Instream Flows as Evolving Institutions

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Abstract

All states west of the one hundredth meridian have decided to adopt prior appropriation as a means by which to organize and manage their hydrologic systems. The structure of prior appropriation imposes certain biases toward resource development that have catalyzed changing cultural expectation of water resource management over time. In particular, instream flow laws have been implemented in response to the degradation of salmon in the Pacific Northwest. Through a comparative case study of instream flow laws in Oregon, Idaho, and Alaska, this study seeks to understand what elements of institutional structure effectively achieve pacific salmon conservation objectives. To better understand the impacts of water management institutions as they evolve, my study employs a modified version of grounded theory that incorporates a state water rights database analysis and a series of expert interviews. Through the use of this methodology, I have concluded that a nested governance regime that incorporates flexibility, collaboration, and consensus leads to institutions that effectively achieve salmon conservation objectives. Furthermore, this study has identified institutional evolution of prior appropriation as a cyclical and iterative process based on the relationship between specific local entities, administrators, and legislators.

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Dedication

I'd like to dedicate my thesis to those individuals who have played a guiding role in my academic journey. The mentorship of Zion Klos was absolutely instrumental in kindling my academic spark to a flame. His unending support and faith in my abilities has allowed me to explore previously unknown avenues. I'd also like to dedicate this document to the strong shoulders and companionship of Megan Baker. Through the winter gales and sun soaked days, your support and love was my safe harbor. Finally, this document is partially a reflection of my mother's set of values. Her journey seems to parallel my own in ways I have yet to fully appreciate.

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Chapter One:
Introduction

Each state government, west of the one hundredth meridian, chose to adopt prior appropriation to manage the fresh water resources within their political boundaries. In turn, the legacy of management through prior appropriation has exhibited a bias toward resource development that has created unintended societal consequences. Prior appropriation is a hierarchical system of water allocation that assigns priority dates and property-like values to water claims in order to develop water as a resource. Through prior appropriation, a water right is established through both diverting the water from its channel and applying it to a beneficial use (Walston. 1986). This system was primarily designed to maximize consumptive water use and provide security for investments in irrigation infrastructure in order to incentive growth in the developing West (Reisner, 1993).[1] While every western state readily adopted the doctrine of prior appropriation, no provisions existed to limit allocation and preserve a minimum stream flow. By the mid 1970's, any stream flow that could possibly occur in a given year had been assigned a water right and a priority date, resulting in the over-allocation of water as a resource. In recognition of this problematic impact of prior appropriation, various state-level solutions have been implemented that are intended to resolve the bias toward water resource development and preserve ecological elements of hydrologic systems (Bonham, 2006).

As cultural perspectives on conservation grow, the existing structure of prior appropriation results in social conflicts over water resources as well as widespread

[1] Consumptive water use refers to the diversion of water that does not return to the hydrologic system in its entirety. This is opposed to non-consumptive uses, such as instream flows, that do not impact streamflow rates.

aesthetic and ecological degradation that failed to achieve collective societal expectations (Reisner, 1993). The implementation of instream flow legislation represents changing cultural expectations of how prior appropriation should function as a water management institution. As a solution to over-developed hydrologic systems, instream flow legislation provides a mechanism for the creation of a non-consumptive water right under prior appropriation that represents a rising conservation sentiment within a society. These non-consumptive rights allow an entity to appropriate a portion of streamflow without a diversion or application to a consumptive use. In essence, instream flow laws allow a legal right to be granted to water left in stream by considering that action a beneficial use. By utilizing the existing structure of prior appropriation, instream flow legislation represents an adaptation of a previously existing water management institution to new uses that are beyond its original design and capacity. As the adoption and implementation of instream water rights is widely variable across western states, the structure of differing instream flow legislation and its resulting social and political impacts can be compared to further examine instream flow's role in reshaping prior appropriation.

Formal legal institutions, such as prior appropriation, are relatively static in comparison to the dynamic natural systems that they intend to manage (Ostrom, 2014). While cultural perspectives and expectations of water management change rapidly in response to resource conflicts and ecological degradation, formal legal institutions are much slower to adapt to the same changes. The evolution of formal legal institutions is incremental and comes as a response to proceeding shifts in cultural perspectives and expectations (Bromley, 2011). In the Pacific Northwest, incremental institutional

change can be seen in the variety of instream flow laws that have been implemented in response to the degradation of pacific salmon populations (Cosens, 2012). Water resource development associated with prior appropriation plays a pivotal role in the general decline of salmon in the Pacific Northwest (White, 1995). States within the range of pacific salmon have implemented instream flow laws as a response to conservation sentiment stemming from changing cultural expectations of watershed management. Before instream flow legislation was implemented, prior appropriation fundamentally framed water allocation through a development based economic lens (Szeptycki, 2015). Instream flow laws are an attempt to restructure water management institutions to account for the complexity of interconnected ecological systems.

This institutional accommodation of conservation sentiment can be seen as evolution incrementally occurring on the ground. In translating conservation value for pacific salmon into institutional thought, particular instream flow laws at the state level have exhibited variable outcomes in achieving salmon conservation goals (Kimbrell, 2012; Neuman, 2006; Capurso, 2011). I have designed my study to understand how the doctrine of prior appropriation has accommodated instream flow laws and investigate this institutional transition on the ground through a social and political lens. *Through a comparative case study of the instream flow laws of Oregon, Idaho, and Alaska*, *this study strives to understand what elements of institutional structure effectively achieve the objectives of pacific salmon conservation.*

Study Overview

I designed my literature review in Chapter Two to contextualize the problems of incorporating instream flow rights into prior appropriation by highlighting theoretical concepts used in institutional economics, natural resource governance, and markets in nature. Chapter three is intended to introduce my study design, study sites, and methodology of modified grounded theory. Beyond study description, chapter three includes an institutional analysis of my case study locations that gives historical and legal context to each state's instream flow legislation. Through the assessment of the state water rights record in chapter four, I assessed instream flow appropriations in state water record databases to build a narrative of intention, strategy, and value. In chapter five, I further developed my theory of effective instream flow institutions through voluntary, semi-structured expert interviews with water administrators and non-profit administers from each state. Finally, in chapter six I elaborate on phenomenon observed throughout the data collection process and create a conceptual model of my findings.

Chapter Two:
Literature Review

This literature review provides an interdisciplinary perspective of instream flow laws using the theoretical concepts from institutional economics, natural resource governance, and markets in nature. By using an institutional framework to understand instream flow laws, I analyze how shifts in societal perspective may change legal regimes over time. As a shared legal doctrine that establishes similar administrative systems, prior appropriation is a common denominator among state water management institutions throughout the American West and Alaska. Each state's particular instream flow regime has retrofitted prior appropriation to use familiar water rights concepts to achieve instream flow goals. This process of amending prior appropriation has created a need for unique mixed governance schemes that have the capacity to address the complexity of the natural world in a variety of ways.

Prior appropriation creates a rather formal and structured administrative system. Within this system, the incorporation of market concepts helps organize individual water right property owners by establishing voluntary systems of exchange. Instream flow laws utilize these market aspects to help individuals express value for water left in stream using the structure of property rights. Instream flow laws do more than simply leave water in the stream; they also alter governance dynamics by creating new opportunities for community input within the water resource management institution. The ability for a community to participate and provide input in natural resource management combines with the formal regulatory regime to create a system of "mixed governance". Using theoretical concepts from natural resource governance, I illustrate various challenges and benefits of mixed governance relationships. Critiques

and advantages from markets in nature literature are discussed to better understand how market concepts are used to structure specific regulations. Using the theoretical concepts discussed in this literature review, I intend to understand the institution of prior appropriation as being in a process of evolution. As tools to understand how governance is structured and implemented, the theoretical concepts in this literature review form the foundation for a review of instream flow laws across my study locations.

Prior Appropriation and Instream Rights

In seeking stability and longevity, American settlers remade the arid West to be compatible with agricultural expectations (Stegner, 1954). Western society became particularly reliant upon water system manipulation to assure continued access and delivery to developing communities (Reisner, 1993). The geographic layout of hydrologic systems dictated settlement in the West as natural river systems became subject to a patchwork of political boundaries (Stegner, 1954).[2] Under the tenth amendment, each state has retained jurisdiction to allocation and use of waterways, excluding navigable waters. As the owner of water resources, each state holds water in trust for its citizenry and may determine the method of allocation and acceptable uses (Sax, 1989).[3] In response to the constraints of the arid landscape, the Western states decided against the doctrine of riparian rights, derived from common law, because of its failure to incentivize developmental investment, such as irrigation infrastructure,

[2] John Wesley Powell would famously recommend drawing political boundaries to mirror watershed boundaries recognizing the controversial nature of sharing a watershed between varying state interests (Stegner, 1954).
[3] Pursuant to the public trust doctrine

through assured flows. Beyond clear state jurisdiction, water management within the United States remains a complexly intertwined authority of competing international, federal, tribal, state, and individual interests (Cosens, 2010).

Arising out of western mining camp claims, the prior appropriation doctrine has reigned over western water law while incentivizing development in the otherwise arid region (Reisner, 1993).[4] Once appropriated, a water right is assigned a date in the state water system and is administered in priority beginning with the most senior users (Trelease, 1977).[5] Managed at the state level and varying in their statutory construction, prior appropriation water rights typically require a diversion and application to beneficial use (MacDonnell, 1993). As water is owned by the state in trust for the people, a property right in water acquired through prior appropriation is a usufructuary or use right (Bonham, 2006; Kimbrell, 2004). Such a right is secure as long as it continues to be put to beneficial use; a water right left instream has historically been subject to forfeiture in all states (Gillilan, 1999).[6] It is through this administrative structure that western states have decided to allow their waterways to be developed, encouraging investment in diversionary structures through the assurance of administration in priority.

Prior appropriation has now been utilized to retroactively develop legal protection for leaving water instream despite it being "fundamentally inconsistent with the core principles of the legal regime" (Szeptycki, 2015; Capurso, 2011). Concerns over

[4] Adopted in some form by every west of the hundredth meridian with the exception of Hawaii

[5] For the purposes of this study, a senior right will be considered a right that occurs within the oldest 10% of appropriations within the specific watershed in question.

[6] Relating to the colloquial "Use it or lose it"- Legal forfeiture is rarely used in western water administration.

stream flows only appeared on the American consciousness once the physical and cultural impacts of over-allocation of water resources became a harsh reality in the West (Reisner, 1993). When western waterways were being developed, beneficial uses did not include fish and wildlife habitat, recreation, aesthetics and environmental factors, which failed to provide an avenue to legally protect these uses of hydrologic systems (Tarlock, 1978). Initially, the legal precedent allowing for the preservation of instream flows had originated incidentally in the federal reserved water rights doctrine. Since the 1908 decision in Winters V. United States, the federal government has been able to reserve water to meet the purposes of federal enclaves (Fisher, 1984).[7] Instream flows weren't conceptualized as beneficial uses in state legislatures until the 1960's.

New cultural prerogatives arose from recently dewatered stream reaches that demanded implementation of minimum instream flow "floors" that predominantly function through the appropriation of junior rights to be held by the state. For the first time, this approach valued stream flow as an amenity and acted to preserve the status quo (Bonham, 2006). By the 1980's transfers of senior water rights explicitly for environmental purposes were amended into state laws that were crafted to satisfy Endangered Species Act provisions (Szeptycki, 2015). Though effective in the reorganization of water allocation, environmental transfers have been hampered by bureaucratic delays and subordination to consumptive uses (Szeptycki, 2015). The current state of instream flow laws across all prior appropriation states presents a

[7] Known as "Winters", this legal decision clarified the water rights for American Indian reservations by acknowledging water rights sufficient to meet the purposes of the reservation. Originally applied to the appropriation of agricultural rights, this precedent would later be applied to federal enclaves for purposes of instream flows in the 1960's. These include National Forests, National Monuments, National Parks, and Native American Reservations etc.

menagerie of differing procedures that recognize the value of leaving water instream. These state-by-state instream flow laws act as unique amendments to the doctrine prior appropriation that are intended to align the outcomes of the western water management institution with changing cultural expectations specific to each state.

Institutional Economics

Law is the formalization of the societal relationships and agreements about how the world should look that is formed from the collective will and the created imaginings of the community planning toward an imagined future (Long, 2011). When a community agrees on an imagined future, regulations, or working rules, are established as to meet commonly held values. These working rules are tangible products of collective societal values and function as the basic mechanisms of the legal system (Bromley, 2011). Institutions are the norms, working rules, and property relations that are structured to produce certain desired relationships among citizens (Bromley, 2011; Long, 2011). Preexisting and continuously evolving, institutions are constantly reassessed by the community to see whether they are likely to achieve the desired outcome within a society (Bromley, 2011). When a desired future seems unlikely under current institutions, a community will act to amend the working rules. Human nature is both a product and a driver of intuitional structure because citizens consistently respond to present working rules (Bromley, 2011).

The doctrine of prior appropriation is an example of an existing institution that is in the process of adapting to accommodate changes in societal values. This study applies a broad institutional framework to examine the working rules of prior appropriation and how instream flows laws act as amendments to better achieve an

imagined conservation-based future. Theoretical tools and concepts from natural resource governance help my study examine dynamics between stakeholders and the relationship between individuals and regulating entities. Furthermore, concepts adapted from markets in nature are used to assess how working rules have been structured across state water management systems to implement instream flow laws. Studying how working rules shift in response to changes in cultural perspectives can contribute to an understanding of the mechanisms of institutional evolution. Using theoretical concepts outlined in my literature review, my comparative case study seeks to shed light on how the governance of water resources has been modified to reflect evolving societal and cultural value change.

Markets in Nature

Prior appropriation is an attempt to govern the relationship between communities and dynamic hydrological systems. Prior appropriation applies concepts of property derived from the American institution of ownership to water as a resource (Blomley, 2008; Dales, 1968). Water rights are a form of property that organizes dynamic natural ecosystems into the hierarchical structure of capital and law (Robertson, 2006). The translation of water resources in a form of natural capital opens the door for governing systems to utilize market-based aspects. Though it is structured as a traditional administrative system, prior appropriation utilizes these market aspects in the voluntary exchange of consumptive and non-consumptive water rights (Capurso, 2011). As the institutional framework that protects and allocates value for water rights,

prior appropriation defines the role of each entity in a system of governance and establishes the basis on which a market can be established (Bonham, 2006).

The primary challenge faced by water as property is the inability to control supply, as water is in essence highly variable, finite, and unpredictable (Dales, 1968). Water's unpredictability is rooted in how it varies over space and time with the use of surface water at one point affecting water use at many other points (Dales, 1968). The dynamic nature of hydrologic systems can elude the necessary confidence that is required for market mechanisms to function. A simplification of the human relationship to water into definitive property rights must take place in order to assimilate water into the American institution of ownership (Blomley, 2008). This simplification can create negative social externalities on the ground because it intentionally neglects water's central role within ecosystems and local cultures (Blomley, 2008). It is important to understand the challenges faced when imprinting property values on water systems and ecosystems a-like. These challenges can be further examined in the implementation of natural resource valuation concepts. The claimed advantages and critiques of natural resource valuation provide a perspective on the consequences of assigning value to non-consumptive instream flow rights as property.

In analyzing how prior appropriation develops systems of exchange for water rights through property concepts it is helpful to examine an analogous examples of natural resources valuation and markets in nature. Various studies and approaches have shown that the development of markets for natural resources can play a role in the improvement of efficiency, equity and sustainability of system management (Balmford et al, 2002; Rosegrant, 1994; Costanza, 1997). A particularly prominent feature of

contemporary natural resource valuation is ecosystem services or "the conditions and processes through which natural ecosystems… sustain and fulfill human life" (Daily, 1997). Often used conceptually to illustrate monetary value for the services that nature provides to society, ecosystem services help translate ecosystem function into economic values that fit within market structures (Engel et al, 2008; Bennett, 2014). By specifically capturing the value of services provided by an ecosystem to a market, policy can then account for the underlying support system of natural benefits that factor into economic decision-making (Costanza, 1997). Having gained political significance over the past twenty years, the ecosystem service model is now prominent throughout the scientific and management communities through efforts such as the Millennium Ecosystem Assessment (Watson, 2003). Similar to the application of property values for water rights, it is difficult for ecosystem services models to fully represent the economic value of culture, aesthetics, and tradition within a market setting.

Various academic articles have pointed out how assigning approximated value through our economic systems can lead to detrimental natural resource management decisions. In a 2007 critique of the efficacy of this ecosystem services, Dale Goble points out that valuation of ecosystem services can be a poor surrogate for biodiversity. Variable across spatial and temporal scales, natural resources elude the traditionally well-defined economic commodity structure that markets rely upon (Goble, 2007). The inclusion of ecosystem services valuation to markets in nature does not necessarily create incentives that foster sustainable resource management choices (Goble, 2007). While assigning financial value to natural resources is an attempt to include conservation sentiment into economic decision-making, it fails to holistically recognize

the true public benefit and cultural centricity of natural resources. In simplifying the human life support system of natural resources into economic units, valuation efforts subject the public interest to cost-benefit analysis and efficiency standards (Kelman, 1981). Furthermore, economic thought processes emphasize resource development of marketable commodities while often excluding more abstract, yet essential, cultural and existence values (Chan 2012; Lant, 2008). Simply put, assigning a value to a resource that in and of itself has no economic value leads to a series of detrimental complications. Economic efficiency, as a standard, does not consistently lead to sustainable watershed management.

Supporting perspectives can be identified in early works of political economics that describe fundamental dangers in pure economic decision-making for natural resource management. Institutional political economist Karl Polanyi discusses the need for "confidence to turn away" from the market system to secure the function of natural resources and ecosystems in the common interest (Polanyi, 1944). In interpreting our natural system through a market lens, we allow for the commoditization of our fundamental life support systems and economic motives to threaten the complete human dependence on these resources. In *A Sand County Almanac*, Leopold argues, "One basic weakness in a conservation system based wholly on economic motives is that most members of the land community have no economic value" (Leopold, 1949). In assigning rights to water resources within the prior appropriation system we are inherently assigning economic value that is subject to cost-benefit analysis. This value brings economic incentives and motivation to human behavior that has the ability to lead to negative consequences for society.

The doctrine of prior appropriation is primarily a top down hierarchical system in which rigid rules are created and enforced to manage the relationship between a community and their water resources. In an attempt to include flexibility into the system, each individual state has agreed on a mixed governance regime that incorporates both community management and market aspects. In particular, market aspects are built into the working rules of transferring water rights, as property, between uses and users. Each market for water rights is inherently dependent on the nature of water resources as a property right. Markets for water resources face structural challenges in their rough translation into the American institution of ownership through property rights (Kimbrell, 2004; Bakker, 2003). The mixed governance relationship within prior appropriation is an attempt to curtail the detriments of relying on individual systems of governance (Cosens, 2010). As these systems transition toward the adoption of instream flow programs, mixed governance provides an avenue to more fully recognize interconnected cultural, aesthetic, and environmental values that cannot be fully represented by a single form of governance alone (Cosens, 2010).

Natural Resource Governance

Governance refers to all forms and processes of social coordination and patterns of rule that arise both formally and informally in an organized society (Bevir, 2012). Governing bodies can be highly structured, as is the case in a federal or state government or an administrative system. Alternatively, governing entities can be more informal and act through social and cultural tradition (Bevir, 2012). Governance can be

understood as the broader overarching process by which humans organize the actors within a community toward some distinct objective (Institute on Governance, 2018). This overarching process occurs through the implementation of multiple institutions on the ground. Each specific institution is a tool of broader governance efforts that puts in place regulatory structure and defines roles of actors within that structure (Bromley, 2011). Prior appropriation acts as specific institution in that it establishes particular rights, regulations, and decision-making structures that guide interactions among individuals within a system. Governance of water resources occurs through the implementation of structure that is outlined in prior appropriation. As a natural resource governance institution, prior appropriation is designed to achieve certain desired objectives through deliberate social coordination.

Like many other natural resource regulatory institutions, prior appropriation must utilize a mixture of overlapping governance structures to achieve the desired objectives of social coordination. There are three basic types of governance structures- 1) Hierarchies based on a system of command 2) Markets based on voluntary systems of exchange 3) Community management based on bottom-up cooperation (Vatn, 2009). Each type of governance structure can be identified within the institution of prior appropriation. Various studies have shown that water does not fit into traditional commodity based resource management structures because it is inconsistent and unpredictable in its supply (Blomley, 2008; Dales, 1968). As a prerequisite for life, water is unpredictable and scare in the American West (Reisner, 1993). Efforts to organize and account for western water resources continue to strain governing institutions to the limits of their abilities through loss of water resource value,

stakeholder conflict, and landscape degradation (Bakker, 2003; White, 1996). In response to this challenge, water management is undergoing multiple transformations into a complex regulatory patchwork that continually exhibits all three basic types of governance structure. Occurring at multiple interdependent levels, water governance involves individuals, private organizations, state, tribal, and federal interests (Cosens, 2010). The desire to legally protect instream flows further complicates and reorganizes the dynamics within this governance system by adding more legal interests and groups of stakeholders. Each prior appropriation state that chooses to adopt instream flow legislation must navigate complex and competing interests in altering the complex governance structure that has already developed in prior appropriation.

Modern day water governance in the United States is a blend of administrative, legislative and cultural practice that is primarily defined by the institution of prior appropriation.[8] Prior appropriation is the institutional framework that allocates and protects an individual's value for water by establishing the claimant's title and method of retaining a property right (Anderson, 1997). This framework provides usufruct property rights, or use rights, that outline the quantity, timing, location, and purpose of the water right. Instream flow rights similarly utilize the water right structure of use rights and act as "restricted common property" (Dales, 1968). Through the expression of instream flow as a property right, watershed conservation becomes a "beneficial use" protected under prior appropriation (Bonham, 2006). By expanding the definition of beneficial use, laws that are intended to consider the public interest can now be

[8] This only applies to those states west of the 100th Meridian that have adopted prior appropriation over the doctrine of riparian rights.

expanded to protect and allocate conservation sentiment of a community.[9] Sax argues that the management of water in the public trust should be a reflection of the opinions of a society whose "contemporary public interest" has already shifted away from the development-centric outcomes (Sax, 1989). Through the enforcement of a property right for water left instream and the development of a system of exchange, prior appropriation establishes a venue for communities to redistribute watershed allocation to better represent their value for conservation.

The management of complex social and ecological systems has traditionally relied upon top down control paradigms that emphasize the profitability of goods and services at the expense of community perspectives (Folke, 2005; Janssen, 2006).[10] It has been established, however, that communities that depend on natural resources will voluntarily organize to gain the benefits of trade, insulate themselves from risk, and create and enforce regulations that protect the social and ecological systems on which they depend (Ostrom, 2000). If mixed governance regimes are to act as an improved conduit for public participation in governance processes, stakeholders must be able to implement their objectives and have them recognized within top down regulatory systems. This participation can be seen as political capital, or "the resources used by [an entity] to influence policy formation processes and realize outcomes that that serve the actors perceived interests" (Birner, 2003). As each state's mixed governance regime is unique, the individual stakeholder's political capital within the governance system will be unique. If stakeholders are able to participate within the establishment and

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[9] In most prior appropriation states, including Idaho and Oregon, instream water rights are held by the state in "the public interest" of the people.

[10] This can be seen in the development oriented structure of prior appropriation

enforcement of working rules and implement local place-based policies, institutional structures will be faster to reflect changing public sentiment (Cosens, 2010).

Institutions that allow communities to participate in self-governance activities are capable of implementing novel and locally based solutions more expediently (Ostrom 2002). As institutions implement self-governed community efforts they are legitimizing community perspective incrementally. This incremental acknowledgement of community management is capable of building and implementing large-scale change more rapidly over time. If institutions are to evolve at a rate that reflects a dynamically changing world, adaptation of institutional structures must be built into the broader governance system (Walker, 2004). In particular, human-landscape interactions are constantly shifting and necessitate the continuous adaptation of legal regimes that drive natural resource management. Transformability, or "the capacity to create a fundamentally new system when ecological, economic, or social structures make the existing system untenable", is now a necessary element of natural resource management institutions (Walker, 2004). Empirical studies have shown that complex and changing ecological systems can be governed by multi-scale governance systems that draw knowledge from diverse system experience and processes and (Janssen, 2006). In a changing world, our very governance systems must learn to incorporate and prepare flexible and novel strategies suited for the challenges posed by irreversible regimes changes in the social and ecological system (Wilson, 2013).

Water Resource Governance

Water management institutions that are rooted in prior appropriation have been historically slow to adapt to new uses of water (Cosens, 2010). Typically these water management institutions in the American West can be characterized as heavily administrative, meaning they rely on top down control paradigms and regulations arising from state control (Capurso, 2011; Bonham, 2006). Based on this literature review, prior appropriation can be studied as an administrative institution that is incrementally evolving in response to shifting cultural perspectives. Heavily administrative systems are able to reconcile the accountability, financial incentives, and balanced consumptive uses that are beneficial for landscape-scale watershed management (Blomquist, 2005). These state based administrative systems, however, are slow to initiate drastic institutional change without the occurrence of large landscape-wide environmental disturbances (Long, 2008). As prior appropriation accommodates new societal values for conservation through instream flow laws, broader systems of governance will need to be restructured in order to build in the capacity to adapt to environmental climate change (Cosens, 2010).

Instream flow laws represent an opportunity for western water management efforts to reconsider existing institutional and governance structures. Previously, prior appropriation incorporated systems of exchange that were only designed for consumptive uses. This has allowed for increased flexibility in moving water rights between users and uses. Currently, Instream flow laws utilize these previously existing systems of exchange to achieve conservation goals that are beyond the scope of the original institution (Kimbrell, 2004). While, the granting of a property right for non-

consumptive uses of water allows an appropriator to represent their abstract value for conservation within a legally recognizable context, the detriments of natural resource valuation as property remain pertinent. The inclusion of instream flow concepts, while fundamentally retaining the institutional framework and mechanisms of prior appropriation, has created various governance systems challenges that are unique to each prior appropriation state (Kimbrell, 2004; Neuman, 2006; Capurso, 2011). By redefining the objectives and scope of prior appropriation to include conservation objectives, conflict increases within an already strained institution.

By using existing institutional mechanisms of prior appropriation to achieve conservation based goals, a reorganization of stakeholders occurs in the relationship between communities, consumptive users, conservation interests and regulators. Furthermore, instream flow laws have the ability to shift the governance dynamics and allow more power to the individual appropriator within a community (Neuman, 2006). Though assigning value to water resources through property rights has been identified by the literature as creating complications, mixed governance schemes provide a plausible solution to ease negative market externalities. As institutions for instream flow vary between states, each instream flow program and governance system is unique in its attributes, incentive structure, and outcomes (Bonham, 2006). Instream flow laws can be assessed by how each piece of legislation structures the unique relationship between the individual appropriator, consumptive water user, and state administrators. This presents an ideal comparative case study to better understand how the granting of a property right for instream flows impacts stakeholder dynamics on the ground.

The literature demonstrates that shifts in societal perspective will drive broader governance change (Bromley, 2011). The incorporation of instream flow laws expands the boundaries of the administrative system to allow more community control in local watershed management. Bottom-up community management has the potential to provide the transformability needed to create an adaptable institutional system, but it remains contingent upon how local perspectives get instilled into actual governance efforts (Walker, 2004; Ostrom, 1990). This transformability could be the key to crafting institutions that are able to effectively govern the human-landscape interactions in a dynamically changing world. As the loss of value from environmental degradation is felt unevenly across society, administrative systems fail to respond to this loss of value until a critical mass is reached. The introduction of local community control provides the possibility to support more transformable outcomes, as these institutions are faster to recognize changing human-landscapes dynamics on the community level (Cosens, 2010; Walker, 2004).

The Pacific Northwest provides an example of institutional evolution as states within the range of Pacific Salmon have led the charge in establishing instream flow programs within prior appropriation (Capurso, 2011). Instream flow rights have reorganized economic decision-making and incentives that guide individual interactions within a social system. The literature, however, fails to address the variety of social and political ramifications that arise from prior appropriation's accommodation of instream flow rights. Within a western watershed context, specific interactions between community entities and administrators in response to instream flow laws have not been critically investigated. In falling short of discussing interactions

that occur between resource dependent communities and administrators, the literature leaves questions unanswered about how variation in governance systems impacts stakeholder dynamics and on the ground outcomes. For the purposes of this thesis, it can be assumed that instream flow laws across the Pacific Northwest are intended to achieve salmon conservation objectives.[11] While these laws present a multitude of mixed governance structures to achieve this goal it remains unclear what combination of community control, market mechanisms, and top down control most effectively achieves salmon conservation objectives.

[11] Salmon conservation is a prominent feature in the "statement of purpose" section found in each state's instream flow law.

Chapter Three:
Study Site Description

To better understand how states have incorporated conservation into water resource governance efforts, I have designed a comparative case study to examine instream flow laws within the range of pacific salmon. At the state level we can observe institutional evolution occurring incrementally in response to specific cultural, hydrologic, and regulatory factors. Each state provides a distinct example of an instream flow program that incorporates a unique governance structure to manage dynamic and unpredictable water resources. My comparative case study is designed to examine how instream flow laws vary by looking at the rights they provide to specific stakeholders. This study seeks to illuminate the ways in which states have decided to structure instream flow laws and further understand the on-the-ground social and political impacts of these management decisions.

My three study locations were chosen to exemplify three distinct instream flow regimes that utilize different governance structures to achieve salmon conservation objectives. I categorize my study cases to be 1) Oregon as a generally diffuse blend of state control and community management, 2) Idaho as state centric top down hierarchy, 3) Alaska as relying upon privatization and market mechanisms. These study sites were chosen to represent common forms of water resource governance within the habitat of pacific salmon. In providing three distinct variations on mixed governance, these case studies will allow me to analyze the relationship between regulations, water appropriators, and salmon conservation. When observing instream flow laws, I focused my observations on social and political outcomes of institutional change at the individual stakeholder level. By trying to understand on the ground outcomes of

legislation, this study strives to discover which vital elements of institutional structure lead to effective instream flow laws.

Definitions

For the purposes of this thesis I utilize certain terms in light of their relationship to water management and prior appropriation. This allows me to develop a common language within the meta-framework of institutional economics that specifically addresses my research question.

Within each state's instream flow legislation, salmon conservation is a commonly held goal found within the statutory statement of purpose.[12] Therefore, I am defining effective instream flow laws as legislation that achieves those stated conservation objectives. Multiple attributes have been identified throughout the literature as effective in on-the-ground conservation. Administratively, these include the agency willingness to implement instream flow laws (Kimbrell, 2004) as well as well defined channels for enforcement of instream rights (Pilz, 2006; Neuman, 2006)[13]. Beyond administration, the legal strength of instream flow property rights can determine how it will fare when challenged by other competing uses (Kimbrell, 2004). Prior appropriation is administered through priority. Therefore, old rights that are transferred to instream flow rights but retain the original priority date are more effective in changing the development-oriented status quo (Capurso, 2011). For the purposes of this thesis, the following metrics can be indicative of effective salmon

[12] Alaska- AS 46.15.145; Oregon- ORS 537.336; Idaho- Idaho Code 42-1501
[13] Enforcement is particularly important when the instream right is held by the state agency.

conservation in prior appropriation 1) *actual administrative recognition and enforcement 2) instream property rights equitable with consumptive uses 3) large quantity of senior priority dates.*[14] Through the use of these metrics, I have been able to assess how the structure of prior appropriation has assigned value to instream rights.

In assessing the structure of prior appropriation I utilize a few terms instrumentally throughout my analysis. Most prominently I discuss the concept of institutions. For the purpose of this thesis, institutions are the sum total of norms, property relations and regulations that act as working rules. Pre-existing and continuously evolving these working rules are structured to produce certain desired relationships among citizens (Bromley, 2011). Most prominently, the regulatory environment created by prior appropriation is discussed as an institution. Furthermore, I recognize that larger institutions are comprised of smaller sets of social and legal working rules that I also refer to as institutions. For instance, I discuss the instream flow programs as specific institutions housed within the broader the regulatory institutional structure of prior appropriation. Using concepts of institutional economics, I hope to illustrate the political organization of water management institutions and how they respond and change over time.

Encompassing the concept of institutions is the broader idea of governance. Governance refers to all forms and processes of social coordination and patterns of rule that arise both formally and informally in an organized society (Bevir, 2012). I understand governance as occurring through the implementation of institutions that bring about working rules or structure to a society (Bromley, 2011). There are three

[14] For the purposes of this study, a senior right will be considered a right that occurs within the oldest 10% of appropriations within the specific watershed in question

basic systems of governance. These can be identified as top down hierarchies, systems of exchange, and community management (Vatn, 2009). I describe any combination of these three systems as mixed governance. For the purposes of this thesis, mixed governance is defined as a system of social coordination in which the responsibilities of governing are shared across multiple entities and levels of an organized society. My study focuses on the relationship between different mixed governance systems within each state's water management institution from a social and political perspective. In particular, I focus on the to the role of community management within this system and the ability of an individual appropriator to participate in an instream flow program.

Institutions for Instream Flows

An institutional structure that is able to transform prior appropriation to account for the complexity of natural systems demonstrates a willingness to accommodate change. The literature focuses on governance and the relationship between community management and administration as critical to adapting water resource management. Instream flow laws provide institutional structure and define the stakeholder's abilities to participate in the governance and management of their local water resources. Throughout my institutional analysis I focused on the developed systems of instream flow allocation within each state that allow local entities and individuals to participate in conserving streamflow. These allocation systems comprise the majority of instream flow programs found in prior appropriation states with the remainder primarily being made up of efforts to establish minimum stream flow floors. By studying instream flow efforts through the lens of public participation I

contextualize institutional evolution as a bottom-up process and further investigate how each institution shares water management between communities and administrators. Administrative and legislative recognition of community management efforts in instream flow programs indicates a fundamental restructuring of prior appropriation to accommodate societal conservation perspectives. What follows is an institutional analysis of instream flow regulation and a basic legislative history for each state within my comparative case study.

Oregon

As a case study site, Oregon is intended to exemplify an institution for instream flows that utilizes a diffuse blend of administrative control and local community participation. The structure of Oregon's instream flow law allows the state to retain control of defining aspects of water management but allows communities input to participate in watershed management (Plumb, 2016). Within this case study, Oregon instream flow program offers a broad assortment of avenues to establish instream flow through a mixed governance strategy.

In 1987, Oregon became the first state that legislatively enacted instream water rights that are legally equivalent to consumptive uses (ORS 537.332-360). Stated differently, instream flow rights in Oregon are able to utilize the same property right protections that heretofore had only been granted to consumptive uses by the doctrine of prior appropriation. Instream rights in Oregon are defined to mean, "a water right held in trust by the Water Resources Department for the benefit of the people of the state of Oregon" (ORS 537.332(3)). Sentiments of instream flow preservation originated

in the scenic waterfalls protection statutes of 1915 that withdrew the streams and rivers of the Columbia River Gorge from appropriation (Blumm, 2012). Such intent continued through the 1955 overhaul of the water code to recognize the instream needs of fish and wildlife. The 1987 Instream Water Rights Act pioneered instream water rights as legally equivalent property rights to consumptive uses that are to be held in the public trust by the Oregon Water Resource Department (Neuman, 2006). Cultural expectations of instream flow conservation have been part of the Oregon water resources management for over a century and can be seen as a product of historical resource development within the state.

Instream flow objectives can be achieved through multiple routes in Oregon. Within an administrative context the Oregon Water Resources Commission may ask the Oregon Water Resources Department to appropriate a new water right for instream purposes. Alternatively, individuals have a few options to restructure water right allocation within watersheds. There are three ways an individual can designate water for instream use in Oregon: 1) instream leases, 2) the allocation of conserved water, and 3) transfers (OWRD, 2009). Each one of these avenues is a way to turn an old right into a new contribution toward instream flow. Though temporary and time-limited, water leases are more flexible and may be split to allow both consumptive and instream uses throughout the year (ORS 537.348(3)). In addition, the state promotes water conservation through incentives for efficiency improvements for consumptive users. Under ORS 537.460-470, this program allows a consumptive user to retain 75% of the water conserved while 25% must remain instream (Aylward, 2013). Finally, permanent transfers of water rights to instream uses allows an individual appropriator to

fundamentally alter the water allocation structure of a watershed through the transfer of senior rights (Plumb, 2016). Instream flow appropriation can be initiated by individuals within a community or by the state but the water right will always be held by the state in public trust. To better understand these mechanisms, I investigate the on-the-ground application of community management under the Oregon's instream flow laws.

Among these three routes for creation of instream flows, permanent transfers of water provide an example of one of the most significant mechanisms for achieving instream conservation goals. Under ORS 537.348, any person may sell, lease or gift a water right to the Water Resources Department for dedication to instream uses, to be satisfied within the original priority date (ORS 537.346). Permanent transfers typically occur when a consumptive water user receives payment in exchange for transferring their water right towards an environmental purposes (Plumb, 2016). More rigid than temporary leases, permanent transfers of senior water rights provide a more reliable source of instream water year after year (Neuman, 2006). In the permanent transfer of a water right toward instream flow, the individual transferring the right is subject to the same *no injury* and public interest criteria as an individual establishing a new water right.[15] Through the granting of instream rights that are the legal equivalents to consumptive property rights, Oregon created a platform of exchange that has the potential to restructure problematic elements of water allocation through the use of the permanent transfer mechanism (Neuman, 2006).

[15] This acts as a backstop to speculative transferring.

In practice, Oregon's instream flow program has had profound impacts on the state's hydrologic systems. Having issued 1,500 water rights for the purposes of maintaining instream flows for recreation, aesthetics, fish and wildlife, Oregon has preserved around 20 million acre feet of water by using instream right appropriations alone (ORS 537.350; OWRD, 2017)[16]. This total includes instream flow rights appropriated by the department itself and is supplemented by flow restoration activities such as transfers, leases, and conserved water activities.[17] Flow restoration activities are more difficult to quantify as these vary across time and space but estimates by ODWR administrators indicate such actions comprise fewer than 10% of instream flow totals.[18] As of 2017, 95% of streams in Oregon had instream water rights that protected a portion of stream flow (ODWR, 2018). Oregon's water administration can be classified as a middle ground diffuse system, in which administrative state control relinquishes certain governance requirements to community management efforts which can both act in pursuing environmental instream flow objectives. Holding instream rights in public trust, the state can create new instream rights and must enforce and monitor their existing rights. Working within the institutional framework, individuals and community entities may self-organize to implement temporarily leases, permanently transfer, or conserve water in order to meet environmental objectives. These actions universally gain the states approval as long as traditional public interest criteria, such as the *no injury* rule, are met.[19] The main challenges faced by Oregon's

[16] As of the 2017 Integrated Water Resource Report.
[17] Personal Communication with Ken Stahr at ODWR
[18] Personal Communication with Ken Stahr and Sarah Henderson
[19] Personal Communication with Sarah Henderson

environmental interests include broad cultural acceptance of instream laws and enforcement of state held instream flow rights (Pilz, 2006; Plumb, 2016).

As a study location, Oregon provides the context of a water management system that has continually exhibited environmental consideration throughout its past and present evolutions. Though still subject to the development oriented biases of prior appropriation, Oregon water management has repeatedly recognized environmental degradation and acted to preserve or restore stream flow within the state's rivers. This tendency can be seen in the development and evolution of Oregon's instream flow laws. Under Oregon's instream flow laws individuals at the community level may pursue multiple options to both protect and restore stream flow that have exhibited continued administrative approval and recognition.

Idaho

Idaho has been included in this case study as a way to investigate an instream flow program that exhibits tendencies of top down hierarchical governance. This type of governance system traditionally defines natural resource management across the American West (Folke, 2005; Janssen 2006). Instream protections within the Gem State are heavily administrative meaning that the state's governance efforts exhibit a pattern of retaining control within the state water management institution. While individuals within a community may petition for instream efforts, all instream activities remain at the discretion of the Idaho Water Resource Board. By retaining this administrative discretion, Idaho separates itself from Oregon's middle ground diffuse system. From this heavily administrative foundation, Idaho water legislation has created unique

channels in which instream flow may be preserved that allow certain community management efforts to exist subject to administrator discretion (Capurso, 2011).

The state legislature passed the Idaho Minimum Streamflow Act (Idaho Code §42-1501-1505), which allows for the Idaho Water Resource Board "to appropriate a minimum stream flow of the unappropriated waters of any stream" (Idaho Code §42-1503) without the requirement of a diversion. Similar to Oregon, an instream flow right in Idaho can only be held by the Idaho Water Resources Board (the board) in public trust for the people (Idaho Code §42-1503). An individual or organization may petition for an instream reservation but the final determination is entirely subject to the discretion of the board (Idaho Code §42-1504).[20] This approach enforces the status quo by creating minimum stream flow "floors" through the appropriation of junior rights but does not allow for the reallocation of senior rights to instream uses.

The governance system employed by the state water management institution is built around top down state control and administrator deference. Idaho's water law has no provision for the permanent transfer of instream flows for environmental purposes.[21] Instream flows, however, have been implemented through targeted legislative efforts that have created opportunities for community participation within watershed governance. Though typically seen as a conservative unaccommodating state hostile to environmental objectives, instream flow conservation efforts have catalyzed collective action and administrative support within particular natural resource dependent communities (Capurso, 2011). Instream flow program that allow for community management in the state of Idaho are tied to federal regulation of Snake

[20] The decision is not able to be appealed or reviewed once made by the board
[21] Personal correspondence with [I1]

River Chinook under the ESA. Under very limited circumstances, over-allocation of hydrologic systems that cross private land has violated ESA protections. Within these circumstances, the state has put forward legislative and administrative solutions that involve the participation of local community members. In order to address the need to move water between users and uses, water banks and rental pools were legislatively created to increase flexibility within water administration. Water banking and local rental pools provide individual stakeholders the ability to access, exchange and temporarily rent water rights (Idaho Code 42-1761, 1766). As an addition to Idaho's water law, these systems of exchange help stakeholders deal with variable water supply and ecological considerations within the hydrologic system.

Water banking is fundamentally administrative and highly regulated while creating an opportunity to temporarily change the beneficial use of water under Idaho law. In theory, this is intended to maximize the beneficial use of the resource by allowing individuals to contribute unused water and avoid the threat of forfeiture (Capurso, 2011). Unused surface and groundwater rights are temporarily leased to the bank, which then provides water to meet the demand of industrial, agricultural, and mining users (IDWR, 2018). In practice, however, the supply of water leased to the bank far outweighs the demand for water.[22] Local rental pools are distinct from banking in that they are specifically implemented within certain watersheds and primarily create a platform for the exchange of storage rights (Idaho Code §42-1761). In specific instances, rental pools may also deal in non-storage right surface water. In the Lemhi

[22] In essence, the bank acts as an elaborate mechanism by which water right holders avoid the remote possibility of forfeiting their water right. Forfeiture is legally possible after five years of not using a water right but this administrative action has never been pursued in the state of Idaho.

river basin, a rental pool has been legislatively established for the purposes of salmon habitat conservation. The Idaho Water Resources Board continues to exercise administrative oversight of both local rental pools and water banks (Capurso, 2011). While both of these platforms increase the flexibility of an individual water right all individual actions remain subject to the discretion of the board.

Established under a similar authority as water banks, the capacity of local rental pools has been expanded to include non-consumptive uses of water (Rule 010.09; IDAPA 37.02.03). In structure, rental pools "provide temporary [leases] of adequate water supplies to benefit new and supplemental water uses" (Idaho Code §42-1761). Local oversight committees are established to manage the rental pools and are generally comprised of individuals from irrigation districts and stakeholders within each basin appointed and regulated by IDWR (IDWR, 2001). Established specifically through legislation in 2001, The Lemhi Basin rental pool was created to meet mandated minimum stream flow for federally listed Salmon, Steelhead, and Bull trout (Idaho Code 42-1765; IDAPA 37.02.03040). Individual water users may lease their consumptive right temporarily to the pool whose primary purpose is to sustain stream flow for spawning habitat. As water rights are administered in priority and multiple junior right holders along a waterway can use return flow, participation in the rental pool often involves compromise and collaboration between multiple stakeholders.[23] Initiated at the impetus the federal Endangered Species Act, the Lemhi rental pool structure is a product of federal coercion leading to increased community capacity (Capurso, 2011).

[23] Multiple stakeholders must collaborate across many federal and state agencies to assure appropriate timing and temperature of flows.

The Lemhi Basin rental pool provides an example of an administrative attempt to restore stream flow in a top down hierarchical system.

Community collaboration and self-organization to avoid conflict have been observed when faced with water scarcity (Eidem, 2012). While Idaho's state centric water administration system is not an intuitively adaptable or flexible institution, certain legislative and administrative efforts to restore stream flow have been pursued. Relying on economic incentives and compensation for flow contribution, specific administrative attempts in the state of Idaho need proactive collaboration from community entities to succeed (Capurso, 2011). While federal coercion under the ESA is a clear driving force, cultural and geographical factors contribute significantly to community participation in streamflow restoration activities. The combination of water scarcity in an arid landscape and a land-centric community ethic are both cited as integral to the success of instream flow efforts (Capurso, 2011).[24] The cultural, political, and geographic landscape of Idaho has created a favorable environment for the adoption of instream flow protections in highly particularized locations.

Alaska

In choosing to adopt prior appropriation Alaskans inherited a system that was built for the hydrologic environment of the American West (Kimbrell, 2004). Furthermore, Alaskan waterways are developing at a time when water resource conservation sentiment is already a prominent societal perspective (Haycox, 2016). This perspective on American water resource management is unique because the

[24] Personal Communication with I3

degradation common to western waterways is all but absent in the 49th state (USFS, 2014; Lowe, 2017). Within this Alaskan context, instream flow efforts play a different role in respect to salmon conservation because they are actively attempting to preserve rather than restore salmon as a natural resource. This case study location is intended to demonstrate how instream rights may be implemented from the onset of a developing water allocation system where conflict arises not over water quantity issues, but rather over how to regulate competing uses within watersheds. The nature of the Alaskan instream flow programs also brings about challenges that are distinct to Alaskan water use. In exhibiting both a unique institutional water management structure as well as a unique geography, Alaska provides valuable perspective for a study of instream flow legislation on the ground.

Beyond its soaring topography, distinct culture, and geographic isolation, Alaska is unique in its application of prior appropriation to a landscape where water is abundant and development is relatively scarce (Klein, 2011). Furthermore, Alaskan water management is notable because it was the first state to grant a private individual the ability to hold instream flow rights through explicit statutory language (Kimbrell, 2004). This statutory provision allows "the state, an agency or political subdivision of the state, an agency of the United States, *or a person*[25] [to] apply to the commissioner to reserve a sufficient water to maintain a specified instream flow" (Alaska Stat. 46.15.145(a))[emphasis added]. Expanding an instream flow program to include privately held instream flow rights could supplement preexisting non-consumptive rights held by the state (Meyer, 1993). In theory, this has the potential to support a

[25] "Person" is defined in the statute to mean any "individual, partnership, association, public or private corporation…" (Alaska Stat §46.15.260(7)).

more robust instream flow program by increasing local community participation, and lessening enforcement, financial, and bureaucratic deficiencies (Kimbrell, 2004). Alaskan instream flow policy is an opportunity to study salmon conservation objectives from a different perspective, as water management in the state is a unique application of prior appropriation.

In Alaska, individuals who have attempted to appropriate instream flow rights have been undermined by a combination of institutional and political factors that create legal handicaps to effective instream flow implementation (Kimbrell, 2004). Similar to Idaho's administrative system, the commissioner of Alaska Department of Natural Resource (ADNR) may practice a great deal of discretion in approving and reviewing applications for instream rights. Unlike consumptive water rights, instream rights are subject to review by the ADNR commissioner every ten years, or whenever the justification of the instream right is called into question (Alaska Stat. §46.15.145(f)).[26] No timeframe exists for adjudications and all reservations are subject to interpretation of loosely defined public interest criteria (Kimbrell, 2004). Additionally, the scientific burden of "proving up" a water right falls on the applicant (Alaska Stat. § 46.15.145(c)(2)). The lack of scientific data makes demonstrating need for the reservation both financially and logistically burdensome because less than 1% of Alaskan waterways are mapped or monitored (Kimbrell, 2004; USFW, 2015).[27] Finally, instream rights cannot be transferred, conveyed, assigned or converted to other uses

[26] Junior users may call for a senior instream reservation to be denied, triggering ADNR review

[27] As of 2004 publications, on average only one stream flow gauge existed for every 7,500 square miles. The applicant would be responsible for purchasing, installing, and monitoring these gauges in the process of proving up their reservation (Kimbrell, 2004)

(Alaska Admin Code tit. 11, §93.146(c)(1)).[28] Alaska provided for the ownership of private instream water rights in explicit statutory language, however, within the structuring of the water management institution non-consumptive instream rights provide far fewer legal protections than their consumptive equivalents.

Alaska has designed a mixed governance system that heavily regulates instream flows as a privatized commodity. On the surface, private instream rights would theoretically rectify aspects of prior appropriation that incentivize development by extending legal protections to non-consumptive uses. The way Alaska has regulated private instream flow rights within its water administration has lead to a diminished abilities for communities to participate in mixed governance efforts. As governance system, Alaska mirrors Idaho's administrative top down control. While an individual may hold actual rights for water left instream, they are entirely subject to the discretion of the ADNR as the administrative entity. This has erected institutional barriers that impede the ability for instream rights to be used toward salmon conservation (Kimbrell, 2004). Alaska is unique in my case study because instream flow rights are incorporated actively rather than retrospectively into developing watersheds. Though geographically and culturally distinct, Alaska provides a nuanced investigation of how water management institutions evolve to incorporate non-consumptive uses.

[28] Though this seems redundant in light of the "no injury" obligation that is ubiquitous across all prior appropriation states (Kimbrell, 2004).

Chapter Four:
Methodology

Through this comparative case study I investigated the social and political context that gave rise to instream flow laws. Furthermore, I attempted to understand how these new laws restructured relationships within existing governance systems. It has been established that legal institutions are expressions of cultural will interacting with the landscape (Long, 2011). Therefore, I investigated instream flow laws as products of changing cultural expectations surrounding how water resources should be managed at the state level. Cultural expectations of natural resource management inevitably shift in response to landscape scale changes or disturbances. By studying instream flow laws through this lens, I better understood the social and political drivers that bring about water management institutions that incorporate non-consumptive uses.

Case studies allow for the investigation of on-the-ground interconnections between individual, cultural, and legal phenomenon through a comparison of institutional structure (Yin, 1984). Through the application of the theoretical tools and concepts of the literature to my institutional analysis in chapter three, I developed a hypothesis that acted as a research proposition. Through the implementation of state water records analysis I established an archival narrative of how appropriators have interacted with the institution through observed patterns in behavior. I primarily focused on applications for water rights, certified water rights, and legal agreements that add to instream flow of hydrologic systems. Expert interviews with administrators pried deeper into that narrative and further elicited administrator perspectives to understand the social and political underpinnings of instream flow laws. My case study

is designed to connect culture and politics to the ways in which legal institutions change and develop over time.

To study the institutional differences between our three regulatory regimes, I identified a test watershed in each state that is emblematic of how prior appropriation began to accommodate changing cultural expectations. Alaska's Iliamna region was an example of a privatization of instream flows interacting with the threat of a large landscape disturbance [Map 1]. In Idaho, the Lemhi River provided an example of the relationship between directed instream flow efforts from the state and collective action within a small community [Map 2]. Finally, The Little Deschutes in Oregon furnished an example of community based stream flow restoration program that is supported by the state [Map 3]. Through the analysis of instream flow legislation and its on the ground impacts, these study watersheds highlighted cultural and political distinctions that are inherent in each particular state institution [Table 4.1].

My study locations were chosen deliberately to illustrate how different modifications to the structure of prior appropriation attempt to mitigate declining salmon populations. The test watersheds utilized in this study embody dramatically different geographies, cultures, and stages of hydrologic development, however, they are all united by their base in prior appropriation and the presence of pacific salmon. Each specific test watershed within my case study is intended to exemplify a consumptive use that is in direct conflict with wild salmon populations. As a commonality of streamflow restoration intent, instream flow laws specifically targeted toward salmon may help us understand how to best mitigate the hydrologic damages from specific disturbances in the landscape. Through my analysis, I focused on how

state specific mechanisms, provided under instream flow laws, have been explicitly implemented to prevent the decline of wild salmon populations.

The robust instream flow program that exists within the Lemhi drainage is an unlikely product of Idaho Water Law. As a basin heavily dominated by irrigation rights, wild salmon populations declined in response to consistent over-allocation of water resources. This culminated in the take of three Snake River Chinook, and subsequent threat of federal action under the Endangered Species Act. While the Lemhi basin is overseen by a heavily top down administrative system of governance, local entities and state officials have been forced to incorporate bottom up participation to achieve salmon conservation objectives. This study location is a unique example that provides insight into how direct administrative action can coalesce a successful instream flow program.

Oregon's Little Deschutes basin provides an example of changing cultural expectations and their impact on institutions for water management. As a diffuse blend of state and local control, Oregon water law has reconciled the competing interests associated with large-scale municipal growth and general societal value for Salmon. Located just upstream from the city of Bend, OR, the Little Deschutes is both valued for its recreational opportunities and threatened by increasing demand for municipal water. Because of this conflict, the Deschutes at large has been the target of specific administrative and legislative programs intended to provide community-based solutions to water resource conflict. This study location provides an example of changing cultural value within watersheds and governance efforts that empower local entities.

As an opportunity to study private instream water rights implemented from the onset of watershed development, the Iliamna region of Alaska provides a unique location to understand a new function for instream flow laws. With few consumptive water rights, the Iliamna region has no problem meeting the water quantity demands of wild salmon. This area, however, is faced with the threat of severe water quality issues from a proposed large-scale mining development. As a common narrative within the 49th state, cultural and economic values for salmon populations and resource development compete on a platform dictated by Alaskan water law. This case study location is intended to understand if Alaska's unique application of instream flow laws is capable of achieving salmon conservation objectives.

Through this investigation, I analyzed the creation of instream flow within the context of the governance relationship between local entities and state administrators. The design of this case study selects certain watersheds for the specific purpose of highlighting differences in basic governance systems. Comparative case study design provides a compelling explanation of specific research questions and can contribute to a robust understanding of the topic of instream flows as an institutional evolution (Yin, 1984). As natural resource governance systems have traditionally relied on top down control paradigms, I studied instream flow laws from the perspective of individual appropriator capacity within the governance systems (Folke, 2005; Janssen, 2006). The selection of these specific study locations allowed me to understand how prior appropriation may be evolving toward a system of more inclusive place-based bottom up governance.

Table 4.1: Study Site Descriptions

	Alaska	**Oregon**	**Idaho**
Adoption of Instream flow law	1980	1987	1980
Study Watershed	Iliamna Region	Little Deschutes River	Lemhi River
Institutional structure	Regulated privatization—relies on individual participation	Diffuse blend of state and local control-- High equity and incentives	Top down state centric-- Community based approach
Instream Mechanism[29]	Individual ability to hold private instream flow right	Transfers, Leases of various durations	Local Rental Pools
Resource Disturbance	Proposed Mining	Municipal Conflict	Irrigation
Climate- Average Annual Precipitation (in)	25.01	21.26	9.29[30]

Modified Grounded Theory

To achieve the goals of my study, I implemented a modified version of grounded theory. As an inductive methodology, grounded theory has been proven to be well suited to the research of organizational phenomenon and the development of theories based in on the ground observations (Breckenridge, 2014). This case study provided

[29] These represented opportunity structures that were made available under each instream flow law. The actual implementation of these mechanisms is discussed in my results section.

[30] Average precipitation totals for valley bottom. The Lemhi is a snowmelt driven system that is directly fed from adjacent mountains that gather that majority of the precipitation for the area. Precipitation totals at Meadow Lake weather station, that drains into the arable valley, often exceed 20 inches a year when snowpack is factored in.

an opportunity to develop a theory through the general method of comparative analysis utilizing an institutional framework, water right records, and expert interviews (Glaser, 1967). Arising from the underlying theories of pragmatism, grounded theory built the process of change and evolution into the methodology as it assesses phenomenon openly and builds toward the development of an explanation or theory (Corbin, 1990). Grounded theory has been identified as a useful tool for the analysis of changing social phenomenon and development of a theoretical framework through the rigorous analysis of empirical data (Charmaz, 2015). Throughout the data collection and analysis process I used core components of grounded theory such as openness, analyzing immediately, coding, comparing, memo writing, and theoretical sampling in the production of a substantive theory detailing institutions for instream flow [Table 3](Sbaraini, 2011).

My modification of grounded theory came in the fact that I created multiple iterations of research propositions that act as hypotheses to be tested deductively. For instance, I developed an initial research proposition that I then tested comparatively against my case study. Grounded theory and inductive reasoning are primarily found in the analysis of data against my research propositions and development of further research propositions. Through the use of the tenants of grounded theory, my methodology allowed me to actively consider and incorporate patterns observed throughout the analysis process in the formation of my final theory. This promoted my understanding of phenomena and research questions to reflect patterns and themes that were present in the data. While my study is fundamentally deductive in nature, grounded theory guides the overall structure through multiple research propositions

that are built on themes present on the ground. As a result of the combination of both inductive and deductive reasoning in modified grounded theory, I believe my analysis better addresses the institutional structure of instream flow water rights as they play out on the ground.

The incorporation of this unique methodology into my case study occurred in three distinct developmental stages adapted from previous publications (Breckenridge, 2014; Sbaraini, 2011; Corbin, 1990). In completing the *preliminary stage* of my study, I developed an initial research proposition out of a descriptive cultural and political institutional analysis. Next, I initiated the *selective coding stage* with data collection of instream flow water rights and expert interviews from each individual test basin. The initial research proposition grew and developed through comparative analysis of phenomenon observed through my data collection. Patterns observed were structured into categories with the objective of isolating a single core category. In the *final theoretical stage*, I stopped collecting data and focused on relationships between categories in an attempt to weave a thread through the observed phenomenon and construct a substantive theory [Table 4.2].

The foundation of my study is the creation of iterative research propositions that represented my changing understanding of prior appropriation as an institution. Arising from the preliminary stage of my thesis is the *initial research proposition* that attempted to answer the question posed by my study.[31] Through the application of this initial research proposition to my state water rights database analysis, I crafted conclusions and built a *modified research proposition* that established categories to

[31] *What elements of institutional structure effectively achieve the objectives of pacific salmon conservation?*

reflect my findings. The modified research proposition was used as the basis of analysis for expert interviews. Finally, a *refined research proposition* was established to reflect the findings of my interview process and conclude my selective coding stage.

Memo writing was a critical component to development of ground theory (Corbin, 1990). I incorporated memo writing into modified grounded theory in order to track how my theoretical process develops as I analyzed two different types of data. Memos are capable of documenting the progress of comparative analysis that is focused on categorical relationships (Breckenridge, 2014). In particular, memos provided a way to analyze how database observations differed from more dynamic and subjective social interview data. In classic grounded theory, data collection and analysis must occur simultaneously (Glaser, 1967). In my modified grounded theory framework, I deductively analyzed my water right database and expert interviews data sets while allowing my metrics and analysis to adapt in response to observations.[32] Memos functioned as a direct link back to raw data that was used to analyze my theoretical development in my final stage. Through the use of adaptable methodologies, I designed my method to be representative of the social, political and economic incentives that are inherent in water resource management.

[32] This necessitated an amendment to my IRB research plan.

Table 4.2: Developmental Stages of Methodology

	Developmental Process	**Data Used**	**Output**
Preliminary Stage ***[Inductive]***	1. Open interpretation of phenomena 2. Case study states defined and labeled by degree of effectiveness 3. Comparing of institutions to create initial research proposition 4. Instream flow mechanisms identified and defined 5. Test watershed identified	Institutional analysis	Initial research proposition, memos
Selective Coding Stage ***[Deductive]***	1. Data collection and analysis occurring simultaneously 2. Record analysis of water rights from three test basins 3. IRB research amendment 4. Expert interviews conducted 5. Creation of categories that are indicative of patterns observed 6. Continual comparison of proposition to new data gathered to achieve further refinement of theory 7. Continual questioning of refined research proposition 8. Core category established 9. Theoretical saturation reached	Archival narrative, interview transcripts	Core category identified, refined research proposition, theoretical saturation, memos
Theoretical stage	1. Cease data collection 2. Sorting and analysis of research memos 3. Focused analysis on relationships between categories 4. Framework Development 5. Conceptual modeling	Established categories, interview transcripts, archival narrative	Substantive theory, conceptual model

State Water Rights Records Analysis Method

State water rights databases are the principle documentation of the interaction between stakeholders and the regulating entity. In order to discover the on the ground nature of each legal regime, I performed a systematic review of instream water rights and constructed a descriptive analysis of apparent patterns and strategies used to conserve pacific salmon. These patterns and strategies demonstrated the various attempts of instream flow implementation within each particular hydrologic system. In practice, I focused on how state mechanisms have been used administratively to achieve certain outcomes. I then crafted a description of how each state has modified the institutional structure of prior appropriation to achieve the commonly held goals of instream flow. This analysis advanced my initial research proposition by vetting it against on the ground institutional outcomes to create a modified research proposition.

In Oregon I focused on water transfers and leases to the Oregon Water Resource Board within the Little Deschutes Basin. This transfer of senior water rights to instream uses, without the loss of their priority date, has allowed for a restructuring of the water governance system toward conservation objectives (Neuman, 2006). In Idaho, I examined local rental pool mechanisms and conservation easements that have arisen in direct response to the administratively state-centric institution. The Lemhi Valley stands as the most prominent example of direct streamflow restoration efforts by the Idaho Department of Water Resources (IDWR). Finally, in Alaska, my analysis focused on privately held instream water rights applications for the Iliamna basin. I analyzed the applications, certificates, and their intended uses for all water rights within the region to understand a reaction to a perceived landscape scale disturbance. I

incorporated a larger regional scale in Alaska to compare sparse instream rights within the context of regional water use. Through archival records we have a well-defined set of individual interactions with the legal institution that creates a narrative of intention, strategy, and societal value.

The state water right database review was designed to identify patterns of instream flow institutions on a state-by-state basis. Through the case study of specific watersheds, I analyzed patterns in the *strategy* of stream reservations within a hydrologic system. This focused on the quantity of reserved flow in each system, the hydrologic serial connectivity of reservations and the order in which stream reservations were pursued and adjudicated. This allowed me to investigate how stakeholders use instream flows to conserve particular ecological function. Furthermore, I assessed *intention* from an analysis of the "purpose for reservation"[33] to understand the stated legal intention of the appropriator's efforts within the institution and their connection to salmon as a resource. This included a categorization of appropriating entity to understand what type of stakeholders are involved as appropriators. Finally, I contextualized the value of each instream flow right by understanding its comparative strength within each system. This was done through an assessment of the instream right priority date in position relative to other rights within the system. The narrative created throughout this process provided a context that became the foundation for expert interviews. This comparative case study analysis

[33] Statutorily defined in each state

allowed me to define how individuals utilize their abilities within each regulatory system.[34]

Table 4.3: Database Metrics

	Metric	Hypothesis	Purpose
Strategy	• Quantity of reserved flow • Hydrologic placement • What instream right was pursued first?	Individual strategy reflects institutional deficiency	Illustration of appropriators response to institutional arrangements
Intention	• Purpose of reservation • Direct or indirect connection to salmon • Categorization of appropriating entity	Individuals directly related to salmon conservation are predominantly present	Understanding intentions of appropriators in order to compare it to actual outcomes
Value	• Instream rights as senior rights • Positioning of instream rights relative to existing rights.	More senior instream rights increases effectiveness	Who is reserving water and how "valuable" are the reservations within the scope of the whole basin

Throughout the database analysis, observations were vetted against my *initial research proposition*. New conclusions and theories were deductively drawn from inconsistencies and patterns within the data. These conclusions were distinct to the database analysis and feed back into the development of a *modified research proposition*. In addition to the modified research proposition, the themes and patterns observed in the database analysis were organized into categories. Categorization is a

[34] Case Studies have been proven to be the most effective qualitative tool to address question of *how and why*. When studying modern phenomenon within a real life context, researchers often utilize case study methodology (Yin, 1984)

qualitative research tool that aids in the organization of theory by the naming and grouping of observed patterns (Breckenridge, 2014). The establishment of representational categories allowed for organization of my observations into a theoretical framework and for the development of interview questions in my following section. A *modified research proposition* was then implemented alongside my developed categories as a new research question that was vetted against the expert interview analysis.

Expert Interview Method

The expert interview process was informed from research conclusions in the database analysis and sought to add crucial social and political perspectives from administrators as context to instream flow institutions. Expert interviews were conducted through the comparison of my modified research proposition to administrator perspectives of instream flow institutions. Interviews were specifically designed to investigate what social and political elements inspired the modification of prior appropriation to adapt to instream flow. Question design was targeted at furthering an understanding of the relationships between my established categories. Voluntary participants in my semi-structured interviews included water administrators at the Oregon Department of Water Resources, Idaho Department of Water Resources, Idaho Office of Species Conservation, and the Alaska Department of Natural Resources. Furthermore, local entities such as Alaskan branch of The Nature Conservancy, The Lemhi Regional Land Trust, and Deschutes River Conservancy were included [See Table 4]. The recruitment criteria used included individuals that: 1) administer water

allocation or instream flow 2) participate in instream flow establishment 3) facilitate stakeholder collaboration surrounding instream flows. Expert interviews represented critical institutional interactions at the basin level and were intended to reflect the social and political motivations that underlie institutional evolution. Though conservation organizations within a basin are numerous, the number of politically significant entities that influence instream transactions was finite and represented by the selection of participants.

Eleven semi-structured phone interviews were conducted over the span of two months. Each interview of the eleven interviews took the form of a 20-50 minute recorded phone conversation. IRB approved procedures were carefully adhered to including a necessary research amendment that followed my database analysis. Calls were recorded and transcribed on an iPhone 6S using the computer program "Rev Call services". All personal identifying factors were removed and replaced with a unique code. Interview recordings were saved as a password protected file and data analysis was done through a password-protected system in Rev Call Recorder and the Mendeley desktop application.

Building upon patterns and categories observed in the state records analysis, interviews delved deeper into social and political factors that participants perceived as vital to the function of an institution for instream flows. Expert interviews allowed me to understand my database analysis results from the perspective of individual administrator participation. The structure of my interview questions adhered to the following themes to better understand institutional function:

1. Descriptive

   a. Instream flow creation- history and transition toward conservation
   b. Stakeholder composition- who are the major players in the basin
   c. Conflicted area assessment- where has conflict occurred
2. Institutional structure
   a. Institutional effectiveness in achieving conservation goals
   b. Role and mission of each entity within institutional structure
   c. Abilities and rights of various entities and their particularized use of instream mechanisms
   d. Enforcement of instream flow rights
3. System Flexibility and Improvement
   a. Ways instream rights changed in their use over time
   b. Opportunities to improve on instream regulations to better achieve conservation goals
   c. Flexibility and adaptability within the instream institution
   d. The transportability of the institutional structure, such as if certain institutional elements are specific to place or generally applicable.

My interview analysis began with an assessment of individual perspectives of emergent narratives, conflicts, and cooperative efforts within instream flow institutions. The semi-structured nature of the interviews allowed me to follow integral nuances within each institutional conversation and illicit further pertinent information. My interview design built upon itself as each observation informs subsequent questions and analysis, per the protocol of grounded theory. Theoretically, I compared observations from interviews against previous categories from my database analysis. I

focused on how categories changed and what relationships existed between categories when considering themes and patterns in my data. Finally, these categories were modified to reflect conclusions made in the expert interview process. A *refined research proposition* was then developed based on the data collected that provided the best explanation of the patterns and observations made through the data collection portion of my thesis.

Beyond understanding institutional structure, expert interviews were designed to illustrate how patterns that were observed in the database analysis occur more broadly throughout other basins in each state. By focusing on one paradigmatic watershed in each state in the database analysis, I intended to isolate distinct phenomenon within state water management. In speaking to administrators at the state level, I intended to ground truth observed phenomenon and scale up observations to a statewide level. My expert interview process increased the scale of my analysis and was able to speak more broadly about statewide institutions. This allowed my analysis to examine broader institutional function as it relates to watershed scale on the ground trends.

Chapter Five:
State Water Rights Record Analysis

The state water rights record analysis is intended to illustrate the on the ground impacts of water management institutions in each of my three test watersheds. In order to understand how instream flow rights have been incorperated into the prior appropriation system, it is necessary to understand how varying systems of governance have structured the relationship between appropriators and administrators. Each test watershed in question has established an instream flow program that creates a unique system of mixed governance. I understand each state's transition toward instream flow through an analysis of water rights and stream flow conservation measures that occur through these mixed governance regimes. Mixed governance systems open the door for individuals to participate in the management of their local water resources (Cosens, 2010). As a product of this database analysis I build a narrative of strategy, intention, and value that can be used to contextualize an individual's role within instream flow laws. I use the database analysis portion of my thesis to examine the on the ground impact of this local community participation.

Initial Research Proposition

The database analysis portion of my thesis is centered on vetting my initial research proposal against on the ground water appropriation. The initial research proposition was developed out of theoretical constructs in this study's literature review that have been applied to observations from the institutional description in chapter three. To establish an initial research proposition, I make the assumption that instream

flows take root in landscapes that have experienced elevated environmental degradation. This supposition frames conservation sentiment as reactionary to a loss in value associated with landscape resource degradation (Long, 2011). Furthermore, my initial research proposition supposes that areas with effective instream flow laws must also have elevated political capital. In the American West, political capital is more typically correlated with population centers than rural regions.

My initial research proposition is that an effective instream flow legal institution requires large-scale resource degradation to be perceived by a politically significant population center that values conservation objectives. This initial research proposition will be utilized to form a base of inquiry in my state water rights database analysis. The performance of each instream flow law has been compared to my initial research proposition and patterns and themes between states form a basis of my discussion. All three case study locations in this thesis have experienced some form of resource degradation that has brought about a need for instream flow protections. While various forms of resource degradation is a commonality among the three locations, the position of each watershed relative to a population center is variable. By constructing my initial research proposition in this way, I hope to understand how differences between each state lead to different instream flow outcomes. The state water rights database analysis allowed me to analyze the outcome of instream flow laws and better understand how law can structured to meet certain desired goals.

The state water rights database analysis marks the onset of my selective coding stage. Within this stage, my initial research proposal was vetted against the collection of water rights data in state records. Instances when my observations were inconsistent

with my *initial research proposition* were noted and form the basis for the conclusion of this section. The output of this chapter is a distinct narrative of strategy, intention, and value that has been displayed by instream water efforts within each watershed. I organized observed patterns and themes of this section into categories that represent reoccurring trends within the data. These conclusions and categories are then used to establish a *modified research proposition* that acts as its own research question for the expert interview process. This iterative process was intended to build toward a substantive theory that fully addressed my research question.

Quantitative and qualitative observations are drawn from statewide databases for water rights. These publicly available databases are maintained by agencies and house information pertaining to active and inactive water rights.[35] Through each database I was able to search using relevant criteria to the particularized metrics. Each states instream flow institution used different mechanisms, identified in chapter three, to establish instream flows within particularized watersheds. Pertinent water right information was then downloaded and analyzed on Microsoft Excel spreadsheets.[36] Information that was unavailable on the databases was collected directly from agency employees and annexed to help form the complete database sets for this thesis. Through this method, on the ground appropriations were used to better understand how instream flow laws function from the perspective of an individual appropriator at the community level.

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[35] AK: http://dnr.alaska.gov/projects/las/; OR: https://www.oregon.gov/owrd/pages/wr/wris.aspx; ID: https://idwr.idaho.gov/apps/ExtSearch/WRAJSearch/WRADJSearch.aspx.
[36] See Annex- (AK Data, OR Data, ID Data)

Beyond the previously specified institutional mechanisms, I allowed my analysis to remain open to other significant mechanisms that impact water allocation.[37] This allowed my modified research proposition and theory to reflect actualized impacts observed throughout the selective coding stage. Groundwater rights across all three case studies were excluded in the database analysis. Though hydrologically connected and important to management strategies, groundwater appropriations were only considered when they were legally connected to instream flow surface water rights. To simplify my analysis, any right that had a variable diversion rate schedule was analyzed by sampling both the high and the low CFS throughout the year. This allowed me to capture the maximum and minimum impact of instream flow potential while still accounting for the dynamic nature of regulations. Because of these variable diversion rate schedules, instream flows in volatile systems occasionally exceed average annual flow. Finally, The scope of my analysis was intended to study equivalent instream flow mechanisms rather than geographical equivalents. In order to understand how the instream flow institution interacts with the landscape, it became imperative to study watersheds that differ dramatically scale.

Discussion

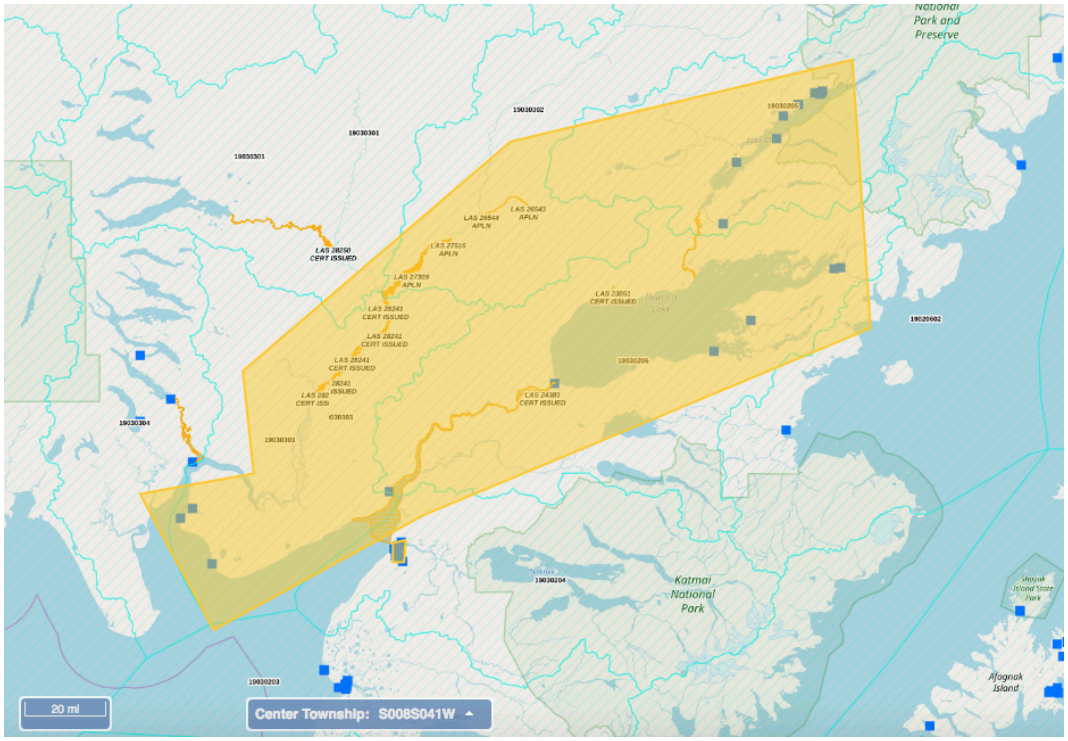
Alaska

In Alaska, data was collected in four adjacent drainages in the Iliamna Region in order to evaluate a relatively undeveloped landscape in the context of a proposed

[37] Per the ground theory concept of "openness" and "analyzing immediately"

copper mine.[38] In order to fully illustrate how Alaskan instream flow mechanisms play out across a region this sample set of multiple watersheds was chosen to better characterize the scale of the landscape. Watersheds were selected and delineated with the administrative "*Alaska Mapper"* application. Using this application I assessed applications and certificates for water rights, hydrologic connections, and character of use (See Figure 4). All geographic data was referenced to administrative records though the "Alaska LAS Case File" query system. Current information was pulled from case files and cross referenced with an agency official to assure that data was accurate and reflected contemporary trends.

Map 5.1 Iliamna Watersheds



The Orange Polygon represents the study area encompassing water rights from four watersheds within the region. Instream reservations appear as orange lines while surface water rights appear as separate blue squares. Watersheds relevant to this study are outlined in blue and have a reservation within the orange polygon.

[38] Labeled within the database as 19030205,19030206, 19030302, and 19030303

Within the data thirty active surface water rights including both non-consumptive and consumptive uses were observed. Instream flow rights, commonly referred to as reservations of water in Alaska, were an abundant presence within the Iliamna region. Out of thirty active surface water rights, ten are reservations of water that are held by three distinct entities- The Nature Conservancy, Southwest Alaska Salmon Habitat Partnership[39] or the Alaska Department of Fish and Game (ADFG).[40] Out of this selection of reservations, only one right was entirely held by a private entity. The Nature Conservancy holds this reservation on upper Talarik Creek for the purposes of cold-water fish habitat. All reservations of water within this region are either directly held by ADFG or are a product of collaboration with ADFG.[41]

All reservations of water followed a similar design and structure. The purpose of use as stated on all instream reservations within this test watershed was explicitly labeled as "Conservation". The legal definition of "Conservation" as a beneficial use lists habitat for pacific salmon as one of many permissible rationales. Reservations likewise follow a distinct variable seasonal diversion rate schedule to best match the timing of salmon runs. Seasonal diversion rates allow for quantities of reserved water to shift throughout the year to continually meet the purpose of the instream reservation. Instream reservation flow rates vary between a high of 43,400 CFS in May on the Nushagak River to a low of zero in portions of lower Talarik Creek as to better balance

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[39] A collaboration housed under the Alaska Department of Fish and Game

[40] This is unique to Alaska, as Oregon and Idaho can only issue instream rights to the agency in trust for the people of the state.

[41] On each reservation of water, collaborators and supporting entities are clearly delineated. Furthermore, this was corroborated via personal communication with A1, 2,3.

the needs of pacific salmon with other opportunities for stream flow development. Reservations occurred on the spectrum of small discharge headwaters creeks to main stem rivers and each and every reservation is clearly tailored, both geographical and seasonally, to salmon runs that exist in the region.

To understand the intention and strategy behind instream reservations, it is imperative to consider adjacent consumptive surface uses. Of the twenty consumptive surface water rights categorized, uses are predominantly industrial seafood production but also include small-scale mining, municipal, and homesteading. Appropriators can be categorized as a mix of Alaska Native villages, Native corporations, individual homeowners, industrial seafood companies, and mining corporations.[42] On the whole, consumptive water rights within this region are negligible in terms of rates of diversion. The largest consumptive surface right of 1.10 CFS is small in comparison to the reservations of water within the same watershed.[43] Notably these thirty certificates for surface water rights, including both reservations and consumptive rights, make up the entirety of the water rights record for this entire region. This remains distinct from my other test watersheds in the fact that water remains in the river awaiting appropriation and water appropriators and administrators are making decisions with available water.

The Iliamna region is characterized by distinct eras when the priority dates of consumptive and non-consumptive uses are analyzed. Priority dates for consumptive uses begin in 1958 with a placer mining operation, while the most recent consumptive water rights were dedicated to municipal use and were issued a certificate in 2013.

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[42] Both originating from Alaskan and out of state interests.
[43]Within the database this surface water right was listed as 720,000 GPD; 1 CFS is equivalent to 646,317 GPD

Occurring more recently, reservations of water do not appear on the administrative record until the year 2000 and continue to be adjudicated throughout these basins. As of 2019, the department has received three applications for private instream flow reservations, resulting in only one certificate issued for a reservation by the Nature Conservancy on Lower Talarik Creek setting aside 454 CFS. At peak seasonal flows and variable diversion rates, public and private reservations of water within these adjacent test watersheds total 102,474 CFS, a truly significant sum and the most plentiful of any of my study watersheds. While reservations of water appear to play an outsized role within the Iliamna, they are relatively new on the scene of water management. Using a broader timeline, the appropriators and uses in the Iliamna region appear to have been established by decade. Early homesteaders existed in the 50's, while industrial seafood interests appeared to have flourished in the 70's and 80's. Most recently, the Iliamna region saw a flourish of instream flow activity that could be understood in light of the societal reaction to the proposed Pebble Mine project.

On the ground reservations can be better illustrated from the perspective of an appropriator pursuing an instream reservation of water. Out of any other water right on record, the single private instream right exhibited the longest bureaucratic wait time to receive an administrative certificate. All segments of the reservation application, known as reaches, lingered in the administrative process for over 17 years.[44] This may be attributed to a heavy scientific burden of proof placed on the appropriator and further exacerbated by agency discretion in adjudicating the process. Current instream

[44] Instream reservations in all of my test watersheds are broken down into distinct portions of the river in which CFS is measured. These are referred to as reaches colloquially and technically.

reservation applications exhibit a similar tendency in bureaucratic delay. On average, private applications for instream reservations have been in the administrative process 12.53 years, some 70% still awaiting final adjudication and administrative decisions. Reservations pursued in the name of the state by ADFG take an average of 7.4 years and have not experienced similar backlogs in bureaucratic wait times. For context, consumptive surface uses within this same region only spent 1.86 years in the administrative process before a final certificate was issued. Reservations of water initiate a much longer approval process and are subjected to careful administrative scrutiny. Private instream reservations appear to demonstrate significantly heavier levels of scrutiny than public reservations of water.

Other varieties of appropriators exist, among which are reservations made by tribal entities that are all currently delayed in the certification process. Tribes are considered public entities and do not go through the more lengthy private right approval process.[45] The TNC reservation was also used on one of the smallest instream appropriations, closest to the area of the proposed Pebble Mine Project. All other applications for private instream rights are similarly for smaller tributaries as well. This indicates a pointed approach for private instream reservations that focuses on headwaters tributaries and distinct facets of a hydrologic system, such as a particular spawning creek or recreational fishing area. Larger reservations of water occur on the Nushagak, Kvichak, and Mulchatna rivers and are held by to the state through ADFG or a subsidiary. Reservations that occur on main-stem rivers appear to be the territory of the state while smaller tributaries are the focus of private reservations.

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[45] From a personal communication with A3

In assessing categories within appropriators themselves, what begins to stand out is the involvement of the state agency, ADFG, in all instream reservations. In the singular instance of a private entity successfully appropriating an instream reservation, ADFG has been a critical collaborator.[46] Likewise, all instream right applicants that have been successful as of July 2018 have been partnered with ADFG.[47] This could be explained by cost and effort of continued monitoring necessitated by private instream flow legislation. As an entity whose mission is "To protect, maintain, and improve the fish, game, and aquatic plant resources of the state, and manage their use and development in the best interest of the economy," [48], ADFG finds itself fundamentally in conflict with natural resource development efforts under the same governor and arising out of ADNR.

The Kvichak and the Mulchatna rivers, adjacent and prominent drainages within the Iliamna region, provide a case study of wilderness that is only recently experienced development and the prospect of resource degradation. Iliamna, in particular, is an area of interest because of the possible permitting and development of the Pebble Mine project. Pebble is an Alaskan mineral exploration project intended to provided molybdenum, gold, and porphyry copper though development of 13.5 square miles of land due north of lake Iliamna (Pebble Limited Partnership, 2018). Mine tailings have the threat of contaminating critical salmon habitat as Pebble is positioned at the headwaters of the Kvichak and Mulchatna rivers above Bristol Bay. Bristol Bay is widely perceived as one of the most economically significant commercial fishing areas within

[46] Their involvement clearly stated on the certificate of reservation
[47] Southwest Alaska Salmon Habitat partnership is also a collaboration with ADFG.
[48] from the department website
http://www.adfg.alaska.gov/index.cfm?adfg=about.mission

the state and Pebble is perceived as a threat on the regional salmon populations and the Alaskan salmon fishing industry at large.[49] The societal response to this proposed development is culturally prominent and reflected within the water right record when assessing reservations of water in the Iliamna region.[50] Most recently the social and political upheaval, attributed largely to Pebble, has brought about the controversial and unsuccessful legislation, Ballot Measure 1, which would increase permitting responsibilities for development within salmon habitat (Stand For Salmon, 2018). Up to this point in time, instream flow rights appear to have been used as a preemptive measure to ensure salmon habitat via flow reservation in response to the development of Pebble Mine.

Unlike my other study locations, Alaska provides examples of watersheds that have not experienced significant environmental degradation or over-allocation. Therefore, the instream rights within the watershed are positioned to form a fundamentally different function. Their intention and strategy is one of preemptive species conservation in the midst of a novel threat of environmental degradation. The Pebble Mine project has created a societal uproar and has struggled to gain social license within the state. Distinct to Alaska, private individuals within the system are legally able to reserve water and hold the instream flow rights. Private instream flow reservations, however, appear to face a serious burden of proof and barrier of entry. Though establishing these private instream flows has proven extremely difficult, public entities, represented by ADFG, have assumed this conservation role. In further assessing the effectiveness of Alaska's instream flow institution, I investigated the

[49] Personal communication with A3
[50] See AK Data

capacity for the public and private instream flow mechanisms to ensure water quantity when challenged by development interests. Throughout the expert interview process, I explored weaknesses in the instream flow institution that are indicative of the economic interests of the state of Alaska trumping instream flow regulations.

Oregon

The Little Deschutes Basin in Oregon is characterized by a history of resource development and degradation followed by a wave of environmental legislative efforts. As a fundamental tributary to the Deschutes River, The Little Deschutes is intended to exemplify well-known pacific salmon habitat that has received stream flow restoration attention in proximity to a relatively high political capital population center. Environmental degradation in this area has occurred within the societal spotlight as the Deschutes flows through the population center of Bend and in the vicinity of Portland.[51] This area provided an ideal study location for how individuals contribute to watershed conservation because it has a relative abundance of instream rights that originate from the community level. Common water appropriators within this basin include timber companies, irrigators, individual domestic, domestic developers and the Oregon Water Resources Department (OWRD).

Water rights records for the Little Deschutes basin were retrieved from the Oregon Water Right Information System and direct contact with ODWR. Transfers and conserved water agreements were then analyzed within the context of the 120 water rights of the Little Deschutes basin. Nineteen instream rights are active within the basin

[51] Both areas of tremendous social capital within the state of Oregon (Personal Correspondence with O3)

comprised of seven permanently transferred rights and four rights that can be attributed to conserved water from efficiency improvements. Transfers fell under the purpose of multiple instream uses and were some of the most senior rights present in the test watershed. The other 8 rights were established as instream minimum flows by the state in the mid 1990's explicitly for "anadromous and resident fish habitat".[52]

Table 5.2: Little Deschutes Water Rights

Oregon	# of Rights	% of Total Rights
Livestock	10	8.3%
Domestic	12	10%
Instream	19	15.8%
Irrigation	48	40%

In characterizing water allocation in The Little Deschutes, instream rights are a prominent feature of the basin. Instream priority dates ranged from 1897 to 1994 with the oldest rights having been converted from consumptive uses through either transfers or conserved water. The average size of instream rights within this basin was comparable to traditional irrigation rights. Another similarity to irrigation rights within the basin was that instream rights exhibited diversion rates that vary seasonally. Variable diversion rates for irrigation exist on a similar timeframe to instream rights intended for salmon conservation, creating both opportunities and challenges for streamflow restoration efforts. The most senior instream rights were created through

[52] Statutorily defined as "migration, spawning, egg incubation, fry emergence, and juvenile rearing."

leases, transfers, and conserved water statutes while other instream rights were appropriated as junior minimum stream flow rights by the state. As a state held junior right, instream rights had diversion rates that ranged as high as 240 CFS to as low as .06 CFS. Instream rights within this basin typically originated as the consumptive uses of irrigation, ranching, or timber harvest rights. To understand instream rights in the Little Deschutes it becomes imperative to investigate the mechanisms within Oregon water law that are used to change consumptive rights into non-consumptive stream flow protections.

Transfers of consumptive water rights to non-consumptive uses are a significant institutional mechanism used within this region. In looking at water right transfers that have occurred within the basin, it was common to see transfers from irrigation to domestic, storage to instream, and irrigation to instream uses. These common transfers accurately convey a landscape in transition from pastoral agriculture to an amenity driven economy. In instances of a transfer from irrigation to instream, the bureaucratic and legal documentation far exceeded that of any other type of transfer. In understanding increased legal filings as a proxy for difficulty, the dramatic increase in "paperwork" needed to transfer irrigation rights to instream uses would indicate an increased burden. From an investigation of all instream rights, transfers appear to need dramatically more paperwork and certifications than any other type of right, often doubling or tripling the amount of filings that are present on instream leases. Even with an increased legal burden, transferring a consumptive irrigation right to non-consumptive instream use was notably frequent within this basin.

As is outlined in regulations, and explicitly stated on each individual right, the holder of the water right is responsible for monitoring and enforcement of the desired streamflow. This presents a management challenge in the case of Oregon, as the state is the only entity legally entitled to hold instream rights. Through this structure, any violation of an instream flow right is only being monitored by the state. While a third party may notify the state of an unfulfilled instream flow right, the extensive nature of Oregon's instream flow program poses an enforcement challenge and threatens to undermine the program (Pilz, 2006). In consideration of the extensive and voluntary nature of stream flow conservation efforts in this region, lack of enforcement and monitoring could be the main weakness of Oregon's instream flow institution. Though grounded in the public trust doctrine, state ownership of instream rights burdens an over-tasked agency that is actively pursuing a conservation agenda.

From a review of the state database of the active water rights within the Little Deschutes Basin, what stands out is the degree to which Oregon Water administration has recognized specific nuances of water use to be administratively catalogued. Through diverse categories of uses found within the database, ODWR provides the ability for an appropriator to craft their water right to a specified purpose beyond other state administrative efforts. Within the Little Deschutes Basin, Oregon has catalogued 25 distinct beneficial uses compared to 10 in the Lemhi basin of Idaho and 7 in the Iliamna region of Alaska. While many Western states have a wide array of beneficial use classifications, appropriators within the Little Deschutes seem to be utilizing the flexibility available to them by the state. In doing so, the fundamental concept of "beneficial use" seems to be broader in Oregon than in our other case study states.

Among the use designations in the Little Deschutes are rights categorized as road watering, campsites, restrooms, quasi-municipal, nursery uses, and road construction. This seemingly more expansive definition of beneficial use could be attributed to the variety of values and services this watershed holds in Central Oregon. Though somewhat tangential to instream uses, I see this wider variety of recognized water uses as indicative of an administrative and societal willingness to re-envision the very concept of water rights within prior appropriation.

In understanding instream rights within this institution, I analyzed active instream flow rights within the basin. Of the nineteen active instream flow rights 626.83 CFS has been reserved to instream flow at peak diversion rates.[53] Of that sum, permanent transfers accounted for 15.15 CFS or 2.4% of instream flow while 1.27 CFS or .002% came from conserved water from efficiency improvements. Quantity-wise, The majority of the instream flow in the Little Deschutes basin has been appropriated by the Oregon Water Resource Department as minimum stream flow and is specifically designated to "Anadromous and Resident Fish Habitat Fish Habitat". These are the largest instream rights in the basin but hold junior priority dates. These function as stopgap measures that only protect stream flow in years that there is enough water to satisfy the assigned junior priority dates. This minimum stream flow emphasizes the status quo through junior rights but relies on the conserved water and transfer mechanisms to reallocate senior water rights and assure streamflow in years of drought. Within the scope and abilities of an individual appropriator within the

[53] Peak flow rates occurring around May to correspond to salmon migration

institution, transfers, leases, and conserved water can be seen as active mechanisms for achieving salmon conservation objectives.

In Oregon, instream water allocation is generally structured to allow individuals to shift their water right to non-consumptive uses at will. In an investigation of strategy, it appears that a third party, the Deschutes River Conservancy (DRC), has interests in negotiating and arranging permanent transfers of senior rights to instream use. Water rights used within permanent transfers have an average priority date of 1899 and typically have been transferred from ranching, timber, or irrigation interests. DRC, advocating for instream flows, seems to have adopted the strategy of targeting influential small senior appropriations on the mainstem of the Little Deschutes. Meanwhile, conserved water from efficiency improvements play a less significant role in both quantity and seniority on this particular stream. All conserved water rights from efficiency improvements in this basin, subject to ORS 537.460-470, originate from canal improvements in the Tumalo Irrigation District.[54]

Oregon's water allocation system presents multiple avenues for an administrator or an individual to preserve instream flow without administrative roadblocks commonly encountered in other states. By combining minimum stream flow rights, permanent transfers, temporary leases, and conserved water benefits Oregon offers actualized flexibility for an instream institution. State administrators appear to have created a system that promotes the adoption of instream flows through flexibility paired with property right protections that are equivalent to consumptive use rights. Transfers, and the ability to maintain senior priority dates, appear to be the most

[54] Such as lining canals in order to mitigate the loss from seepage

powerful tool in restructuring water allocation within this test basin. Though powerful, transfers appear to be the most difficult to establish. Out of our study basins, Oregon has the most instream CFS designated through the volition of private entities and offers the only instream flows that offer comparable protections to their consumptive use counterparts.

Idaho

The Lemhi basin was chosen for its unique response to the administratively centric system of water allocation. As an arid inland mountain basin, the Lemhi provides an example of a collective action in the face of defined administrative deference. A spreadsheet of the active rights within the Lemhi Basin was retrieved from the state water records database. IDWR further provided specific copies of permanent subordination agreements, conservation agreements, and local rental pool transactions. Within the Lemhi basin 4,172 active water rights exist that are predominantly catalogued as irrigation, stockwatering, domestic, and fish propagation. Other uses that repeatedly occurred included recreation, wildlife, and storage (See Table 5.2). Though stockwatering appears to dominate the basin, IDWR considers such a right to be non-consumptive in nature. This is attributed to the fact that the majority of the water that leaves the hydrologic system for purposes of livestock hydration is soon returned to stream flow through conventional biological methods.[55] Likewise, the total amount of fish propagation rights are a result of non-consumptive fish screen installations and can also be considered negligible for this analysis. In focusing just on individual water rights

[55] Personal communication with I1

as a consumptive use, we see water appropriators categorized as individual ranchers, state entities, corporate entities, and the federal government acting through the Department of Agriculture.

Table 5.3: Lemhi Water Rights

Idaho	# of Rights	% of Total Rights	CFS
Domestic	106	2.5%	.79
Stockwater	2559	61%	1,869.3
Fish Propagation	116	2.7%	1.15
Irrigation	1513	36%	29.12

The state water rights record in the Lemhi basin shows a significant amount of traditional consumptive use common for a prior appropriation state in the West. In particular, stockwatering and irrigation are the dominant entities reflected in state appropriations. Out of 2559 stockwatering rights 1425 or 55.7% are owned outright by the US federal government or through the USDA while the state of Idaho only holds 113 stockwatering rights or 4.4%. Though negligible in terms of water use, these rights demonstrate a further federal interest and presence within the basin. While the database shows this as a significant impact on the basin, I have decided to exclude consideration of federal stockwatering rights other than as emblematic of the political interests at play. This course of action is preferable because stockwatering rights remain non-consumptive and are numerous enough to overshadow other trends within

the data.[56] 1,513 irrigation rights exist within the basin. Further emphasizing the federal presence in the basin, 824 rights or 54.5% are federally owned while only 5 rights are owned by the State of Idaho. The federal presence appears to be strong within the Lemhi basin not only in water right certificates, but also through the imposition of environmental regulation.

Though culturally resistant to federal power, the story of water allocation in the Lemhi Basin is one of federal coercion and local stakeholder cooperation. Functionally the Lemhi as a hydrologic system is unique due to two integral factors, the large base of individual stakeholders that appropriate water as well as the presence of anadromous Pacific Chinook. Around 320 individuals hold interest across the arable land of the Basin, significantly more numerous than in the neighboring Pahsimeroi in which around 30 individual water rights exist.[57] Though the Pahsimeroi is relatively uninhabited by comparison it provides a geographically and hydrologically equivalent system by which to judge the unique nature of the Lemhi. The 320 individual stakeholders of the Lemhi quickly coalesced in response to the legal threat of "take" when three juvenile Chinook were found dead above the L6 diversion on the mainstem Lemhi.[58] Snake river salmon were listed under the Endangered Species Act (ESA) in the early 1990's bringing federal concern and regulation to irrigation efforts in the Lemhi Basin (Capurso, 2011). The state has put forward significant legislative efforts in order to comply with measures to ensure the continued survival of Snake River Chinook through the use of mitigation measures. This led to the creation of legislative and

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[56] A sentiment that was corroborated with I1, I3
[57] Personal communication with I3
[58] Personal communication with I1

administrative mechanisms that act as administratively controlled channels for appropriators to move water between uses and users in order to meet a minimum stream flow right held by IDWR.[59] My study expands to include the legislative and administrative mechanisms of local rental pools, conservation easements, and a state mandated minimum stream flow as a representation of direct administrative efforts to enliven community participation in stream flow restoration.

In analyzing conservation easements and rentals, information drawn upon includes the appropriating entity, priority date, diversion rate, and former use of the non-consumptive right. The examination of the state record revealed only two instream rights were leased to the local rental pool. These allowed for the movement of .92 CFS of water from irrigation use to instream use. Both rights were held by the same appropriator and had the priority date in September 1967. Designated CFS was permanently rented to IDWR and the land was idled into perpetuity (Idaho Code 42-1765; IDAPA 37.02.03040). Distinct from Oregon, this can only be done if the state initiates and approves of the transaction. The rental program, a protection from forfeiture that conserves water explicitly for salmon habitat, appears to be rarely utilized. Though both easements and rental pool transactions are explicitly intended to bolster salmon conservation, direct administrative easements upon property rights are more heavily used for salmon conservation than the established rental pool market.

Through the establishment of a mandated minimum stream floor to meet ESA standards, The Idaho Water Resource Board (IWRB) specifically implements conservation easements (Idaho Code 36-104(b)6). Conservation easements are

[59] See House Bill NO. 358 from the Idaho State Legislature-legislature.idaho.gov/sessioninfo/2001/legislation/H0358/

voluntary legal agreements that limit the stakeholder's water right. Once established, they are attached to the legal deed of the parcel of land in question and filed at the courthouse.[60] The easement strategy is primarily pursued by IDWR throughout the basin to meet their goal of a minimum streamflow.[61] IDWR structures these easements to achieve the mandated flow of 35 CFS for 80% of the first 100 days of the irrigation season.[62] For the remainder of the season the river must average 25 CFS for 80% of the existing time period (Idaho Code 42-1506). Conservation easements are achieved administratively through the implementation of permanent subordination agreements that delineate the relationship between IDWR and the landowner in order to meet the terms of the easement (Idaho Code 42-203B). Each permanent subordination agreement dedicates a portion of a water right to instream flow in exchange for a monetary pay out to the water right holder.[63] Permanent subordination agreements facilitate a system of exchange that actively achieves the legal obligation of the conservation easements.[64] Easements are attached to the parcel of land in question while permanent subordination agreements outline the terms of how IDWR and the property owner agree to fulfill the easement requirement. It is the combination of both permanent subordination agreements and easements that provide a vehicle for collaboration between ranching or irrigation stakeholders and conservation interests.

Within this basin, it appears that IDWR is specifically targeting senior rights as to better assure instream flow in times of shortage. The water rights that are limited by

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[60] Personal communication I1
[61] Personal communication with I1, I2
[62] March 15th through November 15th
[63] For example, $155,660 was exchanged for 1.81 CFS of water with a priority date ranging from 1871-1875
[64] Personal communication I1

conservation easements in the Lemhi are entirely senior rights and span from 1869 to 1888. These easements are collectively able to ensure water remains in stream for the intended stretch by relying on the seniority of the rights with which they are associated. Out of 15 irrigation water rights using permanent subordination agreements to fulfill easements, 17.11 CFS of instream flow was indefinitely guaranteed. When implemented these permanent subordination agreements collectively provide 68% of the mandated minimum flow of the Lemhi for each year. Conservation easements as an institutional mechanism signify direct efforts from IDWR to meet standards set by federal regulation under the ESA.

Institutionally, Idaho's approach toward instream flow is reliant on state discretion. Though members of the public must participate in the easement process, the state acts as the buyer. Though highly bureaucratic and hierarchical this approach has still found success in targeted easements on senior rights. Though the Lemhi has the smallest amount of dedicated instream flow of all of our case study basins, it manages to have the highest percentage of senior rights as well. In other words, the Lemhi agreements have produced quality over quantity instream appropriations through selected strategic appropriations. In comparison to state laws that emphasize administrative control and discretion, the database analysis of the instream flow program in the Lemhi exhibited an unforeseen degree of flexibility in allowing appropriators to participate in conservation-based action. Conservation easements in the Lemhi portray an institutional willingness to accommodate new non-consumptive uses of water and modify traditional prior appropriation in order to achieve conservation objectives.

Understanding this situation in light of my initial research proposition the Lemhi does not fit the mold. From a review of the literature, the history of the region, and the state water rights record it becomes clear that the Lemhi basin has faced resource degradation stemming from over-allocation of its water resources. While it meets the degradation criteria of my initial research proposition, the basin is not an area of tremendous political capital federally or within Idaho. With the ESA determination to list the Snake River Salmon, however, this area came under federal coercion and gained the ability to leverage political capital well beyond its own heft. Federal conservation interests have found solid footing in the Lemhi, as culturally significant community members have aligned with conservation objectives. From my analysis it appears as if the federal government has altered the stakeholder dynamic in the traditionally administrative centric system of Idaho water allocation.

Conclusion

Through the database analysis process I vetted my initial research proposal *that an effective instream flow legal institution requires resource degradation to be perceived by a politically significant population center that values conservation.* Through the process of comparative analysis and categorization I identified patterns and themes in the strategy, intention, and value of instream flow databases that supported or conflicted with this initial research proposition. In order to summarize the findings of my database analysis, I relied on the process of categorization to represent narratives that I observed within the data. I was able to identify 5 categories that were repeatedly observed throughout the database analysis: *1) Instream transitions, 2) Catalysts, 3)*

Third party involvement, 4) Selected strategic appropriations, and 5) Flexibility. Each of these categories is representative of themes that were identifiable throughout each case study database. The identification of these themes occurred in juxtaposition to my initial research proposition and is used to build my concept of what elements of institutional structure are vital components of effective instream flow laws. Categories will continually be compared to new findings and results and relationships between categories will be highlighted per the protocols of my modified grounded theory research.

Table 5.4: Database Summary

	Enforcement Ability	**Property Right**	**Permanent Instream right**	**Mechanism for Instream flow**	**Study Site Instream % Senior** [65]
AK	High- private enforcement capacity	Subject to Annulment	Permanent; Subject to Annulment	Private instream flow rights	0%
OR	Monitoring and enforcement difficult	Comparable protection to consumptive	Permanent	Transfers, lease, conserved water	58%
ID	Mandated enforcement to meet ESA goals	Administratively pursued and mandated	Temporary Leases; Permanent Subordination	Conservation Easements, Rental pool	79%

The category of *instream transitions* is intended to be an analysis of the period of time when instream mechanisms were first implemented in the watershed. By focusing on the shift between traditional consumptive water use and non-consumptive instream use, I attempt to understand a period of time when the objectives of prior appropriation

[65] This is % of instream flow that could be considered senior. For the purposes of this study a senior right is defined as a right in the top 10% of the priority administration.

transitioned. In each study locations we see this occurrence as a period of transition when existing watersheds adapt to new uses brought forward by instream flow laws. In Idaho, this instream transition coincided with state efforts to meet ESA mandates and brought about local collective action. Oregon provides an example of instream flow efforts that arise out of a history of legislative conservation efforts. Alaska provides the most distinct and contemporary example of transition to instream use. The Iliamna basin was characterized by negligible consumptive use and wilderness but has recently seen a flurry of instream activity by ADFG and private entities alike. By isolating this period of time in my analysis as important, I am attempting to understand the pivotal moment of institutional evolution when changing cultural expectations began to be reflected within existing regulatory structure.

In understanding the motivations behind these transitioning institutions, I can identify a particular *catalyst* that has spurred on instream appropriations within each study site as a common trend. In each example we see an instream flow adoption as somewhat reactionary to an initial disturbance. What stood out in this analysis was the explicit nature of each disturbance. Instead of a gradual and eventual adoption of instream flows, each study basin has a moment that catalyzed a distinct transition. In each test watershed, these moments were targeted at a particularized source of hydrological degradation. Oregon and Idaho both faced flow degradation that stemmed from irrigation or ranching as a consumptive use. The adoption of instream flow can been seen as reactionary to particularized loss in ecological value that has been perceived by a community. In the instance of Oregon and Idaho, instream efforts fundamentally conflict with basic developmental tenants of prior appropriation. For

example, a direct conflict exists between instream flow rights for salmon conservation and consumptive water rights for irrigators and ranchers. In Alaska, the disturbance takes a different form as Pebble mine acts as the catalyst that coalesces instream efforts in opposition. The Catalyst category will seek to understand how disturbances factors into institutional evolution and how social and political elements of society change on the ground.

The database analysis portion of my study is intended to analyze how actual appropriators have acted within the context of instream flow laws. In order to describe these actions, I have identified particular selected strategies that were apparent throughout each test watershed's instream appropriations. Spurred on by the cost, effort, and controversy associated with instream flow establishment, appropriators in all states developed identifiable strategies that effectively navigated the water management institution. Alaska's approach toward instream flow relied on collaboration between private entities and state entities through instream water reservations to protect distinct areas of the watershed. Hydrologically, ADFG focused on large main-stem appropriations while private applications and private rights focused on small headwaters streams. Oregon exhibited a preference for hydrologic connectivity in pursuing transfers and conserved water. Their approach favored a variety of instream market mechanisms along the entire stream reach that protected restored streamflow from headwaters to main-stem rivers. Idaho's conservation easement approach seemed to strictly favor priority date over any geographic determinants within this over allocated arid basin. The difference between each state's strategies acts as a reflection of the instream flow laws that govern the system.

Development of this category helps further understand stakeholder behavior as part of a complex scheme of incentives and regulations that are dictated by the regulatory structure of prior appropriation and instream flow laws.

Water appropriations are traditionally direct interactions between the state and the water user; each of my case studies however presented a variant of this interaction with the presence of a third party. Third parties appear to be the ubiquitous driving factor in conducting selected strategies within the basin. In all test basins, third parties were local non-profits that represented the conservation interests of certain societal interests. Oregon's permanent transfers, leases, and conserved water efforts were all institutional mechanisms that are driven by the Deschutes River Conservancy. The DRC acts as a mediator and political voice for conservation interests stemming from regional environmental sentiment. The motivation for Idaho's instream program originates with federal regulation but has been continually driven Lemhi Regional Land Trust that acts to preserve the pastoral ranching landscape of the region. In this instance the land trust functions as a crucial collaborator that supports the state administration efforts on-the-ground. Instream water rights in Alaska require a significant burden of scientific proof that has proven insurmountable for a single private entity. All successful instream appropriations in Alaska's Iliamna region have some degree of association with ADFG while non-profit groups collaborate through funding and technical assistance. Local non-profits have made attempts to establish instream reservations, but none have been successful without the assistance of ADFG. In each case study location societal and political will for conservation efforts coalesce within the structure of non-profits as

community entities. Moving forward, a deeper analysis of these groups will help illuminate how social change actually drives institutional evolution.

Diverging from my initial research proposition, population centers themselves seem to be less important than the political capital of the entities involved in conservation efforts. In other words, political significance is not strictly tied to geographical population centers, but rather organizational capacity therein. Active non-profits function as indicators of organizational capacity stemming from changing cultural expectation of water management. Instream flow institutions are tasked with the translation of this value to legal stream flow protections under prior appropriation. The assessment of third party involvement in instream flow establishment provides perspective on the ways social systems value water left instream. This category examines the support system behind instream appropriations to understand how legal structure has been a benefit or detriment to instream appropriations.

Flexibility of the institution appears to be a likely determinant of instream flow regimes that are effective at achieving salmon conservation objectives. This category focuses on the ability of the water allocation institution to continually accommodate new and varied instream flow uses into previously existing structures. This was present in Oregon's diverse instream flow mechanisms available to individuals and continuing efforts to provide non-consumptive rights with equivalent legal protections to consumptive rights. This can also be seen in Idaho as administratively pursued easements and legislative approaches to instream flow establishment help the state meet ESA standards. In both of these instances, water administration accommodated novel approaches to achieve conservation objectives and reimaged the existing

structure of prior appropriation through legislative efforts. Alaska, however, failed to incorporate the flexibility of private instream flow rights into practice rather relying on a legislatively designed privatization approach. From my database analysis, structural flexibility of an institution is enhanced when instream mechanisms can work in tandem to allow conservation objectives to be achieved in a variety of ways. Each solitary mechanism for establishing instream flow is only as effective as the broader institutional system it exists within.

My analysis leads me to believe that the key to institutions that are effective in achieving salmon conservation is flexibility achieved by the willingness to transform. This transformability has been described as "the capacity to create a fundamentally new system when… social structures make the existing system untenable", (Walker, 2004). Changing cultural expectations toward water management efforts have challenged prior appropriation to adapt to new uses. In order to successfully transform to new expectations, the structure of prior appropriation has responded by restructuring the relationship between administrators and individuals. This shift in western water management is marked by a transition from top down governance toward mixed governance efforts. As mixed governance of water resources requires multiple interconnected levels of stakeholders to participate, the institution of prior appropriation must provide the flexibility necessary to allow individual community entities to actually dedicate instream flow. Institutional flexibility allows evolution to respond to changing cultural expectations and may well be critical to understanding why some instream institutions fail to achieve conservation objectives while others succeed.

Chapter Six:
Expert Interviews

Crafted out of database analysis and the observed relationship of categories, I have allowed my observation of patterns to be reflected in a modified research proposal. This *modified research proposition* will be used as a hypothesis for my expert interview process. My modified research proposal is that *an effective institution for instream flows provides structural flexibility that allows politically significant organizations to respond to the degradation of a particular natural resource value*. I have structured this new hypothesis to reflect how observed categories interact when analyzing the intention, strategy, and value of state water right databases. I organized the structure of my interview questions to further elicit administrator perceptions of categories and added new interview participants to better address more complex participant dynamics. The inclusion of one-interview subject from each state that represents a local entity helps illustrate the role of third parties in promoting instream flow establishment and better reflects observed trends in on-the-ground data. Expert interviews are intended to add social and political context to my study of legal regimes for instream flows.

Discussion

Alaska

When structuring my interview schedule in Alaska, I pursued volunteers from the Alaska Department of Natural Resources (ADNR), Alaska Department of Fish and Game (ADFG), and The Nature Conservancy (TNC). This group was selected in response to the collaborative relationship that was observed in the Iliamna Region instream flow

reservations. Each individual was intimately familiar with the instream flow institution and the mechanisms used to establish reservations. For Alaska, my interview participants totaled four administrators from state agencies and non-profits. My representative from ADNR functioned as the state administrator perspective and elaborated on the state's management and structuring the instream flow program. One representative from both ADFG and TNC represented both public and private appropriators respectively. These individuals were integral in understanding the dynamics between regulators and appropriators as well as how reservations are strategically pursued both regionally and at the state level. I had extended interviews with an individual from each of the three major organizations in question and proceeded to have a shorter follow up interview with another specialist at ADFG to further clarify some key points.

Administratively, ADNR presented Alaskan water allocation as uniquely conservation oriented and a specific response to the geography and culture of Alaska. The instream flow institution was presented by the administration as highly functional and its rigor was cast as representative of broader societal interests that exist within the state. Specifically, a representative of ADNR described the high scientific barrier to entry for private instream reservations as establishing equity between developmental and conservation interests:

"Yeah, I mean, once [private instream water right applications] get going and you have… at least 5 years, we require at least 5 years of data to even start adjudication, most of the time in that region you're going to be going up against the big players where they're required to do a lot of environmental studies. So, the playing field can be somewhat equal depending on what you need to get. If they need to gauge, you're also going to need to gauge so you can't just go in and say rubber stamp it and say we're done."

This quote portrays how instream efforts in Alaska are fundamentally positioned in opposition to resource development and that conflict is inherent in the state's instream flow program. By describing the permitting process as an equalizer, the state has constructed a barrier to conservation objectives within the instream institution. By evening out the "playing field" between conservation and development, state water administration makes an objective judgment that its citizens value development to an equal or great degree to conservation. Though all parties agreed Alaska was an opportunity to modernize the motivations of prior appropriation, the ideal outcome of that modernization was not a universally shared vision.

TNC and ADFG, acting as the only appropriators of instream water in our sample set, maintained two drastically different relationships with ADNR. In particular, structured collaborations between ADFG and ADNR include multiple shared administrative employees and commonly held mandates that have created a "fast track for reservations" held by ADFG. This relationship was addressed by a an employee of ADNR that is jointly contracted under ADFG:

"Well, we work with Fish and Game frequently because I do work under a memorandum of understanding with Fish and Game where, essentially, they pay us through us an RSA, they pay a certain portion of my salary and they put in a lot of their applications basically for free. So they get their applications adjudicated quicker than others"

This has created a highly favorable environment for serial reservations to occur at the intra-state level as ADFG openly receives preferential treatment through an administrative preference. This preferential treatment explicitly entails more expedient application processing times. This mechanism is responsible for ADFG reservations becoming the most prevalent within the state because it removes significant barriers to

creating reservations. In open recognition of this preferential regulatory structure, non-profit groups stressed the importance of collaborating with ADFG, through funding and technical support, in order to establish instream reservations.

This assistance has been formalized in the creation of a collaborative conservation based group, the Southwest Alaska Salmon Habitat Partnership (SASHP). As a significant political consolidation of conservation effort, SASHP is a collaboration of stakeholders that is designed as "a [state] program to help protect, restore, and enhance fish habitat" (Troll, 2018). All participants referred to this partnership as the primary and most formal collaboration of environmental interests within the region. This collaboration acts as a platform to bring together goals, funding, and technical expertise in order to effectively pursue reservations that will be held by ADFG or tribal interests. In the specific case of the Iliamna region, SASHP provided funding through federal and private grants to establish a network of stream gages that were intended to bolster future reservation applications. These gauges, once in place, provided a necessary source of data in "proving up" an instream reservation.[66] This process of proving up mandates the collection of large amount of data over the course of years in order to successfully establish an instream reservation. Through collaboration and the consolidation of conservation energy, SASHP acts as a channel for community efforts in Alaska water management.

The relationship between private and public instream flow reservations primarily defines conservation efforts in state water management. Private instream flow rights are much more costly and difficult to establish while remaining subject to

[66] By providing gauges, stream flow data may then be used to establish future reservations on the study stream.

administrative appeal by developmental interests. From a private non-profit perspective, establishing instream reservations was said to be cheaper, easier, faster when the right was to be held by ADFG. While rights held by a state agency are equally as subject to annulment and the consistent discretion of ADNR, they are faster to establish because of existing relationships between administrative agencies. Under this institutional structure the bulk of conservation efforts must work through ADFG to establish a system of widespread instream flow reservations that achieve salmon conservation objectives. While public rights dominate watershed streamflow conservation in the Iliamna region, private instream flow rights are cast in a unique supporting role.

Within this system private instream rights act as a form of political insulation between state administrative agencies. In particular, private rights acts as a political buffer between the administrative agencies and the state governor who oversees both ADFG and ANDR. In other words, privately held instream flow reservations are pursued so that local conservation entities must be consulted when that right is challenged by a developmental interest. A former administrator at The Nature Conservancy in Alaska characterized how local entities utilize private instream flow rights:

> "Well even under the law, in theory, the commissioner's supposed to review those [private instream rights] every 10 years. To determine whether it's still valid, whether there are other competing interests. And so he could remove it. And could remove it at any time if there is a competing interest, although ... so basically we've always viewed it to be ... we don't have a private right to the water, we can't say "you can't take it away". But what we should have is a right to be at the table. So that if the issue does come up, that somebody needs to withdraw water for a purpose, that would be contradictory to the purpose for which the reservation was filed, typically it's fish, in our case"

This "seat at the table" motivation was integral in the TNC's pursuit of private instream rights. Private instream rights act as a significant public comment mechanism that utilizes unique legislative channels. Local entities perceive instream flow efforts to be their most effective route to have their voices heard without approaching major conflict. The nature of the privately held right as subject to annulment was continually acknowledged, however, the intention behind the appropriation was to establish an input mechanism for the perspectives of conservation to an otherwise highly structured system favoring development.

All parties interviewed repeatedly acknowledged the highly regulated and hierarchical nature of the instream flow administration and the large amount of deference given to the director of ADNR. The legal mechanisms of Alaskan instream flow creation are structured to create a solitary market for "second class rights" that are consistently subject to the interests of development.[67] Through this regulatory structure, ADFG as well as local entities have strategically pursued instream reservations that act preventatively in response to a disturbance from resource development. TNC administrators expressed the belief that conservation objectives could not be met through the existing institution. While ADNR and ADFG held the perspective that conservation goals were easily met with the consent of the director of ADNR. This comes as no surprise because TNC is acting as an institutional outsider within a structure that is built to favor ADFG. While no mechanism exists to permanently reserve instream flows, the Alaskan instream flow statute provides a type

[67] Personal communication with A3

of "legal standing" for those entities in possession of the reservation to speak up against development.

My expert interview findings emphasize that Alaska has structured their instream flow institution to reflect the composition of the Alaskan economy. Though commercial and recreational fishing remain culturally important to Alaskan culture, on average 85% of tax revenue comes from resource development (AOGA, 2018).[68] This fact explains the lack of motivation to provide a significant market for any form of instream water reservation. The success of the Lower Talarik instream reservation, the only successful private right to ever receive a certificate from ADNR, was attributed to a lack of developmental attention in the region at that time:

> "There's no question, I mean we did see this. Lower Talarik aside, it was initiated at the time, before Pebble, and it was initiated to protect a stream that was pretty much vital to the tourism industry and the fly-fishing folks ... Around the world, actually. So it had a lot of support for that effort. So when it came to, now, in Southwest Alaska, we're facing the possibility of a mine. One of the things that the law allows us to do to protect salmon that don't require big change, or a big fight, or anything like that. And in-stream flow is one of them. So we definitely looked at, we thought streams that could be affected, to make sure that in the permitting process that water flow would be a factor to be considered, and a way we could assure that, was through in-stream flow reservations. So we're not seeing if I recall at the time we weren't seeing the state moving in to do much in the way of in-stream flow reservations"

This quote underscores the political positioning that private instream reservations have taken in the state. They act as a way to ensure water quantity is a consideration in approving development without inciting controversy. Once certified, however, the Talarik appropriation would catalyze a controversial legislative rebuke. House Bill 77 was introduced shortly thereafter as an effort to eliminate private instream reservations entirely. The inevitable conflict between fishing and resource

[68] Specifically the oil and gas industry

extraction proponents has continued to unfold in the legislative arena and can be seen in the very structure of Alaskan's water administration. Compared to other states in this case study, interview participants universally expressed that instream reservations are highly controversial in Alaskan resource administration, often exhibiting more tentative behavior before speaking on the record.

In my interview analysis, I observed Alaskan instream flow advocates strategizing and collaborating in response to a more regulated institutional structure. At first glance it appears that community capacity was strengthened through the explicit granting of a private right, however, broad administrative deference commonly erected barriers for conservation efforts. The legal apparatus available to conservation interests disincentives wide adoption of privately held instream reservations because it fails to provide legal protection for the water right in the face developmental interests. The state has been able to create a channel for its own instream flow reservations through ADFG but even these remain subject those rights administrative deference. Through the interview process, it is clear that the state is unwilling to relinquish control of its water resources to the privatization mechanisms provided in its own instream flow institution.

Oregon

In Oregon I interviewed four individuals that represented the administrative and local efforts to secure instream flow within the state in order to understand how streamflow restoration efforts have coalesced in the Deschutes basin. From the Oregon Water Resources Department, I interviewed an individual responsible for issuing

instream certificates and managing the statewide water transfers and leases. My second interview for Oregon was also a representative of ODWR who was involved in the monitoring, enforcement, and negotiation of all stream flow rights for the Deschutes River Basin. To represent local streamflow restoration efforts, my interview participants were both non-profit administrators that work for the Deschutes River Conservancy (DRC). These individuals were selected to elaborate on the unique blend of state and local control that has been observed in Oregon and utilized by the DRC. As representatives of a local entity, a regional state representative, and a statewide water administrator, my interview participants were intended to represent the particularized mixed governance system of Oregon's instream flow institution.

Oregon's mechanisms for creating instream flow provide individuals with multiple routes to bring water in stream that vary in duration. Building off my database and institutional analysis, my expert interview process expands consideration of significant instream flow mechanisms in Oregon to include legislative efforts as well as initially overlooked administrative programs. Beyond transfers and leases as mechanisms of instream flow, my expert interviews investigate conserved water programs, mitigation programs, among other mechanisms that contribute to streamflow restoration in the region.

Mechanisms that allow local entities to contribute to streamflow restoration under Oregon water management are as follows. Instream leases, lasting one to five years, these leases allow appropriators[69] to temporarily move their right instream. Irrigators may also seasonally provide water under an instream lease, increasing the

[69] Most often agricultural irrigators. Most instream flow restoration activity in Oregon originates in Agriculture.

adaptability of water rights to the hydrologic system. Additionally, time-limited transfers extend the length of a lease by allowing appropriators to sell their water for up to 25-year increments.[70] This provides a more dependable source of assured flows, but remains subject to a finite and well-defined time period. Finally, the permanent transfer mechanism severs the water from the land and provides permanent instream protection.

Contrary to my database local analysis findings, conserved water from efficiency improvements plays a significant role within the Deschutes basin. A Deschutes administrator discussed his experience with instream rights across the basin in the following quote:

> "No, the list I'm looking at is probably 95% conserved water. And so, from a flow standpoint they're bigger, they're big flows. Some of these... Look at this one from the Deschutes River Conservancy. They piped a section of the north canal, that's 19.6 CFS senior water in-stream. That's a big chunk of water to be throwing in- stream. On reach, all the way down the Deschutes."

Such conserved water programs are specific to the Deschutes region as DRC manages public funds and provides financial backing for these efficiency improvements. In return 100% of the conserved water from each improvement is returned to the Deschutes. This is a variation of the traditional conserved water statute in Oregon (ORS 537.460-470) under which only 25% of conserved water is returned to the stream. Expanding my study to further investigate the Deschutes basin at large has allowed me to analyze the water management institution in a more robust manner. Conclusions from my database analysis that were locally present in the Little Deschutes were in some ways anomalous and led to an inaccurate proportion of the use of the transfer

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[70] Personal communication O1, O2

mechanism. In my expert interview analysis there was a consensus among all interview participants that it is the combination of these mechanisms, beyond leases and transfers, which interact to form the instream flow program in the broader Deschutes basin.

The state of Oregon provides clear and legitimized avenues for local participation into management of watersheds but has also chosen certain aspects over which to assert administrative state authority. A program administrator at the DRC discussed this style in the following quote:

"Oregon has a general spirit in the last 20 years starting with the plan for salmon and watersheds that establish[ed] the Oregon…Watershed Councils. That part of the Oregon way is this locally-based collaborative type. So I think philosophically the state really supports local efforts in watershed groups and things like that. But I think when it comes down to actually changing a water right or doing something with water law, the state is pretty clear on its authority and its statute and rules"

This diffuse blend of local participation and state control is present throughout Oregon's administration of instream flow rights. Each instream mechanism outlined above can be initiated and facilitated at a local level, however each avenue remains subject to the "no injury" and "enlargement" regulations outlined and enforced by the state. Similarly, the state of Oregon actively pursues forfeiture of unused water rights thus motivating use of instream mechanisms locally.[71] In the Deschutes basin, top down state management and local community management consistently limit irrigation efforts to the benefit of streamflow restoration efforts.

Administratively driven conservation efforts in Oregon are prevalent at the statewide, watershed, and local level. Integral to the story of the state and local

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[71] The pursuit of forfeiture indicates an elevated level of enforcement not undertaken by IDWR in the state of Idaho.

management on the Deschutes is the establishment of the groundwater mitigation program. In January 1998, OWRD closed the Deschutes basin to further appropriation and established a mitigation program that has become a catalyst for significant instream flow restoration. This legal finding was based on groundwater appropriation causing interconnected surface flows to drop below mandated levels established through a scenic waterway designation at the state level. A regulatory minimum ground water level was established as a water management standard to be met by all future groundwater appropriators. New appropriators of groundwater within the basin are to meet this standard through the purchase of mitigation credits. Such credits are created by a "mitigation bank" through the purchase of instream leases of senior water rights by DRC. A representative of ODWR attributes the widespread instream flow program adoption of Oregon's mitigation program:

> "Well I think that mitigation program made this program probably successful because there's basically a gun to your head. If you want new water rights, which cities and municipalities have to have, because they're required to grow, and Facebook and other huge corporations that are coming to Central Oregon, they have to take part in this program. So it's kind of an outside money and inside money forced program for in-stream flows. And so, for central Oregon to continue growing, and to move forward, we have to put water in-stream. So that's kind of what's forced this program to be successful."

In response to this aggressive state mandate, localities were able to self-organize and significantly offset development through the use of instream flow mechanisms. This prioritizes the regional hydrologic environment over economic drivers through mandatory offsets established legislatively and implemented administratively. This aggressive regulatory mandate created through the mitigation program arose from local community concerns over hydrologic degradation and was reciprocated

legislatively. This collaborative effort between local entities and the state has prioritized instream uses as the primary standard to be met when appropriating water the Deschutes basin.

While Oregon provides an example of a diffuse blend between local community participation and top down regulation, it is important to understand how stakeholder dynamics function socially and politically. Effective top-down conservation efforts must be compatible with local conservation perspectives in order to gain broad societal support. 3rd parties non-profits provide a vehicle for conservation values of a community to be expressed politically. An integral 3rd party at the local level is the Deschutes River Conservancy (DRC). Originally formed through a coalition of tribes, the Environmental Defense Fund, and irrigation districts the goal of the DRC is to restore streamflow and enhance water quality in the Deschutes River Basin.[72] In 1996, DRC received a congressional appropriation that allowed a significant amount of funding to flow into the basin for the explicit purposes of streamflow restoration. Shortly thereafter, in the early 2000's the Oregon Watershed Enhancement Board directed a portion of state lottery proceeds through to the DRC as well citing its proven track record. Established locally but supported at the state legislative level, the DRC wields tremendous political capital within the basin.

While the water master facilitates water agreements within the letter of the law, DRC acts as a table for a variety of interests within the basin to develop consensus around varying approaches and projects that are available to them. A program director at DRC described their typical integrated approach:

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[72] Personal communication with O4

"We've done a lot of planning as a basin in the last five plus years where all the stakeholders are around the table even beyond our board, but literally like 50 people. We actually just finished a reclamation basin study that the idea was to actually evaluate and identify the most promising projects. So everybody's at that table and then the idea would be that there would be a fair amount of consensus in where to go from there. Like, which projects, which districts, which approaches. Everybody was interested."

DRC finds itself in a role of facilitating collaboration and mediating and differing perspectives to form a consensus. By acting as an intermediary, basin interests can move through the administrative instream process as a united front by building consensus. In addition, DRC is capable of pursuing individual contractual agreements that do not go through the state processes. This increases flexibility, independent of the regulation based water management system, and has allowed DRC to utilize Oregon's instream flow mechanisms in unprecedented ways. For instance, DRC has acted as a vehicle to apply public funds to efficiency improvements for irrigators within the basin. In this arrangement, public money is used to upgrade individual irrigators canal systems with all conserved water being dedicated to instream flow, creating a situation in which all parties benefit. Acting in such a way DRC becomes a critical "bridge" between public interests and water administration through the development of consensus.

A common narrative throughout the basin appears to be of cooperation and collaboration throughout multiple levels of governance. For instance, conserved water from efficiency improvements using public funds incorporates all relevant levels of governance.[73] Funding must be provided at the state, federal, and industry level, regulatory flexibility must occur within state water administration, a third party NGO

[73] Which comprises about 95% of the instream flow restoration across the Deschutes

facilitates, irrigation districts must agree to installation[74], and the individual water right holder must collaborate. Interview participants presented a consensus surrounding the necessity of this nested governance scheme in successful streamflow restoration. Each participant spoke highly of state control, local efforts, and irrigator willingness. One ODWR administrator described the available institutional mechanisms and the importance of local participation:

> "[W]e call it tools in the toolbox. And yeah, I mean, so depending on what someone's individual needs are, we usually have a program or a way to get there … So yeah, it was hugely successful in the beginning. Mainly because the environmental community was so active in this basin. I mean, we have the Deschutes River Conservancy downtown, a couple blocks away, who, that's their goal. And we had Water Trust here. We had a lot of organizations working on this."

Oregon's water administration is able to provide the capacity to create instream flow at the community level through flexibility. Oregon's instream flow laws incentivize wider participation in streamflow restoration by making the "Tools in the Toolbox" broadly relevant and accessible to a diverse stakeholder base.

Most administrators believed that the flexibility of Oregon's institution allowed for more robust instream flow use throughout the Deschutes basin. A state administrator described the flexibility of water administration as an attempt to work with the variability of dynamic hydrologic systems:

> "They'd see the in-stream flow was down one half of one percent for 30 minutes, and would call me. And I'd say, "Hey, we go off of mean daily flows, that's unrealistic to expect the system, I mean, we're running the Deschutes system tighter than a municipality runs a city system. And the Deschutes is a natural river." Well, somewhat natural. But anyways, there was a lot of push back and forth between the environmental community saying, "Hey, we're paying a lot of money for this." And I'm saying, "Well yeah, I didn't hear you [complaining] when I had double the in-stream flow in the other day." Those kind of arguments would go back and forth. But we're finding a way to

[74] Especially pertinent in light of the Fort Vannoy decision that established that irrigation districts have ultimate say over the use of water.

make it work. And I think it's extremely successful. Like I said, we're within probably one percent of the flows. And if you take the in-stream flows from a duty standpoint, a lump sum of water, we always far exceed what's required to be in there by law."

This description further exemplifies not only the attention and effort required administratively, but also the character of administration as receptive to local efforts. Active stream monitoring and enforcement allows for increased plasticity of water resource management to satisfy the variety of interests in the Deschutes basin. Though all parties spoke of Oregon's institution as flexible, NGO groups felt they needed more on-the-ground flexibility to move water in direct response to river fluctuations. Institutionally, the instream flow laws in Oregon's Deschutes basin have grown to mirror both the variability and sense of place of this politically progressive state.

Idaho

In selecting interview participants for Idaho, I relied on the observed relationship between water administration, state officials, and local entities represented by third parties. My interview participants included a water administrator specializing in instream flows in the Salmon, ID field office of IDWR, a representative from the Lemhi Regional Land Trust, and a state representative from the Office of Species Conservation (OSC) housed under the governor. The IDWR administrator and the land trust representative both live and work in the Lemhi basin while the OSC representative acts as a conduit of information directly to the governor. All participants knew each other personally and speak fondly of their relationship to the state regulators and irrigators alike. This sample of three interview participants was

intended to further investigate the social and political dynamic between local entities, water managers and state ESA compliance officials.

All participants discussed the importance of the minimum stream flow right in the Lemhi River to the institutional structure of the basin. This minimum streamflow right was legislated in 2002 following a dewatering incident at the L6 diversion point.[75] The National Oceanic and Atmospheric Administration (NOAA) threatened legal action at both local and state levels that coalesced consensus among community members and legislators. An IDWR administrator described the creation of this right in the following quote:

> "NOAA was threatening to enact signs against the irrigators, so it just brought the local community together to essentially work with the local legislators to try to come up with the solution, and this is what they came up with. They legislated this minimum streamflow, and the reason it's different from at least any other minimum streamflow in the upper Salmon is because the board was asked to do this by the Legislature"

As a collaboration between local irrigators, legislators, and the Idaho water Resource Board, the minimum stream flow is a direct legislative measure in response to federal coercion. The state brought forward specific minimum stream flow legislation that established target flow levels of 35 CFS for 80% of the first 100 days of the irrigation season[76] followed by 25 CFS for the remainder of the year. While this minimum streamflow right is legally junior to much of the irrigation-based rights in this watershed, interview participants consider the enforcement strength of this right to exist mainly in a cultural imperative that is collectively agreed upon in the region. What followed on the local level is an enormous collaborative effort in implementation that

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[75] This is the same incident in which 3 juvenile ESA listed Chinook were found dead.
[76] March 15th to November 15th

all sources referenced as absolutely instrumental to streamflow restoration in the Lemhi.

An extraordinary array of stakeholders has emerged in the Lemhi Basin in response to initial federal regulation under the ESA. The BLM and Forest Service own land while NOAA is responsible for ESA oversight of the Chinook Salmon in the watershed. Idaho Department of Water Resources, the Office of Species Conservation, Idaho Attorneys General, and Idaho Fish and Game manage various state interests. While private entities include over 320 private landowners, the Lemhi Regional Land Trust, TNC, and Trout Unlimited. Significant funding sources include Bonneville Power Administration and Pacific Salmon Recovery Fund. Representatives from each of these entities meet monthly on a technical team comprised of over 20 individuals. When asked what distinguished the Lemhi, one non-profit administrator described the social foundation of the technical team:

> "It's not just the Lemhi individually. It's the whole upper Salmon basin and that's just mostly the group of folks who are working on it. I mean, it's honestly because we all live in Salmon. We all have kids in first or second grade. We all know each other. Everybody. There's like a group of, I don't know, 20 really core folks who just do all of the project work and then we meet once a month. We have a really strong technical team meeting. We choose projects. Everybody is super informed. It's a really tight and well-defined group. Everyone is willing to help everybody else out. Nobody has any ownership over ... oh this is a land trust project. It's not absolutely doesn't exist…"

This description of a well-defined, highly knowledgeable group portrays a sense of communal responsibility to the goal of restoring flows within the Lemhi. This communal responsibility manifests itself as a stewardship ethic that motivates collaboration and compromise between local entities within the community. Once together, mutually agreed upon strategies can be clearly communicated to state administrators and legislators. Though this local watershed technical team steers

instream flow restoration through the building of consensus, nearly all transactions and legal mechanisms must go through the state of Idaho and the Idaho Water Resource Board.

Each interview participant praised the state's continued cooperation and support of the technical team in the Lemhi. In fact, a Lemhi Regional Land Trust representative was unable to provide an instance when the state acted as an impediment to stream flow restoration within the basin. A representative of IDWR emphasized their active pursuit of conservation easements with senior rights as thorough and well known throughout the basin:

> "We have actually a very limited number of water right holders. They have to be senior as well. We can't really do these deals with junior water right holders. Yeah. Well, they wouldn't be in priority long enough to get us anywhere, so we only work with senior water users only within a pretty short reach right above our quantification point at L5. The list is not long, honestly… At this point, unless somebody new comes in, we've talked to everybody. Everybody knows that we're buying water. They know what we're paying for it. The water master is always checking in with these various parties to see if they've changed their mind."

The state has not only removed institutional barriers that were present to instream flow restoration, but also has worked tirelessly in meeting their minimum stream flow requirement. The small population of senior water right holders provides and opportunity for water conservation as communally aware and supportive of the state's water management objectives. IDWR and OSC use this "limited geography" attribute to their advantage in implementing instream flow efforts. Administrative and state efforts are well known in the Lemhi where conservation is a politically popular objective. The tool most often used to achieve the goal of minimum stream flow is the conservation easement. Of the mandated average of 25 CFS that must be in the river

throughout the irrigation season, almost 17 CFS is annually guaranteed through permanent subordination agreements in the fulfillment of conservation easements. Each year, the collaborative technical team assists IDWR in procuring the additional 8 CFS through other short-term novel solutions.[77]

Administrative conservation programs resonate within the Lemhi because they work within the context of the basin both geographically and socially. The Lemhi community is built around a distinct social identity that is common within the basin and the American West at large. The Lemhi community is small yet strong, and fosters a sense of egalitarian interdependence and individualism that arises from the American frontier way of life (Capurso, 2011). In discussing the process of establishing easements, an IDWR administrator emphasized the stakeholder's ability to initiate the transaction:

> "We did have one landowner recently decide that he did want to participate in the program. He's got a little over one CFS, but honestly we're just kind of ... They know we're here and we're waiting and we're willing to pay. We can't necessarily get the money immediately, but we were able to eventually round up the funds to buy these permanent deals."

Conservation easements function within this social and geographical context because they reinforce the capacity of the individual to manage their water. In providing an alternative to move water between uses within prior appropriation, easements allow each individual appropriator to choose conservation as a legally recognizable alternative within Idaho water management. This further contributes to the rugged frontier individualistic sentiment by increasing the capacity of individual

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[77] These include source switching, or changing the point of diversion so that instream water flows into the intended reach.

appropriators to proactively control their own future in the face of more stringent top down ESA regulation. In this way the Lemhi has become an example of proactive community-based efforts to manage instream flows.[78]

Among the most cited factors in why collaborative effort took root in the Lemhi was how the geography impacts regional culture. A state administrator described the banded geography of the Lemhi:

"Everybody settled on the arable land and then after settlement was basically done, the Forest Service came in early and acted prior to the BLM. So the higher elevation stuff came in under the enactment of the Forest Service."

This topography provides the ideal terrain for cow-calf operations to flourish next to public land. The combination of a ranching focused economy with a resourced based commons consisting of American public lands has helped knit the regional community together. Referring to the origin of this regional sense of place one OSC administrator discussed their system of gravity fed irrigation ditches:

"You had to get yours and your neighbor had to get his too, and so now if you were to try to unwind this big tangle you'd never be able to get easements across multiple land owners to run a ditch five miles to your place. But yet you see those kind of situations fairly frequently in the Lemhi."

This spirit of cooperation is pervasive in regional culture and was repeatedly cited as the social context under which senior water rights agree to conservation easements. This combination of culture and geography provided the basis for a unique inter-dependence to form in the face of geographical isolation.

By fostering a common respect for natural systems, ranching culture has translated well to streamflow restoration for salmon in the Lemhi. A representative for

[78] Personal Communication I2

the Lemhi Regional Land Trust, described process of collaborative efforts with landowners through the following description:

"I mean, we have vetted the project all the way through and we're all group deciding what tributary we're going to do. Hey, this landowner came in and started talking about this project. What do we think? Put this on the back burner or is it a really good one? Whose going to do it? We just all build the budget together with the multiple funding sources and then [the OSC administrator] can take it back to his office and makes it happen with the people who administer those funds. So, it's not really one specific instance. It's just constant. There's never a time when they are aren't supporting"

When faced with federal regulation, all stakeholders within the Lemhi have compromised their own interests in order to meet an ESA standard and develop the capacity to control their own future. As a non-profit organization, The Lemhi Regional Land Trust embodies this societal sentiment that the pastoral ranching landscape of the American West is worth preserving, even at a personal cost. As part of the regional landscape, salmon appear to have been included within this definition of an ideal pastoral environment in the Lemhi. Working through a sense of interdependent personal trust, stakeholders within the basin drive transactions and agreements within the basin through personal compromise. In its translation to Idaho water law, this narrative has allowed the Lemhi to standalone in effective stream conservation efforts.

The unique history and culture of the Lemhi provides opportunities and detriments for achieving salmon conservation objectives. State administrators explicitly mentioned three challenges unique to water allocation culture in the Lemhi. First is the fact that the Lemhi is administered "on decree" instead of "on demand". In other words, whatever amount of CFS you are decreed will be delivered to your head gate. An IDWR illustrated challenges with the following example:

"Say you're in a more conservative system. You went from flood to sprinkler. Say you don't need your full rate of flow. You're irrigating your full acreage but with less

water. Well, that's not really accounted for. Whatever your decree is, is what's delivered to the head gate… We don't have a conserved water statute, so you can be under flood and need four CFS and then go to pivot and need half that, but that remaining two that you're not using, that just goes to junior users. That can't be sold or repackaged or anything like that. Because if you want to go back to flood, you have every right to."

This aspect of allocation is a clear remnant of traditional prior appropriation and is emblematic of the development-oriented history of water use in the Lemhi basin. In other states, a conserved water statute would allow efficiency improvements to bolster stream flows. Under Idaho's water law, however, excess water can't be sold or dedicated to instream uses but rather flows to junior users. While not supportive of streamflow restoration objectives, allowing individuals to retain rights to conserved water is yet another expression of the unique rugged frontier individualism. In essence, bolstering the capacity of an individual to manage their water rights is a pervasive cultural sentiment in the Lemhi Valley and in Idaho at large. The fact that streamflow efforts continue to be successful in the Lemhi is an expression of the way in which individuals within that community have chosen to compromise in the pursuit of conservation objectives.

Another form of this narrative presents itself is in the second challenge to Lemhi restoration. This particular basin is one of two basins in Idaho that allows for high water claims.[79] High water claims allow irrigators to appropriate additional water during peak flows throughout the year above and beyond their initial decreed

[79] The second being Reynolds Creek Watershed in Southwest Idaho

amount.[80] A director of the Upper Salmon region for OSC described high water claims for OSC as a unique cultural remnant:

> "They were historic practices. They went through the Snake River Basin adjudication. The special master allowed them, but then did not grant them specific rights. The language is a little vague but it's a cultural practice that's been preserved… The idea of which was that during high flows in the spring, they would divert water onto their fields early to get early green-up. In some cases, there was a belief that this would charge the aquifer for later in the year… This became a practice that has been ingrained and has stood up to legal tests and is observed currently in the Lemhi. You do not see this in other places"

As a unique aspect to this basin, this attenuates peak flows and makes meeting the minimum stream flow floor more difficult. Though occurring at peak flows, high water claims impede the average discharge that is used to measure and monitor minimum stream flow. In other words, attenuated peak flows means that more water must be accounted for later in the year to achieve the legislated minimum streamflow average. Continuing the observed cultural trend, high water claims grant individual landowners more rights and control over their use of a resource, even beyond traditional institutional structures found broadly in prior appropriation. As a facet to Lemhi water management, these administrative nuances in the Lemhi impede instream flow objectives and further emphasize the tenacious anti-regulation sentiment that arises from frontier individualism.

Finally, Idaho water administration does not pursue water right forfeiture though it is explicitly within their legislated authority.[81] This lack of enforcement causes water to go unused and fails to provide a punitive incentive to utilize instream flow

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[80] This practice originally was intended to accelerate early "green-up" as well as reduce stress on head gates, culverts, ditches and bridges. This has stood up to multiple legal tests and proves to be yet another nuance of Lemhi instream flow.

[81] Idaho Code §42-222

mechanisms, such as the local rental pool, that provide the added incentive of protecting from forfeiture. State representatives and land trust officials spoke of these factors as the main detriments to achieving conservation goals. Without forfeiture as a threat, few incentives exist to utilize instream mechanisms that move water between uses and users in times of shortage. High water claims, administration on-decree, and lack of forfeiture are unique factors to water management in the Lemhi that pose potential problem for the establishment of an instream flow program. Surprisingly, while each factor presents challenges toward successful stream flow conservation it is important to note that all interview participants agreed that conservation efforts continued to flourish. In some way, the sentiment of rugged frontier individualism has also been a key factor in the successful adoption of the instream flow program within this watershed.

While individualistic sentiment is a common pattern, an institutional examination of instream flows within the Lemhi reveals that no entity functions in isolation. All participants function in well-defined groups that represent a diverse array of distinct local interests. Federal coercion was the initial motivation that drove the instream flow program. The desire to preserve the regional identity through cooperation and a sense of place has now seems to be the primary motivating factor of the area. When asked what drove conservation efforts, an Land Trust official elaborated on this the collaboration and compromise:

“Everyone is like, "Oh my God, how do we fix this?" Ranchers, agencies, nobody is like, "Keep it dry." Everybody is like, "What can I do to help out?" So, it was definitely being talked about“

Collaborative local efforts that drive instream flow projects and facilitate conservation objectives have become the very identity that is central to the Lemhi Valley. Though the Idaho Water Resource Board holds absolute authority and discretion over local entities, individuals are capable of exercising their own volition through institutional mechanisms of conservation easements. The state has been unfailingly receptive to conservation efforts within this particular watershed. Conflict within water administration appears to be scarce as state regulators continually proved uniquely adaptable to local input. The Lemhi basin is not politically significant in and of itself. With the addition of federal regulation under the ESA, this basin saw a tremendous rise in political capital and moved to establish of a place-based system of nested governance.

Conclusion

Through my expert interview analysis and the addition of administrator perspective, my modified research proposition as well as my categorical classifications has been vetted against my observations. The social elements that underlie instream flow governance appear to be rooted in the structural relationship between local entities and governing bodies. Drawing from our three case study locations, this relationship is most productive when it occurs in an environment that has already experienced loss of resource value due to over-allocation of its water resources. This is the case with both Oregon and Idaho's active instream flow programs that address well-known basins which are functionally closed to further appropriation. Alaska has struggled to find administrative or legislative motivation to set aside water resources,

as it is a landscape that has yet to fully experience landscape-scale degradation in the form of over-allocation.[82] Instream flow laws and the administrative programs they produce are fundamentally designed around addressing water conflicts that are driven by scarcity.

In understanding the role of non-profit organizations within each institution, my 3rd party category has grown to focus more broadly on collaborative relationships between appropriators, local entities, and administrative officials. My modified research proposition focused exclusively on organizations and their capacities within the system. States that have a higher incidence of streamflow restoration activity are characterized by reciprocal relationships in which local efforts are recognized at the legislative and administrative levels. Specifically, the rental pool and minimum stream flow in the Lemhi and the mitigation program and conserved water efforts on the Deschutes provide examples of legislative accommodation of local perspectives. Within water administration, both IDWR and ODWR actively pursued conservation objectives and supported local efforts that established instream flows. In contrast, Alaska has introduced legislation that is openly hostile to instream flow interests and has acted administratively to impede the conservation efforts of local entities.[83] Local perspectives and efforts at management must be enshrined in legislation or administrative policy in order to substantially contribute to broader institutional change.

In describing important pillars of this relationship, administrators from Oregon and Idaho spoke readily of the importance of building consensus between stakeholders

[82] Despite the threat being abundantly present
[83] House Bill 77

before pursuing conservation action. Institutions that minimized opposition to instream flows were able to do so through stakeholder conflict resolution and compromise facilitated by a local entity. Consensus, often catalyzed around a critical incident of resource degradation, has allowed the basin to present a unified front and implement clear and concise action through chosen administrative channels. Alaska's Iliamna region lacked consensus, which caused lengthy bureaucratic and legal delays that exacerbated conflict and further separated interests. Stakeholder consensus appears to arise from functional collaborations and a loss of value tied to resource degradation.

Through collaboration, the Lemhi and Little Deschutes basins have coordinated a basin wide consensus that has brought about an increase in social capital. Collaborative conservation action has been observed to be part of the regional identity in both Oregon and Idaho. These collaborative instream flow efforts were commonly framed by personal investment in the instream flow process as contributing to a regional sense of place. Areas of significant flow restoration activity are characterized by stakeholder willingness to make sacrifices for the betterment of a regional conservation identity. When asked what brought people together in the Lemhi an Idaho non-profit administrator answered:

"Mostly just everybody working together, I guess, [its] kind of a cultural sense. Everyone who lives here just likes Salmon. I grew up here. My husband grew up here. Everybody likes it and wants to make it better. It's just kind of everything together I'd say"

This sentiment of collaboration has proven to be a driver of effective salmon conservation and in doing so it has drawn the attention of federal and private funding entities alike. Successful multi-level collaborations have drawn further attention and funding opportunities for the Lemhi and Deschutes basins. In a society that values

salmon conservation, a plausible element of effective institutions may be their ability to draw attention and publicity that brings about an increase in social capital that is evident in the availability of public and private funding opportunities.

From its inclusion in my initial five categories flexibility has grown to be central in my refined research proposition. Flexibility, as it pertains to instream flows, is defined as the ability of the water allocation institution to continually accommodate new instream flow uses into previously existing institutional structures. Regulatory structures that were able to accommodate varied stakeholder perspectives within a basin showed a flexibility that accurately reflected crucial social nuances of water institutions. In Oregon, flexibility manifests itself as the multitude of "tools in the toolbox", or the variety of ways stakeholders can meet their needs through existing regulations. In Idaho, flexibility has come in the form of continued and reliable state accommodation of local interests, both legislatively and administratively. Alaska is unique in its lack of flexibility; its institutional structure dictated the narrow channel and capacity that instream rights function within. Furthermore, an institution must be flexible enough to allow a diverse stakeholder base to collaborate with one another. For this reason, flexible institutions for instream flows in this study have exhibited a tendency to be facilitated from the bottom up. In other words, through flexibility individuals and local entities are empowered to pursue their abilities and utilize instream flow institutions to meet their conservation objectives.

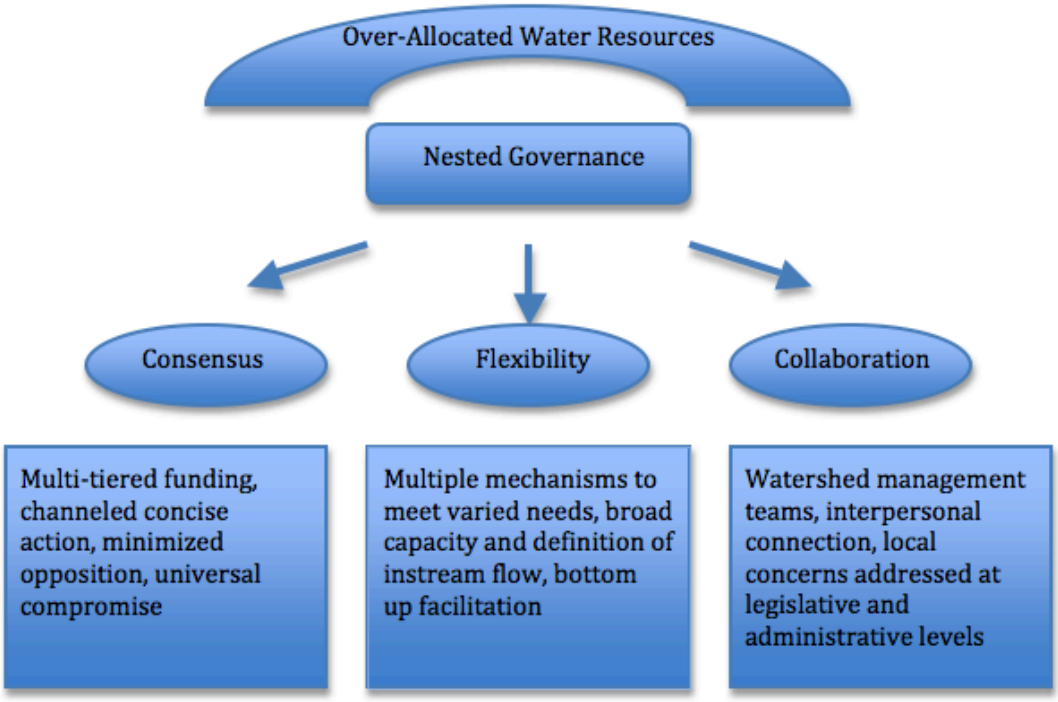
Flexibility allows various interests to collaborate and form consensus. Over time this consensus, or communal agreement between interests, can translate into a regional identity and sense of place. In this study, I observed a sense of place that formed around

a multilevel nested governance structure and created regional conservation-oriented communities. This relationship between collaboration, consensus, and flexibility becomes the foundation of my core category, nested governance. Nested governance is a multi-layered system of governance in which essential regulatory functions, such as establishment and enforcement of rules, are shared between multiple interconnected levels (Ostrom, 2000). For this case study, nested governance describes the general relationship in which the state allows essential elements of the water allocation institution to be delegated to local entities such as non-profits and individuals. Institutions that allowed local perspectives to influence creation of legislation or administrative policy exhibited this definition of flexibility. Furthermore, It has been shown that "complex, nested governance systems operating at multiple levels can effectively govern similarly complex ecological systems at multiple scales," (Janssen, 2006). The very act of creating an instream flow program establishes a channel for the actions of an individual to affect regional water allocation. Instream flow programs that have achieved higher levels of streamflow restoration seem to have done so through the establishment of nested governance. Under nested governance, members of a community can collaborate to manage entire watersheds through administratively approved means. Through my analysis the concept of nested governance has become central to my theory of what makes certain institutions more effective than others.

My refined research proposition is: *a nested governance structure that addresses over-allocation by promoting flexibility, collaboration, and multi-level consensus leads to an effective instream flow institution*. This refined proposition is meant to be reflective of reciprocity observed between localities and the state in instream flow institutions

that are effective in achieving conservation objectives. By synthesizing my data collection and analysis process with the establishment of a core category, my refined research proposition marks the end of the data collection stage.

Figure 6.1: Refined Research Proposition Model



Chapter Seven:
Results

In this final theoretical stage, I conclude my data collection and describe general patterns and possible explanations for my observations. I apply the definition of effectiveness derived from the literature to my case studies and postulate what social and political elements may best explain my results. I then analyze how the process of institutional evolution may be occurring in the development and adoption of instream flows laws.

Ranking of Effectiveness

To classify my case study locations, I utilized the definition of effective institutions to describe the observations made in the selective coding stage. Institutions for instream flows that are effective in achieving conservation objectives have been observed to exhibit 1) *actual administrative recognition and enforcement 2) instream property rights equitable with consumptive uses 3) large quantity of senior priority dates.* The presence on these three elements is an indicator of a governance structure that exhibits the intention to conserve of Pacific Salmon. Through this understanding, I study each institution through the design of their instream flow laws at the local level and create a hierarchy of effectiveness.

Alaska

By the established standard of effective institutions, Alaska's instream flow law is interpreted as ineffective at achieving salmon conservation objectives. At first glance, private instream water rights appear to be a solution through privatization

incorporated at the onset of watershed development. This interpretation, however, is consistently foiled by a lack of collaboration both legislatively and administratively with instream flow reservations. The inability to defend an instream property right and general inequity with consumptive rights from development has undermined the bulk of instream flow legislative efforts. Instream reservations function more as elaborate comment mechanisms than actual legal assurances of instream flow. This instream flow administration has acted deliberately to deter instream conservation efforts. This lack of motivation to achieve conservation objectives appears to be born out of Alaska's distaste for regulation and the politicization of the landscape and its natural resources therein.

American natural resource regulatory regimes, finely tuned to the scale and culture of the coterminous lower 48, were structured in such a way that tension was inevitable in "settling" our 49th state (Haycox 2016). The Alaskan landscape is unique among its coterminous counterparts both in its massive undeveloped scale and its surfeit of natural resource potential. Unlike other western states, less than 1% of waterways in Alaska have appropriations or recorded stream flow data (USFW, 2015). Examples of specific place-based governance for Alaskan land and resources exists, reinforcing the idea that the land itself requires unique statutory consideration under the American legal system. Specifically, natural resource regulatory regimes that govern Alaska reflect legislative intent to approach Alaskan resource management in a unique way.[84] Prior appropriation, however, was adopted in Alaska and remains relatively unchanged as it continues to face unique administrative challenges in its application to

[84] The Alaska Native Claims Settlement Act, Alaska National Interest Lands Conservation Act, and the ongoing Supreme Court case Sturgeon V. Frost

the landscape. Among these challenges is the implementation of conservation-based laws while both prior appropriation and Alaska's own economy exhibit a bias toward resource development. Containing both the largest developed oil deposit in hemisphere and the most extensive network of conservation units, the state of Alaska is forced to reconcile complex and competing interests in natural resource management (Busenberg, 2013).

The adoption of the doctrine of prior appropriation in Alaska transported a legal regime that was designed to handle the aridity of the Western United States to foreign territory. As a water allocation institution, it retains its fundamental structure and lacks any precedent or tools to overcome the challenges posed by an undeveloped and inhabited wilderness. Likewise, instream flow laws, that have originated to solve issues of well-populated and over-allocated basins, have found little purchase among Alaskan hydrologic system management. This study finds that the very structure of the Alaskan instream flow laws has proven to be weak in achieving conservation objectives. This can be attributed to a lack of political will for conservation within the state. Driven by a largely intact natural environment, Alaskan conservation sentiment functions preemptively. An Alaskan administrator at ADNR discussed private instream flows as reactionary to development:

> "I don't see them using it at this point. Most of the stuff, most of the rivers and streams that you see private industries going after or private groups, whoever it may be, tend to be in areas that are more contentious. They generally tend to have coal mines or like pebble mine area or areas where there's gonna be industry coming in and causing some sort of issues that they have with. And that's where we're getting a lot of these private applications for… Yeah, other states are struggling to buy back water and whatnot, so I think we're trying to be proactive as opposed to retroactive, most of the lower 48 is involved with."

Though a tool to express a societal value for intact water resources, private instream flow rights are used solely in reaction to resource threats within the state. Noticeable resource degradation is comparatively absent within the state, so it logically follows that the need for instream flow restoration is equally as elusive. The Alaskan economy finds itself to be vulnerable due in part to isolation and its dependence on natural resource development. Hostile state rhetoric and legislative efforts has made it abundantly clear that it finds little economic advantage in environmental regulations that disincentive economic development. Instream flow efforts in Alaska are another casualty of misplaced natural resource institutions that are not constructed to deal with the actual problems at hand in a particular landscape. Simply put, the instream flow institution in Alaska is designed to be ineffective at achieving conservation objectives because that state doesn't see conservation as a political priority.

Oregon

Within my case study, Oregon's instream flow institution has proven to be effective at achieving conservation objectives. The Beaver state has repeatedly exhibited all three of my metrics for effective institutions. The focus of my analysis shifted away from permanent transfers and toward the variety of mechanisms or "tools in the toolbox" available to local conservation-oriented entities. This study finds that Oregon has effectively implemented nested governance through their administrative and legislative flexibility. This flexibility has allowed local collaboration and consensus a space in place-based watershed governance.

One non-profit administrator in Oregon attributed the drive to achieve conservation objectives through collaboration and consensus to Oregon's politics:

"I think Oregon, we had a history, maybe it was the leadership or some of the politicians at the time, and the governance, some of the congressional representatives, and senators that … might have been Republican, but understood also that Oregon wanted to steward its resources. So there's been a progressive theme I think for a long time in Oregon around natural resources and community-based solutions that might have contributed to that. Then we did pass in 1987 the Instream Water Rights Act that enabled the tools that you're talking about now"

This description makes it clear that beyond political affiliation, the citizenry of Oregon have long since supported conservation efforts and the institution has responded appropriately by bringing their values into law. The Deschutes is optimally positioned to take advantage of this progressive conservation theme. Flowing through Bend and acting as "Portland's playground"[85], the Deschutes has some of the most thorough conservation efforts that reflect the states value set. This politically progressive theme is consistent in Oregon Supreme Court decisions as well as water administration.

Judicially, the 2008 Fort Vannoy Decision was a landmark water law case that empowered local irrigation districts over individual patrons. The Supreme Court of Oregon held that local irrigation districts, which were named as water right's holder, have ultimate say as to the use of the right (De Muniz, 2008). Irrigation districts, as cooperatives that are self-governing, can be seen as a type of irrigators union. This has created mixed outcomes for instream flows, but ultimately has opened the door for collaborative management of water at the regional level rather than with each

[85] Personal communication with O2

individual at the local level.[86] The Fort Vannoy decision is emblematic of Oregon's outlook on water management in that it further establishes the ability of governance to adapt and implement solutions at multiple interconnected levels. By furthering the capacities of water management at the regional level, Oregon has deepened its commitment to its diffuse and shared control of the states water resources through nested governance.

Administratively, Oregon has continued to make unprecedented moves beyond the Deschutes river basin. The Walla Walla Watershed, split between Southeastern Washington and Northeastern Oregon, has grown to become a collaborative reexamination of the prior appropriation system. Through legislative authority from Oregon and Washington, the Walla Walla Watershed Management Partnership established a "unique local governance structure" including both state administrative bodies along with the collaborative participation of basin stakeholders (WWWMP, 2018).[87] A DRC administrator discussed how Walla Walla provides an example for future management of the Deschutes basin:

> "I think the one exception would be the Walla Walla Basin convinced the state to let them suspend the whole prior appropriation framework and figure out their own way ... they have a little more leeway to try, maybe that's an over exaggeration... Yeah, and that's something that we talked about in the Deschutes, if we can get everybody on the same page, could we get a little more flexibility from the state. There's a lot of fear on the part of interest groups of precedent setting of things that might not work in their parts of the state. But philosophically I think that administratively they are still pretty bound to their rules."

In this description, both consensus and flexibility were mentioned as avenues to increase local place-based watershed management. As an experiment, this Walla Walla

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[86] For instance, Irrigation districts may now block permanent transfer to instream flow but they may also collectively bargain and collaborate with conservation interests.
[87] Initially established in Washington state house bill 1580 and codified in RCW 90.92

partnership has set a new standard of local resource control and further evolved the concept of nested governance. Oregon's instream flow institution has exhibited unprecedented flexibility when it allowed water rights administration and instream flow establishment to be delegated to an inter-state collaborative partnership of stakeholders. While Oregon continues to retain aspects of their water resource authority, the state has repeatedly demonstrated respect for the perspectives of local water management efforts. The Walla Walla basin provides another example of nested governance as Oregon continues to emphasize flexibility and place-based watershed management.

Oregon's water administration has consistently exhibited a willingness to allow governance at multiple levels and supply unique solutions to instream flow problems. In many ways, this is unsurprising when examined in the light of the state's politically progressive and environmental reputation. The flexibility of the water administration seems to arise out of an institutional desire to solve the instream flow problem at hand. Historically, Oregon's resource extraction industry was a primary driver of the state, however, a cultural shift toward amenity migration and a broader environmental identity are now present in legislative, judicial, and administrative efforts. Oregon's instream flow institution is effective because it is politically favorable. The water master for the Deschutes basin theorized as to why instream flow has been so successful in the region:

"Well, I think, I think there was a couple things going on. One, the DRC parked themselves right in town here, and their mission was to fix the Deschutes River. So there was this very sharp focus on the Deschutes, and everyone knew where the problem areas were. The other thing is, I mean, it's Bend. We're Portland's playground. So people here care about stuff environmentally that they don't care in other areas of the state. We just have a weird makeup here of the population, and finances, and things

like that. I mean, you'd never see someone spending a million bucks to put a CFS into the Malheur River. But, that's not uncommon here."

Oregon's instream flow success can be attributed to a political backing that fundamentally supports a progressive instream flow institution. Conservation mechanisms are designed to be widely accessible and receive continued administrative and legislative backing. These collaborative efforts capitalize on the regional consensus that conservation is part of Oregon's identity.

Idaho

My case study of the Lemhi Valley in Idaho has demonstrated a moderately effective state water management institution. In a state with significant administrative oversight and control, Idaho has achieved actual administrative recognition and enforcement as well as a channel for instream rights to utilize senior priority dates within this particular basin. Even through the fostering of local collaborations, this system still will not provide instream water rights that have legal protections equivalent to their consumptive counterparts. Within the Lemhi system local efforts have been legitimized through legislative action and administrative support through the use of conservation easements. Such an effective conservation history, however, is not readily apparent in the remainder of the state.

Though the Lemhi is a stream flow restoration success story by many metrics, it is an anomaly within the state of Idaho. Idaho has earned the reputation of demonstrating hostility toward conservation efforts, particularly those focused on salmon conservation. This history is characterized by anti-statist sentiment spurred on

by federal regulation. Such sentiment is evident in Idaho's hostility in the Federal Energy Regulatory Commission Dam relicensing for the Hell's Canyon complex.[88] Throughout other parts of state water management, conservation sentiment only arises when judicial or federal coercion forces that state's hand. The Lemhi basin acts as a counterpoint to this broader state tren. This can be attributed to administrative accommodation of local efforts that play into a common narrative among rural Idahoans.

Individuals within the Lemhi basin are connected by the identity of rugged frontier individualism. This sentiment functions as a bridging element that creates strong relationships within the community through a sense of place. In describing the community centric nature of the Lemhi Valley, a head of the irrigation district said:

> "Unlike highly populated areas where people come and go, the majority of community members in rural Lemhi Valley tend to stay, so it would be unwise for them to burn their bridges."[89]

Participation in this community further builds trust among individuals. Local member of administrative agencies who live and work within the basin are able to utilize this trust in joining the collaborative technical team (Capurso, 2011). This unique community based sense of place within the Lemhi acts to connect individual to local state administrators through a sense of mutual trust and self-reliance. Local participation in nested governance within the Lemhi furthers the capacity of an individual within the system. As an individual gains the ability to participate in governance efforts, he or she gains further control over their lives and property. This

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[88] The Hell's Canyon Dams physically bridge the Snake River between Oregon and Idaho. The FERC conflict sparked conflict with Oregon's conservation-oriented mindset, as Idaho doesn't want Salmon regulations affecting their use of the Upper Snake basin.
[89] Personal Communication from the dissertation- Capurso, 2011

chain of events leads to a situation that plays into the frontier individualism sentiment pervasive throughout rural Idaho.

Successful instream flow rights and local governance efforts within the Lemhi can be seen as an experiment that Idaho was forced to undertake. An IDWR administrator described how the ESA listing of Salmon became a catalyst for conservation in the Lemhi,

> "It wasn't until that dewatering incident, and then there was [the threat of] "take", that things really started to gear up. That was more than five or six years after the listing… Yeah. A pretty visual event where you could walk out, see these dead fish, these dead ESA-listed fish and go, "Okay. We better figure something out here with that." And then NOAA threatening to find people was obviously the instigator of all the work that then started"

The dewatering incident above L6 provided the catalyst for individual interests to come together and compromise in order to solve the issue at hand. Local ranchers, who are well connected to their local resources, capitalized on their established community and provided the political will necessary through the establishment of the Lemhi Regional Land Trust. The threat of punitive federal measures forced uncooperative parties, including the state, to collaborate in order to solve the existing water quantity conflicts. Interview participants were unanimous in their belief that conservation efforts would have occurred independent of the "take" of Chinook Salmon, but cited the incident as a majorly significant catalytic event. Though motivation is lacking in the rest of the state, Idaho has established a template on which to build an effective institution for instream flows if it chooses to pursue conservation action more generally.

Institutional Evolution

In resource use, individuals often do not act to change an institution until it becomes obvious that the current working rules no longer lead to desired on the ground outcomes (Long, 2008). Similar to other resource conflicts in the West, my data shows that preservation of waterways follows a curve in which conservation measures will not arise until severe degradation has taken place (White, 1996; Reisner, 1993). The desire for instream flow conservation is rooted in an individual's interaction with particularized water resources that have lost their value over time. The institutional structure of prior appropriation is specifically designed for the geography and water systems of the landscape it was created in, the arid American West. Instream flow laws are likewise structured to address the streamflow problems encountered in an arid and over-allocated landscape. If flow protections work by allowing societal value to protect water instream, then my results indicate that more populated regions with higher levels of over-allocation experience an elevated incidence of instream flow laws that achieve salmon conservation objectives.

Water rights to secure instream flow are not inherently compatible with the doctrine of prior appropriation and their state-by-state implementation allows us to observe variable institutional structures. As institutions, the regulatory regimes guiding instream flow act as expression of collective societal value. Using this perspective, I understand each of these states as undergoing its own distinct institutional evolution toward conservation-oriented instream flow policy. In this transition toward an prior appropriation institution that values water left instream, each state was observed to be at a different stage of institutional evolution process. For the purposes of this study,

instream flow laws that effectively achieve salmon conservation objectives have been positioned as the end goal of institutional evolution. Therefore, studying the social and political impacts of institutional structures can be used to understand how institutions evolve on the ground. Within this case study, each state institution is undergoing an evolution toward conservation oriented water management through the incorporation of unique mixed governance regimes.

The institutions that have been included in this case study exhibit political motivations that underlie their transition toward conservation-oriented policy. For example, Oregon's effective instream flow law has arisen out of a politically progressive trend that broadly values conservation efforts. This has lead to the sincere administrative and legislative support of an institution that effectively achieves conservation objectives. Idaho's institution, that proved moderately effective at achieving salmon conservation objectives, was established through federal coercion that forced the hand of the state toward collaborating toward conservation objectives. Conveniently, rural Idaho's rugged individualism played into the state's needs and created an island of effective instream restoration in an otherwise development-oriented state. In both Oregon and Idaho, we see clear and consistent examples of legislative accommodation of conservation values that lead to effective salmon conservation. Conservation easements, the rental pool, and mitigation program are all examples of the state altering the working rules of prior appropriation in order to accommodate conservation values. Alaska, as our example of an institution that fails to achieve conservation objectives, exhibits no desire to instill conservation efforts with any political capital that could impede resource development. From these examples,

effective instream flow laws arise from a political system that is willing to legislatively and administratively accommodate the conservation efforts of local entities.

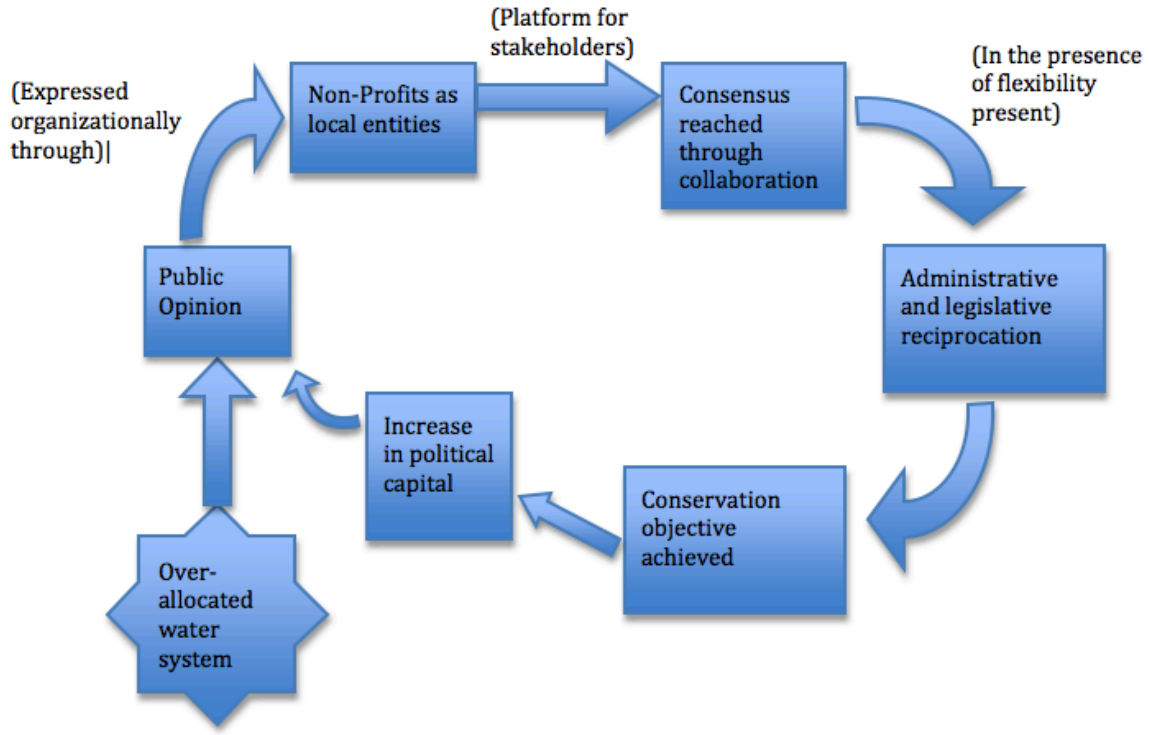
Within this framework, local entities that support conservation sentiment are placed in a role of facilitation. According to the language of §501(c)3 of Internal Revenue Code, public benefit non-profit organizations are granted such a tax-exempt status because they generate a social service that improves the quality of life for communities. The local entities within this study are examples of public benefit non-profits that politically represent the collective will of a community to protect their water resources. In each of my case studies, non-profit organizations were instrumental in facilitating the localized effort to establish instream flows. An ODWR administrator described the facilitation role of DRC:

> "Yeah, they're the driver here. When [The DRC] fired up in 1996, they actually had a congressional appropriation. So they would get, every two years, a big bag of cash to fix the problem here in the Deschutes. And so that was the biggest thing that kicked this thing off, and really got it underway. Well, [the DRC] is way ahead of the game, and so they're very savvy, very smart, know what to do, and are proven to be successful at this. So they're very good at capturing a large portion of that money each year. So we have millions of dollars that come into this basin from the state each year for conservation"

This describes DRC as a conduit of conservation funding that has built capacity to utilize flexible mechanisms of the institution. Non-profit conservation organizations are fundamentally a privatization and consolidation of political will at the community level. The recognition of this political will by the state helps drive institutional change through the building of watershed collaboration and consensus. The process of administrative accommodation and non-profit facilitation can be understood within the workings of a nested governance structure.

This study finds instream flow laws as an iterative and cyclical expression of an institution evolution [see conceptual model]. This process is continually occurring and has been observed to effectively achieve conservation objectives through the implementation of a nested governance framework. Resource degradation, often taking the form of over-allocation, functions as the catalyst that inspires public opinion. Public opinion grows into a political will and is represented organizationally in local entities functioning as non-profit organizations. Non-profit organizations provide a platform around which a diverse stakeholder base can collaborate and discuss avenues for pursuing conservation objectives within the regulatory institution defined by instream flow laws. Through this collaborative effort, stakeholders coalesce and reach consensus around their planned strategy. The institution must provide the flexibility not only so that stakeholders may reach consensus, but also so that state entities may administratively and legislatively accommodate local suggestions. In completion of the cycle a conservation objective is achieved and political capital of basin conservation efforts rises. Elevated political capital can than bring about an increase in funding opportunities for local entities to further advocate for advanced conservation objectives.

Figure 7.1: Institutional Conceptual Model



Applied individually to each of my case study locations, this process offers an explanation as to why I observed a disparity in the effectiveness of achieving conservation objectives. Within Oregon, progressive political motivations have allowed for a flexible instream flow institution to effectively complete this cyclical process multiple times. This is apparent within the Deschutes mitigation and conserved water programs, as well as the statewide transfer and lease mechanisms. Idaho has demonstrated a singular institutional evolution cycle under federal coercion and local cooperation. Outside of the Lemhi, however, the state has shown administrative resistance and even hostility toward similar conservation objectives. Alaska, as our ineffective institution, lacks the occurrence of resource degradation through over-allocation. Though political will for conservation efforts still exists within the state, a failure for local entities to reach consensus with state administrators has arrested

Alaska's institutional evolution cycle. This process reflects the observed nature of the nested governance relationship as it pertains to the effective realization of conservation objectives.

Implications

On the regional watershed level, the results of this study have implications for local power dynamics on the ground. Institutions that are effective at achieving conservation objectives through nested governance have experienced an increase in political capital at the local level. If conservation values are held widely across society, this rise in political capital can lead to more funding opportunities from a variety of private and public sources that support conservation objectives. I observed the nature of this funding to consolidate power within particular non-profit groups. Consolidation of power in local governance essentially privatizes conservation values of a public resource and may crowd out competing conservation organizations. Non-profit organizations must employ collaborative efforts to ensure a fair and even representation of the public trust. While political capital at the local level appears to be growing, the private sector must be careful how it distributes power in nested governing dynamics. Future studies have the opportunity to examine this power consolidation and its potential to create a power disparity among the private sector. Certain mainstream organizations must act benevolently to avoid overwhelming smaller organizations. By allowing certain administrative tasks to be handled locally and within the private sector, nested governance requires additional structure to manage power dynamics at the regional level.

Transitions toward nested governance will help insulate the conservation of water resources from political swings within the state administrative body. A former conservation director for The Nature Conservancy in Alaska discussed issues with instream flow reservations held by other state agencies.

> "So but if the state fish and game holds the reservation, and state DNR decides whether the reservation should be annulled or compromised in some fashion to allow for some development interests, then you can't imagine, they're both under the same governor, you would not expect then fish and game to defend that reservation very strongly."

If the holder of the water right certificate is responsible for monitoring and enforcement, instream flow rights that are established and administered under the same governor offer little protection from development interests. Local instream flow efforts, especially those instilled in legislation, will allow for dispersed watershed management within specific basin that will be independent of state water administration. Legislation, though often slower to react and the outcome of conservation oriented institutional evolution, alters the essence of the law and allows for instream efforts to be instilled into perpetuity. Nested governance efforts accommodated legislatively, offer a new distinguished class of water right that recasts the traditionally centric role of state water administration. Future studies have an opportunity to examine the variable impact between administrative and legislative attempts to establish instream flow programs. Legislation accommodation of local perspectives provides a more secure but less plastic route to achieving conservation objectives through instream flow laws.

Water, as a resource, is held in public trust by each state for its citizens. This study finds that effective instream flow institutions rely on clear administrative state

authority that delegates certain aspects of governance to local entities in a nested governance structure. This allows the management of local watersheds to move away from traditional top-down regulatory regimes. The Walla Walla watershed management program provides us with an experiment for future study of a basin that has been delegated broad authority to locally manage their water resources independent of state authority. Water remains a highly variable, finite, and unpredictable resource that will present coordination challenges in management. A broad restructuring of the state water management institution to allow in-depth local participation will likely have unintended consequences as well. These consequences would be particularly severe in watersheds with diverse socio-economic and political compositions. From the perspective of salmon conservation, the effective management of watersheds is dependant upon hydrologic connectivity and unified efforts within the same watershed. If conservation efforts are to succeed local management must coordinate within hydrologic boundaries. In an interconnected watershed, the state must strike a balance in reconciling differing efforts of place-based management.

Prior appropriation is consistently evolving to better reflect the contemporary public interest of a changing population. Through the lens of institutional economics, an effective instream flow legal regime is an expression of societal desire for stream flow conservation efforts. In consideration of the politics of water, the evolution toward nested governance will occur incrementally in prior appropriation. While over-allocation and resource degradation are common, much of the Western United States is trapped within the first two stages of instream flow evolution. In the majority of rural regions, public opinion heavily favors resource development and will politically impede

the adoption of an instream flow legal regime. This transition has occurred more rapidly within the Pacific Northwest because of the culturally centric nature of Pacific Salmon. As individuals have felt the effects of salmon habitat degradation in their own lives, a statewide shift in public opinion has led to the collaboration and consensus that drives instream flow institutions. Implementation of the nested governance structure establishes legal avenues for place-based water resource management to better represent the values of a particular region.

Institutions for instream flows are the natural evolution of prior appropriation as changing cultural expectation reacts to environmental degradation that is widespread throughout the West. As prior appropriation can structurally contribute to over-allocation of water resources, instream flow laws amend institutional working rules in order to achieve more desirable outcomes on the ground. This study concludes that 1) A nested governance structure that addresses over-allocation by promoting flexibility, collaboration, and multi-level consensus leads to an effective instream flow institution and 2) Through the process of implementing nested governance, institutions for instream flows increase their capacity to achieve conservation objectives. Within the nested governance relationship I observed A) Institutions must be flexible so that a diverse stakeholders from all levels of governance may collaborate to reach consensus, B) non-profit groups act as critical facilitators of local place-based watershed governance, C) a political system must be willing to legislatively and administratively accommodate conservation efforts of local entities. This study aimed to further understand how institutions have structured instream flow rights on the ground. My results indicate that more inclusive and place-based forms of governance hold promise

in effectively achieving salmon conservation objectives. As institutions evolve to incorporate conservation objectives they must turn away from top-down governance and allow new forms of knowledge and perspectives to influence legal regimes.

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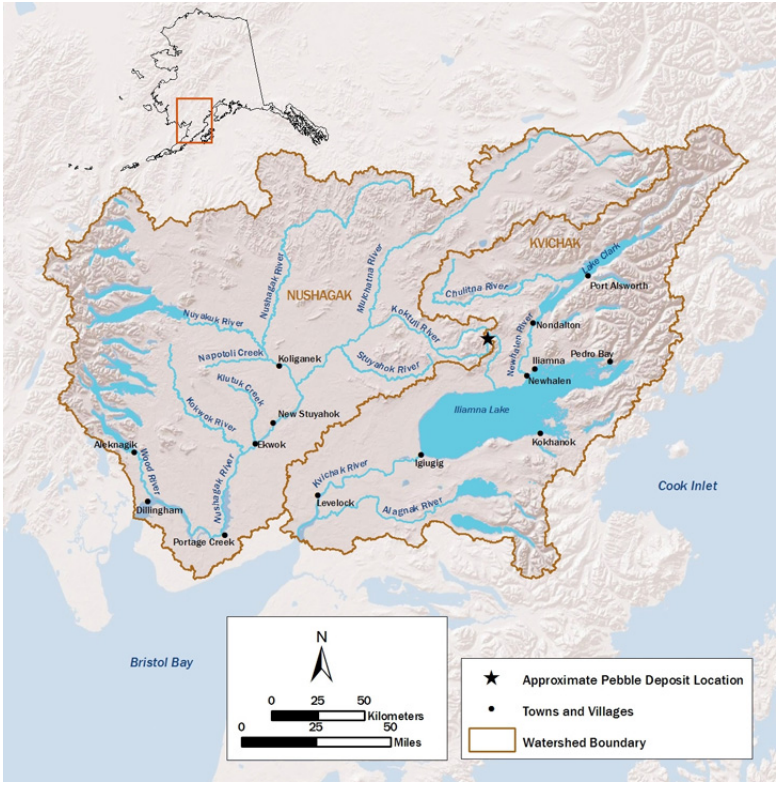
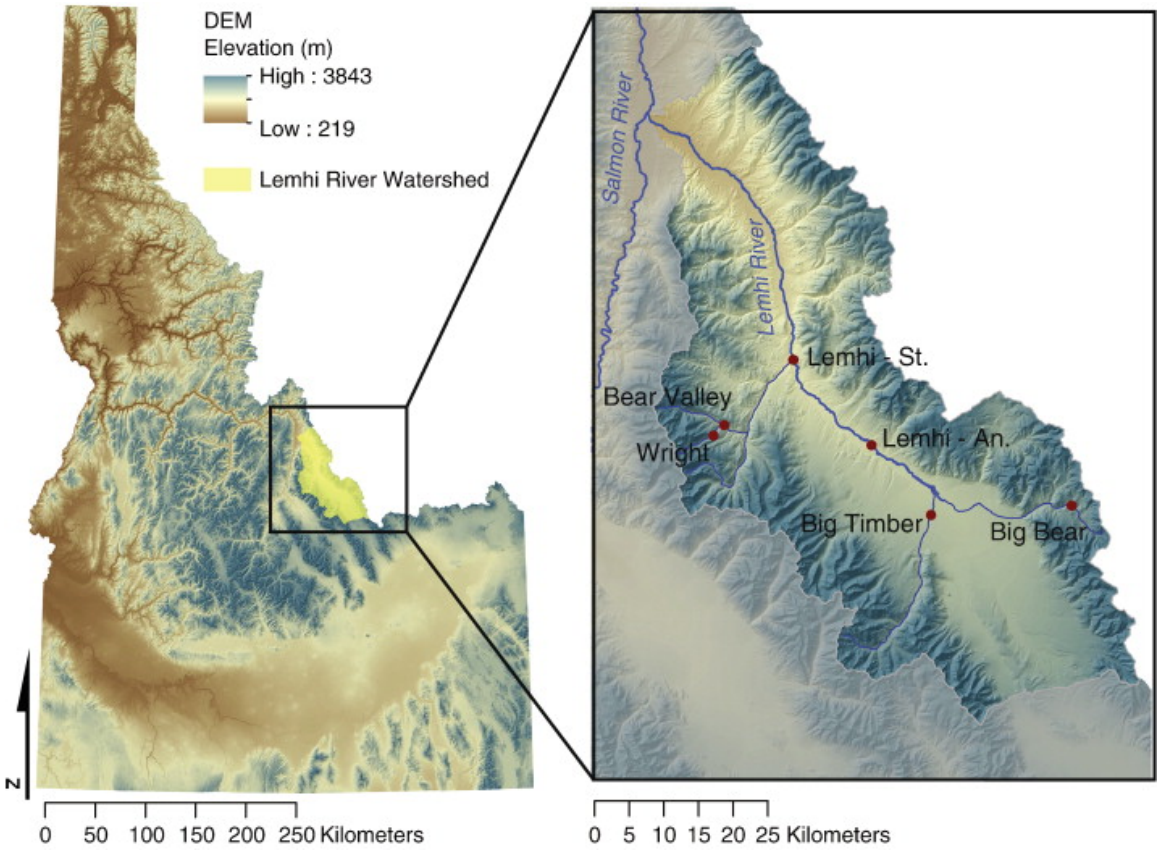
Appendix:

Map A.1: Iliamna Region



Source: https://www.epa.gov/bristolbay

Map A.2: Lemhi Drainage



Source: Bangen, S. G., Wheaton, J. M., Bouwes, N., Bouwes, B., & Jordan, C. (2014). A methodological intercomparison of topographic survey techniques for characterizing wadeable streams and rivers. *Geomorphology*, *206*, 343–361. https://doi.org/10.1016/J.GEOMORPH.2013.10.010

Map A.3: Little Deschutes Drainage

Source: http://www.deschutesriver.org/about-us/

Table A.4: Grounded Theory Tenants

COMPONENT	STAGE	DESCRIPTION
Openness	Throughout the study	Grounded theory methodology emphasises inductive analysis. Deduction is the usual form of analytic thinking in medical research. Deduction moves from the general to the particular: it begins with pre-existing hypotheses or theories, and collects data to test those theories. In contrast, induction moves from the particular to the general: it develops new theories or hypotheses from many observations. Grounded theory particularly emphasises induction. This means that grounded theory studies tend to take a very open approach to the process being studied. The emphasis of a grounded theory study may evolve as it becomes apparent to the researchers what is important to the study participants.
Analysing immediately	Analysis and data collection	In a grounded theory study, the researchers do not wait until the data are collected before commencing analysis. In a grounded theory study, analysis must commence as soon as possible, and continue in parallel with data collection, to allow *theoretical sampling* (see below).
Coding and comparing	Analysis	Data analysis relies on *coding* - a process of breaking data down into much smaller components and labelling those components - and *comparing* - comparing data with data, case with case, event with event, code with code, to understand and explain variation in the data. *Codes* are eventually combined and related to one another - at this stage they are more abstract, and are referred to as *categories* or *concepts*.

Memo-writing (sometimes also drawing diagrams)	Analysis	The analyst writes many memos throughout the project. Memos can be about events, cases, categories, or relationships between categories. Memos are used to stimulate and record the analysts' developing thinking, including the *comparisons* made (see above).
Theoretical sampling	Sampling and data collection	Theoretical sampling is central to grounded theory design. A theoretical sample is informed by *coding, comparison and memo-writing*. Theoretical sampling is designed to serve the developing *theory*. Analysis raises questions, suggests relationships, highlights gaps in the existing data set and reveals what the researchers do not yet know. By carefully selecting *participants* and by modifying the *questions* asked in data collection, the researchers fill gaps, clarify uncertainties, test their interpretations, and build their emerging theory.
Theoretical saturation	Sampling, data collection and analysis	Qualitative researchers generally seek to reach 'saturation' in their studies. Often this is interpreted as meaning that the researchers are hearing nothing new from participants. In a grounded theory study, theoretical saturation is sought. This is a subtly different form of saturation, in which all of the concepts in the substantive theory being developed are well understood and can be substantiated from the data.
Production of a substantive theory	Analysis and interpretation	The results of a grounded theory study are expressed as a substantive theory, that is, as a set of concepts that are related to one another in a cohesive whole. As in most science, this theory is considered to be fallible, dependent on context and never completely final.

Source: Sbaraini, A., Carter, S. M., Evans, R. W., & Blinkhorn, A. (2011). How to do a grounded theory study: a worked example of a study of dental practices. *BMC Medical Research Methodology*, *11*(1), 128. https://doi.org/10.1186/1471-2288-11-128

Table A.5: Interview Participants

State	Entity Representing	Position	Role
Alaska	Alaska Department of Natural Resources	Reservation of Water Program Lead, Statewide	Reviews applications for reservations
Alaska	Alaska Department of Fish and Game	Instream Flow Program Supervisor	Submits applications for state reservations
Alaska	Alaska Department of Fish and Game	Habitat Biologist III	Submits applications for state reservations
Alaska	The Nature Conservancy	Conservation Director	Submits applications for private reservations
Oregon	Oregon Department of Water Resources	Flow Restoration Program Coordinator	Reviews applications for Instream Flow Mechanisms
Oregon	Oregon Department of Water Resources	Deschutes Region Water Master	Enforces all water rights in the Deschutes Region/Coordinates with stakeholders
Oregon	Deschutes River Conservancy	Program Director	Locally coordinates instream transfers and mitigation bank
Oregon	Deschutes River Conservancy	Water Leasing Program Manager	Locally coordinates instream leases
Idaho	Idaho Department of Water Resources	Water Transaction Program Manager	Coordinates Conservation Easements and Rental Agreements
Idaho	Office of Species Conservation	Upper Salmon Basin Watershed Program Manager	Coordinates local concerns to state entities
Idaho	Lemhi Regional Land Trust	Stewardship and Restoration Coordinator	Pursues conservation easements and novel solutions