies prior to introduction of the Eurocentric definition of property rights. For example, prior to European settlement in British Columbia, forests provided a source of sustenance and identity to indigenous populations – far exceeding today’s post-colonial focus on the use of timber (Turner 1998; Turner and Cocksedge 2001). Supporting these uses were well established systems of rights and responsibilities to the land (Trosper 1998; Turner and Jones 2000). Common property regimes have also evolved in response to the inability of governments to enforce its *de jure* state-based rights. In this instance, state incapacity allows resources to fall into *de facto* open access situations until local users coordinate themselves to develop and maintain appropriate access and use levels.

What property rights scholars now generally recognize is that indeed property rights are important, but communal rights are not the villain, open access is, whether complete, *de facto* or limited-user open access. Privatization or conversion to state property was not a necessary requirement. Ciriacy-Wantrup and Bishop (1975) argued that common property systems of coordination should be part of the choice selection among property rights alternatives, especially for “fugitive” or highly mobile resources such as groundwater and fisheries. This is not to say that property rights and their ability to coordinate effective and efficient use of

resources is incorrect; rather, that the clarity in the conceptualization of the problem was incorrect leading to, as many authors have argued, the destruction of perfectly good, effective and equitable regimes whose only failing was that they did not conform to the private property rights model.

Not all writers agree with the usefulness of the property rights typology however. Paavola (2006) argues that natural resource policies are far more diverse across the range of rights. He contends that state property rights mixes concepts of private and common property rights. Paavola argues that state property should be removed from the typology and common property be expanded to include lands and resources held in common and managed for citizens by the state, and resources covered under international regimes. Thus, from Paavola's perspective, the only relevant elements of the typology are open access, collective ownership, and private ownership. The property rights typology, however, focuses on a broad organizational structure of property relations. Finer detail exists in each of the property types outlined in Table 1. The typology also depicts the relationship between the state, private and common interests as distinct, while the state often defines the rights within private and common property. Nonetheless, the typology provides the means to categorize property types under analysis and to help draw initial distinctions between the number of owners/decision makers and the ensuing complexity inherent in those decision making structures.

Beyond private, state or common property descriptors, property rights are further delineated into a bundle of rights. According to Scott (1983) "standard bundles are, in varying degrees, exclusive, enforceable, divisible, and transferable; and in aggregate make up our system of rights" (p. 558). Haley and Luckert (1998) include in this bundle a similar but somewhat

enhanced selection including comprehensiveness, duration, transferability, right to economic benefit, exclusiveness, and security. The property rights' bundle varies in its level of entitlements, with private property arguably having the most well-defined bundle of rights. Common property rights, which are a form of private rights held in common can have as complete a set of rights as private property, but are held and accessed by a group not an individual or corporate entity. The bundle of rights, however defined, is generally attenuated in some manner by those who define the rights, such as the state. Common property rights for example often truncate the right of alienation, restricting the freedom to enter and exit the group, or requiring the approval in the sale or purchase of individual shares. Even private property rights are never fully prescribed, for example private forests in B.C. are in part regulated under the federal *Fisheries Act* (Government of Canada), to guard against any deleterious effects on fish and fish habitat. All *de jure* property rights (i.e., those recognized statutorily) are subject to some form of limitation or truncation of rights. The state often determines the completeness of property rights and provides their legitimacy and protection.

The bundle of rights model is a useful method to analytically differentiate property regimes, but says little about the actual actions of property rights holders or whether any form will result in achieving socially optimal objectives. Property rights theory contends that private property rights lead to greater economic efficiency and increased social welfare. However, this perspective relates to a private good, not a public or common pool good, which somehow needs to be converted to a private good. The definition of the property right provides no guarantee that the holder of that right will make the more socially optimal or responsible choice.

Schlager and Ostrom (1992) take the bundle of rights approach in a somewhat different direction and provide a typology of what a particular rights holder is entitled to or not entitled to do with a particular resource. While the standard bundle of rights approach allows for the description of the content of a property right in multiple forms, the Schlager/Ostrom model associates the bundle elements with positions in a progression of included entitlements, or allowable actions. The position is defined by the rights. The following table is reproduced from Schlager and Ostrom (1992).

Table 2: Bundles of rights, positions and allowable actions.

	Owner	Proprietor	Claimant	Authorized user
Access and withdrawal	X	X	X	X
Management	X	X	X	
Exclusion	X	X		
Alienation	X			

Source: Schlager and Ostrom, 1992.

The Schlager/Ostrom model provides a language that differentiates the range of rights more so than other bundle approaches that do not provide a similar or alternative relational picture between the owner/appropriator and the specific type of rights or allowable actions. By focusing on positions or roles of the rights holder the model is useful in indicating the outcomes of particular regime structures, not only in a descriptive sense, but also in terms of how actionable rights build to form a stepped range of entitlements. Unfortunately, as various scholars caution, no particular property regime necessarily provides the most efficient or effective choice for all resource types in all user situations (Stevenson 1991; Baland and Platteau 1996; Grafton 2000). The various typologies provide very high policy level direction with substantial detail left to consider in the development of a management regime to address access and extraction activity.

Since its publication, the Schlager/Ostrom property rights model has been cited in about 152 journal articles.³ For example, Brady and Waldo (2009) use the property rights model language in the analysis of fisheries in Sweden. Trosper (2003) uses the model to characterize the “proprietorship” approach to land management used by Northwest Coast aboriginal populations. Others have used the model for a platform into a theoretical discussion of property rights and governance (see Berge 2002; Paavola 2006; Sandberg 2007). For example, Berge (2002) separated access and withdrawal rights and added an ‘unauthorized user’ column with rights of access. While this addition reflects an open access situation or one of theft and trespass, it creates a legitimate position in terms of rights. There is some inconsistency with the “rights” within the Schlager/Ostrom model and an unauthorized user, i.e., one with no rights. However, what is viewed as an unauthorized or illegal act by one person may be considered a moral right by another (see Ribot and Peluso 2003), thus the concept of rights tends to shift with this additional user category. This depiction may also be more reflective of actual resource access, certainly as it pertains to Scandinavian countries, which was the subject of Berge’s interest, where “everyman’s right” provides unrestricted access to private or public forest land to harvest non-timber species.

Property rights suggest a rather neat division of who does what where, but a great deal of activity goes on despite property rights. In cases of open access or where the landowner chooses not to or is unable to restrict access, the right to use a particular piece of land does not automatically follow. Laws do not state that when unable to fence one’s land, anyone has the right to enter and benefit from the land. Yet individuals often access areas regardless of having

³ Web of Science, accessed January 20, 2010.

the 'right' to or not; they have the capacity to access by taking action. The "right" to access is only one dimension of deriving benefits from a resource, as such we may need to look beyond property relations as the institutional mechanism to provide, maintain or restrict access. Ribot and Peluso (2003) distinguish between access and property. They consider access as the "ability to benefit from things" and property rights as a "right to benefit from things" (Ribot and Peluso 2003, p. 153). They argue that the "move from concepts of property and tenure to access locates property as one set of factors ... in a larger array of institutions, social and political-economic relations, and discursive strategies that shape benefit flows" (Ribot and Peluso 2003, p. 157). Indeed, as was discussed in the opening introduction, a social-ecological system is the more appropriate unit of analysis, of which institutions underlie the coordination among social actors.

Rather than a "bundle of rights" the authors suggest that the more appropriate bundle to consider is a "bundle of powers" (Ribot and Peluso 2003, p. 173). This dissertation takes interest in resources in open access where some socially-based coordinating mechanism is not present or is ineffective, and where appropriators have the power to access lands unfettered whether they have the right to or not. Understanding that resource related property rights can be trumped by the power to access situates the open access property right definition not at one end of a spectrum, but potentially within any other property right, be it private, common or state – open access can prevail under any 'rights' regime.

To summarize this section, property rights are a coordinating mechanism that structure interactions among holders of property, provide security of the right to a benefit stream from that property, and contribute to certainty and predictability in actions. They are a critical

institutional form necessary to support the efficient allocation of resources, whether to nurture a particular resource or value, or to convert that resource to some other value stream. But they don't eliminate complexity in social-ecological coordination. The definitional model presented in this discussion provides the analyst with a means to characterize a property regime, the incentive structures that each bundle element may provide, and the elements necessary to consider in the design of a property regime. However, the models do not have the capacity to identify the most appropriate property rights regime for any particular public good or common pool good situation. What is clear is that when the rights provided to an individual or group are incomplete or unenforceable, the individual or group incentive will tend towards a short-term perspective and individual, not collective strategies will predominate. Common pool resources introduce a layer of complexity to the discussion of institutions, thus a fuller definition is warranted.

2.4.2. Common pool resources

The following section introduces common pool resources and attempts to characterize how they can influence institutions and individual actions. A common pool resource is a resource type, as differentiated from a property right, which as was discussed previously is a humanly devised institution. This section begins with some basic definitions of resources in order to situate common pool resources within this broader perspective. The section will then discuss ways that the literature more precisely defines common pool resources vis-à-vis other resources and will explore the particular incentives that result. Finally, common pool resources are discussed within the context of institutions and the theory that results.

The natural resource and economics literature generally separate natural resources into non-renewable and renewable resources. As the names suggest, a non-renewable resource is one whose stock does not replenish, even in the long term from a social perspective. Common examples include oil and mined substances such as coal or copper. Renewable resources have a stock that is replenished over a socially relevant time period. Examples include forests, field crops, water or fish. Characteristics differentiating these two types of resources include their stocks and flows. The resulting methods of utilization and management differ distinctly between these two types of resources, with non-renewable resource extraction based on a stock depletion model, and renewable resource exploitation generally based on some form of a long-term sustained extraction of a portion of the flow of resource units produced each year. Examples of a resource flow are the volume of annual tree growth or the volume of fish that hatch and can be harvested without degrading the replenishment of the total volume, or stock of fish. Renewable resources are the focus of this research and the objective is to ensure effective means of management are in place or developed to ensure that the annual extraction of a resource's flow does not compromise the long term health and presence of the resource stock.

Natural resources are also differentiated based on their more socially relevant characteristics. A commonly cited typology of natural resources includes public goods, common pool goods, club goods, and private goods (Ostrom et al. 1994; McKean 2000). These concepts reflect who can benefit from the exploitation of these resources and how that use affects the ability of others to benefit from them, thus are differentiated by their exclusivity and subtractability. Exclusivity is the ability to exclude others from having access to benefiting in some way from the resource, for example harvesting it or perhaps even looking at it for its aesthetic value. Subtractability

refers to the effect of one person using a resource and its subsequent availability to others. For example, harvesting edible wild mushrooms from a forest reduces the volume available to others, or my dumping of chemicals into a stream reduces the supply of clean water to downstream users.

Table 3 outlines this resource typology in terms of exclusivity and subtractability. Public goods as the typology suggests are characterized by the level of difficulty associated with excluding people from enjoying the benefits the good provides and a public good also has low or zero subtractability in that my use of the good doesn't subtract or "detract" from someone else's use of the same good. A public good infers that the public, without exception can enjoy the benefits of a resource without fear of being excluded, for example from the enjoyment of sunshine, a viewscape, or air (not necessarily clean air however).⁴ An individual or private entity is unlikely to provide a public good, invest in producing or maintaining the good as 'free riders' would in all likelihood enjoy the benefits, but pay nothing towards its provision. Private goods have the characteristic of easy exclusion at a reasonable cost and are subtractable. Toll or club goods refer to a resource such as the view from a private resort, where visitors may be easily excluded unless they pay a fee for entry, but once inside can enjoy the view without worry of it being diminished.

⁴ Exceptions are always conceivable. This "right" to enjoy a public good could of course be withheld from a person through incarceration, whether that incarceration is just or unjust.

Table 3: Resource typology

		Subtractability	
		Low	High
Exclusion	Difficult	Public Goods	Common-Pool Resources
	Easy	Toll/Club Goods	Private Goods

Source: Ostrom, Gardner, and Walker. 1994. p. 7.

Common pool resources share some of the characteristics of public and private goods. A common pool resource such as a fishing stream or more complex forest is associated with difficult and costly exclusion and subtractability. Common pool resources, similar to public goods, increase the difficulty in assigning effective property rights, thus being more reliant on collective action. The typology in Table 3, and its qualifiers “easy, difficult, low and high” suggest a rather clear distinction between goods; however, as with property relations, uncertainty and overlaps occur and within each qualifier a range of “easiness” or “difficulty” “low” or “high” exists.

Randall (1983) offers an alternate somewhat more detailed typology of resource types. The typology suggests that the resource type is a function of use and capacity – thus reflecting the stock and flow relationship between a physical ecological entity and its social function. Randall attempts to avoid the terminological confusion and variability in the meaning of common-property, public goods and private goods by directly using the concepts of exclusivity and resource subtractability, or rivalry to categorize resource types. The following table illustrating this typology is taken from Randall (1983).

Table 4: Randall's goods classification typology.

	Non-exclusive	Exclusive	Hyper-exclusive
Non-rival	1	4	7
Congestible	2	5	8
Rival	3	6	9

Source: Randal (1983).

Of interest in this research are goods found within the non-exclusive column: Types 1, 2 and 3, which recognize the cost and physical challenges of creating exclusive access. This typology provides the ability to follow the evolution of a resource's use within a particular social-ecological system. For example, at some point a resource may be non-exclusive and its rate or exploitation and availability would suggest a non-rival level of abundance (level 1); however, increasing population levels or the introduction of new technology can lead to increased rates of exploitation and eventual congestion in the number of users, thereby creating a purely rival situation (levels 2-3). The point of congestion is important in understanding the need for intervention. Randall (1983) defines resource congestion as "a good that is non-rival for some number of users, but rivalry sets in when additional users approach the resource's capacity constraint" (p. 134). He argues that because of the non-exclusive nature of these goods, they will not be "reliably provided by the private sector, or by the public sector financing them with user charges" (p. 136). Who then will take on the task of managing and investing in a non-exclusive rival good? Each classification has implications for the type of management regime that may be most effective.

Ostrom (1990) and Ostrom, Gardner and Walker (1994) provide a detailed description of common pool resources, their use and resulting resource management issues. Ostrom (1990) defines a common pool resource as "a natural or man-made resource system that is sufficiently

large as to make it costly (but not impossible) to exclude potential beneficiaries from obtaining benefits from its use” (p. 30). Ostrom refers to a “resource system” and “resource units” emphasizing the concept of a resource stock and its flow from which users, or “appropriators,” extract benefit and “providers” invest in and maintain that system (Ostrom, 1990, p. 30). Schmid (2004, p. 99-100) considers a common pool resource to be an “important variant” of “high exclusion cost” resources. He highlights this stock/flow description of a common pool resource and stresses that it is the resource system, its stock or pool that is the high exclusion cost good, both in terms of the ability to restrict access but also in terms of maintaining the most efficient flow of benefits from the system.

Individual or group incentives are driven by the ability to capture a portion of the common pool flow. While the common pool stock is high cost and suffers from excludability challenges, the flow can be captured by appropriators, thereby creating a private good. Appropriators are those who participate in extracting the flow of resources (Ostrom, 1990). This ability to convert the common pool flow to a private good allows an appropriator to capture the value stream of the resource, and is also where most investment is observed. For example, fisheries investment in fleet capacity and not the resource system is observed, as is the investment in distribution capacity in the non-timber forest product sector in Washington State (Tedder et al. 2002). The non-exclusive ability to capture the benefit stream leads to actions that may reduce and degrade both the stock and flow of a common pool resource. Providers are those who invest in maintaining the stock and flows of the common pool (Ostrom 1990). They struggle with a lack of incentive to invest in a common pool resource as a result of its high cost exclusion and the inability to reap the full benefits of that investment. The potential outcome of combining this capacity to capture the good with the non-exclusive and subtractable nature of a common pool

resource is the degradation of the resource. Institutional mechanisms are necessary to coordinate individuals to avoid this outcome, but as discussed in greater detail in Chapter 3 these institutional remedies sometimes fail.

Common pool resources are many and varied and while they may share degrees of exclusivity and subtractiveness, other characteristics such as mobility and storage, geographic and temporal heterogeneity also define common pool resources and influence the type and effectiveness of a management response. Schlager et al (1994) provide a typology of common pool resources differentiating them by 1) the absence or presence of the capacity for storage and 2) whether the flow units are mobile (or fugitive) or stationary. For example, wildlife does not adhere to property rights, even fencing may be unable to limit the movement patterns of wildlife. In Texas, large land owners have had to create associations for the management of wildlife species valued as a source of recreation and meat (Wagner 2005). The geographic and temporal heterogeneity of some resources in their flows further complicates the management context. For example, fencing a small patch of edible wild mushrooms to restrict access may be possible, but the maximum flow of benefits from the mushroom resource and any investment would come at the larger forest landscape level. Approaching resource management using small parcels may be at an inappropriate scale, but this conclusion will vary as resource and geographic characteristics dictate. Schlager et al (1994) found that certain combinations of these characteristics led to the need for greater levels of government intervention, such as for highly mobile resources like water systems that may flow over significant lengths, through a variety of jurisdictions, and where local management efforts may have little influence over the unpredictability of flows and use levels in other upstream areas.

Common pool resources introduce a level of complexity to the question of institutional design. Formal institutions confront a greater challenge in overcoming inefficient and potentially degrading actions of common pool resource appropriators, compared to establishing private property rights over a private good for example. Common pool resource theory argues that appropriators and providers must take an active role in ensuring institutional efficacy. The challenge then is to get individual actors to coordinate their actions with or without formal institutions. This 'collective action' among resource users is the subject of the next section.

2.5. Collective action

In previous sections we found that common pool resources are faced with costly exclusion, thus the apportionment to some private or collective entity using property rights is rather problematic. For any property regime to act as a coordinating mechanism of individual action, whether private, state or common, some degree of collective action is necessary among appropriators, providers and those engaging in other actions that may interfere with the resource or somehow introduce additional costs. Deciding on rules requires collective action, the success of rules, i.e., that everyone follows them, requires collective action. Thus collective action is required at various levels within operational and collective choice scales. This section provides a short discussion of collective action and its contribution to the theory and management of common pool resources.

What is collective action and what role does it play in the use of a common pool resource?

Olson's (1965) Logic of Collective Action brought to the forefront the challenge of group cooperation and coordination in the appropriation and provision of public goods, or non-excludable goods. Collective action involves the efforts of individuals to reach an outcome

desirable to the group (Sandler 1992). Poteete and Ostrom (2002) contend that, “for management of a renewable resource system like forests, collective action is needed to limit resource use” (p. 9). How individuals come together and achieve collective action is a central focus of the literature focusing on common pool resource management.

The influence of collective action goes beyond individuals and the groups within which they operate. Bromley (Bromley 2006, p. 217) considers that for “nation-states, this [collective action] is the essence of public policy.” Institutions provide a coordinating structure for our interaction with each other at the operational, collective choice and constitutional levels, but developing, implementing and maintaining these formal and informal relationships requires a collective effort that is not necessarily forthcoming from all individuals. The IAD framework’s operational, collective choice, constitutional and meta-constitutional levels include individuals coming together to make decisions that will affect others at subsequent levels. Who participates and who benefits from those positions plays a significant role in the outcome of collective action.

Olson’s (1965) “logic of collective action” focuses on the provision of public and collective goods within a market and the divergence between the individual versus collective interest. Olson (1965) describes three group types: 1) a privileged group, or a group in which an individual or some sub-group benefits sufficiently from collective action to support its maintenance; 2) an intermediate group where the benefits of collective action are not clear, but the group is small enough that it may evolve; and 3) a latent group which suffers from perpetual failure unless some selective incentive is introduced. For intermediate and latent groups there is no leader willing to provide for the collective interest. In larger less homogeneous groups, individuals will

have the incentive to act in their own interest, increasing personal benefits while imposing higher costs on the group. Each group member pursues this strategy adding further costs onto the group interest. The resulting conclusion is that individuals will be unable to develop collective action approaches to resource use where group access is the norm, unless some “selective incentives” are used to overcome the socially irrational choice of the group’s individuals (Olson, 1965, p. 51). Thus in large and diverse groups individuals need to be coerced into acting in the group’s interest and foregoing higher short term gains.

The relevance of the collective action theory of groups extends beyond its original focus on public goods and has become the focus of theoretical and empirical research efforts concerning common pool resources. Scholars of the property rights school, Gordon (1954), Hardin (1968), Dales (1968) and Alchian and Demsetz (1973) argued that any resources within commons or under common property arrangements were destined for destruction and in need of the imposition of private or state based property rights. Collective action among users of these resources was unlikely and the ‘Tragedy of the Commons’ was inevitable through the actions of free riders, a sentiment supported by the work of Olson (1965). Institutional theory has moved beyond the narrow property rights depiction, yet public goods and common pool goods are still faced with a level of uncertainty about users’ ability to make collectively rational choices when faced with a common pool or collective action dilemma.

Collective action dilemmas reflect a situation in which the individual pursuit of one’s interest leads to a suboptimal group outcome, regardless of more beneficial group oriented alternatives. Collective action dilemmas concern not only the action of the individual pursuing his or her own interest by taking as much of a resource as possible; it also reflects the ability of these users to

act jointly to devise rules that would in some manner preclude the persistence of these collectively irrational decisions. This creation of rules is itself a collective action dilemma where an individual must choose to invest in this effort, or to simply free ride on the efforts of others. These first and second order dilemmas are joined by a third in which individuals must decide whether or not to help maintain the system of rules by monitoring, providing information to the group, and resisting further free riding and shirking.

Two problems frame the dilemma situation: 1) when individuals pursue individually rational actions at the expense of the resource, and 2) when individuals will not interact to coordinate use. Because of the non-exclusive nature of these goods, there are altruistic and trust issues associated with these dilemmas: an individual struggles with his or her level of contribution if others cannot be trusted to also contribute. Because some individuals prefer to free ride, any trust can be quickly dissipated. Individual characteristics, cultural and other group characteristics, the incentive structures operating within the group, how group members interpret the action of other group members, the level of information available, and outside influences all underlie collective action dilemmas. Establishing *de jure* property rights is not the issue, being able to effectively restrict access is, but controlling access remains complex and costly regardless of the particular property regime within which the common pool resource is located. Overcoming the problem of resource degradation first requires overcoming the problem of a lack of individual interaction leading to collective action.

Ostrom (1990) cautions against using the model of the logic of collective action to infer the inevitable depletion of a resource because of individual rationality, and introduces a number of cases where individuals do choose to support the collective, or society's interest. Ostrom (1999)

identifies various resource and user characteristics or conditions under which collective action is more likely to evolve to solve common pool resource dilemmas. Resource attributes include the potential for improvement of the resource, the availability of reliable indicators, resource predictability, and the manageable spatial extent of the resource. User attributes include resource salience among users, a common understanding of the resource and its benefits, a low discount rate, an even or equitable distribution of interests in the resource, trust among users, user autonomy in determining rules, and prior organizational experience. Once created, however, there is significant uncertainty regarding the durability of the collective management regime. The heterogeneity of resources and users creates a highly complex system rendering a simple blueprint for success problematic. Exogenous influences affecting the longevity of common property collaboration include migration, government actions, and market changes. These sources of failure are presented in more detail in Chapter 3.

Experimental research into collective action has become a large contributor to the development of collective action theory. The experimental approach using game theory began with the use of the prisoner's dilemma game, and has since increased in sophistication and the breadth of situations under study (Sandler 1992, Ostrom et al 1994). Game theory allows commons' dilemmas to be reframed in a variety of ways to account for long-term interactions, communication, and the building of trust, for example. It is not the intent here to go into a full description of game theory and its output, but its contributions do inform the discussion. Game theory experimentation has shown that when players (appropriators) are able to communicate over multiple periods, and they have the confidence and trust that other players will act in a joint manner, they too will act collectively. The one shot, no-communication prisoner's dilemma

game results in defection or a sub-optimal outcome, but that rather simplistic reflection of social interactions should not be expected in all operational situations.

Collective action among individuals operating within the same common pool social-ecological system is a necessary ingredient for longer-term group oriented common pool management solutions. Even under a prescriptive state regulatory environment, the exclusivity challenges of a common pool resource open the potential for free riders who may erode the collective faith in group or state solutions. The emergence of collective action efforts can be expected under certain conditions, but when these conditions are lacking the chance of joint effort declines. Collective action research has provided insight into why and how individuals will contribute to the group; nonetheless, the need for 'selective incentives' and state intervention remains a necessary element of common pool resource management – a subject introduced in the following section.

2.6. Governance and the role of the state

The role of the state in the institutional design and management of common pool resources is situated within a broader system of governance. A state government has numerous regulatory tools at its disposal, but its operationalization depends to a large degree on the structure of governance – who is involved, how they participate, and what they do. Government is one actor, albeit a significant one, within a system of governance. The concept of a governance system and government's role in that system provides an indication of how institutional change emerges. Governance concerns not only the contribution of an elected government to that change, but also the functions of other participants who help to shape and are affected by the process of change. These other participants could include government agencies, regional and

community level administrations, non-governmental organizations, and resource appropriator associations. An elected government's role may vary as these other organizations, communities and agencies emerge to deal with institutional failure and change. This section begins with a discussion of governance, what it is and how it contributes to our understanding of the way in which the state government and other actors participate in institutional maintenance and change.

What is governance and how does it differ from policy studies and the institutional characteristics described previously? Kishor and Belle (2004) define governance "as the manner in which power is exercised in the management of a country's economic and social resources," and involves the state government "and contributions of other stakeholders as well" (p. 61).

The state takes a significant role in the semblance of institutional form. The state government's coordinating function involves its rule making ability through legislative and regulatory powers, its enforcement of these rules or laws, and its participation in economic matters. One avenue of political science focuses on policy studies and the development of various models to understand why and how policy evolves as it does (see Sabatier 2007). Policy development is part of institutional development, but the policy process, roles of policy actors, and methods of policy delivery form a broader conceptual setting that fits within the concept of governance. This dissertation is an attempt to understand the pieces that combine into this broader institutional or governance perspective and to identify the role of government in institutions and institutional development and change. Policy may fail to provide the rules or incentives necessary to maintain a common pool resource, but explanations of whom, how and why government and its policy may fail relates more to governance than to the narrower concept of a state government or policy.

The concept of governance encompasses institutions and is conceived as a systems oriented dynamic process of beneficial social coordination. Institutions form part of a governance system joining those who participate in institutional design and implementation and the process through which institutions and governance regimes evolve. Biermann (2008) suggests that the “concept of governance is ... broader than the concept of institutions. It covers a wide area of phenomenon that are crucial for understanding steering systems in the field of human dimensions of global environmental change but that are not completely addressed through the notion of institutions” (p. 279). Governance includes the institutions or “rules of the game,” the organizations that participate in the development, implementation and maintenance of those rules (including government), and how the various actors interact within a broader governance system. Treib et al (2007) define governance in terms of a “process of governing which departs from the traditional model where collectively binding decisions are taken by elected representatives within parliaments and implemented by bureaucrats within public administrations” (p. 3). While institutions change, governance is conceived of as a dynamic concept or process where the state may be the central actor, on the periphery, or completely absent from resource management.

Governance has an inherent intent of good within its definitions. The outcomes of governance, its change and objectives suggest progress towards some optimal goal, whether economic efficiency, equity, environmental integrity, or all three. Paavola (2006) defines governance “as the establishment, reaffirmation, or change of institutions to resolve conflicts over environmental resources” (p. 94). Thus as Young (2008, p. 14) states, governance is seen as a

way to “guide societies towards outcomes that are socially beneficial.” Solving common pool resource dilemmas seems appropriate within the broader understanding of governance.

Reducing governance to its component parts provides a clearer sense of these definitions.

Hoberg (2008) delineates governance “across three dimensions: who participates in what decisions (the *political* dimension); at what levels are decisions made (the *vertical* dimension); and with what instruments (the *regulatory* dimension)” (p. 1, italics in text). Paavola (2006) delineates governance in a similar fashion, but describes the dimensions as functional and structural tiers of institutions, and governance functions. Treib et al (2007) uses the terms “politics, polity, and policy” to describe these components (p. 3). Functional tiers, or the politics or political dimension includes who participates within constitutional, collective choice, and operational levels of decision making; structural tiers, or the polity are the vertical dimension of hierarchical or semi-independent policy delivery agents, such as lower level state or provincial governments, non-governmental organizations, or communities (however defined). Finally the governance function, policy, or regulatory dimension includes the policy tools available to government, whether described in terms of market or command and control based mechanisms, or institutional rules.

These elements of governance can be used to illustrate the evolution in governance and the source of shifts or changes. The analysis of governance can focus on one or across dimensions. For example, Hoberg (2008) looks at the changes in forest policy actors in Canada within the political dimension and identifies First Nations, the environmental movement, multi-stakeholderism, and the advent of certification standards and delivery organizations as the most significant changes to the players in forest policy development, whether or not they sit directly

at government's policy table. In the vertical dimension, governance has moved towards internationalization in environmental policy through such efforts as the Kyoto Protocol, and within nation states the movement towards more decentralized policies that provide greater local control on resources such as forests and fisheries. In the regulatory dimension, Hoberg notes the movement across Canada to include more pluralist land use planning methods and the movement towards results based regulatory requirements, rather than prescriptive based regulations. People historically found outside the political dimension are demanding more of a role in public decision making and government is responding.

The tools available to implement policy also vary and their effects can have far ranging implications and outcomes for operational level actors. The state through its governing institutions uses a variety of policy instruments that can be categorized as organization based (state provision, public corporation, voluntary or market based), and authority based (command and control regulation, delegated self-regulation, advisory committees), and treasure based (taxes, grants, user fees) (Howlett and Ramesh 2003). Treib et al (2007) categorize modes of governance as coercion based, voluntarism, targeting, and framework regulation. These "nonmarket" measures do not necessarily imply or lead to effective, efficient or equitable change (Wolf, 1979). The delivery or application of these instruments can occur through not only government agencies, but also non-governmental organizations. The tools chosen (e.g., regulation or market based) tend to match the strategy chosen (devolution or state operation), and the mode of governance (coercion to regulatory), and who implements or delivers that regime.

The concept of governance, however, may not move the policy analyst any closer to understanding the appropriateness and therefore effectiveness (however defined) of any institutional design or change. This potential outcome was illustrated in the analysis by Kishor and Belle (2004) who found that governance as an indicator of sustainable forest management was insignificant, but that good governance was associated with higher incomes, which in turn had a significant negative correlation with deforestation. Armitage (2008) outlines various sources of change to the commons that can lead to degradation that are exogenous to the existing governance structure. These sources include the migration of people, changing external markets, or the “influences of modernity and capitalism” (Armitage 2008, p. 10). Agrawal and Chhatre (2007) conclude in their analysis of state involvement in co-governance in India that more autonomy in local management leads to better local governance, while more state involvement lowered the success of local resource governance. It is the structural elements of governance, their relationship to the extant contextual factors that shape outcomes. Governance provides a structural framework on which various policy components can be arranged, but what is best for any particular situation remains a question.

The challenge in institutional design is that there is no comprehensive theory of institutions allowing policy makers the luxury of full information and predictable futures. The cause and effect relationship between design principles or other indicators of success and how institutions and their underlying rules should be defined has yet to be formalized. How these success factors link with the context of the situation and lead to the achievement of a policy objective needs further study (Agrawal 2002). The complexity of scale may suggest a more macro-analysis of interactions among and within action arenas, but broader analytical aggregations also lead to broader “less meaningful” theoretical and conceptual constructs (Cox 2008). Governance

thinking and institutional theory dealing with the commons takes a very populist perspective. In other words the individual's role in groups, and in a group's level of equality in its role in the presence, function and evolution of institutions is seen as integral and beneficial to the collective action required for effective common pool resource management. The literature on governance provides another method to understand the coordination of social interactions, but its design contribution remains at a macro level, while suggesting a micro level incorporation of stakeholder values. We are left with a normative suite of variables and actions, but no positive explication of how to move from institutional point A to point B.

The literature on governance of the commons and institutional forms of that governance provides a broad range of analytical perspectives, from institutional rights and rules, to resilience related systems complexity, forms of property rights, and power relations among actors across scales. All generally warn of the dangers of "blueprint" applications of state intervention from macro forms of governance to more micro design of rules. Each resource system context is unique in some manner and in situations of conflict requires unique responses, but often that response (centralization-decentralization; state-community-private-co-management; private property-common property, polycentric) is at the governance level and is based on the more normative outcomes of institutional theory. Berkes (2002) argues that scale-mismatches between institutional forms and social-ecological needs may be inevitable. But how many unique and scale specific policy responses are possible, give the scarcity of government and community resources and capacity?

This section on governance situates institutions within a broader coordinating system that includes various roles and participants within the evolving path of governance. Governance

recognizes the “humanly devised” nature of institutions. The concept of governance is reflected in the IAD decision making structure and action arenas. Government and its policy instruments emerge as central actors involved in change at various levels, thus governments play a significant role in the development, change and maintenance of institutions. But other actors have also entered to influence policy design, including non-governmental organizations that reflect alternative beliefs and objectives. Thus while institutions provide a coordinating mechanism, create a level of certainty from which actors are influenced and subsequently take certain actions, the complexity of governance suggests a far more challenging policy environment in shaping those actions to achieve some social good, however defined. Systems of governance are referenced according to the way in which decision making is established. Common concepts include decentralization, centralization, and polycentric systems which have been observed in successful and unsuccessful cases, with certain governance “flavours” dominating at any one time.

2.7. Common pool resource theory

How does the previous discussion of institutions and the coordinating mechanisms of markets, collective action, and governance mesh with the complex social-ecological environment of common pool resources? Common pool resource theory, alternatively termed common property theory or the theory of the commons has evolved since Hardin’s (1968) “Tragedy of the Commons” to reflect the coordinating capacities of the individuals who rely on common pool resources. The theory argues that people can coordinate their actions to overcome common pool resource dilemmas and that private or state based property rights may not lead to a positive outcome. Nonetheless, success as a certain institutional outcome has as yet no clear theoretical direction.

The theory of common pool resources merges institutional theory and the collective challenges of common pool resources. Schlager (2007) outlines the “critical role” of institutions in commons theory: “First, institutions provide the structure within which individuals interact and the incentives that individuals have in making choices about actions. Second, when individuals attempt to achieve better outcomes, they turn to collective-choice and/or constitutional choice institutions to change operational-level institutions” (Schlager 2007, p. 308-09). At the more macro-level, the theory of common pool resources challenges the property rights school contention that the commons, and/or common pool resources are bound for ruin in the absence of private or state property rights. The institutional focus, however, probes further into the structure of institutions and the relationship between norms, rules and strategies and outcomes of individual and group action within a common pool situation.

The IAD framework was developed to reflect this structure, but as Schlager (2007) notes: “the IAD framework ... and theory of common pool resources fail to provide any guideposts to direct the analyst to particular rules and not to others” (p. 309). The challenge in translating this institutional information to the policy level is the complexity of rule systems and their uncertain applicability to either largely or subtly different situations: social-ecological context and the relational dependence of rule configurations stymies predictive capacity.

Empirical scholars such as Wade (Wade 1988), Ostrom (1990), McKean (1992), and Baland and Platteau (1996) have found that once established there are features or ‘design principles’ reflecting robust, enduring common pool resource management regimes. The most often quoted set of indicators are Ostrom’s (1990) design principles: clearly defined boundaries

defining who has access and withdrawal rights; congruence in assignment of benefits and alignment of rules with scale of resource problem; collective-choice arrangements that allow users to participate; monitoring of compliance and accountability of monitoring systems; graduated sanctions that penalize rule transgressions based on their severity and recurrence; conflict-resolution mechanisms that solve disputes in a speedy, low cost manner; state-recognition of user's right to organize and create locally relevant institutions; and for larger systems a nested system of appropriation, provision, conflict resolution and governance (Ostrom 1990, 1999). Agrawal (2002) synthesizes various sets of indicators into four interrelated categories: resource system characteristics; group characteristics; institutional characteristics; and the external environment. Design principles as indicators of success tend to suggest that these can be translated into policy design tools, but far more contextual variation is present within any system to allow for such use. Certainly the presence of these conditions can indicate the greater likelihood of a more enduring common property system, but that institutional pattern cannot be applied to any dysfunctional common pool system with any certainty of success.

These sets of design principles or indicators are not without critics, however. Authors such as Singleton and Taylor (1992), McCay and Jentoft (1998), Steins and Edwards (1999), Steins, Rolling and Edwards (2000), McCay (2002), and Agrawal (2002) note that many research efforts focus on small, homogeneous examples that do not reflect the heterogeneous nature of common pool resources, the scale of some common pool resources, and the larger collective effort required. They consider the neo-institutional approach of many common pool resource management studies to be limiting. The studies do not consider broader, external contextual factors related to various social, economic and ecological conditions. Others comment on the

danger of design principles being used inappropriately as design templates (something Ostrom has always cautioned against). Finally, Agrawal (2002) notes two features of studies in common pool resource management that he finds troubling: (1) they are “relatively negligent in examining how aspects of the resource system ... the external social, physical and institutional environments, affect institutional durability and long-term management at the local level;” and (2) they do not systematically examine the relative importance and causal relationships between the many design principles identified in case study research.

These studies and common pool resource theory in general look at common property regimes as the function of collective action in common pool resource situations. Stevenson (1991) and Baland and Platteau (1996) argue that common property regimes may not lead to the more efficient use of resources and finding the optimal or an improved solution must be identified and chosen on a case-by-case basis. While there are examples of long-enduring collective action within common property regimes, there are also examples of failures (for example see Ostrom 1990; Acheson 2000; Walker and Hurley 2004; Blaikie 2006). In today’s context of resource commodification, market access, population growth and increasing pressure on resources, many communities of appropriators and providers are less able to maintain existing systems or forge new ones. The state has for better or worse taken a significant role in resource management and related community economic development at various scales. This does not preclude the necessity of collective action, but more commonly it introduces the state government as a necessary actor in collective action efforts. Thus, a specific common pool resource theory need not lead to common property solutions, but to the solution that best suits the particular resource and its contextual environment. Common pool theory as it currently aligns with

common property theory fails to recognize the potential efficacy of various other institutional regimes, or its potential failing for that matter.

2.8. Summary and conclusions

The purpose of Chapter 2 was to introduce the concept and theories of institutions as they relate to the coordination of natural resources, in particular common pool resources. These humanly devised institutions define what we may, must or must not do in any particular situation, and evolve informally through custom and changing norms of habit, or more directed through formal government or community collective-decision making. Institutions emerge to coordinate the way in we interact to achieve our objectives within a social-ecological system.

Institutions coordinating our use of natural resources establish property relations and include the property rights and rules we either formally or informally devise to achieve the coordination necessary to ensure appropriate use of the resources on which we depend. Complexities that confound the coordination challenge include resource types, such as the high cost of exclusion associated with common pool resources, their subtractability, other resource characteristics such as mobility and storage, individual incentives that impose costs on other users, and the challenge associated with getting people to cooperate within a group. To effectively manage a resource, collective action amongst participants is necessary. People need to get along. Free riders are ubiquitous however, thus some cohesive individual or coordinating mechanism must be present.

Government has a strategic role to play in many situations through its role in policy development and implementation, but government involvement is not a necessary or sufficient

condition to ensure the sustainable use of a common pool resource, in fact it can be a detriment. Government policy is a source of coordination among individuals and is used to define and enforce property rights, and to devise the rules that allow or restrict certain actions. Broader than the specific act of policy development and implementation is the governance structure that links multiple layers and levels of institutions, those who make institutions and the tools used to apply those institutions.

The institutional elements of property rights as they pertain to functioning markets, collective action, and government policy are three coordinating mechanisms in common pool resource management and can be used to distinguish sources of institutional failure, the subject of the next chapter.

Chapter 3. Institutional failure

3.1. Introduction

Chapter 2 introduced some of the institutional fundamentals outlining the way in which we benefit from natural resources. Institutions act as mechanisms coordinating individual and group interactions and include in a somewhat overlapping fashion market, collective action and government/policy institutions. These institutional components support the interaction of individuals as they pursue a set of objectives. Being sources of coordination, however, suggests they can also be sources of institutional failure. Chapter 3 examines institutional failure in terms of market, collective action and government/policy coordinating mechanisms. The intent in this chapter is to identify not only what comprises institutional failure, but also the sources of that failure. This literature review supports an underlying thesis or argument posed by this dissertation that to appropriately develop an intervention approach to a resource subject to degradation or underdevelopment, one must first know the problem and the sources of that problem.

While the chapter serves to introduce the varieties of institutional failure one could expect, its ultimate contribution to this dissertation is the development and presentation of the institutional failure model – the first of the three building blocks of the intervention framework. The IAD framework acts as a template to frame and organize the problem definition and identifiable sources of failure that comprise the institutional failure model. The action arena and associated interactions that form a common pool resource social-ecological system are subject to certain risks that may result in some level of degradation or under-investment. Resource, appropriator and institutional attributes then help to define the problem(s) and

identify its sources. These attributes will help to identify the sources of existing degradation, or what may be causing the common pool social-ecological system to move towards a degradation outcome, or continued under-achieved capacity and investment. Figure 1 shows these initial IAD framework based components of the institutional failure model; Figure 2 nearer the end of the chapter presents the developed model and its use of qualitative risk and probability in the identification of the outcome of resource exploitation.

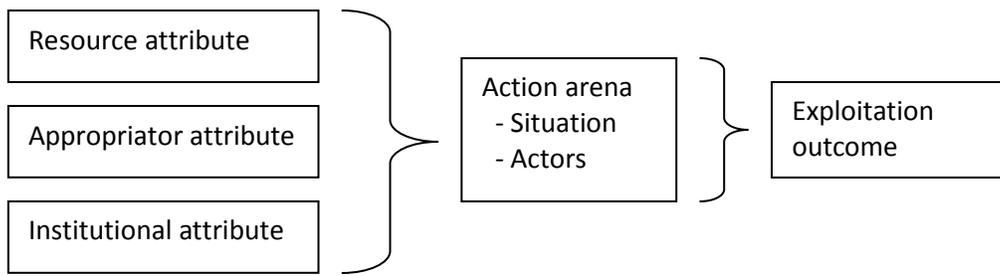


Figure 1: IAD framework components of the institutional failure model.

The discussion to follow takes the reader through various theories underlying institutional failure, focusing on market, collective action and government failures. The intent is not to go into substantial theoretical depth, but to draw out more explicitly the sources of failure and their characteristics. The discussion begins with market failures, followed by collective action and government/policy related institutional failure. This discussion identifies sources of risk that set the action situation on a general exploitation outcome path, while the contextual attributes either supports or minimizes that risk. The development and presentation of the institutional failure model is intended to assist policy analysts clarify the problem and its sources, and if a problem is identified to structure an argument and rationale for intervention.

3.2. Market failure

Chapter 2 established the market as one coordinating mechanism guiding the choices we make. In markets, prices guide how and when we make exchanges and they create the signals necessary to make informed choices about when to transact. The result is a coincidence of social and private net benefits that, theoretically, produce the optimal outcome for society. However, there are necessary conditions to achieve this socially optimal outcome. For the price signal to guide us appropriately markets need to reflect a variety of qualities, such as perfect competition, accurate and fully available information, complete markets, and effective fully prescribed property rights. These conditions tend not to exist outside of textbooks and the full costs of our actions are often ill-reflected in prices, resulting in externalities, for example associated with truncated property rights, imperfect information and incomplete markets that lead to market failure. Swanson (1996) considers a market failure to be “the failure of the economic system to solve its own problems” (p. 11). Thus the market fails to coordinate our actions as well as we would hope, potentially leading to institutional failure.

This section describes the concepts and theory behind market failures as they pertain to the use of natural resources. The market failure discussion provides two perspectives. First, the section describes the outcome of market failures thereby defining the problem(s) we are trying to overcome – resource degradation and/or under-investment. Second, market failures themselves are a source of common pool resource degradation. The discussion to follow focuses on the two institutional features identified in Chapter 2: market failures associated with a lack of property rights and common pool related externalities. The challenge as will be discussed is the quantification of these features and how the social nature of human interaction

influences the outcome of market transactions. The discussion will shed some light on the need to consider other features of social-ecological systems that can help identify the sources of institutional failure in a non-quantitative manner.

3.2.1. Property rights and common pool resources

In Chapter 2 we learned that property rights provide the right to a flow of benefits over time and are a social construct coordinating resource users vis-à-vis a particular resource or good. They range from private property rights, to state and common property rights. The property rights typology also includes open access describing a situation where no property rights have been assigned. Pure open access examples include the open ocean or the atmosphere; *de facto* examples include a forest where state rights are not enforced. Under open access anyone may capture the resource's flow of benefits, thereby creating a particular set of individual incentives. Chapter 2 also introduced the concept of a limited-user open access environment, for example a local stream that is used at will by a select group of local farmers, but who have devised no rules to restrict rates of appropriation.

The ability to assign property rights to a particular resource depends to a great deal on the type of good being assigned. Chapter 2 also introduced resource types from private goods, to common pool resources and public goods. While private goods are amenable to property rights, common pool resources and public goods are much less so, as a result of the inability to exclude beneficiaries, or in the case of a common pool resource the high cost of that exclusion. This high cost exclusion can preclude the assignment of property rights, thus creating an environment of open access to the common pool resource. A common pool resource adds an additional element to the resource management question through its private good like characteristic of

being subtractable, or rivalrous in supply. As discussed in Chapter 2, a subtractable resource is subject to scarcity, consequently is depletable.

3.2.2. Resource appropriation and open access

The lack of effective property rights creating a situation of open access leaves individual appropriators and providers with a sense of insecurity that drives their incentive to harvest at a potentially unsustainable rate and to avoid investing in the resource system. The implications of a resource under open access has been documented by numerous authors (for example Gordon 1954; Clark 1973; Stevenson 1991). One of the more influential economic articles describing the consequences of open access resources is Gordon's 1954 paper examining an open access fishery. Gordon argued that with no effective property rights each fisher has the rational incentive to use additional effort to gain an additional unit of fish. The pattern of competition and the interaction among fishers leads to a free-for-all where additional extraction capacity is used to capture ever more of the resource, but at an increasing cost. If value and demand are sufficiently high and resource scarcity exists, users will eventually overexploit the resource and dissipate all available profit (rent). The overexploitation of the resource flow erodes the resource stock eventually leading to its collapse if access is not controlled and restrictions on use are not forthcoming. This situation reflects both a pure open access situation and a limited-user open access situation. In either case, individuals have the incentive to increase their effort beyond the rent maximizing point.

Appropriators of a resource within open access also place little value on the future availability of the resource, reflecting the user's high discount rate, meaning the user places a higher value on consuming or harvesting a good today rather than waiting for tomorrow. Indeed, in the case of

open access where someone else may take what you leave behind, tomorrow's value may be zero. The social and private discount rates diverge drastically, thus violating a condition for socially optimal resource allocation. The situation of open access is the classic "Tragedy of the Commons" thesis at work (Hardin, 1968) and assumes that an individual user has a short-term perspective and no incentive to consider the welfare of the group or to collaborate for a more socially efficient outcome.

Rent and its dissipation is an important concept for economists who are looking at the potential degradation of a resource. In its simplest form, rent is the excess profit available after accounting for revenue and costs of production, including a normal level of profit for entrepreneurial ability, use of capital etc. The existence of excess profits at a given level of effort attracts additional effort in the form of new entrants or the increased effort of existing participants (Stevenson 1991). The objective under the model of economic efficiency is to operate at a level where rents are maximized, which is the point at which society benefits most from the use of a resource. However, maximizing rent does not mean maximizing the volume of a resource harvested, such as at its maximum annual output. What is relevant for economists is that the harvest level at the point of maximum rent can be sustained over time given the ability of the resource stock to continue producing a harvestable flow.

A private landowner or holder of private rights to a resource, it is argued, will exploit a resource at a level where rent is maximized. However, with no restrictions on access to a resource, in other words no enforced and effective property rights, new entrants or additional effort can be added that will move the level of use away from that optimal rent maximizing point, eventually to a point at which rents no longer exist, no longer captured by more advantaged users but

dissipated by excess capacity. Because the resource supply is finite the rate of extraction begins to erode the stock or the natural capital. Extraction rates approach the resource's carrying capacity and the stock begins to lose the ability to replenish itself (Swanson, 1996). As the resource sector moves away from the point of optimal rent, the profit to the appropriator also declines per unit of effort. This reduction reflects a situation where capital and labour are being used inefficiently, as increasingly more effort incurs higher costs to chase increasingly less of the resource. The dissipation of rent does not necessarily mean that the resource is or will be degraded, thus the problem at hand may be one of economic efficiency and not both efficiency and ecological degradation. The relevant question may be when it is most expedient to intervene in a resource market and what level of information is necessary to understand that point of intervention.

Calculating the level of rent being dissipated and whether or not the use of a resource is nearing a capacity constraint would require data about the resource stock and its flow, the production costs of its participants and information on current and expected future values. Gathering this level of detail is unlikely in most common pool resource situations, but there are other indicators that help to distinguish between rent dissipation and capture. Hegan et al (2003) discuss two conditions that may restrict the number of users and preclude complete rent dissipation and a tragedy of the commons outcome: institutional constraints on use, and heterogeneity of costs among users. Hegan et al (2003) state that for natural resources "open access is a necessary condition for the total rent dissipation outcome..." (p. 181). Consequently, institutional arrangements, whether formal or informal, that limit entry may avert inefficient labour effort and full rent dissipation. Cost heterogeneities suggest that some users may have production advantages over others, such as lower travel costs, technologies or resource

knowledge that would provide opportunity for rent capture, not dissipation through inefficient labour effort. Hegan et al (2003) studied fuelwood rents in Zimbabwe and found that in some villages the existence of social norms and values in addition to heterogeneous costs among households meant that complete rent dissipation was not occurring, subsequently the 'Tragedy of the Commons' was unlikely. The institutional failure model presented at the end of the chapter recognizes these data limitations and follows this more surrogate method of evaluating whether or not rent dissipation is occurring.

Is the outcome of open access to a resource inevitable such that resource degradation will necessarily occur? Gordon (1954) concludes that open access "natural resources are free goods for the individual and scarce goods for society. Under unregulated private exploitation, they can yield no rent; that can be accomplished only by methods which make them private property or public (government) property, in either case subject to a unified directing power." Are all resources found within open access in need of a 'unified directing power'? Pearse (1993) states: "... when a resource is abundant relative to the demands on it, so that its value is low, the system of user's rights will remain crude, and appropriately so. But as resource values rise, raising as well the potential gain from improved allocation arrangements, more sophisticated systems of property rights can be expected to emerge" (p. 82). However, the emergence of property rights, as property rights theory suggests, is confounded by the common pool nature of the resource: the high cost of exclusion may preclude establishing even appropriate access restrictions and a regime to overcome the appropriation externality.

The level of excludability, which can vary, is a limiting factor to effective policy development.

Common pool resources range in character and values, and are subject to varying intensities of

use indicating that some may be at greater risk to overuse and rent dissipation than others. Common pool resources in a high risk situation would be found within an open access environment with little or no user derived rules, and will have high or increasing values that attract additional extraction effort. The institutional failure of interest is the condition of open access and the incentives it creates among users and non-users with an interest in entering the market. Why efforts to restrict access may not succeed or be forthcoming is the subject of the collective action and government/policy sections of this chapter.

3.2.3. Common pool resources

The common pool characteristic of high cost exclusion, similar to a public good, challenges efforts to divide the resource and establish effective property rights, thus leading to a disincentive for individuals to invest in resource maintenance and supply. A public good externality occurs because there is no incentive for a private market participant to invest in a public good. The externality reflects the inability to exclude others from enjoying the benefits of that investment, and an inability of the investor to charge a fee in an attempt to recoup their costs. Any resource within an open access environment could be subject to degradation, but some tend to be more amenable to management efforts through the assignment of property rights than others. Common pool resources are a heterogeneous collection of resource found within most if not all ecosystem types. Not all share the same commercial or subsistence values or are subject to similar levels of use; consequently, not all share the same exclusion related costs. Common to common pool resources, however, is the persistence of free riders who enjoy the benefits of another's investment without contributing.

Ostrom (1990) and Ostrom, Gardner and Walker (1994) refer to the situation of a common pool resource under open access as an appropriation externality. An appropriation externality is related to the subtractable and finite characteristics of a common pool resource. In this situation, the harvest of one unit of a good means there is one less unit available for someone else to harvest, consequently lowering the average return to all appropriators. Thus appropriators seek to capture additional units before someone else captures a portion of the resource and lowers the number of units available. These 'reciprocal externalities' impose costs on all parties operating within the resource system (Stevenson, 1991).

Ostrom, Gardner and Walker (1994) refer to the lack of investment in a common pool resource as provision problems. Provision problems focus on the incentives of appropriators or resource stewards to invest in the resource either through demand or supply side investment. Demand side provision involves actions to change extraction levels or methods, thus lowering potential short-term gains from the resource in support of the longer-term supply. For example, harvesters of wild mushrooms often leave older less valuable mushrooms behind to ensure mushroom spores spread and maintain future crops. Free riders would harvest those older mushrooms. Supply side investments include provision for the maintenance and enhancement of the resource (Ostrom, Gardner and Walker, 1994). For example, salal habitat and growth can be enhanced by thinning of timber stands and fertilization. However, not all appropriators and providers share this stewardship ethic, preferring to free ride on the efforts of others. Some individuals will avoid providing for the resource displaying actions associated with a high personal discount rate consistent with an open access environment. Provision problems occur as a result of a common pool resource's problematic exclusion. Few appropriators or land owners are interested in investing time, labour and capital in a resource when they cannot be

guaranteed a full, or at least a profitable return on their investment. As a result, common pool resources are often under-provided indicating a market failure and a rationale for government intervention.

Consistent with the previous section's discussion on open access, Ostrom, Gardner and Walker (1994) point out that not all common pool resources are subject to appropriation or provision problems. They define a common pool resource situation as one where appropriators may be accessing the resource, but use levels and resource abundance suggest that externalities are not present and suboptimal outcomes (resource degradation and under-investment) are not occurring. However, appropriators following individually rational strategies and not acting collectively to maintain the resource system contribute to the potential congestion and overexploitation of the resource. A common pool resource dilemma eventually arises for the individual: to continue pursuing individual strategies with short-term benefits but longer term costs, or to follow an alternative collective strategy reducing short-term gains but avoiding longer-term resource degradation. Two conditions define a common pool resource dilemma: "(1) suboptimal outcomes and (2) institutionally feasible alternatives" (Ostrom, Gardner and Walker 1994, p. 15). If both conditions are not met, a common pool resource dilemma does not exist. Either the resource situation is not leading to a sub-optimal resource degrading outcome, or no alternative action is feasible. A situation where only the latter prevails would suggest a rather 'tragic' outcome and government failure to act when needed.

Contributing to the challenge of coordinating the use of a common pool resource and introducing additional sources of risk are the characteristics of stationary and storage. A stationary resource, as the word suggests, indicates that it remains geographically in place, such

as a forest, while a non-stationary or mobile resource ranges over a small or large geographic area, such as migrating fish or wildlife. Storage refers to the ability to store or save some of that mobile resource making it available in times of shortage. For example, when drier weather reduces the flow of water, stored water can be accessed from a natural aquifer or constructed reservoir. Fish, for example, can be harvested *en masse* as a result of the storage capacity on ships. Schlager et al (1994) contend that storage and mobility characteristics “affect (1) the severity of the appropriation and provision problems resource users face, (2) the relative ease with which users can resolve those problems, and (3) the kinds of institutional arrangements they are likely to develop and implement” (p. 296-97). Mobile resources also add to the difficulty in collecting accurate information and increase the level of uncertainty associated with resource stock inventories and annual flows. The ability to store a resource may create the incentive to hoard, exacerbating appropriation externalities associated with open access.

Mobile resources may add an additional set of collective action dilemmas if the resource moves across jurisdictional boundaries, subsequently requiring an added layer of coordination between states. Brown (2000, p. 877) refers to these as “jurisdictional externalities” that hinder the creation of markets or coordination agreements. Brown provides examples of the Danube River, which passes through ten different state jurisdictions, and migratory waterfowl that breed in Canada and winter in the United States. Throughout the path of a mobile resource, some volume or flow may be stored or used by appropriators at various locations, subject to the particular institutional conditions present in that jurisdiction. Each local area may value the resource differently and may not incorporate the values of the next jurisdiction in its decision making. The added layer shifts the resource dilemma from the resource sector into the multi-jurisdictional politics, polity and policy sectors of resource governance.

When are use rates problematic; when does a common pool resource situation turn into a dilemma and how can we identify that point? Randall's (1983) typology introduced in Chapter 2 is useful in categorizing and differentiating these resource types, the effects of increasing demand, and need for intervention. He classifies the level of exclusivity by a good's nonrival, congestible, or rival nature, thereby re-naming common pool resources as non-exclusive rival goods. Randall's (1983) concept of congestion is useful in understanding the point or level of demand at which some form of organization or management may be necessary. A congested resource is one subject to increasing use that "becomes intense as the number of users approaches the capacity constraint" (Randall, 1983). Stevenson (1991) concurs noting that in "the range of use that is of economic concern ... the resource is scarce and competition between users occurs" (p. 9). However, as with rent dissipation, knowing when appropriation levels reach a resource's capacity constraint is problematic and in any case may be beyond a point of feasible improvement. Having a common pool resource under open access or limited-user open access creates the initial condition for resource degradation, and highlights the presence of risk within the social-ecological system.

3.2.4. Market and common pool failure summary

The discussion of market failure introduced the implications of ineffective property rights and open access to common pool resources, and natural resources in general. The lack of coordination creates incentives among individual appropriators to increase their level of effort as a result of their expectation that others will also enter to exploit the resource. Increased effort and a lack of resource provision ensures, it is argued, a march towards resource degradation, actions that exceed the resource's capacity, and rent dissipation. Measuring these

outcomes is challenging however. Indicators that can reveal the risk of this type of individual oriented action include high or increasing resource values, high excess profits revealed through a high rate of entry to the sector, and actions such as broader ecosystem destruction indicative of an individual's high discount rate and a short-term perspective. Other indicators were found to include the cost of exclusion and the lack of information necessary to understand resource scarcity. Indicators suggesting that rent dissipation and resource degradation would not result from resource exploitation include institutional constraints on use, such as common property rights and rules among local users, and heterogeneity of costs reflecting various individual cost advantages resulting in rent capture, not its dissipation.

The section on common pool resources introduced other indicators that can enhance the assessment of risk facing a particular common pool resource social-ecological system. Unlike a private good, common pool resources are not easily divisible and amenable to private property rights. This characteristic leads to a higher potential for the resource to be found within an open access environment, whether on state land, private land or the commons, thereby creating the conditions for a higher incidence of free riding. Like a private good, a common pool resource is subtractable, therefore subject to scarcity and potential depletion. The combination of these characteristics suggests a need to invest in or provide for the common pool resource, but this provision is precluded by the high costs of developing and maintaining rules restricting access. Free riders reflect a failure of individuals to collaborate to provide for the resource. This lack of collective action is the subject of the next section.

3.3. Collective action failure

If externalities exist and lead to harm over the longer-term, why do individuals and groups, whether local or national, political or a-political not act to overcome them? Why do markets not form to reflect society's expanding values in the environment? Adding to the risk of appropriators pursuing individually rational actions is the inability of groups of individuals to act collectively to overcome common pool resource dilemmas. This section focuses on some of the reasons for this lack of coordination, including the underlying rationale for the logic of collective action, various group characteristics and transaction costs. Elements from this discussion will form risk factors included in the institutional failure model.

Chapter 2 introduced the concepts and theory underlying collective action. Collective action is the ability of group members to forego individually rational choices and make decisions that benefit or support the group (Sandler 1992). Collective action occurs across many facets of our daily lives: we rely on government to enact laws that we collectively agree to follow (with agreed upon penalties for transgressions), we follow rules within our own households, and we follow the duty to respect other's property rights. These actions all involve our ability to act collectively, whether that action is directed by a collectively elected government, by other laws governing our society, or more informal norms and customs of action.

Why is collective action an important concept to consider for common pool resources? Non-exclusiveness, the inability or significant challenge associated with excluding non-contributors is a feature of public and common pool goods, subsequently compromising the ability to limit access through private property rights or state property rights. Property rights do not alter the common pool characteristic of high cost exclusivity (Ostrom 2003). Collective action thus

becomes necessary for the provision of a common pool good, whether among users within a pure or *de facto* open access resource system, between trespassers and a private forest landowner, between the state and local users, or among nation states. In Ostrom's (2003) study of common pool resources, she argues that "all collective action problems share the problem that excluding non-contributors to a collective benefit is non-trivial" (p. 241). If any semblance of collective action is missing among joint users, if free riders overwhelm collaborative efforts, or if outsiders infringe on the operations of local appropriators the risk of collective action failure and resource degradation increases.

An obvious starting point to bound an enquiry into sources of collective action failure is Olson's (1965) 'Logic of Collective Action.' His was not a statement regarding the emergence of collective action within groups, but an argument about the disjuncture between individual and collective rationality in the provision of public goods. Sandler (1992) considers collective action failures to be a type of market failure through public good externalities, and includes public goods, common pool goods and club goods that share either the non-excludable or non-rival nature of public goods. In public good and common pool situations, collective action among resource appropriators/providers is necessary to overcome the inability to divide the resource (i.e., its non-excludability) and to lower transaction costs. While we concern ourselves about the lack of public goods provision, common pool situations are most acute given not only their exclusivity issues similar to a public good, but also their subtractable nature where a failure to coordinate use could lead to depletion of the particular common pool resource.

Olson (1965) argued that only under certain conditions would collective action emerge, or perhaps stated more accurately, when individuals would not be able to act collectively, thereby

refuting the contention that individual rationality would inevitably lead to socially desirable outcomes. Sandler (1992) summarizes the central themes of Olson's thesis, thus sources of collective failure. First, "Group size is, in part, a root cause of collective failures;" second, "Group asymmetry, in terms of individual's tastes and/or endowments, is related to collective failures;" and, third, "Collective failures may be overcome through selective incentives (giving private benefit inducements) and institutional design." Subsequent research has probed deeper into these group characteristics, but its support of Olson's thesis is inconclusive.

The study of collective action since Olson's (1965) article has followed two research paths: (1) theoretical modeling using game theory; and (2) empirical case-study based theory development. Under the former, the process and outcome of collective action failure (and success) has been modeled using the prisoner's dilemma and a variety of other theoretical game modeling approaches (see Sandler 1992; Ostrom et al 1994). For example, games are modeled using two or more participants, with or without communication among the participants, a one-time versus multiple rounds of a game, the use of sanctions among many other institutional dimensions. Game theory has been used widely to look at cooperation among individual users of a common pool resource to determine under which game structures and incentives (institutions) a participant will make an individually or collectively rational choice (Runge 1984; Ostrom et al. 1994; Baland and Platteau 1996). The results of these cooperation simulations indicate that sub-optimal outcomes will normally result, but depending on the rules, ability to communicate, the benefits of cooperation, and ability to learn through repeated interactions the participants can coordinate their actions and overcome individual strategies that would otherwise lead to the worst of possible outcomes.

Empirical assessments of common pool resource management examine why groups, large or small, with diverse or similar members, do or do not act in the collective interest. Elements of successful collective action in common pool governance include “trust, social capital, common preferences, shared knowledge, collaborative experiences, focusing events and expectations of future interactions” (Heinmiller 2009). The following discussion tries to elicit from that body of research why individuals may not choose to act collectively to overcome common pool dilemmas, or why existing collective action may fail to maintain. It divides the source of collective action failures into three categories: (1) group characteristics, such as group size, heterogeneity, community and social capital; (2) exogenous influences, such as market influences, changing technology, demographic changes, and government intervention; and (3) transaction costs and coordination benefits.

3.3.1. Group and individual characteristics

Empirical research into collective action within common pool resource systems has looked at Olson’s group size and heterogeneity issues, but has also sought clarity on sources of collective action such as group cohesion through community and the building of social capital and trust. In all cases, however, results suggest that success is influenced by a combination of group and resource characteristics. This section will discuss five group and individual related characteristics of collective action and its failure: group size, heterogeneity, community, social capital and trust, and communication.

Olson (1965) identified larger groups as being more prone to group latency. Larger groups are thought to reduce the likelihood of interaction among individuals, provide more opportunity to ‘cheat’ the system, and lessen any incentive to contribute (Poteete and Ostrom 2004). Baland

and Platteau (1996) found that characteristics associated with smaller group size such as personal relationships among members, the frequency of interaction, and the flow of information leads to more long-term thinking and personal responsibility. However, they also note that small group related rivalries and antagonisms may also affect communities and that having a larger group would disperse the influence of that negative interaction. Varughese (1999) found a minor negative relationship between group size and collective action in his study of forestry management in Nepal.

What makes a group large and subject to latency? Each resource system may have its own size threshold of when it overwhelms successful and enduring collective action. Araral (2009) studied irrigation systems in the Philippines and found that, consistent with Olson's thesis, larger groups were associated with lower levels of collective action – a consistent conclusion among irrigation studies. Araral's study looked at farmer irrigation groups that averaged 181 members. Ostrom (1990) provides examples of enduring commons systems with groups from 10s to 1000s. Olson (1965) considered a large or latent group to be as small as necessary to the point at which the benefits of collective action are less than what would be desired by an individual participant, thus rendering the group latent. Consequently, group latency is less a function of an absolute measure of group's size, than the way in which benefits are distributed within the group.

The distribution of both benefits and costs support or hinder collective action, but the latency of larger groups also result from the combination of other contributing factors. Libecap (1994) argues that "the debate over distribution and likelihood of collective action are influenced by (a) the size of the aggregate expected gains, (b) the number and heterogeneity of the bargaining

parties and (c) information problems” (p. 567). Uneven power among individuals and initial wealth differences create expectations of uneven sharing of benefits. If the flow of benefits is large enough however, even small gains will encourage collective agreement. Information concerns the perception of gains from collective action, knowing that benefits are available, and understanding where or to whom those gains will flow. Benefits also appear in the form of lowering costs which can be a function of group size. For example individual costs associated with developing a monitoring system would be lower for a larger group, with more individuals sharing the total cost, than a smaller group in a similar resource situation (Baland and Platteau, 1996). In this case the size of the resource system relative to the user group influences the outcome. Poteete and Ostrom (2004) cite examples from Agrawal (2000; Agrawal and Goyal 2001) who found that paying for guards to assist in monitoring forests in Kumaon Hills, India, was more likely for medium sized villages of about 75 households, than for smaller or larger groups. However, Sandler (1992) notes “there is no simple relationship between being privileged and group size” (p. 48). As group size increases so do transaction costs challenging the ability of individuals to coordinate. Free riding may increase with larger groups, certainly in some difficult to monitor resource systems, and may contribute to the erosion of collective action efforts if they do exist.

The role of heterogeneity in collective action, as with group size, is also uncertain and prone to contextual influences. The literature suggests that heterogeneity may have a positive, negative or neutral influence on collective action depending on the resource, user community and institutional context. For example, Gibson and Koontz (1998) looked at two communities in southern Indiana, United States, which shared similar value sets, but had different collective action outcomes more closely associated with institutional attributes than similarities associated

with resource characteristics and community norms. One community had a stable membership and frequent contact, while the other less successful community had a much greater turn-over in membership and poor member participation in meetings. They concluded that while homogeneous values are important, the “penetration of economic and political markets challenges the stability of the shared value system” (Gibson and Koontz, 1998, p. 643). Libecap (1994) found that “collective action is not apt to take place in a smooth or timely fashion when there are important heterogeneities among the bargaining parties” (p. 590). However, while he found that heterogeneity of capabilities, inequitable distribution of costs and benefits, information, and other related operating characteristics precluded the emergence of collective action in the cases observed, once the losses resulting from a lack of coordination increased and were shared more widely, the user community became more homogeneous in its expectations and level of information.

Olson’s group asymmetry concerns also lay with the presence of different endowments held by individuals. Other authors have also found that heterogeneity of wealth and the proximity to markets influences collective action. Araral (2009) used farm size as a measure of wealth and found that among Philippine farmers who use local irrigation systems, free riding on that system increased with farm size. This result supported the findings by Ternstrom (2003, as cited in Araral, 2009) who found that the richest users of a common pool resource were less likely to cooperate. Araral (2009) also found that free riding was more likely to occur the closer one was located to urban centres and access to alternative markets. It is evident that institutional and situational characteristics combine with Olson’s group size and heterogeneity characteristics to influence the outcome of group latency or intermediacy. Underlying any common pool resource social-ecological system are other group/community and resource conditions weighed by

individuals in their choice to act collectively – including community, social capital, trust, and information to support knowledge.

What are the characteristics of a community that may reduce the risk of collective action failure within an appropriator group? Does the social-ecological system in which appropriators and providers are situated lead to or detract from collective action? Singleton and Taylor (1992) argue that elements of 'community' provide the foundation for a group to act collectively. The authors define community as a "set of people (i) with some shared beliefs ..., (ii) with a more-or-less stable set of members, (iii) who expect to continue interacting with one another ..., and (iv) whose relations are direct ... and multiplex" (p. 315). These characteristics of a community combine to create a presence of mutual vulnerability or interdependence in the output of a resource system. Singleton and Taylor (1992) found that "Community is weakened or undermined ... by great economic and social differences amongst its members ... But modest amounts of inequality and heterogeneity are not impediments to an endogenous solution" (p. 316). Gibson and Koontz (1968) concluded that while homogeneous values are important, the "penetration of economic and political markets challenges the stability of the shared value system" (p. 643). Ostrom (1992) cautions that neither community nor the opposite – government intervention – are necessary or sufficient conditions for solutions to manage the commons. A local social-ecological system is embedded within resource, economic and political environments, as such both endogenous and exogenous factors may be the root cause of community dysfunction and regime failure, be it leading to the failure of the community to have the capacity to adapt, or by destroying the elements of community cohesion.

Endogenous community or situational factors include social capital and the building of trust among members and the level of information and knowledge circulating within and contributing to the community. Lauber et al (2008) examine social networks in successful cases of community based natural resource management. They found that intra-group interactions and inter-group interactions were critical in providing the following functions: “exchanging ideas, disseminating knowledge, providing funds, providing other tangible resources; and exerting influence” (Lauber et al. 2008, p. 682). However, Gibson and Koontz (1998) found that ‘community’ based norms may be insufficient to maintain the objectives of members and that formal legal prescriptions may be a necessary component to ensure the stability of community values. Others have also found weaknesses in community based resource management (see Blaikie, 2006; Campbell et al, 2001). As with other collective action characteristics, there appears to be a wide range in outcomes under various scenarios. It is likely, however that having community cohesion and social capital does not contribute to collective action failure; however, its absence may increase the risk of group latency.

For diverse resource systems part of the challenge facing individuals in collaborating to overcome a collective action dilemma is first knowing with whom to interact, and second having an information base from which to engage others (Meinzen-Dick et al. 2004). More dispersed individuals, larger resource systems, competitive access resulting from no or ineffective access rules, all act towards restricting the flow of information. Libecap (1994) notes that information is not only associated with the ability to interact, but also has links to power, which can be used to gain a greater share of benefits subsequently leading to reduced efforts to act collectively. Information asymmetries can be found in “resource values, in production costs, in output history and in organizational size, wealth and political experience” (Libecap, p. 568). In his look

at fisheries, Libecap (1994) found that a lack of information and uncertainty about the information available affects an individual's calculus of expected benefits from regulation, thereby having a negative influence on the desire to participate in collective action. Poor information flows, the inability or unwillingness to communicate among group members, and the level of dispersion among participants in a common pool resource social-ecological system will increase the risk of individuals being unable to coordinate their interactions. These influences are internal, or endogenous to the group of appropriators accessing the particular resource. Further pressure on the resource may come from outside the community and may have as much or more influence on information flows, trust and social cohesion.

3.3.2. Exogenous influences

Appropriator groups and communities may have success in devising methods to overcome local common pool resource dilemmas, but these internal achievements may be less robust when confronted by a more embedded, interconnected and dynamic social-ecological system.

Pressures related to increasing population levels from internal growth rates or migration, changing technology, changing market preferences influencing resource value and demand, and government intervention are exogenous factors beyond the control of local stakeholders. As Acheson (2006) summarizes, these influences can "result in growing competition for resources and can motivate people to disobey rules, invade areas of others, or increase their exploitative efforts to the detriment of the resource" (p. 128).

Population increases through migration can introduce both greater demand on local resources, and also new tastes, expectations and values. Baland and Platteau (1996) note that in-migration can introduce cultural heterogeneity with potentially negative influences on the evolution or

existence of collective action. An expanding population increases group size and introduces heterogeneities into the social-ecological system that would increase the risk of group latency. Swanson (1996) relates population growth to the capacity of a local or global scale resource system to adapt. He notes the problem of rapid population growth in regions such as Africa where there is little capacity to adjust institutional mechanisms to account for the changes. Mwangi's (2003) examination of Kenya's transformation from communal to private property illustrates the repercussions of a migrant population on traditional systems of land management, in this case through British colonization. Developed countries experience the effects of migrant populations as well. For example, in British Columbia berries are a traditional food of First Nations. Expanding and lucrative markets for wild berry products has resulted in non-local workers entering First Nation's traditional (but not exclusive) areas to harvest these berry crops. Non-local pickers have shown a lack of respect for the resource and disregard for the local population's needs. However, this may simply be the result of a lack of knowledge about First Nations use patterns and their dependence on the particular area. The institutional failure that occurs is the consequence of the poor exchange of information and the inability of the local population or higher level government to provide the appropriate rules to manage access and use rights.

Changing technology may alter the way in which a common pool resource is harvested, potentially increasing the rate of capture or leading to a redistribution or greater concentration of benefits. These changes in technology may evolve as a result of population change and the need to meet local demand, for example through advancements in farming productivity, such as the introduction of equipment and the use of fertilizers (Boserup 1965; Boserup 1981; as cited in Serra 1996). Unintended consequences of technological change were observed in, among

others, Nepal where government's technological investments and management in irrigation projects led to less cooperation among farmers (Lam 1996). Technological change can also enter the social-ecological system through in-migration, changes in demand from outside the community, or through the introduction of demand for other jointly produced resources found within the common pool system. Technology change can also render current institutions ineffective leading to institutional change, as witnessed in the introduction of foreign factory freezer trawlers in the offshore Atlantic Cod fishery and Canada's resulting adoption of a 200-mile offshore territorial limit (Finlayson and McCay 1998).

Markets provide opportunity to trade or sell one's labour output, but they can also introduce new opportunities that a community, government or private entity may seize without the consideration of existing institutional development and resource capacity. The level or rate of resource appropriation is a function of need generated by those who value and use the resource for sustenance, income, or some traditional ceremonial purpose. A recognized change in the value of that resource, or some jointly produced resource, could come from markets outside the community, raising the potential for additional income, poverty alleviation, or access to new sources of benefits. This market penetration could lead to overuse, increased congestion and the potential for resource degradation. In Nepal, for example, the government's need for foreign currency and agricultural conversion led to significant deforestation in parts of the country (Gautum et al. 2004).

Government intervention can also be a source of failure (Acheson, 2006), even when based on good intentions (Lam 1996). Frequently used examples from the common pool resource literature include government introduction of alternative tenure systems or private property

regimes as a means of development and creation of export goods. Lam's (1996) look at irrigation systems in Nepal show keen government investment and management in an effort to improve water access for local farmers. However, these government operated systems reduced the farmers' incentives to act collectively in its use, resulting in government run irrigation systems being more poorly run than farmer managed systems. Often these attempts at externally driven development are at the expense of local indigenous communities who adhere to traditional common property systems, but are unrecognized by government. Swanson (1996) comments in relation to governments' attempts at environmental maintenance that the "effect of their policies has been mainly to disrupt pre-existing common property arrangements, which in the past defined precise rules relating to access and use for all members of the community" (p. 104). Government and policy failure is discussed in greater detail in section 3.4.

3.3.3. Transaction costs and coordination benefits

Transaction costs

One of the reasons individuals do not come together to act collectively when faced with market and property rights imperfections is the presence of transaction costs (Swanson, 1996).

Transaction costs are the costs associated with acquiring information, cooperation and communication among a potentially high number of often unidentified users and resource managers, and the monitoring and enforcement of any rights, rules and responsibilities instituted *de facto* by a common property group or *de jure* by government (Bromley, 1991).

Transaction costs contribute significantly to the challenge in overcoming market failures from open access and common pool externalities. While some authors define transaction costs in more detail, for example Challen (2000) separates transaction costs into static and dynamic categories, the focus in this dissertation is on the information, coordination and enforcement

costs outlined by Bromley (1991). This section begins by situating common pool resources and the commons within the context of transaction costs, followed by examining the sources of those transaction costs and how they influence the outcomes of activities within an action situation.

Although considered a source of market failure, transaction costs are included in this collective action section given their significant influence over individual desires to coordinate activities. Ostrom (2003) notes that if “exclusion is costly, potential beneficiaries face a collective action problem” (p. 248). If there is a collective action problem, then transaction costs impede its resolution. Singleton and Taylor (1992) concur noting that a community will fail to overcome a collective action dilemma if it cannot overcome these costs. However, as has been argued, this evolution of rules is particularly challenging for common pool resources whose resource indivisibility and high exclusion costs often make private property solutions unworkable (Stevenson 1991; Baland and Platteau 1996). Baland and Platteau (2003) consider open access or unregulated common property as having “pervasive transaction costs” (p. 9).

Common pool dilemmas occur at multiple levels and these costs can inhibit progress at any level. While a resource problem may exist in one market, achieving collective action within that market requires overcoming first, second and third order dilemmas, each with associated transaction costs. Thus looking at transaction costs with a collective action and common pool resource lens expands the complexity and potential source of institutional failure. Group size, its heterogeneity and dispersion, resource temporal and spatial heterogeneity, proximity to markets, multiple values and external demand can contribute to the cost of gathering information, and getting appropriators to even begin discussions regarding management. Both

individuals and governments or coordinating agencies are faced with transaction costs, the former in its market transactions and efforts at self-governance, the latter in its efforts to introduce management and maintain existing regimes, and for both in the monitoring of resource use.

Information costs

In the introduction to the institutional failure chapter a set of market characteristics were listed that support economic efficiency. Perfect information was one of those characteristics. Price information was the signal touted as aligning the needs of those who demand things with those who supply things. While information is neither perfect nor equally shared, having quality, reliable and consistent information is still a critical element of natural resource management. We need information, whether a government trying to initiate institutional change and garner collaboration among individuals, or local appropriators trying to meet a market's demand and knowing what their competitors are doing, while trying to ensure that sufficient resources are available to meet longer term needs.

Ostrom (1999) argues that the evolution of self-governance systems among forest communities requires certain resource and user attributes that include information requirements, not only in terms of reliable indicators, but also from sharing a common perception of the resource's condition and a clear recognition of a problem if it exists. Appropriators need to know the effect their harvesting is having on the resource in order to confront first and second order dilemmas. They also want to know what benefits will emerge from any efforts, and how those benefits may be shared, or the threat of them not being shared. Poteete and Ostrom (2002) found that resource users need a clear sense of the potential for overuse and must believe that a low or no-

cost solution is available. The challenge facing many appropriators and providers is the lack of information such that decisions are either not made because a problem is not apparent, or the wrong decisions are made because of poor information or inadequate time to gather the necessary information to make good decisions. Common pool resources within an open access environment are likely to have significant information gaps, which are costly to fill.

Once a regime is in place, appropriators and any governing agency both need to know who is following the rules and who is not. For individuals to collaborate they need to know that other individuals will collaborate over time: the actions or perceived actions of others can influence participation. Information about actions within the social-ecological system necessarily supports this knowledge. Thus, information needs go far beyond the price signal within any market. Collective action failures occur when information is not available or when it is not collated to reveal actions of participants and the broader implications of the exploitation of the resource system.

Information costs, regardless of who is attempting to collect the information, are dependent on characteristics of the resource system. Sandler (1992) notes that transaction costs of collaboration will increase with group size and contribute to group latency. Ostrom (1990) concurs stating that the “larger the resource system and/or the number of appropriators, and the more unpredictable the flow of resource units and the market prices for these units, the more difficult and costly it is for anyone to obtain accurate information about the condition of the resource itself and the likely value of the flow of resource units under any set of rules” (p. 196). Both appropriators and providers (including government) require information for various purposes and at various levels of engagement. Having no or low quality data and whether it is

shared or not can contribute to institutional failure. The costs associated with information collection and dissemination is one source of information gaps that can be accentuated by an unwillingness of the appropriator community to share information.

Collaboration, compliance and expectations

Once convinced of the need to collaborate, the costs associated with meetings, coming to agreement, and ensuring that all or most members of the user community are participating detract from the longer term benefits of this association (Bromley, 1991). This second order commons dilemma has its own set of costs that if significant will limit the effort at collective action. As Rao (2003) states: “in many scenarios, economic agents cannot assess the cost differentials accruing to alternative economic arrangements’ *ex ante* costs [information, cooperation and bargaining], much less the *ex post* costs [monitoring and enforcement]” (p. 9). Within the collective action effort investments in time and other resources to meet, negotiate and come to some agreement may be negated by the lack of apparent benefits that may accrue from a management regime. Even with collaborative effort, ongoing monitoring and enforcement of the collective output is necessary to ensure that users follow designated rules and free riding is minimized. Who pays these costs has a bearing on the benefits that may accrue to the individual and government has a role in minimizing those costs.

Having success at coming together to meet does not necessarily indicate resolution of the problem; participants are faced with a decision making context that has opportunity costs. Collaboration may solve a second order collective action dilemma but achieving the objective of overcoming the first order dilemma and introducing some boundary and choice rules, for example, is faced with implementation costs and the opportunity costs of the management

regime, i.e., how much one may lose as a result of adopting rules. In addition, appropriators and providers may discount any projected benefits associated with a proposed regime, thereby skewing their internal cost-benefit interpretation. Oran Young (2002) argues that compliance with public good or common pool resource rules is based on the costs of compliance versus the benefits of non-compliance. Appropriators and providers will “routinely discount the costs of non-compliance by taking into account the probability that violations will go undetected and that sanctions will be modest even when they are detected” (Young 2002, p. 38-9). In other words, they will choose to free ride regardless of the costs of being caught transgressing the rules. Nonetheless, society does not consist of free riding transgressors, and as Young suggests, individuals and even utility maximizers do not necessarily seek out ways to justify non-compliance.

For some individuals maintaining the status quo may be more appealing than risking the capture of uncertain benefits from an uncertain future. The path dependent attitude of resource users reflects the increasing returns associated with maintaining the particular institution’s historical path, and that shifting that path introduces additional costs and uncertainty (Pierson 2000). Future expected costs add to current cost considerations of engaging in collective action to create rules and complying once in place. A lack of appropriator/provider communication with other market participants, and evidence of avoiding communication with government officials can indicate the community’s perception of high opportunity costs and compromised benefits of collective action. The recalcitrance of a user community to communicate and engage with government to overcome a common pool resource dilemma suggests a collective action failure – one in which government has a noted role.

In summary, Brown (2000) states: “Self governance of open access resources is attractive when it can be achieved with low costs of information, bargaining, monitoring and enforcement” (p. 901). Common pool resources, their physical characteristics of non-exclusiveness, mobility and storage issues, geographic and temporal heterogeneity add to the complexity and uncertainty associated with identifying and quantifying transactions and associated costs among interdependent actors. This suggests, similar to the discussion on rent dissipation, that quantifying transaction costs and incorporating them into a resource user’s or community’s management calculus is problematic. Other indicators that can assist in the understanding of transaction costs and their influence on collective action would include signs of imperfect and poor information, and a lack of user associations that would indicate the absence of collaborative effort. Before rushing to prop-up collective action however, Ostrom (2003) argues that the “first attribute that scholars should examine is whether excluding beneficiaries requires high or low costs” (p. 248).

Coordination benefits

Countering the influence of transaction costs in collective action or resource decision making is the lure of individual gain: the actual or perceived benefits associated with collaboration and resource management. Schofield (1985) and Ostrom (1990) note that benefits are part of an individual’s rationale for contributing to collective action. Schofield (1985) states that “[t]he difficulty of collective action depends not just on the size of the group but also on the ratio ... to costs and benefits” (p. 215). Thus the presence of benefits appropriable from a resource system can either encourage over-exploitation under conditions of open or limited-user open access, or can be the necessary lure for individuals to participate in collective action efforts if they foresee higher benefits as a result of collaboration with others. Ostrom (1990) concurs that actors will

not choose to follow or create new rules unless their expected benefits exceed their expected costs. How appropriators/providers interpret the difference between these benefits and costs will influence their choice.

The ability to recognize benefits, what benefits are included in an individual's concept of value, the timing of benefits and the distribution of benefits, perceived or actual, influence the way in which an individual maintains or supports an institution. Ostrom (1990) takes great care in discussing and explaining the importance of being able to account for the benefits associated with institutional choice. Introducing the element of a heterogeneous distribution of benefits, and/or costs increases the difficulty of achieving collective decisions, as some will vie for the status quo distribution, others will argue for a more equitable distribution, while others will attempt to increase their individual benefits regardless of the redistributive costs. This shift in benefit flows may have little to do with the longer term maintenance of a regime. The persistence of inequitable distributions "becomes the next round of negotiations" (Libecap 1994, p. 570). Collective action failure evolves from not only the absence of positive net benefits, but also their current and expected distribution if these benefits do exist. It is the distributional challenge that Libecap considers the most critical and contentious – a belief in collective action still revolves around which individual benefits most and how individual gain is affected.

Collective action and institutional failure appear in the form of a lack of communication and collaboration in the exploitation of a resource and ultimately in the degradation of the resource. Transaction costs are a source of that collective action failure by reducing or eliminating the desire of individuals to transact in order to preclude the demise of the resource system. Not

until the benefits of collaboration are clear, will individuals join in collective action. The benefits of collaboration can offset these costs if they exist and are clearly attainable. Often, however, government must enter the market to reduce transaction costs in an effort improve the net benefits of collective action. Yet the discussion indicates that various resource and user characteristics will increase the complexity of achieving collective efforts, thus it may be the interaction among various resource, user and institutional characteristics that dictates the ability of users to coordinate themselves, or for government to contribute to that collective effort.

3.3.4. Collective action failure summary

For common pool resources, collective action is necessary whether users need to coordinate themselves to achieve some social objective, or some external agent such as a local community government, regional agency or state government attempts to introduce institutional change. However, the likelihood of collective action is challenged by a variety of disincentives and barriers to communication among individuals. The literature tends to focus on sources of successful collective action and higher level indicators such as trust or communication. As a result, identifying sources of collective action failure, for example what undermines trust or precludes it from evolving, needs to be gleaned from those discussions of success. In the broadest sense, the risk of resource degradation is related to open access to the resource and the inability of individuals to coordinate their actions. However, this risk level is heightened or lessened by various characteristics related to individuals and groups, institutional and socio-economic factors, other events or changes from within and outside the community, and transaction costs.

The characteristics that influence collective action were shown to be group size, asymmetry or heterogeneity, ability to learn through repeated interactions within a group and among other groups, ability to communicate, trust, and social capital. When group size is increasing through endogenous population growth or exogenous migration, the risk for group latency can be expected to increase. Heterogeneity may also increase through population changes and the introduction of new ways of thinking, a migrant's different consideration of resource use and contribution to livelihoods. Social capital and community benefits of collective action are eroded through conflict and antagonisms among the larger community, which could have cultural, familial, or racial origins. Communication and information sharing is central to fostering collective action, but without some type of forum for sharing or other mechanism for individuals to meet, problems may remain unrecognized across a broad and diverse resource system. Transaction costs of information and coordination reduce the attractiveness of collaboration among individuals and establishing these forums for knowledge sharing.

Socio-economic characteristics include the distribution of endowments and wealth, and community stability in membership. Participating in collective action needs to provide some form of benefit. However, the ability to free ride and its persistence erodes collective action efforts, certainly when the net-benefits of non-compliance exceed the net-benefits of compliance. Thus the actions of others influences the choice set faced by those who may see the benefits of collective action, but who discount these benefits because of free riders. The benefits of not participating may also depend on opportunities that exist beyond the user community, for example the proximity to other market opportunities where demand may provide higher returns. Other influences include exogenous variables such as changing technology, changing markets, and government intervention. These exogenous variables may

be beyond the control of the local user community, even if they are engaged in local collective action.

Transaction costs and their relationship to the benefits of cooperation were noted to be a significant source of collective action failure. Transaction costs associated with information, coordination, and monitoring form one set of costs. Further costs, are associated with the implementation of any agreed to regime, and the opportunity costs of adopting the management regime and the potential loss of appropriable benefits. The riskiness for appropriators/providers may be too great to maintain any collective effort. Collective action is critical for the emergence of common pool resource management regimes. The various conditions leading to collective action failure preclude the opportunity to align extraction levels with the capacity of the resource, thus potentially contributing to resource degradation.

Government has a legitimate role in collective action by reducing transaction costs, providing information to private entities and monitoring resource use. Without broad collaborative effort individuals are challenged in their ability to gather information and improve their knowledge of the resource system and its use. Bromley (1991) argues that overcoming the challenges and costs faced by individuals in the acquisition of information is a policy question. However, government also faces challenges of gathering information, for example to identify and communicate with individual participants and to convince them that there is a need for collaborative efforts, to supply information regarding their actions, or to comply with new information rules. These information costs could be considered administrative, necessary for government to absorb in its efforts to coordinate resource use. Getting that collaboration from the user community, however, requires a clear understanding that a problem exists. When the

situation is not well understood and information not shared, an individual's actions will be based on the individual's information, not aggregated information at a sector or ecosystem level. The inability to overcome these information needs can result in institutional failure and resource degradation; the presence of high transaction costs will help perpetuate that trend (Swanson, 1996). Government's 'legitimate' role in common pool resource management, and any resource management, is based on the presence of market failure, but government involvement has its own failed outcomes.

3.4. Government failure

Chapter 2 introduced the concept of governance and the role of the state in the management of natural resources. Government has a critical role in modern governance of natural resources to equitably and efficiently create or affirm rules-of-the-game, allocate public resources, enforce property rights, and resolve conflicts among resource users. Thus government assumes a proportionally high level of responsibility and power interpreting society's objectives for resource management, or alternatively inserting its own parochial objectives into how people and resources are or should be managed. By being a central source of coordination, however, government can also be a source of coordination failure.

Government failure reflects an inability of elected officials or its agencies to formulate and implement policy.⁵ In terms of natural resources and the environment, Swanson (1996, p. 55) defines government failure "as the failure of the state to provide the institutions required for the management of a particular resource, consequentially resulting in its degradation."

⁵ Government failure here is not meant in the same vein as state failure, for example as in the collapse of Soviet style communism.

Government may or may not choose to act when needed, it may not recognize a problem, it may design inappropriate policies, fail to implement good (or bad) policies, and may lack the sophistication in policy design capacity necessary to match the complexity of the particular social and ecological scales. Wolf (1979) refers to these “inadequacies” of government as “nonmarket failures” (p. 107). While the existence of market failures and distributional inequities provide cause for government intervention through nonmarket legislative and administrative remedies, the implementation of these remedies may exacerbate market failures or may create internal inefficiencies that promote, rather than reduce the cost of governance (Wolf 1979). The provision of institutions flows through government’s policy efforts. Policy failure suggests that government in some way has attempted to act when needed, but its policy choice is ill-equipped or inappropriately designed to deal with the particular management issue.

The purpose of this section is to elaborate on government failures and their underlying sources. This section explores the concept of failure as government attempts to negotiate its way through complex market failures and social dilemmas in an effort to balance various competing values and avoid common pool resource degradation. The discussion to follow focuses on four elements of government related institutional failure: 1) policies that encourage degradation; 2) path dependence and policy change; 3) implementation failures and the principal-agent problem, and 4) policy scale mismatches.

3.4.1. Policies that encourage degradation

Olson (1965) suggested the need for selective incentives to encourage latent group cooperation. An external agent such as a government is one source of these selective incentives. Hardin (1968) shared the view of the state or government as a means to ensure cooperation.

Government struggles within a complex policy environment, faced by competing objectives, and a myriad of policy alternatives and tools at its disposal. Winston (2006) considers government failure as pervasive and a significant contributor to welfare loss, either through policies whose costs exceed benefits, or where benefits are present, but at a significantly higher cost than is necessary. While the existence of market and collective action failures suggest that government has a legitimate role in resource governance, it appears that getting the selective incentives right is at the heart of the resource management challenge. This section examines policy failure that reflects the choice of policy instrument and the influence of external pressures that lead to policy choice.

Governments play the delicate role (assuming their objective is to foster the common good) of trying to find a balance between economic efficiency and social equity as it attempts to increase the nation's wealth. Allocating and protecting property rights to natural resources are key roles in government's efforts, and are accomplished via the passing of statutory laws and regulations. But laws and regulations do not always achieve expectations and competing or contradicting policies are often present. Brown (2000) contends that "[g]overnments often pursue policies that create or intensify negative externalities incident on natural resources." Brown (2000) uses examples such as government subsidies that encourage overexploitation, inefficient allocation of rights, and various fiscal measures that result in unintended consequences. He cites examples of policies encouraging deforestation in South America including tax free agricultural income, subsidized land clearings for cattle ranchers, and public road construction. Closer to home, Brown notes the policies that evolved during settlement of the western U.S. and the use of water appropriation rights that encourage 'use it or lose' it incentives.

Swanson (1996) provides an example of the Brazilian government's provision of subsidies and policies that encouraged resettlement and the conversion of tropical forests to agricultural and pasture land. The Brazilian example shows government's attempt to increase the wealth of the nation, but at the longer term cost to not only Brazil's forest stock, but also to the broader atmospheric system. Andersson (2002) describes the challenge associated with encouraging forest management in Bolivia, in part due to competing subsidies and policies associated with converting and maintaining rural land in agricultural production, thus in direct opposition to the objectives of forest management policies. The examples show complementary policies that encourage degradation (the loss of forest ecosystem) or the conversion of one resource for another (forests for agriculture) in the case of Brazil, and competing policies that encourage one sector (agriculture) while attempting to reduce deforestation and encourage forest management in Bolivia. Policies can be used to effect sweeping changes to land use, but often with associated unintended consequences. These failures reflect attempts to balance resource management while using the resource as a tool for development. Laws, subsidies and competing policy objectives interact and conflict to overwhelm government's capacity, thus leading to governance failure.

Institutional failure is not restricted to government action; government inaction can also lead to inefficiencies. Swanson (1996) argues that fundamental causes of resource degradation are "human inattention and underinvestment" (p. 57). Two types of inaction are non-decisions and negative decisions. Non-decisions are when policy issues are ignored or not considered, and negative decisions are when policies are explicitly rejected (Howlett and Ramesh 2003). These negative or non-decisions lead to institutional failure *when* this inaction leads or contributes to socially negative outcomes. Negative decisions may involve policy development proceeding to

the legislative or decision making stage, only to have politicians or powerful stakeholders turn sentiment against the policy, either disputing the problem or advancing a more favourable option. Non-decisions occur “when the dominant values, ... the existing power relations among groups, and the instruments of force ... effectively prevent certain grievances from developing into full-fledged issues which call for decisions” (Bachrach and Baratz 1963, p. 641). For common pool resources, inattention and underinvestment often leads to *de facto* open access situations, thus the failure of government to act when needed leads to the presence of market failures and inefficiency in resource allocation. Recognizing the re-emergence of the problem restarts the policy process, again subject to potential negative or non-decisions.

The decision not to invest in or provide for the management of a common pool resource, in essence to leave it in an unmanaged open access state may be related to how local or global interests value a resource. Swanson (1996) argues that “[o]pen access regimes are better thought of as implicit determinations to not invest in the particular resources, with the object of converting to others that are perceived to be more productive” (p. 69). Values drive the incentives to exploit a resource, whether its demand comes from within or outside the community, region or country. Swanson (1996) discusses the trade in ivory and the near eradication of elephants on the African continent as an example of resource degradation resulting from value driven institutional failure and open access. Government failed in this instance to overcome its own short term objectives and failed to consider the costs associated with the degradation of other values.

But this failure is embedded within a more complex set of institutional pressures faced by these African countries. Swanson (1996) relates that in some African states, the introduction of

firearms and the undervaluation of the conservation value of elephants by local hunters/farmers and state governments contributed to the decline in the elephant's population. The externally driven demand and high return on ivory and the low perceived return on maintaining elephant populations drove the incentives of the hunters and the lack of attention from governments. In other African states, such as Zimbabwe, Swanson (1996) notes that investment in protecting the elephant and generating foreign exchange through tourism contributed to increasing herd populations. In both cases, degradation and conservation, the resource value was externally driven. International demand for ivory products originated from outside the region, and the pressure to stop the trade in endangered species evolved from the high value placed on the preservation of elephants by the global (mainly Western) community. Swanson (1996) concludes that "many policy failures are more properly seen as global failures than domestic ones" (p. 78), the African example illustrates the effects of market changes being introduced into jurisdictions whose wealth, governance capacity and institutional infrastructure is ill-equipped to deal with the consequences.

This section illustrated two types of policy failure: one where internally driven objectives lead to the development of policies that encouraged degradation, and the second where externally driven demand leads to short term incentives to degrade a resource. Initial inaction by government in the latter case was in contrast to the initiating government action in the first case. Complex markets with multiple resources and externally driven demand complicates the policy environment leading to inadequate responses, and at times inattention or a lack of commitment by government to act. Poverty, the drive for modernization and capitalization, and corruption, for example, can contribute to a government's under valuation of local and national resources. While the need for selective incentives is intended to alleviate the presence of

market failure, those incentives can either play a contributing role or form the central cause of the failure.

3.4.2. Historical path dependence and policy failure

Historical path dependence is one source of government inaction when a need for policy change emerges. Governments often find themselves in situations where the maintenance of policy is less disruptive and less costly than the adoption of more significant structural policy change.

Pierson (2000) defines political path dependence based on the economics concept of increasing returns,⁶ where historical contributions of the political process form an institutional structure that maintains existing beneficiaries and becomes increasingly more costly to alter. Increasing returns is a situation where incremental policy change provides positive feedback to the policy environment, leading to non-structural changes and higher political return resulting in policy “lock-in.” Pierson (1993) contends that “Lock-in effects are likely to be important when public policies encourage individuals to make significant investments that are not easily reversed, and when actors have strong incentives to coordinate their activities and to adopt prevailing or anticipated standards” (p. 610). Path dependence, therefore, can significantly influence the policy choice set facing governments, culminating in a too narrow set of options suited towards maintaining the status quo.

⁶ In economics increasing returns indicates a situation in which the return from increasing inputs is proportionally higher, thus doubling inputs results in more than double the level of outputs and value. This creates a positive feedback generating additional increases and reducing any incentive to change course, regardless of its potentially destructive outcome.

There are various factors at work in the previous example. Pierson (1993; 2000) references Arthur's (1994) path dependent factors associated with technology adoption to help define the source of lock-in effects:

- large set up or fixed costs – high initial costs can lead to increasing returns to further investment in maintaining the current regime;
- learning effects – if significant learning is present in the existing regime and would be required under a new regime, increasing returns would be associated with maintaining or minor changes to the existing policy framework.
- coordination effects – the benefits one individual accrues from a particular policy depends on the actions of others, thus as more individuals support and rely on the existing policy, the more others will follow.
- adaptive expectations – while associated with coordination effects, adaptive expectations imply that an inherent desire to be seen to succeed will influence ones expectations about the paths others will follow, subsequently fulfilling ones expectations.

Adapted from Pierson, 1993, p. 607; 2000, p. 254.

These path dependent factors align with several characteristics of common pool resources. Large set up of fixed costs reflect the high cost exclusive nature of common pool resources. High costs may include capital costs associated with the development of infrastructure or capacity, and they also reflect the information, coordination and enforcement transaction costs associated with introducing a management regime, and any costs related to the disruption of linked policy objectives. To lower the cost of institutional change, policy choices may be directed at lower cost options that align with the status quo, justified for example through a least-cost evaluative model. Learning effects may have a similar influence on policy choice. The need for learning, information and knowledge development may have significant costs (pecuniary, time or effort related), potentially detracting from the gains associated with diverging from the status quo. Coordination effects align with collective action outcomes in

which trust and social capital evolve in part from the knowledge that other members of the user community will invest in the common pool resource. The problem that faces many common pool resource situations is defection of members to free rider status, eroding the policy change and returning the system back to its previous state. Arthur's four factors, as Pierson (1993) considers, "provide a foundation for developing hypotheses about when increasing returns processes are likely to operate in the social world" (p. 254). Providing the ability to recognize signs of path dependence can illuminate the intransigence of ineffective policy, the sources of positive feedback, and the potential longer-term, sustained and well crafted effort required to change policy.

Heinmiller (2009) uses the concept of path dependence and positive feedback to evaluate collective action efforts in the management of water basins in the U.S., Canada, and Australia. He argues that the "historical-institutional context in which collective action occurs" is a critical determinant in the ability for collective action (Heinmiller 2009, p. 134). "Positive feedback constrains actor decision-making because it provides positive reinforcement for the institutional status quo compared to potential reform options, prompting actors to forego major institutional reform" (Heinmiller 2009, p. 134). The three water basin cases studied were the Murray-Darling in Australia, the Colorado River in the Western U.S. and the Saskatchewan River in mid-western Canada. Heinmiller found that all three cases showed resistance to incorporating conservation as a management focus and changing how water use was allocated. In each case conservation failed to become a management objective, and instead became another 'user' category. He concluded that adapting the institutions to reflect conservation concerns was inhibited by the existing apportionment institutions, and where change did occur, conservation efforts were

incorporated into the original apportionment institutions rather than becoming an objective of a re-allocation regime.

Heinmiller's (2009) case studies also reveal that the term "path dependence" does not infer a single development path, but multiple paths. Each apportionment of water rights led to the development of other connected paths. Heinmiller notes that in the U.S. case the "apportionment issue was crucial to the riparian states because extensive programs of agricultural and urban development were predicated upon access to Colorado flows" (2009, p. 141). Water apportionment supports urban development, which drives in-migration, employment creation, small and large industry, and increasing needs for water resources, thereby creating a web of dependency on the original policy choice. Institutional change becomes costly, reflecting Arthur's (see page 98) path dependent factors, and perhaps too costly if significant change is necessary. The potential for significant actual or perceived set-up and transitional costs, and the significant level of coordination and reliance on existing systems within a complex multi-dimensional regime conspires against change and precludes the support for change from beneficiaries within the existing system.

The discussion of path dependence would seem to suggest that small changes contribute to the status quo and policy 'lock in', while fundamental institutional change indicates a more objective and relevant change. Significant structural change does come with its risks and policy choice can lead to significant and long-term consequences. Institutional change based on development paradigms, such as centralization, decentralization, or privatization may suggest a more radical change in the affected country or region, but they remain examples of path dependent institutional blueprints for development. These paradigmatic approaches to

institutional development emerge and persist based on contemporary theories, such as privatization models and centralization responses to the inequities of the private model. Agrawal and Chhatre (2007) consider much of today's decentralization policies to have emerged from common property theory – theory that is based on smaller scale, long term, and self-emergent institutional forms. The participation of central agencies, even in decentralized regimes introduces an additional element or variable in the emergence of local level institutions that is not reflected in commons theory. Either small or large institutional change can reflect path dependent lock-in. When there is a problem in need of government attention this policy/institutional intransigence can lead to institutional failure.

3.4.3. Implementation failures

Assume that policy analysts and decision makers have developed and chosen a particular policy response in an effort to overcome or forestall the institutional failure of some common pool resource. The next challenge faced by government is to implement the policy in a manner that will see its intent translate accurately from the collective-choice level to the operational-choice level. Van Gossum et al (2008) define policy implementation as “a process in which decisions or actions are directed towards putting policies into effect” (p. 516). The inability to implement the chosen policy through poor design, bureaucratic or user resistance, whether intentionally resisted or not, is a government failure. Pritchett and Woolcock (2004) argue that our traditional top-down method of policy design and implementation may itself be the source of failure. The point in this section is not to highlight the design flaws of policy, but the failure through the process of policy operationalization – how it fails to proceed from the political forum, through the bureaucracy and to the policy's target group.

There are significant challenges confronting policy implementation that can lead to government failure. Mazmanian and Sabatier (1983) breakdown the implementation process into its dependent stages and various independent variables that affect the implementation process. Their framework focuses on the tractability of the problem, and various statutory and non-statutory influences. They identify a number of “veto” points along the process related to how government agents, target groups, or other constituents may or may not support the implementation process. Failures can enter into the process by, for example, having ambiguous policy that leaves a substantial amount of discretion to agencies, especially when the agency has competing objectives, is poorly funded to implement and monitor the policy, or if its political masters are not supportive. The attempt to introduce a permitting scheme for the commercial harvest of pine mushrooms (*Tricholoma magnivelare*) in British Columbia provides an example of these implementation failures. Following a significant policy development effort which included government and industry representation, a policy to requiring buyers of wild mushrooms to obtain operating permits was passed into legislation. Translating that policy into regulatory action failed, however, as a result of the resistance by the forest district bureaucracy who foresaw significant costs associated with the process of permitting, compliance and enforcement. The pine mushroom industry was just as happy to see the policy fail to proceed as they would have lost the open, costless and unfettered access to the pine mushroom resource. The district level reaction to the policy reflects one of these veto points and the transitional costs and learning effects of policy change.

There are some rather practical constraints governments face in policy development and implementation related to the allocation of scarce regulatory and bureaucratic resources. Mendes (2006) considers technical constraints in policy implementation to include budgets, the

existing regulatory environment, human and other material resource capacity, knowledge and information, and the relationship among various potentially competing policy directions and the policy target-group. There are critical links between the policy objective, the instrument designed to implement that objective, those who will oversee the implementation of that objective, and the target group whose behavior the policy is intended to adjust. Failures can appear at several junctures including the links between government and the target group, between the policy/instrument of choice and the accountable agent, and the implementation process and its budget and financial support.

These links suggest that implementation failure can emanate from not just government, but also from those actors whose actions the policy is intended to change. Van Gossum et al (2008) conclude that to understand the challenges of policy implementation “it is important to look not only to the traditional top-down implementation constraints, but to also incorporate some bottom-up implementation constraints” (p. 521). Van Gossum et al (2008) studied the implementation, or non-implementation as the case may be, of a forest management policy in Flanders, Belgium. They found that the implementation failed as a result of (1) resistance of local farmers, (2) the influence of local stakeholders, (3) poor communication, (4) other competing policies, and (5) insufficient resources to support local farmers. A leading influence on the success of implementation is the acceptability, support and compliance of the actors involved in policy implementation – much of which reflects the filtering of policy from its source to its operationalization, commonly referred to as the principal-agent problem.

Implementation and the principal-agent problem

The expectation of decision makers is that their policy changes will influence the incentives of appropriators/providers and lead to predicted actions consistent with the intent of the policy.

Not all policy reaches the operational level as intended, however, and its interpretation can result in significant departures from the original objective. Government policy is generally based on some legislative acts developed at the constitutional or collective choice level.

Enabling that legislation can be achieved through regulations or policy prescriptions and specific rules designed to move the laws from the legislative books to its operational form, and from its operational form to its operational reality as it affects and influences actions. It is through this translation of rules and the encompassing resource management regime that the principal's intent fails to transfer appropriately through the agent to reach operational reality.

Principal-agent theory highlights the potential struggle between those who make policy and those who live by policy. The actors could include the citizen electors (the principal) and the elected politicians (the agents), or the elected political decision makers, assumed to reflect the desires of the citizenry (the principal) and the administration who delivers the policy (the agent) (Howlett and Rameesh, 2003). The relationship can also refer to government departments as the principal and the target group or resource user as the agent. The principal-agent problem involves the translation of policy intent from its source to its operationalization, generally in terms of the intentional mis-translation or molding of a policy to better fit the aspirations of the agent. Sandler (1992) considers that a key element of control or power held by the agent is information about the level of effort and translation of policy during implementation. "This asymmetric information leads to a moral hazard problem, insofar as the agent may take

advantage of the principal's ignorance as an excuse to supply suboptimal levels of effort”
(Sandler 1992, p. 124).

The failure between policy intent and policy actualization may depend on the perspective one has regarding the policy and its need. Edwards and Steins(1998a) and Steins and Edwards (1999) provide an interesting example of the development of a local fisheries cooperative, the Connemara Shellfish Farming Cooperative, located in west Ireland. The cooperative formed under a government program with the intention to revitalize the local native oyster beds. The association was granted aquaculture licenses and obtained financial, educational and technical support from government agencies. The collective effort did not last however and eventually members began to free ride on the efforts of others. In the end, what the authors learned was that the reason behind much of the original support for the cooperative was to gain control over local fisheries to thereby exclude non-local operators from establishing fish farms. When that objective was achieved, many members found little else of benefit from collaboration. The principal could not have foreseen the agent's underlying objective. From the government's perspective the program intent and resource management effort may have failed, but from the local's perspective it may have succeeded.

The filtering of policy through various implementers and finally through the target group could also allow the molding of a poorly designed policy into a more effective, locally relevant policy. Centralized planning can reflect unitary policy prescriptions that are inappropriate for and inflexible to local social and ecological scales. Local administrators may have better information about local or regional conditions, they may have a better understanding of the actual problem, may see a need to adapt policy to avoid unintended consequences or to meet fiscal realities. As

a result, the target group may either adapt or ignore the policy if irrelevant, ineffective, or if adherence is too costly. Acheson's (2003) study of the development of a management regime for Maine's lobster fishery illustrates how a century of knowledge gained by rather sheltered appropriators influenced and at times competed against the development of the statutory management regime as it evolved. Eventually, new laws evolved to reflect the adapted measures or locally devised rules of the fishers, reflecting a more collaborative approach to resource management. The outcome of a principal-agent problem is not necessarily an institutional failure when inadequate policy is molded to better reflect a particular problem; however, it becomes a problem when policy is altered through rent seeking behaviour or simple disregard. Government may perceive a policy failure has occurred, but from a local perspective the policy's translation or use may be considered a success. Reconciling these differences can prevent some inappropriate policy adjustments that may undermine an effective and efficient policy interpretation.

3.4.4. Inappropriate institutional scale

Government and the policy it devises can fail to recognize and reflect the heterogeneous characteristics of environmental resources, including common pool resources. The result can be policy prescriptions inappropriate to the scale of the resource problem. While concepts of social-ecological coordination such as private property, state or common property suggest a degree of institutional variation, social and ecological variation in space and time suggest a far more complex landscape for policy decision makers. Scale-mismatches can result. Cumming et al (2006) define scale mismatches as "when the scale of environmental variation and the scale of the social organization responsible for management are aligned in such a way that one or more functions of the social-ecological system are disrupted, inefficiencies occur and/or

important components of the system are lost” (p. 3). This section considers government’s role in social and ecological scale mismatches that lead to institutional failure. The section presents a short description of scale and scale mismatches, followed by some discussion of the sources of scale mismatch and the challenges governments face in overcoming them.

The issue of scale in social-ecological interaction concerns the alignment of sets of social and ecological scales (Folke et al. 1998; Cash et al. 2006; Cumming et al. 2006; Folke et al. 2007). Cash et al (2006) describe social-ecological scale in terms of spatial, temporal, jurisdictional, institutional, management, networks, and knowledge scales, each with various sub-scale levels. Ecosystems function at spatial levels based on numerous indicators such as elevation or geographic location, and terrestrial or atmospheric for example. Ecosystems also function at temporal scales, including plant or ecosystem lifecycles, seasonality or evolutionary scales. Societies function at a variety of scales including individual and organizational, through diverse cultural norms and practices, and whose activities are coordinated via various institutional rules and rights within and across political jurisdictions. Matching the coordinating efforts of society’s demands with ecosystem scales has been recognized as the “problem of fit” which can result in “scale mismatches” and can contribute to institutional failure leading to resource degradation (Folke et al 1998, 2007; Cash et al 2006, Cumming et al 2006).

Cummings et al (2006) found that contributing to these sources of scale-mismatch were shifts in governance towards nation-states. They found that a more centralized government structure and institutional approach to resource management led to the adoption of paradigmatic, ‘one-size-fits-all’ approaches that ignored heterogeneities. The departmentalization of government functions also leads to ‘policy silos’ thereby removing the ability to manage across scales and by

creating power centres, influencing information collection and sharing. Other government policy that can contribute to scale mismatches include its role in promoting development through subsidy, and the variety of development related activities including infrastructure investment and changes in tenurial and property rights systems that result in the fragmentation of land holdings based on familial or other allocation regimes and not along spatial or temporal scales. Additional examples of scale issues include jurisdictional issues, for example transboundary water flows, whether surface or groundwater, and internationally significant environmental issues such as carbon emissions. A single state or a single organizational level would fail to adequately deal with these larger multi-level issues. Policy efforts in one country, whether good or bad, can be negated by conflicting policy in adjacent jurisdictions. Monitoring these efforts at a singular scale level can conceal the inadequacies across these geographic and jurisdictional lines.

Examples of these shifts and resulting scale mismatches suggest that the analysis of government and policy failure needs a broader governance perspective from a temporal and spatial consideration. Cumming et al (2006) provide the examples of the shift from hunter-gatherer societies to agricultural strategies, mechanization and changes in food production and their effects on land tenure systems and land uses. Population growth continues to change human settlement patterns, with the most profound shifts occurring through rural to urban migration. Governments need to adapt to these changing contextual factors, but face the challenge of developing policy to match ecosystem and social scales.

Scale adds a level of complexity to government policy development and decision making that requires significant information, knowledge and coordination within governing agencies. The

lack of information and institutional constraints significantly affect the ability to work within this complex policy environment (Young 2002). Cash et al (2006) note this complexity and the resulting challenges in overcoming scale mismatches, including “(1) the failure to recognize important scale and level interactions altogether, (2) the persistence of mismatches between levels and scales in human environment systems, and (3) the failure to recognize heterogeneity in the way that scales are perceived and valued by different actors, even at the same level. Young (2002) sites the public good nature of overcoming scale mismatches as an additional challenge leading to a lack of incentive to invest in, and subsequently free ride on institutional change. Government’s large political and bureaucratic forms struggle within this policy scale environment, through ‘silo’ or value oriented agencies, the need to provide certainty and predictability for businesses and individuals, human and fiscal capacity, and a lack of information about the various resource linkages implicit in resource decisions.

3.4.5. Government failure summary

This section provided a brief description of government induced institutional failure. It separated the causes of these failures into policy instrument choice, path dependence, implementation failures, and scale mismatch. The outcome of these failures, as with market and collective action failures, can lead to resource degradation and can render impotent the efforts of those policy entrepreneurs who seek solutions at a more complex scale.

Policy instrument-choice related failures are the result of government action through inappropriate or efficiency reducing policies, or government inaction through negative or non-decisions. Subsidies, unenforced or inappropriately allocated property rights, and other tax measures may contribute to efforts at rent seeking and ultimate dissipation. Conflicting policies

resulting in cross purpose objectives, a lack of value recognition and destructive revenue generation schemes, corruption and issue avoidance contribute to the wide ranging sources of policy failure.

Path dependence involves failures in government action to move beyond the status quo when necessary, and also relates to the use of development and organizational paradigms. Sources of path dependence include the intransigence of historically based institutional structures, the distribution of the benefits of that structure, the costs related to significant structural change, and learning and coordination effects. The larger the network of participants benefitting from the status quo, the less likely individuals will support change. The complexity in the market and governance regime contributes to 'lock in' that can obscure the recognition of a significant, clear and recognizable problem, consequently leading to a failure to initiate marginal or more structural institutional change.

Implementation failures reflect the failure of policy to reach the operational level at all, or in the manner envisioned by decision makers. Sources of this type of failure include ambiguity in policy design, bureaucratic discretion, poor accountability and financial support, and both bureaucratic and stakeholder resistance. The bureaucracy can fail to support new initiatives if it expands responsibility beyond normal operations, creates budgetary pressures, and/or if it places additional requirements on its human resources. Stakeholders can resist implementation as a result of poor information, confusion based on conflicting policies and a lack of support to implement the changes prescribed.

The failure of the chosen policy(ies) to match the social and ecological scales of the problem and the resource in question is termed scale mismatch and can appear in spatial, temporal and jurisdictional form, among others. The centralization of resource management while potentially broadening the jurisdictional scale, often leads to “one-size-fits-all” approaches when, for example, spatial variability calls for more situational specific policy responses. A lack of information to illuminate the appropriate scale of the ecological issue and management requirement, and the bureaucratic ‘silos’ constraining the focus on organizational scale contribute to scale mismatches that reflect government failure.

The next section incorporates these market, collective action and government/policy institutional failure themes into an institutional failure model. The model is the initial building block of the intervention framework providing an investigation into the existence of a problem and the need for intervention at some institutional scale level, be it government, regional agency, local council or local community intervention, and some scale or intensity of intervention.

3.5. Developing the institutional failure model

3.5.1. Indicators of institutional failure

The economics literature focuses on the dissipation of rent to indicate institutional failure. Does fulfilling the condition of full rent dissipation provide the only justification for government intervention, or are there other ecological and social conditions to consider? Is the condition of full rent dissipation perhaps rather late for considering some form of intervention let alone effective intervention? The condition of rent dissipation is an outcome of individual and group

actions within a resource system. Thus while rent dissipation is a manifestation of institutional failure, it is not a cause, nor does the dissipation of rent suggest that resource degradation will result. Underneath this outcome are incentive structures, coordinating mechanisms, individual actors and the resources they covet interacting within an action arena. The remainder of this chapter uses this perspective to develop the institutional failure model.

A common characteristic of unregulated common pool resources is a lack of information in the hands of government, such that ill-informed and inappropriate decisions may result. How then can a government interpret the need for and structure of intervention, thereby avoiding scale-mismatches and inappropriate responses? The institutional failure model outlined in Figure 2 is intended to provide a starting point and basis for a rationale that can inform the choice of whether or not to intervene in the particular market, how acute the problem is, and what additional information may be needed to make an informed decision. The following discussion identifies a number of variables that emerge from the previous institutional failure discussion.

An underlying assumption of the model is that the resource under investigation is unregulated or under-managed and is effectively being exploited within some form of open access, limited-user open access or situation of under-provision. The specific form of access appropriators operate within will be clarified in the assessment. Focusing the model on open access situations simplifies the analysis somewhat by eliminating the need to establish whether a *de jure* property rights regime is or is not in place, assessing the regime's objectives and effectiveness, and by limiting the range of potential outcomes. This approach allows the model to focus a greater level of detail on the more relevant resource, appropriator, and institutional elements associated with open access variants to common pool resources. Thus, conditions for the

potential degradation of or under-investment in the resource already exist – the model seeks to elaborate on those conditions.

3.5.2. Institutional failure model development and operationalization

The institutional failure model incorporates various categories and criteria of institutional failure and charts the evolution of the resource and its use from a rise in value through to the potential for over-exploitative ruin, thus it provides a rationale for whether or not to intervene.

Intervention could be initiated by a local government or the users themselves, a regional agency, non-governmental organization, or a state or central government. Results from the model can also aid in the identification of information gaps, help to direct research efforts, and expose sources of institutional failure and points of intervention. The model incorporates an initial risk assessment, identifies the sources of failure, an exploitation outcome, followed by an initial framing of the level of intervention necessary. Within each category is a finer level of detail. The exact specifications of the model as presented can obviously be adapted to particular situations. In some cases the indicators will not be relevant and other indicators can be considered. The analyst must be careful not to 'gut' the model however, as each of the categories were intentionally chosen to encompass the range of factors characterizing institutional failure within an open access or under-managed common pool social-ecological system.

The failure model sets the dependent variable as the exploitation outcome, which is a function of the categories within the risk assessment and contextual variables. The initial focus of analysis provides an indication of the level of risk, the second provides more insight into the probability that a certain outcome may occur. The three variables are further disaggregated

into categories describing the sources of failure. From there, a set of indicators and criteria for satisfying the indicators are further elaborated. For example, the initial risk assessment may indicate the rent dissipation outcome, while the attributes indicate whether or not the resource is being or is likely to be degraded. These finer level components of the framework are presented in the model application section to follow.

The choice of a particular outcome is made by an individual or group of analysts, thus is subject to a variation in interpretation. The quality of data, the time available for gathering quantitative and qualitative data will affect the performance of the model. However, the initial risk assessment should provide a robust enough indication of the presence of some threat of institutional failure. The contextual influences provide a probabilistic indication of the risk level associated with that threat and subsequent outcome. Satisfying each contextual indicator heightens the risk of a “tragedy” outcome.

The following variable categories form the model.

Risk assessment

- Resource value
- Resource type – exclusiveness and subtractiveness
- Current and past activity levels

Contextual influences

- Resource attributes
- Appropriator attributes
- Institutional attributes

Exploitation outcome

- Resource over-exploitation, degradation, high congestion and rent dissipation
- Human or natural capacity constraint, rent capture or partial dissipation, mild congestion.
- Robust social-ecological system, wide resource abundance and no congestion.

Endogenous – exogenous influences

The source of failure identified through the resource, appropriator and institutional factors may have endogenous influences sourced from within the social-ecological system, and exogenous influences sourced from outside the social-ecological system and beyond the control of local individuals or user-groups. It is the lack of control over the influence of exogenous variables that make it important for the model to explicitly identify these sources. The presence of exogenous variables increases the complexity of the system, thereby increasing the risk of resource degradation. The greater the complexity, the less likely a local user-group will be able to overcome institutional failure and the more likely a government, or some other more centralized agency will need to participate in the management of the particular common pool resource system.

The institutional failure model provides insight into the complexity of the common pool social-ecological system. The more complex, the more challenging it will be to overcome the particular failure, if one exists, and to develop the appropriate intervention. Figure 2 provides a diagrammatic presentation of the model. An interpretive discussion follows.

3.6. Open access intervention rationale model

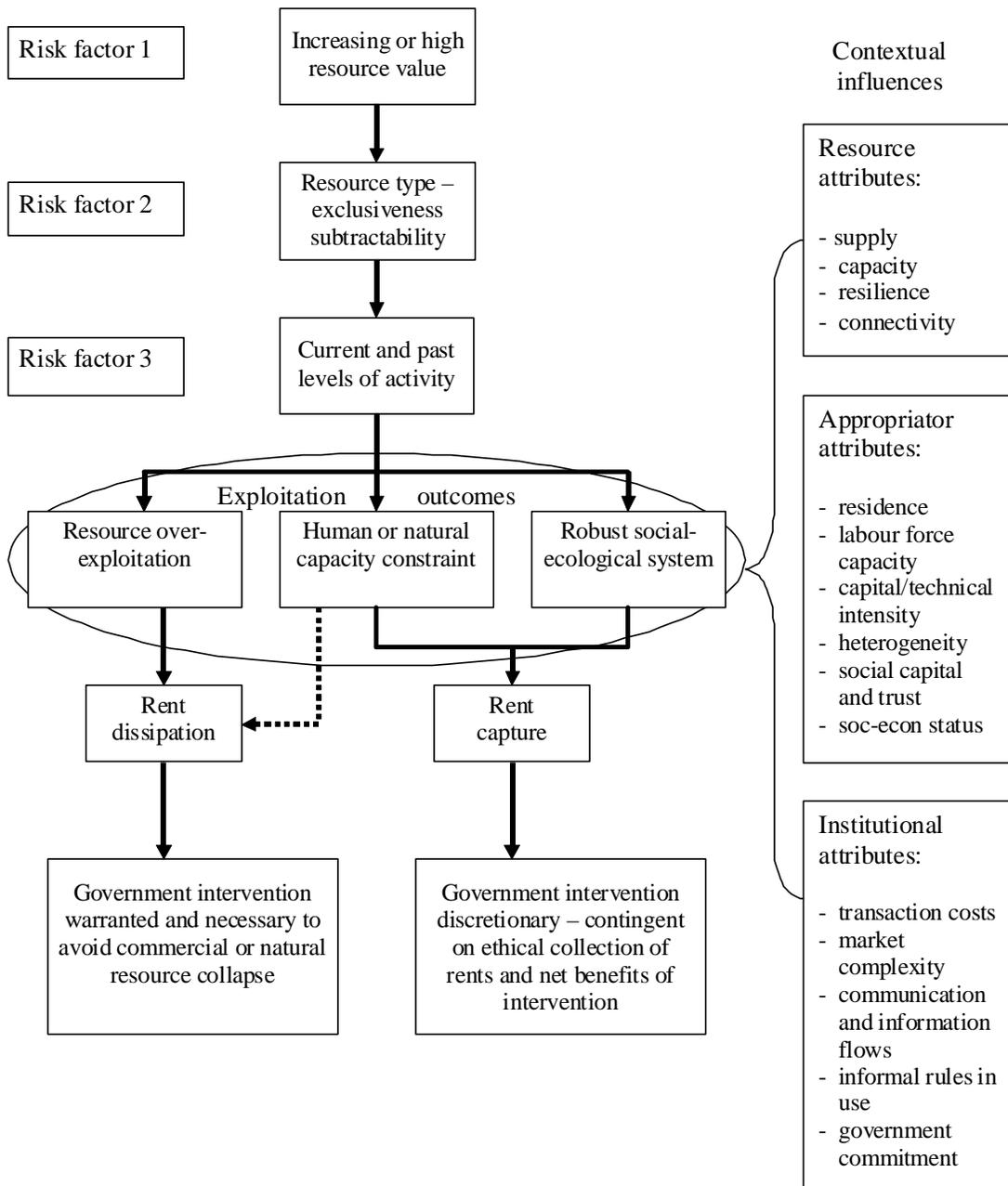


Figure 2: Common pool resource institutional failure model.

3.6.1. Model application: constructing an intervention rationale

The following section introduces in finer detail the operational elements of the institutional failure model, and a communication format for a rationale supporting or not supporting intervention. The discussion proceeds through each component of the model: the risk assessment; contextual factors, exploitation outcome, and intervention type. The model can inform policy for both a resource under existing use pressures, and a resource that is underdeveloped and is being considered for development assistance, for example.

The presentation of the model components follows the process one would use to undertake an assessment.

Risk assessment

Assessing the risk that the resource system is under some threat from its current level of exploitation is explored through three risk assessment (RA) categories: RA1 resource value; RA2 resource type; RA3 current and past levels of activity. Within each of these categories are further indicators to use in an assessment.

RA1. Resource value:

This risk category would be satisfied if the value of the resource is either increasing or has reached a high level relative to other opportunities. A difference, however, exists between resources that have a stable high value compared to those that are experiencing a rapid increase in value. In other words some resources will have higher excess profits or rent available for the taking. A resource with a high but stable price may have a sufficient value to

attract additional labour to the sector, if other wage rates are not as competitive. Some sectors with high values, but unattractive working conditions may deter any significant increase in labour effort. Recent price trends may also reveal future values and the potential for increasing pressure on the resource. Any interpretation of price trend data should be in relation to sufficient market information to understand the source of demand for the good. Rapidly increasing prices with high available rents raise a warning that unsustainable exploitation levels may occur. In these cases, authorities may have much less time to react to the situation. Data availability may become an issue if no formal or informal price data is collected by government or sector participants. Identifying a rapidly increasing value may preclude the use of the model and more rapid policy development may be warranted – this rapid intervention does increase the potential risk of inappropriate policy development.

Resource value indicators:

- Value/price is increasing or high,
- Value/price is high vis-à-vis other resources,
- Wage rates are high or increasing, in absolute and relative terms.

RA2. Resource type:

Under this risk category, the level of risk increases with the degree of non-excludability and subtractability. Common pool resources all share the characteristics of high cost exclusion and subtractability. However, common pool resources can differ in various ways making some more amenable to limiting access, thus having lower exclusion costs. Some common pool resources may be more abundant than others, thus less subtractable and less depletable. The category can examine the exclusiveness of the resource by combining information from other risk and attribute categories, such as the characteristics of use, the ease of entry and exit, the spatial

scale of the resource, or the value of the resource in relation to the costs of restricting access.

In terms of subtractability, any harvest of a portion of the volume available will reduce what is available to others, but what information exists or would assist the analyst to determine if use is nearing congestion? Are harvesters having to continually search for new sources, do they often encounter other harvesters, is the level of frustration and conflict increasing? These and other questions relevant to the particular resource can assist the analyst to clarify the common pool nature of the resource and depending on the level of information available either quantitatively or qualitatively characterize whether or not the resource is at or nearing congestion.

Resource type indicators:

- High cost exclusivity,
- High subtractability,
- Congestion and conflict present.

RA3. Current and past levels of activity:

Information about levels of activity situates the high value resource type within a range of potential outcomes. Certain levels of activity may suggest early or late stages in exploitation history of the resource and how acute the need is for intervention, or of the perceived ability to 'rescue' the resource. High levels of activity may suggest intervention is needed in the short term while low levels may indicate more time is available to investigate various policy options. This risk category enhances and contributes to the two previous risk categories by providing a specific section to understand trends in resource use, appropriation rates, labour effort, prices and demand. Results from these risk categories can also indicate where further exploration of an issue is needed in the subsequent attribute categories of the model. For example, past increases in harvest rates and prices, followed by a leveling or decline in harvest rates or prices

may suggest that the supply has already been reduced below some regenerative threshold, other low cost sources have entered the market, market tastes have changed or the market has simply shifted for some reason and resource degradation is no longer an issue. It is the purpose of this risk indicator to elaborate these trends.

Current and past levels of activity indicators:

- Early or late stage in resource development,
- Volume and value trends,
- Shifts in sources of demand,
- Alternative supply sources,
- Projections of future demand.

Satisfying these three risk categories – high or increasing value, common pool characteristics, and current and past trends – will indicate a high or low exploitation risk and whether or not further investigation is necessary through assessment using the contextual influences.

Gathering information for the subsequent attribute sections may indicate a more intense level of congestion than first thought and that the risk is higher, or lower, than first envisioned. Thus the model is iterative in that there is no reason not to return to an earlier section if new information becomes available.

Contextual influences

The purpose of introducing contextual influences to the analysis is to determine whether or not there are certain attributes of the particular sector and resource that would preclude or contribute to a tragedy of the commons outcome. These attribute categories help the analysis identify the source of the institutional failure. For example, while the state may not provide any

effective *de jure* resource management, harvesters themselves may have created some effective form of organization through collective action efforts. This effort may be invisible to the regulator. If this organizational attribute is not satisfied and the state attempts no resource management, this contextual influence would contribute to a conclusion suggesting a higher likelihood or risk of over-exploitation and potential rent dissipation. The attributes in the model may not be relevant for every case, and other attributes may be added as needed. The intent of the model is to provide a systematic analysis of the particular situation. Some attributes have overlapping influences and may best be discussed together. As stated, the three contextual influences are resource attributes, appropriator attributes, and institutional attributes.

Resource attributes

The resource attribute categories are as follows:

- R1. Available supply of resources to meet current and future expected demand,
- R2. Capacity of resource system to support harvest flow and extraction,
- R3. Resilience of resource to withstand harvesting pressure,
- R4. Resource connectivity.

R1. Available supply of resources to meet current and future expected demand

This attribute category matches resource supply and demand and attempts to understand what may drive the market for more supply, or if prices do increase what lower cost substitutes may be available to replace the use of this resource, thereby avoiding its degradation. This attribute category requires an understanding of the source of demand (local, non-local, both), what is driving that demand and a perception of future demand. Supply is somewhat multifaceted. Not only is it helpful to know the level of supply in the resource system of interest, it is also helpful to know how that local supply contributes to the overall demand for the resource. Is it a large

and important source? Is demand met through all sources or does demand appear insatiable? Are there substitutes? An abundant resource, even with high values may indicate that sufficient supply is available to meet the demands of the market without the implementation of a more onerous regulatory regime. Having a predictable flow contributes to assuring a stable product supply, but the approach of a capacity or supply constraint may introduce unexpected supply shortages. Unfortunately, obtaining decent resource flow information may be a challenge in an un-managed situation where little information is likely collected by or available to government agencies or shared among resource appropriators/providers. Anecdotal information from appropriators or local resource managers may provide some of the answers. The quality of information may suggest a precautionary approach to the use of the resource. Some products may also be seasonal with volumes that fluctuate each year making predictability of the supply of the resource difficult. Edible wild mushrooms are a good example where the volume available for harvest each year is based on soil and weather conditions before and during the fruiting period, leading to the potential for significant variations in the volume available for harvest each year.

Resource supply indicators:

- Available supply and supply shortages,
- Indications of supply constraints,
- Predictability of supply.

R2. Capacity of resource system to support harvest flow and extraction

The supply and demand indicators may indicate a steadily increasing market, but can the resource system continue to meet the demands outlined in R1. The capacity attribute provides a category for the analyst to consider resource stock and flow relationships and the species

productive capacity. Resource capacity suggests that a resource has a finite stock of available product and harvesting at a rate that exceeds its natural rate of growth will compromise its longer-term sustainability. If the resource's productive capacity is strong and, for example, annual or bi-annual growth is significant, there may be less concern at existing levels of activity. The resource's spatial productivity may also influence the outcome of the analysis, for example if the species is abundant over a wide range, or found only in select areas and in a less than predictable pattern. As with the supply attribute, the intention of this category is to consider resource capacity in terms of its use and expected future use. Similar to the supply attribute, however, obtaining information in this attribute category may be difficult and seeking clarity with resource users, other researchers and the landowner may be necessary. Ideally having stock and flow data would allow for a detailed examination of sustainable extraction rates, having such data for many resources is unlikely, and very costly and time consuming to collect. Anecdotal information can assist by determining whether appropriators are having difficulty finding the resource, if their local source is diminished and they are having trouble finding new sources, or if they need to travel further to find it.

Resource capacity indicators:

- Resource stock,
- Resource flow,
- Capacity constraint.

R3. Resilience of resource to withstand change

If R2 shows signs of overharvesting does R3 indicate the resource has the ability to rejuvenate?

The concept of resilience is used here not necessarily to warn of the imminent flipping to some new state of equilibrium, but in the context of its ability to withstand the demands placed upon

it, whether that use leads to the loss of the resource from an ecological, commercial or other related perspective. The resilience indicator introduces a dynamic element to the assessment. The resource's resilience to harvesting is associated with resource supply and capacity, but takes the concept further by referring to its ability to withstand harvest pressure and to regenerate allowing it to provide a stream of benefits over time consistent with its capacity, while not compromising other values, including broader ecosystem values and community values such as traditional and subsistence needs. A resource's commercial resilience refers to its ability to (1) regenerate to a level where additional consumptive use may take place without compromising the broader social-ecological system, and (2) its use or value is resilient to shifting market conditions, thus providing the community with some assurance the resource will continue to provide benefits in some fashion to the local area.

Resource resilience indicators:

- Regenerative capacity,
- Declining use/availability,
- Consistency in species growth,
- Consistency in value/demand.

R4. Resource connectivity

Resource connectivity recognizes that no species exists without the support of the environment it inhabits. Similar to the concept of social embeddedness, resource connectivity situates a resource at various levels within particular ecological systems. Thus resources are linked to others in known and unknown levels of connectivity. Introduce a social aspect to the ecological system and there is a need to recognize that the use of one resource may somehow affect

others. This attribute category moves the resource system under investigation from a single use resource system to a multiple use resource system.

Resource connectivity also recognizes the potential multiple uses of a single resource reflecting the different values that different people may attach to the resource. This heterogeneity of resource uses acknowledges the complex nature of social-ecological systems and the potential error in examining resource use in isolation. Under this assessment, risk increases if the resource has high ecological and appropriation connectivity, significant resource heterogeneity, and if affected by other resource use – use that may be beyond the capacity of local users or groups to control.

Resource connectivity indicators:

- Connectivity/dependence on other resources/species,
- Heterogeneity of resource(s) under study,
- Other resource use impacts.

Appropriator attributes

The appropriator attribute categories are as follows:

- A1. Residence and resource proximity,
- A2. Labour force capacity,
- A3. Capital and technological barriers to entry,
- A4. Appropriator heterogeneity,
- A5. Appropriator/provider/producer trust,
- A6. Socio-economic status.

A1. Residence and resource proximity

It is argued that the closer one resides to and is more dependent on a common pool resource the more likely one is to steward that resource. Harvesters from the local area, who return to harvest a portion of the resource every year, will tend to have a low discount rate, valuing the long-term availability of the resource more highly than someone from outside the community. This generalization must be combined with a socio-economic context, which could alter the longer term perspective for the local and non-local user. For example, severe poverty may lead locals to overharvest as a means to survive, or non-local users who return to the area annually and rely on its income may also have a tendency to nurture the resource. A local appropriator's proximity to urban markets may lead to efforts to reap short-term gains by harvesting and selling in nearby urban markets as a source of quick cash. An example of a non-local user is the wild mushroom circuit picker found in the northwest United States and western Canada, who will follow a circuit and often return to the same areas each year, thereby increasing their dependence on and respect for the growth of the species (Hansis 1998).

Residence and resource proximity indicators:

- Local versus non-local appropriators/providers/producers,
- Consistency of participants – local or non-local,
- Level of resource dependence,
- Proximity of resource users to markets.

A2. Labour force capacity

Expansion of labour effort is an indication of the attraction of available rents and the potential trend towards rent dissipation. Labour capacity refers to the ability of 1) the sector to absorb new entrants, 2) existing appropriators to expand their effort, and 3) the attractiveness of the

sector as a source of income amidst competing sectors. If the sector is generating increased demand is the current workforce able to increase its effort, or is additional labour required? Would the workforce be able to efficiently absorb this increase in the number of harvesters and their effort, such that rents are not dissipated through excess labour effort? This attribute category also provides the ability to consider the attractiveness of the sector as an employment option and the level of competition from alternative employment opportunities.

Labour force capacity indicators:

- Existing workforce capacity to increase effort,
- New labour force availability,
- Wage rates,
- Working conditions,
- Opportunity costs of other available work.

A3. Capital and technological barriers to entry

This attribute category is intended to explore how easy or difficult it is for appropriators to enter and exit the sector. A more capital intensive industry would require higher start-up costs that would increase barriers to entry, thus limiting the sector's growth potential. The value of the resource will have a bearing on the level of capital investment; as such this analysis would be complemented by the resource value section. For less valuable resources the need for transportation to access harvest areas and to transport product could be significant barrier for some individuals trying to enter a sector. A sector based on seasonal market fluctuations, or other significant market uncertainties may require easy entry and exit of labour, which would be hindered by high capitalization and technology requirements. The need for a technological

background or expertise can also be a barrier to entry, but advancements in technology can also lead to expansion of harvesting capacity placing greater pressure on the resource.

Capital and technological capacity indicators:

- High cost entry – fees and/or capital investment requirements,
- Equipment requirements,
- Technical dependency – skill, expertise, education (formal or informal).

A4. Appropriator heterogeneity

Appropriator heterogeneity refers to cultural, socio-economic, or other variation in the character of the user community. Heterogeneity itself may not contribute to collective action failure, but if the community is changing through for example migration, then cultural and norm based differences may infringe on past norms of practice. The user community may have significant asymmetric sharing of benefits and costs that would impede collective action if power sharing was also asymmetric. Heterogeneity also refers to the existence of differences among appropriator extraction related costs. For example, cost variations may exist because the user community may range across a large geographic area and have a variety of distances to travel. In addition, some harvesters may have special knowledge that reduces the effort spent looking for appropriable product, thus leading to higher productivity. As a result, the costs per unit of extraction will vary among harvesters. Heterogeneous costs among resource users operating within open access is a condition that contributes to the prevention of rent dissipation by restricting the number of users.

Appropriator size and heterogeneity indicators:

- Cultural or social heterogeneity,
- Inequitable sharing of benefits or costs,
- Heterogeneous/homogeneous appropriator costs.

A5. Appropriator/provider/producer trust

Trust among participants was found to be an important ingredient for the emergence of collective action efforts and for its maintenance. Trust can be reflected in a sense of community, the building or existence of social capital reflected in communication among participants and their participation in associations. The absence of trust reduces the likelihood of achieving enduring collective action and free riders are likely to defect from the collective action effort, if such effort exists. A lack of trust or social capital may be reflected in the level of conflict observed within the sector, or may be gleaned from conversations with local appropriators. Some sectors may be faced with low levels of trust that preclude any opportunity to coordinate users into a cohesive group. Transaction costs required to coordinate these distrustful individuals will increase as a result.

Appropriator/provider/producer trust indicators:

- Social capital, conflict, social interdependence,
- Communication,
- User community associations.

A6. Socio-economic status

As previously stated, poverty can lead to user decisions to over-exploit a resource as a means of survival. Residents may have little choice but to harvest at unsustainable rates. Socio-economic

status is embedded within broader socio-economic environments; subsequently, there are a range of opportunities that could preclude this poverty driven outcome. This range of opportunities can vary significantly, from few opportunities, such as poverty and drought stricken regions of Africa, to alternative employment opportunities for mushroom pickers in British Columbia in sectors such as logging, or tree planting. In yet other cases, government can provide income assistance to those whose resource-based employment has collapsed, for example the cod fishery in eastern Canada. There is a distinct difference between developed and developing countries and the opportunities and capacities available to those faced with poverty. In situations where there are few options for alternative means of sustenance the resource system would be at greater risk of degradation. The ability to take advantage of these alternative opportunities will depend on the level of workforce mobility. The distribution of benefits and costs among the community was also found to be a determinant of collective action failure. Asymmetric distribution of benefits and costs could also fit within the heterogeneity and trust attribute categories as well.

Socio-economic status indicators:

- Level of poverty among user community,
- Dependence on resource/industry – portion of income from sector, and distributional issues,
- Access to social-safety net,
- Education level of workforce.

Institutional attributes

The institutional attribute categories are as follows:

- I1. Transaction costs;
- I2. Market complexity;
- I3. Communication and information flows among participants;
- I4. Informal/formal rules-in-use by appropriator community;
- I5. Government commitment to resolve common pool and free rider issues.

I1. Transaction costs

Transaction costs include the information, coordination, enforcement and monitoring costs associated with the organization of resource users. An additional cost category of introducing a resource management regime is the opportunity costs associated with the introduction of that regime. These costs, even if perceived and not necessarily actual, will deter the appropriator community from meeting to consider whether or not any benefits would result from cooperation. If significant, each of these costs work to preclude the emergence of a *de facto* or *de jure* management regime, thereby increasing the risk of a resource remaining in open access and the potential for resource degradation.

Transaction costs associated with common pool resources can be exacerbated when appropriators are dispersed over a wide area and have little contact with each other. Gathering information from a disperse group can be difficult, as can the spread of information to these sector participants. If the resource is also spatially dispersed and its supply unpredictable, the cost associated with collecting information to share can exceed any benefit associated with collecting and collating it. Recognizing these sector traits through this institutional attribute

category can be facilitated through the ease at which appropriators can be located for example, or the visibility of the resource and its sector participants.

Transaction cost indicators:

- Availability of information,
- Level of user dispersion – user groups/level of associations,
- Visibility of sector participants in formal and informal economy,
- High exclusivity and requirement for costly monitoring and enforcement,
- Actual or perceived opportunity costs of management among user community.

12. Market complexity

Markets in this attribute category can introduce two levels of complexity that may contribute to institutional failure. First, simple markets would reflect a single resource with few or no interconnections with other resources, thus minimal technological externalities. A complex resource in this case would either generate externalities for other resources, be the recipient of externalities, or both. Second, market complexity will increase the more the particular resource in question is embedded within broader, non-local markets, or where the resource system is used to satisfy the demands of multiple markets. Market complexity does not necessarily increase the likelihood of rent dissipation and resource degradation, but it increases the risk to a particular resource because of its interconnections with other resources or uses, the demands for which may change, or may be caught in the path dependence and trajectory of a more dominant resource sector.

Market complexity indicators:

- Local single use market or non-local commodity market,
- Multiple uses for same resource/species,
- Source of demand for other uses.

I3. Communication and information flows among participants

The availability and sharing of quality information reduces uncertainty and provides stakeholders with the ability to determine appropriate actions. The flow of information is not only a relevant indicator for supply and capacity considerations and transaction costs; it is also an important indicator of the potential for collaboration. Communication, information gathering and sharing suggests some level of trust among a group and in the case of resource use can create awareness among the harvester community of the effects of over-harvesting and inappropriate practices. Evidence of a resource under stress and a lack of communication of information may suggest challenges associated with collaboration to resolve the situation and a high risk of over-exploitation. The absence of and challenge to obtain quality and timely information was raised in several risk and attribute categories.

Appropriators may provide information for general supply and abundance indicators, but are unlikely to provide or want to share in any capacity market or supply related information critical to their operations. This situation is most acute when the resource is under complete open access and where profits are dependent on resource capture, knowledge and stealth. Without effective rights to the flow of benefits, the potential gains of cooperating with government or others in the industry pose significant risk to the appropriator. The inability to gather accurate, dependable information over time from which to monitor use levels may increase the risk level

associated with the resource's extraction to a point where government intervention is warranted to minimize that risk.

Information flow indicators:

- Evidence of communication between and among users / resource managers,
- Evidence of information sharing,
- Information type, availability and ease of gathering,
- Communication within user associations.

14. Informal/formal rules in use by appropriator community

Analysts using this model must seek to clarify any informal rules-in-use that may be directing appropriators in their harvest of the resource flow. Whether formally or informally sanctioned by government, or not sanctioned or recognized at all, the existence of a common property regime developed by the appropriator community may be sufficient to maintain appropriate levels of use. The commons' user-community may not have the ability to effectively limit entry, however, and this category should be juxtaposed with information about market demand and growth pressures, other competing uses of the environment within which the resource is found and the potential for labour market growth. These other exogenous pressures may reduce the effectiveness and longevity of the common property system. In cases where restrictions on the number of users is in place either through informal or formal means, but overuse persists, there may be a lack of choice rules or ineffective choice rules that do not alter or influence operational decisions.

Informal/formal rule indicators:

- User groups or associations visible or known, purpose of associations,
- Local boundary and choice rules,
- Application of rules – local and/or not non-locals.

15. Government commitment to resolve common pool and free rider issues

The issue must have sufficient salience within the governing and regulatory community to support appropriate management efforts. Low cost solutions based on allocating property rights to large existing resource development companies in an effort to ‘internalize’ extraction externalities may inadvertently limit access to those who have come to rely on that access and who most need it. Does the government look to alternative solutions? Does it support research into the use of the resource and have staff monitoring the sector’s activity, evaluating the effects of harvesting or investigating the productivity of the resource? These efforts are some indications of government’s commitment to maintaining the resource, and providing for its efficient and sustainable use.

From the appropriator community’s perspective, an engaged government may provide necessary information and may support appropriator/provider endeavors to enhance the resource in some manner. Past history of successful engagement, support and (perhaps most importantly) a low level of interference may contribute to a coordinated solution to a rent dissipation situation. A lack of trust of government and its intentions will increase the risk of failing to coordinate use and would increase the likelihood of continuing on the path of rent dissipation and resource degradation.

Government commitment indicators:

- Level of salience to government,
- History or consistency in participation / resource investment,
- Open dialogue / participatory approach for other issues,
- Competing objectives.

Exploitation outcome and intervention

If the conditions of these indicators are met, the model posits three possible exploitation outcomes.

Outcome 1: overexploitation, rent dissipation and resource degradation

Overexploitation of the resource, use is congested and is at or exceeds its capacity constraint – the Tragedy of the Commons scenario. Under Outcome 1, the result would be the dissipation of all or most resource rent through excess capital and labor effort, and a decline in the resource stock potentially leading to temporary or permanent resource ruin, and the loss of income and community wealth.

Outcome 2: potential high levels of exploitation, likely rent capture with minimal dissipation

Resource use is nearing congestion, and is either tending towards a capacity constraint or there are some natural or human limits that discourage entry and expansion, thereby stabilizing use rates. Nevertheless, inefficiencies may exist as a result of an inefficient number of companies and laborers vying for a limited volume – a situation that may be compounded by a lack of choice rules. Under Outcome 2, some rent dissipation may be occurring, but rent capture is perhaps more likely at this point. This may be the expedient point to introduce policy measures to avoid Outcome 1. The contextual influences may show a trend or reveal some characteristics

of appropriators that may be pushing the outcome towards, or away from, a higher risk situation for resource degradation. Understanding the direction of this influence is important for this outcome category.

Outcome 3: robust social-ecological system

Resource appropriation is currently not congested, the resource is currently plentiful, and the social-ecological system is robust and able to withstand current levels of use and foreseen user expansion. In this scenario, the resource is able to quickly recover from the rate of harvest and appropriators have the ability to shift to other sites or economic sectors if necessary, while remaining within the local area and contributing to its socio-economic health. Under Outcome 3, rent would be minimal or captured by the resource user, and may not be sufficient at this point to attract additional entrants. Understanding the resource and its uses and markets would be prudent at this point. Outcome 3 may also result if the objective of the analysis is the development of the sector. However, further investigation of the resource through the institutional failure model may reveal other competing values for the resource that may suggest the resource track is already at a mid-level Outcome 2 scenario.

Assessing the information from the attribute sections accomplishes two things: first, it provides enough understanding of the situation to choose between one of the three exploitation outcomes; and second, it helps to identify the attributes where initial management attention may best be directed, i.e., the source of the problem. Remembering the context of the problem is important at this stage, that is, the open access limited-user open access or under-management of a common pool resource – limiting access to which is inherently difficult. The model is obviously interpretive and may result in somewhat different results by different

analysts. However, this section is intended to provide for the presentation of a rationale that highlights the factors contributing to the choice of outcome. A conservative approach or a lack of information may tend to result in a conclusion that rent is being captured or partially dissipated. If this is the case, the analyst should elaborate on risk factors that may result in greater rent dissipation or conditions that may limit that dissipation.

Finally, the section allows a focus on particular elements that may need attention, either through further or enhanced research and information gathering. For example, identification of existing common property institutions may only subtly appear to an outsider. This potential lack of understanding is possible when cultural and language barriers are present, or when the appropriation under investigation is part of a grey or black market and participants are highly secretive. The resource stock and its annual or harvestable flow may also introduce uncertainty with the potential to over-estimate or under-estimate the effect of exploitation rates.

Unfortunately, sufficient time may not be available to avoid resource degradation, thereby increasing the level of risk and need for more careful monitoring. The resulting outcome of the model and subsequent research will describe the problem as best as possible given available information. From this point in the assessment the task is to determine the level of government intervention required and precisely what that means. That quest is the subject of Chapter 4.

3.7. Summary and conclusions

The purpose of this chapter was to 1) provide a primer on institutional failure (market, collective action, or government failure), and 2) to provide policy analysts with a model to evaluate institutional failure in the exploitation of a common pool resource within an unregulated open

access environment, thereby providing a rationale to support or intervention or a more benign level of monitoring to ensure extraction levels to not become problematic.

Institutional failure suggests that government intervention is appropriate, but how do we know if this failure demands intervention and if so what level or intensity of intervention is necessary? In many situations acquiring the necessary quantitative information upon which to assess a common pool situation is difficult, thus developing an econometric justification for intervention may not be possible. Other contextual factors may also influence the outcome of any resource exploitation outcome – factors that may be poorly reflected in quantitative analyses. As such, the paper endeavors to identify a variety of indicators that could be used collectively to suggest that some form of institutional failure is or is not occurring.

The literature review of institutional theory noted the importance of property rights and the outcomes associated with open access or limited-user open access situations. It outlined the underlying motivations created by a lack of property rights, such as incentives to overharvest and under-invest, high personal discount rates, the incidence of free riding, and the chasm between individual and social objectives. The model attempts to reflect these characteristics by focusing on what are perceived to be open access situations; it looks for indicators of over-harvesting and the likelihood of increased effort. Individuals need to have trust in others to act in similar ways, such that any collective effort contributes to a positive outcome and that these efforts are not wasted. Information is critical in this exchange. As was discussed, the collective action dilemma to cooperate emerges at three levels: at the operational level; to meet to decide on operational changes; and once collective action is in place to monitor compliance.

Certain characteristics add to the challenge of coordination among users of a resource, but they can be overcome. These challenges include group size and heterogeneity among competing appropriators. Confounding attempts for collective action efforts is the resource itself, in this case a common pool resource with high exclusion costs and a finite subtractable supply. But also noted was the range in excludability and subtractability, as such not all common pool resources are faced with the same level of challenges. Intervention is necessary at a point where the number of users and the level of use reaches or nears the resource's commercial or ecological capacity constraint. Finally, government policy has the potential to destroy or support local, regional or state level efforts to manage resources sustainably. Inefficient and inequitable policies can be locked-in based on a long history of following certain objectives. Inappropriate policies can also lead to a variety of scale-mismatches between the resource problem and the chosen policy. Alternatively, a government may alter its objectives requiring significant change at collective-choice and operational levels. These efforts are not always sufficiently supported by the enacting government: political, bureaucratic, and appropriator/provider capacity can significantly affect the implementation and longevity of policy change.

The model, based on the institutional theory presented, seeks to capture the sources of failure that could contribute to resource degradation and rent dissipation. None of the indicators alone would be sufficient to reveal resource degradation, but some combination would be necessary. That combination will, of course, differ in each case examined. The model can provide a rationale for government intervention in common pool resource situations where over-exploitation of a resource and tragedy of the commons outcome is possible and pinpoint

attributes of the resource system where intervention is warranted, or where further investigation would be beneficial.

The resulting model is based on the assumption that the potential over-exploitation of the resource already exists if certain conditions apply – the model seeks to elaborate on those conditions. The model is divided into three analytical sections: the first section evaluates the level of risk associated with the exploitation of the particular resource. It uses three risk factors to indicate a problematic situation: rising or high prices, the resource type, and current level of use. Satisfying these conditions suggests that resource congestion may have been reached and a tragedy of the commons outcome may be possible – further investigation is warranted. The second section evaluates the severity of that risk using various resource, appropriator and institutional attributes that indicate a particular exploitation outcome, ranging from a robust resource with little associated threat to the resource or user community, over-exploitation but with natural or human constraints to that use, and finally the tragedy of the commons outcome. Each of these outcomes lead to a particular level of rent dissipation or capture, suggesting a range in the level of government intervention required.

The next challenge is to determine a way to structure institutional change when a need has been identified. How can the results from the institutional failure model be used to inform policy change? It is intended that in addition to revealing that a threat to a common pool resource exists, the model indicates the sources of that institutional failure that can then be the elements where institutional change begins. From these meager beginnings the governance structure will emerge, thus matching the resource problem with the appropriate scale of response. Chapter 4 investigates institutional change in this context.

Chapter 4. Institutional change

4.1. Introduction

This dissertation is about common pool resources and state intervention. It attempts to answer three questions: why, when and how should a state intervene in a common pool resource social-ecological system? Chapter 1 narrows the focus of this study to an institutional analysis of common pool resources in open access, limited-user open access, or simply undermanaged situations where congestion may be occurring, thus leading to the potential degradation of the resource. Chapters 2 and 3 introduce the concepts and theory of institutions and institutional failure, respectively. That more theoretical discussion led to the development of a model to help organize an investigation and rationale into whether or not some form of intervention is necessary to avoid a “tragedy” and if so to identify the sources of that institutional failure. Thus Chapters 2 and 3 answer the questions ‘why’ and ‘when’ intervention is necessary.

The objective of Chapter 4 is to introduce theories of institutional change as the second of three building blocks to developing an intervention framework, the first being the institutional failure model. As with Chapters 2 and 3, this chapter will turn to the literature and institutional theory to understand institutional change, its sources, actors, situations, and contextual factors. The goal here is to learn from the large body of work on institutions and to rather delicately move from the theoretical to practical, from the normative to positive without succumbing to a functionalist technocratically-centred ‘mono-cropping’ approach to solving common pool resource dilemmas. The chapter concludes with a presentation of an intervention typology outlining the range of intervention modes available to a state government or other governance entity. Thus, this chapter is about the role of the state and other actors in institutional change

and seeks to answer the question of 'how' to intervene. What this section intends to show is that while the focus is on the role of the state, the role of the state is multidimensional and can vary to match the particular social-ecological system's institutional and contextual scale.

4.2. Theories of institutions and institutional change

4.2.1. Institutions

Previous chapters established that institutions coordinate human interactions and structure what we may, must, or must not do in particular circumstances, and align our actions through norms and custom. The coordination of these interactions is facilitated through markets, collective action, and government policy. Chapter 2 states in relation to our use of resources, that institutions are the humanly devised rights, rules and responsibilities that define, legitimize and underlie our relationship with each other and the resources we exploit and consume (Dietz et al. 2002). Thus institutions are human constructs establishing constraints and opportunities, but this should not imply that they necessarily exist through intentional design. Institutions can be formal, created, maintained and endorsed by statute or written down in some other fashion whether by a state or local resource-related community. Institutions can also be informal, emergent and spontaneous in nature and the basis for customs, norms and strategies of interaction. Institutions can also fail to support socially optimal outcomes: markets failures lead to incentives to overuse resources, common pool externalities limit exclusiveness and lead to under-investment, individuals fail to collaborate to overcome common pool dilemmas and government and its policy can be poorly designed and mismatch the scale of the problem.

At some point, whether the resource reaches a capacity constraint, prices rise leading to significant additional effort, or new market opportunities emerge, institutions will need to adjust to maintain effective coordination of the many actors who may be participating within the social-ecological system. Whether the actors themselves are able to develop the appropriate solutions or some other external agent is necessary, a change in institutions is inevitable. The objective of the institutional failure model introduced in Chapter 3 is to highlight the need for change, the changing social-ecological conditions, and the intensity of intervention that may be necessary. How then does change proceed, how does a decision maker (user community or government) match the necessary change with the scale of the problem? The next section moves through a discussion of various elements of theories of institutional change, narrowing to the role of the state and other external actors. State involvement ranges from more intense to less, relying on other change agents or the resource users themselves. The range of state involvement if considered at the onset of regime design could contribute to avoiding scale mismatches between the management regime and the resource problem of interest.

4.2.2. Institutional change

If there were no problems with the way in which we coordinate our various interactions, if quality information were widely available, externalities did not exist, if we all shared in an equitable distribution of benefits, and the social-ecological system around us remained in a constant state of equilibrium there would be no need for institutional change. As Chapter 3 presented, however, there are a variety of institutional failures that can lead to resource degradation and various inequities. Thus, when problems arise, when we believe there is a better way of achieving our objectives, or when our objectives change, institutions – the rules,

norms and strategies that guide our interactions – will evolve. Institutional change “rearranges the signposts in our life that reveal what we can and cannot do, what we may and may not do, what we must and must not do, what we can expect the collective power (the authority system) to help us do, and what we are powerless to do in the face of particular behaviors of others that do not please us” (Bromley 2006, p. 81). The social-ecological systems within which we interact evolve and change thus institutions must also adapt, evolve and change. Some theories of institutional change are introduced in this section, then further situated within the context of formal institutional change and the bounds that limit change.

Authors differ in the way in the way in which they describe institutional change, but they tend to focus on some level of dissatisfaction with the way in which individuals benefit from the current institutional configuration. The type of change will then depend on who captures and controls those benefits and who has the power over institutional change. North (1990) argues that institutional change occurs either through a change in relative prices or a change in tastes that influence individual incentives. A change in relative prices may alter the ability of an individual entrepreneur to benefit from the existing set of institutions, thereby affecting the exchanges with which he or she is involved. Pressure for change will mount, first through the renegotiation of contracts through to a formal change in rules of exchange. For example, Chapter 3 noted that a source of institutional failure was the introduction of a new market opportunity to a local community. This new condition may alter the value of the good creating the need to change institutions if the price signal creates an incentive to increase labour effort and new entrants converge on the resource system. In a similar manner, Knight (1992) contends that the incentives for individuals to seek change come from “(1) changes in the asymmetries of power among the actors and (2) changes in the distributional consequences of the institutions” (Knight,

p. 183). Those favored by the current distribution of benefits seek to maintain the current set of institutions and promote stability, rather than change. Conversely, those in conflict with the existing institutionally driven distribution will seek change. There is subsequently a tension between those who vie for change and those who resist it.

The emergence of institutions occurs more formally through intentional design of rules or informally through locally defined rules and more evolutionary changes in customs, norms and strategies. North (1990, p. 89) considers institutional change to be “overwhelmingly incremental” but also considers the opportunity for “discontinuous change” through some form of revolutionary political shift. Informal institutional change occurs slowly over time, while formal change may occur at a more rapid pace as governments attempt to solve the problems at hand. The difference between informal and formal institutions, as North (1990) argues, “is one of degree” (p. 46). Various informal norms of behavior are eventually formalized through law, influencing the way in which individuals interact in both formal and informal action situations. Formal institutions are eventually reflected in our interactions with each other, becoming accepted norms of behavior over time, and more implicitly constraining the choice set perceived by individuals. North (1990) sees the movement of this interconnected evolution through time as linear, or “unidirectional,” becoming more complex as society’s face more complex problems (p. 46). Informal, more spontaneous and evolutionary change is less dependent on the current actions of government or actor’s choices when faced with a problem.

Florensa (2004) notes three patterns of institutional change. First, the evolution of institutions through “learning processes, by the acquisition of new skills, information and knowledge;” second, a redefinition of institutions as a result of changes “in the surrounding social, economic,

or political context;” and third, institutional change through crisis, where issues of asymmetry and marginal change to rules are foregone for a more radical political shift (Florensa, 2004, p. 9). Knight (1992, p. 10) refers to these theories of institutional change as either evolutionary theories that explain change through “spontaneous emergence, market-coordinated change, or social selection,” or intentional design theories where competing political and interest groups negotiate and vie for change. What can be implemented through participant action is the intentional design of formal change in operational constraints and opportunities. Thus, the focus in this dissertation is on the more formal and intentional changes to a subset of institutions, the rules and coordinating mechanisms of resource use, but with the recognition that those formal and informal institutions are linked.

Intentional change suggests decision makers face choice. Do individuals choose to make changes? Do they alter the way in which they act in an effort to change how others act? What is the process of change? Change is an interestingly collective endeavour that evolves, as stated, spontaneously as new practices, norms and strategies are integrated in a more natural organic way into the psyche of individual expectations. Alternatively, change occurs through a collective interest in adjusting the rules of governance through more formal, direct and timely means via government act, or local decision among a group of individuals. Wettersten (2006) sees institutions and institutional change as a means for solving problems, but while problems are solved within an institutional context, “institutions do not have problems, people do” (p. 205). Thus, as people learn, negotiate conflicts and solve problems, institutions evolve when they are no longer able to provide adequate structures (rules for making rules, or operational rules) to provide the support for an appropriate response. However, Wettersten does not see individuals as necessarily having the rational ability to change institutions when problems persist

and the breadth of any change is itself constrained by overriding institutions that govern rule making. Thus, institutions are likely to persist, able to evolve and develop, but unlikely to undergo fundamental change. As individuals are constrained by institutions, institutions themselves are constrained by the institutional trappings of multi-scale embedded systems of rules and decision making. Institutional change is likely to happen in an incremental manner and is the result of collective action efforts, but these changes and the actors supporting it are influenced and constrained by other institutions, the perceptions of these institutions, and other actor's perceptions (Schlager 2007). The path dependent constraint on institutional change is introduced in Chapter 3 as a source of institutional failure.

The intentionality of choice is constrained by the institutional setting, which creates a bounded set of opportunities as would be expected in a more path dependent institutional environment. Developing a framework for the practical design of institutional change is bound within this institutional collective, arranged within a multi-level hierarchy of decision forums at the constitutional, collective choice and operational levels. How do individuals make the choice to change what they may, must or must not do? Economics and neo-institutional perspectives accept the actor as rational or at the least boundedly rational in ones decision making.

Granovetter (1992) comes from a sociological perspective and questions models of institutional change that rely on the atomized, rational actor making choices in isolation. He finds that the economics discipline's reliance on "methodological individualism" has "no ready way to explain institutions as the outgrowth of individual action..." (p. 4). Individual embeddedness in social systems provides a better context for understanding the role of the individual in institutional development. Granovetter argues that institutions are social constructions: "economic institutions (like all institutions) do not arise automatically in some form made inevitable by

external circumstances, but are 'socially constructed' " (Berger and Luckmann 1966; as quoted in Granovetter 1992 p. 4). Granovetter uses cases of the development of electric utilities in the United States and the economic development of overseas Chinese entrepreneurs as examples of the kinship, cultural, political and economic ties among individuals as a core element of why certain institutions are chosen. The reality of problem situations in which we find ourselves is that they are bound by path dependent resistance to change and the trappings of our institutional milieu.

When we talk of institutional change, what is actually being changed? If institutions are rules, norms and shared strategies, it is those elements that change. North (1990) noted the slower time frame associated with informal institutions that form norms and shared strategies, while the more formal institutions such as rules change more intentionally within a shorter time frame. Crawford and Ostrom (Ostrom 2005) focus on rules as the institutional element that can be intentionally changed by decision makers. Institutional change then can be narrowed to focus on a change in rules, who is making these changes, and at what decision level. Crawford and Ostrom (1995, Ostrom 2005) define institutional rules as a set of institutional statements that direct what one may, must, or must not do within any particular situation and the repercussion if one does not follow the rule. Policy analysts and decision makers can thus devise the rules necessary to manage a common pool resource by focusing on what rules are necessary, what rules are already in place, and what rules need to be created in order to meet a certain set of objectives. While institutional change can be discussed in terms of the distributional and conflict oriented process of reallocating or maintaining benefit streams, what institutional change means from a regime design and operational perspective is illustrated by

the nature and function of rules. However, this conclusion does not get us any closer to who is doing the changing or how that change is actualized.

4.3. The role of the state in institutional change

A legitimate role for the state is arguably as a protector of property rights, an intervener when markets fail, when transaction costs are high, or as an arbiter of conflict. This more minimal role of the state assumes that markets can efficiently allocate scarce resources, that individuals are able to act collectively and that government policies when needed efficiently deal with the particular issue, no more no less, and with no unintended consequences. For common pool resources, the presence of market failures resulting from a lack of property rights, public goods and common pool related externalities, and incomplete information, combine with the challenge in overcoming collective action dilemmas. Policy development would be intended to create the incentives among individuals and the collective to invest in the resource and use it in a socially beneficial manner. Policy can come from a variety of collective choice arrangements, however, and focusing on the state as the sole designer and implementer would miss the much more complex, but efficacious opportunities for policy development. This section looks at the role of the state, but within the system of governance. The section seeks to understand the various roles the state may take within various governance arrangements and among collective choice participants.

The discussion in Chapter 2 introduced the concept that a state government is not the only provider of institutions within the governance process. Other participants within the polity include local level organizations whether elected or not, non-governmental organizations, non-elected regional agencies, international organizations, and individual stakeholder groups. Each

may be a participant and plays a varying role within governance, in this case the management of a common pool resource. Common pool resource theory suggests that the commons may be more likely to have less state-centred coordination relying more on user-derived and maintained systems of common property (Schlager 2007). However, this institutional environment is embedded within more complex governance systems. These layers of participants form a hierarchical web of actors interacting within a particular action arena or between other arenas. Ostrom's (1990) constitutional, collective choice, and operational choice levels indicate a formal hierarchical division in terms of policy making and decision structures. The interactions within and among other action arenas form the broader vertically integrated institutional environment, that itself is influenced by hierarchical collective choice decision making capacity. Ultimately, the collective state is the constitutionally mandated driver of institutional change, maintenance and legitimization. However, who influences these decision structures is a function of the governance system in place, and who is allowed to participate in the politics stream of institutional change.

The state is commonly considered the regulator of economic activity through coercion-based command and control measures, or through market oriented incentive policies. These governance methods are intended to achieve particular objectives by either prescribing individual and company actions, or by setting a particular outcome and allowing the individual or company to find its own path. As new issues arise, government must choose to either act or not, then opt for one or the other method of regulation. An example of the evolution in the use of command and control versus market based regimes is the shift in fisheries management from regulated and structured access to tradable permits (i.e., property rights) to a portion of the flow of fish (Tietenberg 2002). Yet within this more market oriented system the state still

maintains a level of control over the total allowable catch allocated to fishers. Perhaps the more fundamental institutional change resulting from this shift to a market oriented system is the role of the fisher community towards a more active level of participation in resource management activities (Mitchell 1997; Yandle 2001). This style of governance reflects the co-management of resources and has become more prevalent as governments and stakeholders alike recognize the inability of governments to have both sufficient information and knowledge of the particular resource system and the capacity to oversee all extractive activities. This example also shows that the state may influence the institutional environment through policy change, but the institutional environment also changes the way in which the state engages in its development and implementation of policy, or its mode of governance.

At its core, the state provides the legal foundation for economic activity, the constitutional orientation towards private property or state property, and specifies the legal content of contracts and their protection. This role is North's (1990) third-party enforcement where the state through its laws and legal system acts "as a bulwark against the violation of contracts" (p. 59). However, North's enforcer role supposes that the legal system and political actors will not "violate contracts" through corruption and political rent seeking. Thus the state could be more obstructionist than actually facilitating economic and social activity. However, government does have a legitimate role in obstructing certain economic activity. For example, government has a role in regulating anti-competitive corporate mergers that may lead to over-concentration of certain sectors and the exercise of market power. Government has both a supporting and obstructing function, or as Bromley (1991, 2006) considers creates both constraints for some and opportunities for others.

As the previous discussion suggests, the state is not the only provider of the public good of governance, and where necessary organizations of collective action will form to fill the coordinating role of government. The provision of governance (not necessarily by the state) may still be necessary, regardless of who provides it. Umbeck (1977) provides an interesting case where a government function was needed to provide the legitimacy and enforcement of locally derived systems of property rights. In his study, Umbeck charts the emergence of contracts and property rights during the California gold rush, supporting the theory that as values rise and congestion intensifies, property rights will emerge. However, what also emerged during this period were local community associations who filled the political governance void and resolved conflicts, drafted rules, created sanctions and threatened enforcement. Thus a *de facto* political regime was created to overcome the inefficiency and failure of the individual negotiation of contracts by adjacent claimants, thus institutional change met the needs of the evolving resource system.

More complex resource environments will need more sophisticated levels of collaboration and coordination. While property rights emerged from the individual interactions among miners in Umbeck's example, a more rigid organizational structure was also needed to foster coordination and compliance. In more simple less complex environments where few actors are in conflict individual negotiation is possible, but as interactions intensify and become more complex, government (in whatever form) coordination becomes legitimate and indeed necessary. Ostrom's (1990) vertical hierarchy of governance at constitutional, collective choice and operational decision nodes, reflects this complex institutional environment, with the state taking its formal constitutional role in establishing the rules that direct collective action decision structures. Schlager et al (1994) outline a variety of government roles within the complex social-

ecological environment of common pool resources. They may take a more active role such as requiring and enforcing agreements. They may also take a less active role depending on the needs of the appropriator community, such as through the collection and provision of information and the support for local user-devised rules such as through the establishment of forums for discussion. Of course the danger lies in how government, the political rulers or its bureaucracy understand the problem and consider responses amidst competing public objectives and values. Government acts as the collective voice of the public in the design and implementation of market or management interventions, but is bound by historical path dependence and asymmetries of power in agenda setting.

Common pool resources add the complexity of high cost exclusion in combination with its subtractable finite supply. As discussed in Chapter 3, these characteristics can lead to a lack of incentive to act collectively or invest in the resource, and ultimately the potential degradation of the common pool. Grafton (2000) identifies a range of approaches to manage common pool resources through state involvement. These include systems of privatization, such as the privatization of the flow of fish, state-based regimes and the provision of protected areas, and the recognition of local community-based resource regimes. Regardless of the approach, the state takes a “facilitating” or “coordinating” role in common pool resource management. Social-ecological complexity influences the role taken. Grafton (2000) argues that the “larger are the non-consumptive benefits from CPRs, the less divisible are the use benefits, and the greater the number of competing uses for the resource, the more likely is there a need for a coordinating role by the state” (p. 514). Complexity begets greater coordination and while property rights may evolve, a concomitant evolution of a system of governance is also needed.

The discussion in this section was meant to consider the wide variation in the role of the state in not only common pool resource management, but also economic and social activity in general. Governments can create institutional change through its formal function of legislator, law maker and enforcer, and its role in policy formulation, but it is not the only actor in this action arena. The natural resources that a government attempts to manage can also have a wide variation in spatial and temporal characteristics, suggesting a multitude of potential responses and levels of engagement with resource appropriators. The next section explores various frameworks that have been developed to describe institutions and institutional change. This discussion leads into the development of a typology of government intervention based on the variety of interactions between the state and appropriators of natural resources. This typology uses elements of the discussion in this section to expand on the intervention outcome from the institutional failure model in Chapter 3 and provides an indication of the range of interventions possible. The typology is the second building block of the intervention framework.

4.4. Frameworks of institutional change

What guideposts are available to direct an appropriate course of action in common pool resource situations of open access, limited user open access, or under-management? Are there models available to provide guidance to the way in which a government or local community can initiate institutional change? Olson (1965) considered the way to encourage 'latent' group collective action in the production of a public good through the application of 'selective incentives' (p. 51). He argued that these incentives, whether positive inducements or negative coercions, should only be 'selectively' applied to those individuals who do not contribute to the collective interest. It is through organizations such as the state, through taxation or subsidies, unions through compulsive membership, or through lobby groups that these selective incentives

may be delivered. Hardin (1968) considered “mutual coercion mutually agreed upon” as the means to save the “commons” by addressing the individualist’s pursuit of additional benefits (p. 1247). He sees the state as the source of that coercion and that it “need not be perfectly just...” (p. 1247). Gordon (1954) argues that unregulated private exploitation of a commons resource will yield no rent. Only under some “unified directing power,” either through the establishment of private property or public property can a common resource yield rent (Gordon 1954, p. 135).

These classic arguments for private or public control of commons resources have been the foundation of institutional change in resource management and land allocation. Yet Olson (1965) not only saw groups as latent, he also found privileged groups who were capable of collective action. Commons research has taught us that there are alternatives to privatization or state-based coordination methods. These methods are not necessarily precursors to success and people have, can and do coordinate their actions for the benefit of the group. However, when the need for state intervention arises choosing the best course of action to meet ones objectives remains a challenge. Indeed, what is the problem and whose objectives are relevant? The following discussion introduces some of the frameworks that have been developed to help clarify the institutional challenge for common pool and public goods provision.

Policy implementation needs a heuristic foundation to allow for policy legitimacy through monitoring and enforcement, and also to provide an evaluative ability to monitor the link between policy objectives and policy outcomes. Ostrom (2005, 2007b) argues that institutional change is an experiment that needs monitoring and adjustment when outcomes vary from the desired path. Marshall (2005), Evans (2004), and Olsson et al (2004) for example, concur with this adaptive management format for complex resource systems. A multitude of frameworks

have been designed to fulfill this heuristic function. Frameworks and models generally focus on *ex post* analyses of institutional performance or change in an effort to distinguish causal relationships among the identified dependent and independent variables. Some frameworks are considered to have predictive powers, but as Ostrom (2005) notes no one can “analytically determine which set of rules will be optimal for the outcomes they value in a particular ecological, economic, social, and political setting” (p. 255).

The most oft used framework for the study of common pool resources and a frequent foundation for the development of other frameworks is the Institutional Analysis and Development framework introduced in Chapter 1 (Kiser and Ostrom 1982; Oakerson 1990; Ostrom et al. 1994; Ostrom 2005). The IAD framework identifies the components of social-ecological interactions, the relationships among these various elements, and the influence on action situations of resource, user and institutional variables. The framework follows the actions and interactions of actors as they make decision and act within some social-ecological system. These actions are influenced by ones’ social and ecological environment through resource, user and institutional variables to produce some outcome. The IAD is a heuristic framework as it incorporates evaluation and learning with feedback to both the action arena where all the fun takes place and the variables influencing that action arena.

The IAD framework moves from a more macro level focusing on vertical levels of interaction, to a micro level that allows for the exploration of rules-in-form reflecting the formal legislative prescripts of a government or more informal rules-in-use reflecting the translation of rules-in-form at the operational level, or more informal rules, norms, and strategies that evolve locally to resolve some problem. Some of Ostrom’s subsequent work (see Crawford and Ostrom 1995;

Ostrom 2005) has focused on this rule-based subset of the IAD framework. Ostrom (2005) defines seven rules that are commonly used in the coordination of resource users, whether formally or informally devised: position, boundary, choice, payoff, information, aggregation, and scope. Ostrom's rules for common pool resources define the institutional elements of social-ecological interaction. The IAD framework has been used in a variety of research efforts including Andersson (2006), Koontz (1998), and Imperial (1999), among many others. Edwards and Steins (Edwards and Steins 1998b) extend the basic components of the IAD framework to reflect a more multiple resource and dynamic nature of common pool social-ecological systems.

A variety of other analytical frameworks have been developed to examine environmental issues. For example, Anderies et al (2004) provide a framework to assess the robustness of social-ecological systems. Fischer et al (2007) develop a framework to assess governance arrangements for natural resources. Both of these frameworks use the IAD framework as a starting point. For the most part, these frameworks follow the path of others in that they inform but are removed from the development process. They are analytical frameworks intended to inform institutional change through an assessment of extant social-ecological and institutional conditions. New institutional economics focuses not on the individual, group, organization or particular action arena as the unit of analysis, but the transaction (Schmid, 2004). If institutions provide coordinating mechanisms for the interaction among individuals and organizations, the intermediary action is the transaction. Schmid offers an institutional framework that provides a means to understand the impacts of institutional structures and the effects of institutional change. He uses "situation," "structure," and "performance" to organize an institutional analysis, either for existing institutions or proposed institutional change. The particular action under observation is the transaction, how actors interact in a given situation;

the resulting performance indicates the outcome of this interaction. Schmid (2004) provides examples of this framework throughout his book "Conflict and Cooperation."

The use of frameworks, various resulting development variables and design principles have moved the conceptual understanding of resource policy development beyond the privatization or centralization approaches to governance, but they have also introduced their own more decentralized format, with attendant failures and further reconfigurations. Pritchett and Woolcock (2004) provide an interesting depiction of the efforts to introduce, fix and re-introduce management paradigms based on governance frameworks. As they account, when the original solution of centralization failed the response was the "intensification, amplification, and policy reform" (p204). Now that these responses have failed, numerous others have surfaced based on more de-centralized forms of governance. The results from these frameworks guide or inform institutional change, but are not able to pinpoint the optimal design for any particular situation. What should be clear now is that these blanket approaches to development and resource management may achieve someone's objectives, but is the original problem being addressed, are the unintended consequences too great? Why is one approach necessarily better than others in all cases?

To avoid the use of "panaceas" or blueprint solutions to complex resource management problems Ostrom (2007c) has developed a multitier framework for analyzing social-ecological systems. Using the synthesis work of Agrawal (2001; 2002), Ostrom (2007c) presents the interactions and outcomes from the IAD framework as being influenced by four variable clusters: resource system variables, governance system, resource units, and users. Within each category cluster there is a second tier of descriptor variables that can be further unpackaged

into a third tier of characterizations. The framework is built on the concept that social-ecological systems are linked within a complex hierarchical system, but that these systems are “decomposable” thus amenable to understanding through these inter-related clusters. Cox (2008) warns of the dangers associated with the decomposition of complex systems and the irrelevance that can result when analysis occurs at an inappropriate level. He notes that frameworks need to apply to individual cases at a level suitable to the situation, something the diagnostics approach reflects with its multi-tiered levels.

Ostrom uses the framework to assess Hardin’s (1968) pasture analogy and shows the very limited notion of the commons he used, and where subsequent work by commons scholars have shown that there is far more diversity in commons and common pool resources situations. She found that all commons systems cannot be placed within the simple pasture analogy used by Hardin. Meinzen-Dick (2007) uses the diagnostic framework to examine water institutions. Using the second tier variables from Ostrom (2007c), Meinzen-Dick examines the outcome of a variety of water management approaches and identifies some third tier variables associated with irrigation systems management. For practitioners, the multitier framework provides an extensive, and rather complex, method to develop a baseline understanding of the particular situation of interest. It is envisioned that the multi-tier diagnostic framework can be further developed and cases of success and failure can be compared with methodological consistency. Unfortunately, knowing what to do does not inform us about how to do it.

There remains a chasm between the theoretical constructs and advice from studies of common pool resources, and the applied, practical approaches necessary to overcome resource coordination problems and to avoid degradation. As Young (2002) states, “the sizable gap

between the world of analysis and the world of praxis is cause for concern” (p. 165). This reflects not the failure of research, but the challenge agencies, governments or policy makers have in knowing how to apply the theoretical and case study lessons in their particular situation. The institutional failure model from Chapter 3 uses as similar approach as Ostrom’s (2007c) multitier diagnostic framework, but focuses on the indicators as sources of failure and not as a map of the social-ecological institution. While the diagnostic framework characterizes which variables are present or not in a particular system, it does not necessarily indicate the source of failure.

For example, the diagnostic framework provides an accessible method of categorizing Hardin’s commons, but why are these herders not communicating and why have they not developed rules to ensure the long-term health of the resource system? The finite size of the resource, a large number of users, mobile resource and the tendency to maximize short-term gains, create the conditions for degradation. However, adding to that is the overarching situation of open access to the meadow that allows the capture of short-term benefits through individual pursuit. Failure may result because the users don’t communicate, they have familial ties that preclude coordinating with other families, they are in a situation of dire poverty, or the pasture is slowly flooding and will be of no use in a matter of years in any case. Getting appropriators/providers to cooperate and agree to some boundary and choice rules may be possible, but whether they follow them could be precluded by the underlying characteristics of failure. By moving to a more analytic evaluation of why degradation is occurring from a more descriptive characterization of the social-ecological system, policy analysts can narrow the choice set facing decision makers in the development and implementation of policy. This focus is consistent with the diagnostic approach in that Ostrom (2007c) notes that the decomposability of social-

ecological systems allows policies to be “explored in one part of a system without imposing uniform formulas on the larger system that might lead to large-scale collapse” (p. 15182).

Steins and Edwards (1999) use a more sociological approach to explaining the outcomes of a common pool social-ecological system. They reject the neo-institutional approach to common pool resource management as it focuses on smaller single-use resources and relies on *a priori* design principles for successful collective action in commons situations. The authors recommend the use of a social constructivist perspective in order to “explain” rather than describe the outcome of common pool resource management (Steins and Edwards, 1999, p. 541). A social constructivist approach considers collective action to involve “not only people and their obligation, dreams, desires, and priorities, but also a variety of non-human resources, such as a common good or problem, a certain technology, paperwork, money, and so on” (p. 544). A social actor operating within some common pool action arena interacts with others and will make choices based on “(1) networks of social relations...; (2) the meaning that is attributed to the collective management system; (3) perceptions of the wider environment in which the collective action process is embedded; and (4) social experience” (p. 544). The researcher will proceed with an investigation with no *a priori* assumptions of success or failure, as would be the case using the design principle approach. This removes much of the agency of individuals and follows a more embedded description of the issue that finds the individual or agent within the structure of a social system (McCay, 2002). It leaves the analysis of common pool situations somewhat less structured and more based on grounded theory to discover situations and outcomes on a case by case basis, but the approach does make one reflect a broader range of contextual factors within an understanding of interactions and cooperation among actors within a complex common pool social-ecological system.

What is common in the objectives of most institutional frameworks and analytical models is the recognition of the complexity of social-ecological systems and their embeddedness within multiple resource and institutional scales. A failure to recognize these linked action systems can lead to inappropriate policy development and failed implementation. Scale or institutional mismatch was introduced in Chapter 3 as a source of institutional failure. Young (2002) emphasizes fit, interplay and scale in his discussion of institutional dimensions. Scale in terms of spatial, temporal and jurisdictional; fit in terms of the transferability of institutional design; and interplay in terms of the interconnections across and within vertical and horizontal scales. However, as Cumming et al (2006) note, the response to scale mismatch is not well understood: “The question of how best to resolve scale mismatches remains a frontier for research on social-ecological management and policy” (p. 16). Cumming et al (2006) argue that the resolution of scale mismatch must start with, first, recognizing that ecological and institutional scale mismatches contribute to the erosion of social-ecological resilience, and second, establishing the conditions for the creation of adaptive co-management.

Young (2002) proposes his own “institutional diagnostics” approach that “attempts to disaggregate environmental issues, identifying elements of individual problems” thus taking a “problem-solving perspective” to reach “conclusions about design features necessary to address each element” (p. 176). Young (2002) describes the approach as “a procedure in which the problems are considered on a case-by-case basis and prescriptions or recommendations are developed that take into account particular combinations of conditions” (p. 176). Young separates the diagnostic process into simple and complex. The simple diagnostic approach involves a description of relevant conditions and an evaluation of their design implications.

Young (2002) provides an example of three diagnostic conditions (among potential others): “ecosystem properties, actor attributes, and implementation issues” (p. 177). He notes however that this simple approach ignores potential interactions among the conditions, for example in such cases as climate change. As such he also introduces the concept of a complex diagnostics approach. While this approach would incorporate the potential interaction of one or multiple other diagnostic conditions, he notes that “a useful typology of these interactions is currently beyond our grasp” (Young 2002, p. 184). This orientation to a problem based approach is consistent with and provides guidance to the development of the framework in this dissertation.

A significant volume of theoretical and empirical work has been done to illuminate the endogenous and exogenous characteristics of common pool resources and their home within the commons. Institutional scholars have moved from early research looking for institutional success ‘design principles’ to a greater emphasis on the relationships among variables, to a micro-depiction of rules, and to the development of methods to diagnose institutional conditions. Numerous empirical case studies have been undertaken that use a variety of methods in the exploration of a variety of theories of common pool resources. The challenge is to use and further benefit from this information in a more aggregated fashion, thereby learning from this common pool of knowledge and combining this resource into a collective benefit. This challenge is the focus of the next section’s presentation of the typology of intervention modes and Chapter 7’s case study assessment.

4.5. Typology of intervention roles

If the institutional failure model identifies that a problem exists, now what? Government has two initial choices: to intervene or not to intervene. Having a politically palatable policy option available can influence policy change; however, a common statement in the literature and adopted here is that change and paths of change are not only path dependent but context specific, thus off-the-shelf policy options may be out of date or of inappropriate scale. Acheson (2006, p. 129) argues that resource “management will be effective only if resources are matched with government structures and management techniques. A governance structure using a certain technique on one resource might succeed, whereas the same governance organization using the same technique might fail miserably when applied to another resource.” Grafton (Grafton 2000, p. 515) concludes that if a state acts as a “facilitator or coordinator” in resource management it “should recognize its limits ... manage within its capabilities ...” and provide a regime that matches “individual incentives with collective interests.” Resource management policy endeavours to assign an institutional regime defining the rights, duties and obligations associated with resource use, but there is no one property system that necessarily provides assured, successful coordination among users (Stevenson 1991; Baland and Platteau 1996; Grafton et al. 2000). As such, Acheson (2006, p. 129) concludes that institutional design will have to “combine various elements of privatization, government control, local control and managerial techniques...” The purpose of this section is to examine the way in which government engages in resource management and indicates the range of intervention possible. The resulting typology is one of the building blocks of the intervention framework developed in this dissertation.

The literature identifies a variety of coordinating methods from assigning or redefining property rights (private or state property), to reconfiguring the locus of decision making (decentralization, centralization, co-management), and a more nested polycentric approach (multiple level, interactive but independent organizations). But what do these terms mean in relation to the specific direction of policy and focus of state intervention? What role does the state need to take to ensure the efficient and sustainable use of an under-managed common pool resource? The preceding discussion suggested that there is a range in the actions government can take in managing resources. The variation in the user community's capacity for participation, the heterogeneity of the resource, and the capacity of the government to effectively participate will have a bearing on the approach taken. There is also a range in the intensity of intervention from a more direct and hands-on regulatory role to a more facilitating role where the government is not the central actor in resource management. The following intervention mode typology attempts to capture this range and variability in social-ecological characteristics and management needs. The typology includes the following modes of intervention: obstructionist, absent, facilitative, coordinating, and prescriptive. A more detailed description follows.

To illustrate and compare the role of the state within each typology mode the following comparative criteria are used:

- Actors,
- Policy mechanism,
- Information,
- Access and use limits,
- State role/function.

The contribution of this typology to the intervention framework is discussed in Chapter 6, and its use is illustrated in the case study in Chapter 7.

4.5.1. Government intervention mode typology

Obstructionist intervention is defined as either the willful or inadvertent policy outcome that obstructs a particular user group or stakeholder from protecting its values, or achieving its own individual objectives. Such policies may be intentional, such as federal policy to monitor levels of market concentration in an effort to ensure market failures do not result from the exercise of monopoly or monopsony power, thereby protecting social benefits. Other policies may exclude local groups, for example, from participating in the management of a local watershed, or by altering or restricting access to a market. These other obstructionist policies act to reduce social benefits. Some policies may inadvertently obstruct the objectives of others. In this example, obstructionist intervention is a purposeful exclusion of some stakeholder or other interest group in either the management of a resource or access to it.

An obstructionist state role is based on the following criteria:

(1) Actors

- Government actors constrain activity in the market, and compete with non-government actors. Tensions among actors can be high.

(2) Policy mechanism

- Policy directly obstructs certain action through legislative or regulatory means.
- Policy creates incentives that foster the development of one sector at the expense of another, either intentionally or unintentionally through legislative or non-legislative (bureaucratic) means.

(3) Information

- Information about the particular common pool resource in question is lacking or not collected leading to knowledge gaps and unknown consequences.
- Information is collected and used against company objectives, such as in anti-combines investigations.

(4) Access and use limits

- Specific limits may restrict appropriation from resource.
- None may be in place for common pool resource of interest, but other property rights or access rules may preclude access.

(5) State role/function

- The state takes active role in hindering the development of the sector or sector-led objectives.
- The state is unaware of the way in which it is hindering the provision of the common pool good via other resource related activities.

Absent describes a situation where the state does not participate in the rule category either during its development or operationalization. There may be no rules defined in this case, by either the state or in collaboration with a local user group, or the user group has developed and operationalized its own rules, or bases use on norms and strategies. The state may be unaware of the level of user management present. Absent policy does not necessarily indicate complete state ignorance of a problem. A non-decision or negative decision may have led to the state's absence in resource management.

An absent state role is based on the following criteria:

(1) Actors

- Government is absent as an actor, leaving non-government agencies, resource appropriators/providers to deal with any issue that arises.

(2) Policy mechanism

- No written policy and legislation; or policy established but state ignores or is incapable of enforcing.

(3) Information

- No information gathering or monitoring by the state.
- Uncertainty regarding the level of resource appropriation and a lack of awareness of an issue if one exists.

(4) Access and use limits

- No formal mechanism to restrict access and use through position, boundary and choice rules.

(5) State role/function

- No role taken. Need for role not recognized or discounted.

In a **facilitative** role the state attempts to aid the user community to more effectively allocate and use resources themselves through the development of user-generated rules. The state may have attempted to provide a secure set of property rights to a resource or land, or to provide information and other support to assist in encouraging the development of a user organized management regime or the reformation of an existing system and set of user generated rules. Rules become more dominant over reliance on norms and strategies among the user-community.

A facilitative case is based on the following criteria:

(1) Actors

- Government participates as an actor, but not in an active sense and more in a supporting role.
- Non-government actors and resource appropriators/providers are expected to take the more active role in dealing with common pool resource issues that may arise.

(2) Policy mechanism

- No legislation or regulations.

(3) Information

- State collects and provides information to user community.

(4) Access and use limits

- Non-legislative policy to provide support for restricting access to resource through position, boundary and choice rules.
- Some of the seven rules have been devised by user-community, but perhaps not all considered.

(5) State role/function

- State promotes the development of and supports user organizations.
- State recognizes local right to devise rules or participate in rule making.

A **coordinating** role indicates that the state takes a stronger leadership or partnering role in the development and maintenance of a management regime. Rather than supporting user groups in rule making and maintenance, the state participates in rule making, coordinates the development, implementation, maintenance and enforcement of a set of rules to coordinate

resource use. Users are required to follow the rules, in contrast to the facilitative role which establishes a foundation and perhaps incentives for user-based regime development, but does not necessitate its use. Property rights are specified, although common pool challenges to restricting access remain, thus the state may not be attempting to overcome all common pool dilemmas.

A coordinating case is based on the following criteria:

(1) Actors

- The presence of the state as an active participant in resource management is visible.
- Working with, rather than simply supporting other non-government actors reflects the relationship among participants.

(2) Policy mechanism

- State requires the establishment of user organization, and participates in meetings.
Could be a legislated requirement to organize, and at the least a policy objective.
- Rules are jointly derived and are clearly stated, or at least written.

(3) Information provision/accessibility

- State collects and uses information to inform and set policy, and provides information to user community.
- Users monitor and report infractions to state authority.

(4) Access and use limits

- Access is restricted to user community, with any necessary use limits set by the community in coordination with state planning functions and information. State facilitation of this rule development may be necessary.

(5) State role/function

- States coordinates or limits access and legislates penalties, establishes position and boundary rules in collaboration with user-community.

A **prescriptive** approach to managing a common pool resource describes a situation where the state is the dominant participant in defining rules that broadly influence the way in which users are provided access, how they participate in resource extraction, the methods used, when and where. The state takes a significant role in information gathering and analysis that is used in the setting of various obligations, requirements, appropriation limits and in the monitoring of infractions. The prescriptive approach tends toward a top down method of rule configuration and implementation.

A prescriptive case is based on the following criteria:

(1) Actors

- Government is the predominant actor in common pool resource decision making.
- Non-government actors are subject to decisions, rather than participants in decision making.

(2) Policy mechanism

- Rules are defined by the state.
- State monitors and enforces rules through legislative authority.

(3) Information provision/function

- State collects and uses information to inform and set policy, and provides information to user community.

- State collects and uses information/data to determine harvestable flows, and to set extraction levels.

(4) Access and use limits

- State limits use, equipment, and requires licenses or permits to access resource.
- Restricted access. Property rights are clearly specified and enforced.
- Property rights apportioned and allocated by the state.

(5) State role/function

- The state assumes a leadership role, not only in setting prescriptive requirements, but also in monitoring and enforcement of rules.

These modes of intervention are not mutually exclusive and can be combined to more effectively fit the situation. An example of a combined approach would be a prescriptive-coordinating approach suggesting that the user community may develop rules, but within potentially very narrow bounds. For example, the procedures, information requirements, and interaction between the appropriator community and government may be legislatively mandated, but the appropriator community takes a dominant role in carrying out the actual monitoring and resource planning within the established limits or requirements. A focus on performance and longer term objectives through scope rules may direct or guide resource development activity.

The intervention mode typology provides guidance as to the intensity of government intervention by assigning the focus of coordinating activity in varying degrees to the individual or the state. While providing an alternative way of approaching the coordination of resource users, at this point the model is a descriptive tool. This point is where many models will stop,

leaving the actual design and implementation of a coordinating or facilitating regime for government to consider. However, this next step is what governments are lacking: a method or approach to structure the way in which it will intervene in a common pool resource market. This approach does not suggest what to do, but how to do it. It is a process of intervention. Determining the elements of that process is the subject of the case study assessment in the next chapter.

4.6. Summary and conclusions

The purpose of this chapter was to introduce theories of institutional change, not in an in-depth comparative discussion of different disciplinary perspectives, but in a way that revealed useful theoretical propositions that could guide the development of the intervention framework and help structure its underlying methods of institutional change. The theoretical discussion was followed by the development of an intervention typology that identified five methods of government intervention, referred to here as intervention modes: obstructionist, absent, facilitative, coordinating, and prescriptive.

Institutions are the formal and informal coordinating mechanisms that structure our interactions with others and how we go about our daily lives. The theoretical discussion suggests that institutional change emerges spontaneously through informal adaptations in the norms and strategies that influence how individuals interact, and more formal directed and intentional change through state enactment of legislation and policy. We may not notice many informal changes as norms evolve slowly and rather subconsciously through a variety of processes, while formal change can be observed more clearly over shorter time frames enacted

by a governing authority or some other organizational entity. Both forms will influence the way in which we interact and coordinate our movement through a social-ecological system.

Change can evolve from distributional conflicts (associated with the distribution of benefits and/or costs), evolving through market related changes, and/or a recognition of the failure of existing institutions to provide the necessary benefits of coordination. While individuals influence and are influenced by institutions, change evolves from a collective movement and is adopted into societal norms through joint acceptance. In many cases, there are winners and losers resulting from institutional change and power asymmetries will influence the direction of change, or may result in the status quo maintaining the current distribution of benefits. Nonetheless, change occurs, whether slowly in an incremental manner, or abruptly through greater conflict and upheaval. In this dissertation, the focus is on the more formal means of institutional change.

We observe the formal mechanisms of institutional change through legislative acts of governments, within corporate organizations establishing codes of conduct for example, or the way in which a local common pool user group will enact new choice rules for its members to follow. The role of the state in the management and coordination of common pool resources was illustrated in government's intervention modes, which include obstructionist, absent, facilitative, coordinating, and prescriptive. The role typology shows the range of intervention possible and that not all cases of resource use require a state-dominated approach. The level of interaction identified in the role typology links back to the output of the institutional failure model. Linking forward to the completion of an intervention framework requires one last building block – a more clear depiction of how a government, agency or other actor moves from

a recognition of a problem and an understanding of the intensity of intervention required to the actual enactment of policy. This is where institutional change models or frameworks tend not to venture.

Chapter 5. Case study analysis of institutional change

5.1. Introduction

The purpose of this chapter is to learn from the work of others and to use that information in the construction of the next building block of the intervention framework: intervention properties. The chapter begins with a review of the methodology used in the analysis of common pool resource case studies, followed by a summary discussion of the cases themselves. The chapter then presents the intervention properties and how they function within the intervention framework.

5.2. Case study review

This section of the dissertation uses published case studies as a source of data. The case study becomes the unit of analysis. Qualitative content analysis was used to identify themes and to develop a model of intervention action items. The use of this method evolved after attempts at using a more structured deductive approach based on Ostrom's (2005) grammar of institutions and rule configuration. However, the case studies generally did not have a sufficient level of detail. So the approach and methods evolved. Similar to Ostrom's (2008) description of her quest for specific patterns in rules, the path of discovery is never direct: "I spent weeks and weeks reading cases, writing them up, redoing statistical analysis, and thinking that I was a dope for not being able to identify regularities...Perhaps what I needed to do was move up a level or two in generality and try to understand more general institutional regularities..." (p. 6). In perhaps a similar fashion, an inductive research focus evolved for this research. As noted by Marshall (2005), an inductive methods approach may be better suited to investigating complex

social-ecological issues faced with path dependent constraints, and may be more suitable supporting adaptive management institutional frameworks.

5.2.1. Case study selection

Case studies contain a wealth of information, although their use in a comparative sense is often limited by the inconsistency in theoretical approach, data collection and analysis – rather murky waters to venture into. The rationale for using published case studies as a source of data was based on two factors: first, the data collection method was inexpensive and was possible while the author continued to work full time elsewhere; and second, case studies can provide a detailed account of the subject under study and have been underutilized as a source of data. The use of published case studies for the study of common pool resources has been promoted and/or adopted by authors such as Agrawal (2002), Pagdee et al (2006), although reaching generalizable conclusions, or having external validity is a concern given the variety of methods used and data collected (Poteete and Ostrom 2008). The topic of common pool resources and common property rights management regimes have been the subject of numerous case studies, providing a rather untapped detailed source of data. Commons scholars are now calling for the careful use of these studies as sources of data to further develop institutional theories. Various methods are available to do this, such as meta-analysis, case survey analysis, comparative case analysis, content analysis, and grounded theory methods.

The central source of case studies used in this dissertation was Ph.D. dissertations downloaded from Dissertation Abstracts database. The selection phrases “common pool resources” and “institutional analysis and development” were used to generate the initial selection of cases. The database is always growing as new works are added to the system; a query on the database

on March 10, 2009, generated 198 documents under common pool resources and 183 under institutional analysis – there was some overlap. To limit the number of studies included in this analysis a purposive criterion based sampling method was used. Further culling of case studies was based on the following selection criteria: use of case study method, a focus on common pool resources, the study of institutional change, and completed within the last 10 to 15 years. Case selection was not based on any specific geographic region or particular resource.

From these searches (multiple searches between 2007 and 2009) 53 dissertations were identified as potential sources of data. Two books were added to this collection. The 55 cases were then reviewed for the level of detail in their institutional analysis of the particular case, their focus on institutional change, the state as participant, and discussion of institutional rules. From this selection process 16 case studies, including the two books, were chosen as sources of data (see Table 5 for a list of case studies). It is likely that further queries could have garnered twice as many case studies, but the final number was somewhat based on time and resources available to the researcher – the 16 cases also revealed clear consistent themes. More recent case studies (i.e., within the last ten years) were generally chosen as their analysis focused on more recent institutional concepts based on either the IAD framework, institutional rules, or natural resource institutions more generally. Since the publication of Ostrom's (2005) *Understanding Institutional Diversity*, work by researchers through the International Forestry Resources and Institutions (IFRI) network (see <http://www.sitemaker.umich.edu/ifri/home>) and the more recent Panaceas work by Ostrom (2007c) and others (Meinzen-Dick 2007; Wilson et al. 2007), new sources of highly consistent and comparable data should be emerging for future studies using published cases as sources of data.

Table 5: Content analysis case study list.

	Case author	Case description	Region
1	Mitchell (1997)	BC geoduck management and the evolution to individual vessel quotas.	British Columbia, Canada
2	Vargas – Prieto (1998)	Decentralization and evolution of <i>ejido</i> (community) based forestry.	Quintana Roo, Mexico
3	Varughese (1999)	Decentralization of resource management in Nepal and the return of community based forestry.	Nepal
4	Chamberlain 2000	Assessment of and recommendations for US Forest Service management of NTFRs.	USA
5	Mascia (2000)	Assessment of marine protected areas in the Bahamas, Barbados, and Belize.	Caribbean
6	McLain 2000	Management of the wild mushroom harvester labour force in Oregon.	Oregon, USA
7	Yandle (2001)	New Zealand fisheries management and shift to individual vessel quotas.	New Zealand
8	Andersson (2002)	Decentralization of forest management in Bolivia, focus on municipality capacity.	Bolivia
9	Acheson (2003)	Evolution in the management of Maine lobster fishery.	Maine, USA
10	Mwangi (2003)	Effects of land privatization on Maasai herders and the failure of group ranches.	Kenya
11	Ballard (2004)	Management of salal in Washington state – focus on influence of land tenure on sustainable practices.	Washington State, USA
12	Blomquist, Schlager, Heikkila (2004)	Development of Arizona conjunctive water management, and water regimes in California and Colorado.	Arizona, USA
13	Spreyer (2004)	Management of salal in Washington state – focus on labour impacts of tenure changes.	Washington State, USA
14	Wagner (2005)	Joint management of groundwater and wildlife among private landowners in Texas.	Texas, USA
15	Jarvis (2007)	Lack of effective trans-boundary groundwater management and recommended institutional reform.	International
16	Pacheco (2007)	Decentralization of forest management in Bolivia, focus on small land owner capacity.	Bolivia

5.2.2. Summary of case studies

The theoretical discussion in Chapters 2, 3 and 4 provide a conceptual focus for a case study comparative assessment of common pool resource management systems. Basic institutional elements from Chapter 2 include the propositions that institutions are important and the state has a role in institutional development, maintenance, success and failure. Important elements within those understandings are the existence of rules and property rights, the necessity of

collective action, and the complexity created by the common pool nature of the social-ecological systems. Chapter 3 highlights the sources of institutional failure to include market, policy, or collective action failures. Chapter 4 considers institutional change, including why change occurs and how government is involved.

The sixteen case studies represent a wide range of common pool resource situations. Each case study in its own way examines the changing institutional context in the management of a common pool resource, including fisheries, forests, groundwater, wildlife, non-timber forest products, and protected areas. The cases are from the U.S.A, Canada, Mexico, Bolivia, Kenya, Nepal, New Zealand, and the Caribbean. Some of the case studies involve resource systems caught within broader more significant institutional change (Andersson 2002, Pacheco 2007, Mwangi 2003, Varughese 1999); others involve more resource specific changes but still contain some fundamental shifts to the institutional context of resource appropriation and provision (Yandle 2001, Vargas-Prieto 1998, Acheson 2003, Spreyer 2004); two provide comparative studies of different common pool resource cases (Mitchell 1998; Blomquist et al 2004); three of the cases look within specific resource sectors to understand the contribution of various institutional elements in the management of a particular common pool resources (Chamberlain 2000, Wagner 2005, Ballard 2004), one case study examines not the exploitation of a common pool resource, but the conservation of common marine areas in the Caribbean (Mascia 2000); and finally one case study examines trans-boundary issues of a common pool groundwater resource (Jarvis 2006). All the case studies involve institutional analysis and provide a detailed account of the situation, the problem, and actors within particular action arenas, and all provide information about interactions among various actors and across action arenas.

Vargas-Prieto (1998), Varughese (1999), Andersson (2002), and Pacheco (2007) examine a variety of methods to bring control and opportunities to the local level through the decentralization of forest management. Two of the case studies, (Andersson, 2002; and Pacheco, 2007), examine the decentralization of forest governance in Bolivia from an institutional analysis perspective. While focusing on the same area and institutional change tends to reduce the overall number of different common pool resources examined, it does provide a re-evaluation of the success or failure of the decentralization process at two different time periods. Andersson questions the movement towards decentralization as a panacea for better forest governance. He examines decentralization as it influences the motivations of municipalities to engage in effective forest governance and concludes that several institutional and socio-economic factors also influence municipal motivations. Pacheco examines decentralization from the perspective of indigenous people's development of commercial community logging ventures. He concludes that while structural or legal mechanisms allowed for the development of indigenous logging, there was a lack of "organizational, financial, technological, and managerial support to timber user groups" (Pacheco 2007, p. 280). Both studies conclude that further engagement and support from more senior levels of government would support the decentralization policies by assisting municipalities to deliver the required services and more effectively facilitating the access of small land holders to reform policies.

Four case studies consider the appropriation of non-timber forest products in the U.S.A. Two of these examine the same resource, but from quite different perspectives: Ballard (2004) and Spreyer (2004) investigate the salal industry in Washington State, McLain (2000) provides an assessment of the wild mushroom harvesting polity in Oregon, while Chamberlain (2000) looks at the way in which NTFRs are incorporated into the forest management plans of national

forests. The pairing of the Washington State salal studies brought different insights and conclusions regarding policy direction. Spreyer examines the salal industry from a political economy perspective and how changing federal and state policy, influenced by the power of the salal wholesale sector, led to the “enclosure of understory resources and the subsumption of labor” (p. 2). Rather than the harvesters gaining longer-term access to the resource and a more secure source of income, larger companies and contractors gained control of access, distancing many harvesters further from control of the resource, subsequently removing many incentives for good resource management. Ballard (2004) looked at the variety of land ownership types in Washington State and their short- or long-term access arrangements, then correlated these types with heavy or light harvesting practices. She found that longer term access arrangements and the level of harvester experience were important for choosing whether to use lighter harvesting practices and systems of rotating areas. The greatest level of interaction and engagement with government and researchers was through an association of harvesters who had long-term access to a distinct landbase. The Northwest Research and Harvester Association (NRHA) in conjunction with the Washington State Department of Natural Resources and Washington State University provided harvester training and collaborated in research efforts. This arrangement provided the longer-term incentives to participate in information sharing and sustainable use of the resource. Thus one study considered the negative consequences of lease type arrangements, while the other found positive implications of larger lease-based access entitlements.

Rebecca McLain (2000) uses a political ecology perspective to examine the policies of the Forest Service to maintain control over the influx of mushroom harvesters to the Sisters Ranger District in Central Oregon. She finds the policies do not fit with the needs of the picker community and

little has been done to incorporate the picker community into decision making. At the broader NTFR resource and national levels, Chamberlain (2000) found that these understory, minor forest products have received sporadic and inconsistent attention, regardless of their socio-economic benefits and the need for policy development and management. Two of the reasons for this relegation of attention are (1) the perception among forest managers that a lack of management is not problematic, and (2) the poor organization of NTFR stakeholders and their lack of ability and desire to vocalize the needs of the NTFR sector. Chamberlain (2000) concludes that information and knowledge sharing is essential to improve the coordination of the NTFR sector.

Three case studies looked at fisheries: Mitchell (1998) examines the geoduck fishery among others in British Columbia; Yandle (2001) examines the near and far-shore salt water fishery in New Zealand; and Acheson (2003) examines the evolution of the lobster fishery in Maine. Each study considers institutional changes to the particular fishery. In the New Zealand and British Columbia examples, fisheries management adopted an individual tradable quota system that reduced excess pressure on the fishery and led to greater interaction among fishers in resource management efforts and research. The evolution of Maine's lobster management regime was traced over about 100 years as the industry, geography and settlement patterns in Maine influenced the industry's organization, with the eventual entry of the state and federal governments attempting to influence the outcome of shifting management needs. The book traces the evolution away from a user-managed regime consisting of regional "lobster gangs" to a state-centred regulated zoned fishery that maintains many of the original user-generated rules and incorporates user organizations within the decision making and management framework

(Acheson, 2003). In each of these fishery cases, the interaction between fishers and government was significant, both during institutional change and maintenance.

Two case studies examine institutional arrangements for the management of groundwater. Blomquist et al (2004) provide a detailed description and assessment of three contrasting groundwater management efforts in Arizona, Colorado and California. The state's function in these cases ranges from having a limited jurisdiction over ground and surface water management and having appropriator/provider organizations and the courts directing policy development, to taking a much more prescriptive approach where the state directs policy development and implementation. Jarvis (2006) examines the complexity of and need for trans-boundary groundwater management. Groundwater differs from other below-ground resources such as oil or minerals in that groundwater is part of a near-term complex hydrologic system linked to surface and ocean waters. He finds that an understanding of aquifer capacity and flows is poor, monitoring of groundwater resources is rarely undertaken, and groundwater recognition is generally absent from treaties or agreements. Jarvis (2006) concludes that a broad international management regime similar to or an adaptation of the UN Commission on the Law of the Sea would best match the needs of managing trans-boundary groundwater issues.

Mascia (2000) provides a very interesting account of the development of three marine protected areas in the Caribbean. He outlines various strengths and weaknesses of the processes in which they were designed and the resulting effectiveness in protecting the marine ecosystems, while also incorporating the economic and subsistence needs of the local populations. He uses a modified set of Ostrom's design principles to assess the evolution and

effectiveness of the Bahamas Marine Reserve, the Exuma Cays Land and Sea Park in Barbados, and the Hol Chan Marine Reserve in Belize. Mascia's results are theoretically consistent: the more closely the regimes align with the design principles, the better the social and biological performance of the regime.

Two of the case studies consider the use of private property to manage common pool resources, but in contrasting regions (Texas and Kenya) and from very different historical and developmental perspectives. Mwangi (2003) provides a critical perspective of the colonial led imposition of private property rights over the managed commons of Kenya's Maasailand and the creation of group ranches as an effort to match the needs of marginalized Maasai herders with what was left of the remaining land base. Competing interests on the land and non-enforced boundaries led to the desire among group members to further subdivide the ranches into individual parcels to provide more secure land title. Individual ranchers were found to collaborate to ensure sufficient grazing for each other's herds. Wagner (2005) looks at how social capital is an integral ingredient in the success of groundwater and wildlife management associations among private landowners in Texas. He looked at levels of social capital among landowner organizations and its contribution towards effective group management of the two highly mobile resources.

The case studies are consistent with the theory of access and the importance of property rights and rules to structure the interaction of users within common pool social ecological systems. What is also clear is the divergence of approaches that can provide that structured interaction, and the formal or informal source of that structure. The case studies examine private property rights (Mwangi 2003; Wagner 2005), private rights within a publicly held resource system

(Mitchell 1997; Yandle 2001; Acheson 2003), community based common property rights (Vargas-Prieto 1998; Varughese 1999), and commons (Mascia, 2000). Three of the case studies involve the access and harvest of resources from public lands (McLain 2000, Ballard 2004, Spreyer 2004). What is common among the case studies is the movement towards providing a more refined set of rules associated with access, use, costs and benefits, and obligations that come with rights to property. A clear trend, at least within the case studies, is away from a state-centred nationalization model of resource management. As the cases in Bolivia (Andersson 2000, and Pacheco 2005), Nepal (Varughese 1999) and Mexico (Vargas-Prieto 1998) suggest, the capacity of the state to assume resource management functions over a large area with limited resources and experience is limited, with a consistent outcome being the reversion of land coordination to a more open access environment leading to resource degradation. All of this change, however, is in response to increasing populations and migration, increasing values and the demand for resources, both from local subsistence or commercial users to large industrial-based companies. Each actor has different objectives for resource use and place different values on how the fishery, forest, water or range resources should be used and how the benefits from that use should be shared.

The case studies have varying levels of detail regarding the specific rules coordinating the management and use of the particular common pool resource. This is true for both formal rules-in-form and the more operationally relevant rules-in-use. The seven-rule categorization system developed by Ostrom (2005) provides a model to organize the components defining any particular resource management regime, and is the ultimate level of focus in the structure of institutional change. However, the contextual variability around which a decision maker may develop these rules does not ensure efficiency, ecological integrity or equity in resource

management and institutional change. The multitude of potential rule definition combinations negates a blueprint application of a common pool resource management regime, yet the direction of change (e.g. from no boundary rules to using boundary rules to limit access) may be clear, suggesting that objectives may be clearly stated, but achieving them requires the appropriate choice among a host of tools and an adaptive management approach. The case studies support this contention that variation will evolve based on the interplay of the situation, the problem or objective, the institutional choices and the contextual milieu within which change is occurring. Yet the case studies also suggest that other intervening variables can affect the outcome of an institutional change and that attention to these variables is necessary. Ostrom's (1990) development of design principles is based the elements of successful enduring institutions that also underwent periods of change, conflict and further change. The case studies illustrate relatively recent institutional change, which is part of this common evolution of rules, norms and strategies. Time, conflict and adjustment may shape these institutions into well functioning regimes. The question is how long does one wait?

Access control in its various forms is important, yet for common pool resources the challenge of maintaining exclusiveness adds to the complexity of resource management. For example, Ballard (2004) and Spreyer (2004) document the continued theft and trespass that occurs within the salal industry in Washington State, regardless of established permitting and lease based access allocation measures, and transportation laws prohibiting the shipment of salal without proper permitting from the source's landowner. Consistent with common pool resource theory, the ability to fence or continually monitor the forests for trespass and theft is too costly, thus while some effort is made among land owners to control access and enforce property rights, theft has become a tolerated nuisance. Mitchell (1998) and Yandle (2001) look at different

examples of the introduction of private property rights in the form of individual tradable quotas for common pool fisheries. Each case study indicated success in lowering levels of access and potentially increasing economic efficiency, but both also led to greater demands among appropriator groups to participate in management and decision making at the collective and operational choice levels. The level of extraction within the fishery resource is not left to the private actor, however, and in each example the state continues its function of estimating the total allowable catch and undertaking stock based research. Structuring the rights to the resource in a more specific, quantifiable way among a set number of users reduced the tendency to overharvest and the highly competitive and dangerous practices associated with limited area and time openings, but the complex nature of stock estimation and setting allowable catch levels continues to be the central source of uncertainty in fisheries management. The fisheries and salal examples contrast the ability to introduce effective access controls and how that can further affect the institutional structure of the particular resource system. Salal is stationary yet any boundary or position rules under the existing system are difficult to enforce, while the two fisheries have been able to develop more effective monitoring and enforcement mechanisms that significantly reduce illegal access. These characteristics support the contention that common pool resources have a range of “common poolness” in that the relative costs of exclusion will vary across resource types and institutional contexts.

The Ballard and Spreyer case studies, as well as Varughese (1999) and Mwangi (2003), also reveal the implications of greater privatization and the effects of denying access to local appropriators through a change in the rights and rules governing local resources. In the case the salal harvest in Washington State, harvesters who were once permitted to enter a particular national forest, lost the individual right of access, thus becoming trespassers and thieves in

previously accessible areas. Varughese's (1999) account of the nationalization of Nepal's forests and the subsequent attempts to reverse the alienation of local appropriators reveals how individual resource management incentives can shift and subsequent mistrust in the state and its bureaucracy can reduce the effectiveness of reform. Mwangi (2003) shows how the colonial-led shift from communal to private property rights for the British then Kenyan elite perpetuated the power and role of private property, regardless of its inappropriateness for the needs of the excluded poorer Maasai herders. Private property was considered the only method available to the common Maasai herder that would ensure formal recognition of exclusive rights and prevent further alienation of their land. Blomquist et al (2004) note the importance of well defined groundwater rights in the evolution of conjunctive water management in Arizona. The highly complex nature of stationarity and storage issues associated with ground and surface water management led to the creation of a complex management framework using a state prescriptive approach in conjunction with the creation of private incentives for conservation and long-term planning. Private rights can vary considerably in their institutional design, thus should not be disregarded as a possible approach, but as with any property rights regime the ultimate design should be consistent with the situation.

The case studies also reveal the result of resource congestion, where the capacity of the resource to supply appropriators with sufficient produce diminishes and a reduction in appropriation levels is necessary. The outcome of that reduction comes either in the form of reduced use by all previous users, or the removal of some users from the system. A common result of institutional change in the case studies was the reduction in the number of appropriators accessing the resource, as a result some people were negatively affected by this loss of economic opportunity (Mitchell 1998, Yandle 2001, Spreyer 2004). In Spreyer's case

however, access restriction simply resulted in a redistribution of access control, and had little effect on appropriation levels. Acheson (2003) discusses the methods to control entry to the lobster fishery (boundary rules using Ostrom's rule configuration) in Maine. Methods included residency restrictions, exit-entry rules, and apprenticeship programs that would allow limited access for younger fishers. Maintaining effective control over access to the fishery was critical to the maintenance of the lobster stock. Different common pool resources have varying levels of value and attention, thus requiring different levels of institutional attention. How access or boundary conditions are set and how allocation and use levels, or choice rules, are defined tend to follow the theory that higher valued resources will be matched with higher levels of management. In each of the case studies the state plays a significant role in choosing the path of institutional design, but not the only role.

The creation and application of rules should not be considered the purview of state governments, certainly in context to the collective action dilemmas associated with common pool resources. As Ostrom (2005) states: "Collective action is required to establish and enforce rules limiting the appropriation of water, fish, forest products, pasturage, and other resource products...Those who try to solve these problems have to cope with complexity as well as coping with the commons" (p. 219). This collective action is not just necessary at the appropriator level. Andersson (2002) concludes in his account of forest sector decentralization in Bolivia that forest "tenure insecurity requires a broad, collective problem-solving effort among a score of different political actors at different levels of authority" (p. 251). In the Bolivia case, the central government decentralized some decision making authority to local municipal government levels, but only a few (at the time of Andersson writing) showed signs of successfully developing and implementing effective forest governance. Any success was due to the level of integration and

information sharing with other communities and organizations, and through the support or engagement of the national level government and non-governmental organizations (Andersson, 2002). The case studies reveal a great deal about the ways in which state actors, resource appropriators, and outside organizations interact and engage with each other, whether negatively or positively.

Collective action, in one form or another, is observable in all of the cases studies and supports the relevance of collective action in common pool resource theory. For example, Chamberlain (2000) discusses the shift in management of US Forest Service lands and the movement towards more “[c]ommunity-based decision making ... as a means to develop collaborative forest management strategies” (p. 10). The lack of collective action among non-timber forest product appropriators means that their collective voice goes unheard. Wagner (2005) examines collective action among private landowners in Texas to manage highly mobile and valuable trans-boundary groundwater and wildlife resources. Contributing to the success of various water and wildlife associations is the level of information sharing, the frequency of association meetings, and a mistrust of state or local government oversight, thus the desire to develop owner-defined management regimes that fit within a higher level coordinated government approach. Acheson (2003) reminds us, however, that collective action must be solved at more than one level to overcome resource management issues. In Maine, the presence of first, second and third order dilemmas meant that fishers not only had to come together to discuss management issues, they also had to agree to specific management measures, and then enforce its implementation such that members of the fisher community did not resort to free riding. Acheson (2003) uses the example of fishers developing informal trap limits for the harvest of lobster in Maine, which were only possible under strict entry rules, leading to the need to devise

perimeter rules, or the establishment of geographic boundaries, and monitoring rules to ensure the adherence to the trap limits and access restrictions.

The state can foster collective action through the creation of or support for user groups, but often collective action is a defensive response of a stakeholder and a desire to influence policy. For example, in the Barbados Marine Reserve Mascia (2000) documents the evolution of fishing and conservation lobby groups each with different access objectives. The state became incapable of adapting protected area rules as each lobby group pressured for adoption of its particular vision. In Belize, the creation of the Hol Chan Marine Reserve led to new non-consumptive tourism related economic opportunities, while reducing other consumptive uses such as fisheries. The appropriators within the Hol Chan Marine Reserve became highly organized, including fisher and tourism organizations, but the changing economic importance of these two groups resulted in the transfer of power from the fisher associations, who no longer held the role as the central economic actor in the area, to the tour guide associations (Mascia 2000). Varughese (1999) documents that the success and failure of users groups is dependent on the ability to interact with different levels of land management agencies and having forums available for the sharing of information. Collective action may be part of a more formal co-management type regime, as in the New Zealand or geoduck fishery, or it may evolve as a natural response to the needs of particular communities as they negotiate new and emergent resource management structures.

The scale and scope of state participation in common pool resource management and its subsequent influence at the collective and operational choice levels varies significantly among the case studies. Scale in this sense indicates the depth or pervasiveness of the state's

involvement, while scope indicates the comprehensiveness of the policy regime. The common property literature is filled with numerous accounts of the positive and negative outcomes associated with state involvement (for example, see Agrawal and Chhatre 2007; Acheson 2006; Evans 2004; Grafton 2000; Lam 1996). As introduced in the previous section, the state's engagement can range from obstructionist, to absent, facilitative, coordinating, or prescriptive. The typology does not infer success or failure, nor does it suggest that moving towards a more prescriptive level of state involvement is necessarily good. Pacheco (2007) describes the efforts of the state's decentralization policy to foster community based commercial forest enterprises as a means of economic development and poverty reduction. However, a cumbersome land allocation approval process, uncertain markets, and conflicting policy encouraging forest conversion to agriculture discouraged local communities and individuals from pursuing these forest-based opportunities. Vargas-Prieto (1998) examines the creation of community, or *ejido* based forest property rights to provide local economic opportunity in Quintana Roo, Mexico. Shifting support from the state threatened the success of this effort and highlighted the importance of consistency in the state's role in institutional transition and its efforts to facilitate economic development opportunities at the local level.

One of the more significant examples of comprehensive state engagement and a prescriptive approach is the Arizona groundwater-surface water management regime (termed conjunctive water management). In contrast to the appropriator/provider and court driven models in Colorado and California, the Arizona state government established an extensive web of state agencies and laws to direct, manage and encourage long-term conjunctive water management for its larger urban centres and industrial/agricultural areas (Blomquist et al 2004). The regime is a mix of regulations requiring plans for long-term use and safe-yields, and it also encourages

its public and private water providers to conserve through a state agency based water banking and credit system. This comprehensive institutional regime to manage ground and surface water required providers to establish long-term water supply plans and to ensure the accommodation of any new development through existing assured water supplies. Underlying this prescriptive conjunctive water management approach is a network of state government agencies operating at various levels within the water management and distribution system. This nested method of institutional design in a large and complex common pool resource system is consistent with Ostrom's design principles.

The case studies also reveal that policy and stakeholder objectives may vary, thus measures and definitions of success will vary also. Spreyer (2004) notes that the US Forest Service shift from using individual access permits to large area-based leases reduced staff time dedicated to issuing bi-weekly salal permits, eliminated the hundreds of individuals lining up for permits at the Forest Service station office, and shifted the responsibility for harvester access and permitting to the lease holder. From the Forest Service perspective the change in the method of access allocation was a success; to salal appropriators the change led to the alienation of many long-term harvesters from direct access to the land base and shifted property rights to salal wholesalers, who now controlled both the purchase of the product and access to the land.

The sources of institutional failure introduced in Chapter 3 are visible in the case studies. In Mitchell's (1998) account of the growth of the geoduck industry in British Columbia, the early open access to the geoduck was replaced by licences and access restrictions. Even with access limits, timed openings, and industry wide total allowable catches the incidences of exceeding quota limits were common. The result of this initial management effort was the creation of a

limited-user open access regime; however, catch limits were disregarded as individual fishers sought to maximize their catch levels. Degradation of the resource became likely, which led to the collaborative effort between industry and government to develop the new individual vessel quota system. A similar story characterizes the New Zealand fishery example. A lack boundary or choice related limits on fishing effort led to concerns over the degradation of the in-shore fishery, and eventual changes in fisheries management. In Bolivia, state policies encouraging the transformation of forested land into agriculture land, the use of short-term forestry concessions, corruption, and a lack of enforcement and local control combined to create ineffective management, resource degradation and an inequitable flow of benefits to local residents. In response, Bolivia's central government implemented decentralization policies to encourage the participation of local municipalities and rural land holders in forest management, monitoring and economic development.

Institutional failure can also be the source of institutional change. In the case of the Maine lobster industry, concerns over harvesting levels and impacts on stocks led to conflicts over the direction of management and policy choices. Acheson (2003) outlines early conflicts between canners and fishers over maintaining the free flow of lobsters versus protecting the resource stock and the live lobster market. Regional differences and conflicts between small versus large fishers in the designation of trap limits also precipitated change. Political entrepreneurship and a low discount rate were also found to influence the evolution of institutions (Acheson, 2003). Institutional change also reflects certain philosophies towards policy options. For example, in 1957 Nepal nationalized its forests as did Bolivia in about 1952, and both countries turned to decentralized policies in the 1970s and 1990s, respectively. Both New Zealand and British Columbia adopted managed allocation systems involving individual tradable vessel quotas

(Yandle 2001, Mitchell 1998). The use of individual tradable quotas was being promoted by academic and government policy entrepreneurs at the time (Yandle, 2001). Thus while institutional change appears to generally follow a threatening increase in the exploitation of a resource and fears of degradation, the policy choices may be driven by certain philosophical beliefs. Not only are path dependent related policy choices a result of a state's internal historically driven management direction, but choice is also influenced by the externally driven direction of policy at the international level.

Many of the case studies revealed that the role of the state is not simply its legislative and regulatory functions defining the constraints and opportunities of resource use. Ongoing coordination or facilitation is also necessary, but in varying degrees depending on the institutional approach (e.g., market or regulatory based) and the level of responsibility assumed by lower levels of government and appropriators/providers. Mascia (2000) found that laws may be passed by government, but without active governance little may change in the day to day operational activity. He found that in the 1960s the initial establishment of the Exuma Cays Land and Sea Park in the Bahamas "did not significantly change the *de facto* regime governing the northern Exuma Cays, making marine resources virtually open access within a 'paper park'" (Mascia 2000, p. 187-8). Yandle's (2001) look at the shift in the New Zealand fishery to a market based individual tradable quota system led to greater interest among fishers to participate more fully in the management of the industry, thus leading to a co-management arrangement with government and industry, and to a lesser extent other stakeholders such as the Maori, recreational users and environmental groups. Yandle (2001) found the regime to be fragile, based on Ostrom's design principles, requiring attention to excluded groups, fishery management boundaries, sanctions and conflict resolution. Acheson (2003) found that federal

involvement in the Maine lobster management frustrated institutional development by not providing clear decision making jurisdictions for lower level governments. The more top-down approach led to inappropriate uniformity in rules and the resulting regime involved overly complex bureaucratic procedures.

The case studies suggest there is an issue of scope regarding institutional design and implementation, not only spatially or in terms of the breadth of interaction and engagement among actors, but also temporally in terms of attention to functions of implementation, monitoring and adaptation. Each of the case studies agrees that ongoing engagement and interaction among stakeholders must be founded upon not only the appropriate structure providing access to the resource, but also, as Chamberlain (2000), Andersson (2002) and Ballard (2004) among others note, the willingness to collect and share information. The ongoing monitoring and collection of information is critical for resilient adaptive systems. For the state to conceptualize a management regime it needs look beyond the passing of regulatory prescriptions and the provision of property rights, especially in cases where collective action dilemmas are present. If our objective is to foster resilient systems that can adapt to various pressures, effective implementation is a longer term effort of nested policy cycles able to adapt to changes where necessary. This adaptability is not self-propelled, but requires active governance, as Mascia (2000) points out.

While the case studies provide numerous descriptions of management regimes for common pool resources and efforts to overcome collective action dilemmas, the examples used do not necessarily reflect successful engagement or interactions among actors. The stories told are often about the lack of successful implementation and the authors' evaluation of missing

elements of regime design and governance. Wagner (2005) found that larger water management associations lacked social capital and were less successful in maintaining group cohesion. Missing from these groups were the trust and reciprocity developed through regular meetings, effective information sharing, the longevity of property ownership, and the length of membership. Wagner (2005) found that an increase in the number of absentee landowners had begun to erode the cohesion of the larger associations studied, and that group heterogeneity detracted from social capital and successful associations. Varughese (1999) outlines the failure of the nationalization of Nepal's forests and a more technical approach to forestry followed by less than successful efforts to return forest management rights to the local level in an effort to curb forest degradation. The state was ill-equipped to manage the vast tracts of nationalized forest land, subsequently forests became neglected and over-exploited in an open access environment. The institutional changes also led to a lack of trust between forest user groups and forestry officials, which Varughese cites as a significant impediment to effective management. Varughese argues that a relationship built on a partnership needs to evolve and that "there are tangible benefits seen in community forestry groups who engage in deliberate long-term patterns of interaction within groups" (Varughese 1999, p. 195). "The lack of interaction between villagers and officials except to enforce rules or exercise oversight does not make for an atmosphere that leads to stable mutual expectations ... assistance for community forestry (and other natural resources) that can be designed with mechanisms that create and nurture trust stand a better chance if viewed as a partnership" (Varughese 1999, p. 197). Varughese concludes that developing these partnerships can begin by focusing on "(1) processes of deliberate, long-term interaction and (2) structure of institutional-choice processes" (p. 197).

Developing partnerships and long term interactions among stakeholder groups and government, and fostering collective action in the design and implementation of institutional change for common pool resources requires some cohesiveness among the appropriator and provider community, at least in terms of having the incentive to converse and discuss issues and conflicts within a mutually respectful format. The need for and benefit of user groups or associations were noted in a number of the case studies. For example, as described by Ballard (2004), the Northwest Research and Harvester Association obtained formal rights of access to certain lands under the condition that the appropriators collaborate with researchers and forest managers. This collaboration led to a successful partnership promoting sustainable harvesting practices and fostering a two-way learning process. Varughese (1999) sees user groups as a necessary ingredient for the successful implementation of forest decentralization policies in Nepal. Groups need to be nested within the broader collective-choice framework. As Varughese (1999) concludes: "Facilitating the creation of institutional arrangements that allow users to adapt to changes in circumstances, to innovate, and to negotiate arrangements with other entities is important" (p. 201). Mitchell's (1998) discussion of the regime to manage the geoduck fishery outlines this type of evolution. Initially, the management system was incapable of handling the significant increase in commercial interest in the geoduck. Harvests exceeded allowable catch limits, regardless of entry restrictions and other management prescriptions. Encouraging the development of the industry while simultaneously ensuring the level of catch would not diminish the geoduck's productive capacity required a balance in entry and catch restrictions and more research to understand this relatively new commercial resource. The somewhat reluctant federal government eventually agreed to the introduction of a tradable quota system and self-monitoring that encouraged appropriator participation. The interaction among

stakeholders was integral to this evolution, as was the eagerness of industry to engage in effective monitoring and research through a third-party research organization.

The incorporation of user groups introduces another set of values into the decision framework, often reserved for the state government or influential lobby groups. The values held by different appropriators, land managers, local or state governments regarding common pool resources, or any resources, may differ significantly depending on the role the good plays in ones' area of interest. For example, the value of fuelwood or a medicinal plant within a local forest may be high for a community member looking to subsist from day to day, while the larger forest within which these resources are found may have greater value to a state agency as commercial timber. Mwangi (2003) notes this chasm in values in Kenya and the use of pasture as does Chamberlain (2000) in his examination of non-timber forest product use in the U.S.A. Reconciling these differences in values within a management regime is far more difficult than simply recognizing or acknowledging them within a management plan. Vargas-Prieto's (1998) look at the allocation of forest property rights at the *ejido* level in Quintana Roo, Mexico, is an example of state recognition of different value scales and the wider contribution of forest resources to local communities. Significant differences in values existed between the community, the state and forest industry players. Changes in both the institutional structure of forest and land organization and in the ways of thinking among state agencies and industry was required. This evolution was not always smooth or consistent and successive governments did not always support this decentralization effort and questioned the value of locally controlled forest resources. The Mexican case, however, provides an example of the recognition of value and scale differences and an attempt to overcome or at least accommodate these differences. Again, the endurance of these institutional changes relies on the longer-term support from state

agencies, something that was challenged in the Mexican case, but what is also clear in this case study is the depth of change across and within a variety of organizations (Vargas-Prieto 1998).

The case study summary indicates that resources, whether the same, similar or different may have the same, similar or different institutional structures. The case studies provide examples that could be considered unsuccessful, and those that appear successful. Often, however, the assessment of success depends on the actual or perceived objectives of the particular management approach and who benefits from the change. Whether centralized, decentralized, or polycentric in design, key elements in the success of institutional change appear to be the strength of the system of interconnected actors, how incentives are promoted or discouraged, the flexibility of institutional design, and the support from and appropriate level of intervention by the state. However, how does the state move from the definition of the issue and source of the problem to a definition of the rules necessary to overcome the issue? Various authors provide design elements of successful institutions and resource and user characteristics that foster collective action. However, there is little guidance for state governments to navigate through institutional change related to common pool resources and how intervention can be structured to achieve the various characteristics of successful enduring institutions. The following section uses the case studies to help develop one possible approach.

5.3. Case study content analysis

To identify some action related elements of a state's intervention (the unit of analysis) in a common pool resource market the case studies (the unit of observation) were analyzed through an inductive qualitative approach using case-oriented comparative content analysis. Ragin (1999) describes a case-oriented approach as being "centrally concerned with making sense of a

relatively small number of cases, usually between one and 50, selected because they are substantively or theoretically significant in some way” (p. 1137-8). As a result, the selection of cases is deliberate based on their relevance to the question of study and underlying theoretical basis of enquiry. In this qualitative comparative sense, variables are not considered as independent, but “combine” with each other to understand a particular outcome (Ragin, 1999). ‘Content analysis’ is a method of enquiry that involves the searching of text to find recurring words, phrases or themes (Patton 2003). Other methods are available to undertake this kind of research including comparative case analysis, case survey analysis, meta-analysis, and grounded theory analysis. Content analysis would fall under what Thomas (2006) would term a “general inductive approach” (p. 241). Methodological concerns associated with comparative analysis methods include potential issues related to ‘constructed’ populations that “may be open to favouring the findings of a particular research question” or that “may contain many irrelevant cases that significantly impact the results” (Mills et al. 2006, p. 622). Mills et al (2006) also discuss concerns related to cross-national or cross-cultural comparative assessments and the argument for the presence of ‘construct equivalence,’ or the same understanding or interpretation across nations or cultures of the meaning behind the units of analysis and observation. Causal inference may also reduce the attractiveness of qualitative case comparisons for reasons of poor internal validity associated with each case study, and external validity associated with the ability to extrapolate case results to other questions and units of analysis.

Content analysis was used in this study for two main reasons: first, most case studies did not provide a standard level of data or information about rules, how they were developed or changed, or how the state functioned within each case. Thus, based on the objectives of this

research using a more structured method such as comparative case analysis or case survey analysis was not practical. Missing or incomplete data and divergent case study objectives and methodologies would have led to the analysis results being unrepresentative. The use of the results from the content analysis in subsequent research using more structured methods is distinctly possible however. In this study, the search for themes was an inductive process of discovery, but structured within the IAD framework using specific or sensitizing concepts as a guide. These included institutional rules, processes of governance, and collaboration among various actors. Once the initial set of themes were identified, a sub-set of themes was chosen and a more deductive search or review of the case studies was undertaken (this process is further described below). The outcome is an analyst constructed set of institutional components that combines within the earlier derived degradation model from Chapter 3, and the typology of intervention modes from Chapter 4 to form an intervention framework.

Narrowing the focus of the content analysis was based on the questions of enquiry, the IAD framework, and influences of the theory and concepts of institutional change and state intervention. A specific list of analysis criteria was not used in order to allow the themes to evolve somewhat more naturally. The three questions of enquiry that situate the research are why, when, and how does the state intervene in the use of a common pool resource? The IAD framework provides an analytical structure for the research, in this case focusing on the interactions within and among action arenas, and the resource, user and rule contextual attributes that influence the outcome of actions within the action arena. For the process of discovery, each case study was read to understand the contextual conditions and the process of change. This was followed by a more focused reading for particular ways the users of the resource, the state and other actors interacted and brought change to the common pool social

ecological system. Many of the case studies dealt with different resources in different areas experiencing different issues. To isolate somewhat these differences the first set of themes were identified through a reading of the conclusions and recommendations of each case study. These final conclusions distilled in a somewhat less context specific manner the core issues, responses, outcomes and author recommendations. Texts from this review were recorded in a simple tabular form and then collated into like concepts. The themes that evolved were extremely clear and final labels evolved from the text. Once these initial themes were identified and defined, a subsequent reading of the case studies occurred using a more refined and structured data collection method. On average, case studies, in whole or in part were read at least three times. While the case studies revealed the elements or actions of intervention, given the substantial body of literature on common pool resources, other sources such as the theoretical literature were used to further legitimize the action items.

5.3.1. Content analysis outcome: intervention properties

The outcome of the content analysis revealed two clear thematic divisions: one grouping was very consistent with Ostrom's design principles. They supported attention to monitoring, accountability, user values and design making capacity, for example. This outcome is not surprising given that many of these studies followed the IAD framework and were influenced by the work of commons scholars. The other division was more unique. It reflected in much greater detail the types of interactions and institutional structure between the collective-choice and operational choice levels, not only in terms of maintenance or change, but also in terms of identifying institutional failure. After identifying the themes I returned to the cases previously read to re-evaluate whether or not I was indeed reflecting actual patterns. I then reframed the

way I was reading new cases. Re-reading a good deal of the theoretical literature at this point also re-grounded the theoretical direction and outcome of the analysis.

The five themes emerging from the case studies appear to be consistent elements in effective institutional change. The themes are not mutually exclusive and case study statements may fall into more than one category. At times, certain themes may fall within or be a function of another theme, but consistent with evolutionary theory a change in a dependent theme may in turn influence an independent theme, and so on. The terms used are not new; they reflect concepts from the institutional and policy literature, but most compelling is the detail underlying these terms and how they are used. The five themes, termed intervention properties⁷ within the institutional framework are as follows:

- Structure,
- Engagement,
- Interactions,
- Implementation, and
- Adaptability.

These properties can be grouped into stock and flow characteristics. Stock properties are the structure and engagement properties, which are the building blocks fundamental to the establishment of the remaining properties and provides a required level regime consistency while the flow properties unfold. Flow properties are the interactions, implementation and adaptability and signify the current and persistent action within the properties and among the

⁷ The name 'intervention property' was chosen to reflect the emergent nature of institutions. Each property is one component of the intervention framework, from which the combined output is a common pool resource management system – a cultural emergent structure.

other flow properties and eventually the stock properties also. Stock properties are the more stable properties reflecting the time necessary for institutional change to create new incentives among the target group, while the flow properties are much more dynamic, involved with exchanges, monitoring and efforts to adjust and interpret the outcome of the proposed change. By noting these two characteristics of the properties the framework becomes more dynamic and institutional change is better aligned to reflect a continuous adaptive focus on change.

The following discussion defines and explains the function of the intervention properties, after which a more detailed depiction of the stock and flow conceptualization is presented.

Structure: structure refers to the institutional building blocks, their component parts such as mandates, budgets, and participants, organizations and their intended influence over people and their interactions with others and their environment. According to Schmid (2004) structure “refers to the institutional alternatives that people can choose to order the interdependencies created by the situation of various technologies. Structure describes the relationships between people that define their relative opportunity sets” (p. 17). Structure molds the way in which people transact among (engage with) each other either through administrative, bargained, customary, or threat transactions (Schmid, 2004) and influences the payoff or net benefit calculus of individuals and groups. Structure is represented in the IAD framework by the function of rules, norms and strategies as described by Crawford and Ostrom (Crawford and Ostrom 1995) and (Ostrom 2005), and vertical levels of decision making (Ostrom, 2005). Structure can be broadly described using centralized, decentralized and polycentric governance terminology and models, but the usefulness of these designations for planning and understanding change is limited.

The case studies illustrate the importance to, first, understand the structure under which institutional change is occurring and, second, how levels from the constitutional, collective-choice and operational choice influence the way in which actors communicate and transact among each other at the same choice level, and between other hierarchical levels. There is no specific structure evident from the case studies that suggest greater likelihood of success, in whatever way success is defined. For example, Wagner (2005) shows that while private land dominates land ownership patterns in Texas, the mobility and values of groundwater and deer transcend private ownership fostering the evolution of cooperative arrangements among private landowners to manage these flows effectively. Not all private landowners entered into cooperative arrangements; however, those that did tended to have higher levels of social capital, local presence and were involved with groups who met frequently, thus had an established and trusted system of interaction (Wagner, 2005). In Arizona's conjunctive water management system the state figures prominently from the constitutional through to the operational level with a variety of state agencies created to deal with particular components of conjunctive water management. Colorado bases its legislative development on local user based agreements and water courts' decisions, with the state limiting itself to technical functions (Blomquist et al. 2004). The decentralization of forest governance in Bolivia led to multiple levels of agencies acquiring responsibilities for managing forests, including communities; however, the opportunity sets facing land holders were unclear and constrained by regulations. Other land use incentives promoted agriculture conversion thereby contributing to the unattractiveness of forestry as an income option (Andersson and Pacheco 2006). This reflects a broader structural imbalance and contradiction in objectives.

The strength and path dependent nature of institutional structure is illustrated by Mwangi (2003) in her description of the perseverance of colonial inspired private property rights in range land. Individualization of range land into private property continues and is supported by those most harmed by privatization, not as a means to ensure sustainable resource use, but to protect what land is left among poorer less powerful Maasai. The case studies illustrate that change may often have to occur within the existing institutional structure regardless of the chosen policy change being the optimal solution to the problem. All problems are embedded within larger contexts increasing the complexity and uncertainty associated with larger structural changes and increasing the likelihood of unintended consequences. Larger structural changes such as shifting from centralized to decentralized systems of organization, as in the Bolivian and Nepalese examples, include not only political and legislative change, but also the appropriate regime structure to establish how government will engage with the resource community and foster interactions and feedback mechanisms. Working within existing structures or partial structures may result in a higher success rate in creating change, but it may limit the extent of change possible.

At a more technical or practical level, structure means the property rights system either in place or being proposed, and the decision making structure and linkages at the collective-choice and operational levels. As Bromley (1991, 2006) points out, property rights are not simply a means to allocate a flow of benefits to the rights holder, they involve a triadic relationship among the rights holder, the resource and others. Allocating the rights to a resource assumes there is a duty of the others not to trespass on that right – an action punishable through state sanction. However, Bromley (1991) points out that there are other correlates that may be considered in the adjustment of property relations, for example through shifting privilege and liability

relations, thus how externalities are able to be resolved and accountability changed. Decision making capacity is a fundamental structural element of property relations. Who gets to choose to do what and why? Structure combined with engagement establish the relationship between the collective choice and operational choice levels, and allocates decision making powers within each choice level, what decisions or action items are included in this decision making power and who participates. Structure is also embedded within or relative to other structures, such that cross-scale interactions may influence how the system emerges. Structure must take into account scale issues. Structure may involve the arrangement of building blocks in different ways through methods of engagement and how interactions are encouraged, thus a myriad of arrangements may be possible; consistency emerges from consideration of the five themes within institutional design.

Engagement: Structure provides the building blocks of institutional design. Engagement begins by understanding how these blocks can be arranged, either anew or based on existing networks. For example, structure can be used to create a new system of water management agencies, such as in Arizona, or it can rely on the existing court system as in Colorado (Blomquist et al 2004). Engagement in this dissertation refers specifically to the way in which the state engages or establishes the level of interaction with stakeholders, other agencies and NGOs, while interactions describe the way in which actors relate, share information and transact. Engagement creates the link between structure and interactions. A variety of the cases reviewed give the impression that if a resource is centralized it needs decentralization, and if too decentralized it needs a degree of centralization. This wavering tends to suggest some equilibrium state where a little bit of decentralization and a bit of centralization would be just right, thus the objective would be to find the right level or combination of engagement.

However, as our understanding of complex systems and heterogeneity within and among common pool resources would suggest, that equilibrium will vary by resource, area, time of year and human value system. How a state may engage in resource management depends on the complexity of the resource system (users, physical environment, rules), the endogenous and exogenous pressures associated with current uses, and history.

The case studies illustrate a range of engagement patterns many of which can have similar problems despite the more central, decentralized or polycentric forms of governance.

Decentralized forms of governance reflect a belief that local users can be or are capable managers whose incentives are based on a stronger relationship to the resource. However, a lack of engagement by the decentralizing authority often leaves local user groups or communities with little assistance to achieve the management expectations of governing bodies (Varughese 1999; Andersson 2002). Thus, an element of failure can also be at least partially explained by the state's level of engagement.

For example, Andersson (2002) and Pacheco (2007) found that, in the case of forest management decentralization in Bolivia, municipalities were given management and monitoring functions, but they often lacked the technical capacity and resources to provide assistance to local forest land holders, who were required to develop forest management plans. As a result, the policy to create incentives for small holder forest development failed to reach many land holders – this example illustrates that allocating property rights is a necessary but not sufficient condition to shift incentives. In highly complex cases, Blomquist et al (2004) illustrate that a significant level of engagement by the State of Arizona overcame numerous provision and incentive problems in the conjunctive management of ground and surface water. In contrast,

Colorado water management relies on water courts to deal with allocation and contested transactions, with constitutionally/legislatively relevant court rulings brought into law by the state as needed. Thus Arizona uses a legislatively based top down, action provision type model while Colorado uses a bottom up adjudication based process to influence legislative change. The structure elements in use differ, so the way the state engages or not with water users differs also. Both seem to work within the particular state circumstances.

In the co-management regime for geoduck in B.C. the provincial and federal governments relinquished some responsibilities to an industry association, but maintained the right to set the total allowable catch and its role as ultimate enforcer and source of information – the effect was to reduce transaction costs within a privatized-flow fishery (Mitchell 1997). A much more conflict oriented but similarly non-mobile fishery example is the Maine lobster industry where competing stakeholders, including fishers, federal and state authorities, struggled with the prescriptive level of management and state control until an appropriate level of engagement was developed, ultimately leaving substantial local autonomy within a narrowly defined range to groups with decades of practical experience (Acheson 2003). Note in this example that the structure did not change, but the means of engagement did. The level of engagement is dependent on how government agencies and other stakeholders are structured to interact with each other and recognition from central agencies that multi-directional vertical and horizontal sharing of expertise and knowledge needs to be facilitated. Too much bureaucratic complexity, however, leads to greater path dependence and constrains the ability to adapt the level of engagement to fit changing circumstances. This oscillation towards some equilibrium level of engagement may be an inevitable characteristic of institutional evolution.

Providing a means for airing differences and negotiation/conflict resolution has been recognized early in the research of common pool resources (see Ostrom 1990). In contrast, private property and interaction through contracts has legal status and a system of formal resolution through the courts or other adjudication body. The commons and many common pool resources found within other forms of property rights generally have no legal body formalizing the interactions among those who value the resource. The exception, among others, to this legal status is Scandinavian countries where “everyman’s right” to access the forest (private or public land) is a legally recognized right shared by its citizens. In many countries, especially those influenced by English common law, the right of the commons does not exist, although in some jurisdictions (British Columbia, Canada for example) government chooses not to enforce its property rights to various common pool resources. The difference between this example and the Scandinavian countries is the stewardship ethic that naturally accompanies many people who access the land. The implication is the need for an engagement framework to include some form of conflict resolution and negotiation forum that can be trusted by the appropriator/provider community to perform when needed, but not to interfere with the operation of the commons.

Interactions: Interactions within a social-ecological system involve information exchanges or flows among actors and the way in which those flows occur, whether through word of mouth, spread from individual to individual, through some form of formal or informal forum.

Interaction can also be described as transacting, whether through exchange of information, ideas or products in a market. Actors exchanging information or goods could be resource appropriators, local or higher level government representatives, non-governmental workers, local women’s groups and so on. Information could be associated with the particular resource

system being used, or could be about the people, the community or regarding a government or non-government agency. Thus, a social-ecological system constitutes a series of relationships or interactions among those who have an interest in a particular resource or resource system and the resource itself. Patterns of interactions in the IAD framework refer to the exchange between actors within a particular action arena, and among other action situations together with the capacity of feedback to further influence action arenas. The intervention property reflects this IAD interaction concept, but seeks to specify more explicitly how that interaction occurs.

Andersson (2002) considers patterns of interactions through three information flows – downward, upward and horizontal – which lead to greater learning through sharing of expertise and experience. Methodologically, the study of interactions can lead to a better understanding of the way in which social dilemmas are overcome within action situations (Andersson, 2006). Communication and having opportunities to communicate facilitates this information sharing. Berkes and Folke (1998) tell us that the “analysis of patterns of interaction requires an evolutionary focus, as both social systems and natural systems have an evolutionary character ... [and] ... a focus on feedback mechanisms” (p. 19). The institutional economics literature describes interactions in terms of transactions – information, coordination and monitoring/enforcement. Schmid (2004) identifies four ways in which people transact among each other as through administrative, bargained, customary, or threat transactions (Schmid, 2004). The costs associated with transacting can be a significant constraint to the introduction and maintenance of rules to manage common pool resources.

The case studies consistently raise interactions as being critical for successful common pool resource management. They are necessary not only for their presence within a management regime's structure, but also in how the interactions occur, who is interacting and the investment into maintaining healthy productive interactions. The case studies also clearly illustrate when interactions fail to support resource management efforts. While interactions help to foster collective action to increase the resilience of resource management, interactions themselves are collective action efforts that will suffer from free riders and a lack of stakeholder investment if sufficient trust, accountability, and respect are not present. The institutional regime that results from the intervention framework proposed in this dissertation is not the only emergent structure of importance. This emergent structure intersects with and depends on other emergent structures such as trust and social capital. Several studies touch upon the need for institutional design to reflect partnerships and to foster interdependencies (Vargas-Prieto 1998; Varughese 1999; Ballard 2004). Interactions can act as conduits for information from the field to others in the field, to user organizations, and external agents, including government and NGOs. Interactions are an important element for building trust, reducing suspicion, building mutual expectations and social capital (Varughese 1999; Wagner 2005). Effective, well structured interactions can lead to benefits of trust, but without trust interactions break down. The interaction as a linking and action item has an operational purpose, but can also act as an indicator of how other emergent structures such as trust and social capital maintain.

Many of the case studies discuss not only the level and quality of communication, but also the importance of facilitating communication through a variety of forums (Vargas-Prieto 1998; Varughese 1999; Chamberlain 2000). This facilitation is described as "engagement" in this framework. Recognizing user groups at the operational level is a critical part of the facilitation

of information flows. The state has a necessary function in reducing transaction costs associated with user group coordination and information provision (Grafton 2000), whether tacitly supporting or overtly establishing this stakeholder participation. Low levels of vertical interaction can lead to institutional failure by leaving local agencies or communities to interpret and implement policy without the necessary support from more senior levels of government (Pacheco 2007). Varughese (1999) found that low levels of interaction within and across groups were associated with socio-economic differences and inadequately informed and designed external intervention (i.e., structure and engagement properties). Wagner (2005) discusses the importance of social capital in his examination of collective action among private landowners. This social capital is fostered and maintained by effective associations that allow for the flow of information through consistency of interactions. Effective interaction, at the appropriate level for the particular circumstance, will build trust among participants and will support the accountability of those acting within the management regime and for the regime itself. Regardless of the broader approach taken by the state (centralized, decentralized, polycentric) the way in which the state establishes, fosters and maintains interactions among stakeholders and external agents may vary significantly across common pool resource systems, but remains a necessary ingredient for sustained, effective common pool resource management.

Implementation: Implementation is a process of moving from a formal rule-in-form, structure or engagement pattern, to an operational status thereby influencing existing rules-in-use or establishing some type of interaction through an adjusted or new mode of engagement.

Implementation begins with the initial establishment of a mandate and there may be several stages or iterations of implementation along the way towards the operational level. Mazmanian and Sabatier (1983) suggest that successful implementation requires clear and consistent

objectives; an understanding of the causal linkages between the issue, the policy instrument of choice and objectives; and the support and commitment from both state leadership and constituent groups. Once an issue reaches the political agenda and a policy response or change in rules is adopted, the policy process enters the critical stage of implementation through translation of the legislation or formal rule into its operational form. Common pool resources often have characteristics that span formal and informal rule systems and methods of transacting. Implementation suggests some external agent introducing new formal rules. However, institutional change can also occur at a more informal user-level through the evolution of internally generated rules, norms and strategies. This thesis is interested in externally introduced changes that influence in some manner the way users engage in resource use whether these changes are directly translated or evolve into a particular informal interpretation. The translation of policy and management objectives from rules-in-form to rules-in-use is critical to achieve management objectives, to create awareness among users, understanding and agreement. Communicating clear and consistent objectives indicates the importance of the linkages between structure, interactions and implementation.

While the focus of implementation is on the specific policy aimed at creating the incentives to access and use a resource system appropriately, implementation also creates a public good that requires investment in cooperation. This collective action dilemma requires its own implementation of incentives for individuals to act in a manner to support the maintenance of the initial resource management policy. This support is generally accomplished through monitoring and enforcement, but not all common pool resources are amenable to long-term intense monitoring and transaction costs can be prohibitive. Acknowledging multi-level collective action dilemmas and the potential for free riders undermining implementation at each

level is the first step in understanding the complexity of an implementation plan. The flow of knowledge and information through interactions may provide a good indicator of this collective action.

The case studies illustrate the importance of considering how implementation is undertaken, not only as a short term enactment measure, but also as a longer-term component of engagement. Some level of government support, presence or oversight is generally acknowledged (whether successful or unsuccessful examples) in most of the case studies, and at a minimum as a means to communicate the details of the policy being implemented and to support the modification of individual incentives (for e.g., see Mwangi 2003; Wagner 2005; Pacheco 2007). The ease at which implementation occurs is related to the complexity of the resource management regime, the level of competition and conflict (Mitchell 1997; Acheson 2003). For example, Mitchell (1997) found that implementing a management regime for geoduck in British Columbia was eased because the initial introduction of rules occurred early in the resource's commercialization, the rules were simple and occurred within an action arena with little competition or conflict. Yandle (2001) found that the eventual implementation of the individual quota system in New Zealand fisheries occurred after the concept was around for a number of years, and stakeholders were familiar with and supported the idea. The period of time to allow institutional change to influence individual incentives and function as intended suggests some necessary patience among decision makers (Vargas-Prieto 1998). The value of local and central policy entrepreneurs to recognize policy windows, to maintain their presence, and to support the introduction of institutional change over time becomes critical. An implementation plan is required that links the actors, the methods of delivery with an institutional framework. The plan should focus on short- and long-term policy implementation

requirements, and outline how the interaction and engagement efforts mesh with the objectives of change. The plan needs to link back to the defined problem, the strategy chosen, and the objectives sought.

Adaptability: Adaptability is a process whereby ongoing change occurs within a social-ecological system that is expected and addressed within the regime's framework. The need for adaptability is a cornerstone of resilient social-ecological systems faced with the uncertainty of complex system dynamics (Berkes et al. 2003). Schmid (2004) references Hayek's (1975) conclusion regarding our inability to design and implement effective institutions as a result of the complex nature of the task and our limited cognitive capacity. While perhaps more focused at centrally planned economies the reference introduces the uncertainty inherent in complex social-ecological systems. The complex systems approach to resource management introduces "nonlinearity, uncertainty, emergence, scale and self-organization" (Berkes et al. 2003 p. 5). It teaches us that not all the components of a social-ecological system are necessarily observable, thus outcomes tend to be unpredictable and emergent in nature – unintended consequences may be inevitable. Knowledge and information reduces uncertainty, but having information does not necessarily mean we understand or have accurate knowledge of the social-ecological situation and its changing nature.

Complexity suggests that resource management systems should be intentionally and explicitly adaptive based on objectives of resilience, and not designed to sustain regimes in time and form – institutions are dynamic thus structure and engagement need to be designed for change. The recognition of scale and scale mismatches is relevant to how adaptability is incorporated into the design. For example, temporal scale introduces uncertainty, not only within the particular

common pool system of interest, but also across systems where relationships may not be well understood. These are relative terms however and each resource situation will have its own sources of failure, significant or insignificant, exogenous or endogenous, that will dictate a response. Institutional resilience is the objective and best suited to complex systems, but that objective is directed at institutions having efficiency, equity and ecological goals.

The complex nature of common pool resource systems runs through each of the themes identified here, and the case studies were often explicit in their recognition of complexity and the necessary adaptive conditions of a management regime. Complexity is firmly rooted in common pool resource social ecological systems and increases depending on particular resource, user or institutional attributes, and common pool characteristics of excludability, stationarity and storage. For example, Jarvis (2007) notes the challenge of cross-jurisdictional issues in transboundary water flows. Highly mobile resources, large and heterogeneous user groups, multi-jurisdictionality, and exogenous sources of institutional failure increase complexity. Ballard (2004) notes that a “myriad social, cultural, economic and ecological factors surrounding salal harvest all interact within a management context...” (p. 175). Andersson (2002) concludes that decentralization is not necessarily a governance panacea for local level users, and that the complex nature of disaggregated governance regimes requires more than a formal recognition of property rights and devolution of responsibilities. More complex management environments may call for a larger role for the state and a move towards more centralized or prescriptive systems. Acheson (2003) found that in the Maine lobster sector, more centralized management occurred where exclusion was difficult, and where there were low levels of interaction, moderate social capital, moderate resource dependence, and higher levels of heterogeneity among fishers. More decentralized local management was maintained

in more remote areas where fishers had a greater sense of community, exclusion was possible and the resource had an important role in the local economy. However, the resilience literature on complex systems suggests the need for inherent adaptability within a regime, especially among more inter-connected economies where change can be rapid and unexpected. Centralized management regimes that may be associated with more complex resource systems tend to be less flexible and more path dependent.

Linking to adaptability is the structure of the system and the placement of the monitoring building block. Monitoring is critical for more formal adaptive management approaches, and also for a basic recognition of the adaptable, experimental nature of policy. Care in designating who monitors appropriation and provision activities and who monitors the monitor can support interactions among participants and build trust if the system is equitable and accountable. Information from monitoring is only useful if it is in some manner collated and used for stock and flow analyses, investigation of infractions, or used to provide summary statistics of use, value and trends. For example, in the US Pacific Northwest, salal buyers are required to obtain permits, record sales and harvester information and retain it for a prescribed period of time in case a state or federal authority requests to see it. Nothing else is done with the information leaving the buyer having to fulfill a bureaucratic and non-beneficial action. The monitoring system is critical for knowledge of adaptability, thus must be accountable, acceptable, and perhaps most importantly, useful.

In summary, the content analysis identified five properties that reflect various means of coordination among the various actors in a common pool social-ecological system. The properties – structure, engagement, interaction, implementation and adaptability – provide the

basis to develop an intervention approach, given the level of intensity or mode of government intervention that is relevant. Table 6: provides a summary of the intervention properties and various considerations within.

Table 6: Intervention properties.

Structure	Engagement	Interactions	Implementation	Adaptability
<p>a. land ownership structure private public</p> <p>b. actors government local agencies appropriators/providers communities NGOs</p> <p>c. provision of rules, decision making state private 3rd party/courts/NGOs</p> <p>d. Rules Boundary Position Choice</p> <p>e. Duration short-term/long-term</p> <p>f. linked to scale match</p>	<p>a. Provision of institutions and change</p> <p>Via state/local government agencies Court system NGOs</p> <p>Via distant mechanisms Legislation/regulation – implementation of formal rules Funding/NGO provision</p> <p>Via close mechanisms Technical provision of expertise/services Capacity development Regional/local presence</p> <p>b. method of transaction administrative bargained customary threat</p>	<p>a. Forums, for exchange or discussion of information, vertical, horizontal Grievances Decision making</p> <p>b. Stakeholder groups local/central government user groups</p> <p>Other local stakeholder groups/NGOs</p> <p>c. Coordinating mechanisms – transactions</p> <p>d. Structure – participation in rule development</p> <p>e. Engagement – personal, frequency, long-term</p>	<p>a. delivery mode: authority-voluntary - prescribed, facilitated, coordinated.</p> <p>necessary focus at each stage of institutional development.</p> <p>b. translation from rules-in-form to rules-in-use at each engagement level</p> <p>c. communication functions through interactions, flow of information prior to implementation necessary</p> <p>d. short-term, long-term strategy. Short-term goals, and long-term goals need to be defined and communicated.</p>	<p>a. addressing complexity information, knowledge</p> <p>b. resilience is resilience visible, can we see institutions molding or bending to change?</p> <p>c. Provision of adaptability Explicit statements of resilience as an objective Monitoring/learning</p> <p>d. Links to structure monitoring and enforcement mechanisms</p>

These properties of institutional change can be further refined into stock and flow categories (see Figure 3). Structure and engagement can be grouped into stock institutions. Stock institutions are stable over the short term, and are the basis from which the flow categories emerge. The flow categories of interactions, implementation, and adaptability have more immediate dynamic functions and suggest a flow of connections among individuals, a flow of ideas and information, and active learning. The stock-flow categories also indicate that the flow institutions have a dependent relationship with the stock institutions. Investment in the stock institutions feeds and nurtures the institutional flow. In turn, the way in which actors use or abuse the institutional flow will affect the ultimate success of the institutional approach, with information on its effectiveness feeding through the adaptability category to inform the stock. Neglect and a lack of investment in the flow categories will eventually lead to the failure and replacement of the approach. The model appears closed to exogenous or contextual influences, but that is not the intent and through interaction and adaptability other influences enter the fray.

- Institutional stock categories
 - Structure
 - Engagement
- Institutional flow categories
 - Interactions
 - Implementation
 - Adaptability

The outcome of the institutional failure model, its intervention rationale and government mode assessment informs definition of the intervention properties. The properties define a policy framework through structure and the policy layers within that framework through engagement. These institutional stock variables create the core from which interaction, implementation and adaptability flow. Creating these stock institutional properties also evolves as a function of the

flow properties. This interactive emergence is informed by and facilitated through the adaptability property. Government needs to engage and interact at a sustained and appropriate level to maintain the stock and flow properties.

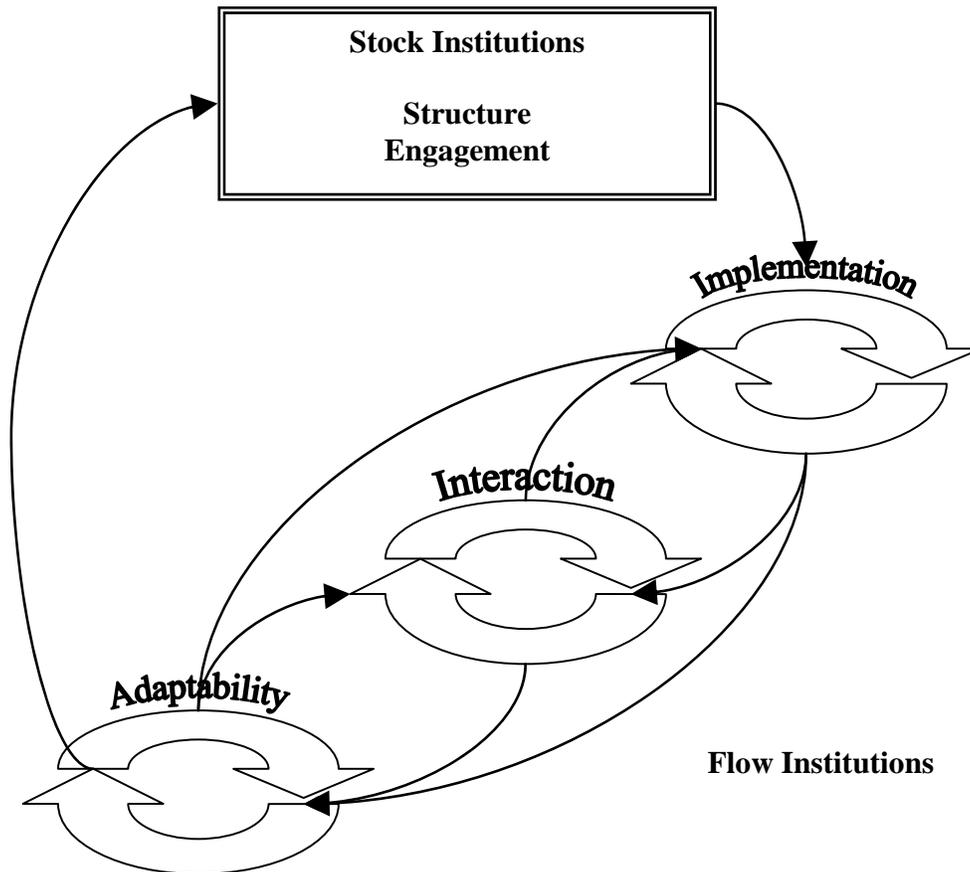


Figure 3: Institutional stock and flow variables.

In the next chapter the pieces of the framework are combined and the process of intervention, discovery and design explained. Each component, the institutional failure model, the intervention mode typology and the intervention properties, is a building block of the eventual intervention framework, which will guide an approach for introducing institutional change

within a particular common pool resource social-ecological system in need. The framework is not intended to tell decision makers what to do in any particular situation, but to provide a process to guide the development and ongoing intervention action within the common pool social-ecological system.

5.4. Summary and conclusions

The purpose of Chapter 5 is to probe deeper into how governments or institutional change agents move through the process of institutional change. A content analysis methodology was used to discover the elements or properties of these actions. The content analysis scanned various dissertations and other published sources to seek common elements of the way in which government, through policy, its agencies or other forms of influence, sought to coordinate the sustainable use and development of common pool natural resource values. Both successful and unsuccessful examples provided similar elements, but revealed different approaches in defining those elements. The resulting intervention properties form the elements of institutional design, while the institutional failure and intervention modes guide this design to the appropriate scale.

The intervention properties are meant to guide policy development through necessary elements of institutional design. There is no *a priori* perception of the outcome of the design, but its method in conjunction with the intervention mode will result in a design that addresses the problem identified through the institutional failure model. The framework is intended to deal with common pool resources in open access, limited user open access, or under-managed situations where resource degradation is occurring or imminent, or where the resource is under-developed and could take a greater role in a community's livelihood.

Chapter 6. Intervention framework, combining institutional failure, intervention modes and properties

6.1. Introduction

The purpose of Chapter 6 is to combine the three intervention components into a single institutional change framework. The institutional failure model, the intervention typology, and the intervention properties are intended to lead the analyst or policy maker through the identification of the problem to the design of an intervention approach.

6.2. Intervention framework

The intervention framework outlined here is not intended to replace design principles, the IAD or multitier framework, or the typology and structure of rules. Nor is the framework envisioned as the single prescription for institutional design and change. Rather it is intended to complement the operationalization of the frameworks and models. The term 'framework' is used to describe the intervention concepts developed in this dissertation because it indicates a relationship between a social-ecological system, institutional failure, and regime design and change. The framework fits within the IAD framework and in this manner it is complementary to it. Within the IAD framework are interactions within an action arena and includes interactions among and between action arenas, leading to outcomes, evaluation and eventually feedback into the action arena directly and indirectly through the exogenous variables of resource, user and rule characteristics. Institutional failure is a function of these action arenas and the exogenous variables that influence them. The institutional failure model identifies institutional failures and evaluates the sources of that failure in order to prepare a rationale for

institutional change and adapt action arenas to function more effectively, efficiently and equitably within the contextual environment of an embedded social-ecological system.

While the framework invokes a top down perspective in its more structured format, the intent is for the resulting approach to be problem based; that is, for the problems identified in the intervention rationale to drive the design. The framework moves beyond institutional definition and suggests the need for greater focus on the system of governance, notably the functional and structural tiers of governance establishing the mechanisms for decision making and the structure of policy delivery agents, as described by Paavola (2006) and summarized in Chapter 2. Allowing for feedback and adaptive systems of governance creates a regime that actively looks for exogenous influences that may shift the outcome of the intervention rationale model from a greater likelihood of rent capture, to rent dissipation and finally resource degradation, thus spurring a new set of institutional adjustments.

If the goal is to develop and implement policy that will create a social-ecological system reflecting design principles, how do we get there? Ostrom's (2007c) multitier framework and rule classification system (Ostrom 2005) is complemented by this intervention framework by operationally linking the descriptive nature of the multitier framework to the rule classification system. The intervention framework is intended to assist policy makers understand the problem or issue (the source of institutional failure), organize relevant information, and then craft an approach to start developing, defining and implementing an appropriate set of rules. The resulting governance regime is based on the intervention framework. As discussed in Chapter 1, the objective of government may be to develop an as yet untapped resource for its economic potential; conversely, the objective may be to address potential or actual resource

degradation. While this dissertation focuses more on the latter, the intervention framework can be used to address both objectives.

There are three steps that guide the development of the common pool management regime: 1) undertaking a situational assessment using the institutional failure model and developing an intervention rationale; 2) identifying the intervention mode; and 3) developing the intervention properties. The intervention framework leads the policy analyst or decision maker through steps 1) to 3). The framework helps to answer the question posed in the introduction: how do we get from institutional point A to institutional point B?

6.2.1. Situational assessment and choosing the intervention mode

A situational assessment provides the underlying rationale for intervention, its context and information necessary to develop the appropriate approach. The situational assessment will guide, influenced by the objectives of the entity seeking change, the choice of intervention type based on the level of complexity in the system under study. The intervention modes from Chapter 4 are obstructionist, absent, facilitative, coordinating or prescriptive. It is envisioned that an obstructionist approach would be replaced by some form of prescriptive measure. A more complex situation, for example one where the resource use is severely degrading a waterway spanning two or more jurisdictions and suffers from a lack of coordination among jurisdictions, requires a more prescriptive approach, than say a resource system providing sustenance for a local community and unaffected by exogenous influences. To understand this complexity, the situational assessment uses the institutional failure model and focuses on three intervention design ingredients: 1) identifying institutional failure as either a robust social and ecological system, a situation where rent capture dominates, or rent dissipation tending

towards resource degradation; 2) identifying the source of institutional failure through resource, appropriator, or institutional attributes; and 3) the failures origin being either endogenous or exogenous.

It is necessary to recognize that state governments and stakeholders in positions of power direct policy objectives, which may not be consistent with the direction coming from the intervention framework. Governance of resource systems, whether through local community organizations, more regional associations or agencies, or central government will be based on particular objectives of the governing body, although the framework should help to shape those objectives. As the case studies indicate, government objectives can lead to substantial shifts in policy and social-ecological organization that may or may not align with local, regional or previous central government policy. While this framework can be used at various levels of governance – local, regional, provincial/state, national – the hierarchical nature of nation states suggest that the objectives of a higher institutional collective choice or constitutional choice level may significantly influence the policy capacity at lower levels. Policy makers need to be aware of various actor's objectives and values within the contextual milieu of governance and institutional change at the constitutional and collective choice levels.

The analysis will reveal the level of complexity, which will help to guide the choice of intervention mode: absent, facilitating, coordinating or prescriptive. Complexity is a function of the size of the resource system, its intensity of use, interconnection with other resources and values, mobility, and the exogenous or endogenous origins of the failure. More complex features reduce the ability of local users to confront and address the failures within the local resource system, subsequently requiring the coordinating ability of a higher level organization.

How the intervention properties are ultimately designed depend to a large degree on the choice of intervention mode(s).

6.2.2. Designing intervention properties

Designing an intervention approach to match the level of institutional failure focuses on stock components (the structure and engagement properties of regime design) and flow components (the implementation, interaction and adaptability properties). Within each of these properties, the analyst must use the situational information combined with an understanding of the intervention modes to determine the governance structure. The governance system is a function of the intervention framework, characterized by how government would engage with the user community, how to foster or support interactions among users, user groups, and government agencies, the depth and length of implementation activities, and the adaptability of the system. A short-term response may be warranted that either addresses an urgent failure or that begins a gradual rate of engagement. In any case, it is envisioned that the regime would evolve and mature as it adjusts to policy and resource related issues over time. Focusing on institutional stock and flow components reiterates the evolving, emergent nature of policy.

6.2.3. Rule definition

The point of the intervention framework is to provide a governance structure that will support the introduction or change in the rules associated with the consumptive use of a common pool resource. Part of the structure is based on who is a participant, their positions, identifying boundary and choice parameters, and the payoff scheme. Forming the remaining supporting rules is necessary following or concurrent to establishing the framework for intervention.

Drawing from Ostrom's (2005) *Understanding Institutional Diversity* assists in that development

as does more resource specific work by other scholars. As was previously indicated, the framework can be used for common pool resources under stress and congestion, or for those experiencing under-investment. The former use is the focus here.

The following relational outline and figure depicts the intervention process from the evaluation of degradation or underdevelopment to the conditions underlying the creation of a short- and long-term intervention program based on or at least striving towards particular social objectives.

6.2.4. Intervention framework relational outline

This section provides a visual representation of the intervention framework. Figure 4 depicts the intervention framework as it links the collective choice and operational levels of decision making thereby illustrating the closing of the institutional gap identified in previous sections. Figure 5 provides a more procedural diagram that is intended to assist the policy analyst understand the process steps envisioned through the framework. The initial list of the frameworks components provides the sections of analysis that feed into each successive stage in the process, from understanding the situational assessment, identifying the intervention modes, developing and defining the intervention modes, followed by design of the intervention properties and definition of the rules.

1. Situational assessment:

- Institutional failure rationale;
- Failure complexity (failure type, source of failure, resource, user and institutional attributes);
- Objective variable (objectives of government, user community, other stakeholders);
- Choice of absent, facilitative, coordinating, prescriptive intervention mode.

2. Intervention approach mapping and design:

Design of intervention properties based on situation assessment and intervention mode.

- Stock institution – collective choice determinants:
 - Structure,
 - Engagement.
- Flow institution – collective choice to/from operational choice:
 - Interactions,
 - Implementation,
 - Adaptability.

3. Rule definition:

- Position, boundary, choice, payoff, information, aggregation, scope.

The links depicted in Figure 4 reveal both the process of design and the how the mapping of the framework occurs. It indicates a rather top down approach as one progresses from the collective choice through to the operational level, but this is not the intent. Whether the final regime reflects a more top down or bottom up format is a function of the design process that emerges as most applicable to the particular situation. In some cases a more top down approach may result, in others a more bottom up design where appropriator or provider capacity to manage the resource is respected. In some cases only a strong central government may be capable of effective intervention, for example in highly complex cases where significant

exogenous influences reduce the ability of regional or local groups to affect change. In other cases, a regional or local group may be far more effective than any central authority, for example in cases where trust is lacking and investment in social capital is necessary.

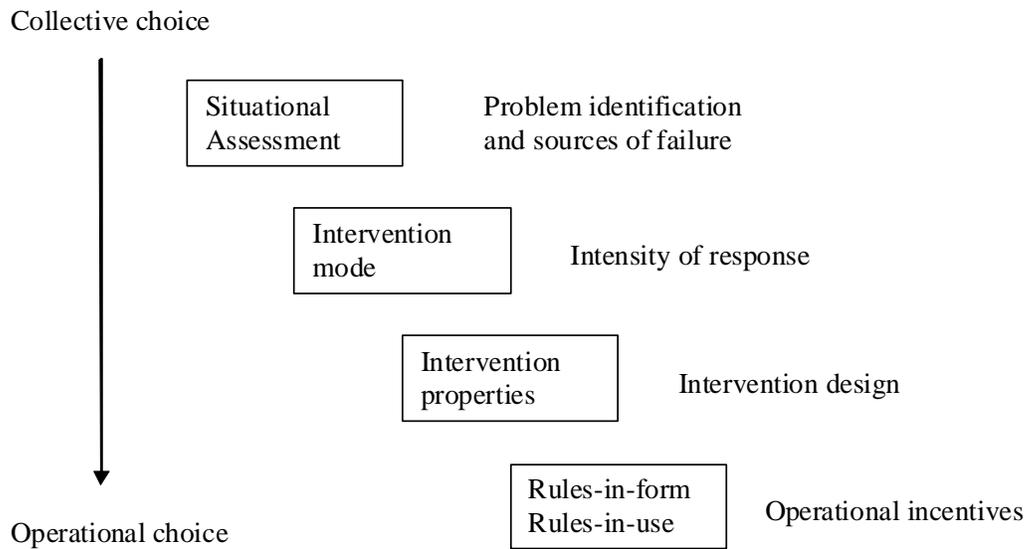


Figure 4: Intervention framework linking collective and operational choice levels

Figure 5 is a process diagram outlining the various steps towards institutional change, moving from the contextual assessment and problem definition, to the identification of the intervention mode and design of the intervention properties.

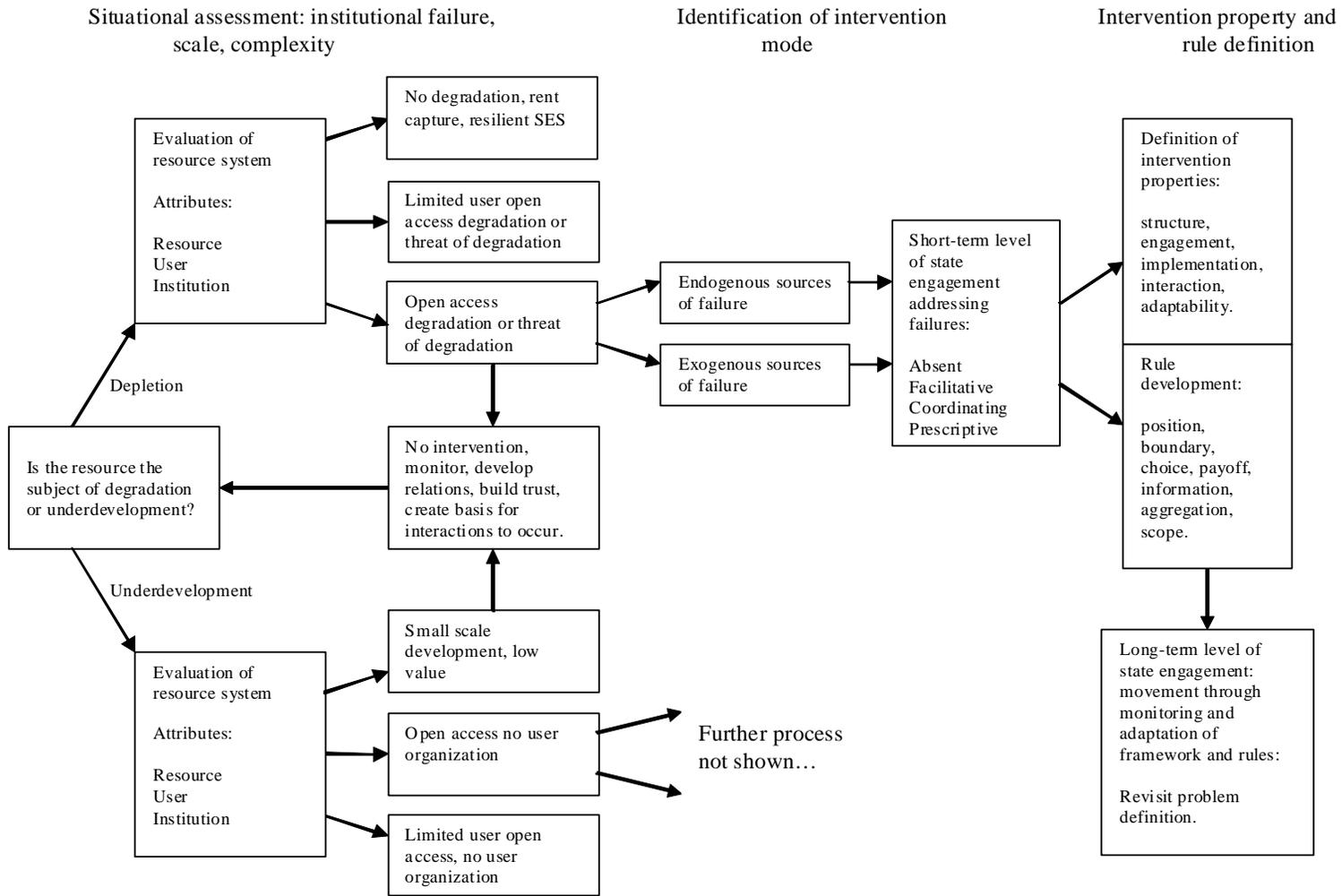


Figure 5: Intervention process – example intervention design process

6.3. Summary and conclusion

The purpose of this chapter was to outline how the institutional failure model, intervention mode, and intervention property components combine to form the intervention framework. The framework is influenced by both the case studies reviewed for this dissertation, and underlying institutional theory. The intent of the framework is to complement the IAD framework and the development of rules for the management of common pool resources. The intervention framework is an attempt to bridge the more theoretical and descriptive models with a practical framework that can guide government policy analysts through institutional change. The challenge is avoiding a positivist spiral into functionalism. Institutional design through this framework is not an equation; it is intended to be a way of being more cognizant of the elements contributing to the emergence of a governance regime for a common pool resource.

But will it work? The next Chapter uses the framework to develop a policy statement for salal, a non-timber forest product in British Columbia that has commercial and traditional First Nations values, but whose use occurs in a *de facto* open access environment.

Chapter 7. Case study application of intervention framework

7.1. Introduction

The purpose of Chapter 7 is to provide an example of the use of the intervention framework.

The commercial harvest of salal in British Columbia (B.C.), Canada, will serve as the case study.

Salal is a green leafy plant used in the floral sector. While not explicitly evident in the presentation, the case study provides two functions: first, it illustrates the use of the framework, but antecedent to that presentation were initial trials to determine what elements of the framework worked well and what did not. The ultimate testing of the framework will occur through an actual implementation of a working regime design; however, that operational test does not form part of this dissertation.

The following case study begins with a contextual introduction to salal, its uses, and geographic and institutional setting. This contextual information is followed by an assessment using the institutional failure model, identifying an appropriate intervention mode(s) government may employ, and a description of the intervention properties that could form a management regime for the salal sector. Finally, from this framework output, a series of recommendations are made to design an appropriate level of management for the commercial salal sector in British Columbia, given the problem definition and scale of intervention required.

Salal provides an interesting case to test the intervention model because of its complexity and level of uncertainty. Salal has some difficult characteristics to consider, including the presence of vast quantities of salal, but limited supplies meeting commercial quality standards. In addition, the harvesting community is extremely difficult to communicate with and to depict as

a whole. There is published information about the biological functioning of salal, but there is little if any information available outlining its stock and flow capacities, who many of the actors are, the revenues and costs of the industry, or the level of collective action among harvester units. Anecdotal evidence from a small number of harvesters, buyers and researchers in most cases must suffice.

Information for the case study was obtained through a survey and interviews with salal industry representatives and the research community. While the survey proved rather unsuccessful (this participation rate was expected; two respondents out of seven, with one completed questionnaire), interviews were conducted with five industry representatives and three researchers. To maintain confidentiality, none of the respondents will be identified and comments will not be attributed to any particular source. Information was also obtained from Ballard (2004), Cocksedge (2003), and Ricou (2007). These sources are cited where appropriate.

7.2. An introduction to non-timber forest products and salal (*Gaultheria shallon*)

Salal is one of many non-timber species used by a variety people for commercial and non-commercial purposes. The term “non-timber forest resources” (NTFRs) is used to describe a broad range of “plant and fungal species in the forest, other than timber, pulpwood, shakes or other wood products” (Gagné 2004).⁸ Other organizations use slightly different definitions (see

⁸ In B.C., the use of the term non-timber forest products has been replaced by non-timber forest resources. The Food and Agriculture Organization of the United Nations (FAO) uses the term non-wood forest products (NWFP) and expands the definition to include all products of biological origin, including game and animal products, other than wood derived from forests, other wooded land and trees outside forests. The FAO also defines NWFPs as gathered from the wild, produced in forest plantations, from

FAO). The human use of NTFRs forms a social-ecological system embedded within the broader system of forests, forest use and community dependence.

NTFRs are characterized by their user and product heterogeneity. In British Columbia, the provincial Ministry of Forests and Range uses the terms NTFRs and botanical forest products and has identified over 200 species harvested for commercial and non-commercial purposes (de Geus 1995). These products can be grouped into the following categories:

- Wild edible mushrooms,
- Floral and greenery products,
- Medicinal, nutraceutical, and pharmaceutical products,
- Wild berries and fruit,
- Herb and vegetable products,
- Landscaping products,
- Craft products, and
- Other, such as honey, and
- Forest based services, such as fungi tours and other forest based eco-tourism related activities.

Appropriators, or users of NTFRs are divided into commercial and non-commercial components, but individuals often fall within both definitions. Users of NTFRs include commercial harvesters seeking a supplemental or main source of income, recreation and subsistence users entering the forest for pleasure and sustenance, and First Nation harvesters seeking traditional products for cultural (food and medicines for example) or ceremonial purposes. For centuries, First Nations have used a variety of products from the forest. Turner (1995; 1998) has identified hundreds of

agroforestry schemes, and from trees outside forests. Agroforestry and trees outside forests are not generally included in the North American definition, but have many similarities.

plants used by First Nations in British Columbia for food, medicines, implements and other tools and technologies. Today's commercial users mix with subsistence and traditional harvesters and often compete for access to non-timber resources. Wills and Lipsey (1999) estimated that in 1998 the commercial harvest of NTFRs supported approximately 32,000 part-time and full-time opportunities and generated about \$280 million in direct revenue. Wetzel et al (2006) estimated the value across Canada to be \$750 million, with a potential to reach at least \$1 billion (Duchesne et al. 2000). There are no estimates of the number of non-commercial users of NTFRs or their value in household subsistence. The provincial government has taken a minimal to non-existent role in the sector.

Salal is indigenous to the coastal Pacific Northwest and is found along a band from southern Alaska to northern California (Brayshaw 1996, as cited in Cocksedge 2003). Salal is a member of the heather family (*Ericaceae*) and grows best in moister climates and elevations below 800 metres (Fraser et al. 1993 as cited in Cocksedge 2003). Salal can grow in extremely dense patches, but will not always uniformly cover a particular stand (Vales 1986; Huffman et al. 1994, as cited in Cocksedge 2003). The growth and fruiting of salal plants also varies by the amount of canopy closure and resulting levels of light. Salal berries for example, fruit under conditions with more light; however, commercial quality salal thrives under partial shade, either in older growth stands, or second growth stands prior to canopy closure (Fredrickson 2000).

As a consumable product salal is used both for its foliage and as a source of berries. First Nations found little use for the salal plant itself for decorative uses (Cocksedge 2003), but salal berries are an important customary food. In the commercial floral greens market, salal is used as a bouquet filler adding a deep green background accentuating the cut flowers. While salal

grows rather invasively in many areas of coastal B.C., commercial quality economic sources of salal are less abundant. The location of most commercial salal harvesting activity is the Pacific Northwest and Olympic Peninsula regions of Washington State, and in B.C. salal is harvested on Vancouver Island as well as some adjacent Gulf Islands and the coastal mainland. Vancouver Island has an area of about 3.2 million hectares with salal harvesting predominantly occurring on the eastern half of the Island, from its southernmost tip to the Island's north. Some salal harvesting occurs on the Island's west coast where transportation routes are nearby.

The structure or value chain of the salal industry involves at least four to five stages: harvester, field buyer, buyer/distributor/exporter, wholesaler, and retailer. The harvest of salal fills demand in both domestic and export markets; however, upwards of 80-90% is destined for export markets. The harvester works either for a particular buyer in harvester groups, works independently but sells to the same buyer each time, or works independently and sells to the nearest buyer or the one offering the best price. Most often harvesters will use the same buyer, building a reputation that may turn into higher piece values based on providing high quality product. All harvesters are independent in that there is no formal employee/employer relationship with a buyer/distributor, as such the harvesters are responsible for obtaining the appropriate insurance, paying taxes and other self-employed government based requirements. The harvester level of the industry is the informal portion of the sector where no rules are in place to manage the harvest or monitor activity. Once harvested, however, the salal product becomes a private good where tracking is easier, although in B.C. the provincial government chooses not to collect that information. The buyers/distributors purchase the salal from the harvesters, they may process it slightly by checking quality, removing any old or damaged leaves, and trimming ends, then will box and ship the product to domestic markets, but

predominantly to wholesale markets in Europe, the U.S. or Asia. A large volume of salal is shipped to the U.S. Pacific Northwest where it is boxed and shipped to its final destination. The largest floral companies are located in Shelton, Washington State. In Europe, a large volume of salal is distributed through the Amsterdam floral auction, shipped to a final country destination, and then distributed to various wholesale and retail outfits. Entering a florist shop in London, for example, one has a good chance of finding salal from the U.S. or Canada.

The main markets for salal foliage are Europe, the U.S. and Canada, and increasingly Japan. The attractiveness of salal as a commodity species is its durability. Salal both travels and ages well, thus can withstand lengthy container shipping times to Europe or Asia and the wholesale-retail marketing process. Wills and Lipsey (1999) estimated the annual value of the floral greens sector (which includes salal, boughs and a variety of other non-timber products) at \$55-60 million per year. In 2006, the Royal Roads University, Centre for Non-timber Resources estimated that the floral greens sector generated an annual wholesale/export value of \$27-65 million (CNTR 2006). In 1991, Schlosser and Blatner reported that about one-third of the floral greens value was paid to the harvester level. These estimates are based on a collection of anecdotal and interpretations of statistical data that may or may not accurately reflect the true volume and value coming from the forest. These estimates also focus on certain periods in time and no annual time series data is collected by statistical agencies with a specific salal designation that could be used to track market trends.⁹

The salal product that is sold commercially into the floral greens sector has shifted in the last ten years, mainly as a result of the declining availability of quality long salal. Salal in all areas was

⁹ Volumes and values for exports/imports of salal are not specifically recorded, but would be included in foliage and plant parts Harmonized System Code 060491.

originally harvested as 'longs' (26-30 inches); however, because of over-harvesting in Washington State companies there began to offer 'tips' (18-24 inches) and bouquet tips (8-10 inches) (Cocksedge, 2003). Europe virtually exclusively imports tips, while Japan is more interested in bouquet tips. Canada and the U.S. market consume mainly longs. The shift to bouquet tips was not led by a change in consumer tastes; rather it reflects a reduction in the available supply of salal and the harvest of new growth at an earlier stage. It also reflects the market power of the larger salal companies in Washington State as they reacted to this supply shortage by successfully promoting alternative products. The value between these different products also varies, with longs valued the highest, followed by tips and bouquet tips (Cocksedge, 2003).

The U.S. imports mostly longs from the B.C. harvest. Longs represent about 70% of the total B.C. harvest. These longer lengths of salal are much less available in Washington State as a result of past harvesting activity, thus B.C. predominantly fills that market. U.S. bound salal from B.C. is shipped to one of the larger brush companies in Washington State where it is further processed and shipped across the U.S. and to Europe. Tips are also exported to the U.S. from B.C., but Europe is the largest consumer of salal tips. Data from the European Union (Eurostat.) indicates that from 1995 to 2003 annual import of foliage branches and other plant parts from Canada more than doubled to 5.4 million kilograms from 2.1 million kilograms, but by 2008 had declined to less than 2 million kilograms.¹⁰ This does not necessarily suggest, however, that the volumes harvested and shipped from B.C. have declined. After 2003, shipments from the U.S. to Europe increased by at least the volume decline seen in Canadian shipments. Shipments of salal to the U.S. are 'processed' then shipped to various destinations,

¹⁰ See Eurostat http://epp.eurostat.ec.europa.eu/portal/page/portal/external_trade/introduction

including Europe. As such, they may not necessarily be captured as re-exports in Canadian trade data. The original reduction in shipments to the European Union 2004-05 was reportedly a result of sectoral restructuring of European importers. Demand was expected to return to at least previous levels as the restructuring completed. The longer-term decline through 2008 likely reflects the current economic recession.

There are limitations to summations based on this trade data, however. The Harmonized System trade data does not have a separate classification for salal and other resources such as bear grass, among potentially many others may also be included in HS category. Statistics Canada data (see Statistics Canada) suggests that about 99% of the fresh foliage exports to Europe originate in B.C. and a report by the Centre for Non-timber Resources (2006) indicates about 85-95% of that volume consists of salal. Because there are no volume and corresponding value data, it is not possible to calculate a per unit value from the available statistics, thus it is not possible to verify statements of per unit value increases or decreases. An industry representative indicated that another source of growth in demand may be China, where increasing wealth and a growing middle class may lead to the demand for more Western-oriented luxuries. Over the longer term, industry informants see little indication that the volume of salal harvested and its price will decline because of any reduction in demand. It appears more likely that the volume demanded will increase.

Salal harvesters are a heterogeneous group, some relying on salal for most or all of their income, and others only for part of their income, often providing income when logging or fishing operations are shut down, for example. In a 1999 study, Wills and Lipsey (1999) estimated the number of salal harvesters in British Columbia at about 13,000. The harvest season lasts about

10 months, stopping only when the new growth is forming around May-June/July. The salal sector provides employment for immigrants who have difficulty entering the mainstream labour market (Hansis 1998; Lynch and McLain 2003). In B.C., the picking sector is characterized by Cambodian, Vietnamese, Indian, and other ethnic groups. In the U.S. Pacific Northwest, the salal industry is dominated by Mexican and Central American laborers. Non-immigrants also participate in the salal industry, often attracted to its unregulated and outdoor nature, and as a source of supplemental income.

Harvesters collect and sell salal in piece units. A “bunch” of salal is the general unit of measure, based on a weight of 1.5 pounds for longs and 0.75 for tips. Harvesters pick and tie each “bunch” together in the field then may check each for its weight once at the buyer. The value to the picker has remained relatively stable over the last ten years, although fluctuations during the year and individual company-initiated market plays have led to sharp price increases at various times (Interview notes, February 2007). In the late 1980’s to early 1990’s the prices paid and intensity of harvesting salal increased significantly resulting in a variety of resource and sustainability concerns in Washington State. Blatner and Alexander (1998) documented an increase in average prices for salal for the period 1989-1996, but prices appear to have stabilized and remained fairly constant since then reaching an upper value of about Cdn\$1.30 to \$1.80 per bunch for longs and Cdn\$0.70 to \$1.20 for tips. Prices tend to be low in the early part of the season in mid- to late-summer and early winter, with prices rising as the more inclement winter weather arrives and peaking during later winter and spring when demand increases for Valentine’s Day, Easter and Mother’s Day. Pricing and demand in B.C. mirrors that in the U.S. Pacific Northwest, although the land base is larger and the supply of labour and resulting

harvest rates lower. Over the last five to ten years anecdotal evidence suggests that prices in B.C. have also tended to stabilize for salal harvesters.

A less productive picker can harvest about 40 to 50 bunches per day, depending on the time of year and location, and a good harvester can collect 70 to 100 or more bunches per day, again depending on the site and growing conditions. Daily wages can range from below \$50 per day to from \$100-200 per day, but this upper end may be somewhat unusual as terrain, availability of high quality commercial salal, and access will temper that potential. Regardless of the earning potential, harvesters and buyers report that fewer people are entering the forest to harvest salal. Company spokespersons indicate that there is a pending labour shortage as the current workforce ages and their children opt for other more mainstream employment opportunities. Companies must find new immigrant communities interested in harvesting non-timber resources and at least one company has considered employing a non-resident labor force. Expectations, competition from other sectors, and the difficult unglamorous work tend to dissuade younger workers. Overharvesting in some areas also affects harvester income as the piece rate for shorter stems is lower, while the effort needed to harvest changes little or increases. Anecdotal information about recent price declines in Europe suggests that prices paid to harvesters are unlikely to rise in the foreseeable future – a trend confirmed by some industry representatives.

In B.C., the harvest of salal and salal berries occurs mainly on public land, but private timber lands comprise about 615 thousand hectares on Vancouver Island, some 20% of the total landbase. Despite high levels of activity, the provincial government does not regulate the harvest of salal. The B.C. *Forest Range and Practices Act* (see B.C. Ministry of Forests and Range,

Forest Range and Practices Act) includes Section 168 allowing for the management of salal and other NTFRs, but no regulations have been developed to enable the legislation. Two private land owners on Vancouver Island have established exclusive contracts on some but not all of their private forest lands, but as with public land, the companies have not incorporated salal management into forest development planning and do not manage the appropriation or distribution of the salal harvest (Tedder 2008). There is also a small community based private forest land owner on southern Vancouver Island that requires harvesters of any NTFR product to purchase a permit, but again there is no monitoring of the volumes or values coming from their forests. Provincial legislation establishes one form of public forest tenure that includes NTFRs in its definition. Community Forest Agreements tenures are small, community based forest tenures that can include the right to manage and charge fees for NTFRs. However, this right is not exclusive and there is no provision to restrict access. In addition other adjacent areas are *de facto* free and open access creating an awkward juxtaposition of potential management capacities. For the most part, on public land in B.C. and most private land, the harvest of salal operates under a system of *de facto* open access: there is no institutional structure in place, no formal position, boundary or choice rules to oversee the appropriate level of access and use of the salal resource, and no corresponding investment in the resource.¹¹

There is also no coordination between the salal and timber sectors that could see benefits from compatible management of the forest. Work by researchers at the Centre for Non-Timber Resources and the Pacific Forestry Centre found potentially significant benefits from compatible management activities in addition to increased timber volumes (Gagné 2004). The research

¹¹ Nisga'a treaty land has high valued Pine or American matsutake mushroom (*Tricholoma magnivelare*) habitat, which are under the exclusive title of the Nisga'a. Through the Nisga'a Lisims government, the appropriation and provision of pine mushrooms are more intensely managed than on other public or private lands.

indicated that fertilization of young timber stands could improve the abundance of commercial quality salal, to \$500 from \$200 per hectare in southern Vancouver Island trial sites to as high as \$2,500 to \$10,000 on some northern Vancouver Island sites. However, the fertilization also results in more rapid canopy closure, thus shortening the period of time that the enhanced levels of salal are available in commercial quantities. Unfortunately, these tests were conducted over a short period of time, with no long term funding available to monitor the full extent of the trials. Funding levels are an indication of the lack of interest in investing in the NTFRs, or incorporating salal into forest management practices, regardless of the potential to offset various timber enhancing silviculture costs. Thinning and other silviculture practices could also enhance commercial salal availability and quality. The salal and timber sectors function well together, in some instances through the building of access roads, the conversion of older areas to new sources of growth, and through tree thinning activity which opens the canopy allowing more light into the understory, which produces higher quality commercial salal. The salal sector has not approached government for assistance, nor has it lobbied for greater salal management as a result of sustainability or market issues. The sector prefers to remain out of sight from the more formal forest management system.

It is the commercial use of salal that creates social, economic and ecological issues. The potential for over-harvesting salal does exist as illustrated by the supply reductions in Washington State and also based on evidence from Vancouver Island, where most of the harvesting of salal occurs in B.C. Cocksedge (2003) found that habitat destruction through urban growth, clear-cut logging, and commercial harvesting of salal was affecting the availability of commercial quality salal on Vancouver Island. Industry participants often cite parts of southern Vancouver Island and the Nanaimo area in particular as severely over-harvested

(Cocksedge, 2003; Industry interviews, February, 2007). Many of the harvesters and buyers interviewed by Cocksedge (2003) believe tenure is necessary to help minimize poor harvesting practices. In Washington State, the land base is divided into numerous private and public areas, most of which have turned to salal leases as a method of managing access. However, in Washington State there appears to be more intense harvesting and trespass is a frequent problem. Ballard (2004) documented the different harvesting intensities on a range of land types in Washington State and found that the long term tenure or lease arrangement were held by companies, so if the harvester who is permitted by the leaseholder felt they had little chance of returning to the area the following year, they would use heavy harvesting practices. Ballard found that the Northwest Research and Harvester Association, a co-management arrangement between salal harvesters, the state, and Washington State University, provided harvesters with a secure long term land base and nurtured collaboration that led to a more managed harvest. In Washington State as in B.C., there is a history of overharvesting suggesting tenure or leases do not themselves lead to good harvesting practices, and may only be one of the components of a sustainable sector.

In B.C., and elsewhere, forest tenure holders on public land raise concerns about safety issues related to the use of forest service roads, the dumping of garbage, vandalism and theft, but in turn companies do look to some salal harvesters as additional eyes and ears monitoring activity in the forest. There is an expectation among residents that public or private land should be open to those who wish to harvest species unwanted or unused by the landowner. On private land, these issues have led to installation of locked gates, which has added to the tensions already existing. There are at least two sources of conflict associated with the commercial harvest of salal. First, within the commercial salal sector significant competition for lower cost

more accessible product does create conflict and tension between harvester groups who access the same areas, and between those who only harvest near their community and those who rove in and out of different areas. Second, any discussion of introducing a system of property rights and rules creates concern among First Nations communities and leadership, and increases the potential for conflict between local First Nations communities and the provincial government. It is within this institutional milieu and resource complexity that commercial activity continues, providing work and income to many. Amidst this commercial activity and competition within the forest, the provincial government is reluctant to intervene. The salal sector is also not prepared to approach government to establish some method of coordination, although some would welcome this development.

The situational environment within which the commercial harvest of salal, and any non-timber forest resource, operates in British Columbia is a function of the objectives and values held by individual participants, participant groups and other stakeholders. These objectives and values can explicitly influence the effort and shape of intervention design, and can also tacitly influence negative or non-decisions. Until the governments of B.C. and Canada are able to reconcile the rights and title issues expressed by First Nations, the ability to develop and implement a management regime for NTFRs will be problematic. This description of the political context suggests that some agreement among the parties will be necessary prior to the use of any framework to interpret, develop, and respond to institutional failure. In the meantime, the commercial harvest of NTFRs continues. The same issues will confront whoever is the rightful land owner of the province's resources.

7.3. Intervention assessment for the commercial harvest of salal in British Columbia

The intervention framework is used to assess the commercial harvest of salal in British Columbia where most of the land base is public with management responsibility vested in the Crown, or government. The commercial use of salal in B.C. has continued for several decades and has grown into an industry generating tens of millions of dollars. Nonetheless, the provincial government has introduced no regulations or other system of resource management to ensure its appropriate use or encourage investment. The result is the *de facto* open access to salal on public land and most private land, with the potential for all the associated problems, including over-exploitation, a lack of investment and resource degradation. What resource, appropriator, and institutional characteristics may contribute to the likelihood of commercial supply degradation, or alternatively may preclude at this time a 'tragic' outcome needs further exploration. The situational context is complicated by a complex policy environment with a myriad of tenure rights to a variety of resources and a highly complex political environment with unsettled land rights and title issues between First Nations and both provincial and federal levels of government.

The assessment to follow is separated into three sections:

- 1) the institutional failure and intervention rationale assessment is used to indicate the severity of the problem and provide an initial guide to a government or other external agency's response;
- 2) identification of the intervention mode(s) and the roles government may wish to pursue given the output of the institutional failure model; and
- 3) the intervention properties assessment outlines the building blocks and implementation strategy of an institutional approach if one is found to be necessary.

If regime transformation is necessary, the intervention rationale and subsequent work will lead to an appropriate scale of intervention. If regime transformation is unnecessary and potentially immensely disruptive, this model will identify the issues or problems that make the existing regime ineffective, and will direct the design of an approach that will more appropriately treat the root of the problem, if a problem exists.

7.3.1. Institutional failure and intervention rationale assessment

The institutional failure model is divided into three analytical sections. The first section provides an evaluation of the level of risk associated with the exploitation of the particular resource. It uses three risk factors to indicate a problematic situation: rising or high prices, the resource type, and resource use trends. Recall that it is already understood that the resource system exists under some form of open access, limited user open access, or some level of under-management. The exact form of access will come clear through the analysis. Satisfying these three risk conditions suggests that resource congestion may have been reached and a tragedy of the commons outcome may be possible – further investigation is thus warranted. The second section evaluates the severity of that risk using various resource, appropriator and institutional attributes that indicate a particular exploitation outcome, ranging from a robust resource with little associated threat to the resource or user community, over-exploitation but with natural or human constraints to that use, and finally the tragedy of the commons outcome. The identification of the outcome is the third section of the analysis. Each of these outcomes leads to a particular assumption about the level of rent dissipation or capture, suggesting a range in the level of government intervention required.

The contextual factors, in addition to indicating the higher level of risk that may be associated with the particular social-ecological system under review, also identify the sources of institutional failure. That source may be or may be influenced by, for example, slow resource reproductive capacity, the introduction of transient workers or a lack of trust among local participants because of a history of broken promises. Identification of factors that appear most acute to the outcome can be further explored to locate underlying tensions. Each indicator will also note whether there are exogenous influences that may introduce resource, appropriator or institutional pressures that are beyond the scope of local appropriator/provider groups to manage.

7.3.2. Risk factor analysis

The risk factor analysis is used to provide an initial determination of the severity, or lack of severity associated with appropriation within the resource system. Indicators of significant interest in the resource include its value, whether it is a commercial or subsistence value, increasing or sufficiently high to be producing positive rents and attracting additional appropriation effort. The second indicator used here describes the resource type and the 'common poolness' of the resource, whether it displays significant and high exclusion cost characteristics, subtractability, and congestion and conflict among appropriators. The third indicator examines resource trends that show whether or not demand for the resource is steadily increasing and if the resource use is in its early or late stages of development.

Decision rule: the resource is more at risk to degradation if the resource value, resource type and resource trend indicators are met. Uncertainty resulting from a lack of information contributes to the level of risk. Results are provided in a tabular format.

Table 7: Institutional failure model – risk assessment

Risk assessment		Indicator direction
R1	Resource value	
	Value/price is increasing or high	Value comes from commercial use of salal in the floral industry. Total sector value in the tens of millions of dollars. First Nations also attach a subsistence value to salal for its berries, but uses not competing. Price increased in past, but appears to have stabilized. Salal demand has declined since 2005, but is expected to return. Good harvesters can earn from \$100-200 per day, making it an above minimum wage for more skilled harvesters. The sale of salal is based on small margins thus keeping volume shipments high is important for buyers/distributors. Total sector value estimated at \$25-65 million, but includes some other products. The potential for large profits based on low margins high volume turn-over.
	Value/price is high vis-à-vis other resources	Comparable, but salal sector dominated by marginal workforce, or workers looking for supplemental income. Other mainstream sectors remain primary choice for most workers.
	Wage rates are high or increasing	Wage rates appear stable. Rates not high enough to attract a significant shift from other sectors, but sector serves as supplemental source of income for fisher, construction and forestry workers. Sector offers high wages for new immigrant populations, who may normally expect opportunities in lower paying sectors.
	Missing data – uncertainty	Annual volume and value data unavailable. Analysis based on published and anecdotal data. Missing and incomplete data increases risk of misunderstanding sector signals and resource system needs.
	Condition satisfied?	Condition partially satisfied. Sector attracts significant level of activity with thousands of individuals reported to be working in harvest sector. Wage rates generally exceeding minimum wage, depending on harvester skill and stamina, sector demands high volumes based on low margin returns.

Risk assessment		Indicator direction
R2	Resource type	
	High cost exclusivity	Large land base, roaded access, and multiple access points create high exclusion cost resource. Road deactivation reducing access in some areas, urban encroachment, timber harvesting and salal overharvesting expanding geographic operating margin, raising costs of accessing remote sites. Lack of investment in resource by industry sector, but is some research by universities and government.
	High subtractability	Salal is a subtractable resource, but growth capacity of resource and large area eases level of scarcity. Nonetheless, areas close to some communities have been overharvested, leading to appropriation externalities. Captured good after harvest leads to investment in distribution node of commodity chain.
	Congestion and conflict present	Congestion in areas closer to communities is occurring, and those more accessible. Conflicts among harvesters do occur, notably between local and non-local harvesters. Some harvesters make de factor claims over salal in certain areas.
	Missing data – uncertainty	Anecdotal information and analysis creates uncertainty in acuteness and severity of congestion.
	Condition satisfied?	Condition satisfied. Common pool resource with high degree of cost prohibitive exclusion. Conflict present.

Risk assessment		Indicator direction
R3	Resource use trends	
	Early or late stage in resource use	Mid-level stage, resource neither subject to sudden increase in demand nor is it in its final stages due to eradication of resource. Entry of additional external source of demand from China may lead to sudden increase in quantity demanded and price.
	Continual rise in volumes harvested and prices	Rising volumes shipped occurred through 1990s to 2003. Volume shipments to Europe have declined since 2003, but re-exports from US uncertain. U.S. shipments to Europe have increased, some of which may be sourced from B.C. Prices have stabilized but Chinese demand may initiate new price increase and volume demand.
	Shifts in source of demand	Demand from China may create significant shift. Additional demand from Asia may also evolve. European demand may remain strong but not be source of growth.
	Projections of future demand	Projections for demand optimistic, but current economic downturn may soften market given its more luxury, non-essential good quality.
	Missing data – uncertainty	No monitoring of trends occurs; subsequently shift from potential sustainable to unsustainable usage may occur, prompting calls for regulation.
	Condition satisfied?	Condition partially satisfied. Past trends indicated strong continued demand for salal. Recent market downturn has affected demand, but expected to return and may experience more demand from Asia.
Exogenous influences		Source of demand, demand shifts, and pricing. European demand down during mid- to late 2000s. Potential shift in demand to China has not yet materialized.
Risk assessment summary conclusion		<p>Resource value condition: partially satisfied Resource type conditions: satisfied Resource trends condition: partially satisfied Exogenous conditions present? Yes.</p> <p>A lack of data for volumes, values and trends in resource use, with the potential for increased demand creates a level of uncertainty resulting in a high risk for unprepared/unexpected growth, subsequent congestion, and institutional failure to ensure a sustainable harvest. Further investigation of resource, appropriator and institutional factors will substantiate direction of resource use.</p>

7.3.3. Contextual influences

The purpose of introducing contextual influences to the analysis is to determine whether or not certain attributes of the particular sector and resource would preclude or contribute to a tragedy of the commons outcome. For example, while the state may not provide any effective *de jure* resource management, harvesters themselves may have created some form of organization through collective action efforts. If this organizational attribute is not satisfied and the state attempts no resource management, this contextual influence would contribute to a conclusion suggesting a higher likelihood of over-exploitation. The attributes in the model may not be relevant for every case, and other attributes may be added as needed. The intent of the model is to provide a framework that allows a systematic analysis of the particular situation. Some attributes have overlapping influences, or have some redundant tendencies and may best be discussed together.

Contextual factor influences are presented in three categories: resource attributes, appropriator attributes, and institutional attributes.

Resource attributes

Resource attributes consist of the following indicators: resource supply; resource capacity; resource resilience and resource connectivity. These attributes are meant to survey the information that is available to indicate whether the resource has the capacity to meet the demand for product, how resilient it is to the harvesting activity and how the supply and its use is connected to other resources. The attributes will provide some sense of the level of congestion associated with the extraction of salal.

Decision rules are as follows: if the following conditions are met, then the resource is at greater risk of degradation,

- resource supply: available supply exceeds demand, supply constraints are visible, resource supply is increasingly inconsistent. A lack of data contributes to uncertainty and increases risk (relevant to all indicators).
- resource capacity: the harvested volume exceeds the stock's annual flow, capacity constraints appear in the form of declining supply, shifting areas of concentration, conflict.
- resource resilience: the stock regenerates at a slow rate, indications of declining use and resource availability, species grows at an inconsistent spatial and temporal rate.
- resource connectivity: risk increases if the resource has high ecological and appropriation connectivity, significant resource heterogeneity, and if affected by other resource use.

Table 8: Contextual factors – resource attributes.

Contextual factors - Resource attributes		Characteristics
RA1	Resource supply	
	Available supply and supply shortages	Species is abundant and will not be eradicated, but commercial quality salal is more limited in supply and can be denuded. Evidence from the US Pacific Northwest and parts of Vancouver Island indicates negative effects of overharvesting. Supply appears sufficient at this time to meet demand, but as more area further from buying stations is accessed for product, costs of access may increase contributing to rent dissipation.
	Indications of supply constraints	Overharvesting of salal has been noted and some areas have become denuded. Commercial quality salal is available in other areas, but further from communities, thus more expensive to access. Urban encroachment, timber harvesting, and reduced access from locked gates adds to constrained supply. The volume of commercial quality salal may decline to a point where availability per area no longer provides enough volume to earn sufficient income. Salal often forms in small patches, requiring harvesters to constantly relocate their activities. No total volume information available by area or region, or whether harvesters are taking more or less volume. Harvesters do mention the need to look further. Companies have investigated supplies from as far as Haida Gwaii.
	Predictability of supply	Salal returns to site after timber clear cut or after fire. Salal plant will supply commercial quality if harvested appropriately, choosing older stems, allowing younger stems to grow for 1 or 2 more years. Plant grows more vigorously when harvested, but growth can be stunted if too much plant is taken annually.
	Missing data – uncertainty	Research into invasiveness of salal has been done, with more of a focus on salal eradication to facilitate timber harvesting. Research into plant's response to harvest intensities, compatibility with timber management and locational characteristics has been done. No supply – demand analysis done.
	Condition satisfied?	Condition partially satisfied. Supply appears sufficient in broad geographic sense, but less so from a local perspective. Supply consistent if harvested appropriately. Significant data related uncertainty. Marginal harvesting costs may be increasing as open access theory would suggest.

Contextual factors - Resource attributes		Characteristics
RA2	Resource capacity	
	Resource stock	Commercial quality salal is some subset of the total volume of salal. Percentage uncertain, but could be in the 20-30% range.
	Resource flow	Total flow a function of stock and growth. Flow of commercial quality salal uncertain. Total volume harvested for commercial purposes uncertain. Growth rate up to several inches per year.
	Capacity constraint	No data collected to indicate if a total or regional capacity constraint has been reached or is approaching. Some supplies in the Nanaimo area and others close to communities have been lost by overharvesting and urban development.
	Missing data – uncertainty	Less research done on salal stock and flow, and volume of salal harvested. Significant uncertainty of relationship between stock, flow and harvest volume.
	Condition satisfied?	Condition partially satisfied. Subject to risk due to lack of information. Resource is abundant, but uncertainty regarding commercial quality supply increases risk. Capacity constraint condition is met in some locations.
RA3	Resource resilience	
	Regenerative capacity	Salal is highly resilient to harvesting or land alteration. Salal returns to clear cut areas providing important source of berries to First Nations, bears, etc. For commercial quality salal, when harvested appropriately salal will provide multiple year supply, if younger shoots allowed to mature. Canopy closure reduces commercial attractiveness of salal, thus supply shifts across landbase as forest stand ages. Thinning of timber stands increases commercial salal quantities.
	Declining use/availability	Declines in supply in 2004-2005 the result of company restructuring in Europe. Harvest of salal does not appear to be waning.
	Consistency in species growth	Extent of salal growth dependent on weather conditions. Growth period generally in May-June, partially July. Harvesting is suspended at this time. Species can have significant growth, responds well to light harvesting methods.
	Consistency in value/demand	Total value can vary per year from volume fluctuations. Annual per unit values not well known. Harvester piece rates have been stable for several years.
	Missing data – uncertainty	The negative effects of overharvesting are understood and annual growth rates have been observed in some areas. No inventory of commercial salal to base either commercial capacity or its underutilized potential.
Condition satisfied?	Condition not satisfied. Resource is robust and will return to landscape. Commercial quality can be maintained if harvested appropriately.	

Contextual factors - Resource attributes		Characteristics
RA4	Resource connectivity	
	Connectivity/dependence on other species	Salal is a forest understory species. Commercial quality salal depends on stand characteristics such as light and moisture. Commercial quality salal requires partial light penetration thus thrives in old growth and newer growth trees prior to full canopy closure.
	Heterogeneity of resource(s)	Geographic spread of salal is limited to coastal areas, with commercial quality in more limited supply. Significant allocation problems could be present in small area designations that would be amenable to exclusive access rights.
	Other resource use impacts	Timber harvesting will eliminate commercial quality salal, but will return in newer stands in 20-30 years. Salal is an important source of berries, and berries are productive with greater sunlight thus earlier than commercial salal for the floral industry. Uses not competing.
	Missing data – uncertainty	Variation across landscape.
	Condition satisfied?	Condition satisfied. Significant connectivity to forest stand conditions and timber sector. Quality and location varies.
Exogenous influences		Resource resilience associated with weather and other growing condition influences. Resource connectivity related to timber industry activity. Loss of commercial salal resulting from logging and urban encroachment.
Summary contextual factors – Resource attributes		Resource supply condition: partially satisfied Resource capacity condition: partially satisfied Resource resilience condition: not satisfied Resource connectivity condition: satisfied Exogenous conditions present? Yes.

Appropriator attributes:

Appropriators and producers of the resource (salal harvesters and buyers/distributors) have certain characteristics that may or may not contribute to the sector's likelihood to over-exploit the resource. These include the residence of workforce, capacity of the labour force to expand, the capital and technical requirements that may limit the entry and exit of sector participants, heterogeneity and other user characteristics, and their socio-economic status.

The decision rule for appropriator attributes is as follows: if the following conditions are met, the resource is at higher risk of degradation,

- residence and resource proximity: appropriators/providers are non-local, do not rely consistently on the resource whether local or non-local, have a low level of dependence on the resource.
- labour force capacity, the existing workforce has significant capacity to increase appropriation effort, additional labour is able to easily enter the sector to increase total effort, and the wage rates and working conditions are attractive.
- capital or technical barriers to entry: minimal or low cost capital requirements to appropriate resource, low cost entry, minimal equipment required, low level of technical capacity or skill required.
- heterogeneity of user characteristics: highly diverse cultural, social and linguistic characteristics of workforce, inequitable sharing of benefits and costs, homogeneous costs.
- appropriator/provider trust: no signs of social capital, low levels of communication, conflict, and a lack of user associations.
- socio-economic status: high level of poverty among appropriators, no universal safety-net or welfare system, high level of dependency on resource, low education level of workforce.

Table 9: Contextual factors – appropriator attributes.

Contextual factors – Appropriator attributes		Characteristics
A1	Residence and resource proximity	
	Local versus non-local harvesters	Both local and non-local harvesters participate in sector. Non-local harvesters usually associated with groups who will enter an area for one to several days. Roving harvesters reportedly have shown less concern for salal, will enter areas that locals manage.
	Consistency or participants – local or non-local	Participants consistent. Part-time harvesters more sporadic, but fill increased demand during high volume times.
	Level of resource dependence	Significant variation. Some depend on salal for 100% of income, others only for supplemental income. Part-time harvesters often have other primary employment sector.
	Missing data – uncertainty	Anecdotal data. No statistical or large survey based data available.
	Condition satisfied?	Condition partially satisfied. Mix of local and non-local users, some inconsistency of users entering sector for supplemental income.
A2	Labour force capacity	
	Existing workforce	Increasing existing labour effort would require higher volumes per worker and area harvested. Uncertain if that is possible. Increasing the time spent harvesting by part time harvesters could increase volume, but not necessarily productivity. Higher piece rates could influence the overall labour effort of full and part time workers. Both existing and new labour may eventually be required to pay workers-compensation insurance costs, which may reduce earning capacity and attractiveness of sector as an employment choice.
	New labour force	Additional new labour could enter to increase the level of harvest. Sector is currently having difficulty attracting new labour. Entry may be precluded by level of wage, working conditions, availability of other opportunities, and the opportunity cost of those other work choices.
	Wage rates	Wage rates are in the \$10-20 dollar range, which are comparable to other non-union sectors such as construction, forest services. Wages may have to be higher to attract shift into the salal harvesting sector. Potential to earn non-taxed income is an inducement.
	Working conditions	Working conditions challenging, 10 months of the year working in adverse conditions, wet weather, hilly and mountainous terrain.

Contextual factors – Appropriator attributes		Characteristics
	Labour force capacity cont.	
	Opportunity costs of other work	Opportunities in other mainstream economic sectors such as construction, fishing and forestry may have greater attraction, but salal sector caters to new-immigrants and is relatively constant compared to fluctuations in other sectors.
	Missing data – uncertainty	No statistical workforce data available. All information anecdotal.
	Condition satisfied?	Condition partially satisfied. Existing part time labour force able to increase effort. Attraction to sector may be limited. Labour shortage expected.
A3	Capital or technical barriers to entry	
	High cost entry – fees or capital requirements	No fees for entry and no capital requirements other than vehicle to access and transport salal. Group members pay fee for driver services and transportation costs. Easy entry and exit.
	Equipment needed	In addition to access to vehicle, boots and wet weather gear needed.
	Technical dependency – skill, expertise, education (formal or informal)	Little technical dependency, but daily volume harvestable depends on skill level. Participants consider about three months is required to become efficient harvester.
	Missing data – uncertainty	Anecdotal data.
	Condition satisfied?	Condition satisfied. No capital or technological barriers to entry as appropriator. Required skill level gained over 3-month period.
Contextual factors – Appropriator attributes		Characteristics
A4	Heterogeneity of user characteristics	
	Cultural or social heterogeneity – local / non-local diversity	Significant cultural and social heterogeneity. Large portion of the workforce from Southeast Asian countries, Laos, Vietnam, Cambodia for example. Other cultural groups include European descendent and First Nations harvesters. Dominance of one group unknown.
	Inequitable sharing of benefits or costs	Inequities unknown. Likely not too prevalent across harvester groups, but may exist between harvester-buyer-distributor levels. No evidence to substantiate this however.

Contextual factors – Appropriator attributes		Characteristics
	Heterogeneity of user characteristics cont.	
	Appropriator cost heterogeneity/homogeneity	Heterogeneous costs associated with travel times, knowledge of high quality commercial sources, and potentially favourable buyer rates for long-affiliated harvesters. Low costs of forest access may nullify these cost differences. Appears to be significant movement to access known salal producing areas. Group cost advantage from shared travel expenses, but higher travel costs must be offset by higher productivity and volumes harvested, likely leading to the use of heavy harvesting methods.
	Missing data – uncertainty	Insufficient data to conclude cost issues.
	Condition satisfied?	Partially satisfied. High level of cultural and social heterogeneity making communication/trust more difficult. Entry somewhat restricted due to knowledge of commercial quality locations, but low level of difficulty to overcome.
A5	Appropriator/provider/producer trust	
	Social capital	Within harvester groups and locals frequenting one buying station social capital likely exists, but does not appear to be present across sector participants. Appears to be little intergroup interactions, or exchange of ideas and knowledge. Highly competitive sector creates conflict, secrecy and lack of cooperation.
	Communication	Minor communication among harvester/provider groups. Participants do appear to know what companies are doing, through knowledge of vehicles, signs of harvesting. Observations of sector indicate secretive, suspicious, non-collaborative participants.
	User community associations	No appropriator or provider associations visible or known to exist.
	Condition satisfied?	Condition satisfied. Lack of trust noticeable among participants, little communication or social capital built, high conflict does occur through confrontations over areas and access rights.

Contextual factors – Appropriator attributes		Characteristics
A6	Socio-economic status	
	Level of poverty among user community	Harvesters vary, with some in lower socio-economic stratum while others using salal as supplemental income may be from higher more diverse levels. Poverty unlikely to be an issue driving the over-harvest of salal in general, but may be an issue for some individual harvesters. Social safety net available to ensure basic level of income.
	Dependence on resource/industry	Disperse group will have very diverse level of dependence on the resource for all or some of income. Uncertainty around the number of harvesters who quickly enter and exit the sector looking for a quick source of income.
	Education level of workforce	Education levels uncertain, likely very diverse.
	Missing data – uncertainty	Anecdotal information. No data available.
	Condition satisfied?	Condition partially satisfied. Existing labour force may have trouble moving to other sectors if required. Social safety-net/welfare eases condition. Poverty unlikely to drive eradication of salal.
Exogenous influences		Non-local users may introduce different harvest strategies and enter areas tended by local users. Social safety net may preclude poverty related degradation of resource.
Summary contextual factors – Appropriator attributes		Residence condition: partially satisfied Labour force condition: partially satisfied Capital/technical condition: satisfied Heterogeneity condition: partially satisfied Trust condition: satisfied Socio-economics condition: partially satisfied Exogenous conditions present? Yes.

Institutional attributes:

Institutional attributes include the transaction costs, market complexity, communication and information flows, informal rules-in-use, and government commitment to sustainable resource use.

The decision rule for institutional attributes is as follows: if the following conditions are met, the resource is at higher risk of degradation,

- transaction costs: information non-existent or highly dispersed, participants, appropriators/providers highly dispersed, informal grey or black market activity, costly monitoring requirements, opportunity costs of alternative management high.
- market complexity: market for resource is non-local, demand is commodity based, resource has multiple commercial and/or subsistence uses, external demand associated with other values/uses.
- communication and information flows: lack of communication and information sharing among appropriators, lack of readily available and centrally collected information, level/type of information used by appropriators inconsistent and kept private.
- informal rules: lack of informal rules among appropriator/provider community, no user groups or associations visible, no informal boundary and/or choice rules established, application of rules if present not applied consistently across local and non-local appropriator groups.
- government commitment: low level of salience to government, lack of participation in resource sector, lack of dialogue between government and appropriator group, competing objectives among appropriators and government, or within government agencies.

Table 10: Contextual factors – institutional attributes.

Contextual factors – Institutional attributes		Characteristics
I1	Transaction costs	
	Availability of information – concentrated or disperse	Information is poor, no annual estimates of volumes and values, spatial scale of harvesting concentration, number or harvesters. No robust collection of data. Some export data included within trade statistics, but not specific to salal and quality unknown. High cost to implement information collection system. Sector participants have information, but information is not collated or shared with resource managers. Data is very difficult to obtain.
	Dispersed versus cohesive participants– user groups/ level of associations	Harvesters are a very dispersed group. About 10-20 buyer, distributor groups but do not provide annual data, except export data that is combined with other products. Many unwilling to share information. No associations exist to collect or provide information.
	Visibility of sector participation in formal / informal economy	Sector part of 'grey market' operating outside of government purview. No listing of buyer's stations or export companies.
	High exclusivity and requirement for costly monitoring/enforcement	The geographic characteristics of salal harvesting and the extent of roaded access indicate high costs to monitor harvesting activity. Low number of buyers/distributors could make monitoring of total volumes possible, but data not specific to the location of harvest where over-extraction issues arise.
	Actual or perceived costs of management among user community	Desire to maintain operations below government scrutiny and free access to the resource indicates the perception among the user community that costs of government intervention too high. A significant cost category for harvesters and employers is the cost of workers' compensation fees and taxation, which contributes to the desire for many to have the industry remain unregulated.
	Missing data – uncertainty	No data or cost estimates to substantiate claims of high cost information or management.
	Condition satisfied?	Condition satisfied. Information difficult to collect. Participants widely dispersed, little communication. High cost exclusion. Potential high opportunity cost of cooperating with government and subsequent management.

Contextual factors – Institutional attributes		Characteristics
I2	I2. Market complexity	
	Local single use market or non-local, commodity market	Salal is a commodity exchanged in international floral markets. Largest market U.S. and Europe. Sector controlled in past by large distributor companies in Washington State. Expanding market in Asia introduces additional demand sources.
	Multiple uses for same resource/species	No other competing uses for salal currently exist. Other value associated with salal berries, but fruiting occurs at different stage of plant age and forest canopy density.
	Source of demand for other uses	N/A
	Missing data – uncertainty	Source of demand and market structure relatively well known, but information often anecdotal.
	Condition satisfied?	Condition partially satisfied. Commodity market, foreign demand drives activity.
I3	Communication and information flows	
	Evidence of communication among users / resource managers	No evidence of significant resource management related communication among sector participants. Minor communication between some sector participants and research/government community, but not structured, only ad hoc. Actual day-to-day communication among companies unknown – intensely competitive industry.
	Evidence of information sharing	Information sharing among individuals associated with same buying station occurs, but location of known well producing patches remains guarded knowledge. Minimal sharing between sector participants and research or government levels.
	Information type, availability and ease of gathering	Information is extremely difficult to obtain. Annual statistical data not available. Size of workforce unavailable. Sector trends based on anecdotal information.
	Missing data – uncertainty	Type and context of any information that may be shared is unknown.
	Condition satisfied?	Condition satisfied. Poor levels of information sharing. May reflect commercial quality supply restrictions and need to maintain secrecy of supply locations.

Contextual factors – Institutional attributes		Characteristics
I4	Informal rules	
	User groups or associations visible or known	No associations or groups known. Minor affiliations among harvesters using the same buying station. Informal rules among these groups not known, other than protecting site information.
	Local boundary and/or choice rules	No formal boundary rules, other than two private land owners. No known user-based boundary rules. Harvesters do pick using the same method, and need to maintain quality level to ensure acceptance from buyer. Quality among shipments not always maintained, however.
	Application of rules – locals and / or not non-locals	No visible application of harvesting related rules, discussion of rules or their development.
	Missing data – uncertainty	High level of uncertainty regarding some of the unspoken rules that may govern harvesting or distribution sub-sectors.
	Condition satisfied?	Condition satisfied. No formal rules managing access, harvest methods or rates.
I5	Government commitment	
	Level of salience to government	Low salience to government – no pressing ecological danger or demand from salal industry for involvement.
	History or consistency in participation / resource investment	Inconsistent history of participation or interest in NTFR sector in general.
	Open dialogue / participatory approach for other issues	Forest district level maintains the closest contact with harvester groups and companies, but do not collect access information or permit access in any way. Most companies operating in sector do not communicate with government.
	Competing objectives	Timber industry, First Nations rights and title issues contribute to government reticence to participate in sector. Other priority issues facing timber industry that take precedence.
	Missing data - uncertainty	No official statement of policy towards NTFRs, thus uncertain as to direction government may take if it chooses to do so.
	Condition satisfied?	Condition satisfied. Little interest in government to manage, promote or support sector. Ad hoc, informal connection between government and sector.

Contextual factors – Institutional attributes	Characteristics
Exogenous influences	Market based on external demand for commodity resource. Lack of government monitoring or role in resource management.
Summary contextual factors – Institutional attributes	Transaction cost condition: satisfied Market complexity condition: partially satisfied Communication and information condition: satisfied Informal rules condition: satisfied Government commitment: satisfied Exogenous conditions present? Yes.

7.3.4. Exploitation outcome:

The analysis suggests a rather typical open access history and outcome. Increasing values lead to exploitation of the resource and there is little collective incentive among appropriators to provide for the resource through investment in access or stand management for commercial quality salal. Individually, there are examples of harvesters tending the resource with a longer term perspective; however, there is a collective failure to ensure that the benefits of this tending are fully realized. In the midst of this use, the public landowner has not intervened. Is the situation facing the resource and the salal sector leading to degradation of the resource and rent dissipation, or is the species highly resilient and market constraints limit its expansion?

The exploitation outcome falls in the middle: resource exploitation with “human or natural capacity constraint.” Given the range of use rates and harvest intensity, denuded areas and the pursuit of salal in more remote areas it is likely that some rent dissipation is occurring; however, rent capture likely predominates at this time. While rents are being generated in the sector, the additional rents left for the taking, thus attracting further entrants is uncertain. Previous entry of new export companies has led to low margins earned by distributors and stable piece rates paid to harvesters, thus driving a need to maximize volumes. Salal is a common pool resource faced with appropriation and provision problems, and high transaction costs. It is also a highly demanded commodity within floral markets. If the marketability of salal continues as the trends and industry information suggests, B.C. will remain one of the market’s central sources.

Generating additional rents and attracting more labour effort will come with increasing demand and resource investment that could enhance the supply of salal closer to communities, thereby reducing transportation costs. However, an uncertain level of commercial quality supply, no

formal management, renewed exports to Europe and expanding markets in China may lead to higher use and greater rent dissipation, pushing the outcome closer to the “tragedy” outcome.

Resource and appropriator attributes suggest that while the salal species is resilient, over-harvesting does occur and has affected the supply of commercial quality salal. This has resulted in increased costs associated with locating new commercial quality patches and transporting salal further distances. As heavily harvested areas become denuded of commercial quality salal, harvesters become less productive and seek new sources, subsequently incurring higher transportation costs, and spending more time and effort to harvest a similar volume. Salal may always return to the landscape, but if low quality shifts the market to a substitute the commercial salal market may not return, pushing values, and rent, to zero. Ensuring a stable and new source of labour is also becoming a challenge as the existing salal workforce ages and leaves the industry and other opportunities provide greater appeal to the younger workforce. Thus, as the market shifts in response to potential supply shortages, quality issues and trends in the floral industry, the demand for salal may diminish. A shift in preferences could also reduce the demand for salal. A more engaged government sector and communicative salal sector could work towards maintaining the resource, its quality and market access. Government is not contributing to this sector however, increasing the risk that the individual oriented focus visible in this sector will not preclude a sector decline even if degradation is visibly approaching.

What may be most limiting to the evolution of a *de jure* or *de facto* management regime is the appropriator community. The industry is made up of hundreds of individual harvesters, and numerous buyers, and distributors. There is no ability for the individual harvester to create collective action among such a disparate and unidentifiable appropriator group. The lack of

trust significantly inhibits the ability to act collectively and may be the most significant attribute contributing to the over-exploitation of the resource, as it precludes the limiting factor of local rules, norms and customs. The lack of a collaborative ethic also significantly increases the transaction costs facing government if it attempts to introduce a management regime developed through user participation and knowledge. The result could be an inappropriate and destructive response by government to an ill-defined problem and perceived management need.

Exogenous attributes can make local, user oriented solutions more difficult to establish, necessitating some level of external intervention capable of addressing the exogenous influences. The most significant exogenous influence is the source of demand for salal. The U.S. and Europe are the largest consumers of salal harvested in B.C. and also set the value, thus price paid to harvesters. The introduction of China as a source of demand may shift the current demand structure, elevating prices as companies attempt to satisfy the new market. In addition, the presence of non-local harvesters and the accompanying lack of communication between harvester groups increase the risk of competing harvest strategies, tension and related conflicts among harvester groups.

The analysis suggests that government intervention is warranted given existing use levels and the presence of conditions that would predict the potential for a “tragedy of the commons” outcome. Perhaps more surprising is the lack of government involvement given the sector’s size and presence in the forest. However, intervention is not a necessary condition to preserve salal or the broader ecosystem, but as an effort to help maintain the commercial salal sector. Intervention is also not necessarily associated with the establishment of private tenures or the

use of other access limiting tools. The industry relies on the rather free entry and exit for harvesters. Research indicates the potential synergies between the forest and salal sectors, but none of these are being exploited at this time.

Seven characteristics appear most salient to the analysis:

1. the potential inability to deal with high cost exclusivity and access management;
2. a lack of information and subsequent significant uncertainty;
3. exogenous demand and potential shift in demand;
4. high collaboration and information costs;
5. a lack of trust and communication among appropriators;
6. appropriator tension and conflict between and among user types, and
7. the sector's low salience to both the timber industry and government, but high salience to First Nations.

Any government attempt to introduce a management regime should recognize the challenges associated with these attributes and focus attention on methods to deal with and incorporate them within any management regime. If the goal of government is to support economic development and rural livelihoods, to engage with sectors generating revenues in the tens of millions of dollars and assist those that are or may experience difficulties (at the least those threatened by collapse) then based on this analysis the salal industry is a candidate for government intervention. However, the salal industry needs to collaborate with government to avoid potentially harmful intervention that could inadvertently introduce inadequate policy that would lead to further institutional failure and scale-mismatch. Collaborative work could be organized to examine the costs of intervention, the information needs and methods to ensure high quality, potentially branded and certified product. An appropriate, effective and equitable government intervention will be supported by industry collective action. Therein lies the

potential “selective incentive:” the threat of government intervention can be the best catalyst for internally generated change.

7.3.5. Intervention mode assessment

The outcome of the failure rationale indicated that resource use had not reached a physical or economic capacity constraint; however, intervention could preclude the sector progressing towards a commercial capacity constraint, and act as a means of enhancing the sector through more directed sustainable development and compatible management. Yet, the growth or demise of the salal sector rests on the fortunes of the floral industry. Demand may increase significantly through the entry of China as a source of demand in world floral markets, or may decline as the costs of the floral sector increase to unsustainable levels. The institutional failure model suggests a facilitative-coordinating mode of intervention, rather than continuing with the absent mode currently followed. The initial characterization of government’s participation within these roles is based on the following criteria: policy mechanism; information; access and use limits; and state role/function. They are intended to indicate the depth of government intervention in a sector and the invasiveness of regulatory requirements.

Policy mechanism

Based on the intervention rationale, the participation of appropriators and producers in some form of joint or collective action is unlikely to occur voluntarily. As a result, a facilitative role is unlikely to successfully encourage increased interaction and collaboration among sector participants that would preclude rent dissipation and potential resource depletion. A coordinating rule is recommended to provide some selective incentives towards participation. A prescriptive role is unnecessary given the lack of imminent or future ecological collapse. The

government's bureaucracy could take a smaller or larger coordinating function and a set of nested groups could be developed to ensure power issues do not silence harvester's voices over those of the buyers/distributors. Regardless of the policy or legal focus, a desire to act collectively will be necessary among appropriators and producers. Once a coordinated set of associations have been established, government can take a more facilitative role to support the identification of sector objectives, problem identification, among other sector specific issues.

Information provision/accessibility

Initially, government needs to begin collecting information to monitor the level of harvest, the geographic spread of the harvest and the values accrued from the commercial use of salal. This monitoring function may require a legislative or regulatory backing to initiate and obtain a reasonable level of compliance. This requirement should be matched with some form of benefit to the resource users. However, initially any benefit may be illusory to or significantly discounted by sector participants – the sector relies on secret patches, no government scrutiny and unrestricted access to most areas, and for many sector participants no payments of costs such as workers compensation and income tax.

An information collection regime would have to be in place if the management of salal were to proceed to a more rule based system where monitoring and enforcing rules became necessary. Thus, various pieces of the institutional puzzle may have to be established prior to any significant rule based system of management. Various examples of improved forest management and increased benefit flows to the salal sector would prove of interest and would become a key part of information dissemination. Information provision and accessibility could eventually contribute to efforts at gaining environmental certification status.

Access and use limits

The persistence of open access to the salal resource on most of the land base will remain a significant challenge. While it does potentially contribute to over-exploitation of the resource, it also facilitates the easy entry and exit from the sector. Implementing boundary and choice rules to limit access and use rates will be costly to enforce, as such moving towards a more regulation based access management regime may not be the optimal policy direction in any case. In addition, there is still uncertainty regarding the ecological implications of salal harvesting, or the level of damage to commercial quality salal over a large geographic area. More information could provide a better indication of the extensive margin of the resource. At this juncture, working with the appropriator community to determine where problematic exploitation rates are occurring and identifying other harvest related issues could be the best direction.

State role/function

Government needs to promote the sector, show that it takes an interest in its development and that it is not simply looking for a new source of revenue. Government needs to support the development of user organizations and should work towards these organizations participating in rule making and implementation. Some regulatory measures may be necessary to collect the appropriate type and level of information, but further encroachment may be ineffective. Apart from information rules there is no need or little ability at this time to establish boundary or choice rules, or to establish formal positions of monitor or enforcer at this point.

Resource provision may initially fall under government, through enhancement activities, market development and access related assistance, and forest management coordination. Any fees

from industry could be re-invested directly into the resource system. Research would be necessary to monitor the benefits from this investment and used for evaluative purposes to ensure management objectives are being met. A government move towards this more active provision of salal would need to be justified from a cost-benefit perspective. Joint provision of timber and salal (and other NTFRs) may be the most prudent way to justify resource enhancing silviculture treatments at this time.

7.3.6. Intervention properties assessment

The outcome of the institutional failure and intervention mode assessments informs definition of the intervention properties. The properties are structure, engagement, interaction, implementation and adaptability. Initial definition of the structure and engagement properties is necessary to initiate interactions, and move towards some implementation of policy. The structure and engagement properties then evolve as the system and its design participants evolve and determine how to proceed. The adaptability property is critical in the initial structure to ensure feedback is noted and incorporated into policy development. As was noted in the development of the framework, there is a hierarchy in the process of property definition that may differ between cases. Some properties will need to be defined, developed and implemented prior to others, followed by an iterative adaptation and finer definition as the management regime matures. Most cases, however, will require either the structure or engagement properties to be dealt with initially. In this case, the comprehensive development of structure properties would be premature, but a minimal design of structure in any regime development is necessary. A more detailed strategy would then focus on defining and implementing an engagement framework that would begin to foster information and

association flows within the interaction property. Structure then begins to fall into place, adding further components in time.

The approach taken here assumes participation of the user community, that the information and knowledge they hold, not to mention their coordinated action is critical to the success of the regime development. The approach also assumes that government takes the leadership role at the outset, given the outcome of the rationale assessment that the user community does not have the capacity at this point to form associations. The following presentation of the properties flows from this hierarchical perspective. Providing a full intervention framework for salal is not possible given the iterative and inclusive approach chosen, but the initial elements are included here.

This example application of the intervention framework also assumes that the design is based on a joint provincial government – First Nations endeavour. Prior to achieving this agreement, an initial approach would have been developed to engage with First Nations. This hypothetical collaboration with First Nations in this regime design recognizes First Nations' role in NTFR management in British Columbia, and it also recognizes that any landowner will likely face similar issues. The depth of any collaboration is made more possible in this circumstance given there is no imminent danger in resource collapse. The intervention mode and subsequent property design is a function of the severity of the problem and other less collaborative approaches may also be options in more severe circumstances.

The design and implementation of an intervention framework in this example has three stages. The development of regimes for other resource systems may have more or less.

1. Development planning phase.
2. Regime design phase.
3. Regime operational phase.

Phase 1: development planning phase.

Phase 1 Structure: To begin any institutional development the institutional change proponents need to secure a mandate and establish objectives. Two sets of objectives in this example include 1) a set of broad objectives reflecting the intended output of institutional change; and 2) a more specific set of objectives focusing directly on the problem or sources of failure. The second set of objectives may be more accurately described as the means to achieving the first set. In the case of salal management, the provincial government would provide a policy mandate to the bureaucracy to develop an approach for the management of salal – whatever that management may look like is uncertain at this stage of the process.

The mandate provides the directive to develop policy and the supporting human and fiscal resources necessary to develop and implement the intervention framework. It is important for the proponent of this intervention to support the use of the framework and not to stray from its process. Adaptation as a mechanism for regime design is recognized and will occur as the process of design unfolds. At this point, the policy option decision to develop a management regime has been made. This is the essence of the structure at this point.

Current Participants:

- Provincial government,
- First Nations.¹²

Mandate: based on allocation of human and fiscal resources,

- To introduce management regime for salal,
- To include salal industry in regime development and operation,
- Initial phase six months, movement into second phase through second six months.

Intervention mode:

- coordinating – facilitative.

Governance Objectives: stated through initial agreement between government and First Nations,

- To allow the appropriate exploitation of the salal resource,
- To develop and promote salal sector,
- To increase wealth generation from the forest,
- To initiate a salal user community based management system.

Intervention Objectives: specific institutional failure focused,

- Increase communication between sector participants,
- Reduce information and coordination costs,
- Improve quality of information available to users and agencies,
- Build trust among user community and with government agencies,
- Develop process/forum to resolve conflicts,
- Increase the salience and legitimacy of salal sector to government and public.

¹² This example tries not to presuppose who among First Nations groups would be a participant at this juncture.

Phase 1 Engagement: Initial engagement with First Nations has occurred with joint planning responsibilities defined. Figure 6 outlines initial engagement network participants.

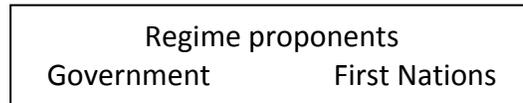


Figure 6: Salal intervention regime proponents

An engagement plan can be developed outlining industry contacts, which sub-sectors to include, and which competing sectors if any that need to be involved or informed. In this case the forestry sector would be an obvious third party participant. The engagement plan will begin to align actors within their respective levels and capacities within 1) regime design, 2) regime implementation, and 3) regime operation. The objectives and how they are further amplified through the interaction property reveals the extent of these roles.

Regime design will include the central regime proponents, regional agencies who will interact more closely with the salal sector, the salal sector, and the timber industry. Figure 6 outlines the evolving engagement framework that includes these participants.

Given that the objective of the salal management regime at this time is to foster user community management responsibility, establishing the appropriate engagement structure and interactions among participants will support that self-management. The perspective of this strategy is that user oriented management may still require the appropriate support and legitimacy from other governance actors. Figure 7 indicates the additional participants.

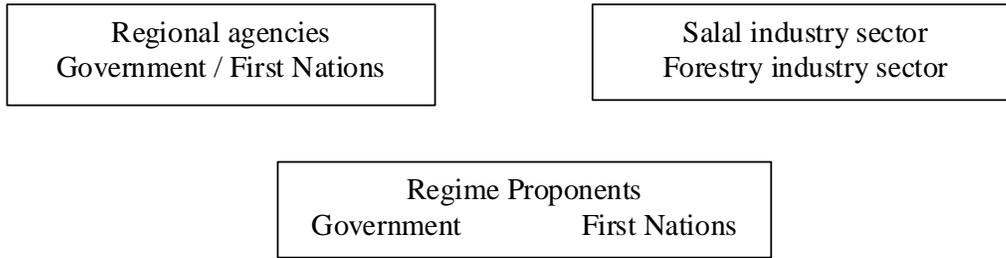


Figure 7: Salal regime engagement framework participants

Phase 1 Interactions: Interactions are communication and action conduits where information is passed or shared and where decisions are made regarding the particular links within the system.

An objective for this management regime is to incorporate the user community within regime design and operationalization. In the salal management regime, there are two ways that the process could go initially. First, the user community could show signs of reciprocating the interaction and begin to participate, although perhaps rather meagerly at first. Second, the user community could refuse any interaction. If the latter, at this point it is important to return to the problem statement and outcome. Is this a problem that needs to be resolved now? If yes, the designers must return to the structure element and obtain a formal policy directive that provides a more coordinating role requiring the development of a user association, and then returning to development of the interaction property. There may be human or fiscal resource needs associated with this adaptation.

Initial interaction nodes are between government and First Nations. Subsequent interactions will include those between the regime proponents (government and First Nations) and the

regional agencies, regional agencies and the salal user community, and eventually between salal user associations and the various management partners. Highlighting these interaction nodes allows the central regime designers to recognize where the provision of information needs to occur and where potential barriers to proceeding may evolve.

Phase 1 Implementation: Implementation at this point has already started. The stock and flow intervention framework figure introduced in Figure 3, Section 5.3, shows the iterative nature of regime design, with feedback loops circulating among each of the properties. In this example, implementation occurs with the completion of each structure and engagement stage. An implementation plan would be drawn at the onset of the intervention, showing the phases of nested intervention levels. For example, design Phases 1, 2, and 3 will evolve to create a nested management regime that has the regime proponents, regional agencies and the salal and forestry sectors. As each level is introduced and implemented, and adjusted as necessary, subsequent implementation plans would evolve.

This mapping provides a clearer picture of the origin of the problem and its progression to resolution, which can be referred back to the policy objectives provided at the onset. The appropriateness of the response to resource and issue scales can also be interpreted through this mapping. For example, do the regional agencies have sufficient staffing, is the resource problem visible in all regions or only some, is the problem's severity manageable by the user community?

Two outcomes have occurred: 1) implementation of a mandate to establish a collaborative management arrangement with First Nations; and 2) identification of the participants for Phase

2 regime design. Implementation of the objectives and mandate set by the regime proponents can now proceed by introducing the Phase 1 engagement framework and establishing interactions with the user community and forest sector.

Phase 1 Adaptability: As with implementation, adaptation has already occurred as the process evolves. Developers of a regime under this framework need to recognize the critical role adaptation plays in the design of a regime that matches the needs of the resource problem with the appropriate scale of response. Thus the adaptation mechanism is a structural element that needs to be established at the initial stages of the process, and recognized for not only its role in the evolution of institutional stock properties, but also its fellow flow properties. Who participates in monitoring the design process and the developing intervention regime should include representatives from each constituent represented in the design process.

The governance regime and design need not necessarily have to adapt in whole to each problem; there can be sub-design structural and engagement properties that may need change. There is an acknowledgement of a nested set of structural and engagement properties associated with regime design, which reflects the emergent nature of a management regime. Adaptation occurs at any nested level helping the emergent structure to achieve the objectives set out in the original mandate. A problem in one level will not result in the collapse of the overall regime system.

For example, if the interactions between the salal association and the forestry industry lead to confrontation and a lack of progress to allow access to the salal resource, the remedy is not to

necessarily revisit the legislative structural elements of the regime, but to activate stronger regional agency participation to provide a forum to deal with the issue.

Phase 2: regime design phase.

The salal management regime becomes more hypothetical at this point in the discussion. Actual discussions with the various parties may result in a different pattern of regime emergence. The following presentation acts as a simple example of how the intervention framework can be used.

Phase 2 Objectives:

Phase 2 objectives could include the following:

- Establish and confirm participants
- Develop interaction linkages
- Design initial basis for rules
- Support development of salal association
- Ensure voices heard

Phase 2 Structure: The mandate to undertake the development of a salal management regime is established and the regime proponents have agreed to the Phase 2 objectives. The participant levels are being established with the upper level being government and First Nations, with subsequent nested participant levels to follow, including regional agencies and the salal user community.

New structural elements will need to be developed at this point. The establishment of a salal industry association, with sub-groups to include an appropriator association and a salal

buyer/distributor association would be encouraged. This will expand the participant group and begin to widen the regime design boundary rules.

Phase 2 Engagement: With the mandate to interact with the salal community provided, an engagement framework needs to be developed. Who do the central regime partners interact with? How does it interact with the community? Who in addition to the user community should be engaged? Engagement can be mapped at this point linking government, its bureaucracies and agencies involved, the user community and others within the governance polity, for example First Nations bands or Tribal Councils. Engagement will establish the flow of information and with whom each participant will interact.

Engagement between the regime proponents and the salal user community will initially have a direct link, but that linkage will eventually be shifted to the forest regional and district administrative offices and First Nations' Tribal Councils¹³ as the salal management regime operationalizes in Phase 3. Figure 8 provides an indication of the emerging engagement framework. Note the design phase engagement framework evolves to become the operational phase framework.

Phase 2 Interactions: Nodes of interaction become clearer at this stage. The participant actors are identified, and how they relate, or interact is established through the engagement property framework.

¹³ The reference to First Nations Tribal Councils as the appropriate representation is hypothetical and only for example purposes.

At this point, there are 11 nodes of potential interaction. Nine of the nodes are depicted in Figure 8, and at this design stage an additional two involve interactions between the regime proponents who are active in the design process and the salal and forestry sectors. Institutional failure could occur at any of these nodes, through collective action failure among users, through principal-agent resistance, or by not being able to address the core issue of the problem – for example, resistance to the formation of a salal industry association that includes both harvesters and buyers/distributors.

Phase 2 Implementation: Implementation of the design phase is well underway at this point and attention now focuses on implementation issues associated with operationalization of the salal management regime.

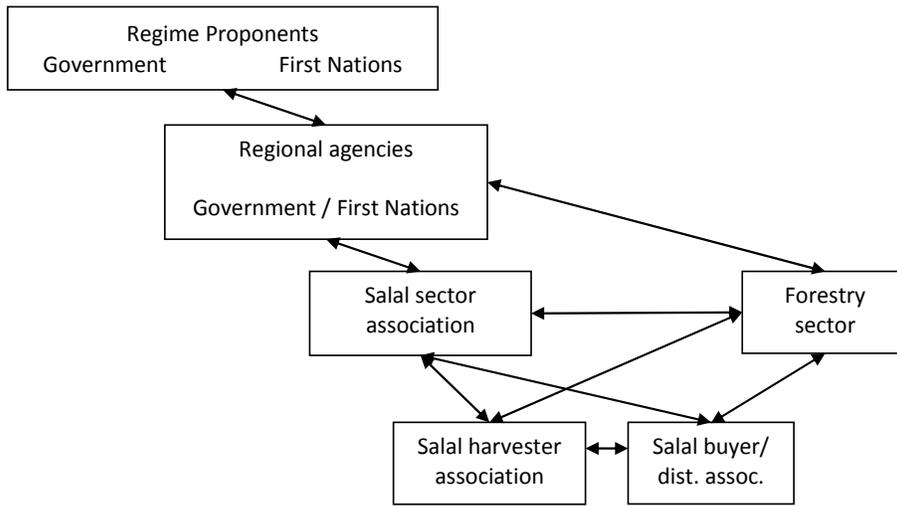
Agreement among regime proponents and salal associations on boundary and/or choice rules, geographic application and information reporting rules need to be established to move into operational implementation. Decisions regarding the channeling of investments into the salal resource should be agreed to at this point and would become a structural element for implementation in Phase 3. This enhancement effort should provide a visible benefit to the salal sector. Co-management arrangements between the salal and forestry sector should be established via the interaction between the design groups and should be ready to implement in Phase 3.

Phase 2 Adaptability: Successful or unsuccessful interactions can indicate whether the design phase is producing workable solutions. At this point salal user groups may disassociate from the design process, or other larger salal companies who are integral for regime success may be

missing from the process. The implementation process will either continue without these groups, or regime proponents may have to revisit the structure property to establish more formal coordinating requirements.

Figure 8 provides the final engagement framework outlining the participants and their nodes of interaction. The final design has nine interaction nodes. The vertical levels reflect the collective and operational choice levels of the IAD framework. Each level has participants with multiple boxes revealing the vertical operational nature of the regime. The importance of maintaining collective action in this regime is illustrated by the interactions between groups. The intervention framework, through its iterative stock and flow approach can re-introduce the regime proponents to the social-ecological system at any time to adjust the higher level structure and engagement properties. The upper portion of Figure 8 shows the vertical collective choice to operational linkages, while the bottom portion of Figure 8 shows the horizontal operational choice engagement among participants. This figure acknowledges that the development of this, and perhaps any, regime will entail some more top down arrangements and operational level structure and engagement patterns.

Vertical collective choice-operational depiction



Horizontal operational depiction

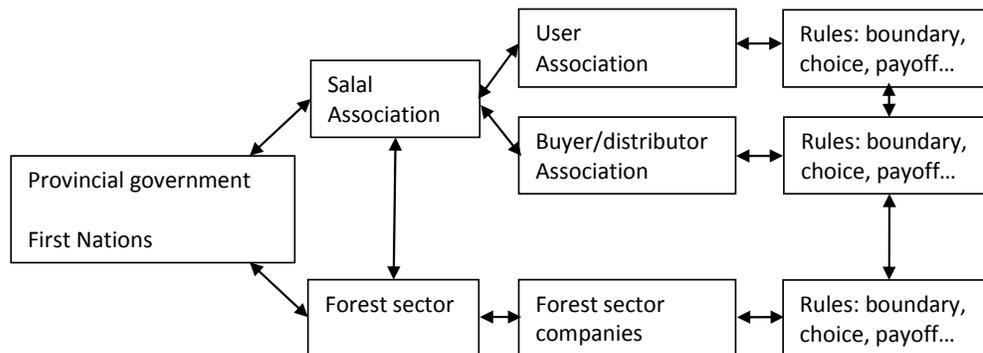


Figure 8: Salal intervention framework – vertical and horizontal engagement and interactions.

Phase 3: regime operationalization phase.

A management plan can be written up at this point to communicate the operational framework, with descriptions of the structure, engagement, interaction, implementation and adaptation properties. An engagement framework diagram can be produced similar to Figure 7.

Phase 3 Objectives: The objectives for the operational management regime can focus on

- intervention design implementation,
- achieving the boundary, choice and other rules set by the user association, and
- developing more in-depth salal investment or enhancement plans, through salal-timber compatible management.¹⁴

Phase 3 Structure: The structure of the management regime will no longer reflect the design components, but will conform to the regime developed through Phases 1 and 2. Participant, boundary and choice rules would have been agreed to by this point. A payment program would be required to administer any payoff rules so that funds can be channeled into research or marketing efforts. The flow of funds would be determined through negotiation between the regime proponents and the salal association.

The structure would need the passing of any necessary legislation or regulations. Participants in the engagement framework will be identified and their roles defined. Monitoring and reporting functions would be established in the design phase and should commence with the implementation of the management regime.

Phase 3 Engagement: The engagement framework remains the same as Figure 7. It has built through the design process into its final form. The figure provides a clear depiction of how the engagement property functions. It identifies who is involved in management at what level and the links between other engagement actors. Responsibility and accountability can be clearly specified through the stock properties of structure and engagement.

¹⁴ The Centre for Non-timber Resources at Royal Roads University provides information and guidance on the compatible management of timber and non-timber resources. See. <http://cntr.royalroads.ca/node/63>

Phase 3 Interactions: Interactions between user associations levels will be the most active at the operational phase. The work of the regime proponents lessens as the user associations begin to manage the resource system based on the management plan devised.

Governance efforts can fail at this juncture, as the local or regional agency in charge of maintaining support and assisting with implementation loses interest or is unable to continue its role due to a lack of funding or staff resources. This failure can be identified or precluded through monitoring of the interaction nodes.

Phase 3 Implementation: Implementation failures can be avoided through the establishment of the necessary legislation or regulation, support from both elected representatives and the bureaucracy, the First Nations partners, the user association and the timber industry.

Implementation may be set for a particular date, it may phase in over some specified time period, or the level of management may evolve and become more coordinating or prescriptive as the need arises.

Phase 3 Adaptability: The regime's adaptability will depend to a significant degree on the structural properties creating the management regime. For example, legislative prescriptions will be much more difficult and time consuming to change than regulations or general operational policy. However, regulations and operational policy may be too malleable in some cases leading to agency-based institutional failure. Monitoring of the objectives and performance of the regime will be based on the design and objectives outlined through the design process.

Monitoring can be established at each interaction node and the outcome level. Minor adaptation may involve increased support from an overseeing agency, or some restructuring of association membership for example.

Other more structural change may be necessary if significant levels of free riding continue, or if markets change and introduce additional pressure on the resource. It is understood within this process that adaptation to changes will be processed through the established intervention framework.

Phase 1, 2, and 3 Outcomes: Assessing whether or not each phase successfully achieves the objectives set by the participants in the salal governance regime is not possible in this example, but some form of assessment would be built into the structure and adaptability properties. As with any adaptive management type policy process, clearly outlining the objectives and some measureable indicators will assist with implementation and adaptation.

For example, in the salal case the failures associated with open access, poor information flows, a lack of trust, and a lack of salience have been directly treated by establishing the nested interactive framework. What allows this more facilitative-coordinating approach is the robustness of the resource and the lack of current levels of significant resource degradation. With the regime in place and operational, the productivity of the salal resource can be improved through compatible management and eventualities such as increased demand from China can be adequately handled at the user-community level. Failures can occur and would be initially noticed at the interaction nodes, assuming agency and associations continue to function.

The objectives and indicators should refer to not only the broader objectives of the intervention process, but also the original problem definition. By linking the intervention process back to the problem through clearly stated objectives and by devising clear indicators it is hoped that this framework can overcome the particular institutional failure. Thus, the result is the evolution of institutional change through a problem based approach this is not reducible to mere functionalism.

The resulting regime in this example has many characteristics of a polycentric governance regime. Nested levels of authority provide independent decision making capacities at various user, government agency, and state levels. Other governance styles may emerge from this intervention framework. For example, a prescriptive approach may result in the state government interacting directly with users of the resource, providing access rights directly and prescribing choice, boundary, and payoff rules, among others. This framework would reflect a more centralized governance model. Other governance models could also emerge from the design process. The important focus in the use of the intervention framework is not to start with the governance regime, but what results may well reflect a particular governance paradigm.

7.3.7. Definition of rules

The definition of rules is a part of the process of regime design, which includes regulators and stakeholders, and cannot be presupposed here. However, comment can be made on the certain elements of these institutional rules in terms of certain essential needs of the design process and the problem the whole effort is trying to overcome.

There are at least three position levels at work in this example. The first layer is the government and its bureaucracy. They have position in the design process and include lead politicians, bureaucrats and other agency personnel. First Nations are also at this first position layer. The second level positions are those involved at the regime design table, including government, First Nations, the salal user community, and stakeholders such as the timber industry and local communities. Finally, there will be a position level that includes participation in the regime once implemented. At the full implementation stage, some first level positions should be less active or noticeable. A new monitoring level will emerge that links each level to the performance of the regime.

Boundary rules are perhaps one of the most critical rule categories, but for a common pool resource like salal perhaps the most challenging to establish effectively. Choice rules are similarly a challenge to establish. The interaction and subsequent collective action that this process is intended to engender may be the only way to limit use to appropriate levels and lead to effective engagement with the timber industry in an effort to enhance the salal resource and total forest benefits.

There will be a cost to the process and any subsequent regime. Like the geoduck fishery in B.C. and fisheries management in New Zealand, payoff rules may be designed so that the user community is able to channel funds into resource management activity. In fact, assured collaboration among user groups may only be possible if there is assurance that any rents that are collected by government are invested in the resource. Any source of government revenue is subject to the risk of appropriation however. Information will be an important funding element

of the regime, as long as it is used, unlike the experience in the Pacific Northwest where data must be collected for each transaction a buyer performs, but is never collected or used by the government authorities prescribing the rule. There must be a point to any rule.

It is uncertain at this point if any aggregation rules or processes will emerge such as those seen in the Maine lobster fishery or the New Zealand fishery where user associations are nested within the management regime. Scope rules may be one way to overcome the need for setting choice rules, if the objectives set out and those involved in regime monitoring and maintenance are sufficiently interested in the outcome of the resource. Establishing longer term resource objectives may be a way to encourage appropriate extraction.

Table 11: Salal case study intervention framework assessment.

Intervention Framework Component	Assessment
1: Intervention rationale	
1.1 Institutional context	<i>De facto</i> open access on state land. No access or harvest restrictions. Salal industry overshadowed by the formal timber industry activity and policy framework. First Nations' interest in NTFRs high. First Nations rights and title issues not resolved in B.C.
1.2 Internal factors	High cost exclusion Information collection and flows poor to non-existent Lack of formal or informal rules Trust issues among harvester groups and between industry and government Right of possession – mutual privilege/no right, creates incentive to overharvest
1.3 External factors	Product demand externally driven Commodity resource Non-local users Timber harvest/urban encroachment
1.4 Rationale outcome	Low to medium rent, partial rent dissipation/capture Requires low level intervention to avoid commercial collapse, further rent dissipation
2: Intervention mode	
2.1 Coordinating	Overcoming information and trust issues requires coordinating role, potentially through company association and registry. Requires liaising with industry participants. Explore methods of incorporating salal and other non-timber forest resources into formal timber management. Need to coordinate public and private land processes, require collection of volume and value data. May be met with resistance from salal sector and First Nations.
2.2 Facilitative	Initial efforts to introduce access restrictions/harvest protocols to deal with significant high cost exclusion and right of possession requires facilitative role. No serious threat of imminent resource collapse that would require significant prescriptive intervention.

Intervention Framework Component	Assessment
3: Intervention properties	
3.1 Structure	Government needs to focus on developing engagement structure, how to communicate with appropriator/producer/provider community, and over longer-term establishing framework for incorporating salal into forest management. Restricting access through formal rules may be too costly, thus creating structure based on developing boundary and choice rules related to access may be unworkable. Short-term and longer-term graduated movement towards establishing broad sector structure, with an underlying informal, non-legislative structure. Scope rules may provide best opportunity to introduce harvest responsibility.
3.2 Engagement	Coordinating role suggests that a more formal process be established to start the initial level of engagement. Government bureaucracy needs to maintain its exposure, develop relationships and build trust that oppressive regulatory approach not necessary. Engagement will be required in the field and within distributor sector. Government investment in sector could be similar to focus in agriculture and agro-forest sector.
3.3 Interaction	Encouraging interaction between companies will be challenging given the highly competitive right-of-capture industry focus. Government can become the conduit for information collection, exchange and dissemination. Different forms of interaction would be required for harvester versus producer level. Given non-degraded resource state, a short-term long-term development of improved interaction is warranted. The establishment of an industry association would be beneficial in engagement, but may have to be coordinated more formally through regulation.

Intervention Framework Component	Assessment
3: Intervention properties cont.	
3.4 Implementation	First requirement: direction from government for its bureaucracy to develop framework structure and begin engagement with salal appropriator and producer community. Second, work with sector and First Nations to develop structure and engagement development process and workplan. Initial participation voluntary, with government seeking incentives to encourage participation. Shift from problem definition of over-use, to problem definition of sustainable development. Third, identification of management approach, definition of rules, from appropriator/producer driven, provider (government) driven, provider (appropriator/producer/government) driven.
3.5 Adaptability	A formal learning process is required as part of the structure and engagement framework that has an established feedback mechanism to both government and industry participants. Interaction and engagement can be encouraged from the knowledge that a program or policy has a formal means of adaptation. Also, knowing that rules-in-form may be re-interpreted by appropriators as rules-in-use in a learning capacity would strengthen the level of participation. Given the lack of resource and industry information available some formal means of collecting data may be required – some of this could be facilitated through an industry association.

7.4. Chapter summary and conclusions

The purpose of this chapter was to use the intervention framework developed in previous chapters. Its use was both an application and test of the framework. The framework was used to develop an intervention approach for the commercial harvest of salal in British Columbia, Canada. Salal is harvested in the U.S. Pacific Northwest and coastal British Columbia and sold into the international floral commodity market. In British Columbia, the harvest and trade of salal is unregulated and most of the land from which it is harvested is under *de facto* open access. Salal is a common pool resource having both high exclusion costs and a subtractable supply. A common pool resource dilemma is present.

While the salal plant is extremely robust and will not be eradicated from the landscape, its commercial quality abundance is far less and overharvesting has been observed in British Columbia and Washington State. Conflict among harvesters, between buyer/distributors and easy access to the forest ensures that collective action among the user community is unlikely. Given these various characteristics, the institutional failure model led to the conclusion that resource degradation is unlikely at this time across all areas of supply. However, locations closer to communities are experiencing high rates of harvest, harvest areas are being reduced as a result of timber harvesting and urban development, thus harvesters have to venture further and search longer for high quality salal. This leads to rent dissipation and with no barriers to access, increases the incentive to use more intense harvesting practices. There are also a variety of salal and timber enhancement measures that could occur through more formal compatible management between the salal and timber sectors. The conclusion drawn from the failure

model was that intervention was not critical, but improved coordination could reduce conflict, minimize the tendency to overharvest, and provide sector support and enhancement through market support and more compatible management between timber and salal.

The institutional failure model led to the choice of a facilitative-coordinating mode of government intervention. The objective for the approach is to have the salal user community adopt most of the management responsibility. In recognition of the challenges associated with the community working together the coordinating measures will require salal users to form associations. The management of salal will proceed through those associations in collaboration with regional agencies and the forestry sector. Harvesting will not eradicate salal as a species, but commercial supplies may be degraded to a point where commercial demand for salal wanes. The approach recommended here is for the salal sector to choose its current or a more coordinated approach to the commercial harvest and trade in salal. The chapter also provided a short presentation of how the intervention properties may be designed. The example was intended to show how the framework evolves through the design of structure, engagement, interactions, implementation and adaptation. The resulting salal intervention framework was depicted in Figure 7.

The important consideration is that the intervention properties match both the scale of the problem and the capacity to overlay a management regime. The process outlined here is iterative, inclusive, but forcefully moves in one direction – towards the design and implementation of a management regime for salal. In a case where the threat to the resource is significant, a much less iterative and directed process would be necessary, and the focus would

turn to a more detailed development of the institutional stock elements of structure and engagement.

The use of the intervention framework in this example was confronted by the political situation of unsettled rights and title issues between First Nations and the provincial and federal governments. Being faced with these different objectives and demands reflects actual complexities that will be found in the field. The application of the framework to the salal case glossed over this important issue by assuming that the provincial government and First Nations that may be affected by any regime implementation were not only at the table prior to the regime's design, but became integral actors within that regime. Achieving this level of cooperation may be more challenging than indicated by the level of attention paid to it in this dissertation. Nonetheless, the way in which First Nations and the provincial government fit within this framework could be a legitimate method of coordinated institution building.

The framework was able to provide a clear depiction of the sources of failure through to the initial design of the intervention; however, it is unclear if the ultimate proposal will be able to effectively overcome the many issues surrounding the commercial harvest of salal in British Columbia. Only through the actual application of the framework would its capacity be tested – that being a subject for further research. What this common pool resource social-ecological system assessment and application of the framework indicate, however, is that the absence of property rights are not the only consideration facing the decision maker. Ecological and social considerations and issues of scale are further recognized. Finally, the politics and polity of governance need to be understood, their influence on institutions expected, and power over intentional institutional change respected.

Chapter 8. Summary, conclusions and contributions

8.1. Purpose of research

The objective of this research was to take what we know about common pool resources and institutions and turn it into knowing what to do. It moves from the normative to the positive, or in Young's (2002) words it attempts to bridge the gap between "the world of analysis and the world of praxis" (p.165). There is no theory to tell decision makers what to do in each situation of institutional crisis and such precise guidance in future is unlikely, but theory does inform us what to expect under certain conditions; it frees us from formulating ideas anew each time we face a problem. Research on the commons has moved us away from preconceptions of individuals being unable to manage resources and that commons need to be privatized or placed under state control. But theory also creates a sense of security in the belief that observed patterns and relationships that form theory can generate universal conclusions about how we should organize and coordinate the complex of interactions that guide our use of common pool resources. The result in many cases of following this approach has been to add a layer of institutional failure onto what may or may not have been an issue. As Prichett and Woolcock (2004) account, we doggedly pursue this course of action, intensifying it until we replace it with another development paradigm, yet continually fail to address the problem. 'We' in this context is the state and its governing agents.

This dissertation set out to provide, not a prescription for the appropriate common pool resource management regime, but a process to find an appropriate management regime. The thesis argues that to appropriately address a common pool resource dilemma, a problem-based approach is necessary. To perform this task the research poses three questions: 1) why would a

state intervene in a common pool resource market; 2) when would a state intervene in a common pool resource market; and 3) how would a state approach solving a common pool resource dilemma. The answers to these three questions become the three building blocks of an intervention framework providing policy analysts and decision makers with a method to identify the common pool problem and construct an intervention rationale, ultimately offering a process for regime design and implementation.

This focus is an attempt to address the challenge set forth by Acheson (2006, p. 130) to answer the questions “How much government do we need?” and “What kind of government do we need?” for the management of common pool resources. To provide answers to these questions the research turned to institutional based theories and the vast amount of published work examining common pool resources. Thus, to move from “analysis to praxis” this dissertation takes note of the concern raised by Poteete and Ostrom (2002) that “management policies have been adopted without consulting prior research...” (p. 58). The use of previously published case studies has been recommended by commons scholars. For example Agrawal (2002) states that with “the large number of studies on commons dilemmas that exist already, it is likely possible to draw on their empirical contents and compare them systematically for understanding on the operations of specific causal mechanisms” (p. 70). This is the approach taken in this dissertation.

8.2. Research approach and summary

The methodological framework for this research is the Institutional Analysis and Development (IAD) framework. The IAD framework depicts a common pool social-ecological system as an action arena made up of actors operating within an action situation. Various interactions occur

within this action arena and between this action arena and others, reflecting the embedded nature of social-ecological systems. Influencing the outcomes of these interactions are resource, user and institutional attributes (rules). The IAD framework is a heuristic tool that helps to organize and interpret the outcome of decisions and actions in a variety of situations. See Ostrom (2005) or Ostrom et al (1994) for a much more detailed and better explanation.

This research rather boldly or perhaps rather naively draws from a variety of theoretical directions. From neo-institutional and new institutional economics theory it accepts that institutions are important, that they constrain and provide opportunities through the coordination of interactions among members of a society. From property rights theory it draws on the concept that property rights are integral to the efficient coordination of resource users; however, it accepts common pool resource theory's contention that private or state property rights may be unable to overcome the high-cost exclusion nature of a common pool resource. Taking from common pool and property rights theory, however, this research notes the potentially 'tragic' consequences of open access.

These common pool situations are not found in isolation, amenable to simple analysis and reconstructive policy action if a problem is found. Common pool resources are part of a social-ecological system embedded within other systems, whether dependent or not. Drawing from social constructivist theory this research accepts that individuals operate within a social and environmental context and that this context influences individual actions and social outcomes. While individuals have choice, individual choice is bounded by informational and cognitive limitations. Choice is situated within a cultural, political, ecological and historical context – it is a function of its institutional environment. Individual choice in many situations may be shaped by

one's socially constructed environment, but decisions concerning the access and exploitation of, for example, a common pool resource for commercial or subsistence reasons are influenced by an underlying concept of gain, whether that gain reflects an individual or social benefit, pecuniary or not.

With that foundation and understanding in mind, the research set out to develop a common pool resource intervention framework that complements the IAD framework. The result was an institutional intervention framework that is intended to guide policy analysts through the identification of the problem and its sources, provide a rationale for intervention, the mode of intervention, and finally a process to construct how that intervention may unfold. The framework is based on various theoretical works and case studies looking at common pool resources. The dissertation is organized to take readers through the intervention framework's process of development. The order in which the three building blocks are developed aligns with the order in which the process of institutional design is to occur.

The first building block is the institutional failure model. Chapters 2 and 3 explore institutional theory and institutional failure en route to the model's introduction. Institutional failure was divided into market, collective action and government/policy failure. The institutional failure model provides an interpretation of the risk of resource degradation and identifies the sources of that likelihood; as such it identifies the underlying problems that may be contributing to or increasing the probability of over-exploitation of a common pool resource. The institutional failure model also provides policy analysts with a format to present or communicate a rationale for intervention and its required intensity.

The result of the institutional failure model and its rationale provides decision makers with justification to intervene or not to intervene at some level of intensity. The journey of intervention design is far from over at this point however. To understand the intensity of government intervention further understanding of institutions and institutional change in particular was necessary. Chapter 4 provides a rather short discussion of the theory of institutional change and the role of the state as actor. The product of this effort is the development of a typology of five intervention modes that reflect the way in which the state attempts to shape actions: obstructionist, absent, facilitating, coordinating, and prescriptive. This typology is the second building block of the intervention framework. Many research efforts providing frameworks of institutional change and common pool resources stop at this point, but the question remains: how does a decision maker proceed from recognizing that a problem in need of attention exists, to implementing an intervention method to address the problem.

The third building block of the intervention framework developed in Chapter 5 provides the link between the descriptive and the operational. The chapter uses previous studies of common pool resources, either in the form of Ph.D. dissertations or books as sources for clues about how state governments intervene in common pool resource social-ecological systems. A case oriented content analysis was undertaken to look for various elements of government intervention. This research uncovered, or at least linked in a more formal manner six elements, called intervention properties, that characterize the way in which a government or other actor can approach intervention in the appropriation of a common pool resource. It is both a process to guide implementation based on the institutional failure model and the intervention modes, and a format of institutional design.

Chapter 6 brings the three components together within a framework format. Chapter 7 uses the framework to assess the need for intervention in the commercial salal market in British Columbia (B.C.) Canada, and to provide a process to design an intervention approach. The salal sector operates within a *de facto* open access regime, attracts significant interest and has experienced overharvesting and a decline of abundance in some but not all areas. The assessment found that the commercial salal sector would likely benefit from some intervention and suffers from trust issues and a lack of information. However, while overharvesting has been recorded in some locations, there were no clear or imminent signs of widespread resource degradation and rent dissipation. The framework pointed to a facilitating-coordinating mode approach to intervention. This mode was then elaborated through development of the intervention properties to provide an example of the use of the framework and its resulting intervention design. In B.C., the actual development of an intervention in any NTFR will need to solve ways to coordinate with First Nations to move beyond the more political rights and title issues that have become part of resource management in the province. Similar political realities leading to more complex situations may well confront many efforts at institutional design in other regions and jurisdictions, thus its presence in this case is instructive.

The framework seems to have functioned well in this case study, but its actual performance can only be measured if used by an agency to develop and implement policy, i.e., to affect rules-in-use at the operational level. Some immediate concerns come to mind, however. First, there may be a rather large chasm between the objectives of an appropriator community using a common pool resource, and either the objectives of the state government or a non-governmental agency looking to influence resource policy. Objectives may range from philosophical beliefs of certain paradigms that focus on economic development through the

earning of foreign exchange at the expense of local wealth, to the use of new forestry or farming techniques that have gained ascendance in development concepts. Success in achieving ones' objectives may mean failure in some manner to another participant. The challenge introduced by potential differences between principal and agent objectives, or concepts and measures of success or failure is no different for any other effort or model to find appropriate management designs for common pool resources. The intervention framework was built to bend and move to these differing objectives, not to thwart decisions but to make them more appropriate to the need and scale of the particular circumstance.

The institutional failure model is the driver of the level of intensity of intervention. The framework and the outcome produced are dependent on the results of the model and the ability of the user. One policy analyst's interpretation of a problem or lack of a problem may be the result of limited information, inadequate resources to properly survey the sector and unearth the variety of detail sought by the framework. The skill in recognizing certain nuances within the model's contextual factors may also influence the outcome. The model was built with a variety of indicators that cross reference the detail within other categories. It was also built to provide an initial assessment of risk related to basic common pool resource characteristics. However, because the model does not result in some quantitatively generated numerical answer some analysts may discount its abilities. Such a positivist attitude is precisely what the framework is trying to avoid. The framework and its institutional failure model can complement and incorporate the results of these quantitative analyses and can direct where those more quantitative perspectives may be most useful, and where they may offer little additional information. The model also provides direction for additional research to assist in the clarification of whether or not failure is occurring and the sources of that failure.

8.3. Conclusions and contributions

While this dissertation provides yet another common pool resource framework, it differentiates itself from success-based frameworks by looking for indicators of failure. Focusing on sources of failure within a common pool social-ecological system forces the analyst to understand the situation, the problem and its sources in greater depth, but then creates a stronger link between the response and the issue being resolved. This in contrast to applying generalized success oriented institutional paradigms to any and all particular situations in a broad experimental manner.

The main contribution of this dissertation to the literature and the theory of common pool resources is the intervention framework. From my perspective as a practitioner and after various efforts to develop common pool oriented policy, there is a fundamental gap between models and frameworks of broad coordinating paradigms and design principles, and the specific rules necessary for effective common pool resource (and other resource) coordination. This gap leaves our understanding of social-ecological coordination theoretically incomplete, and leaves policy analysts and decision makers with little guidance to move from a resource management problem to its resolution.

To move from institutional paradigms (e.g., centralization- decentralization, private property- common property) and design principles as informing the means of overcoming common pool resource dilemmas, this dissertation argues for the need to shift one's focus and confront the problem, the source of the common pool dilemmas. But there remains a chasm between the problem and the rules that need to change in order to avoid the outcome at issue, such as

resource degradation or underinvestment. How to get from the recognition of a problem to identification and specification of rules is based on the relationships between the problem, the intensity of government intervention and the properties of intervention. These properties are the link between the concepts of governance and the practical nature of rules. The properties are structure, engagement, interactions, implementation and adaptability. They close the theoretical and practical gaps currently diminishing the effectiveness of institutional change within actual common pool resource social-ecological systems. For practitioners this link is critical, regardless of the effectiveness of the results from this research. For instance, in the salal case study, this link was shown to not only guide the development of an intervention approach, but the link also became the framework for a functioning and evolving management regime. The intervention framework provides a method of interpretation and design that evolves into the regime's foundation.

In Chapter 2, resource institutions were defined as the norms, strategies and rules that emerge to coordinate the way in which individuals, groups, associations and other entities interact to achieve some individual or group objective or action outcome within a social-ecological system. Institutions have a purpose; they have a function that changes at a variety of time scales to deal with social-ecological change. This latter dynamic reference to institutional change is the most important aspect of institutions on which much of the common pool resource literature focuses. How do we deal with common pool resource dilemmas? I posit a theoretical link between two institutional forms and the social actions of change. Moving from institutional point A to institutional point B is a function of structure, engagement, interaction, implementation and adaptability. With attention to these five properties of institutional change one can map an institutional shift through its various layers and responsibilities to the level of rules-in-use, the

actions of individuals and the interactions among individuals or groups at various governance levels. We can now define this function in more detail using the intervention properties.

Resource institutions are a dynamic means of coordinating the interactions of individual and group actors through structural norms, strategies and rules.

While the previous paragraphs outline what I see as the dissertation's largest contributions, other reflections are also possible. What the research also found, or perhaps the researcher, was that it is rather presumptuous to think that 'government' or the 'state' is the only relevant and/or appropriate intervener in a common pool resource market. Governance theory reminds us that various agents of change may be participants in institutional design, and common pool theory informs us that the common pool user-community is a legitimate provider of resource management, thus how we consider the governance format of a common pool resource broadens significantly. While this dissertation tends to focus on the state and its governing entity as the ultimate intervener, the concept of governance allows that agent of change to be the state, its elected representatives, one of its agencies, a non-governmental organization, a community or regional government, or appropriator/provider association, among others. Regardless of whom initiates and designs change, at some level the state will need to provide legitimacy and assurance that any rules and rights will be protected.

The theory of common pool resources is often presented as equivalent to commons and/or common property theory. As Schlager (2007) states "the theory of common pool resources makes a series of predictions about the ability of resource users to organize themselves and develop self-governing institutions, about the robustness of self-governing institutions, about the effects of resource user behavior on the sustainability of the resource ..." (p. 296). Common

pool resources however are not all amenable to common property constraints and appropriators of common pool resources are not all able to self-organize. Common pool resources are not all small resource systems found in small village or regional environments, or resource systems isolated from the influences of other systems. The term 'common pool resources' describe a complex heterogeneous mixture of many different resources facing a range of high cost exclusion and rival conditions, along with many other different and challenging characteristics. The various theoretical works on scale and scale-mismatches attest to the challenges facing common pool scholars and resource decision makers to overcome common pool related collective action dilemmas. Thus a theory of common pool resources should be complementary to but not be restricted by the theory of common property resources, as useful as the latter theory is to the understanding of property and resource systems. A common property rights system is not the ultimate or only response.

Another challenge faced by common pool/common property theory is the existence of high cost exclusion. The literature, while invariably introducing costly exclusion as a defining characteristic of common pool resources, does not address how to overcome this challenge, other than indicating the importance of collective action and moving into examples of successful common property regimes. Common pool resources do need collective action among its appropriators/providers if some form of effective management is to result – in fact all our actions in some manner reflect collective action regardless of the situation. If an appropriator's cost/benefit calculus indicates benefits will accrue from collaboration they will participate in collective action, perhaps. A variety of social situations may influence their decision. If they choose not to act with their fellow appropriators either precluding collective action or turning to

free riding, common pool theory provides no further understanding. We are left in a quandary only able to watch as the common pool system is degraded.

The movement of common pool/property theory from its resource characteristics to the ability of users to coordinate their actions in some common property format occurs abruptly, with little recognition of how to overcome these costs – it seems an assumed outcome. Ostrom (1990; 1999; 2005) goes into detail about an individual's calculus for contributing to collective action, and collective action theory is about contributing to the social good. However, if remaining as a stand-alone theory, common pool/property theory needs to explore this direction in greater detail to help understand the alternatives to user cohesiveness. Perhaps common property theory should become a sub-set of a new property rights theory leaving common pool resources as a resource theory, not a resource theory mixed with a property type theory.

The institutional outcome of the case study intervention for salal reflects a polycentric system of governance. Each level takes on its own independent level of responsibility, but is nonetheless linked in a hierarchical fashion. Appropriate levels of support and interaction are integral to the success of the regime as a whole. In general, the framework does not necessarily lead to a polycentric style of governance. In cases where a more prescriptive approach is necessary the outcome may be more centralized. In purely facilitative approaches the result may reflect a more decentralized system with perhaps only legal links to a central authority. The perspective going into the research was that the governance regime was not the start, but the end.

Following a problem based approach resulted in the development of a framework that moves in reverse of what would be expected. This approach, however, is not relevant for the pursuit of

state reform, moving from communism to capitalism for example. The framework is intended to offer a means to develop a solution to overcome common pool resource dilemmas.

8.4. Recommendations for further research

As with any research project, more questions emerge as a result of the effort than are likely to be answered. As the researcher, the first question to emerge is how relevant is the intervention framework and will it actually be able to assist policy analysts, communities or other agents to change institutions for the better? Thus, the first area of further research would be to design and operationalize a policy intervention. Hypothetical applications such as the one presented in this dissertation have a limited capacity to indicate problems with the framework and to provide suggestions for improvement, not to mention develop a working regime. If this framework is to contribute to common pool resource theory and institutional practice it needs further testing in a variety of situations.

Scale was raised as an important institutional characteristic. Further research to investigate how well the framework may function at various scales would situate the framework's usefulness within certain social-ecological contexts. The salal example used in this dissertation was smaller in scale, but the species ranged over a large area and the social-ecological system was complex. The community of users is likely in the thousands, but the sector's organizational and market structure revolves around 10-20 companies. The problem, however, was moderate and isolated to a specific region. Larger common pool resource systems or other environmental problems, for example transboundary water use may fit well with the framework. There is no restriction in finding the source of a problem to be jurisdictional inconsistency and a lack of coordination among cross-border users. Assigning the participants and working through the

intervention properties would be similar to the salal example where an initial agreement between the provincial government and First Nations was necessary. Applying the framework to problems at other scales is another topic of further research.

In terms of theoretical development, while the intervention framework was not intended to suggest any specific theoretical insights, the journey to develop it has raised some theoretical issues, as discussed in the previous section. The workings of the framework indicate that institutions have stock and flow variables, suggesting that the level of provision of interaction, implementation, and adaptability ultimately affects the stock variables of structure and engagement. A lack of attention to the provision of flow variables erodes the efficacy of the institutional stock eventually degrading its usefulness. Of course with an inadequate stock, little institutional flow will occur. This stock-flow relationship is extremely nascent in its conceptualization, but it would be an interesting topic to explore. Looking more deeply into the intervention properties of structure, engagement, interaction, implementation and adaptability as the focus of research will strengthen the links outlined in this research and the ways in which they apply to a variety of situations.

Exploring common pool theory in terms of the range in the resource's common 'poolness' and associated organizational characteristics could lead to a theory that more accurately depicts the institutional conditions within which common pool resources are found and managed sustainably. This could help to avoid the adoption of paradigmatic approaches to resource management, such as for example the current focus on decentralization and community based resource management. As was argued in this dissertation, if the objective is to overcome a common pool resource dilemma, starting with the choice of governance assumes an *a priori*

understanding of the problem, ignores scale issues, and assumes one solution fits all. This research provides an alternative to that approach.

The case study application of the framework unfortunately glossed over the political nature of institutional change associated with salal and more general land ownership issues. There is little political gain to managing salal. There are no demands for intervention from the salal sector, from forestry companies or environmental organizations. First Nations claims to rights and title to the provincial landbase and resources also introduces a complication to moving ahead with any management regime. This dissertation assumed First Nations would participate in the development of an institutional design, with the same objective as the provincial government, which was also assumed to align with the framework example. Unfortunately, to show the use of the framework these assumptions were necessary. Further research into how the framework may deal with competing political objectives in a broader sense than suggested in the situational assessment could provide the more politically astute reader with some connection between the framework and the political realities of policy change. All too often however, uniformed and ill-conceived political influence and policy prescriptions are applied to situations when the issue is recognized not as a social-ecological problem, but as a political problem onto which yet another simplistic paradigm-based approach is directed. The intervention framework, as with other frameworks, need to play a role and need to evolve and remain persistent to the informational requirements of governance; the political setting is one, albeit and important and influential one, that shapes institutional change often to the detriment of those within the vicinity of change.

There is no doubt that researchers and scholars will continue to develop old and introduce new frameworks and models with the hope of contributing to the better more sustainable coordination within and among social-ecological systems. This dissertation attempts to provide one suggestion to help improve common pool resource social-ecological systems that may be experiencing too much consumptive attention and not enough coordinating attention. It is intended to provide policy analysts with a socially relevant structure needed to produce a defensible rationale for intervention and process to introduce institutional change. Hopefully this effort will provide some help.

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